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XVII Meeting

ICAR Regional Committee No.V

May 30-31, 2003

Agenda Notes

and

Status of Centre-State Coordination for R&D Linkages in Agricultural Research, Education and Extension

Venue: Acharya N.G. Ranga Agricultural University
Rajendranagar, Hyderabad-500 030

Indian Council of Agricultural Research
Krishi Bhavan, New Delhi 110 001

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30.5.03

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SEVENTEENTH MEETING OF THE ICAR REGIONAL COMMITTEE NO. V

PROGRAMME

Date : May 30-31, 2003
Time : 10.00 hrs
Venue : ANGRAU, Hyderabad

Agenda			Time (hrs)
MAY 30, 2003			
I	Welcome Address	VC, ANGRAU	1000 – 1010
II	Introductory Remarks	DDG (AS), ICAR, New Delhi	1010 – 1025
III	Address by the Hon'ble Ministers concerned regarding status of Agriculture, Animal Husbandry And Fisheries in respective States a) Andhra Pradesh b) Orissa c) Chattisgarh		1025 – 1110
IV	Address by the President	Secretary, DARE & DG, ICAR	1110 – 1130
	Vote of Thanks	Member Secretary	1130 – 1140
	Tea Break		1140 – 1200
V	Presentation of the Action Taken Report on the 16th Meeting of ICAR Regional Committee No. V held at Raipur	Member Secretary	1200 – 1220
VI	Agriculture Production and Productivity Trends in Region No. V	ADG(TC)	1220 – 1230

VII	**Fresh Agenda Items** **State-wise Problems and Research Needs/Development Issues**		
A-1	Statement on Development Issues/ Research Needs of A.P.	APC/Secretaries (Agri./Hort./Animal Science/ Fisheries) Director of Agri./Hort./Animal Sciences/Fisheries/Conservator of Forests/Engineer in Chief (I&CAD) Govt. of A.P.	1230 – 1345
	Lunch		1345 – 1500
B-1	Response to the above	V.C./Dean/Director of Research,ANGRAU, Hyderabad	1500 – 1545
A-2	Statement on Development Issues/Research Needs of Orissa	APC/Secretaries (Agri./Hort./Aninmal Science/Fisheries) Director of Agri.Hort./ Animal Sciences/Fisheries/ Conservator of Forests, Govt. of Orissa	1545 – 1630
B-2	Response to the above	V.C./Dean/Director of Research, OUAT, Bhubaneswar	1630 – 1700
	Tea Break		1700 – 1715
A-3	Statement on Development Issues Research Needs of Chhattisgarh	APC/Secretaries (Agri./Hort./Animal Science/Fisheries) Director of Agri./Hort./ Animal Sciences/Fisheries/ Conservator of Forests, Govt. of Chattisgarh	1715 – 1745
B-3	Response to the above	V.C./Dean/Director of Research, IGKVV, Raipur	1745 – 1830
Cultural Programme			1930 – 2030
Dinner		Hosted by V.C., ANGRAU, Hyderabad	2030 – 2130

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May 31, 2003

VIII	Responses of DDGs of ICAR	930 – 1045

C-1	Crops Sciences	DDG(CS)
C-2	Horticulture Crops	DDG(H)
C-3	Soils, Agronomy and Agroforestry	DDG(NRM)
C-4	Agricultural Engineering	DDG(Engg.)
C-5	Animal Breeding, Health and Nutrition	DDG(AS)
C-6	Fisheries	DDG(Fisheries)
C-7	Agricultural Education	DDG(Edn.)
C-8	NARP II Implementation	PD(NARP) NATP?

Tea 1045 – 1100

Responses of Director of ICAR Institutes 1100 - 1230

D-1 Director, CRRI, Cuttack
D-2 Director, CTRI, Rajamundry
D-3 Director, NRC for Sorghum, Hyderabad
D-4 Director, Directorate of Rice Research, Hyderabad
D-5 Director, Directorate of Oilseeds Research, Hyderabad
D-6 Director, NRC for Oilpalm, Pedavegi
D-7 Director, CRIDA, Hyderabad
D-8 Director, WTC for Eastern Region, Bhubaneswar
D-9 Director, NRC for Women in Agriculture, Bhubaneswar
D-10 Director, NRC for Meat, Hyderabad
D-11 Director, P. Directorate on Poultry, Hyderabad
D-12 Director, CIFA, Bhubaneswar
D-13 Director, NAARM, Hyderabad
D-14 Project Coordinator, AICRP on Sunflower, Hyderabad
D-15 Project Coordinator, AICRP on Castor, Hyderabad
D-16 Project Coordinator, AICRP on Safflower, Hyderabad
D-17 Project Coordinator, Network Project on Tobacco, CTRI, Rajahmundry
D-18 Project Coordinator, All India Coordinated Sorghum Improvement Project, NRC for Sorghum, Hyderabad
D-19 Project Coordinator, AINP on Agril. Ornithology, ANGRAU Veterinary College Campus, Hyderabad
D-20 Project Coordinator, AICRP on Dryland Agriculture, CRIDA, Hyderabad
D-21 Project Coordinator, AICRP on Agril. Meteorology, CRIDA, Hyderabad
D-22 Scientist Incharge, NBPGR Regional Centre, CRRI Campus,

Cuttack
D-23 Head, NBPGR Regional Research Station, Hyderabad
D-24 Technical Officer, SBI Research Centre, Kovvur
D-25 Head, CTRI Research Station, Guntur
D-26 Head, CTRI Research Station, Kandukur
D-27 Head, CTRI Research Station, West Godavari District
D-28 Incharge, Sisal Research Station, CRIJAF, Barma
D-29 Incharge, Off Season Nursery, Agril. Farm, NRC for Sorghum, Warangal
D-30 Head, Regional Centre of CTCRI, Bhubaneswar
D-31 Head, Central Horticulture Experiment Station IIHR, Bhubaneswar
D-32 Incharge, Quality Evaluation Unit of CIRCOT, Agricultural Research Station, Guntur
D-33 Head, CSWCR&TI Research Centre, Koraput
D-34 Head, CARI regional Station, Khurda
D-35 Officer Incharge, Puri Research Centre of CIBA, Puri
D-36 Head, Burla Research Centre, CIFT, Burla
D-37 Scientist, Visakhapatnam Research Centre of CIFT, Visakhapatnam
D-38 Incharge, Kakinada Centre of CIFE, Kakinada
D-39 Incharge, Kakinada Research Centre of CMFRI, Kakinada
D-40 Incharge, Visakhapatnam Research Centre of CMFRI, Visakhapatnam

IX	Research-Extension Linkages			
	E-1	Extension Education	DDG(Extn.)	1230 – 1245
	E-2	Adequacy and Effectiveness By Zonal Coordinators(KVKs)		1245 – 1300
X	Statements of Special Invitees (NABARD/Water & Land Management)			1300 – 1315
XI	Plenary Session Concluding Remarks		Director General, ICAR	1315 – 1345
XII	Vote of Thanks		ADG(TC)	1345 – 1400
	Lunch			1400 – 1500
Visit of ICAR Institutes				1500 – 1800

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Vice-Chancellor, ANGRAU, Hyderabad

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Director General, ICAR

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Address by the Hon'ble Ministers of Andhra Pradesh, Orissa and Chhattisgarh

Agenda Item No. IV

Address by the Chief Guest

Agenda Item No. V

Action Taken Report on the Recommendations of the XVI Meeting of ICAR Regional Committee Members held at IGKV, Raipur

Central Research Institute for Dryland Agriculture Hyderabad 500 059

Action Taken Report on the Recommendations of the XVI Meeting of the ICAR Regional Committee No.V held at Raipur

On September 8-9, 2000

S. No.	Major Recommendation	Concerned Official / Agency	Action Taken Report
Crop Sciences			
A1.	Hybrid rice technology is considered to be a must for upgrading the productivity of rice in the region. Though there may be some short term technical hick-ups the relevance of hybrid rice is considered high on a long term basis. Therefore, each University/Institute and Department in the region should systematically organise large number of frontline demonstrations and identify constraints.	DDG (CS)	On farm demonstrations with three released hybrids, PA 6201, PHB 71 and DRRH-1, were carried out with 50 farmers in the Districts of Cuttack, Angul, Dhenkanal, Kendrapara and Jaipur during kharif 2000. The farmers harvested 5-6 ton paddy/ha and the results are encouraging. At CRRI farm, Cuttack, hybrid rice has recorded an yield of 6-7 ton/ha. A multidisciplinary projects viz., MIP-6: Development of hybrid rice for irrigated and rainfed lowland ecologies is being implemented at the institute level.
		DDG (Agril. Extn)	**Orissa:** In Orissa, the KVK Angul assessed the performance of hybrid rice during rabi and kharif season of 2000-01. FLDs have been organized during kharif 2001-02 by the KVKs at Cuttack, Angul, Dhenkanal. Bhadrak and Keonjhar in Orissa and Bastar in Chhattisgarh. **Andhra Pradesh:** During 1999-2000 and 2000-01, a total of 67 demonstrations on hybrid rice during kharif and rabi were organized covering 37 ha. Besides, 2 field days, 2 kisan melas and 2 film/video shows were organized covering 432, 592 and 230 farmers respectively. KVK Warangal organized 7 training programmes on hybrid rice attended by 140 farmers.
		ZC (V)	
		IGAU	KVK Nalgonda in A.P. has taken up number of activities to promote hybrid rice seed production.
		OUAT	One adhoc project was sanctioned by ICAR for agronomic management practices for hybrid rice. Experiments on nutrient management of hybrid rice were conducted and more than 8.5 t/ha yield has been achieved with optimum nutrient supply. The university has started developing scented fine, long and short slender hybrid rice and the results are encouraging. ICAR has already sanctioned FLD on hybrid rice of 10 acres which will enable to popularize the hybrid rice on well managed area.
		ANGRAU	Considering the importance of hybrid rice for increasing productivity, efforts are under way to evaluate experimental hybrids and released hybrids. Hybrids like PHB 71, KRH 2 and H 6201 were identified as promising ones. Front line demonstrations will be organized in future.
		CRRI, ZC (VII)	

S. No.	Major Recommendation	Concerned Official / Agency	Action Taken Report
			Frontline demonstrations of hybrid rice are being organized by the University. Along with the suitability and yield performance, constraints for adoption are also being identified.
A2.	The breeder seed production for hybrid rice should be given utmost priority in the States of Orissa and Chhattisgarh.	IGAU	The seed production programme of hybrid rice has been started since 2001-02 with the available A line and B line recommended by ICAR. The research work is also initiated to develop hybrid rice. For this purpose A,B and R lines are being developed. The University requires a separate research center/scheme for hybrid rice research so that focused work can be carried out in a time frame.
		OUAT	The Department of Plant Breeding and Genetics has taken steps to identify several promising lines for hybrid rice. After receipt of the indent from the State Government and Govt. of India, the University will take up programme for production of breeder seeds on hybrid rice
		DDG (CS)	
		Dept. Agri., Orissa	Division of Crop Improvement, CRRI, is produing a limited quantity of hybrid seed for research purpose of CRRI bred hybrids viz., CRHR 1, CRHR 4 and CRHR 5
		Chhattisgarh	The inclusion of hybrid rice in State seed chain is under active consideration. The State Govt. is waiting the results of different hybrid rice identified by OUAT in different agroclimate zones.
A3.	Concerted efforts be made by SAUs in the Region to optimally utilise rice fallows in the cropping systems. Groundnut, mungbean, blackgram, lentil and other crops need to be extensively tried. AED Rainfed (NATP) may initiate steps to develop PSR programme involving the relevant institutions in the region. The Universities should make available breeder seed of suitable varieties for the Dept. of Agriculture to conduct frontine demonstrations under oilseed and pulse schemes	ZC (V)	The cultivation of Blackgram in rice fallows of Guntur district of A.P has immense potential. Therefore, KVK, Guntur has undertaken number of Frontline Demonstrations on Blackgram in farmers' fields to demonstrate the potential of improved varieties and other improved technologies. During 2000-01, 2001-02 and 2002-03 FLD on blackgram was conducted in 22,29 and 5 hectares respectively. Increase in yield was about 20 to 86 per cent due to improved practices. **Groundnut**: FLD in paddy fallows were conducted at KVK's Guntur, Srikakulam, Vizianagara, East Godavari and Warangal during 2000-01, 2001-02 and 2002-03 in an area of 18.32 and 20 ha. respectively. 12 to 38% increase in yield is noticed due to improved practices. **Sesamum:** FLD in rice fallows were taken up at Guntur, Karimnagar, Kurnool, Vizianagaram and Visakhapatnam in an area of 20.16 and 5 ha during 2000-01, 2001-02 and 2002-03 respectively. The yield increase was found to be 29 to 37 per cent over farmers practices.
		IGAU	The state government has launched a massive programme in collaboration with university for increasing double croped area in rice / soybean based cropping system by introducing rabi oilseeds and pulses. Also, efforts are being made to increase irrigated area through tube wells and ponds. Under NATP programme 6 projects are in operation in the farmers' fields for increasing the cropping intensity under rainfed conditions with conserved

S. No.	Major Recommendation	Concerned Official / Agency	Action Taken Report
			moisture and by adopting water harvesting techniques. With the introduction of zero till seed drill, it seems that large area can be brought under double crop under rainfed conditions. The Chhattisgarh government has also prepared action plan to bring at least 25 per cent additional land under double cropping system. Demonstrations are being laid-out for improving the productivity of utera (relay cropping system) involving both oilseeds and pulses like lathyrus, gram, lentil, safflower, linseed. Experiments and demonstrations of double crop system in conserved soil moisture have also been laid-out under NWDPRA. Financial constraints limit the production of breeders seed by the University.
		OUAT	The University is trying through trials/experiments in different Regional Research and Technology Transfer Stations to optimally utilize rice fallows by growing groundnut, pulses and mungbean. OUAT has developed a variety for mung bean (OBGG-52) and has recommended the State Release Committee for its release. The University is organizing front line demonstrations on pulses and oilseeds in rice fallows.
		AED Rainfed (NATP)	Five NATP - PSR Projects have been funded with the objective of increasing the cropping intensity by raising Rabi crops on residual moisture. The universities involved were IGKV, Raipur, BAU, Ranchi and OUAT, Bhubaneswar. Nearly 30 cooperating centers were involved in the project. The research is being carried out on the farmers fields. Preliminary results for the first 2 years demonstrated the possibility of using the rice fallows for growing pulses and oilseeds to improve the income of farmers by as much as 50% to 60%. The total outlay on this project is more than 5 crores for a period of 3 to 4 years.
		DDG (AE)	Orissa : Concerted efforts are being made by the KVKs in the region for optimally utilization rice fallow in cropping systems. During Rabi 1999-2000 457 demonstrations were conducted in the districts of Kendrapara, Khurda, Dhankanal, Navagarh, Cuttack, Angul and Ganjam. The yield varied from 4.39 q/ha to 11.2 q/ha compared to check yield of 2.96 q/ha to 8 q/ha. The increase in yield varied between 33% to 86%. During Rabi 1999-2000, 252 demonstrations were also conducted with blackgram on 51 ha. at Ganjam, Puri, Angul, Dhankanal and Cuttack districts. The yield vary from 7.12 q/ha to 10.60 q/ha in contrast to the yield of 4.00 q/ha to 6.7 q/ha obtained in check plots. The increase in yield ranged from 52% to 82%. During 1999-2000, a total number of 1600 demonstrations of groundnut during rabi were conducted on 606 ha in the districts of Ganjam, Nayagarh, Kendrapara, Balasore, Jagatsinghpur, Jajpur, Bhadrak, Cuttack, Bargarh, Puri, Khurda, Dhankanal, Mayurbhanj. The yield demonstrations ranged from 13.43 q/ha to 22.75 q/ha. The yield of check

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			plots varied between 7.12 q/ha to 18.37 q/ha. **During 2000-01**, a total number of 96 FLDs with Sunflower, 56 with Mustard, 102 with Toria, 893 with Groundnut, 63 with Sesamum, 190 with Blackgram and 91 with greengram were conducted by various KVKs in different districts of Orissa. The increase in the yield over the check was 61 to 93, 52 to 155, 32 to 278, 17 to 114, 24 to 75, 50 to 86, 29 to 70, per cent on sunflower, mustard, toria, groundnut, sesamum, blackgram and greengram respectively. **During 2000-01** a total of 115 FLDs with groundnut, 235 with greengram, 15 with tria, 16 with sesamum and 10 with blackgram were conducted by KVKs located in different districts of Orissa. During the years 2000-01, 2001-02 and 2002-03 FLDs *were conducted with groundnut crop in an area of 18.32* and 20 ha by KVK at Guntur, Srikakulam, Vizianagaram, East Godavari and Warangal. The increase in yield was the order of 12 to 38 percent. Similarly, FLDs were conducted with blackgram in an area of 22.29 and 5 ha. respectively for the above years and the increase in the yield was to the extent of 20 to 80 percent over farmers practice. Andhra Pradesh: During 1999-2000, 6 FLDs were conducted on 2 ha. by KVK Guntur during rabi on blackgram in paddy fallows. The results of demonstration revealed an increase of 27.3% over the local practice. The KVK also conducted training programmes and field days benefiting 106 farmers.
		Dept.of Agri., Govt.of Orissa	Rice fallow lands are used in the cropping system to grow groundnut, moong, bean, blackgram and horsegram.
A4.	Diversification of area under upland rice into other profitable crops is urgently required in Chhattisgarh and Orissa. Even non-conventional crops like castorbean and cotton need to be tried through systematic onfarm experiments in the Chhattisgarh region. This can form part of crop diversification research for rainfed uplands under NATP. The Universities may draw specific crop plans with supportive data and help the Departments of Agriculture to organise frontline demonstrations atleast one in each district.	DDG (CS)	Cotton crop is catching up in Orissa and a center under AICCIP has already been started to conduct and coordinate the research activities at two stations, i.e. Umerkote and Bhawanipatna since January 2000. As far as Chhattisgarh is concerned, CICR/Coordinator (Cotton) will offer all technical guidance to the University and the Department of Agriculture for conducting frontline demonstrations/trials. The details on the number and location of FLDs can be worked out once the above mentioned agencies take up the initiative . The Project Coordinator (Cotton) has already written to Director of Research, IGAU, Raipur for conducting trials.
		IGAU	State Government has given due importance for crop diversification specially in areas of uplands, where productivity of rice is very low (5-8 q/ha). About 5.00 lakh ha area will be diverted from uneconomic area to agroforestry, horticulture, oilseeds pulses, tuber crops, medicinal plants etc. The specific plan for crop diversification has been prepared jointly by university and agriculture department, which has been implemented by government from kharif 2001. The university has adopted

S. No.	Major Recommendation	Concerned Official / Agency	Action Taken Report
			5 villages to demonstrate crop diversification programme as a model.
		OUAT	Research work and demonstration have been laid-out in non-convential crops like castor and cotton as substitute of rice in uplands. However, unless processing and marketing facilities are not developed, these crops may not gain popularity.
			The FLDs on different crops as allotted by ICAR have been conducted in many districts so that technology can be shown to the farmers. The state government has been approached to provide some funds for conducting FLDs on different crops. ICAR need to give emphasis on sanctioning of FLDs on crop diversification in uplands.
		WTCER	The University has identified a number of cropping patterns suitable for rainfed uplands. Based on the recommendations of the University, the Agriculture Department, Govt. of Orissa has already taken steps to divert considerable area under upland rice to Cotton, Groundnut, Pulses and other Oilseeds.
		AED Rainfed (NATP)	WTCER, Bhubaneswar, has takenup trials on diversification of upland rice in Orissa for unbunded rice fields under NATP . Maize-horsegram/sesamum and groundnut + pigeonpea have been found most suitable for replacing upland paddy-fallow in the unbuded uplands in Orissa .
			Two specific projects have been funded under NATP (Rainfed) with the aim of crop diversification. IGKV, Raipur is the lead center with cooperating centers in Jharkhand, Madhya Pradesh and Orissa. The main objectives of this project are to diversify Kharif rice areas with pulses and oilseeds or promoting intercroDoing of upland rice with pigeonpea or kharif oilseeds. However, castor bean and cotton have not been included in these experiments. The PIs/CCPIs will be advised to include these two crops in the technical programme.
A5.	SAUs in the region may utilise revolving fund schemes to produce certified seeds of pulses, paddy and other planting material	IGAU	Revolving fund projects on seed production are in operation for rice, vegetables, tuber crops, agroforestry etc. Regarding other planting material, it is felt that development of marketing is prerequisite. The government has declared Chhattisgarh as Horticulture State by providing more financing and administrative support to popularize horticulture crops. The university will prepare and supply planting materials through revolving fund scheme in order to meet the demand of the department.
		OUAT	The Revolving Fund under Breeder Seed Production (NSP crops), NSP (vegetables), production of planting materials of fruits and vegetables and State Plan

S. No.	Major Recommendation	Concerned Official / Agency	Action Taken Report
		ANGRAU	Revolving Fund, etc. have been fully utilized for production of breeder seeds, foundation seeds, certified seeds of paddy, ragi, maize, groundnut, sesamum, niger and planting materials during the year 2001-02. Various kinds of planting materials are being produced using the revolving fund. However, certified seed is not being produced. University is producing only breeders seed and foundation seed. APSSDC is producing the certified seed of all crops.
A6.	A mission mode proposal may be drawn up by OUAT, Orissa covering also the Chhattisgarh region to collect and evaluate the scented rice germplasm. The proposal may be put up to the Council under Cess Fund Scheme.	OUAT	A proposal was submitted to the ICAR through Directorate of Rice Research, Hyderabad for collection, evaluation and utilization of indigenous aromatic rice for higher productivity and the same has been sanctioned as an adhoc project entitled, "Genetic enhancement of small grain aromatic rices for higher productivity and export" . The implementation of the project started during kharif, 2002.
A7	Sesame and niger have good potential in Orissa and Chhattisgarh as alternate crops. The Dept. of Agriculture in both states should obtain the latest released varieties from the DOR, Hyderabad and conduct on-farm research/ demonstrations in different agroclimatic regions of the State.	IGAU	Sesame has good potential during kharif season (variety TKG-21, TKG-22) under rainfed conditions whereas, during rabi-summer, variety Rama and TKG-22 found to be suitable under irrigated conditions. Niger varieties IGP-76 and GA-10 were found to be more suitable as mid season crop (August -September sown). Research on varietal evaluation, refinement of agro-techniques are being addressed on these crop. Demonstration on niger and sesame in different districts have already been conducted under ICAR schemd. However, increased allocation of FLDs are needed to cover more areas in the tribal belt.
		Dept.of Agri., Govt.of Orissa	Latest released varieties of sesamum like uma, pusa and GA-10, IGP-76 of Niger seeds are being used in the state.
A8.	Research on soybean and wheat crops should be given a major thrust in Chhattisgarh. On-farm research on the technologies already available with the NRC Soybean and IARI Regional Station may be made use (and location specific) for appropriate modification/ adaptation.	IGAU	Research on soybean and wheat are being carried out under All India Co-ordinated Research Projects. On-farm research are being conducted in Raipur, Jagdalpur, Bilaspur in different NATP projects. At Bilaspur centre, location specific research has been carried out in collaboration with Regional Agricultural Research Station (RRS) Indore. Similarly research on soybean is conducted at Raipur in collaboration with NRC for soybean. There is very good scope of introducing durum wheat in Chhattisgarh and with the help of wheat RRS, Indore FLDs in more than 300 acres were laid-out in 2001-02 in Bilaspur division. Other districts will be covered in due course.

S. No.	Major Recommendation	Concerned Official / Agency	Action Taken Report
A9.	Although improved varieties of castor have relevance under certain specific situations, concerted efforts may be made to develop and popularise castor hybrids in the region. AP with the largest area under castor should comprehensively test castor hybrids onfarm.	DOR, Hyd.	During 2000-01, 48 and 2001-02 63 FLDs were conducted in 2001-02 and it is planned to conduct 40 FLDs in 2002-03. The recently improved hybrids such as DCH32, DCH-177 and PCH-1 were demonstrated.
		ANGRAU	The variety 'Kranti' released by ANGRAU is performing exceedingly well in Andhra Pradesh. ANGRAU is also paying the much needed attention in development of castor hybrids. ANGRAU has already released one castor hybrids (PCH 8).
		Dept.of Agri. Govt.of AP	Castor hybrid production is being taken up by various seed producing agencies to meet the increasing requirement. However, there is some shortfall in seed supply.
A10.	The new varieties of Lathyrus with less neuro toxin need to be extensively tried and popularised in the region. Seed production must be be augmented	IGAU	Low BOAA content varieties *Pratik* and *Ratan* have been released for Chhattisgarh. The state government has not placed specific indent for the breeder seed. Hence seed production programme is not getting due momentum. In this regard, it is to mention that even the Government of India has not included lathyrus crop in the breeder seed production programme in the country.
A11.	Pulse research needs a major fillip in Chhattisgarh and Orissa. A main centre of pulses research may be set up at Raipur under the All India network.	DDG (CS)	Raipur Centre in Chhattisgarh region is being upgraded as a main center under ACRP on MULLaRP
		IGAU	In Chhattisgarh at least 20 lakh ha area can be brought under pulses during rabi season and the Government is encouraging the production of pulses during kharif and rabi. The ICAR has sanctioned AICRP on MULLaRP and AICRP on chickpea. However, main center of pigeonpea at Raipur and sub-centre of MULLARP need to be sanctioned in tenth 5 year plan. An Intl.Conferencence on chickpea was organized during 20-22 Jan.2002 at IGAU which helped in highlighting the importance of pulses in Chhattisgarh.
A12.	The parental lines of sunflower and castor hybrids may be made available by DOR to the Scientists at IGAU and OUAT in order to enable them produce breeder seeds in sufficient quantity.	DOR	DOR has already supplied parental lines of castor (DCH 32, 177) and Sunflower (KBSH-1) hybrids to IGAU to take up large-scale seed production and demonstration of the crop. The concerned scientist was also trained in Hybrid Seed Production Training of Sunflower and Castor at DOR, Hyderabad. The potential castor growing districts identified are: Nawarangpur and Kalahandi, whereas those for sunflower are the districts of Bolangir and Kalahandi in Orissa. The necessary parental lines are being supplied to OUAT as per their request.
		IGAU	The DOR Hyderabad and GAU, Junagarh were kind enough to provide the parental lines of sunflower, safflower and castor hybrids and IGAU has already taken-up the hybrid seed production programme of these crops. The University has taken steps to collect the parental lines of sunflower and castor hybrids for production of sufficient quantities of hybrids seed

S. No.	Major Recommendation	Concerned Official / Agency	Action Taken Report
A13.	The possibility of upgrading the Berhampur research centre on pulses into a main centre along with the establishment of 4 sub-centres may be examined by the Council. This should be backed by appropriate proposals by the SAU with adequate justification.	DDG (CS)	Berhampur center of Orissa is being upgraded as main center under AICRP on MULLaRP.
		OUAT	The University had already submitted a proposal for establishment of Centre of Pulses Research in OUAT by upgrading the existing pulse research center in Berhampur.
A14.	Large number of rice varieties for deep water, upland, medium land and lowland conditions are stated to be available for the region with potential to yield 25-30% higher than the currently used material. However, their spread is very low. Directors of DRR and CRRI, Cuttack should visit the area and assess the current situation. A meeting may be organised at CRRI, Cuttack to draw-up a specific action plans zone wise for varietal replacement for further action by Dept. of Agriculture.	DDG (CS)	A team of Scientists visited different areas under upland rainfed lowland deep-water rice ecosystems during 2000 wet season and have suggested the replacement of traditional varieties with available high yielding varieties.
		DRR, Hyderabad	The Director, DRR has visited the Region and is in constant touch with the current situation in the region. The potential of the new high yielding varieties viz., Aditya and Tulasi and Poornima, Vandana and Anteswari in rainfed upland system in A.P. and Orissa respectively and krishnahamsa in A.P., poornima, mahamaya and bambleswari in Chhattisgarh and mahanadi, OR 1206-25-1 in Orissa under rainfed shallow water ecosystem has been demonstrated to the farmers through compact block front line demonstrations during 2000-02.
		Dept.of Agri., Govt.of Orissa	A meeting was organized in CRRI, Cuttack, for introduction of newly released varieties and accordingly rice minikits are supplied to the field functionaries to study their performance. 2000 nos.of minikits have been supplied to DDA, for field trials on Naveen and Rajashree varieties.
		OUAT	The University has developed some promising varieties suitable for uplands (Lalitagiri, Udayagir,k or 1513-3, or 1519-2 and ORS- 102-4) Medium land: (Surendera Gajapati, Konark and ORS 201-5); Low land : Ramachandi, Mahanadi and Jagabandhu) and Semi Deep Water : Sabita, Druga, Sarala, or 1358-RAG-4, or 1334-16, CR 661-236 and CR 661-236 and CR 780-1937). These varieties/elite cultures identified for different ecosystems are demonstrated through onfarm trials and frontline demonstrations for rapid spread of area under such high yielding varieties in the region.
A15.	In view of the decreasing importance of tobacco on the global level, there is an urgent need to look for alternative crops to tobacco particularly in black soils and light red soils. Castor,	CTRI, Rajahmundry	Basing on the studies conducted at CTRI and its regional research stations in Andhra Pradesh, the institute has suggested alternative crops to FCV tobacco for different microzones, after discussing the same with officials of Tobacco Board, ANGRAU and A.P. State Department of Agriculture. The list of crops for different zones was

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	soybean, bengalgram, maize could be some of the choices depending on the rainfall and soil conditions. Director, CTRI should organise a special meeting involving the representatives from ANGRAU and the relevant crop coordinators to draw up an action plan for any further research required on the alternate crops		enclosed with the note given for the 16th Meeting of ICAR Regional Committee No.V held at IGAU, Raipur during September 8-9, 2000. Further, the Associated Director of Research, RARS, Lam, Guntur also circulated the list of alternate crops for kharif and rabi after discussion with the scientists of CTRI.
Horticulture & Vegetables			
B1	The Bastar region of Chhattisgarh has immense potential for cashew, sugar crops, spices and hybrid vegetable seed production. The work on the existing research at stations may be intensified on these areas particularly forproduction of superior planting material. In case of gaps necessary assistance may be sought from the Council/NATP.	IGAU	After the formation of Chhattisgarh the Government has taken decision for massive sugarcane plantation programme, it has plan to have 10,000 ha area under sugarcane crop in nearby factory. AICRP on sugarcane needs to be sanctioned. The Government has given due importance to brining more area under cashew. The university is also providing the planting materials and technical know-how developed through All India Research Project on cashew. But the University has a constraint of funds in taking up breeders seed production and non-availability of potential lines from concerned breeders. There is one research Centre under AICRP on Cashew located at Jagdalpur (IGKVV). Nursery facilities are developed at the center to produce about 10,000 cashew grafts/year to supply to the farmers and development agencies.
		DDG (Horti.)	One Research Centre under AICRP on Spices is located at Raigarh. Survey and collection of ginger and turmeric germplasm is being undertaken at the Centre. The Centre is also producing elite planting material of ginger, turmeric and coriander for supply to the farmers of the new state. Hybrid vegetable seed production under All India Coordinated Vegetable Improvement Project has recommended the following hybrids for the region. Tomato - BSS-20 (indet) Brinjal - ARBH-201, PBH-6, JBH-1 Cabbage - Nath 40 1 , Sree Ganesh gol Okra - DVR-3 Bottlegourd - NDBH-4 Bitter gourd - RHRBGH-1
B2	Andhra Pradesh has excelled in mango production. However, to maintain the productivity of the old orchards rejuvenation should be taken up as a campaign. Post harvest processing with necessary	ANGRAU	The University is intensifying research on Post-Harvest Technologies of fruits and vegetables with special emphasis on processing and value addition. The concerned scientists have been instructed to submit schemes on this aspect.

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	infrastructure is the urgent need. Suitable research schemes may be initiated on mango PHT by ANGRAU with inter- disciplinary teams of horticulturists, processing specialists and engineers. Appropriate proposals in this regard may be submitted to the Council for possible funding.		
B3	AP is a leader in production of turmeric and chillies. However, in order to gain entry into export markets the State Govt. has to address the concerns of the pesticide residues and quality. The initiative taken by Govt. of Orissa for the cultivation and export of organic turmeric may be studied and followed by the State.	ANGRAU	The technical programmes of the University are re-oriented towards export oriented agriculture and horticulture.
		Dept.of Agri. Govt. of A.P.	GOI have declared 3 officers ie., ADA (Entomology), Tadepalligudem for issue of phyto sanitary certificates. They are issuing certificates in their respective jurisdiction for export of Agril.products.
		Dept.of Agri., Govt.of Orissa	The cultivation of turmeric without application of chemical pesticides and fertilizer in the districts likeBboudh and Kandhamal have been largely encouraged for export purposes
B4	A technical committee on oilpalm may be set up by the Council to look into various issues regarding the productivity and post harvest processing in order to be competitive at the international level and also help farmers receive minimum remunerative returns. This Committee may have representatives from GOI, research, marketing, oil expelling industry and farmers bodies	DDG (CS)	
B5	A status paper on the potential and prospects of oilpalm in Orissa and Chhattisgarh may be prepared after a thorough study of the experiences of the introduction of the crop so far and the steps to be taken for future expansion considering the experiences gained in AP and Karnataka.	Director, NRC Oilpalm	Awaited
B6	A major thrust on medicinal plants must be given for Chhattisgarh region under crop diversification strategies. Horticulture Departments of IG AU at Raipur and Jagdalpur need to conduct preliminary evaluation trials with necessary technical guidance from NRC on Medicinal and	IGAU	Efforts are being made in this direction. A medicinal plant having more than 250 species has already been established at Raipur and research on production, processing and its utilization as fungicide / pesticide have been started at Bilaspur under NATP project. The medicinal park having indigenous / exotic collection are being established in Jagdalpur and Bilaspur centre. The ICAR may sanction the AICRP on medicinal plants for meeting the future need.

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	Aromatic Plants, Borivai and the relevant CSIR centres in the Region.	AED Rainfed (NATP)	One PSR Project on survey, evaluation and documentation of the medicinal plants used by tribals in Madhya Pradesh and Chhattisgarh has been launched with JNKVV, Indore as the lead centre. The PI is collecting and cataloguing information on medicinal plants in Madhya Pradesh and Chhattisgarh including the districts of Bastar, Durg and Rajanandagaon. The PI will be further advised to work closely with the horticulture departments of IGKV, Raipur and Jagdalpur
Natural Resource Management			
C1	Post-emergence weed management in upland rice is a major constraint in realising the high productivity. NRC Weed Science, Jabalpur may conduct field demonstrations through KVKs in the region on the available technologies and initiate new research project for identification/testing of new chemicals.	NRC Weed Science, Jabalpur	Awaited
C2	Cropping systems research involving legume component is a pre-requisite for improving the sustainability in this region. The PSR (Rainfed AED) and the Directorate of CSR, Modipuram may give priority to this issue in the future funding/technical programme. Improving the productivity of *Liter a* practice may be a priority in this context.	IGAU	Enough emphasis is given to cropping system research involving legume components. Under NATP one competitive grant project was sanctioned in IGAU with main center and research work has been intensified on utera method of cultivation. Research work was undertaken on different aspects like water harvesting, water recycling, crop management, cropping system, use of conserved moisture, water harvesting structure etc.
		AED(Rainfed), NATP	Legumes have been included as major crops both in intercropping with upland rice during Kharif and sequence cropping on residual moisture in a number of PSR Projects being implemented in Chhattisgarh, Jharkhand and Orissa. One network project on *Utera* corpping has been sanctioned with an outlay of Rs.77.6 lakhs for 6 centres with JNKVV as the lead center. The productivity improvement of *Utera* crops has been the main objective in this project. Based on trials on farmers fields, 25%-30% additional income has been recorded by various interventions like use of short duration rice variety and stubble height management during harvesting of rice and nutrient management *Utera* crop.
C3	The soil testing all over the region as a special campaign needs to be taken up to help the farmers optimally use the inputs and for higher productivity. The Dept. of Agriculture of the States in the Region may revitalise the stationary and mobile soil testing	Dept. of Agri., AP,	A comprehensive programme of Macro planning in soil testing has been launched for implementation in the state during the years 2003 and 2004. A total no. of 10 lakhs soil samples will be collected during the above period @ 5 lakhs per year. An amount of Rs.36.5 lakhs has been provided to all the 23 stationery soil testing laboratories and 4 mobile STLs under Agril.Development Fund i.e. for

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	labs by providing suitable funding where necessary.		equipment, glassware & chemicals etc. Wide publicity is being given among the farmers in this regard.
		Dept.of Agri., Govt.of Orissa & Chhattisgarh	The Department of Agriculture has taken up steps to improve soil testing laboratories by providing requisite funds. About one lakh samples have been analysed and test reports are provided to the farmers.
C4	Despite the proven benefits of on-farm rainwater management in improving the productivity of upland rice, a concern was expressed on the poor spread of this technology. The State Government in Orissa in collaboration with OUAT should seriously try and demonstrate the technology for onfarm water management integrated with exploitation of shallow wells by the farming communities.	OUAT	The Head of the Department of Soil Water Conservation Engineering and Agronomy are preparing proposals to demonstrate the technology on on-farm water management integrated with exploitation on shallow wells to the farming community.
		Dept. of Agri. Orissa.	Efforts are on to exploit the groundwater from the funds provided by Govt.of India through installation of shallow tube wells and deep tube wells in the state. However, the progress is slow.
C5	Watershed management technology along with use of hybrids and small farm mechanisation were considered to be the major focus areas for rainfed farming in the region. A sound technical backup may be provided to the ongoing projects under NWDPRA by the University scientists. On the part of the Council, well designed training programmes on watershed management need to be conducted regularly for the University and State Dept. officials.	OUAT	A scheme on training of Govt. officials on watershed development with 20 officers per batch and 12 trainings per year for total period of five years has been prepared by the Dean, College of Agril. Engineering and Technology. It will be submitted to ICAR.
		ANGRAU,	This aspect is being dealt by CRIDA.
		IGAU	The scientists on watershed management have organized training programmes for watershed functionaries of the state department. Based on performance of small farm ponds constructed under different programs based on recommendations of the University, the state government has launched a program on construction of 2 lakh small farm ponds on farmers fields and has issued instructions to field Functionaries to visit water harvesting ponds constructed under NATP RRPS-4 project by the University to enable the selection of suitable sites.
		Dept. of Agri., AP,	Various training programmes for capacity building for the three main categories of personnel associated with NWDPRA viz., administrators and managers, implementers and trainers are being taken up periodically at micro-watershed, district and state level.. KVKs, research stations, CRIDA are being involved for the training programmes.
		Dept.of Agri., Govt.of Orissa and Dir. CSWCRTI &	Twenty officers of Agril.Deptt. have already been trained on "Watershed management by OUAT and few more farm watershed project areas will be trained.

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		CRIDA.	
		ADG (Soils)	Regular training courses are being conducted at CSWCR&TI, Dehra Dun and its regional stations on watershed management. During 1999-2000, 2243 officers from various states have been trained. A technology manual on watershed management programme is under preparation.
C6	Conjunctive use of canal and groundwater in high rainfall areas of the rice based ecosystem should be popularised. WTCERmay popularise the concept through field demonstrations for the department staff in all the states.	WTCER, Bhubaneswar	WTCER is working on conjunctive use of canal and ground water under rice based ecosystem in close coordination with canal area development agencies and State Ground Water Board. Research investigations are on to design conjunctive use sysem in canal command for efficient use of canal and ground water. A project is being initiated to develop viaole system of tanks and wells in canal commands for efficient utilization of seepage water of canal, rain water and ground water for increasing effective canal command area and cropping intensity. The Centre is in constant touch with the State Departments of Agriculture and other allied departments for popularizing this concept of conjunctive use of canal and ground water.
C7	The efforts of NBSSLUP in completing the soil maps of Orissa and Chhattisgarh were greatly appreciated by the Committee. It was further considered that appropriate land use plans are needed for integrated development of the area with focus on crop diversification. NBSSLUP and CSWCRTI Centre at Koraput should together develop land use plans on pilot basis for one or two districts in each state and submit to the State Government for implementation.	ADG (Soils) NBSS&LUP	A bulletin "agroecological sub-region of India for planning and development" has been prepared. The bulletin contains details of agro-ecological setting, land use potentials and constraints for each sub-region along with the information of benchmark soils occurring in the sub-region. The publication will be helpful in macro and meso-level perspective planning for sectoral land use in the country. The Bureau has started to generate the data base for at least one district in each state as a model district database information system. NBSS&LUP has brought out Soil Resource Mapping of Orissa and Chhattisgarh and A.P. states on 1:250,000 scale and 500 copies of each were supplied to State Govt. for planning and development of land use in the state.. The Soil Resource Data was further interpreted for developing suitable land use planning at district level. As per requirement, the resource data was interpreted for planning district-wise land use. For example Soil Resource Atlases for the 22 districts in A.P. and two districts of Bilaspur and Jagdalpur in Chhattisgarh for land use planning are brought out . Similar action for the districts in Orissa are under progress.
C8	Immediate steps may be taken to speed up the work under acid soil network in eastern Region.	Director, IISS	An adhoc project on "Soil Characterisation and Resource Management of Acid Soil Regions for Increasing Productivity" was initiated in a network mode with eight Centres viz., BAU, Ranchi; AAU, Jorhat; ICAR Complex, Shillong, BCKV, Kalyani; OUAT,

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			Bhubaneswar; KAU, Kerala; HPKV, Palampur and KKV, Dapoli to undertake research work under acid soils in eastern region. Dr.A.K.Sarkar of BAU, Ranchi is the PI of this adhoc network project.
Ag.Engineering			
D1	The Agril. Engg. Departments of the Universities may submit proposals for revolving fund to produce prototypes and popularise the machinery developed by the University and the other ICAR institutes in the Region including CIAE, Bhopal	IGAU	An ICAR funded revolving fund schemes are in operation in IGAU, which are running in profit. It is providing implements to farmers directly and through State Department of Agricultural Engineering. The workshop of IGAU sold implements of more than Rs.60 lakh.
		OUAT	Prototypes and production processes of power operated paddy thresher, groundnut decorticator, power and pedal operated groundnut thresher developed by OUAT were finalized at the implment factory, Govt. of Orissa and released for commercial production. All these items are now being manufactured in the state through SSI units. A scheme for prototype production was submitted to ICAR for consideration and the Council has suggested for recasting of the same thoroughly. It will be resubmitted shortly. Development and promotion of prototypes for tillage and seeding in participation with local manufacturers/artisan is in operation since December 2000 thorugh NATP RRPS-33 project for the University and Eastern India with five sub centers located at IGKV, Raipur, CIAE, Bhopal, RAU, Samastripur, NAUAT, Faizabad and AAU, Jorhot. AICRP on Power Tiller at OUAT has been converted to AICRP on FIM since April 2002. Proposal is under process for submission to the Council for prototype production under AICRP on FIM.
		DDG (Engg.)	The SMD has already sanctioned revolving fund schemes to produce prototypes and popularize the machinery to ANGRAU and IGAU, CIAE, Bhopal. Proposal from OUAT is awaited.
		ANGRAU,	ICAR has sanctioned revolving fund to the Agril.Engg. Division of ANGRAU to produce prototypes and popularize the machinery developed at the University.
		CIAE, Bhopal	Prototypes are being manufactured and supplied by CIAE and AICRP on FIM scheme through its centers as and when demand is received. The CIAE has supplied following items in the Region V during the last two years. Andhra Pradesh: 1. Double screen cleaner (1 No.) 2. Tubular maize sheller(1 no.) 3. Groundnut decorticator (1 no.) 4. Single wheel hoe (5 nos.) 5. Peg type weeder (8 nos.) 6. Twin wheel hoe (2 nos.) 7. Grubber weeder (6 nos.) 8. PAU weeder (1 no.) 9. Pedal cum power operated cleaner (1 No.)

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			Total: 26 Chhattisgarh 1. Tubular maize shelters (1 no.) Orissa 1. Tubular sheller (1 no.) 2. Serrated sickle (500 nos.) Total 501 Grand total 528 Year-wise fabrication and supply of prototypes by the Institute in the country as a whole are as follows: i) Year 2001-02 : 3278 units ii) Year 2002-03 : 2105 units
D2	Development efforts should be intensified for water conservation in the region. Small pond technology with plastic lining floating plastic film to be encouraged to prevent percolation and evaporation losses. Other options to be considered are bunding for *in situ* conservation of rainwater, check dams and shallow tubewells.	Dept.of Agri., AP,	These recommendations have been communicated to all the concerned in the department. Water conservation aspect is being considered during execution of various soil conservation structures. Rain water harvesting structures are being encouraged in large scale in watersheds.
		Dept.of Agri., Govt.of Orissa	STWs and Dug Wells are being installed in the field through private initiation by providing subsidy to the farmers. Water conservation measures like check dam, rainwater conservation structur, percolation tanks are being implemented by soil conservation directorate.
D3	Nursery raising of paddy under irrigated condition should be taken up by the State Deptt. in Chhattisgarh	Dept.of Agri., Chhattis garh	
D4	Use of manual, self propelled transplanter, pre-germinated paddy seeds to be used in view of the labour constraints	Dept.of Agri., Chhattis garh	
D5	IGKV should carry out a thorough - study on various aspects of Madagasker system of paddy cultivation	IGKV, Raipur	The studies on madagaskar system of paddy cultivation was undertaken at Raipur, Jagdalpur and Ambikapur. The results are encouraging. This sytem of rice cultivation is suitable for well managed irrigated area.
D6	ANGRAU should submit project proposal from Agril.Engg. College, Bapatla, for consideration of ICAR	Agril. Engg. College, ANGRAU , Bapatla	Action being initiated
D7	Use of vertical conveyor reaper for harvesting and threshing of paddy need to be revived and encouraged in the region.	Dept. of Agri. AP,	This is being done.
		Orissa and Chhattisgarh	Self propelled paddy reaper of KAMCO & Vardhan make are popularized in the State since 2001-02. More than 800 self propelled paddy reapers have been popularized in the state. Pedal operated thresher, power thresher, power thresher-cum-winnower are being popularized in large numbers.

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Animal Husbandry/Poultry			
E1	This region has tremendous scope for backyard poultry. Vanaraja has been introduced and found promising. The Veterinary Colleges in the Universities with the help of the Dept. of Animal Husbandry should evaluate the comparative performance of birds developed by CARI, Kerala, Ranchi and PDF. The POP, Hyderabad should coordinate this task and furnish the recommendation for implementation in different States in a span of two years.	OUAT	The Department of Poultry Science of College of Veterinary Sciences will prepare the programme in consultation with the POP, Hyderabad to evaluate the comparative performance of birds developed by CARI, Kerala, Ranchi and POP.
		ANGRAU	Keeping in view the potentiality of 'Vanaraja' birds, the University organized a National Seminar titled 'Appropriate Poultry for adverse enviroinment' on 11-1-2001 at Rajendranagar, Hyderabad, in collaboration with Project Directorate on Poultry to popularize the Vanaraja and Giriraja birds, suitable to adverse environmental conditions.
		PDP, Hyd;	This recommendation was sent to the Directors of Research, ANGRAU, Hyderabad; BAU, Ranchi; IGAU, Raipur; JNKV, Jabalpur; KAU, Trichur and OUAT, Bhubaneswar, besides Director, CAZRI, Izatnagar, for implementation of the said programme. Meanwhile, POP continued its efforts to propagate Vanaraja and Gramapriya developed by the Directorate. Although vanaraja has been found to be very promising and well accepted throughout AP and almost the entire tribal belt of Orissa, it has also made a dent in Andaman & Nicobar islands at Port Blair. The technical personnel are trained at PD on poultry who in turn train the farmers/beneficiaries in the NEH region. Vanaraja bird although had done exceedingly well in the tribal belt of Orissa being propagated through the CARI Regl.Centre, Bhubaneswar, of late, CARI has introduced its own developed germplasm for rural and tribal people in the tribal areas of Orissa. However, the performance report is awaited. The Grama Priya is laying bird too, which has been developed at this Directorate has been found to give very satisfactory performance in the coastal belt of Kerala. It is being propagated through the revolving fund scheme operated by KAU, Mannuthy. Another laying type bird developed at JNKVV, Jabalpur and is known as KRISHNA-J has been reported to be doing well in the tribal areas of MP. A dual type bird known as GIRIRAJA, which was developed by UAS, B'lore is taking care of the rural household of Karnataka. A bird developed by KVK at Ranchi known as DIVYAYAN has also been reported to be performing satisfactory. Since no authentic scientific data is available to make the comparison to all those developed at different places, the recently established center at Agartala is making all efforts to keep the germplasm and test the performance in the tribal areas at farmers door. Because of the limited facilities, only two stocks are being tested presently and others will be tested turn by turn. Efforts are being made to establish a few more centers during the X Plan, in tribal/hill regions/coastal regions to initiate research activities for the production of poultry germplasm which

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			can withstand the harsh and difficult environment and can produce reasonably well on low cost/input basis. Proposal is being submitted for the approval of the council to establish these centers during X Plan.
E2	A team under the Chairmanship of ADG (AS) may meet and evolve strategies for augmenting fodder availability in the region. Representatives from CRRI and IGFRI may be involved besides the Coordinators dealing with the forage crops. This must be accorded top priority considering that the matter has already been quite delayed.	ADG (AS), ICAR	Director, IGFRI has been informed to initiate the action.
E3	The blue tongue disease of sheep continues to be a major concern in Andhra Pradesh. ANGRAU may intensify research on the problem and submit proposals to the Council for any project based assistance.	DDG (AS)	A network programme on blue tongue has already been prepared and submitted for consideration by SFC. The Agricultural University is one of the collaborating centers of the programme.
		ANGRAU	The University has submitted proposals to ICAR to conduct research on Blue tongue for financial assistance during 2000-01. The ICAR has sanctioned "Network Project on Blue Tongue" at College of Veterinary Science, Rajendranagar, with financial outlay of Rs.6.25 lakhs during 2001-02. The research work is in progress. The University has proposed Rs.56.00 lakhs during X Plan to ICAR for conducting research on Blue tongue.
Fisheries			
F1	In view of the pollution concerns with brackishwater prawn culture, it is essential to encourage freshwater prawn culture in the region. AP has already taken the initiative which need to be extended to other states.	Dept. of Fish., MP	The subordinate officers have been instructed to start prawn culture in their areas. It has started few experiment farms in Jhabua, Balaghat, and Bhopal districts.
		Dept. Fish., AP,	The Govt of A.P. is giving special focus for development of fisheries, which is identified as a Growth Engine under Vision-2020. Freshwater prawn culture is being encouraged in A.P. while keeping in view the pollution concerns in brackishwater prawn culture.
		Orissa	So far as culture of Freshwater prawn is concerned more and more fish farmers are being encouraged to go for freshwater prawn culture. During the year 2002-03, 62.432 lakh of prawn seed have been stocked in 3359.50 hectare water area. Steps have been taken to establish freshwater prawn seed hatchery in private sector to meet the future demand of seed. In the meantime, in addition to one small scale deptl.fresh water prawn seed hatchery (M. rosenbergii) two more hatcheries of the same species of 1 1.25 million capacity have been established.
F2	The latest technology in cage culture may be demonstrated	Dept. of Fish. MP	The CIFA, Bhubaneswar was requested to inform about the tentative dates and venue for demonstration of

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	through FLDs by CIFA in partnership with the State Dept. of Fisheries. The focus should be economic viability of the enterprise for small farmers. The decision was taken in the meeting held at CRIDA in 1998. Hence, the task must be carried out on top priority and action taken reviewed by the midle of 2001.		technology so that some officers of this Department could be sent. However, no reply has been received.
		CIFA	Demonstration of cage and pen culture forms a part of regular training programme of the peninsular acquaculture division of CIFA, Bangalore. Attempts are being made to develop it a Model Lead Centre for demonstration of cage and pen culture. Liaisoning is being maintained with the State Fisheries Departments for technology demonstration. One such Sardar Sarovar Project for cage culture with State Fisheries Dept.of Gujarat is in pipeline.
		Dep. of Fish. Orissa	Culture of improved Jayanti rohu was undertaken in cage ($10m^2$) with stocking density of 1 00 and 1 50 at this center. After 6 months of culture, mean length increased from 263.4±5.84 mm to 320.39± 16.74 mm and weight from 237.67±4.84g to 446.36±59.01 g. however, the growth rate was higher (1.16g/day) in lower stocking (100) density as compared to those (0.68 g/day) reared under high stocking (150).
F3	In view of the recurring occurrence of white spot disease of prawns the possibility of setting up of a disease diagnostic centre in Krishna or West Godavari district of A.P. maybe explored.	ANGRAU	The University is considering to establish one disease diagnostic laboratory for fisheries in Krishna/West Godavari districts to cater to the needs of farmers and on spot diagnosis of dreadful diseases of fisheries (white spot). Suitable proposals for assistance by ICAR are being submitted separately.
Ag.Education/Extension			
G1	The model of district agricultural advisory and technology transfer (DAATT) centres for technology demonstration to the farmers as introduced by the Govt. of Andhra Pradesh has started yielding good results. It was suggested that the Govt. of Orissa and Chhattisgarh may follow this novel model from Andhra Pradesh.	Dept. of Agri. Orissa and Chhattisgarh	The actions will be initiated for formation of DAATT for transfer of technology demonstration to the farmers.
G2	Some of the Depts. Like microbiology, biotechnology and the existing dept. of agricultural engineering at Bapatla of ANGRAU need to be strengthened in view of the increasing role of these disciplines and the relatively weak position of the University at present. The University may send specific proposal to the Council for appropriate assistance.	ANGRAU	Proposals were already submitted to ICAR for improving infrastructural facilities are College of Agricultural Engineering, Bapatla. Under AHRD, sophisticated equipment was purchased for Microbiology and Biotechnology Departments. A separate Department of Agricultural Biotechnology was established and M.Sc. programme has been started from the academic year 2001-02. Proposals were sent to AP-NL Biotechnology Project and Government of Andhra Pradesh for providing funds. The matter is being pursued with the Government.

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G3	There is a need to strengthen veterinary and dairy technology colleges in IGAU and OUAT to bring them on par with other colleges in the country. A suitable assistance mechanism may be devised by the DDG (Edn.). Meanwhile the Departments may develop up specific and time bound research schemes for assistance under Cess Fund/NATP CGP to get some assistance to build up the capital assets and initiate research.	IGAU	The project for strengthening the veterinary and dairy technology colleges have been submitted both to ICAR and state government. The adhoc projects under NATP and CESS funds were sent to ICAR and three NATP projects have been sanctioned in both the faculties.
		OUAT	The University had earlier submitted a proposal to ICAR for establishment of Dairy Technology College in OUAT. It may meet the demands for eastern India. It may be considered at ICAR level
		DDG (Edn)	
G4	There is a need to popularise the various financial schemes/opportunities provided through NABARD regional offices to entrepreneurs in agriculture and animal husbandry. The KVKs in the zone should interface between the progressive farmers/entrepreneurs and the NABARD offices in setting up some viable projects. The ZCs in the region should take special interest on this issue and monitor the progress from time to time.	ZC(V)	All the KVKs in AP were requested to take necessary action as per the recommendations of the Regional Committee. In this regard, as per the information received from some of the KVKs, the NABARD office in the respective districts has been contacted for taking necessary action. In case of one of the KVKs at Karimnagar, it was reported to be in active interaction with NABARD for implementation of various programmes since 1994. Vikas Voluntary Vahini, a farmers club was started at Marripalligudem Village of Kamalapur Mandal, in 1994-95. The club members were provided with crop loans and Dairy loans with the assistance of NABARD. Pragathi Mahila club, another one was started at Challur village with 60 women. The women were encouraged to take thrift and credit activity. Desilting of tank was taken up with the assistance of NABARD and Andhra Bank. Linkage of self help group of women was also helped by NABARD through local banks. So far about 50 Self Help Groups (SHGs) were linked to the banks for financial assistance.
		ZC (VII)	
		DDG (Engg.)	
		DDG(AE)	The SMD and NABARD organized one Seminar on Post Harvest Technology at Lucknow. The NABARD is implementing various financial schemes through State Government and not directly with the farmers.

Agenda Item No. VI

Agricultural Production and Productivity Trends in Region V

PRODUCTION AND PRODUCTIVITY TRENDS IN REGION NO.V DURING 1997-98 TO 2001-2002.

The Region No. V comprises of Orissa, Andhra Pradesh and the newly created state Chhattisgarh. However, in the present analysis, only some part of the data for Chhattisgarh have been used as complete data is not available at present. In the last Regional Committee Meeting held at the Raipur on 8-9th September, 2000, an analysis was presented for the period from 1994-95 to 1998-99. Here on analysis is being presented on the production and productivity trends in Region No. V during 1997-98 to 2001-2002.

The region produced a total of 28.21 million tonnes of foodgrains during 2001-2002 from an area of 17.49 million ha. Thus, the average productivity of foodgrains was 1613 kg/ha which was slightly below the national average productivity of 1739 kg/ha during 2001-2002. The productivity of foodgrains in Andha Pradesh was 2106 kg/ha which is about 20 percent higher than the national productivity. Nonetheless, it is a food deficit state because of higher population percentage. (Table 1 & 2).

Orissa is also considered as a marginally food deicit state with foodgrain - 3.57 percent of total production in the Country for the 3.58 percent of total population in the Country. Chhattisgarh with a total area of 5.03 million hactares under foodgrains production of 5.81 million tonnes with an average productivity of 1156 kg/ha which is about two third of the national average productivity.

Fertiliser consumption (N,P,K) in Orissa is erratic in nature during the period from 1997-98 to 2000-2001 and one - fourth of Andhra Pradesh. The trend in Andhra Pradesh has been growing up with highest fertiliser consumption of 179.20 kg/ha in 2000-01. The data on Gross Cropped Area and Irrigated Area (%) are not completely available. (Table 3).

Rice production during 1997-98 to 2001-2002

Area as well as yield under rice production have registered an increasing trend in both Orissa & Andhra Pradesh during the period from 1997-98 to 2001-2002. The yield of rice has increased by 15.14% in Orissa against an increase in area by 0.07% only. There has been increase of 22.50% in productivity against increase in area by 9.29% in Andhra Pradesh. (Table 4 & 5).

Wheat production during 1997-98 to 2001-2002

Both area and yield under wheat production have increased in both the states viz Orissa and Andhra Pradesh by 40.00% and 27.27% in area and 14.7% and 31.0% in productivity respectively.

Total Coarse Cereals production during 1997-98 to 2001-2002

A marginal fall in area by 2.63% corresponding to decrease in yield of total coarse cereals by 11.20% has occurred in Orissa whereas the yield of Coarse Cereals has increased by 43.10% despite the decrease in area by 10.17% in Andhra Pradesh.

Total Pulses production during 1997-98 to 2001-2002

The yield under total pulses has increased significantly by 80.30% in Andhra Pradesh against an increase in area by 21.91%. In case of Orissa, area has decreased very marginally by 7.30% and correspondingly yield has increased marginally by 4.12%.

Production of Oilseeds during 1997-98 to 2001-2002

During the period from 1997-98 to 2001-2002 both Orissa and Andhra Pradesh registered a decreasing trend in area under total oilseeds by 25.81% and 6.04% respectively which was also noticed in earlier analysis made for the period from 1994-95 to 1998-99. Corresponding to the decrease in area, there has been increase in yield by 20.62% in Andhra Pradesh during the period from 1997-98 to 2001-2002 while it stagnated in Orissa. The yield of rapeseed/mustard has gone up significantly by 206.75% in Andhra Pradesh against the decrease in area by 53.49% during 1997-98 to 2001-2002. The productivity under sesamum has also increased quite substantially by 81.42% despite decrease in area by 5.51% in Andhra Pradesh during 1997-98 to 2001-2002. One noticeable point is that both area as well as yield under Groundnut and Rapeseed/Mustard have exhibited a down trend in Orissa during 1997-98 to 2001-2002.

Producltion of Cotton, Sugarcane & Potato during 1997-98 to 2001-2002

Area under Cotton in Orissa and Andhra Pradesh has increased by 62.73% & 21.44% and correspondingly yield has also increased very marginally by 2.16% in Orissa and substantially by 16.53% Andhra Pradesh. Sugarcane exhibited down fall in area as well as yield by 40.64% and 4.62% respectively in Orissa whereas both area and yield of Sugarcane in Andha Pradesh have shown an increasing trend by increasing by 10.61% and 14.07% respectively during 1997-98 to 2001-2002. Under Potato production, area has suffered a set back by 14.61% but yield has increased by 5.05% in Orissa and the reverse happened in case of Andhra Pradesh. In Andha Pradesh, the yield of Potato has gone down by 1.56% against an increase in area by 33.33% during 1997-98 to 2001-2002.

Production of Horticultural Crops during 1997-98 to 2000-2001

Banana, Citrus, Papaya, Mango and Sapota are major fruits in Orissa and Andhra Pradesh. No data is available in the state of Chhattisgarh. Yield of Banana has increased by 9.26% despite a fall of in area by 31.38% in Orissa during 1997-98 to 1999-2000. In Andhra Pradesh also, yield of Papaya has increased very marginally by 0.40% against percent decrease in area by 28.03%. Under Citrus production, both area and yield have increased by 5.40% and 9.62% respectively in Orissa during 1997-98 to 2000-2001. Yield of Citrus has suffered a setback by 10.00% in Andhra Pradesh though area has increased by 21.53%. Area as well as yield under Papaya production have increased by 38.10% and 54.35% respectively in Andhra Pradesh. Yield of Mango in both Orissa and Andhra Pradesh exhibited a decreasing trend by 18.60% and 33.33% respectively, though corresponding area has gone up by 6.35% and 10.86% during 1997-98 to 2000-2001. Yield under Sapota in Andhra Pradesh has remained almost static despite an increase in area by 6.38% in Andhra Pradesh whereas yield of

Sapota has gone up by 24.24% in Orissa against a fall off percentage in area by 23.08% during 1997-98 to 2000-2001.

Production of Milk, Egg, Wool and Fish during 1997-98 to 2001-2002

Milk production has exhibited an increasing trend in both Orissa and Andhra Pradesh during 1997-98 to 2000-2001. The percent increase in milk for the period 1997-98 to 2001-2002 has been 28.72% and 15.02% respectively in Orissa and Andhra Pradesh. Egg production has significantly increased by 60.62% in Orissa for the period from 1997-98 to 2001-2002. There is no Wool production in Orissa as usual. There is no much percent change in the production of egg and wool in Andhra Pradesh during 1997-98 to 2001-2002. There has been remarkable increase in fish production by 81.33% in Andhra Pradesh and a decrease in production in Orissa by 8.90% during 1997-98 to 2001-2002.

In the above analysis that is presented here, no attempt has been made to analyse the reasons or constraints for the changes in area and productivity. It is expected that the respective states will present their own point of view with regard to these issues and put forward their suggestions for research agenda.

'ABLE 1: AREA, PRODUCTION AND PRODUCTIVITY OF FOODGRAINS DURING 1997-98 TO 2001-2002 IN REGION NO. V.

A – Area in M. Ha. P – Production in M. Tonnes Y – Productivity in Kg/Ha.

ES ?RISIN E ON	WHEAT			RICE			TOTAL COARSE CEREALS			TOTAL PULSES			TOTAL OILSEEDS			TOTAL FOODGRAINS		
	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
;A																		
8	0.005	0.007	1320	4.50	6.20	1380	0.19	0.14	723	0.79	0.29	364	0.42	0.19	452	5.48	6.64	1211
9	0.004	0.004	1189	4.45	5.39	1212	0.20	0.15	758	0.72	0.25	345	0.38	0.16	424	5.37	5.79	1079
000	0.006	0.008	1305	4.60	5.19	1127	0.20	0.16	832	0.68	0.26	387	0.34	0.16	469	5.49	5.62	1025
001	0.009	0.013	1466	4.43	4.61	1041	0.20	0.14	729	0.60	0.21	352	0.28	0.12	425	5.25	4.98	950
002	0.007	0.011	1514	4.50	7.15	1589	0.19	0.12	642	0.73	0.28	379	0.31	0.14	453	5.42	7.56	1393
RA ESH																		
8	0.011	0.006	545	3.50	8.51	2431	1.44	1.79	1239	1.56	0.52	330	2.60	1.42	548	6.52	10.82	1660
9	0.012	0.006	500	4.32	11.88	2752	1.46	2.19	1508	1.59	0.83	521	2.75	2.47	898	7.37	14.90	2022
000	0.014	0.009	667	4.01	10.64	2650	1.47	2.25	1535	1.64	0.80	486	2.57	1.38	536	7.14	13.70	1919
001	0.014	0.008	571	4.24	12.46	2936	1.51	2.51	1658	1.90	1.05	554	2.71	2.51	927	7.67	16.03	2089
002	0.014	0.010	714	3.82	11.39	2978	1.30	2.30	1773	1.91	1.14	595	2.44	1.61	661	7.04	14.84	2106
.TTIS																		
8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
001	0.078	0.080	1022	3.77	2.37	629	0.41	0.18	452	0.67	0.27	400	0.27	0.09	329	4.93	2.90	589
002	0.097	0.099	1024	3.73	5.13	1374	0.37	0.16	421	0.82	0.42	514	0.30	0.11	387	5.03	5.81	1156
NDIA AGE 002	-	-	2770	-	-	2086	-	-	1142	-	-	609	-	-	897	-	-	1739

LE 3: AREA, IRRIGATION AND MAJOR INPUTS IN REGION NO. V DURING 1997-98 TO 2001-2002.

O.	STATES COMPRISING THE REGION	GROSS CROPPED AREA (M.HA)	IRRIGATED AREA (%)	AREA UNDER FOODGRAINS (M.HA)	FERTILIZER (N,P,K) CONSUMPTION (KG/HA)
	ORISSA				
	1997-98	8.64	26.81	5.48	30.08
	1998-99	8.42	27.99	5.37	36.41
	1999-2000	-	-	5.49	41.66
	2000-2001	-	-	5.25	36.93
	2001-2002	-	-	5.42	-
	ANDHRA PRADESH				
	1997-98	12.14	42.50	6.52	129.93
	1998-99	13.62	44.71	7.37	149.73
	1999-2000	-	-	7.14	174.59
	2000-2001	-	-	7.67	179.20
	2001-2002	-	-	7.04	
	CHHATTISGARH				
	1997-98	-	-	-	-
	1998-99	-	-	-	-
	1999-2000	-	-	-	-
	2000-2001	-	-	4.93	-
	2001-2002	-	-	5.03	-

TABLE 4: PERCENT CHANGE IN AREA UNDER FOODGRAINS IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	CROP/COMMODITIES	ORISSA	ANDHRA PRADESH	CHHATTISGARH
1	WHEAT	40.00	27.27	-
2	RICE	0.07	9.29	-
3	PEARL MILLET	5.26	-4.17	-
4	SORGHUM	-8.67	-19.01	-
5	MAIZE	-1.15	8.33	-
6	TOTAL COARSE CEREALS	-2.63	-10.17	-
7	TOTAL PULSES	-7.30	21.91	-
8	TOTAL FOODGRAINS	-1.05	8.04	-

TABLE 5: PERCENT CHANGE IN PRODUCTIVITY UNDER FOODGRAINS IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	CROP/COMMODITIES	ORISSA	ANDHRA PRADESH	CHHATTISGARH
1	WHEAT	14.70	31.01	-
2	RICE	15.14	22.50	-
3	PEARL MILLET	-9.70	9.03	-
4	SORGHUM	6.75	51.91	-
5	MAIZE	-26.14	24.35	-
6	TOTAL COARSE CEREALS	-11.20	43.10	-
7	TOTAL PULSES	4.12	80.30	-
8	TOTAL FOODGRAINS	15.03	26.87	-

TABLE 6: PERCENT CHANGE IN AREA UNDER OILSEEDS IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	CROP/COMMODITIES	ORISSA	ANDHRA PRADESH
1	GROUNDNUT	-34.57	7.82
2	CASTOR	-15.45	66.31
3	RAPESEED/MUSTARD	-28.28	-53.49
4	SESAMUM	-18.84	-5.51
5	SOYABEAN	-	25.16
6	TOTAL OILSEEDS	-25.81	-6.04

TABLE 7: PERCENT CHANGE IN PRODUCTIVITY UNDER OILSEEDS IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	CROP/COMMODITIES	ORISSA	ANDHRA PRADESH
1	GROUNDNUT	4.12	17.30
2	CASTOR	-2.01	18.15
3	RAPESEED/MUSTARD	-4.32	206.75
4	SESAMUM	17.55	81.42
5	SOYABEAN	-	7.07
6	TOTAL OILSEEDS	0.22	20.62

TABLE 8: AREA, PRODUCTION AND YIELD OF COTTON, SUGARCANE AND POTATO IN REGION NO. V DURING 1997-98 TO 2001-2002.

S.NO.	STATES COMPRISING THE REGION	COTTON			SUGARCANE			POTATO		
		A (Th. Ha.)	P (Th. Bales of 170 Kgs each)	Y (Kg./Ha.)	A (Th. Ha.)	P (Th. Tonnes)	Y (Kg./Ha.)	A (Th./Ha.)	P (Th. Tonnes)	Y (Kg./Ha.)
1	ORISSA									
	1997-98	22.0	36.0	278	18.7	1144.0	61176	8.9	87.4	9820
	1998-99	29.0	53.0	311	22.3	1469.5	65897	8.0	92.6	11575
	1999-2000	38.1	61.0	272	20.6	1080.3	52442	8.8	84.8	9636
	2000-2001	40.4	65.3	275	16.8	963.9	57375	8.3	85.9	10349
	2001-2002	35.8	59.8	284	11.1	647.7	58351	7.6	78.4	10316
2	ANDHRA PRADESH									
	1997-98	906.1	1320.4	248	192.2	13955.0	72607	1.8	11.2	6222
	1998-99	1280.9	1522.0	202	213.7	16503.3	77226	1.5	11.2	7467
	1999-2000	1039.0	1595.0	261	231.0	18508.0	80121	1.7	11.3	6647
	2000-2001	1021.7	1662.7	277	217.4	17690.1	81371	2.0	14.0	7000
	2001-2002	1100.4	1871.5	289	212.6	17607.5	82820	2.4	14.7	6125
3	CHHATTISGARH									
	1997-98	-	-	-	-	-	-	-	-	-
	1998-99	-	-	-	-	-	-	-	-	-
	1999-2000	-	-	-	-	-	-	-	-	-
	2000-2001	0.1	Neg	-	3.3	8.6	2606	9.1	66.0	7253
	2001-2002	0.1	0.1	170	4.0	10.2	2550	9.6	71.3	7427

TABLE 9: PERCENT CHANGE IN AREA UNDER COTTON, SUGARCANE AND POTATO IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	CROP/COMMODITIES	ORISSA	ANDHRA PRADESH
1	COTTON	62.73	21.44
2	SUGARCANE	-40.64	10.61
3	POTATO	-14.61	33.33

TABLE 10: PERCENT CHANGE IN PRODUCTIVITY UNDER COTTON, SUGARCANE AND POTATO IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	CROP/COMMODITIES	ORISSA	ANDHRA PRADESH
1	COTTON	2.16	16.53
2	SUGARCANE	-4.62	14.07
3	POTATO	5.05	-1.56

TABLE 11: AREA, PRODUCTION AND PRODUCTIVITY OF MAJOR HORTICULTURAL PRODUCTS DURING 1997-98 TO 2000-2001 IN REGION NO. V.

A – Area in Th. Hq. P – Production in Th. Mt. Y – Productivity in Mt./Hq.

SL. NO.	STATES COMPRISING THE REGION	BANANA			CITRUS			PAPAYA			MANGO			SAPOTA		
		A	P	Y	A	P	Y	A	P	Y	A	P	Y	A	P	Y
1	ORISSA															
	1997-98	23.9	257.4	10.8	22.2	115.8	5.2	16.8	282.8	16.8	97.6	417.4	4.3	3.9	12.8	3.3
	1998-99	24.7	276.8	11.2	23.6	177.4	7.5	17.9	285.0	15.9	109.8	490.6	4.5	4.1	16.9	4.1
	1999-2000	16.4	193.5	11.8	21.3	124.2	5.8	10.4	199.5	19.2	96.2	343.5	3.6	2.9	11.8	4.1
	2000-2001	-	-	-	23.4	132.7	5.7	10.7	219.7	20.5	103.8	363.3	3.5	3.0	12.2	4.1
	2001-2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	ANDHRA PRADESH															
	1997-98	45.3	1131.9	25.0	~~67.8~~	~~1017.4~~	~~15.0~~	2.1	156.9	74.7	276.2	3314.4	12.0	4.7	56.4	12.0
	1998-99	36.9	922.1	25.0	65.0	952.8	14.7	1.4	105.8	75.6	252.1	2269.6	9.0	4.1	57.6	14.0
	1999-2000	48.5	1212.5	25.0	77.7	1166.1	15.0	1.8	132.0	73.3	297.5	2379.6	8.0	5.0	60.2	12.0
	2000-2001	32.6	819.7	25.1	82.4	1113.8	13.5	2.9	334.3	115.3	306.2	2449.5	8.0	5.0	59.8	12.0
	2001-2002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	CHHATTISGARH															
	1996-97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1997-98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1998-99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1999-2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2000-2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 12: PERCENT CHANGE IN AREA UNDER MAJOR HORTICULTURAL PRODUCTS DURING 1997-98 TO 2000-2001.

SL. NO.	STATES	BANANA	CITRUS	PAPAYA	MANGO	SAPOTA
1	ORISSA	-31.38*	5.40	-36.31	6.35	-23.08
2	ANDHRA PRADESH	-28.03	21.53	38.10	10.86	6.38

NOTE: * PERCENT CHANGE IS CALCULATED FOR THE PERIOD FROM 1997-98 TO 1999-2000

TABLE 13: PERCENT CHANGE IN PRODUCTIVITY UNDER MAJOR HORTICULTURAL PRODUCTS DURING 1997-98 TO 2000-2001.

SL. NO.	STATES	BANANA	CITRUS	PAPAYA	MANGO	SAPOTA
1	ORISSA	9.26*	9.62	22.02	-18.60	24.24
2	ANDHRA PRADESH	0.40	-10.00	54.35	-33.33	0.00

NOTE: *PERCENT CHANGE IS CALCULATED FOR THE PERIOD FROM 1997-98 TO 1999-2000

TABLE 14: PRODUCTION OF MILK, EGGS, WOOL AND FISH IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	STATES COMPRISING THE REGION	MILK (IN TH. TONNES)	EGGS (IN LAKH NOS.)	WOOL (IN TH. KGS.)	FISH (IN TH. TONNES)
1	ORISSA				
	1997-98	672	7300	-	309.51
	1998-99	733	7628	-	284.23
	1999-2000	847	6483	-	261.24
	2000-2001	875	7301	-	259.64
	2001-2002	865*	11725*	-	281.95**
2	ANDHRA PRADESH				
	1997-98	4473	57516	2972	372.86
	1998-99	4842	59248	3080	410.82
	1999-2000	5122	63450	3136	547.06
	2000-2001	5521	68004	3289	589.69
	2001-2002	5145*	63160*	3392*	676.11**
3	CHHATTIS-GARH				
	1997-98	-	-	-	-
	1998-99	-	-	-	-
	1999-2000	-	-	-	-
	2000-2001	-	-	-	43.39
	2001-2002	-	-	-	95.76**

NOTE: * Anticipated Achievement.
**Provisional

TABLE 15: PERCENT CHANGE IN PRODUCTION OF MILK, EGG, WOOL AND FISH IN REGION NO. V DURING 1997-98 TO 2001-2002.

SL. NO.	STATES COMPRISING THE REGION	MILK	EGG	WOOL	FISH
1	ORISSA	28.72	60.62	-	-8.90
2	ANDHRA PRADESH	15.02	9.81	14.13	81.33

Agenda Item No. VII

Fresh Agenda Items

VII. FRESH AGENDA ITEMS:

State-wise Problems and Research Needs/Development Issues

Andhra Pradesh

A-1 Issues/problems/concerns raised by State Dept.of Agriculture/Hortitulture/
Animal Husbandry/Fisheries
APC/Secretary (Agri./Hort./AH/Fisheries)
Director of Agri. ./Hort./AH/Fisheries)

B-1 Responses by the SAUs
VC/Dir.of Research/Dir.of Extn.

Orissa

A-2 Issues/problems/concerns raised by State Dept.of Agriculture/Hortitulture/
Animal Husbandry/Fisheries
APC/Secretary (Agri./Hort./AH/Fisheries)
Director of Agri. ./Hort./AH/Fisheries)

B-2 Responses by the SAUs
VC/Dir.of Research/Dir.of Extn.

Chhattisgarh

A-3 Issues/problems/concerns raised by State Dept.of Agriculture/Hortitulture/
Animal Husbandry/Fisheries
APC/Secretary (Agri./Hort./AH/Fisheries)
Director of Agri. ./Hort./AH/Fisheries)

B-3 Responses by the SAUs
VC/Dir.of Research/Dir.of Extn.

FRESH AGENDA ITEMS

A 1: ISSUES / PROBLEMS / CONCERNS RAISED BY STATE DEPT. OF AGRICULTURE / HORTICULTURE / ANIMAL HUSBANDRY / FISHERIES

A 1.1: STATUS REPORT ON AGRICULTURAL DEVELOPMENT IN ANDHRA PRADESH (DIRECTOR OF AGRICULTURE, GOVT. OF ANDHRA PRADESH)

2. Project proposals of pre-identified areas based on the recommendations of the last Regional Committee meeting for certain NABARD, R &D funding involving State Govts. SAU and ICAR Institutes in a partnership role.

Action will be taken after communication of identified areas and guidelines by the NABARD.

3. The status/constraints and failures, if any, of the technologies that were passed on to the extension functionaries of the State Govt. by the R & D Institutions.

A report on status/constraints/failures on technologies that were passed on to the extension functionaries of the State Govt. by the R.D institutions

a. Status of varieties of seeds/planting material released

Sl.No	Crop/culture	Research station where developed	Name proposed	Salient features/justification for release
1.	Paddy JGL – 1798	R.A.R.S.;Jagtial	Jagtial sannalu	Suitable for Telangana region for June & July planting, medium duration, medium slender grain, resistant to gallmidge.
2.	JGL-384	RARS; Jagtial	Jagtial Mashuri	Suitable for Northern Telangana medium duration fertiliser responsive to fertiliser tolerant to BLB, BPH, Blast and gallmidge.
3	WGL-14377 (IET-14848)	ARS; Warangal	Varalu	Developed on basis of gaps identified in ZREAC. Suitable for direct sowing extra short duration , resistance to gallmidge. Cold resistance. Suitable for Kharif and Rabi
4	RNR-18833	ARI; Rajendranagar	Sumathi	Highly scented rice yield higher than "Pusa Basmathi" with 71% milling percentage,

Sl.No	Crop/culture	Research station where developed	Name proposed	Salient features/justification for release
				13 mm kernel. Suitable for kharif photo- insensitive. Tolerent to blast & gallmidge.
5	BPT-1768	RRS; Baptla	Bapatla sannalu	Developed to avoid cyclone problem, requires low nitrogen, withstands submergence. Fine variety. Photo-insensitive.
6	NLR-33654	ARS; Nellore	Apoorva	Suitable for raw consumption. Fertiliser responsive. Resistant to blast. Suitable for kharif and also in Rabi in North Eastern monsoon influential areas.
7	NDLR-8	RARS; Nandyal	Nandyal sannalu	Suitable for Kurnool and Ananthapur. Tolerance to BPH, leaf folder. Good substitute for BPT 5204.
8	MTU-1031	ARS; Maruteru	Tholakari	Good substitute for "Krishnaveni". Non-lodging. High yielding, tolerant to BPH & BLB.
9	MTU-1032	ARS; Maruteru	Godavari	Good replacement for "Chaitanya". Non-lodging. Photo insensitive. Tolerant to BLB & BPH. Only one week dormancy.
10	IET-12884	DRR; Rajendranagar	Shanthi	Resistant to leaf blast. Moderately resistant to WBPH and sheathrot. Good substitute for IR-64. Developed to overcome the broken rice problem in IR-64. Suitable for Northern and Southern Telangana.
11	**Sorghum** SPV-1293 (PSV.16)	RARS; Palem	Palem-2	Suitable for rainfed areas in kharif. Bold and pearly white grain, dual purpose. Suitable for roti making.
12	NJ-2401	RARS;Nandyal	Nandyala Tellajonna	Early maturing, non loging. tolerant to charcoal rot, shootfly. Escapes, terminal drought.
13	**Foxtail Millet** SiA-2644	RARS;Nandyal	Srilakshmi	Short duration, drooping ear head, tolerant to downy mildew, rust leaf blast. Fodder is palatable.

Sl.No	Crop/culture	Research station where developed	Name proposed	Salient features/justification for release
14	**Pulses Redgram** WRG-27	ARS;Warangal	Rudrama	Suitable for Rabi condition. Yielded 20% more, suitable for Kharif & irrigated dry condition.
15	LRG-38	RARS; Lam	Chitrabhanu	Suitable for all regions of A.P. for Kharif and rabi as sole or inter crop. Recovery of dall is high. Performed well in rain fed condition.. Substitute for LRG-30.
16	Blackgram PBG-107	ARS;Podalakur	Penusila	Photo sensitive. Suitable for Rabi season. Tolerant to storage pest and pod borers. Suitable for upland rice fallows.
17	Blackgram LBG-645	RARS; Lam	Banda polish	Useful for late sowing fetches good price. Suitable for rabi season in rice fallows and up-lands. Resistant to wilt.
18	Blackgram PBG-1	ARS;Podalakur	Podalakur minumu.	Suitable for sowing between January and February. Photo-insensitive. Tolerent to pod borers.
19	Greengram MGG-348	ARS; Madhira	Bhadradri	Resistant to yellow mosaic virus. Suitable for entire state as sole inter crop.
20	**Groundnut** TCGS-320	RARS;Tirupati	Kalahasthi	Suitable for rabi groundnut in Chittoor and Nellore districts. Resistant to "Kalahasti malady" and tolerant to bud necrosis and Jassids.
21	TCGS-29	RARS;Tirupati	Narayani	Short duration. Suitable for rain fed kharif and rabi irrigated.
22	K-1224	ARS; Kadiri	Kadiri-5	Suitable for Ananthapur and drought prone areas for kharif and rabi moderately tolerate to late leaf spot.
23	K-1240	ARS; Kadiri	Kadiri-6	Short duration suitable for kharif rain fed and rabi irrigated.

Sl.No	Crop/culture	Research station where developed	Name proposed	Salient features/justification for release
24	**Castor** PCS-124	RARS; Palem.	Haritha	Non shattering , resistant to drought. Suitable for early and late sown condition in Southern Telangana and Rayalaseem and Prakasham district.
25	PCS-136	RARS; Palem	Kiran	Short duration . Suitalbe for rain fed kharif and rice fallows. Resistant to jassid and tolerant to drought.
26	**Sunflower** NDSH-15	RARS; Nandyal	NDSH-1	Hybrid, suitable for Kurnool, Ananthapur Northern Telangana. Fertiliser responsive. Resistant to downey mildew. Tolerance to rust jassid, drought.
27	**COTTON** Desi cotton MDL - 1875	ARS; Mudhol	Veena	Good substituc for American cotton can be grown in all types of soils suitable for Adilabad and Nizamabad. Tolerant to jassid, bol worms and grey mildew.
28	Cotton hybrid NSPHH-5	RARS; Lam	NSPHH-5	Suitable for NSP ayacut areas in A.P., also in rain fed areas in A.P., can be cultivated in kharif in black soils. Resistant to bacterial leaf blight.
29	**Sugarcane** 83 V-15 (CoV-9 2102)	ARS; Vyyuru	Kanaka	Suitable for rain fed condition. Good tillering. Resistant to red rot and smut. Gives good ratoon crop.
30	91 V 83 (CoV-95101)	ARS; Vyyuru	Krishna	Suitable for coastal districts. Resistant to red rot and smut less susceptable to early shoot borer.
31	84 A 125	RARS; Anakapalli	Madhu	Resistant to red rot, smut useful for good quality jaggery.
32	87 A 298	RARS; Anakapalli	Viswamitra	Good ratoonability, preferred for jaggery making.
33	83 R 23	RARS; Anakapalli	Vasudha	Suitable for irrigated and moisture stress condition. Excellent ratoonability besides

Sl.No	Crop/culture	Research station where developed	Name proposed	Salient features/justification for release
				resistant to red rot and tolerant to smut.
34	**Black Mustard** LBM-428	RARS; Lam	Surya	Suitable for upland as an alterative crop and as an intercrop in Rice fallows. Preferred for culinary purpose. Tolerant to diamond back math, aphids and drought.
35	**Sesame** JCS-94	RARS; Jagtial.	Chandana	Tolerant to bugs, capsule borer, gallmidge. Suitable for late sown condition and for kharif and rabi /summer.

b. Responses to the package of practices relating to soil nutrient, plant nutrient, plant protection irrigation, agronomy, agricultural practices etc. Plant protection :

Previously i.e. in early 70's, farmers were using chemical pesticides indiscriminately and non judiciously which led to several health hazards. environmental pollution, pest resurgence (like outbreak of whitefly as major pest.), prsticide residues etc. To overcome, this department is popularizing IPM measures as alternative to chemical pesticides through conduct of FFS, OFEDS, Whole village IPM programme, production and supply of bio-agents through 14 B.C.labs. Implementation of APNL (BTU) project etc. Govt. of India has sent booklets on IPM package of all important crops i.e. cotton, groundnut, paddy, sunflower, sugarcane, maize, pearl millets,. redgram , bengalgram etc. The above books were translated into Telugu and they are being published in Padipantalu (37,000 copies every month) @ one crop each month. Padipantalu are being supplied to all extension staff of department, farmers on IPM practices and District Joint Directors of Agriculture and FTCs.

Due to effective implementation of IPM measures, the No. of pesticides sprays by farmers were reduced from 15 - 20 to 5-8, especially on cotton. The pesticides consumption was also reduced from 7298 Mts. during 1997-98 to 2207 Mts. during 2002-03 (upto Feb.).

c. Assessment of Technology and package of practices for reclamation of lands (saline, waterlogged etc.)

In order to encourage reclamation of problematic soils, the department of Agriculture has taken up in big way for supply of gypsum on 50% subsidy. A total Qty. of 60000 Mts. of Gypsum was distributed to the needy farmers during 2002-03. Fly ash was also distributed for the first time as demonstration. Further, a qty. of 50000 Mts. Of Green manure seed was distributed on 50% subsidy.

For water logged areas, paddy varieties such as Swarna, Chaitanya are being recommended.

In A.P., 8.7% soils are saline , 1.2% are alkaline and 4.9% land is under water logged conditions.

The farmers are being thoroughly trained during various training programmes on the reclamation of above problematic soils.

d. Success or failure of new crop rotations/cropping sequences/mixed croppings etc.

It is observed that farmers are taking up maize crop replacing cotton in rainfed areas. In some of the Telangana districts, blackgram and greengram are being taken up prior to fodder Jowar as an additional crop. Under mixed cropping, redgram with jowar is still practiced in large areas and the combination is found to be successful. Jowar crop is being encouraged as boarder crop in rainfed cotton. Farmers are adopting ploughing and sowing across the slope . Groundnut farmers are still not adopting closer spacing , consequent on which, the population as well as yields were recorded less. However, these aspects are being covered during various training programmes.

e. Acceptance of processors/products developed and released by the R & D institutions.

f. Performance of equipments and machinery introduced.

Small tractors and power tillers were already tested by the Central Govt. Testing Institute at Budhini, M.P. and performances are evaluated in all types of fields. Based on that Govt. of India have given approval to accept only the successufully performed machinery i.e. Tractors & power tillers. All the equipment are being supplied with one year guarantee. After sales service and repairs (except major repairs) are to be taken up at field level on free of cost during the guarantee period. If, any break-down occurs the firm has to give free replacement with new one.

Regarding performance of other equipment and machinery, we have applied ISI certified farm machinery and implements manufactured by M/s.Sonalika Tractors Pvt. Ltd. Hoshiarpur, Punjab, M/s J.S. Corporation Ltd. Akola, Maharastra , M/s Dogoba Engineering works Nagpur, M/s. Kerala Agro Machines Corporation, Athoni Kerala and M/s. Vardhaman Equipments Ltd. Ahmedabad are the suppliers of machinery to the Dept. of Agriculture, A.P. All most all equipments are having testing certificates for their performance. Any defects noticed will be rectified by the companies through their dealers network.

However, the performance of equipments and machinery mainly depends on its maintenance i.e. daily checking, cleaning, maintenance of oil levels, changing of filters in time are to be attended regularly. The cultivators require weekly or fortnightly training programme on operation and maintenance of Agril. machinery for which ICAR, New Delhi is considering to implement through Cenral Govt. Training & Testing Centres for Agril. machinery and equipment.

g. Popularity of new strains/species in cattle/poulty/fisheries.

It pertains to Animal Husbandry Department.

h. Efficacy of new programmes in extension education.

The following programmes sponsored by Govt. of India are being implemented by the Department which were found to be most useful and essential to be continuted during entire X five year plan period.

a.Farmers exchange programme:

Farmers are being benefited much and being exposed to various technologies being adopted in other states in the country.

b. Exchange visit of Extension functionaries:

The Agricultural Officers are being deputed to other states in the country to interact with their counter parts and to study the Agricultural Extension set up in these states and also to study the various agricultural technologies being adopted in these states.

c. Farmer's scientist inter action programmes:

It is also a novel programme for getting direct feed back by scientists from farmers.

d. Staff Trainings:

Deputation of functionaries of Agril. Dept. to various National Trainings being organized in the country to update the knowledge and skills and the expenditure borned by G.O.I.

e. Deputation of in-service candidates to study M.Sc.(Ag)

Quite useful to enchance the professional competence of Agril. Officers and present quota of two seats may be enhanced to 4 No. per state.

Information in respect of Oil seeds production programmes being implemented by the Department for the last two years, constraints and future programme proposed to be implemented is furnished hereunder.

i. TARGETS ANDACHIEVEMENTS FOR THE LAST TWO YEARS (2001 –2002 & 2002-03) . The statements are enclosed .

ii. MAJORCONSTRAINTS IN IMPLEMENTIG THE SCHEME:

- For proper availability and allocation of funds under scheme Oilseeds Production Programme , the overall budget allocation for the ensuing year should be finalized in the month of December itself before finalization of budget estimates

- Flexibility should be given to the state Government for non seed inter components diversification and also powers should be given to state government to alter subsidy pattern but not exceeding the limitations fixed by Government of India .

- Construction of Godowns under infrastructure development will take lot of time and the funds allotted would not be utilized in the same financial year . Hence the state Government may be permitted to draw the funds well in advance and the same may be kept with C&DA for subsequent utilization after getting expenditure reports from concerned Agencies .

- Generally the Grow out tests results for foundation seed produced during Rabi are expected in May- July . It is becoming difficult for drawal of funds before receipt of the results. Hence funds as per seed supply plan for Kharif are to be provided to C&DA by January to enable to make advance arrangements for next Kharif.

iii. FUTURE PROGRAMME FOR 2003-04 UNDER O.P.P.

The scheme Oil Seeds Production Programme for the year 2003-04 has been prepared with an outlay of Rs. 2217.52 lakhs .(Componentwise physical Targets & Financial allocations is enclosed)

I. SEED COMPONENTS:

i. *Purchase of Breader Seed*: To ensure the supply of quality foundation seed for seed village programme, the actual cost of breader seed will be reimbursed. The departmental seed farms , APstate seed development corporation , APOILFED, are implementing this component

ii. *Production of foundation seed* : The conversion and multiplication of Breader seed in to foundation seed is being done through APSSDC Ltd. , and APOILFED under strict supervision of Technical staff.

iii. *Production of Certified Seed under seed village programme*: Conversion and multiplication of foundation seed into certified seed under seed village programme is programmed to implement through departmental seed farms, APSSDC, APOILFED,

iv. *Distribution of certified seed on subsidy*: To make available quality of seed, the certified seed/Truthfully labeled seed of Groundnut and Soybean are being distributed to the needy farmers.

v. *Infraustructure development for seed production*: Assistance for seed storage facility and threshing floors and minor irrigation facilities in the government / Co-operative owned farms is available to encourage seed production under oilseed production programme, this facility is mainly available for groundnut and soybean seed production and seed storage. At present allotted amounts are being utilized for construction of Oilseed godowns in the state.

II. NON-SEED COMPONENTS:

i. *On Farm Extension Demonstration Plots*: To popularize and create awareness for new varieties of seed and production technologies , the OFEDs are organized comprising of various activities in different plots.

ii. *Improved Farm implements* : In order to encourage use of improved farm implements and to reduce manual labour subsidized distribution of improved agricultural implements like seed drills , cultivaters, harvesters , decorticators an d other improved implements of manual or bulluck drawn will be distributed . To facilitate farmers for timely completion of field operations a new sub component of power driven implements have been included in the improved farm implements

iii. *Seed Treatment* : For optimum results in germination and survival of plants it is necessary that the seed must be treeted with fungicides against seed and soil born diseases

iv. *Integrated Pest Management* : For prevention and control of pest and diseases, the emphasis and thrust is now shifted to integrated approach of pest management involving the techniques of agronomical , mechanical, and biological . In order to promote integrated pest management approach is proposed to organize IPM in farmer fields to generate interest and awareness in them for IPM strategies. Special measures are taken for Red Hairy Caterpiller.

v. *Control of Rootgrub*: Rootgrub is a serious pest of groundnut in Rayalaseema region and Mahabubnagar in Telangana region.in Kharif. To encourage farmers to control root grub in areas where it is endemic , the financial assistance is provided for purchase of lighttraps etc.

vi. *Supply of Rhizobium culture/Phosphate solubulising bacteria*: Treatement of seed with crop specific rhyzobium culture helps in building up of the population and fixation of atmospheric nitrogen through symbiotic activity of rhizobium bacterial in root nodules of the crop. **PSB** has capacity to release phosphorus from unavailable form to available form and thus helps to reduce 25% phosphatic fertilizer requirement of the crops.. Combination of **R.I** with **PSB** enhances nodule formation and nitrogen fixation.

vii. *Gypsum*: Application of gypsum not only increases the production of Oilseed crops but also increase oil content by 10 to 15%. The major constraint in making available gypsum to the farmers is due to its high transport cost.

viii. *Sprinklers*: To bring more area under oilseeds production and judicious use of awailable ground water, the Sprinkler Irrigation sets under Micro Irrigation are being provided on subsidy to the oil seeds production farmers.

ix. *Trainings* : Training is one of the effective tools for speedy transfer of technology to the farmers . Pre seasonal post Harvest trainings will be conducted in the villages on oilseed crop production technology.

A 1.2: ANDHRA PRADESH LIVESTOCK DEVELOPMENT AGENCY

Shantinagar, Hyderabad

Status Report on Bovine Breeding Activities

Introduction:
According to the house hold survey conducted by APLDA during the year 2000 the breedable bovine population in Andhra Pradesh is as follows.

S.No.	Type of Animals	In lakhs
a.	Non-descript Cows	27.60
b.	Crossbred cows	5.26
c.	Indigenous cows	0.15
d.	Non-descript buffaloes	51.21
e.	Graded buffaloes	13.33
Total		97.55

The State Govt has planned to improve rural economy by increasing productivity of existing unproductive animals through AI. To achieve the goal, the State Government, with the financial assistance from Govt of India, has launched a massive programme of restructuring of Breeding Operations in cattle in the State under National Project for Cattle and Buffaloe Breeding (NPCBB). To implement this programme, A.P. Livestock Development (APLDA) has been established and started functioning from April 2000.

Achievements as on February 2003:

The basic idea is that the doorstep Artificial Insemination facility has to be provided in all the villages of Andhra Pradesh. The AI facility, stationary, is available in 3809 Vety Institutions out of existing 5004 Vety Institutions under AH Dept. The villages, which are not covered by the Vety Institutions, need to be covered by establishing a trained AI practitioner (Gopalamitra).

The activities to be undertaken, in the directions described above, by the APLDA in the state are,

- AI has to be introduced in 1195 departmental institutions where there is no AI.
- Mobile facility has to be created in all the institutions.
- In places where there are no departmental institutions, 3027 Gopalamitra centers (Private AI Practitioners) are to be established.
- Frozen Semen Bull Stations should be strengthened to increase FS production from 20 lakhs to 70 lakh doses.

After formation of APLDA AI was introduced in 973 departmental centers, in 3115 centers mobile facility was created and 1453 Gopalamitra centers (Private AI Practitioners) were established. The details of expansion of AI centers and the AI conducted as per the type of AI center, year war, are given below.

S. No.	Type of AI center	1999-2000		2000-2001		2001-2002		2002-03 Up to Feb03	
		No.	AIdone (in lakhs)	No.	AIdone (in lakhs)	No.	AIdone (in lakhs)	No.	AIdone (in lakhs)
1.	Deptl stationary AI centers	3809	22.93	4265	23.87	4643	22.76	4782	22.86
2.	Deptl mobile AI centers	Nil	-	1305	0.42	2768	0.84	3115	0.57
3.	Gopalamitra centers	Nil	-	516	0.88	1120	1.64	1453	2.22
4.	JK Trust ILDCs	Nil	-	150	0.54	150	0.68	150	0.82
5.	BAIF	Nil	-	41	0.27	43	0.28	47	0.29
6.	Dairy Coop Milk Unions	111	NA	286	1.20	199	0.95	217	0.51
	Total	3920	22.93	5258	27.18	6155	27.15	6649	27.27

In order to meet the increased demand of Frozen Semen due to expansion of AI activity all the Frozen Semen Bull Stations have been strengthened to produce 40 lakh doses of Frozen Semen per annum. Four FSBSs have produced 33.81 lakhs of FS doses during the year 2001-02 and 28.00 lakhs during 2002-03 up to February 2003. 300 breeding bulls are stationed in all the four FSBSs.

Preservation of Ongole breed:

- Farmer wise survey conducted in AP revealed that there are 15,000 of pure Ongole breed cows and approximately 5.00 lakhs of Ongole breed type breedable animals available. In order to improve the population of pure Ongole type animals Ongole bulls (sons of champions) selected from the breeding tract are being used at FSB S for semen collection for inseminating the Ongole type animals in 11 districts.

- Earlier the selection of "bull was done basing on only the Phenotypic characters but now under APLDA the Pedigree of the sire dam and dam is being considered for selection of a bull.

- During the year 2001-02, 71,626 inseminations conducted and produced 23,790 calves. During the year 2002-03 up to Feb 2003, 93,208 inseminations conducted and produced 27,812 calves. It is planned to procure 100 Ongole bull calves during this year for distribution into the field for Natural Service. Already 44 Young Ongole male calves have been purchased from the field and they are under rearing.

Constraints:

- The Gopalamitras are unable to sustain themselves especially in Telangana area due to lack of awareness among the farmers and existence of less number of good quality animals. Due to this the results of dropouts are more. Hence, the Gopalamitras may be given some financial assistance as sustenance allowance and incentives for their livelihood.

- Since the concept of doorstep AI is introduced it would be convenient if all the villages are provided with the Trevises for restraining of animals during AI and other treatment aspect.

- Since the budget for implementation of the above items is not provided by the Govt of India it may be necessary to tap any of the sources or State Govt for their implementation

A 1.3: COMMISSIONER OF FISHERIES, GOVT.OF ANDHRA PRADESH

3. Action Plan for Vision-2020:

The strategies proposed under Operationalisation of Vision 2020 to strengthen the research base for fisheries in the state are as follows:

A. Request Indian Council of Agriculture Research , New Delhi to set up an exclusive research institute for fresh water prawn culture:

The fresh water prawn culture has been taken up as a viable alternative for shrimpexports, in view of the uncertainties in due to disease problems in tiger shrimp culture . Andhra Pradesh is now having more than 25,000 ha of area under culture stands first in the country in the area developed, production and rate of production. The state is contributing Rs.2400Crores of marine product exports, (incl: shrimp and scamp), out of Rs 6400 Crores from the country (40% of total exports) .

FW prawn culture

Southern states in ICAR region (V)	**Area under culture (Ha) 2001-02**	**Production 2001-02 (Tons)**	**Productivity (Tons/ ha)**	
Andhra Pradesh	**22,340**	**20,910**	**0.94**	**1.5 times**
Tamilnadu	170	140	0.82	
Karnataka	150	100	0.67	
Kerala	770	200	0.26	
Orissa	3100	400	0.13	
Maharashtra	4150	140	0.03	
Other states (**)	5960	2340		
ALL INDIA	**36,640**	**24,230**	**0.66**	

Source: MPEDA, Cochin (**) W.Bengal & Gujrat

The Dept. of Fisheries has also taken up the culture of fresh water prawn in irrigation tanks with cluster approach and the interest shown by the fishermen, technical feasibility and economic viability for this scheme shows that fresh water prawn culture will very shortly prove to be a gold mine for upland areas, provided the fishermen and farmers adopt healthy management practices. <u>But, there is no exclusive research institute for Fresh water prawn culture in the country, though CIFA is also looking after the culture of fresh water prawn. It is also pertinent to mention that there is no ICAR fisheries research institute having its head quarters in Andhra Pradesh.</u>

The Dept of Fisheries will be willing to have a exclusive research institute for fresh water prawn culture located either in Nellore or in Krishna district, which are having the largest areas of fresh water prawn culture in the state . The Dept of fisheries is having sufficient place near to Nellore or near to Vijayawada for taking up construction of ICAR institute to provide logistic support for the proposed research institute ..

B. Request Indian Council of Agriculture Research, New Delhi to set up 3 branches/ projects :

There is a need for having the exclusive research branches of the existing research institutes like CIFA, CIBA, CIFT etc in Andhra Pradesh with special focus on 3 research needs namely

i. Culture of Tilapia nilotica: It is an exotic fresh water fish which has good demand in other countries. The Govt.of India have accorded permission for taking up of (2) demonstration projects for culture of Tilapia nilotica to M/s Amalgam fisheries and Kakatee aqua tech but not much has been done after that. The Dept. of Fisheries in association with Centre for Cellular and Molecular Biology(CCMB), Hyderabad has taken up the culture of Red Tilapia in 1986 but the problems of obtaining the pure strain and sex reversal could not be solved.

The scientist from Israel who has visited the state and Ms/ Mc Kinsey& Co , consultants who have studied the culture of this fish in Thailand have suggested to take up the culture of Tilapa nilotica in controlled conditions, to boost exports, as there is good demand for this fish in South- East Asian countries and the supplies are far below the demand in the markets.

Unless the ICAR recommends the transfer of technology tested in a laboratory in India, it may become counter-productive as has been the experience with T.mosambica . The ICAR may take up the mater seriously and start a research station in Andhra Pradesh for culture of T.nilotica.

ii. Culture of Brackish water shrimp with special focus on the prophylactic measures / control of White Spot Disease syndrome in Tiger shrimp as A.P.stands first in the country in Brackish water shrimp production and more than 70,000 Ha. the BW area has been developed .

BW shrimp culture Southern states in ICAR region (V)	**Area under culture (Ha)**	**Production 2001-02 (Tons)**	**Productivity (Tons/ ha)**
Andhra Pradesh	79600 (61%)	51,230	0.64
Tamilnadu	2480	4710	1.90
Karnataka	3080	3500	1.14
Kerala	14700	5540	0.38
Orissa	8120	8960	1.1
Maharashtra	300	320	1.07
Other states (W.Benga & Gujrat)	47290	2950	
ALL INDIA	**156,500**	**102,940**	**0.66**

Source: MPEDA,Cochin

The aqua farmers in the state are incurring losses due to white spot disease syndrome

The details of losses occurred due to diseases are as follows :

Year	Area under culture (Ha)	Area utilized for 2 Crops (Ha)	Area effected by diseases (Ha)	Loss of production (Tonnes)
1994-95	34,455	34,455	23,170	21,292
1995-96	48,776	51,042	15,954	4,271
1996-97	52,714	59,932	9,480	3,319
1997-98	70,249	1,05,064	41,282	9,380
1999-2000	77,420	95,718	23,341 total 25,420 partial	
2000-01	62,700	97,137	19,445 total 34,335 partial	18,550
2001-02	62,670	58,535	20 ,334 total 43,766 partial	19,727
Source	MPEDA, Cochin			

There is a crop loss of about 20,000 tonnes every year valued Rs 300.00 crores. To minimize the losses efforts are taken to create awareness among the farmers and organizing them in to aqua clubs. The PCR labs are established to detect the virus in shrimp seed before stocking with the assistance from Marine Products Export Development Authority (MPEDA) . The PCR (Poymerase chain reaction testing labs are set up 5 nos in Govt. sector (Dept.of Fisheries/ TASPARC/MPEDA) and 14 more in private sector.

There is a need for establishing a branch of Central Institute of Brackish water aqua culture in the state to study the local problems and suggest the remedial measures.

iii. Study of various aspects of post- harvest fisheries such as value addition, packing, branding and certification to give boost for shrimp exports, fish exports and for quantum jump in domestic fish sales.

4. Other research initiatives :

A. Research by ANGR Agr. University

I have discussed about the research needs to suit the local conditions with the ANG Ranga Agriculture University. The university has already set up 5 research stations in the state and they are being involved in the research aspects related to the local field conditions .

B. Upgrade the State Institute of Fisheries technology, Kakinada

The Dept. of Fisheries has planned to upgrade the State Institute of Fisheries Technology, Kakinada to be a recognized center of the ANGR Agriculture University for carrying out research in the labs . The Dept. of Fisheries has already established a microbiological lab and a PCR lab at the state institute of fisheries technology, Kakinada. The antibiotic residue testing lab with LCMS Ms equipment is being set up at Kakinada. he institute has 2 demonstration centres for Brackish water and fresh water aqua culture at Polekurru and Kadium . A mobile lab has also been provided to serve the aqua farmers at their farm-gate itself. The ICAR may give guidance to develop the institute as a center of excellence in fisheries sector .

5. Popularity of new strains/ species in fisheries:

Fresh water aquaculture- Introduction of Jayanti Rohu : In tanks, reservoirs and dug out ponds, the important species culture are Catla and Rohu. In addition, the bottom feeders like Common carp and Mrigala are being cultured The CIFA Operational Research project at Penamaluru, Krishna dt, Andhra Pradesh has developed a new variety, Jayanti Rohu which has been released commercially this year

Fresh water prawn culture: As aqua farmers were incurring losses in coastal aqua culture due to the problem of White spot disease syndrome, an alternative was suggested to take up culture of fresh water prawn in fresh water dug out ponds and also in irrigation tanks .

A 1.4: RURAL DEVELOPMENT, GOVT. OF A.P.

Government of Andhra Pradesh has undertaken a massive programme for development of all rainfed and degraded lands in the state through watershed approach. An action plan for treatment of 100 lakh ha. area had also been proposed over a span of 10 years from 1997-2007 duly involving the following departments:

Agriculture Department	4.54052 lakh ha.
Forest Department	17.25200 lakh ha.
Rural Development Dept.	78.20748 lakh ha.
Total	100.00000 lakh ha

The latest achievements in developing degraded lands by various departments since 1997 till todate are as follows:

Agriculture Department	1.34025 lakh ha.
Forest Department	7.51348 lakh ha.
Rural Development Dept.	36.75000 lakh ha.
Total	45.60373 lakh ha

1. Employment Generation:

Area development on watershed basis is a key towards employment generation, poverty reduction and mitigating drought situation.

So far 7.98 crores mandays of employment have been generated in the implementation of watershed development programmes through Rural Development Department duly covering an area of 36.75 lakh ha till todate as envisaged above. Moreover, the employment generation and poverty alleviation are the main objectives of watershed development programme.

2. Watershed management technology along with use of hybrids and small farm machanisation:

One of the activities of watershed development is popularization of new hybrids/varieties and demonstration of successful technologies/management practices/designs that are relevant to maximization of agricultural production.

The popular agricultural implements will become a permanent assets to the watershed committee and can be utilized by all the farmers of watershed on cooperative basis. The implements which meet the requirements of tillage, ridging, intercultural operations, with uniform depth etc. are being popularized at watershed level.

3. Small pond technology with plastic lining:

As rightly highlighted by Dr.A. Alam, DDG (Engg.) about the sealing of farm ponds for effective utilization of conserved water is the immediate need of the watershed development programme.

Some of the major activities taken up in the watersheds till todate are as follows:

1. CCT (in rmt)	139.90 lakh
2. Non-cemented WHS (in Nos.)	288219
3. Cemented WHS (in Nos.)	36289
4. Other structures (in Nos)	108021
5. Bunding (in ha)	566760
6. Addl.area brought under cultivation (in ac.)	334755
7. Addl.area brought under horticulture/ afforestation (in Ac.)	356046

A 2.1: DIRECTOR OF AGRICULTURE, GOVT. OF ORISSA

2. Projects proposals on pre-identified areas based on the recommendations of the last Regional Committee meeting for certain NABARD, R & D inviting State Government, SAU and ICAR Institutes in a partnership role.

NABARD ASSISTANCE FOR IRRIGATION PROJECTS

Harnessing Ground Water Resources for increasing agricultural production:

Agriculture is the main stake of the people of Orissa. Inadequate irrigation facility and dependence on rain fed agriculture are the important factors of low productivity. Only 13.73 lakh hect. (21%) of the net cultivable area of 63.00 lakh hect. is irrigated.

Orissa has vast ground water potential. Only 14% of the ground water potential have been exploited in the State, excepting 3 (three) Blocks namely Baliapal, Bhograi and Basta where the exploitation is higher. There is still 9.14 lakh hect. Meter of ground water resources which can be utilized for irrigation purposes. The gross area that can be utilized for irrigation with untapped ground water resources works out to 38.22 lakhs hect. assuming 200% cropping intensity. The study conducted by Ground Water Survey & Investigation, Orissa reveals that with the balanced untapped ground water resources (ground water exploitation has been restricted to the critical value of exploitation of 60%) additional 94,733 STWs (2.45 HM unit draft), 2,59,350 Bore wells (2 HM unit draft) and 2,27,346 Dug Wells (0.64 HM Unit draft) are feasible for installation.

During 2000-01, the State Government availed RIDF assistance of NABARD for installation of 10,000 STWs, 800 MTWs & 5164 Bore Wells in the State with a total outlay of Rs.104.45 Crores. The loan from NABARD (RIDF Assistance) is Rs.39.20 Crores. The State Government contribution and beneficiary contribution were Rs.14.56 Crores & Rs.50.69 Crores respectively. So **far, 10,229 STWs, 994 MTWs & 1432 Bore Wells have been installed in the State through Private Lift Irrigation in the State and 25,310 hectares of additional cultivable land have been brought under assured irrigation.**

During 2003-04, Government has made a programme for installation on one lakh Private Lift irrigation Points (STW-72,879, MTW-13,200, Dug Well 13,921) in the State availing RIDF assistance from NABARD. The proposal for sanction of RIDF has been sent to NABARD Regional Office, Bhubaneswar and the sanction is awaited.

3. The status constraints and failures, if any, of the technologies that were passed on to the Extension functionaries of the State Government by the R & D Institutions

1. Status of varieties of seeds/ planting materials released.

The following varieties of paddy & non-paddy have been released by different research organisation for the state.

Sl. No.	Crop	Variety	Name of the research organisation	Duration (Days)
1	Paddy	Udayagiri,	OUAT	90
		Lalitagiri	OUAT	90
		Sebati	OUAT	125
		Bhoi,	OUAT	120
		Konarka	OUAT	130
		Surendra	OUAT	135
		Gajapati	OUAT	125
		Kharavela	OUAT	125
		Prachi	OUAT	155
		Ramachandi	OUAT	155
		Mahanadi	OUAT	150
		Indravati	OUAT	150
		Jagabandhu	OUAT	155
		Durga	CRRI	155
		Sarala	CRRI	155
		Vandana	CRRI	90
2	Toria mustard	Anuradha	OUAT	70
		Parbati	OUAT	70
3	Green Gram	OBGG-52	OUAT	65
		OUM 11-15	OUAT	65
4	Sesamum	Prachi	OUAT	80
5	Colocassea	Muktakeshi	CTCRI	
6	Tobacco	Gajapati	OUAT	
7	Brinjal	Utkal Jyoti	OUAT	
8	Chilli	Utkal Ava	OUAT	
9	Turmeric	Roma	OUAT	
		Suroma	OUAT	
10	Ginger	Suruchi	OUAT	
		Suprava	OUAT	

N. B. :- Orissa is the 1st State in the country to have notified ginger and turmeric varieties developed by OUAT.

Constraints/ failures:

Keonjhar District

- Mahanandi variety of paddy shows maturity at 140 days instead of 150 –155 days creating problem in harvesting when grown in low land.
- Surendra has shown symptoms of early maturity from 10 to 15 days.
- Heavy infestation of blast in Khandagiri at flower stage need to be study by OUAT.

Phulbani District

- Rhizome rot and leaf blight are major diseases of turmeric and ginger and brings set back in the yield. The farmers grow these crops organically.
- Paddy variety Durga is more susceptible to BLB.

Research/ Studies are to be done by OUAT on these constraints.

2. Response to the package of practices relating to soil nutrients, plant nutrients, plant protection, irrigation, agronomy agricultural practices etc.

- **Soil Nutrients and Plant nutrients:**

Steps have been taken to collect soil samples scientifically and analyse them and send recommendation of analysis to farmers. During 2002-2003, 102559 nos. of soil samples have been analysed. The response to application of phosphorus and Potash is very high where as application of gypsum as a source of sulphur has resulted in higher yields of Groundnut. About 3500 MT. of Gypsum have been applied during Rabi 2002-2003.

Phospho gypsum as source of sulphur may be included as Fertiliser in schedule-I of FCO 1985 to facilitate its standardisation, labelling and marketing . The supply of gypsum is limited only to programmes sponsored under various CP and CSP schemes.

Growing up of powdery mildew tolerant green gram varieties like PDM-54, TARM-1, C0-4 etc. in Rabi has given good results. Cotton (MCU-5, Savita and Bunny) has given good yield during 2002-2003 in inland district viz. Rayagada, Nowrangpur, Kalahandi and Bolangir. Yield of Savita hybrid cotton is found to be 13.5 qtl./ hectare where as it is 12.18 qtl./ hectare in case of Bunny. Bt. Cotton was grown on trial basis during kharif 2002 of variety MEH-162 MEH-184, MEH-12. The yield data is reported below.

Sl. No.	Name of variety	Yield in qtl./ hect	
		Irrigated Condition	Non-irrigated condition
1	MEH-12	23.75	8.3
2	MEH-184	17.93	14.6
3	MEH-162	14.18	8.6

The yield of sugarcane (ratoon crop) increase by about 13% in Keonjhar and 26% in Kalahandi district due to application of 25% additional dose of Nitrogen.

- **Plant Protection**

The package of practices on plant protection sector of the R & D Institution like IPM technology which includes cultural practices, mechanical practices, biological control practices, behavioural control (pheromone trap), need based application of chemical pesticides, weed management etc have already been passed on to the extension functionaries with very good results in the field.

- **Irrigation**

Suitable water management practices have been developed by the scientists of OUAT & CRRI, Cuttack to utilise the rain water and irrigation water of the command area effectively and efficiently. The extension functionaries of Agriculture Department is playing a major role in transfer of these technologies through **"Pani-Panchayat"** programme. The state level Panipanchayat programme was inaugurated by the Hon'ble Chief Minister on 29.9.2000. Since then, the Chief Minister also participated in the awareness programme on panipanchayat in different districts. Besides the Officers of Agriculture Department and Deptt. of Water Resources educated the farmers on panipanchayat including participatory irrigation management (PIM) through GRAMSAT programme. This programme is widely accepted by the farming community and gaining importance day by day (particularly in the command areas). This programme is operating in the command areas of 33 major & medium Irrigation Projects identified by Water Resources Department in an area of 3.32 lakh hectare (O W R C P areas) covering 23 Agricultural Districts
through 726 panipanchayats with assistance from World Bank. The farmers were guided on .

(i) Equitable distribution of Irrigation water in the command areas,
(ii) Operation and maintenance of the canal system,
(iii) Adoption of suitable cropping pattern including crop diversification,
(iv) Economic use of water for sustainable agriculture,
(v) Scheduling of irrigation for different crops etc.

Under State Agriculture Policy, emphasis was given for providing assured irrigation facility to the farmers by exploiting ground water through installation of private lift Irrigation points (STW, MTW, & BW) 50% subsidy limited to Rs.50000/- was provided against private lift irrigation points set up by the farmers. So far 31224 (STW- 25838, MTW- 994 & BW- 4392) Private Lift Irrigation points have been installed in the State under Agril. policy & RIDF by which 62448 hects. of additional cultivable land have been brought under assured irrigation, During 2003-04, programme has been made for installation of one lakh Private Lift Irrigation points (STW- 72879, MTW-13200 and Dugwell-13921) in the State availing RIDF assistance from NABARD. The field functionaries such as DAO, AAO. & JAO have been advised to make the programme successful and also prepare the cropping plan for the Private Lift Irrigation Commands keeping close liasion with the farmers/ beneficiaries.

Besides, the Centrally sponsored Scheme "Onfarm water management" is being implemented through NABARD & State Govt. (Agril. Deptt.). The main objective is to ensure substantial increase in agricultural production & productivity and per capita income. The procedure of implementation of this scheme is like State Plan scheme (Agril. policy) through Krishi Sahayak Kendra (KSK). The State level workshop for Govt. officials & bankers have been conducted and the salient features of the scheme have been published in leading Oriya Dailies and telecasted in Doordarshan Oriya channel for awareness of the farmers. So far, applications for 7695 STW and 2997 Dug wells have been collected and sponsored to banks by KSKs.

WTCER is located at Chandrasekharpur, Bhubaneswar . This Institute is mainly conducting research activities with respect to Rain water management, exploitation of ground water potential and its use , on farm water management for waterlogged areas, saline areas and command areas of the State for increasing water use efficiency (WUE) in crop production. Besides, this institute also imparts training to the officers, farmers involved in Command Area Development .

3. Assessment of technology and package of practices for reclamation of land (saline and water logged etc)

Accepted Packages are :-

- Management of Coastal salt affected soils through appropriate farming system and pond technology
- Construction of suitable drainage system to flush out the soluble salts, construction of sluice across the creeks and raising of shelter belts to check salinity hazards.
- Management of waterlogged rice soils through 1m x 1m drain spacing at 10m/ 15m apart and field channeling to propel out excess water.
- Liming of acid soils by the groundnut farmers in coastal districts.

4. Success or failure of new crop rotations/ cropping sequences/ mixed cropping etc.

Crop rotation/ crop sequence & Mixed cropping

Crop rotation and crop sequences are practised in Orissa, mixed cropping has been accepted as a methodology for crop insurance and getting higher yield by utilising limited cropping area. The farmers have adopted the following mixed cropping.

Paddy + Arhar
Groundnut + Arhar
Maize + Cotton
Sugarcane + Green gram

The tribal farmers of Koraput/ Malkangiri/ Nuapada/ Kalahandi/ Phulbani/ Mayurbhanj and Sundargarh are adopting mixed cropping where in line sowing is not adopted. But different seeds of various crops are mixed together and shown at random which have different maturity timings and variations in plant heights.

5. Acceptance of products Developed & Released by R & D Institution (Farm Implements)

The following Institutions are involved in development and release of new agricultural implements in the State.

Central Rice Research Institute (CRRI), Cuttack
Regional Research Laboratory (RRL), Bhubaneswar
Farm Implements Development Unit (FIDU), OUAT,BBSR
Govt. Implement Factory (I/F), Bhubaneswar

The implements developed by the above institutions are thoroughly tested under different agro-climatic condition of the state. The test results along with the
technical details of the product developed are put-up before the State Level Technical Committee (SLTC) of Farm Implements constituted by the Govt. Keeping in view of its performance and utility, the SLTC approved the implements/ equipments developed for popularisation in the State. The Govt. Implement Factory, Bhubaneswar prepares the production process, zigs & fixtures required for mass

production, technical drawings and also take up the proto-type development at the beginning stage for extensive field trials and gets the feed-back for further modification and developments if required. In this process implements developed in the state becomes acceptable to the farmers.

The newly developed implements (apart from the previously developed implements) those are used by the farmers are as follows;

Multi crop seed drill.
Multi crop seed-cum-fertiliser drill
Manual paddy transplanter
Oil engine operated thresher-cum-winnower
Pedal winnower
Low Lift Pump
Groundnut thresher (Manual/ Power operated)
Groundnut digger
Cotton weeder
Pre-germinated seed drill.

The Implements, those under different stages of development are as follow;

Maize planter
Sunflower thresher
Clod crusher (BD)
Cotton stalk puller (Manual)
Potato planter

6. **Performance of machineries & Equipments introduced**

The manual and bullock drawn implements are extensively used by the small and marginal farmers of the state. Besides, special emphasis has been given for popularisation of self propelled and power driven implements for rapid mechanisation of agricultural activity. Self propelled paddy reaper, self propelled paddy transplanter, sugarcane cutter planter, sugarcane ridger, tractor drawn rotavator, power maize sheller, power pulse thresher-cum-cleaner, tractor drawn axial flow thresher apart from tractor and power tiller are some of the self propelled/ power driven implements which have been well accepted by the farmers of the state. These implements have been demonstrated in the farmers field and good demand has been created in the field.

Demonstrations are being organised for zero-till-fertiliser seed drill and strip till drill in different areas of the state by procuring those implements from outside state.

Status of Farm-Mechanisation Infrastructure in Orissa.

(i) **Research & Development-**

FIDU (OUAT),RRL, BBSR, CRRI, Cuttack & Govt. implement factory, BBSR are mainly responsible for all types of research, development and testing of farm implements suitable for the various agro-climatic zones of the state.

(ii) Production

196 Small Scale Industrial (SSI) units have been registered with the Directorate of Agril. & Foo Production, Orissa, Bhubaneswar for supply of farm implements as per the specified design approved b SLTC. Out of 196 SSI units, about 100 such units are actively engaged in productions & supply of thes implements.

Implements are technically checked by the representatives of the Orissa Small Industri Corporation Ltd., Orissa Agro Industries Corporation (OAIC) and the Dist. Asst. Agril. Engineer befo acceptance for supply to the farmers. These SSI units have a production capacity of implements wor Rs.50.00 crore per annum.

(iii) Extension & supply

In 30 districts, Asst. Agril. Engineers with active support of Agril Extension functionaries at t field level are popularising these implements through field demonstrations. In order to have ea availability of these implements more than 600 sale outlets (almost two per block) have been establishe Besides, the sale outlets of department and OAIC Ltd in each subdivision also supply these agı implements. Mobile demonstration units are also supplying the implements at the door step of t farmers. No problem in regards to availability and supply of farm implements as per the seasor demand is being experienced in the state. The only constraint for timely supply and to meet the dema is availability of adequate subsidy under various CSP schemes.

8. Efficacy of New Programmes in Extension Education :

The T & V system of Agril. Extension Programme is still in operation in the state. The appropri technologies generated by OUAT & ICAR institutions are transmitted through the extension manag functionaries of the Agril. Deptt. to the farming community.

- Regular interfaces between the extension functionaries & scientists of OUAT/ RRTTS/ KVKs, otl ICAR institution/ and deptt. SMSs are arranged through monthly SMS workshops/ bi-weekly trainir for finalisation of the technologies for dissemination.

- Queries made by the farmers are always complied with solutions by the scientists of SA departmental SMSs and extension functionaries through direct interaction.

- Analysis on follow up actions and feed backs on recommended technologies are being taken up the Deptt. to value the aspiration of emerging front line farmers of the state.

However, the existing extension system is to be broad based, demand driven and integrated in to a wh farming system through the bottom-up approach, since the present set up of extension is not able address the emerging issues in the wake of charging economic scenario. The new extension system (be able to face the new challenges of technology dissemination which will respond to food ε nutritional security, poverty alleviation, diversification of market demand, export opportunities ε environmental balance and ultimately help in promoting the sustainable agriculture.

Actions will be initiated to formulate action plans within the framework parameters for improving the extension services after consultation with the experts from State Government organisations and SAU and as well as availing financial assistance from Government of India.

A 2.2: FISHERIES DEPARTMENT, GOVT.OF ORISSA

Agenda items:

1. Standardization of breeding technology of M.maloolmsonii

2. Standardization of cage culture technology with reference to reservoirs of Orissa

B 1: RESPONSE BY THE SAUS (ANDHRA PRADESH)

B 1.1: ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY, HYDERABAD

1: Project proposals of pre-identified areas based on the recommendations of the last Regional Committee Meeting for certain NABARD, R & D funding involving State Govts., SAUs and ICAR Institutes in a partnership role

To further strengthen the research efforts, proposals on the priority areas were submitted for funding under National Agricultural Technology Project (NATP), Competitive Grant Programme (CGP), Comprehensive Development Project, Netherlands programme (through Institute of Public Enterprises), NABARD, NRSA, Universities and USDA, USA etc. Sanctions for some schemes under various funding agencies have already been received and in operation and some are at various stages of processing.

2. The status/constraints and failures, if any, of the technologies that were passed on to the extension functionaries of the State Government by the R & D Institutions

i) Status of the varieties of seeds/planting material released:

34 more improved crop varieties (9 in rice, 2 in sorghum, 1 in foxtail millet, 2 in redgram, 3 in blackgram, 1 in greengram, 4 in groundnut, 2 in castor, 1 in black mustard, 1 in sunflower, 1 in sesamum, 2 in cotton, 5 in sugarcane) were developed and released during July, 2002 and passed on to the Extension functionaries. Jagtial Sannalu (JGL 1798) and Nandyal Sannalu (NDLR 8) with cooking quality on par with Samba Mahsuri are becoming highly popular in Telangana and Rayalaseema regions.

University produces and supplies breeder seed and foundation seed, for further multiplication in the seed production chain. The production and supply of Breeder and Foundation Seed during the last 3 years is as below:

		1999-2000	2000-2001	2001-2002
Breeder seed	:	1663.84 q	2157.45 q	2412.11 q
Foundation seed	:	5380.00 q	6763.00 q	5482.07 q

The improved varieties of the University in rice, the major food grain crop of the state, continues to occupy more than 80 per cent of the area in *kharif* and about 65 per cent in *rabi*. About 25 per cent (10 m ha) of rice area in India (40 m ha) is covered by the varieties released by ANGRAU. It is proud to note that around 11 per cent of the area under high yielding varieties of rice in India is occupied by Swarna, Vijetha and MTU 1010. Kranti castor has spread to larger areas and is becoming highly popular. Premier Rice Research Station at Maruteru will soon be giving a "Wonder rice" variety (The Super Rice) which has high quality rice grain, having a L:B ratio of 3.2, as a gift to the farmers of the State. This variety has about 600 or more paddy grains per panicle and a theoretical yield potential of about 15 t/ha. The University also supplies planting material mainly buddings, grafts and layers of the horticultural crops to the Department of Horticulture, farmers, nursery men etc. *Rhizobium, Azospirillum* and PSB cultures are also being produced and supplied to the farmers.

ii) Response to the package of practices relating to soil nutrient, plant nutrient, plant protection, irrigation:

IPM and IDM Technologies Developed:

University has developed and standardized Integrated Pest Management and Integrated Disease Management technologies for crops like cotton, groundnut, chillies, rice, redgram, bengalgram and vegetables. The pesticide use in the State which has otherwise been highest in the country is constantly declining.

Canna indica, sorghum and maize were identified as new non-citrus herbaceous hosts for Citrus Yellow Mosaic Virus (CYMV). New protocol for purification of CYMV was established.

The production of NPV is being undertaken in several villages by farmers themselves in Guntur district as they were totally convinced and confident of the biopesticidal technology

Sub-surface Drainage:

Sub-surface drainage system developed by the University for the improvement of soil health and micro environment under ill drained conditions resulting in increasing the productivity of crops is gaining popularity among the farmers.

Improved Doruvu Technology:

Improved Doruvu Technology for irrigation is revelutionishing the agricultural operations in the coastal sands. This technology is also being utilized for providing potable water in the villages along the coast where supply of drinking water poses a serious problem.

At Bapatla, the additional income realised in rice nursery and chillies cropping system was Rs.50,400/- under irrigation through improved *doruvu* technology. In rice groundnut system an additional income of Rs.20,500/- was realised due to improved *doruvu* technology

iii) Assessment of technology and package of practices for reclamation of lands (Saline, water logged etc.)

Studies carried out by ANGRAU at Uppugunduru and Konanki areas also revealed that the rice yields could be increased by 30% by providing sub-surface drainage in the water logged soils of these areas. The technology reduced the soil salinity to well below the crop tolerance limits. The system facilitated taking up of pulses and vegetables after *kharif* rice. The practice also enabled the survival of *daincha* and sunhemp in these soils before *kharif* rice crop, which was not found possible prior to the installation of sub-surface drainage system.

On-farm research and extension activities have been successfully taken up on a large scale for efficient management of irrigation water under Sriram Sagar Project and Srisailam Right Bank Canal under world Bank assisted AP III irrigation Project.

Crop ad Contingency Plans:

Official documents "Andhra Pradesh -- crop strategies and contingency plans" for the years 2001-2002 and 2002-2003 were brought out and supplied to the Government, DOA officials and scientists for follow up action.

The University has been providing alternate and contingency crop plans from time to time to suit the changing behaviour of monsoon and drought conditions during this year (2002-2003).

iv) Success or failure of new crop rotations/cropping sequences/mixed croppings etc.

Coconut + cocoa + pepper + banana + elephant foot yam was found to be remunerative cropping system with a high cost benefit ratio of 1.74.

Soybean + pigeonpea intercropping and soybean followed chickpea cropping systems were found to be more economical compared to sole cotton.

Alternate remunerative crops and cropping systems for cotton in red *chalka* soils and black soils were suggested.

Alternative remunerative cropping systems to tobacco suggested for each situation and season by the University were accepted by the farmers and found satisfactory during the year 2001-2002.

v) Acceptance of process/products developed and released by the R & D institutions

A Pneumatic Pressure Boiling Vessel was developed at Regional Agricultural Research Station, Anakapalle, to process parboiled rice, with attractive white colour.

Conversion of tobacco barn for chilli drying was found feasible.

Recommended technology of stem application of monocrotophos in the initial stages of cotton is estimated to account for a saving of 80 crores per year to the farmers, on pesticide use.

vi) Farm Implements and machinery introduced

Based on the demand, a number of improved farm implements and machinery developed by the University have been manufactured by the implements/machine manufacturers in the state. ANGRAU puddler is manufactured and supplied by the AP Agro-industries Development Corporation in hundreds every year. The list of equipment which are commercialised and which are ready for commercialisation is as follows:

vii) Performance of equipment and machinery introduced

a) Implements suitable for Region V

1. Self propelled paddy transplanter
2. Self propelled paddy harvester
3. Self propelled boom sprayer
4. Tractor operated we land leveller
5. Tractor drawn ferti-seed drill
6. Bullock drawn ferti-seed drill
7. Power weeder for dry land crops
8. Power weeder for sugarcane
9. Vegetable seed thresher
10. Multi crop thresher
11. Groundnut pod stripper
12. Paddy row seeder

b) Technology/implements commercially available

1. Multi crop thresher

2. Self propelled paddy reaper
3. Tractor drawn & bullock drawn seed drills
4. Power operated Groundnut pod stripper
5. Tractor drawn wet land leveller
6. Manual paddy row seeder
7. Power operated sunflower/maize thresher

c) Technology ready for commercialization

1. Self propelled boom sprayer

d) Technology yet to be commercialized

1. Self propelled paddy transplanter
2. Power weeder for dryland crops & sugarcane
3. Vegetable seed thresher

viii) Popularity of new strains/species in cattle/poultry/fisheries

Exploited Embryo Transfer Technology in livestock improvement and achieved successful transfer of Ongole cattle embryos. Eight Ongole calves were born through Embryo Transfer Technology at Livestock Research Station, Lam, Guntru and in the farmers fields.

Developed a technology for artificial hatching of Emu eggs under local conditions that was not possible earlier. Abount 25 chicks have emerged already through this technology.

The marine crab and sea bass culture, developed by the University, as alternate species to tiger prawn and development and propagation of commercial fresh water prawn culture as an alternate to shrimp culture, are gaining popularity among farming community in the state.

A calendar on 'Seasonal Occurrence of Bacterial and parasitic disease in Fresh Water Fish in Andhra Pradesh', was brought out in Telugu, for the use of aqua-farmers.

ix) Home Science

More than 600 textile colour shades were developed on cotton yarn using vegetable dyes obtained from Annatto, *Bombax malabaricum* and *Eclipta prostrata* with different combinations of mordants.
Tested the modified row seeders for paddy sowing directly in the puddled soils to reduce the drudgery of women.

x) Efficacy of new programmes in Extension Education

District wise database on land utilization pattern, crops, cropping systems, productivity level, soils and soil health problems and animal health, for all the districts, except the Hyderabad urban district, have been documented by the District Agricultural Advisory and Transfer of Technology Centres (DAATTCs). Production constraints have been listed for both crop and cropping system wise for planning technology assessment and refinement programmes effectively.

Organized Farmer – Scientist interaction meetings - *Annadata – Vedika*, on drought management at Palem, Ongole, Anantapur, Khammam and Anakapalle, in collaboration with the Department of Agriculture, Eenadu and E-TV, for the benefit of farmers.

The Electronic Media Wing of Agricultural Information and Communication Centre of ANGRAU has produced programmes on Agriculture and allied areas for telecast through E-TV programme, *Annadata – Velugubata*, twice a week, and for telecast by Teja T.V. under *Rythu Mitra* programme daily, benefiting lakhs of farmers in the state of Andhra Pradesh.

Scientists of the University are participating in the daily live session of phone-in-programme for half-an-hour under *Rytu Mitra* programme, and are answering the farmers' queries.

Diagnostic survey reports, indicating the severity of the pest and disease incidence and nutrient deficiencies in various crops, received from the DAATTCs, are transmitted to *Rytu Mitra* programme on the same day, for the benefit of large number of farmers.

Farmers Training Programmes were organized by the Scientists of the University at 276 Agricultural Market Committees in the state, in which over three lakhs of farmers got the benefit of interaction with the scientists, and it became a powerful tool for transfer of technology.

Inter-Institutional and International Collaboration for Scientific works

Such arrangements have been made and MoU signed with the Universities of Londrina and North Parana of Brazil, University of Cornell, Ithaca, USA, University of California, Riverside, USA and Florida A & M University, USA, Wageningen Agricultural University and Research Center (WUR), Wageningen, Virginia Polytechnic Institute and State University at Blacksburg, Virginia, USA, International Research Institute for Climate Prediction, New York, USA, Foundation for Genetic Research Houston, USA and Centre for DNA Finger Printing and Diagnostics, Hyderabad

Collaborative arrangements are agreed in principle by Federal Institute of Technology, Zurich, Switzerland, International Soil Reference and Information Centre, Wageningen, The Netherlands, International Food Policy Research Institute, Washington DC, USA, University of Wisconsin, Madison, USA, Purdue University, West Lafayet, Indiana Polis, USA, University of Illinois, Urbana, Champaign, USA and Texas A&M University, College Station, USA.

3 a) Trends in Area, Production and Productivity of major crops in Andhra Pradesh:

CROP	Area (lakh ha)		Production (lakh tonnes)		Productivity (Kg/ha)	
	1999-2000	2000-2001	1999-2000	2000-2001	1999-2000	2000-2001
RICE	40.14	42.43	106.38	124.58	2710	2936
JOWAR	7.36	6.77	5.35	6.19	728	570
BAJRA	1.17	1.43	0.98	1.49	836	1033
MAIZE	4.52	5.28	14.72	15.71	3258	2994
RAGI	0.96	0.99	1.11	1.20	1143	1210
REDGRAM	4.32	5.13	1.55	2.18	358	427
GREENGRAM	4.59	5.20	2.11	1.84	460	354
BLACKGRAM	4.61	5.55	2.95	3.90	640	704
GROUNDNUT	17.95	18.74	10.89	21.43	607	1145
SESAMUM	1.71	1.83	0.38	0.37	220	344
CASTOR	2.64	3.99	0.59	1.37	221	344
SUNFLOWER	2.78	1.97	1.59	1.68	573	851
COTTON (LINT)	10.46	10.22	15.79 *	16.63 *	257	277
MESTA	0.76	0.78	6.23 **	6.87 **	1470	1589
CHILLIES	2.67	2.38	4.96	5.26	1852	2211
TOBACCO	1.72	0.52	1.93	0.88	1122	1903
SUGARCANE (COMING TO HARVEST)	2.31	2.17	185.08	176.9	79963	81314

* LAKH BALES OF 170 KG EACH

SOURCE : AN OUTLINE OF AGRICULTURAL SITUATION IN ANDHRA PRADESH

SEASONAL AND CROP CONDITIONS IN ANDHRA PRADESH DURING 2001

The seasonal conditions during the year 2000-2001 on the whole were satisfactory. The state received an annual rainfall of 925 mm as against normal rainfall of 940 mm, the deficit being 1.6%. The south west monsoon entered into some parts of Rayalaseema and South Coastal Andhra on 2nd June 2000 and advanced into remaining parts of Rayalaseema on 3rd June. During the south west monsoon period the state as a whole received an average rainfall of 759 mm as against the normal rainfall of 624 mm excess being 22%. During north east monsoon period the state as a whole received an average rainfall of 91 mm as against the normal rainfall of 224 mm the deficit being 59%.

During the year 2000-2001, the net area sown increased to 111.15 lakh ha from 106.10 lakh ha in 1999-2000. The cropping intensity remained more or less the same at 122 per cent.

The productivity of crops like rice, *bajra*, *ragi*, redgram, blackgram, groundnut, castor, cotton, chillies and mesta were increased as compared to previous year.

SEASONAL AND CROP CONDITIONS IN ANDHRA PRADESH DURING 2002

Rainfall: South West Monsoon (1-6-2002 to 30-09-2002)

The South West Monsoon advanced into the State on 3rd June and covered the entire State by 12th June. The date of arrival of monsoon was more or less normal. During the South-West Monsoon season ending 30-09-2002, the State as a whole received deficit rainfall (-28%). The rainfall received during the period under report was 456 mm as against the normal of 634 mm.

Region-wise rainfall data revealed that, all five regions in the State received deficit rainfall.

District-wise rainfall data revealed that, sixteen of 23 districts viz., East Godavari, Vizianagaram, West Godavari, Krishna, Guntur, Nellore and Prakasam in Coastal region and Anantapur, Cuddapah and Kurnool in Rayalaseema region, Medak, Nizamabad, Warangal, Mahaboobnagar, Nalgonda and Hyderabad in Telangana region received deficit rainfall, while remaining seven districts in the State received normal rainfall.

However, a close look at rainfall distribution in different districts revealed that, more or less, all the districts in the State have experienced dry spell for five weeks from 26-06-2002 and in most of the districts rainfed crops could not be sown due to this dry spell. During the first fortnight of August due to revival of monsoon as a result of low pressure developed over Bay of Bengal, wide spread rains were received in different parts of the State. These rains could help the already sown rainfed crops besides helping in taking-up sowing of crops like groundnut in Rayalaseema region, and castor and sunflower in other regions. Further, these rains have also helped to take-up transplanting of rice to certain extent.

In Telangana region, all the districts except Nalgonda and Mahaboobnagar received excess rainfall which helped to some extent for partial filling-up of tanks during the week ending 28-08-2002. Further, the districts of Anantapur, Cuddapah and Kurnool have experienced dry spell for the period from 15-08-2002 to 11-09-2002. However, the rains received during the week ending 18-09-2002 in the Rayalaseema districts particularly Anantapur, Cuddapah and Chittoor helped the groundnut crop which is in early and late reproductive stage to certain extent. The region has again experienced dry spell for the period from 19-09-2002 to 09-10-2002.

More or less all the districts in Coastal and Telangana regions have experienced dry spell during

September month.

The South West Monsoon withdrew from the State on 25-10-2002 and simultaneously North East Monsoon set-in in over South Coastal Andhra and Rayalaseema.

North East Monsoon (01-10-2002 to 31-12-2002)

During the season ending 31-12-2002, the State as a whole received deficit rainfall (-25%). The rainfall received was 157 mm as against the normal of 210 mm. District wise data revealed that Kurnool, Mahaboobnagar and Ranga Reddy received excess rainfall, Prakasam, Cuddapah, Medak, Nalgonda and Hyderabad received normal rainfall, Vizianagaram received scanty rainfall, and remaining fourteen districts in the State received deficit rainfall (Table 1).

Total Monsoon Period (01-06-2002 to 31-12-2002)

During the season ending 31-12-2002, the State as a whole received deficit rainfall (-27%). The rainfall received during the period under report was 613 mm as against the normal of 844 mm. District-wise rainfall data revealed that, five of 23 districts viz., Adilabad, Karimnagar, Khammam, Mahaboobnagar and Ranga Reddy received normal rainfall and remaining districts in the State received deficit rainfall.

Dry weather prevailed during the week ending 01-01-2003 in all the districts of the State.
Seasonal and crop conditions in the zones

K.G. Zone

During the year 2002 the rainfall received through out the zone was suboptimal and fell short of the average by 25-40% in different districts of the zone. The worst affected districts are Prakasam and Guntur. Added to this, the level of water in the reservoirs in Nagrjuna Sagar from Krishna river and also in Godavari was very low due to meager inflow of rain into the system.

All crops raised in the *kharif* season throughout the zone suffered moisture shortage of varying magnitude, resulting in fluctuating yields in all the crops.

Rice could not be planted in the entire command area. Little area was planted under bore wells. Due non-availability of water ID crops like blackgram, bengalgram were sown extensively and fodder sorghum to a lesser extent was sown with the help of rains in November first fortnight. These crops also withered as there was no rain after sowing.

In Krishna delta, vide fluctuations in yields are observed. Consequent to the decision of non release of water in the entire Krishna delta, farmers resorted to blackgram in rice fallows extensively.

In Godavari delta, vide fluctuations in yields are observed depending on the prevalence of the conditions. Out of 9 lakh ha under Godavari delta only 5 lakhs was covered, other 4 lakh ha was planted with pulses.

The yields of cotton are moderate (4-6 q/acre). Under irrigated conditions yields are good.

The area under chillies declined sharply due to prevailing drought conditions. Planting of chillies was delayed and extended to November month also. The standing crop is affected by severe moisture stress and was attacked by several sucking pests like thrips, mites and aphids and performance is poor.

Redgram is the major pulse sown during *kharif* followed by greengram and blackgram in the zone. Due to the prolonged moisture stress, the crop withered.

Blackgram was sown extensively in uplands and also in the NSP right command area due to non availability of water. Upland blackgram suffered moderately due to moisture stress. In mango flowering is delayed due to meagre rainfall received.

Bengalgram was sown extensively in the Prakasam district during October but affected due to drought.

North Coastal Zone:

Low/deficit rainfall, ill distribution of rainfall, prolonged dry spells, high atmospheric temperature (48-49^{O} C of maximum temperature), dry winds and cloudy skies during the *kharif* season adversely affected the crop growth. Rainfall received during South West monsoon in the north coastal districts is below normal except in June (the range of deviation being between – 13.6% to – 78.0%).

There was deficit rainfall during south west and north east monsoon period resulting in severe drought in majority of mandals in Vizianagaram and Visakhapatnam districts. Water level in wells, canals and tanks is meagre due to failure of monsoon. About 87 mandals out of 124 mandals were declared as drought affected mandals. There was a shortfall of 21 to 40% in the area under rice in the zone. The groundnut area was also reduced by 18-35%. The area under Sugarcane and Maize was increased to the tune of 5.5 to 19% and 8.0 to 84% respectively. The normal coverage of mesta was recorded in the principal districts of Vizianagaram and Srikakulam.

Rice:

The deficit rainfall, prolonged dry spells from July onwards had an adverse affect on the crop. The crop experienced moisture stress in critical stage of crop growth leading to complete withering of the crop in certain areas. The adverse weather conditions ultimately led to poor performance of the crop. Severe incidence of leaf folder, moderate infestation of panicle mite and green jassids was noticed. Moderate to severe incidence of sheath blight and blast was also noticed. Crop in problem soils exhibited zinc and iron deficiencies on an increasing scale.

The expected yield reduction due to biotic and abiotic stresses in the districts of Vizianagaram and Visakhapatnam ranges between 29-62% with the exception in Srikakulam district

Sugarcane:

The crop grown as rainfed and ratoon suffered due to moisture stress and exhibited stunted growth (in extreme cases only 3-4 internodes per cane). Severe infestation of early shoot borer, internodal borer, scale, mealybug and whitefly was noticed in certain varieties subjected to severe moisture stress. Severity of smut and ring spot increased under stress conditions. Reduction in yields in the range of 26- 29% is expected in the zone due to drought and biotic stresses.

Groundnut:

The crop is worst affected due to drought among all *kharif* crops. The crop was subjected to severe moisture stress especially at peg penetration which is most critical. Precipitation received in October however retrieved the situation. Drastic reduction in yield is expected to a range of 28 to 68% (maximum reduction is expected in Vizianagaram district upto 68%)

Mesta:

Retarded growth was noticed in mesta due to deficit rainfall in Vizianagaram and Srikakulam Districts. Yield reduction to the tune of 15-25% is expected.

Maize:

The crop suffered substantially due to prolonged dry spells, leading to wilting in certain areas as the crop is known to be sensitive to moisture stress.

Other dry crops:

The dry spells also affected the grain formation in *Bajra, Jowar, Ragi,* Sorghum and Redgram and substantial reduction in yield is observed.

Southern Zone:

In Nellore, 40% deficit was observed in South-West monsoon. In Chittoor though, the deficit was only 11%, the distribution of rainfall is uneven. In Cuddapah severe drought with deficit about 50% per cent in South West monsoon.

In Nellore as most of *kharif* crops like rice, groundnut were grown under assured irrigation i.e. borewells, the crop coverage & yield were normal. *Rabi* season started with good rainfall. In Chittoor in *kharif* only 30-35% of normal area was sown with groundnut. The expected yield is very low (200-400 kg/ha).

In Western parts of the district sorghum, horsegram & greengram crops were satisfactory.

In *rabi* rice & maize sowings are being taken up in Eastern parts of the district. Only 50% of groundnut area was covered & total failure of crop was noticed. Cotton & redgram were also affected. Sowing of *rabi* crops sunflower, bengalgram & coriander is in progress. Horsegram area increased in red soils.

Late sown *kharif* crops suffered from moisture stress resulting in low yields. Water table is low and *rabi* crops and sugarcane may be affected in summer months. Pulses mainly blackgram experienced terminal drought and expected yield will be about 1-2 q/acre. Rice, bengalgram sown in black soils as post rainy season crop is in good condition and the expected yield is about 4-6 q/acre. Horsegram was badly affected. Sunflower raised under rainfed conditions showing wilting symptoms and expected yield is about 2 q/acre in red soils and 3 q/acre in black soils respectively.

Northern Telangana Zone:

The total rainfall received from the beginning of kharif season till the end of October, 2002 was less than the normal in all the districts of Northern Telangana Zone. However, among the districts, Adilabad and Nizamabad received maximum (78.1%) and minimum (64.6%) of their normal rainfall respectively upto the end of October, 2002. During last two months, the districts Nizamabad in September, Khammam and Warangal in October month and Medak in both September and October months received maximum per cent of their normal rainfall i.e., 79,102, 95, 66 and 87 per cent respectively leading to a coverage of 7.82, 4.82, 14.42 and 56.13 per cent of their normal rabi areas respectively.

The coverage under different crops during *kharif* 2002 in Northern Telangana Zone was only 81.43% of its normal area with just above average yields. Among the districts, maximum percentage of normal coverage was found with Adilabad (98.26%) followed by Karimnagar (83.19%) and Warangal (79.88%).

Warangal with 77 per cent of normal coverage and expected yield of 2.5 t/ha. However, the crop in Khammam covered under only 50 per cent of normal area was worstly effected due to shortage of water under rainfed condition with an expected minimum productivity of 0.4 t/ha. In majority of the areas severe incidence of WBPH was noticed in BPT 5204, JGL 384, JGL 1798, M 7. At certain locations the crop was also infected with panicle mite in addition to sheath blight. With regard to Maize, Nizamabad and Karimnagar districts are expected to yield a maximum of 33 and 32 q/ha from their 20 per cent less and 8 per cent more of their normal area coverages respectively.

Among oilseed crops, groundnut in Karimnagar under 29 per cent of normal area was damaged due to dry spells and is expected to yield about 5.9 q/ha. However, in Medak groundnut crop had performed well with an expected productivity of 11.58 q/ha from about 43 per centof its normal coverage. Cotton in major growing districts of Northern Telangana Zone, i.e., Adilabad, Karimnagar, Warangal and Khammam under reduced normal coverages ranging from 57 to 83 per cent is expected to yield about 1.6 q lint, 3.1, 4.6 and 2.6 q seed cotton/ha respectively. The crop is in boll formation to busting stage in the above districts. The incidence of *Helicoverpa* in major cotton growing areas of Northern Telangana Zone is below the ETL.

Sugarcane covering nearly 20,000 ha in Nizamabad (0.5% over and above normal area) is in maturity stage and experiencing moisture stress and pyrilla incidence with an expected productivity of 55 t/ha. Turmeric covered in about 111 per cent of normal area in Nizamabad is in rhizome formation stage with leaf spot incidence and is expected to yield around 3.5 t/ha.

Rabi

During *rabi*, the actual crop coverage in the zone was less than 60 per cent of normal coverage, mainly due to lack of sufficient moisture in the soil and also irrigation facilities. Among the districts a maximum of about 82 per cent of normal coverage was observed in Karimnagar followed by Khammam (76%) and Warangal (75%). Major *rabi* crop under irrigated conditions paddy was taken up in only 25 per cent of normal area in the zone. Due to wide fluctuation in minimum and maximum temperature during December and January months *rabi* nurseries were succumbed to cold injury showing yellowing and stunted growth.

Late transplanted BPT 5204, JGL 384 and other long duration paddy varieties were badly affected due to timely setting of winter season resulting in sterility and low yields.

The *rabi* pulse crop coverage was more than 7 times of its normal area in Warangal, while the same was more than 4 times of their normal areas each in Karimnagar and Nizamabad. Among the pulse crops, blackgram took lead in covering maximum area followed by redgram, bengalgram and greengram. In majority places infestation of thrips, aphids and severe incidence of powdery mildew was noticed in blackgram, while in some places Blackgram and bengalgram suffered much due to terminal moisture stress. *Rabi* redgram, was drastically affected due to pod fly.

In some areas of Warangal district, wilt incidence (20-42%) was noticed in redgram, which was in physiological maturity stage.

All the districts recorded less than 50% of their normal coverage of oil seeds (groundnut and sesamum) except Krimnagar and Warangal recorded more than 80% of normal groundnut.

Chilli that was taken up in less than normal coverages during *kharif* most of the hybrids affected due to blossom midge. Similarly, sugarcane yields were also drastically affected due to moisture stress during formative and grand growth period.

Due to prolonged dry spells during *kharif* and subsequent unfavourable climatic conditions there was much variation in mango flowering behaviour.

Southern Telangana Zone:

Major crops, rice sorghum, castor, redgram benefited due to good rainfall during October. Although some stress was observed during September, sorghum & maize which were sown early gave normal yields while maize planted in July 2nd fortnight suffered severely. However castor area has increased by 25 per cent. Due to good rainfall during October normal yields were regarded. The redgram also sown in normal area and October rains helped good vegetative Growth & flowering resulting in normal yields.

The area under paddy is drastically reduced in all the districts and the yields are likely to be reduced slightly due to non-availability of water and power shortage. The area under sorghum has increased in Nalgonda district and normal areas maintained in Mahabubnagar and Ranga Reddy district, while it was decreased to 25% in Medak district. The black gram area has increased to 25000 ha against 11000 ha, while the areas under Bengalgram, Safflower, Groundnut have reduced drastically in Medak and maintained same level of areas to that of 2002 in Ranga Reddy district.

Scarce Rainfall Zone:

Deficit rainfall & prolonged dry spells prevailed in all the districts.

In Kurnool district a total of 436 mm was received which amounted to a deficit of 47.2%. Due to prolonged dry spells and lack of sufficient moisture storage in soil profile (even in vertisols) the *kharif* rainfed crops were almost dried up particularly long duration crops like redgram & cotton. Below average yields are expected for short duration crops like greengram, blackgram, sunflower, *bajra, bhendi* and gingely. Groundnut crop was removed as it withered/dried completely.

In Anantapur less than normal rainfall was received. Groundnut crop experienced 40-45 days dry spell. In black soils farmers removed early sown crop as the crop completely dried up. Contingent crops sorghum, horsegram were sown in some parts.

In Cuddapah 1/5 of normal area was only sown. Maximum reduction in cotton area was observed which was occupied by bengalgram, sunflower & sorghum. Below average yields are expected in groundnut.

In Prakasam, wide spread drought situation prevailed during *kharif* affecting mungari cotton, greengram, gingelly, redgram, tomato, chillies etc.. These crops withered due to moisture stress. With the limited rainfall received during October sowings of bengalgram was taken up.

The weather conditions for *rabi* sown crops/sowings were good in some parts of Kurnool, Prakasam, Cuddapah districts. The sowings of Bengalgram and Sunflower were takenup in large areas while sorghum, blackgram, vegetable crops were sown in considerable areas. In general there was an increase in areas of sunflower, sorghum and bengalgram crops. The crops such as maize, corriander etc., were taken up in limited areas.

High Altitude And Tribal Area Zone:

Area under rice (28.74%), jowar (27.23%), ragi (27.9%), redgram (19%) reduced. Due to failure of monsoon during *kharif* 2002 and lack of sufficient water to *rabi* crops, 10.64% of area reduced and yields may be reduced up to an extent of 20-25%.

Major achievements during last 2 years

University
Research
Agriculture

Unstinted efforts of the scientists of the University resulted in development and release of 34 more improved varieties, including nine in rice; five in sugarcane; four in groundnut; three in blackgram; two each in sorghum, redgram, castor and cotton; and one each in *korra*, greengram, mustard, sunflower and sesame, during 2002-2003, thus bringing the total number of varieties released so far by the University to 302.

University produced and supplied 2412.11 q of breeder seed and 5482.07q of foundation seed, during the year.
Coconut + cocoa + pepper + banana + elephant foot yam was found to be remunerative cropping system with a high cost benefit ratio of 1.74.

Twenty automatic weather forecasting stations were installed to strengthen agro-met advisory services. Work on development of weather based pest and disease forecast models for major crops has started.

A Pneumatic Pressure Boiling Vessel was developed at Regional Agricultural Research Station, Anakapalle, to process parboiled rice, with attractive white colour.
University has developed and standardized Integrated Pest Management and Integrated Disease Management technologies for crops like cotton, groundnut, chillies, rice, redgram, bengalgram and vegetables.

Research on organic farming was initiated in the University for increasing export potentiality.

Veterinary Science:

Exploited Embryo Transfer Technology in livestock improvement and achieved successful transfer of Ongole cattle embryos. Five Ongole calves were born through Embryo Transfer Technology at Livestock Research Station, Lam, Guntur and in the farmers fields.

Model milking parlor was established at Buffalo Research Station, Venkataramannagudem, with automatic animal washing system and milking machine.

Home Science:

More than 600 textile colour shades were developed on cotton yarn using vegetable dyes obtained from Annatto, *Bombax malabaricum* and *Eclipta prostrata* with different combinations of mordants. Tested the modified row seeders for paddy sowing directly in the puddled soils to reduce the drudgery of women.

University Extension:

District wise database on land utilization pattern, crops, cropping systems, productivity level, soils and soil health problems and animal health, for all the districts, except the Hyderabad urban district, have been documented by the District Agricultural Advisory and Transfer of Technology Centres (DAATTCs). Production constraints have been listed for both crop and cropping system wise for planning technology assessment and refinement programmes effectively.

ANGRAU has organized Farmer – Scientist interaction meetings - *Annadata – Vedika*, on drought management at Palem, Ongole, Anantapur, Khammam and Anakapalle, in collaboration with the Department of Agriculture, Eenadu and E-TV, for the benefit of farmers.

The Electronic Media Wing of Agricultural Information and Communication Centre of ANGRAU has produced programmes on Agriculture and allied areas for telecast through E-TV programme, *Annadata Velugubata*, twice a week, and for telecast by Teja T.V. under *Rythu Mitra* programme daily, benefiting lakhs of farmers in the state of Andhra Pradesh.

Scientists of the University are participating in the daily live session of phone-in-programme for half-an-hour under *Rytu Mitra* programme, and are answering the farmers' queries.

Diagnostic survey reports, indicating the severity of the pest and disease incidence and nutrient deficiencies in various crops, received from the DAATTCs, are transmitted to *Rytu Mitra* programme on the same day, for the benefit of large number of farmers.

Farmers Training Programmes were organized by the Scientists of the University at 276 Agricultural Market Committees in the state, in which over three lakhs of farmers got the benefit of interaction with the scientists, and it became a powerful tool for transfer of technology.

Government

Neeru-Meeru Programme: Neeru-Meeru programme in Andhra Pradesh was initiated on 1-4-2000 to improve and recharge the ground water through water conservation with local participation.
The works relating to construction of checkdams, deepening ponds etc. has been completed in 5 phases and the sixth is in progress.

Water Users Associations: Govt.of Andhra Pradesh transferred management of all irrigation systems to farmers organizations (elected) under A.P. Farmers Management of Irrigation Systems Act, - 10,292 WUAs.

Vana Samrakshana (Tree Planting & Protection): About 132 crores seedlings raised and planted during last 6 years (1997 – 2003)

Clean And Green Programme : Every 3rd Saturday is allocated for Clean and Green Programme in A.P.

Jalachaitanyam: An awareness programme on efficient utilisation and conservation of water was taken up all over Andhra Pradesh from 1st April to 10th April. The scientists of the University extended required technical support and actively coordinated and participate in this programme.

C. Major problems during the last 2 years

2000-2001

Groundnut

A further set back to the agriculture in the state was in the form of unprecedented outbreak of peanut budnecrosis virus disease on groundnut in the major groundnut growing districts of Anantapur, Kurnool and Chittoor. This is in succession of the crop failure in preceeding year due to unfavourable season. With great difficulty the state could mobilise and distribute the seed and the farmers cropped it in large areas with many hopes incurring heavily on inputs. It was sown in about 8 lakh ha in Anantapur, 2 lakh ha in Kurnool and 1.7 lakh ha in Chittoor district. The crop suffered 20 to 80 per cent loss in Anantapur, the district which accounts for about 50 per cent of the groundnut area in *kharif* in the State. Scientists and officials of the University including the Vice-Chancellor, toured extensively the affected areas, assessed the damage and passed on the recommendations to contain its spread. The DOA officials, scientists of ICAR, ICRISAT also collaborated in this effort. The crop was also affected by red hairy caterpillar in Chittoor district.

Cotton

Because of the cyclonic rains, *Helicoverpa* (*Heliothis*) incidence was noticed above threshold limits in parts of Guntur, Krishna and Warangal districts. Due to prolonged sowings, overlapping generations of the pest were observed. Farmers could contain the pest to some extent by adopting hand picking and destruction of the larvae of the pest, a component of the recommended IPM package of the University. The continuing heavy load of egg masses of the pest in many areas still poses a threat and needs constant vigilance in the pest management.

The diagnostic teams constituted by the University in respective districts are regularly monitoring the pest position, giving wide publicity through print and electronic media on the detection of the pests, other problems and their management. They are also conducting demonstrations/trainings etc. on the mass multiplication and use of NPV etc. by farmers themselves.

Coconut

Coconut is cultivated in area of about 2.5 lakh ha in the districts of East Godavari, West Godavari, Krishna, Khammam, Guntur, Chittoor and Srikakulam.

Infestation of coconut by Eriophyid mite transmitted through air has been reported in a severe form causing damage to the nuts. The Scientists of the University and officials of the Department of Horticulture surveyed the areas and suggested the required cultural and chemical control measures to arrest the spread of the disease. Demonstrations were also held on effective root feeding technology for application of the pesticide.

Rice

The leaf and panicle mite incidence was severe during this season. The unknown malady called as *Nallakanki Tegulu* appears to be caused by panicle mite *Steneotarsonemus spink*

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2001-2002

Cotton

A severe incidence of pests on cotton in Warangal District was observed during the current *kharif* season. The Director of Research along with a team of scientists visited the areas of high pest incidence and decided to monitor the pests and educate the farmers in these areas for a period of one month w.e.f. 30-9-2001. As a course of action of this decision, two member team of Entomologists from ANGRAU monitored the pests on cotton daily from 30-9-2001 to 30-10-2001 in Warangal district and educated farmers on spraying the recommended pesticides to control the pests, safe handling and correct methods of pesticide application.

Farmers x Scientists Interaction Meetings (Annadata Vedikas) were organised by Eenadu Group at Miryalaguda, Jagtial, Palem and Ongole during August, 2001 in which several scientists from Research Stations have participated. The Director of Research has also participated in Miryalaguda meeting. Awareness was created among farmers on the measures to mitigate the adverse affects of prolonged dry spells, technologies to utilize overaged rice seedlings, crop production and protection technologies etc. in these meetings through direct interaction with the farmers.

2002-2003

An official document "Andhra Pradesh – crop strategies and contingency plans 2002-2003" was brought out and supplied to the Government, DOA officials and scientists for follow up action.

The University has been providing alternate and contingency crop plans and Agro Advisory bulletins from time to time to suit the changing behaviour of monsoon and drought conditions during this year.

Contingency plans were prepared in co-ordination with Directorate of Agriculture and Directorate of Horticulture suggesting alternate crops and varieties to be taken under existing dry situation and wide publicity was given through electronic and print media in all the zones.

Diagnostic field visits were organised regularly by research stations scientists and DAATTCs independently and in collaboration with DOE and timely recommendations were given on spot and the messages were also disseminated through AIR, Visakhapatnam, Press and T.V.

Drought interaction meetings were orgnaised in collaboration with DOA and farmers were educated on measures to mitigate drought.

Campaigns and meetings were also organised by Scientists of research stations, DAATTCs and KVKs to enlighten the farmers.

A-2 Issues / problems / concerns raised by State Dept. of Agriculture / Horticulture / Animal Husbandry / Fisheries APC/Secretary (Agri./Hort.) AH/Fisheries

Orissa

B.2.1 STATUS REPORT ON AGRICULTURAL EDUCATION, RESEARCH & EXTENSION EDUCATION OF ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY

Introduction:

The Orissa University of Agriculture & Technology, the second oldest Agricultural University in the country, made its humble beginning in the year 1962 with two colleges, College of Agriculture and College of Veterinary Science and Animal Husbandry. Now it has grown into a fulfledged Institution having 8 (eight) constituent colleges imparting education and training in various aspects of Agriculture, Animal Husbandry and Veterinary Sciences, Agricultural Engineering & Technology, Home Science, Fisheries, Forestry, General Engineering and Basic Sciences. The University has developed a strong research base for generation of technology capable of improving productivity, stability, profitability and sustainability of the major farming systems under varied agro-climatic situations of the State. Dissemination of the latest technology covering different areas of agriculture and allied discipline is one of the major responsibilities of the University. This is achieved through various types of training, distance education programmes, on-farm trials and demonstrations in farmers' fields, farmers fairs and various mass communication programmes.

2. ACADEMIC PROGRAMME AND ACHIEVEMENT:

There are eight constituent colleges under the University with student strength of 2981, of which six are located in the main campus at Bhubaneswar. The College of Fisheries is located at Rangailunda, Berhampur in Ganjam district and the second college of Agriculture is at Chiplima in Sambalpur district. The six colleges that are located in the main campus at Bhubaneswar are College of Agriculture, College of Veterinary Science & Animal Husbandry, College of Basic Science & Humanities, College of Agricultural Engineering & Technology, College of Home Science and College of Engineering and Technology. There is a Department of Forestry in the College of Agriculture, which awards B.Sc. (Forestry) degree.

Degree Programmes

The University offers Bachelor's Degrees in Agriculture, Veterinary Science, Agricultural Engineering, Home Science, Fishery, Forestry, Civil, Mechanical, Electrical, Architectural Engineering, Instrumentation & Electronics and Computer Science and Information technology. It offers M.Sc. (Ag.) degree in Agriculture, M.V.Sc. degree in Veterinary Science, M.F.Sc. Degree in Aquaculture, M.Tech. Degree in Agricultural Engineering, M.Sc. degree in Microbiology and Master in Computer Application, Ph.D degree is offered in Agriculture, Veterinary Science and Fisheries faculties in selected subjects. The College of Basic Science & Humanities prepares students for +2 Science and +3 Science (B.Sc.degree).

3. RESEARCH PROGRAMME AND ACHIEVEMENT

Research Net Work

The University has a research network covering all the ten agro-climatic zones of the state. It has eight Regional Research and Technology Transfer Stations, four Regional Research and Technology Transfer Sub-stations, ten commodity research centers and thirteen adaptive research centres. In addition to this forty-six All India Co-ordinated Reserach Projects with 75:25 funding and more than 20 adhoc research projects with 100% assistance from the Indian Council of Agricultural Research (ICAR) other agencies are operating in the University. Besides the University has implemented forty-one technology projects since last two years financed by Indian Council of Agril. Research (ICAR) under National Agril. Technology Project (NATP)

SALIENT RESEARCH FINDINGS

The University has made significant contributions in generating technologies worth adopting by the farming community of the State in the fields of agriculture, veterinary and allied sciences.

A. Agricultural Sciences

Crop Improvement

Under the crop improvement programme, different varieties/cultures of field crops were identified, screened and evolved for various situations prevailing in the State. Some of the rice varieties released by this University have been popularly adopted not only at the National level, but accepted by the International Farming Community, too. The lowland rice culture "OR 142-99" has been released in Cambodia by the name "Santepheap-3" meaning "Peace". International Rice Research Institute, Philippines, has identified "Rambha" as a suitable variety for the shallow lowlands of Myanmar, Sarathi for irrigated conditions of Bangladesh, China. Malaysia, Egypt and Vietnam.

- OUAT has so far released 88 different high yielding crop varieties suitable for cultivation in the State. Forty-seven of these varieties belong to rice among which Parijat, Pathara, Khandagiri, Lalat, Konark, Kharavel, Surendra, Gajapati, Mahanadi, Kanchan, Indravati, Ramachandi and Prachi are the popular varieties for different land situations. Rice variety Jagabandhu suitable for low land situation with yield potential of 4.5 t/ha was recently released (April,2002), Indravati is gaining popularity in the Tamil Nadu as a substitute for CR 1009.

- During July 2001, a ragi variety 'Chilka' and little millet varieties 'Kolab' and 'Tarini' were developed by OUAT and have been released by the Central Varietal Release Committee. Government of India for five States, viz., M.P., A.P., Karnatak, Gujarat and Orissa. The yield potential of these varieties are 35 and 27 q/ha, respectively.

- A white seeded ragi variety 'Subhra' had already been released in the State.

- Important crop varieties developed by OUAT in oilseeds are Parbati in toria (released in October 2000), Smruti in groundnut and Uma & Usha in sesamum. Toria variety Anuradha was released during April 2002. It has a yield potential of 1.3 to 1.5 t/ha and suitable for cultivation through out the state under rainfed/irrigated situations.

- Spices Research Station, Pottangi has developed ginger varieties, viz. Suprava, Suruchi and Suravi and turmeric varieties of Roma, Suroma, Ranga and Rashmi which yield 5 to 6 times higher than the local types of these crops. Average fresh yield of local varieties of ginger and turmeric is 8.0 t/ha respectively.

- On vegetable crops, the University has developed Utkal Tarini, Utkal Madhuri and Utkal Keshari in brinjal; Utkal Pallavi, Utkal Deepti, Utkal Kumari and Utkal Urbasi in tomato; Utkal Rasmi and Utkal

Abha in chilli and Utkal Gaurav in okra which are being admired by the farmers of the State for their performance.

- A tobacco variety, Pyruvithanum, was released during April 2002 for cultivation in Gajapati district of Orissa.

- Mungbean var. Dhauli and Urdbean var. Sarala have been released by OUAT. Further mungbean variety OUM 11-5 (Kamadev) has been identified in the national level. Proposed moong variety 'Durga', blackgram variety 'Prasad' and sesamum variety 'Prachi' are in the pipeline for release for specific locations.

Crop Production :

- Rice variety ZHU II - 26 when intercropped with greengram variety PDM 54 in rainfed uplands of Phulbani district (2:1), it becomes profitable with yields of 1.6 t. rice and 0.3 t. greengram per hectare. Under rainfed medium lands, rice-greengram sequence is best in Kalahandi district, whereas rice - vegetable (cauliflower) becomes most remunerative (net profit Rs.18,880/ha) in irrigated uplands of the same district.

- Medium duration rice varieties (Naveen/Lalat/Swarna) can suitably be grown after harvest of jute crop (Baladev/Jagadev) in Kendrapara area to obtain 3.6 to 4.0 t. of rice yield per hectare.

- The major intercropping systems recommended for the rainfed uplands of the State are Arhar + groundnut, Arhar + rice/ragi, Maize + cowpea both for grain and fodder. Nearly 2.00 lakh hectares have been put under Arhar + groundnut/rice intercropping system. Application of fertilizer to the Arhar + rice or maize + cowpea on the basis of area occupied by each crop is remunerative.

- In rice-groundnut cropping system application of the recommended dose of fertilizer (RD) + lime (0.25 LR) to kharif rice and RD + gypsum (250 kg/ha) + boron (15 kg borax/ha) soil application once in two years maximised the yield of rice (5.8 t/ha) and groundnut (3.0 t/ha). All P should be applied to rice as a mixture of SSP & RP (1:1) required for both the crops.

- Application of 0.3% borax as foliar spray in mustard maximized the seed yield (1.8 t/ha) and oil yield (0.7 t/ha).

- Rajmash, a non-traditional pulse, produced a seed yield of 2.1 t/ha with 6 irrigations and 80 kg N/ha. It removed 87 kg.N, 19 kg P and 66 kg K/ha. The water requirement was 500 mm and water use efficiency was 46 kg seed/ha-cm.

- Niger should be sown during the first fortnight of August for doubling the yield. It is an important non-monetary input for the tribal farmers.

- Yam can be grown in rainfed uplands without staking at a spacing of 100 cm x 50 cm. It conserves soil & water and yields up to 17 t/ha. It can impart food security to the tribal farmers.

- For mulching in turmeric and ginger, mustard and gram stalks, mango and jackfruit leaves can be used in place of sal leaves (Shorea robusta). Arhar and cluster bean may be intercropped with ginger.

- Cereal + legume intercropping of maize and cowpea in 2:2 ratio recorded highest green forage yield (37t/ha $^{-1}$) with net return of Rs. 15,678/- and benefit - cost ratio of 3.41.

Crop Protection

Peak periods of infestation, nature of damage, economic threshold level (TEL) of different insects and diseases of major crops of the state have been determined by our scientists through regular research and se\urvey work. Identification of the effective chemicals, their concentrations and frequency of use for almost all the crops have been recommended to the farmers for controlling various pests. Biological control of pests, though of limited utility at present, has proved to be much effective without any danger of residual toxicity - as frequently encountered in the use of chemicals.

- The coconut black-headed caterpiller has been successfully controlled by releasing paratoids (Bracon hebetor, B. brevicornis and Goniozus nephantidis). The breeding techniques have been standardised.
- Integrated Pest Management modules for important crop pests of rice, sugarcane, brinjal, cole crops, mustard and cotton have been developed and refined. Farmers are being benefitted by adopting these eco-friendly pest control measures.
- Honey yield per hive has been increased through adoption of improved management practices for Indian and Italian bees. Italian honey bees increased the seed yield by 34% in sunflower.
- Some new generation insecticides such as Imidacloprid, Naclmfoa, Actara 25 WG and Rampage are effective against okra jassids and aphids, chilli thrips and cabbage diamond back moth.
- Transplanting of rice before 15 July reduces incidence of bacterial blight, blast, sheath blight, sheath rot in rice. Seed treatment with plantomycin (100 ppm) + Carbendazim (0.15%) and foliar spray of caubendazim (0.7%) controls BLB and BLS in rice.
- Bacterial wilt of groundnut can be effectively controlled by drenching the soil with plantomycin (0.1%) or streptocyclin (0.01%).
- Application of Rice-guard ten days after transplanting of rice controlled weeds, increased weed control efficiency (92%) and produced 4.8 t/ha of grain in summer rice.

B. ANIMAL SCIENCE

- A multi-coloured broiler bird has been developed in the University. This bird attains the body weight of 1.40 kg. in six weeks with feed efficiency of less than 2.0 and mortality less than 5%. This breed is gradually gaining popularity in the state.
- Extra supplementation of 0.5% Oyster shell meal or ground limestone in ration of cattle fed paddy straw to prevent calcium deficiency.
- A method of Cryo-surgery has been developed and equipment has been improvised with available liquefied nitrogen container in field hospitals for treatment of ulcers, wounds, warts in the animals.
- The cost of production of milk could reduce by 35% by feeding forage mixture than feeding straw and concentrate mixture.
- A package of practice for blood transfusion has been standardized and practiced in the field in cases of anaemia due to different blood protozoan and other hemorrhagic diseases at the farmer's door step.
- A metabolic profile has been developed to predict production diseases in crossbreed dairy cows well before calving.
- EDS-76 virus was isolated for the 1st time in India.
- The double sandwich-ELISA has been standardised for the detection of serum antibodies to IBR.

Presently the faculty is conducting research on:

(a) Sustainable livestock production in rain-fed rice production system
(b) Improving the utilization of coarse cereal crop residues by strategic supplementation for livestock feeding.
(c) Control of parasitic diseases in stall-fed and grazing livestock.
(d) Weather based animal disease forecasts.

C. AGRICULTURAL ENGINEERING

The Equipment like power operated paddy thresher, oscillating type groundnut decorticator, manually and power operated groundnut thresher and low volume sprayer have been developed. These are commercially manufactured by SSI units and made available to the farmers under various schemes of the Government.

Light weight power tiller and four row manually operated rice transplanter have been developed through collaboration of university and local industry.

Prilled urea applicator, sunflower thresher, cotton stalk puller, fruit plucker, power operated pulse thresher and rice puffing machine developed and have been sent to the Government Implement Factory for prototype production.

Self-propelled paddy transplanter and power paddy reaper and tractor operated rotavator after evaluation in the university farm have been recommended for adoption in the state.

Implements like ginger and turmeric washer-cum-polisher, betel leaf conditioning machine are in the final stage of development.

D. NATIONAL AGRIL. TECHNOLOGY PROJECTS (NATP)

ICAR has sanctioned 42 NATP projects in favour of OUAT for development of technology in agriculture and its allied disciplines. The University is developing technology in the following areas.

- Integrated plant nutrient management strategy for different soil moisture regions.
- Identification of rice variety for rainfed.
- Development of technology for sustainable livestock production in rainfed rice farming situation.
- Development of shrimp and fish broad stock under captive condition.
- Socio-economic dynamics of changes in rice production system.
- Crop management strategy to increase cropping intensity in rainfed rice area.
- Management of Excess water in Medium and Low Lands for sustainable productivity.

- Agro-techniques for vegetable cultivation and storage in rainfed rice based ecosystem.
- Geo-referenced resources inventory preparation for rainfed rice eco-system
- Development of Rice based Agro forestry systems on field bunds and fallow marginal lands.
- Soil Tillage requirement for rainfed rice production system.
- Improving the traditional biasi system in the production system.
- Development of Improved jute cultivars for Quality Textile Fibre.
- Integrated Nutrient Management on yield targetting for Jute-Rice Production System.
- Developing integrated production package for enhancing productivity of cashew.
- Develop and promote prototype of implements for tillage and seeding in participation with local manufacturers/artisans.
- Land use planning for management of Agricultural resources.

E. FISHERIES

- Better growth of mud crab Scylla serrata was recorded in temperature between 2.4° C to 33.5° C, pH between 6.5 to 8.0 and salinity between 15-20 ppt. Further the combination of natural feed, supplementary feed and pellate feeds cause maximum growth in the species than and single type of feed. The growth of crabs are more in earthen ponds than cemented cistern. Females grow faster than males.
- Immunological responses of Lrohita against the bacteria Aeromonas hydrophila has been studied in detail. The efficacy of vaccine prepared from various cell components of A hydrophila has been tested through both in vitro and in vivo processes.
- The studies on the catching effieicney of four gears viz., 2-seam, High Opening Bottom Trawl. and Large Mesh Trawl in demersal water bodies of Orissa coast revealed that the Large Mesh Tawl has relatively higher catching efficiency that the rest of the other gears.
- The catch of crabs was maximum in LMT and the average bycatch was found to be lowest in LMT when compared with other 2 - seam and High Opening Bottom Trawl nets.

F. SOCIAL SCIENCE

The University is undertaking a study on socio economic in rainfed upland and low land rice production system. It will estimate economic cost of drought, farmers strategy and socio economic changes in rainfed situation during drought period.

G. SEED PRODUCTION:

The University has assumed the responsibility of producing breeder and foundation seeds to cater to the needs of the State's line departments of Agriculture, Horticulture, State Seeds Corporation and the farmers of the State.

University has produced 6,937 qtls. of paddy seeds including breeder, foundation and certified during the year 2001-2002. Besides, the breeder seeds of Groundnut (235 qtl), Ragi (61 qtl.), Turmeric (300 qtls.) and Ginger (100 qtls.) were also produced. 37,000 Nos. of planting materials were also produced during the year 2001-2002.

University has planned to produce 10,500 qtls. of paddy seeds including 500 qtls. of breeder seeds of paddy during the year 2002-2003. Besides, steps have been taken to produce 57,000 Nos. of planting materials during the next year. Vegetable seeds on Tomato, Chilly, Okra will also be produced. Besides, the breeder seeds of groundnut (250 qtls.), Ginger (100 qtls.) and Turmeric (300 qtls.) will be produced during 2002-2003.

H. TECHNOLOGY DEVELOPED THROUGH CO-ORDINATED PROJECTS

AICRP on Pulse Improvement Project :

- Mung bean variety OBGG-52 and Urd bean variety B-3-8-8 is in the process of release.
- Application of Pendimethalin @ 1.0 kg a.i/ha reduced weed in kharif and rabi pulses

AICRP on Maize Improvement Project :

- In medium duration group, Novjot, Pusa composite-2 and hybrids like KH-540, KH-101 are suitable for kharif cultivation.

AICRP on Honey Bee Improvement Project :

- Installation of 3 Indian honey boxes/ha increases the mustard, sesamum and sunflower yield to the tune of 35%, 33% and 76% respectively.
- A.*Mallifora* is the suitable honey bee and gives maximum honey yield of 42-45 kg/flow season under static condition in hilly tract.

AICRP on Vegetable Improvement Project :

- Tomato variety BT-117-5-3-1, Brinjal var. BB-46 and Chilli var. Utkal Ragini are suitable for profitable cultivation.
- Foliar application of Carbendazim (0.15%) at 10 days interval from the initiation of disease controls the Cercospora leaf spot in Okra.

AICRP on Weed Control :

- Pre-emergence application of Butachlor @ 0.75 kg a.i/ha and 2,4-D @ 0.4 a.i/ha as post emergence spray control weeds effectively in transplanted paddy.

AICRP on Plant Parasitic Nematodes :

- Rice-Groundnut/ Mustard-Greengram/ Sesamum cropping sequence is best for the management of *Hirschmanniella miscromata*.

AICRP on Rice Improvement Project, Chiplima

- ORS-206-1 was the highest yielder under medium land situation (79.5 q/ha) followed by ORS-201-5 (65.5 q/ha).

AICRP on Rice Improvement Project, Jeypore

- OR-1509-9 and RR-347-7 recorded highest yield of 2212 and 3039 kg/ha under direct sown condition.

AICRP on Micro and Secondary Nutrients :

- Kalinga-III (extra early group), Ghanteswari (early group), Birupa and Swarna (medium late) and Kanchan, Mahalaxmi, Panidhan are found to be tolerant to Fe toxicity.

AICRP on Potato Improvement Project

- Cultivars maturing beyond 75 days do not suit to the mild winter conditions of coastal district and if harvested beyond 90 DAP (early varieties 75 days) the yield is reduced.

AICRP on Castor and Sunflower :

- Suitable castor varieties are D.C.S.9 (12Q/ha), PCS-4 (13 Q/ha). Among hybrids GCH-4 and GCH-5 records an yield of 15-16 q/ha.

- Suitable sunflower varieties which records higher yield of 12Q/ha are PAC-36, KBSH-1, MFSH-17.

AICRP on Rapeseed and Mustard :

- Suitable mustard varieties are Parbati, Anuradha, PT-303, PT-507 yielding about 15Q/ha.

AICRP on Cotton Improvement Project :

- Suitable cotton variety for the state is MCU-5 and among hybrids Savita and Bunny performs wells. IPM module developed and tested increases yield and reduces pest and disease load successfully.

AICRP on Water Management Project :

- Rice-potato-okra is the most remunerative cropping sequence with a net profit of Rs.20,014/ha and cost benefit ratio of 1.26.

AICRP on Long Term Fertilizer Experiment :

- 100% NPK + FYM sustained productivity of rice-rice system over years

AICRP on Groundnut :

- Variety Smruti is recommended for kharif and rabi for better yield (15.40 q/ha)
- January is the suitable month for summer groundnut cultivation.

AICRP on Betelvine Project :

- Application of tricoderma vinde controls the root-knot nematodes.

AICRP on Dryland Agricultural Project :

- Phulbani Dryland Weeder is a low-cost implements and is best suited for weeding of row-crops.
- Polythene mulch enhanced the groundnut yield up to 18%.

AICRP on Sugarcane :

- CoC-97061 (97.23 t/ha) and CoC 97062 (93.6 t/ha) are found to be the best yielder in early group maturing in 10 months and also records the average sucrose yield of 16.9 and 18.09% respectively.

AICRP on Linseed :

- Padmini and Kiran are the suitable linseed variety with an yield of 9.0 and 7.0 quintals/ha in rainfed situation and are moderately resistance to powdery mildew.

AICRP on Spices Improvement Project :

- Promising varieties identified are V1E8-2 in ginger and PTS-43 in turmeric found high yield, better adaptability and disease resistance.

AICRP on Sesamum :

- Suitable varieties identified for better yield are OS-SEL-2 (Black seeded) and OS-SEL-164(White seeded) and is in the pipe line for release.
- OS-SEL-2 and OS_SEL-24 and OS-SEL-253 has been identified as donor parent as used for breeding programme.

AICRP on Jute Improvement Project :

- Among the *Olitorius* varieties JRO, 2346 and JRO-2350 and in *Capsularies* JRC-212 and C-433 were found promising.

AICRP on Cropping System Research

- Among different cropping pattern tried, maximum net profit was obtained in rice-field pea-sesamum cropping sequence at Bhubaneswar.
- At Chiplima Rice-potato-sesamum was the most remunerative cropping sequence.

AICRP on Pesticide Residue :

- The underground tube well water is.more safe for drinking as compared to surface water because it is free from pesticide residues of HCH, DDT, aldrin, dieldrin and malathi
- The soil samples collected from cotton and vegetable fields were found to be free from pesticide residues of HCH, DDT, aldrin, dieldrin, endosulfan, malathion, butachlor, lindane.

Wide acceptance of refined technologies by the farmers

(The technologies were refined through field trials and recommended by the KVKs)

Some of the significant achievements made for the benefit of the farming community through on-farm testing are given below:

- Spraying of Renbeli bark extract at growth and fruiting stage effectively control fruit and shoot borer attack in brinjal next to chemical spraying in Semiliguda area.
- Treating food grains with mustard on @ 2 ml/kg of grain effectively control the attack of stored grain pests in Kendrapara area.
- Mixing of dry neem and begonia leaves for effective control of stored grain pests compared to EDB amples in Bhanjanagar.
- O.U.A.T. released BT 10, BT – 12 and BT – 2 tomatoes are wilt tolerant.
- Tissue culture banana has not any significant difference on yield but comes earlier fruiting than suckers.
- Turmeric variety BSR – 1, Ranga and Rasmi are better yielders in terms of more recovery rate and better curcumin content.
- Hybrid brinjal variety "Supriya" gives high yield but farmers preferred hybrid "Saurav" due to size, shape and demand in local market.
- Sungrow hybrid brinjal gives highest yield but farmers are not preferring due to high seed cost.
- Farmer's practice of using 150 kg/ha seed in upland rice gave lowest yield and 100 kg/ha seed is sufficient to get a desirable yield.
- Azospirillum with 40:20:20 NPK kg/ha gave12.5% extra yield than the farmer's practice of 60:30:30 kg NPK/ha in Sambalpur area.
- Rice yield was 20.9 qt/ha under farmer's practice by applying 60:15:15 kg NPK/ha which jumped to 40.2 q/ha by applying 60:30:30 dose in Baliapal area.
- Seiving niger with 15 and 20 mesh separated coscuta seeds.
- Soil application of boron followed by two spraying at interval of 30 and 45 days after planting checked stem hallowing in cauliflower.

- After detaching mother rhizome, drenching of Bavistin with plantomycin to the root zone successfully control rotting of ginger.
- Phorate application in nursery 5 days before uprooting and at P.I. stage followed by monocrotophos spraying after 30 days transplanting effectively controlled the pests of rice.
- Trichogamma chilonis egg parasite is the only alternative to control early shoot borer attack in sugarcane.
- Spraying of metasystox with monocrotophos was found to be better in controlling cotton bole worm than the farmer's practice of spraying only monocrotophos.
- Spraying endosulfan and synthetic pyrethroid at 15 to 20 days interval from flower initiation reduces the fruit and shoot borer attack in brinjal.
- Sal leaves is the most suitable mulching material in turmeric than other mulching materials.
- Niger sticks are equally suitable for raising oyster mushroom if straw not available.
- Oyster mushroom cultures pleuroutus Sajarcaju and pleuroutus florida are high yielder and good keeping quality than others.
- Seed requirement to cover one hectare area of rice was 43% less with seed drill than broadcasting.
- Field capacity for intercultural operations was highest 0.101 ha/hr by the rake weeder developed by a progressive farmer of Baragarh in comparison to farmers practice of only 0.0165 ha/ha.

Dryland technology developed by OUAT:

The University has given much importance on development of dryland technology through its research network. Dry farming research is going on at different regional research stations spread over the state. Some of the dry farming practices developed for different locations are described here.

Tillage and Farm Implements:

- One ploughing by tractor-drawn disc plough followed by one ploughing by country plough gives 32% higher yield in upland rice than one ploughing by country plough alone.
- Cultivation of pigeonpea requires conventional tillage (cultivator used thrice) while rice needs reduced (cultivator used twice) or no tillage for higher grain yield under red lateritic soil conditions. Pigeonpea gives 57% higher monetary return under conventional tillage as compared to no tillage condition and rice gives 20% higher monetary advantage under reduced tillage condition as compared to conventional tillage.
- The performance index of Gujarat State Fertiliser Corporation Seed-cum-fertiliser drill in sowing ragi is the best as compared to other seed-drills namely Ragi seeder, Ridger seeder, Enati Garu and Birsa seeder.
- Bishu MB plough –2 gives the best performance (57% higher yield) as a primary tillage implement in production of rice as compared to other MB ploughs such as Bose plough, Sabash plough, Bishu MB plough- 1 and plough of Implement Factory, Govt. of Orissa.
- Sowing rice seeds in rainfed soils by 2-row seed-cum-fertiliser drill developed by Agricultural Engineering Division of Department of Agriculture, Govt.of Orissa gives yield advantage of 149% over broadcasting and 80% as compared to the seed-drills namely Implement Factory Seed Drill, Annapurna Seed-cum-Fertiliser Drill, CAET 3-row Seed Drill and CAET 5-row Seed Drill.
- The "Phulbani Dryland Weeder" reduces the manpower in weeding operation by more than 50% as compared to the other weeders like Rake Weeder, Wheel Finger Weeder, Rotary Peg Weeder and Local Weeder (*Gadi*). The weeder also works as a crust-breaker.

Land Treatment:

- Among the grasses, *Vetiveria zizanoides* is the best bund stabilizer. It retains the cross sectional area up to 85% at the end of the second year due to better root growth (52 cm).
- Planting crops on the contour and growing vetiver in the interspace check soil loss up to 56% and increase yield by 73% in sloppy lands.
- Intercropping of arhar and ragi reduces soil loss (3.4 t/ha) compared to cultivated fallow (9.4 t/ha). Groundnut and greengram grown alone or in combination with arhar reduces soil loss by 56%. Provision of grass cover (*Cynodon dactylon*) reduces run off by 25% and soil loss by 38%compared to fallow land without cover.
- Ridge and furrow sowing of blackgram and rice on sloppy terrain increases the yield of both the crops compared to flat sowing.
- Sole cropping of pigeonpea, rice and ragi reduces the run off by 25, 28 and 30%, respectively, as compared to cultivated fallow. The alternate strips of pigeonpea and rice produces 32% lower runoff than cultivated fallow and proves superior to the alternate strips of pigeonpea and ragi. The intercropping of pigeonpea and rice gives30% less runoff than cultivated fallow and is found better than intercropping of pigeonpea and ragi. Among the crops and cropping systems, pigeonpea shows the maximum soil loss (5.28 t/ha) and the intercropping of pigeonpea and ragi the minimum (3.37 t/ha).
- The practice on contour cultivation associated with interterrace earth bunding covered with *Cynodon dactylon* exhibits the highest cowpea yield (32.2 q/ha) with the lowest amount of soil loss (2.04 t/ha) and the lowest run off (24.5 %) as compared to farmers ' practice (yield: 18.6 q/ha, soil loss: 4.5t/ha and run off: 31.2%).

Crops and Varieties identified for drought prone area:

Rice is the major crop of the State. It contributes nearly 83 % to the total food grain production.About 41% is irrigated. The rest of the paddy land is rainfed. Out of the total area of 46 lakh hectares upland area is about 8 lakh hectares, which is severely affected by drought. It contributes only 14% of the total rice production. Crop diversification is necessary in this area. Efficient crops such as non-paddy crops should be grown in this area to avoid drought. Instead the farmers grow paddy which needs more water. Dry spells more than a week affect the crop. The University has identified/developed suitable varieties for upland and early medium drought prone lands of the affected districts such as Koraput, Bolangir, Kalahandi, and Phulbani. These varieties can yield more than 2 t/ha under rainfed conditions. Early varieties of drought tolerant rice such as Lalitagiri and Udayagiri for Koraput, Vandana, ZHU 11-26, Sankar and Udayagiri for Bolangir, Vandana and ZHU 11-26 for Phulbani districts are recommended for cultivation.

Performance of very early rice varieties in upland conditions

Variety	Duration (days)	Yield (kg/ha)
Koraput District		
Lalitgiri	100	2516
Udayagiri	110	2183
Pathara	112	1833
ORS 102-4	110	1650

Bolangir District		
ZHU 11-26	85	2180
Sankar	86	2120
Vandana	92	2220
Udayagiri	99	2140
Saria(Local)	92	1400
OR 1509-3-S1C	96	2260
Phulbani District		
ZHU 11-26	83	3420
BAU 4045-8	84	3140
Vandana	84	3500
Heera	75	2700
Pathara	109	2930

Performance of early medium group of rice in rainfed medium land conditions

Variety	Duration (days)	Yield (kg/ha)
Kalahandi District		
Lalat	123	5950
Konark	130	6550
Sebati	125	5700
ORS-199-5	123	5700
Dasaramantia(Local)	127	3700

For early medium land of Kalahandi District varieties such as Konark, Lalat and Sebati should be choosen.

The University has identified/released other varieties such as Kalinga III, Khandagiri, Badami, Ghanteswari for rainfed uplands of the drought-affected districts. The non-paddy crop varieties are also tested in different locations and recommended for cultivation in the drought prone areas as follows.

Suitable groundnut varieties

Variety	Duratioin (days)	Yield (kg/ha)
Smruti	103	1470
TAG 26	104	1530
TAG 24	98	1170
BARC 4-3	103	1270
ICGS 11	103	1490
JL 24	102	1220
Suitable blackgram varieties		
OBG 15	68	1130
OBG 23	70	1080

OBG 17	66	1050
LBG 17	82	1030
LBG 645	86	1010
T 9	66	1000
OBG 19	67	990
Pant U 30	69	950
Sarala	69	910
B 3-8-8	68	920

Suitable turmeric varieties (dry)

Sudarsan	190	5720
Suguna	190	5680
Subarna	190	5640
Rajendra Horti 5	200	5250
BSR 1	200	4520

Suitable ginger varieties for tribal districts (fresh)

Vardhan	200	16100
China	200	15900
Nadia	200	14500
Maran	200	13200
Suprabha	200	12800
Daringibadi local	200	10800

In other non-paddy crops varieties found suitable under rainfed conditions are as follows:

Cereals:

Maize – Composite- Navjot, Shakti 1, Hybrid-Deccan 103, Ganga 5, Cargil 633, Cargil 900m, KH 510, MMH 69

Ragi- Dibyasingh, Neelachal, Subhra, Vairabi, Chilika

Pulses:

Greengram - PDM 11, 54, K 851, ML 5, Ratila Selection, Nayagarh local
Arhar - UPAS 120, ICPL 151, ICPH 8
Bengalgram - ICCC 4, JG 62, 74
Fieldpea - EC 33866, Rachana
Cowpea - FS 68, SEB 2, Pusa Barsati
Ricebean - RBL 6, BRB1

Oilseeds:

Sesamum - Konark, Kalika, Uma, Usha, Tilottama
Toria - PT 303, Parbati, Anuradha
Niger - Deomali, IGP 76, Alasi-1
Linseed - Hima, Neelum, Subhra, Gaurav
Castor - Aruna, Bhagya, SA 2, Jyoti

Fibre crops:

Cotton	- Variety: MCU 5 Hybrid: Šabitha	
Mesta	- HC 583 - AMV 1 - HS 4288	

VEGETABLES

Brinjal	- Utkal Tarini, BB 49, BB44, Pusa Kranti, Penthi
Okra	- Utkal Gaurav, Baisali Vandhu
Sweet Potato	- Samrat, Gouri, Sankar
Pumpkin	- Guamal, Arka Suryamukhi, Arka Chandan

FRUITS

Mango	- Amrapalli, Mallika, Banganpalle, Suvarnarekha, Lengda, Sindhu
Papaya	- Honey Dew, Co.1, Co.2, Pusa Delicious
Pineapple	- Kew, Queen
Guava	- Allahabad Safed, Chittidar
Pomegranate	- Paper Shell, Ganesh Gol
Sapota	- Cricket Ball, Kalipati
Litchi	- China, Calcutta, Muzaffarpur
Cashewnut	-Bhubaneswar- 1,Vengrula 1,4, NRCS 1

Cropping systems

Intercropping systems

Sl No.	Intercropping	Row ratio	Set specification	Row distance of intercrop
	Arhar based itercropping systems			
1	Arhar + Groundnut	2:6	30-210-30	30
2	Arhar +Sesamum/ Niger	2:4	30-150-30	30
3	Arhar + Greengram/ Blackgram	2:3	30-120-30	30
4	Arhar + Ragi	2:4	30-100-30	20
5	Arhar + Rice	2:5	30-120-30	20
6	Arhar + Rice(mixed broadcast)	40:60 (Seed rate)		
7	Arhar+Radish	2:2	30-120-30	30
8	Arhar+Okra	2:2	30-120-30	30
	Maize based intercropping systems			
9	Maize + Cowpea(low	2:2	30-120-30	30

Sl No.	Intercropping	Row ratio	Set specification	Row distance of intercrop
	trailing)			
10	Maize + Cowpea(Non-trailing)	1:1	Uniform rows of maize and cowpea 30 cm apart	
11	Maize + Runnerbean	2:2	30-120-30	60
12	Maize+Cowpea(fodder)	2:1	30-30	30
13	Maize + Pigeonpea	1:1	Maize and Pigeon pea in uniform rows of 30cm apart	
	Rice based intercropping	**systems**		
14	Rice + Radish	4:2	30-105-30	30
15	Rice + Okra	4:2	30-105-30	30
16	Rice + Blackgram	5:2	30-120-30	30
	Yam based intercropping	**systems**		
17	Yam + Maize	1:2	Yam at 90 cm uniform rows	2 maize rows between 2 yam rows

Sequence cropping

Systems	Variety
Rice – Horsegram	Rice: ZHU 11-26/Vandana/Heera Horsegram: Local
Maize –Toria	Maize : Novjot Toria : PT-303/M-27
Maize+Cowpea-Toria	Maize: Novjot Cowpea: GL-1 Toria : PT-303
Cowpea-Niger	Cowpea: SEB-2/SGL-1 Niger : Local
Sannhemp – Niger (greenmanure)	Sannhemp : local Niger : Phulbani local

Relay cropping

Rice + Blackgram/ Fieldpea — Blackgram : Local; Field pea : Rachana

Fertiliser Management

- Application of full dose of chemical fertilizer (60-40-40 kg N-P_2O_5-K_2O/ha) to rice crop enhances the yield for initial 4 years and then the yield level starts declining. On the other hand, application of 50% N through FYM and 50% N as chemical fertilizer enhances the rice yield from the 5th year of experimentation. Application of organic manure also improves water holding capacity and other physico-chemical properties of soil and also reduces the expenditure in chemical fertilizer.

- Application of 15kg N through compost and 10kg N through chemical fertilizer to rice + blackgram intercropping system produces the highest rice-equivalent yield over other combinations of chemical and organic fertilizer alongwith improvement in physical and chemical properties of soil.

- The yield of turmeric increases significantly when 50% recommended chemical fertilizer is applied with 25% lime requirement and 20t/ha FYM as compared to 100% recommended dose, 50% recommended dose, FYM 20t/ha and other combinations of chemical fertilizers and organic manures.

- Application of *Mimosa* as organic mulch in maize + pigeonpea intercropping enhances the system yield by 15-20% as compared to other mulches like maize stover, cassia leaf and *Glyricidia* leaf.

- Application of green manure /green leaf manure records higher grain yield of maize as well as toria in maize – *toria* sequence cropping system as compared to control. Moreover greenleaf manures give 10% higher grain yield of maize as compared to green manures. Application of maize stover to *toria* in *rabi* as mulching material @ 4t/ha enhances the seed yield of *toria* by 30%.

- Application of full N through organic source (FYM) enhances the pigeonpea yield in rice (ZHU 11–26)- Pigeonpea (UPAS 120) relay cropping system.

Moisture Conservation

- Application of FYM to supply 30 kg N/ha alongwith 50 % P_2O_5 and K_2O (20-20 kg/ha) improves the water use efficiency of upland rice by 38 and 130% over 100% recommended dose and control, respectively.
- The interterrace treatment of miniature earth bund turfed with *Cynodon dactylon* in upland rice improves the soil moisture status and records the highest rice yield of 3220 kg/ha.
- Use of polyethylene mulch (15 micron thickness white films) in *kharif* groundnut helped in improving the moisture status of upper soil layer (0-15 cm) at the time of critical dry spell. Polyethylene mulch recorded 86, 62 and 19% higher moisture content (gravimetric) over control (no mulch), crop residue mulch and crop residue incorporation, respectively, during critical dry spell at vegetative stage. The corresponding values at harvest were 18, 22 and 17%. Polyethylene mulch gave 33, 13 and 21% higher pod yield than control, crop residue mulching and crop residue incorporation, respectively.

Crop Protection

Weeds cause serious problems in the upland crops during the rainy season. These should be controlled properly for conservation of moisture and nutrients. Some of the packages developed for weed control are given below.

- Summer ploughing and stale seed bed
- Use well decomposed organic manure
- Adopt crop rotation
- Use weed free crop seeds
- Weed out the field at early stages
- Use chemicals to control weeds

Upland Rice	:	Thiobencarb or butachlor 1.0 kg/ha as Pre-emergence spray
Maize	:	Atrazine 1.0 kg/ha as pre-emergence spray Blackgram/
Greengram/:		Fluchloralin 1.0 kg/ha as pre-plant incorporation or Thiobencarb 1.0 Arhar kg/ha as pre-emergence spray
Groundnut	:	Fluchloralin 1.0 kg as pre-plant incorporation or Pendimethalin 1.0 kg as pre-emergency spray
Sesam	:	Fluchloralin 0.5 kg as pre-plant incorporation or Alachlor 1.0 kg as pre-emergence spray

For controlling insects and diseases, the pest control schedule has been developed for individual crops and recommended for the farmers of the drought affected regions.More emphasis is being given on IPM.

Agroforestry

Agri-silvi system	Maize, cowpea and little millet are found compatible with tree sps. of *Albizzia lebbeck* (Siris) and *Gmelina arborea* (Gambhari)
Silvi-pastoral system	Grasses such as Dinnath, Guinea and hybrid napier can be grown with *Leucaena leucocephala* (Subabul), *Eucalyptus* hybrids (Eucalyptus), D*albergia sissoo*(Sissoo),*Acacia auriculiformis* (Acacia) and *Albizzia lebbeck* (Siris)
Agri-horti system	Maize, arhar, cowpea, niger and okra are compatible with guava, custard apple, mango, jackfruit and pomegra

Dryland Horticulture

Dryland horticulture has been given importance in the drought prone areas. It can replace the upland paddy area and serve as a regular source of income for the farmers. Fruit trees such as mango, guava, jackfruit, custard apple, pomegranate, tamarind and cashew nut are suitable.

4. EXTENSION EDUCATION:

The Directorate of Extension Education has been functioning for transfer of technology to the Extension functionaries and farming community of the state. It has various components which includes (1)University Extension and Block Programme; (2) Information and Communication; (3) Distance Education; (4) Video Project and (5) Krishi Vigyan Kendras(KVK).

University Extension Block Programme (UEBP)

The unit is working in three districts namely, Khurda, Nayagarh and Puri with 8841 selected farm families spread over 60 villages. Field validation of new technology, consultancy service to farmers, collection of field problems, carrying out the demonstration, training of farmers are the major functions of this unit.

Information and Communication

The section publishes **'Chasira Sathi'** and **'Chasira Sansar'** regularly in Oriya language for the benefit of the farmers and extension workers. About 325 booklets, on various fields in Agril., Horticulture, Animal Husbandry, Agril.Engg., Fishery, Home Science etc. have been published. This division provides agricultural information to All India Radio, Doordarsan and news papers for benefit of farming communities.

Distance Education

The unit has trained 10,940 farmers, 982 farm women in 10 advance technologies out of which 8,700 have adopted these technologies. The unit makes scientist - farmers interactions on different subjects on regular basis to enrich the transfer of technology system.

Agricultural Technology Information Centre

During 2001 the Agricultural Technology Information Centre has been established as a single window support system linking various units of Research and Extension with intermediary user and end users (farmers) in decision making, input and information support and problem solving process.

Video Project

The unit has produced, 73 cassette containing technologies in the field of agriculture and allied areas which are being widely used in the utilization centers.

Krishi Vigyan Kendras (KVK)

The University is having eleven KVKs functioning in Koraput, Keonjhar, Balasore, Ganjam, Kandhamal, Kalahandi, Baragarh, Kendrapara, Dhenkanal, Angul and Jajpur. The last KVK for Jajpur was sanctioned in June, 2002. KVKs are the only Transfer of Technology centers which provide need based vocational training in the area of Crop Production, Horticulture, Crop Protection, Home Science, Animal Production, Soil and Water Management, Agro-Forestry and Fishery. The emphasis had been given on

- Sowing technologies of different crops
- Fertilizer management in Cereals, Oilseeds & Pulses
- Propagation technologies of different fruit trees
- Integrated Pest Management on Cereals and Vegetables
- Integrated nutrient management
- Post harvesting storage techniques
- Rearing techniques of broiler poultry
- Composite pisciculture
- Pearl Culture

- Mushroom cultivation both Oyster and Paddy straw
- Seed Production techniques
- Use of Improved machineries
- Dairy Management for more milk yield
- Off-season vegetable cultivation
- Problem soil management

KVKs have so far trained 1,00,422 farmers, 25,061 farm women, 23,540 rural youths and 22,604 extension personnel in different areas.

In addition to training the KVKs also undertake on farm testing of new technologies aiming at field level micro modifications suitable to farmers needs.

B 2.2: DIRECTORATE OF EXTENSION EDUCATION

Constraints in execution of technologies passed on to the extension functionaries.

* Poor economic condition and low education of tribal farmers
* Non-availability of adequate quantities of suitable mulching materials for turmeric and ginger
* Inputs like quality seeds, fertilisers, pesticides,etc. to be made available in nearby in simple window system
* Farmers not occustomed to mixed cropping practices and mostly follow broadcasting of seeds in some areas
* Suitable improved variety of greengram not available for early winter season
* Gypsum not adequately for groudnut in acid soils
* Cattle menace in rabi and summer seasons stands as &he social barrier for more technological adoption
* Available irrigation water not used properly, to grow profitable crops like vegetables, winter spices, etc.

Agenda Items

* Release of funds in time
* Procurement of specific implements/mechinaries for some crops
* Preservation and processing units to be established in the subdivision Block level
* Formation of Service- Cooperatives in the village level for more efficient procurement of inputs & marketing of the perishable items
* Trainings to be imparted on processing, preservation and storage of produces
* Emphasis on use of eco-friendly inputs like bio-fertilisers, bio-pesticides and on organic farming

A-3 Issues / problems / concerns raised by State Dept. of Agriculture / Horticulture / Animal Husbandry / Fisheries (Chhattisgarh),

Directorate of Fisheries, Government of Chhattisgarh

A 3.1: DEPARTMENT OF FISHERIES CHHATTISGARH STATE

Chhattisgarh is newly carved out state from Madhya Pradesh. It is located in between 17 47' – 24 6' North and 80 15'- 84 51' East. The total land spread area of the state is 1,35,194 square kilometer. The state is divided in to Three Agroclimatic zones viz.

(i) **Chhattisgarh Plains** – It comprises of 6 districts i.e. Raipur, Dhamtari, Mahasamund, Durg, Rajnandgaon, Kawardha.

(ii) **Baster Platen** – It comprises of 3 districts viz. Kanker, Jagdalpur & Dantewada.

(iii) **North Hills** – It comprise of 7 districts i.e. Ambikapur, Raigarh, Jaspur, Korba, Bilaspur, Jhanjgir, Korea.

Thus Chhattisgarh state has 16 districts with 19720 number of villages

I – General climatic feature:

The climate of the state in general is sub humid type with an average annual rain fall of about 1400 m.m. The day time temperature during peak summer season are usually very high in the entire state varying from 43 C at Raigarh to 38 C at Jagdalpur in the month of May However Raipur the Capital town of the state the day time temperature is constantly high (above 40 C) right from the second forte night of April to first week of June.

II – Fisheries Resources:

Chhattisgarh has vast and varied resources in the form of village ponds, irrigation, reservoirs and rivers the details are as under.

No.	Category	Available water area Ha.	Water Area under Fish culture (Ha)
(a)	Village ponds	70,000	55,200
(b)	Irrigation Reservoirs	83,800	78,300
	Total	**1,53,800**	**1,33,500**

All the water bodies except beyond 2000 ha. water area have been leased out by the local panchayat administration since 1995. Village ponds and reservoirs up to 10 ha. are leased out by Gram Panchayat, 10 to 100 ha. water area is leased out by Janpat (Block) Panchayat and the water area 100 to 2000 ha. is leased at Zila (Distt) Panchayat etc. Water bodies above 2000 ha. are under control of Matsya Maha Sangh.

Water bodies below 1 ha. is allotted to individual fisherman and above 1.0 ha. water bodies are leased out to fisherman co-operative societies and groups for a period of 7 to 10 years. Department of fisheries has reserved a small Dam in each district for the procurement of breeders.

(c) – Rivers

Mahanadi system and Godavari system are the only two river system contributing 3572 killo meter length to rivers. Fishing in Rivers is free since 1983.

III. Fish seed production resources:

There are 39 circular hatcheries in the state 19 under Govt. 6 under matsaya mahasangh and 14 under private sector 157 Ha. water area is being used for fish seed rearing Annually 113 crores of spawn is produced from which 32 crores of standard fry is reaped-out. Target for the year 2003-04 is 42 crores of st. fry. The annual demand of standard fry is 45 crores. About 10 to 13 crores of st. fry is imported from West Bengal every year. Seasonal ponds fit for fish seed rearing are being identified and made allotted to fish farmers for increasing the fish seed production. The state Govt. has now permitted to construct small ponds "(Dubri)" on private land under "Draught Relief Progrmme", it is expected that this additional water area will prove a boon to fish seed rearing and fish culture programmes. Efforts are being made to establish more circular hatcheries in private sector in the coming years.

4. Fish Production :

The average fish productivity of village ponds is 2120 kg/ha There are limitations in increasing it further as these ponds are community ponds where use of inputs is prohibited by the villagers. The average productivity of reservoirs is 69 kg/ha. which is quite satisfactory. The annual total fish production of the state is estimated to about 96000 tons. The target for the year 2003-04 is 1.0 lac ton of fish production. Its value at production site comes to about Rs. 153 crores.

5. Manpower:

Average Estimated manpower generated in fishing industry is about 65 lac man days.

NEW PROGRAMME

(i) Prawn Culture :

Monoculture of M. rosenbergii in this region is presently not much profitable due to high cost of prawn seed and its feed. Only poly culture programme of M.rosenbergii and C. Catla fish has been taken up since last year. In 101 Tanks 3.54 lacks Juveniles were stocked and 6 tons of prawn was produced. For the year 2002-03 a target of 25 lack Juveniles was fixed, but due to draught conditions only 2.71 lacks juveniles in 75 tanks could be stocked.

(ii) Ornamental Fish Culture:

Realizing the progress achieved in the rural areas of 24 pargana District in West Bengal. Chhattisgarh state has also taken up this programme in Five districts viz. Raipur, Durg, Bilaspur, Jagdalpur and Ambikapur. In the first phase during the current years 5 breeding units at the cost of Rs. 4.10 lacks are to established in Govt. sector in aforesaid five districts. Production of fish seed of live bearers and gold fish will be taken up in the year 2003-04. Seven Departmental fisheries officers have also been got trained from CIFA Bhubneshwar. 98 have been sent to West Bengal and Tamilnadu State for field visits.

New Dimensions:

I- Freshwater Prawn Hatchery :

For the first time in the country a private company Chhattisgarh Prawn Park (Prawn Production And Aquaculture Research Kendera) Pvt. Ltd. D-39 Sector 1 Tagore Nagar Raipur – 492001 has come up in Inland state which has successfully produced 60,000 post larva of M. rosenbergii. The company has established a Hatchery of 1.5 million P.L. Capacity in a 12.8 Acres farm in village Tikari. The company has also proposed to establish a feed mill in the farm. The company proposes to raise the capacity of Hatchery to 3.00 million P.L. in the future. Artificial seawater has been successfully used in the Hatchery. The company will prove a boon to state in propagating prawn culture.

Feed Back:

1. Chryogenic Preservation of fish sperms:

In circular hatcheries shortage of male breeders specially of catla is severely felt in late Mansoon season. Beside this same fish stock is repeatedly used every year. This Inbreeding progeny will pose severe problems in coming future. To overcome these problem introduction of chryogenic preservation of fish sperms is the only remedy. Sperms from fast growing healthy stock could easily be collected from rivers and large reservoirs of the country and get crossed with the locally available females in order to improve the local strains.

Such research Unit which is proposed to be establish in Chhattisgarh state under the technical guidance of "CIFA" Bhubneshwar and "National Bureau of Fish Genetic Resources" Lucknow. A state research unit with one class II officer and two Research Assistants are already working in the state. They can take up the task provided technology and package practice is extended by central research units.

2. Banning Seed Transportation of "Thailand Maghur" and "Big Head" from West Bengal:

The culture of afore said two species is not uncommon in state. The fish seed of these two species is being imported from West Bengal state. No seed of these fishes is being produced in Chhattisagarh state. Since High court Andhrapradesh has already given decision in Govt.'s favour West Bengal Govt. may be asked to take necessary steps so that its seed may not be propagated further and transported to other states specially Chhattisgarh.

B 3.1: INDIRA GANDHI KRISHI VISHWAVIDYALAYA, RAIPUR

Agricultural development of any region, the agricultural research and education are the basic needs, which form the pillars of the agricultural development. Chhattisgarh State is basically an agrarian state with more than 80 per cent of the population depend upon agriculture. Also, being a tribal and scheduled caste predominant state, the condition of agriculture is somewhat different as compared to other agricultural states. The location-specific technologies are which may also take care of the cultural preferences of farmers of the region . Hence, it is these necessary to develop a strong research base for the location specific research technologies blending with ethnic preferences.

In the University there are 26 All India Coordinated Research Projects and 35 Adhoc & NATP projects. They address only a few specific problems of crop improvement and also on strategy research. But some of the research needs of the state are not called through these research projects and they are to be strengthened by ICAR and State budgets. In view of the above, proposals are seeing made for strengthening the agricultural research, education and extension in the state.

1. Germplasm: inventory, collection and evaluation:

Chhattisgarh has a very rich agricultural biodiversity including medicinal and aromatic plants. It is well established that the native germplasm of agricultural crops is well preserved in rainfed areas especially in tribal pockets. Thus the bio diversity in districts like Bastar, Surguja, Jashpur and Raigarh etc. is a treasure of the state. With the initiation of WTO and intellectual property rights (IPR), germplasm play crucial role in the development of country like India.

It is therefore, necessary to conduct inventory survey of the biodiversity in the state, collect the germplasm, evaluate the critical and important characteristics and preserve them through molecular marking and DNA finger printing. It is assumed that this would give rich dividends to the state and country in the near future.

2. Establishment off rice research centre:

Rice is the major crop of the state and is the staple food for the entire population of the state. Hence, rice cultivation remain with the farmers of the state for at least in this centuries. But rice is cultivated in a very traditional manner with very low productivity. Also, some of the rice varieties have good aromas, quality, as well as medicinal value. But the production potential of these varieties are yet to be assessed, and genetically improved. The M.P. Rice Research Institute established by Late Dr. R.H. Richharia, with the same objectives, in 1976 was merged with the then Zonal Agricultural Research Station. But now the new state is looking for agricultural development through export quality rice production.

It is, therefore, high time to establish a Rice Research Centre (RRC) within the University to give more emphasis and provide storming support for rice research in improving the general productivity and also for improving the genetically, morphological characteristics of the aromatic and medicinal rice germplasm. The RRC will concentrates on the genetically improvement, crop production and crop protection aspects of rice research.

3. Establishment of horticulture research centre (HRC):

Chhattisgarh has a diverse soil and climatic condition, which favour temperate to tropical fruit and vegetable crops. The government of Chhattisgarh, immediately after the formation of the new state, emphasized on the horticultural development in the state and a comprehensive master plan for the horticulture development of the state was prepared. The state is now marching ahead to implement the master plan and was footing efforts have been initiated.

However, for horticultural development in the state, with different demographic, ethnic and socio-economic characteristics, need a strong research supports for the horticultural development in the state. It is, therefore, necessary to establish a Horticulture Research Centre (HRC) in the University to cater the research and extension needs in horticulture.

4. Strengthening of oilseed and pulse research:

After the formation of the state efforts are being to emphasize crop diversification in those area where rice is not a suitable crop from economical and ecological points of view. The diversification primarily is needed in upland and unproductive areas with suitable pulses and oilseed crops with relatively less growing period. But the pulse and oilseed crops of the area like lathyrus, linseed, Niger need more then .2 million ha. of land can be brought under double crops after rice if proper need based technology of generations research back up from increasing production potential to plant protection points of view. Hence, it is necessary to strengthen the research activities in the pulse and oilseed crops of the University.

5. Strengthening biotechnological research and development:

It has well established now that biotechnology can play a crucial role in agricultural development, normally through genetic improvement but also through mass production through tissue culture, especially fruits and agroforestry tree species looking into the tremendous scope of the horticultural crops like banana, mango, figs, litchis, guava, chiku etc. strengthening of the biotechnology research and development activities in the University is needed.

6. Establishment of biodynamics and organic farming research centre:

With summer temperatures going upto 46-47°C and soil temperature at 0-5 cm layer reaching upto 55-60°C the soil microorganism get completely destroyed and hence it is necessary to identify biotypes tolerant to high temperatures. Also organic farming is the only economically viable technology for the small and marginal farmers of the region. Hence, it is necessary to establish a research centre on biodynamic and organic farming in the University.

7. Establishment of new research stations:

a) Regional agricultural research station of Champa and Janjgir:

commercial crops and quality rice. A research center for location specific research work is required. The Government of Chhattisgarh also trying to established Agriculture College/Research Station/Krishi Vigyan Kendra at Champa and Janjgir.

b) Regional agricultural research station (RARS), Rajnandgaon:

The Rajnandgaon, Kawardha district and Bemetara area in Durg and Bilaspur districts have predominantly black soil (locally called bharri). Soybean and arhar are the main crops in the area. The black soils are extensive in nature, unlike in other areas where black soils occur as a topo sequence. Hence, the field hydrology is different for these areas and hence the location specific technologies for these areas should be different from other topo-sequence. There areas are locatd rainfed area and rainfall varies between 700-900 mm the state average rainfall 1200-1400 mm. Hence, it is necessary to establish a regional research station at Rajnandgaon to cater the research needs of these black soils with predominantly oilseeds and pulses.

c) Regional agricultural research station (RARS), Jashpur:

In Chhattisgarh State, temperate climate conditions exist in Jashpur district with hilly terrain predominantly with tribal population. The kind of crops and cropping pattern needed for this area is different from other areas. The rainfall starts right from mid April here due to thunderstorm activity and sowing of rice starts from mid April. In view of this, the crop calendar, cropping pattern and crop varieties in this area are different from other areas. Considering this, it is necessary to establish a Regional Research Station at Jashpur Nagar.

8. Establishment of commercial crop research centre:

It has been found that commercial crops like sugarcane, cotton, jute & masta etc. have a great scope in Chhattisgarh region and they need good research support by developing location-specific technologies for each crop. This would definitely improve the socio-economic conditions of the farmers and thereby the economy of the state. It is, therefore necessary to establish a commercial crop research centre at IGAU.

9. Animal husbandry research centre:

Chhattisgarh State has a large live stock population but the productivity is very low. In order to improve the economic conditions of the farmers, farming system research(FSR) is the need for the state. The Veterinary & Animal Husbandry College of Anjora just caters the needs of veterinary education with a very little research support. It is, therefore, necessary to establish an Animal Research Centre (ARC) at Anjora as a compliment to the existing veterinary college. This would help to improve the cattle health and thereby milk production. Not only this, the research center will caters the research needs of gottary, piggories, poulty and other animal research too.

10. Fisheries research centre:

In Chhattisgarh tanks exist since time immemorial and tanks have become a part of Chhattisgarh culture. However, the tanks are under utilized in all the parts of Chhattisgarh region. A Fisheries Research Centre can help to develop need based and socio-economic culture based technologies to suit the village tanks, which are also used for domestic purposes. With more than 35,000 tanks in the state, establishment of a Fisheries Research Centre at Champa can help in developing suitable technology for fish seed, fingerlings and fish production in the state. Besides, the potential for prawn cultivation in the state can also be exploited by developing suitable technologies including processing etc..

11. Strengthening water management research:

In Chhattisgarh, lack of good water management is a big constraint for improving the productivity of crops both under rainfed and irrigated eco-system. Under canal irrigation, defection irrigative practices like field to field irrigation without field channels are responsible for low inputs and thereby low yields. In hilly areas like Surguja and Jashpur district sprinkler and drip irrigation practices are to be well developed in order to utilize the ground water resources. Similarly in Bastar plateau area, the kind of crops and cropping pattern need different types of irrigation practices especially for crops like coffee, spices, plantation crops etc.

It is, therefore, necessary to strengthen the water management research components by establishing new research centres at .

Water management for irrigated area	-	ZARS, Raipur
Water management for hilly area	-	ZARS, Ambikapur
Water management for plantation crop	-	ZARS, Jagdalpur

Establishment of these 3 water management research centres can greatly help to develop suitable technologies for each of these three situations separately.

12. Establishment of food processing research centre:

With a thrust on developing horticultural and other commercial crops in the state development of agro industries (both cottage and small scale) are also necessary for fast increase in the acreage and adoption by farmers with good potential of marketing. Especially the Bastar area of the state has a very good potential for horticultural crops like tuber crops, spices, plantation crops etc. Hence, establishment of a 'Food Processing Research Unit' at ZARS, Jagdalpur is very much needed to simultaneous development of processing techniques along with the development activities of horticultural and other commercial crops.

13. Centre for Hybrid Rice Research:

The seed production programme of hybrid rice has been started since kharif 2001-02 with the available A and B line recommended by ICAR. The research work is also initiated to develop hybrid rice. For this purpose A, B and R lines are being developed. The ICAR may also provide center for hybrid rice research so that systematic work can be taken-up and hybrid rice suitable for Chhattisgarh can be developed. The center of hybrid rice will also develop hybrid seeds and management practices

14. AICRP on medicinal plants:

Efforts are being made in this direction. A medical park having more than 250 medicinal plant species has already been established at Raipur and the research on preservation, production, processing and its utilization as fungicide / pesticide have been started at Bilaspur under NATP project. The medicinal park having indigenous / exotic collection are being established in Raipur and Bilaspur centre. The ICAR may sanction the AICRP on medicinal plant for meeting the future need.

15. AICRP on forage crop:

The Chhattisgarh State is deficit in the milk production though the number of milch animals are large in numbers. One of the cause for the low productivity of milch animals is due to lack of appropriate feed and forage supply round the year. Even the high yielding breed of the milch animals are not getting the green forage supply round the year. Due to this the potential milk yield can not be obtained by the milch animals also.

The climatic conditions of this state is very much favourable for the cultivation of forage crops both under Agriculture and forests land, but due to the lack of appropriate technology and its extension has not been given due importance in this state and b the University in the past. Not only this, lot of forage produced in the forest is not preserved in a scientific way causing the national loss. Presently, the cropping intensity of the state is varying between 120-126 % depending upon the rainfall pattern. Thus, there is a good scope of increasing the cropping intensity under forage seed production programme without replacing any crop of the state. Forage trees can also be introduced in the forest and bunds of agriculture fields in a large scale, but before that proper research has to be carried out. This will also help in providing employment to the labourers and additional profit to the farmers.

16. Net-work projects on composite fish culture and Air Breeding Fish culture:

In the 1970s' ALL India Co-ordinated Research Project on composite fish culture and AICRP on AIRCRP on Air Breeding fish several centers and cultural technologies were developed. However, the technologies remained restricted to certain urban and semi urban areas in India. The technologies did not penetrate to the tribal and backward areas like Chhattisgarh, Jharkhand, Parts of Orissa, parents of Maharashtra and tribal parents of Andhra Pradesh. Therefore, it would be of great benefit if the technologies are demonstrated along with research components as it would generate employment and also the living standard over a period of time.

17. FLD's on medicinal and horticultural crops :

Looking to the scope of important medicinal and horticultural crops in the state, FLD's on medicinal and horticultural crops need to be carried out. This will be helpful to demonstrate the technology to farmers and distribution of planting materials among farmers.

18. Demonstration unit of mini dal mill :

To increase area under pulses, the processing unit like dal mill, especially mini dal mill should be demonstrated. This dal mill can easily installed at farmer/ village level.

19. Demonstration of zero till seed drill :

The zero till seed drill gaining popularity in rainfed rice based cropping system for sowing of rabi crops. There is a need to conduct demonstration in large area to popularize zero till seed drill in the state. For this purpose ICAR may allot FLDs on 2000 seed drill.

20. **Demonstration of mini oil extraction pland for aromatic crops :**

To harvest good oil yield from aromatic and medicinal crops at farmers / village level, demonstration of mini oil extraction plant is required. By this farmers can get a good economic yield from these crops.

21. **Jute production:**

In Chhattisgarh there is good scope at Jute production. To increase area and production transfer of technology like FLD's, distribution of improved seed etc. should be propagated among farmers. The Jute based industries also have potential in the state.

22. Rice-based vegetable cropping system:

Under rice based cropping system, rabi vegetables have good possibilities under irrigated as well as rainfed situation. The research work on rice-based vegetable cropping system to generate proper information on this aspect is urgently required

23. Proposal submitted to ICAR for 10th V year plan:

A) Co-ordinated Research Project:

Following proposals in 10th V year plan. The ICAR is requested to sanction these project to IGAU in 10th Five year plan.

S.N.	Proposals	Sent to	Letter No. and date
1	AICRP on renewable energy sources	Director General, ICAR Copy to concerned DDG, ICAR	DRS/T-1/1725 dt: 11-6-2001
2	AICRP on sesame and niger	-do-	-do-
3	AICRP on safflower	-do-	-do-
4	AICRP on Tropical and sub-tropical fruits	-do-	-do-
5	AICRP on Floriculture	-do-	-do-
6	AICRP on pesticides residue	-do-	-do-
7	AICRP on medicinal and aromatic plants	-do-	-do-
8	AICRP on micro and secondary nutrient and pollutant elements in soils and plants	Director General ICAR,	DRS/T-1/6744 dt: 21-12-2001
9	AICRP on Tuber Crops at Ambikapur	-do-	-do-
10	AICRP on Spices at Jagdalpur and Ambikapur	-do-	-do-
11	AICRP on Mushroom Improvement Project at Ambikapur and Jagdalpur	-do-	-do-
12	AICRP on Weed Control at Jagdalpur and Ambikapur	-do-	-do-
13	All India Coordinated Vegetable Improvement Project at Jagdalpur and Ambikapur	-do-	-do-

S.N.	Proposals	Sent to	Letter No. and date
14	Mass production, demonstration and utility training of bio-control agents	-do-	-do-
15	Sericulture mass production, demonstration and utility training	-do-	-do-
16	AICRP on Beekeepine	-do-	-do-
17	AICRP on Lae cultivation	-do-	-do-
18	Use of medicinal plants in pest management	-do-	-do-
19	AICRP on Rodent Control	-do-	-do-
20	Entomological research in vegetable crops	-do-	-do-
21	Entomological research in fruits crops	-do-	-do-
22	AICRP on Sunflower	Director General ICAR, New Delhi	DRS/T-1/2001/6735 dt: 20-12-201
23	AICRP on Groundnut	-do-	-do-
24	AICRP on Safflower	-do-	-do-
25	AICRP on Post Harvest Technology of Horticultural Crops	-do-	-do-
26	AICRP on Onion	-do-	-do-
27	AICRP on Grapes	-do-	-do-
28	AICRP on Banana	-do-	-do-
29	AICP on Sunflower and Safflower	Project director DOR, Hyderabad	DRS/T-1/7086 dt.29-12-2001
30	AICRP on Sugarcane	Project Coodinator IISR, Lucknow	DRS/T-1/6624 Dt: 31-1-2003
31	AICRP on Arid legumes	Project Coordinator CAZRI, Jodhpur	DRS/T-1/8525 dt: 4-2-2002
32	AICRP on forage crop	DDG Crops ICAR, New Delhi	DRS/T-1/3673 dt: 24-8-2002

B) Adhoc- Research project

S.N.	Proposals	Sent to	Letter No. and date
1	I-Modernization of microbiology laboratory II molecular level chracterizaiton of indigenous microbial germplasm	Dept. of Science & Technology, New Delhi	DRS/t4/2038 dt 11-4-2000
2	Studies on the epidemiology and genetic of leaf blight of wheat under the agro-climatic conditions of Chhattisgarh MP	Project Director Wheat Research Kernal	DRS/T4/2047 dt 13-4-2000
3	Studies on quality and characteristics of whet produced from cottage industries and their physico-chemical treatment to reduce pollution potential	Joint Director MPCOST, Bhopal	DRS/T4/6671 dt: 8-8-2000
4	Mass multiplication of important tree	Director	DRS/T4/11051

S.N.	Proposals	Sent to	Letter No. and date
	borne oilseed speices (sal, mahua and palas) of Chhattisgarh through tissue culture technology	NOVOD, Gurgoan, Haryana	dt:7-12-2000
5	Exploiting leucaena leucocephala rhizobium symbiosis for improving productivity of waste lands in Chhattisgarh	DRS/T4/2001 Dt 3-4-2001	
6	A study on changes in agricultural production and socio-economic status of farmers of khurang commond of Bilaspur district of Chhattisgarh	Director MPCOST, Bhopal	DRS/T4/13227 dt: 22-3-2001
7	National perspective plan for integrated pest management in Chhattisgarh	Director IPM Haryana	ENT/1124 dt: 31-3-2001
8	Establishment and strengthening of laboratory for detection of adultration and contamination in milk and milk products	Jr. Secretary Dairy Division ICAR, New Delhi	DRS/T4/1363 dt.: 1-6-2001
9	Exploiting bio-inoculants for improving quality and quantity of silk production through participation of rural women of Chhattisgarh	Advisor DBT New Delhi	No. DRS/ADR/4897 dt:17-10-2001
10	Comparative analysis of bio-mass production and nutrient cycling in three types of agro forestry system in Chhattisgarh region	Project Coordinator	DRS/T4/752 dt.13-5-2002
11	Incorporation of gall midge (orzeolia oryzae) resistance in NA cytosteriles	ADG (FFC) New Delhi	No. 6539 dt:26-11-2001
12	Development of temperature and drought tolerant rhizobia for pulses and oilseeds in rainfed situations in central India	Project Coordinator (BNF) Bhopal	DRS/T4/8852 dt 19-2-2002
13	Exploring possibilities to improve agronomic efficiency of phosphatic fertilizer in vertisols of Chhattisgarh	ADG (Agronomy) ICAR, New Delhi	No. DRS/T4/9502 dt. 30-03-2002
14	Management of root knot disease of solanacesus crop through IDM technique and estimation of occurrence of knot nematodes (Incloidogyne spp.) in Chhattisgarh	ADG (Pl. Protection) ICAR, New Delhi	NO.DRS/T$/2003 dt 147-1-2003
15	Cultivation practices of some important medicinal and aromatic plants under agro-forestry system	Dy. Secretary (IC) Minsitery of Health, New Delhi	No. DRS/800 dt 15-5-2002
16	Evaluation and characterization of suitable linseed genotypes for utera cultivation	Project coordinator (Linseed) ICAR	No. DRS/T4/ 3231 dt: 31-7-2002
17	Induction of lectation in cows having reproductive disorders in	ADG (Animal Sciencie) ICAR, New Delhi	No. DRS/T4/ 3746

S.N.	Proposals	Sent to	Letter No. and date
	Chhattisgarh region		dt :28-8-2102
18	In vitro mutation and fertilizaiton of caprine oocytes in animal production system	ADG (Animal Sciencie) ICAR, New Delhi	No. DRS/T4/5116 dt 7-1-2002
19	Establishment of bio-control laboratory for the production of Trichoderma harzianum at Bilaspur Chhattisgarh	Secretary and Director Agril. Raipur	No. DRS/T4/5969 dt 30-12-2002
20	Prospects of Betelvine (Piper lectle L.) cultivation in Chhattisgarh with special reference to epidemeology and management of important disease	Proejct Coordinator Medicinal and Arom. & Bet. Anand (Gujrat)	No. DRS/T4/5541
21	Impact of watershed development programme on the socio-economic status and land productivity of farmers of Surguja district of Chhattisgarh	ADG (Extension) ICAR, New Delhi	No. DRS/T4/6334 dt: 17-1-2003
22	Introduction and mass propagation of edible ---- for young short production in Chhattisgarh	Project Coordinator (AICRPAF) ICAR, Jhansi	No. DRS/T4/6235
23	Evaluation of commercially important aromatic plants under silvi –agriculture system in system	Exec. Director medicinal Plant Board Gov. of C.G. Raipur	No. DRS/T4/6208 dt: 7-1-2003
24	Cultivation practices of some important medicinal and aromatic plants under agro-forestry systems in Chhattisgarh	Exec. Director medicinal Plant Board Govt. of C.G. Raipur	No. DRS/T4/6208 dt: 7-1-2003

24. Feedback for R&D:

The University has carried out for crop diversification in uplands to replace rice which is not economical. However, the rate of adoption is very slow so far due to following constraints: Rice is the staple food for small land holders majority of whom own upland fields. There is a need of water management for these holders so that they can increase productivity of rice and use some area for upland oilseed and pulse crops. Government support for these farmers for water management is required.

Proposed intervention: Improved crop and water management research to address this problem. There is a need of constraint analysis study for slow adoption and identification of appropriate technology. Suitable varieties of pulses and oilseeds and weed management practice for such area need to be identified.

25. Strengthening of Directorate of Extension.

26. Establishment of new KVKs in remaining 10 districts of Chhattisgarh.

27. Establishment of farmers hostel at KVKs-Jagdalpur,Ambikapur and Durg

28. Establishment of farmers hostel with the capacity of 50 farmers at Vishwavidyalaya campus, Raipur (The existing farmers hostel building has been occupied by the Govt. for their offices and no alternate arrangement is available).

29. IVLP should be modified to make it Institution Watershed Linkage Programme (IWLP) with a view to understand as how to achieve increased participation of farmers and develop model watershed.

30. Establishment of training center for Agri. business for entrepreneure development for agriculture and allied science graduates.

31. Establishment at a Home Science College at Vishwavidyalaya.

FRESH AGENDA ITEMS

ACHARYA N.G. RANGA AGRICULTURAL UNIVERSITY, HYDERABAD

1. Data to be furnished on details of soil samples/profiles, location, their characteristics analysed, relevant particulars generated during the preparation of different soil maps, fertility maps and crop use maps for the Gove rnment of A.P. by NBSS & LUP, Nagpur & Bangalore Centres

The Government of Andhra Pradesh has paid an amount of Rs.8.8 lakhs to National Bureau of Soil Survey & Land Use (ICAR), Nagpur to prepare various soil snd its related maps, fertility and crop suitability maps for the state in the scale of 1:250,000. NBSS & LUP, Nagpur in association with Bangalore Centre has prepared these maps and submitted to the government of A.P. These maps were found to be useful for planners, extension workers and to Agricultural University for research.

However, NBSS & LUP, Nagpur and its associated centre, Bangalore is retaining the information such as number of soil and profile samples collected for preparation of these useful maps, the data of various soil characteristics analysed along with details of the location of soil and profile collection particulars. This information, if supplied to Govt. of A.P./ANGRAU would help the state to verify the ground realities as well as to upgrade the quality of the maps generated. This will also help ANGRAU/Govt. of A.P. to avoid duplication of soil/profile sampling while upgrading the maps or during larger scale mapping. Since this data will be usua ly in the database of NBSS & LUP and Govt. of A.P. having paid for this, may kindly be handed over to Govt. of A.P. or ANGRAU with intimation to the Govt of A.P.

2. Biotechnology

Biotechnology is the hope of future food and nutrition security for the developing countries. Increase in population and shift in dietary habits create pressure on food needs and other demands. The decline in arable land, natural resource degradation and the impact of global competition will continue to influence agriculture in the coming years. Nevertheless general awareness of ecological costs of increasing the productivity necessitates the r<*orientation of agriculture towards sustainability. Intellectual property rights creates an exigency of understanding, characterization, utilization and preservation of indigenous genotypes. Agriculture will become more and more intensive and profit oriented in future atleast in the better endowed areas. Biotechnology is expected to play a key role for agriculture and industry. The University has so far concentrated on traditional approach on biotechnology and needs to shift its research to modern methods such as recombinant DNA technology, monoclonal antibodies, genetic engineering etc. Provision has to be made for infrastructure and other facilities for strengthening the research on biotechnology.

3. Grant for Annual Maintenance and Development under Research & Extension:

Acharya N.G. Ranga Agricultural University established in 1964 is unique, being the only one Agricultural University in Andhra Pradesh, the 4th biggest State in India and has a mandate of serving vast area of entire State. It has inherited all the infrastructure created several decades ago by the Madras State and Nizam Government. It has a wide net work of 67 Research Stations, 20 colleges and 22 district Agro Agvisory and Transfer of Technology Centres apart from five polytechnics and 7(+3) KVKs. Thus, the University has good infrastructure for research, supported by equally wide extension network.

The infrastructure facilities inherited from the respective Departments of the State Government, and augmented later under the National Agricultural Research Project (Phase I & II) covering AC laboratories, controlled condition structures and systems , farmers hostels, office buildings, residential quarters, and equipment and machinery need regular upkeep and maintenance. The meager provisions available with the University hardly permit any such activity. As a result so many buildings are not getting even the routine repairs and white wash.

Though the Teaching Institutions were provided with some development grant by ICAR, such a provision has not been forthcoming for repairs and maintenance for Research and Extension from any source.

These activities are estimated to cost around Rs. 20 crores per year on an average. Hence, this additional provision of Rs. 20 crores per year may be considered for ANGRAU under Development Grant exclusively meant for Research and Extension, so that it can serve the farmers very effectively.

4. Strengthening linkages between Universities and ICAR Institutes {Exchange of material, expertise and infrastructure)

Inter Institutional Collaboration in exchange of material, scientists' expertise end infrastructure, between SAUs and the ICAR Institutes at respective campuses will go a long way in effective and economic utilization of certain scarce resources and expertise to the mutual advantage. Though, this is practiced to a limited extent through goodwill of the Institutes involved, it is tetter the procedure is streamlined by the ICAR to improve the system.

5. Establishment of State Agricultural Human Resource Development Institute (AHRDI)

Agricultural science is increasingly posed with unprecedented challenges and equally expanding opportunities to overcome the same. What is needed is u ^dating the skills and knowledge in tune with the above on the part of the Human Resource. The changes are taking place very fast. As a result, the manpower need to be properly exposed to these developments and properly trained to exploit their energies more scientifically and efficiently at least once ir 5 years apart from the entry level orientation training.

For a University of a magnitude of its nature with around 1858 scientific, 2135 supporting and 1891 Administrative positions, scattered across the fourth largest state of the country, a Training Institute exclusively for the ANGRAU personnel is considered essential and helpful.

Under the Career Advancement Scheme the Scientists are generally getting two advancements, in their service after the initial entry into the service. They need atleast two trainings each time in their service. Similarly the Supporting aid Administrative personnel in their respective areas to make them serve better. Provision has to be made for the establishment of such Institutes.

ORISSA UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESWAR

a) Technical Aspects :

➢ Droughts, floods and cyclones are the regular features of Orissa. Agricultural Technologies developed in the State to Combat against the problems arising out of such natural calamities are not enough, a strong research base is required for that, ICAR may take steps for establishment of a Flood and Cyclone Mitigation Research Centre in the Coastal Region, a Drought Mitigation Research Centre" in the interior rural districts and open " Agricultural Metereology" Department in the College of Agriculture, OUAT, Bhubaneswar to address the problems related to agriculture.

➢ Big canals are creating water stagnation and waterlodged areas in the State due to direct use of water from the canal for irrigation purposes. This type of use should be checked, Canals in such areas may be used to recharge the agricult jral lands only. Lift points, dugwell may be constructed and water be used from those for irrigation purposes, This will check the water stagnation and water logged situation to a desired extent in those areas and bring higher acreage under irrigation.

➢ The present scope for employment/engagement of the students of agriculture, agricultural engineering, forestry, fishery and home science is limited which creates a disturbing situation in the academic sphere of Agricultural Universities, particularly of OUAT, It needs a serious thought to cope-up with the situation.

➢ Collection and supply of suitable drought resistant crop varieties to the deserving states, particularly rice varieties for Orissa drought prone areas.

➢ Development of a marketing network atleast for three states i.e. Orissa. Andhra Pradesh and Madhya Pradesh (Chhatisgarh).

b) Financial Aspects :

➢ Strengthening of Regional Research Stations and Sub-stations in terms of financial support by the ICAR.

➢ Providing catch-up/development grant to meet research expenditures

➢ 100% grant for All India Coordinated Research Projects by the ICAR for State like Orissa.

➢ Provision of salary of 50% scientific positions in the Regional Research and Technology Transfer Station/Sub-Stations by the ICAR.

➢ Continuance of NATP Schemes during entire 10th plan period

Agenda Item No. VIII

Responses to the issues raised by State Agencies by the DDGs of ICAR / Directors of ICAR Institutes

C 1: CROP SCIENCE

1. Important crops of the region :

A.P. - Rice, Jowar, Groundnut, Cotton, Oilseeds, Sugarcane

Orissa - Rice, Groundnut, Oilseeds, Ragi, Sugarcane

Besides other field crops, jute and mesta are also grown in these states. Andhra Pradesh is a major mesta growing area covering 16 districts . Orissa grows both jute and mesta.

2. Area, Production and Productivity :

The details regarding area, production and productivity are given in Annexure-I.

3. Research support in the region :

a) Institutes |

|

b) Coordinated Project |

| Annexure-II

c) Cess Fund Schemes |

|

d) Other support |

4. Major Achievements :

Jute & Mesta

a) Recommended Varieties :

Jute : *Corchorus capsularis* - JRC-4444, JRC-212, JRC-321, JRC-7447, JRC-698,KC-1; *C. Olitorius* - JRO-524 : JRO-878, JRO-7835, JRO-8432, JRO-66,TJ-40,KOM 62,

Mesta: HC583, AMC-108, HS-7910, AMV-1, AMV-2, AMV-3, AMV-4

Andhra Pradesh

Cannabinus Mesta : AMC-108

SabdariffaMesto : AMV-1, AMV-2, AMV-3, AMV-4.

Sugarcane:

State	Early maturing	Mid-late maturing
A.P.	CoC 671, Co 6907, Co 7508, Co 8014,. Co 7704, 85A261, 81V48, 81A99, 91V83, CoC 97061, CoC 97063	CoA 7602, Co 6304, Co 7219, CoA 95082, 89V74, CoC 96262, Co 86249
Orissa	Co 6907, Co 7508, CoC 97061, CoC 671, Co 87002	Co 6304, Co 7219, Co 62175, CoA 7601, CoT 8201, Co 83089, Co 87043, Co 87044

Cotton:

A.P. – MCU.5, LK 861, L389, Narasimha, Savitha, NHH-44, Lam Hy.I

Orissa – MCU.5, Savitha, JKHy-1, LRA 5166

Tobacco:

FCV TOBACCO:

Traditional black soils: VT-1158, Hema, Gauthami, Jayasree(MR), Kanthi and Hemadri

Northern light soils: 16/103, Mcnair-12, CM-12 (KA) and K-326 (NLS-4) Southern light soils:* Gauthami, Hema, Jayasree(MR), VT-1 158 and Kanthi

<u>NATU TOBACCO:</u>

Black soil natu tobacco: Prabhath, Viswanath, WAF, Natu Special and Bhairavi
Light soil natu tobacco: Peddavithanam, Pyruvithanam, Rangapuram, Kommugudem
LANKA TOBACCO: Lanka Special

HDBRG TOBACCO: HDBRG

BURLEY TOBACCO: Burley-21, Banket-A1, Sweta

BIDI TOBACCO: Anand 119

PIKKA TOBACCO: Pyruvithanam, JP1

b) New varieties identified/ released:

Andhra Pradesh:

Sugarcane: Early maturing -Co 94008, CoA 96081, CoA 89081, CoA 82081 Mid-late maturing- Co 86032, CoV 92102

Jute : Four varieties of H.S. mesta such as AHS-103, JBS-10, NBr-4 and AMI and one variety of H.C. mesta JBM-89-1306 have been found promising in the region and promoted for adaptive trial through AINP on Jute & Allied Fibres during last Workshop.

Cotton : L 604, Aravinda, LAHH 4, Bunny and Mallika.

The newly released private R&D hybrids Bunny and Mallika have made rapid strides in this area. In view of its high yield and superior fibre quality, these hybrids occupy a major area in the State.

Orissa:

Sugarcane: Early maturing- CoA 96081, Co 90017, CoA 89081, CoC 85036, Mid-late maturing - Co 87043, CoV 92102, Co 87044

Tobacco:

FCV tobacco - K-326 (NLS-4) forNLS area, Kanti for SLS & SBS area and Hemadri for black soil area.

Natu tobacco - Bhairavi for black soil area

Burley tobacco - Sweta for rainfed (monsoon) alfisols of agency area/ tribal belt.

Pikka tobacco - Pyruvithanam

Jute: *Olitorius* jute : JRO-128

c) Disease/Pest problem :

Sugarcane:

A.P. - Red rot, smut, grassy shoot, scale insect, early shoot borer

Orissa - Red rot, smut, white grub, early shoot borer

Jute & Allied Fibres :

In mesta foot and stem rot were prevalent in all the places surveyed, intensity varying from 3.8 - 20.5%. Local varieties cultivated by farmers were more susceptible than the recommended improved varieties. Yellow vein mosaic disease in H.C. mesta is spreading in the region.

Cotton :

Andhra Pradesh :

Due to severe drought, unusually high incidence of thrips was seen during the current year which continued upto the receipt of rain in October. Aphid incidence sharply increased in November following good monsoon rains. Jassid and Whitefly population remained low. There was also escalated mealybug damage in most parts due to extreme dry conditions.

Helicoverpa appeared early this year in October itself, as an immigration population from greengram and blackgram, which were abandoned due to drought. Thereafter it remained low.

Due to prolonged dreught, diseases were at a low level. After rainfall in September, Alternaria leaf spot appearances is moderate form.

Orissa:

The pest population in general was very low due to the very severe drought conditions which was not congenial for their development. However, the bollworm damage was restricted below 10%, particularly from spotted bollworm and later half of the season, pink bollworm was seen upto 15%. No diseases were reported from the crop from Orissa.

Tobacco:

Spodoptera litura continues to be the major pest of tobacco nurseries. In the transplanted crop, leaf curl disease vectored by white fly, *Bemisia tabaci* is the major limiting factor of productivity. The infestation of other major pests viz., *Spodoptera litura, Heliothis armigera, Myzus nicotianae* is sporadic.

d) Package of practices : Sugarcane :

i. Planting of recommended varieties
ii. Seed treatment: Heat treatment of seed cane before planting followed by dipping of setts in malathion (0.1%) for the management of sett borne diseases and scale insect. Sett treatment with chlorpyriphos @ 0.1% is helpful in controlling early shoot borer,
iii. Seed rate : 40,0000 three bud setts/ha specially taken from short duration seed nursery,
iv. Fertilizers: Application of nitrogen @ 112 Kg/ha in two splits at 45 and 90 days of planting, phosphorus @ lOOkg/ha and potassium @ 120 Kg/ha as basal,
v. Irrigation : Once in six days in summer and once in 15 to 21 days from November to harvest,
vi. Weed Control: Application of ametryn/pendimethalin/metribuzin followed by one hand weeding has been found efficient for the control of weeds,
vii. Ratoon management : Integration of agro-techniques, such as stubble shaving, trash mulching, gap filling and application of phorate 10 G at 15 Kg/ha has been found to sustain the cane yield of ratoons at higher level.

Jute & Allied Fibres :

(1) Effect of potash, borax and harvesting schedule was evaluated on *capsularis* jute. It was observed that yield varied due to different date of harvesting (80, 100 and 120 days). But borax application had no impaet on the yield of jute.
(2) Chemical weeding followed by four wheel hoeing and urea top dressing was compared with manual weeding twice followed by wheel hoeing and urea top dressing in both *capsularis* and *olitohus* jute.
(3) *Olitorius* varieties like JRO-66, JRO-524 and JRO-632 were found highly resistant to the root knot nematode *(Meloidogyne incognita)*. Other three varieties viz., JRO-878, JRO-7835 and KOM-62 were resistant.
(4) With IPM practices for both pest and diseases 11% higher yield was obtained over control.

However, insect pests were better controlled with recommended practices while diseases were better controlled in case of IPM practices.

(5) Weedici de pendimethaline (stomp) followed by two to three wheel hoeing + one hand weeding yielded 17.40 q/ha compared to manual weeding twice + two to three wheel hoeing (16.65 q.ha) in H. S. mesta.
(6) In case of H. S. mesta poultry manure as the organic substitute for inorganic nitrogen has been found very promising.
(7) Studies indicated that 25% of nitrogen can very effectively be substituted even by one foliar spray of 2% DAP in H. S. mesta.
(8) Combination of insecticides, fungicides and bacteria was found to be superior over other treatments for controlling incidence of jassids in H. S. mesta.

Cotton :

General package of practices as recommended by the State Agricultural Universities exist.

e) Seed production efforts :

Jute & Allied Fibres:

The breeder seed of jute and mesta are produced by CRIJAF at Central Seed Research Station for Jute & Allied Fibres, Bud Bud, Burdwan, West Bengal and are supplied to various Government and non-government agencies. The National Seed Corporation, States Seed Corporations and registered seed agencies produce the foundation and certified seeds.

Sugarcane :

In the zone no. V, the research efforts have been made to produce and distribute quality seed of sugarcane through Breeder Seed Production programme of Centrally Sponsored Scheme on sustainable development of sugarcane based cropping system (SUBCAS). The seed thus produced was supplied to different agencies including farmers for further multiplication.

Cotton :

There are no constraints in seed production. Private hybrids occupy major area in Andhra Pradesh. Breeder seed production in respect of State varieties have been organized by the University.

5. Major constraints :

Jute & Allied Fibres:

Price fluctuation of raw jute (both jute and mesta) is the major constraint. Due to non-intervention of govt. agencies farmers are forced to sell their produce to middle-men. This situation often leads farmers to divert land for food crops.

Non-availability of retting water at the time of harvest of the crop is also a constraint.

Sugarcane :

i. Non availability of quality seed
ii. Inadequate supply of irrigation water during summer/ spoilage of land resulting in

water logged condition in canal areas.

iii. Inadequate supply of organic matter resulting into deterioration in soil health,

iv. Improper attention to ratoon crop,

v. Lack of varietal planning resulting in poor recovery in early crushing and loss of sugar due to late harvesting of early varieties,

vi. High incidence of diseases and pests.

Cotton :

Andhra Pradesh:

The onset of monsoon was late in Andhra Pradesh during the current year. Hence, sowings were completed only in August, instead of July. After the initial rain, the crop was subjected to severe drought. As against a normal rainfall of 900 mm. only 500 mm. was received during the crop season. Because of this, both area and production showed a decline during the current year.

Orissa:

The major constraints in Orissa seem to be lack of facility for Post harvest handling and processing of raw cotton. The Cotton Corporation of India has been the major player in the procurement of cotton cultivation as well as marketing in this State. However, it is found that during last two years, their marketing interventions were virtually late reflexes. Consequently, private traders and middlemen seem to exploit the cotton growers who produce one of the best quality fibres in the country in the three districts, viz., Kalahandi, Bolanghir and Koraput.

There is a serious dearth of ginneries. The Government of Orissa shall strive to establish suitable ginneries and market yards under the auspices of 'Technology Mission on Cotton- Mini Mission III &iy.

Tobacco :

- Unpredictable and erratic rainfall pattern and frequent drought during the crop growth period
  hampers the productivity.
- Suitable watershed based strategies/ techniques and efficient water management techniques
  are yet to be developed / popularized for different rainfed/ irrigated areas.
- Degradation of organic matter leading to low productivity levels and low quality leaf.
- Lack of modules for prediction and forecasting of weather system in relation to insect pests
  and diseases.
- Higher content of pesticide residues in leaf/ end product.
- Increasing production cost in all sectors of crop production is leading to marginal profits
- Ignorance of farmers towards improved crop husbandry.
- Lack of resistance in existing varieties against certain insect pests and diseases viz.,
  Spodoptera, Heliothis, leaf curl, fusarium, nematodes and lack of proper control measures
  for root parasite Orabanche / broomrape.

6. Suggestions for improvement:

Sugarcane :

i. Proper varietal planning : early, mid and late maturing varieties.

ii. Cultivation of varieties suitable for late harvesting without deterioration in sugar.

iii. Development of varieties suited for abiotic stresses, like drought, saline, alkaline soils etc.

iv. Soil fertility management organic recycling, use of spent wash, press-mud cake compost, composting of trash in situ.

v. Quick multiplication of quality seed cane, especially of newly released/developed, varieties through spaced transplanting/tissue culture technique

vi. Exploring the possibilities of mechanisation in sugarcane production, development of user friendly implements suitable for small and medium land holders,

vii. Development of integrated disease and pest management strategies for reducing the losses caused by disease and pests.

Cotton :
Andhra Pradesh:

a) The Cotton production in the state is directly related to price in the market since fluctuation in area is driven by price offered by market. The state could manage the cotton marketing with a strong emphasis on pricing for good fibre with good strength, length and micronaire. Under Technology Mission on Cotton, upgradation of market yards including installation of High Volume Instrument (HVI) have been undertaken. The state could ensure that cotton growers are getting fair price based on fibre quality.

b) Establishment of modern post harvest processing (ginning) facility for cotton may be introduced in all cotton market yards.

c) Being a progressive state that is receptive to reformation, Andhra Pradesh may be the first state to introduce trading of lint (fibre) instead of seed cotton. Necessary planning to create infrastructure in this regard may be done to-harvest the benefits of Technology Mission on Cotton (TMC) and pass on those to cotton growers and user industry alike.

d) The excellent technological support of Acharya N.G.Ranga Agricultural University has to be widely utilized to identify mandals that can produce tailor-made fibre as per the requirement of industry. With a reduced seed index, efforts to grow long staple cotton varieties and hybrids in the resource-rich mandals at reduced cost of cultivation by implementing a strong Advisory system under Mini Mission II of TMC may be implemented. The rainfed cotton growing mandals should be encouraged to grow medium - long staple cotton varieties and hybrids. Desi *(G.arboreum)* cotton hybrids should be used in low rainfall areas.

e) In resource-poor mandals, pulses and oilseed-based dryland crops, as inMaharashtra, should be promoted with cotton as one of the crops. Desi cotton varieties with good fibre length upto 24 mm. are now available and have to be introduced in low rainfall areas.

Orissa:

a) The Cotton production is directly related to price in the market since fluctuation in area is driven by price offered by market. The state should manage the cotton market with a strong emphasis on pricing for good fibre with good strength, length and micronaire. Under Technology Mission on Cotton, upgradation of market yards including installation of High Volume Instrument (HVI) have been undertaken. The state should ensure that cotton growers are getting fair price based on fibre quality.

b) Kalahandi, Bolanghir and Koraput have been now identified as the most promising areas in Orissa for the production of excellent cotton fibre which could be used production of export - quality yarn and textile and non textile finishings. Hence, the Orissa Government may concentrate on establishing appropriate post-harvest processes as well as user industries and facilities in these three districts where the cotton area expanding year after year. The Orissa University of Agriculture andTechnology should strengthen the AICCIP Centre at Bhavanipatna with full compliment of staff allotted to it so as to focus R & D of the problems specific to these three districts. It may also consider establishing its own Government cotton scheme so as to ensure staff and infrastructure facilities.

Tobacco:

Andhra Pradesh:

- Conservation of rain water through watershed based strategies/ techniques and providing life saving irrigation at critical stage will help alleviate the drought problem to a greater extent.
- Field level demonstration of fertigation and drip system may help improve the productivity levels, quality leaf production and water use proficiency. Under the changed situation, and occurrence of frequent drought, rain water conservation and effective utilization has assumed a paramount importance for sustainability of crop and risk management.
- All biological wastes are to be conserved and converted into degradable enriched organic manure as a social programme to keep the clean environment and alternative effective utilization of this organic manure for farm purpose.
- Increasing proportion of organic manure has resulted in the production of less harmful constituents in tobacco like TSNA and Indian tobacco is found relatively less harmful as compared to other leading tobacco producing countries.
- The fuel consumption in tobacco curing has been brought down to a minimum through integrated barn technique and enhanced fuel use efficiency. The waste land grown xerophytes are mainly being used for this purpose as their energy delivering system is quit high and controllable. Afforestation has become a social programme and all the tobacco farmers are being advised to use all the waste land for growing energy plantations. However majority of farmers still go for fossil fuel i.e. coal and other alternate source of energy for curing tobacco and needs to be minimized through constant training and awareness programmes.

- Tobacco is highly quality conscious crop. Any minor variations reflect upon the quality leaf production. Hence, efforts are being made to develop modules to control the pest incidence by using the weather forecast methods under epidemic, endemic and sporadic incidence of insect pests and disease problem.
- Since pesticide residue is reported to affect human health over a period of time, efforts are being made to introduce integrated pest management system/ module and popularizing the use of bio-pesticides to keep the harmful pests under check and to preserve and encourage natural parasites and predators on these insects so as to make the pest management less expensive and eco-friendly. Excessive use of pesticides have become a bottleneck in the control of pests. The defective application technology is the main cause for non-control of pest. Efforts are being made to standardize and popularize the application techniques. Mechanization and modernization of application system/ appliances are found to reduce pesticide load, application time, increasing use efficiency and giving effective control.
- Too much dependence on chemical fertilizers is affecting soil and crop health, because of change in rhizophere microflora and chemical properties and consequently affecting the *quality of tobacco leaf. Incorporation of biological in fixing naturally available nitrogen and* solubilising the natural phosphorus in the crop nutrition schedule will help in suppling the biologically available nutrients to the crop in steady and slow fashion to cope up with the need of the crop. This also ensures guarantee against the unprecedented rains and the quality is also maintained.
- With the change in requirement of overseas buyers i.e. increasing demand for organically produced clean tobacco, farmers are being advised to go for cheaper sources of equally effective substitutes in crop nutrition, improving fertilizer and pesticide application technologies, bio-farming for animal based organic manures development, improvement of curing technologies, use of alternative fuels for tobacco curing etc. to reduce the overhead charges.
- CTRI has taken up the transfer of technology as a challenging task and the technical know-how on the improved production technologies has been taken to the farming community by developing an online farmers portal www.indiantobaccofarmer.com in collaboration with Tobacco Board and ITC for online interaction with the FCV tobacco farmers of Andhra Pradesh and Karnataka in local languages on the problems faced by them and thereby solving problems instantly and it is functioning well. Two kiosks one each at CTRI, Rajahmundry and CTRI Research Station, Hunsur were set up for on-line interaction with farmers. Kiosks were also setup at different Auction Platforms of Tobacco Board and in some important tobacco growing villages for on-line interaction. These kiosks may be extended for other tobacco growing villages also in due course.
- Biotechnological tools have to be utilized fully for development of resistant varieties to biotic and abiotic stresses.

Orissa:

- Research works are to be carried out for all types of tobaccos grown in Orissa Extension activities are to be extended for this crop for the improvement of socio-economic status of the tobacco farmers
- Awareness is to be created to the tobacco growers of the Orissa regarding tobacco based cropping system etc.
- Marketing system of FCV and non- FCV tobacco is to be streamlined to improve the socio-economic status of the farming community and as well as trade. Potential areas in Orissa are to be explored and identified for growing FCV tobacco.

Jute:

Government agencies should be active in purchasing fibre during the peak season of fibre marketing. Government is required to encourage in forming farmers' cooperatives for this purpose.

ANNEXURE-I

AREA, PRODUCTION & PRODUCTIVITY TRENDS OF COMMERCIAL CROPS IN ANDHRA PRADESH AND ORISSA

Crop		Andhra Pradesh			Orissa		
	Year	A	P	Y	A	P	Y
Cotton	1998-1999	2.20	25.0	424	-	-	-
	1999-2000	2.50	23.0	430	-	-	-
	2000-2001	1.33	26.1	498	-	-	-
	2001-2002	1.60	26.8	458	-	-	-
	2002-2003	1.15	21.5	406	-	-	-
Tobacco	1996-1997	164.4	183.3	1115	9.32	5.88	631
	1997-1998	202.0	197.2	976	13.7	8.0	584
	1998-1999	193.0	246.0	1275	7.75	5.61	724
	1999-2000	171.4	193.4	1128	7.43	6.18	832
Jute	1997-1998	-	-	-	16.7	127.6	1375
	1998-1999	-	-	-	5.3	41.6	1413
	1999-2000	-	-	-	4.1	39.2	1721
	2000-2001	-	-	-	3.9	36.5	1685
	2001-2002	-	-	-	4.6	37.8	1479
Mesta	1997-1998	86.0	562.0	1176	31.7	134.2	762
	1998-1999	69.0	542.0	1414	29.0	110.0	683
	1999-2000	76.3	623.2	1470	30.4	129.6	767
	2000-2001	78.0	687.0	1585	24.0	104.0	780
	2001-2002	79.0	667.0	1520	27.8	114.5	741
Sugarcane	1996-1997	199	15030	75.4	23	1332	56.7
	1997-1998	192	13955	72.6	19	1144	61.2
	1998-1999	214	16503	77.2	22	1470	65.9
	1999-2000	231	18508	80.1	21	1080	52.4
	2000-2001	217	17690	81.5	17	964	57.4

Area is in thousand hectare, production of cotton, jute and mesta is in thousand bales and for tobacco and sugarcane is in thousand tonnes. The yield is in Kg/ha, however for sugarcane it is in t/ha

RESEARCH CENTRES

I. Central Institutes:

1) Central Tobacco Research Institute, Rajahmundry, A.P.

II. Research Centres:

Crop	Location	Instt/Univ	State
Cotton	Guntur	ANGRAU	A.P.
	Nandyal	ANGRAU	A.P.
	Umerkote	OUAT	Orissa
Jute & Allied Fibres	Amadalavalasa	ANGRAU	A.P.
	Kendrapara	OUAT	Orissa
	Bamra (Sisal)	OUAT	Orissa
Sugarcane	Amadalavalasa	ANGRAU	A. P.
	Anakapalle	ANGRAU	A.P.
	Vuyyuru	SBI	A.P.
	Rudrur	SBI	A.P.
	Perumalpalle	SBI	A.P.
	Nayagarh	SBI	A.P.
	Chiplima *	OUAT	Orissa
Tobacco	Nandyal	APAU	A.P.
	Jeellugumilli	CTRI	A.P.
	Guntur	CTRI	A.P.
	Kandukur	CTRI	A.P.
	Jeddangi	CTRI	A.P.
	Berhampur	OUAT	Orissa

C 1.1: FOOD & FODDER CROPS

1. Important Crops of the Region

This region comprises the states of Andhra Pradesh, Orissa and Chhattisgarh. The crops predominantly grown in the region are rice, maize, wheat, sorghum, bajra, ragi and other small millets. Rice is the main crop grown in the region.

2. Area, Production and productivity of Principal crops

This area produced 28.20 million tonnes of food grains from an area of 17.48 million hectares during the year 2001-02. Thus, this region with about 14.3% of area under total food grains contributed nearly 13.3% of total foodgrain production of the country. In comparision to national average of 1739 kg / ha, the average food grain productivity during 2001-2002 in case of Andhra Pradesh is 2106 kg/ha. In case of Chhattisgarh and Orissa the average productivity is 1156 kg/ha and 1393 kg/ha respectively.

The statistics on area, production and productivity in respect of major food crop of the region for the last five years (1997-98 to 2001-02) in given in Annexure-I.

3. Research Support in the Region.

a) Institute and Regional Station

The following Institutes and Research Stations of ICAR are functioning in the region:

i) Central Rice Research Institute, Cuttack (Orissa).
ii) Directorate of Rice Research, Hyderabad (A.P.).
iii) National Research Centre for Sorghum, Hyderabad (A.P.).

b) Coordinated Projects/Centres.

The list of the research centres in operation under All India Coordinated Research Projects in the region along-with financial allocation for 2002-2003 is given in Annexure-II.

c) Cess Fund Schemes

Details of the Cess Fund Schemes sponsored by ICAR and in operation in the region are given in Annexure-III.

4. Major Achievements

a) Recommended Varieties

Many varieties of food and fodder crops have been developed and released for the region. Some important varieties for the region are presented in Annexure-IV.

b) Disease and Pest problems of the region

The major diseases and pests which have been found prevalent in the region are as follows:-

i)	Rice	-	Bacterial leaf blight, blast, gall midge, stemborer
ii)	Wheat	-	Leaf blight, rusts
iii)	Sorghum	-	Grain mold, shootfly
iv)	Maize	-	Leaf blight, brown spot,
v)	Small millet	-	Blast, rust, smut, blight, shootfly

c) Other problems:

i) Deficiency of phosphorous and zinc in rice in Andhra Pradesh.
ii) Low fertility status of the soils and low fertilizer use in Orissa and Chhattisgarh.
iii) Iron chlorosis in alkaline soils in rain-fed uplands of Orissa and Chhattisgarh.
iv) New and emerging problems like micro-nutrient deficiencies such as phosphorus, zinc and sulpher in rain-fed shallow lands of Orissa and Chhattisgarh.
v) Non-availability of quality seeds.

d) Package of practices developed for the region

i. Rice-groundnut rotation (two irrigations to groundnut), rice-sorghum rotation (one irrigation to sorghum) and rice-pigeonpea rotation were found to be most promising rotations in Andhra Pradesh.

ii. In low rain-fall light soil areas, sorghum hybrid CSH 6 OR CSH 14 with medium duration pigeonpea C 11 or BDN 2 in 2:1 row ratio has been recommended. In case of high rain-fall and relatively heavy soils, CSH9 with pigeonpea C11 or BDN 2 in 3:3 row ratio is recommended. Fertilizer application to inter-cropping system will be the same as that of sole sorghum crop.

iii. Inter-cropping of little millet + black gram in 2:1 for Orissa, little millet + seasmum or soybean or pigeon pea in 2:1 for Chhattisgarh is recommended.

iv. Application of rock-phosphate reduced input cost and has residual effect in acid soils in Chhattisgarh and Sambalpur district of Orissa.

v. Use of herbicides like butachlor (1.0 kg a.i/ha) or Anilophas (0.4 kg a.i/ha) followed by 2,4-D (0.4 kg a.i/ha) applied at 20-25 DAT recorded best results for weed control under transplanted rice while under rainfed uplands, butachlor 1.0 kg a.i/ha or Pendimethaline 1.0 kg a.i./ha followed by 2,4-D (0.6 kg.a.i/ha) applied 25-30DAT was found most effective to control weeds.

vi. Application of Attrazine @0.5 kg a.i/ha is recommended for spraying as pre-emergence application i.e. on 2^{nd} or 3^{rd} day of sowing for weed control in sorghum.

vii. Application of Zinc in the form of Zinc Sulphate (0.2% solution) and iron in the form of iron sulphate (0.15% solution) by way of foliar spray from 35-65 days of the crop increases grain yield to an extent of 11 to 18%.

viii. Application of phorate granules @ 8-10 kg/ha in the seed furrows is recommended to minimize shootfly damage in sorghum.

ix. Ethofenprox sprays (75 g a.i./ha) helps in preventing the resurgence of planthoppers in rice.

x. Spray of 0.2% Diathane M-45 or 0.1% Kitazine helps in controlling blight and brown spot disease of finger millet.

Major constraints:

i. Impeded drainage and salinity in deltaic alluvial soils in East Godavari, West Godavari and Nellore.

ii. Development of high yielding varieties of rice with resistance to biotic stresses for different ecological conditions.

iii. Low fertility status of soils and low fertilizer uses (Orissa 21.4 kg/ha) and Chhattisgarh 35.7 kg/ha.

iv. Pest and disease problems are severe and no resistant cultivars of sorghum are available.

v. There is need to identify short duration, early maturing wheat varieties, possessing tolerance to higher temperature.

vi. Development of high yielding single crosses of maize.

vii. In Orissa the area under maize is mostly under rain-fed specially within tribal areas. Efforts need to be made to popularize high yielding early maturing composites.

Area, Production and Yield of important food crops in the region during the year 1997-98 to 2001-2002.

A-Area 000/ha
P-Production 000/tn
Y-Yield kg/ha

Crop	A-P-Y	1997-98	1998-99	1999-2000	2000-2001	2001-2002
Andhra Pradesh						
Rice	A	3500.0	4112.0	4014.2	4243.0	3825.0
	P	8510.0	11434.0	10637.8	12458.0	11390.0
	Y	2431	2781	2650	2936	2978
Sorghum	A	789.0	787.0	736.0	677.0	639.0
	P	515.0	547.0	535.0	619.0	634.0
	Y	853	695	727	914	992
Bajra	A	96.0	122.7	117.0	143.0	92.0
	P	67.0	144.4	98.0	149.0	70.0
	Y	698	938	838	1042	761
Maize	A	396.0	405.0	452.0	528.0	429.0
	P	1083.0	1348.0	1472.0	1581.0	1459.0
	Y	2735	3328	3257	2994	3401
Ragi	A	97.8	106.0	96.7	99.2	81.9
	P	90.0	134.0	110.6	120.2	104.3
	Y	920	1264	1144	1212	1274
Small Millet	A	85.9	76.6	63.7	66.5	55.9
	P	35.6	47.6	33.6	39.8	33.4
	Y	540	621	527	598	597
Total Food Grain	A	6520.7	7187.7	7138.0	7672.9	7044.7
	P	10822.3	14395.3	13696.2	16029.2	14835.8
	Y	1660	2003	1919	2089	2106
Orissa						
Rice	A	4496.8	4447.1	4601.8	4434.0	4500.0
	P	6204.6	5391.5	5187.0	4614.0	7148.4
	Y	1380	1212	1127	1041	1589
Maize	A	52.1	51.0	54.0	54.4	51.5
	P	64.0	66.4	81.0	68.9	46.7
	Y	1228	1302	1500	1267	907

Crop	A-P-Y	1997-98	1998-99	1999-2000	2000-2001	2001-2002
Ragi	A	79.9	80.4	82.0	84.0	76.3
	P	47.1	51.3	53.0	46.5	45.1
	Y	589	638	646	554	591
Small Millet	A	93.0	42.0	42.0	41.9	43.2
	P	19.0	20.0	19.0	19.2	19.6
	Y	442	476	452	458	454
Total Food Grain	A	5481.8	5378.8	5487.7	5245.4	5424.5
	P	6637.8	5806.5	5622.5	4984.2	7556.4
	Y	1211	1080	1025	950	1393
Chhattisgarh		1997-98	1998-99	1999-2000	2000-01	2001-02
Rice	A	-	-	-	3769.7	3734.6
	P	-	-	-	2369.3	5132.6
	Y	-	-	-	629	1334
Wheat	A	-	-	-	77.8	96.8
	P	-	-	-	79.5	99.1
	Y	-	-	-	1022	1024
Maize	A	-	-	-	93.4	95.2
	P	-	-	-	125.7	70.9
	Y	-	-	-	1345	745
Small Millet	A	-	-	-	289.6	252.9
	P	-	-	-	45.9	71.6
	Y	-	-	-	158	283
Total Food Grain	A	-	-	-	4925.3	5026.1
	P	-	-	-	2901.3	5811.1
	Y	-	-	-	1589	1156
All India Food Grain	A	123846.9	125355.4	123103.9	121048.3	121911.7
	P	192258.7	203042.9	209801.5	199535.6	212033.8
	Y	1552	1620	1704	1648	1739

List of Centres in operation under All India Coordinated Research Improvement Projects in the region.

State/Crops Project	Name & Location of Centre	Allocation during 2002-2003 (Rs. in lakhs)
Andhra Pradesh		
Rice	Rajendranagar	18.75
	Maruteru	28.05
	Warangal	6.97
Maize	Hyderabad	34.45
	Karimnagar	12.85
Sorghum	Tandur	4.85
	Palem	16.84
Pearl Millet	Anantpur	4.79
Small Millet	Vizianagaram	10.82
	Nandyal	6.78
	Hyderabad	17.02
Forage	Hyderabad	17.02
Chhattisgarh		
Rice	Raipur	17.85
Wheat	Bilaspur	5.37
Maize	Ambikapur	13.05
Pearl Millet	Gwalior	5.75
Small Millet	Jagdalpur	7.82
UUC	Raipur	2.92
Rice	Jeypore	3.00
	Chiplima	22.95
Maize	Jashipur	12.97
Small Millet	Behrampur	13.91
Forage	Bhubaneshwer	16.62
UUC	Bhubaneshwer	5.25

Annexure - III

List of Cess Fund Schemes in operation in the Region

S.N.	Name of the scheme	Location	Date of Start	Amount sanctioned (Rs. in lakh)
Andhra Pradesh				
1.	Genetic enhancement of aromatic short grain rice for higher productivity and export.	DRR, Hyderabad	15.7.2002	14.12
2.	Genetic enhancement of aromatic short grain rice for higher productivity and export.	IICT, Hyderabad	15.7.2002	7.51
Chhattisgarh				
1.	Development of near isogenic lines for different gall midge (Orseolia Oryzae) resistant genes.	IGKVV, Raipur	1.1.2003	7.99
2.	Genetic enhancement of aromatic short grain rice for higher productivity and export.	IGKVV, Raipur	15.7.2002	6.15
Orissa				
1.	Deferral of panicle senescence in rice and its impact on grain yield.	Sambalpur University, Orissa	1.10.2002	5.16
2.	Genetic enhancement of aromatic short grain rice for higher productivity and export.	OUAT, Bhubaneshwer	15.7.2002	6.00

Varieties and Hybrids of Food & Fodder Crops recommended for the Region

Andhra Pradesh

Rice	Suraksha, Rasi, Telia Hansa, Badrakali, Surekha, Triguna, Nidhi, Vikramarya, Chaitanya, Sama, Mahsuri, Swarna, Vijetha, Vasundhara, Bharani Penna, Kesava, Indur Samba, Sivathi Siva, KRH-2, Krishna Hamsa.
Maize	Trishulata, Deccan 105, Ganga 11, Prabhat, Dhawal, DHM-107, DHM-109, Prakash, Shakti-I, Pro 311, Bio 9681, Prakash.
Sorghum	Kharif Hybrids:- CSH6, CSH14, CSH5, CSH10, CSH11, CSH13, CSH9, CSH 18 Kharif varieties: CSV10,CSV11 Moti, CSV 13, CSV 15 Rabi Hybrids:- CSH13R, CSH12R, CSH15R, CSH8R Rabi Varieties:- CSV 8R, CSV14R, SPV 462 (PSV1), Moti, NTJ-2, M35-1, CSV8R, CSV14R.
Bajra	ICMP 8203, MP155, Pusa Safed, ICMV155, Mallikarjun, Mukta, VBH-4, ICMV 221, MBH-136, Nandi-30 (M11515) GK 1004, PAC 903, CZ-IC-923, MLBH 504.
Small Millet	Finger Millet:-GPU45, OEB10, VR708, Bhairabi Fox-tail Millet:-PS-4, Krishnadevarya, Narasimharaya, Prasad Porso millet:-Nagarjuna, Sagar. Kodo millet:-GPUK-3.

Forages	Forage Sorghum	Harasona,HC308,CSH13
	Oats Cowpea	OL-125
	Bajra x Napier	UPC-8705
	Ricebean	CO-3, PGG-616, Bidhan

Chhattisearh

Rice	Aditya, Purva, Tulasi, Armada, Prabhavathi, Mahamaya, Syamla, Kranti, Ruchi, Safri-17, IR36, Ajaya, Jawahar Rice, Pooja, CR1002.
Wheat	GW 273, GW190, NW2004, HI 1077, Swapnil (JWS 17), DL 788-2, Sujata.
Maize	Trishulata, Deccan 105, Ganga 11, Prabhat, Dhawal, DHM-107, HIM 129, Prakash, Pusa Early Hybrid Makka-1, Pusa Early Hybrid Makka-2, Vivek Hybrid-4, Shakti-1, Mahi Kanchan, Pro 311, PAC 705, Pro 312
Sorghum	Hybrid- CSH6, CSH9, CSH10, CSH11, CSH13, CSH16, CSH17, CSH18 Varieties - CSV10, CSV11, CSV13, CSV15, SPV235, JJ741, JJ938,

Bajra	MP 155, RCB-IC9, VBH-4, ICMV 221, ICMH-423, MLBH-285 MH-518 MBH-136, VBH-4, CMV221, MBH-136, CZ-IC-923, GHB-316, Pusa605, JBV2, Nandi32, MP334.
Small Millet	Finger Millet VL-149, RAU8, Bhairabi, Barnyard Millet-VL 29 Kodo Millet-GPUL-3, JK41, RBK155 Little Millet-JK-8, KGBKL Harasona, CSH-13 UPC-8705

Forage	Oats	OL-125
	Fodder Sorghum	Harasona, CSH-13
	Cowpea	UPC-8705

Orissa

Rice	Annapurna, Mahalaxmi, Seema, Salivahana, Samalei, Utkalaprabha, CR1002, CR 1014, Samaltha, Manika, Urvashi, Manila Lunishree, CSR 10, Narendra Dhan 97, Narendra Dhan 359, Mahamaya, Jawahar Rice, Pooja.
Wheat	HP 1633, K-8962, K 9107, Ganga (HD-2643), HP-1761, HUW 468 Sagarika, NW 1014, HW 2045, PBW 443, HD 2733,
Maize	Trishulata, Deccan 105, Ganga 11, Prabhat, Dhawal, DHM-107, Prakash, Shakti-I, Pro 311, PAC705, BIO9681, DHM 109, Him 129, Prakash.
Sorghum	SSV 84, CSH 14, CSV14R, CSH13R, CSH16, CSH15R. Raj 171,
Bajra	Eknath 301, ICMV-155, HHB-67, Pusa 23, MBH 130
Small Millet	Finger Millet :- VL149, RAU8 Kodo Millet: Bhairabi, OEB10, GPUK3 Little Millet: OLM 203, OLM 20
Forages	Fodder Sorghum: Hara Sona, CSH 13 Cowpea: UPC 9202 Berseem: Bundel Berseem -3 Rice bean: Bidhan-1

C 1.2: SEED SECTION

The details are as under :

1. **Andhra Pradesh** - Both Breeder Seed production and Seed Technology Research components exists at ANGRAU, Hyderabad.

2. **Orissa** - Both Breeder Seed and Seed Technology Research components exists at OUA&T Bhubneshwar.

3. **Chattisgarh** - Only Breeder Seed Production component exists at IGKVV, Raipur.

Research Progress:

A) **Breeder Seed Production** - All the 3 institutions have been producing good amount of breeder seed of different crops varieties which has made it possible to run the seed production chain in these states. The details of breeder seed produced have been given in Table-1.

B) **Seed Technology Research** - The major findings/recommendations are as follows :

a) Results obtained from different centres over years in mung ODV seeds collected from STLs and GOT conducted at OUA&T, Bhubaneshwar have indicated that ODVs in this crop were true ODV in the GOT as the plants raised from these seeds were other crop varieties and therefore seed standard for ODV should exist and proper care need to be taken in seed multiplication chain to avoid ODVs.

b) Information collected from the State Seed Testing Laboratories of A.P., Gujarat, Karnataka, M.P., Maharashtra and Tamil Nadu for 3 consecutive years clearly revealed that the germination status of **cotton hybrid seed** is fairly high (more than 70% in majority of the samples). This was further confirmed by testing 5% samples of STLs in STR laboratories. The germination of cotton hybrid seed from private seed industry was found to be still higher (above 90%). Therefore, it is strongly recommended that MSCS for germination of **cotton hybrid seed** should be upgraded from 65 to 70%. This will not affect the availability of hybrid cotton seed but will help in providing better quality seed to the farmers.

c) Studies on large scale seed storage confirmed that HDPE interwoven, non-laminated bags may be used for bulk seed storage as a substitute to jute canvas bag, provided the seed is dried properly (moisture content not exceeding 10% at the time of packing). Packing less than the capacity of the bag helps in proper stacking of the bags.

d) Validity of certification of groundnut seed for 9 months is appropriate when stored under favourable storage conditions. If stored under high- RH and temperature conditions, like Bhubneshwar, the validity period should be limited to 6 months.

e) Even one pair of lesser grain borer *(Rhizopertha dominicif)* was found to cause injury to cereal seed above MSCS of 0.5% under different agro-climatic conditions, and hence seed should be kept free from lesser grain borer.

f) The effect of pre-sowing seed treatment was found non-significant on germination, emergence or yield in maize at ANGRAU. Hyderabad. However, days to 50% flowering and days to maturity were hastened by pre-treatments for 4-5 days.

g) The electrophoretic banding pattern using SDS-PAGE has been standardized at ANGRAU. Hyderabad in rice (92 genotypes including varieties, hybrids and parental lines), groundnut (67 varieties), castor (27 genotypes including varieties. hybrids and parental lines) and maize (28 genotypes including varieties, hybrids and parental lines).

Table - 1: Breeder Seed Produced during 2001-2002 in Orissa, Andhra Pradesh and Chattisgarh.

(in quintals)

S.N.	State	Centre	Crop	Indent	Production
1.	Orissa	OUA&T, Bhubaneshwar	CEREAL CROPS Paddy	352.00	392.67
			Maize	0.80	1.10
			Ragi	50.60	32.60
		Total		403.40	426.37
			PULSES CROPS Pigeonpea	3.00	
			Mung	3.20	-
		Total		6.20	-
			OILSEED Groundnut	201.00	189.70
			Niger	1.45	1.45
			Sesamum	1.45	4.00
		Total		203.90	195.15
		Total of OUA&T, Bhubaneshwar		613.50	621.52
2.	Andhra Pradesh	ANGRAU, Hyderabad	CEREAL CROPS Paddy	2028.20	2144.88
			Maize	-	13.78
			Sorghum	3.90	6.90
			Ragi	0.30	0.50
		Total		2032.40	2166.06
			PULSES CROPS Pigeonpea	48.35	40.36
			Mung	45.10	22.85
			Urd	104.60	60.71
			Chickpea	6.10	6.10
		Total		204.15	130.02

S.N.	State	Centre	Crop	Indent	Production
			OILSEED CROPS Groundnut	310.80	65.00
			Sesamum	5.77	2.52
			Castor	40.55	18.49
			Sunflower	6.12	7.62
			Safflower	0.14	0.20
		Total		363.38	93.83
			FIBRE CROPS Cotton	15.20	14.15
			Mesta	00.50	00.75
		Total		15.70	14.90
		Total (Hyderabad)		2615.63	2404.81
3.	Chattisgarh	IGKVV, Raipur	CEREAL CROPS Wheat	246.00	219.00
			Paddy	581.50	766.05
		Total		827.50	985.05
			PULSE CROPS Chickpea	103.00	111.60
			Pigeonpea	15.70	18.74
			Urd	2.00	3.80
			Lentil	4.50	2.10
			Fieldpea	10.00	8.00
			Lathyrus	2.00	2.00
		Total		157.20	180.24
			OILSEED CROPS Soybean	475.00	318.40
			Safflower	12.00	12.00
			Linseed	14.75	20.20
		Total		501.75	350.60
		Total (Raipur)		1486.45	1515.89

Agenda items:

1. Strengthening of seed programme of hybrids
2. Work on molecular aspect of seed
3. Participatory seed production at farmers level

C 2.1: FRUIT CROPS

Recommended Varieties:

Andhra Pradesh

Acid lime - Acid lime and Tenali selection
Banana - Karupura chakkerakeli (AAB), Telia Chakkerakeli (AAA), Amrutapani (AAB) and Bontha (ABB) are the predominant native cultivars of the region. Robusta (AAA), Dwarf Cavendish (AAA) and KBS-8 (AAA) were added recently. In addition, a cooking cultivar, Koovur Bantha (AAB) has been recommended.
Sweet orange - Sathgudi
Aonla: NA-10,NA-6,
Tamarind: PKM-1, Selection V-I
Custard apple: Balanagar, ATPS-2

2.1.1 Significant Research Achievements and important package of practices:

Mango: At Sangareddy, FRS (AP), a total of 400 exotic and indigenous accessions are maintained. Sixteen germplasm accessions were collected and planted in the field. One clone of Bangalpalli was selected on the basis of good yield, regularity in bearing and good fruit quality. Amrapali, Mallika, Neeluddin and Neelphonso produced higher yield as compared to other mango hybrids. The hybrid Sindhu had produced 'off season' flowering and fruiting. In the evaluation by different methods of propagation, it is revealed that veneer grafted plants recorded highest yield followed by patch budded plants.

Citrus: At Tirupati (ANGRAU), under Genetic resources 67 varieties/species of Citrus are maintained. In acid lime, Tenali selection continued to perform well with tolerance to canker. This clone is being planted at other centres besides supplying to farmers. Among other selections RHR - L-122 and TAL- 95-4 were found promising. Acidlime plants applied with 800g N + 200g P_2O_5 + 300g K_2O recorded highest growth (plant height of 2.98 m and plant volume 37.17 m^3) and yield characters (27.48 kg/ plant with 685.67 of fruits). Among the sweet orange varieties, Rangpur lime rootstock continued to show its superiority for sweet orange. Nadimpalle selection was found promising in terms of growth and yield. Kodur Sathgudi is performing well with respect to cumulative yield. Application of 600g N (50% as Urea, 25% as FYM and 25% as oil cakes) + 200g P_2O_5 + 400g K_2O per plant in Sathgudi sweet orange produced highest growth (plant height of 3.38 m and plant volume 51.17 m^3) and yield (119.0 kg/tree with 833 fruits) characters. In a comparative nutritional trial on inorganic and organic manuring on Sathgudi, it was observed that the plants applied with 7.5kg of Neem cake + 600g N + 450g P_2O_5 + 450g K_2O per plant produced higher yield (83.13 kg/plant with 450 fruits) besides recording favourable growth characters (maximum plant height of 4.1m, plant volume of 89.08 m^3).

Banana: A total of 101 accessions are being maintained at Kowur.MC-91-02 (AAB) and MC-92-02 (ABB) dessert types were recommended to release for cultivation. The clone KBS-8 from Dwarf Cavendish, consistently recorded higher bunch weight with a yield of 110-115 t/ha under Kowur conditions and the plant material is supplied to growers for field trials. A clone from Robusta has been selected based on the extensive survey carried out in seven districts of Andhra Pradesh. It recorded a bunch weight of 38.5kg having 187 fingers. The crop matured in 427 days and took 308 days for shooting. The suckers of this clone are being multiplied for further evaluation. For planting Telia Chakkerakeli (AAA) banana, June-October was found ideal but incidence of disease was less for June -August planting. Application of 50% of recommended dose of N and K (200g/plant/crop) recorded significantly higher yield over control, thus indicating 50% nutrient saving if resorted to fertigation. All the growth and yield characters were favourably influenced with this treatment for Robusta (AAA). In addition, crop cycle was significantly lower than control (234.53 and 175.42 days in PC-1 and R-1 for fertigation as compared to 259.78 and 231.32 days in PC-1 and R-1 cycle for control, respectively). In cropping sequence studies, growing amorphophallus as an intercrop has recorded higher net returns and cost benefit ratio (1:2.68) followed by colocasia.

Sapota: A total of 27 accessions are being maintained at Kowur. Experiments on varietal trial on sapota revealed that, PKM-1 recorded highest yield of 41.42 kg/tree (439.33 fruits) followed by Kalipatti (15.67 kg/tree with 157.33 fruits) for 6 Year old trees. Plant spacing of 5 x 5m recorded highest plant height while, 10 x 10m spacing recorded maximum canopy spread. Application of 200g N, P_2O_5 and 150g K_2O per plant per year along with 25kg FYM recorded good vegetative growth (Plant height of 328.33 cm and canopy spread of 310cm) for 6th year old plants of Kalipatti.

Guava : A total of 27 germplasm accessions were collected and maintained at FRS,Sangareddy. The evaluation of germplam revealed that the cv. Kohir Red, Apple collour and Red Guava were superior in growth attributes and observed to be vigorous.

Jackfruit: Three promising varieties have been planted besides selecting 11 clones for further planting. One variety Khajawa from ICAR research complex for eastern region, Ranchi (Bihar) and two varieties NJ-1 and NJ-2 from Narendradev University of Agriculture and Technology, Faizabad (Uttar Pradesh) were collected and planted in August and October, 2000 respectively.

Arid-zone Fruits: Maximum fruit yield per ha. was recorded in 6x6 m. catchment area with 5% gradient in ber under Andhra Pradesh conditions. Pruning at 0cm height gave significantly better growth and yield/plant in Phalsa. Highest fruit yield was recorded with drip system in Pomegranate in comparison to basin irrigation.

2.1.2: Diseases . Insect & pests and their control:

Mango: Survey conducted in Chitur Nuzvid area revealed that cvs. Rumani, Ratna, Swarna, Jehangir were found free from stone weevil infestation. Also in Nuzbvid area Benishan, Totapuri, Neelam, Jalal, Chinarasam and Peddarasam cultivars were found free from the stone weevil infestation.

Citrus: At Tirupati (ANGRAU), roving survey conducted for insect pests revealed that, severe incidence of blackfly and leaf miner was noticed. Fixed plot survey revealed that severe incidence of citrus leaf miner during January, February and October to December, citrus butterfly in November to December and rust mite in April to June was observed. Significant positive correlation was noticed with mean temperature for leaf miner. Incidence of the nematode *Tylenchulus semipenetrans* was noticed. Studies on biology of citrus leaf miner during September and December revealed that, the total life cycle varied from 11 to 18 days and 10 to 14 days, respectively. Population dynamics of citrus leaf miner revealed that the leaf miner was severe (26.47 to 31.76%) in November. Two sprays of fenvalerate (0.005%) with two weeks interval was found significantly superior in reducing the leaf miner incidence. Roving survey conducted for diseases revealed that Gummosis, dry root rot and greening diseases are becoming major problems on both sweet orange and acid lime in AP. Citrus yellow mosaic, a major viral disease is prevalent in almost all the sweet orange growing areas. In fixed plot survey, it was found that dry root rot, greening, bacterial canker with bark eruption on stem and shallow soils were found responsible for acid lime decline in Nellore and Chittoor districts of AP. Soil drenching in tree basins with hexaconozole (0.4%) + carbendazim (0.2%) two times at one month interval effectively controlled the dry root rot in Sathgudi sweet orange. Two potential native *Trichoderma* isolates were identified and found effective in inhibiting *Fusarium solani,* the casual agent of dry root rot of Sathgudi sweet orange. Tenali acid lime clone and RHRL 124 were found resistant to bacterial canker under artificial and natural epiphytotic conditions. Twig blight was serious in all surveyed areas during March-July Pruning with spray of carbendazim (0.1%) f.b. COC (0.3%) f.b. captofol (0.2%) at 3 monthly interval was effective in controlling the twig blight of acid lime. Four sprays of carbendazim (0.1%) at monthly intervals from the 4th month of fruit set was effective to control pre-harvest stem end rot of Sweet orange. Among the virus diseases^mosaic and greening were the serious.It was found that mealy bug, *Planococcus citri* transmits citrus yellow mosaic virus. Drying of sweet orange and acid lime twigs were found to be due to pink disease.

Banana: At Kowur (ANGRAU), Panama wilt incidence is mostly observed in accessions belonging to the silk (AAB) sub group and diploid accessions (AB) Ney Poovan and its synonyms. Incidence of *Fusarial* wilt is on the increase with the reintroduction of susceptible cultivars, Malbogh and Mortmon (AAB, Silk) from West Bengal. Rhizome rot has become a major problem in Telia Chakkerakeli (AAA) in alluvial and black soils of East and West Godavari District. Banana bract mosaic continues to be a major threat to banana cultivation although its incidence is on the decline with the increasing awareness among farmers. Symptom manifestation was observed to vary with genome. Observations on symptom manifestation were recorded on cultivars belonging to different genomes so that they can be exploited in the selection of a disease free planting material. Studies on incidence of rhizome rot (Telia Chakkerakeli) revealed that, temperature has a profound influence along with rainy days on the disease spread. Irrespective of the quantity of rainfall, rain splashes must have contributed to the spread of bacterium and temperature may have favoured the infection. Cultural and morphological studies of *Fusarium* indicated that, although all the isolates were found to belong to race 1 (as reported earlier), they differed in their cultural characteristics. Maximum radial growth of the colony was in the isolate from Telia chakkerakeli and the lowest was in the isolate from Kowur bontha. Epidemiology of sigatoka leaf spot studied from six planting in eyery even month revealed that higher disease severity during period having higher relative humidity was observed. Regression analysis performed between PDI and weekly means of weather variables revealed that RH (Morning & evening), maximum temperature and minimum temperature are important weather factors, which influenced the disease progress. Shooting to harvest is the critical time for the crop with respect to Sigatoka disease infection.

Arid-zone Fruits: The chemical spray schedule for control of powdery mildew in ber and fruit spot of pomegranate have been standardized. Lowest disease index was recorded in ber when first spray was given after appearance of powdery mildew and subsequent 6 sprays of wettable sulphur 0.2% at 10 days interval. Fruit spot of pomegranate can be effectively controlled by foliar spray of Thiophonate (0.1%) or Copper oxychloride (0.4%) or Carbendazim (0.1%). *Alterneria* leaf blight in custard apple reported to be common disease in the region. Spray of 0.04% ploytrin (profenophos 40%+cypermethrin 4%) was found best followed by Monocrotophos (0.03%) for the control of fruit borer.

2.1.3 Multiplication of Planting Material:

Planting material of fruit trees were multiplied and distributed to the farmers/State Departments as per requirement.

2.1.4 Technology ready for transfer: Mango: Veneer grafting technique in mango propagation is recommended

Citrus: In acid lime, Tenali selection has been recommended for cultivation, as it is tolerance to canker besides giving good yield.

Rootstock Rangpur lime has been recommended for sweet orange. Among the sweet orange varieties Kodur Sathgudi is performing well and hence recommended for cultivation. For leaf miner; two sprays of fenvalerate (0.005%) with two weeks interval are recommended. Soil drenching in tree basins with hexaconozole (0.4%) + carbendazim (0.2%) two times at one month interval is effective to control dry root rot in Sathgudi sweet orange. Pruning with carbendazim (0.1%) f.b. COC (0.3%) f.b. captofol (0.2%) at three months interval is recommended for effective control of twig blight of acid lime. Four sprays of carbendazim (0.1%) at monthly intervals from 4^{th} month of fruit set has been recommended to control pre-harvest stem end rot of Sweet orange.

Banana: MC - 91.02 (AAB) and MC - 92-02 (ABB) dessert types were recommended for farmer's cultivation. Clone KBS - 8 has been recommended for the farmers who were growing Dwarf Cavendish as it yields more than Dwarf Cavendish. For Telia Chakkerakeli (AAA), June-October planting banana is ideal but for less incidence of disease with more yields, June to August planting is ideal. The best time to plant banana (cv. Robusta) is between June and August to avoid Sigatoka diseases severity and to obtain higher yields. Application of 50% of recommended dose of N and K (200g/plant/crop) is recommended to apply through fertigation. Growing amorphophallus or colocasia as an intercrop in banana orchards is ideal for higher net returns and cost benefit ratio.

2.1.5 Constraints, if any: -Nil-

Post-Harvest Technology of Hort. Crops:

1. The bars of mango var. Totapuri made with 30% sugar along with 0.5% citric acid and 1000 ppm KMS had the best colour, texture, flavour and taste. Bars made in cabinet drier did not set up properly and gave dark colour bars.
2. The data over the period of three years revealed that the storage temperature of 15° - 18° C suited best to custard apple fruits as compared to 12° C and ambient condition. The maximum shelf life of fruits was 3 days (ambient condition), 9 days (18° C) and 12 days (15° C).
3. Post harvest disease was found to be least in

- Banana fruits treated with mustard oil (15%) followed by boric acid (1.7%) and carbendazim (3.8%) after 10 days of storage at RT.
- Mango fruits treatd with carbendazim and mustard oil at 15 days after storage.
- Guava fruits treated with carbendazim and thiophanate methyl at 8 days of storage.

4. Sapotato fruits treated with Ethral @ 750 ppm exhibited higher ripening, TSS, reducing sugar and organoleptic score. However, PLW losses were more with treated fruits.
5. Minor fruits like phalsa could be utilized as one of the processing methods, for blending juice with other fruits like mango (0.5,0.5:1) papaya (1:0.5) plum (1: 0.5) blue grapes (1:1) jamun (1:0.5) as nutritive organic drinks.
6. Use of tomato powder was found to increased the shelf life of all the three products viz. maida, semolina, and rice rawa. Maximum increased (40 days) was observed in case of maidia and least in wheat rawa. (20 days) with appreciable change in the moisture level 0.5% level of incorporation gave the best results of shelf life and organoleptic score.

7. Microwave treatment could be used for improving the shelf life of vegetables viz. brinjal, beans, tomato, carrot, littlegourd, bittergourd, clusterbeans, green chilli, lady finger, cucumber, onion and potato. Vegetables treated for 30 seconds and above with MW resulted in cooked flavour and in rapid rotting. Treatment of 15 second was slightly better than others.
8. Microwae dried products of potato were comparable to deep fried chips in terms of colour, taste and flavour. However, due to low fat they were slightly harder in texture. The fat content of microwave dried chips ranged between 4-5% as against 28-30% in conventionally made chips.
9. In cauliflower use of composite preservatives (metabisulphite and sulphite) and a combination of low temperature(60° C) and higher temperature 100° C of blanching with intermitted exposure to air for 60 minutes gave the best results in terms of colour, texture, appearance and rehydration ratio.
10. Gladioli spikes of Nova lux variety harvested at 1st basal floret colour development could be stored to the maximum extent (21 days) withSHQ solution in cold storage condition followed by ZECC (11 days) as compared to control (7 days).

Appendices:

1. **Listof ICARInstitutes/NRC in the region: -Nil-**

2. **All India Coordinated Research Projects Centre:**

(A) Tropical Fruits:

Kovur (A.P.)
Tirupati (A.P.)

(B) Sub-Tropical Fruits:

Sangareddy (A.P.) Rewa (Chattisgarah)

(C) Arid Fruits:

Anantapur (A.P.)

(D) Post-Harvest Technology:

Hyderabad

3. **List of Ad-hoc research Scheme in operation in the region:**

Molecular diagnosis and integrated management of dry root rot in Sathgudi sweet orange, ANG RAU, Hyderabad. Rs. 18,30,808.

C 2.2: VEGETABLE CROPS

Recommended varieties:

Tomato: BT-116-3-2, BT 20-2-1, BSS-20
Chilli : BC-14-2
Brinjal : ARBH-541, PHB-6, JBH-1
Cucumber : PCUCH-1
Bottle gourd : NDBH-4
Bitter gourd : RHRBGH-1
Okra : DVR-3, DVR-4, (VRO-3, VRO-4)
Watermelon : MHW-6
Peas : DPP-68, NDW-250, KS-245
Muskmelon : DMDR-2
Cassava : Sree Jaya and Sree Vijaya
Colocasia : Muktakeshi
Amorphophallus: Gajendra
Potato : IPS hybrid 92-PT-27
Mushroom : CM-9 and CM-7 strains *Agaricus bisporus; Pleurotus sajor caju, P.florida*
Gladiolus : Arun and Hybrid-1, cv. Shubhangini
Chrysanthemum: cv.Basanthi; cv.CO-2, snow scm, cv.Ratlam selection, CO-1
Tuberose : cv. Calcutta single and Calcutta double

Research achievements and package of practices

Vegetables:

In Cabbage application of 120 Kg nitrogen and planting of 60x30 cm spacing gave maximum yield of 313 q/ha and C.B ratio 1:2.57. Phosphorus @ 100 kg and Potash @ 80 kg/ha. 140 kg nitrogen alongwith Azotobacter produced maximum head yield (376.78 q/ha) with C.B ratio of 1:3.41.

Potato:

Heat tolerant hybrid HT/920/621 and a red skin culture MS/92-2105 are in pre release stages of evaluation under AICRPIP. New hybrids with red skin tubers viz. MP/92-56, 94-P-5, 94-P-31, 94-P-59, 94-P-60 and 95-P-42 have been introduced in 2002. Early maturing hybrids viz. J/92-167, J/93-4, J/93-97, J/93-81, J/93-86, J/93-87 were introduced. Remunerative potato based crop sequences were identified for different regions. Biofertilizers viz. Azotobacter + Phosphobacteria resulted in higher net returns followed by *Bacillus* as compared to control.Potato stem necrosis (PSDN) caused by topso virus is a newly emerged problem in Gujrat (Deesa), Rajasthan (Kota) and M.P areas (Chindwara & Gwalior) & is more aggressive under hot and dry conditions.

Tuber Crops:

In Cassava seed production programme was intitiated at Paddapuram for rapid multiplication and spread of the two identified varieties Sree Jaya and Sree Vijaya for the farmers. Inter crop in banana, amorphophallus, colocasia, dioscorea were tried at Kowur and adjoining areas. The highest net return and cost benefit ratio was recorded when colocasia was grown as intercrop.

Sweet potato:

IPM involving Synthetic sex pheromone was superior to application of chemical and control in sweet potato. At Chhattisgarh, in sweet potato based cropping system trials, vegetable, cowpea, sweet potato system was found to be the best sequence. A mean tuber yield of 21 tonnes/ha tuber green pod yield 6.3 t/ha were recorded.

Cococasia:

Trials undertaken to identify colocasia blight tolerant varieties revealed that the variety Muktakeshi is highly tolerant to Phytophthora blight. Multi locational trials were conducted to identify blight tolerant varieties. Muktakeshi was recommended for release in Orissa state.

Mushroom:

Dipping treatment of button mushroom fruiting bodies in 75 ppm and 200 ppm EDTA improved keeping quality of fruiting bodies at par to KMS (0.5%) dipped mushroom. Chemical pasteurization of long method compost with Formalin+Bavistin gave good results in button mushrooms. Spraying of mushroom beds with Veradix enhanced mushroom yield. Chemical sterilization of substrate with Formalin+Bavistin proved best. Supplementation of substrate with wheat bran @ 5% enhanced with mushroom yield over unsupplemented substrate. In Oyster mushroom locally available substrate paddy straw followed by soybean straw gave good results. Chemical sterilization of substrate with Bavistin 75 ppm + formalin 500 ppm solution, gave the best results. In Paddy Straw Mushroom *Volvariella* cultivation supplementation with gram dal powder was helpful. Substrate prepared from wheat straw + paddy straw gave highest yield *ofCalocybe indica* and wheat bran @ 4% supplemnted wheat straw enchanced yield *ofAiyiculariapolytricha.*

Floriculture:

In Gladilous post harvest management studies, the chemicals Sucrose 4% + Dichlorophene 50 ppm was found significant in increasing vase life and in promoting the longevity of 2^{nd} opened floret for the variety Trader horn. Polypropylene sleeves were found to be effective for the days taken for the basal floret to open and longevity of 2^{nd} open flower. In Chrysanthemum, significant differences in vase life duration with treatment viz. Sucrose 2% + Citric acid 75 ppm + Silver nitrate 25 ppm in cv. Ravikiran was observed. In Tuberose combined application of NPK @ 200 : 200 kg /ha resulted in increased weight of spike. In post harvest studies vase life was significant in the treatment Sucrose 2% + Cobalt choloride 100 ppm.

Multiplication of planting material;

About 250 farmers of East Godavari districts were supplied with planting material of cassava. Elephant foot yam Gajendra was introduced and popularized. 1.5 metric tones tubers were supplied to 650 farmers and 2.5 quintals seed material were distributed to the extenstion agencies. In potato, 12 hybrids and two cultivars (Kufri Jyoti and Kufri Griraj), 36 hybrids and 12 varieties at Modipuram are being multiplied/maintained for supplying to different AICRP centres in the hills and plains. In mushrooms about 5000 kg of commercial spawn, 60 Kg of mother spawn and 30 cultures of edible mushrooms were supplied to farmers and commercial spawn units in and around the Centre.

Technologies for transfer;

- In vegetables crops, 20 varieties / hybrids have been developed and recommended for their cultivation in the region.
- Five improved package of practices in tomato, cabbage, chilli and French bean were identified and recommended for the transfer among the farmers.
- Five package of practices for seed production in Okra, Tomato, Chilli, Bell Pepper and Brinjal crops were developed and recommended for adoption by the farmers.
- In mushroom, paddy straw was the best substrate for oyster mushroom followed by soyabean straw. Supplementation of substrate with 5% soyabean meal instead of plain substrate for mushroom is advised .Chemical sterilization of substrate with 75 ppm Bavistin + 500 ppm formalin in oyster mushroom is recommended .
- Spiral techniques of paddy straw mushroom cultivation. Chemical pasteurization of long method of compost for obtaining disease free crop.
- In floriculture, planting of tuberose bulbs during July-September with balanced fertilization of NPK @ 200:200:200 Kg/ha was found optimum.
- In Gladiolus, vase solution comprising Sucrose 4% + Dichlorophene 50 ppm increased the vase life in cv. Trade horn.
- Vase life of tuberose was significantly increased in the treatment Sucrose 2% + Cobalt chloride 100 ppm against control.

Constraint If any: Nil

LIST OF ICAR INSTITUTES/NRC/AICRP CENTRES:

ICAR Institute/NRC - Nil AICRP Centres:
Lam - APAU, Hyderabad Hyderabad- PAU, Hyderabad Bhubaneswar-OUAT, Bhubaneswar Raipur - IGKW, Raipur.

List of ad-hoc schemes:

1. Integrated approach for selection, induction and chacterization for development of salt tolerant sweet potato and taro was in operation at Regional Centre of CTCRI Aiginia, Dumduma, Bhubaneswar from 01.5.2002 to 30.04.05 at a total outlay of Rs. 6,65,8087-

2. Collection, conservation and evaluation of major tuber crops germplasm for different toposequences of Bastar plateau zone was in operation at IGAU, Kumhrawand Jagdalpur (ZARS) from 01.06.02 to 31.05.05 at total outlay of Rs. 7,23,9007-.

C 2.3: PLANTATION CROPS

The region comprises of the state of Andhra Pradesh, Orissa and Chhatisgarh.

Recommended varieties:

Coconut :	Godhavari Ganga (EOT x GBGD), Kerasankara (WCT x COD), Chandrakalpa (Laccadive Ordinary), Double Century (Philippines Ordinary) and Sakhigopal Tall.
Coriander:	Hisar Sugandh , UD - 446 .
Fenugreek :	Hisar Suvarna , Hisar Madhavi, Hisar Mukta .
Turmeric :	TCP-2.
Cashew :	BPP 4, BPP 6, and BPP 8, Bhubaneshwarl, Dhana (V-1 and V4), BLA 39-4
Betelvine:	Utkal sudam, Sanchi.

Research achievements and package of practices:

COCONUT

At Ambajipeta (Andhra Pradesh) Sakhigopal tall accession yielded 75nuts/palm/year. ECT x GBGD, GBGD x Fiji and GBGD x LCT were found to be promising in terms of mean nut yield during pre cyclone period. However, under the post cyclone period GBGD x LCT gave a highest mean nut yield of 34.22 nuts/palm. COD x WCT and WCT x COD and Laccadive ordinary were found to perform better in terms of mean nut yield of 72,73 and 65 nuts/palm/year respectively. Application of 50 kg composted coir pith (43.0 nuts/palm) and 50% composted coir pith plus 50% chemical fertilizers (36.3 nuts/palm) was found to be effective. The coconut based cropping system involving cocoa, Elephant foot yam, banana, pineapple, colocasia, turmeric and cinnamon generated a net return of Rs.20,795/- with a cost benefit ratio of 1:1:86. At Ambajipeta, pathogenicity of *Ganoderma applanatum* isolated from coconut to other palms i.e., arecanut and oil palm was established. *Ganoderma applanatum* was re-isolated from oil palm and arecanut roots. Disease spread in the palms can be checked by treating the affected palms with *Trichoderma viride* 50 g + neem cake 5 kg/palm (or) by root feeding 100 ml 1% Hexaconozole + neem cake 5 kg/palm (or) root feeding, 100 ml 2% Tridemorph plus *Trichoderma viride* 30 g + neem cake 5 kg. Survey in six districts indicated the incidence of *baculovirus* between 5.91% and 23.8%. Release of baculovirus infected beetles in selected villages resulted in reducing leaf damage (79.1% to 46.7%) and spindle damage (40.9%to 4.7) considerably. Rhinolure trap was effective for 49 days and resulted in reducing leaf and spindle damage in experimental sites. Chemical treatments with sulphur, and root feeding of monocrotophos reduced nut drop and improved the size of nuts in the Eriophyid mite infested palms. At Konark, GBGD x ECT, GBGD x PHOT and ACT x GBGD were performing better. Palms under INM treatments viz., 50% composted coir pith plus 50% chemical fertilizers, and full dose of chemical fertilizers produced more female flowers (115 and 102 respectively) and shown promise of better recovery. At Jagadalpur, accessions Java, MOD, Fiji and Gonthembili produced on an average 8 inflorescences per year and yielded 17-24 nuts/palm. Fiji Tall produced 43 nuts/palm, hybrids WCT x COD, ECT x GBGD and ECT x MYD showed promising results.

PALMYRAH

At Pandirimamidi, eighteen more accessions were added to the palmyrah germplasm making the total collection at the centre to 88. These accessions would be used in future selection programme.

OIL PALM

At Vijayarai , the cumulative yield of tenera hybrids for eight years from 1992-93 to 1999-2000 showed superiority of yield in basin irrigation combined with application of 1200:600:2700 g N,P_205,K_2O/palm/year, the best combination recording a yield of 15.92 t FFB/ha.Application of 1200:600:2700 g N,P205,K20/palm/year in two equal split doses during June-July and November-December was found to be the best method for good growth and yield of oil palm. In Oil palm a germplasm bank consisting of 76 accessions from 11 countries has been established at Palode. Two seed gardens are established in A. P. - Rajahmundry and Lakshmipuram. In yield performance trial of eleven hybrids from Costa Rica, Ivory coast, Palode and Papua New Guinea (PNG), PNG was highest yielder followed by Palode, Ivory coast and Coasta Rica. Banana and seed maize was found to be most profitable intercrops grown in oil palm. In Irrigation studies, better growth of oil palm in the drip and micro jet systems compared to that of basin was observed. Nutrient surveys have revealed that majority of plantations had optimum leaf N and Mg contents. Only 50% of plantations in Godavari Districts possessed optimum K levels. Rhinoceros beetle is a major pest in oil palm. Other pests include termites, psychids, beetles. IPM practices for control was developed. Major diseases observed fn A. P. are basal stem rot, stem wet rot, bunch rot, fruit rot and bunch end rot. Spraying of Glyphosate @ 17.5 ml per 3 m radius keeps the oil palm basin free from weeds for one year.

SPICES

In Black pepper, Panniyur-1 was found to be the best performer in Andhra Pradesh. Silver Oak is recommended as the best standard for trailing pepper in Andhra Pradesh. A fertilizer recommendation of 100:60: 160 kg N, K20/vine in two splits (July and September) is considered to be optimum under rain fed conditions in high altitudes and tribal zones . Drenching of 1% Bordeaux mixture or copper oxychloride 0.2% @ 5 lit./vine as soil drench around the basins followed by two rounds of foliar spray during July and August along with soil application of neem cake @ 1 kg/vine for the management of *Phytophthora* foot rot disease in pepper is recommended. Bio-control studies of *Phytophthora* foot rot at Chintapalli revealed less disease incidence by using of antagonistic agents like *Trichoderma harzianum* and *T. viridis* along with spraying and drenching of 1.0 % Bordeaux mixture. The optimum sowing time of turmeric has been fixed to be the first fortnight of May for turmeric at Pottangi (Orissa) and the optimum rhizome size for planting is 20-25 g . BSR-1 and PTS-62 observed superiority in the high altitude and tribal area of Andhra Pradesh. At Raigarh centre, suitable varieties of turmeric were RH-5, Rajendra Sonia, Acc.361, JTS-2, IISR-Prabha and IISR-Prabitha. Turmeric variety PTS-43 a high yielding, high curcumin, high dry recovery with wide adaptability and disease tolerance is identified and proposed for release at Pottangi. Turmeric variety PTS-59, PTS-55, PTS-43 were also identified as promising ones. The optimum fertilizer dose recommended by Raigarh centre is 150:125:125 NPK/ha for turmeric. Jagtial centre isolated and identified the rhizome rot pathogen of turmeric and recommended the use of biocontrol agents 7. *viride* + *P. florescence*. Seed and soil tent along with recommended NPK + FYM for the management of rhizome rot. For Leaf blotch of turmeric foliar application of Dithane M-45 (0.25%) was effective. Spraying with Carbendazim (0.1%) or 1.0% Bordeaux Mixture at monthly intervals is recommended for the *Taphrina* leaf blotch. In Ginger, the optimum sowing time is first fortnight of April at Pottangi. IISR-Varada was found in high altitude and tribal areas of Andhra Pradesh. At Raigarh .fertilizer application @ 150:125:125 kg/ha NPK was observed the best ratio and yielded significantly highest fresh rhizome yield (26.57 t/ha) closely followed by the application of NPK @ 175:150:150 kg/ha (26.25 t/ha). The NPK requirement in ginger has been found to be 125:100:100 kg instead of 75:50:50kg/ha for higher economic yield at Pottangi. Ginger variety ViE_8-2 a high yielding low fibre, high oleoresin, disease tolerant with wide adaptability is proposed for release at Pottangi. Another variety V_3Si-8 is identified as promising . Soybean and red, green gram are found to be the best intercrops for the main crop of ginger at Pottangi. Mulching with paddy straw organic leaves improves the rhizome yield in ginger. For soft rot in ginger, seed treatment of ginger rhizomes with mancozeb (3g/lit. of water) for 30 minutes before storage and before planting, spraying of Mancozeb (2.5g/lit.) planting of rhizomes in raised beds, and retention of mother seed rhizomes in the plant are recommended by Chintapalli centre. Application of blitox-50 (0.3%) Macozeb (0.3%) Topsin (0.1%) is advised for the management of *Phyllosticta* leaf spot by Raigarh centre. Neem cake (5%) and Mahua cake (5%) application were effective for the control of rhizome rot besides giving high yield in ginger. The Raigarh centre identified best accessions IC-1, IC-2 in coriander. Two genotypes of coriander ie. LCC-128 (genotype) EC-232666 (grain purpose) have been identified and are in pre-release testing at Guntur.

CASHEW

In Cashew, at Bapatla 129 germplasm accessions of cashew were conserved and are being evaluated . Application of 1000g N, 125 P_2O_5 per tree was found to be the most effective for clonally propagated cashew plants. Among the inter crops tried, cluster bean and black gram during kharif and rabi season were found to be remunerative at Bapatla. At Bhubaneshwar 45 germplasm accessions of cashew were conserved and are being evaluated. At the centre , NPK application of 1000g N, 250g P_2O_5 and 250g K_2O was found to be the most effective treatment. Among the inter crops tried, intercropping with turmeric was found most economic under cashew plantation. Growing amorphophalous as well as cowpea were also found to be economical. Six demonstration plots were raised during the year 2001 with clonal material. At Jagdalpur 10 germplasm accessions of cashew were conserved and are being evaluated. NPK application of 1000g N. 250g P_2O_5 and 250g K_2O was found to be the most effective treatment. Inflorescence thrips and stem and root borer are the serious problems for cashew growing in these regions. Recommended spray of Monocrotophos (0.05%) one spray at flushing and Carbaryl (0.1%) one spray at flowering and one spray at fruiting controls the tea mosquito bug, inflorescence thrips and other minor pests effectively. Extraction of grubs followed by Swabbing with coal tar + Kerosene (1:2) or mud slurry + carbaryl four times along with application of Lindance 0.2% (Sevidol 75g/tree) was found to be effective method for control of CSRB.

BETELVINE

In betel vine, furrow irrigation in each row at APAU was reported to be superior in respect of leaf production. Triacontanol (0.05%) sprayed thrice at 30 days interval gave favourable influence in growth and yield of betelvine in APAU, OUAT centres. Application of FYM has increased the growth and yield significantly in addition to reducing the disease incidence in OUAT. In APAU, application of neem cake with urea (1:1) gave maximum vine growth and leaf yield. Neem coated urea (NCU) was superior to tar coated urea and prilled urea in terms of growth, yield and quality and tolerance to pests and disease. At APAU with NCU increased leaf yield was recorded. In Halishar sanchi (WB) lowest root knot index was recorded in Orissa . In Andhra Pradesh, severe damage by *Spodoptera litura* (up to 30%) and red spider mite (up to 8%) was observed during October. An incidence of 5-15% mirid bug *(Disphinctus politus)* was recorded around Tuni area during monsoon months which caused 40-50% damage during post monsoon months in Visakapatnam districts.

Build up of white mite started during second fortnight of November and was maximum during December-January months. Lower temperature was favourable for the development of the pest.

Multiplication of planting material:

lakh oil palm sprouts has been supplied to different states implementing the OPDP. In A.P. 21,000 Cashew grafts were produced and sold to farmers during the year 2001. Clonally propagated planting materials are only multiplied and distributed for planting. High yielding cashew varieties are multiplied and total of 1,63,566 grafts were supplied to farmers, developmental agencies and Government Departments. Production of elite/planting material/nucleus seeds/breeder seeds/foundation seeds of released and promising varieties are taken up by the AICRPS centres. Multiplication of quality planting materials of turmeric and ginger up to the tune of 9021 in ginger and 5101 in turmeric during 2001 -2002 in Orissa were made. The Guntur centre multiplied and distributed 440 kg of new coriander varieties viz. Sindhu, Sadhana, Swathi, LCC-128 and Pottangi centre ginger (3700 kg), turmeric (2600 kg) and mango ginger (700kg).

Technology ready for transfer

- In oil palm, the -over aged seedlings could be managed by following practices like - Topping the leaves, Mulching with empty fruit bunches, dried leaves. Sowing of sunhemp around the basins in 2-3 lines, Fertilizers to be applied one-fourth of normal dose and Ablation till three years.

- A .decorticator (modified coconut decorticator) has been developed to extract fibre from oil palm empty fruit bunches and mesocarp waste.

- Compost from oil palm wastes consists of 1.4% N, 0.13% P, 0.63% K. 0.28% Ca and 0.26% Mg in addition to micro nutrients. This can meet 94% of N, 42% of P and 51 % of K requirement of the crop.

- In cashew ,60 cm cubic pits at 5x5 m, 5x4m as well as 4x4m, accommodating 200-400, 500-625 plants respectively have been recommended for beneficial returns in the very initial years of planting.

- The recommended fertilizer application dose is 500g N, 250g P and 250g K for cashew trees. During the first year, 1/5th of the normal, during second year 1/4th of the normal, during third year 1/3rd of the normal, during fourth year 1/ 2 of normal and full dose in subsequent years in two equal applications is recommended. However, based on soil test data available for Bhubaneshwar 106% N, 48% P, 106% K of the normal dose and for Khurda 97% N, 60% P, 106% K of the normal are recommended.

- Soil and water conservation in elevated lands by means of terraces and catch pits are recommended.

- In betelvine leaves are to be graded and the washed leaves are to be packed in bamboo baskets lined with moist dry plantation leaves/ paddy straw to withstand long transport and prolonging the shelf-life.

- Halishar sanchi was found to posses multiple resistance against *Phytophthora* foot rot, *Anthracnose* and bacterial leaf/stem infection and basal rot of betelvine.

- *Phytophthora* leaf and stem rot can be controlled by spraying Bordeaux mixture (0.5%) followed by drenching Bordeaux mixture (1%).

- Superiority of baclerinol (0.1 %n ai) with bordeaux mixture (0.5%) treatment was observed next to streptocycline (250 ppm) treatment.

- Four drenching + eight spraying of bordeaux mixture uniformly starting from June to September at monthly and fortnightly intervals were found to be superior in controlling *Phytophthora* in OUAT.

- Field application of *Paecilomyces lillacinus* inoculated oil cake thrice at 500 kg effectively controls the root knot nematode and increases the leaf yield production.

- Application of oil cakes (500 kg/ha) with soil drench of carbofuran (0.1%) and three application of *P. lilacinus* inoculated oil cakes (500 kg/ha) was on par with carbofuran (1.5 kg/ha) in OUAT centre with respect to root knot index and leaf yield.

- Package of practices for Turmeric for the high elevation region of Eastern Ghats were standardized by the Chintapalli (Andhra Pradesh) includes a seed rate of 2500 kg/ha. Sowing first fortnight of May at 30 x 20 cm spacing in raised beds and fertilizer schedule of $N:P_2O_5: K_20$ at 30:30:60 kg/ha was ideal. Three organic mulching is recommended for higher yield in Turmeric at Pottangi.

- A package of practice for ginger in high elevation region of Eastern Ghats were standardized by Chintapalli involves the time of sowing of ginger in June-July and seed rate of 1700 kg/ha at 30 x 20 cm. Spray and fertilizer recommended is 75:50:50 N P_20s K_20 kg/ha.

- Harvesting of old rhizomes after germination reduces yield in ginger as well as makes it prone to disease (Pottangi).
- Pit method of storage, under shade is a one meter wide 30 cm deep- 5 cm long pit/ arranged with 1 cm thick straw ginger or turmeric is slane in a heap covered with straw and 3 cm thick loose soil can be stored for 5 months after harvesting recommended by Pottangi centre.
- Seed treatment of rhizomes of ginger and turmeric with insecticides, fungicides and bactericides for 30 months before planting is recommended to prevent rhizome rot by Pottangi.

Constraints, if any –

- At Jagdalpur, both the posts of scientists are vacant and therefore technical programmes of the project are not implemented properly.
- At Ambajipeta centre, Recurring contingency of Rs.40,000/- per scientist should be enhanced to Rs.60,000/-.
- Super cyclone of October 1999 and frequent damage to experimental sites by wild elephants has completely damaged the experiments at Konark centre and they are being started afresh.

List of ICAR Institute/NRC and AICRP Centres :

ICAR Institute	Nil
NRC for Oilpalm	Pedavegi (AP)
AICRP on Palms Centres	Ambajipeta (ANGRAU) Vijayarai (ANGRAU) Pandirimamidi (ANGRAU) Konark (OUAT) Jagdalpur(IGKW)
AICRP on Spices Centres	Guntur (ANGRAU) Chintapalli (ANGRAU) Jagtail (ANGRAU) Pottangi (OUAT)
AICRP on Cashew Centres	Bapatla (ANGRAU) Bhubaneshwar (OUAT) Jagdalpur (IGKVV)
AICRP on Betelvine Centres	Bapatla (ANGRAU) Bhubaneshwar (OUAT)

Ad-hoc schemes of the Plantation Crops:

1. Studies on the re establishment and yield performance of oil palm trees uprooted by cyclone in West Godawari district of Andhra Pradesh was in operation at NRC for Oil Palm, Pedavagi from 01.05.1998 to 31.07.2002 at total outlay of Rs. 17,49,440/-.

2. Determining the vectorial role of putative insect vectors with reference to spear rot disease of oil palm at NRC for Oil Palm from 01.04.1998 to 31.01.2001 at total outlay of Rs. 13,67,560/-.

3. Oil Palm information system was operational at NRC for Oil Palm from 01.09.2000 to 31.08.2003 at total outlay of Rs. 7,80,320/-.

C 3: NATURAL RESOURCE MANAGEMENT

C 3.1: AICRP on STCR

BHUBANESWAR (ORISSA):

Soil Test-Crop Response Correlation (STCR) project centre Bhubaneswar has started functioning from September 1996. During the last two years, the centre has developed nutrient adjustment equations for targeted yields of crops in Rice-greengram and rice-rice cropping systems. The centre has also prepared soil fertility maps based on soil test data generated in the State Soil Testing Laboratories from the period from 1988 to 1996. The centre is extending soil testing facilities on payment basis to the progressive farmers and extension agencies.

CHHATTISGARH:

The Raipur centre has generated integrated nutrient prescriptions for kharif rice with green manure and farm yard manure as sources of nutrients. Integrated nutrient recommendations were also generated for vegetable crops okra and potato. The centre has prepared soil fertility maps and super imposed the targeted yield recommendations over the fertility maps using GIS. These maps will help in recommending fertilisers on crop - area basis. The centre also developed rapid soil testing kit for use by the extension agencies and 150 kits have already been sold so far.

ANDHRA PRADESH:

The Hyderabad centre has generated fertiliser adjustment equations for prescribing nutrients for targeted yields of crops - groundnut TIVIV-2 on Alflsols under rain fed conditions at Palam, sugarcane (87A-298) on alluvial soils of Nellore, kharif rice (NLR-28600) on alluvial soils of Nellore, kharif rice (BPT - 5204) on V'ertisols of Nandyal, Jowar jCSH-9 on Alfisol under rainfed conditions at Palern, cotton (Narasimha) on Vertisols under rainfed conditions of Nandyal and Coriander (cv.CS-4) on versitols of Nandyal.

Follow up trials on integrated nutrient management in rice with-FYM/green manure, green leaf manure etc. were conducted. Green manure has been found to be highly beneficial in rice on alluvial soils of Nellore. The centre has also onducted frontline demonstrations on oilseed - groundnut (TIVIV-2) in alluvial oils, Nellore; lateritic soils, Tirupati; Alfisols, Anantapur; lateritic soils, Chittor districts. The seed yields and cost: benefit ratios were higher in the treatments there soil test based nutrients were applied for targeted yields of groundnut.

C 3.2: AICRP ON BNF

Progress of Research work during 2002:

SPECIFIC ACHIEVEMENTS:

Strains of *Azospirillwn* and *Azolobacler* isolated from chillies and cotton and black gram grown in rice fallows in areas with high application rales of fertilizers and pesticides (Amaravathi, A.P.) which arc at testing stage.

Inoculation of diazotrophs *(Azospirillwn+Azotobacler)* with application of 40-60 kg N/ha produced similar rice grain yield as 80 kg N/ha alone thus saving 20-40 kg N in coastal soils of Orissa . Absolute increase in grain yield was nearly 3.2q/ha due to inoculation at 40 kg N. Bioferlilizer application (40 N -I BF) boosted the nutrient uptake in rice by 4.5 kg N, 0.9 kg P and 23.8 kg K over 40 N alone leading to higher apparent rccovery of applied NPK of 11.3, 5 and 76 kg/ha respectively (Bhubancswar).

Rice gruel and chickpea powder (Bascon) and Isabgof jelly were good sticking material for application of inoculum to rice seedlings. Pre-incubation of FYM and culture mixture (25:1 for 5 days at 50% WHC) was better than direct soil application of FYM-culture mixture. On application of pre-incubated lignite based culture, population of diazotrophs increased 14 fold. Dual inoculation of *Azotobacter* and *Azospririlliiin* an acid soil increased fruit yield of Okra by 16.6q/ha (averaged over amendments) over uninoculated control.

N, P, K, Ca uptake increased by 18.9, 3.8, 25.6 and 13.0 kg/ha (Bhubaneswar). *Rhizobium* inoculation of cowpea (vegetable) increased the pod yield by 8.7 q/ha (28.2 % increase averaged over amendments). The additional yield obtained by inoculation ranged from 7.1-10. q/ha which promised an yield increase landing on 20.7-32.8%. Additional NPK uptake of 18, 3.4 and 28.8 kg of NPK/ha was recorded due to inoculation (Bhubaneswar).

3. New areas to be tackled:

1. In all the three agricultural universities in the region (A.P., Orissa and IGKV), the teaching and research programmes in Microbiology and Biotechnology needs to be strengthened and strongly supported from X plan onwards.

2. Production facilities for bio-inoculants are available at Amaravathi, A.P. They need to be set up in Raipur and Bhubaneswar by concerned agricultural university to supply quality inoculants to farmers.

Biofertilizers for vegetable crops along with IPNS technology needs to be developed.

C 3.3: AICRP MICRO AND SECONDARY NUTRIENTS AND POLLUTANT ELEMENTS IN SOILS AND PLANTS

To evaluating sulphur (S) status of soils of Andhra Pradesh and delineating sulphur deficient areas, Hyderabad centre of AICRP Micro and Secondary Nutrients and Pollutant Elements in Soils and Plants analysed about 6000 surface soil samples at a grid of 10 km. Sulphur status in soils of Rayalaseema and Telangana region ranged from 1.98 to 92.88 mg S kg^{-1} and 2.50 to 95.24 mg S kg^{-1} respectively and about 50% soil samples were tested to be S deficient. In Coastal districts, sulphur status ranged from 1.78 to 97.6 mg kg^{-1} soil with a mean of 19.38 mg kg^{-1}. Only 38% of the soils are deficient in available S. Based on analysis of 600 soil samples mean available S status of soils in Andhra Pradesh was found to be 14.88 mg kg^{-1} with over all 46% S deficient soils. Soils of Mahboobnagar, Medak, Rangareddy, Cuddapah, Nellore, Prakasham and East Godavari have 40-50% S deficient area. Map showing sulphur deficient areas have been prepared.

Application of 20-40 kg S ha^{-1} or 5 kg Zn+ 20 kg S ha^{-1} resulted in significant increase in groundnut pod yield over the control. The percent increase in yield due to application of different combinations of micronutrients and S ranged from 12 to 29.5 percent. No significant effect of boron on increasing pod yield of groundnut was observed.

To delineate Mo and B deficient areas, survey carried out by Hyderabad centres for high altitude soils having neutral to acidic soils revealed that 49 percent soil of Srikakulam and Vizianagaram districts are deficient in Molybdenum (53% in Srikakulam and 45.7% in Vizianagaram districts). Similarly, boron deficiency was observed in soils to an extent of 53 percent in soils and up to 52 percent in coconut orchards of East Godavari districts in Andhra Pradesh due to sandy texture. Extent and severity of deficiency increased from 53 to 89 percent with an increase in soil depth. With respect to other micronutrients Zn, Mn and Fe deficiencies were noticed in coconut leaves to an extent of 88, 34 and 11 percent respectively. This suggest need for balanced nutrition of coconut for sustaining higher crop yields.

To develop amelioration technology, studies revealed that soil application of 12.5 kg $ZnSO_4$ ha^{-1} combined with 0.2% foliar spray of $ZnSO_4$ + 0.5% foliar spray of $FeSO_4$ (3 times) at later stages increased the tomato fruit yield by 11.12 t ha^{-1} over control with 39% response. Application FYM and pressmud proved equally efficient. Soil application of zinc @ 25 kg $ZnSO_4$ ha^{-1} combined with three foliar application of 0.5 per cent iron sulphate was found more beneficial in terms of increasing yield and nutrient quality of fodder jowar in zinc and iron deficient red soil.

C.3.4. AICRP LONG TERM FERTILIZER EXPERIMENTS TO STUDY CHANGES IN SOIL QUALITY, CROP PRODUCTIVITY AND SUSTAINABILITY

Centre of AICRP LTFE at IGKV, Raipur and OUAT Bhubaeswar revealed that balanced application of recommended dose of NPK significantly increased the crop productivity of rice-wheat in Inceptisols of Chhattishgarh and rice-rice cropping system in Alfisol of Orissa. In Inceptisols of Raipur, application NP, NPK or NPK+FYM gave rice yield of 4.69, 4.76 and 5.08 t ha^{-1} which were significantly higher than 2.96 and 1.95 t ha-1 of the N and control treatments. Similarly in Alfisols of Bhubaneswar when any single rice cropped land is brought under double rice cropping the rate of nutrient mineralization decreased due to wet puddled condition for more than 9 months and sharing of native fertility by two crops. Application of FYM along with NPK fertilizers improved the yield marginally for the first 8 cropping cycles at Bhubaneswar. Subsequently, more than 1 ton additional yield could be obtained due to its direct, residual and cumulative effect and the response increased progressively over the years. Similarly, at Raipur integrated use of FYM+ NPK application gave maximum yield of rice (5.08 t/ha) and wheat (2.80 t/ha) which were 160.5 and 73.9% higher than that was obtained with control (1.95 and 1.61 t/ha, respectively). Moreover the yield of rice increased by 58.4% due to P application. Thus, addition of P and use of 10 t ha^{-1} organic manure is very much essential to optimize yield of rice-rice system.

C.3.5. AICRP ON CROPPING SYSTEMS RESEARCH

SALIENT ACHIEVEMENTS

1. PD Cropping System Research, Modipuram

Orissa:

Cropping system research centres are located at Bhubaneshwar, Chiplima (On-station) and Bhawanipatna and Ranital (On farm). At Bhubaneshwsar, rice-maize-cowpea can well replace rice-mustard-greengram with a margin of Rs. 58045/- in gross return. Under long-term experiment application of 50% recommended fertilizer through chemicals and rest through compost/FYM/gobar gas slurry during *kharif and* 100% recommended NPK through fertilizer during rabi resulted in7.8 t o (rice+wheat)/ha in a rice-rice system. Experiment on long-range effect of continuous cropping and manuring revealed that application of Ngo IMG to kharif rice and NIIO Pgo to rabi rice produced about 6.1 t of rice grain/ha in a rice-rice system. EN a rice-rice system, recommended level (Ngo P4oK4o) of fertilizer to both the crops can perhaps conserve the organic carbon well as shown by its top yield of 6.71 of rice grain/ha.

At Chiplima, long-term experiment on integrated nutrient management showed the superiority of application of 50% NPK through fertilizer + 50% through compost/FYM during both the seasons in rice-rice system with about 91 grain/ha. In another experiment recommended level of N (80 Kg/ha) + cellulose decomposing enzyme during both the seasons in a rice-rice system gave rise to 8.3 t/ha o system grain yield.

Experiment on farmer's field at Bhavanipatna showed rice-mustard the best system with 6 t rice and 1.6 t mustard/ha giving a net return of Rs. 46692/ha. At this centre lack of balanced fertilization was found to be a constraint to rice yield. In this respect, application of 60:30:30 of N:P:K gave 5.3 t/ha rice grain yield. Under frontline demonstration there was production of 5.11 rice and 2.1 t sunflower in a rice-sunflower system with improved practices resulting in 35% grain over the farmer's practice.

On farmer's field at Ranital, the responses of rice-rice system to applied in N, P and K were 8 kg grain/ kg N, 20 kg grain/ Kg PiOs and 15 kg grain/kg K2O.

Andhra Pradesh

Cropping systems research centres are located at Rajendranagar, Rudrur, Maruteru (On station) and at Lam (Guntur) (On farm). At Rajendranagar, experiment on need based cropping system has shown two prominent cropping systems, which are economically profitable, and energetically viable. These are maize (cob)-tomato (Rs. 48534 gross return and 57549 kilo calorie with 44 t maize cob and 10.6 tomato/ha) and lady's finger-maize (cob) (Rs. 32830 gross return and 62075 kilo calorie with 3.4 t lady's finger and 48.7 t maize (cob). Experiment on herbicide application in system model revealed that application of Butachlor plus one hand weeding during both the seasons recorded more than 9 t of rice-rice system yield/ha whereas Butachlor during kharif and Pendimethalin during rabi shot up the yield only up to 7.5 t/ha. Permanent plot experiment on integrated nutrient supply system recorded the highest system yield of 11.7 t/ha from a rice-rice system when 50% recommended NPK was supplied through fertilizer and rest through green manuring or through Azolla during kharif and the entire recommended NPK was supplied through fertilizer in rabi.

At Rudrur, results of need based cropping system showed soybean-safflower

(2.5 t ' soybean, 2t safflower, Rs. 43028 gross return) and greengram-safflower (1.4 t green gram, 2 t safflower and Rs. 360733 gross return/ha) as the most prominent systems under rainfed conditions. Long term integrated nutrient management recorded 6.6 t of rice and 1.3. t of mustard from a rice-mustard system when 75% o recommended NPK was supplied through fertilizer and rest through green manuring or Azolla to rice and mustard was supplied only 75% recommended NPK and that also only through fertilizer.

At Maruteru, experiment on rotation of herbicide in rice-rice system for the prevention of new biotypes of weeds proved application of Anilophos during kharif and 2, 4-D during rabi the best with more than 12 t of system grain yield. On farm experiment at Lam (Guntur) showed that under farmer's level of management inclusion of improved variety increased the yield of greengram by 1.1 q/ha and blackgram by 1 q/ha over control. Application o recommended fertilizer ($N_{20}P_{50}$) in addition to the above level of management pushed the yield further by 60 kg/ha in greengram and 100 kg/ha in blackgram, A further increase of 65 kg greengram and 84 kg blackgram/ha was noted with improved practices in addition to improved variety and recommended levels of fertilizer.

Chhatisgarh:

Cropping system research centres are located at Raipur (on-station) and at Ambikapur (On farm). At Raipur experiment on need based cropping system brought out two cropping systems prominent both economically and energetically. These are rice-berseem (F) with 5.3 t rice 58 t berseem (F), Rs. 728527- gross return and 18148 kilo calorie energy and rice-tomato with 3.3 t rice, 2.4 t tomato, Rs. 75990/- gross return and 16987 kilo calorie of energy/ha. System based maximum yield research recorded top yield of 6.7 t rice and 1.9 t sunflower from a rice-sunflower system when both the crops received 150% recommended fertilizer (Recommended fertilizer -$N_{120}P_{60}K_{40}$) in addition to 10 t FYM/ha. Permanent plot experiment on integrated nutrient supply in rice-wheat system recorded 5.5 t rice and 2.1 t wheat/ha when 50% recommended NPK was supplied through fertilizer and rest through green manuring or Azolla to rice whereas wheat received the recommended level entirely through fertilizer.

Experiment on cultivator's field at Ambikapur showed that from economic viewpoint rice-potato (4.6 t rice, 18.5 t potato and Rs. 54092 net return/ha) was the top most system, Experiment to derive the extent of response of different cropping systems to applied plant nutrients recorded a response of 7 kg grain/kg N applied to rice of wheat, 17 to 24 kg grain/kg P_2O_5 to rice or wheat and 4 to 4.5 kg grain kg K2O applied to rice or wheat of a rice-wheat system. Similarly, the corresponding response figures for a maize-mustard system were 5-7 kg grain/kg N, 10-25 kg grain/kg P_2O_5 and 5-8.5 kg grain/kg K_2O applied to the crops. Since lack of fertilizer application and weed control measures were found to be principal constraints, experiment in this angle showed that application of $N_{100}P_{64}$ + weedicide under transplanted rice and $N_{100}P_{64}K_{32}$ + line sowing in wheat proved quite successful resulting in 4.2 t rice and 4.2 wheat/ha amounting to 58% increase in rice yield and 123% increase in wheat yield than that under farmer's practice.

C 3.6: ALL INDIA COORDINATED RESEARCH PROJECT ON DRYLAND AGRICULTURE, ANANTAPUR

Groundnut based production system in kharif arid shallow alfisols:

1. Region

Anantapur, Kurnool, and Chittoor districts of Andhra Pradesh

2. Climate

The decennial mean annual rainfall is 616 mm received in 36 rainy days. There is increase in the rainfall during the period from 1990-2000. In the recent past, the sowing rains are being received during August first week instead of second fortnight of July. The decennial normal rainfall during kharif (June- September) is 394 mm received in 21 rainy days. Among the months, the mean decennial rainfall in August turned out to be heavy rainfall month with 116.5 mm received in 6 rainy days. The analysis of the rainfall indicated that the crop is subjected to terminal season drought. There are no significant fluctuations in the temperature during the cropping period. High wind velocity ranging between 12.1 to 17.9 km/h exists between May and August.

3. Soils

The soils of the region are red sandy loams with compact sub-soil having 10-15 cm/m available water meter depth storage capacity. Soils have serious crusting problems and high infiltration. There are near neutral in soil reaction, deficient in nitrogen and zinc and medium to high in potassium and phosphorus.

4. Crops and varieties

Crops	Varieties/ Hybrids	Duration (days)	Reaction to pests and diseases	Remarks
Groundnut	TMV - 2	105-110	Susceptible for foliar diseases	Suitable for scarce rainfall areas, no dormancy
	Vemana	105-110	Tolerant to foliar diseases	Tolerant to drought, dormancy present.
	TPT-4	105-110		Tolerant to drought
Sorghum	CSH-5	105-110	Tolerant to grain molds	---
	CSH-9	105-110	Tolerant to grain molds	---
	CSH-13	110-115	---	Tall and yields more fodder
	NTJ-1	105	---	Drought tolerant and grain is easily separated from the panicle
	NTJ-2	95-100		Early in duration, bold white shiny grain and easily separated from the panicle
	NTJ-3	100-105	Tolerant to leaf spot disease	Yields more fodder and drought tolerant.

Crops	Varieties/ Hybrids	Duration (days)	Reaction to pests and diseases	Remarks
Pearlmillet	ICTP-8203	80-85	Tolerant to green ear disease	Grain white and bold, tolerant to drought.
	ICMV-221	85-90	Tolerant to green ear disease	Composite variety
	ICMH-451	85-90	Tolerant to green ear disease	Hybrid, grows upto 175cm; 2-3 tillers, grain medium bold, ash colour
Setaria	Lepakshi	80-85	---	Tolerant to drought, suitable for shallow soils with low rainfall areas, more tillers and quality straw
	Krishnadevaraya	80-85		Bold grain, light yellow colour, plant height up to 110 cm, 4-6 tillers with quality straw
	Narasimharaya	80-85		Bold grain and yellow in colour, plant height up to 110-120 cm, more number of tillers
Castor	Kranthi	90-150		Drought tolerant, bold seed
	GCH-4	150-210	Tolerant to wilt and dry root rot diseases	
Pigeonpea	Palnadu (LRG - 30)	170-180		Bushy plant, yellow flowers, medium bold grain with brown pod coat. Suitable for intercropping in groundnut

5. Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern spacing (cm^2)	
		Inter	Intra
Groundnut	100	30	10
Castor	10	90	30
Pigeonpea	15	90	20
Pearl millet	5	45	10
Setaria	5	30	5
Sorghum	8	45	15

6. Nutrient management

Crop	Nutrients (kg/ha)			Remarks
	N	P_2O_5	K_2O	
Groundnut	20	40	40	For groundnut apply P_2O_5 and K_2O as per soil test values. Reduce to 50% of

Crop	Nutrients (kg/ha)			Remarks
	N	P_2O_5	K_2O	
				recommendation if soil test value is medium; do not apply if soil test value is high. If soil test value is low, apply as per recommendation.
Castor	60	40	30	
Pigeonpea	20	40	40	
Pearlmillet	40	40	40	N dose ranges from 40-80 kg N/ha depending on rainfall.
Setaria	40	40	40	

7. Pest and disease management weed management (mechanical)

Crop	Pest/ disease	Control measures
Groundnut	Root grub	Apply Thimmet or Phorate granules at 10 kg/ha to soil before sowing or treat the seed with chloropyriphos @ 6 ml/kg seed.
	Aphids,leaf miner	Spray 0.05% Endosulfan or dimethoate or monocrotophos
	Red hairy caterpillar	Arrange bonfires 2 days after soaking rain from 8 PM to 10 PM
		Make a furrow around the field, and apply carbaryl dust in the furrow and also on the bunds
		For second and third instars larvae spray dimethoate @2 ml/l or monocrotophos @1.6 ml/l
		Poison bait with 10 kg rice bran + 1 kg jaggery + 500ml quinolphos can be applied for effective control.
	Late leaf spot	Spray mancozeb 2 g + carbendazim 1g/litre or hexaconazole @ 2 ml/l for chittoor district. Spraying can be taken up based on leaf wetness at 70 days after sowing in Anantapur district. There is no need to spray for July sown crop in Anantapur and Kurnool districts
	Stem necrosis	Removal of weeds particularly parthenium on the bunds and in the field.
Sorghum	Shoot fly	Prevent sowing early with first showers in the season, use more seed rate and thin by removing the affected seedlings to maintain optimum stand.
	Stem borer	Apply carbofuran granules @ 10 kg/ha in whorls with in 35-40 days after sowing
	Mite	Sprays wettable sulphur 3 l or Phosalone 35EC at 2.5 ml/l
Pigeonpea	Pod borer	Spray chloropyriphos @ 2.5 l during flower initiation stage and quinolphos @ 2 l or acephate @ 1 kg in 750-1000 l of water during flowering stage, with hand compression sprayer.
Castor	Semilooper	Spray carboryl (50%) @ 3 g/l or monocrotophos (36%) @ 1.5 ml/l or curacron @ 2 ml/l

Crop	Pest/ disease	Control measures
	Capsule borer	Spray monocrotophos @1.6ml/ l or quinolphos @ 2ml/l once at flowering and again after 15 days

8. Alternate land use

- Crop + livestock (sheep @10/ha) system of farming will give 80% more income than crop system alone.

9. Suitable cropping system

- Monocropping of groundnut: In 50% of the area.
- Pigeonpea: Mostly as an intercrop in groundnut. Groundnut + pigeonpea in 7:1 ratio: The most popular intercropping system. Groundnut + Pigeonpea in 11:1 ratio and a tamarind tree for every one ha.
- Horsegram: Mostly as contingent crop.
- Castor Groundnut + castor in 7:1 or 11:1 ratio

10. Farm Implements/ tools

Name	Cost/unit in Rs.	Operation
Eenatigorru (bullock drawn, four row)	1500-00	Useful for sowing, seed and fertilizer placement. Suitable for those who have light draft animals.
Seed drill/planter (tractor drawn, nine row)	16000-00	It is a mechanical seed drill. More area can covered in a day and intra row spacing is maintained.
Ashaguntaka (tractor drawn, seven row)	20000-00	Useful for harvesting of ground nut crop. More field capacity and labour saving.
Groundnut thresher cum decorticator	45000-00	Useful for separating groundnut pods from haulms. It was found advantageous to thresh the groundnut after 3-5 days after harvest. The cost of operation was Rs. 224/ha. It can also be used as decorticator with minor modifications. Perform timely operation and labour saving.

11. Contingent crop planning

- Early onset of monsoon: Sorghum, greengram, pigeonpea, castor (May - June)
- Normal onset of monsoon: Groundnut, Pigeonpea, Groundnut + Pigeonpea (July).
- Late onset of monsoon: Pearlmillet, sorghum, greengram (after August 15th)
- Very late onset of monsoon: Pearl millet, cowpea, horsegram (early September)

12. Other supportive practices

- Deep ploughing once in three years, where soil depth is 20 cm or more.
- Preparatory cultivation with country plough or "Chekkala guntaka", a traditional implement increases the yield of groundnut.
- Sand application @ 40t/ha applied during summer increases the yield of groundnut
- Drought management practices like application of groundnut shells @ 5 t/ha at 10 days after sowing.
- Contour bunding with a cross section of 0.63m and with horizontal spacing of 25m to 125m is recommended for red soils. The other soil conservation measures like

compartmental bunds of 15m length and 10m width or conservation furrow at 3.6m interval or intercropping with mixed pulses like cowpea and horsegram can be adopted.

- Seepage losses in farm ponds can be reduced by lining the pond with Cuddapah slabs.

Rainfed Rice based Production System in Kharif Sub-Humid Deep Alfisols/ Oxisols Phulbani

1. Region

Phulbani centre caters to the needs of the North Eastern Ghat Zone of Orissa. The zone occupies an area of 32,089 km^2 comprising 21% of the total geographical area of the state. It extends from $19^0 00 - 20^0 40'$ N latitude and $82^0 50' - 84^0 45'$ E longitude. The zone consists of five revenue districts i.e., Phulbani, Boudh, Rayagada, Gajapati and part of Ganjam districts covering five agricultural districts i.e Phulbani, Boudh, Rayagada, Gajapati and Aska.

2. Climate

The climate of the zone is tropical hot moist sub humid with mean annual rainfall of 1597 mm received in 77 rainy days. Monsoon (June-September), pre-monsoon (February-May) and rabi (October – January) periods receive 79,10 and 11% of total rainfall, respectively. About 48% of the annual rainfall is received during July and August. The mean maximum temperature in the hottest month (May) is 38.4^0C and the mean minimum temperature in the coldest month (December) is 7.7^0C. The highest and the lowest temperature recorded are 41^0C and 1^0 C, respectively.

The area in the zone excepting Northern part of Boudh, Gajapati and Rayagada consists of hill ranges which belong to the main line of Eastern Ghats along with some plains and valleys lying between the hill ranges. These hill ranges also contain a large area under plateau some of which have an elevation of 300 to 800 m.

Cultivated area and gross cropped area district-wise in North – Eastern Ghat Zone of Orissa (area in'000 ha)

District	Cultivated area				Gross cropped area			
	High land	Medium land	Low land	Total	*Kharif*	*Rabi*	Fruit crops	Total
Ganjam	178	118	102	398	412	205	33	650
Gajapati	50	19	11	80	78	24	11	113
Rayagada	138	43	22	203	160	55	9	224
Phulbani	135	21	11	167	122	25	8	155
Boudh	56	21	12	89	74	37	2	113
Orissa	2 939	1 924	1 557	6 420	5 952	2 134	339	8 425

Source: Orissa Agricultural Statistics. Directorate of Agriculture and Food Production, Orissa, Bhubaneswar. pp. 7-11.

3. Soils

Red and yellow soils and brown forest soils belonging to alfisol and oxisol orders pre-dominate. A regular toposequence sof soils occur from upper hill to Jhola land through mid-hill, foot hill, unbunded upland, bunded upland, medium and low land. Uplands constitute 45-81% of total cultivated area in different revenue districts compared to state average of 46%. The upland soils are well drained, light textured sandy loams and prone to crust formation. Soil depth varies from 45 cm to more than 100 cm. Soils are acidic with low organic carbon, low available N, low available P and medium available K. Deficiency of calcium, sulphur and boron are noted. Phosphorus fixation is a problem due to low soil pH (5.0 - 5.5). Alluvial sandy clays occur in medium and low lands. Iron toxicity occurs in medium and low land transplanted rice.

4. Crops and varieties

Crop(s)	Varieties	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease, pest & stress condition	Remarks
Upland rice	ZHU 11-26	2.99	57	82	Tolerant to leaf blast disease and moisture stress	Suitable for intercropping and sequence cropping systems in rainfed uplands
	Vandana	2.91	68	93	Tolerant to leaf blast, bacterial leaf blight disease and moisture stress	Suitable for sequence cropping system
	Pathara	2.93	82	109	Moderately tolerant to leaf blast and bacterial leaf blight disease	Care must be taken to sow the crop early at the onset of monsoon to escape the terminal drought situation
Blackgram	OBG-23	1.26	36	69	Moderately resistant to cercospora leaf spot, powdery mildew and yellow mosaic virus	Suitable for sowing in last week of July in rainfed upland condition to synchronize harvesting with dry period
	OBG-15	1.18	37	67		
	Pant U-30	1.10		72		
	T-9	0.99		69		
	Sarala	1.01	36	70		
	LBG-645	1.11	47	87	Moderately resistant to cercospora leaf spot and powdery mildew disease	
Greengram	PDM-54	0.69	36	70		

Crop(s)	Varieties	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease, pest & stress condition	Remarks
	K-851	0.80	35	60-65	Tolerant to Yellow mosaic virus, moderately tolerant to powdery and susceptible to cercospora leaf spot disease during Kharif season.	Suitable for sowing in last week of July in rainfed upland condition to overcome harvesting problem
Pigeonpea	R-60	1.00	140-145	180	Susceptible to pod borer	Suitable for mono and intercropping systems in rainfed uplands
	T-21	0.80	120-125	160	Susceptible to pod borer	Suitable for mono cropping in rainfed uplands
Fingermillet	PR-717	2.50	70-75	100	Susceptible to neck blast	Suitable for mono cropping
	Sodangi-6	2.40				
	A 2-3-4	2.00	60-65	90		
	Dibyasingha	1.80	55	85		Suitable for mono and intercropping
	Nilachal	2.50		110		Suitable for mono cropping
	Bhairabi	3.00		105		
Maize	Navjot	3.85	45	95	Moderately resistant to leaf blight disease	The variety is suitable for accommodating cowpea (cv. SEB-2 and SGL-1) as intercrop & is also suitable for sequence cropping like maize-mustard
	DHM-103	4.22	47	100		

Crop(s)	Varieties	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease, pest & stress condition	Remarks
Cowpea	SEB-2	0.75	49	90	Susceptible to leaf eating caterpillar and pod borer	The variety is suitable for intercropping with maize and sequence cropping in cowpea-mustard system during Kharif
	SGL-1	0.64	42	70		The variety is suitable for intercropping with maize and sequence cropping in cowpea-mustard system during Kharif. For seed purpose sowing should be done during last week of July to 1st week of August
Groundnut	Smruti (OG 52-1)	1.69	28	103	Moderately tolerant to leaf eating caterpillar and tikka disease	Suitable for sequence cropping system like Groundnut-mustard in rainfed uplands
	JL-24 (HN)	1.66	29	101	Moderately tolerant to tikka disease	
	TAG-26	1.53	26	104	Moderately tolerant to leaf eating caterpillar and tikka disease	
	ICGS-11	1.51	29	103		
Castor	DCH-177	0.75	57	106	Tolerant to wilt disease	Suitable for monocropping in rainfed uplands
	DCH-30	0.50	61	104		
	Aruna	0.48	57	106		

Crop(s)	Varieties	Yield potential (t/ha)	Days to 50% flowering	Duration (days)	Reaction to disease, pest & stress condition	Remarks
Mustard	M-27	0.78	30	75	Moderately tolerant to pod borer	Suitable for sequence cropping in maize-mustard and upland rice (short duration) -mustard system
Horsegram	Urmi	0.75	53	94	Tolerant to moisture stress moderately resistant to leaf spot, leaf eating caterpillar and pod borer	Suitable for rainfed uplands after harvest of early rice in Orissa
Sesame	Usha	0.59	-	83	-	-
	Uma	0.58	-			
Niger	Phulbani local	0.50	55-60	85	No serious disease or pest problem	Suitable for sequence cropping after cowpea
	Deomali(GA-10)	0.55	63	110		
	IGP-76	0.50	60	106		
Turmeric	Sudarsan	5.72	-	190	Resistant to leaf spot and leaf blotch disease	Suitable for moncropping in rainfed uplands & has high curcumin content 7-8%
	Suguna	5.68				
	Subarna	5.64		200		
Ginger	Vardhan	4.30	-	200	Moderately resistant to soft rot and leaf-spot disease	Suitable for moncropping in rainfed uplands
	China	3.90	-		Resistant to soft rot and leaf spot disease	
	Nadia	3.42	-		Moderately resistant to soft rot and leaf-spot disease	

5. Seed rate and planting pattern

Crop	Seed rate (kg/ha)	Planting pattern (cm)	
		Inter row	Intra plant
Upland rice	100	15-20	-
Medium land rice (Transplanted)	50-75	15-20	10-15
Maize	15	60	30
Fingermillet (Direct sown)	10	20	-
Fingermillet (Transplanted)	6	15-20	10
Pigeonpea (Early variety)	20	45	20
Pigeonpea (Late variety)	15	60	30
Blackgram	25	30	10
Greengram	25	30	10
Horsegram	50	30	5-10
Cowpea	20	45	15
Niger	10	30	10
Sesame	7	30	10
Groundnut	105 (kernels) i.e. 150 (pods)	30	10-15
Mustard	8	30	8-10
Sunflower	10	45	30
Linseed	25	30	5
Turmeric	1700 (fresh rhizome)	30	20
Ginger	1000 (fresh rhizome)	25	20
Yam	925 (tuber pieces of 50-100g should be used)	90	90
Cotton	2-3 (hybrids)	120	60

6. Nutrient management

Crop	Nutrients (kg/ha)			Mode of application			Remarks
	N	P_2O_5	K_2O	Basal	1[st] top dressing	2[nd] top dressing	
Upland rice							
Local	30	20	20	All P_2O_5 and K_2O, 25% N	50% N at 21 days after germination	25% N at Panicle initiation stage	
Improved	40	20	20				
High yielding	60	30	30				
Medium land rice							
Local	50	25	25	All P_2O_5 and K_2O, 25% N at transplanting	50% N three weeks after transplanting	25% N at PI stage	
Improved	60	30	30				
High yielding	80	40	40				
Maize	80	40	40	All P_2O_5 and	50% N at 21	25% N at	

Crop	Nutrients (kg/ha)			Mode of application			Remarks
	N	P_2O_5	K_2O	Basal	1[st] top dressing	2[nd] top dressing	
				K_2O, 25% N	days after germination	6-7 weeks after germination	
Fingermillet	20	12	12	All P_2O_5 and K_2O, 50% N	50% N at 21 days after germination	-	
Pigeonpea (Early variety)	20	40	20	All N, P_2O_5 and K_2O	-	-	
Pigeonpea (Late variety)	20	60	20	All N, P_2O_5 and K_2O	-	-	
Blackgram	20	40	20	All N, P_2O_5 and K_2O	-	-	
Greengram	20	40	20	All N, P_2O_5 and K_2O	-	-	
Horsegram	10	25	0	All N and P_2O_5	-	-	
Cowpea	25	50	25	All N, P_2O_5 and K_2O	-	-	
Niger	40	20	20	All P_2O_5 and K_2O, 50% N	50% N at 21 days after germination	-	-
Sesame	40	20	20	All P_2O_5 and K_2O, 50% N	50% N at 21 days after germination	-	
Groundnut	20	40	40	All N, P_2O_5 and K_2O	-	-	Lime should be applied based on the pH value for correction of soil acidity
Mustard	30	15	15	All N, P_2O_5 and K_2O	-	-	
Linseed	30	20	15	All N, P_2O_5 and K_2O	-	-	
Sunflower	60	30	30	All P_2O_5, K_2O and 50% N	50% N at 3-4 week stage	-	
Turmeric	60	30	90	100% P_2O_5 and 50% K_2O	50% N at 45 DAP	50% N and 50% K_2O at 90 DAP	15,5 and 5t/ha Sal twigs are applied as mulch after

Crop	Nutrients (kg/ha)			Mode of application			Remarks
	N	P_2O_5	K_2O	Basal	1st top dressing	2nd top dressing	
							planting, at first topdressing and second top dressing respectively
Ginger	125	100	100	100% P_2O_5 and 50% K_2O	50% N at 45 DAP	50% N and 50% K_2O at 90 DAP	15,5 and 5t/ha Sal twigs are applied as mulch after planting, at first topdressing and second top dressing respectively
Yam	80	60	80	All P_2O_5	50% N and 50% K_2O at 30 DAP	50% N and 50% K_2O at 60 DAP	Nitrogen and Potash can be given in three equal splits at 30,60 and 75 DAP in sandy soils.
Cotton (Hybrids)	120	60	60	All P_2O_5 50% K_2O and 25% N	50% N at 21 Days after germination	25% N, 50% K_2O at 45 Days after germination	

7. Suitable cropping system

Systems are described for nonarable, arable, unbunded uplands, other uplands, medium land, low land and jhola land

- Non – arable wastelands
- Tree farming (Sal, Teak)
- Silvi-pastoral (Shisham/ leucaena/ gambar + stylo/ cenchrus/ mixure)
- Arable wastelands
- Agri-horticulture: Fruit crops (mango/ citrus/ sapota/ pomegranate/ custard apple/ aonla/ litchi/ jackfruit/ phalsa) + field crops (pulses/ oilseeds). Hybrid mango varieties viz. Pusa Amrapalli and Pusa Mallika are becoming increasingly popular in the zone.
- Alley cropping: Leucaena + turmeric/ ginger
- Low fertility, unbunded uplands

- Sunnhemp (green manure) – Niger (IGP 76, Phulbani local)
- Cowpea (SGL-1, SEB-2) – Niger (IGP-76, Phulbani local)
- Uplands
- Mono, sequence, alley and intercropping are described

- Monocropping
- Turmeric (Sudarsan, Suguna, Subarna). Planting is done in 1.0 m width, 15-30 cm high beds. Channels of 30cm width are left between the beds.
- Ginger (Suprabha, Nadia, Vardhan and China) planting is done in beds as in turmeric.
- Sequence cropping
- Rice (ZHU 11-26/ Vandana/ Heera) – Horsegram (Urmi/local) / Toria (M-27, PT-303)
- Maize (Navjot) – toria (PT 303/M-27)
- Maize (Navjot) + cowpea (SGL-1, Arka Kamal)- toria (PT 303, M-27).
- Groundnut – pigeonpea/ horsegram
- Fingermillet – pigeonpea/ horsegram
- Rice – pigeonpea/ horsegram

- **Relay cropping**
- Rice (ZHU 11-26, Heera) + horsegram (Urmi, local).
- Rice (ZHU 11-26, Heera) + pigeonpea (UPAS 120)

In relay cropping, short statured rice is sown in 20 cm apart rows. The succeeding crops are dibbled in the inter row space alternately. The row spacing of the succeeding crop is maintained at 40 cm. Skipping of one row facilitates harvesting of rice. The intercultural operations and final top-dressing in rice should be over before dibbling of succeeding crops. In general, dibbling is done one month before harvesting of rice. After harvesting of rice, one hoeing is given to check the emerging weeds.

- Intercropping
- Pigeonpea, maize, rice and yam based production system are described
- Pigeonpea based
- Pigeonpea (T-21, R-60) + rice (ZHU 11-26) (2:5): Five rows of short statured, drought tolerant and short duration rice varieties in 15cm apart rows are intercropped in 90cm space between paired rows of long duration pigeonpea with set specification 30-90-30cm. In this system, 100% population of sole pigeonpea and 62.5% of sole rice are maintained.

- Pigeonpea (T-21, R-60) + groundnut (OG 52-1, JL 24) (2:6): Six rows of short duration, bunch type groundnut are grown in 210 cm interspace between paired rows of long duration pigeonpea with set specification 30-210-30cm. Plant protection in pigeonpea becomes easier in this row ratio as compared to row ratio of 2:4 (set specification 30-150-30cm).

- Pigeonpea (T-21, R-60) + greengram (PDM 54, K 851) or blackgram (Pant U 30, T-9, Sarala) (2:3): Three rows of short statured, short duration greengram or blackgram varieties are grown between paired rows of long duration pigeonpea with set specification 30-120-30cm. The intercrops are grown in 30cm apart rows. Harvesting of greengram or blackgram coincides with wetspell. Matured pods should be plucked in phased manner, dried and threshed to check moisture related damage.

- Pigeonpea (T-21, R-60) + fingermillet (Dibyasingha): Four rows of short duration, short statured fingermillet in 20cm apart rows are intercropped in 100 cm interspace between paired rows of pigeonpea with set specification 30-100-30cm.

- Pigeonpea (T-21, R-60) + radish (Pusa chetki): Two rows of radish are intercropped between paired rows of pigeonpea with set specification 30-90-30cm. Radish in harvested early within 40-50 days.

- Pigeonpea (T-21, R-60) + Okra (Parbhani kranti): Two rows of okra are intercropped in between the paired rows of pigeonpea with set specification 30-90-30cm.
- Maize based

- Maize (Navjot) + pigeonpea (T-21, R-60): Short duration maize and long duration pigeonpea are grown in uniform alternate rows in 1:1 row ratio or paired rows of maize are alternated with paired rows of pigeonpea in 2:2 row ratio. Maize is harvested before canopy development starts in pigeonpea. In this system, 100% population of each of the sole crop is maintained.

- Maize (Navjot) + cowpea (SEB-2): Two rows of low-trailing cowpea are grown between paired rows of maize with set specification 30-90-30cm. Green pods of cowpea are harvested during 60-70 days after germination.

- Maize (Navjot) + cowpea (SGL-1, Arka Kamal):

- Maize and non-trailing cowpeas are grown in 30cm apart uniform rows alternately. Green pods of cowpea are harvested within 50-60 days after germination. Green biomass of cowpea is used as mulch-cum-manure between rows of maize. Cowpea may be harvested for grain purpose at 70 days after germination.

- Maize (Navjot) + Runnerbean (local): Runnerbean is planted in basins prepared with 90cm spacing. In each basin, 2 runnerbean plants are maintained. Two rows of maize are planted in 90cm spacing between 2 basins of runnerbean. Maize acts as live-staking material for runnerbean.
- Rice based
- Rice (ZHU 11-26, Vandana) + radish (Pusa chetki): Four rows of rice in 15 cm apart rows are grown in the 75cm interspace between paired rows of radish with set specification 30 (radish) – 75 (rice)-30cm (radish).
- Rice (ZHU 11-26) + Okra (Parbhani kranti): Four rows of rice in 15cm apart rows are grown in 75cm space between paired rows of okra with set specification 30 (okra) – 75 (rice) – 30cm (okra).
- Rice (ZHU 11-26) + blackgram (Pant U 30)/greengram (PDM 54): Five rows of rice, spaced at 15cm, are sown between paired rows of blackgram/ greengram with set specification 30 (blackgram/greengram) – 90 (rice) – 30cm (blackgram/ greengram). The blackgram varieties are ready for harvest in 60-70 days.
- Rice and blackgram/ greengram may be grown in 2:1 row ratio: If rice crop fails in drought years, pulse crop is maintained. If rainfall is normal, pulse crop is cut for fodder and rice crop is maintained.

- Yam based
- Yam (Hatikhoja) + maize (Navjot): The well-drained light texured soil of the zone is very congenial for tuber crops like yam. Yam is planted in mounds with row to row and plant to plant spacing of 90cm. Two rows of maize are planted in both sides of yam to act as live staking. Green cobs of maize are harvested at 75 days after crop emergence.
- Medium lands
- Sequence cropping
- Rice (Lalat, Konark) – Linseed (Kiran, Laxmi 27 and Pusa 3)
- Rice (Lalat, Konark) – rapeseed mustard (PT 303, M-27, Local rai)
- Rice – greengram/ blackgram/ linseed/ sunflower/ safflower/ mustard
- Paira (Relay) cropping
- Rice (Lalat, Konark, Jajati, Swarna) – Lathyrus (Local).
- Low land
- Sequence cropping
- Rice (CR 1014, Utkal Prabha) – greengram (PDM-54)
- Rice – linseed/ castor
- Relay cropping
- Rice (CR 1014, Utkalprabha) – Lathyrus
- Paired rows of maize + 3 rows of horsegram/ pigeonpea
- Paired rows of sorghum + 3 rows of horsegram/ pigeonpea
- Paired rows of figermillet + 2 rows of horsegram / pigeonpea
- Jhola land: Rice

7. Farm Implements/ tools

- Bishu mould board plough for preparatory tillage
- Gujarat state fertilizer corporation seed drill for seeding in fingermillet
- Implement factory seed – cum fertilizer drill for line sowing of upland rice

8. Contingent crop planning

- Normal Season
- Rice:
- Very early group (less than 95 days): Heera, Rudra, ZHU 11-26, Vandana
- Early group (95 days to 115 days):Pathara, Khandagiri, Udayagiri. Ghanteswari and Parijat
- Early medium (115 days to 120 days): Sarathi and Bhoi
- Medium duration (125 to 145 days): Lalat, IR-64, Konark, Gajapati, Surendra, Jajati, Swarna,MTU-1001 and Padmini
- Late duration: Utkalaprava, Gayatri, Savitri,Prachi, Ramachani , Mahanadi and Indrabati
- Fingermillet: Dibyasinha, Nilachala, Bhairabi and Subhra
- Maize: Navjot, Vijaya, DHM-103 and Ganga-5
- Greengram: PDM-54, K- 851, Dhauli and TARM-2
- Blackgram: Pant U-30, T-9 and Sarala
- Pigeonpea: UPAS-120, R-60, T-21 and S-5
- Cowpea: SEB-2, SGL-1, Arka Kamal
- Horsegram: Urmi and Local
- Groundnut: Smruti (OG 52-1), JL-24, ICGS-11 and AK 12-24
- Castor: Aruna, DCH-177 and DCH-30

- Mustard: PT- 303, M-27, Parvati and Anuradha
- Sesame: Vinayak, Uma, Usha and Prachi
- Niger: Deomali (GA-10), IGP-76 and Phulbani Local
- Linseed: Kiran, Laxmi-27, Pusa-3, Padmini
- Sunflower: Morden
- Cotton: MCU-5, NHH-44, Somanath, Savita and Bunny
- Ginger: Vardhan, China and Nadia
- Turmeric: Sudarsan, Suguna, Subarna and Rajendra Horti-5.
- Yam: Hatikhoja, Srikirti, Srirupa
- Aberrant weather
- Upland
- Early season drought/ Delay in onset of monsoon
- When upland rice is completely damaged, the crop may be cut down for supplying straw to the cattle. Non-paddy crops viz. ragi (Subhra, Bhairabi, Dibyasingha and Godavari), Greengram (K 851, PDM-11 and PDM-54), blackgram (T-9, Sarala and Pant U-30), Cowpea (SEB-2, SGL-1, Arka Kamal), horsegram (Urmi), ricebean (RBL 6), Sesame (Usha, Uma) and castor (Aruna, DCS-9), niger (IGP-76 and Deomali) or sunflower (Morden) should be taken. Drought tolerant varieties of crop(s)/ cropping system(s) should be taken up. The crop /variety should be selected basing on available effective growing season.
- Mid-season drought
- Weeding and hoeing should be done in all the crops except groundnut in flowering stage. Weeds in groundnut should be cut or uprooted not to interfere in pegging and pod formation. Hoeing creates soil mulch and decreases moisture loss from the soil. Uprooted weeds should be used as mulch between crop rows.
- Foliar spraying of 2% urea in upland rice and fingermillet gives good results. For this, 200 g of urea is mixed with 10 l of water and sprayed on the foliage of the crop. Plant protection chemicals may be mixed with urea solution to minimize the cost of spraying. In a single spray 10 kg/ha of urea is applied through 500 l solution.
- Excess plants in the crop row should be thinned to reduce moisture loss from the soil.
- Use of tender twigs of Leucaena, Glyricidia sepium, Cassia siamea and Mimosa invisa and plants of sunhemp as mulch-cum-manure reduces evaporation loss from the soil.
- Spraying of planofix 10 ppm at 45 days after sowing and 20 ppm at flowering in cotton to prevent fruit drop.
- Late season drought.
- Harvested rainwater or shallow ground water should be recycled as life saving irrigation.
- Medium and low land
- Direct sown rice
- Re-sowing of rice is needed if plant population is less than 50%. Line sowing of pre-germinated seeds of rice (125 days duration) should be done. Nursery for comparatively shorter duration rice varieties may be done. If plant population is more than 50% and 'beushaning' is not possible, weeds are uprooted by manual means. Even distribution of plants (Khelua) should be taken up immediately by using local tools. Tillers with roots may be detached from hills with profuse tillering for planting in gappy areas. Urea solution (2%) may be sprayed to improve crop growth.

- Transplanted rice
- If puddling and transplanting is not possible, seedlings should not be uprooted. Weeds are removed to keep the nursery beds clean. Adequate plant protection measures are taken to protect the seedlings from disease and pest attack. When rainfall occurs, puddling is done by tractor drawn powertiller or rotovator for better puddling. Close planting of 45-day old seedlings in case of medium duration varieties and 60-70 day old seedlings in late varieties should be done. There should be 60-65 hills/m^2. Instead of 2 to 3 seedlings, 4 to 5 seedlings/ hill should be planted. Adequate fertilizer should be applied at transplanting. When seedlings are insufficient, seedlings may be raised by dapog method.

9. Other supportive practices

- Method of cultivation on sloppy lands near foot-hills (3-5% slope) with crops viz. one row of pigeonpea or two rows of blackgram on ridges and two rows of short duration rice or fingermillet in the furrows offer many advantages.
- Ridges and furrows, 60 cm apart, are laid out across the slope at a gradient of 0.3%.
- Integrated nutrient supply system comprising 50% N (30 kg N/ha through chemical fertilizer) + 50% N (30 kg through Farm yard manure) and full (40-40 kg) phosphorus and potash maintains soil health and gives sustained productivity of rice and horsegram in rice – horsegram sequence cropping system over years, while application of full recommended fertilizer from chemical fertilizer only deteriorated soil health leading to continuous decline in crop yields from the fourth year onwards.
- Application of 20 kg N as FYM or green leaf + 25 kg N/ha as chemical fertilizer or 45 kg N/ha as greenleaf gives similar yield as 45 kg N/ha from chemical source in pigeonpea + paddy (2:5) intercropping system. Resource poor rainfed farmers should raise green leaf manuring plants viz. Leucaena leucocephala (Subabul), Glyricidia sepium (Glyricidia) and Cassia siamea (cassia) in field boundaries/road sides to meet nitrogen need of the system.
- Establishment of vetiver barriers in unbunded (2-3% slope) upland rice at 0.4 m vertical intervals reduces runoff by 26% and soil loss by 52% and increases rice yield by 49% as compared to no vegetative barrier. Vetiver is preferable to other vegetative barriers from ease of establishment and sustainability point of view.
- Application of thiobencarb @ 1.0 kg/ha as pre emergence spray in pigeonpea + paddy and oxadiazon @ 0.5 kg/ha as pre-emergence spray in pigeonpea + blackgram intercropping system reduce cost of cultivation, offer satisfactory weed control and increase crop yield.
- Fingermillet - application of farmyard manure or water hyacinth compost + 50% recommended dose of fertilizer i.e., 30 kg N/ha + 20 kg P_2O_5/ha + 20 kg K_2O /ha
- Maize – 800kg /ha of calcium carbonate (liming) + 40 kg P_2O_5 + 40 kg K_2O /ha
- Soybean – application of phosphorus @ 60 kg P_2O_5/ha either to rock phosphate and super phosphate or mixture of rock phosphate and super phosphate (1:1) is recommended for red and lateritic upland soil.
- Groundnut – application of single superphosphate 100 % @ 60 kg P_2O_5/ha or soil application of sulphur @ 25 kg /ha increases pod yield.
- In medium and low land situation – direct seeding of short duration rice (DR –92) + with late duration jaganath in 2:2 ratio and followed by transplanting of jaganath after harvesting o f DR – 92.

C 3.7: ALL INDIA COORDINATED RESEARCH PROJECT ON AGROMETEOROLOGY

Material for the Regional Committee No. V

The following Cooperating Centres of AICRPAM, viz., Anantapur (Andhra Pradesh), Bhubaneswar (Orissa) and Raipur (Chhattisgarh) are located in Region No. V. The salient research findings of these research centres are given as under:

Anantapur

- Agro-climatic analysis of Kurnool district brought out that the date of onset of monsoon varied from being as early as 152nd Julian day and as late as 212th Julian day. Also the duration of the rainy season ranged between 49 and 163 days in Kurnool area indicating high variability.

- Crop-weather relationship studies in groundnut for 13 years (1990-2002) revealed that pod-filling phase is sensitive to moisture stress and any dry spell during this phenophases drastically reduces the pod yield. While the *kharif* groundnut yields are influenced strongly by moisture regime, the irrigated *rabi* groundnut yields are influenced by increase in temperature and decrease in RH.

- Intercropping of groundnut and redgram in 7:1 ratio is found to be optimum system from moisture availability point of view for late sowing conditions in Anantapur region.

- A mode for predicting groundnut leaf miner based on rainfall and minimum temperature was developed as follows. It showed that occurrence of leaf miner is adversely affected by increase rainfall

  $Y = 0.85 + 0.04TM - 0.001\ RF \qquad R^2 = 0.52$

  Where

  Y = Leaf miner incidence;

  TM = Minimum temperature (°C);

  RF = Rainfall (mm)

Bhubaneswar

- Low sunshine hours from tillering to panicle initiation were found to be responsible for yield reduction in paddy (by 26%) under delayed planting conditions compared to early planting.

- Pest and weather relationship studies in rice crop brought out that weather conditions during panicle initiation to flowering were most critical for insect pest and disease incidence.

- A multiple linear regression model with cumulative rainfall (15 days prior to prediction date), afternoon humidity (14 days prior) and maximum temperature (7 days prior) and stage of the crop as independent variables was developed to predict bacterial leaf blight (BLB) incidence in rice. This model successfully predicted the incidence of BLB with R^2 above 0.90. Similarly, leaf folder in rice could be successfully predicted ($R^2 = 0.81$) based on bright sunshine hours and average temperature accumulated over past 15 days prior to the incidence of the pest.

- Analysis of rice yield data over 20 years (1981 to 2000) revealed that out of 314 revenue blocks of Orissa, 163 blocks (52%) produced below state average *kharif* (includes both autumn and winter) paddy yield. These blocks giving low winter rice yields are concentrated in two coastal agroclimatic zones, viz., west central tableland zone and north central plateau zone. Further, study is being carried out to identify the climatic, edaphic and socio-economic constraints responsible for low yields in these regions.

Raipur

- As winter period is shorter in this area, there is demand for thermal stress tolerant wheat varieties for *rabi* season. For this purpose, eight varieties of wheat were evaluated for their thermal stress tolerance using a thermal sensitivity index (TSI). Varieties Kanchan, Sujata and Arpan were found suitable for normal sowing whereas Lok-1 was found to be more stable as it gives consistently better yields even under moderate thermal stress conditions.

- Like wheat varieties, five varieties of tomato were evaluated for their thermal stress tolerance. Varieties NS 815, Punjab Chhauhara and Punjab Kesri were found to be thermal stress tolerant whereas Pusa Rubi was found to be highly susceptible to thermal stress.

- Studies on drought climatology of the 16 districts of Chhattisgarh state based on the historic rainfall data (1901-2000) revealed that drought intensity increased in 80's and 90's decades as compared to 70's or earlier decades in all the districts.

- A modified water balance approach for bunded rice fields was adopted by Raipur centre. A new definition of drought for rainfed rice was proposed by this centre.

- It was observed that micro-regional rainfall pattern / climate shifts are responsible for the spatial variability of frequency and intensity of drought. Hence, it was suggested that location specific technology based on micro-regional rainfall and climate analysis need to be developed.

C 3.8: PROGRESS OF RESEARCH IN AGRONOMY

1. INFRASTRUCTURE : The following coordinated Research Projects and adhoc research schemes are being implemented in the Regional Committee No. V

Name of the State : Andhra Pradesh

S. No.	Name of the Project	Sponsoring Authority	Location
1.	AICRP on Cropping System Research	ANG RAU, Hyderabad	Main Centre: Rajendranagar Sub Centre: 1. Rudrur 2. Maurteru On Farm Centre: 1. Nandyal 2. Guntur
2.	AICRP on Dryland Agriculture	ANG RAU, Hyderabad	Main Centre: Anantapur ORP: Anantapur
3.	AICRP on Agrometeorology	ANG RAU, Hyderabad	Anantapur
4.	AICRP on Weed Control	ANG RAU, Hyderabad	Hyderabad

Adhoc Schemes

Sl. No	Name of the scheme	Sponsoring authority	Date of start	Date of termination	Outlay
1.	Crop-crop diversity as key component of IPM for dryland crop pests.	CRID A, Hyderabad	1.2.2003	31.1.2006	9,91,611
2.	Interaction of elevated carbon dioxide and water deficit on seed viability germination and initial plant establishment of dryland crops.	CRID A, Hyderabad	1.10.2002	30.9.2005	17,69,616
3.	Crop diversification for sustainability of drylands through dye yielding crop.	CRID A, Hyderabad	1.2.2003	31.1.2006	17,19,616

Name of the State : Orissa

S. No.	Name of the Project	Sponsoring Authority	Location
1.	AICRP on Cropping System Research	OUAT, Bhubaneshwar	**Main Centre: Bhubaneshwar** **Sub Centre** 1. Chiplima **On Farm Centre** 1. Bhawanipatnam 2. Ranital
2.	AICRP on Dryland Agriculture	OUAT, Bhubaneshwar	Main Centre: Bhubaneshwar
3.	AICRP on Agrometeorology	OUAT, Bhubaneshwar	Bhubaneshwar
4.	AICRP on Weed Control	OUAT, Bhubaneshwar	Bhubaneshwar

Adhoc Schemes

Sl. No	Name of the scheme	Sponsoring authority	Date of start	Date of termination	Outlay
Nil					

Name of the State : Chattisgarh

Sl. No.	Name of the Project	Sponsoring Authority	Location
1.	AICRP on Cropping System Research	IGKVV, Raipur	**Main Centre : Raipur** On Farm Centre 1. Ambikapur
2.	AICRP on Dryland Agriculture	IGKVV, Raipur	Raipur
3.	AICRP on Agrometeorology	IGKVV, Raipur	Raipur
4.	AICRP on Weed Control	IGKVV, Raipur	Raipur

Adhoc Schemes

Sl. No	Name of the scheme	Sponsoring authority	Date of start	Date of termination	Outlay
1.	Studies on green manures intercropping in rainfed maize based cropping system for fertilizer economy total productivity and sustainable agriculture	IGKVV, Raipur	1.3.2003	28.2.2006	14,33,560

C 3.9: PROGRESS OF RESEARCH IN AGROFORESTRY

INFRASTRUCTURE

In the zone of this Regional Committee there are three centres of All India Coordinated Research Project in operation in the field of Agroforestry.

Name of the Project	State	Sponsoring Authority	Location
I. All India Coordinated Research Project on Agroforestry	Andhra Pradesh	ANGRAU	Hyderabad
	Orissa	OUAT	Bhubaneshwar
	Chattisgarh	IGAU	Raipur

II. Adhoc Schemes: Nil.

ORISS A UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, BHUBANESHWAR

MPTS Evaluation Trial

- In a species evaluation trial, comprising 15 species, it was observed that the initial growth in terms of plant height was faster *in Acacia mangium* (102.0 cm). *Prosopis cineraria* (91.8 cm), *Dalbergia* 5/5500(8!.0 cm), *Albizia chinensis* (79.5 cm), Eucalyptus hybrid (74.8 cm) at six months of age. Collar diameter was also highest in *A. mangium* (0.9 cm) followed by *G. arborea* (0.7 cm) and Eucalyptus hybrid, *Albizia chinensis, Sesbania grandiflora* (all 0.6 cm)

- In a plantation optimization study, three tree species *(A. mangium, D. sissoo* and *G. arbored)* were planted at 2 x 2, 3x2 and 3x3 m spacing in August, 2000. The growth observation revealed that the spacing has no significant effect on tree growth at establishment phase of plants. However, the spacing at 3x2 m had the highest growth of trees (Ht. 100.4 cm and CD 1.2 cm).

Agroforestry Management

- In a silvipastoral trial, three fodder grasses (Guinea, Hybrid napier and Thin napier) were grown in alley of tree rows *(A. mangium, D. sissoo* and *G. arbored)* spaced at 6 x 4m spacing in rainfed uplands during 2000 kharif season. The mean green forage yield was highest in Thin napier (7.0 t/ha) followed by hybrid napier (4.8 t/ha) and Guinea grass (1.7 t/ha). Tree growth in terms of plant height and collar diameter was highest in *G. arboria* (173.3 and 3.4 cm, respectively) with highest survival (87%) of saplings.

- In Guava based agrihortisilvipasture system, the intercrop yield was assessed under the integrated influence of silvi and horti trees. The intercrop Sesamum with a mean grain yield of 2.33 q/ha and 1.41q/ha respectively in association with 3 and 7 years old Guava plant emerged as a most suitable crop. It indicate that older Guava trees affect the yield adversely reducing by 50 % while the yield recovery was 82 % with three year old Guava trees.

- In an Anola based agri- silvi - horti system, the intercrop yield and growth of trees were studied. *D. sissoo* recorded the highest survivability (82.2%). The highest growth in terms of height was recorded in *A. mangium(5.13* m) while highest collar girth of 16.63 cm was recorded in *G. arborea*. The intercrop yield was maximum in *D. sissoo* emerged as the most compatible tree in system.

MPTS Evaluation Trial

- The promising multipurpose trees found in Chhattisgarh region were selected for their evaluation to introduce them in agroforestry systems in the region. The *Dalbergia sissoo, Albizia procera, Moringa oleifera, Artocarpus heterophyllus, Madhuca indica,Buchnania latifolia* were planted and their morphological growth characteristics are recorded periodically. The Results on growth performance of MPTS revealed that the survival of MPTS ranged from 50 to 100 per cent. *D. sissoo* recorded hundred percent survival followed by *M. olerifera, A. procera, M. indica* and *A. heterophyllus.* The lowest survival was recorded in *B. latifolia.* After three years of planting, DBH ranged from 1.06 to 7.71 cm. The *D. sissoo, A. procera* andM *oleifera* recorded higher DBH compared to other species. These three species are statically at par for both the characters. The lowest DBH were found in *B. latifolia.* A maximum height of 6.48 m was recorded in *D. sissoo* followed by *A. procera, M. olerifera* and *M. indica* species. The height growth was found to be lowest in *B. latifolia. D. sissoo* and *A. procera* were found be statistically at par for the tree height.

- A survey was conducted and ten candidate plus trees (CPTs) of G. *arborea* were selected from three localities (Badora, Shivtarai and Ratanpur) of Bilaspur district. Morphological growth characters of selected plus trees and their seed characters showed that total height of the trees ranged from 13 to 18 m, DBH from 30 to 36 cm and clean bole from 9 to 11 m. Among the different CPTs, BA1 (Badora-1) and RT-3 (Ratanpur-3) were found to be superior in growth both in terms of DBH and height. Except test weight, no significant differences were observed in length, diameter and germination of seeds collected from different plus trees. The germination percentage ranged from 58.87 to 76.00 per cent. The higher germination was observed in seeds of RT-1 CPT. Variation in seeds and its influence on germination, seedling growth and biomass production of *Gmelina arborea* were studied among different provenances. All the morphological growth characters of seeds namely seed length, width and test weight showed significant variation among the different provenances of G. *arborea.* Maximum seed length, seed width and test weight were observed in Pandaria provenance, where as the lowest values showed in Ratanpur provenance. Similarly, the germination was poor in seeds collected from Ratanpur, whereas highest germination was recorded in seeds of Pandaria provenance.

Agroforestry Management

- In *Ceiba pentandra* based agrisilviculture system no mortality of trees were observed in any of the spacings. The total tree height was maximum (5.07m) in 4x4 m spacing where as it was lowest in 4x8 m spacing. All the yield attributing parameters and yield showed significant interaction due to tree spacing x crop distances (Table - 1). S3D3 treatment recorded highest number of effective tiller, grain and straw yield of wheat.

Table -1 : Inter effects of tree spacing and distance on yield parameter of wheat

Treatment	Effective tiller/sqm	Spike length (cm)	Seeds/ Spike	Test weight (g)	Grain yield (q/ha)	Straw yield (q/ha)
S1D1	175.76	7.16	27.67	32.11	16.39	26.94
S1D2	214.04	7.00	29.86	36.46	22.94	35.68
S1D3	262.54	7.24	30.06	40.38	31.42	48.68
S2D1	186.82	7.18	29.16	34.26	17.95	29.40
S2D2	229.66	7.02	29.50	39.78	25.18	42.16
S2D3	270.56	7.58	30.30	41.82	33.80	54.02
S3D1	198.92	7.42	29.22	33.88	19.78	32.26
S3D2	243.90	7.56	29.90	41.86	30.54	47.32
S3D3	282.60	8.01	32.12	43.08	38.34	56.76
CD (0.05)	16.66	1.10	2.15	3.02	3.17	4.15

S1 : 4x4 m, S2 : 4x6, S3 : 4x8, D1 : 0.5-1.0, D2 : 1.0-1.5 and D3 : Centre of the plot.

Tree Improvement

- Ten candidate plus trees of *Gmelina arborea* were selected in Bilaspur region. Total height of the trees ranged from 13 to 18m, DBH from 30 to 36 cm and clean bole height from 9 to 11m. Among different CPTs, BA1 and RT3 were found to be superior in growth. The higher germination was observed in RT1.

- The performance of different poplar clones in agrisilvicultural system was evaluated and result revealed that except DBH all other growth parameters showed significant variation between different clones. The maximum plant height (12. 14 m), DBH (12.48 cm) and net primary productivity (15.51 t/ha/yr) was recorded in 65/27 clone and photosynthetic efficiency was maximum for G48 clone.

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MPTS Evaluation Trial

- A total of 41 germplasm collections were made from various parts of Andhra Pradesh and were planted in the arboretum being maintained by Agroforestry wing of Acharya N.G. Ranga Agricultural University. The evaluation of these lines revealed that the variety collected from Kalagada village of Cuddapah district was superior in its growth as compared to other lines. These lines however, have not reached bearing stage as yet to definitely conclude the superiority of any particular line.

- As per the mandate assigned to Hyderabad centre of All India Coordinated Research Project on Agroforestry 35 germplasm lines were collected during the month of July 1999, and were sown in polybags for transferring them to main field. The seedlings after attaining 8 months pf age were transferred to main field. The establishment of seedlings in the main field was good, and the growth was satisfactory. Neem germplasm for 12 lines from different villages of Ranga Reddy, Nalgonda & Medak have been collected and are being evaluated on field at AICRP on Agroforestry centre Hyderabad. Among the 12 lines collected, line 28 collected from Moinabad mandal recorded highest mean height of 254.75 cm and by appearance the tree is straight and branchy. Line 31 collected from Tukkuguda Mandal recorded lowest height. The tissue culture line evaluated recorded 221.8 cm. However, collection and evaluation of neem and Dalbergia is being continued.

Agroforestry Management

- Studies on standardization of pruning techniques indicated that by adopting coppicing at a height of 60 cm from the ground level optimum yields can be obtained *Albizia lebbeck* based agrisilviculture system. Mean gross and net returns from this system was worked out and presented in table -2 .

Table - 2: Economic analysis of *A. lebbeck* based silvipasture system.

Treatments	Gross returns	Cost of cultivation	Net returns	B:C ratio
Sole crop	9560	4270	5290	1024
Sole tree without pruning	-	-	-	-
Crop with tree + without pruning	3020	4270	- 1250	-0.29
Coppicing at ground level	9605	4770	4835	1.01
Coppicing at 30 cm	9013	4770	4243	0.89
Coppicing at 60 cm	11048	4770	6278	1.32
Pollarding at 1.5 m	10267	4770	5497	1.15
Pollarding at 2.0 m	10558	4770	5788	1.21
Pollarding at 2.5 m	8428	4770	3658	0.77
Lopping	6332	4770	1562	0.33

The studies on active root distribution of *Emblica officinalis* and *Tamarindus indica* revealed that about 70 per cent of active roots of *E. officinalis* were concentrated between 20-40 cm vertically and about 60 per cent of active roots were distributed laterally from 100 - 250 cm distance. These results suggest that for the fruit plants like aonla, fertilizer placement should be done at a depth of 20-40 cm and laterally upto 250 cm to drive maximum use efficiency of applied fertilizer. In case of *T. indica* 72 per cent of active roots were concentrated vertically between 20-40 cm and 70 per cent were spread laterally upto 250 cm.

Tree Improvement

The comparative performance showed that tissue culture raised clones of teak after 35 months of planting were found to be inferior to stump raised seedlings. The mean height of tissue culture clone NC-21 was 495, which was inferior to 554 cm recorded by stump raised seedlings.

C 3.10: PROGRESS OF RESEARCH IN WATER MANAGEMENT

1. INFRASTRUCTURE : The following coordinated Research Projects and Adhoc research schemes are being implemented in the Regional Committee No. V

Name of the State:

S. No.	Name of the Project	Sponsoring Authority	Location
1.	AICRP on Water Management	JNKVV, Jabalpur OUAT, Bhubaneswar	Bilaspur
2.	AICRP on Management of Salt Affected Soils and Use of saline water in Agriculture	ANGRAU, Hyderabad	Bapatla

The ICAR regional committee No. V includes the states of Orissa, Andhra Pradesh and Chhattisgarh. In this region the AICRP on Water Management has two centres one each located at Chiplima (Orissa) and the other located at Bilaspur (Madhya Pradesh). There is no AICRP centre on Water Management in Andhra Pradesh. Bilaspur centre is located in agro-ecd region No. 11 with hot subhumid climate and red and yellow soils. The region is located at 292.3 m above mean sea level and receives an annual rainfall of 1280 mm. Chiplima centre falls in agro-eco region No. 12 with hot subhumid climate and red and lateritic soils and receives an annual rainfall of 1350 mm.

The salient achievements of the research work done at these AICRP centres during the last two years are described briefly below:

A. SALIENT RESEARCH

FINDINGS BILASPUR 2000-01

Rice is the major crop of the region. In rabi, wheat, gram and mustard are taken by some farmers. Other major crops are kodo-kutki, lentil and lathyrus. Major water management constraints are water congestion due to impeded drainage during early phase of crop growth and inadequate moisture during reproduction and maturity phase. The canal water supply is interrupted and farmers are not aware of improved water management technology. The soils are very deficient in nitrogen and have high fixation capacity for phosphorus. Deficiency of some micro-nutrients like zinc and molybdenum has also been observed.

RICE

An experiment was conducted to study the effect of differential irrigation and methods of planting on grain yield of rice and to assess the effect of minimum tillage on subsequent wheat crop yield'after the harvest of rice. Four irrigation schedules (1, 3, 5, 7 DAD, IW = 7 cm) two planting methods (direct seeding and transplanting); and four tillage treatments (line sowing with zero tillage, cultivator thrice + two plankings, one cultivator + one rotavator, two cultivator + one rotavator) were evaluated. The crop (cv. Mahamaya) was directly seeded on July 5, 2000 and transplanted on July 30, 2000 and harvested on November 11, 2000. A total of 39.8, 42.2, $4:6 and 49.8 cm of effective rainfall was received under 1, 3, 5 and 7 DAD irrigation schedules, respectively.

Result indicates that differential irrigation schedules affected the grain yield significantly. Highest grain yield of 5.41 t/ha was obtained under irrigation schedule of continuous submergence on par with irrigation level of 1 DAD (5.26 t/ha) requiring 8 and 6 irrigations, respectively. These yields were 14.1 and 11.0 per cent higher over that under irrigation applied at 5 DAD. The grain yields under 1 and 3 DAD were at par. Total water expense increased with increase in irrigation level. Maximum water expense was under continuous submergence and contribution of effective rainfall was less in this treatment as compared to others. Water-use efficiency was highest when 3 days drying period was allowed after disappearance of ponded water followed by 5 day drying period.

Thus irrigation schedule of 3 DAD produced optimum grain yields requiring 5 irrigations and reflected highest water-use efficiency and is a suitable practice for the region. The method of planting had no significant effect on the grain yield of rice and the yields under both methods of planting were comparable. The results are at variance to those reported last year.

Another experiment to assess and evaluate the extent to which organic manuring and reduced puddling in the rice crop could improve the productivity of rice and succeeding wheat crop in the rice-wheat crop rotation under differential irrigation regimes initiated in 1999 was continued during 2000. Three irrigation levels (7 cm irrigation at 1, 3 and 5 DAD); three manuring treatments (control, sesbania green manure and FYM @ 10 t/ha); and two puddling treatments (conventional puddling with desi plough and reduced puddling through rotovator) were evaluated. Rice (cv. Mahamaya) was transplanted on July 25, 2000 and harvested on November 10, 2000. A recommended dose of 80:50:30 kg NPK/ha was applied to rice. A total of 41.6, 44.2 and 48.8 cm of effective rainfall was received during the crop growing period for 1, 3 and 5 DAD irrigation treatments, respectively.

The results indicate that the differential irrigation had significant effect on the grain yield of rice. A schedule of 7 cm irrigation at 3 DAD produced 5.29 t/ha rice grain yield on par with 5.42 t/ha maximum grain yield under 1 DAD and saved about 28.6 per cent water. However, grain yield was significantly reduced when 5 days drying period was allowed after disappearance of ponded water. Last year, irrigation treatments failed to influence rice grain yield significantly due to well distributed rainfall.

Manuring had significant effect on grain yield of rice. It was observed that the nutrients supplied through manures or green manures produced higher grain yield as compared to inorganic fertilizer applied alone. Application of FYM @ 10 t/ha produced maximum grain yield of 5.44 t/ha and incorporation of sesbania @ 10 t/ha produced 5.36 t/ha grain yield, 10.8 and 9.0 per cent higher respectively over no manuring treatment. Both the treatments were at par. Organic manures not only enhanced the productivity but also improved the soil health which in turn helps in supplying nutrient to the plant resulting in higher production. Puddling treatments had no significant influence on rice grain yield during this year. The results are at variance with previous years results when reduced puddling produced significantly higher yields over conventional puddling.

In order to assess the decomposition pattern of organic matter in combination with urea fertilizer under rainfed and irrigated conditions, an experiment was conducted in silt loam soils during kharif, 2000. The treatments consisted of two water regime (irrigated i.e. continuous submergence/saturation and rainfed), two dates of planting (July 9 and July 23, 2000) and four combinations of two nitrogen sources (no nitrogen, 80 kg N through FYM, 40 kg N through urea + 40 kg N through FYM and 80 kg N through urea). The crop (cv. Kranti) was transplanted on 09 and 23 July, 2000 and harvested on October 30, 2000. Fertilisers @ 80 kg P_2Os/ha and 30 kg K_2O were applied as a basal dose at time of transplanting. A total of 52.7 and 36.0 cm rainfall was received in early and late sown plots, respectively.

The results showed that the water regimes, dates of planting and nitrogen sources influenced the rice grain yield significantly. Yield of irrigated rice (3.38 t/ha) was almost three folds higher over rainfed. Early transplanting of rainfed rice produced 2.41 t/ha grain yield about 13 per cent higher over late transplanting rice. Interaction effect of soil moisture regime and planting date indicated that early planting of rainfed rice producing significantly higher grain yield of paddy might have happened due to favourable moisture regimes due to effective utilization of rainfall. Between sources of nitrogen supply, application of FYM equivalent to 40 kg N//ha in combination with 40 kg N/ha through urea produced 2.54 t/ha rice grain yield on par with 80 kg N/ha through urea. Application of FYM equivalent to 80 kg N/ha produced only 2.29 t/ha. This is mainly due to wider C:N ratio of FYM at the tune of application and slow decomposition under rainfed conditions. Combination of FYM and urea prdved better over others because presence of urea facilitates the organic matter decomposition despite the wider C:N ratio. Such combination provides a steady stream of macro and micro nutrients to the crop. A positive interaction of irrigated water regime was observed with sources of nitrogen. Irrigated rice nourished with 80 kg N through FYM and urea produce 3.92 t/ha grain yield at par with 80 Kg/N through urea alone. In rainfed rice, all sources of N and control were found to be at par with respect to grain yield. Thus for the higher productivity, the crop may be transplanted early (in the first week of July) and nitrogen may be applied through FYM in combination with urea.

Another experiment was conducted to evaluate the water requirement of summer rice varieties in silt loam soil at Bilaspur. The treatments consisted of three irrigation schedules (continuous submergence, 6 cm irrigation at 1 and 3 DAD) and four summer rice varieties (IR-36, Mahamáya, R-1154-503 and R-642-984).The crop was transplanted on March 6, 2000 and harvested on June 12, 2000. Fertilisers were applied @ 80 kg N/ha 50 kg P_205/ha and 30 kg K^O/ha as a basal dose at the time of transplanting. A total of 7.9 cm rainfall was received during the crop growth period.

The results indicated that only differential irrigation schedules influenced the rice grain yield significantly. Continuous submergence produced 4.72 t/ha seed grain yield of rice significantly superior over 1 and 3 DAD treatments. The total water applied was maximum in the case of continuous submergence which was about 300 cm, followed by 150 and 123 cm in case of 1 and 3 DAD irrigation schedules respectively. All the genotypes produced at par grain yield and hence in summer, under Bilaspur conditions, any of these cultivars can be grown satisfactorily. The interaction effect between irrigation schedules and varieties was absent.

RICE

An experiment was conducted to assess and evaluate the extent to which organic manuring and reducing puddling in the rice crop would improve the productivity of rice and succeeding wheat crop in the rice-wheat crop rotation under differential irrigation regimes during 2000. Three irrigations levels (7 cm irrigations at 1,3 and 5 DAD); three nitrogen treatments @ 80 kg N/ha (50% through FYM+5-% through urea, 50% through green manure + 5-% through urea and 1~% through urea) and two puddling treatments (conventional puddling with desi plough and reduced puddling with rotation) were evaluated. Rice (cv. Mahamaya) was transplanted on August 23,2001 and harvested on December 4, 2001. Phosphorus and potash were applied as basal dose @ 50 and 30 kg $P_2$0s and $K_2$0, respectively. A total of 81.2 cm effective rainfall was received during the crop growing season.

The results indicated that the rice grown yield was significantly influenced by irrigation, nitrogen and puddling treatments. Irrigation at 1 DAD produced 5.51 t/ha and rice grain yield, significantly superior over 3 and 5 DAD. Supplementing 50% nitrogen through green manure or FYM produced significantly higher yields than 100% urea. Slow decomposition of green manure provides a slow, steady and continuous flow of nutrients through out the crop period and also helps in improving the soil structure. Conventional puddling using as desi plough produced 5.20 t/ha grain yield, significantly superior over reduced puddling.

In another experiment nitrogen transformation was studied in relation to methods of planting under irrigated and rainfed conditions in rice-safflower cropping sequence. Treatments connected of two irrigation regimes (continuous submergence and rainfed), two planting methods (direct sowing and transplanting) and five manures/fertilizer levels(control, no nitrogen, 40 kg N/ha through urea and 80 kg N/ha through urea). Rice crop (cv. Mahamaya) was transplanted on August 3 2001 and harvested on November 23,2001. The crop was fertilized with 50 and 30 kg P2Os and K^O/ha, respectively. During the crop growth period a total of 81.2 cm effective rainfall was received.

The results indicate that the irrigation regimes and nitrogen level significantly influenced the rice grain yield. Continuous submergence produced 4.82 t/ha grain yield, significantly superior over rainfed. Application of nitrogen @60 kg N/ha FYM and 60 kg N/ha as urea produced '5.42 t/ha grain yields significantly superior over all other combinations. Planting methods failed to influence rice grain yield significantly. A positive interaction between irrigation regimes and nitrogen was observed.

Another experiment was conducted to evaluate the water requirement of summer rice varieties in silt loamy soil at Bilaspur. The experiment initiated in 2000 was continued during 200%. The treatments consisted of three irrigation schedules (continuous submergence 6 cm irrigation at 1 and 3 DAD) and four summer varieties (IR_64, Mahamaya, R-1154-503 and R-642-984). The crop was transplanted on February 27, 2001 and harvested between

June 1-
4, 2001. Fertilizers were applied @80 kg N/ha, 50 kg P_2O_5/ha and 30 kg K_2O/ha as basal
dose at the time of transplanting. A total of 7.23, 7.31, 7.31 and 8.83 cm rainfall was
received by IR.64, Mahamaya, R-l 145-503 and R-642=984 varieties, respectively. The results showed that not only the irrigation schedules and varieties influenced grain yield significantly, but the interactive effects between irrigation and varieties were positive and significant. Continuous submergence produced 6.37 t/ha grain yield, significantly superior over other irrigation schedules. Summer rice variety R-l 145-503 out yielded the remaining varieties by producing 6.56 t/ha, significantly highest rice grain yield. Continuous submergence to rice cv. R-l 145-504 produced 7.59 t/ha rice grain yield and observed to be highly water responsive variety.

WHEAT

Residual effect of irrigation levels, puddling and organic manure applied to rice on succeeding wheat crop was studied in silt loams soils at Bilaspur, treatment for rice consisted 3 irrigation schedules (irrigation at 1,3 and 5 DAD), 3 manure/fertilizer levels(30 kg N/ha as 50% (FYM)+50% (Urea), 50% (Green manure) + 50% urea and 100% (Urea) and two puddlling levels (conventional puddling by desi plough and reduced puddling by rotovator). After harvest of rice, wheat crop (cv. Kanchan) was sown on December 7,2000 and harvested on Apri 1, 2001.

Results indicated that irrigation and puddling treatments in rice did not show significant residual effects on the grain .yield of^succeeding wheat. However, application of 80 kg N/ha as 50% (green manure)+50% (urea) in rice produced 3.56 t/ha wheat grain yield, significantly superior over all other manure/fertilizer combinations.

In order to evaluate irrigation water requirement of new genotypes of wheat in relation to nitrogen levels, a study was carried out in silt loam soils at Bilaspur. The treastments consisted of four irrigation schedules (no irrigation, 6 cm irrigation at CRI stage, at CRI+flowery stage and at IW/CPE=0.9), two varieties (HW-2004 and HI-8498) and two nitrogen levels (60 and 120 kg N/ha). The crop 2as sown on November 30, 2000 and harvested on March 31, 2001. Phosphorous and potassium were applied as basal dose @ 60 kg P2Os and 40 kg K^O/h. A total of 2.5 cm effective rainfall was received during the crop growth period.

The results revealed that irrigation, varieties and nitrogen influenced wheat grain yield significantly. Three irrigations, each of 6 cm depth scheduled at IW/CPE=0.9, besides a common irrigation of 4 cm, produced 3.95 t/ha wheat grain yield, significantly superior over other irrigation schedules. Wheat genotgype HW-2004 produced 3.40 t/na grain yield, significantly superior over HI-8498. Application of nitrogen @120 kg N/ha produced 3.20 t/ha wheat grain yield, significantly superior over 60 kg N/ha.

Irrigation-variety and irrigation-nitrogen interactions were absent but variety fertilizer interaction was positive and significant. Wheat genotype HW-2004 was observed to be highly responsive to nitrogen and produced 3.73 t/has grain yield when fertilizer with 120 kg N/ha

Irrigation water needs of summer and kharif hybrid rice in relation to fertility levels were investigated in sandy loam soils during summer and kharif 2000. The experiment initiated in 1 998 was continued through 2000. Four irrigation schedules (5±2 cm continuous shallow submergence, 7 cm irrigation at 1,3 DAD, and rainfed in kharif and 7 cm irrigation at 5 DAD in summer); and four fertility levels in summer (80:40:40, 120:60:60, 160:80:80, 200:100:100) and kharif (consisting of 80:40:40, 50 percent of 80:40:40, 120:60:60, 50 per cent of 120:60:60, 160:80:80, 50 per cent of 160:80:80, 200: 100:100 and 50 per cent of 200:100:100 NPK/ha) were evaluated. The summer crop (cv. Pro Agro 6201) was transplanted on Feb. 23, 2000 and harvested on May 19, 2000. The kharif crop was transplanted on August 8, 2000 and harvested on November 5, 2000. Nitrogen was applied in 1:2:1 splits top dressed and PiOs and K.20 as basal. A total of 4.8 cm rainfall was received during the summer crop season and 39.7 cm in kharif season. The water-table fluctuated between 0.05 to 0.60 m bgl during summer 98-99 and 0.25 to 0.30 m bgl in kharif 1999.

The results indicate that differential irrigation schedules influenced the summer hybrid rice significantly. Continuous shallow submergence of 5±2 cm produced highest grain yield of 4.16 t/ha significantly higher over other schedules but at par with 1 DAD. 5 DAD treatment recorded the lowest grain yield (2.52 t/ha). The observed values of per cent gradual reduction in yield and per cent saving in water in different irrigation schedules over continuous submergence are 4.1 and 13.3 in case of 1 DAD; 20.4 and 26.7 cm in case of 3 DAD; and 43.0 and 46.7 in case of 5 DAD. Thus for optimum grain yield of hybrid rice in summer, irrigation may be scheduled at 1 DAD. The increase in the grain yield due to differential fertility levels was observed upto application of 160:80:80 kg NPK/ha. Further increase in the fertility levels did not increase the yield. Normal fertility level used for high yielding varieties (80:40:40 kg NPK/ha) produced lowest grain yield of 3.14 t/ha. The interaction between irrigation and fertilizer level was absent. Water-use efficiency at 41.6 kg/ha-cm was highest under 7cm irrigation at 1 DAD.

Like summer season crop, Kharif season results (Table 3.1.6) also showed that continuous shallow submergence produced higfiest grain yield of 5.12 t/ha at par with that 4.94 t/ha obtained in 1 DAD irrigation schedule. The latter schedule saved 14 per cent irrigation water. The paired values for reduction in yield and saving in irrigation water over continuous submergence are 11.5 and 24.6 per cent under 3 DAD. The rainfed treatment gave lowest grain yield of 2.29 t/ha about 55.2 per cent less over continuous submergence. Like summer rice, the differential fertility levels influenced the grain yields upto 160:80:80 NPK/ha only. The interaction of fertilizer and irrigation was non-significant. Water-use efficiency at 57.25 kg /ha-cm was highest in case of rainfed treatment. The results are in agreement with the findings of last two years.

Thus both summer and crop season crops behave in a similar fashion and gave optimum grain yield under 1 DAD irrigation schedule though kharif season mean grain yield are higher. Both kharif and summer season crops gave response upto 160:80:80 fertilizer applications only.

RAJMASH

Irrigation water requirements of Rajmash *(Phaseolus vulgaris)* in relation to sowing time were investigated in sandy clay loam soils at Chiplima during rabi

1999-2000. Treatments consisted of five irrigation schedules (6 cm irrigation at flowering stage and IW/CPE = 0.6, 0.8, 1.0 and 1.2) and four sowing dates (November 15 and 30 and December 15 and 30). The crop (cv. Chitra) was sown as per the treatments at a spacing of 45 x 10 cm. The crop was harvested on February 3, March 10, March 18 and March 18 as per their respective sowing dates. The crop was fertilized with 100:60:40 kg N^Os^O/ha. Half of the nitrogen and full phosphorus and potash was applied as a basal dose at the time of sowing. Remaining nitrogen was applied 3 weeks after sowing. A total of 5.2 cm rainfall was received during the crop growing season. The rainfall was uniform in the plots sown on different dates.

Results indicate that the irrigation schedules and sowing dates influenced seed yield of Rajmash significantly. Mean maximum seed yield of 0.98 t/ha was obtained under IW/CPE = 1.2 with 5 irrigations was at par with (0.90 t/ha) IW/CPE = 1.0 requiring four irrigations each of 6 cm depth. Among the sowing dates, mean maximum seed yield of 1.17 t/ha was produced when sowing was done on November 15th. This yield was significantly superior over all other sowing dates. The yield differences between two subsequent sowing dates work also significant Delaying sowing upto November 30, December 15 and December 30 declined Rajmash seed yield by 10, 27 and 82 per cent over sowing on November 15th. Average water-use efficiency was maximum at 54.4 kg/ha-cm in the most stressed treatment of irrigation at flowering stage.

Rajmash crop required more time to attain maturity with 108 days when sown on 15th November. The duration decreased appreciably to 100, 91 and 78 days when sowing was delayed by 15 days up till December, 30. This in turn influenced the irrigation and water requirement of the crop.

SUGARCANE

Irrigation water requirements of autumn planted sugarcane in relation to the planting geometries were investigated in the sandy loam soils of Chiplima during 1998-99. The treatments consists of four irrigation schedules (6 cm irrigation at IW/CPE = 0.6, 0.8, 1.0 and 1.2); and five planting techniques (normal planting with row to row spacing of 60, 80, 100 cm, paired row planting with set to set placement as 30 cm row to row and 90 cm pair to pair; and paired row planting with eye to eye placement as 30 cm row to row and 90 cm pair to pair). The crop (cv. Co-87037) was planted with trench method on October 29, 1998 and harvested on December 13, 1999 on maturity. The crop was fertilized with 250:100:60 kg N: P205: K2O/ha. Nitrogen was top dressed in 3 equal splits, first at 35 days after planting and at 30 days interval thereafter. Full quantity of P and K was applied as a basal dose at the time of planting. Irrigation was scheduled by furrow method. A total 113.3 cm rainfall was received during the crop growing period out of which 39.1cm was effective.

The results indicate that the cane yield was significantly influenced by irrigation schedules and planting techniques. Cane yield increased significantly from stressed regime of IW/CPE = 0.6 to wettest regime of IW/CPE = 1.2. Higher cane yield of 129.37 t/ha was obtained with IW/CPE = 1.2 requiring 21 irrigations each of 6 cm depth. A linear response of autumn planted sugarcane to the applied irrigation was observed and therefore higher irrigation levels may be tried for further experimentation. Water requirement was maximum (169.3 cm) under IW/CPE= 1.2

and minimum (125.1cm) under IW/CPE = 0.6. On an average, planting techniques did not vary appreciably with respect to their water need.

Among the planting techniques, maximum cane yield of 116.67 t/ha was obtained under normal planting with row-to-row spacing of 80 cm. This was followed by 112.35 t/ha under normal planting with row-to-row spacing of 100 cm. The mean reduction is yield was conspicuous when planting density was high as compared to when the density was low (100 and 80 cm row to row spacing). In general, average yield under normal planting was 7.5 per cent higher over paired row planting. Water-use efficiency at 1092 kg/ha-cm was maximum at IW/CPE =1.0. Interaction effects of planting techniques on fixed irrigation and irrigation on fixed planting techniques were observed to be positive. A treatment combination of IW/CPE = 1.0 and 80cm row-to-row spacing gave maximum 133.3 t/ha cane yield significantly superior over other combinations.

CHIPLIMA 2001-02

BANANA

An experiment was carried out to study the management in kharif planted banana in sandy loam soils at Chiplima during 2000. Eight irrigation schedules tried were 7 cm irrigations at:

I_1: IW/CPE=1.4 through out (No stress)
I_2. IW/CPE=1.4upto flowering followed by no irrigation (stress)
I_3: No stress upto flowering followed by mulching (Banana leaves/shows)
I_4: No stress upto flowering followed by IW/CPE=1.2 + mulching
I_5: No stress upto flowering followed by IW/CPE=0.9 + mulching
I_6: No stress upto flowering followed by IW/CPE=0.6 + mulching
I_7: No stress upto flowering followed by drum irrigation (5 l/plant/week)
I_8: No stress upto flowering followed by drum drip at 80% PE

Banana (cv. Robusta) was planted on July 27, 2000 in pits at a spacing of 1.8 m x 1.8 m and harvested on October 15, 2001. Each pit was fertilized with 200, 200 and 150 g of urea at 40, 70, and 110 days after planting FYM @ 10 kg and single super phosphate @150 g were applied in the pit as a basal dose. A total of 245% cm rainfall was received during the crop growth period.

Results revealed that fruit yield of Banana was significantly influenced by irrigation schedules. NO stress upto flowering followed by drum drip at 80% PE produced highest (14.9 t/ha) Banana fruit yield, on par with that obtained under irrigation at IW/CPE =1.4 through out the crop period but saved about 15% irrigation water. In general, the yield levels were very low due to temperature (41°C) induced* heat injury resulted in leaf burning and premature dropping of the fruits.

B. STAFF POSITION

The sanctioned scientific staff position at the centres of AICRP on Water Management in Region No. V and latest vacancy position is given in Table 1.

Table 1. Sanctioned and In-position staff at AICRP centres of Water Management.

Centres	Staff Position		
	Sanctioned	In-Position	Vacant
Bilaspur	05	05	00
Chiplima	05	05	00

The post of Soil Physicist is vacant at Bilaspur centre, which may be filled up at the earliest in order to smoothly implement the technical programme of the centre.

C 3.11:NATIONAL AGRICULTURAL TECHNOLOGY PROJECTS

Status of the NATP projects in Andhra Pradesh, Orissa and Chhattisgarh under the Production System Research mode

State	No of Projects/centers under the Agro-ecosystem				Amount (Rs In lakh)
AED	Rainfed	Irrigated	Coastal	Total	Total
Andhara Pradesh	75	6	24	105	2450.70
Orissa	48	1	14	63	1262.78
Chhattisgarh	25	-		25	665.49
Total	148	7	38	193	4378.97

Salient Achievements

Coastal Agro-ecosystem

- Covering Banana bunches with poly bags were found effective in fetching higher returns due to uniform colour development. As an intercrop in banana variety Telia Chakkerakeli Carrot recorded the highest net return of Rs. 19229/- ha ~' followed by maize (Rs. 90777/- ha^{-1}). Cauliflower and amaranthus were also found economical to grow as intercrop. Among the different treatments, 75% fertigation at 1.8 x3.6m, with 2 suckers/pit - 3086 plants per ha recorded highest bunch weight. (AP)

- Full dose application of neem cake recorded the higher fresh weight of Beetlevine leaves than neem cake mixed with urea (1:1). Drip irrigation recorded the maximum vine elongation and internodal length. However maximum leaf area, fresh wt. of 100 leaves and leaf yield were obtained with the irrigation at 0.75 IW: CPE at 3 cm depth as compared to the lowest leaf yield in farmer's practice. **(A.P., Orissa)** .

- Among the intercrops like maize, banana and chillies grown during the juvenile phase of the oil palm, the maximum net return was that of maize. Maize as intercrop gaVe a net return of Rs. 23000/ha and this will help the oilpalm farmers financially when the crop is in the juvenile phase and is not yielding. **(A.P)**

- For effective weevil catch traps are to be set with both pheromone lute and food bait. Sterilized coir pith, as rearing mediator grubs of *Oryctes rhinoceros* was helpful in maintenance of Baculovirus cultures in the lab without bacterial contamination. A most suitable food bait viz. Banana var. Palayankondan was identified for efficient trapping for red weevil using pheromone lure.**(A.P)**

- Flood irrigation and addition of green manure (sunhemp grown in the basin) recorded lesser mite incidence compared to other irrigation methods. **(AP)**

- Crude oil extraction mini press was developed for lab extraction of oil from fruits. Decorticator of extraction of oil palm fibre is developed **(A.P)**
- Designed and fabricated a power operated sprayer using molded PVC pipes he stand designed can be placed in all types of terrain at a distance of 10 m from the telescopic pipe and double barrel piston pump. The advantage of this system is two pipes move simultaneously while rotating the ratchet mechanism. **(A.P.,Orissa)**
- Breaking the coconut in to two halves and also for removing the shell after partial drying is a continuous problem of attention in coconut growing areas hence a coconut splitter which is simple to use has been designed with a provision to collect the nut water. **(A.P., Orissa)**
- Fermented low value feeds and soybean flakes and flour could be used as a substitute for high value massive protein in shrimp feed. **(A.P., Orissa)** White Spot Virus (WSV) disease was recorded as primary causal agent for the disease out breaks in shrimps. **(A.P., Orissa)**
- Farmer friendly PCR protocols have been developed for diagnosis of WSV disease in shrimp. **(A.P., Orissa)**
- A breakthrough has been achieved in captive shrimp brood stock production and raising of three massive generations of brood stocks. **(A.P., Orissa)**

Rainfed Agro-ecosystem:

- In **Orissa,** Vandana in upland eco system, CR-619-475 under medium land and Savatri and Sarala under low lands were identified as promising varieties in terms of yield and water use efficiency.
- The current cropping intensity is low in **Orissa and Chhattisgarh** Cropping is restricted to kharif season and hardly any rabi crop is taken because of inadequate carry over moisture. Increasing cropping intensity even in 25% of such monocropped (rice) area could, have therefore large impact in augmenting farmer's income and providing off-season employment. Advancement of rice seeding by 9-12 days enabled raising successful rabi crops like lentil and gram.
- Construction of on-farm reservoirs of 1000-2000 m^3 helped in storing excess runoff water. The water stored in a 1000 m^3 reservoir saved about 1 ha of rice crop through life saving irrigation. **(Orissa and Chhattisgarh)**
- **In Orissa,** the excess water stored in ponds could be successfully used for fish culture. For the first time, in Orissa, oil seed/crops could be raised on such lands using the stored water. This technology of storing water was well received by more than 200 farmers.
- Among the *Utera* crops tried for different location Linseed prove most efficient for districts of **Orissa,** whereas Lathyrus and Field pea performed best at **Chhattisgarh**
- The paddy-cum-fish (Mrigal and Rohu) and paddy-duckling (Khaki Campbell) culture resulted in 100% increase in income of tribals in **Chhattisgarh** states.
- By broadcasting under *biasi* system comprising Mahamaya rice variety and using *biasi* plough (tifan) resulted in higher net returns (Rs. 14000-15550/ha) and B: C ratio (2.6 to 3.0) in rainfed rice areas of **Chhattisgarh, Orissa**

- To improve the livelihood of finger millet farmers, OFAR was conducted in **Orissa and A.P.** in predominantly tribal areas by introducing legumes like pigeonpea, cowpea and black gram as inter/sequence crops in the finger millet based cropping system.
- IPM technologies for pigeon pea and chickpea, proved conclusively that losses up to 15-20% can be cut down through IPM and at the same time reducing the use of harmful pesticides by as much as 50%. (AP)
- Pilot studies at **NRCS, Hyderabad** revealed that net returns for the farmer from growing sweet sorghum for alcohol works out to be approximately Rs.20, 000 per hectare. This technology offers great promise for commercialization and improves the farmers income in the context of Govt. of India decision to permit admixture of 5% alcohol in petrol.

Irrigated Agro-ecosystem:

- Quality protein maize hybrid CML 142 x CML 150 gave 25% yield superiority over the check Shaktiman-1. This hybrid is also one of the female parent of Shaktiman-1. Hybrid B QPM H 024 developed by **Hyderabad centre** gave an yield superiority of 31.81% over Shakti 1 and 5.39% over Shaktiman - 2. **(A.P.)**

- PAU-2343-60-2-3, IET- 16775, IET -17021, IET-16310, IET -13549, IET -15392, IET -16313, IET -16776, IET -17022, IET -17025, NDR-6139 and NDR-6134 have been identified to combine lodging resistance, high productivity and resistance to biotic stresses and grain quality at par with Taraori basmati used as a check. One donor line viz RW 2002 (PAU 2343- 60-2-3) for providing resistance of Bacterial Leaf Blight (BLB) in basmati has been identified for utilization in hybridization programme. **(A.P.)**

- The best non-basmati cultures identified with respect to various quality indices include PR 114, PR 116, RAU 1306, RYT 2613, IET 11771, IET 1 2884, IET 9979, KET 1 7 1 38 and IET 1 7079. One donor line of rice for providing resistance of Bacterial Leaf Blight (BLB) RW 1005 (RYT 24912), have been identified for utilization in non-basmati rice for hybridization programme. **(A.P.)**

- Economical feeding is a key to success for dairy enterprise. The studies revealed that the mixture of good quality roughages and concentrate in 40: 60 ratio was found to sustain the growth rate of 650-700g/head/day in growing cross-bred animals. Whereas, for targeted range of milk production (11-15 kg milk/day) the optimum ratio of roughages and concentrate was 60:40. (A.P.)

Team of Excellence Mode

The following Sub-projects of NATP approved under Team of Excellence Mode are under operation in AP, Orrisa and Chattisgarh states of India:

Name of State	Name of NATP sub-Project	Allocation (Rs. In Lakh)
AP	TOE on Feed Technology & Quality Assurance	114.25
Orrisa	TOE on Freshwater Pearl Culture TOE on Greenhouse Gas Emission	69.87 57.76
Chattisgarh	Nil	Nil

The Salient achievements under various sub-projects approved under **Team of Excellence mode** are as follows:

Feed Technology and Quality Assurance (At ANGARU, Hyderabad)

- Detoxification of rapeseed meal and neemseed cake will help for feeding them to livestock in a safe way without deleterious effect on animal health.
- Transfer of technology in terms of conducting on-farm experiments using complete diets has created awareness among farmers about the technology which in turn will help for utilizing locally available crop residues.
- Two trainings were conducted in which 18 scientists from SAUs and ICAR institutes participated.

Greenhouse Gas Emission From Rice And Rice-based Cropping System (at CRRI, Cuttack)

- Research methodology on sampling and measurement of CH_4 and N_2O flux from experimental fields have been developed and standardized.

- A simple laboratory incubation procedure for measuring N_2O production from soil samples has been developed. The method is being used to quantify N_2O production of soils.

- N_2O emission from flooded rice fields was correlated to application of fertilizer-N and could be reduced significantly by use of nitrification inhibitors.

- Potassium application results in to a significant decrease in CH_4 emission flux from rice plants and could be ideally developed into a mitigation option for reducing CH_4 emission.

- Two students have been registered for their Ph.D. degree. A total of 4 students from different universities of India have submitted their M.Sc. thesis under the Team.

- One training was conducted in which 8 Scientist from SAUs and ICAR institutes participated.

Freshwater Pearl Culture (AT CIFA, Bhubaneshwar)

- Development of cost-effective alternative nuclear material in comparison to imported shell bead nuclei.

- Value addition to freshwater culture pearls through chemical and physical treatments.

- Mapping of pearl mussel resources in different agro-ecological regions of the country.

- Development and dissemination of technology of induced breeding and peral culture.

- Two of the trainees (one each in Orissa and Andhra Pradesh) have already taken up pearl culture at commercial level while several others are in the process of setting up the commercial venture.

- During the year 2 trainings were conducted in which 88 scientists from SAUs, ICAR institutes participated.

Mission mode sub-projects in Andhra pradesh, Chhatishgarh and Orissa

ANDHRA PRADESH:

I. **Project:**-Development of Weather Based Forewarning Systems for Crop
Pests and Diseases.
Centres: - DRR, Hyderabad (LC); ANGRAU, RARS, Lam ; ANGRAU, RARS, Tirupati; ANGRAU, RARS, Warangal; CRIDA, Hyderabad **(Main LC). Total Funds:-** 240.65

II. **Project**:- Integrated National Agriculture Resources Information System
Centres:- CRIDA, Hyderabad. **Total Funds:-55.21**

III. **Project:-** Use of Improved Tools for Mechanization of Dryland Agriculture.
Centres:- CRIDA, Hyderabad ; AICRPDA, Centre, ANGRAU, Anantpur.
Total Funds:- 106.63

CHHATTISGARH

I. **Project:-:-** Development of Weather Based Forewarning Systems for Crop Pests and Diseases.
Centres:- IGKVV,
Raipur. **Total Funds:-**
14.58

II. **Project:-** Increasing Wheat Production and Builiding up of Research
Capabilities in tha Warmer Areas and Eastern India.
Centres:- IGKVV, RARS,
Bilaspur. **Total Funds:-21.98**

ORISSA

I. **Project:-:-** Development of Weather Based Forewarning Systems for Crop Pests and Diseases.
Centres:- CRRI,
Cuttack **Total Funds:-**
17.089

II. **Project:-** Empowerment of Women in Agriculture.
Centres: - NRCWA, Bhuneshwar
Total Funds:- 42.99

Participating Centres:

1. Development Of Weather Based Forewarning Systems For Crop Pests and Diseases:
A.P :- DRR, Hyderabad (LC); ANGRAU, RARS, Lam ; ANGRAU, RARS, Tirupati; ANGRAU, RARS, Warangal; CRIDA, Hyderabad **(Main LC);**
Orissa :- CRRI, Cuttack.
Chhattisgarh :- IGKVV, Raipur.

2. Use of Improved Tools for Mechanization of Dryland Agriculture.

A.P :- CRIDA, Hyderabad (LC); AICRPDA, Centre, ANGRAU, Anantpur .

3. Integrated National Agriculture Resources Information System

A.P :-CRIDA, Hyderabad

4. Increasing Wheat Production and Builiding up of Research Capabilities in tha Warmer Areas and Eastern India.

Chhattisgarh :- IGKW, RARS, Bilaspur

5. Empowerment of Women in Agriculture. Orissa:- NRCWA, Bhubaneshwar

Achievements:

Development of Weather Based Forewarning Systems for Crop Pests and Diseases:

- Empirical models for predicting the occurrence of bacterial leaf blight and *Alternaria* leaf blight one week in advance in cotton.
- Seasonal occurrence of *Helicoverpa armigera* was reviewed and a comprehensive calendar was prepared according to agro-ecological zones of India.
- The weather factors responsible for the *Helicoverpa armigera* outbreak in cotton have been identified.
- A forecasting model for jassids on cotton has been developed.
- Long-term light trap data (26 years) for yellow stem borer has been analyzed.
- Regression models for rice blasts have been developed.
- Regression models for predicting rice gall midge have been developed.

- A simple model for forecasting of leafminer incidence in groundnut has been developed for TMV-2 variety.

- Weather based rule for groundnut aphid has been developed.

- Predictive equations for leaf spot, rust leafminer on groundnut for two locations have been developed.

- Forecasting models for aphid, *Alternaria* blight and whiter rust on mustard for several locations have been developed.

- A weather based rule for predicting *Helicoverpa armigera* on pigeonpea has been developed.

Use Of Improved Tools For Mechanization Of Dryland Agriculture:

- Castor planter and castor sheller have been tested on farmers field.
- Rotavator has been tested for incorporation of sorghum and cotton stubbles.
- CRIDA - 9-Row groundnut planter has been tested at research farm and was selected for use on fanners field on custom hiring service.

- Bangalore Center tested Self propelled weeder for inter-culture in Finger Millet crop has been tested and selected for testing on farmers field and custom hiring.

Empowerment Of Women In Agriculture:

- Selection of Blocks and Villages has been completed.
- Eighteen women self help groups (SHG) have been formed and their link workers have been identified and trained.
- Series of meetings were held with local leaders such as sarpanch, ward panch, school teachers, prominent local leaders etc. to ensure participation of rural women and their active cooperation in the project implementation. A preliminary survey has been undertaken in the villages. A large number of meetings and group discussions were held with rural women. PRA techniques were used to identify drudgery tasks of farm women.
- Environment building has been done at all the centres. As an outcome of the effective environment building, the whole village developed awareness about the project. The leaders and government functionaries in the local area have assured to extend the needed support for successful implementation of the project. Research tools are pre-tested and finalized. A set of finalized research tools have been set to all the cooperating centers.
- Benchmark survey has been completed. Identification of need based technologies in agriculture and animal husbandry has been done.

Status of the CGP projects in Andhra Pradesh, Orissa and Chattisgarh

State	No. of projects under CGP				Amount (Rs. In lakhs)
	CGP I	CGPII	CGPHI	Total	Total
Andhra Pradesh	6	5	6	17	424.33
Orissa	1	1	3	5	117.84
Chattisgarh	-	3	7	10	159.66
Total	7	9	16	32	701.83

Salient achievements of the projects sanctioned in the first two rounds under states of A.P., Orissa and Chattisgarh

Andhra Pradesh

- To generate multiple gene recombinants for Bacterial leaf blight (BLB) resistance in rice, SSI 113 plants that were confirmed to be homozygous for *Xa21, xa5* and *xa13* resistance genes were crossed to BPT5204 and Triguna. Marker assisted selection was used for background selection and to identify plants with all three genes. BC_4F_2 plants in SSI 113 X BPT5204 cross and BC_3F_2 plants in cross SSI 113 X Triguna were generated.
- Cloned and tested a novel root-specific promoter from Arabidopsis. It is likely that in crop plants that are closely related to Arabidopsis such as Indian mustard, cauliflower, and cabbage, the promoter will show similar properties as in Arabidopsis and hence may be successfully used for root-specific expression of different transgenes.
- Genetic transformation protocol for groundnut cv. JL 24 has been standardized.
- Pheromone components of banana pseudostemborer *Odoiporus longicollis* (Oliv.) (Curculionidae.Coleoptera) have been isolated and identified from crude extracts of host plants and insects for the first time in India by Gas Chromatography(GC) combined with electro-antennogram technique (EAG). Promising pheromonal activity in four compounds was found by bio efficacy studies. Procedures for the pretreatment of dispensers and loading of active component were standardized.
- These pheromones and dispensers will form an important component of the IPM for the important pest of banana.
- Three types of antigens viz. Porcine Cyst Sonicate (PCS), Antigen B (Ag B) and Excretory/Secretory antigen (E/S Ag) were prepared and immunodiagnostic tests were

standardized with the above three antigens for ante-mortem diagnosis of porcine cysticercosis, a serious pig disease. The Dot -ELISA was found to be more sensitive, cheapest and suitable for field application.

- Polyclonal antiserum of Citrus yellow mosaic virus (CYMV) which is propagated through vegetative clones was produced and protocol for sero-indexing of nucellar mother trees of Sathgudi sweet orange has been standardized. This will help in identifying disease free clones for mass propagation.
- Nine strains of fluorescent Pseudomonads, *Pseudomonas fluorescens* exhibited good growth even at 41° c and showed good against *Rhizoctonia solani* (24.07- 37.03%) and against *Pyriailaria oryzae* (38.3-64.8%).
- In the process of genetically improving local isolates of the bio-control fungi *Beauveria bassiana* and *Metarhizium anisopliae,* a protocol for generation of protoplasts and their regeneration and fusion was developed. For mass multiplication of bio-agents, cost effective and easy to handle procedures were developed and the diphasic technique was standardized. In bid to recycle organic wastes and add value to.them, composting chopped urban wastes and agricultural wastes (combination of cereals, legumes and oilseeds) inoculated with *Pleurotus sojarcaju* (1 kg/t of waste) and rock phosphate (2% P2Os) and urea (1%N) as mineral additives enhanced the total content of P in the final product, the bio-inoculum improved the decomposition of mature and quality compost. Aerobic compost is preferred to get rid off the bad odour of degrading organic wastes.
- Light weight aluminum pole was introduced for harvesting oil palm fresh fruit bunches. For trees more than 3 m tall, a power tiller operated hydraulic ladder attachment was developed, the maximum height of reach was 8m and it could be extended to 10 m in combination with the primer. These devices will improve the efficiency of harvesting and tackle the problem of labour shortage.

Orissa

- Designing and development of Airlift bio-filter recirculatory system for the generation of brood stock and seed production of Indian river prawn *Macrobrachwm malcolmsonii* has been standardized. Production rate was 17.08 Post Larvae /1.

- Enhancing the quality of surimi-based products from dark fleshed pelagic fish like sardine was achieved, particularly with respect to gel strength by washing the picked meat in solution of sodium bicarbonate (3%). Value added surimi based products such as fish sausage, ham, amaboko, chikwa, hampen, fish ball, fish cake were prepared from these species.

Chattisgarh

- Medicinal plant spp. in the forests of Chhattisgarh are in higher concentration in mixed forests followed by Sal *(Shorea robusta)* and Teak *(Tectona grandis)* forests. Ninety-two and seventy-two extracts of medicinal plant species were found to have anti-bacterial and anti fungal properties respectively.

C 4: AGRICULTURAL ENGINEERING AND POST HARVEST ENGINEERING & TECHNOLOGY

Region V comprises of states of Andhra Pradesh, Chattisgarh and Orissa. The progress made during the past two years in this Region is given below:

1. FARM MACHINERY AND POWER

1.1 Power tiller operated wetland Leveler

The power tiller operated wetland Leveler was developed by ANGRAU, Hyderabad Centre of PTS. In one day equipment can cover 1 ha area for different type of soils; red, black cotton and chalka soils. The cost of leveler is Rs. 4,000/. This equipment is ready for multi-location trials.

1.2 Manually operated low land rice seeder

A low land rice seeder weighing 112 kg has been developed for sowing pre-germinated rice in puddled fields. The labour requirement varies from 15-20 man h/ha. ANGRAU, Hyderabad centre of FIM conducted demonstration of this machine & sowed different rice varieties covering 0.8 ha at farmers fields. It saves 93% labour, 63% operating time and 80% cost of operation compared to hand transplanting. It can cover 1 ha in a day. The cost of machine is Rs, 25.00 and its cost of operation is Rs. 600/ha.

Pre- germinated manual rice seeder was also demonstrated in Brahmagiri block of Puri Distt., covering 0.2 ha by centre of AICRP on FIM in Orissa.

1.3 VST Self-propelled rice transplanter

VST self --propelled rice transplanter was evaluated by ANGRAU, Hyderabad centre of FIM. The unit is single wheel driven fitted with 2.4 kW diesel engine. The machine covers 8-rows with 238 mm row spacing in single pass & have effective field capacity of 0.13 ha/h.

1.4 ANGRAU Animal drawn seed-cum fertiliser drill

Animal drawn seed-cum-fertiliser drill has been developed for planting groundnut, castor and sunflower. The use of machine saves 86% labour, 58% time and 52-68% cost of operation. The effective field capacity varies from 0.04-0.18ha/h . The cost of machine is Rs. 4,500/ and its cost of operation is Rs. 165/ha.

1.5 ANGRAU Animal drawn vegetable planter

ANGRAU, Hyderabad centre of FIM Project developed animal drawn vegetable planter costing Rs. 5,000/-. Its cost of operation varies from Rs. 220-306/ha. The effective field capacity is 0.10-15 ha/h. Ten units were manufactured by this centre & distributed for multi-location trials. The equipment is ready for commercialisation. The machine was used on farmers field for planting of French beans, lady's fingers and cluster beans.

1.6 Tractor Mounted sugarcane sett cutter planter

Evaluation of tractor mounted sugarcane sett cutter planter was done by OUAT, Bhubaneshwar. *It covers 1.5 ha area in one day. Use of this planter reduces labour requirement by 78% & saves*

50% time as compared to traditional practices. The sett are placed at uniform depth & distance. It reduces human drudgery because sett cutting and chemical (pesticides/fungicide) are also applied in single pass. The cost of operation is Rs. 1,468/ha.

1.7 ANGRAU self- propelled boom sprayer

ANGRAU centre of AICRP on FIM developed a Self- propelled boom spayer The field capacity of the unit is 0.60 ha/h with the discharge rate of 500 l/ha. It was demonstrated in 3.25 ha are in Aziznagar and Pochampalli villages to spray Rogar and Monochrotopos in lady fingers and cotton. The cost of the unit is Rs. 20,000/ and its cost of operation is Rs. 172/ha. The equipment is ready for multi-location trials.

1.8 Tractor mounted groundnut digger

Tractor mounted groundnut digger has been developed by ANGRAU, Hyderabad. It saves 64% labour and 43% operating time compared to manual digging. The cost of digging is Rs. 620/ha. It covers 2 ha area in a day and gives total 4% pod losses during digging operations. The cost of unit is Rs. 10,000/. Two manufacturers have supplied 80 units of this digger.

1.9 Groundnut Pod stripper

ANGRAU, Hyderabad centre developed a groundnut pod stripper. It consists of a wire loop type cylinder powered with 2 hp electric motor. It gives stripping capacity of 120 kg/h with no losses and 98% cleaning efficiency. The cost of equipment is Rs. 12,000/- Three manufacturers have supplied 500 units.

1.10 Multi-crop thresher

ANGRAU, Hyderabad centre of FIM Project developed 5 hp multi-crop thresher for threshing of paddy, pulses and oilseed crops. The cost of thresher is Rs. 35,000/ and its cost of operation is Rs. 56/q. Four manufacturers have supplied 1,000 units.

1.11 *Castor thresher*

ANGRAU, Hyderabad Centre developed a power operated castor thresher (3 hp) which has an output capacity of 250 kg/h. The cost of castor thresher is Rs. 16,000/-. Four manufacturers have supplied 100 units.

1.12 Tractor PTO operated winnower

A tractor (PTO operated) winnower was designed and developed by Hyderabad centre. It can discharge large volumes of air with high velocity. Hence cleaning efficiency is extremely high and 30-40 quintals of seed can be winnowed at a stretch. Two people can do winnowing operation simultaneously and it has an output capacity of 1000 kg/h in case of wheat.

1.13 Mechanisation Survey Project

A survey was conduct to know the level of mechanisation in Andhra Pradesh. Mechanisation study showed requirement of high capacity direct sowing devices and efficient self -propelled weeders for rice crop, sugarcane harvesters,self propelled high clearance sprayer, tractor mounted rotavator with ridger attachments for groundnut, potato, carrot, vegetable planters, tall tree sprayer, cotton pickers, orchard sprayer, power operated tree shaker for mango, sapota, guava, lemon, oranges. dehusker cum thresher for maize, self propelled harvester and thresher for green gram, black gram and Bengal gram crops.

1.14 Transfer of technology in Orissa

OUAT, Bhubaneshwar Centre of FIM (PT) Project carried out demonstrations of Balaram light weight power tiller for ploughing, puddling and tilling operations covering 3 ha area. Six training programmes on repair and maintenance of power tiller and 10 demonstrations were conducted during last two years. In Khurda district power tiller (National 6.5 hp) operated front mounted vertical conveyor reaper was demonstrated in rice growing region covering 0.4 ha. A farmers training programme was also organized at the above places. The survey was made to assess the annual use of power tiller in Khurda distt. The Power Tiller centre also demonstrated power tiller operated thresher- cum- winnower in villages namely Paniora (Mendhasal block) and in Jajarsingh village of Khurda distt.

Pregermianted manual rice seeder has been demonstrated in Brahmagiri block of Puri distt. covering 0.2 ha. Field demonstration of groundnut planter was carried out in Kuakhia Village of Jaipur distt., Bhuban village of Dhenkanal distt. and Panijora of Bhubaneshwar block. Industrial liaisoning for promotion of improved equipment were made by PTS of QUAT, Bhubaneshwar Centre to M/s Shekhar Engg. Works, Cuttack and M/s Nigam Engg. Bhubaneshwar.

2.0 POST HARVEST ENGINEERING AND TECHNOLOGY

2.1 Studies for conversion of existing tobacco barns for large scale drying of chillies

A survey was conducted to gather information on construction and operational details of tobacco barns. The tiers were used to place bamboo mats so that 30 cm. thickness of chillies could be loaded. The capacity of barn for drying chillies was 8 to 10 quintals of ripe pods depending on barn size. Experiments conducted recently indicated that 10-12 quintals of fresh chillies could be loaded on the tiers in existing tobacco barns for drying chillies through incorporating suitable modifications such as placing bamboo mats/iron grills. The drying time was 80-100 hours . The temperature ranges from 45^0 C to 50^0 C were found appropriate for drying of chillies. The colour appearance was superior than the product obtained by open yard drying. The discoloured pod was only 3.5% in barn dried produce in comparison to 10% in open yard sun drying. Further large scale study is needed to verify the findings.

2.2 Development of a high capacity chilli drier

A high capacity chilli dryer has been developed The designs to get large capacity batch and continuous type chilli dryer have been worked out in collabroation with a commercial manufacturer. The continuous model drier would have conveyor, drying unit anteroom, furnace, hot air circulatory system and moisture removing ducts. In batch type drier, cabinet and burner and heat exchanger could be transported to fields and assembled when required. A batch dryer with separate hot air generator could be preferred to minimise maintenance and drying costs. The quality of the product depends on type of heating system,number of times circulation of hot air takes place. The machine is being fabricated by the manufacturer.

2.3 Status of post harvest activities and agro processing industry.

A survey of various agro- processing industries viz. rice bran oil extraction plants, cashew processing industry, mango pulping units was conducted. Survey of various local post harvest practices and agro industries is in progress. The information about area, production, and productivity of various cereals and commercial crops had been completed. The data indicate that there were production clusters where processing industry could be established. It was observed that large paddy growing area exist. This was supported by presence of established rice million industry in Bhimavaram,Tadepalli Gudem, gudiada, Miryalagude, Nizamabad and Nellore. The processing clusters for pulses were at Tenali, ponnur and Narasaraopet. The production clusters for fish, prawn farming and horticultural crops were also identified.

2.4 PKV Dhall Mill

PKV dhall mill Bapatla installed PKV Dal mill and demonstrated it to popularise it amongst the farmers of this state & the traders for adoption. The dhall mill gave an output capacity of 100-120 kg/h while threshing black gram. The dal recovery was 77-78%.

2.5 Chilli seed Extractor

TNAU & PKV models of chilli seed extractor were installed by ANGRAU Bapatla and these were demonstrated to farmers & traders for adoption. The seed extraction efficiency of TNAU chilli seed extractor was found to be 98-99% and breakage was 1.2 to 2.5 %. The PKV chilli seed extractor being completely enclosed minimises the scrorehing, body irritation, continuous sneezing etc.

2.6 Studies on Sulphur content and other physico-chemical characteristics of Jaggery in different areas ofAndhra Pradesh

The information on prevailing practices of jaggery making in respect of cultural practices and manufacturing techniques followed by jaggery farmers for identification of problems in different jaggery areas of West Godavari District of Andhra Pradesh was collected and analysed. The study revealed that most of the farmers (medium to large) are following the recommended cultural practices for growing quality cane. The farmers are lacking improved cane varieties of different duration suited to the water logged conditions and those resistant to red rot. Farmers are applying the high quantity of fertilizers, especially, nitrogen. Due to irregular planting and harvesting of cane crop, lower cane and jaggery yield (11.6%- 31.5% and 15.3-36.3%, respectively) were observed. The present juice recovery ranged from 56-60% in vertical crushers & 58-62% in horizontal crushers.

Burugupalle jaggery has very good quality with respect to taste hardness and storage High quality jaggery popularly known as Dorabellam through black in colour is being prepared which has very good keeping quality and medicinal properties. The analysis of jaggery samples collected from different areas of West Godavari district revealed that out of 76 samples, 55 samples recorded 3-6 time more than 70 ppm SO^2 (critical limit). Burugupalle type of jaggery recorded less SO^2 content. The sucrose and total non sugar content of Burugupalle jaggery samples ranged from 82.0-88.6% and 4.4-8.4% respectively with less pore space of 1.18-4.45 cc/100 gms and less moisture content of 3.8-5.4%. Whereas rectangular block jaggery recorded sucrose and total non sugar content of 78.6-87.3% and 5.3-14.4%, respectively with high pore space of 3.63-5.39 cc/100 g. The keeping quality of Burugupalle jaggery was found to be good due to less initial moisture content (3.8-5.8%) and less pore space (1.18-4.45 cc. 100 g) with hardness.

2.7 Demonstration of improved technologies for jaggery making in different forms

Demonstration of making jaggery in granular, liquid and cubes using gur moulding frames was conducted in some of the villages of Vishakhapatnam district and training programme on the above was conducted in Srikakulam, Vishakhapatnam, East and West Godavari districts by Ankapalle centre of AICRP on J&K. Jaggery farmers showed considerably interest in making jaggery in above forms in large scale. Making jaggery in cubes and blocks (bucket shaped) using wooden/steel gur moulding frames is already practised by the farmers of Medak, East and West Godavari and Vishakhapatnam district and 100 g and 200 g cubes and 1 kg bucket shaped jaggery blocks are available in the market.

2.8 Development of technology for production of quality granular jaggery from immature and over aged sugar cane

Studies were conducted on preparation of quality granular jaggery from immature (10 months age) and over aged cane ('14 months age) of cane variety Co 7706 (12 months variety) by adjusting the pH of juice to different levels (6.2,6.5 and 6.8) and striking points (120°C and 122°C) and with and without addition of sugar @ 5 kg/1 tonne of cane of 600 kg juice. The quality of granular jaggery and its shelf life obtained from immature cane adjusted to pH 6.5 at striking point of 120°C with addition of sugar @ 5 kg/1 tonnes of cane or 600 kg juice to the syrup before making granules was found to be good. The quality and shelf life of granular jaggery prepared from over aged cane was improved by adjusting the pH of juice to 6.2 to 6.5 and at striking point of 120 °C with addition sugar @ 5 kg/1 tonne of cane or 600 kg juice to the syrup before making granules.

2.9 Status of post harvest activities and agro- processing industry

Survey of various agro- processing industries viz, rice bran oil extraction plants, cashew processing industry, mango pulping units was conducted ANGRAU, Bapatla. Survey of various local post- harvest practices and agro-industries is in progress. The information about area, production, and productivity of various cereals and commercial crops had been completed. The data indicate that there were production clusters where processing industry could be established. It was observed that large paddy growing are a exist. This was supported by presence of established rice milling industry in Bhimavaram, Tadepalli Gudem, Gudivada Miryalagude, Nizamabad and Nellore. The processing clusters for pulses were at Tenali, Ponnur and Narasaraopet. The production clusters for fish, prawn farming and horticultural crops were also identified..

3.0 ENERGY MANAGEMENT IN AGRICULTURE

At the centre of AICRP on RES located at CRRI, Cuttack, work on following projects is in progress:-

a) Multi-location trials of PAU packed bed solar air heater for drying paddy & other crops.

b) ORP of commercial solar water heater for parboiling of paddy.

c) ORP for PAU portable farm solar dryer & PAU domestic solar dryer.

COMMERCIALLY AVAILABLE FARM IMPLEMENTS AND MACHINERY SUITABLE FOR REGION -V

S. No.	Name of Equipment	Power source	Centre where developed	Work capacity ha/h	Cost Rs.		Benefit over conventional method % Saving in				Units manufactured (manufacturers)
					Initial (1997)	Operation per ha	Labour	Time	Cost	Increase in yield	
COMMERCIALLY AVAILABLE FARM IMPLEMENTS AND MACHINERY SUITABLE FOR REGION -V											
1	Animal drawn puddler	Bullock pair	APAU	0.07	1500	260	66-88	66-88	66-82	-	40,000(4)
2	Manually operated fertilizer broadcaster	One person	PAU	0.8	800	10	60	60	55	-	5000(4)
3	Twin wheel hoe	One person	CIAE	0.01	250	500	59	59	58	-	25000(3)
4	Naveen sickle	One person	CIAE	0.018	30	600	26	26	25		1200000(2)
5	Tubular maize sheller	One person	CIAE	18-20	20	30	66	66	70		1,25,000(5)
6	CIAE Groundnut cum castor decorticator	One person	CIAE	40-68	600	56	98	98	89	-	20000(5)
7	PKV Dhall mill	Two person	PKV	100-120 kg/h	40,000	50/quintal					
8	Chilli seed extractor	Two person	TNAU & PKV	80 kg/h	10,000						
9	Mango harvester	One person	IIHR	500 fruits/h	-	0.10 fruit					
10	CIAE Groundnut cum castor decorticator	One person	CIAE	40-68	600	56	98	98	89	-	20000(5)
FARM IMPLEMENTS AND MACHINERY UNDER COMMERCIALISATION FOR REGION -V											
1	Naveen dibbler	One person	CIAE	0.028	200	150	35	35	36		50
2	Rotary Dibbler	One person	CIAE	0.042	500	100	57	57	58		70
3	Seeding attachment to CIAE animal drawn tool frame	Bullock pair	CIAE	0.098-0.284	2500	90	73	73	55	10-18	30
FARM IMPLEMENTS AND MACHINERY YET TO BE COMMERCIALISED IN REGION-V											
1	Low Land Rice Seeder	Two person	TNAU	0.12	1200	370	93	63	80	16	-
2	Animal drawn potato planter	Bullock pair	IISR	0.1	8000	400	50	85	60	-	-
3	Tomato seed extractor	Two person	PKV, Akola								
4	Insect trap bin	One person	TNAU								
5	Cassava chipper	Two person	TNAU								

List of A.P. Cess Funded Adhoc Schemes

S. No.	Project	Place
1	Commercialisation of improved agricultural implements and machinery	ANGRU, Hyderabad (A.P.)
2	Manufacture and supply of CRIDA seeds drills/planter and other implements	CRIDA, Hyderabad
3	Antinutritional constituents in oilseeds and oilcakes	DOR, Hyderabad
4	Farm Implement manufacturing repair and servicing	IGKV,Raipur (Chattisgarh)
5	Evaluation and improvements of hydraulic structures and system operation in Mahanadi delta irrigation command	OUAT, Bhubaneshwar

C 5: ANIMAL HEALTH

1. ANDHRA PRADESH

1.1. Livestock Population

As per the Livestock census 1992, the state Comprises of Cattle 13322000, Buffaloes 13612000, Sheep 778800, Goats 4328000, Horses and Ponies 8,000, Donkey 41000, Pigs 650000. Poultry has the strength of 1977800.

1.2 Major Animal Health Problems

The state continues to record the outbreaks of FMD in cattle, sheep and goats. Among Poultry, Marek's Disease and IBD is quite common, however on account of better health management, the intensity of the disease considerably reduced. The migration of animals continues to be one of the greatest source of infection.

1.3 Infrastructural facilities

(a) Agricultural University

The state has a well developed Agricultural University having three Veterinary Colleges located at Hyderabad, Tirupati and at Vishakhapatnam. The College possess adequate facilities and are imparting education up to Ph.D. level in various desciplines.

(b) Directorate of Animal Husbandry

The state possess sufficient trained Veterinararians to look into the various health aspects of the state. It has a Veterinary Biological Production Unit (VBRI) located at Hyderabad which is engaged in the production, supply of various bacterial and viral vaccines.

1.4 ICAR PROGRAMMES

(a) **FMD Project:** One of the regional research centre of PD - FMD is located at VBRI Hyderabad and is in operation since 1968. The Centres is engaged in carrying out FMD virus typing and epidemiological studies in the region. Virus Type "O" is dominent in the region. The progress report was reviewed at the last annual scientist meet on FMD held at IVRI, Bangalore during Sept., 2002 and important recommendations made.

(b) **PD – ADMAS:** One of the regional unit is located at VBRI Hyderabad and is in operation since 1987. The extensive surveillance of all nationally important disease is being carried out. The unit has been adequately strengthened during the IX five year Plan in terms of various sophesticated equipments. The serum based brucellosis and IBR kits developed by PD - ADMAS were used for sero surveillance of the disease and significant obserations have been recorded. The annual progress report was last reviewed at the Annual Scientist Meet held at VBRI Hyderabad during Sept., 2002.

(c) Network on Blue tongue: One of the collaborating unit has recently been set up at College of Veterinary Sciences, APAU, Hyderabad and is engaged in the isolation and identification of virus. The progress is likely to be reviewed during Annual SCIENTIST MEET GOING TO BE HELD AT Hyderabad shortly

2. ORISSA

2.1 Livestock Population:

As per the livestock census 1992, the state comprises of cattle 17756000, Buffaloes 1924000, sheep 1838000, Goats 4943000, Pigs 584000.
Poultry has the strength of 6294000

2.2 Major Animals Health Problems:

The state continues to record sporadic incidence of FMD, HS and other Poultry diseases. The shortage of clean drinking water and feeds and fodder are the main sources of ill health.

2.3 Infrastructure facilites

The state has a full flodged state Directorate of Animal Husbandry located at Bhubaneswar. The state possess sufficient number of trained Veterinarians to look after and to provide health cover to its animals.
The state possess a well developed Veterinary *College* which imparts post graduate and research facilities to its students in the various desciplines of Animal Health. A well developed Animal Disease Research Laboratory catering to the need of disease diagnosis and control is existing. A Veterinary Biological Production unit is also existing and catering to other requirement of the state and manufacturing different biologicals for the control of diseases in Livestock and Poultry.

2.4 ICAR PROGRAMME

Adhoc schemes (in operation) Schemes	Duration	Total outlay
1 Mycoplasma infection in sheep and goats of Orissa and Control	24.2.2000 to 23.2.2003	24,70,000
2 Impact of f luorosis in Livestock of Orissa and its management.	Not yet started	19,10,000
3 Control of Blood Protista diseases in domestic animals with herbal medicines. Coordinated Project	18.11.2000 to 17.11.2003	19,50,000

(i) A collaborating Centre of PD - FMD is already in operation at the state of Orissa under the control of Directorate of Animal Husbandry. The unit primarily engaged in conducting epidemiological surveillance in the region. The report was reviewed in the last annual scientist meet on FMD held at IVRI Bangalore during Sept. 2002.

(ii) A collaborating unit of HS is already functioning in the College of Veterinary Science, Bhubaneswar. The unit engaged in conducting epidemiological surveillance and disease diagnosis.

(iii) One of the collaborating unit of ADMAS project is in operation and was set up in the IX Plan under the State Director of AH, Orissa. The unit is primarily engaged in conducting the extensive surveillance of all nationally important diseases.

3. CHHATISHGARH

3.1 Livestock Population :

There is no livestock population as the newly formed state is yet to conduct *exercise* in this directions.

3.2 Major Animal Health Problem

The newly formed state is yet to develop facilities to conduct various Livestock Health Programmes. Thee is no vaccine/Biological production.

3.3. INFRASTRUCTURE FACILITIES

State Animal Husbandry Department is having a network of Veterinary Hospitals and aid centre, with one College of Veterinary Sciences at burg under Indira Gandhi Agricultural University and engaged in imparting undergraduate, post graduate and doctoral education.

C 6: FISHERIES

The Fisheries Research under the ICAR in the Region No. V covering the States of Andhra Pradesh, Orissa and Chattisgarh is represented by the Central Institute of Fisheries Technology (CIFT), the Fisheries Research Institutes, namely, the Central Marine Fisheries Research Institute (CMFRI), the Central Institute of Freshwater Aquaculture (CIFA), the Central Institute of Fisheries Education (CIFE), the Central Inland Fisheries Research Institute (CIFRI) and the Central Institute of Brackishwater Aquaculture (CIBA) with the presence of either their Headquarters or their Research / Field Centres.

A. CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY (CIFT)

The CIFT with its research centres at Visakhapatnam in Andhra Pradesh and Burla in Orissa has undertaken research programmes for developing fishing and fish processing technologies in this region.

I. Review of Progress :

(i) The Visakhapatnam Research Centre of CIFT has operated following in-house projects in harvest & post harvest aspects during the period under report. These projects are ongoing.

- Development of Eco-friendly demersal trawls and resource specific trawls for demersal fishing
- Studies on the effectiveness of Experimental installation of Fish Attracting Devices (FADs) for fishery resource enhancement in and around Visakhapatnam coast
- Performance evaluation of suitable selective devices for elimination of fish by-catch (BRD) and Turtle Excluder Device (TED) in shrimp trawling
- Studies on Investigations on Post Harvest handling and processing of fish and shell fish of Andhra Pradesh.
- Studies on Bio-chemical, nutritional and functional properties of fish constituents.
- Studies on Nutrients, Toxicants, pollutants and growth promoters in aquaculture systems and processed marine products.
- Investigations on the prevalence of microbial hazards in fish & fishery environments and development of methods for their control.

Progress achieved during the reported period is:

Two designs of Eco-friendly trawls were designed and performance evaluation done by field trials. 23 fishing operations were made with Eco-friendly trawls. The Catch Per Unit Effort (C.P.U.E) recorded was 20 Kg/hr. These trawls found eco friendly and obtained a good catch of silver bellies followed by Ribbon fish, Sciaenids and squids

Multi disciplinary survey as a team are conducted at three places namely 1. In and around Visakhapatnam fishing harbour 2. Lawsons Bay fishing Village & 3. Muvvalavanipalem A design of benthic FADs constructed with scarp type and other discarded materials has been installed at 25 m depth off Visakhapatnam coast. Surveys were conducted around FADs to study the aggregation of fish and productivity. Gill nets and boat seines were operated around FAD to exploit FAD fishery. The gill net catches recorded were of Seer fish, Mackerel, Carangids, Tunas and Engraulids. The catches recorded from boat seine were Ribbon fish, Carangids, Engraulids, Lizard fish, sardines and Acetes. The average catch per boat recorded were of 40-50 Kgs.

Three designs of by-catch reduction devices and square mesh cod ends were evaluated for elimination of by-catch from shrimp trawls. Square mesh window and circular grid was fitted in a shrimp trawl. Escaped fish was collected in the cover and the morphometric data analysed, 50-60% of escaped catch recorded was the juveniles of fishes. Oval grid tied with square mesh cod end was fitted to the fish trawl. Small fishes were escaped through square meshes and bigger ones were retain in the cod end. 60 trawl owners were trained in designing, fabrication and installation of CIFT designed TED at Kakinada . The escapement of catch in TED installed shrimp trawl was (0.24%) at Visakhapatnam . By catch landings were monitored regularly at Visakhapatnam landing Center. The impact of pre and post conservation period of prawn fishery was also monitored.

About 200 sample tissues of edible muscle, skin, liver of different varieties of fish/shell fishes were digested for **heavy metal analysis.** These include marine fishes from East Coast, fresh water fishes from Hirakud reservoir area, Godavari river, Kolleru lake area. Total mercury in the meat of all the shrimp and fishes being exported is very negligible and well below the tolerable limit. Other heavy metals Pb,Cd, Zn, Cu were also within tolerable limits. Further monitoring is continued.

Analysis of about 50 samples of fish tissues caught from the inshore waters of fishing harbour in Visakhapatnam where the water is exposed to oil pollution, were analysed for the presence of **Poly Aromatic Hydrocarbon (PAH)** compound. The result showed the presence of naphthalene, acenapthalene, phenanthrene and anthracene compounds.

Fish procured from fish landing centres, fish markets and sea food processing plants, water, ice samples and swabs from processing plants & workers were analysed for the **presence of pathogens and indicator bacteria**

The sample were analysed for the presence of faecal streptococci, MPN total coliforms, MPN faecal coliforms, MPN E.coli, total enterobacteriaceae count and sulphite reducing clostridia. The levels of all these indicators are higher in market samples than in processing plant and landing centre samples. The sanitation quality of water and ice used for processing sea food was found to be good as indicated by the absence of indicator bacteria

The samples were checked for the presence of *Staphylococcus aureus, Vibrio cholerae* and *Salmonella.* Market samples, landing centre samples and processing plant samples were positive for the presence of coagulase positive staphylococci but the levels were within acceptable limit. Vibrio cholerae and salmonella could not be detected in any of these samples. However, salmonella was detected in one finished product of scampi.

Under the programme to study control of insect infestation in cured and dried fish, the treatment of cured and dried fish samples with a mixture of STPP + sodium benzoate + Citronella oil was found to be effective in controlling the four major spoilage problems namely the insect infestation, red halophalic bacterial attack, fungal growths and rancidity development. The treated samples of cured and dried ribbon fish (with STPP + benzoate + citronella oil) were in good condition without red halophiles and insect infestation and fungal growth even after 10 months storage at room temperature packed in polythene bags. Where as control samples (i.e. only cured with salt) showed red halophilic bacterial attack after 5 months storage and insect infestation after 8 months. The moisture content varied from 26 to 30% in all the samples. The Total Volatile Nitrogen (TVN) content in the control sample was 329 mg/100gm after 10 months whereas the treated samples showed in the range of (144 to 155) mg/100gm. The Peroxide Value (PV) were comparatively lower in treated samples. The overall appearance and quality of treated samples was superior to control samples after 10 months storage.

Under the programme on development of a simple process for removal of bones from fish fillets, to popularize utilization of fresh water carps, especially for export market, one block of specific needles were fabricated to remove the bones from the fish fillets and the bones were removed using the block, manually with a little damage to the tissue of the fillet. An overall decrease of around 10% was observed in the Wt. of the fillet after the bones were removed along with some bone-meal. The product had a higher consumer acceptability.

(ii) The Birla Research Centre of CIFT has operated projects in harvest & post harvest aspects during the period under report. The projects are ongoing. Progress during the reported period is as under;

Fishing Technology:

Trammel nets made of PP outer and nylon inner having seven different mesh sizes were tested for 197 fishing operations. A total of 12 fish species weighing 133.5 kgs caught from these fishing operations. *Labeo rohita, C. catla , S. silondia, L. fimbriatus and C. mrigala* were the dominated species consisting of 75 % of the catches. Nets having mesh sizes of 50, 55 and 60 shown the better performances with 58% contribution of the total catches.
Gill Nets made of High Tenacity Nylon Monofilament having seven different mesh sizes were operated for 294 fishing operations. A total of 24 species of fish, weighing 566 kgs. were caught from these nets. The catches were mainly comprised of *S. silondia, E. vacha, C. mrigala, L. rohita and M. singhala* about 73% of the total catches, which is followed by *R. cotio, L. fimbriatus, L calbasu, G chapra, R. chrysea and C. catla.* Nets having mesh sizes of 30, 35 and 40 contributed 61% of the total catches.

Two units of monoline consisting of 30 hooks of different numbers each was tested during 198 fishing operations. Small sized prawns and fishes were used as baits. A total of 20 fish species weighing 68 kgs caught from these monolines. The catches mainly comprised of *M. armatus, R. chrysea,M. gulio, M.seenghala, N. chitala, G.guiris and Anguilla bengalensis.* Catches from hooks numbers 15,16 and 17 were found 59% of the total catches.

Fish Processing:

Physical quality parameters and sensory evaluations were done on 432 fresh and iced fish from different wet-fish markets, landing centres and mobile vendors. Freshness of the samples were analysed using Intellectron Fish Freshness Tester. The observation revealed availability of poor quality of the fish due to fish sellers either do not use ice or not in proper quantities.

Ice storage studies were carried out on *Labeo rohita, Silonia silondia and Labeo calbasu* at predetermined intervals, for physical, biochemical, bacteriological and sensory changes. The studies revealed that fish procured from different markets were acceptabile up to 14 day while the farm fresh fish although having lower average weight were acceptable for 18 days.

Studies on physical, bacteriological, biochemical quality and sensory evaluation quality of commercial smoked freshwater fish were conducted on samples collected from different markets around Hirakud reservoir.

(iii) Training / Extension/ Education/ Demontration / Consultancy /Advisory

During the period under report, the CIFT organized short-term training programmes in fish handling, traditional fish processing techniques, product development, quality control, assurance and hygiene, fish harvesting techniques, gear fabrication etc. for the benefit of the entrepreneurs, fisher women & state fisheries officials.

The institute provided the analytical services to the fish processing industry. Samples of water, ice, fish meal, frozen fish and fish products were analyzed for the benefit of the industry.

Under transfer of technology training-cum-demonstrations were conducted on preparation of pickle, fish wafer and smoked fish in Guwahati (Assam), Shillong (Meghalaya), and Itanagar (Arunacahal Pradesh) in two separate programmes during the reporting period.

NABARD officials were given demonstration of smoking the fish in Burla model smoking kiln. The Burla model and the method of smoking were accepted by them for financing it to the fishermen community of Hirakud Reservoir.

Twenty seven fishing villages around close proximity of Hirakud reservoir were surveyed for socio-economic condition, types of fish harvested, methods of processing especially smoke curing, preservation and method of transportation. Observations reveal that fishermen are bound to sell their catch at very low prices to the middlemen due to lack of transportation and debt trap. Women are engaged in fish drying, fish smoking and selling their products in far off markets.

Survey work was undertaken in two phases during the period under report in Assam, Arunachal Pradesh and Meghalaya to assess the technological needs in NEH region in the fisheries sector, development of techniques for processing of fresh water fishes and imparting training in relevant aspects of fisheries technology for the NEH region. This resulted in identification of potential areas for transfer of technology developed by CIFT.

II. Constraints experienced and remedial measures. NIL

III. New Technology ready for transfer NIL

IV. Salient major achievements Covered under Progress of Research

V. Collaboration and liaison requirements

At present technologies are transferred in collaboration with agencies such as ATMA, other NGO's and respective Departments of the State Fisheries. The centres are collaborating with other sister institutions in multi-disciplinary research and development activities.

VI. Manpower training requirements.

The Scientists have to be trained in advanced analytical methods in fish processing technology and in computer aided design in gear modeling.

B. CENTRAL MARINE FISHERIES RESEARCH INSTITUTE (CMFRI)

In Region No. V. the Central Marine Fisheries Research Institute has one Regional Centre at Visakhapatnam, one Research Centre at Kakinada and six Field Centres in Andhra Pradesh and two Field Centres in Orissa. During the reporting period, a total of 38 projects were implemented at these Centres. The research projects on various aspects of capture and culture fisheries were successfully implemented and all the projects have registered good progress.

I. Review of Progress

Visakhapatnam Research Centre and Kakinada Research Centre monitor the impact of exploitation on finfish and shellfish stocks of the respective areas. Biology and stock assessment of demersal resources such as goatfishes, sciaenids, lizard fishes, nemipterids and pelagic resources such as sardines, mackerel, seerfishes and ribbonfishes are made. Studies were also being conducted on the various aspects of prawn fisheries of the northeast coast of India. Assessment of bivalve and gastropod resources of the region is also being carried out. Environmental characteristics of the inshore waters in relation to the fisheries are also being monitored. Research results indicated that there is scope for increasing the production of ribbonfish by increasing the age at first capture and effort. Mixed fisheries stock assessment of demersal fishes such as threadfin breams *(Nemipterus japonicus)*, sciaenids *(Johnius carutta)* and silverbellies *(Leiognathus bindus)* indicate that exploitation of these species have reached the MSY level. Investigations on crustacean resources indicate that the yield of *Penaeus monodon and P. indicus* have reached optimum level of exploitation.

(i) Capture Fisheries

Trends in marine fish landings along Orissa & Andhra Pradesh Coast

The marine fish landings of the coastal region consisting of Orissa and Andhra Pradesh, during 2002, has been estimated by CMFRI at 2.32 lakh tonnes which recorded a slight increase of about 7000 tonnes, compared to that of 2001. The important groups which contributed to the fishery were elasmobranchs, clupeids, croakers, ribbonfishes, pomfrets, mackerels, seerfishes and penaeid prawns. The contribution of elasmobranchs was 8000 tonnes which showed a reduction of about 4000 t. Among clupeids, lesser sardines catch was to the tune of 30,000 t during 2002, which showed an increase of 4000 t. Hilsa shad fishery during 2002 was 4000 t with a decline of 2000 t. The landings of croakers was 11,000 t and that of ribbonfishes 18,000 t. Mackerel fishery improved from 10,000 t to 15,000 t in 2002 whereas landings of seerfishes declined by 2000 t with an estimate of 8000 t. Penaeid prawn landings during 2002 was 24,000 t which recorded an increase of 4000 t.

Monitored the mass nesting of olive ridley turtle *Lepidochelys olivacea* along the Orissa coast (Bhitarkanika Wildlife Sanctuary). A total number of 7.4 lakhs of olive ridley nested during 2001 season along the Gahirmatha, Rushikulya and Devi river mouth when compared to 7 lakhs of olive ridley nested in March during 2000.

(ii) Mariculture

Mariculture activities include onshore learl culture and perfection of technology to produce disease free gravid females of tiger shrimp *Penaeus monodon.* In the onshore pearl culture technique, the pearl oysters are grown in cement tanks constructed close to the sea. The oysters are fed with a mixed diet of various species of phytoplankton. Growth of oysters is fast and they reach implantation size in about 6 to 8 months from spat. A major breakthrough in successful domestication of the tiger shrimp *P. monodon* has been achieved at Visakhapatnam Regional Centre.

II. Constraints experienced and remedial measures - NIL

III. New Technology ready for transfer - NIL

IV. Salient major achievements

Covered under Progress of Research

V. Collaboration and liaison requirements

The Visakhapatnam and Kakinada Research Centres of the institute have been maintaining collaboration and close liaison with sister fisheries institutions as well as other State & Central Government Agencies dealing with different aspects of marine fisheries.

VI. Manpower training requirements - NIL

C. CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE (CIFA)

The CIFA, in this region, is represented by its Headquarters and a KVK / TTC at Kausalyaganga in Orissa and a research centre at Vijyawada in A.P. with one ORP Centre each in Orissa, Andhra Pradesh & Balaghat (Chattisgarh) in this region.

I. Review of Progress

Research for Tribal Region

Technology of carp polyculture is being disseminated through demonstration and training in three Blocks of Kalahandi (Orissa - Koksora, Dharmagarh and Junagarh) and three Blocks of Bastar (Chhattisgarh - Bastar, Jagadalpur and Tokapal). 31 ponds covering 18 ha water area have been adopted involving as many as 206 beneficiaries in Kalahandi district. With a maximum of 2.45 t/ha, mean production levels of 1.4t/ha were achieved in adopted ponds of the centre during culture period of 6-8 months with regulated fertilization and supplementary feeding registering 3-4 times higher production in comparison to pre-adoption levels. Several off campus training were organized to educate the beneficiaries about various aspects of carp culture.

Multilocational testing of improved Jayanti rohu

Under multilocational field testing experiments, *Jayanti* rohu was cultured at Vijayawada Centre (Andhra Pradesh). Results indicated higher growth efficiency of improved rohy over control at the centre. Genetically improved rohy seed were also distribute to carp hatchery as well as seed tank owners for improvement of genetic status of rohuin their hatcheries. Breeding was taken up for *Jayanti* rohu at Vijayawada in collaboration with Andhra Pradesh State Fisheries Department.

Breeding of the ornamental fishes

Mass breeding of goldfish *(Carassius auratus)* and the indigenous rosy barb *(Puntius conchonius)* also achieved in small cement tanks at CIFA, Bhubaneshwar. In goldfish, colour development was noticed after one month when the fry measured 15-20 mm. A total of four variants in body colouration and caudal fin formation were recorded. Rural women of Khamanga Sasan and Mukhi Sahi (Balipatna Block) were trained (with demonstration) in rearing and culture of guppy, molly, swardtail and platy.

Participatory Technology Implementation

As part of participatory technology implementation, carp breeding was carried out in Sarakana village and village farmers were organized to take up carp fry and fingerling rearing in 13 ponds (0.99ha). Community - based aquaculture was undertaken at Balunga Sahi village of Khurda district involving 100 households in 1.6 ha Grampanchayat pond. Multicropping aquaculture based on the stocking with multi-sized carp fingerlings at high stocking density was also introduced to the farmers in a Grampanchayat pond of 3.5 ha for enhanced fish production. Poor village women of Sarakana and Dekhota carried out common carp breeding and produced 32 lakhs spawn fetching a net income of Rs. 8,345 with 187.3% return to total expenditure.

Management of coastal agro-ecosystem affected by super cyclone

Seven selected Grampanchayat ponds in super cyclone-hit Blocks of Ersama (Jagatsinghpu) and Astarang (Puri) were taken up composite fish culture with catla, rohu, mrigal, grass carp and common carp together with the giant freshwater prawn *(M. rosenbergii)* as poverty alleviation programme. Fishes were stocked @ 4000-5000 fingerlings + 10,000 post larvae (prawn)/ha. Farmers were supplied with inputs like rice bran, rice polish, groundnut oil-cake, soyabean and were advised to prepare supplementary feed by incorporating vitamins, minerals and probiotics. A partial harvest has shown 500-700 g size and 30-45 g size prawns in six months duration.

Spawning and seed production of non-conventional fishes

In order to diversify freshwater aquaculture, successful induced breeding and larval rearing of *Anabas testudineus, Clarias batrachus, Heteropneustes fossilis, Ompok pabda, Mystus vittatus, Labeo fimbriatus, Puntius gonionatus, Channa striatus* and *Pangassius pangassius* were achieved. Attempts are being made for mass-scale rearing of seed for commercial aquaculture.

Training of Rural Youths in Freshwater Aquaculture

Programmes were organized to impart training in the latest technologies in the frontier areas of freshwater aquaculture production system. 134 trainees were participated from Andhra Pradesh, 242 from Orissa and 131 from Chhattisgarh.

II. **Constraints experienced and remedial measures** - NIL

III. **New Technology ready for transfer** - NIL

IV. **Salient major achievements**

Covered under Progress of Research

V. Collaboration and liaison requirements

The institute has been maintaining close liaison and collaboration with sister fisheries institutions, State Agricultural Universities & Conventional Universities as well as other State & Central Government Agencies dealing with different aspects of fisheries and aquaculture.

VI. Manpower training requirements - NIL

D. CENTRAL INSTITUTE OF FISHERIES EDUCATION (CIFE)

The CIFE through its research centre at Kakinada in Andhra Pradesh is engaged in human resources development in various aspects of Fisheries Science through training, demonstration, extension education & education programmes besides location specific research on grow out culture practices.

I. Review of Progress

Experiments on eco-friendly culture practices in brackishwater aquaculture

In monoculture and polyculture experiments *P. monodon* stock was infected with WSSV (white spot) and clinical symptoms were observed in 40 days of culture. However, mortality was observed from 60^{th} day onwards. Therefore, ponds were harvested. The average weight range of prawns was 6.3-15.5 g and survival rate 12.5 to 57.3%.

Culture of Milkfish *(Chanos chanos)* in polyculture ponds was continued for 6 months period with an yield rate of 698 kg/ha/6 months. While in monoculture at higher stocking density production of 933- 969 kg/ha/7 months was recorded with survival of 78 to 81 %.

Sea bass culture was conducted for 8 months period with a stocking density @ 8,000 nos/ha gave a production of 557 kg/ha/6 months with a survival of 18.6% . The seabass was fed on indigenously formulated diet, which was applied at 5% body weight.

Seabass *(Lates Calcarifer)* Culture

Monoculture : 600 nos of seabass (average length 19.75 mm) procured from Central Institute of Brackishwater Aquaculture, Chennai were acclimatized and stocked in 0.081 ha pond @ 7400 nos/ha) during the month of September, 2000. The seed was fed with mysids and adult Artemia. 95% survival rate was recorded in seed phase. The fry were fed with live mysids and trash fish mixed with rice bran, soya cake and shark liver oil @ 3-5% of body weight in two schedules. After 100 days of culture period 37.9 kg production was achieved with 23% survival. The production rate was 467.9 kg/ha/in 100 days.

Training / Extension/ Education/ Demontration / Consultancy /Advisory

The institute organized short-term training programmes through its research centre at Kakinada during the period under report in Brackishwater finfish and shellfish culture, Fresh Water Prawn and Fish Culture, Giant Prawn Hatchery Management and Grow-out Techniques, Breeding and Culture of Carps, Brackishwater finfish & Shellfish, Freshwater Prawn Hatchery Management, some aspects of Inland Fisheries for the A.P. State department officers of SIFT, Kakinada, Freshwater Prawn and Fish Farming, Awareness cum-training programme on Scampi Farming.

Besides, the training programmes, the institute has transferred the technology of scampi culture to the farmers of Telangana Region of A.P. Technical guidance was provided on stock manipulation, partial culling, health management etc.

Farmers meet was regularly organized by CIFE Centre at Kakinada in management of Giant Freshwater Prawn Hatchery and advances in immuno-pathological techniques in fish & shellfish health management.

II. Constraints experienced and remedial measures - NIL

III. New Technology ready for transfer - NIL

IV. Salient major achievements

Covered under Progress of Research

V. Collaboration and liaison requirements

The centre has been maintaining close liaison and collaboration with sister fisheries institutions, State Agricultural Universities & Conventional Universities as well as other State & Central Government Agencies and NGOs dealing with different aspects of fisheries and aquaculture.

VI. Manpower training requirements NIL

E. CENTRAL INLAND FISHERIES RESEARCH INSTITUTE (CIFRI)

The CICFRI has directed its efforts to collect fish catch statistics data from certain selected reservoirs of Andhra Pradesh through its centre located at Eluru. The progress during the period under report is;

Monitoring of fish catch and effort in selected reservoirs of Andhra Pradesh

Yerrakalva Reservoir

The fish catch structure of the reservoir indicated substantial increase in fish productivity during the post introduction phase of major carps. The Indian Major Carp catch has increased from 36% to 60% (*C. catla* 30% and *L. rohita* 25%). Besides, there are positive indications to suggest that the Indian major carps are breeding in the reservoir, a phenomenon generally rare in small and medium reservoirs.

Wyra Reservoir

The fish catch structure of Wyra reservoir indicated the dominance of miscellaneous fish species to the tune of 69.8%. Among the miscellaneous groups the Gobiids were predominant (20.6%) group followed by catfish (11.5%), *E. suratensis* (7.4%), *M. guentherii* (6.6%) and others small fishes including Channa spp. (22.7%). The contribution of Carp fishery (IMC as well as minor carps) was estimated at 31.2%.

II. Constraints experienced and remedial measures - NIL

III. New Technology ready for transfer NIL

IV. Salient major achievements

Covered under Progress of Research

V. Collaboration and liaison requirements

The centre has been maintaining close liaison and collaboration with the Fisheries department of the Andhra Pradesh.

VI. Manpower training requirements - NIL

F. CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE (CIBA)

The CIBA represents Region No. V through its Puri Research Centre. The work programmes taken up at Puri under the Institute's projects during the period under report are:

a) Culture of tiger shrimp *Penaeus monodon* in low saline environment
b) Culture of seabass in freshwater pond at CIFA
c) Survey of shrimp farms for disease monitoring
d) Shrimp health and soil and water quality monitoring of shrimp farms

Progress under each project is;

a) Culture of tiger shrimp *Penaeus monodon* in low saline environment

Culture of *P. monodon* in freshwater conditions was taken up in a 800 m^2 pond at CIFA, Bhubaneswar. Postlarvae and advanced juveniles of *P. monodon* were gradually acclimatized to low saline conditions (upto 2 ppt) in the hatchery to stock in freshwater ponds. Reduction of salinity below 2 ppt resulted in heavy mortality and total mortality occurred at 0 ppt.

b) Culture of seabass in freshwater pond at CIFA

Seabass fry produced at CIBA hatchery at Muttukadu were acclimatized to freshwater conditions at CIFA, Bhubaneswar and stocked in a 800 m^2 pond. In 5 months, the fishes attained average weight of 200 g.

c) Survey of shrimp farms for disease monitoring

The dynamics of white spot virus disease in zero water exchange ponds (confined ponds) of Orissa was studied. Benthic organisms like amphipods were found to be major carriers of WSSV.

e) Shrimp health and soil and water quality monitoring of shrimp farms

Shrimp farms located at Nagpur, Astaranga and Tichna Chandrabhaga in Puri district were monitored. The production of *P. monodon* ranged from 921 to 1360 kg/ha. White spot viral disease was reported from all the farms.

Progress of research work at Andhra Pradesh

The Institute has no research centre in Andhra Pradesh. However, the Institute has taken several research programmes which have a bearing on the state of Andhra Pradesh.

Under genetic characterization of shrimp and fishes, the Asian seabass *L. calcarifer* and *P. monodon* from Kakinada were analysed at morphometric and molecular levels.

Regular surveys were conducted to monitor the incidence of white spot virus disease in the shrimp farms of Nellore, Krisha and East Godavari districts.

Database on the socio-economic evaluation of farming practices and environmental impact assessment of shrimp farming is prepared based on extensive surveys carried out in the coastal districts of Andhra Pradesh. Two training programmes were also conducted on aspects of brackishwater aquaculture, wherein one was exclusively for fisherwomen.

II. Constraints experienced and remedial measures - NIL

III. New Technology ready for transfer - NIL

IV. Salient major achievements

Covered under Progress of Research

V. Collaboration and liaison requirements

The Puri Research Centre of CIBA is involved in providing advisory services to farmers in liaison with State Fisheries Dept./BFDAs. Monitoring of farmers' ponds for shrimp health and water and soil quality is being carried out by this centre in the shrimp farms located in the northern region of Puri at three villages viz., Tichna 8Chandrabhaga, Astarang and Nagpur under an ICAR Adhoc-Scheme (AP Cess Fund Scheme) entitled "Shrimp health and soil quality monitoring for sustainable shrimp farming".

VI. Manpower training requirements

Since the Puri Centre is mainly engaged in monitoring and advisory services to farmers, the scientific and technical personnel at this centre may require short term training in shrimp / fish health management and water / soil quality monitoring and management of culture systems.

Ad-hoc Schemes in operation during the last two years (2000-02) in the States of Orissa, Andhra Pradesh & Chattisgarh.

- "Technological innovations in aquaculture and its effect on sustainability of farming systems in Andhra Pradesh" implemented through CIFA, Bhubaneswar.
- "Improvization of a farm feed for juvanile & sub-adult carps through incorporation of plant and animal ingredients" implemented through Andhra University.
- "Fish health management through herbal materials for sustainable aquaculture" implemented through CIFA, Bhubaneswar.

- "Effect of ambient iodine on the growth and reproduction of catfish, *Clarias batrachus*" implemented through College of Fisheries, Berhampur.
- "Hatchery technology for large scale seed production of Indian river prawn *M. malcolmsonii*" implemented through CIFA, Bhubaneshwar.
- Effect of a synthetic pyrethroid and carbofuren of Indian Major Carp on their impact on Aquatic environment" implemented through CIFA, Bhubaneshwar.
- Accumulation, magnification and removal of heavy metals in sewage fed ecosystem" implemented through CIFA, Bhubaneshwar.
- "Development of newer immunodiagnostics against important microbial diseases of fish & shellfish" implemented through CIFA, Bhubaneshwar.
- "Investigation on genotoxic effects of various pesticides, insecticides and weedicides used in Agriculture & Aquaculture on Indian Major Carps" implemented through CIFA, Bhubaneshwar.
- "Studies on algal associations in freshwater pond system with reference to bio-active compounds" implemented through CIFA, Bhubaneshwar.
- Fish Production during the last five years (1996-2001)

(In , 000 tonnes)

Year	**Andhra Pradesh**	**Orissa**	**Chattisgarh**
1996-97	359.36	276.96	-
1997-98	372.86	309.51	-
1998-99	410.82	284.23	-
1999-00	547.06	261.24	-
2000-01	589.65	259.65	43.39

C 7: AGRICULTURAL EDUCATION

Education Division supports and promotes agricultural education in the country. This objective is fulfilled by providing financial assistance for education development and HRD activities undertaken by SAUs. Besides these, activities of AICRP on Home Science and A.P. Cess Fund projects are also supported by the Education Division. In the Region V, Education Division is having interaction with the following institutions:

- Acharya N.G. Ranga Agriculture University, Hyderabad
- Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh
- Orrisa University of Agriculture and Technology, Bhubaneshwar
- National Academy of Agricultural Research Management, Hyderabad
- Centre Rice Research Institute, Cuttack
- Centre Research Institute for Dryland Agriculture, Hyderabad
- Directorate of Oilseeds Research, Hyderabad
- Directorate of Rice Research, Hyderabad
- Central Institute of Freshwater Aquaculture, Bhubaneswar (Orissa)

1. Financial support provided during 2002-2003:

Scheme	Budget sanctioned (Rs. in Lacs)			
	ANGRAU	IGKV	OUAT	NAARM
Plan				250.00
Development & Strengthening of Education including RAWE	215.00	165.00	147.00	
AICRP	47.82	-	-	
Centre of Advance Studies	7.44			
Non Plan	-	-	-	433.00

For the timely release of funds, grant utilization certificate for the first release and Audit Utilization Certificate for the subsequent releases is the requirement. SAUs had delayed in meeting this requirement.

2. Development and Strengthening of Agricultural Education:

In the Region II, support to three SAUs viz. Acharya N.G. Ranga Agriculture University, Hyderabad, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh, Orrisa University of Agriculture and Technology, Bhubaneshwar was provided for the following activities:

- *Repair, renovation and replacement of the existing facilities:*

- Curriculum development and delivery systems
- Establishment of student computer laboratory at College level.
- *Establishment of a Central Instrumentation Facility at College level.*
- Student Study and Educational Tours.
- Participation of faculty in any National and International Symposia/Workshops/Conferences
- Faculty exchange programme among SAUs/DUs/CUs.
- Rural Awareness Work Experience.

3. Human Resource Development:

- Training Courses: The following courses were organised by the SAUs and ICAR Institutes of the region for scientists and faculty members:

- Summer/ Winter School and Short Courses of the year 2002-2003

Orissa

Subject	Course Director	Institute
Rice - Fish Farming	Dr. D. P. Sinhababu Principal Scientist	Central Rice Research Institute, Cuttack - 753006
Advances in Propagational Methods for the Production of Quality Planting Materials of Tropical and Sub-tropical Horticultural Crops.	Dr. D. P. Ray Professor and Head	Department of Horticulture, Orissa University of Agriculture and Technology, Bhubaneshwar – 751003
Characterisation and Sustainable Management of Acid Soils of Eastern India.	Dr. U. K. Misra Professor and Dean	Deparment of Soil Science & Agri. Chemistry, Orissa University of Agriculture & Technology, Bhubaneshwar-751003

Advances in Agricultural Marketing	Dr. S. Subba Reddy Head	S.V. Agricultural College, ANGR Agricultural University, Tirupati-517502,
Advances in Natural Resources Economics and Management.	Dr. V. T. Raju Professor and Head	Department of Agricultural Economics., Agril. College, ANGR Agricultural University, Bapatala-522101 (Andhra Pradesh)
Value Added Fish products from Low Cost Fish	Dr. G. Vidya Sagar Reddy Associate Professor and Head	Dept. of Fish Processing Technology, College of Fishery Science, Acharya N.G. Ranga Agricultural University, Muthukur - 524344
	Dr. D. Srinivasulu Reddy, Professor and Head	S.V. Agricultural College, ANGR Agricultural University,' Tirupati - 517502, Chittoor
Organic Farming for Sustainable Agriculture.	Dr. Sharada Devi Anne Professor and Head	College of Home Science, ANGR Agricultural University, Saifabad, Hyderabad - 500004
Computer Aided Apparel Designing.		
Visual Presentation Techniques in Interior Designing.	Dr.(Mrs.) Mahalashmi V. Reddy Associate Professor	Department of Resource Management and Consumer Science, College of Home Science, Hyderabad-500004
Drought Management.	Dr. K.D. Sharma Principal Scientist & Head	Central Research Institute for Dryland Agriculture, Santoshnagar, Saidabad, Hyderabad-500059
New Dimensions in Integrated Insect Pest Management in Major Field Crops.	Dr. Harvir Singh Principal Scientist and Head	Crop Protection Section, Directorate of Oilseeds Research, Rajendranagar, Hyderabad - 500030
Advances in Hybrid Rice Technology	Dr. B. C. Viraktamath Principal Scientist & Head	Directorate of Rice Research Rajendranagar, Hyderabad-500030
Wasteland Development in Rainfed Areas.	Dr. J. V. Rao Principal Scientist & Head	Agronomy Cell, Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad - 500059

- Dr. A.K. Sahu, ICAR National Fellow at CIFA is operating a National Fellow Scheme entitled "Enhancement of Seed Production of Asiatic Catfish, Clarias batrachus using sustained hormone preparations." Results obtained have shown enhancement of seed production on Asiatic Catfish, *clarias, batrachus* by hormones.

- Centre of Advanced Studies on Foods & Nutrition at ANGRAU, Hyderabad. The Centre organised the following two training programmes during the year 2002-2003. Recent advance in Rumen Microbiology and Biotechnology Recent advance in Energy Metabolisum.

4. Home Science

a. AICRP on Home Science (Multidisciplinary):

There are nine AICRP centres, of these one Centre at AAU,Assam is in Region II. The thrust of the project is on Nutritional Security for Human Health in Agrarian Ecosystem; Comprehensive Child Care through Farm Creche, Ergonomic Management of Drudgery; Value Addition to Agro and Animal Based Fibres; Indigenous Knowledge used by rural women in farming and animal husbandry. Following are the highlights of achievements:

- Nutritional guide developed.
  - Data collected from 32,990 rural children for child care and growth norms of rural children.
  - 36 plant based dye material identified and used to dye Cotton and soils in 5400 different shades.
  - For empowerment or rural women database of 27,000 rural women of 41 agro-climatic zones developed on for their indegrons knowledge, participation in decision making and time use pattern.
- Based on indigenous knowledge of farm women technology kits prepared.
- Guidelines and methods for drudgery reduction in farming and home activities are
- being developed. „

The mission mode project of NATP "Empowerment of Women in Agriculture" Under NATP project, orissa sate is concerned. The project envisages its mission as "Technological and economic empowerment of farm women" to reduce their drudgeries and increase work efficiency in the context of agriculture and animal husbandry and skill development for entreprenurship development. The project is placed under NRCWA, Bhuwaneshwar.

5. A. P. Cess Fund:

One scheme each at ANGRAU Hyderabad and at OUA&T, Orissa are currently under implementation. Three new schemes one of ANGRAU and two at NAARM have been accorded financial sancation.

6. All India Entrance Examination for UG & PG admissions:

Admission in U.G. and P.G.Programmes

For admissions in U.G. and P.O. Programmes to filling 15% positions in U.G. and 25% in P.O. candidates were allotted from the All India Competitive Entrance Examination merit list to the following universities in Region- V.

- Acharya N.G. Ranga Agricultural University, Hyderabad
- Orissa University of Agriculture and Technology Bhubaneswar
- Indira Gandhi Krishi Vishwavidyalaya, Raipur

A total of 96 students from ANGRAU, 27 from OUA&T and 21 from IGKV were successful in the All India Entrance Examinations held during June 2002 and were admitted in P.G. Programmes in different universities of the country. The admissions to these universities had been 58, 29 and 15 respectively. In under Graduate programmes, 73, 20, and 12 candidates took admissions in the three Universities respectively. The number of Junior Research Fellowships earned by the students of these universities out of total 450 were 24, 7, and 5 respectively. Where as the number of JRF students from other universities seeking admission in the above universities were 21,2 and 3 respectively.

Among all the SAUs in the country, the ANGRAU stood fifth and OUA&T stood ninth as far as the number of JRF is considered during the[1] year 2002.

7. National Academy of Agricultural Research Management

The mission of NAARM is to "enhance the performance of NARS by building capacity in research and education policy, planning and management and to foster a scientific culture that can make the NARS highly productive globally".

Initially NAARM was mandate primarily to organize induction level training programmes or the ARS entrants. Later on, the training activity was expanded to cover the scientists at all levels. Subsequents, NAARM accepted the responsibility or organizing training programmes. Workshops and seminars in the specialized areas of agricultural research and education management for the scientists of ICAR institutes. State Agricultural Universities (SAUs), public and private sector units.

The current mandate of NAARM is presented below:

- To organize and conduct training programmes in agricultural research management for the scientists at various levels.
- To build up high quality resource material in agricultural research management based on actual field experience.
- To undertake systematic review and study of management problems of agricultural research institutes, programmes and systems.
- To plan, organize and conduct workshops and seminars in research management and educational technology.
- To organize, liaise and coordinate programmes of international cooperation in the field of agricultural research management.
- To assist the State Agricultural Universities in developing Regional Centers of Management to cater to the needs of various Universities.

Training programmes organized in the year 2002

Sl.No	Title	Sponsors/ Revenue Generated *	Coordinator(s)
A. Foundation Course for Agricultural Research Service (FOCARS)			
1	74 FOCARS	ICAR	D Rama Rao, BS Chandel KHRao
2	75 FOCARS	ICAR	MM Anwer, N Sandhya Shenoy RVS Rao

B. Refresher Courses (covered under CAS)			
3	Information Technology in Agriculture	1.85	M Narayana Reddy, NH Rao
4	Information Technology in Agriculture	1.80	K Vidyasagar Rao, BS Sontakki
5	Agricultural Research Project Management	0.96	MM Anwer, D Rama Rao VKJRRao
6	Agricultural Research Project Management	0.76	SN Saha, R Kalpana Sastry
7	Information Technology in Agriculture	1.80	K Vidyasagar Rao, KM Reddy
C. Senior Programmes			
8	Refresher Course on Administrative and Financial Management	0.75.	M Suresh Kumar, SK Pathak
9	Methodologies for Manpower Planning in Agriculture	0.42	D Rama Rao, SK Nanda
10	Workshop on Gahan Hindi Prashikshan	0.80	A Gopalam, J Renuka
11	Computer Applications in Agriculture	0,28	K Vidyasagar Rao, KM Reddy
12	Project Management Using Microsoft Project	0.18	SK Nanda, NH Rao D Rama Rao
13	Workshop on Change Management	0.16	SN Saha, MM Anwer BS Sontakki
14	Workshop on Motivation Techniques	0.04	MM Anwer, KH Rao RVSRao
15	Agricultural Research Prioritization Techniques	NATP	BS Chandel, SK Soam
16	Statistical Analysis for the Socio- Economic Research Project Data (Co-Pi's of NATP)	0.10	K Vidyasagar Rao, M Narayana Reddy
17	Leadership and Personality Development	0.20	P Manikandan, MM Anwer
18	Executive Development Programme in Agricultural Research Management	0.21	J Challa, SN Saha
19	Workshop on Gahan Hindi Prashikshan	0.94	A Gopalam, Pradeep Singh
20	Stress Management	0.16	S Shanmugam, P Manikandan
21	Computer Applications for Administrative and Financial Management	1.84	K Vidyasagar Rao, R Kalpana Sastry, SK Pathak
22	Workshop on Management of Agricultural Education	0.28	SN Saha, A Gopalam
23	Agricultural Research Prioritization Techniques	0.56	BS Chandel, SK Soam
24	Management Programme for Women Scientists	0.27	N Sandhya Shenoy, R Kalpana Sastry

25	Impact Assessment of Agricultural R&D	0.22	BS Chandel SKSoam
26	Web Designing and Developing Web Pages	0.27	N Sandhya Shenoy M Narayana Reddy
27	Computer Applications in Agriculture	0.52	KM Reddy K Vidyasagar Rao
28	Educational Video Production	0.68	KR Prabhakar Janardhan Rao
29	GIS Applications in Agricultural Research	0.28	M Narayana Reddy NHRao
30	Management Development Programme in Agricultural Research	0.30	J Challa, RVS Rao
31	Workshop on Official Language Policy	0.92	A Gopalam, D Venkateswarlu
D. Sponsored Programmes including summer/winter schools			
32	National Seminar on Veterinary Drugs and Pharmaceutical	DST	D Rama Rao, KS Reddy (ANGRAU)
33	Summer School on Recent Advances in Agricultural Research Project Management (covered under CAS)	ICAR	Director, Summer School T Balaguru, Coordinators S Shanmugam, NH Rao SKNanda, SKSoam
34	Summer School on Educational Methodology and Instructional Technology for Teachers of SAU's	ICAR	Director, Summer School A Gopalam, Coordinators P Manikandan, MM Anwer BS Sontakki, KH Rao
35	Winter School on Advanced Course on Management of Human Resources in Agriculture	ICAR	Director, Summer School MM Anwer
36	Retreat for Top 20 ICAR Leadership	NATP	Prof. Indira Parikh IIM, Ahmedabad
E. International Programmes			
37	Study Tour of Mr Sameer Omar Ahmed from yemen	FAO (US $ 10,4007-per participant)	NHRao
F. Other Programmes			
38	One-day workshop-cum- Meeting on Review of Performance Appraisal (participants from local ICAR institutes)	ICAR	D. Rama Rao

* Rs. in Lakh

C 8: AGRICULTURAL EXTENSION

There are 34 Krishi Vigyan Kendras (KVK) functioning in the region comprising the states of Andhra Pradesh, Orissa and Chhattisgarh. Out of which 13 KVKs are in Orissa, 17 in Andhra Pradesh and 4 in Chhattisgarh. Besides, the ICAR has also strengthened the existing Zonal Agricultural Research Stations (ZARS) under State Agricultural Universities to take up the additional functions of KVK under National Agricultural Technology Project (NATP) in five districts viz. two in Orissa and three in Andhra Pradesh. The Council hs also sanctioned four Agricultural Technology Information Centres (ATIC) one each in Andhra Pradesh, Chhattisgarh and two in Orissa; five Institution-Village Linkage Programmes (IVLP) one each in Andhra Pradesh, Chhattisgarh and three in Orissa.

The State-wise progress of research is given below:

1) Orissa:

During the last two years, the KVKs organized a total number of 757 training programmes benefiting 13,608 farmers, farm women, rural youths and extension functionaries on various aspects of crop production, soil conservation, plant protection, horticulture, livestock production and management, use of improved tools and implements, home science and other related areas. Besides, the KVK organized various extension activities numbering 295 including kisan melas, kisan goshties, field days, radio/TV talks, newspaper coverages, advisory services etc. which were participated by 11,326 beneficiaries. The KVKs also published 107 extension literature for the benefit of farmers and extension personnel for their day to days use. The KVKs organized Frontline Demonstrations (FLD) on oilseed and pulses on 6678 ha. and 204.9 ha. which benefitted 2572 and 770 farmers respectively. Besides, the FLD on oilseeds, the KVK also organized Frontline Demonstrations on horticultural and other cereal crops on 240 ha. benefitting 1288 farmers. The KVKs produced 994.93q. quality seeds of various cereal crops and raised 17,23,153 seedlings/saplings of various crops including vegetables, fruits etc.

2) Andhra Pradesh:

In the state of Andhra Pradesh, the KVKs organised 2572 training programmes benefiting 70,523 farmers, farm women, rural youths and extension functionaries on various aspects of crop production, soil conservation, plant protection, horticulture, livestock production and management, use of improved tools and implements, home science and other related areas. In addition, the KVKs orgnised 154 field days, 84 kisan melas, 352 other activities including exhibition, kisan goshties, diagnostic visits and other farm advisory activities. Apart, KVKs organising Frontline Demonstrations on Oilseeds and Pulses on 844.3 ha. in a participatory mode with 2098 farmers. Besides, FLDs were also conducted on cereal crops covering 607 ha. with 1085 farmers for disemination of various technologies. The KVKs produced 552.9 tonnes of seeds of cereal crops, 16.8 tonnes of pulses, 29.6 tonnes of oilseeds and 1.1 tonne of vegetable seeds and 2.81 lakhs saplings/seedlings were also produced for fruit, vegetables and plantation crops.

3) Chhattisgarh

There are four KVKs are functioning in the State. During the last two years, the KVKs organized 271 training programmes benefiting 5820 farmers, farm women, rural youths and extension functionaries on various aspects of agriculture, horticulture, animal husbandry, fisheries. Besides, the KVKs organized *56* various extension events viz., Field days, Kisan Mela, Kisan Goshties, Clinic Diagnostic services, newspaper coverages etc. The KVKs published 38 extension pamphlets for the benefit of farming community. The Frontline Demonstrations were conducted on oilseeds amd pulses on 60 ha. and 30 ha. benefiting 155 and 75 farmers respectively. Besides oilseed and pulses demonstrations, the KVKs organized other demonstrations viz., horticultural crops and cereal crops on 59 ha. benefiting 329 farmers. 682. 91q. seed of various crops and 1550 seedlings/saplings of fruit crops were also produced and sold to the farmers.
Under the National Agricultural Technology Project (NATP), the Council have sanctioned four Agricultural Technology Information Centres (ATIC) one each in Andhra Pradesh and Chhattisgarh and two in Orissa. Under the ATICs, a total number of 4690 farmers visited ATICs during the last two years. A total number of 3820 Farm Advisory services were also provided through telephone, postal to 3802 farmers. 25.26 quality seeds, 20126 seedlings/saplings, 435 packages of bio-fertilizers were made availble by ATICs to the farmers for various cereals and vegetable crops. Besides, 590 soil and 341 plant samples were analysed and recommendations were made. Literatures relating of agriculture, animal husbandry and allied areas were made available to 17192 farmers. A total number of 26603 animals were treated under ATICs. The gross income of Rs. 106.81 lakhs was reported for Chhattisgarh and Orissa.

Under strengthening of Zonal Agricultural Research Stations (ZARS} to take up the additional functions of KVK (3 in Andhra Pradesh and 2 in Orissa), a total number of 325 training programmes were conducted benefiting 9113 farmers, rural youths and extension functionaries. The ZARS producted 878.20q. seed of various crops and 3740 planting materials were sold to the farmers. The FLDJwere conducted on 126 ha. covering 433 farmers under oilseed and pulses demonstrations. The Institution-Village Linkage Programme (IVLP) is functioning at five centres one each in Andhra Pradesh, Chhattisgarh and three in Orissa. A total number of 4083 farmers have been covered in 22 villages. 154 technological interventions, 74 on-farm trials and 72 varital trials were conducted.

STATEWISE LIST OF KRISHI VIGYAN KENDRAS (KVKs) AND TRAINING CENTRES (TTCs)

ANDHRA PRADESH

ADILABAD

1. KVK, Sri Krishan Educational and Charitable Society, Manchiryal, Adilabad.
2. AICRP - Agronomic Research, Adilabad (Andhra Pradesh Agricultural University)

Renamed as KVK, Adilabad

ANANTAPUR

1. KVK at Andhra Pradesh Agricultural University, Anantapur.
2. Agricultural Research Station of APAU, Anantapur.
3. AICRP - Millets, Anantapur (Andhra Pradesh Agricultural University)
4. AICRP - Arid Fruits, Anantapur (Andhra Pradesh Agricultural University)
5. AICRP - Dryland Agriculture, Anantapur (Andhra Pradesh Agricultural University)
6. AICRP - Agro-Meteorology, Anantapur (Andhra Pradesh Agricultural University)

CHITTOOR

1. KVK, Rayalaseema Seva Samithi, Tirupati, Chittor.
2. S.V. Agricultural College, Tirupati, Chittor.
3. College of Veterinary Science, Tirupati, Chittor.
4. Dairy Science College, Tirupati, Chittot.
5. AICRP - Agronomic Research, Chittor (Andhra Pradesh Agricultural University)
6. AICRP - Tropical Fruits, Tirupati, Chittor (Andhra Pradesh Agricultural University)
7. AICRP - Production of Breeder Seeds of Oilseeds, Tirupati, Chittor (Andhra Pradesh Agricultural University)
8. AICRP - Oilseeds (Groundnut), Kadiri, Chittor (Andhra Pradesh Agricultural University)
9. AICRP - Prodttction of Breeder Seeds of Oilseeds (Groundnut) Kadiri, Chittor (Andhra Pradesh Agricultural University)

EAST GODAVARI

1. AICRP - Tobacco, Venkataramannagudem, East Godavari (Andhra Pradesh Agricultural University)
2. AICRP - Palms, Ambajipet/Razole, East GodaVari (Andhra Pradesh Agricultural University)

KVK

ELURU

1. Eluru Research Centre of CICFRI, Ramachandraraopet, Eluru,

GUNTUR

1. KVK, Prof. N.G. Ranga Krishi Vigyan Kendra, Kawera Guntur.
2. College of Agriculture, Bapatla, Guntur.
3. Agricultural Engineering College, Bapatla, Guntur.
4. Regional Agricultural Research Station of APAU, Lam, Guntur.
5. Cashew Research Station of APAU, Bapatla, Guntur.
6. CTRI Research Station, Guntur.
7. CTRI Quality Evaluation Unit, Guntur.
8. AICRP - Pulses, Guntur (Andhra Pradesh Agricultural University)
9. AICRP - Cotton, Guntur (Andhra Pradesh Agricultural University)
10. AICRP - Spices, Guntur (Andhra Pradesh Agricultural University)
11. AICRP - Tobacco, Guntur (Central Tobacco Research Institute)
12. AICRP - Vegetables, Lam, Guntur (Andhra Pradesh Agricultural University)
13. AICRP - Cotton, Parchur, Guntur (Andhra Pradesh Agricultural University)
14. AICRP - Cashew Bapatla, Guntur (Andhra Pradesh Agricultural University)
15. AICRP - Multistate Cashew, Bapatla, Guntur (Andhra Pradesh Agricultural University)
16. AICRP - Management of Salt Affected Soils & Use of Saline Water Bapatla, Guntur (Andhra Pradesh Agricultural University)

HYDERABAD

1. National Academy of Agricultural Research and Management, Hyderabad.
2. Central Research Institute for Dryland Agriculture, Hyderabad.
3. National Research Centre for Sorghum, Hyderabad.
4. Directorate of Rice Research, Hyderabad.
5. Directorate of Oilseeds Research, Hyderabad.
6. National Training and Communication Centre for Oilseeds, Hyderabad.
7. CIFE Extension framing Centre, Hyderabad.
8. KVK, Hayathnagar, Hyderabad.
9. TTC, Hyderabad.
10. Andhra Pradesh Agricultural University, Hyderabad.
11. College of Agriculture, Hyderabad.
12. Horticultural College, Hyderabad.
13. College of Veterinary Sciences, Hyderabad.
14. College of Home Science, Hyderabad.
15. Grape Research Station of APAU, Rajendranagar, Hyderabad.
16. AICRP - Rice, Hyderabad (Andhra Pradesh Agricultural University)
17. AICRP - Wheat, Hyderabad (Andhra Pradesh Agricultural University).
18. AICRP - Oilseeds, Hyderabad (Andhra Pradesh Agricultural University).
19. AICRP - Sorghum, Hyderabad (Andhra Pradesh Agricultural University).
20. AICRP - Pulses, Hyderabad (Andhra Pradesh Agricultural University).

21. AICRP - Forage Crops, Hyderabad (Andhra Pradesh Agricultural University).
22. AICRP - National Seed Project (Seed Technology Research Unit), Hyderabad (Andhra Pradesh Agricultural University).
23. AICRP - National Seed Project (Breeder's Seed Production Unit), Hyderabad (Andhra Pradesh Agricultural University).
24. AICRP - Sub-Tropical Fruits, Hyderabad (Andhra Pradesh Agricultural University).
25. AICRP - Tuber Crops, Hyderabad (Andhra Pradesh Agricultural University).
26. AICRP - Seed Brone Diseases, Hyderabad (Andhra Pradesh Agricultural University).
27. AICRP - Rodent Control, Hyderabad (Andhra Pradesh Agricultural University).
28. AICRP - Biological Control of Crop Pests, Hyderabad (Andhra Pradesh Agricultural University).
29. AICRP - Economic Orinthology, Hyderabad (Andhra Pradesh Agricultural University).
30. AICRP - Betelvine Diseases, Hyderabad (Andhra Pradesh Agricultural University).
31. AICRP - Water Management, Hyderabad (Andhra Pradesh Agricultural University).
32. AICRP - Correlation of soil Tests with Crop Response, Hyderabad (Andhra Pradesh Agricultural University).
33. AICRP - Improvement of soil Physical Conditions, Hyderabad (Andhra Pradesh Agricultural University).
34. AICRP - Long-term Fertilizer Experiments, Hyderabad (Andhra Pradesh Agricultural University).
35. AICRP - Micronutrients of Soil and Plants, Hyderabad (Andhra Pradesh Agricultural University).
36. AICRP - Farm Implements and Machinery, Hyderabad (Andhra Pradesh Agricultural University).
37. AICRP - Agronomic Research, Hyderabad (Andhra Pradesh Agricultural University).
38. AICRP - Honeybees, Hyderabad (Andhra Pradesh Agricultural University).
39. AICRP - Home Science, Hyderabad (Andhra Pradesh Agricultural University).
40. AICRP - Production of Super Elite and Elite Sunflower seeds, Hyderabad (Andhra Pradesh Agricultural University).
41. AICRP - Production of Breeder Seeds of Oilseeds, Hyderabad (Andhra Pradesh Agricultural University).
42. AICRP - Soil Test Crop Response Correlation (Coordinating Cell), CRIDA, Hyderabad.
43. AICRP - Energy Requirements in Agricultural Sector, (CRIDA), Hyderabad.
44. AICRP - Agro-Meteorology (Coordinating Cell), CRIDA, Hyderabad.
45. AICRP - Rice Project Directorate, Hyderabad (Andhra Pradesh Agricultural University).

KAKINADA

1. CIFRI Research Centre (Prawn Breeding), Kakinada.
2. CMFRI Research Centre, Kakinada.
3. GIFT Research Centre, Kakinada.
4. CIFE Brackishwater Fish Farm, Kakinada.

KANDUKUR

1. CTRI Research Station, Kandukur. Karimnagar.
2. KVK, Grama Nava Nirman Samithi, Jammikunta, Karimnagar.
3. Regional Agricultural Research Station of APAU, Jagtial
4. AICRP - Oilseeds (Sesamum) Jagtial, Karimnagar (Andhra Pradesh Agricultural University).
5. AICRP - Oilseeds (Groundnut), Karimnagar (Andhra Pradesh Agricultural University).

KHAMMAM

1. KVK, Bharat Karshak Parishad, Khammam KURNOOL
2. KVK, Nandyal, Kurnool.
3. KVK, Sri Hanumanthyarai Edn. and Chairtable Society, Yaganitipalli, Kurnool.
4. Regional Agricultural Research Station of APAU, Nandyal, Kurnool.
5. AICRP - Agronomic Research, Kurnool (Andhra Pradesh Agricultural University).
6. AICRP - Millets, Nandyal, Kurnool (Andhra Pradesh Agricultural University).
7. AICRP - Cotton, Nandyal, Kurnool (Andhra Pradesh Agricultural University).

MACHILIPATNAM

1. AICRP - Agricultural Drainage, Machilipatnam (Andhra Pradesh Agricultural University).

MAHBOOBNAGAR

1. KVK, Youth for Action, Kothakota, Mahaboobnagar.
2. Regional Agricultural Research Station of APAU, Palem, Mahaboobnagar.
3. Agricultural Research Station of APAU, Palem, Mahaboobnagar.
4. AICRP - Production of Breeder Seeds of Oilseeds (Castor), Palem, Mahaboobnagar (Andhra Pradesh Agricultural University).

MEDAK

1. KVK, Deccan Development Society, Pastapur, Medak.
2. Fruit Research Station of APAU, Sangareddy, Medak.
3. AICRP - Sub-Tropical Fruits, Sangareddy, Medak (Andhra Pradesh Agricultural University).

NALGONDA

1. KVK, Sri Aravindo Institute of Rural Development, Gaddipalli, Nalgoda. 11

NIZAMABAD

1. AICRP - Agronomic Research, Rudrur, Nizamabad (Andhra Pradesh Agricultural University).

No KVK

RAJAHMUNDRY

1. KVK at CTRI, Rajahmundry. 12
2. Central Tobacco Research Institute, Rajahmundry.
3. AICRP - Biological Control of Crop Pests, (CTRI), Rajahmundry.
4. AICRP - Tobacco, (CTRI), Rajahmundry.

SRIKAKULAM

1. KVK, Amadalavalasa, Srikakulam. 13
2. AICRP - Jute and Allied Fibres, Amadalavalasa, Srikakulam (Andhra Pradesh Agricultural University).
3. AICRP - Agronomic Research, Srikakulam (Andhra Pradesh Agricultural University).

VISHAKHAPATNAM

1. Regional Agricultural Research Station of APAU, Anakapalli, Vishakhapatnam.
2. Betelvine Research Station of APAU, Chintapalli, Vishakhapatnam.
3. CTRI Research Station, Chintapalli, Vishakhapatnam.
4. CMFRI Research Centre, Waltair, Vishakhapatnam.
5. AICRP - Oilseeds (Sesamum), Yelmanchili, Vishakhapatnam.
6. AICRP - Sugarcane, Anakapalli, Vishakhapatnam (Andhra Pradesh Agricultural University).
7. AICRP - Spices, Chintapalli, Vishakhapatnam (Andhra Pradesh Agricultural University).

KVK, 14 Bhagavatula Charitable Trust

VIZIANAGARAM

1. KVK, Rastakuntabai, Vizianagaram. 15
2. AICRP - Millets, Vizianagaram (Andhra Pradesh Agricultural University).

WARANGAL

1. KVK, Malyal, Warangal. 16
2. AICRP - Rice, Warangal (Andhra Pradesh Agricultural University).
3. AICRP - Pulses, Warangal (Andhra Pradesh Agricultural University).

WEST GODAVARI

1. KVK, Chintalpadu Bapi Raju Dharam Samsthan, Talla Gokavaram, West Godavari.
2. Agricultural Research Station of APAU, Maruteru, West Godavari.
3. CTRI Research Station, Devarapalli, West Godavari.
4. COFRO Research Centre (Freshwater Prawn and Fish Culture), Tadepalligudem, West Godavari.
5. AICRP - Rice, Maruteru, West Godavari (Andhra Pradesh Agricultural University).
6. AICRP - Agronomic Research, Maruteru, West Godavari (Andhra Pradesh Agricultural University).

ORISSA

CUTTACK

1. Central Rice Research Institute, Cuttack.
2. AICRP - Agronomic Research(ECF), Cuttack (Orissa University of Agriculture and Technology).
3. National Seed Project, Cuttack.
4. Biological Control, Cuttack.
5. Water Management, Cuttack.
6. Biological Nitrogen Fixation, Cuttack.
7. Energy Requirements in Agricultural Sector, Cuttack.
8. Renewable Energy Sources for Agriculture and Agro-based Industries, Cuttack. (Biogas, Solar, Wind)
9. Harvest and Post-Harvest Technology, Cuttack.
10. Agronomic Research, Cuttack (Zonal Coordinating Unit)
11. Weed Control (Coordinating Unit), Cuttack.
12. Krishi Vigyan Kendra, Kendrapara, Cuttack.

BHUBANESWAR

1. Central Institute of Freshwater Aquaculture, Dhauli, Bhubaneswar.
2. CTCRI Regional Centre, Bhubaneswar.
3. AICRP - Wheat, Bhubaneswar.
4. AICRP - National Seed Project, Bhubaneswar. (Seed Technology Research Unit). Cuttack (Orissa University of Agriculture and Technology).
5. AICRP - National Seed Project, Bhubaneswar. (Breeders' Seed Production). Cuttack (Orissa University of Agriculture and Technology).
6. AICRP - Oilseeds (Sesamum and Tree Crop/Minor Oilseeds), Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
7. AICRP - Potato, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).

8. AICRP - Vegetables, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
9. AICRP - Multi-State Cashew, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
10. AICRP - Cashew,-Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
11. AICRP - Seed Borne Diseases, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
12. AICRP - Nematode Pests, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
13. AICRP - Betelvine Diseases, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
14. AICRP - Dryland Agriculture, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
15. AICRP - Long Term Fertilizer Experiments, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
16. AICRP - Agronomic Research, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
17. AICRP - Underutilized/Under Exploited Plants, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
18. AICRP - Honey Bees, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
19. AICRP - Production of Breeder Seeds of Oilseeds (Sesamum), Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
20. CTCRI Regional Centre, Bhubaneswar.
21. Tuber Crops, Bhubaneswar. (Coordinating Unit)
22. Epidemiological Studies of Foot and Mouth Diseases, Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
23. NARP - Bhubaneswar. Cuttack (Orissa University of Agriculture and Technology).
24. Orissa University of Agriculture and Technology, Bhubaneswar.
25. Agriculture College, Bhubaneswar.
26. Veterinary College, Bhubaneswar.
27. College of Basic Sciences and Humanities, Bhubaneswar.
28. Engineering College, Bhubaneswar.
29. Home Science College, Bhubaneswar.
30. Krishi Vigyan Kendra, Kausalayagang, Bhubaneswar.
31. Freshwater Aquaculture Research and Training Centre - CICFRI, Kaushalyaganj, Bhubaneswar.

SAMBALPUR

1. Sisal Research Centre, JARI, Bambra, Sambalpur.
2. AICRP - Rice, Sambalpur. Cuttack (Orissa University of Agriculture and Technology).
3. AICRP - Agronomic Research (ECF), Sambalpur. Cuttack (Orissa University of Agriculture and Technology).
4. Krishi Vigyan Kendra, Sambalpur.

PURI

1. CIFRI Research Centre, Puri.
2. Central Inland Fisheries'Research Station, Dhauli, Puri.
3. Trainers' Training Centre, Dhauli, Puri.

BURLA

1. CEFT Research Centre, Burla.

JEYPORE

1. AICRP - Rice, Jeypore. Cuttack (Orissa University of Agriculture and Technology).
2. AICRP - Millets, Jeypore. Cuttack (Orissa University of Agriculture and Technology).
3. NARP - Jeypore. Cuttack (Orissa University of Agriculture and Technology).

CHIPLIMA

1. AICRP - Oilseeds (Groundnut), Chiplima. Cuttack (Orissa University of Agriculture and Technology).
2. AICRP - Water Management, Chiplima. Cuttack (Orissa University of Agriculture and Technology).
3. AICRP - Agronomic Research, Chiplima. Cuttack (Orissa University of Agriculture and Technology).
4. AICRP - Production of Breeder Seeds of Oilseeds (Groundnut) Chiplima. Cuttack (Orissa University of Agriculture and Technology).
5. NARP - Chiplima. Cuttack (Orissa University of Agriculture and Technology).
6. College of Agriculture, Chiplima.

KENDRAPARA

1. AICRP - Jute and allied Fibres, Kendrapara. Cuttack (Orissa University of Agriculture and Technology).

POTTANGI

1. AICRP - Spices, Pottangi. Cuttack (Orissa University of Agriculture and Technology).

KONARK

1. AICRP - Palms, Konaric. Cuttack (Orissa University of Agriculture and Technology).

KALAHANDI

1. AICRP - Agronomic Research (ECF), Kalahandi. Cuttack (Orissa University of Agriculture and Technology).
2. Krishi Vigyan Kendra, Kalahandi.

DHENKANAL

1. AICRP - Agronomic Research (ECF), Dhenkanal. Cuttack (Orissa University of Agriculture and Technology).

SHIPLIMA

1. AICRP - Sugarcane, Shiplima. Cuttack (Orissa University of Agriculture and Technology).

NORTH-EASTERN PLATEAU ZONE

1. NARP - North-Eastern Plateau Zone. Cuttack (Orissa University of Agriculture and Technology).

KEONJHAR

1. NARP - Keonjhar. Cuttack (Orissa University of Agriculture and Technology).
2. Krishi Vigyan Kendra, Keonjhar.

RANITAL

1. NARP - Ranital. Cuttack (Orissa University of Agriculture and Technology).

G. UDAIGERI

1. NARP - G. Udaigiri. Cuttack (Orissa University of Agriculture and Technology).

BHAWANIPATNA

1. NARP - Bhawanipatna. Cuttack (Orissa University of Agriculture and Technology).

MAHISPAT

1. NARP - Mahispat. Cuttack (Orissa University of Agriculture and Technology).

GOPALPUR

1. College of Fisheries, Railgaiida, Gopalpur.

KORAPUT

1. Krishi Vigyan Kendra, Semiliguda, Koraput.
2. AICRP - Millets, Semiliguda. Cuttack (Orissa University of Agriculture and Technology).
3. AICRP - Oilseeds (Niger), Semiliguda. Cuttack (Orissa University of Agriculture and Technology).
4. AICRP - Soybean, Semiliguda. Cuttack (Orissa University of Agriculture and Technology).
5. AICRP - Agroforestry, Semiliguda. Cuttack (Orissa University of Agriculture and Technology).
6. NARP - Semiliguda. Cuttack (Orissa University of Agriculture and Technology).
7. Krishi Vigyan Kendra, Semiliguda.

BALASORE

1. Krishi Vigyan Kendra, Balasore

GANJAM

1. Krishi Vigyan Kendra, Ganjam.

ICAR Institutes / All India Coordinated Research Projects

D 1: Central Rice Research Institute, Cuttack

Crop Improvement Division

Varietal Release (2002)

- **Vandana** (Yield 3 t/ha) – Orissa, SVRC
- **Anjali** (Yield 3.5 t/ha)- Jharkhand, Orissa, West Bengal, Assam, CVRC
- Variety Recommended for On-farm testing
- CRLC 899 (IET 16481)- DRR trials (Yield 4.5 t/ha) for Orissa, West Bengal, Assam
- Late planting situations after Rice-Jute cultivation
- **Durga** : Yield 2.4 t/ha
- Transplanted second week of September
- Resistance to BLB and RTD
- Released for deep-water rice up to 100 cm water depth

Scented Rice

- Pusa Basmati – Awned, WS, 125 days, DS (135 days), ELS CRM 2203-4 (Awnless Pusa Basmati-1 mutant)
- Kalanamak (U.P.) : Collection and selection from land races from Basti district of UP, PS.
- Dubhraj (Orissa) : PS, MS
- Sugandha and Kamod (Bihar): PS, SS
- Kala Joha (Assam) : PS
- CR 2007-1 (Basmati 370 mutant): 4.5 t/ha
- Keteki joha (Assam): PS, MS

Hybrid Rice

- PHB 71: 7.5 t/ha 125 days, WS, DS
- CRHR 5: 7.4 t/ha125 days, (CRMS 32A/IR 42266-29.3R)
- CRHR 1: 7.25 t/ha 145 days

Cytoplasmic Sterile Lines

- CRMS 31A (Other than WA Cytoplasm)
- CRMS 32 A

Doubled Haploid Lines from Elite Heterotic Hybrids

- PHB 71: 169
- PA 6201: 122 : 339 Field Evaluations
- DRRH 1: 48

Wide Hybridization: *O. longistaminata* (BLB)
O. brachyantha (SB)

Panicle Gallmidge

- 116 varieties grown at CRRI during *kharif,* 2001, 9 varieties found resistant
- Incidence as high as 76% (variety Matangini)

Exploration and Collection of Rice

Wild rice germplasm

- West Bengal (133): *Porteresia coarctata: 8* South 24 Parganas
  Oryza nivera : 71
  *Oryza rufipogon :*54

Wild Rice from Orissa

- Brahmagiri (Puri):*Oryza rufipogon:* 4

Boro Rice from : 65

- North Bihar (40
- North Bengal (25)

Rice Germplasm Characterization

169 accessions of wild rice - 40 morpho agronomic traits

524 accessions of cultivated rice - 35 morpho-agronomic traits

Rejuvenation : 3500 accessions

Conservation: 7,500 CRRI gene bank 4°C, 35% RH

Breeder Seed Production (24 Varieties)

Sl.No.	Variety	Quantity (Kgs)
1	Annada	800
2	Heera	1700
3	CR 1009	1020
4	Lunishree	750
5	Ratna	1100
6	Vanaprabha	1400
7	Kalinga III	2000
8	Radhi	2000
9	Tapaswini	3300
10	Moti	90
11	Sonamani	950
12	Pooja	3360
13	Durga	2040
14	Padmini	240
15	Tulasi	60
16	Panidhan	240
17	CR 1017	480
18	CR 1018	1770
19	CR 1030	210

20	CR 1014	30
21	Sarala	2310
22	Vandana	90
23	Anjali	210
24	Dhala Heera	600

Crop Production:

Agronomy:

Rainfed upland areas of Kandabindha under NATP

- Integrated weed management practices like
- Mechanical weeding with finger weeder (MW) + one hand weeding (HW)
- Chemical weed control (CW) with the application of pre-emergence Butachlor @ 1.5 kg a.i./ha + one hand weeding (HW) economical

Jute + rice intercropping

- Gayatri + Jute in rainfed lowland
- Jute-Rice common practice

Rice – rice – rice system

(16 t/ha) by adopting standard agronomic package

- Wet season (Jun-Nov) Gayatri: Yield 7.6 t/ha
- Dry season (Dec-Mar) ProAgro 6201: Yield 6.7 t/ha
- Summer season (Apr-May) CR 749-20-2: Yield 1.5 t/ha, damaged due to flood.

Rice – maize – pulse cropping system

- Tapaswini – 6 t/ha
- Maize DMR 137: Yield 7.7 t/ha
  DMR 136: Yield 7.5 t/ha
- Mungbean, cowpea, urdbean in summer season 1-1.5 t/ha.

Sustainable rice-based farming system model for small and marginal farmers under irrigated condition

- Total income generated one acre farm: Rs.40,000
- Food crops: 12 to 18 t Rice-rice-rice, vegetable, fruits-spices
- Fish: 0.3 to 0.4 t
- Fodder: 3 to 4 t as rice straw
- Agro-forestry and plantation crops: Arecanut, Teak, Sesamum (Til), Eucalyptus.
- Employment: 450-500 mandays/year
- Net Income: Rs.15,000

Agro-meteorological Interpretation of Crop Weather data at CRRI, Cuttack

- CRRI Agromet Observatory (60 years) 1941-2000
- Rainfall: 1535 mm average
- 75% of total annual rainfall 3 months: Jul to Sep
- Cyclone disturbances: October
- Maximum storms/depression: August
- Minimum temperature: Jan first week (13.7°C-27.2°C)
- Maximum temperature: May last week (26.7°C-37.6°C)

Hybrid Rice performance

- KRH 2: 6.64 t/ha followed by PHB 71: 6.30 t/ha and CRHR 1: 5.98 t/ha

Fertilizer: 120:60:60 kg NPK/ha

Summer Rice

- CR 749-20-2 (Navin) : 125 days, 6 t/ha *rabi*, 4.5 t/ha *kharif*
- Better than Lalat in yield and disease, pest resistance
- Suitable for direct seeding in coastal Orissa
- On-farm testing has been conducted in Orissa, West Bengal

Research Gap in Intercropping System in Rainfed Condition in Dhenkanal district (NATP RRPS-10)

- Common: Rice + Arhar
  Mungbean/Urdbean + Arhar
  Groundnut + Mesta/Arhar
- Problems : Lack of appropriate varieties
  Improper use of fertilizer

Institute Village Linkage Programme (IVLP)

- Short duration rice (Vandana)_ very good drought tolerant
- Short duration arhar (UPAS 120) in 4:1 (rice and arhar)

Soil Science and Microbiology

- Sporocarp and sporoling technology in *Azolla* developed
- Methane emission : Less due to increase use of applied K_2O (60 and 120 kg/ha)
- Zinc deficiency tolerant cultivars and Iron deficiency tolerant cultures have been identified.

Hybrid Rice

- PHB 71 : 7.5 t/ha
- Use of Organic (7.0 t/ha FYM) and in organic fertilizer 135: 45 : 90 kg NPK/ha, K topdressing

Agricultural Engineering

CRRI manual 4-row rice transplanter

Tested at : 3 ha of Chandol of Kendrapara district during *kharif* 2001 and 2002. Transplanter saved Rs.5,000/ha.

Plant Pathology

Characterization of bacterial blight and blast pathogen isolates employing molecular tools (rice biotechnology)

Bacterial blight pathogen

A set of 36 isolates of the bacterial pathogen obtained from the disease trap nursery 2001WS were genotyped using DNA fingerprinting method. This has revealed the presence of 20 different lineages of the bacterial pathogen. Of these, seven lineages were harboured by the highly susceptible cultivar Karuna and two lineages by IR 24 (carrying resistance gene Xa18). The remaining 11 lineages were isolated from near-isogenic lines carrying either single known resistance gene and from lines carrying multiple resistance genes. The isolates harboured by resistant lines (which showed only restricted lesion development) may not have any epidemiological significance. However, the fingerprints of these lineages would be of value for comparing the future isolates.

Comparison of isolates infecting inbred cultivars/lines with those infecting hybrid lines

In an effort to understand whether the bacterial blight pathogen isolates infecting inbred cultivars/lines are different from those affecting hybrid lines and their CMS, restorer and maintainer lines, a set of 30 isolates were genotyped and their virulence analyzed using two different sets of differentials described above. The virulence pattern observed with the pathogen isolates obtained from rice hybrids reveal that all of them are compatible with the resistance genes *Xa3* and *Xa4*. However, the pathotypes were incompatible with the genes, *xa5, Xa10, xa13* and *Xa21* suggesting the possibility of deploying them for in enhancing the resistance of the rice hybrids tested.

Disease management

Effect of nitrogen on slow -blasting resistance

Although there was an increase in number of blast lesions with increased dosages of nitrogen application from 0-160 kg N/ha in both fast-blasting and slow-blasting genotypes ; the increase in the later was not in a stage to breakdown the resistance. Comparison of disease progress curves through the 1st ranking parameters *viz*; AUDPC, RAUDPC and the logistic apparent infection rate (r) was considered as the most efficient and sensitive method for differentiation among the treatments, over the terminal disease severity score.

Blast

Chemical control

Sivic 75 WP spraying @ 0.6 g/l of water proved most effective in reducing foliar blast disease of rice, amongst the 10 new formulations tested.

Effect of silica on blast

In addition to commercial formulations of sodium silicate (laboratory grade), burnt rice husk was applied to the field 10 days before sowing at 2, 4 and 6 t/ha. Application of 1 t burnt rice husk ash controlled blast (18 % DLA) followed by 4 t/ha (20 % DLA disease incidence) against the control which recorded 80% DLA.

Botanicals

Blast occurred in a devastating epidemic form in Ganjam district of Orissa during the wet season of 2002. The epidemic caused serious damage to the seedlings in the nursery and to the transplanted crop in the main fields wherever the farmers have raised the crop using the available water. The high yielding cultivar Swarna, grown in about 75% of the total nursery sown area (approx. 10,000 ha) recorded 70% damage to the seedlings. The disease was aggravated by the farourable weather conditions such as scanty rainfall and drought conditions. A team of scientists from CRRI visited the place and demonstrated to the farmers with the cooperation of the State Department of Agriculture, the effectiveness of botanical extract based technology developed for rice blast control at CRRI using commonly available *bael* (*Aegle marmelos* and *tulasi* (*Ocimum sanctum*). The technology has been broadcast through mass media like television, radio and distribution of pamphlets. A number of farmers have utilized the technology and effectively controlled the disease in the transplanted crops.

Brown spot

Among five chemicals tested under field conditions, Tilt and Contaf controlled the disease effectively (1.5 and 2.5% diseased leaf area, respectively) when compared to Hinosan, Mancozeb and Beam 75 which recorded 5.0, 7.0 and 9.5% diseased leaf area respectively. The effective chemicals, Tilt (Propiconazole 25%EC) and Contaf (Hexaconazole 5%EC) are recommended at 1 and 2 ml/l, respectively for managing brown spot effectively.

Sheath blight

Out of 11 fungicides, Sheathmar (Validamycin) EC @ 0.25% was found to be the best for control of sheath blight disease with highest number of grains per panicle, as well as panicle weight and grain yield; followed by Rhizocin 20% EC @ 0.20% and Monocot 50WP @ 0.10%. Potash application as basal and at maximum tillering stage was found to be on par with Bavistin spraying.

Rice necrosis mosaic virus (RNMV)

The on-farm trial conducted in village Veda of Salipur block (Cuttack district), on the effect of RNMV on Jute crop exhibited promotion on growth as well as base diameter in comparison with control , in the variety JRO-524.

Marker-assisted breeding for improving resistance to bacterial blight and blast (rice biotechnology)

Two popular rice cultivars, IR 64 and Swarna as recurrent parents for improving their resistance to bacterial blight and another set of two popular upland rice cultivars, Kalinga III and Vandana were selected as recurrent parents for improving their resistance to blast using marker-assisted selection.

This strategy has finally resulted (2002 wet season) in 50 lines in the background of IR 64 (BC_4F_6) and 45 lines (BC_4F_4) in the background of Swarna which carry bacterial blight resistance genes, *xa5, xa13* and *Xa21*either singly or in different combinations. The IR 64 lines have been evaluated for disease resistance and for yield. The Swarna lines are under evaluation in the current season (2003 dry season). Similarly, plants in the background of Kalinga III and in the background of Vandana carrying blast resistance genes, *Pi-2(t)* and *Pi-9(t)* singly in combinations were selected. These will be further advanced for disease and yield evaluations under field conditions.

Entomology

Some of the popularly grown varieties across the country were screened to know their reaction to gall midge biotype 2 in the net house. Only Sarasa, Samalei, Samanta and Phalguna recorded nil incidence while rest of them showed susceptible reaction recording more than 70% plant damage.

Seventeen released rice varieties along with the susceptible (TN 1) and resistant (Tapaswini) checks were tested for their reaction to WBPH under artificial infestation in the net house. Of these Tulasi scored 3 (resistant), Dhala Heera, Jaya, Konark, Tapaswini and Sarasa scored 5 (moderately resistant) and other scored 7 to 9 (moderately susceptible and susceptible) on damage rating scale under Standard Evaluation System.

Chloropyriphos @ 1.0 kg a.i./100 kg seed when applied as seed treatment retarded germination. Therefore, of several chemicals evaluated for the control of termites and also tested for their phytotoxic symptoms on germinated seeds, fipronil and imidacloprid @ 50 gram a.i./100 gram checked termite damage effectively and seeds did not show any phytotoxic symptoms on the germinated seeds.

A new pest problem called as panicle mites (tarsonemid mites, *Steneotarsonemus spinki* and *Tarsonemus cuttacki)* associated with rice grain sterility is being encountered in the irrigated rice fields for last few years especially in Andhra Pradesh and coastal Orissa. These tiny tarsonemid mites, feed on the reproductive parts of the flower and cause sterility and subsequently mites infestation is followed by infestion of the fungi causing grain discolouration. In West and East Godawari districts of Andhra Pradesh, these mites caused about 10-30% sterility in variety Vijeta and Sambha Mashuri during *kharif,* 2001.

The plant *Polygonum hydropiper,* commonly known as water pepper having insecticidal property found to control brown plant hopper (BPH) in rice by applying the crude extract of leaf at a dose of 5% i.e. 5 g. leaf in 100 ml of water.

Plant Physiology

Hybrid Rice seed production: Synchronization of A, B and R lines

- CRHR 1 (IR6589A x Gayatri)
- CRHR 5 (CRMS 32A x IR42266R)

Drought Tolerance

- Screening germplasm for drought tolerance (dry season) 2,300 lines: 35 highly resistant.

Social Science, Extension, Communication and Training

Database on rice related statistics Orissa State & India

- Block and season wise data
- Area, production and productivity from 1981-82 to 1999-2000
- 314 blocks of Orissa

NATP Coastal Agro Ecosystem

- 12.6 tons of paddy varieties of Lunishree, Padmini, Gayatri, Savitri, Rajashree and Moti distributed.
- 5 kg each farmer in super cyclone affected areas Ersama of Jagatsinghpur district (8.5 t/h), Astarang of Puri district (4.1 t/h).
- *Azolla* use by farmers in Astarang and Ersama
- 43 village, 2,800 farmers
- 7 ICAR Institutes and OUAT working together

Training Programme

- Rainfed Rice Production Technology (4-7 Sept., 2001) – DRD, Patna
- Rice Production Technology (21-25 Jan 2002) for Department of Agriculture, Government of Uttar Pradesh.
- Farmers training every month.

Institute Seminars

- A good nos. of Institute seminars have been organised.

Popularization of CRRI Technology

- Farm School on AIR Programme on *kharif* paddy cultivation, AIR, Cuttack
- A good nos. of Doordarshan Programmes.
- Annadata (Oriya) on ETV.
- Technology bulletins (20) released. Efforts are made to develop in Oriya and Hindi also.

Visitors Advisory Service

- A large nos. of visitors comprising of farmers/farm women, AEOs/SMSs, Scientists and other dignitaries have visited CRRI during the period.

Agri Exhibitions

- AGRI INTEX 2001 (Agricultural International Exhibition 2001), Codissia Trade Fair Complex, Coimbatore, Tamil Nadu from 1-7 Aug 2001.
- India International Trade Fair (IITF), New Delhi from 14-27 Nov 2001.
- AGRITECH 2002, Chhatisgarh from 11-12 Jan 2002.
- Krushak Mela, OUAT, Bhubaneswar from 23-24 Feb 2002.
- Krishi Expo 2002, New Delhi from 27 Feb – 5 Mar 2002.
- Krishi Vigyan Mela, New Delhi from 14-16 Mar 2002.
- Krishi Expo 2003, New Delhi from 10-16 Mar, 2003.

CRURRS, Hazaribag, Jharkhand

- Anjali released 2002
- RR 347-166 (IET 16430)
- Jharkhand front-line demonstration 2.84 t Vs 1.84 t/ha

- On-farm testing Vandana
- 1,000 kits Orissa, Chhattishgarh
- 1,500 kits, Jharkhand
- 500 kits Assam-Direct seeded Ahu.
- IPM technology demonstration
- Drought tolerant screening
- Blast screening
- Breeder seed production: Kalinga III and Vandana

RRLRRS, Gerua, Assam

- Tapaswini, Chandrama adoption in farmers field
- Vandana testing in Assam
- Integrated rice-fish-horticulture-duck farming model (125 mx45 m)

New lines identified

- CR 306-37-13, CR 876-6, CR 981-3, RR 165-1160, RR 272-1745 and RR 34701

Hispa resistance rice

ARC 5764, ARC 5778 and INRC 9362

D 2: Central Tobacco Research Institute , Rajahmundry

Project proposals of pre-identified areas based on the recommendations of the last Regional Committee Meeting for certain NABARD, R&D funding involving State Govts. SAUs and ICAR Institutes in a partnership role.

- Due to changing tobacco scenario, now emphasis is being given for alternate uses of tobacco. In this regard processes were developed for extraction of value added products like nicotine sulphate, solanesol, organic acids, proteins and tobacco seed oil. Application for combined patent by ICAR and CSIR for the invention "Process for purification of solanesol (95+%) from crude/ enriched extracts of tobacco green leaf/ tobacco cured leaf/ tobacco waste" was filed with the Controller of Patents, Patent Office, Delhi Branch, New Delhi. Tobacco Board has sanctioned a collaborative study for setting up a pilot plant for extraction of phytochemicals from tobacco with an outlay of rupees one crore in collaboration with IICT, Hyderabad. An ad-hoc scheme "Synthesis and biological evaluation of solanesol derivatives as novel bioactive substances" is being implemented in CTRI in collaboration with CDRI, Lucknow.

2. **The status/constraints and failures, if any, of the technologies that were passed on to the extension functionaries of the State Government by the R&D Institutions.**

- In case of FCV tobacco, 30% of cost of cultivation goes for curing of tobacco. To minimize curing costs several efforts were made and an integrated barn using paddy straw ceiling insulation with modified flue pipe system and venturi furnace in a low profile barn was developed and found that the fuel use efficiency was 2.43 kg per kg of cured leaf as against 5.00 kg in the conventional barn. This technology was passed on to Tobacco Board and farming community. These technologies need large scale modification of the tobacco curing barns which involves about Rs 10000 to 13000 per barn to be financed/subsidized by Tobacco Board/ bank.

- To reduce the use of wood fuel in curing process, it was recommended to use brickets made of paddy husk, coffee husk and saw dust and also use of left over stubbles of old coffee plantations, maize cob stone etc. Units for manufacturing of brickets have to be set up for large scale use of agro-wastes.

- The KVK of CTRI has designed a machine called "Banana fibre extractor" for extraction of fibre from pseudo stems, leaf stalks and peduncle of banana. The machine is first of its kind in this field developed for the commercial exploitation of unutilized banana waste. The machine reduces the drudgery and increases fibre production 50 times compared to manual process. It is user friendly, and economical with less maintenance cost and safe to operate. Superior quality fibre in terms of length, softness, strength and colour can be obtained. The machine helps banana cultivators to get additional income of Rs 2500/acre. There is heavy demand for this machine from different parts of the Country. The manufacturing rights were given to AP Agro Industries Corporation, Hyderabad.

D 3: National Research Centre for Sorghum, Hyderabad

1 STATUS OF CROP IN THE REGION

(trend in area, production and productivity)

Sorghum is being cultivated in Andhra Pradesh both for grain as well as for fodder during kharif and rabi seasons. In Chattisgarh and Orissa sorghum cultivation is relatively negligible compared to other sorghum growing states of the country. The status of area, production and average yield of sorghum crop in the above three states are given below.

Table 1: Production statistics of sorghum in the region of V of India

Season	Andhra Pradesh			Chattisgarh			Orissa		
	Area	*Production*	*Yield*	*Area*	*Production*	*Yield*	*Area*	*Production*	*Yield*
Kharif	320	287	898.67	8.75	6.85	810.50	13.57	7.93	585.00
Rabi	364	309	858.00	-	-	-	-	-	-
Total	684	596	877.67	8.75	6.85	810.50	13.57	7.93	585.00
% Kharif to total	46.78	48.15	-	100.00	100.00	100.00	100.00	100.00	-
% Rabi to total	53.22	51.85	-	-	-	-	-	-	-

Note: - TE 2001= average (1999, 2000 & 2001)

Area (000' hectares); Production (000' tones) & Yield (kg/ha)

- In Andhra Pradesh the percentage area under rabi sorghum (53.22%) was more than rabi sorghum (46.78%) area. Similarly the contribution of rabi sorghum (51.85%) was more than kharif sorghum (48.15%) to the total production. On contrary to this average yield of kharif sorghum (897kg/ha) was marginally higher than the average yield of rabi sorghum (858kg/ha).

- In Chattisgarh and Orissa sorghum cultivation is restricted only to kharif season

- Area and production of kharif sorghum was more in Orissa than in Chattisgarh. But yield levels of kharif sorghum were high in case of Chattisgarh than Orissa. However, when compared to AP both in terms of area and production in there two states it was negligibly low.

2 PROGRESS OF RESEARCH DURING THE LAST TWO YEARS

- The research efforts have been directed to evolve tall, dual purpose, stay-green sorghums through population improvements and recurrent selection best suited for Andhra Pradesh, Chattisgarh and Orissa.
- Efforts are on to evolve multicut sorghum-sudan grass hybrids having lower HCN content in early initial crop growth stages.
- Enhancing the potential of sweet sorghum to produce jaggery and ethanol and also to supplement sorghum to produce sugar, starch and syrup are on top priority.

➢ The possibilities are being explored to establish sorghum in non-traditional areas and non-traditional cropping systems consisting rice fallows.

➢ Two field experiments in rice fallows were conducted at CRRI, Cuttack under irrigated situation, to study suitable sowing period of rabi sorghum (forage) and to find suitable / promising sorghum genotypes. the highest green foliage yield (70 t/ha) was obtained with Jan 20th sowing followed by Dec 18 sowing (61.3 t/ha). The highest green foliage yield was recorded by cultivar SPV 1500 (62.7 t/ha) and SPV 1155 (62.0 t/ha).

➢ Promotion of alternate uses of sorghum through better industrial utilization to produce novel food products, potable alcohol from molded grain, lager beer, high fructose syrup, liquid and powder glucose and sorghum ethanol as bio-fuel.

3 PRODUCTION PROBLEMS OF THE REGION. NEW ROBLEMS THAT HAVE ARISEN IN THE IMPLEMENTATION OF THE PROJECT

Kharif: Major production constraints are:

➢ Lower profit and non-competitiveness with cotton, sunflower, castor and pulses.

➢ Inadequate supply and availability of seeds of improved dual-purpose varieties and hybrids of sorghum.

➢ Low adoption of improved production technology, due to moisture stress in Alfisols, subnormal distribution of rainfall.

➢ Susceptibility to shoot fly and earhead bug under delayed plantings.

➢ Grain mold susceptibility during the years of extended monsoon at grain maturity and susceptibility to stem borer under dry weather condition.

Rabi: No ideal hybrid is available for rabi season.

➢ Non availability of seeds of released rabi hybrids/varieties

➢ Stem borer susceptibility.

➢ Moisture limiting environmental conditions constraining farm yields.

In totality pest and disease problems are severe and no resistant cultivars are available.

4 MAJOR RECOMMENDATIONS CONCERNING VARIETIES CROP PRODUCTION AND PRODUCTION TECHNOLOGY

a) Recommended varieties/hybrids

	Early Maturity	**Medium Maturity**
Grain sorghum - kharif		
Hybrids	CSH 6, CSH 14	CSH 5, CSH 9, CSH 13, CSH 16, CSH 18
Varieties	CSV 10	CSV 10, CSV 13, CSV 15, SPV 96, SPV 245
Grain sorghum - rabi		
Hybrids		CSH 15R, CSH 19R
Varieties		CSV 8R (SPV 86), CSV 14R (SPV 839), CSV 216R

Sweet sorghum		
Variety		SSV 84
Forage sorghum		
Single cut		HC 308, HC 171, HC 136, HC 260, CSV 15, CSH 13
Multi cut	SSG 59-3, PC 106	
Dual purpose sorghum		
Hybrid		CSH 13
Variety		CSV 15

CSV= Coordinated Sorghum Variety; CSH= Coordinated Sorghum Hybrid

b) Recommended crop production technology and protection packages

	Kharif	**Rabi**
Land preparation	2-3 summer ploughing followed by leveling for good tilth.	In high rainfall areas or on vertisol areas raise short season legume crop during kharif. Ploughing followed by leveling for good tilth.
Planting time	Onset of monsoon last week of May to second week of June.	Last week of September to second week of October.
Plant population	2.1 to 2.2 lakh /ha	2 lakhs/ha
Seed rate	8 kg/ha	8-10 kg/ha
Spacing	45 x 10 cm	45 x 10 cm
Manure	10 t FYM/ha	10 t FYM/ha
Fertilizers and its Application	80 kg N, 40 kg P_2O_5	80 kg N, 40 kg P_2O_5
	50% N and full P_2O_5 at sowing, balance 50% 30 days after sowing.	50% N and full P_2O_5 at sowing, balance 50% 30 days after sowing.
Inter-cultivation	Weeding 20 days after sowing.	Weeding 20 days after sowing.
Plant protection	Furrow application of Carbofuran 36 @ 2 g/m row for control of shoot fly and spray of Endosulfan 35 Ec 2 ml/lit of water at 7th & 14th day after germination. Captan 0.2%+200 ppm Auriafungin or Captan or Dithane M45 0.2% at time of seed setting for control of grain mold.	Furrow application of Carbofuran 36 @ 2 g/m for shoot fly control followed by spray of Endosulfan, 35 Ec 2 ml/lit at 7th & 14th day.
Amelioration of nutrient depletion	Appling $ZnSO_4$ (0.2%) and $FeSO_4$ (0.15%) as foliar spray between 35-65 days in Fe and Zn deficient soils, increases yields by 11-18 %	

5 SIGNIFICANT ACHIEVEMENTS RELATED TO THE REGION

- During 2000, a kharif hybrid, CSH 19R and a rabi variety CSV 216 have been released nationally. For Andhra Pradesh a tall and bold grain variety NTJ 3 (SPV 1162) has been released.
- The protocols have been standardized to commercialize the production of alcohol, lager beer and novel food products from sorghum.
- The potential of sweet sorghum (SSV 84) with green cane and grain yield more than 40 tonnes and 1.3 t/ha respectively, with average juice brix of 18.4%

consistent promises to produce a minimum of 125% sucrose 15% total fermentable and 50-60% recovery.

- The varieties CSV 15 and CSH 16 have been found to be best for good quality alcohol production.

6 ISSUE RELATED TO THE TRANSFER OF TECHNOLOGY

- Through Front-line Demonstrations (FLD's), the high yielding hybrids and varieties are being popularized in the states of Andhra Pradesh and Chattisgarh, apart from other sorghum growing states. However, there exists a 50% gap in the actual potential and realized productivity on the farmer's fields. CSV 15 has been popularized in Andhra Pradesh and Madhya Pradesh, including established and newly released hybrids CSH 9, CSH 13, CSH 14, CSH 16 and CSH 18.
- To popularize further, the farmer participatory approaches, farmer scientist reaction, meetings, fields days and researchers produce interface- has been established.
- The practical research recommendations have been put to test through NATP programme in the farmers' field. The advantages of harvesting sorghum at physiological maturity and artificial drying have shown to reduce grain mold incidence and damage in kharif season. Similar efforts, to test the validity of other research recommendations are being pursued vigorously.
- The continuation of such efforts will strengthen the concept of lab to land by laying a potent foundation to transfer the technology to the farmer at a faster pace.

7 ANY OTHER SUGGESTIONS FOR THE REGION

Much more needed to done to develop the market for sorghum

D 4: Directorate of Rice Research, Hyderabad

Project proposals of pre-identified areas based on the recommendations of the last Regional Committee Meeting for certain NABARD, R&D funding involving State Govts., SAUs and ICAR Institutes in partnership role

DRR has not been identified for this activity

The status/constraints and failures, if any, of the technologies that were passed on to the Extension functionaries of the State Government by the R& D Institutions

The potential of the new high yielding rice varieties under different ecosystem of this region has been demonstrated to the farmers through compact block FLDs. List of promising varieties and their yield range realized in FLDs during 2000-02 period is given below:

State	Ecosystem	Selected superior varieties	Yield ($t\ ha^{-1}$) 2001 Mean	Kharif range
A.P.	RUP	Aditya,	1.325	0.985-1.7
		Tulasi	1.2	1.0 –1.435
	RShL	Krishnahamsa	2.45	1.36-3.3
Chhattisgarh	RUP	Poornima	3.63	2.8-4.46
		Vandana,	2.3	(Kharif 1999)
		Danteswari	3.63	3.05-4.46
	RShL	Poornima	2.98	0.67-5.5
		Mahamaya	4.105	3.05-5.0
		Bambleswari	4.66	(Kharif 1999)
Orissa	RShL	Mahanadi	7.0	(Kharif 2000)
		OR 1206-25.1	5.4	--

RUP – Rainfed Upland ecosystem, RShL – Rainfed Shallow Water ecosystem

STATUS AND STRATEGIES FOR INCREASING AND STABILIZING RICE PRODUCTION IN ANDHRA PRADESH, ORISSA AND CHHATTISGARH

1. Rice Production Statistics :

The region comprising the states of Andhra Pradesh, Orissa and Chhattisgarh is the traditional rice growing area which accounted for 27% of the total rice area (44.36 m.ha) of the country and contributed 22.7% of the country's rice production (84.87 m.t. as per 2000-2001 data). The average yields in the predominantly rainfed areas of Orissa and Chhattisgarh were 1.0 and 0.9 t/ha respectively where as it was 2.84 t/ha in Andhra Pradesh which is mostly irrigated (95.9%) area. The data are given in tables 1(a), 1(b) and 1(c).

The high yielding varieties of rice coverage is 91% in Andhra Pradesh while it is around 75% in Orissa and 70.0% in Madhya Pradesh (data for Chhattisgarh not available). The irrigated area under rice in A.P. is about 96% while it is 38% and 23% in Orissa and Madhya Pradesh (data for Chhattisgarh not available), respectively. The fertilizer consumption (kg/ha of the gross cropped area of all the crops) in A.P., M.P. and Orissa are 154, 49 and 30.9 respectively. Data are given in Tables 1(d), 1(e) and 1(f).

Table 1(a) : Area ('000 hectares)

State	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Orissa	4455.7	4529.0	4461.3	4496.8	4409.0	4600.0	4430.0
Andhra Pradesh	3546.7	3512.6	3678.0	3500.8	4112.0	3900.0	4030.0
Madhya Pradesh	3541.0	4031.0	4127.4	5403.4	5305.0	5350.0	3600 Chhattisgarh

Table 1(b) : Production ('000 tonnes)

State	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Orissa	6356.2	6226.2	4395.5	6204.6	534530	5190.0	4610.0
Andhra Pradesh	9221.0	9194.0	9900.2	8510.0	11434.0	10490.0	11450.0
Madhya Pradesh	5219.1	5003.4	5394.8	4387.6	5374.0	6380.0	3240 Chhattisgarh

Table 1(c) : Yield (kg/ha)

State	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Orissa	1426.5	1374.7	985.3	1379.8	1212.4	1128.3	1041.0
Andhra Pradesh	2599.9	2617.4	2691.7	2430.9	2780.6	2689.7	2842.0
Madhya Pradesh	1473.9	1241.2	1307.1	812.0	1013.0	1192.5	900.0 Chhattisgarh

Table 1(d) : Area under HYVs (%)

State	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00
Orissa	64.00	67.40	68.70	70.1	69.7	74.7
Andhra Pradesh	85.90	89.20	90.00	81.3	81.5	90.8
Madhya Pradesh	73.50	63.70	65.40	66.2	53.3	70.2

Table 1(e) : Irrigated area (%)

State	1990-91	1991-92	1992-93	1995-96	1997-98	1998-99
Orissa	35.6	37.3	34.7	35.5	36.2	38.4
Andhra Pradesh	94.9	94.9	94.5	94.8	96.3	99.7
Madhya Pradesh	20.1	22.2	23.3	23.7	23.7	23.9

Table 1(f) : Fertilizer consumption (kg per hectare)*

State	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
Orissa	21.4	21.06	21.2	22.4	25.2	30.1	30.9
Andhra Pradesh	120.3	114.2	117.0	125.2	137.3	129.9	153.9
Madhya Pradesh	35.7	35.33	33.50	38.00	34.70	48.20	19.00

* Gross cropped area

2. Production Problems of the Region :

Rainfed ecology itself is a constraint to higher and stable yields in the predominantly rainfed areas of Orissa and Chhatisgarh. Increased inland salinity and multi-nutrient deficiency syndrome, resulting from unscientific irrigation and unbalanced nutrition management, are the problems in irrigated areas of Andhra Pradesh. Narrow choice of high yielding varieties for varied rainfed ecologies and inadequate supply of quality seed in Orissa and Madhya Pradesh, biotic stresses all over the region contribute to low/static level of productivity as summarised below:

Andhra Pradesh

- Impeded drainage and salinity in deltaic alluvial soils in East Godavari, West Godavari and Nellore.
- Widespread deficiency of phosphorus and zinc.
- The soils are classified high for available K_2O but respond to fertilisers in several areas. Potassium deficiency was reported in parts of Karimnagar, Chittoor and Nellore districts of A.P.
- Imbalanced use of fertilisers, particularly excessive use of nitrogen in Godavari, Khammam and Nellore districts.
- Cyclones/floods in coastal areas during late growth stages of crops.
- Erratic monsoon delaying the canal opening and the consequent delay in planting.
- Very limited use of certified seed of high yielding varieties. The farmer to farmer spread of high yielding varieties leading to increased seed impurity.
- Pest and disease epidemics due to continuous/staggered rice cropping, excessive use of N fertilisers and indiscriminate use of pesticides.
- Restrictions on the inter district and inter State movement of paddy.

Orissa and Chhattisgarh:

Rainfed Uplands :

- Low fertility status of the soils and low fertiliser use (Orissa 21.4 kg/ha and Chhatisgarh 35.7 kg/ha).
- Soil erosion leading to losses of soils, nutrients and moisture.
- Iron chlorosis in calcareous/alkaline soils.

- Poor land preparation and stand establishment and severe weed infestation.
- Pest and disease problems like stem borer, blast and brown spot.

Rainfed shallow lowlands :

- Impeded drainage and waterlogging leading to accumulation of toxic decomposition products (Fe toxicity and sulphide injury).
- Delay in monsoon leading often to delayed planting.
- Intermittent drought and flash floods.
- Slow change over to improved varieties from traditional tall varieties.
- New and emerging problems like multinutrient deficiencies such as P, Zn and S.
- Poor stand establishment and sub optimal plant population.
- Inadequate and lack of timely supply of quality seed.
- Excessive weed infestation particularly under broadcast sown condition and inadequate attention to weeding.
- Very low use of fertilisers due to little scope for high input management.
- Chronic and endemic disease and pest problems (bacterial leaf blight, blast, sheath rot, gall midge, stem borer, brown planthopper, leaf folder and hispa).

3. Major Recommendations Concerning Varieties, Crop Production and Protection Technologies :

During the recent past efforts were made (a) to increase and stabilise the yield level through introduction of better adopted and higher yielding varieties especially in rainfed ecologies and varieties with specific/multiple resistance in the irrigated ecology, and (b) to improve the net return of the rice grower through introduction of cost effective packages of crop improvement.

i. Varietal improvement :

A number of high yielding varieties combining desired adaptability to biotic/abiotic/ nutritional stresses and quality attributes have been released for general cultivation in rainfed and irrigated ecosystems of this region, as detailed in Appendix I. Continuation of the organising frontline demonstrations with the new recommended varieties with recommended crop management practices will not only familiarise the technologies but also facilitates rapid spread of promising varieties through seed exchange.

Recently released rice hybrids (Appendix III) like KRH-2 and DRRH-1 along with recommended management practices need to demonstrated.

ii. Crop production and protection

- Integrated nutrient management practices involving balanced use of plant nutrients, efficient use of inorganic fertilisers and organo-inorganic combinations, appropriate stubble management and green manuring practices, increased the input use efficiency and cost effectiveness in this region.
- Use of herbicides like butachlor (1.0 kg a.i./ha) or Anilophos (0.4 kg a.i./ha) at 0-7 DAT followed by 2,4-DEE (0.4-0.53 kg a.i./ha) applied at 20-25 DAT recorded best results of weed control under transplanted rice while under

rainfed uplands, butachlor (1.0 kg a.i./ha) on Pendimethaline (1.0 kg a.i./ha) applied within week after sowing followed by 2,4-D NA (0.6 kg a.i./ha) applied 25-30 DAT was found most effective to control weeds.

- Cartap granules (1.0 kg a.i./ha) could be used for effective control of stem borer and leaf folder.
- Ethofenprox (75 g a.i./ha) spray helps in preventing the resurgence of planthoppers.
- Granules of carbofuran or cartap at 1.5 kg a.i./ha applied in nursery 5 days before pulling the seedlings protected the early transplanted crop in main field from stem borer, whorl maggot and leaf folder similar to seedling root dip in 0.02% chlorphyriphos and this could serve as an alternate cost -effective technology.
- Tricyclazole or pyroquilon for seed treatment against blast, hexaconazole and propiconazole against sheath blight, chlorothanil against false smut are effective fungicides.
- Effective management of rice tungro disease in south coastal and north coastal of Andhra Pradesh by dispensing with summer rice crop by replacing with pulses/oil seeds which would reduce disease inoculum by breaking disease cycle.
- **New Insecticides as alternatives to traditional insecticides :** Traditional insecticides like organophosphates and carbamates have to be applied @ 400 to 500 g a.i./ha as sprays and 750 to 1000 g a.i./ha as granules. As alternatives to such insecticides, new groups of insecticides like phenyl pyrazoles and nitroguanidines have been evaluated and found effective. Thiamethoxam and imidacloprid at 25 g a.i./ha (nitroguanidines) were found to be exceptionally effective against planthoppers (BPH and WBPH) and leaf hoppers (GLH) and moderately effective against stem borer and leaf folder. Fipronil (a phenyl pyrazole insecticide) at 50 g a.i./ha as spray and 75 g a.i./ha as granules exhibited broad spectrum of efficacy against stem borer, gall midge, leaf folder, BPH, WBPH and GLH. These insecticides can serve as alternatives to traditional organophosphates and carbamates in pest management at the same time reducing environmental contamination and residue problems.
- **Nursery application of granules as alternative to seedling root dip:** Seedling root dip in 0.02% chlorpyriphos for 12 hours prior to planting has been a proven technology for control of insect pests like stem borer, gall midge and whorl maggot in early stage of transplanted crop. However, this technology did not find acceptance among farming community for various reasons. As alternative to this, nursery application with granular insecticides like carbofuran or quinalphos or phorate @ 1500 g a.i./ha of nursery 5 days before pulling seedlings resulted in good control of insect pests in early stages of transplanted crop. As a further refinement nursery drenching with insecticides like fipronil (100 g a.i./ha) or thiamethoxam (75 g a.i./ha) or imidacloprid (75 g a.i./ha) 5 days prior to pulling seedlings has also given promising results in checking early stage insect pests like stem borer, gall midge, whorl maggot and thrips.
- **Monitoring and management of yellow stem borer in rice through sex pheromones :** For monitoring of yellow stem borer (YSB) populations, 3 sleeve traps loaded with rubber dispenser (impregnated with 5 mg pheromone) are to be installed at an inter trap distance of 60 m in a triangular pattern in a rice field of about one acre. The trap height should be maintained at 0.5 m

during vegetative stage and just above crop canopy subsequently. Sudden increase in the average catch of the traps coincides with the emergence of brood (adults). Weekly catch of 30 males/trap/week at such point of time can be reckoned as the capture threshold which is followed by borer damage (dead heart/white ear) after 7 to 10 days.

For mass trapping pheromone traps at the rate of 8 per acre can be used at a spacing of 20 x 25 mts. The traps should be maintained throughout the crop stage by replacing the dispensers / lures 3 to 4 times at 20 days intervals. Under moderate pest incidence of 20 - 23% white ears, 2/3rd reduction in the pest damage can be achieved through these techniques. On the basis of prevailing prices, the cost of use of pheromones over a season approximately matches with 1 spray of conventional insecticide. In areas with severe pest incidence, only 1 insecticidal application may be needed when pheromone traps are used.

This technique may be especially useful in rabi season and pest prone areas of North Western India cultivating Basmati rices. It would also be useful for semi-deep areas were the use of conventional insecticides has practical limitations.

iii. Development and Extension measures

- Improvement of drainage in waterlogged areas.
- Early sowing in direct seeded areas and/or timely transplanting (by minimising staggered planting) on a watershed basis with due emphasis on the establishment of minimum desired level of plant population.
- Popularising small farm machinery such as puddlers, power tillers, threshers, reaper harvesters, simple grain dryers and grain storage equipments.
- Provision of crop like saving irrigations through organised shallow tube wells/village tanks (particularly in command areas) to facilitate early sowing of nurseries and tiding up with prolonged intermittent drought spells during rice growing period.
- Extension of unutilised areas during boro season in Orissa with provision of tube wells.

4. Significant Recent Achievements :

Varietal Improvement :

Efforts are continued to consolidate the yield gains to the irrigated ecosystem through genetic enhancement of the improved ecosystem through genetic enhancement of the improved genotypes with built-in resistance to major biotic and abiotic stresses. For maximisation of yields of rainfed ecosystem, it is aimed to select right type of genetic material adaptable for stresses like drought and blast in uplands and waterlogging in low lands. Recent cultures identified for different ecologies and stresses of the region are presented in Appendix I-IV.

Hybrid Rice :

Intensive research efforts for "Development and Use of Hybrid Rice Technology" continued with the objective of increasing the genetic yield level in irrigated areas where yields of the existing HYVs are approaching the potential level. At present 17 hybrids including four private sector bred hybrids are made available for cultivation in the country. The total area under hybrid rice is estimated to be around 2,00,000 ha.

Multilocation evaluation of experimental hybrids across the country resulted in identification of promising hybrids like KRH-2, PHB-71, Sahyadri, PA 6201, NDRH-2, and DRRH-1, etc.

Genetic Enhancement of Quality Rices :

Continued efforts on genetic enhancement of quality rices for higher productivity and export have enabled to release of new high yielding rice varieties like Yamni (CSR 30), Vasumati, Pusa Sugandh-2, Pusa Sugandh-3. Of these, Yamini is the first salt tolerant variety with basmati features and is recommended for normal and sodic soils. A rice hybrid Pusa RH-10 has been released with high quality features.

Soil and Crop Management Practices :

The results from ongoing soil fertility and crop management trials clearly indicate the fact that further increases in N-supply alone cannot bring about any further increase in crop productivity and that balanced nutrient use could gain more prominence, so as to maintain rice production sustainability at higher levels and to arrest the declining trend in input use efficiency and grain yield. Application of N alone in the past in many rice growing areas resulted in the removal of more amounts of P, K and Sulphur as compared to unfertilised plots and as such "N-driven systems" are now found unsustainable over a period of time.

The grain yield response to P application was significant in most acid soil locations and the super phosphate soil slurry root dipping technique (using 16 kg P_2O_5/ha) recorded comparable results as with 40 kg P_2O_5/ha applied in soil as DAP in high rainfall areas of Moncompu (Kerala) and Chiplima (Orissa); where nursery application of a lower dose of P_2O_5 also proved effective, in terms of cost reduction, with no appreciable reduction in grain yield.

Variety screening and utilisation of genetic variations in terms of tolerance of low P, Zn and Fe have identified promising rice cultivars and nutrient management techniques for increasing the efficiency of these nutrients.

Studies on sulphur nutrition at Kharagpur (West Bengal) using moderate levels of NPK in conjunction with elemental sulphur @ 20 kg S/ha recorded a rice grain yield response of 0.75 t/ha more of rice production (due to sulphur) over a base yield of 4.65 t/ha in NPK plots. Marginal responses to sulphur were also recorded at other test locations in Bihar, Orissa and West Bengal.

Studies on green manuring as substitute for meeting part of the N requirement of rice as also for increasing the N-use efficiency have clearly shown that it can help maintain favourable N-balance in the soil and can increase the N-use efficiency to a great extent in wet land rice. To that extent, the use of organic manures or green manuring in conjunction with inorganics as a blend is not a compromise but a compulsion, as a possible solution to many of the soil fertility problems and to help increase productivity and maintain better levels of rice production sustainability.

SPAD-based N management : The SPAD-based N application resulted significantly higher grain yield of 4.80 t/ha over N-135 kg/ha during Kharif, while comparable grain yield of 4.96 t/ha was recorded during Rabi with maximum application of 135 kg/ha. Mean over the seasons and varieties the grain yield increase was to the tune of 45 and 43% over control with SPAD-based N and N-135 kg/ha respectively. Less amount of N was applied in SPAD-based N method (75 kg N/ha during Kharif and 80 kg N/ha during Rabi). In other words saving of N is possible with SPAD based N application.

At Jagdalpur (Madhya Pradesh) under rainfed uplands, intercropping of rice variety Annada with pigeonpea (local variety) was most remunerative than growing of sole crop of rice.

Evaluation of Rice Germplasm for Biotic Stresses :

Due to improper storage and conservation, the identity of the rice germplasm collection in the country is getting eroded and due to lack of organised evaluation of the same for their useful traits, the entire collection remains useless. Keeping this in view, an ICAR funded project for evaluation of the germplasm for biotic stresses has been implemented from 1993 to 1998 and thereafter as a core activity of DRR in the co-ordinated programme with the objective to characterize and evaluate the existing germplasm against major pests and diseases; documenting the results and make available the new resistant genetic sources for use. During the eight years period, a total of 18000 germplasm accessions obtained from CRRI, Cuttack and IGKVV, Raipur were evaluated at hot-spot locations such as Maruteru, Ragolu, Nellore (Andhra Pradesh), Raipur, Jagdalpur (Madhya Pradesh), Sambalpur and Jeypur (Orissa). Number of accessions are found to possess resistance to stem borer, gall midge, brown planthopper, leaf folder, leaf blast, bacterial leaf blight, sheath blight etc. which would be used for further genetic enhancement.

Rice Row Seeder

A row seeder for direct sowing of pregerminated paddy has been developed. The seeder saves labour by dispensing away with operations like nursery raising and transplanting. The seeder requires only 8 man hours to cover one hectare against 214 and 347 man hrs/ha by transplanter or manual transplanting with a net saving of Rs.649/- and Rs.1080/- per ha. Respectively.

On-farm Research, Extension and Training:

Technology generated under the national coordinated programme/networks is disseminated to the farmers by training extension personnel through various types of structured training programmes or workshops and through frontline demonstrations and special on-farm demonstrations in low productive problem areas.

Frontline Demonstrations:

Frontline demonstrations were organised in 400 acres spread over states of Eastern Madhya Pradesh, Orissa and Andhra Pradesh suffering yield losses on account of pest and disease constraints, with a view of familiarising the farmers with improved varieties and management technologies. Most of the new varieties demonstrated along with improved management practices resulted in impressive yield gains. Besides, the farmers had access to seeds of new varieties. New varieties that have given impressive yield gains with improved management practices are listed below:

State	Ecosystem/problems	Selected Varieties
Andhra Pradesh	RUP	Tulasi, Aditya,
	RShL	Krishnahamsa, Triguna, Nidhi
Orissa	SShL	Mahanadi, Ramchandi, OR 1206-25-1, OR 1206-26-2
Chhattisgarh	RUP	Poornima, Vandana, JR 345, Danteswari
	RShL	Bamleshwari, Mahamaya, Poornima

RUP - Rainfed Upland ecosystem
RShL - Rainfd Shallow water system

Appendix –I

Recommended Varieties for the Region

State	Ecosystem	Names of the varieties
Andhra Pradesh		
1.	Rainfed upland	Tulasi, Aditya, Prasanna, Ravi, Satya, Rudrama Maruteru SannaluSomasila
2.	Irrigated	Rasi, Vikas, Tella Hamsa, Prabhat, Rajendra, Divya, Sasyasree, IR 64, Ajaya, Satya, Saleem, Surekha, Krishna Hamsa, Swarna, Samba Mahsuri, Triguna, Kesava, Indur Samba, Shiva, Vijetha, KRH-2
3.	Gall midge endemic areas	Suraksha, RGL 2538, IET 10831, Bhadrakali, Phalguna, Suredha, Kavya, Abhaya, Vibhava, Erramallelu,
4.	RTV endemic areas	Nidhi, Vikramarya, NLR 3-491
5.	Saline & alkaline soils	Vikas, Prakasah
6.	Rainfed shallow water	Swarnadhan, Manasarovar, Phalguna, Mandya Vijaya, Nandi, Pinakini, Krishna veni, Thikkana, Chaitanya, Pothana, Orugallu, Sri Ranga, Sagar Samba, Simhapuri Surya, Vedagiri
Chattisgarh		
1.	Rainfed upland	Tulasi, Aditya, Heera, Purva, JR 75, Radhi, Annada, R 281-31-1, Jawahardhan 3-45
2.	Irrigated	Ruchi, Mahamaya, Patel 85, Madhuri, Ajaya, Suraksha, Abhaya
3.	Rainfed shallow water	Shyamala, Swarnadhan, Phalguna, Mahsuri, CR 1002, Safri 17, Kranti, Swarna, Surekha, Mahamaya
Orissa		
1.	Rainfed upland	Heera, Kalinga III, Annada, Parijat, Pathara, Kalyani II, Sattari, Neela, Rudra, Vanaprabha, Khandagiri, Nilagiri
2.	Irrigated	Rajeswari, Seema, Parijat, CR 1014, Jajati, Urbashi, Samalei, Tapaswini, Dalaheera, Radhi, Luit, IET 12241
3.	Rainfed shallow water	Rajeswari, Seema, Parijat, CR 1014, Jajati, Urbashi, Samalae, Tapaswini, Dalaheera, Radhi, Luit, IET 12241
4.	Rainfed semi-deep water	Utkalprabha, Ramba, Jogen, Sabita, Amulya, Manika, Mahalaxmi, Kanchan, FR 13 A, Panidhan

Appendix – II

Promising cultures identified for the region:

Andhra Pradesh		
Rainfed upland	:	IET Nos. 13181, 12630, 13652, 14364, 14350, 16813 (up to 100 days)
Rainfed shallow	:	IET Nos. 13336, 13394, 14089, 14339, (145 – 150 days)
Irrigated areas	:	IET No. 15352, 15358, 16535, 17041, (135 days)
Saline areas	:	IET 12863, 16151
Orissa		
Rainfed upland	:	IET No. 13623, 13943, 13664, 16945,(up to 100 days)
Rainfed shallow	:	IET Nos. 13354, 13396, 13356, 13509, 13520, 14100, 14101 (145 – 150 days)
Rainfed semi-deep water	:	IET No. 11904, 13119, 15204, 15206, 16472, 16481, 17318 (145 – 150 days)
Deep water	:	IET 11873 (Photo sensitive)
Irrigated areas	:	IET No. 13423, 14101, 14106, 14062, 14466, 14467, 14431, 14432, 14290, 14468, 15001, 17048
Saline areas	:	IET 12863
Chhattisgarh		
Rainfed upland	:	IET No. 13832, 13194, 13623, 13664, 13630, 15169, 15296, 15299
Rainfed shallow	:	IET No. 13509, 13508, 14405
Irrigated areas	:	IET No. 14038, 14433, 14444, 15084, 15068, 15178, 16555

Appendix – III

Salient features of popular released rice hybrids

S. No.	Name of Hybrid/ Year of Release	Duration (days)	Yield in OFT (t ha^{-1}) Hybrid	Check	Yield adv. over check (%)	Released for the state of
1	APHR-1 (1994)	130-135	7.14	5.27 (Chaitanya)	35.4	Andhra Pradesh
2	APHR-2 (1994)	120-125	7.52	5.21 (Chaitanya)	44.2	Andhra Pradesh
3	DRRH-1 (1996)	125-130	7.30	5.50 (Tellahamsa)	32.7	Andhra Pradesh
4	KRH-2 (1996)	130-135	7.40	6.10 (Jaya)	21.3	Karnataka
5	PA 6201 (2000)*	125-130	6.18	5.03 (Jaya)	22.9	Eastern and some parts of Southern India.
6	HRI 120*(2001)	135-140	6.11	4.91 (Jaya)	24.4	Southern, Eastern, western regions
7	Pusa RH 10* (2001)	120-125	4.35	3.11 (Pusa Bas.1)	39.9	Haryana, Delhi, Uttranchal

Appendix-IV

Efficient varieties in deficient soils

Deficiency	Variety
Nitrogen	Swarna
Phosphorus	Rasi, Bharani
Zinc	IR50, IR36,Vikas

D 5: Directorate of Oilseeds Research, Hyderabad

The ICAR Regional Committee No. V looks after the states of Andhra Pradesh, Orissa and Chattisgarh. The progress made during the last three years in respect of mandate crops viz., sunflower, safflower and castor are:

Status of the Crops in the Region

S.No.	Crop/ State	1999-2000			2000-01			2001-02		
	Sunflower	A	P	Y	^	P	Y	A	P	Y
1	Aiidhra Pradesh	278	159	572	197	168	853	264	184	r'697
2	Orissa	9	7	787	5	5	1000	7	7	1000
3	Chattisgarh	..	..	..	..	..	..	19	18	947
	Safflower	..	..	..	..	..	..			
1	Andhra Pradesh	17	8	471	16	5	321	15	7	467
2	Orissa	2	1	500	2	2	1000	2	1	500
3	Chhaattisgarh	..	..	..	..	..	..	1	2	2000
	Csstor									
1	Andhra Pradesh	264	59	223	393	131	333	283	83	293
2	Orissa	22	11	500	18	7	389	22	9	409

A= Area (1000 ha); P= Production (1000 tonnes) ;Y= Yield (kg/ha)

Production Problems in the Region

Sunflower necrosis disease
Wilt, macrophomina and nematodes in castor
Non-availability of hybrids and varieties tolerant to Botrytis
Use of pool quality seeds by farmers

State-wise and crop-wise recommended varieties and hybrids for the region V

State	Sunflower	Safflower	Castor
Andhra Pradesh	Morden, KRSH-1, APSH-11, Sidheshwar(LS-II). MLSFH-47 (AH-n-34)	DSH-129.MKH-11, Sagar Muthyalu, Manjeera, NARKS	DCH-32.DCH-177, GCH-4, Kranti (PCS-4),
Orissa	Morden, KBSH-1, Sidheshwar(LS-II), MbSFH-47 (AH-TT-34)	DSH-129,MKH-11, A-1, NARI6	Aruna, DCH-177SA-2
Chattisgarh	Morden, KBSH-1, Sidheshwar(LS-II), MLSFH-47 (AH-n-34)	DSH-129.MKH-11, JSF-1, JSI-73	...

Research Achievements Sunflower

- The most critical factor affecting sunflower productivity is thinning at Hyderabd and weeding at Nandyal

- Sunflower - Sunflower and groundnut-sunflower sequences were more prc ductive than other sequences at Nandyal in Andhra Pradesh
- Combined seed treatment with Azotobacter and Azospirillum could give yield increase equivalent to 50% N in sunflower at Hyderabad.
- Imidacloprid 70 WS @ 5.0 g/kg of seed as seed dresser or Imidacloprid 200 SL
  @ 0.1 ml/l lof water as foliar spray at 15-20 days interval is effective against sucking pests (leaf hopper, thripsO and as well as in reducing the necrosis disease
  of sunflower during early stages of the crop.
- Necrosis virus has been successfully transmitted from sunflower to sunflower and
  to several crop plants and weed hosts, both with mechanical sap and thrips transmission under grlass house conditions.

Safflower

To enhance safflower yields, plant protection in Telangana region of Andhra Pradesh and fertilizer use in Malwa plateau of Madhya Pradesh need to be given special attention as they are the major constraints.

- In fò-.langana region of Andhra Pradesh, cycocel spray @ lOOOppm at 50% flowering significantly enhances the seed yield and net returns.
- Sulphur fertilization up to 15 kg/ha at Tandur through single super phosphate significantly enhances yield and returns in safflower.
- Plant protection appeared to be the major production constraint for maximizing the safflower productivity at Tandur in Telengana region of Andhra Pradesh.
- Seec. treatment with Azotobacter + Azospirillum could save 50% N in safflower.

Castor

- A simple laboratory and field screening technique for Botrytis grey rot was
perfected at DOR for screening large number of germplasm and breeding material
- For Botrytis management adoption of 90x90cm spacing was beneficial in terms of
reduced infestation and yield increase. Removal of affected spikes + Bvistin span.y lg/l + top dressing 20 kg N/ha after cessation of inclement weather enhaiced yields.
- Application of 50% RDF + Azospirillum seed treatment + 25% N through FYM
(147.. kg) gave higher yield at Palem centre.

- Castor + pigeonpea (ICPL 88039) in 1:2 ratio is more remunerative than sole castor or pigionpea

Issues related to Transfer of Technology

The productivity potentials and profitability of the latest improved production

technologies in castor, safflower and sunflower under real farm situations were
demonstrated at different AICRP centres in the^egion under the project FLD on oilseed
crops.

Implementation of Frontline demonstrations in the Region

State/Crop	1997-98	1998-99	1999-2000	2000-01	2001-02
Andhra Pradesh					
Castor	16	45	80	48	63
Safflower	..	11	8	9	10
Sunflower	..	3	..	..	15
Orissa	.,				
Castor	15	9	10	10	20
Safflower	..	..	..	..	..
Sunflower	..	25	..	..	10
Chattisgarh	.,	..	..		
Castor	..	..	..	..	..
Safflower	..	..	..	5	15
Sunflower	.,	..	..	..	10

The improved varieties in castor like Kranthi (PCS-4) and Jyothi (DCS-9) gave yield increase of 19-1485 and 29-67% respectively under rainfed and irrigated conditions respectively While the hybrids DCH-32, DCH-177, GCH-4, GCH_5 and PCH-1 gave yield increase ranging from43-257% under rainfed and 17-75% under irrigated conditions.

In villages iround Hyderabad, the potentiality of castor crop was demonstrated compared with various competing crops like tomato, cotton and sorghum. The additional net returns ranged frorr. Rs. 459 to Rs.3145/ha under rainfed situations.

Major constraints

Timely availability of certified seeds of sunflower and castor is a constraint for increasing their productivity

D 6: NRC for Oilpalm, Pedavegi

D 7: Central Research Institute for Dryland Agriculture, Hyderabad

The Central Research Institute for Dryland Agriculture (CRIDA) was established over a decade and a halfback. The institute, in close association with All India Coordinated Research Project for Dryland Agriculture (AICRPDA) and All India Coordinated Research Project on Agro-meteorology (AICRPAM) is engaged in basic and strategic research leaving location specific problems to the coordinating centers located across different agro-ecological regions.

The institute has developed close linkages with national and international, voluntary and private industries/organizations to reinforce and broad base its mandated activities for augmenting the productivity of rainfed areas on a sustainable basis. CRIDA has been duly recognized through its contributions in the field of biophysical research for integrated watershed management, and the development of low cost and effective farm implements.

During the past two years, research activities were pursued on resource characterization, rainwater management, crops and cropping systems, INM, IPM, alternate landuse systems, socioeconomic issues, transfer of technology and the like. Biotechnology and post-harvest technology have also been given due consideration. CRIDA is also vested with the responsibility of leading rainfed Agroecosystem Directorate under NATP.

Resource Characterization

Based on the moisture adequacy index, photoperiod and temperature, yield prediction equations were developed for castor cultivars VP-1,48-1, GCH-4 and Aruna. The contribution of Common Pool Resources to the economics of rural poor in different semi-arid regions of India was examined. A declining trend in CPRs was noticed which may be due to environmental degradation, population growth and the breakdown of traditional systems of management. Food grain production of 216.8 m.t. in the country has been estimated using the sub-divisional rainfall data received upto September 2002. Prediction equations for important pests in different crops was also developed using historical data on pests and weather. Dynamic website for Agromet data bank was designed and developed for browsing through CRIDA Internet. Agromet conditions over AP were monitored in near real-time, and thematic maps prepared for Agromet Advisory Services, and time to time contingency plans were issued by ANGRAU. Cotton crop suitability analysis for A.P., Gujarat, Karnataka, M.P., and Maharashtra were completed using the spatial information on climatic and soil parameters using law of minimum and law of addition. Spatial maps have been generated for all these states. Computer programs were also developed to estimate the potential yield of cotton based on radiation and duration of crop.

Integrated Nutrient Management

The long term experiment on "Assessment and improvement of soil quality and resilience for rainfed production system" indicated that conventional tillage proved superior over zero tillage and that the application of residues was effective and aggradative compared to 'no residue' application. From the viewpoint of improving soil quality, conventional tillage with the application of gliricidia lopping @ 2t/ha+90 kg N/ha through urea proved superior most.

A five year trial on 'low tillage and integrated nutrient management strategies for semi-arid tropics' involving sorghum (cv CSH-9) and greengram (cv ML-267) showed that:
The highest sorghum grain yield (2383 kg ha^{-1}) was observed with combined application of 4t FYM + 20 kg N through urea followed by 2t Gliricidia loppings + 20 kg N through urea (2367 kg ha^{-1}). Under reduced tillage also, these two treatments performed well.

Highest greengram yield was obtained by application of 1t Gliricidia loppings + 10 kg N through urea (993 kg ha^{-1}) and 2t FYM + 10 kg N (843 kg ha^{-1}) under conventional and reduced tillage systems respectively. Available nitrogen and organic C in soil increased considerably in INM treatments over control over a period of 5 years, more so in reduced tillage than in conventional one.

Rainwater management

Ten on-farm trials were conducted in five villages of Nalgonda district to emphasize the effectiveness of conservation furrows in moisture conservation and run-off management. The area under the intervention stored 8-35% more soil moisture thereby resulting in 16-17% higher yield of castor and pigeonpea. Based on the information collected from 37 watersheds under different agro-eco regions, a marginal increase in groundwater table (0.1 to 2.5 m), afforestation, cropping intensity and productivity, and decrease in soil and water runoff was noticed as compared to non-watershed areas.
The project on "Documentation and analysis of indigenous methods of in situ conservation and runoff management" resulted in two publications entitled: 1) ITKs in soil and water conservation; and 2) Soil & water conservation reviews.

Crops and cropping systems

Maize cvs Harsha and DHM-105 were identified as two high yielding and stable genotypes, suitable both for fodder and grain, cv DHM-105 also showed higher resistance to lodging and more tolerance to moisture stress. Under biotechnology project, efficient, rapid and season independent protocol for regeneration of sorghum cv SPV 462 was developed. Comparative analysis of the influence of water deficits on sorghum cv SPV 462 and hybrid CSH-14 indicated that hybrid CSH 14 maintained better water relations compared to SPV 462 probably due to higher accumulation of compatible solutes such as total soluble sugars and free amino acids. Preparation of crescent shaped basins and bunds all along slopes, and application of 75 kg compost, 1 kg N, 0.75 kg P_2O_5, 1 kg K_2O and 0.2 kg $ZnSO_4$ /plant to > 10 year old mango orchard resulted in maximum fruit yield (9.2 to 10.5 tonnes/ha) vs 2.6 to 6.2 obtained following farmers' practices. On-farm participatory evaluation of bio-intensive IPM modules was conducted in 30 acres of castor in the target villages, Nandimallagadda, Wanaparthy Mandal, Mahabubnagar district, A.P. Average castor yield from 2-3 pickings was 685 kgha with the highest yield of 1470 kg ha"[1] in early sown castor (sole). Cost benefit ratio varied between 1:1.8-4.2 depending on soil type, crop management and cropping system.

Alternate landuse systems

In a 9-year old mango plantation, cultivation of kharif groundnut was quite successful. Under a pilot project, 15 on-farm trials were conducted on teak and neem, and elite planting material was popularized among farmers. After successful completion of the Phase 1, the next phase was launched on micropropagation of neem and teak with emphasis on extension of technology through rural biocentres.

In tree-crop intercropping studies with 4 year old amla, tamarind and *Acacia Senegal,* Amla was found least competitive with the intercrops. In this system, greengram was more compatible, yielding 84% of sole, while castor yielded only 63%.

Mango cv Kesar was successfully in situ grafted in the field on one year old seedlings of cv Totapari. This -technique is highly useful for establishment and survival of fruit plants in harsh semi-arid eco-system. Pruning of custard apple cv Balanagar, and provision of trenches for harvesting rain water helped in increased fruit set and yield. Large scale and participatory agroforestry programme is under operation in six villages of Nalgonda and Mahabubnagar districts of Andhra Pradesh. It was found desirable to have integration of soil and water conversation, vermicomposting and vegetative fencing components for making agroforestry a success.

Farm machinery

Design of Castor Shelter and Vegetable Preservator was completed and licensed to industry.
Orchard sprayer was successfully tested on large (300 ha) farmers fields in Mahabubnagar and Nalgonda districts. Saving of 50% cost and time was achieved. Design of this machine has been licensed to industry.

Nine-row groundnut/soyabean planter design was completed and tested on large scale at Anantapur and Indore. Design has been licensed to 3 industries. MoU was signed with 4 industries for manufacturing of 12 implement designs.

Socio-economic studies

In a survey conducted in three villages of Ranga Reddy district, gender disparity in wages was found to be high even though women worked for longer hours in the field. In a Rapid Rural Survey conducted in Nallavelli village of Rangareddy district, sheep and goat farming was found more remunerative.

Transfer of Technology

In a study conducted at 17 AICRPDA centers, it was noticed that awareness and adoption of most of the soil and water conservation measures was medium. Kisan Mela and Kisan Divas were celebrated. Twelve farmers were honoured for their achievements. A number of courses/training programmes were organized for state functionaries, farmers, farm women and farm youth.

Education

Eight students from Universities located in Hyderabad and Dharwad were engaged in research leading to post-graduate degrees, and are being guided by the institute scientists. Four scientists of the Institute are pursuing higher studies at different universities. Five scientists of the Institute acquired doctoral degrees.

The B.Sc. Dryland Agriculture vocational course, run in collaboration with Osmania University, Hyderabad has successfully entered into the third year. Twenty eight students from the third year, 15 from the first and 20 from the second are currently on roster. A MoU was also signed between the University and the Institute.

Constraints

A large number of posts are lying vacant at number of centres and this hinders effective implementation of the technical programme. At a number of centres it has been reported that the staff at the universities is mostly engaged in the teaching work and they do not spare sufficient time for conducting the field experiments as per the planned programme under coordinated project. At some centres the sanctioned vehicles are pooled by the University and they are not made available to the Officer-in-Charge of a particular project which affects the work of the project. The Scientists-in-charge a number of times are not submitting the progress reports in time to the Project Coordinator and to the Headquarters.

Remedial measures

The concerned Universities/Institutes are requested to take immediate action for filling up of the vacant posts and effective utilization of the resources. The scientific staff situated at the Universities may be requested to devote their major share of time for conducting the field experiments as per the approved technical programme rather than devoting more time to the teaching work only

D 8: Water Technology Centre For Eastern Region, Bhubaneswar

Water Technology Centre for Eastern Region (WTCER), Bhubaneswar was established by ICAR on 12 May 1988 as a National Research Centre during VII Five year plan period. The Centre is located at Chandrasekharpur, Bhubaneswar on a 5.71ha of land along with its main office-cum- laboratory building, training hostel and residential complex. It is about 8 km north of Bhubaneswar railway station and at about 15 km away from Biju Pattnaik airport Bhubaneswar. The site location is at about $20^0 15'$ N and $85^0 52'$ E at 23 m above mean sea level. Research farm of the Institute (63.71 ha of farm land) is located at Deras, Mendhasal ($20^0 30'$N and $87^0 48' 10''$E) and is at 30 km away from main Institute complex.

Mandate

The mandate of the Centre as approved by the council is as follows:

- To undertake basic and applied research for developing strategies for efficient management of on-farm resources to enhance agricultural productivity on sustainable basis in the eastern region.
- To provide leadership role and coordinate network of research with the State Agricultural Universities in generating location-specific technologies for efficient use of water resources in the eastern region
- To act as a centre for training in research methodologies and technology update in the areas of agricultural water management in the region
- To act as repository of information on agricultural water management in the eastern region
- To collaborate with relevant national and international agencies in achieving the above objectives
- To provide consultancy in agricultural water management

Research Achievements

The Institute research effort during its establishment stage has been mainly concentrated on climatic data analysis for scientific planning of irrigation and drainage, development and standardization of *in-situ* rainwater conservation measures (optimum dike height in rice field), water harvesting and rain water management techniques, surface drainage of water logged area, evaluation of different improved irrigation methods such as drip and sprinkler systems and performance of canal irrigation systems. The institute has made significant achievements in some of these fields.

Priority Research Area

The following priority areas of research are outlined for x plan.

- Multiple use of water for increasing water productivity.

- Conjunctive use of rain, surface and groundwater for maintaining sustainable hydrologic regime.
- Hydraulic and hydrological study of irrigation system and its command area.
- Increasing water use efficiency through efficient utilization of available irrigation water.
- Increasing small irrigation water resources.
- Integrated watershed, water resources and command area development to improve productivity of land and water.

ONGOING PROJECTS DURING 2001-2003

For fulfilling its mandate effectively, the research activities of WTCER are carried out mainly under five programme modes i.e., Rain water management, Ground water management, Canal water management, Waterlogged area management, and On-farm research and transfer of technology. Under these five programme modes, 39 research projects and 8 externally funded projects (seven NATPs and one INCID project) are presently operational. AICRP on Water Management has already been shifted from ICAR Research Complex, Patna to WTCER, Bhubaneswar w.e.f. 1st April, 2002 and AICRP on Ground Water Utilization is being shifted to WTCER from ICAR Research Complex; Patna. The Centre took up two consultancy projects, one with NGO (AGRAGAMEE) to prepare comprehensive plan for development of water resources in Adri Panchayat of Thuamal Rampur block of Kalahandi and another with Chilka Development Authority on planning of water resource development by water harvesting and enhancing recharge of ground water and their efficient and optimum utilization in Bengal Pahad watershed in Chilka lagoon.

The programme-wise research highlights for the last two years is given below:

Rain Water Management

- A mathematical model for designing integrated multi-tank irrigation system based on combination of farm ponds, percolation tanks and well has been formulated.
- To improve use efficiency of harvested rainwater, drip irrigation was tried in different vegetable crops at Deras farm during *rabi* season.
  - Amongst five tomato varieties, BT-10 was found suitable for growing after paddy with fertigation. Fertigation gave highest nitrogen use efficiency and fruit yield.
  - Soil incorporation and fertigation methods of applying N (100 kg urea N/ha) were compared in ladies finger. It was found that at the end of one month of crop growth, mineral N available in 0-45 cm soil was 68, and 43 kg/ha, when urea was basally incorporated into the soil.
- Preliminary studies showed that lined trenches (covered and uncovered) could be an effective means for rainwater in sloppy areas. However, they

could not meet total irrigation requirement for initial establishment of mango orchards.

- In rice-fish integration system, productivity of fish and prawn was 1026.7, 962.8 and 906.6 kg/ha/4months in plots with 10 cm, 12.5 cm and 15 cm dyke height, respectively. Higher productivity at less dyke height was due to increased spill out water supply to the refuge and more natural food availability. Highest grain yield was recorded at 15 cm dyke height (3629 kg/ha), which was significantly superior to that of 10 cm dyke height (2988 kg/ha). Rice yield was increased by 7.9-8.6% under rice-fish integration system as compared to the rice cultivation alone.

Canal Water Management

- Twenty-one subgroups of soils of Orissa were characterized and classified according to their moisture storage properties.
- A model for alternative canal delivery schedule based on daily water balance simulation of the entire command was developed for *kharif* season. Model simulation results indicated that fifteen days rotational delivery schedule (15 days ON followed by 15 days canal closure) would be a suitable alternative to the existing continuous delivery schedule.
- Irrigation through field channel and use of recommended dose of fertilizers gave significantly higher yield than that obtained by field to field irrigation using farmer's fertilzer dose in rice (variety: Gayatri). Mineral N availability in the plow layer soil of Balipatana under the canal irrigation command ranged from 0-14 ppm at panicle initiation stage of rice.
- An alternative method of rice crop establishment, viz. wet-seeding in puddle field, was developed in canal irrigation command for better water use and higher economic returns.
- Field pea showed higher water use efficiency as compared to the safflower and black gram when they were grown with two irrigation and rice stubble mulch.
- Performance of three un-irrigated *rabi* crops, viz. horse gram, green gram and sesamum, were tested at Balipatna under Nimapara Branch Canal Command. It was found that 41.7%, 38.2% and 33.2% of the total water use by horse gram, green gram and green gram, respectively were contributed by the upward flux i.e., by the ground water table.
- Drought-tolerant legumes like horse gram, black gram and green gram were grown at Balipatna under the Nimapara Branch Canal Command during *rabi* season. Total N accumulation in aboveground biomass was about 160 kg/ha in horse gram, 112.7 kg/ha in black gram and 82.2 kg/ha in green gram. This accumulated N could be recycled to following rice crop for sustaining nitrogen fertility of the soil.
- Yield loss in sugarcane was more (40.58%) in wide row spacing (150 cm) due to moisture stress during formative stage than in paired planting. Addition of trash mulch @ 7 t/ha increased the cane yield by 20% under the moisture stress condition.

- Performance of a drought-tolerant tuber crop, sweet potato was tested at Balipatna during *rabi* season when no canal irrigation was available. Application of rice straw mulch @ 5 t/ha increased the tuber yield from 8.15 to 16.35 t/ha. Soil analysis revealed that mulching treatment maintained high moisture level and increased availability of N by about 85% and that of K by about 40%.
- Constraint analyses through preferential ranking technique delineated as many as nine constraints related to canal irrigation with their relative priority as perceived by the farmers. There was alarming gap between potential created and potential utilized in canal command area.
- Irrigation with 5 cm water at IW/CPE 0.7 was found suitable for raising safflower in sandy loam Aeric Haplaquepts.

Ground Water Management

- Ground water table at Erasama (Jagatsinghpur district, Orissa) was found within 2 m depth below the ground during the summer. Aquifer of these areas lies in the granular zone and there is presence of alternate layer of sand and clay up to 95 m depth below the soil surface. The aquifers of upper lithounit are more porous, permeable and high yielding.
- In western part of Orissa, ground water development was very low due to low water bearing strata and low discharge rate. So installation of tube wells in un-command area is not recommended.

Waterlogged Area Management

- One thirty four ha of waterlogged land at Biswanathpur in Khurda district of Orissa was improved by laying out surface drainage consisting of main drain (1.785 ha) and four link drains (2.583 km length). Watermelon and ladies finger were identified as suitable crops for growing in *rabi* season flood-prone lowland at Biswanathpur. Further, availability of N and K was found higher in flood-prone lowland as compared to that in adjacent uplands.
- Five swamp taro cultivars were tried in swampy lowland area at Mendhasal in Khurda district. The cultivar 'BCST 15' gave the highest runner yield (19.95 t/ha) with maximum contribution during July-August.
- Water standing in pond/ reservoir was utilized for growing economic crops like water chestnut from June to November months at Mendhasal in Khurda district. Nut yields were found higher in green than the red type cultivars.

On-farm Research and Transfer of Technology

- Two on-farm research trials were conducted during *kharif* season.
    - First one was on performance evaluation of rice varieties under different water depths with scientific and farmer's practices at

Arada village in Cuttack district. Rice variety *Durga* and *Tulsi* performed well at 30-35 cm water depth.

  - Another trial was conducted at Balipatana on drainage at different growth stages of rice. Drainage for 7-10 days at tillering stage enhanced the tiller number in rice resulting into higher yield.

- A conceptual model was developed indicating interrelationship between adoption gap and perceived feasibility of technology needs, perceived appropriateness of technologies with respect to different indicators, different types of constraints, socio-personal, socio-economic, psychological and communicational variables. The feasibility of eighty-six water management technologies, recommended by different organizations working in the field of water management in the state of Orissa and West Bengal was assessed. It was found that the forty technologies were having feasibility score $\geq$ 4.0, while eight technologies were having score $\leq$ 3.0 and rest of the thirty-eight technologies were with feasibility score in between 3.0-4.0 on a feasibility continuum ranges from 1.0 (not feasible) to 5.0 (highly feasible). Perceived reasons for non-feasibility delineated.

Miscellaneous Projects

- Irrigation scheduled @ 100 % pan evaporation at two days interval in combination with 100 % of the recommended dose of fertilizer (180: 90:90 kg N, P_2O_5, K_2O/ha) in eight equal splits through drip produced maximum fruit yield (3.71 t/ha) of pointed gourd. Application of rice straw mulch @ 15.0 t/ha recorded 7.7 % more fruit yield than 7.5 t/ha mulch. Further, the effect of differential amount of irrigation on fruit yield was not in proportion to the amount of water applied and hence the irrigation water use efficiency was 53.6, 49.3 and 51.9 kg fruit/ha-cm of irrigation water applied in 100, 80 and 60 % of PE, respectively.
- Prototype software for web-based Water Resources Information System (WRIS) for eastern region was developed. Different database tables to organize district-wise information were developed in Microsoft-Access. The software to access and update this information was developed in Visual Basic (VB).
- Characteristics of point sources' discharge indicated that the prospect of use of effluents from paper mill, breweries and distilleries, sugar distilleries, galvanizing unit, coco-cola beverage ltd., shrimp processing unit and ash pond water are more in agriculture. The effluent of Emami Paper Mill when diluted by more than 2.5 times could be used to irrigate green gram, black gram, maize, sunflower and rice in sandy loam Aeric Haplaquepts.
- Fifty-three irrigation water samples (11 surface water and 42 ground water) and 9 drainage waters collected from different places/ agricultural farms of Balasore, Jagatsinghpur, Khurda and Puri districts of Orissa were analyzed for various quality parameters. Quality of the drainage water indicated their suitability for reuse as irrigation water.

- Most water resources in the coastal belts of Orissa became saline when seawater intruded there during the 1999 super-cyclone. Monitoring of the quality of water in those areas indicated a progressive and substantial decrease in salinity over the period of last three years.
- Highest field water use efficiency in pea (3.55 kg/ha-mm) and lowest in chickpea (1.50 kg/ha-mm) was found at three irrigations. The 32.1-60.1%, 37-69%, 15.3-52.7%, 20.4-53% and 42-80% yield reductions were observed in pea, chickpea, linseed, safflower and mustard, respectively when less than three irrigation were applied at two experimental sites (Deras farm, Bhubaneswar and Arnapurnapur village, Dhenkanal).

NATPs and Sponsored Project

- Among the legume based intercropping, groundnut + pigeonpea gave highest rainwater use efficiency and rice equivalent yield (7146.5 kg/ha) with highest net economic return (Rs. 21585/ha). It also revealed that maize-horse gram/ sesamum crop rotation was the best for double cropping in light-textured upland which produced total net economic return of Rs. 15,800/ha from maize-horse gram and Rs. 17,440/ha from maize-sesamum. Among rice based intercropping, rice + pigeonpea proven to be most productive giving rice equivalent yield of 2973 kg/ha with net economic return of Rs. 14,400/ha under integrated weed management practices.
- Construction of water harvesting structures had a favourable impact on crop yield and farm income. About 25% of investment was recovered back within the first year itself.
- Pilot study on pressurized irrigation system forming adjunct with canal irrigation in Deras Command, Khurda district revealed that irrigation requirement of post-monsoon crop was reduced by about 30%, when it was irrigated by sprinkler. The system was designed in such a manner that the water flow by gravity during *kharif* season for irrigating rice.
- Introduction of high-yielding technology packages in Kuladera Nallaha Watershed of Keonjhar district, Orissa improved production of cereals by 21%, pulses by 10%, oilseeds by 12% and vegetables by 35%.
- In the rainfed rice production system (medium land), two-stage rainwater conservation through optimum dike height and construction of refuge has resulted a highest rice equivalent yield of 5.67 t/ha at 20 cm dike height plots. Similarly, in lowlands the rice equivalent yield has gone up to 4.48 t/ha due to drainage channel and pond construction. Utilizing the stored water in refuges, second crop was taken up during *rabi* season.

AICRP ON WATER MANAGEMENT

The All India Coordinated Research Project on Water Management has been shifted from ICAR Research Complex, Patna to WTCER, Bhubaneswar w.e.f. 1st April, 2002 . . The network of AICRP on Water Management consists of 25 centres located in different agro-ecological regions of the country. The network centres are located at Almora (Uttaranchal), Bhatinda (Punjab), Belvatgi

(Karnataka), Bhavanisagar (Tamil Nadu), Bilaspur (Chhattisgarh), Chalakudy (Kerala), Chiplima (Orissa), Dapoli (Maharashtra), Faizabad (U.P.), Gayeshpur (W.B.), Hisar (Haryana), Jammu (J&K), Jorhat (Assam), Kota (Rajasthan), Madurai (Tamil Nadu), Morena (M.P.). Navsari (Gujarat), Palampur (H.P.), Pantnagar (Uttaranchal), Parbhani (Maharashtra), Powarkheda (M.P.), Pusa (Bihar), Rahuri (Maharashtra), Shillong (Meghalaya) and Sriganganagar (Rajasthan). Whereas 21 centres are located in major and medium irrigation commands, 4 centres are located in hilly and high rainfall areas. The centres fall under the jurisdiction of 21 State Agricultural Universities and 2 ICAR Institutes. All the network centers conduct research on various aspects of water management under a model technical programme consisting of 5 major research themes: (i) Assessment of water availability at regional level and to devise interventions for matching water supply with the agricultural production systems' demands, (ii) Design and evaluation of gravity and pressurized irrigation systems, (iii) Management of rain and other natural sources of water, (iv) Basic studies on soil-water-plant-atmospheric environment relationships, and (v) Water management in different agricultural production systems including horticultural and other high value crops. Besides the network research, Coordinating Unit on Water Management is engaged in processing *ad-hoc* research project proposals related to Water Management submitted by Investigators/Scientists throughout the country under ICAR A.P. Cess Fund.

Training and Extension Activities

- A training programme on watershed management technology under NATP-WTMM Project was organized at the Centre from 12th to 24th February, 2001. Officers from Governments of Orissa, Chattisgarh, Jharkhan and West Bengal and scientists from OUAT, Bhubaneswar, IGKV, Raipur, DVC, Hazaribagh and WTCER, Bhubaneswar participated in this training

- A training programme was organized from 25-26 May 2001 under TIFAC project for the farmers of Narsing Prasad, Jaimangal Prasad and Pathara village of Nayagarh district of Orissa. Scientific methods of seed treatment, paddy nursery raising and other input applications were dealt during training. The training also covered improved crop husbandry practices along with pisciculture.

- One moth training was imparted to 2nd year agricultural engineering students of CAET, OUAT, Bhubaneswar from 1-30 June, 2001.

- Three M.Tech (Soil & Water Engg.) students from JNKVV, Jabalpur underwent one month's training in June, 2001.

- Training cum discussion programme on "Integrated Coastal Zone Management" was organized for high-level officials of Bangaldesh water development board from 8-10 November, 2001.

- A National level CAD training programme (IInd phase) was organized for the senior and middle level officers engaged in implementation of command area development programme from 27th February to 5th March, 2002. The training programme was sponsored by WAPCOS, New Delhi on Participatory Irrigation Management.

- A training programme was organized on "Rain water harvest technologies" for the progressive farmers of Khurda district from 13-15 March, 2002. The programme was financed by ATMA, Khurda.

Miscellaneous

- Geographical Information System (GIS) laboratory has been established in the Centre to compile and analyz e natural resources data.

- A full day brain storming session on future strategies for efficient management of water for sustainable agricultural production was held at the Centre on 21st September, 2002.

- WTCER has created its own website (http://www.wtcer.stpbh.soft.net) which is being updated regularly.

D 9: NRC for Women in Agriculture, Bhubaneswar

D 10: NRC for Meat, Hyderabad

D 11: Project Directorate on Poultry, Hyderabad

- **The progress of research during the past two years**

As a follow up action based n the recommendations made at the Regional Committee No. V held at Raipur during 8th & 9th September, 2000, the PDP has further strengthened the research work on development of newer varieties of germplasm suitable for backyard poultry farming. High selection intensity were given for general immune status (against SRBC inoculation), longer shanks and egg production. Different cross combinations (15) among various parent lines identified for backyard poultry farming have been produced and kept for assessing their relative production efficiency in terms of egg production, livability and immune response against SRBC and New Castle Disease vaccination under farm conditions at the Directorate. Now the birds are in growing phase.

The PD on Poultry has a new centre of All India Coordinated Research Project (AICRP) on Poultry Breeding at Agartala, to study the relative performance of various germplasm that are available in the country for utilization by rural/backyard/tribal areas. The centre has already initiated work on testing the relative performance of Vanaraja and Giriraja under experimental and free-range conditions of North-Eastern Hilly (NEH) region. It is observed that both male and females of Vanaraja birds were weighing less and consuming less quantity of feed compared to Giriraja birds of the same age. The livability of Vanaraja birds is better than Giriraja under experimental conditions, the similar trend was observed under free-range conditions at farmer's level.

- **Constraints and project proposals**

This Directorate is propagating the rural germplasm to different user agencies (KVK, NGO, Self-help groups) and individual farmers directly. There is no franchiser in disseminating this technology to the rural / tribal population, with the result, this technology is not able to be effectively disseminated to the vast area under this region. Further, the help of veterinary / para-veterinary staff is required in controlling and prevention of the diseases that are commonly occurred in rural / tribal areas (New Castle Disease). Therefore, it would be ideal to have a liaison between PD on Poultry and the local agencies (State Animal Husbandry Department, State Agriculture University) operating in the particular region. Since, the main mandate of PD on Poultry is to develop different types of chicken germplasm with specific objectives, the manpower and resources available are not adequate to take-up the technology transfer aspect. Adding to this, no trained manpower in TOT is available at this Directorate. In view of the above, the following two aspects need to be considered in future for effective implementation of Vanaraja propagation as a potential tool to alleviate protein malnutrition and to enhance the social and economic status of the rural / tribal people.

1. Animal Husbandry Departments and Agriculture Universities located in Andhra Pradesh, Orissa and Chattisgarh, should work hand-in-hand with PD on Poultry to propagate Vanaraja free-range farming. Supply of the seed materials (i.e. parent and commercial day-old chicks and fertile eggs of Vanaraja) and technical know-how will be the responsibility of PD on Poultry, while propagation and para-veterinary support may be the responsibility of local agencies (State Animal Husbandry Department, State Agriculture University etc.).

2. Strengthening of in extension activities including manpower at PD on Poultry to establish effective linkage between PD on Poultry and user agencies.

D 12: CIFA, Bhubaneswar

D 13: National Academy for Agricultural Research and Management, Hyderabad

Research Achievements

The Academy undertakes focused research in the areas of agricultural research and education management, agricultural policy, research project management, transfer of technology, human resources development and information technology. These are primarily meant to serve as input for various training programmes and workshops organized at the Academy. The management problems encountered by the ICAR institutes and the agricultural universities form the basis for undertaking such research. Besides, some policy issues requiring attention of research planners and administrators for the effective implementation of various agricultural programmes are also considered while formulating research projects. Funding for some of the projects is through AP Cess, DFID and NATP. A list of the projects carried out during 2002-03 is detailed below:

S. No.	Project Title	Funded by	Investigators
1	Management parameters of state agricultural universities and emerging policy issues and implications	A. P. Cess	A. Gopalam
2	Developing instructional modules for gender in agriculture curriculum	A. P. Cess	A. Gopalam
3	HRD strategies for organizational effectiveness of NARS	A. P. Cess	Jagannadham Challa K. Vidyasagar Rao
4	Research priority setting at micro level: Strategic Research and Extension Plan (SREP)	NATP	B. S. Chandel, N. Sandhya Shenoy, S. K. Soam, V. K. J. Rao B. S. Sontakki
5	Performance assessment and accountability enhancement: of Indian NAROs	NATP	T. Balaguru
6	Forecasting trained agricultural manpower	NATP	D. Rama Rao S.K. Nanda
7	Development of computer mediated courseware for facilitating learning - teaching	NATP	A. Gopalam
8	Capacity building of NARS in developing decision support system using CIS	NATP	N. H. Rao M.N. Reddy B.S. Chandel S.K. Soam and K.H. Rao
9	Development of virtual campus for agricultural research and education management	NATP	K. Vidyasagar Rao N.H. Rao M.N. Reddy K.M. Reddy
10	Distance training for agricultural research management (In collaboration with ISNAR, COL & Wye College)	DFID	Jagannadham Challa Dr. Byron Mook, ISNAR

11	Impact assessment of oilseed research in India	NAARM	B.S. Chandel
12	Role of Government organization and Non Government organization run Krishi Vigyan Kendras in agricultural Development with	NAARM	N. Sandhya Shenoy K. Vidyasagar Rao
13	Research project management in NARS	NAARM	P. Manikandan T. Balaguru S.N. Saha

Major research accomplishments

Major activities and accomplishments of the projects during the year 2002-03 are briefly given below.

A.P.CESS fund projects

1. Management parameters of State Agricultural Universities and emerging policy issues and implications

Objectives:

- To study the ICAR model act and its implications in various agricultural universities.
- To probe into the acts, statutes and functioning of management bodies of SAUs.
- To ascertain the organizational structure of universities and their physical development.
- To investigate the integrated function of teaching, research and extension within the universities, and allied institutions within the state and the state departments of agriculture.
- To outline the course credit and internal assessment systems in various agricultural universities. To review investment pattern in SAUs and the outcomes.
- To scrutinize the recruitment and staffing pattern vis-a-vis the load of work and the outcome.
- To understand the planning, monitoring and evaluation mechanisms in the SAUs.
- To specify recommendations as a result of the above eight objectives and enlist the policy resulting out of this study.

Progress:

The project out come and results were discussed in a workshop on Management of Agricultural Education, which was held on July 23 to 25, 2002. The organizational set up of different universities was presented for meeting the mandatory requirements of agricultural education. The project further dealt with suggested improvements for strengthening the agricultural research, education and extension.

2. Developing instructional modules for gender in agriculture curriculum

Background:

A research scheme with funding from A.P. Cess on developing instructional modules for integrating gender in agricultural curriculum was initiated during February 2001. The back ground of initiating such a research scheme is that urban graduates are reluctant to serve in rural areas, more number of rural students be admitted in the agricultural courses so as to increase the number of professional graduates with rural back ground, who may take up extension related jobs / activities. Women reservations are extended to all activities supported by state such as scholarships, admissions, and nominations to awards, curricular and co-curricular activities in order to ensure the gender equity in all developmental activities relating to agriculture. It is required that the organizational climate in the line departments needs to be made gender-friendly to encourage women to take up extension jobs and the women employees are to be provided necessary facilities and services like transport, accommodation and spouse employment, etc., in order to ensure more women participate in the over all social development.

Progress:

It is proposed to use the instructional resource modules as courseware in Under Graduate instruction and thereby sensitize on the gender role in agriculture after initial validation and testing The developed instructional modules will have the components for which adequate research work is contemplated.

Six modules on the areas on different gender related issues is broadly divided into seven categories viz. Gender for development, Gender roles in agriculture, Gender in time and labour use, Gender in knowledge/skill, Gender and resource management, Impact of Gender systems, trends in development and their gender impact. A software CD is being prepared entitled AGENDA (Aggregated Gender Dimensions Assessment)

3. HRD strategies for organizational effectiveness of NAPS

Objectives:

- To develop management systems approach for enhancement of organizational effectiveness.
- To develop and standardize case models for selected institutions for research productivity and personnel development of individuals.

Progress:

The project aimed to develop management systems approach for enhancement of organizational effectiveness of the institutions of ICAR and SAUs. In the process a lot of relevant data and information on various HRD attributes was generated. The strategies have been evolved from out of this study are expected to enhance research productivity and personnel development of individuals and groups in the system. The study used the output from personal interviews, brainstorming sessions, mini workshops, consultations, qualitative and quantitative survey through questionnaires, holistic data and dynamic analysis. Several ICAR institutes and SAUs were visited, several management experts were consulted, hundreds of scientists, officers and staff were interacted during the course of this project. The project was completed on May 31, 2002. The Project Report was released in the National Workshop on HRD Strategies for Organizational Effectiveness of NARS held on March 11th and 12th, 2003. Some of the salient findings and strategies based on the synthesis are given below.

1. The most important aspects of research management for organizational effectiveness as perceived by the scientists are "management of human resources", "resource mobilization", "Infrastructure development", and "research planning, project development and implementation". The most important skills required to be a successful research manager are "managing people at work", "administration" and "supervision and monitoring". The important changes need to be brought into management practices

are "humanizing the environment in organizations", "professional management approach" and "visibility with outside agencies".

2. The foremost recommendations are to provide more delegation of powers at all levels to decentralize the function of management, ICAR to develop its own administrative and financial rules to avail full functional autonomy, introduce project based budgeting and accountability through five yearly assessment target in research output, reduce the administrative procedures and channels, objective assessment of scientists and staff annually, introduce contract system of appointments for all cadres, change the system of interviews at ASRB, restore the old concept of ARS, and provide welfare facilities for women.

3. The personality type analysis of scientists of NARS reveals that there is need for training in personality development on the lines of neuro linguistic programmes (NLP), need for enhancing creativity among the rank and file of scientists and academicians, aptitude tests may be introduced at the entry level of scientists and introduce personality development in course curricula of UG and PG programmes.

4. A comprehensive quantitative analysis on the HRD requirements of administrative and finance functionaries of ICAR was carried out and the most salient findings and recommendations are as follows:

   - Compulsory training at the entry level for all staff and refresher courses once in three years.
   - Officers and staff may be encouraged to attend job-related seminars and conferences to develop their perspectives.
   - Need Evaluation Factors (NEF) for a variety of office functions were statistically calculated based on functional requirement, difficulties encountered, supervisors' choice of training and choice of Heads of Office. Accordingly, based on the NEF values obtained the training areas were classified on *Compulsory, Vital, Essential and Desirable* for the administrative and finance functionaries of ICAR.

5. A new concept of *scientist administration-finance interface* for agricultural research has been proposed for effective integration of the three wings and optimum performance. The most inherent features of this interface are decision-making processes, attitudinal changes, role perceptions, opinions, prejudices and role expectations of the three wings of research management. System barriers at organizational level and institute level were identified and several ideas and solutions have been proposed in manpower utilization, HRD and functional areas. Organizational culture factors were obtained from scientists for a variety of activities and functions of research management. Accordingly, the following activities and functions have been shown in very poor light in the institutes.

   - Delegation of powers, Bottom up planning and functioning, Project based budgeting, "Refer to the council" approach, Perspective planning, Communication of information and transparency, Decision-making processes and general administration of institutes

6. Management Assessment Factors were obtained from administrative and finance officers of ICAR institutes for a variety of management functions of institutes.

7. Accordingly the following functions require professional improvement in general.
   - Internal training programmes for staff, Catering to the needs of women cell, HRD activities for staff, Collective diagnosis and problem solving approach, Regular

interface meetings, Internal auditing, Periodic internal institute review, Periodic review of resources, Social welfare activities.

8. The most important aspects for effective interface are management style of institutes, attitudes to each other and work, role perceptions, role expectations, ignorance and finally the concept of a learning organization. The following research management functions need to be addressed very sincerely for improvement in effectiveness of the institutes.

   - Internal seminars of research, Adoption/impact studies, Economic cost benefit analysis, External institute reviews, Review of research proposals at the division/station level, On-farm evaluation of technologies, Research programme planning meetings, Field visits reporting.

9. Agricultural research management competency needs have been assessed and a variety of knowledge and skill components required at all levels of scientists and at senior level have been identified based on the responses of scientists of NARS. These need to be included as training inputs with comprehensive preparation and planning. For example, managing research, team building and dynamics, interpersonal relationships, personality development, communication skills, consulting and partnership skills, time management etc are required for all levels of scientists. The functional autonomy in ICAR was reviewed historically and the availing of full functional autonomy for organizational effectiveness was discussed and presented. Accordingly, ICAR should develop its own administrative and financial rules and develop purchase procedures for speedy procurement as suitable to agricultural research and more delegation of powers to decentralize the institutes under ICAR for less dependence on the headquarters. Various issues that are relevant to organizational autonomy of ICAR have been highlighted.

National Agricultural Technology Projects (NATP)

4. Research priority setting at Micro Level

Objectives:

- To develop appropriate research priority setting methods at the micro level
- To train the scientists in micro-level priority setting

Progress:

- By utilizing the resource material developed by NAARM, two training programmes of one-week duration were organized during April 15 to 20 and August 26-31, 2002 which were attended by 55 scientists from ICAR Institutes and SAUs.
- Training manual developed for using resource material in training programmes.
- Research study on Prioritization of production constraints at fishing in coastal agro eco zone in progress.

5. **Performance assessment and accountability enhancement of Indian NAROs**

Objectives:

- To build NAARM's capacity in the area of organizational performance assessment and accountability enhancement
- To introduce innovative organizational performance assessment methods and processes for improving the performance of research institutions in ICAR

Progress:

- On the basis of interaction and consultation that the Academy's faculty had with international agencies working with developing country NARS, a methodological framework for assessing the performance of agricultural research organizations has been developed. In order to elicit information on various parameters for assessing the performance of agricultural research organizations, a questionnaire survey was carried out. The requisite information was collected from senior level functionaries, both in service and retired from ICAR institutes and SAUs. Significant number of senior officers (30%) responded to the questionnaire and very valuable information was received from them. With a view to further refining the performance assessment methodology by critically examining the basic methodological framework already developed in conjunction with the response received through the questionnaire survey, a National Workshop on "Performance Assessment of Agricultural Research Organizations" was organized at NAARM, Hyderabad, for two days on March 3rd and 4th, 2003.

6. **Forecasting trained agricultural manpower**

Objectives:

- To design training programmes to forecast manpower needs in agriculture
- To provide policy guidelines for planning agricultural education so as to develop needed manpower in different occupations.

Progress:

- Five different questionnaires were developed and mailed to seek information on students, profiles of employing organizations, postgraduate students and senior executives perceptions on agr-education and universities plans on revamping education.
- List of under-graduates passed out from various agricultural universities in 1991 was obtained. Efforts are made to reach the graduataes and a database of these graduates was continuously updatead following snow ball technique.

7. **Development of computer mediated courseware for effective learning -teaching**

Objectives:

- To develop interactive learning modules in various agricultural subjects
- To develop educational technology learning modules for use in distance education

Progress:

Various high-end software like Flash and Director were tested for the production of instructional "materials. Flash animation protocols were tried for providing simulation. Director software was tried which accommodates simulation and variety of animation sequences. The same software will now tried for agricultural science subjects and the efficacy will be worked out. The effect of coupling various video segments in the Pinnacle system and the director will be further studied. The instructional modules on Gender will be further improved by adding special effects created in director.

8. Capacity building ofNARS in developing decision support system using GIS

Objectives:

- To establish GIS Lab at NAARM
- To develop GIS base decision support system (DSS) for sustainable management of agricultural resources.
- To use the DSS as training tools for the scientists of NARS

Progress:

- Developed CIS training laboratory
- District level Database of agricultural production and resources updated for all districts of AP to 2000.
- State level database NAARM-AGRISTAT developed earlier is updated.
- Two maps - agroecological sub regions of India, and the states of India -were digitized using ARCGIS.
- Spatial information systems for sustainability indicators are being developed at district level for AP State.
- A RICE GIS was developed for Andhra Pradesh by digitizing the State and agroecological subregions maps in ARCGIS and linking them with the district
- . databases for rice area and production. A complete case study project with detailed instruction manuals has been developed for training in ARCGIS
- Work on development of Spatial Information System on Indian Agriculture (AgSIS) has been initiated using the above maps and the state level database (NAARM-AGRISTAT) by integrating the maps and databases in MapObjects
- Two training programmes of 10 days duration on GIS applications in agriculture were organized

9. Development of virtual campus for agricultural research and education management

Objectives:

- To provide opportunities for scientists of NARS, learn and contaribute to Agricultural Research and Education Management
- To provide accessibility to the scientists to get the management training at any time and anywhere without disturbing their work schedules
- To cover more number of scientists in the sytem in less time and money
- To make use of contemporary information technology tools for effective and interactive training on internet

Progress:

- Developed Virtual Learning Centre (VLC) on the NAARM intranet (http://naarmweb.naarm.ernet.in)

- Homepage designed for the virtual learning centre providing easy access to the course moduTes. Finalized the overall structure for delivery of different course modules. Three modules on Research Project Management; GIS and HRM were devealoped implemented on the web site of the VLC for the benefit of trainees and NAARM faculty
- Interactive Course modules on GIS concepts and use of GIS software viz. Geomedia and ARCGIS developed for the VLC.

NAARM - ISNAR Collaborative Project

10. Distance training for agricultural research management

Objectives:

The higher-level objective of this project is to enhance the contribution of National Agricultural Research for Sustainable Rural Development leading to the Alleviation of Rural Poverty in India. Poverty Alleviation is a National priority for India and a commitment of the CGIAR.

Progress:

The third meeting of the Project Advisory Group was convened on May 18, 2002 to discuss the progress of the Adaptive Research. The National Conference on Distance Training for Agricultural Research Management was held on November 7 and 8, 2002. It was inaugurated by Dr. Mohan Kanda, IAS, Special Secretary, Govt. of India. About 100 delegates attended the Conference including 10 VCs and several Directors and retired eminent scientists, international project partners and scientists from the five participating SAUs (ANGRAU, Hyderabad; UAS, Dharwad; MPKV, Rahuri; TNAU, Coimbatore, and TANUVAS, Chennai). The Adaptive Research Report was released in the National Conference. The redesigned Distance Training Strategy evolved has the following key features:

The preferred distance training strategy developed at the end of the Applied Research phase was adapted into a distance-training package on the theme of *"focusing agricultural research on poverty alleviation"*.

The training module was developed as an interactive print-based training package with email and other communication channels for interactivity between the learners and NAARM with no face-to-face contact sessions at all. The training module was designed as a 16-week course to be completed in a period of five months between November 2001 and March 2002. The most important feature of the pilot distance training programme was that the training was designed for group learning, experiential learning, interactive learning and peer learning with hands-on experiences through group exercises, individual exercises, field surveys, group seminars, report writing and research project proposal writing. Informative reading handouts were included exclusively for self-learning as a prelude to practical field exercises.
A support system consisting of Nodal Officers and Site Coordinators and the required logistical support was put in place in consultation with the authorities of the five SAUs. 14 learning sites were selected in ANGRAU, MPKV, UAS-D, TNAU and TANUVAS representing Andhra Pradesh, Maharashtra, Karnataka and Tamil Nadu states. As per the preferred strategy, a group of five scientists were selected as learners at each learning site, a total of 70 learners in all to undergo the Pilot Distance Training Programme (PDTP) in a case study approach.

The monitoring of the programme was carried out by NAARM project team through periodic visits to the learning sites and record data and feedback on each leaning activity and qualitatively assess the progress of the learning. Towards the end of the course the learners were encouraged to evaluate the pilot distance training programme anonymously to obtain free and frank feedback and assessment of the learners' perception on the pilot distance- training programme. The third meeting of the Project Advisory Group was convened in May 2002 to present and discuss the progress of the Adaptive Research phase and the pilot distance-training programme.

The average time taken to successfully complete the pilot distance-training programme was 27 weeks as against the planned period of 21 weeks. All the groups of learners at the learning sites produced three documents with new information collected through field surveys viz., *technology impact assessment on resource poor farmers (RPF), technology and information needs of the resource poor farmers and a research project proposal focusing agricultural research on poverty alleviation.* The research project proposals produced were of multi-disciplinary in nature with a focus on poverty alleviation with a variety of ideas and plans for their respective areas of agro-climatic zones.

Most of the groups of learners enjoyed the freedom to learn at their own pace while on their respective jobs and do things as per their own choice in groups. 60 per cent of the exercise responses, assignments and documents produced are of high quality. While some groups interacted with NAARM through e-mail regularly, some groups did not interact at all with NAARM. About one-third of the learners did not have personal e-mail ID at all. According to the learners' perception, collaborative learning and experiential learning are the highlights of the whole experience. The qualitative assessment of the learners' progress was carried out from time to time during the monitoring visits of the learning sites. Majority of the learners have performed from 'Good to *Excellent* in various exercises and assignments. However, it was also observed that a significant number of learners did not fill their respective manuals with their responses to the questions and other exercises and assignments. The learners were also encouraged to self evaluate themselves for each unit of activities. A very high percentage of learners have rated their performance as 'Good to *Excellent'* with regard to various group processes and overall learning experience. According to the learners the most important topics of learning were: time management, working in groups, impact of agricultural research on RPF, methodology for impact assessment survey, understanding the problems of RPF, holistic approach to poverty alleviation through agricultural research, PRA techniques, village seminar, concept note writing, log frame technique and writing of a winning research proposal.

The learners were also encouraged to evaluate the entire PDTP anonymously. According to the learners, the objectives of the PDTP, leaning activities and the learning outcomes deserved an achievement rating of 70 to 83 per cent. The feedback on the general organization of the course, logistics does indicate a variety of responses, which have been considered for the redesigned distance strategy. The individual benefits for the learners from the PDTP have been rated between 'to Some *Extent' to 'a Great Extent* by a majority of the learners. However, the learners appreciated that the new knowledge on RPF was the biggest gain followed by project preparation skills and project management skills. The skills and knowledge gained by the learners have been listed in the main text. Based on the feedback the learners are of the opinion that the time structuring for the course should be increased, the season for the course may be altered, more financial resources may be provided and include more practical exercises and reduce the reading handouts.

The learning outcomes produced by the learners in the form of documents have also been evaluated. Most of the documents produced by the learners contain a lot of new information, which is of great value to the respective universities for research and extension activities. Majority of the research project proposals written by the learners are of multi-disciplinary in nature with new ideas for focusing agricultural research on poverty alleviation. Most of the 14 projects generated are proposed for AP Cess scheme of ICAR.

Based on the experience gained and the feedback obtained and evaluation on the PDTP a revised distance training strategy is proposed for future sustenance of such programmes in the Indian NARS. The DT programmes are certainly cost effective compared to *in situ* training programmes of NAARM, which are of either institute proposed or sponsored in nature. The proposed revised DT strategy has the following key features:

- Group learning will be the key emphasis for all DT programmes in agricultural research management
- Experiential mode of learning to be the prime philosophy in an action-learning process
- Selective use of ICT starting with print-based training manuals with gradual integration of IT developments
- The appropriate season for such DT programmes would be from August to January with 6 months of part-time on-the-job non-formal training without exceeding 15 per cent of learners' workload
- DT programmes need to be recognized as refresher courses in career advancement scheme of scientists to give effective patronage for the sustenance and success of DT programmes
- A consortium of NARS institutions, NAARM and Open Universities is proposed for planning, development of DT programmes
- NAARM will basically play the role of a consulting agency for content development, design, production and delivery of DT programmes
- Regional Nodal centers need to be created in NARS institutions for effective implementation and monitoring of programmes
- Sponsoring of DT programmes to be from the NARS institutions in terms of resources and support system

The project was finally completed and closed w.e.f. December 30, 2002. The necessary reports and Audit Utilization Certificate have been submitted to ISNAR by March 2003.

Institute projects / Case studies

11. ***Impact Assessment of oilseed research in India***

Objectives:

- To estimate change in productivity and cost structure of oilseed crops
- To determine contribution of research and policy support to oilseeds productivity
- To evaluate return to investment of oilseed research in major oilseed crops in India.

Progress:

Preliminary results compiled. During last three decades, the yield has contributed 45 per cent in increase of total oilseeds production. This is the result of research investment, which increased at a growth rate of 6.4 percent during 80s and 90s. The total factor productivity is the another measure of impact of research investment. It was,observed that TFP grew in case of rapeseed, mustard, groundnut, and sunflower. While it decreased in case of soyabean, sesamum and safflower.

12. Role of Government and Non-Government organization run Krishi Vigyan Kendras in agricultural development with respect to A.P.

Objectives:

- To study, compare and assess the selected Organizational, Workgroup, and Job involvement variables and roles performed in agricultural development by the GO and NGO KVKs
- To note the expectation of the select clientele groups of the GO and NGO KVKs in view of changing agricultural scenario
- To find the inter-institutional linkage patterns among the NGO KVKs and other line departments, their expectations, operational constraints and suggestions for meaningful collaboration.

Progress:

The data from 6 KVKs (3 GO KVKs and 3 NGO KVKs) from three regions viz., Telangana, Coastal and Rayalaseem were collected. Clientele group includes 30 farmers in each KVK and KVK staff. The compilation and the analysis of data is over.

The preparation of final report is in progress

13. Research project Management in NARS

Objectives

- To study the system of research project management in NARS
- To suggest a comprehensive system of project management

Progress:

The information on the management of research project, through three different questionnaires from Heads of Divisions, Scientists and in-charges of Technical Cell were collected from ICAR institutes and SAUs. The information collected is being compiled.

D 14: AICRP on Sunflower, Hyderabad

D 15: AICRP on Castor, Hyderabad

D 16: AICRP on Safflower, Hyderabad

D 17: Network Project on Tobacco, CTRI, Rajahmundry

D 18: AIC Sorghum Improvement Project, NRC for Sorghum, Hyderabad

D 19: AINP on Agricultural Ornithology, ANGRAU, Hyderabad

Large scale development of agriculture in India during the past 40 years has destroyed the natural habitat of birds by bringing more of the land area under cultivation. This has not only resulted in the decline of a number of avian species but also created favourable conditions for the survival and reproduction of many other species. Food in agricultural habitats is often concentrated and abundant, which enables, some granivorous and frugivorous birds to harvest energy and produce offspring more efficiently in agricultural than in natural habitats. Consequently, population of some granivorous and frugivorous birds have increased in agricultural areas to such high levels, that they have attained pest status and warrant management. The rose ringed parakeet (*Psittacula krameri*) is one such bird. It is the most important pest bird in India causing serious damage to many agricultural, horticultural and vegetable crops and to stored grains.

Crops are being damaged by birds at sowing, ripening and harvesting stages. Even after crop harvest, bird damage continues at grain stores, shelling yards and market places. Some crops suffer heavy bird damage at the sprouting stage – some times this damage is to so severe that farmers have to resow the affected fields. This involves extra labour, time and money. Moreover, the resown crop may mature later than those sown at the normal time and suffer relating more bird damage at the ripening stage.

Crop losses due to the depredatory birds can occur either due to one species (parakeet) as in sunflower or a community of bird complex as in pearl millet, sorghum, paddy, groundnut and apple. Negative impact of birds on agricultural crops vary from region to region, season to season, depending on number of factors like number of depredatory species and their density, area under crop, ecology of the area, concentration of migrants, their food habits as well as the physiological status of birds involved.

To meet the food requirements of increasing human population, our approach has remained to maximize crop production by all possible means, and any factor reducing it is not acceptable. Therefore, even the birds causing a little damage to the crop are now being viewed seriously, and they are often categorized as "pests". Increasing cost and inputs of crop production have compelled the farmer to take every measure to stop birds damaging his crop. On the other hand, there are birds, which are destroyers of insect pests and rodents, and hence they are beneficial to the crop and the farmers. Such beneficial birds need to be encouraged and conserved.

However today in our country, views of the administrators and agricultural research scientists towards the depredatory birds have certainly changed. Attitude of the farmers towards birds is changing at slower rate but they are still tolerant as they are under the influence of religious preaching. Under present economical crisis and modernization of agricultural ecosystem, there is a need to manage all the pests, including birds.

Recognizing the importance of the subject, in 1982 ICAR launched an All India Coordinated Research Project on Agricultural Ornithology at National level with six centers viz., ANGR Agricultural University, Hyderabad; Gujarat Agricultural University, Anand; Punjab Agricultural University, Ludhiana; Maharana Pratap University of Agricultural & Technology, Udaipur; Kerala Agricultural University, Thrissur and Dr. YSP Univ. of Horticulture & Forestry, Solan aiming at management of harmful and beneficial birds in agricultural ecosystem. The new centers during IX plan were sanctioned to give coverage fruit crops in Himachal Pradesh & Coastal agricultural crops in Kerala.

Mandate of Objectives

- To undertake multi-location surveys of key bird species affecting agricultural crops and to assess crop losses.
- To study the population dynamics and community structure of depredatory birds on crops.
- To study the food, feeding habits and breeding biology of depredatory and beneficial birds.
- To understand the beneficial role of birds to use them as a component of IPM.
- To evolve eco-friendly management strategies for depredatory birds.
- To study the effect of agro-chemicals on bird fauna.

The project has made a steady progress over two decades and brought awareness amongst the farming community and scientists on the role of birds in relation to crop production. Feeding and breeding ecology of birds and their behavioural pattern in relation to habitat and climatic conditions were studied in detail to draw management strategies. The project has also evolved a number of economically feasible technologies, keeping in view of the varied agricultural practices to protect crop from bird depredation.

The investment so far made by the ICAR from the inception of this unique project has paid rich dividends, as evident from the development of a number of need based bird management practices for adoption by the farming community in the country.

An investigation on both basic and applied aspects of birds as harmful and beneficial components in agricultural ecosystems has generated valid information that has helped to evolve technologies for their management for increasing crop production. A total of 63 species of birds belonging to 19 families have been identified to damaging several crops. The number of bird species that affected various crops was: cereals – 52, pulses – 14, oilseeds – 15 and fruits- 23. Amongst the 46 species of beneficial birds, which devoured insects and rodent pests, all fed on insects while six of them also consumed rodents. Twenty eight species of birds that inflicted damages to crops and fifteen of the beneficial species were omnivorous. Omnivorous birds have a dual role in our agro-ecosystem.

Salient achievements

- Evaluated the crop losses by key bird pests on different crops and established the vulnerable stages and pinpointed the extent of damage in relation to ecology and physiological status of birds in the country.
- Standardized techniques of survey methods, estimation and assessment of damage.
- Food preference and feeding habits of key bird pests were analyzed qualitatively and quantitatively during their breeding and non-breeding seasons and establishes its relationship between crop types and food compositions.
- Major bird pest species, their population dynamics crop losses were determined based on standard methods on crops like maize, sorghum, pearl millet, paddy, wheat, sunflower, safflower, groundnut, oil palms and orchards like guava, pomegranate, grapes, date palm, apples, kinnow and banana.
- Developed a low cost technology of protecting crops with reflective ribbon, which has become popular all over the country, as the farmers have accepted the technology. In consultation with the ICAR, the Minister of Agriculture recommended its use in their package of practices under plant protection.
- Standardized the techniques of wrapping method in maize by wrapping maize cobs with adjacent green leaves around them in outer three rows of the field to reduce the damage to a negligible level by parakeets and crows.
- Developed and standardized bioacoustics –Broadcasting distress calls of birds by using amplifier and tape recorder to minimize the bird damage in cereals and orchard crops.

- Successfully evaluated the effectiveness of screen crop around maize to reduce parakeet damage and providing additional fodder.
- Developed and standardized IBPM (Integrated Bird Pest Management) concept as a new approach to the crop protection from bird damage.
- Successfully evaluated the effective role of botanicals as potential repellents.
- Several species of birds feed on both insect and rodent pests and play a significant role in the natural suppression of their populations. Amongst the beneficial birds, the Cattle egret *(Bubulcus ibis)*; Rosy pastor (*S. roseus*); Indian roller (*Coracias benghalensis*); Spotted owlet (*Athene brama)* and Barn owl (*Tyto alba*) are the most important species.
- Laboratory experiments proved that Cattle egret, Indian myna and House sparrow are capable of dispersing *Bascillus papillae* var. *Holotrichae* causing milky disease in white grub (*holotrichia consanguinea*).
- Indian myna, Bank myna and House sparrow indiscriminately feed on the diseased larvae of *H. armigera* and help in the dispersal of Nuclear Polyhedrosis Virus (NPV).
- The concept of IPM with the ornithology as one of the potential components has been worked out qualitatively and quantitatively particularly on the crops cotton, red gram, chickpea, etc. in checking the *Helicoverpa armigera* population in different agro-climatic regions by various bird attracting methods. In groundnut crop, birds alone can control about 65% of the white grubs (*Holotrichea spp.*) population during ploughing operations.

Effect of Agro-chemicals on bird fauna

- The migratory birds such as Brahminy Duck, Pintail, Lesser Whistling Teal, Comb Duck and Spot-billed Duck died due to the ill effect of insecticides applied to sprouting paddy seeds in nurseries in Andhra Pradesh.
- Pond Heron have been observed dead due to pesticide poisoning in the paddy fields of Kerala.
- The Sarus Crane which is a threatened species and closely dependent on paddy crop, has also been reported dead after the consumption of treated seeds in Gujarat and Rajasthan.
- Poisoning of Median egret, Little egret, Cattle egret and Pond heron after consuming prey from paddy fields have been reported dead from Gujarat.
- Peafowl have died at several places in the country after suspected consumption of pesticide treated grains.
- Besides Peafowl, death of Jungle babbler and Red turtle dove after consumption of treated wheat grains was reported from Gujarat.

- The absence of House sparrows in different parts of Andhra Pradesh and Kerala and its decreasing population elsewhere, disappearance of vulture population, reduction in the population of the House crow and Baya may be due to the residual effect of agro-chemicals. ***Detailed study on this aspect is urgently needed.***

Recommendations

- Developed the low cost technology of protecting the crop with Reflective Ribbon.
- White grub prone areas were recommended three bullocks driven ploughing in three consecutive days and if the soil is dry one or more irrigation prior to ploughing is suggested. 70% of the white grubs population can be controlled before they go for pupation by this method.
- 60 cm row distance than 45 cm coupled with spraying of endosulphon 0.07% at the pod formation stage in chickpea will give more encouraging results.
- Standardized the technique of wrapping maize leaves around cobs at the grain maturity stage.
- Providing 'T' shaped perches 20 / acre or 50 / ha proved more useful in reducing the *Helicoverpa* population.
- Sowing tall crops among the shorter crops provides natural perches (Growing few maize or jowar plants).
- Implementation of IPM concept with the Ornithology as one of the potential component on the crops like Cotton, Red gram in checking the *Helicoverpa* population.
- Recommended block plantation of sunflower crop to avoid parakeet damage.
- Planting of some fruit bearing trees like Manila tamarind, Flame of the forest (*Butea monosperma*) and mulberry and *Salvadora persica* attracts large number of insectivorous birds.
- Developed Integrated Bird Pest Management (IBPM) methods for the management of depredatory species at the vulnerable stage of the crop.
- Habitat manipulation of bird pest management against weaver birds & closing the entrance of the nests of parakeets in the vicinity of crops areas was found desirable in reducing their population.
- Suggested sorghum as lure (decoy) crop to protect maize crop from bird damage.
- Cattle egret is the most important avian predator in the agricultural landscape and remains present during every agricultural operation to capture insect pests. Hence, it should be given due importance in the IPM programme. The species can be encouraged to breed on thorny trees at the edges of village ponds near human settlements.

Constraints and short comings

The project during the year made great strides in the progress of the subject of agricultural ornithology and a number of useful lessons have been learnt in relation to its importance. However, the following are the few constraints/impediments, which need to be critically looked into with broader outlook to overcome the same, so as to enable the project to deliver the information successfully.

- It is time that the subject of ornithology is recognised and is taken for specialisation like agrometeriology, agroforestry, agroecology which have been recently inducted in the agricultural universities. On similar pattern agricultural ornithology should also be introduced at least in few selected universities located in various agro-climatic zones of the country to produce trained personnel for undertaking work in agricultural ornithology. In this regard ANGRAU already initiated the action and formulated 1+1 course at PG level after obtaining concurrence from the Board of Management.
- It is time that agricultural Scientists Recruitment Board (ASRB) of ICAR should introduce the subject of agricultural Ornithology or Vertebrate Management with specialisation in ornithology as a separate subject for ASRB examination for inducting new scientists who could be appointed in ornithology project. This is the critical gap, which needs to be overcome at the earliest possible.
- It should be mandatory for the centres to be managed by trained agricultural ornithologists. In the event of non-availability of trained scientists with an aptitude, need to be oriented to the subject and given training. Only such arrangement will help in avoiding any failures in the programme of work.
- It is time to conduct workshop / training programmes for the Agricultural Extension Officers / Agricultural Officers and farmers on regular basis at all regions of the country to create awareness and use of technology for sustainable agricultural production.

The following shortcomings in the Project are identified.

(a) The transfer of technology developed by the Project in relation to bird management could not reach the common farmer/grass root level worker.

(b) Impact of Anthropogenic activities and consequences on avian community in the agricultural landscape could not be highlighted properly.

(c) Application of modern information technology techniques in agricultural ornithology including use of remote sensing with the combination with GIS is not worked out to identify bird habitat suitability and conservation strategies.

(d) Toxicological impact of hazardous chemicals on the conservation of avian species.

(e) Exploitation of traditional knowledge in controlling bird damage and use of bio-pesticides could not be covered to the extent possible.

(f) The AINP concept in Agricultural Ornithology has been modified into a Net Work Project needs to be upgraded to full fledge AICR Project.

- The future thrust area has multi-disciplinary approach with an ultimate objective to reduce farmer-bird conflict and environmental conservation. The project is an ideal project to demonstrate how the agricultural development and bio-diversity conservation can go together. This project has made tremendous progress in terms of information generation, recommendations for the farmers and scientific communities. Several recommendations generated for the IPM, particularly of *Helicoverpa armigera* are of special mention as they are eco-friendly and supportive to the bio-diversity conservation in the agricultural landscape. This has been possible only because this was a coordinated project.
- The birds are indicators of the healthy ecosystem as they play a vital role in energy cycling. As about 55% of the total land is cultivated, the agro-ecosystem plays a vital role in the conservation of the avian biodiversity. India is a signatory to the Biodiversity Convention (Rio convention, 1991), and hence it would be mandatory for us to take up measure for the management and conservation of birds in the agriculture landscape.
- The over all thrust of the project is to evolve appropriate research / management strategies to harness useful avian biodiversity for sustainable development without further depleting our natural resources. To achieve this, the studies will be integrated with the traditional knowledge and wisdom for appropriate technology generation.

D 20: AICRP on Dryland Agriculture, CRIDA, Hyderabad

D 21: AICRP on Agrometeorology, CRIDA, Hyderabad

D 22: NBPGR Regional Centre, CRRI Campus, Cuttack

D 23: NBPGR Regional Research Station, Hyderabad

D 24: SBI Research Centre, Kovvur

D 25: CTRI Research Station, Guntur

D 26: CTRI Research Station, Kandukur

D 27: CTRI Research Station, West Godavari District

D 28: Sisal Research Station, CRIJAF, Barma

D 29: Off Season Nursery, Agril. Farm, NRC for Sorghum, Warangal

D 30: Regional Centre of CTCRI, Bhubaneswar

D 31: Central Horticulture Experiment Station IIHR, Bhubaneswar

D 32: Quality Evaluation Unit of CIRCOT, Agricultural Research Station, Guntur

D 33: CSWCR&TI Research Centre, Koraput

D 34: CARI regional Station, Khurda

D 35: Puri Research Centre of CIBA, Puri

D 36: Burla Research Centre, CIFT, Burla

D 37: Visakhapatnam Research Centre of CIFT, Visakhapatnam

D 38: Kakinada Centre of CIFE, Kakinada

D39: Kakinada Research Centre of CMFRI, Kakinada

D40: Visakhapatnam Research Centre of CMFRI, Visakhapatnam

Agenda Item No. IX

Research and Extension Linkages
Extension Education
Adequacy and Effectiveness
by

Zonal Coordiantors (KVK)

Agenda Item No. X

Statement of Special Invitees (NABARD / Water & Land Management)