Salient Research Achievements of Navsari Agricultural University (2004 - 2014)

Rektorate of Research
Navsari Agricultural University
Navsari - 396 450 (Gujarat)
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Salient Research Achievements of Navsari Agricultural University (2004 - 2014)
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FOREWORD

With the promulgation of Gujarat Agricultural Universities Act 2004 on May 1, 2004 heralding formation of Navsari Agricultural University (NAU) with Navsari as head quarters. NAU's jurisdiction covers seven districts of south Gujarat viz., Narmada, Bharuch, Surat, Tapi, Navsari, Dangs and Valsad. The University has made remarkable growth in Education, Research, and Extension Education and in infrastructure development. The Navsari Agricultural university caters to the needs of the farmers of the plantation crops in the heartland of Gujarat; the Kanam zone of cotton, sorghum and pigeon pea and hill millets of tribal belt. Besides the above, this area is also well known for its forest tree species like teak, Khair, Kalam and bamboo. The University has provided technological backup for the agricultural development in its domain as well as state and ultimately to Nation.

In the present publication efforts have been made to summarize the research results in different crops and area so far achieved by the scientists in Navsari Agricultural University during the first decade. This has been done primarily with a view to taking stock of the situation in agricultural research in the state and to re-dedicate ourselves to the stupendous task of National building, lying ahead of us.

I feel immense pleasure to put forth the latest edition of “Salient Research Achievements of Navsari Agricultural University from 2004 to 2014” containing location specific and need based technologies developed by the scientists of different faculties of this University for farming as well as scientific community of the state. I congratulate all the scientists and all others connected with research in the University for the valuable work done by them which has helped to increase the tempo of agricultural development in the state.

I am highly indebted to Dr. C. J. Dangaria, Hon'ble Vice Chancellor of Navsari Agricultural University, Navsari for his constant guidance and support provided for bringing out this publication. I am also thankful to all the staff members of Directorate of Research, N.A.U., Navsari for preparation of this booklet.

I hope that this booklet will be highly useful for those associated with agriculture and its allied fields. The technologies developed will definitely help to improve the agricultural production and welfare of the farming community of the state.

(A. N. Sabalpara)
Director of Research & Dean
Faculty of PG Studies
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1. INTRODUCTION
The Navsari Zone of erstwhile GAU had attained the status of independent State Agricultural University (SAU) with the promulgation of Gujarat Agricultural Universities Act 2004 on May 1, 2004 heralding formation of Navsari Agricultural University (NAU) with Navsari as head quarters. NAU's jurisdiction covers seven districts of south Gujarat viz., Narmada, Bharuch, Surat, Tapi, Navsari, Dangs and Valsad. The University has made remarkable growth in Education, Research, and Extension Education and in infrastructure development.

Navsari campus had its humble beginning in 1965 with a College of Agriculture. The college was affiliated to Gujarat University, Ahmedabad from 1965 to 1968 and from 1968 to 1972 to South Gujarat University, Surat. Thereafter, Gujarat Agricultural University was established during the year 1972 with the head quarter at Sardarkrushinagar, Dist. Banaskantha and consequently the N. M. College of Agriculture, Navsari along with 11 State Government research centers located at Surat, Bharuch, Achhalia, Waghai, Gandevi, Vyara, Paria, Tanchha, Hansot, Bardoli and Danti-Umbharat were transferred to Gujarat Agricultural University. The faculties of Horticulture and Forestry were added in the year 1988-89. After attaining the status of independent University w.e.f May 01, 2004, the University commenced Post Graduate programme in Agri-business Management in 2007 and full-fledged faculty of Veterinary Science and A.H. in 2008 under the aegis of Chief Minister’s Ten Point Programme for holistic upliftment of the tribal areas of the state. In the year 2012, NAU has introduced three new colleges viz, College of Agriculture, Bharuch and Waghai, Gujarat Agricultural Biotechnology Institute, Surat. Besides existing diploma school were upgraded as polytechnics to provide middle level technician for working at grass root level. Polytechnic in Agriculture was started in 2009 at Dediyapada followed by Polytechnic in Horticulture at Navsari, Polytechnic in Agriculture at Bharuch and Vyara and Polytechnic in Agriculture Marketing Co-operative and Banking at Waghai in the year 2010. During the year 2012-13 by upgrading LITC, Polytechnic in Animal Husbandry at Navsari and another Polytechnic in Horticulture at Paria have been started. In the year 2013, University initiated education in Agricultural Engineering by establishing a new College of Agricultural Engineering at Dediyapada. Recently, Ministry of Agriculture and Co-operation, Government of Gujarat has sanctioned College of Fisheries at NAU, Navsari during the year 2014-15.

In the main campus of the University, other facilities available are Auditorium, Sports Complex, Central Examination Hall, Bio-diversity park, Guest House, International Hostel, Farmers's hostel, Bank, Post office and Shopping centre.
### Chronology of Development of Navsari Agricultural University, Navsari

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<thead>
<tr>
<th>Year</th>
<th>Centre Established</th>
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<tbody>
<tr>
<td>1896</td>
<td>Research Farm for Cotton at Surat which was later on converted to Main Cotton Research Station (1904).</td>
</tr>
<tr>
<td>1913</td>
<td>Research Station for cotton at Bharuch later on converted to Regional Cotton Research Station.</td>
</tr>
<tr>
<td>1934</td>
<td>Sugarcane Research Station at Vyara, which is changed to Regional Rice Research Station</td>
</tr>
<tr>
<td>1935</td>
<td>Research Farm at Gandevi which is designated as Tropical Fruit Research Station</td>
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<tr>
<td>1954</td>
<td>Hill Millet Research Centre and Scheme on Paddy at Waghai</td>
</tr>
<tr>
<td>1959</td>
<td>Agricultural Research Station Tanchha</td>
</tr>
<tr>
<td>1962</td>
<td>Main Sorghum Research Station, Surat</td>
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<tr>
<td>1964</td>
<td>Cotton Wilt Control Breeding Station, Hansot</td>
</tr>
<tr>
<td></td>
<td>Cotton Sub- Research Station, Achhalia</td>
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<td>1965</td>
<td>N. M. College of Agricultural, Navsari</td>
</tr>
<tr>
<td>1966</td>
<td>Soil Salinity Research Station, Danti- Ubharat.</td>
</tr>
<tr>
<td>1970</td>
<td>Agricultural Diploma School, Bharuch</td>
</tr>
<tr>
<td>1971</td>
<td>Agricultural Diploma School, Navsari</td>
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<tr>
<td>1972</td>
<td>Formation of Gujarat Agricultural University</td>
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<td></td>
<td>Fruit Sub- Tropical Research Station, Paria</td>
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<td>1978</td>
<td>Establishment of Livestock Research Station, NAU, Navsari</td>
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<td>1980</td>
<td>Wheat Research Station, Bardoli</td>
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<td></td>
<td>Bakery School, Navsari</td>
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<tr>
<td>1982</td>
<td>Agricultural Diploma School, Vyara</td>
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<tr>
<td>1984</td>
<td>Agricultural Diploma School, Waghai</td>
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<tr>
<td>1985</td>
<td>Krishi Vigyan Kendra, Waghai</td>
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<tr>
<td>1986</td>
<td>Livestock Inspector Training Centre, Navsari</td>
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<tr>
<td>1988</td>
<td>ASPEE College of Horticulture and Forestry, Navsari</td>
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<tr>
<td>1990</td>
<td>Niger Research station, Vanarasi</td>
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<tr>
<td>1999</td>
<td>Gardeners’ (Mali) Training Centre, Navsari</td>
</tr>
<tr>
<td>2000</td>
<td>Krishi Vigyan Kendra at Zonal Agricultural Research Station, Vyara</td>
</tr>
<tr>
<td>2004</td>
<td><strong>Formation of Navsari Agricultural University</strong></td>
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<td>2005</td>
<td>Agricultural Research Station, Mangrol</td>
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<td>2007</td>
<td>Institute of Agri Businesss Management, Navsari</td>
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<tr>
<td></td>
<td>Krishi Vigyan Kendra, Dediyapada</td>
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<td>2008</td>
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<td></td>
<td>Krishi Vigayn Kendra, Navsari</td>
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<td>2009</td>
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<td>2010</td>
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<td></td>
<td>Polytechnic in Agriculture, Bharuch &amp; Vyara</td>
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<tr>
<td></td>
<td>Polytechnic of Agricultural Marketing, Co-operative &amp; Banking, Waghai (Converted to Polytechnic in Agriculture in year 2013-14)</td>
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ABOUT THE UNIVERSITY

<table>
<thead>
<tr>
<th>Year</th>
<th>Centre Established</th>
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<tr>
<td>2011</td>
<td>Krishi Vigayn Kendra, Surat</td>
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<td>2012</td>
<td>College of Agriculture, Bharuch</td>
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<td></td>
<td>College of Agriculture, Waghai</td>
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<tr>
<td></td>
<td>Gujarat Agricultural Biotechnology Institute, Surat</td>
</tr>
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<td></td>
<td>Polytechnic in Animal Husbandry, Nasvari</td>
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<td></td>
<td>Polytechnic in Horticulture, Paria</td>
</tr>
<tr>
<td>2013</td>
<td>College of Agricultural Engineering, Dediyapada</td>
</tr>
<tr>
<td>2015</td>
<td>College of Fisheries, Navsari</td>
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Mandate of the University

1. Making provision for imparting higher and lower education in different faculties viz., Agriculture, Horticulture, Forestry, Veterinary Sciences and Animal Husbandry, Agribusiness Management, Agricultural Engineering and Technology and other fields of Agriculture and allied sciences like Food Processing Technology, Biotechnology etc.
2. Further advancement of education and location specific research in agriculture and allied sciences for all farmer's related problems.
3. Implement innovative extension education programmes for transfer of technology.
4. Such other academic and research programmes as the University may initiate from time to time based on the location specific need and demands including modern sciences.

Goals

- Diversification of educational programmes
- Strengthening of Central and College Libraries
- Counseling and Placement through campus interviews
- Enhance Total Factor Productivity of mandated crops of South Gujarat
- Reduction in the cost of cultivation to improve profit margin
- Value addition and by product utilization
- Evolving Remunerative and Sustainable farming systems

Vision

Transform Navsari Agricultural University into a Knowledge Power Centre by the year 2020

Mission Statement

Attain excellence in education, relevance in research and outreach in extension education.
2. RESEARCH ORGANISATION AND ACTIVITIES

Director of Research and Dean PGS monitors research activities, PG admission and PG studies of the University. In the capacity of Director of Research, he coordinates research of University in close cooperation with the Deans of faculties, Research scientists and other officers of University. He also supervises and ensures efficient working of the research stations of the University.

Objectives of Research

- Broaden and strengthen the research base of the south Gujarat region of Gujarat.
- Enhancement of genetic yield potential through conventional and biotechnological tools.
- Evolve need based location specific market oriented, remunerative, productive, sustainable, eco-friendly and scale neutral technologies for different agro-eco-socio economic situations of south Gujarat.
- Develop technologies for rejuvenation, reclamation and conservation of natural resources including bio-diversity.
- Evolving modern agricultural practices, value addition and processing technologies for increasing the Total Factor Productivity of various agriculture occupations like Horticulture, Floriculture, Animal husbandry and Inland Fisheries.
- Design and set up viable mechanisms for developing situation specific management models/modules for different production systems based on changing needs and demands.
- Production of Breeders’, Foundation and Certified seeds/grafts/seedlings/ of the mandate crops to assure higher yield, pest and disease resistance and quality.

NAU has a strong research base to cater the needs of the farmers of south Gujarat. The primary goal of research in the university is to generate technologies for augmenting agricultural productivity and farm returns synchronizing with the states objectives, Socio-economic and cultural needs of the farming community on a sustainable basis. The university mainly undertakes research on the crops grown in south Gujarat viz., cotton, paddy, sugarcane, pulses sorghum, hill millets, niger, soybean, castor and horticultural crops like, mango, banana, sapota, papaya, cashew nut and vegetable crops.

Apart from this, University is also working on soil and water management, organic farming, bio-fertilizers and bio-pesticides, post harvest technology, value addition, Agroforestry, fisheries, animal husbandry, protected cultivation, climate change and agriculture, soil health, forage crops, food quality and food testing and nutritional security.

Socio-economically, the jurisdictional area of NAU is again divided into tribal and non-tribal areas. Out of seven districts which fall under NAU jurisdictional area, four districts namely Narmada, Tapi, Dang and Valsad are tribal dominated areas. The total geographical area of South Gujarat is 2663107 ha and out of which tribal area is 891629 ha (33.48%), whereas, rest of the three districts viz., Navsari, Surat and Bharuch are very well urbanized and industrialized.

South Gujarat is considered as the horticultural bowl of the state. This region is blessed with abundance of water resources as out of twelve rivers of Gujarat, eleven including the Narmada river traverse through the South Gujarat. Cultivated area of South Gujarat is 1385269 ha with 577897 ha irrigated area (41.71%). NAU jurisdiction area also has around 300 km of coastal line.
LOCATION MAP OF RESEARCH STATION UNDER JURISDICTIONS OF NAU

NAU has very good research set-up in terms of two zonal research stations, four main research stations, two regional research stations and 9 verification and testing centers to accomplish area specific need based agricultural research activities in south Gujarat.
DISTRICT-WISE MAJOR CULTIVATED CROPS

Various cereals, pulses, oilseeds, fruits and vegetables are grown in different districts of south Gujarat. Important crops like cotton is cultivated in Bharuch and Narmada districts, amongst cereals, paddy is largely grown in Navsari, Surat, Bharuch, Valsad, Tapi and Dang districts. Sugarcane is largely grown in entire south Gujarat area except Dang district and grain of poor people sorghum is grown in five out of seven districts. Pulses are cultivated mainly in Narmada, Tapi and Valsad districts and finger millets, vari and niger are largely grown in tribal dominated Valsad and Dang districts of south Gujarat. Main fruit crops of south Gujarat are mango, banana and sapota but other fruits like papaya, cashew, ber, guava and custard-apples are also grown. Major vegetable crops of south Gujarat are brinjal, okra, chili, tomato, cucurbits, Indian bean and tuber crops.

PLANNING AND MONITORING OF RESEARCH

NAU has a mission to develop and disseminate modern agricultural technologies which are location specific, cost effective and suitable for wide acceptance by the farming community. To achieve holistic goal in proper manner, the Agricultural Research Council acts as apex body for planning and implementing long, medium and short term schedules and guidelines. The Director of Research and Dean P.G. Studies under the guidance of Vice-chancellor co-ordinates, monitors, evaluates and lays future plans in consultation with experts and scientists of the University for research to be implemented at main stations and sub centres.
RESEARCH SUBCOMMITTEES

NAU gives priority to undertake the research based on challenges faced by the farmers of south Gujarat. The feedback of farmers is received through KVKs and Line departments during the biannual meeting of Zonal Research and Extension Action Committee. Thereafter, new technical programmes are framed and proposed to various Research Sub-Committees for further discussion, deliberations and finalization.

The detailed discussion and deliberations are held in various sub-committee meetings regarding new research proposals, research results and recommendations. Post Graduate research works which are valuable and are of high standard also discussed to take this for further research by the respective department. The proposed research work is implemented only after approval of respective research sub-committee. There are nine different sub committees to look after research proposal, progress of research work and submission of final reports to various funding agencies. The meeting of sub-committee is conducted under the chairmanship of Director of Research and under the supervision of Vice Chancellor of the University.

ABOUT THE TECHNOLOGIES

After attaining the status of an independent University in the year 2004, NAU has developed a total of 415 technologies for the benefit of farmers and scientific communities. Technologies have been developed in the field of crop improvement (32), natural resource management (176), horticulture and agro-forestry (66), plant protection (87), agriculture engineering (20), animal health (10), animal production and fisheries (12), basic sciences (9) and social sciences (3).

The NAU has released 32 high yielding good quality varieties of rice, sugarcane, cotton, sorghum, moong, Indian bean, pigeon pea, nagli, vari, turmeric, coriander and little gourd during last 10 years. In the year 2013-14, NAU has released five varieties viz., Paddy (Purna), Cotton (GN Cot. Hy.-14), Indian Bean (GNIB-21), Pointed gourd (GNPG-1) and Nagli (GN-6).

Out of above varieties, few varieties worth mentioning like Gujarat Sugarcane-5 with 140.00 t/ha productivity and other qualities like high sugar content, good ratooning ability in addition to wilt and red rot resistance. In cotton, two Bt cotton varieties viz., G.Cot.Hy.-6 (BG II) and G.Cot.Hy.-8 (BG II) have been released as Bt hybrid first by any public sector and recorded productivity is 1981 kg/ha and 2231 kg/ha, respectively. These hybrids were free from spodoptera, heliothis and pink ball worm damage. Recently, Gujarat Navsari Rice – 4 (GNR – 4) a Bio-fortified fine grain rice with characteristics like dwarf statured, fine grained culture possessing red colour kernel has also been released.

The scientists of NAU have been working for evolving and optimizing technologies in relation to MIS with and without mulching, nutrient management based on soil health cards, schedule of nutrient supplement to enhance productivity of various crops grown in South Gujarat. Thus NAU has recommended as many as 176 packages of practices for soil, water and nutrient management. Some of the important technologies like drip irrigation and nutrient management for fruit crops, grain crops and vegetables; drip irrigation, mulching and fertigation technology for banana and other crops, sub-surface drainage for combating water logging and saline area, drainage technologies for prevention of soil erosion and water logging have been recommended by NAU. Other technologies for the benefit of farmers have been developed viz., Intercropping of banana and turmeric in oil palm, area based cropping sequences for round the year farming, planting time and schedule of nutrient management of various crops, green manuring, use of bio-fertilizers for seed and soil treatment, weed management, land configuration and utilization of banana pseudostem sap for substitution of chemical fertilizers in various crops.
Scientists of NAU developed technologies for minimizing losses caused by various diseases and pest in various crops. Based on feedback of farmers specific IPM technologies have been developed and propagated for control of various crop diseases as well pest incidence to enhance productivity. NAU has recommended 87 technologies of IPM since 2004. Some important technologies like Methyl uginol and sex pheromone traps for control of fruit flies in mango, sapota and vegetable crops; black Tulsi extract baited trap for chicku bud borer, effective control of white fly in okra, brinjal and cotton; sucking pest and bollworm in cotton, leaf blight and stem borer in paddy, stem borer, other borers, red rot and wilt in sugarcane, Culture of Mulberry worm in castor crop have been developed for the benefit of farmers of South Gujarat.

Besides, 66 technologies for improvement in the field of vegetables, fruits, flowers, medicinal and aromatic plants, forest and plantation trees have also been developed for the benefit of farmers of South Gujarat. Technologies worth mentioning are high density planting in mango, precision farming of banana, papaya, and brinjal; organic farming of fruits, vegetables and tuber crops; paired row planting in banana, nutrient management of banana, papaya and other vegetables; early flowering of mango, canopy management in mango, de-sucking of banana, post shooting management of banana, pitcher method of irrigation in mango and rejuvenation of mango. Further, technologies of value addition for enhancing the income of farmers like value addition of banana pseudostem, preservation of fresh mango pulp, value addition of fruits like banana, sapota, guava and flower crops and enhancement of shelf life of banana and mango have been developed.

Over and above various Agroforestry technologies have been developed for improving productivity and sustainability in Agriculture. University has standardized nutritional formulations for enhancing milk production of milch animals and improving work efficiency of farm animals. Successful attempts have been made to improve the work efficiencies of farm implements for better farming like development of banana pseudostem cutter and six rows paddy transplanter for the farming community. Several other technologies for improvement of agriculture and allied sciences have also been developed.

The University has successfully developed synthetic leather, cellulose powder, high quality paper and fibers from waste banana pseudostem. The University got success in developing edibles from central core of banana pseudostem like candy, pickle, chips and RTS under NAIP on Banana pseudostem project.

Department of Plant Pathology produced 6.2 lakh liters of bio-fertilizer of various strains like PSB, Rhizobium, Azotobacter, Acetobacter and Azospirillum in liquid form during last two years and distributed/sold to farmers of South Gujarat.

NAU, Navsari has patented two technologies viz. “Preparation of Candy from Central Core of Banana Pseudostem” and “Preparation of Novel Organic Fertilizer from Banana Pseudostem”. Further, other two technologies developed with collaboration of CIRCOT, Mumbai are under consideration for patenting.
### 3. RESEARCH STATIONS AND RESEARCH PROJECTS

**WORK DOMAIN OF DIFFERENT RESEARCH STATIONS UNDER NAU**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Location</th>
<th>Category</th>
<th>Year of establishment</th>
<th>Area (ha)</th>
<th>Cultivated area (ha)</th>
<th>Mandate Research area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Navsari</td>
<td>Zonal, Main &amp; Regional</td>
<td>1964</td>
<td>400.62</td>
<td>291.65</td>
<td>Crops: Sugarcane, Paddy, Pulses, Castor (rabi), Forage crops, Fruit crops (Mango, Sapota, Banana, Papaya, Coconut), Vegetable crops (Pointed gourd, Little gourd, Spine gourd), Tuber crops, Floriculture, Jatropha Area: Soil &amp; Water Management, Soil Science, Organic Farming, Precision farming, Bio-control, Biotechnology, Bio-fertilizers, Bio-pesticides, Pesticide residue, Food quality testing, Acarology, Livestock Research, Seed Technology, Post Harvest Technology, Hi-tech Horticulture, Protected cultivation, Seed Production etc.</td>
</tr>
<tr>
<td>2</td>
<td>Bharuch</td>
<td>Zonal (NARP)</td>
<td>1913</td>
<td>39.19</td>
<td>31.00</td>
<td>Pigeon pea, cotton, and seed production</td>
</tr>
<tr>
<td>3</td>
<td>Surat</td>
<td>Main</td>
<td>1896</td>
<td>87.58</td>
<td>81.21</td>
<td>Cotton &amp; Sorghum, Seed production</td>
</tr>
<tr>
<td>4</td>
<td>Paria</td>
<td>Main</td>
<td>1972</td>
<td>142.73</td>
<td>127.73</td>
<td>Sub-tropical fruits (Mango &amp; Sapota), Cashew nut, Oil palm, Vegetable and fruit crop, Demonstration for tribal farmers, Watershed Research, Water management Production of planting material of fruit crops, seed production of paddy, castor, pigeon pea and green gram</td>
</tr>
<tr>
<td>5</td>
<td>Vyara</td>
<td>Regional</td>
<td>1965</td>
<td>40.33</td>
<td>29.87</td>
<td>Paddy (Transplanted, drilled &amp; Aerobic) and Groundnut, Water Management, seed production</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Location</td>
<td>Type</td>
<td>Year</td>
<td>Area</td>
<td>Productivity</td>
<td>Research Focus</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
<td>----------</td>
<td>--------</td>
<td>-------</td>
<td>--------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6</td>
<td>Waghai</td>
<td>Regional</td>
<td>1954</td>
<td>28.59</td>
<td>19.81</td>
<td>Minor millets (Nagli, Vari &amp; Kodo millet), Tuber crops, Paddy (RFTP &amp; Rainfed) and Seed production</td>
</tr>
<tr>
<td>7</td>
<td>Gandevi</td>
<td>Verification</td>
<td>1935</td>
<td>12.23</td>
<td>10.18</td>
<td>Banana, Sapota (AICRP)</td>
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<tr>
<td>8</td>
<td>Bardoli</td>
<td>Verification</td>
<td>1980</td>
<td>8.90</td>
<td>7.94</td>
<td>Wheat, Barley, seed production of paddy</td>
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<td>9</td>
<td>Achhalia</td>
<td>Verification</td>
<td>1964</td>
<td>45.89</td>
<td>40.81</td>
<td>Cotton, Pigeon pea and Jatropha (5.00 ha for Jatropha), water management</td>
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<tr>
<td>10</td>
<td>Tanchha</td>
<td>Verification</td>
<td>1959</td>
<td>19.42</td>
<td>14.89</td>
<td>Sorghum, Rainfed wheat, Mung, Pigeon pea and SSNL</td>
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<tr>
<td>11</td>
<td>Hansot</td>
<td>Verification</td>
<td>1964</td>
<td>16.30</td>
<td>14.10</td>
<td>Deshi Cotton, Pigeon pea, Jatropha, Seed production</td>
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<tr>
<td>12</td>
<td>Danti- Umbharat</td>
<td>Verification</td>
<td>1966</td>
<td>14.47</td>
<td>12.00</td>
<td>Salinity Research, Water Management, Paddy, Aquaculture, Seed production of paddy</td>
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<tr>
<td>13</td>
<td>Vanarasi</td>
<td>Verification</td>
<td>1989</td>
<td>9.11</td>
<td>8.70</td>
<td>Niger, Soybean, Soil &amp; water management, Seed production</td>
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<td>14</td>
<td>Mangrol</td>
<td>Verification</td>
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<td>8.80</td>
<td>Pulses, sorghum, Jatropha, and seed production</td>
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<td>15</td>
<td>Dediypada</td>
<td>Verification</td>
<td>2009-10</td>
<td>21.80</td>
<td>15.80</td>
<td>Pulses, Sorghum, Drilled paddy</td>
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<tr>
<td><strong>Total</strong></td>
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<td></td>
<td></td>
<td>897.26</td>
<td>714.49</td>
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**Research projects (2013-14)**

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<th>Sr.No.</th>
<th>Types of Scheme</th>
<th>Number of Schemes</th>
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<td>1</td>
<td>Plan scheme (Plan+TSP)</td>
<td>87 (67+20)</td>
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<tr>
<td>2</td>
<td>Non Plan scheme</td>
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<td>3</td>
<td>ICAR</td>
<td>20</td>
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<td>4</td>
<td>NAIP</td>
<td>03</td>
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<tr>
<td>5</td>
<td>Other agency including RKVY, NHM, GHM etc</td>
<td>34</td>
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<tr>
<td><strong>Total</strong></td>
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<td>171</td>
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## Research recommendations for farming and scientific community

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<tr>
<td>1</td>
<td>Crop Improvement</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
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<td>3</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>32</td>
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<td>2</td>
<td>Natural Resource Management</td>
<td>15</td>
<td>6</td>
<td>17</td>
<td>11</td>
<td>16</td>
<td>18</td>
<td>17</td>
<td>23</td>
<td>20</td>
<td>24</td>
<td>9</td>
<td>176</td>
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<tr>
<td>3</td>
<td>Horticulture &amp; Agroforestry</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>16</td>
<td>10</td>
<td>7</td>
<td>12</td>
<td>66</td>
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<td>4</td>
<td>Plant Protection</td>
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<td>4</td>
<td>4</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td>4</td>
<td>10</td>
<td>12</td>
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<td>2</td>
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<td>Animal Production and Fisheries</td>
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<td>0</td>
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<td>5</td>
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<td>10</td>
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<td>9</td>
<td>Social Science</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>21</strong></td>
<td><strong>16</strong></td>
<td><strong>28</strong></td>
<td><strong>25</strong></td>
<td><strong>30</strong></td>
<td><strong>36</strong></td>
<td><strong>30</strong></td>
<td><strong>51</strong></td>
<td><strong>59</strong></td>
<td><strong>57</strong></td>
<td><strong>62</strong></td>
<td><strong>415</strong></td>
</tr>
</tbody>
</table>
### Mega Seed Project

- Selling of seed and university product under brand name "NAUROI".
- Seed sold to farmers / farmers cooperatives from Navsari and other centre of the University as well as ATIC.

#### Mega Seed Project (Summary of seed/planting material production)

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Type of Seed</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
<th>2010-11</th>
<th>2011-12</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nucleus Seed</td>
<td>15.00</td>
<td>1.05</td>
<td>9.15</td>
<td>4.99</td>
<td>4.55</td>
<td>5.00</td>
<td>5.12</td>
</tr>
<tr>
<td>2</td>
<td>Breeder Seed</td>
<td>217.00</td>
<td>201.30</td>
<td>228.85</td>
<td>325.70</td>
<td>331.95</td>
<td>341.53</td>
<td>282.83</td>
</tr>
<tr>
<td>3</td>
<td>Foundation Seed</td>
<td>164.30</td>
<td>106.25</td>
<td>639.70</td>
<td>501.92</td>
<td>545.90</td>
<td>302.50</td>
<td>395.81</td>
</tr>
<tr>
<td>4</td>
<td>Certified Seed</td>
<td>1616.83</td>
<td>1737.55</td>
<td>3083.71</td>
<td>3405.00</td>
<td>3614.10</td>
<td>3023.72</td>
<td>2849.62</td>
</tr>
<tr>
<td>5</td>
<td>Truthfully labelled/</td>
<td>6475.08</td>
<td>140.41</td>
<td>636.07</td>
<td>691.90</td>
<td>752.30</td>
<td>1893.95</td>
<td>1296.59</td>
</tr>
<tr>
<td></td>
<td>university Seed</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>8488.21</strong></td>
<td><strong>2186.56</strong></td>
<td><strong>4597.48</strong></td>
<td><strong>4933.51</strong></td>
<td><strong>5244.25</strong></td>
<td><strong>5539.70</strong></td>
<td><strong>4829.97</strong></td>
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<tr>
<td>6</td>
<td>Planting Material (Sugarcane)</td>
<td>6400.00</td>
<td>8650.00</td>
<td>11732.00</td>
<td>9900.00</td>
<td>2860.00</td>
<td>3320.00</td>
<td>4040.00</td>
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<tr>
<td>7</td>
<td>Planting Material (Fruits, Vegetables and Flower crops) (in lakh)</td>
<td>14.69</td>
<td></td>
<td>18.55</td>
<td>15.85</td>
<td>6.29</td>
<td>7.82</td>
<td>8.28</td>
</tr>
</tbody>
</table>

**Tissue culture Plants (in Lakh):**

- Sugarcane: 1.30, 0.42, 0.75, 0.71, 1.30, 3.22, 4.5
- Banana: 0.20, 0.00, 0.00, 0.26, 0.15, 0.25, 0.25
### Seed production of different crop varieties

<table>
<thead>
<tr>
<th>Crop</th>
<th>Name of varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddy</td>
<td>GR 3, GR 4, GR 5, GR 7, GR 11, Jaya, Masuri, Gurjarri, NAUR 1, NAUR 2, IR 28, GNR-3, GNR-4</td>
</tr>
<tr>
<td>Moong</td>
<td>Meha, K 851, Pusa vishal, GM 3&amp;4, Co 4, GBM 1</td>
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<tr>
<td>Arhar</td>
<td>BDN 2, Vaishali, GT 1, GT 102</td>
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<tr>
<td>Groundnut</td>
<td>GG 2, GG 6</td>
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<tr>
<td>Cotton</td>
<td>G.Cot. 20, G.Cot.. 23, G.Cot.Hy-6, G.Cot.Hy-8 and others</td>
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<tr>
<td>Soybean</td>
<td>JS 335, GS 2</td>
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<tr>
<td>Sorghum</td>
<td>GJ 38, GJ 41, GJ 42</td>
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<tr>
<td>Sugarcane</td>
<td>GS 4, GS 5, GS 6, GS 7, GS 8, Co 86032, Co 99004 (Sugarcane setts and Tissue culture plantlets)</td>
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<tr>
<td>Nagli</td>
<td>GN 4, GN 5</td>
</tr>
<tr>
<td>Vari</td>
<td>GV 1, GV 2</td>
</tr>
<tr>
<td>Niger</td>
<td>GN 1</td>
</tr>
<tr>
<td>Blackgram</td>
<td>T 9</td>
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<tr>
<td>Castor</td>
<td>GCH 7</td>
</tr>
</tbody>
</table>

### DETAILS OF SEED VILLAGE PROGRAMME:

About 1078 ha area was covered under seed village programme and 2200 t seed was produced wherein 800 t of paddy seed and 600 t of pulses seed was produced. Total 68 farmers training on scientific farming in different field crops were arranged.

**Thrust Area for Research**

**Agriculture:**

- Development of new high yielding, better quality and resistant to abiotic and biotic stress varieties of rice, cotton, sugarcane, millets, pulses and oilseeds grown in south Gujarat through conventional and biotechnological approaches.
- Identification of wild varieties of various crops resistant to biotic and abiotic stress for introduction of genes into available hybrids for enhancing productivity.
- Research on value addition of important crops for enhancing returns.
- Development of remunerative package of practices for major crops of the area.

**Plant Protection:**

- Development of IPM/IDM and organic farming packages.
- Plant protection schedule for important crops.
- Surveillance and control measures of insect/diseases and crop losses every year.
Horticulture:

- Development of better hybrids of fruits and vegetables rich in nutrition with higher productivity and suitable for export.

- Development of remunerative package of practices for promoting Urban and Peri-urban horticulture.

- Standardization of technologies for off-season fruits and vegetable production under protected cultivation as per the need of south Gujarat.

- Package of practices for organic farming of important crops.

- Rejuvenation of old mango and sapota orchards.

- Development of package of practices for floriculture in open and protected conditions along with introduction of new crops.

- Development of Urban and Peri-urban cultivation technologies.

Agro-forestry:

- Conservation and characterization of important trees of forests of The Dangs.

- Development of package and practices for cultivation of useful medicinal plants as per demand of Pharmaceuticals.

Post Harvest Technologies:

- Development/standardization of post harvest technologies for minimizing losses of fruits and vegetables and enhancing income of farmers.

- Development of cold chain technologies for promoting export of quality fruits and vegetables.

- Development of technologies for enhancing shelf-life of fruits and vegetables.

Natural Resource Management:

- Development of technologies of MIS/ mulching for all crops including fruits and vegetables.

- Research on maintaining soil and water health for sustainable agriculture.

- Recycling of farm, city and industrial waste for use in agriculture.

- Research on organic farming including green manuring, plant residues, composting and vermin-composting for enriching soil.

- Bio-remedial of heavy metal contaminated soil.

Animal Sciences:

- Conservation and improvement of Surti buffalo and Surti goat of south Gujarat.

- Marker assisted selection of animals for developing disease resistant milch animals.
• Basic research on stem cell and cloning in milch animals for enhancing milk production.

• Mitigation strategies for reducing methanogenesis in livestock.

• Research on forage, feed and fodder for enhancing milk production.

**Agricultural Engineering:**

• Development of user friendly tools for addressing labour shortage for agricultural practices.

• Designing and development of energy efficient and women friendly agricultural tools.

• Designing and development of efficient tools for harvesting and post harvest processing of farm produce.

**Fisheries:**

• Enhancing production and productivity of marine, brackish water and fresh water fish.

• Breed improvement, feed formulation, health management, biodiversity, quarantine and processing of aquaculture.

• Management of inland open water fishery.
A. CEREAL CROPS

1. RICE

1.1 Crop improvement
1.) Rice : Navsari Agricultural University
Rice 1 (NAUR-1)

This variety gave an average yield of 5998 kg/ha during kharif season showing an yield advantage of 21.47% over GR-7. The variety has slender grain having a length of 9.30 mm and L/B ratio of 3.48. It has non-lodging habit with green and strong culm. The reaction to major diseases and pests is comparable to check. It is recommended for transplanted rice growing area of south Gujarat including coastal belt. (2008)

2.) Rice : Gujarat Navsari Rice 2 (GN Rice-2)

GN Rice-2 is fine grain, high yielding (4678 kg/ha) salt tolerant variety, revealing 23 and 11% higher yield over GR-11 and Dandi, respectively. It also showed 12% yield advantage (5310 kg/ha) over GR-11 under favourable conditions. Among the major pests, it is resistant to stem borer and BPH, whereas moderately resistant to leaf folder. It is resistant to BLB and false smut and moderately resistant to grain discoloration. Grain quality is comparable with GR-11. The variety is recommended for cultivation in the salt affected soils of south Gujarat heavy rainfall zone (AES-IV). (2010)

3.) Rice : Gujarat Navsari Rice-3 (GNR-3)

The variety is developed from a cross combination of IR-28 x GR-4. It recorded 5918 kg/ha grain yield under irrigated transplanted condition and 5698 kg/ha grain yield under rainfed transplanted condition with yield advantage of 19.4% and 29.3%, respectively over Gurjari in irrigated transplanted condition and over GR-7 under rainfed transplanted
condition. It is coarse grain type especially suitable for pohuva preparation. It showed resistance against BLB, blast and moderate resistance to sheath rot, grain discoloration, leaf folder and stem borer. Looking to its superiority for grain yield over Gurjari and GR-7, it is recommended for transplanted area of south Gujarat. (2012)

4.) Rice : Endorsement of NAUR-1 for aerobic condition
The variety NAUR-1 recorded significantly higher grain yield of 4121 kg/ha in South Gujarat and emerged out as top ranking genotype in aerobic conditions. It is recommended for aerobic rice cultivation in south Gujarat. (2012)

5.) Paddy : Gujarat Navsari Rice-4 (GNR-4)
Bio-fortified fine grain rice variety was developed from a cross NAUR-1 x Lal Kada. It is a dwarf statured, fine grained culture possessing red colour kernel. From various categories of trials in south Gujarat over three years, it revealed that 103 % yield increased over Lal Kada and 11.2 % over GR-11 with an average yield of 3500-4500 kg/ha. The proposed strain had moderate resistance against major diseases and insect pests. It is a first of its kind promising culture with high iron and dietary fiber content and therefore it is recommended for transplanted area of south Gujarat. (2013)

6.) Paddy : Purna
The variety of rice IET-18654 (Purna) is derived from a cross between Annada x RR 151-3 at CRURRS, Hazirabaug, Jharkhand. It performed well in south Gujarat and produced 22 % and 8.8 % higher grain yield over checks GR-5 and GR-9, respectively. This variety is approved for release in upland rice growing region of south Gujarat. (2014)
**1.2 Crop Production**

7.) It is recommended that the developed manually operated 6-row paddy transplanter can transplant 0.38 ha area in one day using mat type seedlings. The farmers can save 60 per cent transplanting cost.

In heavy soils of south Gujarat and clay content having more than 40 per cent, use of envelope is not necessary for closed subsurface drainage system. (2004)

8.) The farmers of south Gujarat heavy rainfall zone growing drilled paddy (GR-8) are advised to apply the mixture of 65 kg urea + 300 kg neem cake + 65 kg soil as basal and 65 kg urea/ha as top dressing at 30 days after emergence (DAE) or 65 kg urea + 300 kg FYM + 65 kg soil as basal and 65 kg urea/ha as top dressing at 30 DAE for getting higher yield and net income. The mixture should be prepared one day before its application. (2005)

9.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing summer paddy are advised not to seed nursery after 15th December. (2005)
10.) Farmers of coastal areas of south Gujarat agro-climatic zone (AES-IV) growing "kharif" paddy are advised to prefer six weeks old seedlings of Jaya and four to six weeks old seedlings of Dandi for transplanting to obtain higher grain yield. (2006)

11.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) growing transplanted summer paddy (Jaya) are advised to sow the nursery during 1st week of November. Under the circumstances of late sowing of nursery, they are advised to use UV stabilized polythene dome to get transplantable seedling within 30 to 35 days. (2006)

12.) The farmers of south Gujarat heavy rainfall agro-climatic zone-I (AES-III) following paddy-paddy (var. Jaya) sequence on soils having marginal Fe and deficient Zn status are advised to use soil application of micronutrient mixture (Fe 2%, Mn-0.5%, Zn-5.0%, Cu-0.2% and B-0.5% equivalent to Govt. notified general grade-V) @ 20 kg/ha to first crop only at the time of puddling as a basal dose to get higher paddy yield and net return. Alternately, farmers may also follow foliar spray of 1% mixture of multi-micronutrient formulation having Fe-2%, Mn-0.5%, Zn-4.0%, Cu-0.3% and B-0.5% equivalent to Govt. notified grade-I (Normal) at 15, 30, 45 and 60 DAT to get higher paddy yield and net return. (2006)

13.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) are advised to spray their kharif paddy (var. Masuri) with paclobutrazol (a.i. 23%) 15 mg/l (i.e 6.5 ml/100 L) at 20 days after transplanting to get 38% higher yield and 66% more net profit by increasing the number of tillers and minimizing the lodging. (2006)

14.) The farmers of south Gujarat heavy rainfall zone (AES-III) following paddy (k)-paddy (s) sequence are advised to apply pressmud @ 10 t/ha + 75% RDP (22.5 kg P₂O₅/ha) in addition to recommended dose of nitrogen to both the crops for obtaining profitable yield as well as sustaining soil fertility. (2007)

15.) The farmers of south Gujarat heavy rainfall zone (AES-III) following paddy (k)-paddy (s) crop sequence are advised to apply the fertilizer as per the soil test values.

or

In absence of soil testing, farmers are advised to apply 100% N and 50% P₂O₅ of RD to both the crops + PSB for realizing higher income.

or

They are advised to apply recommended doses of N, P and K (120:30:0 kg/ha) or FYM @ 6t/ha + poultry manure @ 1.5 t/ha + 60 kg N/ha to both the crops. (2007)

16.) The farmers of AES-III of south Gujarat heavy rainfall zone are advised to sow pigeon pea as intercrop after every six rows of drilled paddy (GR-5) sown at a row spacing of 30 cm. They are recommended to apply N @ 75% of RD of paddy (56 kg N/ha) for realizing 39% higher net profit with a saving of fertilizer N to the extent of 25%. (2007)
17.) The farmers of south Gujarat heavy rainfall zone (AES-III), growing summer paddy, are advised to adopt puddling with power tiller and reirrigate the crop 3 to 5 days after disappearance of standing water. (2008)

18.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing kharif paddy are advised to transplant 20 days old seedlings at a spacing of 20 cm x 25 cm for securing higher yield and net profit. (2009)

19.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing kharif paddy are advised to adopt sprouted seed method or SIRA technology for realizing higher yield and net profit.

Savant’s Integrated Rice Agrotechnology (SIRA)

- Seedling should be raised by applying black-gray ash of rice husk @ 0.5-1.5 kg/m2.
- Paddy straw (2 t/ha) and green gliricidia leaves (5 t/ha) should be incorporated into soil before transplanting.
- Square planting of rice seedling (15 x 15 x 25 cm).
- Fertilizers (57 kg N + 29 kg P₂O₅/ha) should be applied through Urea-DAP (60:40) briquettes (2.7 g briquette) to be placed in every four hill square at 7 to 10 cm soil depth on the same day of transplanting. (2010)

20.) The farmers of south Gujarat agro-climatic zone (AES-III) following paddy (kharif)-gram (rabi) sequence are advised to adopt earlier recommended practices for transplanted paddy cultivation (puddling, transplanting of 25-30 days old 2-3 seedlings/hill at a spacing of 20 cm x 15 cm) to realize higher net profit on sequence basis as compared to farmers practice. (2010)

21.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing paddy are advised to adopt SRI method (10-12 days old single seedling per hill at 25 cm x 25 cm spacing) to realize higher grain yield and net income besides 41 per cent saving in irrigation water. Alternatively, from water saving (40%) point of view, they are advised to adopt aerobic sowing (irrigated drilled) of rice at a row spacing of 30 cm to get higher cost: benefit ratio as compared to conventional paddy cultivation. (2012)

22.) The farmers of south Gujarat heavy rainfall zone (AES-III) intended to follow aerobic rice cultivation are advised to use 40 kg/ha seed rate and sow their crop at 30 cm row spacing for getting higher yield and net return. (2013)
23.) The farmers of coastal areas of south Gujarat (AES-IV) intended to follow paddy (kharif)-castor (rabi) sequence are advised to take dhaincha as green manure crop before kharif paddy along with application of 75 per cent recommended dose of fertilizer (90:30:0 NPK kg/ha) to paddy crop only for getting higher yield and net realization. (2013)

24.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated drilled paddy (aerobic rice) are advised to apply pendimethalin @ 1.0 kg/ha as pre emergence for effective weed control or hand weeding followed by interculturing at 20 and 40 DAS or Bispribac sodium @ 45 g/ha as post emergence at 20 DAS for effective weed control and realizing higher net income. (2013)
25.) The farmers of AES III of south Gujarat zone growing transplanted rice during summer are advised to treat the seed with thiourea @1000 ppm (1 g/litre of water) for 12 h for raising the seedlings and also spray thiourea solution of 1000 ppm (10 g/10 litre of water) at second leaf stage of rice nursery for obtaining higher grain yield. (2014)

1.3 Plant protection

26.) The paddy growing farmers of south Gujarat zone are advised to apply imidacloprid 0.005 % (CBR 1:11.86) or acetamiprid 0.004 % (CBR 1:7.82) for the effective control of gundhi bug (Leptocorisa acuta) after appearance of the pest on earheads. (2004)

27.) The paddy growing farmers of south Gujarat are advised to carry out spray of dichlorvos 76 EC @ 0.036 % (CBR 1:12.33) or acephate 75 SP @ 0.075 % (CBR 1:3.46) at the economic threshold level (2 damaged leaves per hill) for the control of paddy leaf folders. (2005)

28.) The paddy growing farmers of south Gujarat are advised to apply neem cake powder @ 75 kg/1000 sq.m in basal and carbofuran 3G @ 10 kg/1000 sq.m. (CBR 1:8.60) at 15 days of seeding for effective control of insect pest complex in nursery and transplanted field up to 45 days. (2005)

29.) Paddy growers of south Gujarat are advised to give three sprays of mancozeb @ 3 g/l of water (CBR 1:3.92) or propiconazole @ 1 ml/l of water (CBR 1:2.64) for effective control of sheath rot of paddy. The first spray should be given immediately after appearance of disease and the remaining two sprays thereafter at 10 days interval. (2006)

30.) Farmers growing bacterial leaf blight susceptible rice varieties in endemic area are advised to spray 1 g streptocycline (98% WP) + 10 g Copper oxychloride (50% WP) in 20 litres of water (CBR 1:3.8) OR 50 g Copper hydroxide (54% DF) in 20 litres of water (CBR 1:1.64) to manage bacterial blight effectively and to get more yield and income. (2008)

31.) Paddy growers of south Gujarat are advised to apply IPDM practices as under to get more grain and straw yield (CBR 1:25.75): (2008)

1) Removal of dead hearts from seedlings

2) Root dip treatment in Azospirillium (2 x 108 CFU/g) @ 200 g/20 lit of water for 15 minutes

3) Cleaning of bunds

4) Make 30 heaps of 60 kg straw on bund and broadcast 60 kg straw in field (per ha)
CEREAL CROPS

5) Apply carbofuran 3G @ 10 kg/1000 m² in nursery after 15 days of sowing followed by spraying of monocrotophos 0.036% (15 and 40 DAT) and imidachloprid 0.005% (65 DAT)

6) Spraying of mancozeb 0.3% at panicle emergence.

32.) Paddy growers of south Gujarat are advised to give spot application of recommended insecticides viz., carbofuran, monocrotophos, imidachloprid (CBR 1: 19.46) for effective and economical management of stem borer, blue beetle, hoppers and ear head bug. (2008)

33.) The Paddy growers of south Gujarat agro-climatic zone are advised to apply three sprays of carbendazim 12 WP + mancozeb 63 WP 0.11% (15 g/10 l) or hexaconazole 5 EC 0.01% (20 ml/10 l) for effective control of grain discoloration and to harvest higher healthy grains and straw yield. The first spray should be given at boot leaf stage and the remaining two sprays thereafter at 10 days interval. (2010)

34.) The paddy growing farmers of south Gujarat are recommended to apply DDVP 76 EC 0.05%, at economic threshold level at two damaged leaves per hill for the control of rice leaf folder. (2011)

35.) Paddy growing farmers of south Gujarat AES-III are recommended to spray ethion 50 EC, 0.05% + mancozeb 75 WP, 0.25% (10 ml ethion + 33 g mancozeb in 10 litre water) on initiation of sheath mite for effective control of sheath mite as well as grain discoloration and to get higher grain yield and net profit. The period of 42 days between last application of ethion 50 EC, 0.05% + mancozeb 75 WP, 0.25% and of harvesting should be maintained. (2012)

2. Sorghum

2.1 Crop improvement
1.) Sorghum: Gujarat Jowar-42 (GJ 42)

This variety gave 23.7% and 27.8% higher grain (3108 kg/ha) as well as 7.8% and 28.2% higher dry fodder yields (10801 kg/ha) than GJ 38 and GJ 40, respectively having superior grain quality. Grains are pearly white and attractive. The variety has non-lodging habit with optimum panicle exertion, straight peduncle and semi-loose panicle, less disease and comparable pest incidence. This variety is recommended for south Gujarat region. (2008)

2.2 Crop Production

2.) The farmers of AES-III of south Gujarat heavy rainfall zone, growing sorghum in rabi season, are advised to prefer BP 53 or GJ-38 variety and irrigate at 0.6 IW/CPE ratio which requires six irrigations. The schedule of irrigation is first at sowing, second at 8 to 10 days after sowing and remaining four irrigations at 20-24 days interval. (2008)
2.3 Plant Protection

3.) Under south Gujarat condition, Thiamethoxam 35 FS @ 2 g ai/kg seed (CBR 1:41.56) is recommended as a seed treatment for the control of shoot fly and stem borer in sorghum. (2006)

4.) For the control of sorghum shoot fly and stem borer, any one of the following IPM modules is recommended for the farmers of south Gujarat. (2006)

1. Normal sowing with normal seed rate @ 8 kg/ha + seed soaking for 8 h in CaCl2 (2%) + whorl application of carbofuran 3G @ 7.5 kg/ha at 30 DAE (CBR 1:25.65).

2. Late sowing (15 days late) with high seed rate @ 10 kg/ha + seed soaking for 8 h in CaCl2 (2%) + whorl application of carbofuran 3G @ 7.5 kg/ha at 30 DAE (CBR 1:22.52).

3. Wheat

1.) The farmers of AES-IV of south Gujarat heavy rainfall zone growing wheat (Lok-1 or GW-273 or GW-173) are advised to irrigate their crop at sowing, CRI, tillering, boot leaf, flowering, grain filling and dough stages to secure higher yield and net profit.

Under the constraints of irrigation water, farmers are advised to select either Lok 1 or GW-273 variety and give five irrigations i.e. at sowing, CRI, tillering, boot leaf and flowering for getting economical grain yield. This will give higher net profit along with saving in irrigation water to the tune of 30 per cent. (2004)

2.) The farmers of coastal areas of south Gujarat heavy rainfall zone (AES-IV) growing wheat after khari paddy are advised to sow wheat on raised bed (bed width 90 cm and furrow depth 15-20 cm). Further, they are advised to apply 100% RDF (180-90-00 NPK kg/ha) and biocompost @ 10 t/ha for achieving higher yield and net profit along with improvement in soil aggregation. (2011)
4. Oat

1.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing oat for seed purpose are advised to avoid green fodder cutting for securing higher seed yield and net income. The crop should be fertilized with 120 kg N/ha in three equal splits i.e. at basal, 30 and 45 DAS. Phosphorus @ 30 kg/ha should also be applied as basal. (2010)

5. Sweet corn

1.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing sweet corn during rabi season are advised to adopt drip method of irrigation along with fertigation of N and K (120:60:60 NPK kg/ha) for getting higher yield and net profit. N and K fertigation should be done in 5 equal splits starting from 30 DAS. Full dose of P should be applied as basal. (2010)

The system details are:

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<thead>
<tr>
<th>Lateral spacing (cm)</th>
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<tbody>
<tr>
<td>Dripper spacing (cm)</td>
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<td>Dripper discharge (lph)</td>
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<td>Operating pressure (kg/cm²)</td>
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<tr>
<td>Dec-Jan</td>
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<td>Feb-March</td>
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<td>Operating frequency</td>
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<td></td>
<td>Alternate day</td>
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</table>
2.) The farmers of AES-III of south Gujarat heavy rainfall zone are advised to sow *rabi* sweet corn at 45 cm x 20 cm spacing and apply atrazine @ 1.0 kg a.i./ha as pre-emergence coupled with hand weeding at 40 DAS or keep the crop weed free by three hand weeding (20, 40 and 60 DAS) for getting higher yield and net profit. There was no adverse effect of weedicide application on succeeding summer green gram crop. (2011)

6. Minor Millet

6.1. Nagli

6.1.1 Crop improvement

1.) **Gujarat Nagli-4 (Nagli WN-228)**

This variety has been developed through selection from a culture KM-228. The average yield of the variety is 2392 kg/ha which is 20.9% higher than the variety Gujarat Nagli-3. Grains of the variety are bold and reddish in colour. It is a drought tolerant variety and practically free from pests and diseases under field condition. The variety Gujarat Nagli-4 is recommended for rainfed hilly areas of Dangs and Valsad districts. (2006)

2.) **Nagli : Gujarat Nagli-5**

The variety GN-5 has been developed through selection from local germplasm collected from Dangs district. It registered 24.89% and 18.92% yield superiority over, GN-3 and GN-4, respectively. It has white and bold grains with superior nutritional value. This variety is less susceptible to pests and diseases. It is moderately resistant to leaf blast and resistant to neck and finger blast. The variety Gujarat Nagli-5 is recommended for hilly regions of Dangs and Valsad districts of Gujarat. (2009)
3.) Nagli (Finger Millet): Gujarat Navsari Nagli-6 (GNN-6)
The variety of Nagli GNN 6 was developed through selection from local germplasm collected from the Dang district. It gave 17.91% and 30.52% higher yield than checks GN-4 and VR-708, respectively. This variety is approved for release in dry lands/ hilly / tribal region of south Gujarat and Panchmahal district of middle Gujarat. (2013)

6.) Finger millet (Nagli) growing farmers of south Gujarat AES-I are advised to treat seedlings with 200 ml/ha liquid biofertilizer of native Azotobacter chroococcum ABN-1 (N.A.U.) (1x10^8 cfu/ml) or AAU commercial strain (1x10^8 cfu/ml) mixed in 1% jaggery solution for 30 minutes and soil application of liquid biofertilizer native Azotobacter chroococcum ABN-1 (N.A.U.) 1 lit/ha or AAU commercial strain 1 lit/ha mixed with pulverized soil (20 Kg/ha) as spot application at the time of transplanting to save 50% nitrogenous fertilizer and get higher yield. (2011)

6.1.3 Plant Protection

7.) Finger millet (Nagli) growing farmers of south Gujarat AES-I are advised three spray of Pseudomonas aeruginosa Rambhas Ambika River (PaRs) Strain 2x10^7 cfu/ml, 0.6% (60 ml/10 lit of water) or Pseudomonas aeruginosa Navsari farm pond (PaNs) Strain 2x10^7 cfu/ml, 0.6% (60 ml/10 lit of water) at 15 days interval, starting at 21 days of transplanting for effective and economical management of leaf blast. (2011)

8.) Finger millet growing farmers of south Gujarat are advised for three sprays of tricyclazole 75 WP @ 0.6 g/litre (0.045%; 225 g. a.i./ha) of water starting from initiation of disease and two subsequent sprays at an interval of 15 days for effective and economical management of blast disease. PHI for this fungicide is 35 days. (2013)
9.) Niger growing farmers of south Gujarat are advised for the effective management of *Alternaria* and *Cercospora* leaf spot diseases of niger, two sprays of carbendazim 12% + mancozeb 63%, 75 WP @ 2 g/lit. (0.15%; 600 g. a.i./ha) first at the initiation of the disease and second at 15 days after first spray is recommended. PHI for this fungicide is 35 days. (2013)

<table>
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<th>Year</th>
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<tr>
<td>Crop</td>
<td>Niger</td>
</tr>
<tr>
<td>Pest</td>
<td><em>Alternaria</em> &amp; <em>Cercospora</em> leafspot</td>
</tr>
<tr>
<td>Pesticide with formulation</td>
<td>Carbendazim 12% + Mancozeb 63% 75WP</td>
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<table>
<thead>
<tr>
<th>Dosage /ha</th>
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</thead>
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<tr>
<td>a.i. (g)</td>
</tr>
<tr>
<td>Formulation (g/ml)</td>
</tr>
<tr>
<td>Water requirement (liter)</td>
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</tbody>
</table>

| Formulation in water (10 lit) | 20 ml |
| Appl. schedule | first spray at initiation of diseases and two spray at 15 days interval |
| Waiting period/PHI (Days) | 35 |
| Remark | - |
6.2. Vari

1. Gujarat Vari-2 (Waghai Vari-13)
The variety has been developed through mutation in released variety Gujarat Vari-1, having an average yield of 1731 kg/ha i.e. 32.6% higher than the variety Gujarat Vari-1. Grains of the variety are bold and yellow in colour. It has non lodging habit and practically free from pests and diseases under field condition. The variety Gujarat Vari-2 is recommended for rainfed hilly areas of Dangs and Valsad districts. (2006)
B. PULSES

1. Pigeonpea

1.1 Crop improvement

1.) GT-102 (GAUT-9111)
This variety has been developed through selection from farmer's field at Hansot (Dist. Bharuch). It gives an average yield of 1595 kg/ha during rabi season showing yield advantage of 47.8% and 16.5% over BDN-2 and C-11, respectively. Seeds are bold and white. This variety is suitable for vegetable as well as grain purpose, having good Dal recovery and tolerance to sterility mosaic. The GT-102 is recommended for rabi cultivation in south Gujarat for irrigated as well as conserved moisture condition. (2006)

2.) Vaishali (BSMR-853)
The variety registered 18.43% and 10.91% higher yield over the check, BDN-2 in south Gujarat and the whole state, respectively. It possessed desirable seed colour and bold seeds. It exhibited high degree of resistance to SMD, wilt diseases and low infestation of major pests. The variety is recommended for endorsement for the entire state of Gujarat. (2007)

1.2 Crop production

3.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing pigeonpea during kharif season are advised to apply FYM @ 10 t/ha or Gypsum 3 t/ha and to sow their crop on raised bed (providing 30 cm deep and 25 cm wide furrow after four rows of the crop) along with seed inoculation of Rhizobium for getting higher yield. (2004)
4.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated rabi pigeonpea (Cv. BDN-2) are advised to fertilize the crop @ 18-40-20-20 NPKS kg/ha with sodium molybdate @ 2 kg/ha for realizing higher net profit. (2005)

1.3 Plant protection

5.) For effective management of pod borers in pigeonpea, farmers of south Gujarat AES-V are advised to apply two sprays of chlorantraniliprole 18.5 SC, 0.006% (3 ml/10 lit of water) or flubendiamide 48 SC, 0.0096% (2 ml/10 lit of water); first at 50% flowering and second at 50% pod formation stage for getting higher yield and better returns. Further, the residues of these insecticides remained below determination level in dry grains of pigeonpea.

The period between last application and of harvesting for chlorantraniliprole 18.5 SC, 0.006% (3 ml/10 lit of water) and flubendiamide 48 SC, 0.0096% (2 ml/10 lit of water) should be 47 and 30 days, respectively. (2012)

2.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) growing rabi mung (Co-4) are advised to sow their crop around 15th October by keeping a row spacing of 60 cm and fertilizing it @ 20 kg P₂O₅/ha + PSM culture for getting higher yield and net profit. (2006)

2. Moong bean

2.1 Crop improvement

1.) Moong bean: GBM-1 (RTM-10)
This variety giving 930 kg/ha yield showed 27.75% yield advantage over Co-4. It is a short duration, medium tall variety having black coloured bold seeds, moderately resistant to MYMV, powdery mildew and macrophomina blight diseases and suitable for rabi cultivation under conserved moisture condition. This variety is recommended for south Gujarat region. (2008)
3.) The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to keep rabi green gram crop weed free by two hand weedicings at 20 and 40 days after sowing to obtain higher yield of rabi green gram (Cv. Co-4). (2009)

4.) The farmers of AES-III of south Gujarat heavy rainfall zone growing rabi greengram (Co-4) in kyari land are advised to adopt raised bed system of sowing and fertilize the crop as per recommended dose (20-40-0 N-P₂O₅-K₂O kg/ha) for obtaining higher yield and net return. (2014)

3. Gram

3.1 Crop production

1.) Farmers of south Gujarat agro-climatic zone-II growing gram cv. GG-2 are advised to inoculate seeds with phosphate solubilizing culture (Bacillus sp. Navsari isolate) PBN-1 (CBR 1:475) @ 30 g culture/kg seed containing 10⁶ viable cells/g before sowing to save 40 kg P₂O₅/ha and to get higher yield. (2005)

2.) Under limited water supply in the Bara tract of Narmada command area, the farmers growing gram (GG-2) are advised to give one irrigation at branching to get 60% more yield. (2006)

4. Indian bean

4.1 Crop improvement

1.) Gujarat Wal-2 (NW-104)

The proposed variety NW-104 recorded 23.81% and 40.7% higher seed yields as compared to the checks, Gujarat Wal-1 and NW 125-36, respectively. It matured 15 and 25 days earlier than Gujarat Wal-1 and NW-125-36, respectively. Its plant type is erect with synchronous maturity and possesses white seed, higher dal recovery, less cooking time as compared to checks. The culture exhibited less incidence of diseases and pests. The variety is recommended for commercial cultivation in south Gujarat heavy rainfall zone under rainfed condition. (2007)
2.) **Indian bean : Gujarat Navsari Indian bean-21 (GNIB-21)**

The variety of Indian bean is developed from cross of Arka Jay x Katargam. It recorded 10.08% higher green pod yield over Katargam. It recorded near about 4 t/ha green pod yield at even closer distance due to its erect nature. On large scale demonstration on farmer’s field it has given 53% higher green pod yield over check under productive management. This variety is approved for release in south Gujarat heavy rainfall zone. (2014)

3.) **Crop production**

The farmers of south Gujarat heavy rainfall zone AES-III growing Indian bean after kharif paddy under irrigated condition are advised to cultivate G.Wal-1 at a spacing of 60 cm x 15 cm. The sowing should be done preferably up to first November. First irrigation should be given at sowing time and second at flowering stage (75 DAS). (2004)

4.) Farmers of south Gujarat agro-climatic zone-II growing Indian bean cv. G.Wal-1 are advised to inoculate the seeds with phosphate solubilizing culture (*Bacillus* sp Navsari isolate) PBN-2 (CBR 1:357) @ 30 g culture/kg seeds containing 10⁸ viable cell/g before sowing to save 40 kg P₂O₅/ha and to get higher yield. (2005)
C. OILSEED CROPS

1. Castor

1.1 Crop production

1.) The farmers of Bara tract of Narmada command area with limited water availability growing castor (GCH-5) during late kharif, are advised to irrigate their crop in alternate furrows and mulch the crop with black plastic (50 micron) for realizing 51% more yield and 21% higher net profit. (2006)

2.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) growing castor in rabi season are advised to irrigate their crop at 0.6 IW/CPE ratio which requires six irrigations. The first irrigation should be given at sowing, second at 8 to 10 days after sowing and remaining four at 22-25 days interval.

   Crop should be mulched with sugarcane trash @ 5 t/ha for obtaining 18% higher yield and 27% more net income. Due to higher cost, plastic mulch was not found economical. (2006)

3.) The farmers of AES-III of south Gujarat heavy rainfall zone are advised to grow castor after kharif paddy and apply 8 irrigations (60 mm). Of which, the first 4 irrigations should be applied at 20-25 days interval and the remaining 4 at an interval of 12-18 days for getting higher net income.

4.) Under the constraint of irrigation water, they are advised to plant their crop in paired row (60 x 60 x 120 cm) and adopt drip method of irrigation to save 39% water and 40% fertilizer. The system should be laid out at a lateral distance of 1.8 m and dripper (8 Lph) at spacing of 1.2 m and operated at 1.2 kg/cm² pressure for 40 to 60 minutes during November to January and 60 to 100 minutes during February till harvest on alternate days. (2007)

The farmers of coastal area of south Gujarat (AES-IV) are advised to apply 6 irrigations to rabi castor (GCH-4) sown before 15th November i.e. after kharif paddy. The first irrigation should be given at sowing and the remaining five irrigations at 20-25 days interval. It is further recommended to mulch the crop with grass @ 5 t/ha for realizing higher seed yield and net return. (2008)
5.) The farmers of AES-III of south Gujarat heavy rainfall zone growing castor after paddy are advised to prefer castor hybrid GCH-5 and sow the crop during second fortnight of October to first fortnight of November to secure higher yield and net income. (2009)

6.) The farmers of south Gujarat zone-II (AES-I) are advised to grow *rabi* castor in paired row planting (60 cm x 60 cm x 120 cm). They should adopt drip method of irrigation (0.4 PEF) along with mulching with black plastic (56% coverage) for getting higher seed yield and net profit besides 39% saving in water. (2009)

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**The system details are :**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral spacing</td>
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</tr>
<tr>
<td>Dripper spacing</td>
<td>1.2 m</td>
</tr>
<tr>
<td>Dripper discharge</td>
<td>8 l/h</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>1.2 kg/cm²</td>
</tr>
<tr>
<td>Operating time</td>
<td>November to January: 40 to 60 minutes at alternate days&lt;br&gt;February to harvest: 60 to 100 minutes at alternate days</td>
</tr>
</tbody>
</table>

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7.) The farmers of coastal areas of south Gujarat heavy rainfall agro-climatic zone (AES-IV) are advised to cultivate *rabi* castor at 90 x 60 cm spacing either as a sole crop or castor + onion intercrop. Four rows of onion at 15 x10 cm spacing should be transplanted between two rows of castor (1:4 row ratio). For both, castor (80:40:00 NPK kg/ha) as well as onion (125:50:50 NPK kg/ha) respective recommended doses of fertilizer should be applied on the basis of area under intercrop. (2012)

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8.) The farmers of south Gujarat heavy rain fall zone (AES-III) growing castor (Cv. GCH 4) during *rabi* season under drip method of irrigation and operating the system on alternate day are advised to impose water stress by stopping drip irrigation for a period of 20 days in case of without mulch or 30 days with Black plastic mulch starting from 50 per cent emergence of main spike stage. By adopting this no cost practice, farmer can save irrigation water up to 18 per cent as compared to normal operation of the drip system. (2012)

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9.) Farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated castor (GCH-7) during *rabi* season are advised to follow recommended practices of weed management, fertilizer application and need based plant protection to achieve higher yield and net profit. However, under the situations of resource constraints, the resources should be prioritized in order of 'Weed management > Fertilizer application > Plant protection'. (2013)
10.) Farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated castor (GCH-7) during *rabi* season are advised to sow the crop at 120 cm x 90 cm spacing. (2013)

11.) The farmers of coastal areas of south Gujarat heavy rainfall agro climatic zone (AES-IV) growing *rabi* hybrid castor are advised to apply N @ 120 kg/ha through drip in 8-12 splits at an interval of 10-15 days starting from 20 days after sowing. By adopting this fertigation schedule, farmers can get higher yield and net profit over control (N @ 80 kg/ha through drip in 4 splits at an interval of 20 days). Basal dose of P₂O₅ should be applied. (2013)

The system details are:

<table>
<thead>
<tr>
<th>Type of drip system</th>
<th>On line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral spacing (cm)</td>
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</tr>
<tr>
<td>Lateral diameter (mm)</td>
<td>16</td>
</tr>
<tr>
<td>Dripper discharge rate (lph)</td>
<td>8</td>
</tr>
<tr>
<td>Dripper spacing (cm)</td>
<td>120</td>
</tr>
<tr>
<td>Operating pressure (kg/cm²)</td>
<td>1.20</td>
</tr>
<tr>
<td>Operation frequency</td>
<td>Alternate day</td>
</tr>
<tr>
<td>Schedule for drip irrigation</td>
<td>November - January : 75-105 minutes</td>
</tr>
<tr>
<td></td>
<td>February - April : 90-140 minutes</td>
</tr>
</tbody>
</table>
12.) Farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated castor (GCH 7) during rabi season are advised to apply 120 kg N/ha in three equal splits for achieving higher seed yield and economic returns. One-third nitrogen should be applied as basal and remaining at 35-40 and 75-80 DAS. Phosphorous and potassium application should be made on soil test basis. (2013)

14.) The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to keep the rabi castor field weed free from 45-90 days after sowing which is critical period for crop weed competition for getting higher yield and profit. (2013)

2. **Groundnut**

1.) The farmers of south Gujarat heavy rainfall zone AES-III are advised to follow two hand weedings + IC at 25 and 45 DAS for effective weed control in summer groundnut. Under paucity of labours, pre-emergence application of oxyfluorfen 0.15 lit/ha dissolved in 500 lit of water along with one hand weeding at 45 DAS can be followed to keep the crop weed free and to obtain higher yield of summer groundnut. (2005)

2.) The farmers of AES-III of south Gujarat heavy rainfall zone, adopting paddy-summer groundnut sequence, are advised to follow 6" deep ploughing after harvest of paddy for higher yield and net return. (2008)

3.) The farmers of AES-III of South Gujarat heavy rainfall zone growing summer groundnut are advised to apply either biocompost @ 5 t/ha or FYM @ 10 t/ha or vermicompost @ 2.5 t/ha along with recommended dose of fertilizer (25:50:00 NPK kg/ha) for getting higher yield and net profit. (2011)
3. Mustard

1.) The farmers of coastal belt of South Gujarat (AES-IV), growing mustard after transplanted kharif paddy, are advised to open 15-20 cm deep and 25-30 cm wide furrow after every 3 rows of mustard and apply 6 irrigations each of 40 mm depth in furrow to save 20% water without reduction in yield. (2008)

4. Soybean

1.) The farmers of AES-II of south Gujarat heavy rainfall zone, growing rainfed soybean (Gujarat Soybean-2), are advised to apply 60 kg N and 30 kg P₂O₅ to realize higher seed yield and net return. The 50% N and 100% P₂O₅ are to be applied as basal and remaining 50% N is to be applied at 30 days after crop emergence.

In the event of monetary constraint, they are advised to apply only P @ 30 kg P₂O₅/ha. (2008)

5. Sesamum

1.) The farmers of south Gujarat heavy rainfall zone-I are advised to grow sesamum during summer instead of paddy by keeping row spacing of 45 cm on flat bed or 4 rows at 30 cm on raised bed of 120 cm top width and furrow of 60 cm wide and 15-20 cm deep. They are further advised to apply total of 8-9 irrigations at an interval of 10-12 days. Mulching with paddy straw was not found economical in sesame (s) crop despite of significant increase in seed yield due to mulching. (2014)
6. Niger

1.) The farmers of south Gujarat heavy rainfall zone (AES-III) intending to grow *rabi* niger are advised to give 4 irrigations for getting higher seed yield and net return. The first irrigation should be given at the time of sowing, second at 18-20 days after sowing and remaining 2 at an interval of 24-25 days. The crop should be fertilized with either RDF (40-20-00 NPK kg/ha) or FYM @ 5 t/ha + 50% RDF (20-10-00 NPK kg/ha) for obtaining higher seed yield and net return.

They are further advised to grow summer green gram as succeeding crop without applying any fertilizer for obtaining higher net return. (2008)
D. CASH CROPS

1. Sugarcane

1.1 Crop improvement

1.) Gujarat Sugarcane-4 (CoN 03131)
This variety showed 36.22 and 31.53 % yield advantage under fresh planting (155.63 t/ha) and 23.47 and 28.21 % yield advantage under ratoon condition (129.27 t/ha) over CoC 671 and CoN 95132, respectively. It is early maturing, non-lodging, high sugared variety, moderately resistant to wilt and red rot diseases with negligible incidence of insect pests. The variety is recommended for south Gujarat region. (2005)

2.) Gujarat Sugarcane-5 (CoN 05071)
The clone CoN 05071 (Gujarat Sugarcane 5), belonging to early maturity group, gave 26.37 and 24.63% higher cane yield over zonal (CoC 671) and state (CoN 95132) checks, respectively. It also recorded a sugar yield of 18.7 t/ha which was 25.11 and 19.20% higher over the zonal and state checks, respectively. The clone had added advantage of high sugar content, good ratooning ability in addition to wilt and red rot resistance. (2007)
3.) Gujarat Sugarcane-6 (CoN 05072)
The clone CoN 05072 (Gujarat Sugarcane 6) belonging to mid late maturity group recorded 26.47 and 23.62% higher cane yields over zonal (Co 6304) and state (CoN 85134) checks, respectively. It registered sugar yield of 16.9 t/ha, which was 26.15 and 22.14 percent higher over the zonal and state checks, respectively. It exhibited good ratooning ability, besides it was resistant to wilt and red rot diseases. (2007)

4.) Sugarcane: GN Sugarcane-7
The variety GN Sugarcane-7 has been developed from a cross Co 95021 x Co 8347. It is mid-late maturing, high sugar content and suitable for ratooning also. This variety exhibited overall 15.6%, 14.4% and 2.3% higher cane yield over the checks Co 86032, Co 91132 and CoN 05072, respectively. It is moderately resistant to red rot and wilt and less infested by major insect pests. Due to non-flowering and non-lodging erect growing habit, the variety is suitable for mechanical harvesting. It is recommended for cultivation in south Gujarat region. (2011)

5.) Sugarcane: Gujarat Navsari Sugarcane-8 (GNS-8)
The early maturing sugarcane variety GNS-8 has been derived from a cross CoS 8436 X Co 86002. It registered 10.37 % cane yield increase over the check CoN 05071 in overall mean of eight plant and three ratoon trials. It is also found better in juice quality parameters over the check. It is moderately resistance to red rot, wilt and resistance to whip smut. It is recommended for cultivation in south Gujarat region. (2013)
1.2 Crop production

6.) The farmers of south Gujarat heavy rainfall zone AES III planting sugarcane (Nov.-March) are advised to follow either green manuring practice with sunhemp two months prior to sugarcane planting or FYM @ 10 t/ha + Castor cake @ 0.5 t/ha besides the recommended dose of inorganic fertilizers for securing economical higher production of plant and ratoon sugarcane (CoN 91132) as well as to maintain soil fertility. (2004)

7.) Sugarcane growers of south Gujarat heavy rainfall zone, AES-III are advised to apply 250 kg N/ha to sugarcane crop in four splits i.e. 15 % at basal (at the time of planting), 30 % at 45 DAP, 20 % at 90 DAP and 35 % at 150 DAP (at final earthing up) to obtain quality produce of sugarcane CoLK 8001. (2004)

8.) Sugarcane growers of south Gujarat heavy rainfall zone, AES-III are advised to keep their sugarcane field weed free from 30 to 150 DAP or for first 90 DAP. (2004)

9.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) growing sugarcane (variety CoN 91132/ Gujarat sugarcane-1) are advised to apply 25 t FYM, 250 125-125 NPK kg/ha and not to apply Fe and Zn. (2006)

10.) Sugarcane (CoN 91132/Gujarat Sugarcane-1) growers of south Gujarat heavy rainfall agro-climatic zone (AES-III) are advised to take two ratoon crops of sugarcane which should be fertilized with 100% recommended dose of NPK (300-62.5-125 kg/ha) along with trash incorporation (10 t/ha) to get sustainable higher sugarcane yield. The marginal farmer can apply 75% RDF with 10.0 t/ha trash incorporation. Under both the treatments, rotational kharif paddy also gave higher yield, without any adverse effect on soil quality. (2006)

Note:
For each tonne of trash, 10.0 kg Single Super Phosphate + 8.0 kg Urea + 100.0 kg dung + 1.0 kg decomposing culture were taken. The slurry was prepared and poured on trash.
11.) Sugarcane growers of south Gujarat heavy rainfall agro-climatic zone (AES-III) are advised to adopt paired row planting following 60-120-60 cm spacing and sown gram (PG-5) as smoother crop (three rows) for getting the highest sugarcane yield and net return. Alternatively, they may also plant the crop at 90 cm (normal planting + two rows of intercrop) or 120 cm (twin row planting + three rows of intercrop), coupled gram as smoother crop or three hand weedicings at 30 + 60 + 90 DAP + two interculturings at 45 + 90 DAP. (2006)

12.) The sugarcane growing farmers of south Gujarat heavy rainfall zone (AES-III) are advised to apply 100% RDF (250-125-125 NPK kg/ha) + 25% N through FYM + bio fertilizers (Azotobacter + PSB each @ 2 kg/ha) to plant crop and 100% RDF (300-62.5-125 NPK kg/ha) + trash incorporation @ 10 t/ha with cellulolytic culture + bio fertilizers (Azotobactor + PSB each @ 2 kg/ha) to ratoon crop for higher cane yield and net income and also for sustaining soil health. (2007)

13.) Farmers of south Gujarat heavy rainfall zone (AES-III), adopting paddy (kharif)-sugarcane crop sequence, are advised to cultivate two times with tractor-drawn-cultivator before monsoon followed by just planking before transplanting paddy to get higher yield of sugarcane and net return from the sequence. (2008)

14.) The farmers of AES-I of south Gujarat (Zone-II) following green manure-sugarcane sequence are advised to apply either pressmud @ 15 t/ha alone or rock phosphate @ 0.5 t/ha + PM @ 10 t/ha prior to green manuring with dhaincha for getting 24% higher cane yield and 14% net return as compared to without green manuring. Further, they are recommended to apply 50% RD of P + phosphorous solubilizing bacteria culture (PSB) for getting higher yield and net return. (2009)

15.) The sugarcane growers of south Gujarat agro climatic zones are advised to apply banana pseudostem sap @ 5000 l/ha through drip along with 60 per cent RDF (150:75:75 NPK kg/ha) for realizing higher net profit. The 100 per cent P₂O₅, 15 per cent N and K₂O should be applied at the time of planting. While the remaining N and K₂O should be applied along with sap in 10 equal splits at an interval of 10 days starting from 60 DAP. The system details are as follow. (2012)

<table>
<thead>
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<tbody>
<tr>
<td>Lateral spacing (cm)</td>
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<td>Dripper spacing (cm)</td>
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<td>Dripper discharge rate (lph)</td>
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<tr>
<td>Operating pressure (kg/cm²)</td>
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<tr>
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<td>Alternate day</td>
</tr>
<tr>
<td>Operating time</td>
<td></td>
</tr>
<tr>
<td>Winter</td>
<td>1.50 - 2.00 hrs</td>
</tr>
<tr>
<td>Summer</td>
<td>2.00 - 2.75 hrs</td>
</tr>
</tbody>
</table>
16.) The farmers of south Gujarat agroclimatic zone growing sugarcane under drip system are advised to apply FYM @ 20 t/ha + RDF (250:125:125 NPK kg/ha) for realizing higher net income. Under the circumstance of shortage or unavailability of FYM, they can apply pseudostem based vermicompost @ 5 t/ha in addition to RDF. (2012)

<table>
<thead>
<tr>
<th>System details:</th>
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<tbody>
<tr>
<td>Lateral spacing (cm)</td>
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</tr>
<tr>
<td>Summer</td>
<td>2.00 - 2.75 hrs</td>
</tr>
</tbody>
</table>

Note:
- Plant two eye budded 8 setts/pit treated with Trichoderma viride (Navsari isolate) and Pseudomonas fluorescens (Navsari isolate).
- Apply 100 ml/pit of 0.5% Azotobacter (Navsari isolate) and 0.5% PSB (Navsari isolate) (each 1x108 cfu/ml) at the time of planting and 0.5% Acetobacter (Navsari isolate) (1x107 cfu/ml) at the time of earthing up.
- Apply two combine spray of cow urine and butter milk each @ 2% at tillering and cane development stage. (2013)

18.) Sugarcane growers of south Gujarat heavy rainfall zone (AES-III) are advised to prepare land by mould board plough and plant at a row spacing of 75 cm in combination with recommended practices of irrigation for getting higher cane yield and net return. (2013)

19.) Sugarcane growers of south Gujarat heavy rainfall zone (AES-III) are advised to plant sugarcane crop with paired cum trench planting (at 30:150 cm row spacing) and to irrigate the crop with 15 irrigations each of 80 mm depth (0.9 IW/CPE). The first irrigation should be given at the time of planting and the rests at 19-20 days interval during winter season and 13-14 days interval during summer season for getting higher cane yield and net return. (2013)

18.) The farmers of south Gujarat who have adopted organic farming in sugarcane with pit method of planting (diameter 0.6 m and depth 0.45 m spaced at 2.4 m x 1.2 m) are advised to apply 1.4 kg vermicompost + 0.43 kg castor cake or 0.4 kg neem cake per pit at the time of filling the pits and 0.7 kg vermicompost + 0.215 kg castor cake or 0.2 kg neem cake at the time of tillering as first split and repeat the same dose at the time of earthing up as second split.

20.) Sugarcane growers of south Gujarat are advised to treat the setts with native Acetobacter-each ACN-1 & PSB-PBN-1 @ 300 ml/ha (each 1x108 cfu/ml) by mixing together in one per cent jaggery solution as required for 30 minutes before planting and soil applications of native Acetobacter-ACN-1 & PSB-PBN-1 each @ 1000 ml/ha (1x108 cfu/ml) mixed in pulverized soil (100 kg/ha); first at the time of planting and the second at the time of
earthing up along with 50:50:100 % recommended dose of NPK fertilizers to realize higher cane yield and save 50 per cent nitrogen and phosphorus in plant crop. (2013)

21.) Sugarcane growers of south Gujarat heavy rainfall zone (AES-III) are advised to apply either biocompost @ 15 t/ha or poultry manure @ 5 t/ha or castor cake @ 2 t/ha and fertilize the crop with 125% recommended dose of nitrogen (312.5 kg/ha in plant and 375 kg/ha in ratoon crop) and 100% recommended dose of phosphorus and potassium (125-125 kg P₂O₅-K₂O/ha in plant and 62.5-125 kg P₂O₅-K₂O in ratoon crop, respectively) along with Acetobacter- ACN-1 (1×10⁸ cfu/ml) 2 kg/ha as soil application to sugarcane variety CoN 05071 for obtaining higher cane yield, net return and sustaining soil health. (2014)

1.3 Plant protection

22.) Sugarcane growers of south Gujarat (AES-III of SGHRZ) are advised to take any one of the following measures for the control of the major insect pests of sugarcane (cv.CoN.91132).

1. Spray endosulfan 35 EC @ 0.075% at 120 DAP (days after planting), release Trichogramma chilonis parasites @ 40,000/ha at 135 and 150 DAP and apply carbofuran 3 G @ 1 kg a.i./ha in soil at 150 DAP (CBR 1:3.68)

 or

2. Apply carbofuran 3 G @ 1 kg a.i./ha at 30 DAP, apply phorate 10 G @ 1 kg a.i./ha in soil at 60 DAP and spray endosulfan 35 EC @ 0.075% at 120 DAP (CBR 1:3.33). (2007)

2. COTTON

2.1 Crop improvement


It is an intra hirsutum, early maturing hybrid with 25.9, 15.9 and 24.0 % yield advantage, respectively over G.Cot.Hy 6, G.Cot.Hy-8 and G.Cot.Hy-10 under rainfed conditions. The hybrid possesses bigger boll size and better fiber quality parameters. The performance of the hybrid was found better under rainfed conditions and therefore, it was approved for the rainfed areas. (2004)

G.Cot.Hy-12
2. **Cotton : G.Cot-20 (GSHV-97/59)**

This is a medium long staple hirsutum variety, having an average yield of 1760 kg/ha. It showed yield superiority to the tune of 29.2%, 30.5%, 25.1% and 50.4% over G.Cot-10, G.Cot-16, G.Cot-18 and LRA-5166, respectively under irrigated condition. It is moderately tolerant to jassid, aphids, thrips and boll worms and moderately resistant to bacterial blight, moderately susceptible to alternaria leaf spot and free from grey mildew disease. This variety is recommended for irrigated area of Gujarat state. (2006)

3. **Cotton : GN Cot-25 (GBhv-226)**

Medium staple deshi cotton variety, GN Cot-25 (GBhv-226) registered 63.0%, 57.3% and 18.0% higher seed cotton yield (1500 kg/ha) over Digvijay, G.Cot-17 and G.Cot-23, respectively. The variety also recorded 69.5%, 61.8% and 18.4% higher lint yield than the corresponding checks (Digvijay, G.Cot-17 and G.Cot-23). Pest reaction showed lower incidence of aphids and jassids but slightly higher incidence of whitefly and thrips when compared with G.Cot-23. It is free from bacterial blight, alternaria, grey mildew and wilt diseases. The fiber quality of the variety is at par with check variety G.Cot-23. This variety is recommended for cultivation in rainfed cotton growing tract of the state. (2010)
4. **Cotton : Endorsement of G. Cot. Hy. 6 (BG II)**
The first Bt cotton hybrid G.Cot.Hy.-6 (BG II) from public sector carrying BG-II (Mon 15985 event) was evaluated with its non Bt counter part and prescribed checks. It recorded seed cotton yield of 1981 kg/ha which was 31.4% higher than non Bt counter part and 12.6%, 13.6% and 6% higher over checks RCH-2 (BG II), VICH-5 (BG II) and G.Cot.-12, respectively. The fiber quality of the hybrid was at par with its non Bt counter part. The hybrid was free from spodoptera, heliothis and pink ball worm damage (Green boll). For sucking pests it is comparable with non Bt and Bt checks. The variety is recommended for cotton growing areas of Gujarat. (2012)

5. **Cotton : Endorsement of G. Cot. Hy. 8 (BG II)**
The first Bt cotton hybrid G.Cot.Hy.-8 from public sector carrying BG-II (Mon 15985 event) was evaluated with its non Bt counter part and prescribed checks. It recorded seed cotton yield of 2231 kg/ha which was 21.3% higher than non Bt counter part and 26.8%, 28.4% and 19.4% over checks RCH-2 (BG II) and VICH-5 (BG II) and G.Cot.Hy.-12, respectively. The fiber quality of the hybrid was at par with its non Bt counter part. The hybrid was free from spodoptera, heliothis and pink ball worm damage (Green boll). For sucking pests it is comparable well with non Bt and Bt checks. The variety is recommended for cotton growing areas of Gujarat. (2012)
6. **Cotton : Gujarat Navsari Cotton-22 (GN. Cot. 22)**

The variety is developed from cross of G.Cot.10 X GISV-140. The GSV-140 is developed through interspecific hybridization using G. stocksii, G. armoria and G. anomium. It is a first of its kind variety developed through interspecific hybridization. It is immune to Jassid infestation. It was evaluated in beside several preliminary trials. On the basis of overall performance across the zones (47 replicated trials at nine locations for seven years in irrigated as well as rainfed conditions), it has recorded 8.1 to 45.7% yield superiority over different check varieties. It has showed high level of resistance to sucking pests. The variety is recommended for cotton growing areas of Gujarat. (2013)

7. **Cotton : Gujarat Navsari Hybrid Cotton-14 (GN.Cot.Hy.-14)**

The hybrid GSHH-2729 of cotton was developed from crossing two diverse parents in 2008. It gave 2552 kg/ha seed cotton yield on overall basis which is 26.1%, 16.2% and 70.6% higher than G. Cot. Hy-10, G. Cot. Hy-12 and Ankur-651, respectively. It recorded lint yield of 831 kg/ha which is 30.4%, 16.3% and 66.0% higher than G. Cot. Hy-10, G. Cot. Hy-12 and Ankur-651, respectively. This hybrid is approved for release in irrigated area of Gujarat. (2014)
2.2 Crop Production

8.) Farmers of south Gujarat Zone-II growing rainfed cotton are advised to sow cotton var. G.Cot-23 at 120 cm x 90 cm spacing with application of 80 Kg N/ha in three equal splits i.e. first at 25-30 days after germination and subsequently twice at one month interval for getting higher yield and net return. Application of phosphorus was not found advantageous. (2004)

9.) The farmers of AES-V of South Gujarat Agro-climatic Zone-II growing kharif cotton on black soils are advised to open 22.5 cm deep furrow after either four or two rows of cotton sown at a row spacing of 120 cm. This results in 83 % more income than flat bed sowing. (2005)

10.) Farmers of south Gujarat agro-climatic zone-II growing desi cotton hybrid G.Cot.MDH-11 (arb x arb) under rainfed condition are advised to fertilize the crop with 80:00 NP kg/ha. (2006)

11.) The farmers of Bara tract of Narmada command area growing cotton (G.Cot.Hy-8) are advised to apply either FYM @ 10 t/ha or gypsum @ 6 t/ha or press mud @ 6 t/ha as an amendment along with RDN (80 kg N/ha) for achieving higher yield and net profit along with improvement in soil properties. (2006)

12.) Farmers of south Gujarat zone-II, growing cotton (G.Cot.Hy-12) on high P status soils under rainfed conditions, are advised to sow the crop at a spacing of 120 cm x 60 cm and apply 80 kg N/ha in 2-3 equal splits. (2006)

13.) The farmers of south Gujarat (Zone-II) growing rainfed cotton (G.Cot.Hy-12) are advised to plough their field 20 cm deep before monsoon and to adopt ridges and furrow method of sowing for getting higher seed cotton yield. (2009)

14.) The farmers of south Gujarat (Zone-II) growing cotton (G.Cot.Hy-12) are advised to apply 75% RDN (180 kg N through urea) + 25% N through castor cake (1.2 t/ha) to obtain higher seed cotton yield and maintain soil fertility. (2009)

15.) The farmers of south Gujarat zone growing Bt cotton (RCH-2) under irrigated conditions are advised to sow the crop at 120 cm x 45 cm spacing and fertilize @ 240 kg N/ha in three equal splits i.e. 50% as basal, 25% at branching and 25% at squaring to obtain higher yield and net profit. If the available P status is marginal to deficient, farmers are advised to apply P2O5 @ 40 kg/ha as basal. (2010)

16.) The farmers of south Gujarat Zone growing cotton (G.Cot.Hy-10) under irrigated conditions are advised to apply spray of 3% KNO3 at squaring, flowering and boll development stages besides RDN (240 kg/ha) for getting higher seed cotton yield and net profit. (2010)
17.) The farmers of south Gujarat (Zone-II) growing Bt cotton (RCH-2) are advised to apply recommended dose of nitrogen (240 kg/ha) in five equal splits at 30, 60, 75, 90 and 105 DAS to obtain higher seed cotton yield and net returns. (2011)

18.) The farmers of south Gujarat (Zone-II) growing irrigated Bt cotton are advised to apply pendimethalin @ 1.00 kg a.i./ha as pre-emergence followed by two hand weedings at 30 and 60 days after sowing to obtain higher seed cotton yield and net profit. (2011)

19.) The farmers of south Gujarat growing Bt cotton are advised to spray 45 ppm of 39% commercial ethylene (1.125 ml/10 lit) at square initiation stage (35-40 DAS) to obtain higher yield and net return. (2011)

20.) Farmers of south Gujarat agro-climatic zone-II growing rainfed cotton (GN Cot.-25) are advised to follow spacing of 120 x 45 cm with application of 80 kg N/ha for getting higher seed cotton yield and net profit. The nitrogen should be applied in two splits i.e., 50% as basal and 50% at 1-1.5 month after sowing. (2012)

21.) Farmers of south Gujarat agro-climatic zone II growing irrigated Bt cotton are advised to adopt deep ploughing (22.5 cm depth) in summer and apply two irrigations i.e., first (80 mm) at 25 days after cessation of monsoon and second (60 mm) at 50 days after first irrigation for obtaining higher seed cotton yield and net profit. (2012)

22.) The farmers of south Gujarat agro-climatic zone–II growing Bt cotton under irrigated conditions are advised to adopt drip irrigation in paired row planting (60 x 45 x 180 cm) and schedule irrigation at 0.8 PEF. Further, they are advised to apply 180 kg N/ha (75% RDN) in 6 equal splits at 15 days interval starting from 15 DAS through drip system to obtain higher seed cotton yield and net profit besides with saving of irrigation water by 20% and nitrogen by 25%. (2012)

<table>
<thead>
<tr>
<th>System details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Main line</td>
<td>75 mm</td>
</tr>
<tr>
<td>Sub main line</td>
<td>63 mm</td>
</tr>
<tr>
<td>Lateral (Inline)</td>
<td>16 mm</td>
</tr>
<tr>
<td>Lateral spacing</td>
<td>240 cm</td>
</tr>
<tr>
<td>Dripper</td>
<td>4 lph</td>
</tr>
<tr>
<td>Dripper spacing</td>
<td>45 cm</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>1.2 kg/cm²</td>
</tr>
<tr>
<td>Operating frequency</td>
<td>Alternate day</td>
</tr>
<tr>
<td>Operating time</td>
<td>70-85 minutes</td>
</tr>
</tbody>
</table>

23.) Farmers of south Gujarat growing Bt or conventional cotton hybrids under irrigated conditions are advised to go for detopping at 95 days after sowing followed by nipping of sympodial meristem at 105 DAS to obtain high yield and net returns. (2012)
2.3 Plant Protection

24.) For the effective and economic control of cotton pink bollworm in hybrid cotton, G.Cot.Hy-10 application of spinosad 45 SC @ 50 g a.i./ha (100 ml/ha), CBR 1:3.58; or deltamethrin tablet 25 % @ 10 g a.i./ha (20 tablet/ha each of 2 g weight), CBR 1:10.38; or betacyfluthrin 2.5 SC @ 18 g a.i./ha (720 ml/ha), CBR 1:6.10, at 10 days interval starting from incidence of pink bollworm, are recommended under south Gujarat agro climatic condition (Zone-II). (2005)

25.) Farmers of South Gujarat Agro-climatic Zone II growing G.Cot.Hy-10 are advised for extended sprays against pink bollworm when pheromone trap catches cross the threshold of 8 male moths/trap for three consecutive nights which aids in reducing its incidence and damage. (2010)

26.) For effective management of mealybug (Phenacoccus solenopsis) in cotton, farmers of South Gujarat are advised to use imidacloprid 70 WG 0.00375% (0.53 g/10 l) or acetamiprid 20 SP 0.004% (2 g/10 l) or acetamiprid 20 SP 0.004% (2 g/10 l) + chlorpyriphos 20 EC 0.05% (25 ml/10 l) at 15 days intervals starting from initiation of the pest for higher yield and better returns. (2010)

27.) The farmers of South Gujarat Agro-climatic Zone growing cotton are advised to give seed treatment with *Pseudomonas fluorescens* (Pf-1) @ 10 g/kg seeds + three sprays of *P. fluorescens* 0.2% (20 g/10 l) at 30 days intervals starting from 30 days after sowing for effective and economical management of angular leaf spot disease. (2010)

28.) Farmers of south Gujarat agro climatic zone- II (AES 2) growing Bt cotton are advised to apply recommended dose of fertilizer based on soil test value + FYM 10 t/ha + one spray of 2% urea at flowering stage and one spray of 1% urea + 1% MgSO4 during boll development stage for minimizing leaf reddening and obtaining higher seed cotton yield and net return. (2013)
E. HORTICULTURAL CROPS

E.1 Fruit crops

1. Mango

1.1 Crop Production

1.) The farmers of south Gujarat heavy rainfall zone-I, AES-II, growing mango cv. Kesar willing to go for high density plantation through hedge row system are advised for 10 m x 5 m plantation for realizing the highest fruit yield as well as highest net profit per unit area. (2004)

2.) The farmers of AES-II of south Gujarat heavy rainfall zone are advised to adopt pitcher method of irrigation in newly planted mango orchard. They are recommended to place either 1 pitcher of 10 L capacity or 2 pitchers of 7 L capacity below ground surface adjacent to plant till first four years of age. One pitcher of 10 L capacity or two pitcher of 7 L capacity when filled weekly would result in 50% and 30% water saving, respectively as compared to ring method of irrigation. (2007)

3.) The farmers of Gujarat desiring to establish new orchard of mango cv. Kesar are advised to adopt softwood graft in situ for higher yield and net return. (2008)

4.) The farmers of south Gujarat heavy rainfall zone (AES-III) raising mango seedlings are advised to follow mulching with paddy straw @ 10 t/ha or interculturing at 30, 60 and 90 days after sowing to keep mango seedling nursery weed free thereby fetching higher returns and healthy seedlings. (2009)

5.) The farmers of south Gujarat heavy rainfall zone-I, AES-III desiring to establish new orchard of mango cv. Alphonso are advised to plant a filler tree of cv. Neelphonso in the centre of regularly planted four Alphonso trees at 10 m x 10 m spacing upto 12 years of age for getting higher net realization and BCR. (2009)
6.) The farmers of south Gujarat heavy rainfall zone-I, AES-III are advised to drench Paclobutrazol at 5 g a.i./tree (Cultar 20 ml/tree) in mid of July in more than 35 years old mango Cvs. Alphonso, Kesar and Rajapuri to obtain early flowering, higher net realization and BCR. (2009)

7.) The farmers of south Gujarat heavy rainfall zone-I, AES-II are advised to include regular bearer mango hybrids Amrapali and Mallika in their new orchards to get higher net return after Kesar and Alphonso. (2009)

8.) The farmers of south Gujarat heavy rainfall zone-I, AES-II are advised to include regular bearer mango hybrids Sonpari and Neelphonso in their new mango orchards to get higher net return after Kesar and Alphonso. (2009)
9.) The farmers of Gujarat growing mango Cv. Kesar planted at normal distance i.e. 10 x 10 m are advised to carry out pruning from sixth year of planting to overcrowded branchlets and centre opening immediately after fruit harvest every fourth year for getting higher production and economic return without affecting fruit quality. (2011)

10.) The farmers of Gujarat growing mango Cv. Kesar under high density plantation (5 x 5 m) are advised to carry out pruning from sixth year of planting by heading back of 10 to 20 cm terminal shoot immediately after fruit harvest at alternate year for getting higher production and economic return without affecting fruit quality. (2011)

11.) Farmers having mango orchard in south Gujarat heavy rainfall zone (AES-III) are advised to apply four sprays of banana pseudostem sap and vermiwash in 1:1 ratio with 5% concentration during its flowering period. First spray at the time of flower initiation, second at 25% flower opening (15 days after 1st spray), third at 50% flower opening (25 days after 1st spray) and last at 100% flower opening (35 days after 1st spray) for getting higher fruit retention, fruit yield and net income. (2012)

12.) The farmers of Gujarat growing mango Cv. Alphonso are advised to apply either 4 g paclobutrazol/tree every year or 4 and 2 g paclobutrazol/tree in alternate years during first fortnight of August along with 1.5 times recommended dose of fertilizer (i.e. 150 kg FYM/tree and 1125:240:1125 g NPK/tree) to adult trees for receiving higher production and better fruit quality along with a week early harvesting. (2012)

13.) The farmers of Gujarat growing mango cv. Kesar are advised to apply mulching covering 1.5m from tree trunk with 100 micron black polyethylene plastic during October-November for obtaining good quality of fruits and longer storage life with higher yield and economic return. (2012)

14.) The farmers of south Gujarat growing mango cv. Kesar are advised to spray 12 g boric acid with 36 g calcium nitrate per 10 lit water at 50% flowering stage for obtaining higher fruit set, yield and economic return. (2012)
15.) Mango pulp processing was profitable and provided a rate of return on investment of 0.10, 0.13 and 0.14 at small, medium and large scale of production respectively and therefore all the mango pulp processors and start up entrepreneurs in south Gujarat are advised to tap the market potential by processing Kesar and Alphonso varieties, setting up proper marketing network, maintaining taste and quality, using improved packaging and hygiene standards, understanding requirements of different markets and ensuring regular and cost effective supply of raw materials for processing. (2012)

16.) Farmers and merchants are advised to pre-cool the Kesar mango fruit at 10°C in pre-cooling chamber with air movement of 300-350 m³/min for 8 hr. and pack them in 75 micron polypropylene bag and store at 11±1°C with 90-95% RH. This would delay the initiation of ripening process up to 25 days of storage and extend the shelf life up to 35 days. (2013)

17.) Farmers are recommended to prepare ready-to-eat pickle (Moriya) from the immature dropped mango (Marva) through the process of washing, cutting and subsequently dipping in hot water (50°C) for 5 min, 2% brine solution for 5 min and 5% acetic acid (vinegar) for 5 min, and finally mixing with the groundnut oil (2.5%)-spices-mix and packing of in 75 micron HDPE bag to achieve shelf life of 6 days and 15 days at ambient and refrigerated storage condition, respectively. (2013)

18.) The farmers of south Gujarat heavy rainfall zone intend to adopt organic farming in mango cv. Kesar (20 years old tree) are advised to apply 100 % RDN through 17 kg Neem cake (4.5 % nitrogen) with 100 kg FYM + Azotobacter (Navsari isolate) @ 250 g + PSB (Navsari isolate) @ 250 g/plant in the month of June. By adopting this organic farming, farmers can get higher yield and better quality fruits in terms of TSS, acidity and shelf life and higher net realization as compared to inorganic farming. It also improves the soil properties. (2014)

19.) The farmers of Gujarat growing mango cv. Alphonso and have an overcrowded orchard are advised to thinning up to the crowded branches and centre opening for obtaining higher number of fruits and yield with higher economic returns. (2014)

20.) The farmers of Gujarat growing mango cv. Kesar are advised to spray 1% KH₂PO₄ (Potassium dihydrogen orthophosphate) alone or with 1% KNO₃ (Potassium nitrate) during last week of October to first week of November (45 days after new vegetative flush) for obtaining higher yield and economic returns. (2014)

21.) Farmers and merchants are advised to pre-cool the Alphonso mango fruit at 10°C in pre-cooling room with air movement of 300-350 m³/min for 8 h to achieve the fruit core temperature of 10±1 °C, and pack them in 75 micron polypropylene bag to store at 11±1 °C
with 90-95% RH. This could delay the initiation of ripening process up to 15 days of storage and extend the shelf life up to 30 days. (2014)

1.2 Plant Protection

For the control of important insect pest of mango viz., hopper, thrips, leaf gall midge and blossom midge, the mango orchardists of South Gujarat are advised to apply thiamethoxam 25 WG (0.0084 % i.e. 3.4 g in10 liters of water) (CBR 1:36.63) or imidacloprid 17.8 SL (0.005 % i.e. 2.8 ml in 10 liters of water) (CBR 1:30.96) commencing from bud burst stage followed by subsequent sprays on need basis. (2005)

Farmers of South Gujarat are advised to monitor fruit fly in mango orchard during April to July in general and second fortnight of June to second fortnight of July in particular. Prevalence of low sunshine coupled with high humidity, higher rainfall with more rainy days and higher wind velocity during the fruiting and late harvest period of the crop (third week of June to fourth week of July) may result in high population of fruit fly, therefore, the farmers of South Gujarat are suggested to adopt recommended measures (installation of methyl eugenol impregnated wood block traps @ 10/ha and collection and disposal of fallen fruits). (2008)
24.) Mango growers of south Gujarat are forewarned that powdery mildew infection in cv. Kesar occurs during third week of November to second week of December i.e. elongation of inflorescence still protected by bracts stage. Therefore, they are advised to adopt recommended plant protection measures at aforesaid time to avoid losses due to powdery mildew. (2013)

26.) For the control of hopper in mango, need base application of imidacloprid 17.8 SL at 15 days interval @ 3 ml/10 litre water /tree (0.53 g a.i./tree) up to marble stage do not pose residue problem. Considering the MRL of imidacloprid (0.2 μg/g) for mango, PHI of one day is recommended for the harvest of mango under south Gujarat conditions. (2014)

2. Banana

2.1 Crop Production

1.) The farmers of south Gujarat heavy rainfall zone, growing banana cv. Basrai in clay loam soils under high density plantation with paired row planting method, are recommended to apply 150 g nitrogen and potassium each in form of urea and muriate of potash, respectively through drip in six equal splits at 15 days interval after three months of planting. It gives higher yield of banana fruits (106.01 t/ha) with CBR, 1:2.55. The phosphorus @ 90 g/plant should be applied in pit at the time of planting. (2004)

2.) Farmers of south Gujarat heavy rainfall agro-climatic zone-I (AES-III) are advised to use tissue culture plant for planting banana cv. Grand Nain. Further, they are also advised to apply 300 g nitrogen/plant in four equal splits at 2, 3, 4 and 5 months after planting. The basal dose of FYM 10 kg/plant at the time of planting, 90 g phosphorus/plant at 3 months after planting and 200 g potash/plant in three equal splits at 3, 4 and 5 months after planting should also be applied. (2006)
3.) Farmers of south Gujarat heavy rainfall agro-climatic zone I (AES-III) growing banana cv. Grand Nain are advised to apply 10 kg FYM, 250 g nitrogen, 45 g phosphorus and 200 g potash per plant along with 6 kg PSM/ha and 6 kg Azotobacter/ha for getting maximum net return with higher benefit cost ratio. FYM should be applied as basal before planting. The bio-fertilizers should be applied in two equal splits at 1st and 2nd month after planting, full dose of phosphorus at 3rd month while nitrogen and potash should be applied in three equal splits at 3rd, 4th and 5th month after planting. (2006)

4.) The farmers of south Gujarat heavy rainfall zone are advised to grow Grand Nain variety of banana for getting early maturity with quality fruits and maximum net income with higher cost benefit ratio. (2007)

5.) The farmers of south Gujarat heavy rainfall zone-I Agricultural Situation III growing banana cv. Grand Nain are advised to apply 300 g N, 90 g P and 200 g K per plant for obtaining maximum net return with higher benefit cost ratio. Farm yard manure 10 kg per plant should be applied as basal. Nitrogen should be applied in four equal splits at 2, 3, 4 and 5 months after planting; full dose of phosphorus should be applied at three months after planting and potash should be applied in three equal splits at 3, 4 and 5 months after planting. (2007)

6.) The farmers of south Gujarat heavy rainfall zone growing banana are advised to use tissue culture plants as planting material for getting higher yield, net return and cost benefit ratio (CBR 1:2.20). (2007)

7.) The farmers of south Gujarat heavy rainfall zone-I, AES-III growing banana Cv. Grand Nain under clay loam soils are recommended to apply 50 g Azospirillum per plant at two months of planting along with 100% recommended dose of fertilizers (10 kg FYM + 200 g nitrogen + 90 g phosphorus + 200 g potash) to get 16.86% higher yield over control. (2009)

8.) The farmers of south Gujarat heavy rainfall zone-I, AES-III growing banana Cv. Grand Nain at 1.8 m x 1.8 m spacing under clay loam soil are recommended to grow cabbage Cv. Golden Acre planted at 45 cm x 30 cm as an intercrop, at early growth stage of banana planted in late kharif, to get higher income. (2009)
9.) The farmers of south Gujarat heavy rainfall zone-I, AES-III growing banana Cv. Grand Nain, are advised to spray GA₃ (100 mg/litre) on banana bunch after complete opening and covering the bunch with blue polyethylene sleeve (50 micron) for better quality, higher production and net return. (2009)

10.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing banana cv. Grand Nain under medium black and clay loam soils are recommended to harvest banana (i) at 75% maturity stage (75 days after shooting) and store the same in cold storage at 12°C for export purpose (bunch weight will be less up to 19.55% at 75% maturity as compared to 100% maturity), (ii) at 90% maturity stage (90 days after shooting) and store the same in cold storage at 14°C for distant market (bunch weight will be less up to 10.07% at 90% maturity as compared to 100% maturity), (iii) at 100% maturity stage (100 days after shooting) and store the same in cold storage at 16°C for local market. These treatments increased shelf life of banana fruits for 29.13, 25.17 and 21.00 days in i, ii and iii case, respectively without deterioration in quality. (2010)

11.) The farmers of south Gujarat growing banana are advised to apply either FYM @ 5 kg/plant or biocompost @ 3 kg/plant or pseudostem based vermicompost (prepared by using banana pseudostem scutcher and dung in 70:30 ratio) @ 3 kg/plant in addition to RDF (300:90:200 NPK g/plant) for achieving higher fruit yield and net profit. Application of these organics also maintain the soil fertility. (2010)

12.) The banana growers of Gujarat are advised to apply three liters banana pseudostem sap per plant along with 80% of RDF (240:72:160 NPK g/plant) for getting higher yield and net profit. The sap should be applied in 10 equal splits through drip irrigation system at an interval of 10 days starting from 60 days after planting. (2010)
13.) The banana (Cv. Grand Naine) growers of south Gujarat heavy rainfall zone are advised to apply stage based irrigation through drip system at an alternate day as under for getting higher yield and net profit. (2011)

<table>
<thead>
<tr>
<th>Stage</th>
<th>PEF</th>
<th>Month</th>
<th>Operating Time (Min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting to bud initiation (Except rainy days)</td>
<td>0.8</td>
<td>July - Nov.</td>
<td>140-150</td>
</tr>
<tr>
<td>Bud initiation to shooting</td>
<td>0.6</td>
<td>Dec. - April</td>
<td>140-150</td>
</tr>
<tr>
<td>Shooting to last hand opening</td>
<td>0.7</td>
<td>May</td>
<td>180-190</td>
</tr>
<tr>
<td>Last hand opening to one month before harvesting</td>
<td>0.8</td>
<td>June</td>
<td>235-245 (Except rainy days)</td>
</tr>
</tbody>
</table>

The system details are:
- Lateral spacing: 1.8 m
- Dripper spacing: 0.3 m away from either side of plant (2 drippers)
- Dripper discharge: 4 lph
- Operating pressure: 1.2 kg/cm²
- Operational frequency: Alternate day

14.) The banana (cv. Grand Naine) growers of south Gujarat heavy rainfall zone are advised to apply irrigation through drip system (0.70 PEF) at an alternate day with the application of 75 per cent recommended dose of nitrogen (225 g/plant) and 100 per cent recommended dose of each phosphorus (90 g/plant) and potash (200 g/plant) for getting higher yield and net profit. (2011)

The system details are:
- Lateral spacing: 1.8 m
- Dripper spacing: 0.3 m away from either side of plant (2 drippers)
- Dripper discharge: 4 lph
- Operating pressure: 1.2 kg/cm²
- Operational frequency: Alternate day
- Operating time:
  - Winter: 120-130 min
  - Summer: 170-180 min
15.) The farmers of south Gujarat adopting drip irrigation in banana planted during September-October are recommended to take onion as intercrop for realizing higher net income. Four rows of onion (i.e. 40 cm) should be planted on both sides of banana row by leaving about 20 cm space on all the sides of stem + 8 rows (80 cm) in between two rows of banana or 8 rows (80 cm) of onion only in between two rows of banana. This intercropping system also improves the land use efficiency. They are further advised to apply respective recommended doses of fertilizer to both the crops. (2013)

16.) The banana growers of south Gujarat are recommended to follow integrated nutrient management system (PFDC package) for realizing more net profit than organic or inorganic alone nutrient management system. Further, adoption of INM or organic alone maintain the soil fertility also.

**Recommendation for banana processing industries:**

Based on the pooled results of physico-chemical quality parameters and shelf life, following variety and nutrient management are recommended for fruits and its processed products. (2013)

**Fruit:**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Suitable Variety + NMS</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shelf life</td>
<td>i. Basarai + Organic</td>
<td>14-15</td>
</tr>
<tr>
<td></td>
<td>ii. Mahalaxmi + Organic</td>
<td>Days</td>
</tr>
<tr>
<td>Overall</td>
<td>i. Basarai + Organic</td>
<td>8.7</td>
</tr>
<tr>
<td>Acceptability</td>
<td>ii. Mahalaxmi + Organic</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>iii. Grand Naine + Organic</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td>iv. Basarai + PFDC package</td>
<td>8.2</td>
</tr>
</tbody>
</table>
### Processed products:

<table>
<thead>
<tr>
<th>Products</th>
<th>Suitable Variety + NMS</th>
<th>Value (O.A.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wafer i. Grand Naine + Organic &gt; INM &gt; Inorganic</td>
<td>i. Grand Naine + Organic 7</td>
<td></td>
</tr>
</tbody>
</table>
| ii. Basarai + Organic  | >8
| Flour i. Grand Naine + Organic  |
| ii. Basarai + Organic  |
| iii. Mahalaxmi + Organic  |
| Fig i. Grand Naine + Organic 8  |
| ii. Mahalaxmi + Organic  |
| iii. Basarai + Organic  |
| Ketchup i. Grand Naine + Organic 8  |
| ii. Basarai + Organic  |
| iii. Mahalaxmi + Organic  |
| Puree i. Grand Naine + Organic 8  |
| ii. Mahalaxmi + Organic  |
| iii. Basarai + Organic  |
| Cheese i. Grand Naine + Organic 8  |
| ii. Mahalaxmi + Organic  |
| iii. Basarai + Organic  |

O.A.: Overall Acceptability

17.) The farmers of south Gujarat heavy rainfall zone growing banana cv. Grand Naine in clay loam soils and similar climatic conditions are recommended to apply 80 per cent recommended dose of 240 g N and 160 g K₂O/plant, i.e. (1) 96 g N and 40 g K₂O at 3rd month (vegetative stage), (2) 72 g N and 56 g K₂O at 5th month (flower bud initiation stage), (3) 72 g N and 40 g K₂O at 7th month (flowering stage) and (4) 0 g N and 24 g K₂O at 9th month (bunch development) after planting. FYM 10 kg/plant and total dose of P₂O₅ @ 90 g/plant should be applied at planting. It gives higher yield with 20 per cent fertilizer saving. (2013)
The banana growers of south Gujarat planting their crop during off-season (January – February) are advised to sow two rows of til as nurse crop on both the sides of banana row after 25-30 days of planting. The nurse crop should be harvested 2 months after sowing (around flowering stage) and the biomass should be applied as mulch. Further, they are also advised to follow fertilizer schedule as given below beside 5 kg FYM/plant as basal.

<table>
<thead>
<tr>
<th>Element</th>
<th>Planting</th>
<th>Days after planting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(basal)</td>
<td>30</td>
</tr>
<tr>
<td>N</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>P</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>K</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Adoption of this technology gives higher fruit yield as well as net return.
19.) The banana growers of south Gujarat are advised to apply 3 to 5 drops/sucker of 2,4-D (60 g/lit. solution) for effective sucker control. Alternatively, they can apply 4 g SSP/sucker. The use of SSP minimizes emergence of new side suckers. Further, the quantity of SSP applied for controlling suckers should be subtracted from the RD of P (approximately 64 g SSP/plant). (2014)
20.) The banana growers of south Gujarat region are recommended to apply banana pseudo stem enriched sap @ 120 ml/plant in three equal splits through cone feeding at monthly interval starting from 3 months after planting or apply whole 120 ml/plant at 6 month after planting or apply sap @ 240 ml/plant in 6 equal splits by injection at 15 days interval starting from 3 months after planting for getting higher yield and net return. (2014)

![Cane feeding of banana pseudo stem enriched sap](image)

21.) The processors are recommended to prepare banana pseudostem central core candy which is rich in iron, digestible fibre and vitamins. Further, flavoured candy can also be prepared by using any natural as well as synthetic flavour. Candy prepared from central core is delicious with acceptable sensory parameters. Since, the procedure for preparing banana pseudostem central core candy is patented by NAU, Navsari, the processors need to take licence for commercial scale production and marketing of banana central core candy. (2014)

22.) Housewives/processors are recommended to prepare traditional pickles by using 25% banana pseudo stem central core cube with other raw materials using groundnut oil + fenugreek + unripe mango & lime. This reduces the processing cost without affecting quality of pickles. (2014)

23.) The farmers of south Gujarat heavy rainfall zone AES-III are advised to use 10 ml/plant each of native azotobacter (NAUAZN-1) (cfu-10^9/ml) and native PSB (NAUPSB-1) (cfu-10^9/ml) mixed with 500 g FYM/plant two times, first at the time of planting and second at three months after the planting to improve the soil and crop health with saving of 50% chemical fertilizers (N & P) and realize higher yield of banana. (2014)

24.) The farmers and vendors are recommended to ripe the Grand Naine banana in sealed ripening chamber for 48 hours at 16°C and 90-95% RH with air movement of 150-200 m³/min as well as 100 ppm ethylene gas concentration and then putting the banana under same circulatory air for 48 hours which resulted in uniform yellow colour and ripening. (2014)

![Ripening stage of Banana in recommended procedure](image)
2.2 Plant Protection

25.) Farmers of south Gujarat (AES-III of SGHRZ) are advised to apply bioagent, *Trichoderma harzianum* @ 50 gm/plant (CBR 1:55) or *Trichoderma viride* @ 50 gm/plant + *Pseudomonas fluorescens* @ 15 gm/plant + *Paecilomyces lilacinus* @ 10 gm/plant (CBR 1:25) in the banana pit at the time of planting for effective and economical control of rhizome rot disease (*Fusarium, Erwinia* sp. and nematodes) of banana. (2007)

26.) Farmers of South Gujarat (AES-III) are advised to spray copper hydroxide (10 g/10 l) four times at 21 days interval starting after 8 months of planting for effective and economical management of Sigatoka leaf spot and Deightoniella leaf blight diseases of banana. (2010)

27.) The farmers of south Gujarat heavy rain fall zone AES-III are advised to adopt the following integrated disease management module of banana for the effective management of sigatoka leaf spot and leaf blight for higher fruit yield. (2014)

**IDM Module:**

- Selection of healthy rhizome
- Rhizome’s dip in *Trichoderma viride* (Navsari isolate) (CFU- 10⁷/g) @ 10 g/litre for 30 minutes
- Soil application of *Trichoderma viride* (Navsari isolate) (CFU- 10⁷/g) @ 50 g/plant + *Pseudomonas fluorescens* (Navsari isolate) (CFU- 10⁷/g) @ 15 ml/plant + *Paecilomyces lilacinus* (Navsari isolate) (CFU- 10⁷/g) @ 10 g/plant at the time of planting
- Spraying of *Pseudomonas fluorescens* (Navsari isolate) (CFU- 10⁴/ml) @ 5 ml/l after 8th month of planting and then spraying of propiconazole 25 EC @ 1 ml/l (0.025%; 150 g a.i./ha) after 9th and 10th month of planting with detergent powder (0.5 g/l) as sticker.

<table>
<thead>
<tr>
<th>PHI for propiconazloe is 45 days</th>
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<tbody>
<tr>
<td><strong>Year</strong></td>
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<tr>
<td><strong>Crop</strong></td>
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<tr>
<td><strong>Pest</strong></td>
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<tr>
<td><strong>Pesticide with formulation</strong></td>
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<tr>
<td><strong>Dosage /ha</strong></td>
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<td><strong>Formulation (g/ml)</strong></td>
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<tr>
<td><strong>Water requirement (liter)</strong></td>
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<tr>
<td><strong>Formulation in water (10 lit)</strong></td>
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<tr>
<td><strong>Appl. schedule</strong></td>
</tr>
<tr>
<td><strong>Waiting period/</strong></td>
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<tr>
<td><strong>PHI (Days)</strong></td>
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<tr>
<td><strong>Remark</strong></td>
</tr>
</tbody>
</table>
28.) Farmers of south Gujarat heavy rainfall zone-I growing banana cv. Grand Naine are advised to plant healthy sucker of banana followed by drenching of Streptocyclin sulphate 9% + Tetracyclin hydroxide 1% -SP @ 500 ppm (0.5 g/litre) 1 litre (0.005%; 150 g a.i./ha) solution per plant at 15 days, 2 month and 4 months after planting with green manuring of sunhemp (three times) in the interspaces till 6 months of planting for effective management of bacterial rhizome rot disease. The PHI for this combination product is 180 days. (2014)

<table>
<thead>
<tr>
<th>PHI for propiconazloe is 45 days</th>
<th></th>
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<tbody>
<tr>
<td>Year</td>
<td>Year</td>
<td>2014</td>
</tr>
<tr>
<td>Crop</td>
<td>Crop</td>
<td>Banana</td>
</tr>
<tr>
<td>Pest</td>
<td>Pest</td>
<td>Bacterial rhizome rot</td>
</tr>
<tr>
<td>Pesticide with formulation</td>
<td>Pesticide with formulation</td>
<td>Streptocyclin 9% + Tetracyclin Hydrochloride 1%-SP</td>
</tr>
<tr>
<td>Dosage /ha</td>
<td>Dosage /ha</td>
<td>a.i. (g) 150</td>
</tr>
<tr>
<td></td>
<td>Formulation /g/ml</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Water requirement /liter</td>
<td>3000</td>
</tr>
<tr>
<td>Formulation in water (10 lit)</td>
<td>Formulation in water (10 lit)</td>
<td>5 g</td>
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<tr>
<td>Appl. schedule</td>
<td>Appl. schedule</td>
<td>Drenching at 15 days, 2 month, 4 month after planting</td>
</tr>
<tr>
<td>Waiting period</td>
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<td>PHI (Dias)</td>
<td>PHI (Dias)</td>
<td>35</td>
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<tr>
<td>Remark</td>
<td>Remark</td>
<td>-</td>
</tr>
</tbody>
</table>

3. Sapota

3.1 Crop Production

1.) The farmers of AES-II of south Gujarat heavy rainfall zone growing sapota Cv. Kalipatti under low land areas are advised to irrigate their more than 10 years old plantation at 50 days interval during winter and 30 days interval during summer season (0.3 IW/CPE ratio) for getting higher production. They are further advised to mulch 20% of canopy area around the trunk of the tree with grass or plastic. (2011)

2.) The farmers of AES-II of south Gujarat heavy rainfall zone growing sapota Cv. Kalipatti (more than 10 years old trees) may irrigate their crop by surface method of irrigation at an interval of 16 days during winter and 10 days during summer season (0.90 IW/CPE). While, farmers from water scarcity areas may adopt drip method of irrigation (0.75 PEF) to save 14% of irrigation water. The system should have 8 drippers of 8 lph capacities at 40 cm spacing on the lateral laid around the tree at 2 m distance from trunk. The system should be operated at 1.2 kg/cm² pressure on alternate days for 4-5 and 8-10 hours during winter and summer season, respectively. (2011)
3.) The sapota growers of Gujarat are advised to dip sapota fruits in 1% calcium hydroxide for 5 minutes and wet rubbed after drying for improving the appearance of fruits then again dipped in 2,4-D 4 mg/l for extending the shelf-life without affecting quality of sapota fruits as compared to farmers' practice i.e. wet or dry rubbing only. (2011)

4.) The wholesale buyers of sapota fruits (co-operatives/traders) are recommended to establish a cold chain for extending shelf-life of sapota fruits. Immediately after harvest, sapota fruits should be pre-cooled at 10°C for 8 hrs in pre-cooling chamber. Subsequently, pre-cooled sapota fruits should be packed in perforated polythene bag (50 micron, 1.2% vent) and kept in CFB box and then stored at 12°C temperature with 85-90% relative humidity in cold storage. These treatments extend the shelf-life of sapota fruits upto 15 days without adverse effect on quality. (2011)

5.) Farmers, entrepreneurs and stake holders of sapota fruit are advised to pre-cool the fruit at 2°C for 5 hours with air flow rate of 283-340 m³/min to bring down the fruit core temperature at 8°C and to delay initiation of fruit ripening by two days. (2012)

6.) It is recommended to the processors that, freeze drying of sapota should be carried when TSS, reducing sugar, total sugar, moisture content and firmness of sapota fruit reaches between 20-22°Brix, 11-12%, 17-18%, 86-88% (w.b.) and 4-5kgf/cm², respectively after harvest (i.e. after 5 days of harvest) with 5 mm thickness of chips followed by standard freezing at -30°C for at least 10h and freeze drying under vacuum (760 mm of Hg) at 70°C temperature for getting better quality product and increased the B/C ratio by 9.5%. (2012)

7.) The farmers of south Gujarat heavy rainfall zone having sapota cv. Kalipatti orchard in clay loam soils are recommended to apply 100 percent recommended dose of fertilizers (1000-500-500 g NPK/tree/year) to adult trees in three ratio of NPK i.e. 25:100:25 (250-500-125 g NPK), 50:00:50 (500-00-250 g NPK) and 25:00:25 (250-00-125 g NPK) percent during June, August and October, respectively instead of two equal split i.e. June and October. (2013)
8.) The farmers of South Gujarat, growing sapota cv. Kalipatti are advised to spray 1 g Gibbrellic Acid (GA₃) in 10 litre of water in first week of November, December and January for getting higher production of better sized quality fruits in winter season with higher economic returns. (2014)

4. Papaya

4.1 Crop production

1.) The farmers of South Gujarat growing papaya are recommended to adopt following package of practices for higher fruit yield and net profit besides 40% saving in water.

2.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing papaya var. Madhu Bindu are advised to adopt fertigation and apply 80% recommended dose of N and K₂O (160 g N and 200 g K₂O/per plant) in 12 equal splits starting from 45 days after transplanting and subsequently at 15 days interval through drip irrigation along with 10 kg FYM/pit as basal and 100 g P₂O₅/per plant each at 1.5 and 3 months after transplanting as soil application. By adopting drip method of irrigation and fertigation, farmers can get 32% increase in yield with better quality fruits and 20% saving of water and fertilizer as compared to conventional method of irrigation along with maximum benefit cost ratio of 3.50. (2011)
3.) The farmers of south Gujarat heavy rainfall agro-climatic zone who have adopted organic cultivation of papaya are advised to apply biocompost, vermicompost and castor cake in equal proportion to supply N @ 200 g/plant and banana pseudostem sap @ 8 l/plant for achieving higher and better quality of papaya fruit. The schedule of applying organics is as under. (2013)

- Apply 222 g/plant biocompost + 256 g/plant vermicompost + 76 g/plant castor cake + 1.6 g/plant each of Azatobactor (Navsari isolate) and PSB (Navsari isolate) at the time of planting.

- Apply 111 g/plant biocompost + 128 g/plant vermicompost + 38 g/plant castor cake at 2 months of planting and repeat this dose at four months after planting.

- Banana pseudostem sap is to be applied @ 8 l/plant in 8 equal splits at an interval of one month, starting from two months after planting.

4.) The farmers of south Gujarat heavy rainfall zone growing papaya cv. Taiwan Red Lady are advised to spray Calcium nitrate– 1000 + Borax– 30 + Zinc sulphate– 200 + Ferrous sulphate– 200 mg/l at 60, 90 and 120 days after transplanting along with the application of RDF. By adopting 3 foliar sprays of combined micronutrients, farmers can increase the yield with better quality of fruits along with higher net realization. (2014)

4.2 Plant Protection

5.) The farmers of south Gujarat heavy rainfall zone-I, growing papaya are advised to raise the papaya seedlings under Nylon net (40-60 mesh) and spraying of acephate 75 SP 1.5 g/litre of water at 3 days before planting as well as grow two rows of border crop of maize sown 15 days before planting. Apply 1% Neem oil @ 2 ml/litre with acephate 75 SP 1.5 g/litre of water (0.11%; 675 g a.i./ha) at 15 days interval up to 5 months for effective management of papaya ring spot virus disease.
5. **Cashew**

1.) Farmers of south Gujarat heavy rainfall zone (AES-II) are advised to spray need based application of endosulfan 0.07% at flowering stage for controlling important insect-pests of cashew viz., tea mosquito bug, thrips, apple borer and nut borer. (2011)

6. **Guava**

1.) The farmers of south Gujarat heavy rainfall zone-I, AES-III desiring to grow guava organically are advised to grow Sardar (L-49) variety. They are advised to apply FYM @ 60 kg/tree (equal to 500 g Nitrogen/tree) alongwith bio-fertilizer 100 g/tree each of Azatobacter and PSB after mrig bahar treatment for getting higher net realization. (2009)
7. **Coconut**

1.) Farmers of south Gujarat growing coconut are recommended to adopt the package consisting of application of 50 kg FYM + 5 kg neem cake + 500 g magnesium sulphate + 50 g borax + 500:320:1200 g NPK in two splits/palm/year + crown spraying with azadirachtin 1500 ppm @ 30 ml/10 l of water thrice in a year to harvest the higher number of healthy nuts and low incidence of eriophyide mite. (2010)

8. **Water melon**

1.) The farmers of south Gujarat growing watermelon on raised bed during summer season are advised to follow paired row planting (1 m x 0.8 m: 3.2 m) with drip irrigation and mulching using black plastic (thickness: 50 μ and 38% area coverage) for getting higher fruit yield and net return besides 29 per cent water saving over conventional method of irrigation. Full dose of P and 10% each of N and K should be applied as basal and the remaining N and K should be applied through drip system in 8 equal splits at an interval of 8 days starting from 3-4 leaves stage. (2014)

<table>
<thead>
<tr>
<th>System details are:</th>
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<tbody>
<tr>
<td><strong>System details:</strong></td>
</tr>
<tr>
<td>1 Lateral spacing</td>
</tr>
<tr>
<td>2 Dripper spacing</td>
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<tr>
<td>3 Dripper discharge</td>
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<tr>
<td>4 Operating pressure</td>
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<td>5 Operating frequency</td>
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<tr>
<td>6 Operating time</td>
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</table>

9. **Oil palm**

1.) The farmers of south Gujarat heavy rainfall zone growing oil palm (9 m x 9 m) are advised to take banana (1.5 m x 1.5 m) as intercrop to obtain higher profit. The second option can be turmeric (30 cm x 15 cm). Intercrops should be fertilized with recommended dose of respective crop. Intercropping can be followed for first three years in new oil palm plantation which helps to improve vegetative growth of oil palm. (2004)
### System details

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Year-I</th>
<th>Year-II</th>
<th>Year-III onward</th>
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<tr>
<td>Lateral spacing (m)</td>
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<td>Two laterals per row</td>
<td>Two laterals per row</td>
</tr>
<tr>
<td>Lateral diameter (mm)</td>
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<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Dripper discharge rate (lph)</td>
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<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Number of dripper/tree</td>
<td>2</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Operating pressure (kg/cm²)</td>
<td>1.20</td>
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<td>1.20</td>
</tr>
<tr>
<td>Operation frequency</td>
<td>Alternate day</td>
<td>Alternate day</td>
<td>Alternate day</td>
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### Operation schedule (hrs)

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<tbody>
<tr>
<td></td>
<td>3.0 to 3.5</td>
<td>5.0 to 5.5</td>
<td>5.5 to 6.0</td>
<td>3.0 to 3.4</td>
<td>4.3 to 4.6</td>
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<tr>
<td></td>
<td>1.5 to 2.0</td>
<td>2.5 to 3.15</td>
<td>2.5 to 3.5</td>
<td>1.5 to 2.0</td>
<td>2.2 to 2.5</td>
</tr>
<tr>
<td></td>
<td>3.0 to 3.75</td>
<td>5.0 to 5.30</td>
<td>5.15 to 6.0</td>
<td>2.5 to 3.0</td>
<td>1.75 to 2.25</td>
</tr>
</tbody>
</table>

2.) The farmers of AES-III of south Gujarat heavy rainfall zone intended to grow oil palm are advised to adopt triangular method of planting (9 x 9 x 9 m) and drip method of irrigation. The drip system should be placed at 0.5 m away from trunk for first two years and third year onward 1.5 m away from the trunk. The system details and operation schedule are given below.

3.) The farmers of AES-III of south Gujarat heavy rainfall zone having well established oil palm orchard are advised to irrigate their palm through drip method and fertigate N and K₂O each @ 2400 g/tree/year in four equal splits using Urea and White MoP as sources, respectively. The fertigation of N and K₂O should be done during May, June, October and November months. While P₂O₅ (600 g/tree) should be applied in soil in two equal splits i.e. before and after monsoon for getting higher fresh fruit bunch (FFB) yield and net profit.
E.2 VEGETABLE CROPS

1. Brinjal

1.) The farmers of hilly areas of south Gujarat having kitchen garden are advised to irrigate brinjal crop through low cost drip system in about 25 to 35 m² area using 35 lit of water per day for realizing a net profit of about Rs. 300 to 350. The crop should be planted in paired rows (0.6 m x 0.6 m x 1.2 m) with row length of 4.8 m. Such 4 sets of pair rows can be made in the available area. The lateral should be placed in between two rows and micro tube (7.5 cm length) should be placed at 60 cm apart i.e. each micro tube (1.2 mm) cover two plants. The system should be operated on alternate day. (2004)

2.) The farmers of AES-I of south Gujarat Zone-II growing brinjal (Surati ravaiya) during rabi/summer are advised to adopt drip irrigation (0.6 PEF) and fertigate the crop with 80 kg N/ha. By doing so, farmers can get 11 % higher yield and 5 % higher net profit along with saving of 36 % water and 20 % of fertilizer N. The crop should be planted in paired row (60 cm x 60 cm x 120 cm). The lateral should be placed at a spacing of 1.8 m and dripper spacing of 0.6 m using dripper of 4 lph capacity. The system should be operated at 1.2 kg/cm² on alternate day for 1.5 hrs during December to February, 2.5 hrs during March and April and 3.0 hrs thereafter up to harvesting. (2004)

3.) The farmers of south Gujarat heavy rainfall zone growing brinjal cv. "Surti Ravaiya" during rabi season are advised to fertilize their crop with 75% recommended dose of fertilizer (75:28:28 kg N, P₂O₅, K₂O/ha) along with 20 tonnes pressmud/ha or 10 tonnes of biocompost/ha to obtain higher yield as well as to improve the soil health. (2007)

4.) The farmers of south Gujarat growing brinjal (Variety Surati Ravaiya) are recommended to adopt following package of practices for higher yield and net return.

i) Paired row planting (0.6 m x 0.6 m x 1.2 m)
ii) System details : lateral spacing 1.8 m, dripper spacing 1.0 m, dripper discharge 8 lph. Operate the system for 1.5 hrs during November to January, 2.5 hrs during February to March and 3.0 hrs during April to June on alternate day at 1.25 kg/cm² pressure.

iii) Fertigation schedule : 80-50-50 NPK kg/ha (i.e. 80% N of RD) of which 16:50:50 NPK kg/ha as basal and remaining 64 kg N/ha to be applied in 4 equal splits through fertigation at monthly interval from date of transplanting.

iv) Black plastic mulch : 25 μ (45% coverage). (2007)
5.) The farmers of AES-III of south Gujarat heavy rainfall zone growing brinjal in paired row during rabi season using saline water (up to 4 dS/m) for irrigation through drip are advised to mulch their crop either with sugarcane trash or black plastic (25 micron, 50% coverage) for getting higher fruit yield (17%) and net profit (10-11%) as compared to no mulch treatment. Irrigation with saline water should be started at 30 or 45 days after transplanting of brinjal. After brinjal, they should grow transplanted paddy during kharif for minimizing deleterious effects of saline water usage on soil salinity/sodicity parameters. However, it is advisable to apply gypsum @ 50% of gypsum requirement once in 2 to 3 years to minimize rise in ESP. (2009)

2.) Onion

The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to adopt mini sprinkler system of irrigation along with fertigation for their onion crop to get 23 per cent higher net income along with saving of 20 per cent in fertilizer and 42 per cent in water over surface method. The 50 per cent N as urea should be applied at the time of planting and remaining 50 per cent in three equal splits at 30, 45 and 60 DAT through mini sprinkler.

The mini sprinkler should be laid out at the spacing of 2.5 x 2.5 m and system should he operated at 0.6 IW/CPE with a pressure of 1.5 kg/cm² for 8 hrs for getting 50 mm depth of irrigation. (2005)

2.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-I & II) who wish to grow onion after kharif paddy are advised to fertigate their crop through mini sprinkler for getting higher yield and net profit. The N should be applied @ 100 kg/ha through urea in three equal splits at 20 days interval starting from 20 days after the transplanting of onion. They are also advised to apply common dose of FYM (@ 15 t/ha), P₂O₅ and K₂O @ 50 kg/ha as basal. The system should be laid out at a grid of 3 m x 3 m and be operated at 1.5 kg/cm² pressure so as to achieve 25 mm depth of irrigation. The interval between two irrigations should be 10-12 days during January -February, 8 days in March and 5 days in April. (2006)
3.) Farmers of south Gujarat heavy rainfall zone (AES III) growing onion after kharif paddy are recommended to plant their crop on raised bed of 1.5 m width followed by furrow of 20 cm deep and 30 cm wide, and apply gypsum @ 6 t/ha (once in a three years) along with either 100% RDF (125-50-50 NPK kg/ha) or 50% RDF (62.5-25-25 kg NPK/ha) + PM @ 6 t/ha. This gives higher yields and more net profit along with 17% saving of water as compared to conventional practices. The latter treatment i.e. 50% RDF + PM @ 6 t/ha also decreases storage losses of onion. (2007)

4.) The farmers of south Gujarat heavy rainfall zone growing onion after kharif paddy are advised to adopt drip method of irrigation to obtain higher bulb yield and net profit over conventional method of irrigation. (2010)

5.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing white onion (Cv. GWO 1) crop after kharif paddy are recommended to transplant onion on raised bed (top width 90 cm followed by 30 cm wide and 15-20 cm deep furrow) and be irrigated through drip and fertigated @ 80% RDF i.e. 100 : 40 kg NK/ha along with banana pseudostem sap @ 1500 l/ha. While full dose of P (50 kg/ha) should be applied as basal, N, K2O and sap should be applied in five equal splits at an interval of 10 days starting from 15 days after transplanting for getting higher bulb yield and net income beside saving of 30 per cent of irrigation water as compared to conventional practice. (2012)

6.) Farmers of coastal areas of south Gujarat heavy rainfall zone (AES-IV) can grow onion profitably during rabi season either organically (under drip method of irrigation) or under INM system (surface irrigation). For organic cultivation, they are advised to apply 40 kg N/ha through biocompost as basal and 40 kg N/ha through castor cake at 40 DAT. Adoption of organic nutrient management systems also improves soil properties. (2013)
### Schedule of irrigation: Drip irrigation method:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of drip system</td>
<td>On line</td>
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<tr>
<td>Lateral spacing (cm)</td>
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</tr>
<tr>
<td>Lateral diameter (mm)</td>
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</tr>
<tr>
<td>Dripper discharge rate (lph)</td>
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<tr>
<td>Dripper spacing (cm)</td>
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<tr>
<td>Operating pressure (kg/cm²)</td>
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</tr>
<tr>
<td>Operation frequency</td>
<td>Alternate day</td>
</tr>
<tr>
<td>Schedule for drip irrigation</td>
<td>December-February 50-75 minute</td>
</tr>
<tr>
<td></td>
<td>March- April 90-140 minutes</td>
</tr>
</tbody>
</table>

### Surface irrigation method:

**Irrigation interval**
- December: Total 7 to 8 irrigation
- Jan.- Feb.: 19 days (0.8 IW/CPE, Depth: 60 mm)
- March: 11-17 days
- April: 9-15 days

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7. The farmers of south Gujarat heavy rainfall zone growing onion organically are advised to apply recommended 125 kg N/ha through organic manure as well as apply liquid organic fertilizer as per scheduled given below to get higher yield and net profit.

- After transplanting, 62.5 kg N/ha should be applied through 1.2 t/ha Biocompost (1.74% nitrogen), 0.45 t/ha castor cake (4.63% nitrogen) and 1.6 t/ha vermicompost (1.32% nitrogen). Repeat the same dose one month after transplanting.

- Foliar spray of enriched banana pseudo stem sap @ 2% should be applied after transplanting at 15, 30 and 45 days. (2014)

**Note:**

- Treat the seedlings with 0.1% *Tricoderma* (Navsari isolate) solution for about 5 minutes and transplant at 15 cm x 10 cm spacing on raised bed.
- Maize should be grown as trap crop at the border.
- Sticky trap should be used @ 40/ha.
3. **Okra**

1.) Under the coastal salt affected soil conditions (AES-IV) of south Gujarat heavy rainfall zone, growing okra (Parbhani Kranti) during summer season was found economically viable. For realizing higher yield and net income, farmers are advised to irrigate their crop at 1.00 IW/CPE ratio, with 60 mm depth of irrigation and mulching with black plastic (50 micron) and fertilizing @ 125 kg N/ha. The first irrigation should be given at the time of sowing, second and third at 18 20 days interval and remaining 4 irrigations at 10-12 days interval. (2004)

2.) Farmers of south Gujarat heavy rainfall zone (AES I to IV) are advised to avoid use of dicofol 18.5 EC to control okra mite (*Tetranychus macferraneti*) as this mite species has developed resistance against it. The farmers may use other recommended acaricides to control okra mite. (2009)

3.) The farmers of south Gujarat heavy rainfall zone, AES-III, growing summer okra Cv. GO-2 are advised to sow the crop at 45 x 20 cm distance. Further, this treatments gave higher net realization and benefit cost ratio. (2011)

4. **Tomato**

1.) The farmers of south Gujarat agro-climatic zone cultivating hybrid tomato are advised to use tissue culture raised planting material during summer cultivation under Agronet (50 % shade and green colour) to get earlier and higher fruit yield along with more economic gain with higher CBR (2.63). (2005)

2.) The farmers of south Gujarat heavy rainfall zone growing tomato organically are advised to apply recommended 75 kg N/ha through organic manures as per schedule given bellow to get higher yield and net profit.
At the time of transplanting, 1.03 t/ha biocompost (1.74% N) + 0.44 t/ha castor cake (4.63% N) or 0.21 t/ha neem cake (4.5% N) + 2.32 t/ha vermicompost (1.32% N) should be applied. Repeat the same dose one month after transplanting. (2014)

Note:

- Apply common dose of *Azotobacter* (Navsari isolate) biofertilizer @ 2 kg/ha.

- Treat the seedlings with 0.1% *Tricoderma* (Navsari isolate) solution for about 5 minutes and transplant at 60 cm x 60 cm spacing.

- After transplanting apply foliar spray of vermiwash @ 0.5% and cow urine @ 1% at monthly interval.

- Maize should be grown as trap crop at the border.

5. Garlic

1.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing garlic after *kharif* paddy are advised to adopt minisprinkler method of irrigation and apply N as urea @ 80% RD (80 kg /ha) through minisprinkler in five equal splits at an interval of 10-12 days starting from 15 days after sowing. They are further recommended to apply gypsum @ 2 t/ha for improving soil physical conditions. Adoption of this technology enables farmers to save 20% irrigation water and gives higher bulb yield.(2009)

2.) The farmers of south Gujarat heavy rainfall zone (AES-III) intending to grow garlic after *kharif* paddy are advised to give 11 irrigations i.e., first irrigation just after sowing, second at 9 10 days after sowing and remaining 9 irrigations at an interval of 9-15 days. i.e. during Dec-Jan 16-14 days, Feb. 12 days and March 9 to 10 days interval. They are further advised to apply 50% RDN as urea + 50% N through bio compost for achieving higher bulb yield and net profit. (2012)
6. Turmeric

6.1 Crop Improvement

1.) Turmeric: GN Turmeric-1 (NVST-37)
Turmeric variety, GN Turmeric-1 gave 21.5% and 16.4% higher rhizome yield (33.6 t/ha) than Sughandham and Kesar, respectively. This is a fibreless variety having more number of fingers and broad dark green foliage. The variety possesses red orange colour powder having better recovery on dry weight basis (83.9%), higher curcumin (2.84%) and oleoresin (8.68%) contents. It is resistant to rhizome rot disease. This variety is recommended for cultivation in South Gujarat heavy rainfall zone. (2010)

6.2 Crop production

2.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing turmeric in clay soil are advised to apply PM based bio-compost @ 25 t/ha as soil conditioner at the time of land preparation in addition to RDF (60:60:60 NPK kg/ha) and plant three rows of turmeric on raised bed, prepared by opening 60 cm wide and 30 cm deep furrows 135 cm apart to obtain higher rhizome yield and net realization. (2010)

3.) The farmer of AES-III of south Gujarat heavy rainfall agro climatic zone I are recommended to plant three rows of turmeric (Sugandhm) (30 x 20 cm) on raised bed (90 cm width followed by 45 cm wide and 30 cm deep furrow) and irrigate the crop by drip method. They should apply 80% of recommended dose of N and K₂O i.e., 48:48 kg NK/ha. Full dose of P₂O₅ (60 kg/ha) and half dose of N and K₂O should be applied at the time of planting. The remaining 50% of N and K should be applied in nine equal splits through drip system at an interval of 15 days starting after cessation of monsoon. By adoption of this technology, farmer can realize higher net income and yield beside 32 per cent water and 20 per cent fertilizer saving as compared to conventional practices. (2012)

<table>
<thead>
<tr>
<th>System details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral spacing (cm)</td>
<td>135</td>
</tr>
<tr>
<td>Dripper spacing (cm)</td>
<td>100</td>
</tr>
<tr>
<td>Dripper discharge rate (lph)</td>
<td>8</td>
</tr>
<tr>
<td>Operating pressure (kg/cm²)</td>
<td>1.2</td>
</tr>
<tr>
<td>Operation frequency</td>
<td>Alternate day</td>
</tr>
<tr>
<td>Operating time</td>
<td></td>
</tr>
<tr>
<td>Sept.-Dec.</td>
<td>45 - 60 min</td>
</tr>
<tr>
<td>Jan.-March</td>
<td>50 - 75 min</td>
</tr>
</tbody>
</table>
4.) The farmers of south Gujarat who adopted turmeric cultivation under organic farming are recommended to apply biocompost and neem cake in equal proportion to supply 60 kg N/ha for achieving higher yield and better quality turmeric. Organics i.e. biocompost @ 830 kg/ha + neem cake @ 290 kg/ha should be applied twice, first at the time of planting and the second dose 3 months after planting.

Note:

- Apply *Azotobacter* (Navsari isolate) and PSB (Navsari isolate) each @ 2 kg/ha at the time of planting.

- Apply spray mixture of cow urine (1.5%) + butter milk (1.5%) + jaggery (0.5%) 2 month after planting.
- Drench 0.5% solution each of *Trichoderma* (Navsari isolate) and *Pseudomonas* (Navsari isolate) at 2 months after planting. (2013)

6.3 Plant protection

5.) The farmers of south Gujarat heavy rainfall zone AES-III are advised for two sprays of propiconazole 25 EC @ 1 ml/litre (0.025%; 150 g a.i./ha) or carbenazim 50 WP @ 0.5 g/litre (0.025%; 150 g a.i./ha) at initiation of disease and second at 15 days after first spray for effective management of the turmeric leaf spot. The PHI for these fungicides is 70 days. (2014)

<table>
<thead>
<tr>
<th>Year</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop</td>
<td>Turmeric</td>
</tr>
<tr>
<td>Pest</td>
<td>Colletotrichum leaf spot</td>
</tr>
<tr>
<td>Pesticide with formulation</td>
<td>Carbendazim 50 WP</td>
</tr>
<tr>
<td></td>
<td>Propiconazole 25 EC</td>
</tr>
<tr>
<td>Dosage /ha</td>
<td>a.i. (g)</td>
</tr>
<tr>
<td></td>
<td>Formulation (g/ml)</td>
</tr>
<tr>
<td></td>
<td>Water requirement (liter)</td>
</tr>
<tr>
<td>Formulation in water (10 lit)</td>
<td>5 ml</td>
</tr>
<tr>
<td>Appl. schedule</td>
<td>spray at diseases initiation &amp; after 15 days</td>
</tr>
<tr>
<td>Waiting period/ PHI (Days)</td>
<td>70</td>
</tr>
<tr>
<td>Remark</td>
<td>-</td>
</tr>
</tbody>
</table>

7. Pointed gourd (Parwal)

7.1 Crop Improvement

1.) Pointed Gourd: Gujarat Navsari Pointed Gourd-1 (GNPG-1)

Pointed Gourd variety GNPG-1 is a selection from local germplasm. It has recorded 47.13% higher fruit yield over the local variety. The variety has long, light green fruit with fair whitish strip. This variety is approved for release in south Gujarat (2014)
7.2 Crop production

2.) The farmer of AES-III of south Gujarat heavy rainfall zone growing pointed gourd (local) at a spacing of 1 x 2 m are advised to adopt drip method of irrigation (0.6 PEF) along with black plastic mulch (50 μ) with 25% area coverage for getting higher yield and net return with water saving than unmulched control. (2011)

4.) Farmers, exporters and stake holders are advised to use 25μ LDPE bags as packaging material after washing and cleaning for storage and marketing of pointed gourd at ambient condition to increase the shelf life up to 9 days and with the vacuum packaging (300 mm of Hg, 60.5% vacuum and 12.78% initial O₂ level) to increase the shelf life up to 12 days for acceptable visual quality (appearance) and minimum weight loss. (2012)

The system details are:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral spacing</td>
<td>2 m</td>
</tr>
<tr>
<td>Dripper spacing</td>
<td>1 m</td>
</tr>
<tr>
<td>Dripper discharge</td>
<td>4 lph</td>
</tr>
<tr>
<td>Operating pressure</td>
<td>1.2 kg/cm²</td>
</tr>
<tr>
<td>Operational frequency</td>
<td>Alternate day</td>
</tr>
<tr>
<td>Operating time</td>
<td>Winter : 70 - 80 min, Summer : 80 - 155 min</td>
</tr>
</tbody>
</table>

3.) The Parwal growing farmers of south Gujarat are advised to grow pointed gourd (parwal) cv. Local under INM system with basal dose of FYM (20 t/ha) and fertilize their crop with the combination of 50% recommended dose of fertilizers (60:30:20 NPK kg/ha) along with 10 tons of biocompost/ha to obtain higher fruit yield. Entire quantity of biocompost, phosphorus and potash should be applied as basal and nitrogen should be applied in two equal splits at 30th and 60th day after planting and subsequently next year after pruning. (2011)

8. Little gourd

8.1 Crop Improvement

1. Little Gourd : Gujarat Navsari Little Gourd-1 (GNLG-1)

This is the first variety of little gourd in the state. It recorded 15.6 tons/ha fruit yield with yield advantage of 32.9% over local check. It produced more number of fruits per vine in addition to its better quality. In disease and pest reaction, it is also found superior with respect to anthracnose, powdery mildew and vine borer as compared to local check. It is recommended for cultivation in South Gujarat region. (2012)
8.2 Crop production

2.) The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to adopt drip method of irrigation for their little gourd crop (spacing 2.5 x 2.5 m) for achieving about 46% higher net income and 32% saving in water over surface method.

3.) The system should be laid out at a lateral spacing of 2.5 m with two drippers (4 Lph capacity) per plant at 30 cm away on either side of the plant. System should be operated at 1.2 kg/cm² pressure for 150 to 250 minutes during March to June and 110 to 160 minutes during October to December on alternate days. (2007)

10. Capsicum

1.) The farmers of south Gujarat are advised to grow capsicum (Yellow Orbella) preferably in naturally ventilated poly house instead of fan and pad cooling system poly house and open field conditions. (2011)

9. Smooth Gourd

1.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) growing smooth gourd as rabi-summer crop are advised to adopt mulching with sugarcane trash @ 2.5 t/ha for getting more yield (23%) and net return (18%).
11. Greater yam

1.) The farmers of south Gujarat heavy rain fall zone, AES-III growing greater yam cv. Local Round are advised to plant the crop on ridge furrow of 30 cm height at 90 cm x 90 cm distance and fertilize with FYM @ 20 t/ha along with recommended dose of fertilizer @ 80 : 60 : 80 NPK kg/ha. Full dose of FYM, P₂O₅ and half dose of N and K₂O applied at plating then remaining half dose of N and K₂O fertilizer should be applied in two equal splits at 90 and 135 days after planting for getting higher tuber yield and maximum economic return. (2012)

2.) The farmers of south Gujarat intending to grow greater yam through organic farming are advised to apply 75 per cent of 80 kg recommended N/ha through vermicompost (1.21%N) @ 5 t/ha and the remaining 25% of N through castor cake (4.31%N) @ 500 kg/ha to get good quality produce and improvement in soil health. The organics should be applied in two equal splits i.e. at sowing and one month after sowing. (2012)

12. Elephant foot yam

1.) The farmers of south Gujarat intending to grow elephant foot yam (cv. Gajendra) through organic farming are advised to apply vermicompost (1.21% N) @ 5 t/ha + Azospirillum @ 5 kg/ha + Phosphobacteria @ 5 kg/ha + ash @ 5 t/ha to get good quality produce and improving soil health. The vermicompost should be applied in two equal split i.e. at sowing and one month after sowing. (2012)

2.) The farmers of south Gujarat heavy rainfall agro-climatic zone growing elephant foot yam cv. Gajendra are advised to plant elephant foot yam at the distance of 60 cm x 60 cm by using seed corm set of 250 g weight for obtaining higher BCR. By this way farmers can obtain higher yield and save the seed corm cost. (2014)

13. Cabbage

1.) Farmers of south Gujarat having soil containing organic C from 0.4 to 0.6 and 0.8 per cent and above are advised to apply N:P:K @ 150:75:75 kg/ha and 125:62.5:62.5 kg/ha, respectively, to cabbage for achieving higher yield and net profit. Adoption of this package of fertilizer application also improves physico-chemical properties of soil.

Schedule of fertilizer application:
Fifty per cent of N and 100% P and K of fertilizer should be applied as basal. The remaining 50% N should be applied in two equal splits at 25 and 50 DATP. (2013)
14. **Round melon (Indian squash)**

1.) The farmers of AES-III of South Gujarat heavy rainfall zone intended to grow round melon (Tinsa) during summer for vegetable purpose are advised to adopt drip method (0.8 PEF) of irrigation. They are also advised to apply 100 kg P₂O₅/ha as basal and N @ 100 kg/ha as well as K @ 50 kg/ha through drip in 10 equal splits at 10 days interval starting from 10 days after sowing for getting higher yield and net profit. (2011)

<table>
<thead>
<tr>
<th>The system details are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral spacing</td>
</tr>
<tr>
<td>Dripper spacing</td>
</tr>
<tr>
<td>Dripper discharge</td>
</tr>
<tr>
<td>Operating pressure</td>
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<tr>
<td>Operational frequency</td>
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<tr>
<td>Operating time</td>
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</tbody>
</table>

15. **Salicornia**

1.) The farmers of coastal areas of South Gujarat heavy rainfall zone (AES-IV) having waste land in the vicinity of sea is advised to cultivate salicornia. They are recommended to broadcast salicornia seeds on dry raised bed for getting higher yield and net profit. (2009)

2.) The farmers of coastal areas of South Gujarat heavy rainfall zone (AES-IV) having waste lands in the vicinity of sea are advised to cultivate salicornia. For getting higher yield and net profit, they are recommended to fertilize salicornia with biocompost @ 20 t/ha and inorganic fertilizer @ 250:75:50 kg NPK/ha. The 50% of N and full dose of P₂O₅ and K₂O should be applied as basal and the remaining 50% N at 110 days after sowing. (2012)

3.) The brackish water aquaculture farmers of south Gujarat heavy rainfall zone (AES- IV) adopting brackish water aquaculture are advised to grow salicornia on the waste land available around the ponds. Further, they are recommended to use aquaculture effluent water for irrigating salicornia along with application of fertilizer @ 250-75-50 N-P₂O₅-K₂O kg/ha to get higher fresh biomass yield and net return. (2014)
17. **Leafy vegetables**

Farmers of south Gujarat growing leafy vegetables under different shade net house during summer season are advised to select leafy vegetables in following preferential order for realizing higher income. (2013)

<table>
<thead>
<tr>
<th>Shade net (%)</th>
<th>Suitable crop (Summer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75</td>
<td>Fenugreek &gt; Coriander</td>
</tr>
<tr>
<td>50</td>
<td>None (fenugreek, coriander, amaranthus and spinach)</td>
</tr>
<tr>
<td>30</td>
<td>Amanthus &gt; Spinach</td>
</tr>
<tr>
<td>Open field</td>
<td>Amanthus</td>
</tr>
</tbody>
</table>

16. **Fenugreek**

Farmers of south Gujarat growing fenugreek - fenugreek in sequence under shade net house during November-December are advised to prefer the following practices for higher yield and net income.

1. They should prefer cultivation of fenugreek under open field or 30 % shade net house condition, if available.
2. They should apply recommended dose of P (@ 20 kg P₂O₅/ha) as basal to individual crop.
3. Apply two sprays (I-10 DAS and II-20 DAS) of 2% enriched sap (banana pseudostem based). (2013)

18. **Vegetable Nursery**

Vegetable nursery growers of AES-III of South Gujarat heavy rainfall zone are advised to spray 1% solution of either enriched sap or vermiwash + sap @ 1:1 to achieve about 8 to 10 days earlier transplantable seedling of brinjal and chillies. In all, 4 sprays are to be done starting from 2 leaf stage of seedling at an interval of 4 days. By adopting this spray schedule nursery grower can realize higher net income. (2011)
E.3. FLOWER AND ORNAMENTAL CROPS

1. Rose

1.) The farmers of south Gujarat heavy rainfall zone-I Agricultural Situation III who are interested in rose cultivation cv. Gladiator are advised to grow the rose plants under 50% shade net and treat the plants with 3/4th dose of nitrogen (56.25 g/pl) + 2 g Azotobacter + foliar spray of Benzila Adinine 100 mg/l for getting better quality flower and higher economic return during both, winter and summer seasons. Azotobacter should be applied just after pruning. Nitrogen should be applied in two equal splits i.e. 7 days after pruning and 1 month after 1st dose. Foliar spray of Benzila Adinine, 100 mg/l, should be given at 15 days after pruning. Common dose of P and K each at 25 g/plant and FYM 5 kg/plant should also be applied at 7 days after pruning. The shade net should be removed in monsoon every year. (2007)

2.) Green house rose growers are advised during periods of market glut to store cut roses in cold storage at 2°C using dry storage method with PP packaging (24 microns) instead of regular practice of wet storage in Al₂(SO₄)₃, 200 mg/l or water for maintaining better post storage quality and vase life. Using this technique cut roses can be stored for a period of 10 days without any deterioration in flower quality and flower opening as compared to wet storage. (2011)

3.) The farmers of south Gujarat heavy rainfall zone, AES-III growing roses under naturally ventilated poly house are advised to grow Passion and First Red varieties for higher yield with better quality and higher economic returns. (2011)
2.) The farmers cultivating tuberose are advised to grow tuberose improved variety Prajwal among single type and variety Suvasini among double type for quality cut flower production and to get 171.22% and 127.29% higher net realization, respectively over local single and double type varieties. (2011)

3. Golden rod

1.) The flower growers of Gujarat are advised to harvest Golden rod panicles at fully mature unopened stage to obtain better vase life. Further, the vase solution treatment of 0.02% 8 HQ (200 mg/litre) with 2% sucrose (20 g/litre) can be used to further improve the over all flower quality and vase life upto to 11 days. (2009)
4. Gladiolus

1.) The farmers of AES-III of south Gujarat heavy rainfall zone intending to grow gladiolus (cv. Psittacinus Hybrid) during rabi season are advised to adopt drip irrigation (0.8 PEF) method (water saving 24%) along with fertigation of N and K @ 200:100 kg/ha. Fertigation should be done in 10 equal splits at an interval of 7 days starting from 30 days after planting. Full dose of P (100 kg/ha) should be applied as basal. By adopting these practices, farmers can get higher yield and net profit as compared to conventional method of irrigation. (2011)

2.) The farmers of south Gujarat heavy rainfall zone AES-3 cultivating flower crops are advised to grow Gladiolus variety Sancerre (white) for qualitative as well as quantitative cut spike production. However, if the farmers wish to grow other coloured varieties according to market demand, varieties like Punjab Dawn (peach with red throat), Pricilla (whitish pink), Shagun (cream) Psittacinus Hybrid (Saffron with yellow throat), Gunjan (light peach), and American Beauty (pink) are also recommended for quality flower production. (2012)

5. Spider lily

1.) Farmers of AES-III of south Gujarat heavy rainfall zone growing spider lily in canal command are advised to apply 20 irrigations (IW/CPE = 1.0) each of 60 mm depth at an interval of 13-15 days during winter (November to February) and 7-10 days during summer (March to June) for realizing higher bud yield and net profit as compared to farmers’ method (standing water).

Alternatively, farmers growing lily using canal as well as ground water conjunctively are advised to adopt drip method (0.6 PEF) of irrigation for saving irrigation water upto 40% without any reduction in the bud yield. (2011)
The system details are:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>Dripper spacing</td>
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<tr>
<td>Dripper discharge</td>
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<td>Operating pressure</td>
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<td>Operational frequency</td>
<td>Alternate day</td>
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<tr>
<td>Operating time</td>
<td>Winter : 75 - 100 min</td>
</tr>
<tr>
<td></td>
<td>Summer : 100 - 150 min</td>
</tr>
</tbody>
</table>

6. Gerbera

1.) The farmers of south Gujarat heavy rainfall zone-1, AES-III, growing gerbera under naturally ventilated greenhouse are advised to grow Mademoiselle (red), Dream (pink) and Gucci (yellow) varieties for higher yield with better quality and higher economic returns. (2012)

7. Mogra

1.) The flower growing farmers of south Gujarat heavy rainfall zone, AES-III are advised to grow long budded double flowered Barmasi Mogra for higher flower production (44.53%) as compared to single type Deshi Local variety. (2011)

8. Heliconia

1.) The farmers of south Gujarat heavy rainfall zone AES-3 cultivating flower crops are advised to grow Heliconia stricta variety Iris Bannochie (red) for qualitative as well as quantitative cut spike production. In addition, if the farmers wish to cultivate varieties with different colours and forms, according to market demand, varieties like Parrot Beach (red with yellow edges), Lobster Claw-II (orange-red), Pedro Ortiz (cherry red), H. wagneria "Red" (red), Orange (crimson) and Golden Torch (yellow) are also recommended for quality flower production. Heliconia produces good quality flowers up to three years after planting under 50% shade net. (2012)
2.) Farmers are advised to harvest heliconia flowers (spike) cv. Golden Torch at three bracts open stage for quality production. Further, florists (wholesalers and retailers) are also advised to spray GA, 100mg/l or BSA 50mg/l one day after harvest (two times at alternate day) to enhance vase life by almost double (two weeks) and better quality in terms of colour and freshness. (2012)

9. **Chrysanthemum**

1.) The farmers of south Gujarat heavy rainfall zone cultivating flower crops are advised to grow chrysanthemum variety Ratlam Selection (white) which has higher market demand due to white colour and good quality. Moreover, there is market demand for red and yellow colour which can be met by growing Red Gold (red) and CS-16 (yellow) varieties which produce better quality flowers. (2013)

10. **Marigold**

1.) The farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) growing summer marigold are advised to give 8 (1+7) irrigations for obtaining higher flower yield and net profit. The first irrigation should be given on the day of planting and the second and third at an interval of 20-22 days. The remaining four irrigations should be applied at an interval of 14-16 days.
2.) They are further advised to mulch their crop with sugarcane trash @ 5 t/ha (100% coverage) for obtaining 25 and 29% higher flower yield and net profit, respectively. In absence of trash, they may use black plastic (25 μ, 100% coverage) for achieving 27 and 14% more flower yield and net profit, respectively. (2006)

11. Furcraea

1.) Furcraea is a ornamental plant widely grown, even in harsh condition. The foliages are green. A variant has been developed using callus culture. The new variant has white margin variegated leaves having greater height, circumference, number of foliages and overall aesthetic value.

The recommendation is as under.

"A new variant with white margin is developed from green Furcraea foliage ornamental plant". (2005)
7. **VETERINARY SCIENCE AND ANIMAL PRODUCTION**

1.) Grazing should be avoided for horses as internal parasitic load was found more in grazing horses than stall fed. (2011)

2.) Rearing crossbred cows is economically beneficial over buffaloes for dairy farmers of south Gujarat region. (2011)

3.) Dairy farmers are recommended to follow chaffing and mixing of fodders, preserve fodders when excess availability, colostrum feeding to calves within 2 hours of birth, sanitation of shelter, mineral mixture supplementation, follow full hand milking with dry hand at Navsari and Jalalpore talukas of Navsari district. (2012)

4.) The farmers of coastal areas of south Gujarat following freshwater carp culture are advised to use pelleted mixture of 30% banana pseudostem based vermi compost + 70% compounded cattle feed (BIS type-II) as Rohu (carp) fish feed reduces 12% cost of production as compared to use of cattle feed alone as fish feed. (2012)

5.) Supplementation of garlic powder @ 0.5% in ration of broilers increases final body weight (8.5%) at 6 weeks of age resulting in more return per bird. (2013)
6. The farmers of south Gujarat are recommended to supplement 50% regular concentrate mixture with 50% bypass protein (formaldehyde treated) containing concentrate mixture in the ration of growing Surti buffalo heifers (15-17 months old) for a period of 6 months for achieving better growth by 17% and 13% decrease in cost per kg body weight gain than fed cotton seed cake alone as a concentrate. (2013)

7. It is recommended to the farmers that feeding of ration containing concentrate (25%), cotton seed cake (7%), hybrid napier grass (28%) and paddy straw (40%) can be replaced during lean period by a ration containing 19% concentrate mixture, 13% cotton seed cake, 14% hybrid napier grass, 37% paddy straw and 17% sugar beet tubers without affecting milk production, composition and cost of feeding in Surti buffalo. (2014)

8. It is recommended to farming community that the primiparous Surti buffalos having docile temperament produce more milk (492.1 vs. 328.6 kg) during early lactation (100 days) than the animals having restless-nervous temperament. Therefore, farmers are advised to interact more generously with them particularly with first calver Surti buffaloes. (2014)
1. **Cropping system**

1.) The farmers of south Gujarat heavy rainfall zone (AES-III) following summer greengram-kharif rice cropping system should fertilize their summer greengram crop with 20 kg P/ha with PSB culture @ 30 g/kg seeds and succeeding kharif rice crop should be fertilized with 75% of the recommended dose (75.0 kg N + 16.4 kg P/ha) so as to obtain higher yield and economic return as well as to sustain the soil fertility in long run. (2004)

2.) The farmers of south Gujarat heavy rainfall agro-climatic Zone (AES-III) following cropping sequence of summer groundnut - kharif rice are advised to fertilize groundnut with 34 kg P₂O₅/ha from SSP and pressmud 10.0 t/ha along with 2.5 kg/ha phosphate solubilising microorganisms (PSM). The succeeding kharif rice should be fertilized with 75% RDF only i.e. 75 kg N/ha + 22.5 kg P₂O₅/ha to obtain higher yield and economic return as well as to sustain the soil fertility. (2006)

3.) The farmers of south Gujarat agro-climatic Zone-II (AES-I) are recommended to grow cotton (G.Cot.Hy-8) on raised bed of 7.5 m width followed by drilled paddy (GR-5) in 2 m wide and 20 cm deep furrow for getting higher net profit and better land utilization under rainfed situation. (2006)

4.) In south Gujarat heavy rainfall zone (AES-III), farmers are advised to follow paddy (k)-groundnut (s) sequence under the areas of assured availability of irrigation water and paddy (k) – castor (r) sequence under restricted availability of irrigation water, for realizing higher net income. (2007)

5.) The farmers of south Gujarat heavy rainfall zone are recommended to adopt following nutrient management packages for kharif paddy based cropping sequences for realizing higher yield and income. (2007)

**Option-I: For realizing higher net income**

1. **Paddy-Indian bean**
   Paddy: 120:30:00 NPK kg/ha
   Indian bean: 20:40:00 NPK kg/ha

2. **Paddy-Groundnut**
   Paddy: 120:30:00 NPK kg/ha
   Groundnut: 25:50:00 NPK kg/ha

**Option-II: For optimum yield and maintaining soil fertility**

1. **Paddy-Indian bean**
   Paddy: FYM 6.0 t/ha + Poultry manure 1.5 t/ha + 60 kg N/ha
   Indian bean: FYM 1.0 t/ha + Poultry manure 250 kg/ha + 10 kg N/ha
2. **Paddy-Groundnut**

   Paddy: FYM 6.0 t/ha + Poultry manure 1.5 t/ha + 60 kg N/ha
   Groundnut: FYM 1.25 t/ha + Castor cake 150 kg/ha + 12.5 kg N/ha or FYM 5.0 t/ha

6.) The farmers of south Gujarat heavy rainfall zone growing *rabi* crops (castor or sorghum or wheat) after *kharif* transplanted paddy are advised to sow their crop on raised bed of 1.8 m width followed by furrow of 15 cm deep and 25 cm wide. Further, they are advised to grow either castor or sorghum by applying recommended dose of fertilizer along with an application of either pressmud @ 6.0 t/ha or FYM @ 10 t/ha for realizing higher net income. Application of PM or FYM also improves soil health. (2007)

7.) The farmers of AES-III of south Gujarat heavy rainfall zone are advised to adopt the early group of Paddy (GR-3)-Fenugreek (Vegetable)-Okra (Vegetable) or Paddy (GR-3)-Onion-Cow pea (Vegetable) crop sequence for securing higher production and net return. (2008)

8.) The farmers of south Gujarat heavy rainfall zone are recommended to adopt following nutrient management package for *kharif* paddy-sugarcane (2 years) sequence for realizing higher yield and net return. (2008)

**Option-I : Based on soil test values**

   Paddy: 110-30-00 NPK kg/ha
   Sugarcane (Plant): 280-125-45 NPK kg/ha
   Sugarcane (Ratoon): 310-125-75 NPK kg/ha

**Option-II : For improving soil fertility**

   Paddy: FYM 6.0 t/ha + Poultry manure 1.5 t/ha + 60 kg N/ha
   Sugarcane (Plant): FYM 12.5 t/ha + Poultry manure 3.12 t/ha + 125 kg N/ha
   Sugarcane (Ratoon): FYM 15 t/ha + Poultry manure 3.7 t/ha + 150 kg N/ha

9.) The farmers of south Gujarat heavy rainfall zone (AES-III) growing lucerne-fodder sorghum in sequence are advised to fertilize lucerne with 50 kg P₂O₅/ha through SSP along with VAM @ 2 kg/ha. The succeeding fodder sorghum should be fertilized with 50 per cent of recommended dose (40 kg N + 20 kg P₂O₅/ha) to obtain higher fodder yields and net profit. (2010)

10.) The farmers of south Gujarat heavy rainfall agro-climatic zone adopting paddy (k)-paddy (s) are advised to follow paddy (k)-castor (r)-green manure (s) or paddy (k)-sorghum (r)-green manure (s) sequence for realizing higher net income as compared to paddy (k)-paddy (s) sequence. Further, these sequences also save 62 per cent irrigation water in comparison to summer paddy. (2012)
11.) The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to adopt the paddy - sorghum (Grain) - sorghum ratoon (Grain) sequence or paddy-sweet corn-blackgram crop sequence for securing higher production and net income. However, for maintaining soil health and securing higher production farmers are advised to adopt paddy greengram groundnut crop sequence. (2013)

12.) The farmers of coastal area of south Gujarat (AES-IV) are recommended to follow raised bed (top width: 1.8m) and sunken bed (bottom width: 3.6 m) configuration and grow brinjal on raised bed (kharif - rabi) and paddy (kharif)-wheat (rabi) in sunken bed for realizing higher yield and net return as compared to sole paddy -wheat sequence only. Alternatively, they are advised to grow either castor (kharif-rabi) and paddy (kharif) - wheat (rabi) in the same land configuration or sole brinjal during kharif-rabi seasons on flat bed. (2014)

2. Fodder and Forage crops

2.1.) Fodder Sorghum: Endorsement of CSV 21F
The fodder Sorghum culture CSV 21F (SRF 286) is a stable fodder variety identified by AICRP as national fodder sorghum variety in the year 2006. It has registered 20.9% higher green fodder and 18.9% higher dry fodder yield than the check GFS-5. It has showed very low HCN content. It has sweet and juicy stem capable of producing high biomass than GFS-5. As this is the first single cut fodder variety possessing lowest HCN content, it is recommended for sorghum growing area of Gujarat. (2012)
2.) The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to follow fodder sorghum + cowpea intercropping system in 2:1 row ratio at 30 cm row spacing to obtain higher green fodder yield and net income. The system also utilizes the land resource efficiently. (2010)

3.) The farmers of south Gujarat agro climatic zone- II (AES-II) growing kharif fodder sorghum are advised to apply 120:60:00 kg NPK/ha (50% N and whole P as basal and remaining 50% N at 30 DAS) for getting higher fodder yield and net profit. (2013)

2.3 Kanchru (Natural grass)

The farmers of AES-III of south Gujarat heavy rainfall zone are advised to cultivate the Kanchru (Apluda aristata) fodder under three cutting management system i.e. 45, 75 and 105 DAS along with the application of 120 kg N and 20 kg P₂O₅ per hectare. The nitrogen should be applied in three splits comprising 50% basal, 25% after first cut (45 DAS) and rest 25% after second cut (75 DAS). Chemical analysis of the fodder revealed that it is of maintenance type fodder and can sustain the maintenance requirement of ruminant animals. (2011)

1.) Farmers of south Gujarat heavy rainfall agro-climatic zone (AES-III) growing fodder hybrid Napier grass (Cv. Co-3) are advised to apply 900 kg N/ha along with 60 kg/ha each of P₂O₅ and K₂O every year for getting higher green fodder yield of Napier grass. They are advised to apply full dose of P and K along with 100 kg N/ha as basal dose. The remaining N is to be applied in eight equal splits after each cutting, besides the application of FYM @ 20 t/ha every year as common practice. (2008)
3. Aromatic and Medicinal crops

3.1. Palmarosa

1.) The farmers of AES-III of south Gujarat heavy rainfall zone growing palmarosa are advised to fertilize the crop with 15 t FYM, 150 kg N and 60 kg P\textsubscript{2}O\textsubscript{5}/ha/year to achieve higher oil yield and net profit. The phosphorus should be applied as basal, while N should be applied in three equal splits i.e. 50 kg N as basal and 50 kg N after each cutting. The potassium application should be made on soil test basis. (2010)

2.) The farmers of AES-III of south Gujarat heavy rainfall zone intending to grow palmarosa are advised to irrigate the crop at 0.6 IW/CPE ratio (14 irrigations). First irrigation should be given at transplanting or at cutting after monsoon, subsequent 7 irrigations at an interval of 18-20 days during winter and remaining 6 at 12-14 days interval during summer. The farmers should also apply N @ 100 kg/ha (20 kg/ha as basal, 16 kg/ha after 30 DAP, 16 kg/ha after first cut, 16 kg/ha after 30 days of first cut, 16 kg/ha after second cut and 16 kg/ha after 30 days of second cut) besides basal doses of P\textsubscript{2}O\textsubscript{5} @ 60 kg/ha, K\textsubscript{2}O @ 40 kg/ha and ZnSO\textsubscript{4} @ 10 kg/ha every year. (2008)

4. Preparation/Enrichment of organics

1.) Farmers of south Gujarat can prepare enriched FYM of different grades within 45-50 days through microbial consortium composting process using dung, waste/by products of wheat, pigeonpea and Indian bean, leaves/twigs of gliricidia, subabul and sunhemp, rock phosphate, animal urine, castor cake, FYM and soil by adopting following ratio of raw materials.
Enrichment of dung can be done in pit-cum-heap method maintaining a ratio of raw materials given as above. Make a pit-cum-heap of approximately 3 m length x 2 m width x 1 m height size. The entire pit should be sufficiently moistened with water. Then raw materials (chopped to about 2-3 cm size) are to be spread in layer form right from the bottom of the pit. Each layer of raw material should be of about 5 cm height. After spreading each layer, material should be properly moistened with water taking sufficient time to allow the material to soak water. Subsequently, active Effective Microorganism-1 (EM-1) spraying solution [EM-1 stock solution is to be prepared by mixing in 1 litre EM-1 mother solution with 2 kg jaggery and 17 litres water in 20 litres capacity plastic container. The container is to be filled completely with water so that no air is left inside and is to be kept in dark for 7 to 10 days till whitish yeast starts appearing. Spraying solution of EM-1 can be prepared by taking 170 ml stock solution with 100 g jaggery and making up to 10 litres] is to be sprayed on the material thoroughly so as to moisten the whole material properly. Then, second and other layers are to be imposed following the same procedure. Throughout the composting period, 50-55% moisture level is to be maintained. Normally 4-6 such layers can serve the purpose of making enriched material. Pit-cum-heap should be covered with gunny bags to avoid nutrients losses. Material (dark brown to black in colour) becomes ready for harvesting after 45-50 days. (2009)
2.1) Preparation of vermicompost:

Farmers of south Gujarat specially those cultivating banana are advised to utilize banana pseudostem for preparing quality vermicompost by mixing it with cattle dung in the ratio of 1:1 (w/w) = cattle dung: banana pseudostem (chopped to 2 to 3 cm size) with addition of 5% rock phosphate through process of partial decomposition of raw materials by good decomposing culture for one month and subsequently by vermicomposting through use of earthworm (*Eudrilus eugeniae*) for about 2 months to obtain superior quality vermicompost with C:N ratio of 16:1 and total N, P and K content of about 2.4%, 1.4% and 0.7%, respectively. Further, farmers are advised to make alternate layers (5 to 6 layers each with 6 to 7 cm depth) of cattle dung and banana pseudostem.

2.2) Preparation of compost:

Farmers of south Gujarat specially those cultivating banana are advised to utilize banana pseudostem for preparation of good quality compost (with about C:N ratio of 18.8:1 and total N, P, and K content of about 2.1%, 1.6% and 0.8%, respectively) by mixing it (banana pseudostem chopped to 2 to 3 cm size) with cattle dung in the ratio of 1:1 (w/w) with addition of 5% rock phosphate and completely saturating with “spraying solution of microbial consortium” consisting *Lactobacillus* sp., *Rhodopseudomonas* sp. and *Saccharomyces* sp. for quick process of microbial decomposition of raw materials for 53-55 days i.e. in about 35 days less time as compared to duration for preparation of vermicompost. Further, farmers are advised to make alternate layers (5 to 6 layers each of 6 to 7 cm depth) of cattle dung and banana pseudostem saturated with “spraying solution of microbial consortium”.

**Procedure for preparing “spraying solution of microbial consortium” from stock solution.**

It involves two steps. Firstly for multiplication of microbial population, 1 lit stock solution consisting *Lactobacillus* sp., *Rhodopseudomonas* sp. and *Saccharomyces* sp. is mixed with 2 lit molasses or 2 kg jaggery and 17 lit of water. The prepared solution is kept in an air tight clean plastic container leaving no air
inside the container. Then the container is stored in shade, away from sunlight at ambient temperature. Gas is allowed to be released by opening the cap of the container for few seconds once in 24 hours. When whitish layer of yeast starts to appear on surface of the solution after 7-10 days with a pleasant smell and pH drops below 3.5, the solution is ready. In the 2nd step, 500 ml of above prepared solution is mixed with 300 g of jaggery and 30 lit of water in a plastic bucket for preparation of about 30 lit of “spraying solution of microbial consortium”. (2013)

5. Silkworm

1.) Farmers of south Gujarat heavy rainfall zone (AES I to IV) are advised to rear silkworm race, Nistari x NB4D2 on mulberry varieties S 1635 or TR-10 or K-2 for higher production of silk. (2009)

2.) Farmers of south Gujarat heavy rainfall zone (AES I to IV) are advised to rear eri silkworm on leaves of castor hybrids, GCH-5 or GCH-4 to obtain higher eri silk. (2009)

Rearing on GCH-5  Rearing on GCH-4

3.) Farmers of south Gujarat heavy rainfall zone, AES-III are advised to use castor leaves or tapioca leaves as a suitable food material for rearing of eri silkworm. (2012)

4.) The farmers rearing eri silkworm are advised that if dichlorvos 76 EC @ 0.05 % is used for the pest management in castor crop, leaves from such crop can be used only after 10 days of spraying for safe rearing of eri silkworm. (2013)

5.) For successful rearing of mulberry silkworm race PM X CSR2, mulberry varieties S-30, S-36 and TR-10 are found more suitable and recommended to farmers of south Gujarat. (2014)
6. **Agricultural Engineering**

1.) The farmers of south Gujarat agro-climatic zone (AES-III) growing mango (Kesar) young plantation are advised to adopt Oozy pipe irrigation system at 0.9 PEF for achieving better growth. The pipes (16 mm ID) should be placed at 2 m away from trunk, around the tree, at 20 cm below ground level and operated at 0.4 kg/cm². During establishment stage of mango, i.e., 1, 2 and 3 years, apply 36, 140 and 160 litres of water on alternate day, respectively. During fruiting stage of mango (4, 5 and 6 years age), apply 156, 160 and 200 litres of water per tree on alternate day, respectively. (2009)

2.) The farmers of coastal areas of south Gujarat are recommended to construct a percolation pit near their bore well, in the available natural depression/monsoon drain. The pit of size 4.0 m x 3.0 m x 2.0 m (for a field of about 2 ha) along with 200 mm PVC strainer pipe, inserted before digging the pit up to first aquifer (about 12 m depth) for improving the ground water quality. The pipe should be about 0.6 m above ground with cap on top. (2010)

3.) The banana growers using raspador machine for extracting fiber from pseudostem are advised to use pseudostem cutter machine developed by SWMRU, NAU, Navsari for splitting pseudostem in two halves. Using this cutter machine, banana growers can realize an additional income of 30% in comparison to manual splitting of pseudostem. (2011)

4.) Farmers of the south Gujarat coastal region are recommended to harvest as much rain water as possible to maintain ground water quality below (EC=2 dS/m) as per catchment area as tabulated below. The suggested modes of harvesting in decreasing order of preference could be Pond, Check dam, Percolation pit, Percolation well, Trenches and Sub soiling, as per availability of land, catchment area, water demands, financial capacity, topography, rainfall pattern, soil type, vegetative cover and nearness to sea. (2012)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Area (ha)</th>
<th>Mode of Harvesting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt; 2</td>
<td>Pond &amp; Check Dam</td>
</tr>
<tr>
<td>2</td>
<td>2 to 1</td>
<td>Percolation pit</td>
</tr>
<tr>
<td>3</td>
<td>1 to 2</td>
<td>Percolation well</td>
</tr>
<tr>
<td>4</td>
<td>&lt; 0.5</td>
<td>Trenches &amp; Sub soiling</td>
</tr>
</tbody>
</table>
5.) Roof water harvesting to tackle the problem of drinking water scarcity in rural areas of south Gujarat

Part-A

Roof top rain water harvesting is recommended for collecting potable water. Storage capacity of tank should be approximately 1000 L/capita/yr. constructed in such a way that no light or air enters inside to prevent bacterial growth and the tank may at least 0.5 m above ground level to prevent direct entry of runoff water. Water from the tank could be pumped out by means of hand pump or electric operated self priming shallow lift pump.

Precautions to be adopted are:

- Roof tops and conveyance pipes should be thoroughly cleaned at the time of onset of monsoon. First flush of rain water should be allowed to bypass the storage tank, as well as during long gaps between two rainy events.
- Roof water may be allowed to pass through gravel – sand filter, consisting of layers (30-50 cm) of coarse sand, 25 mm gravel, 50 mm gravel to remove organic impurity.
- Calcium Carbonate powder kept in earthen pots (7 L capacity / 5000 L), tied with muslin cloth on the mouth may be submerged into the storage tank.
- Walls of tank could be white washed with lime solution.
- Anaerobic bacteria may develop with time which could be removed by boiling / adding 0.5 g tablet of chlorine in 20 L of water / storage of water in copper vessel for 8 – 10 hrs / by using commercially available UV filter.
Part-B
To disinfect drinking water against any microbial activity, water could be safely stored in a copper vessel for 12 h and 24 h to reduce total Coliform by 85% and 90 % and total bacterial count by 67 and 81 %, respectively.

6.) Farmers of Dediapada taluka are recommended to proceed for *kharif* sowing operations from 27º SMW (onset of monsoon). Farmers are also advised for in-situ moisture conservation and runoff collection in tanks during active monsoon for providing supplemental irrigation at critical stages of rain-fed crops after the withdrawal of rainfall i.e. 36th SMW (first week of September) to get maximum production.

7. Forest species

1.) The tree growers and farmers of south Gujarat heavy rainfall zone, Southern moist mixed deciduous forest-3B/C2 and AES-III are advised to grow block plantation of *Albizia procera* (Kilai, white siris) or *Terminalia arjuna* (Arjun sadad) at 4 m x 4 m spacing as long rotation (20 years) for vigorous growth, improvement of soil fertility and higher economic returns. (2011)

2.) The tree growers and farmers of south Gujarat heavy rainfall zone, Southern moist mixed deciduous forest-3B/C2 and AES-III are advised to grow *Acacia mangium* (Mangium) in block plantation at the spacing of 2.5 m x 2.5 m for vigorous growth, improvement of soil fertility and higher economic returns. (2011)

Note: Lebal claim for various crops as per CIB. Endosulfan is banned.
RECOMMENDATIONS FOR
SCIENTIFIC COMMUNITY

Cropping system

1. **Integrated nutrient management in rice-castor (rabi) cropping system**

Growing dhaincha as green manure crop prior to *kharif* paddy and application of recommended dose of fertilizer to paddy (100:30 NP kg/ha) and castor (80:40 NP kg/ha) gave higher yield of both the crops under south Gujarat heavy rainfall zone. The practice of nutrient management in paddy (*kharif*)-castor (*rabi*) sequence also sustained soil fertility. (2010)

2. **Survey for the identification of potential natural enemies of gundhi bug, Leptocorisa sp.**

The incidence of rice gundhi bug, *Leptocorisa* sp. generally occurs in 37 std. week and continues till 42 std. week in rice fields during *kharif* season. Multiple parasitism of two egg parasitoids viz. *Trissolcus* sp. (Hymenoptera: Scelionidae) and *Oenocyrto utetheisae* (Hymenoptera: Encyrtidae) occurs from last week of September and remains active till third week of October with a peak in second week of October. (2012)

3. **Physiological analysis of growth and productivity in hybrid rice under South Gujarat condition**

Rice breeders are advised to use photosynthetic parameters (stomatal resistance, photosynthesis rate and transpiration rate) at 30, 60 and 90 days after transplanting for the screening of germplasm for higher yield in rice. (2012)

4. **Evaluation of yield performance of new rice genotype under different fertility levels**

From the results and economics, it is concluded that for fine grain genotypes and NAUR-1 optimum dose of N is 100 kg N/ha which confirm the earlier recommendation for the same group of varieties. (2013)

Cereal Crops

Paddy

1. **Screening of paddy varieties against sheath mite**

Out of 8 early (GR-3, GR-4, GR-5, GR-6, GR-7, IR 21, IR-28, IR-50) and 9 mid-late to late (GR-11, Jaya, Gurjari, GR-10, Narmada, GR-101, GR-102, GR 103 and Masuri) genotypes of paddy, screened against rice sheath mite, *Steneotarsonemus spinki*. IR-50 and Masuri were found tolerant, whereas GR-6, Jaya and Gurjari were found highly susceptible. (2008)
5. Physiological parameters and productivity of rice varieties under saline water irrigation

Among the rice varieties (Dandi, NAUR 1, GNR 2 and IR 28) tested, NAUR 1 showed higher tolerance to salinity than rest of varieties and recorded higher seedling vigour, photosynthetic rate and yield upto 9 dS/m EC under saline water irrigated pot culture. (2013)

6. Study the influence of different temperature regimes on growth and yield of rice

On the basis of two seasons experiment under controlled environmental conditions, it has been realized that there is need to develop new rice varieties in context of future global warming. The significant yield reduction was recorded in all three rice varieties viz. Jaya, Gurjari and GNR 2. The yield reduction was to the tune of 18% and 36.6% when rice crop experienced rise of 1.3°C and 2.7°C, respectively, in average daily temperature above average temperature of last 10 years (Max. 32.1°C and Min. 21.6°C). (2014)

Pulses

Pigeonpea

1. Evaluation of resistant genotype/s against S.M. disease in SMD Nursery

The pigeonpea genotypes GAUT-9317 and ICPL 87119 X BP-94-03 were found Moderately Resistant against Sterility Mosaic Disease. (2012)

2. Screening of pigeonpea genotypes/varieties against pod borer and pod fly

The pigeonpea genotypes BP-06-38, BP-07-09 and BP-07-05 were found less susceptible against pod borer, whereas, BP-07-12, BP-01-110 and BP-06-33 were found less susceptible against pod fly. (2012)
3. *Helicoverpa armigera* moth catches in pigeonpea through sex pheromones

The peak activity of moths and larvae of *Helicoverpa armigera* in pigeonpea were showed during mid of November to March and end of October to December, respectively. Seasonal & yearly moth and seasonal larval activities of *H. armigera* were significantly negatively correlated with minimum temperature, morning & evening relative humidity, rainfall and rainy days, while it was significantly positive correlated with sun shine hours. *H. armigera* moths were significantly negatively correlated with maximum temperature and wind speed during crop season and year, respectively. Seasonal larval incidence and moth catches of *H. armigera* were showed significantly positive correlation. (2014)

2. Cotton: GSB-39

The extra long staple Barbadense cotton genotype GSB-39 was proposed for the recommendation. The house expressed that at present, there is no area of *Babadense cotton* in Gujarat. This genotype proved to be a good parental line and hence, it should be registered with PPV & FRA/NBPGR and may be utilized in future for hybrid development programme. (2012)

Sugarcane

1. Screening of sugarcane varieties/clones against wilt and red rot

Sugarcane varieties/clones viz., CoS 767, 94-764, 2001 N 343 and CoM 0259 were found moderately resistant to red rot and wilt diseases. (2009)

2. Studies on soil sodicity in relation to sugarcane grown under south Gujarat condition

- The critical limit of ESP for sugarcane grown on clay soils of South Gujarat is between 4.5 and 6.3. Such soils need gypsum application in conjunction with organics for achieving normal cane yield under south Gujarat condition.
RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

- Soil samples should be collected at the time of sugarcane planting at 0-60 cm depth for appraisal of salinity/sodicity hazards.
- The equation for predicting EC<sub>2</sub> at tillering stage based on EC<sub>35</sub> values at the time of planting is \( Y = 0.2138 + 1.0092X \) (\( R^2 = 0.51^* \)).
  Where, \( Y = EC_2 \), value at tillering stage, \( X = EC_35 \), value at planting. (2010)

3. Studies on soil sodicity in relation to sugarcane grown under south Gujarat condition

- Variety CoLK 8001 recorded higher cane yield than CoN 03131 under sodic soil situation.
- Increase in sodicity deteriorates soil physical properties (water stable aggregates and hydraulic conductivity) as well as quality parameters of sugarcane viz., juice purity and sucrose content in cane. (2010)

4. Large scale testing of improved package of practices for sugarcane on research farm as well as on farmers’ fields

  - Adoption of improved practices (paired row, irrigation @ 0.6 PEF, fertigation of N & K) could enhance sugarcane productivity by 16 to 20% along with saving in water as well as fertilizer to the tune of 40%.
  - Apart from increase in cane yield, improvement in quality parameters of sugarcane were also observed with improved practices over conventional practices. (2011)
  (Recommendation for Cooperatives)

5. Knowledge and adoption level of drip irrigation in sugarcane

  - Sugarcane growers are not having adequate knowledge about proper use of drip system in sugarcane. There is need to train the sugarcane growers about improved technologies related to MIS.
8. Screening of sugarcane genotypes for early shoot borer and top borer resistance

Sugarcane genotypes viz., CoSnk 05104, CoVSI 05122, 2004 N 492, CoVSI 05123 and Co 05001 were found less susceptible against early shoot borer and top borer under natural field conditions. (2013)

9. Screening of sugarcane genotypes for scale insect and mealy bug resistance

Sugarcane genotype 2004 N 492 was found less susceptible against scale insect whereas, genotypes 2004 N 492 and Co Snk 05101 were found moderately susceptible against mealy bug under natural field conditions. (2013)

10. Screening of sugarcane genotypes for wilt resistance

Sugarcane entries viz., Co 05001, Co 05008, Co 0403, CoSnk 03754, Co 0415, and Co 0416 exhibited moderately resistant reaction to wilt disease in wilt sick plot. (2013)

11. Screening of sugarcane genotypes for red rot resistance

Sugarcane entries viz., Co 05001, CoVSI 05121, CoVSI 05123, 2004 N 596 and 2004 N 663 were found to be moderately resistant to red rot in plug and nodal inoculation methods. (2013)

6. Studies on soil sodicity in relation to sugarcane productivity

The critical limit of exchangeable sodium percentage (ESP) for sugarcane crop grown on clay soils of Ukai Kakrapar Command area be considered as 6 ESP instead of 15 ESP for determining the gypsum requirement of soils. (2012)

7. Studies on seed cane economy in sugarcane cultivation

Sugarcane growers of south Gujarat heavy rainfall zone (AES-III) are advised to plant sugarcane crop with two bud sett and 100 per cent of recommended seed rate (50,000 eye bud) for getting higher cane yield and net return. (2013)
12. Screening of sugarcane varieties for smut resistance
Sugarcane genotypes Co 07008 and Co 07009 showed resistant reaction against smut disease, while Co 07012, PI 07131 and Co 07010 exhibited moderately resistant. (2014)

Oilseeds crops

Castor

1. Demonstration on rabi castor
From the results of the demonstration conducted for three years, it is concluded that by adoption of paired row planting in castor and placing laterals at 1.8 m, dripper at 0.6 m with 4 lph discharge rate was found more remunerative than the other two systems. (2011)

(Recommendation for GGRC)

Soybean

1. Integrated nutrient management in soybean (summer) under different land configurations
Growing soybean during summer season under south Gujarat condition was not found remunerative due to low yield levels. (2013)

Horticultural crops

Fruit crops:

1. Mango

1. Impact of abiotic factors on abundance of sucking pests in mango

There is need to monitor the hopper and thrips population on mango during flowering and fruit setting in general and pea cum marble stage of fruits in particular as the prevalence of high humidity (>70%) increases the population of mango hopper under south Gujarat condition. (2008)
2. Screening of mango germplasm against pests of mango

The mango hybrids viz., A.U. Rumani, Neelgoa, Arka Punit, Neleshan Gujarat and Mehmood Bahar, and cultivars viz., Calcutta Langra, Dilpasand, Dilrajan, Gandevi Selection-I & II, Khandesi Borsio and Police have been found less susceptible to hopper, thrips, leaf miner, leaf gall midge, inflorescence midge, shoot borer and fruit fly. (2009)

3. Screening of mango germplasm against powdery mildew

The mango cultivars viz., Totapuri, Totapuri Small Red, Mehmuda, Lohra and Olour were found resistant against powdery mildew disease. (2009)

4. Crop loss assessment against mango hopper

Mango hopper causes about 66.08% fruit loss which can be avoided by three sprays of recommended insecticides. (2010)

5. Effect of drip irrigation method in mango cv. Alphonso

Under south Gujarat heavy rainfall zone (AES-II), mango cultivar Alphonso needs three irrigations i.e. first at pea stage, second at marble stage and third at 20 days after second irrigation for higher production in ten years old trees. (2011)

6. Market assessment for mango pulp in south Gujarat

The mango growers should be encouraged by providing training, technical guidance and marketing information support for setting up small or micro enterprises for mango pulp processing. (2012)
7. Forewarning of powdery mildew caused by Oidium mangiferae in mango (Mangifera indica)

As the powdery mildew infection in mango cv. Kesar occurs during 47th to 50th SMW (1.33 to 18.00 PDI) therefore, scientific community are herewith informed that the following model should be used for timely forecasting of first appearance of disease in the benefit of farming community.

Where

\[ T_i = A_i + \sum_{j=1}^{1} a_{ij} Z_{ij} + \sum_{j=1}^{1} a_{ij} Z_{ij} + c T_f + e \]

\[ Z_{ij} = \sum_{w=1}^{p} r_{iw} X_w, \quad Z_{ij} = \sum_{w=1}^{p} r_{iw} X_w X_w \]

- \( T_d \) Time of first appearance of disease (week)
- \( T_i \) Week of flower bud initiation
- \( X_w \) Value of \( w \)th weather variable in \( w \)th week
- \( r_{iw} \) Correlation coefficient between \( T_d \) and \( X_w \)
- \( r_{iw} \) Correlation coefficient between \( T_d \) and product of \( X_w \) and \( X_w \)
- \( p \) Number of weather variables considered
- \( n_i/n_f \) Initial/final week for which weather data are included in the model
- \( e \) error term distributed as N (0, \( \sigma^2 \))
- \( A_i, a_{ij} \) are regression coefficients
- \( X_i \) is value of \( i \)th weather variable in \( W \)th week.

(2013)

8. Qualitative analysis of mango varieties, Kesar and Alphonso

The nutritional quality of mango varied with variety, crop management practices under south Gujarat condition. The findings are mentioned below:

- Nutritional quality of Alphonso and Kesar was more or less same but Fe, Mn, Zn, P, K, Ca, Mg, and Na contents were higher in Alphonso.
- Organically grown mango was superior in protein, total antioxidant capacity, vitamin-C, folic acid, P, K, Mg, Fe, Mn, Zn and Cu content than inorganically grown mangoes.
- Total antioxidant power, vitamin-C, folic acid, Ca and Cu content in non-irrigated mango were higher than irrigated mango. (2014)

2. Sapota

1. Population dynamics of sapota fruit mite Tuckerella kumaoensis Gupta (Acari: Tuckerellidae)

The sapota fruit mite Tuckerella kumaoensis Gupta (Acari : Tuckerellidae) remains active round the year under south Gujarat agroclimatic situation III with higher population in the 18th to 20th Standard Meteorological Week. The mite population showed a significant
positive correlation with maximum temperature and a significant negative correlation with morning and evening Relative Humidity. (2013)

2. Pruning trial in sapota cv. Kalipatti
The pruning treatments imposed on 20 years old sapota cv. Kalipatti planted at 10X5 m spacing under south Gujarat heavy rainfall zone could not show significant improvement in yield in comparison to conventional spacing (10X10 m). But pruning treatment heading back of scaffold branches 60 cm away from the point of interlocking resulted in significantly higher fruit diameter and pulp skin ratio in terms of physico-chemical properties. Significantly higher TSS recorded in treatment topping the tree height above 4th tier. The increase in fruit weight also recorded in treatment combination heading back of scaffold branches and topping. Thus pruning treatment improved physico-chemical properties of fruit. (2013)

3. Screening of sapota varieties against sapota mite Tuckrellia kumaonensis Gupta (Acari : Tuckrellia)
The sapota fruit mite, Tuckrellia kumaonensis Gupta (Acari:Tuckrellidae) remains active round the year under south Gujarat conditions. However, the sapota varieties Cricket ball, Kalipatti, Murabba, Challa Collection-3 and Paria collection showed higher population of mite than the variety Zama Khiya. (2014)

3. Banana

1. Nutrient, pseudo stem and sucker management in ratoon banana under drip irrigation
For obtaining higher fruit yield of ratoon banana, it is necessary to apply 100% of RDF along with retaining mother pseudostem as such and adopting chemical desuckering practice. (2009)

2. Pilot scale testing of improved package of practices for banana on research farm and farmers’ fields

- Adoption of improved practices (irrigation @ 0.6 PEF, fertigation 60% RD of N & K and mulching with 50 micron black plastic @ 42-67% coverage) in banana could enhance banana productivity by 13 to 21% along with saving in water as well as fertilizer. This ultimately improves the net realization of banana cultivation by about 25%. 

RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

- Banana fruit yield can be predicted well in advance using lower girth at the age of six month or by using length of bunch, number of hands per bunch and number of fingers per bunch. This will help the farmers or cooperative in planning the sound marketing strategy well in advance.

$$Y = 3.36031 - 0.02390X_1 + 0.28456 X_2 + 0.11338 X_3, \quad \ldots \ldots \ldots \ldots \quad (R^2=0.428)$$

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<tr>
<td>Y</td>
<td>Bunch yield (kg)</td>
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<tr>
<td>X</td>
<td>Bunch length (inch)</td>
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<tr>
<td>X_1</td>
<td>Number of hands per bunch</td>
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<tr>
<td>X_2</td>
<td>Number of fingers per bunch</td>
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This equation is also showing good fit, so it can be used for predicting the yield of banana 3 month prior to harvesting. (2011)
(Recommendation for Cooperatives)

3. **Desuckering of banana through use of conventional fertilizers**

Based on the results of two sets, it is concluded that for effective sucker control in banana, 2-4 D treatment was found to be the best. However, it was closely followed by SSP 4 g/sucker or SSP 5 g/sucker which implies that these treatments can be an effective alternative to 2-4 D treatment. The SSP treatments will also minimize the risk of deformation caused due to unscientific use of 2-4 D for desuckering. (2012)

4. **Varetial trial in banana**

Banana cultivar Gandevi Selection has proved higher productivity (97.20 t/ha) than Grand Naine (73.70 t/ha) under south Gujarat agro-climatic condition, however both the varieties are at par with each other on the basis of per day production i.e. 192.60 kg (Gandevi selection) and 189.87 kg (Grand Naine), which proves that inspite of longer crop period, Gandevi selection provides almost the same per day production and higher benefit in comparison to cultivar Grand Naine. Gandevi Selection is equally economically remunerative as Grand Naine on the basis of productivity per hectare per day. (2013)
3. Residue and dissipation pattern of fipronil in okra and brinjal
Application of fipronil 5 SC @ 0.05 kg a.i./ha, do not pose residue problem in okra and brinjal when harvested 5 and 7 days, respectively after spray.(2014)

4. Status of insecticide residue in farm gate samples of okra, brinjal and chilli
Farm gate samples of brinjal collected from Navsari (AES-III) found free from 41 pesticides but some of okra and chilli samples found positive with organophosphate insecticide such as monocrotophos, ethion and triazophos. (2014)

5. Monitoring of pesticide residue in market samples of okra and brinjal
Market samples of brinjal obtained from different talukas of Navsari, Surat and Tapi district were free from pesticide while that of okra samples were positive with organophosphate insecticides among them, monocrotophos was frequently detected. (2014)

Vegetable crops

1. Okra and Brinjal

1. Mechanism of resistance of okra varieties to spider mite
Mite population was low in varieties of okra having low hair density. AOL 04 02 and JOL 05 07 were found less susceptible, while Parbhani Kranti, GO 2 and JOL 05 03 were found highly susceptible. (2008)

2. Residue and dissipation pattern of indoxacarb, bifenthrin, fipronil and novaluron in okra
Foliar application of indoxacarb 15.8 EC, bifenthrin 10 EC and novaluron 10 EC @ 0.22, 0.125 and 0.5 kg a.i./ha respectively, do not pose residue problem in okra when harvested one day after spray and therefore, PHI of one day is recommended in okra. (2014)
6. Residue and dissipation pattern of indoxacarb, bifenthrin, fipronil and novaluron in brinjal

Foliar application of indoxacarb 15.8 EC, bifenthrin 10 EC and novaluron 10 EC @ 0.22, 0.125 and 0.5 kg a.i./ha respectively, do not pose residue problem in brinjal when harvested one day after spray and therefore, PHI of one day is recommended in brinjal. (2014)

Drip Irrigation System

1. Economics of drip irrigation in sugarcane and banana - a survey

- The magnitude of net profit realized by the sugarcane and banana farmers empathetically proves the economic viability of DIS under farmers’ fields situation.

- Some of the important suggestions given by the farmers based on their experiences may form basis for taking policy decisions by Government of Gujarat as well as Government of India.

- For enhancing know-how of the DIS, there is need to train the farmers. (2009)

2. Adoption of drip/sprinkler in potato - a survey

- In potato, sprinkler system is preferred over drip system in North Gujarat.

- There is need to maintain recommended plant population.

- There is need to train the farmers.

- This survey needs to be repeated after 2/3 years. (2009)

3. Impact of trainings given by SWMRU, Navsari

- There is need to train the farmers in depth about improved technologies to be adopted by them.

- In order to cover large number of farmers, there is need to do Human Resource Development, minimum at district level.

- The pattern of adoption of technology is drip > drainage > sprinkler > green house & mulching.
RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

3. Impact assessment of "Yuva Tribal Juth" training (one month duration) organized by GGRC in collaboration with PFDC

The following conclusions have emerged from the impact assessment study.

- The receptivity of knowledge and extent of adoption was good in the trainees having educational level above SSC.

- Training on micro irrigation systems (MIS) helped in securing jobs to 20% of the trainees. (2010)

4. Impact of trainers' training program on knowledge level of trainees

The following conclusions emerged from the impact analysis of trainers' training programme.

- The initial knowledge level of trainees was in the order: drip > fertigation > sprinkler > mulch > greenhouse technology.

- The increase in level of knowledge of trainees after training was in the order of greenhouse > sprinkler > mulch > drip > fertigation. (2010)

5. Indicative survey on quality of irrigation water in relation to clogging of drippers

- The risk of emitter clogging is considerably high when saline water is used through drip system having low discharge rate dripper.

- The uniformity coefficient of drip system is distorted when saline water is used in drip system with low discharge rate dripper.
- Use of saline water for irrigation through drip deteriorates the chemical properties viz., pH, EC and ESP of soil.

- There is need to train the farmers about operation and maintenances of drip system thoroughly. (2011)

Procedure for 1 ton of raw material:

1) Select a suitable place under shade of trees (or so) at slightly elevated position. Make one layer (10 m x 5 m) with 140 kg of cattle dung and above that one layer with 60 kg of Sugarcane trash.

2) Sprinkle water sufficiently to moist the material up to around 60%.

3) Make slurry with 1 kg decomposing culture of microorganisms (VSI, Pune), 8 kg urea, and 10 kg SSP and 100 kg cow dung. Add 1/5th of this slurry thoroughly on the trash layer.

4) Continue the above steps to have 5 alternate layers of cattle dung and sugarcane trash.

Others:

1. Preparation of nutrient enriched organic manure through vermicomposting

It is advised to prepare enriched vermicompost by using dung and sugarcane trash (70:30 w/w) in south Gujarat by adopting the procedure given below:
5) Seal the upper surface of heap with a thin layer of semi-solid cattle dung and then cover with gunny bag (jute). Allow to decompose the heap for about a month maintaining optimum moisture (around 60%) with two intermittent turnings.

6) Incorporate 2.5 kg earthworms (preferably Eudrilus enginae of medium size) in the moist zone of the heap making small holes at 14/15 places.

7) Continue to sprinkle water at 2 to 3 days interval to maintain moisture (around 60%). Material is ready when brownish dark colour appears after about 75 to 80 days. Stop watering at least 6 days before harvesting and harvest vermicompost gradually from the surface of the heap.(2008)

2. Green house cultivation in South Gujarat - A survey

Based on the information of survey of green house cultivation, following conclusions have emerged.

1) Green house cultivation of gerbera, rose, carnation and capsicum crops is economically viable under South Gujarat. Among the crops, floriculture crops were found more remunerative than capsicum.
2) The major problems encountered by the farmers are:

- No erection company in Gujarat
- No information available from Govt.
- No training centre in Gujarat.
- Planting material not available locally
- Pest and diseases
- High summer temperature
- High power charge
- High cost of fertilizer
- High cost of planting material. (2008)

3) Other problems

- Unavailability of quality planting material
- High cost of planting material
- Inadequate extraction unit
- Lack of marketing net work (2008)

3. Patchouli cultivation in South Gujarat - A survey

From the information generated through survey, following conclusions have emerged.

1) Patchouli cultivation is economically viable under South Gujarat conditions.
2) Problems experienced by the growers are:

- Water stagnation during monsoonic months
- Pests and disease
- Weed problem
- Absence of improved varieties (high oil content)
- Water and nutrient management
- Poor awareness about cultivation practices among the farmers

4. Impact of major abiotic factors on abundance of rose spider mite

The incidence of two spotted spider mite prevails round the year on rose under South Gujarat conditions. Lower population of mite was recorded during winter season and negligible during monsoon. Mite population increased with the increase of temperature and reached its peak during the month of May. (2010)
5. Evaluation of sap based products on growth of oil palm nursery

Based on the results of both primary and secondary nursery, it is concluded that in oilpalm nursery spray of either sap or vermiwash was not found beneficial. (2011)

6. Studies on varietal preference of mulberry to silkworm

Mulberry varieties S-30, S-36, S-1635, K-2, TR-10 and C-776 were found comparatively more suitable for rearing of mulberry silkworm race Nistari. (2011)

7. Isolation and identification of lactic acid bacteria and their various biochemical activity

Fourteen microorganisms were isolated from khira of dhokla and khaman samples and preliminary study reveals that, among them ten isolates belongs to Lactobacilli and remaining were yeast. (2013)

8. Time series analysis of weather parameters in relation to crop productivity

The monsoon onset is delayed by a week and recedes a week early. Higher evaporation of 8% and 18% were observed during summer and rabi seasons, respectively Therefore, scientists are recommended to

1) Evolve shorter duration crop varieties suitable for delayed monsoon and
2) Reassess the crop water requirements for south Gujarat region. (2012)

9. Adoption of new recommendations made by NAU, Navsari by the tribal farmers of south Gujarat

For enhancing the knowledge and adoption of technologies recommended by Navsari Agricultural University for tribal farmers of south Gujarat, the educated, young, having membership in social organization with scientific orientation should be selected on priority basis in extension activities. (2012)

10. Characterization of natural resources of Vanarasi area

Based on the characterization of natural resources of Vanarasi area, following conclusions are emerged.
RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

- Highly suitable existing crops:
  Field crops: Paddy, Pigeon pea, Sorghum, Okra and Cowpea
  Horticultural crops: Mango, Ber and Aonla
  Forest trees: Teak, Ain, Arjun, Kher, Mahuda, Katesavar and Palas

- Existing crop but not suitable: Sugarcane
- Highly suitable new crops/trees (proposed):

ANIMAL SCIENCE AND FISHERIES

1. Incidence of metallic foreign bodies in the stomach of large ruminants

Cattle and buffaloes showing symptoms viz. pyrexia, anorexia, stiffness, tympany, drop in milk production, colic, diarrhoea, difficult respiration, brisket oedema etc. and also found positive for metallic foreign bodies on ferroscopic examination should be critically re-examined for differential diagnosis of other clinical conditions prior to rumenotomy. (2011)

2. Effects of graded molasses supplementation on milk yield its composition and reproductive status in Surti buffaloes

Supplementation of paddy based ration with molasses enhanced dry matter intake and body condition scoring in Surti buffaloes at 9% molasses supplementation to basal ration. (2011)

3. Estimation of gastro intestinal parasitic load in stall fed vs. grazing horses

- Stronglylus were found to be the most common parasitic infestation in the Gastro Intestinal Tract (GIT) of horses in South Gujarat. Hence deworming should be done with the drugs effective against Strongyulus.

- GIT parasitism is significantly (p<0.01) more in grazing horses of South Gujarat than the stall fed horses.

- Horse breeders of South Gujarat region cover their mares on 5th and/or 6th day of oestrus. (Information for Scientific Community) (2011)

4. Incidence of metallic foreign bodies in the stomach of large ruminants

- Dairy farmers of South Gujarat region are to be educated about the feeding and health management practices of their animals since a few of them are adopting chaffed fodder feeding (10.4%), regular deworming (28.7%), regular vaccination (46.3%) and manger feeding (55.5%).

- To enhance and achieve better results in breed improvement programme run by various agencies, the farmers of south Gujarat region must be approached and encouraged to adopt AI programme in buffaloes. (Information for Extension workers) (2011)
5. Estimation of gastrointestinal parasitic load in stall fed vs. grazing horses

- Horse keepers of south Gujarat region are to be educated about the health management practices, since a very few of them are adopting regular vaccination (7.2%) and regular deworming (24.7%).
- In South Gujarat region, horses are mostly kept for business purpose with an average annual income of Rs. 35000/- per animal. (Information for Scientific Community) (2011)

6. Effect of deworming on growth rate of pups of various breeds

Since the follow-up of deworming appeared irregular, the pet owners should be educated by the dog breeders for role of regular deworming in health management at the time of selling pups. (Information for Pet Breeders) (2011)

7. Incidence of gastrointestinal parasitic load in bovine

(1) Oral administration of Fenbendazole (10mg/kg b.w.) and Ivermectin (200 μg/kg b.w.) combination is recommended for prophylactic deworming against flukes and nematodes in bovines of high rainfall area of south Gujarat.

(2) Oral administration of Oxytocanide (10 mg/kg b.w.) and Levamisole (7.5 mg/kg b.w.) combination is recommended for prophylactic deworming against flukes in bovines of high rainfall area of South Gujarat. (2012)

8. To study the incidence of blood protozoans in cattle and canines

Simultaneous administration of injection Oxytetracycline HCl at the dose rate of 5-10 mg/kg body weight IV for three days with single dose of an appropriate antiparasitic therapy for specific animal species is recommended for better results in cases of haemoparasite infections in bovine and canines. (Information for Scientific Community) (2012)

9. Incidence, diagnosis and surgical management of diaphragmatic hernia in bovines

In buffaloes, for trans abdominal diaphragmatic herniorrhaphy, simple continuous suture pattern using polypropylene (fish net # 3) is advisable. (2012)

10. Assessment of soil fertility of eastern hilly belt of south Gujarat

- Within eastern hilly tract of South Gujarat, considerable variations with respect to climate (semi-arid to humid), rainfall (1004 mm in Nandod to 2384 mm in Dharampur and Kaparada) and LGP (105 to 150 days lower limit and 120 to 165 day upper limit) was observed.
- The predominant soil series occurring in hilly tract are Baldha, Billimora, Bedmal and Vadhwania which are shallow in depth, excessively drained and subjected to
11. Relative toxicity of newer insecticides to egg parasitoid *Trichogramma chilonis* (Ishii)

Imidacloprid 17.8 SL 0.005%, acetamiprid 20 SP 0.004% and spinosad 45 SC 0.002% were found safer to the *Trichogramma* wasp. (2014)

12. Relative toxicity of newer insecticides to predatory green lace wing, *Chrysoperla zastrowi sillemi* (Esben-Petersen)

Imidacloprid 17.8 SL 0.005%, thiamethoxam 25 WG 0.005%, clothianidin 50 WG 0.003%, and spinosad 45 SL 0.002% were found safer to the larvae of *Chrysoperla zastrowi sillemi* under laboratory condition. (2014)

13. Evaluation of the drinking water of Navsari and surroundings

Potable water samples collected from the Navsari and its surroundings were free from 41 pesticides while other chemical properties were under the acceptable limit *Escherichia coli* (bacteria) were detected across the seasons but found higher in winter followed by monsoon and summer seasons. (2014)

14. Analysis of the microbial contaminant and adulteration in milk

The branded pasteurized milk samples procured from Navsari and its surrounding places found excellent to good while some of the raw milk samples were poor from the microbial quality point of view, across the seasons. Some of the raw milk samples were found positive with *Escherichia coli* (bacteria) out of which maximum positive samples were in winter followed by monsoon and summer. None of the pasteurized milk sample found positive with E. coli and none of the milk samples were found positive to chemical adulterant. (2014)

15. Standardization of preservative solution for different fruits as sample

The fresh fruits of different varieties of mango and citrus can be preserved with their natural colour at acceptable level up to six months in Ethanol 75% solution compared to other solutions viz. general solution (50 ml Formaldehyde 40% + 300 ml Ethyl Alcohol 95% + 2000 ml water) and Hessler’s solution. Banana fruits could not be preserved in any tested solution. (2014)
16. Rainfall analysis of Dediapada taluka of Narmada district of Gujarat

- 27th SMW receives 24 mm, 26 mm and 35 mm rainfall amount at 75%, 71% and 60% probability respectively.

- Rainfall is withdrawn after 39th, 38th and 36th SMW at 50%, 60% and 75% probability respectively.

- The length of kharif season is 112, 105 and 70 days at 50%, 60% and 75% probability respectively.

- There are 60 and 75% probability to get sufficient rainfall for rainfed crops (> 10 mm) for continuous 11 SMW (77 days) with 31 rainy days from 27th to 37th week and 10 SMW (70 days) with 21 rainy days from 27th to 36th week respectively. Supplementary irrigation is not required during this period.

- Log-Pearson type III distribution is best fitted among the Normal, Log-normal, Pearson, Log-Pearson and Gumbel distribution for maximum one-day rainfall as it gives lowest chi-square value of 22.83.

- Spillway may be designed for maximum one-day rainfall for different return periods from Log-Pearson type III distribution i.e. 5, 10, 15, 20, 25, 50 and 100 years are respectively 189, 245, 280, 307, 329, 405 and 493 mm. (2014)

17. Study on effects of non-genetic factors on milk composition in Surti buffaloes

The milk composition of surti buffalo varies with stage of lactation, parity and time of sampling. Higher fat % in milk is observed in multiparous animal, evening milk and advanced stage of lactation. (2013)

18. Studies on supplementation of herbal feed additives on growth performance and gut microbial health of broilers

Supplementation of garlic powder @0.5% alone or in combination with fenugreek seed powder @0.5% in ration of broilers for 6 weeks results in 8.5 and 7.5% more body weight, 9.5 and 7.5% less feed conversion ratio (FCR), 41.50 and 31.0% more nitrogen retention, respectively. (2013)

19. Effect of dietary supplementation of bypass protein on growth and reproductive performance in Surti buffalo heifers

Replacement of 50% regular concentrate mixture with concentrate mixture containing formaldehyde treated protein (bypass protein) in the ration of growing Surti buffalo heifers (15-17 months old) for 6 months results in 13% more average daily gain, 15% better Feed Conversion Ratio and animal shows first estrus earlier as compared to animals kept on 100% regular concentrate mixture. (2013)
20. **Standardization of rhino-pharyngeal endoscopic procedures in non-sedated farm animals.**

Naso-pharyngeal endoscopy with 1.0 cm diameter flexible endoscope under surface analgesia @ 5 ml of 2 % lignocaine HCl solution in each nostril is recommended for diagnosis of gross pathological conditions in standing cattle and buffaloes.” (2013)

21. **To study the incidence of intestinal obstruction and its surgical management in bovines.**

Entero-anastomosis through Schimeden's technique using vicryl # 3/0 is recommended to achieve maximum lumen diameter of intestinal loops in bovine. (2013)

22. **Influence of body condition score on performance and blood-biochemical profile in Surti buffalo**

It is advised to maintain body condition score of Surti buffaloes between 3.25 and 3.5 at calving as it improves milk production (465.1 vs. 330.9 Kg/100 days & peak yield 7.3 vs. 5.8 Kg), postpartum interval to estrus (32.4 vs. 46.5 days), service period (61.9 vs. 75.5 days) and estrus intensity score (3.6 vs. 2.5). (2014)

23. **To study diaphoretic pattern of Surti buffalo**

It is advised to prefer neck dorsum & lateral brisket and fore flank regions over other body regions for diaphoretic study in Surti buffalo. (2014)

24. **A. Studies on pharmacokinetics and pharmacodynamic relationship of Cepirome in cow calves**

B. **Studies on pharmacokinetics and pharmacodynamic relationship of Cepirome in goats**

It is recommended to scientific community that Cepirome is to be administrated at 10 mg/kg body weight intravenously then repeated at 8 hour interval or intramuscularly at 12 hour interval in cattle and goat. (2014)

25. **Diagnosis of udder and teat disorders using ultrasonography in bovines**

It is recommended to scientific community that the direct contact technique of ultrasonography provides better visualization of proximal and middle portion of the teat whereas use of water bath technique provides better visualization of distal portion of the teat. (2014)
26. **Epidemiological and techno-economic aspect of bovine brucellosis in south Gujarat**

It is recommended to scientific community that the overall prevalence of bovine brucellosis was 14.18% amongst various reproductive disorders in bovines in south Gujarat. Out of these reproductive disorders, the highest prevalence was in cases of abortion (39.44%) followed by retention of placenta (13.51%), metritis/endometritis (13.33%), repeat breeding (5.65%) and still birth (4.62%). The milk-ELISA proved best for screening of herd and individual animals in comparison to STAT, RBPT and MRT and is recommended for the use by veterinarians at field level. (2014)
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