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AGRICULTURAL DEVELOPMENT IN VARIOUS DISTRICTS OF MAHARASHTRA STATE

BY

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M. Sc. (Ag.)

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Date : 15/7/82 (G.M. Potekar)

CERTIFICATE I

Shri. Gopal Madhavrao Potekar has satisfactorily prosecuted his course of research for a period of not less than two years and that the dissertation entitled " AGRICULTURAL DEVELOPMENT IN VARIOUS DISTRICTS OF MAHARASHTRA STATE " submitted by him is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the dissertation or part thereof has not been previously submitted by him for a degree of any University.

Date : July ,1982.

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CERTIFICATE II

This is to certify that the dissertation entitled "AGRICULTURAL DEVELOPMENT IN VARIOUS DISTRICTS OF MAHARASHTRA STATE" submitted by Shri. Gopal Madhavrao Potekar to the Marathwada Agricultural University in partial fulfilment of the requirement for the degree of DOCTOR OF PHILOSOPHY in the subject of AGRICULTURAL ECONOMICS has been approved by the student's advisory committee after oral examination in collaboration with the external examiner.

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INTRODUCTION

INTRODUCTION

1.1 Economic Development :

Economic development is a process in which the efficiency of providing goods and services is being increased, though there is an increase in population, by increasing per capita levels of living and general well being. The process is a dynamic one, involving constant change in the structure of procedures of the economy. In relatively high income countries, where a large and complex administrative structure and high rate of capital formation are more readily available, growth tends to proceed more rapidly than in low income countries.

Economic development of nation is generally classified in to two categories, viz; (i) developed countries, and (ii) under developed countries or backward economics. The united nation's experts have defined an under-developed country as one, " in which per capita real income is low when compared with the per capita real income of U.S.A., Canada, Australia and Western Europe". The Indian planning Commission defined under development as one " which is characterized by co-existence, in greater or less degree of unutilized man power, on the one hand and of unexploited natural resources on the other". Development of agriculture is helpful in low income countries to achieve the higher levels of living and more rapid growth.

The pace of economic transformation has important implications for both the role and the strategy of agricultural development. It is a key detriminant of the size and the rate of change of agricultural labour force, which in turn influences labour and capital productivity, and agricultural income conversely. The size and growth rate of nature of the agricultural sector will determine the extent to which economic development can depend on capital formation in agriculture and capital transfers from agriculture to the other sectors. Total economic growth is the composition of different types of developments such as agricultural development, industrial development and the social development.

The most of the labour force and land resources in low income countries are being engaged in agriculture. In early stages of development, 60 to 80 per cent of the population is being engaged in agriculture, and 50 per cent or more of the gross national income is generated through the agricultural sector. Therefore, eventhough agriculture utilizes comparatively less capital, it commands a high proportion ofthe total capital resources of such nations.

1.2 Agricultural Development :

On the occession of the dominance of the agricultural sector of low income countries, the inter play between development means and development objectives are

particularly important in that sector. The initial size and backwardness of agriculture suggests wide scope for raising gross national product through initial development. The same factors also provide scope for the rural sector to combine income distribution objectives with development objective through plans, which, increases production and income across a wide spectrum of the agricultural sector.

Technological change in agriculture usually requires an added capital input, often of types which can not be directly formed within the agricultural sector it self. Agricultural development is aggregate result of the combined inputs of technological skill, labour, finance and managerial skill. The diversity of agricultural conditions and of the general economic situation is different in developing countries and within farming region of an individual country makes it impossible to formulate universally valid policies or prescription for promoting agricultural development.

Authorities are now agreed that if steady and lasting progress is to be made, agricultural programming must be conducted as an intergral part of the comprehensive, multisector approach to the planning of over all economic development. There are two sets of reasons of this, on the side of theory, it is recognized that developments in agriculture and in

other sectors are inter dependent and should be mutually supporting. In development planning, it is important to exploit as far as possible the positive linkages between the sectors and keep some kind of balance in over all growth. This is possible only if the nature of agricultural programming therefore partakes to a large extent of the nature of general economic planning.

There are three primary objectives of agricultural development, as it provides food and fibres to the growth of population, it supplies capital and foreign exchange for the economic growth and it contributes to a direct increase in rural welfare.

In agricultural development, policies (indirect inputs) are as important as the quantum and pattern of investment (direct input.).Policies for improving the institutional structure, eg. land policy, credit policy, trade policy etc. may not require much investment but may involve quite difficult political and administrative issues and take considerable time.

Inspite of its importance, agriculture in India was in a hopeless condition of stagnation and neglect. Little attention was paid by the Government to the various suggestions of the Famine commissions of 1880 1898 and 1902 and also the Irrigation Commission of 1903 towards the improvement of agriculture in the country.

India's First Five Year Plan was a brave effort at solving the country's economic problems. National income increased by 18 per cent, per capita income went up by 11 per cent, and food production from 52.2 million tonnes to 65.8 million tonnes, during the First Five Year Plan period. The national income of India increased by 20 per cent as the plan target of 25 per cent and the per capita income by 8 per cent. The slow growth per capita income was explained by an increase of 10.3 per cent of the population during the second plan period, as against 6 per cent growth in Third Plan, the annual rate of increase in national income in the first two years was estimated at only 2.5 per cent largely on account of a set-back in agricultural production. At the commencement of third plan in 1960-61, food production touched 82 million tonnes in 1962-63, and at the time of crossing the plan, food production fell to 72 million tonnes. Agricultural production as a whole was kept in line with the Fourth Plan projections in the first two years ofthe plan. After 95.1 per cent increase in 1969-70, it rose by 7.3 per cent in 1970-71, but production declined by 1.7 per cent in 1971-72. Against the Fourth Plan target of to 129 million tonnes of food grains in 1973-74, production increased from 99.5 million tonnes in 1969-70 to 108.4 million tonnes in 1971-72. High lights of the Fifth Five Year Plan were

expansion of productive employment opportunities, extended programme of social welfare, emphasis on additional agricultural production as well as agricultural education and researches, rural development and doubling of irrigation with special emphasis on drought prone areas, adequate supply of mass consumption goods and potential attention to energy policy and its exploration.

In the Fourth Five Year Plan, an attempt was made to indicate production goals, programme targets and outlays to each state. The intention was that each state would break them into block programmes and targets. It was also proposed that the agricultural planning cell should be set up to formulate block and district level plans.

1.3 Regional Approach :

The regional approach offers the best and only solution for rapid development. The real problem relates to the regional planning of rural areas. In India first pioneering attempt at regional planning was made by the 'Sarvodaya' team led by Shri Annasaheb Sahastrabudhe at Koraput in Orissa. Then followed the substantial efforts made by Prof. D.R. Gadgil at Wardha district in Maharashtra State. A systemmastise attempt has been made by the National Council of Applied Economic and Research. The criteria for adopting a

territorial approach to the national development programmes are many. When ever a country is vast, comprising heterogeneous, compact tract, region wise planning is the only sound basis for over all economic advancement. For the planned development of a country or state, where the natural resources, factors of production and per capita income are not uniform, the regional approach is almost unavoidable.

Agricultural development in India varies from one state to other, depending on many factors. In the various states of India wide disparities have been seen in the agricultural sector. The states of Punjab and Haryana had given comparatively more stress on agricultural development and they succeeded in it. In various districts of Maharashtra State also the wide disparities in agriculture are in existence. For quantifying the disparities the study entitled "Agricultural development in various districts of Maharashtra State" has been undertaken with some limitations.

Maharashtra State is one of the developing and progressive states in the country. This state is not an exception in adopting agriculture as its main occupation. There exists wide fluctuations in case of agriculture in the districts of Maharashtra State, so it becomes of utmost importance to conduct the study of agricultural

development by adopting district as a base.

1.4 Hypothesis :

1. There is agricultural development in all the districts of Maharashtra State, however there exists disparity among them.

2. Modern technology in agriculture viz; irrigation, fertilizers, high yielding varieties etc, contributed in the process of agricultural development.

1.5 Objectives :

1) to exmine the agricultural developmeht in all the district of Maharashtra State and find out the disparties in agricultural development,

2) to identify factors of progress and non-progress,

3) to study the effects of various factors in the process of agricultural development.

1.6 Scope :

The various districts will be getting number of new technologies and schemes. This will enhance change in cropping pattern and will accelerate agricultural income. This study will project the various problems on the basis of present and past performances. The results of this study, which will be considering the relationship of production process, will help the policy makers, administrators, research workers and farmers.

The major factors which will effect the agricultural development will be indetified. Farmers would be benefitted to arrange their cropping pattern for maximising income, with available resources.

SALIENT FEATURES OF MAHARASHTRA STATE

SALIENT FEATURES OF MAHARASHTRA STATE

2.1 Introduction and Location :

The state of Maharashtra came into being on May 1, 1960 as a result of the bifurcation of the composite Bombay state which had been created in 1956 by combining the old Bombay state with Saurashtra and Kutch, the Vidharbha region from old Madhya Pradesh and Marathwada from Hyderabad. The state of Maharashtra forms a major part of peninsular India with the coast on its western side. It lies between 16.4 and 22.1 degrees north latitude and 72.6 and 80.9 degrees east longitude.

2.2 Boundaries :

The boundaries of the state are, the Arabian sea in the west; Gujarat state in the north west, Madhya Pradesh in the north, Andhra Pradesh in the south. It has an area of 3,07,762 Sq.Kms.

2.3 Divisions and Districts :

Historically, Western Maharashtra, Vidharbha and Marathwada are three components of the state. Administratively the state has been divided in to seven divisions and twenty six districts. They are as follows :

2.3.1 Konkan Division :

Konkan division includes the districts of Greater Bombay, Thane, Raigad (old Kulaba) and Ratnagiri.

2.3.2 Nasik Division :

It includes the districts of Nasik, Dhule and Jalgaon.

2.3.3 Pune Division :

Ahmednagar, Pune and Solapur districts are included in Pune division.

2.3.4 Kolhapur Division :

The districts of Satara, Sangli and Kolhapur forms the Kolhapur division.

2.3.5 Aurangabad Division :

Aurangabad division has been formed by the districts of Aurangabad, Parbhani, Beed, Nanded and Osmanabad.

2.3.6 Amravati Division :

The districts of Buldhana, Akola, Amravati and Yavatmal formed Amravati division.

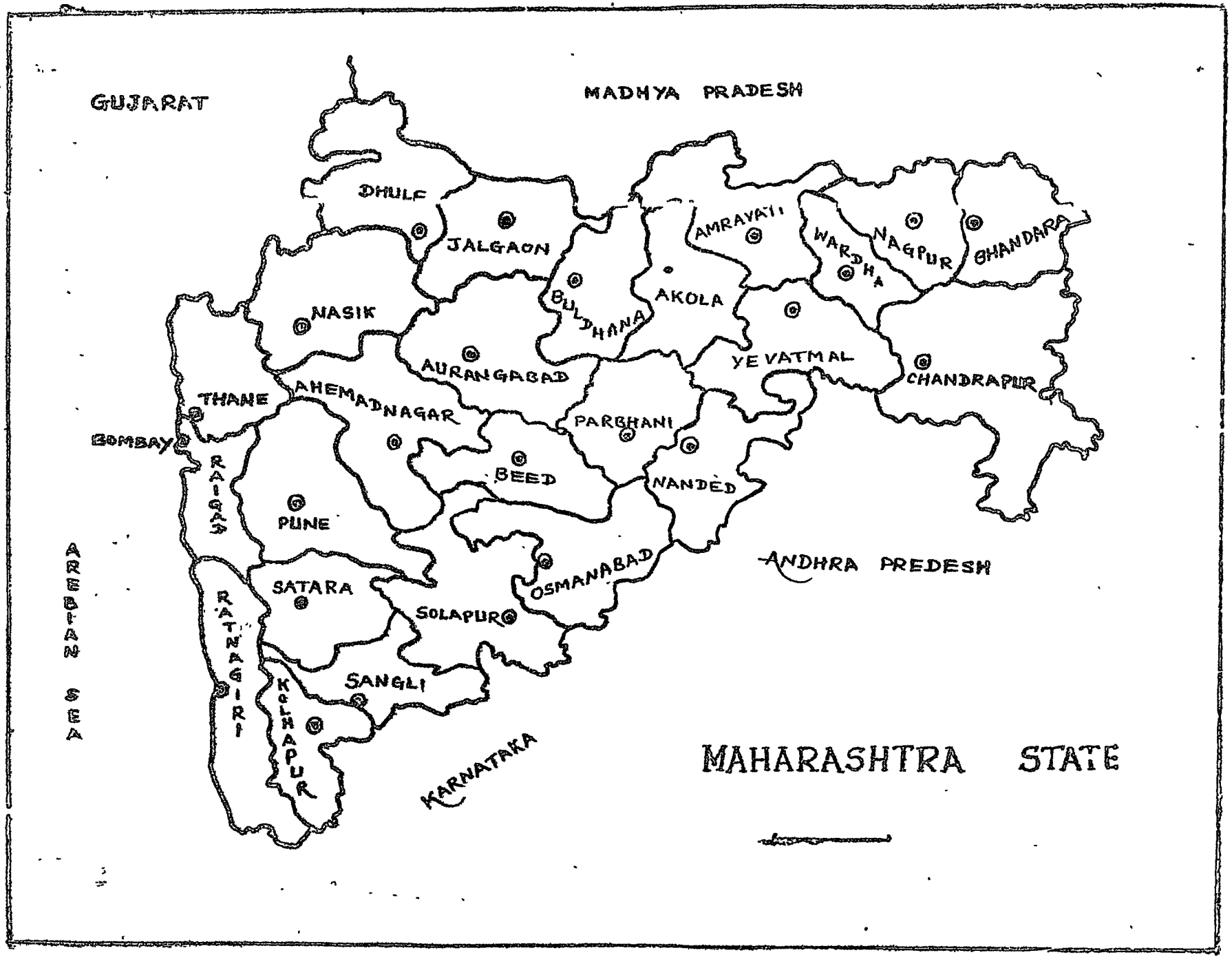
2.3.7 Nagpur Division :

The districts of Wardha, Nagpur, Bhandara and Chandrapur are included in Nagpur division.

Jalna and Sindhudurg are the newly formed districts.

2.4 <u>Agro-Climatic Zones</u> :

Considerable variations in climate and rain fall are found within the districts of Maharashtra State.


GUJARAT
MADHYA PRADESH
DHULE
JALGAON
AMRAVATI
WARDHA
NAGPUR
BHANDARA
NASIK
BULDHANA
AKOLA
YEVATMAL
CHANDRAPUR
AURANGABAD
AHEMADNAGAR
THANE
BOMBAY
PARBHANI
BEED
NANDED
RAIGAD
PUNE
OSMANABAD
ANDHRA PREDESH
SATARA
SOLAPUR
RATNAGIRI
SANGLI
KOLHAPUR
KARNATAKA
ARABIAN SEA
MAHARASHTRA STATE

Maharashtra State is divided in to nine agro-climatic zones.

2.4.1 Zone-1 Very high rain fall with Lateritic soils :

This zone includes the whole of Ratnagiri district and western border strip of Kolhapur and Raigad.

The climate is warm and humid with more than 2,500 ml of rain fall per year. The maximum and minimum temperature varies between 30.31 C^0 and 22.24 C^0 respectively. The general topography is hilly to undulating, and the soil depth varies from less than 30 cm on hill strips to about 100 to 150 cm in valleys. The soils are red to reddish brown.

2.4.2 Zone-2 Very high rain fall with non-lateritic soils :

This zone comprises whole of Thane, ramaining Raigad and western parts of Nasik district. The climate of this zone is slightly more warm and humid than zone-1. The general topography is hilly to undulating but mostly less than 300 metres altitude. The soils are non-lateritic in nature and depth varies from 30 to 120 cm.

2.4.3 Zone-3 Ghat Zone :

It includes the unevenly narrow strip running from north to south along the rest of the Sahyadri ranges having about 1,000 metre altitude towards western and upto 600 metre towards the eastern sides. The area included under this zone comprises the hilly,

high laying terrian round about the Ghats of Amboli, Fonda and Amba in Kolhapur district, Koyana and M Mahabaleshwar in Satara district, Lonavala and Khandala in Pune district, Kalsoobai hills in Ahmednagar district and Igatpuri and Trimbak in Nasik district. The maximum and minimum temperatures are the lowest among all the zones. The high laying hilly terrians have more than 5,000 ml rain fall per year. The soils are of inferior quality.

2.4.4 Zone-4 Transition 1 with red to reddish brown soils :

It comprises a narrow strip running through the western hilly flank of Kolhapur district, western part of Shirala taluka of Sangli district, central strip of patan and Madha talukas of Satara disirict, western part of Pune and Ahmadnagar and central part of Nasik district. The rain fall is between 1,750 to 2,500 ml. The soils are mainly red to brown.

2.4.5 Zone-5 Transition 2 with greyish black soils :

This is a wider strip running parallel and to the eastern side of Tr-1, and extends towards east upto the line where the scarcity zone starts. It comprises of eastern strip of Kolhapur district. Central strip of Satara district, central part of Pune district, central portions of Ahmadnagar and Nasik districts, and some part of Dhule district. The rain fall varies between

700 to 1750 ml. Summers and winters are warmer than zones 3 and 4. The soil are greyish black in colour. The area grows mostly kharif crops.

2.4.6 Zone-6 Scarcity Zone :

This vast area in mid western Maharashtra is traditionally known as the famine area of the state; it comprises shirol taluka of Kolhapur district, entire Sangli, Satara, Pune, Ahmadnagar, Nasik and Dhule district excluding the areas covered by the other zones, western strip from Amalner to Chalisgaon in Jalgaon district, western strip of Beed district, Bhoom, Ahmedpur, Paranda and Nilanga talukas of Osmanabad district and whole of Solapur district excluding the eastern strip of Barsi and Solapur talukas. The average rain fall is round about 500 ml per year. The soils are calcareous, gryish black in colour and varying in depth and textures. The main cropping pattern is of kharif type. Rabi crops are also grown on finer and deeper soils.

2.4.7 Zone-7 Assured rain fall with kharif cropping :

This zone includes the remaining parts of Solapur, Osmanabad, Beed, Aurangabad and Jalgaon districts, Shirur taluka of Dhule district, Buldhana, Akola district excluding washim and Mangrulpir talukas, whole of Amravati district excluding estern part of Chandur and Morshi talukas, western part of Parbhani and southern part of Nanded district. The rain fall on western side

is 700 ml and it increases upto 900 ml on eastern side. The cropping pattern is of more of kharif type. Greyish black and deep clayey soils are seen.

2.4.8 Zone-8 Moderate to moderately high rain fall with soils formed from trap :

It includes the remaining parts of Nanded, Parbhani, Akola and Amravati districts, whole of Yavatmal and Wardha districts, whole of Nagpur excluding the eastern strip of Nagpur and western part of Chandrapur districts. This is predominantly a kharif tract with a rain fall of 900 ml on the western side increasing upto 1,250 ml on the eastern side. Soils are just similar to zone 6 and 7. Kharif crops like cotton, jowar, ground nut and rabi crops like wheat, gram and linseed are grown.

2.4.9 Zone-9 High rain fall with soils formed from mixed rocks :

The whole of Bhandara district and remaining parts of Nagpur and Chandrapur districts are included in this zone. The rain fall varies between 1,250 to 1,700 ml. The soils are yellowish brown to red in colour and coarse in texture. The pre-dominant crops like wheat, gram, linseed, rabi jowar are grown in rabi season.

2.5 Rivers :

The main rivers which flow through the state are Godavari, Tapi, Krishna, Bhima, Purna, Pravara, Girna,

Koyana, Wainganga and Painganga. Besides these larger rivers many subsidiary and small rivers flow through the state.

2.6 Forests :

Tropical wet evergreen forests which are typical rain forests, are found along the western ghats. The tropical wet evergreen forests of the ghats are flanked on either side by semi evergreen forests. These forests, especially on the Konkan side grow palms and bamboos, on the eastern side ofthe ghats. They are a transition to the most deciducus forests. There are throny shrub forests which cover the major part of Maharashtra on its eastern side. These forests lie in areas with rain fall below 750 ml. Babul and khair are very prominant species. These forests have been further depleted owing the grazing by cattle and browsing by goats and sheeps. Babul is, however, a good source of domestic fuel and for agricultural tools while khair has certain chemical and industrial uses.

The forests of Chandrapur district are a treasure of wheelth which includes teak, bamboo, dhavada, anjan, hirda, tembhurni and many other vegetations of commercial importance and Medicinal value.

Grass lands growing primarily Marvel and Pawana grasses are found scattered throughout the state in areas

with less than 1000 ml of rain fall, the principal ones are found along the banks of the Krishna river.

2.7 Soils :

The main geological formation in the entire state is the deccan trap or basalt. Its laterization is however, noticed in Ratnagiri district. The far eastern region of Chandrapur and Bhandara districts, has various rock formation. Following type of soils are present in Maharashtra State.

2.7.1 Black Soils :

These are the most important soils covering the maximum area in the state. They are derived from Deccan trap and are found in almost all the districts excepting Ratnagiri district and parts of Chandrapur district.

2.7.2 Red Soils :

In western Maharashtra these soils are observed in Thane and Raigad districts and also in the western portion of Pune district. In the east they are noticed in Chandrapur and Bhandara districts.

2.7.3 Lateritic Soils :

These soils are observed in the southern part of Raigad, most of Ratnagiri and western part of Satara, Sangli, Nasik and Kolhapur districts.

2.7.4 Alluvial Soils :

These soils are of two types, (i) alluviams along

the rivers like Tapi, Bhima, Godavari, Krishna etc.
(ii) coastal alluviams as noticed on the coastal side of Thane and Ratnagiri districts.

2.7.5 Forests and Hilly Soils :

These soils are also derived from trap and occupy the mountaineous terrian in the west in the districts of Nasik, Ahmadnagar, Pune, Satara, Sangli and Kolhapur dis districts and in the east in Chandrapur district.

2.7.6 Coastal Saline Soils :

The coastal saline soils occur all along the west coast in the districts of Thane, Raigad and Ratnagiri.

2.8 Agriculture :

In Maharashtra, as in India agriculture is the most important economic activity and among the least productive. Agriculture is primary occupation of nearly 70 per cent of the working population and produces nearly 50 per cent of the state income. As compared to India, Maharashtra derives a major proportion of its income and employment from agriculture. The gross value of output per hectare and per capita is low as compared to India.

2.9 Regional Variations :

2.9.1 Konkan Division :

The main crop is rice. The average yields are also higher than the other regions for the rice crop.

The irrigation facilities are limited. Cultivation of vegetables and orchard crops, for which there is ready market in Bombay city, has developed in Thane and Raigad districts while mango, cashew nut and coconut plantations are found along sea-coast.

2.9.2 Nasik Division :

The districts of Dhule and Jalgaon receive moderate rain fall, while in some pockets of Nasik district the fain fall is very less. Irrigation facilities are moderate. The cereals like rice, jowar wheat and bajra are grown. More area is under kharif crops. In cash crops ground nut and sugar cane cultivation is in practice.

2.9.3 Pune Division :

It includes the districts of Pune, Ahmednagar and Solapur. Parts of Ahmednagar and Solapur districts come under the scarcity zone. Both kharif and rabi crops are grown. In Solapur district the more area is covered by rabi jowar as compared to others. The irrigation facilities are adequate as compared with others. Different crops are grown with irrigation in large extent as compared to others. Average yields are greater. Sugar cane is important crop in Ahmadnagar district.

2.9.4 Kolhapur Division :

The soils of the Kolhapur division are fertile and suitable for irrigation. In Kolhapur district rain fall is adequate. In Sangli and Satara district the irrigation

facilities are comparatively more. Sugar cane and rice are grown on large area. The average yields are greater. The per capita and per hectare agricultural income is greater in Kolhapur district with comparision to other district.

2.9.5 Aurangabad Division :

The part of Aurangabad and Osmanabad districts comes under scarcity zone, remaining part comes under assured rain fall zone. Irrigation facilities are increasing every year due to the Jaikwadi project. In Parbhani and Nanded, cotton, rice, wheat, ground nut and rabi jowar are grown on large area. In Osmanabad and Beed district rice and kharif jowar are grown. In Aurangabad district the large area is under bajra. Average yields are less.

2.9.6 Amravati Division :

The rains in this division are best suited for cotton. Nearly 40-50 per cent area is covered by the cotton crop. The next important crop is kharif jowar. The average yields are low. Irrigation facilities are very less.

2.9.7 Nagpur Division :

Bhandara and Chandrapur districts receive higher rain fall than the districts of Wardha and Nagpur. Irrigation facilities are less. In Chandrapur and Bhandara districts rice is an important crop. In Nagpur and Wardha districts kharif as well as rabi crops are

grown. The average per capita and per hectare agricultural incomes are comparatively less.

2.10 Land Utilization :

The proportion of the cultivated area to the non cultivated area in a tract depends chiefly on its soil climate complex. In the coastal districts of Thane, Raigad and Ratnagiri which have comparatively poorer soils, the proportion of the cultivated area is about two third of the total area under forests. In the districts of Pune, Ahmadnagar, Nasik, Satara, Sangli, Kolhapur and Solapur, this proportion is fairly high and there is consderable area under forests especially down the ghats. There are also good permanent pastures and grass lands in Nasik, Solapur and Kolhapur districts. In the deccan tract comprising Dhule, Jalgaon and districts of Marathwada, the cultivated area varies from 49 to 89 per cent, in Vidharbha the proportion varies from 27 to 74 per cent. In Chandrapur district area under forest in high. Table 1 shows land utilization pattern of Maharashtra State and India.

Table 1 : Land Utilization.

(Figs. in per cent)

Sr.No.	Items	Maharashtra	India
1.	Forests	17.6	21.5
2.	Barren and uncultivated lands.	5.9	9.9
3.	Land put to non agricultural uses.	2.8	5.2
4.	Cultivable waste	4.8	5.1
5.	Land under trees	0.7	1.4
6.	Permanent pastures	5.4	4.2
7.	Current fallows	2.7	3.6
8.	Other fallows	2.7	3.0
9.	Net sown area	57.4	46.1
	Total	100.00	100.00

2.11 Cropping Pattern :

Different crops are grown in the various districts oft the state. The major area is covered in kharif season. Table 2 shows area covered by the principal crops in the state.

Table 2 : Area covered by the principal crops in Maharashtra State (1960-61 to 1977-78).

(Figs. in per cent)

Sr.No.	Crop	Area
1.	Rice	7.187
2.	Kharif jowar	13.752
3.	Bajra	9.694
4.	Tur	3.135
5.	Gram	0.194
6.	Cotton	13.804
7.	Wheat	4.813
8.	Rabi jowar	18.074
9.	Sugar cane	1.023
10.	Ground nut	5.045
11.	Net cropped area	94.808
12.	Double cropped area	5.192
13.	Gross cropped area	100.000

2.12 Irrigation :

Development of irrigation is of utmost importance for agricultural property and general economic well being of the population of the state. The goal, therefore is set to stabilize agriculture at an appreciably higher level to achieve self sufficiency in food production. For this purpose, due to priority to the schemes in the

irrigation sector has been accorded in the state's fifth plan.

The state has some pioneering irrigation works. The state is lagging behind the national average of irrigated area to the gross cropped area. Hardly 8.5 per cent area of the gross cropped in the state is under irrigation compared to all India average of 23 per cent. This is because, apart from the common factor of resource constraint, the state suffers from the following handicaps.

1) Lack of perennial rivers, which allows irrigation only with storage projects costs of which are comperatively high.

2) The vagaries of the mansoon and the undulting topography on account of which area in need of irrigation are situated for away from the storages existing or proposed.

3) A large number of the projects convinced by the state were held up due to the inter state water disputes.

Table 3 : Important Irrigation Projects.

(Figs.in hectares)

Sr. No.	Project	Benefitting districts.	Irrigation potential.
1.	Upper Godavari	Nasik, Ahmadnagar	44270
2.	Upper Tapi Stage(I)	Jalgaon	55230
3.	Khadakwasla	Pune	38880
4.	Warna	Sangli,Kolhapur	99050
5.	Krishna	Satara, Sangli	106130
6.	Kukadi stage(I)	Pune, Ahmadnagar	107620
7.	Bhima	Pune, Solapur	173800
8.	Jaikwadi state(I)	Aurangabad,Parbhani	141640
9.	Kal	Raigad	14840
10.	Tulshi	Kolhapur	3160
11.	Bagh	Bhandara	33670
12.	Itiadoh	Bhandara,Chandrapur	36140
13.	Mula	Ahmadnagar	72080
14.	Dudhganga	Kolhapur	55260
15.	Upper Penganga	Parbhani, Nanded Yavatmal.	111500
16.	Upper Wardha	Beed, Osmanabad	27790
17.	Pench	Nagpur, Bhandara	74670
18.	Surya	Thane	23430
19.	Waghur	Jalgaon	23580
20.	Jaikwadi stage(II)	Aurangabad,Nanded, Ahmadnagar, Beed, Parbhani.	135000

1.	2.	3.	4.
21.	Upper Tapi stage (II)	Jalgaon, Dhule	57020
22.	Vishnupuri	Nanded	52560
23.	Purna	Parbhani, Nanded	61560
24.	Ghod	Pune, Ahmednagar	24600
25.	Girna	Nasik	57210
26.	Pawna	Pune	2400
27.	Medium projects		54930
28.	Minor projects		168050
29.	Wells		935800
	Total		2791870

Source : Maharashtra : 1975-76 : P.: 75-96.

2.13 Land Development :

Land development activities are mainly undertaken through Soil Conservation Schemes of Agricultural Department and C.A.D.A. The details are as below :

1. Contour Bunding.
2. Reclamation of saline and alkaline soils.
3. Nala Bunding.
4. Terracing.
5. Land development-cum-horticultural development.
6. Ayacut development schemes.

One hundred twenty five lakh hectares of land has been bunded, seven to eight hundred hectares of land is

reclaimed per year. The potential of nala bunding is roughly estimated around 16,000 nalas in the D.P.A.P. The items of the terracing is executed for conservation of work as lands or lands under minor millets. The districts adjoining western ghats and Chandrapur, Bhandara, part of Nagpur, Amravati, Wardha and Yavatmal are included in the area of operation. The Ayacut work in the command area of the entire medium and major irrigation projects is carried out by the land development agency.

2.14 Production Development Programmes :

For increasing the food production efforts have been made. Different schemes have been started. High yielding varieties programme isbeing oriented since the year 1965. Intensive cultivation of food crops in selected area is being taken. Different production programmes for pulse crops also being in operation. Schemes for development of long stapled cotton has been successfully started. Different plant protection schemes are being implemented accordingly.

2.15 Co-operation :

In Maharashtra state a strong Co-operative structure has been built through the primary Agricultural Societies at village level and with the other Co-operative societies. There were 50,709 Co-operative societies with the membership of 1,16,54,000 borrowers.

The working capital of all co-operative societies was Rs. 2,861 crores in the year 1975-76 and the loan advanced by the primary agricultural societies was 170 crores. 4,570 bank offices were established at 1,399 places in Maharashtra State.

2.16 Transport :

The railway and road transport facilities are available in Maharashtra State, the total railway length is 5,226 Kms. The average railway length per 100 Sq.Km. of area is 1.7 Km. The average road length per 100 Sq.Km is 37 Km. The total road length is 88,757 Km. The length of village roads is 36,434 Km.

2.17 Agricultural Implements :

Different types of agricultural implements are used. 6,000 tractors were used for agricultural purpose in the year 1975-76 and 1,74,000 electric pumps were installed.

2.18 Factories :

In Maharashtra State 8,393 factories were working. Only 138 factories were belonging to agriculture and allied activities, 4,569 factories were of processing and manufacturing in nature, 103 cotton textiles were working. Sugar factories were 68 in number.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Research results published in the past on the aspects relevant to the present project are compiled here and presented.

3.1 General :

The composite index of gross agricultural output per acre was highest in Tamil Nadu (176.2 per cent), mainly due to high yield index (157.7 per cent), it was followed by Assam (174.0 per cent) and west Bengal (168.1 per cent) and the pattern indices for these states were 152.0 and 148.1 per cent respectively. The composite index for Maharashtra state was 165.1 per cent, (Anand 1964).

Saran (1964) observed that, the expenditure on the use of manures, fertilizers, improved seeds etc. increased the profitability from farming. In Tamil Nadu lesser use of manures increased the productivity of rice crop.

On account of high density of population, the land man ratio was about 0.08 hectares in Taiwan and South Korea, 0.37 hectares in India and 0.29 in Pakistan, (Roy,1967), while it was stated that few inefficiencies in resource allocation in different regions are present in Indian agriculture, (Sahota, 1968).

Kulkarni (1969) observed an improvement in yields of various crops in contour bunded areas in Maharashtra state, whereas the contribution of contour bunding in increased production was quite substantial.

It is suggested with the Cobb-Douglas functional analysis, that, the scope remained for investigation of the alternative hypothesisof utility maximization which unlike profit maximization explicitly allows for subjective risk considerations and might therefore provide a more realistic basis for policies aimed at the modernization of traditional agriculture, (Dillon and Anderson, 1971).

Agricultural development in India was governed with the new agricultural technology and increased level of production, but, most attention has been placed on factors of production and market prices in order to boost output on an aggregate level, (Michie,1973), whereas, agricultural development in Canada was governed by the prices and productive uses of agricultural land, water, energy, labour and technology,(Manning,1976).

Regression model for measuring the impact of the components of regional development in Colombia, credit, technical assistance and roads were among the components found to be have the significant effects on farm development, (Feaster, 1976), and regression coefficients of labour, animal power, credit, infrastructures,

technology and ecology were among the variables explaining the productivity differences in Rajasthan, (Bumb, 1976).

Increased investment was the main factor for rapid agricultural development in poland for the period of 1971-74 (Zegar, 1976), whereas, gross income in arid zones of Rajasthan declined as the size of farms declines. There was positive relationship between farm investment, size of farm and gross income (Kalla and Vyas, 1976).

Quiggin and Anderson (1977) observed that risk in agricultural production was seen in yields and prices, stabilization of prices helped for reduction the risks in agricultural production in Australia.

Forni and Tost (1980) stated that agricultural development strategies must consider the regional differences in resource availability, whereas, Bolar (1980) concluded that the priority should be given to block plans, and they should create productive employment for bridging the income gaps. Governmental efforts should be made for stimulation and organization of production.

3.2 Contributory Factors :

Nair (1965) concluded the following as the obstacles in agricultural development, these are divided in to two, (1) structural obstacles, such as small size

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of land holding, poor soils, inadequate reinfall, adverse land man ratio, and surplus unproductive animals and (ii) technological obstacles viz., type of land utilization, use of inadequate fertilizers, minimum use of agricultural implements and machinery.

Shah (1967) identified the factors of agricultural development such as, the increased use of fertilizers, irrigation, improved seeds, land reforms, agricultural extension, research and education while (i) total food production, and per capita food production (ii) irrigation (iii) productivity of some important crops (iv) use of insecticides (v) land use and (vi) consumption of chemical fertilizers were also considered as the factors of agricultural development (Lahiri, 1967). and, Parikh (1967) listed the following as the factors for agricultural development, viz ; new technology, fertilizers, irrigation and extension education, and also, human and non human factors were supposed the factors, of agricultural development, with collaboration with cropped area, cropping pattern, productivity of important crops, and other factors like land tenure system, marketing facilities and credit availability (Nair, 1967).

Increase in the application of fertilizers was the main factor, responsible for increase in the rice crop while for wheat along with fertilizers, the irrigated area were the responsible factors. The growth in

productivity of rice and wheat was mainly on account of increase in the application of fertilizers (Abraham and Raheja, 1967), whereas, agriculture, in the over populated developing countries, is, characterized by the existence of vicious circle of low productivity, low capital and high population density. Multiprolonged attempt should be implemented such as land reforms, agricultural extension services, adoption of new technology, use of machinery and efficient administration, for agricultural development in the developing countries (Khaund, 1967).

Schuh (1968) stated that agricultural development refers to increases in per capita income to those who earn their living in agricultural sector.

Misra (1974) identified the factors of growth of yield and output in Gujarat were; distribution of land holdings, pattern of land ownership, rainfall, irrigated area, pumps, engins, fertilizer use and intensity of cropping, whereas, it was concluded that (i) the rainfall and consumption of fertilizers have been significantly responsible for agricultural production in Gujarat State during 1961-62 to 1973-74, (ii) long term loans influenced capital formation in agriculture, (iii) capital intensiveness was significantly influenced by the per capita land availability for cultivation, (iv) short term loans had the significant impact on the level of consumption of fertilizers and (v) there was significant direct

relationship between rainfall and per capita land put to use (Jayaraman and Sadasiva, 1976).

Intensity of cropping and locational shifts in the area are the factors of agricultural growth (Narain, 1976), while, increased quantity and quality of irrigation, HYVs of crops, were the promising sources of output growth for wheat and the development of rural roads, markets, HYVs and the increased irrigation were the important factors for output growth of rice crop in India (Easter et al.,1977).

3.3 Cropping Pattern :

Suitable cropping pattern is one of the basic aspect of agricultural development (Singh, 1952), whereas Padmanabhan (1959) concluded that concentrated efforts should be done for making the availability of requisites of farmers for better cropping especially the improved seeds, irrigation, improved implements, insecticides and pesticides etc.

In the regions of homogeneous soil and climatic features, urbanization introduces diversification in the cropping pattern, such as, introduction of more cash crops, fruits, vegetables and flowers. A good market centre in the vicinity, with the well connected roads and facilities of cheap transport system, exerts its influence, on the cropping pattern of a village, are very high with regards to individual cropping. The food

fodder and cash needs explain only small amount of the variation in percentage area alloted to for food crops (Malaya, 1963), whereas, in unirrigated land, the most of the land newly brought under cultivation and the areas of bajra and linseed were shifted to ground nut, whereas the areas of bajra and ground nut, had been diverted to onion and paddy in irrigated areas of Nasik district of Maharashtra State.

Sharma (1964) revealed that the districts of Surat, Baroda, Broach, Panchmahals and Junagadh indicated higher level of rainfall coupled with lower level of irrigation and in the districts like Ahemadabad, Amroli, Banaskantha, Mehsana and Sabarkantha, the opposite trend was observed. In irrigated area the intensity was relatively less because ofthe cotton crop, while for increasing the cropping intensity in Tamil Nadu, the new irrigation sources either supplementary or independent will have to be developed (Giri, 1968).

Combination of cotton andjowar in the proportion of 0.2 : 0.8 gave maximum stability which was achieved by sacrificing higher incomes. The combination of cotton and ground nut in the proportion of 0.7 : 0.3 assured maximum stability of income, and cotton and wheat in the proportion of 0.6 : 0.4 in the dry farming areas of Maharashtra State (Shingarey, 1971), and , Sau (1971) concluded that in India only 20 per cent of the cropped area was irrigated and double cropping was

practised on only 15 per cent of the total cultivated land. It implied that, agricultural output could be increased if just double cropping is extended to the whole of the irrigated areas, whereas, with the Cobb-Douglas functional analysis, it was indicated, that, the allocation inefficiencies existed mostly in the transition form of subsistence oriented economy to a double cropping commercially oriented economy (Huang, 1971).

Sidhu and Sankhayan (1972) streased that in the absence of corrective measures at the right time, there may arise imbalances in Punjab agriculture, giving rise to acute shortages particulary of cereal crops and particularly of wheat may cause equally important problems.

Rao and Satyapriya (1975) observed that the overall intensity of land use, as reflected in the intensity of cropping was very low, chiefly because of very low annual percipitation lack of irrigation in Bellary district of Karnataka State.

Existing traditional cropping pattern in the hilly regions of Uttar Pradesh needs some adjustments in view of the increased needs of the people for higher production and income as well as for maintaining ecological sound environment (Singh and Rahim, 1978), whereas, it was observed that the intensity of cropping

in the districts of Himachal Pradesh, west Bangal and Tripura increased significantly, during the period from 1965-66 to 1971-72. It was also found that positive change in the cropping intensity between the northern and western region were stastically significant. The percentage of net sown area under irrigation increased in the eastern region while it fell slightly in the northern region. The annual compound growth rates in the area, declined during the period 1966-67 to 1970-71, as compared to those in the previous period i.e. 1960-61 to 1965-66 in case of all fruit crops in Himachal Pradesh. However there was an increase in the growth rate of production between the periods, most fruit crops implying a rise in the productivity (Atteri et al .,1978), and due to the change in the cropping pattern an economic gain of Rs. 40.24 lakhs was achieved in hilly areas of Amravati district of Maharashtra State (Deshpande et al., 1978).

Irrigation has been the limiting factor in the process of changes in the cropping pattern in Ratnagiri district and observed some desirable trends in the cropping pattern of rainfed crops (Pawar and Borude,1978).

3.4 Agricultural Income :

In Kanpur district of Uttar Pradesh, the per hectare average value of gross capital formation on the cultivators holdings, using HYVs came to Rs. 116.67,which

was about 48 per cent more than that of traditional. The irrigation structure contributed the largest share of 48.49 per cent of gross capital formation on the cultivators holdings, using the seeds ofhigh yielding varieties of different crops, specially wheat, while live stock contributed highest share of 67.41 per cent in gross capital formation on cultivators holdings using traditional varieties. The gross capital formation rose from 28.26 per cent in 1966-67 to about 40 per cent in 1968-69, while the net capital formation rose from 24.53 per cent to 36.08 per cent, whereas in Jabalpur district of Madhya Pradesh an increase of 150 per cent in per hectare income on irrigated farms as compered to the unirrigated farms was seen (Shukla,1971).

Per capita gross income at constant prices in Maharashtra State increased from Rs. 409 in 1960-61 to Rs. 410.80 in 1968-69 i.e. by 0.4 per cent, during the same period National per capita income increased by 4.9 per cent from Rs. 306.40 to Rs. 321.40 (Notes on Maharashtra, 1971).

Pant et al.(1972) observed that year to year production and variability are the chief characteristics of dry farming areas in general and particular in Madhya Pradesh. The farm income in any particular year is a function of production which in turn is a multiplicative function of area and yield. Year to year variation, in any one, of these components results in

production and income variations. Mexican wheat gave the highest returns, followed by HYVs of paddy. The production function analysis showed that the MVP of fertilizer was high (6.02) in crop production, followed by irrigation (5.8) and seeds (2.97), indicating the possibility of raising income by more intensive use of these factors in Madhya Pradesh (Garg and Singh, 1972), and Marothia (1974) showed that cotton had given the higher net return as compared to jowar, maize and ground nut, further he stated that shift in cotton cultivation from other crops was most profitable in Khargene district of Madhya Pradesh.

Miglani et al (1975) concluded that technological developments in Indian agriculture have increased absolute farm incomes. Irrigated farms achieved the higher incomes, and noted the income inequality among the different farm sizes.

Garg et al (1978) observed that in the Janpur district of Uttar Pradesh the net income, on an average amounted to Rs. 2116.10 per acre on the non-borrower's farms, it was higher at Rs. 2989.67 per acre on the borrower's farms, there by indicating an income increase of over 40 per cent as compared to former. The increase was associated with the increased investment and output per acre on the borrower's farms, which helped in the

repayment of loans to a large extent, whereas in Fatehpur district of Uttar Pradesh, the per hectare net income (crop + milk) on borrower's farms amounted to Rs. 1976.29 on an investment of Rs. 3077.78 per hectare as compared to net income of Rs. 1452.08 on non borrower's farms, which was obtained by an investment of Rs. 2658.22 per hectare. Similarly the utilization of labour worked out to 189 and 166 days on borrower's and non borrower's farms respectively.

3.5 Performance of Crops :

Sastri and Sharma (1959) studied the relative contribution of the area under rice and yield per acre during the First Five Year Plan period, in the states of Andhra Pradesh, Tamil Nadu and Bihar, and concluded that the increase in the production of rice during first plan period was concentrated in a few districts of above states. Increase in the yield per acre has contributed relatively more to increased production than in the increase in the area, and major rice growing states appeaently established a case for greater concentration of intensive development in particular districts, whereas substabtial increase in the production of food grains cotton, jute, sugar cane and various non-food crops during the First Five Year Plan. About 3.8 per cent increase in agricultural production was obtained in second five year plan. Near about 76 per cent irrigation potential was used during Second Five Year Plan.

as against 50 per cent in First Five Year Plan. The consumption of chemical fertilizers also showed significant increase. The area under improved seeds rose to 55 million hectares in 1960-61 from 7 million hectares at the end of First Plan (Ahuja, 1961).

Ganguli (1964) concluded that the overall increase in agricultural production during 1951-52 to 1961-62 has been 43.40 per cent, with an annual rate of increase at compound rate of 3.34 per cent. The annual rate, however, declined from 3.38 per cent during the period of first plan to 2.38 per cent during second plan. The cropped area under food grains declined from 77.4 per cent in 1949-50 to 76.1 per cent in 1961-62 i.e. by only 1.3 per cent. The annual rate of increase of output of non food crops since 1949-50 has been 4.19 per cent, while the rate has been 3.60 per cent in case of food grain crops. In the category of food crops the crops, the output of which has shown a higher than the average rate of increases were 3.75 and 6.01 per cent for rice and wheat respectively. Higher than the average per cent increase of output has been recorded for ground nut (4.5 per cent), sugarcane (5.61 per cent) and cotton (6.56 per cent) in the category of non food grains. In the case of food grains there has been 1.58 per cent annual increase of area and 1.81 per cent annual increase of productivity during 1949-50 to 1961-62 and for non food crops it was 1.84 and 1.18 per cent respectively.

In the survey study (1965) it was observed that minor rice growing states of Punjab and Himachal Pradesh showed an increase by 12.3 and 7.86 per cent per annum for production during the period of 1952-53 to 1961-62. West Bengal has got the lowest growth rate while the states of Bihar, Madhya Pradesh, Uttar Pradesh and Maharashtra showed higher growth rates in production than the at all India level (3.29 per cent).

Maharashtra showed a higher growth rate, of over 4 per cent, as compared to other states, for jowar production. Madhya Pradesh had negative growth rate for production, Uttar Pradesh, Rajasthan and Gujarat had negative growth rate for jowar production.

The all India growth rate for wheat production was 4.24 per cent, Uttar Pradesh showed 2.11 per cent increase, Punjab and Madhya Pradesh showed the growth rates of 5.49 and 5.38 per cent respectively. Maharashtra has got a fair growth rate. Rajasthan had negative growth rate for productivity. Himachal Pradesh showed highest growth rate and Bihar registered very low growth rate for wheat production.

The all India increases for area, production and productivity of gram were 3.04, 2.47 and 0.50 per cent per year respectively. All the states except Uttar Pradesh showed positive trends.

Gujarat showed increase in area and production but decline in productivity of ground nut. Tamil Nadu, Maharashtra and Madhya Pradesh accounted for high growth rates and Andhra Pradesh showed negative growth rate for ground nut production.

For all India the growth rate accounted for 1.83 per cent in cotton production, but, productivity has got the negative trend. Gujarat, Punjab and Tamil Nadu registered the fairly high growth rates, Karnataka equilized all India increase, whereas Maharashtra has got low production growth rate, and Madhya Pradesh and Andhra Pradesh showed decline.

Sugar cane production increased with the rate of 8.56 per cent per annum at all India level and except Uttar Pradesh and Assam all the states showed fairly high growth rates in sugar cane production.

Parikh (1966) observed that changes in cropping pattern contributed more than 45 per cent to the growth in agricultural output in Madhya Pradesh, Tamil Nadu, Karnataka, Rajasthan and Uttar Pradesh. For Bihar, Kerala, Madhya Pradesh and West Bengal area growth contributed more than 55 per cent to the total growth, but, for Bihar and Tamil Nadu the growth in productivity played a relatively important role in explaning the growth rate in aggregate index of agricultural production. Growth in output was explained to the extent of 70 per cent

or more by area in West Bengal, Utter Pradesh, Rajasthan, Madhya Pradesh and Bihar. In case of Tamil Nadu, Kerla, Karnataka, the extension of irrigation explained 60-65 per cent of growth in output on the other hand an increase in the production of rice and wheat in India for the period 1951-52 to 1964-65 was 12.6 and 3.5 million tonnes. The input factors viz; the unirrigated area, irrigated area and fertilizer consumption accounted for 7, 16, 77 and 30, 35 and 45 per cent respectively. Fertilizer was the main factor responsible for increase in the production of rice while for wheat these three factors contributed almost equal shares (Abraham and Raheja, 1967).

Bandopadhya and Ghosh (1967) studied the agricultural development in Mexico, Taiwan and India and observed that Mexico achieved more than 50 per cent rise in production of wheat, Taiwan recorded more than 35 per cent increase in rice production, while India's increase was 26 and 10 per cent in rice and wheat production.

Pathak and Singh (1967) stated that the demand for food in the developing countries increased by 5.8 per cent while population increased with 2.5 to 5 per cent per annum at the compound rate during the period for the years of 1937 to 1964, whereas in the comparative study of agricultural growth in India, Taiwan, S.Korea and Isreal, wide variatious were seen in the trends of growth in total and gross domestic products, and, corresponding

growth rates in agricultural and food production. The highest growth rate of 11.59 per cent in gross domestic product supported by 14.08 per cent in agriculture and 13 per cent in food has been achieved by Isreal followed in descending order by Taiwan and S. Korea. India with its low growth rates of 4.18, 3.04 and 3.01 per cent in gross domestic products, in agriculture and in food production trails at the bottom in the list (Sancheti, 1967).

Shingarey and Waghmare (1968) observed the considerable variations in the growth rates of major crops for the period of 1952-53 to 1963-64 in Maharashtra State. The growth rates of area of food crops varied between 1.12 per cent and 5.57 per cent for cash crops. The highest growth rate of irrigated area was observed in respect of cotton, which was 10 times more than sugar cane. Among the cereals, jowar showed higher growth rates of 5.57 per cent for irrigated area. Ground nut also registered a high growth rate. Due to the higher cash returns from the commercial crops higher growth rates were obtained for cotton, sugar cane and ground nut compared to food crops.

Schutjer and Weigel (1969) revealed that in less developed countries changes in agricultural production during 1960-62 and 1964-66 was statistically related to the land area cultivated, the increase in labour employment and agricultural aid per hectare. Aid to

agriculture was subdivided in to 3 categories, viz; (1) aid in financing agricultural inputs such as fertilizers (ii) technical assistence and (iii) aid to finance facilities which produces agricultural inputs. The Cobb-douglas analysis showed that there was a statistically relationship between aid finance for inputs and agricultural output, while in another study an increase of 25 million hectares in gross cropped area during the period of 1950-51 to 1966-67 was observed. The average rate of growth of agricultural output during the period was 3 per cent for all India, with inter state variations from 4.56 per cent in Punjab- Haryana to 1.17 per cent in Gujarat. only 4 states viz; Punjab, Haryana, Tamil Nadu and Karnataka had rates higher than all India average rate. The range of inter state difference in consumption of chemical fertilizers(1962-63) was from 11.00 Kgs per hectare of cropped area in Tamil Nadu to 0.3 Kg in Assam. In case of co-operative credit (1963-64) the range was much larger from Rs.56.30 per hectare of cropped area to Rs. 0.6, but Tamil Nadu and Assam were again the states with highest and lowest values (Nath, 1970).

At all India level the average quinquenial yield of rice in the first, second and third plans had increased by 45, 90 and 20 Kgs per hectare, and Tamil Nadu was the only state which showed a steady increase in yield per hectare of rice during all the three five year plans.

Next to Tamil Nadu, Andhra Pradesh recorded significant increase in yield rates during first two plan periods. Unlike rice, plan effort had very little impact on the productivity of wheat, at all India level the increase in yield rates of wheat in the first and theird plan were 80 and 72 Kgs per hectare respectively, while practically no increase in the yield was recorded in the second plan. The states of Gujarat, Punjab and Uttar Pradesh had contributed significantly to the increase in yield rates during the third plan period (Saxena and Sardana, 1971).

Tyagi and Avasthi (1972) have shown that there are wide district variations in the area, production and productivity of various crops in Uttar Pradesh. Wheat and rice registered comparatively higher growth rates particularly after 1966-67.

Arthagnani (1972) concluded that at all India level, the average rate of growth of production during the period 1951 to 1971 was 3.6 per cent. The rate of growth was 5 per cent in First plan, 3.5 per cent in the second plan and (-)2.4 per cent in Third plan (due to drought in 1965-66). Food grain production increased from 553 Kgs per hectare in 1951 to 870 Kgs per hectare in 1971, on the similar line the comparative low growth rates were observed in food grain production from the period of 1949-50 to 1970-71 over 1949-50 to 1964-65. The over all growth

rate of agricultural output was declined from 3.2 to 2.9 per cent. The imbalances were observed in food grain and the non food grain components of agricultural production (Narain, 1972).

Singh and Prakash (1972) studies the growth behaviour of production of important crops for early and late sixties in Gujarat state. The trend analysis showed that in both the periods the growth was positive for all relected crops. The growth rates were higher in the early sixties compared to that in late sixties for all crops except maize and cotton. The inter crop comparison of growth rates showed that bajra has achieved highest growth in both the periods followed by ground nut and jowar in the early sixties. According to an analysis of official data, the area under all pulses taken together had declined between 1964-65 and 1967-68 by 5 per cent, the corresponding decline in the production was 2.14 per cent. Again in 1970-71, compared to 1967-68, area and production were lowered by 1.0 and 4.4 per cent. The share of area and production for the years 1964-65 and 1970-71 was 15.0, 13.6 and 10.7 per cent respectively. Area under pulses between 1964-65 and 1970-71 declined by 49.7, 17.7 and 14.9 per cent in Punjab, Uttar Pradesh and Harayana and the respective decline in the production was 55.8, 16.5 and 17.5 per cent respectively. in Maharashtra area increased by 3.6 per cent but

production and productivity declined by 9.6 and 12.6 per cent. In Andhra Pradesh area, production and productivity declined by 1.1, 28.4 and 27.0 per cent respectively (Note of correspondent 1973).

Sharma and Joshi (1973) observed an increase in the area under HYVs of rice from 6 to 11 per cent in Maharashtra State for the period of 1968-69 to 1970-71. The HYVs gave an additional yield of 44 to 54 per cent over the traditional varieties. Highest rise in hectarage was observed for bajra i.e. 19 per cent. HYVs of bajra gave an additional 65 to 80 per cent higher yields over the traditional varieties, about 15 per cent area was covered with hybrid jowar. Area under HYVs of wheat increased from 10 to 16 per cent and yield by 47 to 55 per cent. Use of fertilizers and irrigation enhanced the yields, but in the state of Rajasthan the commercial crops, taken together, did not register any significant change during 1960, while oilseeds, as a group recorded an increase 3.5 per cent in their productivity. The area under ground nut and cotton increased and showed decline for linseed and tobacco. Productivity of cotton has shown increasing trend where as it was of declining for sugar cane. The relative prices have significant effect on the area under oilseeds (ground nut and rape mustard) and potato, in Rajasthan and for which they explained 23 to 44 per cent variations (Acharya and Agarwal, 1974).

Singh and Sirohi (1974) studied the disparities in agricultural growth and equity in India and concluded that the growth rates for productivity and production in the two periods revealed that the disparities existed between various states and they further widened in the green revolution period due to variations in the growth of productivity of HYVs, specially of wheat crop, whereas annual growth, of 2.8 per cent in food grain production during the period of 1950-51 to 1969-70, was observed, and it was 4.2 and 1.9 per cent for the periods of 1951-60 and 1961 to 70 respectively (Vyas and Bandopadhya, 1975), in the similar fashion, it was concluded that in India wheat production was doubled in 1971-72 over the year 1966-67. It increased from 11.4 million tonnes in 1966-67 to 26.4 million tonnes in 1971-72, i.e. by 14.27 per cent, and its share of world wheat production from less than 4 per cent in 1965-66, increased, to nearly 8 per cent in 1971-72, while, rice production increased at an annual rate of 3.65 per cent and that of total cereals by 5.46 per cent respectively, Vyas (1975).

Narain (1977) used the decomposition model of growth and has shown the substansive set-up in the growth of productivity for the 1960's and there after over that the 1950's had been significantly larger.

Sah and Guleria (1978) concluded that in Himachal Pradesh, the growth in the total food grain production during the period of 1966-67 to 1975-76 was steady but modest. The changes in the average yield rather than in cropping pattern or area under food grains was the main determinant of ove: all growth, as well as, year to year changes in food grain production. The response superiority of HYVs over local rather than price incentives was the main season of a shift in the importance of wheat in the cropping pattern. It depended on the growth in the irrigated area which governs the growth in HYVs in irrigated area as well as rapid growth in fertilizer use. In another study it was observed that, in the pre-green revolution period, was trend values of all the important food grains except gram were positive, but those for all the cash crops were negative. In the pre green revolution period the trend values for all the important crops except black gram were positive. Important food grain crops and cash crops have shown high and positive trends in area and important food grain crops have shown high and positive trends in area and productivity (Bhadauria et al., 1978).

Nweke (1978) observed that during the period of 1960-75, Ghana achieved relatively high growth rates in food grain production. The average annual compound growth rates for food grains were 5.42, 4.7 and

0.72 per cent for production, area and productivity. The increase in food grain production was achieved through expansion of area, and that was made possible by tractor machahization.

Deshpande et al.(1978) observed in hilly regions of Amravati district of Maharashtra State, the index of improved seeds and fertilizer rose to 178.36 and 297.63 in 1965-66 with 1964-65 as base and declined to 92.79 and 94.13 respectively in 1973-74. There was an overall increase in the net sown area and gross cropped area in 1973-74 and these changes in these areas worked out to 9.54 and 10.39 per cent respectively. The productivity ofjowar, bajra, cotton and ground nut has increased over the decade. The productivity of rice declined due to the fact that the distribution of HYVs of rice was relatively less in 1973-74. The overall crop yield index for 1973-74.worked out to 101.54, whereas in Ratnagiri district of Maharashtra, the net sown area increased at an annual rate of 0.44 per cent, and total cropped area with 0.42 per cent. The area under different crops showed uneven growth rates during last 25 years. The area of rice increased at 0.75 per cent, the area under pulses declined at an annual rate of 2.14 per cent. The irrigated area was only 4.1 per cent of total cropped area(Pawar and Borude,1978), while in Marathwada region the output of

all crops decreased, increased and decreased at the rate of 2.30, 1.60 and 7.10 per cent per annum during the period of 1957-58 to 1974-75, pre HYV and post HYV period respectively. More or less similar pattern was observed with respect of food grain and non food grain production. It was also observed that major component responsible for decrease in agricultural production of all crops, i.e. by 2.30 per cent during 1957-58 to 1974-75, was the yield per hectare. While in pre HYV period the increase in production was mainly due to increase in yield per hectare (68-70 per cent) and favourable cropping pattern (25.00 per cent). In post HYV period the decline in production was mainly exhibited to decrease in yield per hectare (83.10 per cent) and decrease in area (14.08 per cent). This was due to occurance to drought during the years of 1970-71 to 1972-73, in the region (Bharambe, 1979).

Ryan and Asokan (1979) observed 22 per cent increase in area of wheat and decline of 8 per cent in area of pulses, during the period of preceeding 10 years to 1964 at all India level. Increase in wheat area was due to the HYVs of wheat crop.

Nath (1979) concluded that the total food grain production, which was less than 61 million tonnes in 1949-50 increased to 125 million tonnes in 1977-78. This large increase has been mainly due to area

increase under production and also higher productivity. The apread of green revolution has not been uniform. Average food grain's yield per hectare varied as much as 300 per cent between states and by wider margins for certain crops. The pattern ofincome gains had widen the gap between the small and big cultivators.

3.6 New Agricultural Technology :

Srinivasan (1947) revealed that pump irrigation was more economic than bullock lifts, and between the pump used, those driven by electric power were easier to operate than the pumps operated with oilengins, secondly, the pump irrigation afforded the scope for developing areas under irrigation and intensive cultivation, while it was not so with the bullock lifts. This has given the filip to consolidate holdings and increase the irrigable area in holdings in combaitore district, while irrigation is the mainstay of agricultural development (Bhange, 1953).

Jain (1960) concluded that the agricultural technologies especially the use of HYVs was concentrated in some parts of India, where the resources available were in plenty, further stated that though there was significant increase in the use of HYVs seed but no appriciable changes in the techniques of production or in the efficiency of operations were seen.

Apte (1962) observed the favourable changes in the incomes with the implementation of new technologies in Osmanabad district.

Joshi (1963) stated that Soviet agriculture since 1953 withessed a rapid growth. Total output grains rose from 5.0 billion poods in 1953 to 8.4 billion poods in 1961. Agriculture which had suffered a set back in 1953 was being reoriented. Total area under crops also increased during the period by about 35 per cent. This was achieved with the implementation of developmental efforts such as land reclamation, irrigation facilities, libralization of restrictions in the disposal of grain harvest of collective farms, while in the villages of Intensive cultivation block of I.A.R.I., farmers are using the low quantities of fertilizers. Besides fertilizers, use of improved seeds, better soil and water management practices, increased facilities for irrigation and soil conservation measures helped in pushing the technical efficiency from low level to high level (Joshi and Kahlon, 1963).

Dayal (1963) stated that though the average yield of different crops was more in Punjab than average for India, the cropping pattern was found to be of inferior quality. The value of output per acre in Punjab was Rs. 92 as against Rs. 123 for country. Further he stated that the cropping pattern in Punjab was mainly

influenced by three factors viz; the supply of irrigation, the food requirements and the demand for cattle food.

Apte and Mulla (1963) found that electrically operated pump was more economical as compared to bullock drawn water lifts and oil engine operated pump.

Panse and Singh (1966) stated that technological change in agriculture, consists of adoption of farming techniques developed through research and calculated to bring about diversification and increase of production and greater economic returns to the farmers. Use of fertilizers, pesticides, improved seeds and improved implements and counter bunding for conservation of moisture and soils are the examples of such techniques. Introduction of irrigation in new areas is also very important technological change. Speedy and extensive introduction of technological change is new recognized as the crucial factor in India's, agricultural development and in some of the I.A.D.P. districts an increase was observed in the production of various crops by extensive use of inputs like fertilizer insecticides, pesticides, HYV seeds and irrigation (Narula, 1966).

Panicker (1967) studied production conditions, in respect of three countries, viz; Thialand, Taiwan and Japan (1978-1917), and were discussed to isolate the

common factors which have accelerated agricultural development in this region as a whole and above countries in particular. The production conditions were grouped into two main categories (i) institutional (ii) scientific and technical. The factors like land development, land regislation, credit and marketing and price incentives, were included in the former while the use of fertilizers, pesticides, research, extension and education were included in latter, and concluded that failure of agriculture in Asia was mainly due to the failure of rural development and it was seen that soil reclamation and tapping of ground water was mostly practized in Isreal. Extension work had been done in all the countries, viz; India, Taiwan, S.Korea and Isreal, but it could not be as effective as in India (Sancheti, 1967).

Shingarey (1967) stated that technology has the great potentialities. In Japan it was widely used. In Japan productivity on the large majority of farms of average sizes of 1 hectare was 2-3 times more, than that of farms of same size in other countries in Asia, as a result of effective agricultural extension work, increased use of fertilizers and labor input, irrigation practices, double cropping and improved cultural practices. Increase in agricultural productivity through technological development, which made intensive labour

use more possible, is the key to economic growth in over populated countries, on the other hand irriation facility was considered to be the most important factor contributing towards the differential growth in agriculture, as a result, higher productivity shifts were seen in the districts possessing the adequate irrigational facility than the districts of Punjab where these facility was inadequate or absent (Paul and Jhol, 1967).

Mann et al. (1968) revealed that larger amounts of fertilizers are needed in order to maximize food output and farm incomes. Further changes in price policy will be necessary to maintain production of crops where no improved yield potential varieties are available. Only uniform allocations of scarce fertilizer supplies within a state will not maximize agricultural production and incomes.

Agrawal and Jain (1969) concluded that irrigation and land levelling were the important factors of agricultural development in Tarai region of Nainital and Rampur districts of Utter Pradesh, whereas chemical fertilizers and HYV seeds are supposed to be the new profitable inputs for transformation of low productive traditional agriculture to highly productive agriculture (Hayami, 1969), while technological factor was main contributing factor among the other factors

in the wheat production in New Zealand during the period of 1918 to 1967 (Guise, 1969).

Acharya (1969) revealed that investment per farm increased more than three fold on agricultural work and 16 fold on improved tools and implements. With the adoption of HYVs the pattern of investment had been changed, as HYV require the frequent irrigation, frequent use of control measures, high doses of fertilizers and comparatively more inter culturing operations, while in recent years in Andhra Pradesh the gradual increase in investment in agriculture both in public and private sector was noticed. Water pumps for irrigational purposes by oilengine were replaced by electric power and bullock labour by the mechanical devices.

Roy (1971) reported that 37 and 12 per cent area was covered by the HYVs of wheat and rice ofthe total area of respective crops in India in the year 1969-70, and it is seen that recent break-throughs of HYVs and initial success of new agricultural development strategy, had combined to provoke a new optmism on agricultural development in India (Dorving, 1972), whereas it was revealed that HYVs are comparatively more labour intensive and responsive to fertilizers as compared to local (Choursia and Singh, 1972; Mitra, 1972), while new technology had affected the production pattern of

all crops enterprise in general and wheat in particular in India (Wycliffe and Vishwanath, 1972).

Moorti and Mellor (1972) concluded thatthe private tube well farms have a better control of water supply in terms of its quality, availability in adequate quantity which resulted in higher cropping intensity, yields and therefore higher crop incomes in Aligarh district of Uttar Pradesh while,Wills (1972) revealed that, although adoption of new seeds, fertilizers and irrigation had increased employment and agricultural wages, it has also increased the disparity between income of farmers. With proper distribution of credit and fertilizers, new technology will be reducing the disparities of incomes, where in the estimates of income inequality indexes indicated an over all decline in the farm income in Aligarh district of Uttar Pradesh in the period of 1963-64 to 1968-69. The results of the regression analysis showed that the new agricultural technology, had been significantly influential in explaining block to block and year to year differences in the farm income inequality and that the mean level of farm income was negatively correlated with the farm income inequality in the districts (Singh, 1973).

Motilal (1973) concluded that the cropping, intensity was significantly high for the small sized tractor farms in comparison to those operated by bullocks.

The average yields were higher on the tractor farms. The tractor farms devoted a large area to HYVs of different crops in the union teritory of Delhi.

Acharya (1973) in the state of Rajasthan observed that the adoption of HYVs has increased human labour employment by 31.7 per cent. The installation of pumping sets had declined labour use by 18 to 20 per cent. However mostly it has accompainied by the adoption of HYVs and an increase in the intensity of cropping, with the installation of pumps and adoption of HYVs the decline and increase of 27.6 and 36.3 per cent was observed in labour use respectively.

Singh (1973) stated that the supply of fertilizers, improved seeds and pesticides, the total output in Aligarh district had been doubled during the last 10 years period together with increasing multiple cropping programme and increased area under irrigation.

Soltani (1974) suggested that mechanization should proceed gradually and it should be accompanied by diversification of agriculture and improved irrigation.

Mukhopadhyay (1974) observed that the impact of overall technological change or profitability appears to be the maximum in case of American cotton in Ferozpur district of Punjab state. The profitability of a switch over from desi to foreign varieties of wheat as well as cotton has been observed to be quite high. Of course in

the case of cotton the effect of a change over from desi to foreign variety was favourable, though the increase in the area under American cotton, however, has not been commonsurate with the increase in its relative profitability over its desi counter part. With the increased profitability there was devotion of area to mexican varieties of wheat in the state, where in expansion of H-4 cotton programme was very successful in Gujarat state and it had definately brought considerable changes in rural economy. The seed production as well as commercial crop production of H-4 cotton in both irrigated and rainfed area were very remunerative (Madalia and Charan, 1974).

East Banas project in Rajasthan has helped in raising the level of incomes ofthe lowest earning groups, thus bringing them above the poverty line (Charan,1974). The new technologies of agriculture are cost saving (Sidhu, 1974).

Srivastva et al.(1975) observed an increase in food production with the improved technology and utilization of HYVs of rice by farmers has moved at a moderate by steadily increasing rate from 1966 to 1973, when between 20-25 per cent of the entire rice area was planted with new varieties (Freeman 1975), an increase in the production of food grain in Eastern Utter Pradesh was observed due to the adoption of HYVs of

crops (Singh et al.,1977), Naidu (1977) also found the positive inter action between the use of tractors, HYVs and irrigation.

Desai (1977) concluded that in Surat district the increasing irrigation facilities helped in shifting the existing cropping pattern in to remunerative one. Goswami (1978) observed that in Kumon hills of Uttar Pradesh the traditional method of farming was in practice and the productivity was still less, this can be improved with modern technology, especially with the increasing irrigation facilities.

With the adoption of new technology the higher growth rates were observed in yields in post green revolution period as compared to pre green revolution period. Public and private investment and institutional development have substantially contributed to the growth of agriculture in Himachal Pradesh (Bhadauria et al.,1978).

Mehra (1980) found that in Indian agriculture, irrigation has a large potential for increasing employment, even where the development of HYVs has lagged. Seed, fertilizer technology also has increased labour use, but, because, its spread has been accompanied by mechanization, the substitution of capital for labour has reduced rather than enlarged the need for labour, inturn off set by a shift from less labour intensive to more labour intensive crops.

3.7 Prices :

Response of production of commercial crops like jute, sugar cane, and oil seeds to changes in price was uneven but was fairly good. The response was quick and considerable due to the substitution of these crops for other crops (Misra, 1962), while in economically less developed countries the effect of price supports, particularly when used as intensives to increased production, would not be lonely, there must be coordination among the price support policy and the institutional factors such as marketing, provision of credit and some times the systems of land tenure (Fonseka, 1963).

Price policy designed to stimulate the production of food crops in Kerala, is not likely to succeed by merely fixing a floor price for these commodities, On the other hand, it should seek to stabilize the relative prices of food crops, in terms of the other agricultural commodities produced in the state and should be maintained the same by constant vigilance and supervision (George, 1965), while the agricultural price policy should be an integral part of economic policy, designed to accelerate the rate of growth in developing countries (Shah, 1967).

Jaikrishna and Rao (1967) stated that the acreage under wheat was fairly elastic to changes in relative prices of wheat and substitute crops in Uttar Pradesh,

while positive changes in prices will favour the farmers with higher incomes (Epp, 1969), whereas changes in relative acreage under sugar cane in Andhra Pradesh were positively associated with the changes in the prices (Subbarao, 1969), but on the other hand, the declining trends in crop production and price were observed, and suggested that Government should take timely measures to see that the prices of agricultural commodities should not be fail to an uneconomic levels (George and Singh, 1971).

Prices of food articles increased by 28.7 per cent in 1973-74, on top of a rise of 15.5 per cent in 1972-73. In these two years the price index of food articles rose by 49 per cent. In the food articles group, the index for food grains rose by 28.4 per cent in 1973-74 and 17.4 per cent in 1972-73. Among food grains, prices of rice recorded the highest rise of 35.2 per cent in 1973-74, in addition to an increase of 17.4 per cent in 1972-73, followed by pulses, the index of which increased by 29 and 24.2 per cent respectively. The price index of raw cotton increased by 103 per cent of ground nut rose from 189.6 to 376.8 i.e. by 99 per cent (Correspondent's review, 1974), and on the other hand, positive and significant impact of relative price of rice on area sown under the crop, and the fairly quick adjustment behaviour of the farmers in the different regions of

Andhra Pradesh, provided a strong support for the use of relative prices as a variable for desired crop coverage in the desired direction (Rao and Pandey,1976), but in the state of Tamil Nadu, the general level of agricultural prices and other flexibility coefficient for paddy did not show a significant linear association, and Cob-Web model explained the relationship between farm harvest prices and production level, but an upward movement of fertilizer prices curtailed the production level (Rao, 1976)

Broadway et al.(1976) observed that the farmers do not get disheartened with higher input prices as long as their returns are sizable enough to cover the cost of production besides a margin of profit, while, the yields of wheat in Punjab could be stimulated through spread of area under mexican varieties and through the positive price policy (Sidhu, 1978).

Shukla and Misra (1979) revealed that during the first plan period the price trend has been declined for all crops but was significant for rice and maize (8.6 and 4.1 per cent) among cereals, 7 per cent for tur, 14.5 and 8.6 per cent for castor seed and ground nut. There was further decline during the Second plan for crops like wheat, barley and jowar among cereals, mustard, sugar cane and potato among non food crops. There was an increasing trend after this period and prices increased by more than 12 per cent per annum.

3.8 Co-operatives and Credit :

Co-operative finance has made a definate contribution to the capital formation on land and consequently helped in raising its productivity. The reasources of co-operatives should be reinforced in meet the challanges of the farmer's community (Singhji,1963) as co-operatives has an important role in agricultural development, but co-operatives have yet to establish them selves soundly as the higher over dues and other financial weakness are increasing day by day. Both agricultural credit in general and co-operative credit in particular are inadequate, hence for getting the best results of productivity, credit plans have to be closely related and to be based on production plans (Bose, 1963), whereas, the co-operatives have the potentiality in meeting the essential needs of the farmers for raising the agricultural production, but, for effective and efficient participation the working of co-operative needs a modification (Randhawa, 1965).

Patel (1968) observed that farmer's associations and co-operatives played an important role in agricultural development in Taiwan. The different associations and co-operatives helped farmers in procuring fertilizers, insecticides and pesticides, etc, and also provided technical advise to them, however, the managerial ability and long term loan limits are the major factors for

influencing the farm firm growth (Patrick and Eisgruber, 1968).

Sharma and Prasad (1971) concluded that the improved technology without any credit facilities would not have significant impact on incomes of farmers, but, the emphasis should be placed on realistic pricing of rural credit and mubilizing rural savings for credit use through interest incentives (Adams, 1971).

Athavale et al.(1971) reported that the contribution of co-operative credit in the HYV programme varied considerably in Raipur and Tikamgarh districts of Madhya Pradesh. The proportion of loan distributed to calculated requirement was only 6.26 per cent in Raipur and 54.46 per cent in Tikamgarh district. The defaulters were large in number in Raipur district as compared to Tikamgarh district. In both the districts co-operative credit was used mainly for seeds, fertilizers and pesticides.

Narasimhan (1971) revealed that, short term and medium term co-operative credit in 1951-52 was only Rs. 24 crores, in 1967-68 it increased to Rs. 428 crors. From 3 per cent, the share ofthe co-operatives as a source of cultivators borrowing rose to over 15 per cent by 1961-62 and 25 per cent in 1970, while there has been marked growth in the loan operations of banks in India. The quantum of loans advanced, which was Rs. 1.38 crores during 1950-51 increased to Rs. 2186 crores during 1955-56

and 58.4 crores during 1966-67. The figures went up to 91.5 crores during 1966-67 to Rs. 139.25 crores during 1968-69 and Rs. 153.36 crores during 1969-70, whereas it was revealed that, the organizational as well as technological changes showed increase in the capital and credit requirements on all farm. The credit need of the farmers are expected to increase further with the change in technology, therefore efforts have to be made by the landing institutional agencies to extend credit facilities to the farmers based on their crop plans (Agrawal and Kumawat, 1974).

Expanding co-operative credit availability increased fertilizer use and encouraged a shift to higher income crops on irrigated small farms, in Surat district. Greater flexibility of loan repayment made small farmers more willing to use available credit on irrigated farms, for that research must play a vital role in increasing yields (Schluter, 1975).

Guglani (1975) concluded that during 1970-71, co-operatives distributed agricultural production requirements of the order of Rs. 317.2 crores as against only Rs. 35.7 crores in 1960-61. Co-operatives have distributed improved seeds worth about Rs. 39.49 crores during 1970-71 as against Rs. 3 crores in 1960-61. The agricultural credit societies disbursed short term credit to the tune of Rs. 614.63 crores in 1971-72 as against

320 crores in 1961-62. The long term credit advanced by the LDB was Rs. 154.44 crores in 1971-72 and it increased to Rs. 171.89 crores in 1972-73.

Bangokok Bank monthly Review (1976) reported that more credit must be made available through the commercial banks. At least 5 per cent of total lending must be kept reserve for credit purposes.

Nandwani (1977) concluded that the share of co-operatives in the distribution of fertilizers which was 4.2 per cent during 1961-62 of the total fertilizers distributed in the country increased to 60 per cent in 1968-69 and over 60 per cent in 1975-76.

Increasing the capacity of the cultivator member of the co-operatives to repay their liabilities isthe key to reduce the overdues position of the co-operatives. Efforts towards improving irrigation facilities, and switching on to a more favourable cropping pattern with stress on higher income yielding crops are some solutions to a growing problem of the over dues (Jayaraman, 1978).

Waghmare et al.(1978) observed that in Parbhani district of Maharashtra State, the loans advanced, during the period of 1966-67 to 1976-77, for agricultural purposes declined at a linear rate of 3.42 per cent, whereas loans for non-agricultural purposes and bad debts significantly increased at the rate of 13.60 per cent

and 21.28 per cent with an increase in total capital at the rate of 12.77 per cent. The functional relationship between total deposits, loans for agriculture and bad debts in linear form as well as in logarithemic form showed that the coefficient of multiple regression and bad debts was significant. The linear and cubb-Doughlas function gave high value of R^2, i.e. 68 and 74 per cent respectively, whereas, it was seen that the per hectare flow of rural credit ranged from as low as Re 0.17 in orissa to as high as Rs. 19.59 in Kerala in 1969, and it ranged from Rs.6.12 in Madhya Pradesh to Rs. 133.47 in Kerala in 1974. The flow of rural bank credit per hectare of net cultivated area among the different states was found to be significantly higher in the post nationalization period. The estimates of co-efficient of variation worked out to 1.02 in 1969 and 0.33 in 1974. The linear regression equation showed that the number of rural bank offices, village electrification, area under high yielding varieties and average yield of food grain crops were significant variables, influencing the flow of rural credit in different states and their contribution was found to be positive, whereas the contribution of irrigated area was found to be negative. All the variables included in the regression analysis explained 86 per cent of the variation in the per hectare flow of rural bank credit in different states (Tewari and Sharma, 1978).

Arora et al. (1978) observed that the seasonal agricultural operations including seeds and fertilizers received a lion's share in the short term credit, advanced by the primary agricultural societies in almost all the states and union territories with the exception of Nagaland and Laskhadweep. Kerala was the only state, where the distribution of co-operative short term credit was more equitable among various purposes. The per hectare short term credit advanced by the societies in different states and union territories was estimated to range from Re. 0.26 to Rs. 226.29 in Mizoram and Pondecheroy.

In Jaunpur district of Uttar Pradesh, marked shift was observed in cropping pattern and intensity of cropping on the borrowers farms, as compared non-borrowers. Favourable shift was observed in area of HYVs and cash crops compared with the local varieties of crops. The intensity of cropping was also highest at 167 per cent on the farms of borrowers as compared to 149.39 per cent on the non-borrowers farms (Garg et al.,1978), and in Fatehpur district the borrower farmers devoted more area under high yielding varieties as compared to non-borrowers, who cultivated less remunerative crops like barley, jowar+ tur and other local varieties. The credit advance on borrower's farms resulted in bringing more area under irrigation and increasing the intensity of

cropping (Singh et al., 1978), and the significant shift in favour of the remunerative cereals and fibre crops with availability of credit was seen in agriculture in Punjab state (Singh et al.,1978).

Hajela (1978) reported that the share of co-operative credit in the total agricultural credit requirement has increased from 3 per cent in 1951-52 to 41 per cent in 1975-76.

Jukhet (1978) summarized that, net work of 1.26 lakh Primary Agricultural Societies covering 95 per cent villages and 41 per cent of village population in the country, and provides the main institutional base for supply of agricultural inputs to the farmers. The role of the co-operatives in the distribution of pesticides and insecticides contrnued to be limited. The co-operatives have made good progress in the distribution of agricultural implements and machinery as their distribution accounted Rs. 20.87 crores during 1974-75 as against of Rs. 13.75 crores during 1973-74.

Multiagency approach to the agricultural financing should function with the basic assumption of supplementing the co-operatives. This can be done if the PAC is allowed to work as a sole institution for the distribution of agricultural credit at the village level, and other financing institutions must play a supporting role (Vishwanathan,1979 ; Sharda, 1979).

Sharda (1980) observed that the outstanding loans for agricultural purposes by the PACs were around Rs. 1800 crores. They continue to meet the major portion of the short term loan requirements of the members. Some improvement in the control and supervision systems, measures to improve the recoveries and certain changes in the procedure are urgentely needed for the development of Primary Agricultural Societies.

3.9 Government Policies :

Sinha (1960) stated that the financial allocation of the total out lay, in the first two Five Year plans, on agriculture and allied items of agriculture amounted to 33 and 22 per cent respectively. Achievement and success can be measured in terms of increased productivity. All round increase in agricultural productivity imparted stability in the national economy. Between 1951 and 1959, production of food grains, sugar, cotton, jute, etc. increased rapidly. Area under irrigation increased, the japanese method of cultivation gave suprising results in increasing the per hectare yields. Increased use of chemical fertilizers was made possible. National Extension services and Community Development Project provided the institutional frame works of agricultural development. Improved credit facilities were also provided, whereas Japanese Government has accepted and implemented the crop insurance scheme in better way.

In India also the japanese experience has some significant lessons in regard to the role of crop insurance in the planned development of agriculture. Compulsion subsidization and integration of crop insurance with rural credit which characterize the japanese crop insurance programme are features which could be incorporated in a crop insurance system under Indian conditions (Murthy, 1960).

Regional approach must be adopted for the study of agricultural development, and it should be measured not with the agricultural production and productivity but with the other factors like irrigation, fertilizers, improved seeds, extent of cultivated area, labour etc., and also the assesment of the level of development, each of these physical inputs can reflect broadly the potential level of agricultural development, which may or may not be reflected in the average productivity level (Sharma, 1964), whereas agricultural production is the result of individual planning or decisions taken and efforts put by the individual farmers. An agricultural plan becomes a plan in the true sense of the terms and targets, acquire real meaning, validity and sanction, only in the national goals or broad targets which are concentrated to set a specific programme through village, block and district plans. The State and Central Government must play their respective roles in the agricultural development, as Government has authority to

make decisions and initiate actions in factors, responsible, for agricultural development, with the construction of new irrigation project, by supplying chemical fertilizers, seeds of high yielding varieties, by spreading the extension services, and by adopting suitable policy of credit for agriculture at micro level (Dandekar, 1967).

Narayanan and Patel (1967) revealed that Taiwan's agricultural stratgy was based on (i) agricultural education to farmers (ii) invovations and new techniques competible with the research and (iii) an extension system oriented to obtain voluntary acceptance of developmental programme, further it was seen that during the period of 1900 and 1967, agricultural development in Taiwan has been remarkable due to labour intensive technology. However after 1952, institutional factors like land reforms, farmers association and co-operatives played an important role in agricultural development. The different associations and co-operatives helped farmers in producing fertilizers, insecticides, pesticides and provided technical advise to them. The expansion of education was another important contributory factor. Throughout the agricultural development the role of Government has remained positive and encouraging in all respects. The different improvements were so marked, that the yields of all crops increased substantially and of rice increased from 1998 Kgs in 1952

to 2937 Kgs per hectare in 1964 (Patel, 1967).

Seevers (1968) reported that the imports of food grains were beneficial in India.

Sudan (1968) observed that the Israeli co-operative farm is characterised by a high rate of expansion, the annual rate of growth of the co-operative gross product was 11.5 per cent. The analysis of growth pattern of this enterprise from 1936 to 1960 suggested that 2 per cent of the annual rate of growth of the gross product was attributed to capital, 1.5 per cent to land and labour, 5 per cent to the extended utilization of raw materials, and 3 per cent to technical progress.

In the Punjab state, due to the imposing of land ceiling some loss was seen in agricultural output whereas all the improved practices were generally used by the large farmers (Soni, 1969).

Alagh *et al.* (1971) revealed that the regional planning in the context of Indian planning has to be primarily concerned with evolving an optimum pattern of inter regional allocation of resources consistant with the given diverse regional production potential and demand characteristics, so as to ensure the achievements of a stipulated rate of national growth and at the same time meet the short term potential requirements of inter regional equity, and in Haryana State the absolute and relative gains in farm income

were positively correlated with the size of land holding, level of mechanization and formal education of the farmers (Nandal, 1969).

One of the major result of the Government policy with regard to food grains has been the extension of food grain production to all kinds of lands in all parts of India. Optimal production may be achieved with the appropriate stratgy at every stage of decision making or planning (Pant, 1972).

Singh (1973) pointed out that economic development is the result of interactions between various technological, economical and institutional factors. To increase the total output from an individuals farm, it is necessary to introduce new technology and provide him with sufficient resources at his hand properly.

Area planning is a continuous exercise of formulating the realistic projects, when such projects are integrated in to the country's economic plan, planning assumes the character of continuous struggle of masses to improve their living conditions. Considerable efforts in all respect are necessary to make area planning successful (Joshi, 1973).

For transformation of traditional agriculture in to progressive agriculture, leading to higher productivity and equitable distribution of opportunities for growth, the planning of agricultural services and supplies,

mechanization, use of man power, marketing and distribution will have to be fitted in a better way (Sharma, 1974).

Brahme et al. (1975) stated that regional planning can be used as an instrument for a more direct regulation of the development of different regions, through providing appropriate guide lines, as regional plan includes more specific suggestions about the locational patterns.

The structure of land holdings, in India, is at last showing some definate signs in the direction towards an equal distribution. The share of large farms-6 hectares and above, is declining both in the total number, as well as in the total area. On the other hand, the small farms are adding to their share in number of operational holdings as well as in the total area (Singh,1976), while the land reform measures enacted since, independence have been instrumental in causing great structural changes in ryotwari villages, where, the average size of holding has gone down to 60 per cent during the period (Galgaliker et al.,1976). there fore the policy measures such as land reforms, have to be cast in a more dynamic frame work in agricultural development, but today agricultural productivity is not so positively correlated with the size of the holdings (George and Joseph, 1976).

Thiruvenkatcharl (1976) stated that the APC, must be asked to consider the regional variations in cost of agricultural production, as a policy matter, and Government must specify controlled inputs for agriculture, with the help of essential commodity act.

Singh et al.(1977) observed that the developing countries which are deficit in food are keeping a balance between food production and population growth, should across higher priorities to the programme of agricultural development and at the same time must rationalise their population policies to restrict the growth of numbers.

Singh (1977) conducted the study on the hilly regions of Utter Pradesh and revealed that there is urgent need for an appropriate land use policy to discourage unwise and waste ful land and other related resources and to promote proper land use planning and management.

Acharya et al. (1977) observed that the impact of the IAD pilot project on the economy of small farmers in Tasgaon taluka of Sangli district, was positive and encouraging, as a result of that, the annual net income, savings and investment of the participants had significantly increased due to approach of the scheme for improving land productivity, irrigation potential and generating employment and income of the small farmers.

The cost benefit ratio of the pilot project came to 1 : 2.52 in the year 1969-70.

Gupta et al. (1978) reported that the supply of co-operative credit in progressive regions is increasing dis proportionately, there by widening the inequalities further between agriculturally developed and under developed regions, while an over all planning model should encompass not only the interconnections of different regions of national economy but also the sectoral interconnections of a given region with that of each region (Venkat Ramiah et al., 1979).

There is need for regional strategy to develop and significantly expand the agriculture and food industry of the Atlantic provinces, and more attention should be given on the potential that exists in the agriculture and food industry of the region (Wright,1979), as planning has got an important place in the regional development every where (Dutt, 1980).

MATERIALS AND METHODS

MATERIALS AND METHODS

New agricultural technology in agriculture is more adoptable where the resources are adequate and cultivators are enterprising. The variations in adoption of new agricultural technology has caused the wide gaps in agricultural development in various parts of the country. To examine the extent, reasons and solutions for bridging this gap, it is necessary to adopt sound methodology. In present study adopted methodology is divided in three parts. First part consists of locating the indicators of agricultural development, second part consists of selection of area, time, collection and processing of data for statistical analysis, and third part explains the analytical part.

4.1 Regional Approach :

Natural factors and the availability of resources are not homogenous and uniform everywhere, so the regional variations do occur in the agricultural sector. For minimizing the regional gap, the regional or district planning must be considered, as an effective unit for drawing up an integrated plan and budget for agricultural development however is the district. Different programmes in the field of land improvement, irrigation, input supplies, crop production and development, etc. can be brought together in to a

single plan at this level. It is also at this level that co-ordination of inter-sectiral plans should be effected. Thus while agricultural schemes and programmes can be built up from below wherever necessary and feasible, planning in the real sense should be done at the district level (N.C.A.R.,1976). In the Fourth Five Year Plan, district planning has been accepted, as national goals can be achieved through the village, block or district plans. Dandekar (1967) and Mecrone (1973) also strongly supported the regional planning as the starting point for the planning for Nation or country. Nicholes (1969), Potekar et al.(1974), Bramhe et al.(1975), Gupta et al.(1978), Raheja et al.(1979), Wright(1979) and Waghmare et al.(1979) showed that regional and inter district variations are in existence in agricultural field, and, Gopalkrishna and Rao (1964), Sapre and Deshpande (1964), Alagh et al.(1971), Singh (1973), and Nair (1978) also accepted the regional planning as the best instrument in agricultural development.

4.2 Assement of Agricultural Development :

'Per hectare' gross agricultural income and 'per capita' gross agricultural income are the best criteria for measurement of agricultural development. Bose (1962), Dayal (1963), Techno Economic Report of Maharashtra State (1968), Five Year Plan Report (1968), Mellor (1968), Mecrone (1973), Report of the National Commission on Agriculture (1976),Hutchison et al.(1977)

studied the agricultural development at various locations on the same pattern. Agricultural income is dependent on many factors. Some of the contributory factors for agricultural development are identified and analysed. They are area, production, productivity and irrigated area of the principal crops, area under high yielding varieties of selected cerealcrops, consumption of chemical fertilizers, availability of credit through the primary agricultural societies and the farm harvest prices. Thirumalai (1950), Rao (1962), Shah (1967), Lahiri (1967), Parikh (1967), Nair (1967), Chatterji(1967), Schuh (1968), Narain (1976), Jairaman and Sadasiva (1978) and Singh et al.(1978) identified the selected factors as the contributory factors for the agricultural development. Many research workers studied the agrarian policies in relation with the agricultural development, but in the present study it has been kept aside wisely, as some improvement in the agricultural sector has been seen with the implementation with the agrarian reforms and with the projects like, IADP, IAAP, DPAP, etc.

4.3 Computation of Agricultural Income :

Current prices of the agricultural produce increased over the time period, due to many factors ofinputs. Current prices are inefficient to visualize the correct picture. For obtaining correct idea about the changes in the agricultural income, deflation of current prices

into constant prices is atmost important. Deflation of current prices in to constant prices was performed as,

$$P'_{ij} = \frac{P_{ij}}{Wp_i} \times 100$$

whereas,

P' = constant price,

P = current price,

Wp = wholesale price index,

i = years,

j = crop.

Gross income of various crops was obtained by multiplication of its quantity and constant prices.

$$GI_{ij} = Q_{ij} \times P'_{ij}$$

whereas,

GI = gross income,

Q = quantity,

P' = price (constant),

i = year,

j = crop.

Summation of important crop's gross income was supposed as the gross agricultural income (Bose,1969).

Per hectare and per capita agricultural income was obtained by dividing the gross agricultural income by

cropped area of selected crops and estimated rural population respectively.

For better comparison the time period of 1960-61 to 1977-78 was subdivided in to 3 sub divisions on the basis of adoption of high yielding varieties for the study of per hectare and per capita agricultural income respectively. These sub-divisions are as follows.

1) First period (Pre HYV period) i.e. 1960-61 to 1965-66.
2) Second period (commencement period of HYV) i.e. 1966-67 to 1972-73.
3) Third period (adoption period of HYV) i.e. 1973-74 to 1977-78.
4) Over all period i.e. 1960-61 to 1977-78.

As already said, Agricultural income depends on number of factors. In the following, some of the major factors are listed.

4.4 Indicators of Agricultural Development :

4.4.1 Area :

With the implementation of different land reform measures and increase in the population, the number of land owners has been increased and resulted in declined per capita land holding. Per capita availability of land in India went down from 0.44 hectare in 1921 to 0.42 hectare in 1931, to 0.38 hectare in 1941, to 0.34 hectare in 1951 to 0.30 hectare in 1961 and to 0.29 hectare

in 1971. Supply of land can be increased by two means, viz; (i) bringing waste land under plough and (ii) increasing double cropping area. However, these means have limited use. Area under different crops is directly proportional to the quantum of the land available for cultivation prior to normal climatic conditions. About 50 per cent of the geographical area can be pooled for cultivation purposes.

In Maharashtra State gross cropped area was 61.20 per cent, 63.17 per cent and 64.33 per cent of geographical area in the years 1960, 1970 and 1978 respectively. Due to the increase in the population the pressure on land has been increased to a greater extent in the span of18 years.

On account of variations in the fertility status of the soil, suitable crop mixers are most important. Generally farmers select crop rotations and crop mixers with their own past experience. Crop varieties with less duration, i.e. high yielding varieties made farmers to revise the cropping pattern followed earlier. The selected cropping pattern should be such that, which, ensures not only the higher income, and should help in increasing the soil fertility status. Allotment of this limited cultivable land under various crops is an important problem. Farmers, under Indian conditions, where, the subsistence nature of agriculture still exists, depend upon the family needs, soil fertility

and climatic conditions. Changes in the cropping pattern take place mainly due to the introduction of HYVs, irrigation facilities, availability of credit and fertilizers and remunerative prices of agricultural produce. It is therefore essential to examine the availability and covered area under various crops over a period of time, and find out the important remunerative crops. This further helps to suggest changes in cropping pattern, if necessary, to minimize the developmental gap in different districts or regions.

4.4.2 Production :

In India and especially in Maharashtra State the diversified farming is in existance, since long back mainly due to the changing climate. The production of the different crops is the output of area and average yield of the respective crops. For determination of the gross income the production of the respective crops has got vital important place. More area is being devoted towards the food crops, rather than commercial or cash crops, heve got an importance in the Indian economy. The cultivation of commercial crops require higher degrees of various inputs. Indian farmer being subsistence one, prefers food grain crops and not the commercial crops. The subsistence type of farming results in deficit agricultural economy. In India agriculture remained as the low income occupation. Low production

leads
leads to low marketable surplus, low purchasing power, low incomes, less investment for land improvement and ultimately ends in low agricultural production. New agricultural strategies have been introduced since 1965, till then some concrete efforts were made with all directions for increasing the agricultural production. The production of different crops contribute major share in gross agricultural income, as agricultural production and the agricultural income is correlated with each other. Agricultural income of a particular region is the aggregation of incomes achieved from all the crops grown in the specific region.

In Maharashtra State in different climatic conditions, different crops are grown. In the regions, where, the resources are adequate, the agricultural production is comparatively more than other regions, so there exists the wide gaps in the agricultural sector in the various districts of the state. To examine the production gap, and find out the conclusions, to suggest some remedies, the study of production of important crops is of utmost importance.

4.4.3 Productivity :

The Ford Foundation team has reported the best in Indian agriculture is comparable to the best in other countries, but the average is unduly low in India as compared to others. The task before the country is to

develop the ways of rising the low average productivity. Over the last few years average productivity has been increasing mainly due to the use of hybrids and high yielding varieties of crops, greater application of chemical fertilizers, launching of land improvement programmes, and increased availability of irrigation facility with different sources, followed by the adoption of scientific methods of cultivation etc.

Productivity or average yield of particular crop has got much more variations within the states of India. The average yields of some important crops in Maharashtra State are also possessing the significant differences with other states in India. It is clear from the previous studies and pre anal ysis of the data, that the differences in average yields are existing in various districts of Maharashtra State. New agricultural strategy is mainly based for increasing the agricultural production, through the increased average productivity of various crops. Regional variations in agricultural development are mainly due to the differences in average yields. It is therefore necessary to study the indicator "Productivity" critically. It will be helpful in identifying the causes of developmental gap and some concrete solutions to bridge them.

4.4.4 Irrigation :

Scanty rainfall in large areas and by erratic

mansoon where the partial failure or even delayed arrival of the mansoon can cause extensive damage to crops. Concious efforts are therefore being made contineously to supplement rainfall and to mitigate the grave consequences of a dry spell by supplementing water by artificial means to parched lands. Irrigation implies, maintaining the storage of water in the soil, required for plant growth, at times and places of deficit water supply. Irrigation facility provided help in increasing the land use and changes in cropping pattern in positive directions. However, irrigation facilities are not made available uniformly in different regions due to many factors. This is one of the important factors, which has potential to increase the unequal agricultural development in different regions.

4.4.5 High yielding varieties programme :

High yielding varieties programme was started from the year 1965-66, for achieving an additional yields of the crops especially food grains. The HYVs of all the cereals prooved better. However, these new varieties require higher off farm inputs such as fertilizers and disease and pest control measures. Adoption of such new varieties are more pronounced either in favourable climatic conditions or where the irrigation facilities exist. HYVs prooved to be more profitable than the earlier crop varieties and hence it has got an important place in agricultural development.

4.4.6 Consumption of Chemical Fertilizers :

High yielding varieties of crops and commercial crops require higher doses of plant nutrients such as nitrogen, phosphrus and potash as important one. These are supplied to the plants through chemical fertilizers in easy available form. Comparatively more consumption is observed in HYVs and cash crops, especially in a region where assured moisture supply is made available. Agricultural income increases with adoption of HYVs and by allowing more area towards the best crop combinations. Fertilizer consumption is considered to be one of the most important contributory factors of the agricultural development.

4.4.7 Agricultural Credit :

In subsistence agriculture, farmers do not require more cash for traditional cultivation, but with the adoption of new technology, it is not possible for the majority of the farmers to carry out the cultivation, unless they seek some financial assistance from out side. Number of financing agencies are coming up for agricultural lending. This encourages farmers to adopt improved technology and increase the agricultural production. In Maharashtra State co-operative agency is efficiently working. Almost all the villages are provided with primary agricultural society, seperately or jontly. Major share is contributed by the short term loans. The

study of the Primary Agricultural Societies will be worth while in agricultural development.

4.4.8 Farm Harvest Prices :

It is well known fact, that by and large the farmers attitude towards area allocation is traditional, but the prices regulate the agricultural production and ultimately the agricultural income to some extent. Increasing cost structure has forced farmers to allocate their limited area to the various crops. With the adoption of new agricultural strategy shifts in the area of important crops and changes in the cropping pattern have shown some positive signs. In recent years Indian agriculture is built with the changes in the prices. New agricultural prices are encouraging to the farmers and are responsible for increament in the agricultural income and helps in agricultural development.

4.5 Analytical Methods :

Wide gaps in agricultural development were observed within the states by many economists earlier very few studies have been conducted in the field of agricultural development in Maharashtra State, so, Maharashtra State was selected for the study. All the districts except Greater Bombay were included, as in Greater Bombay very less importance was given towards the agriculture, and almost all the land is being converted towards the non agricultural uses, especially for

industries and for rather than agricultural crops. In the year 1960 the state came in to existance. For examining and evaluating the changes over the base, the time period from 1960-61 to 1977-78 was selected. The published secondary data were collected from the different sources.

Time series is generally affected by various fluctuations which arise due to seasonal, cyclical and irregular variations. Yearly totals or averages do not possess the seasonal effects. The ups and downs of the time series minimize the irregular fluctuations it self. Moving average with properly selected period smooths out cyclical fluctuations from the series. In agriculture generally 3 years cycle is assumed, (Plan report). The three years moving averages were workedout for all the data.

4.6 Measurement of Trend :

Measurement of trend is generally done for two reasons. The first is to study the manner in which the value of a variable behaves in long time. The second reason for measurement of trend is to study the fluctuations in the values of variables.

In agriculture it is an accepted fact, that, the new technology has increased the agricultural production, and the growth in agriculture is supposed to be the vertical one. The increase or decline is either by a constant absolute or constant relative rate.

Straight line arithetic trend is used for a constant absolute amount of change and the geometric straight line was used for constant percentage change. Following equations were fitted.

i) Linear :

$$Y = b_o + b_1 X$$

whereas,

Y = estimated value of dependent variable,

b_o = intercept,

b_1 = slope,

X = independent variable (year).

ii) Semi-Logarithmic :

$$Y = b_o b_1^X$$

whereas,

Y = estimated value of dependent variable,

b_o = intercept,

b_1 = slope,

X = independent variable (year).

when expressed in logarimethic form,

$$\text{Log } Y = \text{Log } b_o + X \text{ Log } b_1$$

Percentage growth rates are calculated as,

$$\text{Linear average rate} = \frac{b_1}{Y} \times 100$$

Compound rate = (Antilog of b_1 - 1) x 100.

The growth rates and slopes were tested with 't' statistic.

For the sake of simplicity the compound growth rates are discussed.

4.7 Analysis of Variance :

The two way analysis of variance technique is used for the categorization of the districts. The districts were classified in to three categories.

1) Developed as compared to state,

2) At par with the state, and

3) less developed as compared with the state.

Classification was done with the help of state average and critical difference, as follows :

State average ± Critical Difference.

4.8 Multiple Regression Analysis :

For estimating the contribution of factors affecting the per hectare Agricultural Income, for that functional analysis was carried out. The following functions were carried out,

i) Linear

ii) Cobb-Douglas.

Results of best fitting equation (i.e.Cobb-Douglas) were presented, whereas best fitting function was reffered in the context ofthe one having comparatively a higher R^2 and a maximum number of significant regression parameters.

The mathemetical forms of the equations were,

Linear :

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$$

and

Cobb-Douglas form :

$$Y = b_0 \; X_1^{b_1} \; X_2^{b_2} \; X_3^{b_3} \; X_4^{b_4} \; X_5^{b_5} \; X_6^{b_6} \; X_7^{b_7}$$

whereas,

Y = Per hectare agricultural income,

X_1 = Gross cropped area,

X_2 = Food grain production,

X_3 = Cotton production,

X_4 = Sugar cane production,

X_5 = Ground nut production,

X_6 = Gross irrigated area,

X_7 = HYVs of cereal crops area,

b_0 = Intercept,

(b_1 .. b_7) = regression parameters.

The significance of the coefficients of Multiple Determination (R^2) was tested with 'F' statistic.

RESULTS

RESULTS

Agricultural development has created wide regional disparities even in developing countries like India, where the resources have not yet been fully utilized. It is generally observed that new technology has increased the per hectare and per capita income in agriculture. Maharashtra State is also not exception to this general observation. In various districts of Maharashtra , Agricultural development differed considerably. In this chapter results of the study are presented.

5.1 Principal crops grown in various districts :

It was not possible to select all the crops grown in the districts for determining the income due to non availability of districtwise time series data with respect oto area, production and prices. Selection of the crops was based on the availability of data, proportion of area covered and economic importance of the crops in the state. In table 4 proportion of area under selected crops to the total cropped area is presented. These proportions were based on the averages of the area during 1960-61 to 1977-78.

The table 4 revealed that the selected crops covered 78.598 per cent of the gross cropped area and 93.12 per cent of the available area for agricultural crops. (Non agricultural) crops covered 6.88 per cent of

gross cropped area. Proportion of total cereals was 59.903 per cent of which 53.820 per cent was covered by the selected cereals. This means 91.320 per cent of the area was covered by the selected cereals in the state. Among the pulses, tur and gram covered 5.102 per cent of the total area. Other pulses grown in the state were mung, horse gram and kulthi. Cotton, sugar cane, ground nut and sesamum covered 20.656 per cent of the total area. The districtwise picture in this regard is described in following paragraphs.

5.1.1 Thane :

The selected crops covered 56.921 per cent of gross cropped area. Rice was the main crop which shared 54.238 per cent of gross cropped area in this district. Non agricultural crops covered 29.83 per cent of gross cropped area.

5.1.2 Raigad :

In this district 68.791 per cent area was covered by the selected crops. Rabi jowar, cotton and ground nut are not grown in this district generally. Largest proportion of area was under rice which accounted to the 67.026 per cent ofthe gross cropped area. Rice crop accounted 10.152 per cent area in the state and secured fourth rank.

Table 4 : Area covered by the principal crops. (1960-61 - 1977-78)

(Figs.in per cent)

Sr. No.	Districts	Rice	Wheat	Kharif jowar	Rabi jowar	Bajra	Total cereals	Gram	Tur	Total pulses	Total food grains	Cotton	Sugar cane	Ground nut	Sesamum
1.	Thane	54.238	0.080	0.175	-	-	67.370	0.628	1.403	5.240	72.610	-	0.035	0.010	0.313
2.	Raigad	67.026	-	0.047	-	-	80.734	0.369	0.595	5.087	85.821	-	-	-	0.643
3.	Ratnagiri	38.598	-	0.027	-	-	61.690	0.027	0.118	3.683	65.373	-	0.100	0.088	1.049
4.	Nasik	3.959	9.695	1.570	5.066	39.020	66.342	2.178	0.651	10.984	77.326	1.109	1.362	6.013	0.093
5.	Dhule	3. 214	6.634	6.938	12.018	20.432	55.041	1.159	1.079	14.858	69.899	9.915	0.636	15.368	0.926
6.	Jalgaon	0.879	4.613	17.270	3.098	10.198	36.375	0.635	1.284	21.135	57.510	25.099	0.281	9.509	0.700
7.	Ahmadnagar	0.693	3.729	0.554	44.903	22.820	74.116	1.456	1.331	7.698	81.814	1.914	3.427	1.697	0.146
8.	Pune	4.519	2.284	2.125	37.002	16.685	64.373	1.694	0.567	6.049	71.422	0.532	1.527	2.473	0.216
9.	Satara	4.114	2.407	10.657	20.602	19.375	60.256	1.883	0.952	9.235	69.491	0.726	1.995	9.576	0.010
10.	Sangli	2.290	2.650	20.289	15.840	18.013	59.981	1.791	2.464	11.041	71.022	0.490	2.627	11.649	0.155
11.	Kolhapur	22.687	0.801	11.805	0.674	0.357	49.618	0.546	1.323	3.987	53.605	0.284	9.727	13.212	0.137
12.	Solapur	0.263	2.550	0.381	61.975	7.394	76.145	2.080	3.688	10.206	86.351	0.811	1.145	4.555	0.313
13.	Aurangabad	0.387	6.181	6.645	24.729	15.214	53.446	2.889	3.754	19.484	72.930	12.900	0.781	3.244	0.407
14.	Parbhani	1.512	5.703	16.369	20.950	0.963	45.396	3.038	4.176	19.140	64.536	23.346	0.277	2.066	0.361
15.	Beed	1.097	5.548	10.865	28.890	13.148	60.974	3.751	2.884	16.338	77.312	5.514	0.319	5.310	0.548
16.	Nanded	3.836	3.682	32.884	6.754	0.271	47.822	2.878	5.108	15.485	63.307	25.612	0.518	4.044	0.872
17.	Osmanabad	2.881	5.355	20.144	18.450	3.041	50.595	4.855	6.897	21.279	71.874	3.596	0.710	10.449	0.630
18.	Buldhana	0.440	5.173	35.635	0.174	1.159	42.709	0.832	3.552	13.881	56.590	33.967	0.205	3.829	0.299
19.	Akola	0.973	6.576	32.331	0.010	0.809	40.846	1.550	4.383	13.127	53.973	40.726	0.055	3.799	0.398
20.	Amravati	1.483	5.409	24.536	-	0.993	33.981	1.107	5.544	9.2900	43.271	49.339	0.014	4.100	0.605
21.	Yavatmal	1.617	2.537	33.872	0.030	1.537	39.668	0.939	5.544	12.066	51.734	42.055	0.076	3.609	1.000
22.	Wardha	1.558	9.190	29.538	0.315	0.294	41.013	1.000	6.161	11.865	52.878	40.202	0.024	1.347	1.832
23.	Nagpur	5.560	13.074	28.747	9.811	0.040	57.029	1.757	6.897	11.530	68.559	14.882	0.020	2.357	3.045
24.	Bhandara	55.595	6.754	0.520	6.928	-	69.199	2.260	1.835	20.223	89.422	-	0.129	0.183	0.133
25.	Chandrapur	32.051	5.527	5.423	24.273	0.032	67.870	1.634	1.572	14.964	82.841	4.817	0.027	0.029	6.318
26.	State	7.231	4.858	13.759	18.224	9.748	58.903	1.978	3.124	13.449	72.352	13.889	1.038	5.013	0.716

5.1.3 Ratnagiri :

Rice crop covered 38.598 per cent of the gross cropped area, and the other crops viz; tur, gram, sugar cane, ground nut and sesamum covered 1.372 per cent area. Area under non agricultural crops was 32.55 per cent.

5.1.4 Nasik :

Bajra was the most important crop in the district. It covered 39.020 per cent of gross cropped area, wheat was next important crop in the category of cereals with 9.695 per cent area. The average area of total cereals was 66.342 per cent of which selected cereals covered 59.310 per cent area. Area under total food grains was 77.254 per cent.

Out of the total area under bajra and wheat in the state 19.22 and 9.738 per cent was in this district, while the proportion of sugar cane and ground nut of this district to the state was 6.393 and 5.708 per cent.

Area covered for the study was 70.696 per cent of the gross cropped area in the district. Mostly kharif crops are grown in the district and occupied 80.790 per cent of gross cropped area. Food crops covered 80.670 per cent of gross cropped area, The average intensity of cropping was 105.050 per cent

5.1.5 Dhule :

The selected crops for the study covered

76.323 per cent of gross cropped area. Bajra occupied the largest area in the district which comes to 20.432 per cent of gross area cropped. Ground nut and rabi jowar were the next important crops with the proportions of 15.368 and 12.018 per cent area. Total cereals covered 55.041 per cent out of which 49.236 per cent area was covered by the selected cereals crops.

Ground nut and bajra crops shared 12.099 and 8.444 per cent area in the state and were ranked second and fifth in the order for area covered. Wheat has shared a considerable area of 5.127 per cent in the total area of wheat in the state.

Kharif and rabi crops were grown in the proportion of 0.82 : 0.18. Area under total food crops and non food crops was 71.780 and 28.220 per cent of gross cropped area. The average intensity of cropping was 110.296 per cent.

5.1.6 Jalgaon :

The selected crops covered an area of 73.376 per cent of gross cropped area. Non agricultural (Plantation) crops occupied 4.57 per cent of gross cropped area. Cotton was one of the most important crops in the district and occupied 25.099 per cent of gross cropped area. Kharif jowar and bajra were the other important crops with 17.270 and 10.198 per cent share in gross cropped area.

Out of the total area under cotton and ground nut in the state this district has got the proportions of

8.511 and 8.516 per cent and secured sixth and third rank. Rice and kharif jowar had contributed a small share in the state area.

Food and non food crops were grown in the proportion of 0.62 : 0.38, kharif crops occupied 92.110 per cent of gross cropped area. The average intensity of cropping was 107.153 per cent.

5.1.7 Ahmadnagar :

Rabi jowar covered the largest area (44.903 per cent) followed by bajra (22.820 per cent). The selected crops coverage was 82.770 per cent of gross cropped area. The non agricultural crops covered 6.29 per cent of gross cropped area.

Total cereals covered 74.116 per cent out of which the selected cereals occupied 72.699 per cent area. Sugar cane acquired 3.427 per cent of gross cropped area but it's share in the state was 22.918 per cent and was first in ranking. Rabi jowar and bajra secured second rank in the state area with 17.209 and 16.845 per cent area.

In this district rabi crops dominated the cropping pattern and covered 56.310 per cent of gross cropped area. The food and non food crops were grown in the proportion of 0.82 : 0.18. The average intensity was 105.429 per cent.

5.1.8 Pune :

Out of the gross cropped area, 63.624 per cent was

covered by the selected crops, kharif crops acquired 54.271 per cent. The proportion of food and non food crops was 0.75 : 0.25. The intensity of cropping was 108.595 per cent.

Rabi jowar and bajra shared the greater shares of 37.002 and 16.685 per cent in gross cropped area. Rice covered 4.519 per cent area. The share of rabi jowar, bajra and sugar cane was 11.607, 9.825 and 8.306 per cent in the state area for the same crops.

5.1.9 Satara :

Proportions of rabi jowar, bajra, kharif jowar and ground nut were 20.002, 19.375, 10.657 and 9.576 per cent in gross cropped area respectively, and the selected crops occupied 71.755 per cent in the gross cropped area.

The area of ground nut and sugar cane of this district possessed 6.921 and 6.674 per cent in the state area for the respective crops and were ranked fifth and sixth in the order. The proportion of kharif and rabi crops was 0.72 : 0.28 and the proportion of food and non food crops was nearly in same proportion. The average intensity of cropping was 108.610 per cent.

5.1.10 Sangli :

The selected crops for the percent study covered an area 68.258 per cent of gross cropped area and 12.42 per cent was covered by the non agricultural crops.

Area under cereals under study was 59.981 per cent, out of which the shares of kharif jowar, bajra and rabi jowar was 20.289, 18.013 and 15.840 per cent of gross cropped respectively. Ground nut covered an area of 11.649 per cent.

Sugar cane and ground nut possessed third and fourth rank in the state area of the same crops and contributed 8.695 and 8.046 per cent area. The shares of kharif jowar, rabi jowar and bajra were 5.088 and 2.983 and 6.532 per cent respectively.

Kharif crops were grown on 77.964 per cent of the gross cropped area and the proportion of food and non food crops was 0.75 : 0.25. The average intensity of cropping was 103.682 per cent.

5.1.11 Kolhapur :

Non agricultural crops occupied 24.12 per cent in gross cropped area and 75.88 per cent area was available for the cultivation of agricultural crops, out of gross cropped area 61.553 per cent was covered by the selected crops. Rice was the main area sharing crop and accounted to 22.687 per cent of gross cropped area, ground nut , kharif jowar and sugar cane were the other important crops, and their shares were 13.212, 11.805 and 9.727 per cent respectively.

Sugar cane and ground nut secured second and seventh rank in total area of the same crops in the state, and recorded 20.868 and 5.906 per cent area.

The average intensity of cropping was 104.303 per cent. The proportion of food and non food crops was 0.64 : 0.36 kharif crops covered 96.847 per cent area and only 3.153 per cent was under rabi crops.

5.1.12 Solapur :

In this district area under selected crops was 85.155 per cent of cross cropped area. Rabi crops were grown on large area and they covered 70.460 per cent of gross cropped area. The main rabi crop was the rabi jowar and was grown on 61.975 per cent of gross cropped area. The next important crops in the district were bajra and ground nut which accounted for 7.394 and 4.515 per cent of gross cropped area.

Rabi jowar, sugar cane and ground nut secured the first, fifth and sixth ranks for the area in the state. The individual contribution of these crops to the area was 21.810, 6.834 and 5.931 per cent in the state.

The proportion of food and non food crops was 0.87 : 0.13. The average intensity of cropping was 102.116 per cent.

5.1.13 Aurangabad :

Rabi jowar, bajra and cotton were the major crops, and contributed to 24.729, 15.214 and 12.901 per cent in the gross cropped area of the district, and 9.594, 11.304 and 6.694 per cent area of the same crops in the state,

the first two crops were fourth and third in ranking. The district contributed 8.948 per cent area of wheat in the total area of wheat in the state.

The selected crops of the study contributed 76.132 per cent area. The proportion of kharif and rabi crops was 0.47 : 0.53. Total food and non food crops occupied 73.786 and 26.214 per cent of gross cropped area. The average intensity of cropping was 105.696 per cent.

5.1.14 Parbhani :

Area under selected crops was 77.061 per cent of the gross cropped area while 1.11 per cent of gross cropped area was under the non agricultural crops. The average intensity of cropping was 108.530 per cent. In kharif season 63.189 and in rabi season 36.811 per cent area was brought under different crops. The food and non food crops hold the proportion of 0.65 : 0.35.

The largest proportion of the gross cropped area was under cotton crop with the share of 23.346 per cent. Rabi jowar and kharif jowar followed it with an area of 20.950 and 16.369 per cent of gross cropped area. Gram and tur comined together shared 7.214 per cent area.

Cotton and wheat got the fifth rank for their area in the state and their individual share was 9.084 and 6.208 per cent respectively. The contribution of area under kharif and rabi jowar to area under these crops in the state was 6.384 and 6.179 per cent respectively.

5.1.15 Beed :

The average intensity of cropping was 105.708 per cent. Kharif crops covered 58.419 per cent of gross cropped area. The food crops and non food crops were grown in the proportion of 0.78 : 0.22.

The selected crops of the study occupied 77.964 per cent of gross cropped area. The non agricultural crops covered 1.55 per cent area. The total cereals were grown on 60.974 per cent area and the selected cereals 59.548 per cent of gross cropped area. Rabi jowar was the major crop covering 28.890 per cent area. Bajra and kharif jowar contributed 13.148 and 10.865 per cent of gross cropped area in the district.

Rabi jowar secured fifth rank for its area in the state with the contribution of 6.584 per cent.

5.1.16 Nanded :

In this district 86.459 per cent of gross cropped area was covered by the selected crops for the study. The proportion of food crops and non food crops was 6.67 : 0.33. In this district kharif jowar occupied the largest area of 32.884 per cent, cotton was the succeding crop which covered 25.612 per cent of gross cropped area. Total cereals covered 47.822 per cent area, and selected cereals covered 86.459 per cent of gross cropped area. Gram and tur occupied 50 per cent of area under pulse crops.

Nanded district ranked fourth and seventh in area ranking of kharif jowar and cotton, which covered 9.422 and 7.280 per cent of total area of the respectively crops in the state. The average intensity of cropping was 103.429 per cent.

5.1.17 Osmanabad :

Jowar was the dominating crop in the district. Kharif jowar and rabi jowar covered 20.144 and 18.450 per cent of gross cropped area respectively. The selected crops covered 77.008 per cent of gross cropped area.

The district achieved the first, fourth and fifth ranks for area of ground nut, wheat and kharif jowar respectively. Their respective contributions in the total area in the state were 12.681, 6.650 and 8.744 per cent respectively.

Food crops were grown on 74.331 per cent and non food crops were grown on 25.669 per cent of gross cropped area. Kharif crops covered 64. 521 per cent area. The intensity of cropping was 104.944 per cent.

5.1.18 Buldhana :

The selected crops covered 81.265 per cent of the gross cropped area. The food crops and the non food crops were in the proportion of 0.56 : 0.44. Kharif crops were mainly grown, which covered 91.530 per cent of gross cropped area.

The main area contributing crops were kharif jowar and cotton, which occupied 36.365 and 33.967 per cent of gross area cropped. The other important crops were wheat and ground nut. kharif jowar and cotton were second and fourth in ranking for their areas in the state, and contributed 9.935 and 9.475 per cent area in the state. The average intensity of cropping was 103.584 per cent.

5.1.19 Akola :

Cotton and kharif jowar were the main crops and covered 40.726 and 32.331 per cent of gross cropped area. The selected crops covered 90.556 per cent of gross cropped area. Tur, wheat and ground nut crops covered 4.383, 6.576 and 3.799 per cent of gross cropped area.

Kharif jowar and cotton secured third rank for their area in the state, their contributions were 9.759 and 12.727 per cent respectively. The food crops and non food crops covered 52.750 and 47.250 per cent of gross cropped area. The average intensity of cropping for the period was 101.162 per cent.

5.1.20 Amravati :

The selected crops covered 84.962 per cent of gross cropped area. Kharif crops occupied 92.995 per cent of gross cropped area. Highest share of gross cropped area was under cotton i.e. 49.339 per cent while kharif jowar contributed 24.536 per cent of gross cropped area. Gram and tur combined together occupied 6.651 per cent of

gross area cropped. Food and non food crops were grown in the proportion of 0.44 : 0.56.

Cotton crop has got the first rank for the area in the state, and contributed 13.538 per cent area. The average intensity of cropping was 100.947 per cent.

5.1.21 Yavatmal :

Cotton and kharif jowar covered large area of 42.055 and 33.872 per cent of gross cropped area. The selected crops covered 92.805 per cent and kharif crops occupied 95.554 per cent of gross cropped area. Food grains occupied 51.734 per cent area the intensity of cropping was 100.933 per cent. Kharif jowar and cotton occupied 10.473 and 13.043 per cent of their area in the state and were ranked first and second in order of merit.

5.1.22 Wardha :

The selected crops covered 91.200 per cent of gross cropped area. Kharif crops covered 85.334 per cent while food crops covered 54.287 per cent of gross cropped area. The average intensity of cropping was 101.442 per cent. Cotton,kharif jowar, wheat and tur contributed 40.022, 29.538, 9.090 and 6.161 per cent of gross cropped area.

5.1.23 Nagpur :

Kharif jowar, cotton, wheat, rabi jowar and tur were major crops and occupied 28.747, 14.882, 13.074,

9.811 and 6.897 per cent of gross cropped area. The selected crops covered 86.190 and kharif crops occupied 66.113 per cent of gross cropped area. Food crops and non food crops were grown in the proportion of 0.75 : 0.25.

In respect of area under wheat this district ranked third in the state and had 7.849 per cent area in the state. The average intensity of cropping was 101.817 per cent.

5:1.24 Bhandara :

The selected crops contributed 74.337 per cent of gross cropped area. The major contribution was made by the rice crop, which contributed 55.595 per cent area.

Rice contributed 20.106 per cent of the total area in the state. Kharif crops occupied 58.761 per cent area. The intensity of cropping was 130.609 per cent.

5:1.25 Chandrapur :

Rice and rabi jowar contributed 32:051 and 24.273 per cent and sesamum covered 6:318 per cent of gross cropped area: Selected crops covered 81:604 per cent of gross cropped area.

Rice secured second position for its area in the state. The food crops and non food crops were grown in the proportion of 0:85 : 0.15: The average intensity of cropping was 108.170 per cent.

5.2 Variations in the area, production and productivity of principal crops :

In this section coefficient of variations along with the means of different crops in various district of Maharashtra State are presented in table 5,6 and 7. Coefficient of variation indicates percentage fluctuations from the mean which leads to conclude in agriculture the extent of risk in the crop production process. The knowledge of percentage variations and mean would indicate the importance of crop along with the element of risk, which would lead to effect measures to minimize the variations aspecially in production and productivity. On following paragraphs mean for the area, production and productivity along with percentage variations are presented for various districts.

5.2.1 Thane, Raigad and Ratnagiri :

The average productivity of rice was 1536.175 Kgs per hectare in Thane district, it was followed by Raigad (1468.525 kgs) and Ratnagiri (1183.781 Kgs) districts. The coefficient of variations were much lower, wherein Thane they were 12.996 per cent followed by Ratnagiri (12.638 per cent) and Raigad (8.208 per cent). From the results it was observed that area under rice in these districts was much stable than the production. In case of total cereals as well as total food grains the fluctuations were comparatively lower than the other districts.

Table 5 : Average cropped area and coefficient of variation of principal crops. (1960-61 to 1972-73) (Figs.Av.area in '00' hectares)

Sr. No.	Districts	Rice		Wheat		Kharif jowar		Rabi jowar		Bajra		Total cereals	
		Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV
1.	Thane	1463.175	6.258	1.1.912	192.311	4.150	20.891	0.362	127.724	-	-	1819.043	2.748
2.	Raigad	1372.412	2.330	0.337	175.667	2.656	213.893	-	-	-	-	1632.068	3.156
3.	Ratnagiri	1365.893	4.758	-	-	-	-	-	-	-	-	2231.000	1.693
4.	Nasik	364.031	5.328	884.575	11.467	147.987	35.722	456.418	37.392	3630.818	7.385	6146.168	6.758
5.	Dhule	236.175	15.776	465.762	32.738	526.587	10.509	848.268	21.344	1539.012	8.216	4077.612	2.944
6.	Jalgaon	97.025	94.729	394.718	27.567	1461.118	10.833	256.037	19.688	896.325	18.921	3092.756	12.980
7.	Ahmadnagar	84.031	18.900	483.575	26.850	62.143	158.663	5863.956	6.905	3069.975	17.341	9661.943	2.429
8.	Pune	483.400	6.659	236.731	26.007	217.068	28.983	3954.993	4.373	1790.581	4.195	6889.231	4.894
9.	Satara	270.100	8.746	156.575	16.442	696.212	16.093	1427.506	11.828	1325.762	14.396	4045.856	3.260
10.	Sangli	148.012	6.092	164.000	38.461	1308.950	14.857	1016.525	11.641	1190.431	15.569	3886.743	6.246
11.	Kolhapur	946.536	7.170	30.843	66.839	462.831	8.854	27.950	38.119	14.600	19.181	2029.131	4.323
12.	Solapur	74.343	29.756	300.225	40.826	40.000	88.991	7431.787	6.175	911.856	19.814	8943.462	6.469
13.	Aurangabad	55.518	20.437	812.756	9.679	860.293	17.982	3209.381	5.314	2060.237	14.150	7087.706	4.170
14.	Parbhani	146.700	22.670	563.943	11.626	1642.362	6.921	2105.568	5.130	102.875	64.042	4546.287	6.018
15.	Beed	84.112	20.911	429.662	13.230	826.500	17.835	2243.581	5.679	1056.756	21.132	4649.818	8.622
16.	Nanded	280.725	12.572	267.175	19.420	2424.100	3.852	479.737	19.441	19.956	18.247	3491.893	4.179
17.	Osmanabad	323.325	8.613	604.081	6.752	2257.275	9.374	2059.175	8.799	261. 737	25.049	5802.118	7.143
18.	Buldhana	31.281	10.993	363.175	17 .036	2555.900	7.050	12.531	27.141	85.762	37.822	3037.462	7.761
19.	Akola	83.200	6.283	524.262	11.923	2510.737	5.553	0.743	104.375	65.850	22.970	3213.062	6.085
20.	Amravati	104.962	22.840	377.318	9.573	1753.643	6.297	0.206	194.317	70.556	20.489	2384.900	5.958
21.	Yavatmal	128.000	11.790	197.218	23.663	2694.325	3.284	2.181	112.137	124.712	17.168	3153.481	4.244
22.	Wardha	91.243	100.956	386.806	9.643	1269.756	4.646	12.606	45.454	12.712	19.668	1753.337	3.750
23.	Nagpur	310.181	20.070	712.987	8.839	1593.868	2.842	545.012	6.432	2.243	15.942	3153.937	3.082
24.	Bhandara	2718.168	3.925	338.143	6.927	25.406	27.401	350.106	4.071	-	-	3477.856	3.198
25.	Chandrapur	2256.318	4.570	386.325	5.968	385.712	15.650	1709.187	15.650	1.943	109.844	4777.493	4.792
26.	State	13518.866	1.739	9083.104	11.652	28729.579	5.127	34073.816	4.169	18234.699	8.203	104984.363	3.135

Table 5 : (Continued) :

Sr. No.	Districts	Gram		Tur		Total pulses		Total food grains		Cotton		Sugar cane	
		Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV
1.	Thane	12.793	19.409	37.231	8.662	137.575	9.283	1956.618	3.812	-	-	0.850	41.411
2.	Raigad	4.762	28.391	9.662	22.924	100.356	14.670	1732.434	3.598	-	-	-	-
3.	Ratnagiri	0.650	59.538	4.537	10.820	127.487	17.051	2358.457	3.081	-	-	3.012	34.257
4.	Nasik	220.012	10.030	60.118	11.595	1017.612	6.604	7163.780	6.205	105.625	48.960	124.100	23.340
5.	Dhule	84.275	15.613	79.387	12.066	1098.600	13.841	5176.212	3.871	748.941	15.279	45.225	64.771
6.	Jalgaon	53.643	40.383	110.412	4.444	2000.612	8.417	5053.368	10.584	2210.256	19.830	21.756	75.303
7.	Ahmadnagar	200.568	15.306	173.750	23.436	1014.556	17.753	10676.49	3.650	244.756	65.977	444.843	20.638
8.	Pune	191.731	21.935	60.581	12.666	644.368	9.867	7533.599	5.371	57.968	23.372	161.231	18.500
9.	Satara	126.612	19.790	63.406	10.529	519.481	9.393	4665.337	3.475	49.200	21.470	129.550	21.032
10.	Sangli	110.893	23.299	159.356	28.623	712.175	9.668	4598.918	5.965	31.825	35.851	168.775	26.259
11.	Kolhapur	21.031	35.616	54.375	14.784	163.381	13.043	2192.512	8.526	11.343	41.798	405.062	21.381
12.	Solapur	248.412	21.297	458.312	18.952	1255.406	18.991	10198.868	5.755	99.575	30.050	132.656	20.116
13.	Aurangabad	371.325	13.055	497.387	11.343	2564.481	7.790	9652.187	4.873	1738.443	19.473	100.487	19.685
14.	Parbhani	300.568	9.496	423.975	9.736	1932.856	10.364	6479.143	6.334	2358.887	9.564	26.975	24.089
15.	Beed	294.268	15.415	225.556	23.140	1290.150	11.335	5939.968	13.602	431.737	40.444	24.3310	47.627
16.	Nanded	214.693	8.666	374.981	11.045	1154.318	12.109	4646.211	4.037	1890.525	4.156	37.0310	32.282
17.	Osmanabad	553.018	8.911	779.818	12.173	2408.237	11.425	8210.355	24.868	398.4750	29.407	78.2370	37.462
18.	Buldhana	56.725	30.786	253.400	7.512	1008.575	13.089	4046.037	8.000	2480.400	7.488	14.843	10.531
19.	Akola	121.743	15.206	355.381	7.644	1062.575	13.152	4275.637	7.730	3305.087	2.172	4.656	24.284
20.	Amravati	74.087	23.276	392.943	3.753	656.600	6.641	3014.500	5.944	3515.562	2.850	1.375	31.365
21.	Yavatmal	73.687	22.274	444.406	4.016	964.056	5.098	4117.537	4.201	3387.025	5.225	5.781	48.540
22.	Wardha	42.100	15.501	263.806	10.881	510.331	7.769	2263.674	9.454	1743.543	5.047	1.000	--
23.	Nagpur	94.925	16.964	381.700	10.284	634.612	8.125	3788.549	3.277	834.375	7.411	1.093	13.130
24.	Bhandara	113.650	8.347	101.012	52.550	1016.962	4.343	4494.818	2.755	--	--	6.268	22.315
25.	Chandrapur	114.162	15.768	113.112	9.457	1049.893	4.764	5827.386	17.896	343.662	17.513	1.862	41.118
26.	State	3701.333	9.668	5878.604	6.343	25145.255	7.414	130102.604	3.659	25967.194	6.620	1940.999	24.086

Table 5 : (Continued) :

Sr. No.	Districts	Ground nut		Sesamum		Net cropped area		Double cropped area		Gross cropped area		Av.intensity of cropping
		Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV	Av.area	CV	
1.	Thane	0.925	35.135	-	-	2794.807	8.691	68.138	33.492	2862.945	9.767	102.406
2.	Raigad	-	-	13.800	13.347	2078.015	6.348	131.407	13.828	2209.422	6.062	106.170
3.	Ratnagiri	3.662	35.358	40.146	37.430	3535.553	1.391	108.100	16.981	3643.653	1.579	103.053
4.	Nasik	535.068	23.358	6.946	45.306	8773.000	5.842	442.661	15.631	9215.661	5.885	105.050
5.	Dhule	1134.087	11.325	62.792	22.085	6691.846	0.779	689.392	16.459	7381.238	1.821	110.296
6.	Jalgaon	798.262	25.325	52.638	23.350	7941.323	1.211	565.446	27.148	8506.769	1.275	107.153
7.	Ahmadnagar	213.825	39.567	17.230	20.040	12288.300	2.570	677.384	11.622	12965.684	2.862	105.429
8.	Pune	261.612	12.327	23.2920	28.044	9796.607	4.771	846.784	17.450	10643.391	3.175	108.595
9.	Satara	688.756	4.032	0.584	61.216	6385.230	10.630	536.884	11.498	6922.114	9.784	108.610
10.	Sangli	754.156	23.757	10.861	48.433	6207.992	6.521	234.730	15.649	6442.722	6.105	103.682
11.	Kolhapur	553.612	5.739	7.107	89.843	4052.792	1.059	78.076	21.748	4130.868	1.249	104.303
12.	Solapur	556.000	46.329	36.838	15.682	11401.053	7.397	501.038	12.759	11902.091	7.268	102.116
13.	Aurangabad	421.550	39.019	54.376	31.375	12554.553	5.289	714.938	7.389	13269.491	5.231	105.696
14.	Parbhani	193.800	47.886	33.046	26.403	9041.661	2.133	772.261	12.145	9813.922	2.672	108.530
15.	Beed	454,906	45.299	40.861	26.932	7290.423	5.579	407.969	18.175	7698.392	6.019	105.708
16.	Nanded	301.425	9.676	63.030	37.088	7095.930	2.572	241.223	14.476	7337.153	2.712	103.429
17.	Osmanabad	1188.656	22.472	67.115	9.984	10505.292	2.265	505.107	34.002	11010.399	2.493	104.944
18.	Buldhana	267.718	21.313	19.630	17.559	6830.653	1.397	201.176	37.259	7031.829	2.665	103.584
19.	Akola	298.925	11.664	30.646	12.723	7645.961	7.007	99.553	44.093	7745.514	7.452	101.162
20.	Amravati	289.618	17.042	39.023	14.966	6962.538	1.776	69.584	84.003	7032.122	10.562	100.947
21.	Yavatmal	289.143	24.515	77.476	7.650	7862.153	4.099	77.753	26.081	7939.906	4.271	100.933
22.	Wardha	60.400	53.284	76.553	24.779	4179.530	2.900	62.230	32.550	4242.160	2.994	101.442
23.	Nagpur	135.368	24.220	146.889	38.637	5386.492	1.858	103.853	27.352	5490.345	2.313	101.817
24.	Bhandara	9.481	42.090	5.969	25.766	3732.338	9.613	1175.161	8.347	4907.499	2.428	130.609
25.	Chandrapur	1.981	46.487	412.476	18.336	6452.361	2.533	487.507	11.584	6939.868	2.768	108.170
26.	State	9372.936	13.362	1339.304	11.751	177486.403	2.157	9798.355	6.139	187284.758	1.930	105.353

5.2.2 Nasik :

Cotton, sesamum, rabi jowar and kharif jowar showed considerable fluctuations in the area. They were 48.960, 37.392 and 35.722 per cent respectively. Rice area had least fluctuations (5.328 per cent), followed by bajra (7.385 per cent). As regards the production of kharif jowar showed the highest fluction of the crops i.e. 119.393 per cent, as initial production of the crop in the district was very meagre. Highest fluctuations were in cotton (52.867 per cent) and rabi jowar (44.849 per cent) production, and were lowest in bajra (18.432 per cent). Highest and lowest fluctuations in productivity were in gram (10.415 per cent) and kharif jowar (72,625 per cent). Fluctuations in the productivity of total cereals; total pulses and other crops were around 20 per cent.

5.2.3 Dhule :

Sugar cane showed the highest variations(64.771 per cent) and was followed by wheat 32.738 per cent for their respective area. Least fluctuations were seen in the area of bajra (8.216 per cent), and for remaining crops they were not more than 21 per cent. In the case of area of total cereals, and total food grains these were of only 2.944 and 3.871 per cent respectively. Sugar cane and kharif jowar production registered the wide fluctuations in the order of 77.356 and 68.642 per cent respectively. Least variations were observed in

bajra (17.798 per cent), For remaining crops they were in the range of 22 to 45 per cent.

In the case of productivity least fluctuations were seen in tur (15.072 per cent) followed by ground nut (16.442 per cent). Kharif jowar productivity has shown the variations of 44.832 per cent. For remaining crops they were around 20 per cent.

3.2.4 Jalgaon :

In the case of area rice has got very much fluctuations of 94.729 per cent, and was followed by sugar cane (75.303 per cent). Tur area has got the least fluctuations (4.444 per cent). The area of kharif jowar, total cereals, total pulses and total food grains did not respound for much variations.

Sugar cane exhibited highest production fluctuations (84.698 per cent), followed by rice (84.698 per cent). Least fluctuations in production were observed in tur production (19.456 per cent). For remaining crops they were above 30 per cent.

In the case of productivity highest and lowest variations were exhibited by rice (42.014 per cent) and rabi jowar (15.021 per cent) respectively. All the remaining crops had shown the variations round above 20 per cent where in kharif jowar, they were in the order of 30.867 per cent.

5.2.5 Ahmadnagar :

Kharif jowar and rabi jowar showed the highest and lowest variations in their respective area, they were 158.663 and 6.905 per cent respectively. Area of sugar cane has got the fluctuations of 20.638 per cent and for cotton they were 65.997 per cent. Total cereals and total food grains did not shown variations more than 4 per cent.

In the case of production, kharif jowar has shown very much variations (201.943 per cent). Sugar cane production possessed the variations in the order of 18.476 per cent. Wheat production also recorded considerable variations (70.851 per cent). The production of total cereals, pulses and food grains were more than 20 per cent. Least fluctuations in the productivity were seen in sugar cane (18.079 per cent), followed by bajra (20.867 per cent). Wheat and kharif jowar productivity exhibited considerable variations of 45.154 and 43.642 per cent respectively.

5.2.6 Pune :

Least fluctuations in area were observed in bajra, rabi jowar and rice, they were 4.195, 4.373 and 6.659 per cent respectively. In the case of area of kharif jowar highest fluctuations were seen, they were 28.983 per cent. In the case of area of total cereals, total pulses and total food grains variations were of lower

degree viz; 4.894, 9.867 and 5.371 per cent respectively.

In the production of kharif jowar and bajra wide and small variations were noticed, they were 86.374 and 6.982 per cent respectively. Wheat production also got the considerable variations in the order of 74.202 per cent. Rice and sesamum production achieved the vatiations about 40 per cent and remaining crops about 20 per cent.

Kharif jowar registered the maximum fluctuations of 63.461 per cent followed by wheat (44.802 per cent) and rice (40.386 per cent) for their respectively productivity. Least variations in the productivity were, noticed in bajra (5.962 per cent). For remaining all the crops the variations in the productivity were not more than 25 per cent.

5.2.7 Satara :

In the area of all the crops except sesamum, variations were of moderate size and they were not more than 25 per cent. Least fluctuations, were observed in ground nut (4.032 per cent), and was followed by bajra (4.195 per cent) rabi jowar (4.373 per cent) and rice (8.746 per cent) respectively. The area of total cereals and total food grains shown very less fluctuation of 3.260 and 3.475 per cent wherein total pulses 4.393 per cent respectively. The variations in the production were in the range of 17.742 to 37.734 per cent in bajra and

Table 6 : Average production and coefficient of variation of principal crops (Figs.Av.production in '00' tonnes)

Sr. No.	Districts	Rice		Wheat		Kharif jowar		Rabi jowar		Bajra		Total cereals		Gram	
		Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV
1.	Thane	2205.943	12.286	2.137	205.726	1.981	76.173	-	-	-	-	2440.768	11.940	3.684	31.400
2.	Raigad	2006.100	9.183	-	-	-	-	-	-	-	-	2263.231	8.882	1.537	46.833
3.	Ratnagiri	1646.787	17.744	-	-	-	-	-	-	-	-	2114.468	16.012	-	-
4.	Nasik	350.818	30.456	483.850	38.171	109.012	119.593	148.362	44.849	1247.656	18.432	2811.075	23.043	69.731	20.620
5.	Dhule	110.106	28.672	346.900	30.453	299.243	68.642	492.131	33.630	678.031	17.798	2105.818	22.763	33.056	24.683
6.	Jalgaon	58.831	84.698	339.112	43.772	1371.818	37.250	165.237	30.366	328.200	37.104	2283.831	31.110	23.762	54.018
7.	Ahmadnagar	84.543	46.495	319.400	70.851	87.487	201.943	2066.975	23.995	788.818	22.600	3362.968	23.864	67.375	20.387
8.	Pune	522.056	40.966	187.950	74.202	167.612	86.374	1252.637	26.025	619.137	6.982	2927.962	27.079	62.975	30.792
9.	Satara	271.631	30.136	119.150	36.843	576.918	37.734	706.462	20.569	368.525	17.743	2132.112	18.122	43.350	25.581
10.	Sangli	156.756	42.985	109.825	62.338	1277.215	27.907	259.262	25.447	175.825	19.009	2081.356	24.684	40.087	38.110
11.	Kolhapur	1184.961	25.257	27.856	103.003	593.881	23.933	11.512	59.566	2.112	32.607	2141.150	23.518	8.568	42.057
12.	Solapur	62.550	52.056	226.387	57.996	40.525	155.451	2606.618	24.695	131.125	35.866	3174.968	19.973	73.568	24.675
13.	Aurangabad	29.218	50.691	388.525	56.109	475.400	55.297	1466.156	27.775	549.087	29.164	2897.618	26.320	107.150	21.637
14.	Parbhani	81.625	58.471	249.131	37.820	797.812	34.964	963.662	24.407	27.362	62.791	2180.043	33.424	82.387	18.015
15.	Beed	43.487	50.717	167.112	29.860	434.162	58.766	1130.681	26.159	325.468	41.929	2131.556	26.001	95.081	14.725
16.	Nanded	169.200	55.752	140.306	68.889	1379.118	27.703	246.750	37.180	5.050	25.818	1930.987	29.180	59.731	22.657
17.	Osmanabad	164.150	34.726	283.481	54.028	1214.156	34.116	1135.850	28.919	69.050	31.965	2900.906	28.710	167.793	19.923
18.	Buldhana	20.562	34.580	193.543	42.941	1631.625	32.975	5.937	38.454	22.437	53.253	1880.362	33.271	116.568	41.136
19.	Akola	39.175	34.826	258.525	45.968	1444.800	26.386	0.643	94.057	16.831	39.768	1765.487	27.762	34.956	29.425
20.	Amravati	47.300	34.993	207.131	47.875	1030.737	30.654	0.225	176.663	17.912	39.197	1326.581	32.603	25.087	42.745
21.	Yavatmal	59.387	34.151	111.750	72.366	1494.543	21.996	0.768	145.063	31.550	30.670	1703.475	24.946	22.550	36.354
22.	Wardha	47.800	57.279	177.506	51.530	688.512	24.651	4.718	59.080	3.137	29.324	917.593	27.723	12.193	30.378
23.	Nagpur	257.487	38.849	353.062	32.160	721.635	36.914	213.193	22.786	0.831	56.377	1567.893	24.448	31.755	25.272
24.	Bhandara	2556.975	21.973	140.431	31.272	11.893	26.659	120.643	18.488	-	-	2859.256	20.556	45.443	9.124
25.	Chandrapur	2134.367	24.090	182.193	22.397	198.150	21.686	697.625	17.850	0.412	102.422	3233.031	17.690	42.887	11.937
26.	State	14311.815	20.441	5015.263	44.901	16008.185	29.970	13696.110	23.603	5408.556	17.100	57073.895	21.183	1173.474	19.959

Table 6 : (Continued) :

Sr. No.	Districts	Tur		Total pulses		Total food grains		Cotton		Sugar cane		Ground nut		Sesamum	
		Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV	Av.prod.	CV
1.	Thane	10.637	14.855	38.516	11.821	2479.284	10.815	--	--	3.668	89.186	0.332	90.635	1.166	14.85
2.	Raigad	2.9430	28.743	29.837	15.027	2293.068	25.731	--	--	--	--	--	--	--	--
3.	Ratnagiri	1.468	23.151	34.306	15.772	2148.775	15.386	--	--	21.934	52.963	3.788	42.554	9.389	52.357
4.	Nasik	38.068	21.081	391.862	24.009	3202.937	22.873	17.550	52.867	1083.262	40.193	376.800	30.778	1.207	43.875
5.	Dhule	50.762	24.689	329.818	26.238	2435.636	22.730	83.862	27.071	387.156	77.356	712.393	23.346	14.892	30.541
6.	Jalgaon	68.350	19.456	707.675	22.314	2990.906	28.780	223.531	29.562	168.231	91.947	471.331	39.611	13.776	31.147
7.	Ahmadnagar	96.031	34.605	265.943	25.896	3628.911	23.805	35.993	37.962	3715.450	18.476	134.543	35.769	4.000	24.600
8.	Pune	31.875	27.364	195.425	24.779	3123.387	26.989	14.843	16.837	1153.100	19.422	228.475	17.040	5.615	35.287
9.	Satara	42.462	20.527	233.925	18.849	2366.037	17.938	12.840	21.049	866.131	35.065	644.550	18.505	0.666	30.257
10.	Sangli	111.481	17.378	314.531	21.612	2335.887	23.736	5.562	45.041	1130.593	34.005	507.425	28.772	3.376	55.547
11.	Kolhapur	37.362	25.551	82.443	25.101	2223.593	23.283	1 .218	23.169	3393.881	25.319	545.800	11.202	1.200	108.279
12.	Solapur	171.618	48.770	364.943	23.923	3539.911	19.614	20.283	16.999	1029.462	28.282	328.312	47.903	7.730	14.799
13.	Aurangabad	133.137	22.870	633.368	19.660	3530.986	25.715	55.500	64.821	601.200	31.898	162.537	44.710	8.015	32.488
14.	Parbhani	199.787	18.250	599.487	19.606	2779.530	26.335	80.546	80.149	152.612	25.158	107.581	52.285	6.438	24.992
15.	Beed	55.350	50.497	295.668	25.448	2427.224	25.652	12.120	59.167	156.506	52.881	303.768	58.742	10.500	34.490
16.	Nanded	161.600	25.017	338.006	23.519	2298.993	27.352	64.762	75.935	288.937	45.140	157.431	23.045	6.676	40.578
17.	Osmanabad	258.218	18.195	649.900	23.753	3550.806	27.371	9.352	57.840	483.512	47.972	668.625	35.806	15.246	23.080
18.	Buldhana	164.718	22.641	316.937	25.970	2197.299	31.828	190.138	14.814	83.712	37.632	119.531	30.464	3.869	19.003
19.	Akola	213.400	27.332	361.656	23.135	2127.143	26.299	224.173	10.608	27.112	45.085	151.381	21.782	6.669	15.694
20.	Amravati	317.975	21.521	389.475	20.716	1716.056	27.303	288.603	16.209	8.625	56.656	183.775	32.009	8.323	19.503
21.	Yavatmal	387.750	13.833	484.806	12.944	2188.281	20.155	262.558	9.924	35.725	76.109	168.375	29.418	14.515	10.649
22.	Wardha	258.625	17.632	300.643	16.673	1218.236	20.132	113.212	17.602	4.906	44.502	33.825	64.884	16.707	22.835
23.	Nagpur	190.862	25.816	259.450	24.260	1827.343	20.676	64.4660	11.575	5.718	42.108	71.268	24.776	30.946	30.101
24.	Bhandara	35.250	22.174	284.743	15.380	3144.636	19.177	--	--	33.693	38.806	4.950	70.747	1.715	41.416
25.	Chandrapur	58.618	25.398	287.987	8.926	3521.018	16.414	23.430	23.570	10.687	28.472	0.968	85.182	83.553	15.261
26.	State	3098.347	14.078	8221.350	17.522	65295.245	19.681	1804.722	11.816	14741.813	27.971	6087.694	19.673	275.523	18.603

kharif jowar respectively. Ground nut and wheat production followed with 18.505 and 36.843 per cent respectively. The variations for all the remaining crops were about 20 perccent.

In the case of productivity of various crops least fluctuation were observed in bajra (8.345 per cent) and for remaining crops they were not exceeding than 25 per cent.

5.2.8 Sangli :

Seasmum, wheat and cotton registered the considerable variations in case of area, they were 48.433, 38.461 and 35.851 per cent respectively, where as area of tur showed the minimum variations of 5.928 per cent, followed by rice (6.092 per cent). The area fluctuation in the area of total cereals, pulses and food grains were less than 10 per cent.

In the case of production wheat, sesamum and cotton showed considerable variations of 62.338, 55.547 and 45.041 per cent respectively, shereas tur and bajra production has got the low variations in the order of 17.378 and 19.009 per cent respectively. Tur and bajra productivity showed the smaller variations of about 12 per cent, wherein rice showed maximum variations of 37.228 per cent. For the remaining crops they are within the range of 20 per cent.

5.2.9 Kolhapur :

The area of ground nut, rice and kharif jowar showed the variations of 5.739, 7.170 and 8.854 per cent respectively. They were highest in sesamum (89.843 per cent) followed by kharif jowar (66.839 per cent) and cotton (41.798 per cent) respectively. Area of total cereals and total pulses has shown small variations, they were less than 10 per cent. The area of sugar cane has shown the variations in the order of 21.381 per cent.

Sesamum and wheat production showed very wide fluctuations, they were more than 100 per cent. Least variations were seen in the production of ground nut (11.202 per cent). Sugar cane production has shown 25 per cent variations. Rice, kharif jowar, bajra, tur and cotton production registered about 30 per cent variations.

In the case of productivity sugar cane and ground nut has got the least variations of 6.954 and 9.731 per cent. Highest fluctuations were seen in rabi jowar (37.130 per cent), Rice, wheat and cotton productivity has got the variations greater than 25 per cent and for other crops lesser than 20 per cent respectively.

5.2.10 Solapur :

Least fluctuations in the area were observed in rabi jowar (6.175 per cent) followed by sesamum (15.682 per cent). Highest variations were seen in

kharif jowar (88.991 per cent) area followed by ground nut (46.329 per cent). Wheat and cotton area showed the variations in the order of 40 and 30 per cent. In the case of area of total cereals and total food grains variations were of lower degree viz; 6.469 and 5.755 per cent respectively.

In the productions, kharif jowar registered wide fluctuations, they were 155.451 per cent, least fluctuations were in the production of sesamum and cotton observed, and they were 14.799 and 16.999 per cent respectively. Rabi jowar has shown 27.775 per cent variations in production.

Gram, wheat, sugar cane and ground nut registered less than 20 per cent variations in the productivity. Rice, wheat and tur productivity possessed the variations in the order of 50.002, 52.575 and 60.233 per cent respectively.

5.2.11 Aurangabad :

Rabi jowar and wheat area has got the least variations in the order of 5.314 and 9.679 per cent, followed by tur (11.343 per cent). Maximum fluctuations in the area were observed in ground nut i.e. 39 per cent, followed by sesamum (31.00 per cent). In All the remaining crops they were about 20 per cent.

In the case of production, tur and gram showed about 22 per cent variations. Cotton, wheat, rice and

kharif jowar production fluctuated considerably, and the fluctuations were greater than 50 per cent. Rabi jowar and bajra production showed 27.775 and 29.164 per cent variations.

For productivity of gram, bajra and sugar cane the variations were lesser than 20 per cent, cotton productivity has shown 96 per cent variations, wheat and kharif jowar productivity showed, the fluctuations in the order of 49.803 and 41.780 per cent respectively.

5.2.12 Parbhani :

Area of rabi jowar, kharif jowar, gram, cotton and tur has got the fluctuations less than 10 per cent, they were 5.130, 6.921, 9.496, 9.564 and 9.736 per cent respectively. Considerable wide fluctuations in the area of bajra and ground nut were observed viz; 64.042 and 47.886 per cent respectively. Area of total cereals and total food grains did not fluctuated more.

In the case of production gram and tur reported the minimum variations of 18.015 and 18.520 per cent respectively, wherein they were highest in cotton (80.149 per cent). Rice, bajra and ground nut production registered the variations of above 50 per cent whereas they were in the range of 24 to 37 per cent for all the remaining crops.

Productivity of tur, sugar cane, gram and ground nut received the variations in the order of

Table 7 : Average yield and coefficient of variation of principal crops. (Figs.Av.yields in 'Kgs'per hectare)

Sr. No.	Districts	Rice		Wheat		Kharif jowar		Rabi jowar		Bajra		Total cereals		Tur	
		Av.yield	CV	Av.yield	CV	Av.yield	CV	Av.yield	CV	Av.yield	CV	Av.yield	CV	Av.yield	CV
1.	Thane	1536.175	12.996	--	--	541.250	85.308	--	--	--	--	1344.137	12.628	285.000	13.378
2.	Raigad	1468.525	8.208	--	--	--	--	--	--	--	--	1364,068	7.434	304.8370	13.637
3.	Ratnagiri	1183.781	12.638	--	--	--	--	--	--	--	--	958.618	14.472	339.668	17.813
4.	Nasik	959.581	28.061	525.987	26.755	605.306	72.625	331.331	34.605	339.712	16.528	450.600	19.620	546.418	17.605
5.	Dhule	470.681	23.229	787.368	19.446	538.468	44.832	570.768	18.622	445.600	19.531	516.093	21.451	642.375	15.072
6.	Jalgaon	339.987	42.014	848.412	19.733	936.250	30.867	639.062	15.021	364.581	21.583	737.381	22.567	641.218	19.600
7.	Ahmadnagar	963.050	37.146	601.131	43.154	967.962	43.642.	358.193	23.772	258.800	20.867	348.000	22.308	546.575	23.123
8.	Pune	1076.656	40.386	718.868	44.802	743.243	63.461	315.625	22.240	345.462	5.962	416.862	21.593	527.025	19.275
9.	Satara	982.356	23.411	753.462	22.178	818.362	23.028	505.556	21.986	273.056	8.345	524.800	17.311	674.037	15.109
10.	Sangli	1033.025	37.228	630.681	21.273	941.837	18.456	266.475	24.565	212.487	118.509	512.293	22.462	685.250	11.386
11.	Kolhapur	1260.975	28.698	758.962	28.472	1189.475	18.707	402.925	37.310	153.012	16.914	1241.487	6.976	705.437	18.901
12.	Solapur	824. 950	50.002	655.018	19.026	726.550	52.572	343.425	22.169	139.362	24.046	348.393	18.992	332.025	60.233
13.	Aurangabad	521.431	39.401	467.056	49.803	508.506	41.780	442.737	28.284	258.262	19.990	399.956	27.235	266.706	22.807
14.	Parbhani	589.450	48.517	456.593	35.899	483.512	29.407	463.218	24.385	260.112	20.271	461.325	27.223	466.418	12.118
15.	Beed	497.837	35.321	406.156	29.060	502.081	34.939	505.187	26.200	284.800	24.166	461.593	23.590	232.537	31.996
16.	Nanded	592.650	41.745	479.425	37.252.	578.700	27.131	506.875	23.981	254.137	20.075	554.006	26.290	428.400	18.978
17.	Osmanabad	551.181	35.694	454.662	47.598	558.281	23.848	545.550	23.035	260.637	20.115	506.387	25.118	333.581	13.918
18.	Buldhana	665.331	32.163	524.956	29.689	641.175	25.457	485.287	30.005	252.925	23.414	628.681	28.039	650.031	22.805
19.	Akola	469.793	28.511	476.793	32.224	568.743	21.482	159.543	93.062	251.381	23.210	544.506	21.362	601.056	27.174
20.	Amravati	451.725	17.765	538.775	33.594	586.956	25.965	39.012	205.820	248.662	24.211	546.668	24.886	823.088	23.946
21.	Yavatmal	454.137	21.145	516.456	43.650	550.731	18.810	124.318	99.222	251.650	23.528	535.200	19.874	876.437	17.025
22.	Wardha	683.906	31.870	448.562	43.100	537.275	21.475	395.756	19.938	252.937	23.030	530.593	21.439	1007.825	15.589
23.	Nagpur	819.306	23.824	488.468	26.055	476.506	26.475	375.062	23.063	352.200	67.284	493.862	21.280	490.506	18.242
24.	Bhandara	937.625	19.542	408.262	23.319	482.393	29.159	345.337	17.868	37.293	139.988	818.743	18.434	436.787	10.861
25.	Chandrapur	940.3810	19.440	466.925	17.697	501.237	9.408	410.531	17.382	182.081	71.576	475.656	13.660	536.850	29.105
26.	State	1065.800	18.908	534.106	30.122	613.993	23.307	398.031	21.546	291.468	13.773	200.512	10.066	523.125	13.616

Table 7 : (Continued) :

Sr. No.	Districts	Sugar cane		Cotton		Total pulses		Ground nut		Sesamum		Total food grains	
		Av.yield	CV	Av.yield	CV	Av.yield	CV	Av.yield	CV	Av.yield	CV	Av.yield	CV
1.	Thane	---	---	---	---	---	---	---	---	179.800	79.180		
2.	Raigad	---	---	---	---	---	---	---	---	192.066	67.094		
3.	Ratnagiri	6533.131	28.801	---	---	911.558	22.078	---	---	256.066	19.799		
4.	Nasik	8970.231	23.487	165.934	21.547	675.012	20.385	237.800	39.465				
5.	Dhule	6997.068	27.124	113.621	29.128	621.893	16.442	238.933	27.677				
6.	Jalgaon	7195.981	20.690	100.268	20.197	582.025	19.725	278.666	10.8065				
7.	Ahmadnagar	10295.756	18.079	176.080	36.699	639.262	25.031	249.400	33.435				
8.	Pune	8874.675	22.113	259.226	20.518	872.256	15.205	252.533	30.217				
9.	Satara	7686.018	24.202	263.163	18.396	1000.250	16.524	400.066	126.737				
10.	Sangli	8043.681	17.000	169.954	18.918	769.143	15.590	358.066	59.740				
11.	Kolhapur	8372.768	6.954	129.808	29.995	988.125	9.731	199.866	140.474				
12.	Solapur	8535.887	14.729	221.163	22.666	592.206	17.539	237.200	37.275				
13.	Aurangabad	5984.281	11.420	40.621	96.294	382.387	20.268	145.866	25.391				
14.	Parbhani	5850.206	13.871	37.121	86.076	567.325	18.595	204.933	26.432				
15.	Beed	6466.543	15.624	35.706	90.880	590.100	28.566	270.733	25.991				
16.	Nanded	5994.081	18.355	35.350	77.786	533.425	22.163	143.600	25.803				
17.	Osmanabad	6024.312	26.079	29.518	86.678	551.475	19.451	231.666	29.385				
18.	Buldhana	5558.231	32.190	75.060	15.254	461.737	24.956	208.133	31.890				
19.	Akola	5499.287	34.365	67.788	11.784	509.718	22.595	223.600	42.226				
20.	Amravati	5803.562	34.386	84.643	15.375	642.218	22.907	214.133	17.545				
21.	Yavatmal	5497.965	33.451	78.955	98.886	586.675	12.930	193.066	21.027				
22.	Wardha	4973.718	42.273	64.891	15.299	539.718	19.635	221.333	15.850				
23.	Nagpur	5392.993	46.045	29.850	13.641	564.562	23.014	220.866	24.554				
24.	Bhandara	5542.918	29.608	---	---	483.656	33.475	291.400	44.427				
25.	Chandrapur	6098.831	21.567	68.330	19.915	379.625	74.597	188.200	16.898				
26.	State	8993.875	8.046	78.325	10.526	639.625	18.253	211.530	20.525				

Sr. No.	Districts	Gram		Total pulses		Total food grains	
		Av.yield	CV	Av.yield	CV	Av.yield	CV
1.	Thane	259.581	30.422	286.150	12.442	1320.143	12.471
2.	Raigad	323.837	24.575	334.081	18.069	1303.437	7.811
3.	Ratnagiri	---	---	269.581	8.921	920.225	14.938
4.	Nasik	342.106	10.415	371.750	14.364	439.768	18.602
5.	Dhule	396.756	17.061	293.375	13.815	467.468	19.725
6.	Jalgaon	417.231	18.208	360.675	18.807	575.406	25.313
7.	Ahmadnagar	481.868	22.599	264.706	14.588	351.700	28.721
8.	Pune	334.218	17.314	292.137	15.863	408.162	23.001
9.	Satara	312.743	21.505	360.950	24.140	507.150	15.590
10.	Sangli	339.931	20.269	432.568	14.462	680.312	30.105
11.	Kolhapur	404.093	11.130	516.968	14.046	1013.062	21.541
12.	Solapur	300.500	11.111	292.662	26.125	338.762	18.616
13.	Aurangabad	280.468	14.302	261.193	21.064	360.243	24.824
14.	Parbhani	274.056	14.885	311.893	13.681	421.212	22.727
15.	Beed	324.018	18.575	232.075	20.764	397.193	23.126
16.	Nanded	305.537	32.295	322.987	18.294	493.156	25.100
17.	Osmanabad	302.237	17.041	266.493	16.928	436.568	23.190
18.	Buldhana	261.687	13.078	314.625	19.023	533.862	23.846
19.	Akola	280.225	20.543	343.312	19.352	495.125	19.373
20.	Amravati	309.531	27.334	596.093	22.331	572.062	22.110
21.	Yavatmal	298.262	15.406	505.500	14.314	536.850	14.337
22.	Wardha	266.262	22.930	592.531	14.333	450.337	31.507
23.	Nagpur	335.525	18.525	490.443	22.768	479.112	18.548
24.	Bhandara	449.600	46.967	280.662	11.999	693.418	17.386
25.	Chandrapur	383.831	5.537	274.393	5.851	599.012	13.154
26.	State	314.125	10.653	330.251	15.219	499.700	17.575

12.118, 13.871, 14.885 and 18.595 per cent respectively. Highest variations were noticed in case of cotton productivity (86.076 per cent), followed rice (48.517 per cent). The productivity of total cereals and total food grains fluctuated by about 25 per cent.

5.2.13 Beed :

Least variations for the area were observed in rabi jowar (5.679 per cent) followed by wheat (13.230 per cent). Sugar cane and ground nut area showed wide cariations in the order of 47.627 and 45.299 per cent respectively, cotton followed with 40 per cent variations. For all the remaining crops they were about 20 per cent.

Gram production exhibited the least variations of 14.725 per cent. Fluctuations of more than 50 per cent were observed in the productions of rice, kharif jowar, tur, cotton, sugar cane and ground nut.

In the case of productivity least fluctuations were seen in sugar cane (15.625 per cent) and gram (18.575 per cent). Very much wide variations were achieved for cotton productivity (90.880 per cent). Remaining crops possessed the fluctuations round about 30 per cent for their respective productivity.

5.2.14 Nanded :

Kharif jowar and cotton area showed the least variations of 3.852 and 4.156 per cent respectively, and was followed by ground nut (9.676 per cent) and gram

(8.662 per cent) respectively. Highest fluctuations of 37.088 per cent were observed in sesamum and sugar cane followed it with 37.412 per cent variations for respective area.

Considerable variations in the order of 75.935, 68.889 and 52.752 per cent were observed in the production of cotton, wheat and rice respectively. Gram production exhibited the lowest variations (22.657 per cent) ground nut (23.045 per cent) followed it. The production of total cereals and total food grains fluctuated in the order of 30 per cent.

In the case of productivity; sugar cane and tur possessed the smaller fluctuations of 18.355 and 18.978 per cent, bajra (20.075 per cent) followed the order. Cotton has shown the highest fluctuations in the order of 77.786 per cent and it was followed by rice (41.475 per cent) and wheat (37.352 per cent) respectively.

5.2.15 Osmanabad :

Rice, wheat, kharif jowar, rabi jowar, gram and sesamum showed the smaller fluctuations in the area, they were 8.613, 6.752, 9.374, 8.799, 8.911 and 9.984 per cent respectively. Highest fluctuations of 37.412 per cent were reported in the area of sugar cane, cotton followed it with 29.407 per cent.

Tur and gram production has got the lowest fluctuations in the district, they were 18.195 and

19.923 per cent respectively. Wide variations in the order of 57.840 and 54.028 per cent were reported in the productions of cotton and wheat respectively. Ground nut and rabi jowar production possessed 35.806 and 28.919 per cent fluctuations respectively.

Productivity of tur, gram and ground nut showed the fluctuations of lesser than 20 per cent, they were 13.918, 17.041 and 19.451 per cent respectively. Cotton productivity has got wide fluctuations of 86.678 per cent, and wheat (47.598 per cent) followed it.

5.2.16 Buldhana :

The area of kharif jowar, cotton, sugar cane and rice showed small fluctuations, they were 7.050, 7.488, 10.531 and 10.993 per cent respectively. Highest variations were reported in area of bajra (37.822 per cent) and was followed by gram (30.786 per cent). The area of total cereals and total food grains possessed about 8 per cent fluctuations whereas in total pulses these were of 13 per cent during the time period.

Least fluctuations in the production were observed in cotton (14.384 per cent), it was followed by sesamum (19.003 per cent). In all the remaining crops except tur the variations were more than 30 per cent. Highest fluctuations were noticed in bajra (53.253 per cent) followed by wheat (42.941 per cent).

In case of productivity least variations were registered by gram and cotton crops, viz; 13.078 and 15.254 per cent respectively. Highest fluctuations were seen in sugar cane (32.190 per cent) followed by rice (32.163 per cent). Productivity of kharif jowar has got the fluctuations in the order of 25.457 per cent.

5.2.17 Akola :

Rabi jowar area has got very much fluctuations (104.375 per cent). For all the remaining crops they were not exceeding than 25 per cent. Cotton, kharif jowar, rice and tur area possessed very small fluctuations, they were 2.172, 5.553, 6.283 and 7.644 per cent respectively. Area of total cereals and total food grains fluctuated by 6.085 and 7.730 per cent respectively.

Cotton and rabi jowar production registered minimum and maximum variations of 10.608 and 94.057 per cent respectively. Sugar cane and wheat productions showed about 45 per cent variations whereas kharif jowar, gram, tur, ground nut and sesamum production showed the variations of less than 30 per cent.

As observed in production, cotton and rabi jowar showed minimum and maximum fluctuations in productivity viz; 11.784 and 93.062 per cent respectively. For all the remaining crops they were in the range of 20 to 35 per cent.

5.2.18 Amravati :

Cotton, tur, kharif jowar and wheat showed comparatively smaller fluctuations in area, they were 2.850, 3.753, 6.297 and 9.573 per cent respectively. Highest fluctuations were observed in the area of rabi jowar (104.375 per cent) sugar cane (31.365 per cent) followed it. Area of total cereals, total pulses and total food grains fluctuated by about 6 per cent.

Cotton, sesamum and tur production showed minimum variations, they were 16.209, 19.504 and 21.521 per cent respectively. Rabi jowar has got the highest fluctuations of 176.663 per cent, sugar cane and wheat followed with 56.656 and 47.875 per cent. Kharif jowar production registered 30 per cent variations.

In the case of productivity minimum fluctuations were observed in cotton (15.375 per cent) and rice (17.765 per cent). Rabi jowar showed very wide (205.820 per cent) fluctuations , sugar cane and wheat followed it with about 34 per cent variations in productivity.

5.2.19 Yavatmal :

Least variations in the order of 2.850, 3.284, 4.016 and 6.650 per cent were observed in the area of cotton, kharif jowar, tur and sesamum. Rabi jowar possessed the highest variations (112.137 per cent) sugar cane and ground nut followed it with 48.540 and 24.515 per cent variations. Area of total cereals, pulses and food grains fluctuated by about 5 per cent.

Rabi jowar production explained very wide (145.063 per cent) variations, which was followed by sugar cane (76.109 per cent) cotton, sesamum and tur production has shown about 10 per cent fluctuations. Wheat production achieved 72.366 per cent variations. Kharif jowar, total cereals and total food grains possessed about 20 per cent variations.

Rabi jowar and wheat productivity achieved the maximum fluctuations, they were 99.222 and 43.560 per cent. Cotton showed least variations (8.886 per cent). For remaining they were about 20 per cent and in sugar cane they were 33 per cent.

5.2.20 Wardha :

Kharif jowar, cotton, wheat and tur showed the least fluctuations in their respective area, they were 4.646, 5.047, 9.043 and 10.881 per cent respectively. Rice has got the maximum variations (10.956 per cent), ground nut (53.284 per cent) followed it. Fluctuations of smaller than 10 per cent were reported for the area of total cereals and food grains.

Cotton and tur production has got minimum variations viz; 17.602 and 17.632 per cent respectively. In the case of production of rice, wheat, rabi jowar, and ground nut considerable variations were observed and they were more than 50 per cent. Production of total cereals, pulses and food grains registered the variations in the degree of

27.723, 15.115 and 20.132 per cent respectively.

Cotton, tur, and ground nut showed minimum variations in productivity, they were 15.299, 15.589 and 19.835 per cent respectively. Sugar cane and wheat showed the maximum variations of 47.273 and 43.100 per cent. Total pulses registered 14.314 per cent variations in productivity.

5.2.21 Nagpur :

Kharif jowar, rabi jowar, cotton and wheat area possessed the smaller fluctuation of 2.842, 6.432, 7.411 and 8.839 per cent respectively. Maximum variations were observed in sesamum (38.637 per cent) and ground nut followed it (24.220 per cent). About 3 per cent variations were observed in the area of total cereals and total food grains.

Highest and lowest fluctuations in production were seen in bajra (56.377 per cent) and cotton (11.577 per cent) Rice, wheat, kharif jowar, sugar cane and sesamum production fluctuated by more than 30 per cent during the time period. All the remaining crop had about 20 per cent variations.

In the case of productivity, smaller fluctuations were observed in cotton, tur and gram, they were 13.641, 18.242 and 18.541 per cent. Highest fluctuations were reported in bajra (67.284 per cent). For remaining crops

these were in the range of 20.30 per cent, for sugar cane the value of variation was 46.045 per cent.

5.2.22 Bhandara :

Rice, wheat, rabi jowar, gram, total cereals, pulses and food grains showed the minimum fluctuations in area, they were lesser than 10 per cent. Tur, ground nut and sesamum area has got considerable variations of 52.550, 42.090 and 25.766 per cent respectively.

Ground nut and gram production showed highest and lowest fluctuations viz; 70.747 and 9.124 per cent. Rice production has got the variations of 21.793 per cent. Total cereals, pulses and food grains production registered about 20 per cent variations.

Tur and ground nut productivity showed minimum and maximum fluctuations of 10 and 33 per cent. For all the remaining crops they were in the range of 17 to 30 per cent.

5.2.23 Chandrapur :

Least area fluctuations of 4.095, 4.570, 5.968 and 9.407 per cent were observed in rabi jowar, rice, wheat and tur. Highest fluctuations were observed in bajra (109.844 per cent), ground nut followed it (46.487 per cent).

Bajra and ground nut production showed the wide variations in the order of 102.422 and 85.182 per cent. For all the remaining crops these were about 20 per cent.

Gram and kharif jowar productivity registered minimum variations of 5.537 and 9.408 per cent. For bajra and ground nut these were 71.570 and 74.597 per cent respectively. Rice showed about 20 per cent variations. Total cereals and total food grain production has got 13 per cent variations.

5.2.24 State :

Almost all the cereal crops were stable. The variations in area were smaller in amount. Rice and wheat, possessed minimum (2.739 per cent) and maximum (11.652 per cent) area variations, in the category of cereal crops. Gram and tur also possessed the area variations less than 10 per cent. Sugar cane has got moderate area variations (24.086 per cent), while cotton area fluctuated with only 6.620 per cent. Ground nut and sesamum possessed 13.362 and 11.751 per cent area variations.

For almost all the crops moderate production fluctuations were noticed. Wheat recorded highest production fluctuations among all the crops, which were 44.901 per cent. Kharif jowar and rabi jowar production fluctuated with 29.970 and 23.603 per cent respectively. Cotton has got least variations in production (11.816 per cent), whereas these were of 27.971, 19.673 and 18.063 per cent in the production of sugar cane, ground nut and seaamum respectively.

Highest variations in productivity were registered in wheat crop (30.122 per cent), kharif jowar and rabi jowar followed it with 23.307 and 21.546 per cent respectively. Tur and gram possessed of about 10 per cent variations in productivity. In case of cotton, sugar cane and ground nut these were 10.526, 8.046 and 13.253 per cent respectively.

5.3 Income contribution of principal crops :

5.3.1 Agricultural income has been contributed mainly from the crop activities. In this section an attempt has been made to examine the contribution of each selected crops to the agricultural income in various districts of Maharashtra State. These proportions have been worked for three periods, so as to examine the direction of development in each district, and are presented in table 8.

5.3.1 Thane :

Major crop of this district was rice. Out of the ten selected crops 98.323 per cent income was contributed by rice. However this proportion declined to some extent over a period of time. This slight decline was merely due to the contribution of some income by the crops of jowar, sugar cane and gram.

5.3.2 Raigad :

In this district also rice was the main crop. Its share declined by 2.040 per cent in third period as

Table 8 : Contribution of principal crops in gross agricultural income

(Figs.in per cent)

Sr. No.	Districts	Rice				Wheat				Jowar				Bajra			
		Ist Period	IInd period	IIIrd period	overall period	Ist period	IInd period	IIIrd period	overall period	Ist period	IInd period	IIIrd period	overall period	Ist period	IInd period	IIIrd period	overall period
1.	Thane	99.108	99.036	96.983	99.323	--	--	0.593	0.164	0.033	0.075	0.262	0.113	--	--	--	--
2.	Raigad	99.662	99.408	97.622	98.996	--	--	0.120	0.033	--	--	1.355	0.375	--	--	--	--
3.	Ratnagiri	96.931	96.045	96.193	96.381	--	--	0.051	0.015	--	--	0.429	0.119	--	--	--	--
4.	Nasik	8.517	5.671	9.037	7.554	11.835	11.726	14.201	12.449	5.259	2.840	7.004	4.803	31.665	28.166	16.484	26.087
5.	Dhule	3.024	2.450	2.582	2.678	8.458	11.658	10.218	10.191	18.361	10.861	17.378	15.171	15.615	16.696	13.661	15.492
6.	Jalgaon	0.686	1.338	2.706	1.467	5.338	11.251	9.398	8.765	25.444	18.418	31.395	24.364	4.213	8.241	7.332	6.643
7.	Ahmadnagar	1.421	0.706	1.546	1.177	2.693	3.865	7.276	4.421	20.272	17.692	23.991	20.301	7.533	8.839	8.712	5.274
8.	Pune	10.206	7.356	11.227	9.381	2.624	3.974	6.119	4.120	29.343	20.835	26.756	25.315	14.436	13.882	26.741	17.638
9.	Satara	5.147	5.637	1.493	4.322	2.772	2.460	3.262	2.786	24.926	22.124	25.607	24.025	7.961	7.340	3.971	6.611
10.	Sangli	15.310	3.143	4.045	7.449	1.981	2.090	5.194	2.916	33.936	21.396	31.971	28.515	3.502	2.683	2.971	3.036
11.	Kolhapur	18.982	10.814	18.251	15.603	00.295	0.228	1.091	0.490	11.904	8.504	9.090	9.800	0.045	0.023	0.018	0.028
12.	Solapur	1.133	0.760	1.762	1.180	3.221	4.495	8.345	5.139	48.606	36.460	44.661	42.807	1.941	2.816	1.905	2.271
13.	Aurangabad	0.960	0.426	0.905	0.751	10.134	8.237	11.720	9.837	43.626	26.302	38.457	35.453	10.240	16.093	6.588	11.501
14.	Parbhani	2.538	1.669	3.217	2.388	9.835	8.951	9.084	9.283	54.847	40.289	40.065	45.079	0.308	0.893	0.681	0.639
15.	Beed	1.734	1.543	1.805	1.679	6.443	7.456	6.912	6.977	46.942	40.113	53.640	46.146	6.721	14.875	9.233	10.580
16.	Nanded	6.883	3.509	6.603	5.493	5.435	4.282	6.819	5.371	52.140	39.427	40.805	44.047	0.509	00.163	0.106	0.262
17.	Osmanabad	3.046	1.720	3.317	2.605	5.663	4.781	9.285	6.236	41.754	29.557	41.977	37.072	0.865	1.318	0.986	1.075
18.	Buldhana	2.237	0.815	0.883	1.307	6.706	5.040	7.667	5.991	31.225	37.229	46.559	37.819	0.389	0.573	0.746	0.559
19.	Akola	0.874	1.249	1.397	1.165	6.339	8.493	9.560	8.071	36.866	30.678	32.477	33.240	0.332	0.436	0.460	0.408
20.	Amravati	0.718	1.763	1.545	1.354	4.954	6.475	7.600	6.280	15.522	21.042	27.770	21.070	0.316	0.414	0.525	0.412
21.	Yavatmal	1.337	1.815	1.696	1.622	2.580	2.276	4.913	3.110	23.502	28.113	29.485	26.957	0.548	0.654	0.687	0.627
22.	Wardha	1.303	2.576	2.829	2.222	9.654	8.915	12.932	10.277	2.868	25.059	26.198	17.978	0.245	0.132	0.099	0.160
23.	Nagpur	4.296	8.284	11.601	7.876	18.275	17.002	17.707	17.622	28.404	25.480	33.925	28.000	0.050	0.028	0.030	0.036
24.	Bhandara	80.743	74.492	82.357	80.705	6.338	6.072	7.243	6.097	5.662	4.891	3.504	4.762	--	--	--	--
25.	Chandrapur	54.701	56.173	57.573	59.960	7.883	6.059	7.509	7.069	20.090	18.579	21.148	19.796	0.482	0.002	0.171	0.302
26.	State	20.836	19.569	20.527	20.550	5.754	5.826	7.414	6.148	24.862	21.052	27.039	25.136	4.317	4.970	4.167	4.248

Table 8 : (Continued) :

Sr. No.	Districts	Tur				Grem				Cotton			
		Ist period	IInd period	IIIrd period	overall period	Ist period	IInd period	IIIrd period	overall period	Ist period	IInd period	IIIrd period	overall period
1.	Thane	0.489	0.500	0.775	0.573	0.255	0.239	0.397	0.288	--	--	--	--
2.	Raigad	0.180	0.131	0.276	0.187	0.123	0.089	0.198	0.130	--	--	--	--
3.	Ratnagiri	0.094	0.096	0.092	0.094	--	--	--	--	--	--	--	--
4.	Nasik	0.771	0.919	1.028	0.899	2.100	1.762	1.692	1.855	5.018	2.950	1.150	3.236
5.	Dhule	1.210	1.269	1.552	1.327	1.015	1.066	1.013	1.034	16.383	15.436	13.700	15.269
6.	Jalgaon	1.397	1.954	1.663	1.687	0.297	0.702	0.883	0.617	43.620	37.489	20.797	34.896
7.	Ahmadnagar	2.826	2.101	1.566	2.194	1.102	1.114	0.862	1.040	7.279	2.705	0.097	3.671
8.	Pune	1.661	1.066	1.004	1.247	3.147	1.654	1.269	2.044	6.295	2.659	0.896	3.379
9.	Satara	2.168	1.617	1.619	1.801	1.272	1.023	0.945	1.085	1.539	2.485	1.013	1.760
10.	Sangli	4.343	4.179	4.566	4.341	1.231	0.848	1.254	1.088	1.395	0.703	0.560	0.894
11.	Kolhapur	1.658	0.853	1.195	1.216	0.194	0.123	0.231	0.177	0.202	0.103	0.809	0.940
12.	Solapur	8.410	7.440	3.673	6.716	1.498	1.843	2.148	1.812	3.816	3.503	0.754	2.483
13.	Aurangabad	5.335	8.379	6.887	6.949	3.577	3.104	2.664	3.139	4.912	7.792	9.489	7.303
14.	Parbhani	10.140	13.710	0.983	11.443	3.589	3.476	2.215	3.163	6.322	18.712	26.720	16.806
15.	Beed	3.221	4.223	5.198	4.159	3.969	5.216	3.371	4.287	2.099	1.556	4.250	2.485
16.	Nanded	10.278	12.266	8.787	10.636	3.352	2.224	2.043	2.616	5.843	13.228	19.572	12.528
17.	Osmanabad	9.129	10.533	8.692	9.553	3.985	3.880	4.530	4.095	6.576	10.034	4.846	7.440
18.	Buldhana	9.352	8.436	9.531	9.045	0.635	0.353	0.623	0.522	42.874	37.114	25.755	35.879
19.	Akola	9.039	14.410	12.329	12.129	0.796	1.343	1.171	1.113	39.030	31.853	34.636	35.018
20.	Amravati	19.010	19.710	13.045	17.625	0.506	0.744	1.057	0.752	53.756	40.339	37.084	43.907
21.	Yavatmal	21.129	20.905	13.601	18.950	0.668	0.636	0.650	0.650	44.626	35.905	38.599	39.560
22.	Wardha	36.504	25.835	22.402	28.437	0.891	0.805	0.737	0.814	45.011	30.903	29.385	35.184
23.	Nagpur	21.630	16.735	12.922	17.307	1.446	1.598	1.740	1.586	20.241	20.230	14.384	18.609
24.	Bhandara	3.903	3.294	2.401	3.249	2.087	2.546	1.892	2.211	--	--	--	--
25.	Chandrapur	4.711	4.616	2.336	4.014	1.538	2.130	1.450	1.744	4.354	3.609	4.498	4.104
26.	State	7.500	7.420	4.988	7.031	1.501	1.571	1.485	1.015	14.424	12.769	11.584	13.028

Table 8 : (Continued) :

Sr. No.	Districts	Sugar cane				Ground nut				Sesamum			
		Ist period	IInd period	IIIrd period	overall period	Ist period	IInd period	IIIrd period	overall period	Ist period	IInd period	IIIrd period	overall period
1.	Thane	--	--	0.654	0.276	--	--	0.096	0.026	0.136	0.147	0.236	0.065
2.	Raigad	--	--	--	--	--	--	--	--	0.034	0.370	0.428	0.274
3.	Ratnagiri	0.831	2.882	2.594	1.887	0.428	0.326	0.413	0.389	1.715	0.648	0.207	0.881
4.	Nasik	20.728	36.620	34.294	30.676	14.019	9.296	14.700	12.371	0.083	0.046	0.406	0.409
5.	Dhule	3.718	11.511	15.929	10.140	31.187	27.966	23.299	27.743	1.024	1.081	0.662	0.946
6.	Jalgaon	2.106	3.684	8.394	4.466	16.246	16.078	16.666	16.297	0.649	0.839	0.761	0.754
7.	Ahmadnagar	53.605	60.779	52.881	58.582	3.164	2.094	2.129	2.460	0.101	0.101	0.334	0.165
8.	Pune	25.613	39.738	20.705	29.742	6.321	8.640	4.988	6.822	0.351	0.193	0.297	0.274
9.	Satara	3.921	29.103	25.071	19.589	50.291	28.207	36.993	38.008	--	--	0.021	0.006
10.	Sangli	19.518	40.337	37.261	32.542	16.779	24.518	12.125	18.495	2.002	0.097	0.041	0.821
11.	Kolhapur	53.687	69.387	58.257	61.062	13.031	9.906	11.021	11.257	--	0.054	0.031	0.029
12.	Solapur	18.258	31.930	31.524	27.185	12.792	10.427	4.914	9.683	0.321	0.321	0.308	0.317
13.	Aurangabad	11.276	23.964	18.917	18.333	9.363	5.261	4.086	6.302	0.571	0.399	0.282	0.424
14.	Parbhani	4.785	8.377	5.415	6.356	7.287	3.301	2.356	4.367	0.343	0.617	0.406	0.466
15.	Beed	3.295	9.512	8.196	7.074	24.793	14.273	7.073	15.779	0.779	1.229	0.317	0.825
16.	Nanded	4.571	15.048	11.061	10.448	10.534	8.887	3.797	8.022	0.450	0.961	0.402	0.635
17.	Osmanabad	5.588	14.906	15.555	11.980	22.778	22.472	10.365	19.210	0.610	0.795	0.443	0.635
18.	Buldhana	1.496	5.389	3.034	3.437	4.803	4.801	5.052	4.871	0.279	0.245	0.146	1.085
19.	Akola	0.396	1.831	0.770	1.051	5.725	9.115	6.720	7.320	0.331	0.589	0.475	0.471
20.	Amravati	0.101	0.416	0.406	0.308	4.797	8.455	10.306	7.749	0.315	0.636	0.657	0.612
21.	Yavatmal	0.374	1.284	1.916	1.156	4.611	7.456	8.027	6.666	0.620	0.952	0.421	0.694
22.	Wardha	0.216	0.429	0.383	0.345	0.723	3.361	3.536	2.480	2.582	1.908	1.494	2.045
23.	Nagpur	0.184	0.547	0.300	0.357	3.428	5.565	4.947	4.597	2.042	4.525	2.440	3.118
24.	Bhandara	1.089	3.014	1.979	2.084	0.082	0.417	0.531	0.337	0.093	0.269	0.090	0.162
25.	Chandrapur	0.421	0.677	0.240	0.329	--	0.080	0.096	0.198	5.816	8.069	4.974	4.713
26.	State	9.432	16.462	14.229	13.076	10.524	9.234	7.777	9.233	0.850	1.027	0.790	0.535

compared to first one. This decline was mainly due to the contribution of some income by the crops of jowar, wheat and sesamum.

5.3.3 Ratnagiri :

The major contribution of the agricultural income in this district was made by the rice crop. It contributed 96 per cent of the total income in all the periods and remained constant.

5.3.4 Nasik :

Bajra, sugar cane, wheat and ground nut were the major crops, which contributed substantially to agricultural income. Out of these crops, contribution of bajra was the highest (31.665 per cent) in the first period but it declined to 16.484 per cent in third period. Contribution of sugar cane has been increased from 20.728 per cent in first period to 34.294 per cent in third period, however it declined by 2.326 per cent in third period as comparred to the second one. Contribution of wheat and ground nut remained almost the same during the three periods. Decline in contribution was seen in cotton and bajra. Shares of remaining crops were such less than the above discussed crops.

5.3.5 Dhule :

Ground nut was the major crop in the district, but its contribution during the three periods declined from

31.187 per cent in first period to 27.966 per cent in second period and finally to 23.299 per cent in third period respectively. Other important crops were jowar, cotton, bajra, sugar cane and wheat. Considerable increase in the proportion of sugar cane and wheat was observed. In the case of sugar cane it was increased from 3.718 to 11.511 per cent and to 15.929 per cent in second and third period respectively. All other crops have shown decline for the same periods. The highest decline was observed in ground nut i.e. from 31.187 per cent(first period) to 23.299 per cent (third period). The overall contributions of ground nut, bajra, jowar, cotton and sugar cane were 27.743, 15.492, 15.171, 15.269 and 10.140 per cent of gross agricultural income.

5.3.6 Jalgaon :

Considerable increase in the proportion of agricultural income contributed by sugar cane was observed in three periods. It increased by 1.578 per cent and 4.710 per cent from first to second and second to third period respectively. In the case of jowar, though there some decline was observed in second period, but its contribution increased from 25.444 to 31.395 per cent from first to third period. Increase in the proportion of wheat was also observed. The income contribution made by the cotton crop was declined from 43.620 per cent (first period to 20.797 per cent (third period). The other important crop in this

district, which contributed substantially, was ground nut whose proportion was remained almost constant, it was around 16 per cent in all the three periods. In the case of other crops it remained almost constant except rice wherein it proportion increased from 0.586 to 2.706 per cent from first to third period.

5.3.7 Ahmadnagar :

In this district sugar cane was the major source of the income, whose constribution was 58.582 per cent on overall basis, however it remained almost constant in first and third period while it increased by 7.174 per cent in second period. Jowar was the second important crop whose contribution also increased by 3.719 per cent in third period over first one. Its overall contribution in agricultural income was 20.301 per cent. An average proportion of income contribution of bajra was 5.274 per cent and was more or less constant in first and third period, but declined drastically to 0.884 per cent in second period. In case of wheat continuous increase was observed and was highest in third period i.e. 7.276 per cent. The income contributions in other crops remained more or less constant and their proportions were considerably low.

5.3.8 Pune :

During the period of study contributions of sugar cane and jowar were more or less the same. These

were 29.742 and 25.315 per cent on overall basis respectively. The contributions of bajra, rice and ground nut were 17.638, 9.381 and 6.822 per cent respectively. Consistent increase in the share of wheat was observed, which increased from 2.624 to 6.119 per cent from first to third period. In the case bajra during first two periods of study the share was almost remained unchanged, but during the third period it increased to more than 11 per cent. Decline in the share in income of ground nut was seen. It declined by 1.333 per cent in third period as compared to first one. In the case of remaining crops the contributions were smaller in amount and remained more or less the same.

5.3.9 Satara :

The major portion of the gross income was contributed by the non food crops such as sugar cane and ground nut. The overall contributions of these crops were 19.589 and 38.008 per cent respectively. The contribution of ground nut has declined in second and third period, on the other hand in the case of sugar cane it increased throughout all the periods, they were 3.922, 29.104 and25.701 per cent for first, second and third period respectively. Considerable decline in the share of ground nut was observed. It declined to 28.207 and 36.993 per cent in second and third period as compared with (50.291 per cent) first one. Overall

contribution of the jowar crop was 24.025 per cent and it was more or less the constant. Contributions of tur, gram, cotton and wheat did not differed much.

5.3.10 Sangli :

In this district jowar, sugar cane and ground nut shared lions share of agricultural income. On an average basis the share of sugar cane was the highest followed by jowar and ground nut, the contributions were 32.542, 28.515 and 18.495 per cent respectively. The another important crop of this district was rice, which accounted the 7.449 per cent share, however its share declined 3.143 and 4.045 per cent from (15.310 per cent) first to other two periods respectively. In the case of sugar cane the share was doubled from first to second period with a marginal decline in third period compared with second one. In the case of jowar the proportion was almost the same except in second period, which declined by 12.540 per cent over first one. Proportion of bajra, tur, gram, cotton and sesamum was less and did not changed considerably.

5.3.11 Kolhapur :

The overall constributions of sugar cane, rice and ground nut were 61.062, 15.603 and 11.257 per cent of gross income. Jowar crop succeeded with 9.800 per cent. In all the three periods sugar cane contributed large amount, but on the other hand its contribution for second period (69.387 per cent) was the highest, it declined to

58.257 per cent in third period, but was higher than the first period. The contribution of rice crop did not differed much in first and third period. Bajra, gram and sesamum contributed nearly the same shares for all the three periods. In the case of wheat and ground nut increase was observed and in the case of jowar and cotton decline in the income contribution was seen. In this district cash crops were dominating over the food grain crops.

5.3.12 Solapur :

Jowar was the main source for income in the district, which contributed 42.807 per cent of gross income on overall basis. The crops like sugar cane, ground nut and tur hold the subsequent ranks with 27.185, 9.783 and 6.716 per cent of agricultural income. The selected food crops covered major portion of the income. The proportion of wheat, gram and sugar cane increased in which larger increase was observed in sugar cane. It increased by 13.673 per cent in second period over first period and remained just same in third period also, whereas jowar, cotton and ground nut showed decrease for the same. Remaining crops contributed comparatively smaller share in the agricultural income.

5.3.13 Aurangabad :

Jowar, sugar cane and bajra secured the first three ranks in order for their overall income contribution,

with the shares of 35.453, 18.333 and 11.501 per cent. For all the three periods the ranks of these crops remained same. The contribution of income of cotton increased consistently through all the periods. It increased from 4.912 to 7.792 and 9.489 per cent in first to second and third period. Contribution in income of wheat, tur and sugar cane increased their respective shares by 1.585, 1.552 and 7.641 per cent from first to third period. Decline of 5.169, 3.652, 0.913 and 5.278 percent was observed in the income contribution of jowar, bajra, gram and ground nut respectively in third period as compared to first one. The contribution of sesamum was the lowest in this district.

5.3.14 Parbhani :

Jowar contributed highest share in the agricultural income (45.089 per cent), however its contribution declined to round about 14 per cent in second and third per cent compared to that of first one. The next important crop was cotton which contributed 16.826 per cent on overall basis in the agricultural income. The share of cotton increased by 12.389 per cent and 8.008 per cent from first to second and from second to third period. Cotton was the only crop in the district, wherein the proportion of increase was seen with such a fast rate. The contribution of wheat remained almost the same, its overall contribution was 9.283 per cent. Tur also

contributed considerable proportion in income of 11.453 per cent. Contribution of ground nut declined from 7.287 to 2.356 per cent from first to third period. The overall contribution of sugar cane was 6.356 per cent. Contribution of the crops like gram, rice and sesamum were comparatively less and remained more or less unchanged.

5.3.15 Beed :

Jowar and ground nut were the major crops in this district, and their contributions to the income were 46.146 and 15.779 per cent respectively. Bajra, wheat and sugar cane also contributed more than 7 per cent each. The comparison between various periods revealed that jowar maintained its first rank and there was an increase in the income constribution of 6.698 per cent in third period compared with first one. Contribution of sugar cane also increased by 3 times in this district. Wheat , tur, gram and sesamum maintained their share of contribution, while there was a considerable decline in the proportion in income of ground nut. It was 24.793 per cent in first period and 7.073 per cent in third period. Marginal increase in the share was also observed in cotton.

5.3.16 Nanded :

The major share of agricultural income was derived from jowar, i.e. 44.047 per cent. Tur, cotton

and ground nut also contributed more than 8 per cent each. Proportion of income derived from jowar was declined by about 12 per cent during the period of study, while in case of cotton it increased by about 14 per cent. In case of sugar cane this increase was around 7 per cent considerable decline about 7 per cent was seen in ground nut. In case of remaining crops share was remained just unchanged.

5.3.17 Osmanabad :

Jowar contributed 37.073 per cent in total agricultural income, which remained the same, i.e. more than 41 per cent in first and third period, while it declined by about 12 per cent in second period. Contribution of sugar cane increased from 5.588 per cent to 15.555 per cent from first to third period and in the case of ground nut declined more than 12 per cent. Proportion of wheat increased in third period substantially over first period. Contribution of tur was around 9 per cent in all the three periods. Remaining crops contributed minor proportions to the income.

5.3.18 Buldhana :

Jowar and cotton shared almost equal proportion of the income in this district, but in the case of jowar increasing trend (31.225 to 46.559 per cent) was observed while in case of cotton it declined from

42.874 to 25.755 per cent during first to third period respectively. Tur was the next important crop which contributed round about 9 per cent in all the three periods. Contributions in income of wheat crop were 6.706, 5.040, 7.067 per cent in first, second and third period respectively.

5.3.19 Akola :

As in Buldhana district cotton and jowar shared almost equal proportion in this district also, it was 35.018 and 30.678 per cent respectively. In case of cotton the share was almost equal while the share of jowar declined from 36.866 to 32.477 per cent from first to third period. Tur contributed about 12 per cent and it was stable. Wheat and ground nut contributed 8.071 and 7.320 per cent of the agricultural income.

5.3.20 Amravati :

Major source of income in this district was cotton whose share was declined from 53.756 to 37.084 per cent from first to third period, while in anpther crop i.e. jowar, its share increased by more than 12 per cent from first to third period. The share of ground nut wheat increased by about 6 and 3 per cent respectively. In case of tur the constribution was almost the same in the first two periods i.e. 19 per cent but declined to 13.045 per cent in third period. The overall contribution of tur was 17.625 per cent.

5.3.21 Yavatmal :

In this district the contribution of cotton was 39.560 per cent which declined about 6 per cent in second and third period compared to first one. Tur has exhibited stability in first two periods i.e. around 21 per cent, but declined by 7 per cent in the third period. Ground nut showed an increase in income by 3 per cent from first to second period and remained almost constant in third period. The constribution of wheat was around 3 per cent, it increased in third period by about 2 per cent compared with first and second period. The contribution of remaining crops was much less.

5.3.22 Wardha :

Jowar, tur and cotton were the major income contributing crops in the district. The highest share on overall basis was from cotton, followed by tur and jowar. They were 35.184, 28.437 and 17.978 per cent respectively. The share of jowar was increased considerably from first to remaining two periods. It was 2.868 per cent in first period while in second and third period the same was 26.059 and 26.198 per cent respectively. Cotton and tur exhibited declining trend in income. In case of tur it declined by about 14 per cent while in case of cotton it was 16 per cent during first to third period. Wheat was another important crop which contributed 10.227 per cent and exhibited very less

fluctuations in the share of income in different periods. Ground nut contributed 2.480 per cent on overall basis and exhibited increase in the income in said time periods. It increased from 0.723 to 3.536 per cent from first to third period.

5.3.23 Nagpur :

Wheat, cotton, tur and jowar were the major crops and their respective contribution to the income was 17.622, 18.609, 17.307 and 28.801 per cent respectively. Contribution of tur declined by about 10 per cent. Cotton exhibited almost same share in first two periods and in third period it declined to 14.384 per cent. Jowar showed increasing trend while wheat showed stability in the income contribution in three periods. Proportion of rice increased about 3 times i.e. from 4.297 to 11.602 per cent during first to third period. Sesamum also exhibited the good source of income to the tune of 3.118 per cent.

5.3.24 Bhandara :

Rice was the major crop whose overall share in the income was 80.705 per cent and did not exhibited much fluctuation. Wheat was the next important crop whose overall share was 6.097 per cent. Jowar and tur contributed 4.762 and 3.249 per cent respectively.

5.3.25 Chandrapur :

As observed in Bhandara district, rice was the major source of income in this district also. Its share was around 60 per cent to the agricultural income. The share of jowar remained almost same, i.e. 20 per cent. Contribution of wheat was 7 per cent and remained almost constant, while, tur, cotton and sesamum constributed to the income by about 4 per cent in all the three periods.

5.3.26 State :

Food grain crops contributed more than 60 per cent of gross income. Cotton, sugar cane and ground nut contributed more than 10 per cent respectively. Decline in the shares of cotton and ground nut was observed, but an increase was seed for sugar cane crop for the different time periods.

5.4 Agricultural income :

Two major criteria used to determine the agricultural development in various districts of Maharashtra State, were (i) per hectare gross agricultural income and (ii) per capita gross agricultural income. In the case of per hectare income cropped area under major crops; while in the case of per capita income rural population in given districts were considered, and presented in table 9 and 10.

5.4.1 Per hectare income :

5.4.1.1 Thane :

During the period of study, per hectare gross

income in this district declined, due to which its rank declined from second to ninth. The decline in income was Rs. 216.71 in third period as compared to first. Overall rank of this district was fourth and average per hectare income was Rs. 593.16.

5.4.1.2 Raigad :

The performance of this district with respect to ranks was almost constant except in second period. Oneverall basis it ranked third. The per hectare income was highest in second period i.e. Rs. 628.17 while from first to third period it increased by Rs. 13.58.

5.4.1.3 Ratnagiri :

The highest per hectare income of this district was Rs. 702.38 in second period due to which its rank increased from five in first period to two in second period. However the income declined in the third period to the tune of Rs. 496.05, hence for this period it secured seventh position. Overall rank of this district was five with an average income of Rs. 573.19.

5.4.1.4 Nasik :

This district has shown good performance in per hectare agricultural income from first period to remaining two periods. Its position was 17th, 9th and 10th for the three periods respectively. The per hectare income was increased by Rs. 53.10 and Rs. 122.14 during second and third period respectively compared to first one.

(Income in 'Rs.')

Sr. No.	Districts	Ist period		IInd period		IIIrd period		Overall period	
		Rank	Av.income	Rank	Av.income	Rank	Av.income	Rank	Av.income
1.	Thane	2	690.63	4	594.80	9	473.92	4	593.16
2.	Raigad	4	501.34	3	628.17	4	584.92	3	597.37
3.	Ratnagiri	5	486.83	2	702.38	7	496.05	5	573.19
4.	Nasik	17	272.62	9	325.72	10	447.86	10	341.94
5.	Dhule	10	302.94	12	290.38	6	499.79	9	352.74
6.	Jalgaon	3	655.88	5	582.15	3	665.00	2	629.97
7.	Ahmadnagar	8	354.82	8	332.12	8	482.88	8	387.02
8.	Pune	13	280.64	10	296.52	12	411.22	12	323.08
9.	Satara	7	373.95	6	549.94	2	717.03	6	537.69
10.	Sangli	6	379.72	7	456.53	5	563.68	7	460.68
11.	Kolhapur	1	1044.91	1	1514.17	1	1567.11	1	1372.45
12.	Solapur	22	236.19	21	218.12	22	313.01	22	250.50
13.	Aurangabad	24	180.07	24	193.96	24	295.17	24	217.03
14.	Parbhani	25	177.80	25	176.71	25	291.75	25	209.03
15.	Beed	20	239.25	22	198.55	23	302.31	23	240.94
16.	Nanded	23	194.61	20	220.26	17	361.43	21	250.92
17.	Osmanabad	12	264.36	13	273.58	21	327.65	16	292.19
18.	Buldhana	15	276.56	14	265.91	13	397.54	14	306.02
19.	Akola	18	269.11	23	194.77	18	353.35	19	263.60
20.	Amravati	9	320.79	17	244.20	11	418.31	13	318.13
21.	Yavatmal	14	279.85	16	252.31	16	372.77	15	294.95
22.	Wardha	16	275.99	19	225.68	15	377.25	17	284.55
23.	Nagpur	21	236.31	18	226.65	20	337.88	20	260.77
24.	Bhandara	11	297.88	11	294.78	14	296.13	11	323.95
25.	Chandrapur	19	247.66	15	263.52	19	348.96	18	280.57
26.	State		357.55		384.34		471.88		399.66
	C.D.		98.19		116.22		115.02		78.62
	F		29.80**		43.59**		19.89**		69.02**

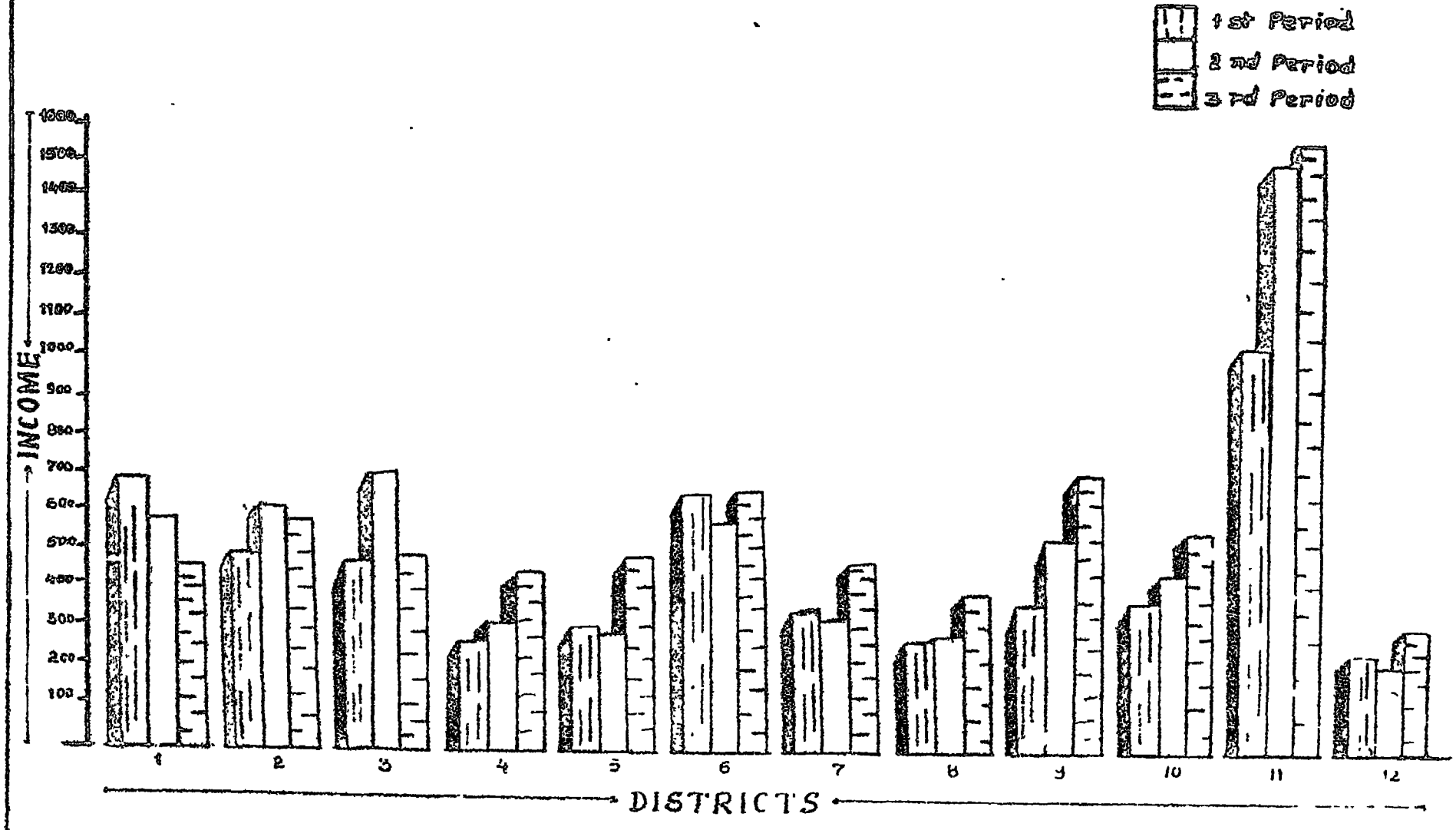


Fig. 2. PER HECTARE INCOME

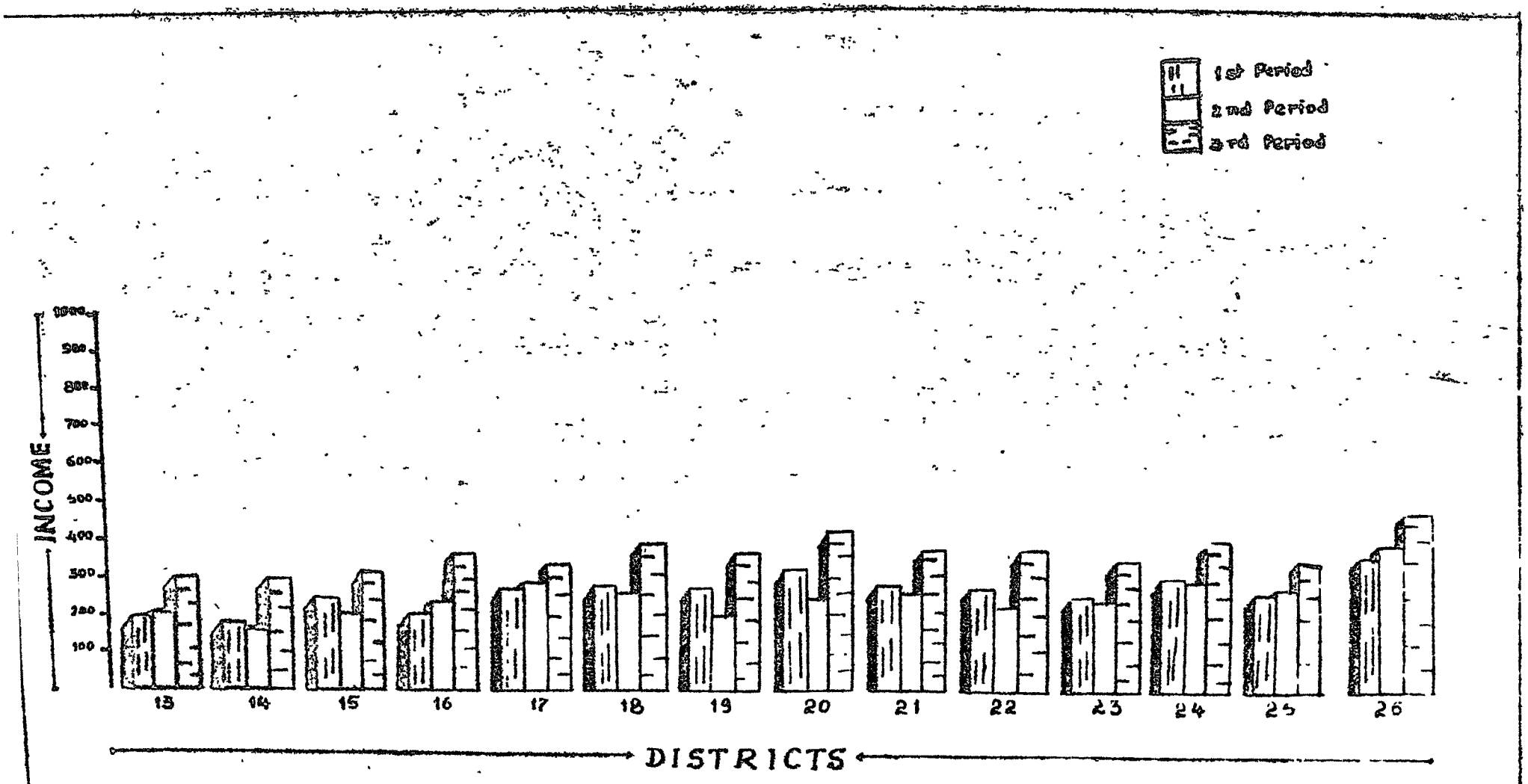


Fig.2 A. PER HECTARE INCOME

5.4.1.5 Dhule :

There was no marked agricultural development for first two periods in this district, however in the third period considerable increase in per hectare income was observed. In the third period per hectare income was the highest i.e. Rs. 499:79 and secured sixth rank in order of merit.

5.4.1:6 Jalgaon :

Overall rank of this district was second and average per hectare income was Rs. 629.97. It ranked third, second and fifth for respective three periods. There was a decline in average per hectare income of Rs. 73:73 in second period compared with first and an increase of Rs. 82.85 in third compared with second period.

5:4.1:7 Ahmadnagar :

This district maintained same ranking in all the periods i.e. eighth. However, there was a slight decline in average per hectare income in second period as compared to first one, but it again increased to the tune of Rs. 482.88 in third period.

5.4.1:8 Pune :

There was no much difference in ranking of this district. An increase in average per hectare income was observed by Rs. 15.88 in second period compared with first and Rs. 119:70 in third period over second period.

The overall average per hectare income was Rs.323.08 and it ranked 12th in the over.

5.4.1.9 Satara :

Consistent development was observed in this district, due to which its ranking was improved. Increase in average income was of Rs. 175.99 andRRs. 243.08 in second and third period as compared to first one.

5.4.1.10 Sangli :

Average per hectare income increased contineously in all the three periods, but its ranking did not changed much. It was six, seven and five in order of first, second and third period respectively. Overall average per hectare income of this district was Rs. 460.68.

5.4.1.11 Kolhapur :

The district maintained its highest position for all the periods. Overall per hectare income was Rs.1302.45 and increase in income was seen by Rs.469.26 and Rs. 522.20 in second and third periods respectively over the first period. It was further observed that the average per hectare income was statistically significant in all the districts for all the periods.

5.4.1.12 Solapur :

The average per hectare income was increased with Rs. 76.82 and Rs. 94.89 in third period over first and

second period respectively. The district stood 22nd in first, third and overall period.

5.4.1.13 Aurangabad :

The ranking of this district did not show any change for all the periods. It secured 24th rank ofor all the periods. Average per hectare income was increased by Rs. 13.89 and Rs. 101.21 in second and third period over first and second period respectively.

5.4.1.14 Parbhani :

The average per hectare income in this district in all periods was the lowest among all the districts of Maharashtra State. However average per hectare income was increased by Rs. 113.95 in third period as compared to first period. No considerable change in average per hectare income in first and sefond period was observed.

5.4.1.15 Beed :

The standing of this district in Maharashtra State in relation to agricultural development declined from 20th rank in first period to 23rd in third one. The lowest average per hectare income was in second period, i.e. Rs. 198.55 and it was the highest in third period i.e. Rs. 302.31.

5.4.1.16 Nanded :

The district has shown consistent progress in average per hectare income, due to this its ranks

increased from 23 to 20 and from 20 to 17 during second and third period respectively. As compared to first period the average per hectare income was increased by 13.30 and 85.90 per cent in second and third period respectively.

5.4.1.17 Osmanabad :

This district was on 12th and 13th place in first and second period and was placed on 21st rank in order of merit for third period eventhough per hectare income was increased considerably for the third period. Overall rank of this district was 16 and average per hectare income was Rs. 292.19.

5.4.1.18 Buldhana :

This district secured 15th and 13th rank for first and third period and was on 14th place in second and overall period. An increament of Rs. 120.98 and Rs. 131.63 was achieved for third period over first and second period respectively. Highest average per hectare income was in the third period i.e. Rs. 397.54.

5.4.1.19 Akola :

The ranking of this district was 18 in first and third period but it declined to 23 in second period. The overall average per hectare income was Rs. 263.60 and overall rank was 19th in order of merit.

5.4.1.20 Amravati :

The district showed less progress during the period of study, due to which, its ranks declined from nine to 17 in second period, however in third it improved its position to 11. The overall average per hectare income was Rs. 318.13 and it was 13th in the order.

5.4.1.21 Yavatmal :

The rank of this district declined from14 to 16 in second period compared with first and remained the same in the third period. The lowest per hectare income of Rs. 252.31 was in second period while it was the highest (Rs. 273.77) in third period.

5.4.1.22 Wardha :

The overall average per hectare income was Rs. 284.55. This district possessed 15th rank for the third period while it was on 16th and 19th position in first and second period. The per hectare income declined from Rs. 275.99 in first to Rs. 225.68 in second and increased to Rs. 377.25 in third period respectively.

5.4.1.23 Nagpur :

Eventhough in third period the ranks of this district declined from 18 (second period) to 20 but average per hectare income increased by Rs. 111.23. The district showed consistence performance over a period of time.

5.4.1.24 Bhandara :

There was no much difference in average per hectare income in first and second period, but considerable improvement was observed in third period, however its ranks declined from 11 to 14 in third period compared to first and second period.

5.4.1.25 Chandrapur :

District showed contineous decline in ranking its rank declined from 9th 15 in second period and further to 19 in third period. However per hectare income increased during these three periods.

5.4.1.26 State :

The average per hectare income of the state increased contineously throughout the time periods. The overall income was Rs. 399.66. An increase of Rs.26.99 and Rs.87.54 was accounted for the second and third period as compared to first and second period respectively.

Per hectare income between various district resulted that Kolhapur, Thane, Raigad and Ratnagiri districts were significantly superior over the state average, while Aurangabad, Parbhani, Nanded, Solapur, Nagpur, Beed and Chandrapur districts had significantly lower per hectare income than that the state average in first period.

In second period the average per hectare income for state increased by Rs. 26.79 over first period and the

per hectare income of Satara district also significantly increased in addition to the district of the first period.

In the third period the per hectare income increased by Rs. 87.54. The districts of Konkan division which were significantly superior over the state average were at par with the per hectare income of Jalgaon and Satara.

Kolhapur district remained at its first position in all the three periods and had significantly higher income in all the districts. The lowest per hectare income was in Parbhani followed by Aurangabad district, for all the periods whose ranking was 25th and 24th respectively.

5.4.2 Per capita income :

Determination of per capita income is one of the major criteria to examine the disparity in inter district development in agriculture more than 90 per cent of the rural population depends directly or indirectly on agriculture, on that basis whole rural population is considered for calculating the per capita income. The results of the per capita income along with the ranks for various district in Maharashtra are presented in this section.

5.4.2.1 Thane :

The per capita income of this district declined contineously. This district ranked 24th for second,

third and overall period. The highest per capita income was in the first period i.e. Rs. 87.96 and this declined to Rs. 51.29 in third period. Average per capita income for overall period was Rs. 68.64.

5.4.2.2 Raigad :

Average per capita income declined through the time periods. The district ranked 23rd in second, third and overall period, while in first period its rank was 25th in the order. Average per capita income has been declined with an amount of Rs. 5.02 and Rs.10.32 in second and third period as compared to the first and second respectively. The overall per capita income was Rs. 74.15.

5.4.2.3 Ratnagiri :

The rank was declined from 24 in first period to 25 in second, third and overall period. There was no much difference in average income of third and overall period. The highest average per capita income was recorded in first period i.e. Rs. 87.02. The average per capita income declined by Rs. 37.85 and Rs. 45.46 per second and third period respectively as compared with first one.

5.4.2.4 Nasik :

The rank of this district was increased from one period to other. It was 19 in first, 17 in second

and 13 in third period. The average per capita income was Rs. 132.22. The highest per capita income was observed in third period, i.e. Rs. 152.21. The average per capita income declined by Rs. 8.53 in second period as compared to first and increased in third period by Rs. 23.11 as compared to first and by Rs. 31.64 as compared to second period.

5.4.2.5 Dhule :

The overall average per capita income was Rs. 144.79. The rank of the district increased from 14 in first to 7 in third period. The lowest per capita income was Rs. 118.60 in second period. An increase of Rs. 14.54 was seen in the third period compared to first period.

5.4.2.6 Jalgaon :

Average per capita income has been declined in second and third period as compared to first one. The overall income was Rs. 134.08 and its rank was 17th in the order. Average per capita income declined with an amount of Rs. 28.61 in third period, compared with first period.

5.4.2.7 Ahmadnagar :

This district ranked first in first, while it was third and second in second and third period respectively. The overall average per capita income was

Table 10 : Districtwise per capita agricultural income. (Income in 'Rs.')

Sr. No.	Districts	Ist period		IInd period		IIIrd period		Overall period	
		Rank	Av.income	Rank	Av.income	Rank	Av.income	Rank	Av.income
1.	Thane	23	87.96	24	64.46	24	51.29	24	68.64
2.	Raigad	25	79.30	23	74.28	23	64.96	23	74.15
3.	Ratnagiri	24	87.02	25	49.17	25	41.56	25	43.00
4.	Nasik	19	129.10	17	120.57	13	152.21	19	132.22
5.	Dhule	14	154.85	18	118.60	7	169.39	14	144.79
6.	Jalgaon	12	164.27	21	107.08	19	135.66	17	134.08
7.	Ahmadnagar	1	232.31	3	191.76	2	226.62	2	214.95
8.	Pune	18	134.41	19	114.21	17	150.29	20	130.96
9.	Satara	16	138.12	4	168.32	5	187.91	8	163.69
10.	Sangli	3	199.14	2	196.52	3	197.02	3	197.54
11.	Kolhapur	5	195.19	1	237.87	1	241.08	1	224.54
12.	Solapur	10	178.50	12	136.80	20	131.98	13	148.99
13.	Aurangabad	17	135.79	15	123.16	14	151.94	15	135.36
14.	Parbhani	13	156.06	11	138.32	6	185.12	11	157.23
15.	Beed	7	191.68	9	146.43	8	168.55	6	167.66
16.	Nanded	20	127.62	16	122.49	12	152.23	18	132.46
17.	Osmanabad	11	178.42	10	143.15	10	158.81	10	159.26
18.	Buldhana	8	182.52	7	151.47	11	157.81	9	163.58
19.	Akola	4	196.52	13	126.23	16	151.09	12	156.56
20.	Amravati	2	208.55	8	148.35	4	196.72	4	181.72
21.	Yavatmal	6	192.53	5	162.06	15	151.87	5	169.38
22.	Wardha	9	181.22	6	154.76	9	162.18	7	165.64
23.	Nagpur	15	141.02	14	124.74	18	140.65	16	134.47
24.	Bhandara	22	90.09	22	79.97	22	93.76	22	87.18
25.	Chandrapur	21	109.61	20	111.53	21	119.43	21	113.08
26.	State		152.77		132.96		149.49		143.77
	C.D.		32.89		31.97		35.26		20.34
	F		14.91**		12.58**		13.74**		33.04**

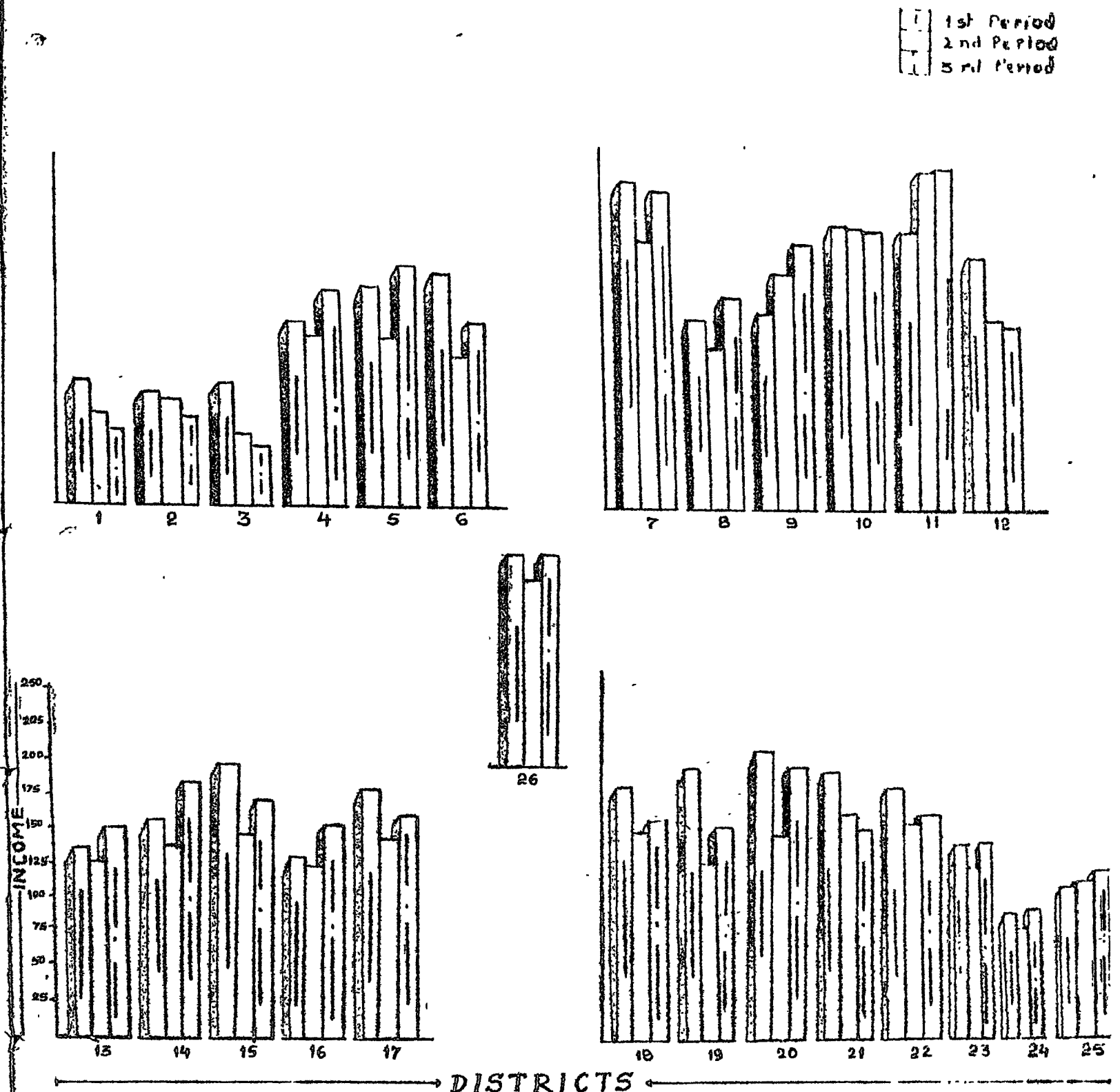


Fig. 3. PER CAPITA INCOME

Rs. 214.95 . The highest average per capita income was in the first period i.e. Rs. 232.31. There was very slight difference in the average per capita income in the first and third period.

5.4.2.8 Pune :

No much differences were seen in the ranks in all the three periods. The overall average per capita income was Rs. 130.96. The lowest average income was in the second period whereas it was the highest in third period. Average per capita income increased to Rs.150.29 in third period with an increament of Rs. 15.88 and Rs. 36.08 as compared to first and second period respectively.

5.4.2.9 Satara :

This district has improved its rank from 16 in first to 5 in third period. The overall average per capita income was Rs. 163.69 and was on 8th rank in order. Average income increased in the succeeding periods. It increased by an amount of Rs. 49.79 in third period over the first period.

5.4.2.10 Sangli :

This district hold third rank in first, third and overall period and was second in second period per capita income declined slightly, but there was no much difference in average per capita income within the periods studied.

5.4.2.11 Kolhapur :

The rank of this district increased from five in first period to one in other remaining periods. The overall average per capita income of this district was Rs. 224.54, and was statistically significant in all the district except Ahmadnagar. Average per capita income increased in all the periods over previous one but there considerable difference was not observed in the average per capita income of second and third period.

5.4.2.12 Solapur :

The overall average per capital income was Rs. 148.99, and was 13th in the order of merit. The ranking of this district has been declined from 10 in first to 12 and 20 in succeeding periods, and resulted in declined average per capita income. There was slight difference in average income of second and third period, but the decline of Rs. 46.52 was noticed in third period as compared with first one.

5.4.2.13 Aurangabad :

The overall per capita income was Rs. 135.36 and was placed on 15th position in the sequence. The rank in the second period was improved but the average per capita income was declined to Rs. 123.16 from Rs. 135.79. The highest average income was seen in the third period i.e. Rs. 151.94 and was greater than first period with an amount of Rs. 16.15.

5.4.2.14 Parbhani :

The ranking of this district has been increased from 13 in first to 6 in third periods, and was 11 in second period. Slight decline in income was recorded in second period. The overall average per capita income of this district was Rs. 157.23. Average per capita income in first and overall period was almost the same but in increased to Rs. 185.12 in the third period.

5.4.2.15 Beed :

The ranking of this district has been declined from 7 in first to 9th in second and 8th in third period. The overall rank was six and the overall average per capita income was Rs. 167.66. The average income did not differed much. The highest income among these periods was in first i.e. Rs. 191.68 and it declined in other two periods.

5.4.2.16 Nanded :

The overall rank of this district was 18 and the per capita income was Rs. 132.46. The ranking in the second and third period has been improved to 16 and 12 from 20 in first period. In third period average per capita income was Rs. 152.23 and was higher with an amount of Rs. 24.61 over the first period. In second, the average per capita income was lesser by Rs. 5.13 than the income of first period.

5.4.2.17 Osmanabad :

This district secured 10th rank for second, third and overall period and 11 th for first period. The average per capita income declined to Rs. 143.15 and Rs. 158.81 in second and third period from Rs. 178.42 in first period. The overall average per capita income of the district was Rs. 159.26.

5.4.2.18 Buldhana :

The overall average income of the district was Rs. 163.58 and ranked 9th in the order. The rank as well as average per capita income has been declined to 11 and to Rs. 157.81 in third period as compared to first one, and the decline was of Rs. 24.71.

5.4.2.19 Akola :

The overall average per capita income of district was Rs. 156.56 and was 12th in the order. The ranking of this district was lowered down to 13 and 16 in second and third period from in the first period. The highest per capita income of Rs. 196.52 was in the first period and was higher by an amount of Rs. 70.29 and Rs. 45.43 than the second and third period respectively.

5.4.2.20 Amravati :

This district possessed fourth rank for third and overall period, whereas it was on second in first and 8th in second period. Failure of rank has resulted

in declining the average per capita income. In third period per capita income was declined by Rs. 12.33 as compared to first period.

5.4.2.21 Yavatmal :

Per capita income of this district has declined constantly in the three periods. The decline was Rs. 30.47 in second and Rs. 40.66 in third period as compared to the first one. The ranking also declined from 5th in first period to 15th in third period. However on overall basis it ranked fifth with an income of Rs. 169.38.

5.4.2.22 Wardha :

Average per capita income of this district was Rs. 165.14 and secured seventh rank. Per capita income has been declined in the subsequent periods and compared to first one. This decline was of Rs. 26.46 and 19.04 in second and third period respectively.

5.4.2.23 Nagpur :

The overall average per capita income of this district was Rs. 134.47 and it was 16th in the order. The rank of the district was declined from 15 in first period to 18 in third period but the average income was just constant.

5.4.2.24 Bhandara :

There was no change in the ranking for all the

periods. This district possessed 22nd rank. The overall average per capita income was Rs. 87.18. In second period the average income was lowest among all the periods. An increase of Rs. 3.67 was observed in third period over first one.

5.4.2.25 Chandrapur :

This district was 21st in the order of merit for first, third and overall period and 20th in second period. The overall average per capita income was Rs. 113.08. The average per capita income has been increased through all the time periods. The average income increased with an amount of Rs. 1.92 and Rs. 9.82 in second and third period over the income of Rs. 109.61 in first period.

5.4.2.26 State :

The overall average per capita income was Rs. 143.77. The lowest and highest income was seen in the second and first period with Rs. 132.96 and Rs. 152.77 respectively. In third period it was Rs. 149.53 as compared to first and second period respectively. Within the district per capita income was significantly differing in all the three periods.

Comparison between the various district in the first period revealed that in the district like Ahmadnagar, Amravati, Sangli, Akola, Kolhapur, Yavatmal and Beed, it was significantly higher than state average, while in Chandrapur, Bhandara and all the districts of Konkan was significantly lower than the state average.

In second period per capita income of only Kolhapur, Ahmadnagar, Satara and Sangli was significantly higher, while the per capita income of Chandrapur district did not fall in the lower income group.

In third period Amravati district was included in upper group in addition with the districts in second period. The same districts had the significantly lower income in third period also.

K Kolhapur district was on the top rank for all the periods except first period. Its per capita income was significantly, higher overall the districts except Ahmadnagar. The districts ofKonkan had the lowest income in all the time periods and their respective ranking remained the same for all the periods.

5.5 Growth Analysis :

5.5.1 Area of the crops :

Growth rates in the area under different crops pertaining to various districts were calculated to quantify the changes taken place in the respective areas

of the crops. This analysis would help to trace out the development taken place, may be positive or negative in different crops. Two types of functions viz; (i) compound and (ii) linear were used. However, for the sake of simplicity only the results of compound growth rates are discussed in this section and are presented in table 11. Districtwise results are as under.

5.5.1.1 Thane :

Rice was the major crop of this district, but the area under this crops showed the decline in the order of 0.534 per cent per year. This decline however was not statistically significant. The area under rice crop remained almost constant as the fluctuations were of very low degree. The area of tur and sugar cane declined significantly, but these crops covered very low area.

5.5.1.2 Raigad :

In this district also rice was the main area covering crops . The area under rice crop has increased with 0.387 per cent and was statistically not significant. The other crops like tur and gram showed up ward trend in area but was not statistically significant. Sesamum showed significant negative trend; but area under this crop was much less. The area of total cereals and total food grain crops exhibited upward trend whereas total pulse crop the significant negative growth rate.

Table 11 : Compound growth rates of cropped area of principal crops.

Sr. No.	Districts	Rice	Wheat	Kharif jowar	Rabi jowar	Total jowar	Bajra	Total cereals	Gram	Tur	Total pulses
1.	Thane	(-) 0.534	--	--	--	--	--	(-) 0.417*	1.609	(-) 0.657*	(-) 1.180*
2.	Raigad	0.387	--	--	--	--	--	0.210	2.135	0.180	(-) 1.603*
3.	Ratnagiri	0.941*	--	--	--	--	--	0.044	--	--	(-) 2.680*
4.	Nasik	(-) 0.640*	0.644	0.883	(-) 5.052	(-) 3.541*	(-) 0.152	(-) 0.384	(-)0.139	(-) 1.058	0.862*
5.	Dhule	(-) 2.199*	4.320*	(-) 0.958	(-) 3.685	(-) 2.792*	0.550	0.018	0.974	0.717	2.572*
6.	Jalgaon	3.447	5.546*	2.110	1.011	0.815	3.739*	2.359*	8.747*	(-) 0.745	1.343*
7.	Ahmednagar	(-) 2.509*	4.195*	25.375	(-) 0.261	(-) 0.003	0.564	0.139	(-)0.770	(-) 2.548	(-) 0.815
8.	Pune	(-) 1.019*	3.759*	(-) 2.082	(-) 0.237	(-) 0.320	(-) 0.228	(-) 0.041	(-)0.639	(-) 0.378	(-) 0.682
9.	Satara	0.683	2.511*	3.050	0.492	0.824	(-) 2.392*	(-) 0.263	(-)1.589	(-) 0.341	(-) 0.456
10.	Sangli	0.758*	4.270*	(-) 1.854	0.330	(-) 0.854*	(-) 2.357*	(-) 0.932*	(-)0.409	(-) 0.268	0.609
11.	Kolhapur	(-) 1.323*	7.992*	0.631	0.301	0.346	(-) 3.126*	(-) 0.393	(-)1.484	(-) 2.587	(-) 0.983
12.	Solapur	(-) 4.797*	6.192*	10.498	(-) 1.047	(-) 0.962	(-) 2.367*	(-) 0.992*	5.201*	0.910	2.409
13.	Aurangabad	0.815	(-) 0.325	(-) 2.306	0.483	0.180	1.810*	0.532*	(-)0.781	(-) 0.896	(-) 0.175
14.	Parbhani	(-) 0.200	1.079	0.652	0.585	0.620*	14.476*	0.972*	1.038*	1.271*	2.027*
15.	Beed	(-) 0.376	2.296*	3.169	0.256	1.041*	3.462*	1.515*	1.989*	3.786*	1.300*
16.	Nanded	(-) 0.351	1.399	0.428	(-) 3.056*	(-) 0.178	(-) 0.340	(-) 0.004	(-)0.058	2.132*	2.545*
17.	Osmanabad	0.898*	0.294	1.551	(-) 1.452*	1.989	4.996*	(-) 0.011	1.625*	2.050*	2.236*
18.	Buldhana	0.279	0.232	1.254	2.457	1.152*	8.417*	1.015*	0.546	0.946*	2.696*
19.	Akola	(-) 0.031	0.738	0.996	--	1.025*	4.517*	0.997*	0.525	1.532*	2.751*
20.	Amravati	4.382*	0.547	0.858	--	0.859*	4.094*	0.699*	2.029	0.327	1.179*
21.	Yavatmal	2.106*	1.563	0.460.463*	--	0.451*	3.330*	0.732*	(-)0.275	0.713*	0.989*
22.	Wardha	4.989	(-) 0.153	0.463	(-) 0.223	0.418	(-) 2.630*	0.474*	1.901*	0.659*	0.774
23.	Nagpur	4.286*	(-) 0.583	(-) 0.275	(-) 0.386	(-) 0.264	0.706	0.142	2.612*	0.215*	0.718
24.	Bhandara	0.728*	0.806*	(-) 4.589	(-) 0.285	(-) 0.570*	--	0.602*	1.170*	(-) 1.658	(-) 0.136
25.	Chandrapur	0.923*	0.019	2.429	0.399	0.811*	(-) 8.101	0.966*	3.036*	1.241*	0.093
26.	State	0.365*	1.339*	0.661*	(-) 0.654*	-- 7	0.219	0.152	0.660	0.781*	1.133*

Table 11 : (Continued) :

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Sr. No.	Districts	Total food grains	Sugar cane	Cotton	Ground nut	Sesamum	Total oils	Gross cropped area	Double cropped area	Net cropped area	Av.intensity of cropping
1.	Thane	(-) 0.470*	(-) 5.279*	--	--	--	1.521*	(-) 2.202*	(-) 4.366	(-) 7.684*	(-) 0.054
2.	Raigad	0.084	--	--	--	(-) 3.285*	(-) 2.024*	(-) 1.132*	0.532	(-) 1.214*	0.080
3.	Ratnagiri	(-) 0.152	7.908*	--	(-) 2.857	(-) 3.227	(-) 0.646*	(-) 0.122	(-) 1.353	(-) 0.081	(-) 0.034
4.	Nasik	(-) 0.206	4.966*	(-) 9.950*	(-) 0.171	0.920	(-) 3.419*	(-) 1.234*	(-) 1.862	(-) 1.190	(-) 0.044
5.	Dhule	0.541	12.495*	(-) 2.893*	(-) 1.399*	(-) 3.023*	(-) 2.500*	(-) 0.422*	(-) 3.936*	(-) 0.457	(-) 0.372
6.	Jalgaon	1.971*	10.171*	(-) 3.782*	(-) 0.189	(-) 2.488	(-) 3.202*	0.181*	4.589	(-) 0.167*	0.350
7.	Ahmadnagar	0.057	4.349*	(-)16.001*	(-) 7.268*	(-) 0.140	0.374	(-) 0.509*	(-) 1.755*	(-) 0.454*	(-) 0.123
8.	Pune	(-) 0.228	3.730*	(-) 3.826*	(+) 1.037	(-) 2.668	0.374	(-) 0.641*	2.146	(-) 0.888*	0.266
9.	Satara	(-) 0.117	4.248*	2.000	(-) 0.290	--	(-) 0.035	(-) 2.186*	(-) 0.906	(-) 2.297*	0.106
10.	Sangli	(-) 0.687*	5.822*	(-) 5.622*	(-) 4.452*	(-)13.541*	(-) 2.543*	(-) 1.440*	(-) 0.115	(-) 1.500	0.023
11.	Kolhapur	(-) 0.008	4.290*	(-) 1.768	(-) 0.796*	--	(-) 0.417	(-) 0.290	(-) 2.202	(-) 0.230*	0.131
12.	Solapur	0.370	3.713	(-) 4.308	(-)10.173*	(-) 0.777	(-) 4.286*	(-) 0.931	2.366	(-) 1.341*	(-) 0.079
13.	Aurangabad	0.310	1.446	(-) 3.823*	(-) 7.210*	(-) 8.131*	(-) 1.193*	(-) 0.828	0.684	(-) 0.894*	0.085
14.	Parbhani	1.202*	2.075*	1.254*	(-) 6.314*	6.815*	2.119*	0.591*	2.481*	0.420*	0.180
15.	Beed	(-) 2.984*	5.691*	(-) 8.237*	(-) 8.574*	(-) 4.370*	1.520	0.047	(-) 1.683	0.124	(-) 0.007
16.	Nanded	0.633*	4.982*	(-) 0.285	1.417	9.332*	2.299*	0.535*	3.160*	0.457*	0.069
17.	Osmanabad	2.155	4.969*	(-) 6.138*	(-) 0.556*	2.257*	(-) 2.085*	0.350*	6.497*	0.013	0.350
18.	Buldhana	1.512*	2.008*	1.275*	(-) 0.998	3.053*	3.761*	0.662*	9.479*	0.332*	0.291
19.	Akola	1.487*	4.434*	0.148*	(-) 1.949*	3.023*	(-) 1.862	1.753*	12.296*	1.661*	0.117
20.	Amravati	0.782*	5.766*	(-) 0.021	2.704*	3.640*	4.101	1.023	14.082*	0.372*	0.122
21.	Yavatmal	0.795*	8.549*	0.991*	5.030*	1.429*	4.157*	1.087*	5.439*	1.052*	0.033
22.	Wardha	1.181*	--	0.793*	16.650*	(-) 4.585*	2.554*	0.748*	8.855*	0.701*	0.106
23.	Nagpur	0.237	(-) 0.730	1.124*	4.185*	10.792*	4.334*	0.574*	6.208*	0.464*	0.085
24.	Bhandara	0.445*	3.391*	--	10.055*	6.636*	(-) 3.020*	0.131	(-) 0.612	1.016	(-) 0.281
25.	Chandrapur	(-) 0.133	(-) 8.458*	3.479*	10.200*	3.170*	0.644	0.663*	1.835*	0.546*	0.111
26.	State	0.342	4.865*	(-) 1.155*	(-) 2.499*	1.605*	(-) 0.100	(-) 0.297*	1.075*	(-) 0.217	0.157

5.5.1.3 Ratnagiri :

Sugar cane and rice showed significant increasing trend. In the case of rice it increased by 0.941 per cent per annum while in the case of sugar cane with 7.908 per cent. Downward slopping trend was observed for all the remaining crops. The gross, net and double cropped area exhibited the negative trend.

5.5.1.4 Nasik :

Wheat and kharif jowar exhibited non significant increasing trends while area under rabi jowar and rice declined significantly. The decline was in the order of 5.052 and 0.640 per cent respectively. Area under sugar cane increased significantly with 4.966 per cent while in case of cotton it declined by 9.950 per cent. Area under Bajra, which was an important crop in this district, showed no much variation with respect to its area. Total cereal and total food grain crops were having the negative growth rates for their respective areas. Statistically significant declining trend was observed for gross and net cropped area. Shifts in the area of rabi jowar, tur, cotton and sugar cane were observed.

5.5.1.5 Dhule :

Wheat and sugar cane area showed significant upward trend. It increased with 4.320 and 12.495 per cent

per year and rice, rabi jowar, cotton and ground nut and sesamum area registered the significant declining trend. The area of rabi jowar, cotton and ground nut declined with 3.685, 2.893 and 1.399 per cent per year at the compound rate. Area under total cereals total pulses and total food grains has shown increasing trends. Significant negative trend was noticed for double and gross cropped area. In almost all the crops shift in area were observed.

5.5.1.6 Jalgaon :

All the cereals showed increasing trend, but it was significant in case of wheat and bajra, which increased by 5.546 and 3.379 per cent respectively. Gram area increased by 8.747 per cent which was statistically significant. Area under sugar cane increased by 10.171 per cent and cotton area declined by 3.782 per cent per year, the increase and decrease was significant. Regarding the area under other crops, no much variations were seen. Kharif jowar, cotton and ground nut occupied major area in this district. The area of total cereals, total pulses and total food grains increased significantly. Gross and double cropped area increased significantly but on the counter part significant decline in the net cropped area was observed.

5.5.1.7 Ahmadnagar :

Kharif jowar and wheat has got the significant increasing trend for their respective area. It increased by 23.375 and 4.320 per cent per year respectively. The area of rice declined significantly with 2.509 per cent per year. All the selected pulse crops recorded negative growth rates. Sugar cane exhibited the significant increasing trend whereas cotton has shown significant decreasing trend in area. The area of sugar cane increased by 4.349 per cent and that of cotton declined by 16.001 per cent respectively. Ground nut and sesamum also recorded the down ward slopping trend in area. Significant decline in net, double and gross cropped area was observed.

5.5.1.8 Pune :

In the category of cereals declining trend was observed for all the crops except wheat. The area under rice declined significantly with 1.019 per cent per year, while the area of wheat increased with 3.759 per cent per year significantly. Non significant negative growth rates were observed for the area of gram and tur. The area of sugar cane and cotton increased and declined significantly in the order of 3.730 and 3.826 per cent respectively. The area under total cereals, total pulses and total food grains declined but not significantly. Double cropped area has shown an increase but the net and gross cropped area declined significantly.

5.5.1.9 Satara :

The area of wheat, kharif jowar and rabi jowar has shown increasing trend. The area of wheat and kharif jowar increased significantly by 2.511 and 3.050 per cent per year respectively. The area of rice declined non significantly with 0.683 per cent. Negative growth rates were observed for the area of tur and gram. The area of cotton and sugar cane increased and the increase was statistically significant for sugar cane. Area under ground nut declined but not significantly. Total cereals, total pulses and total food grains registered declining trend in area. Gross and net cropped area declined with significant rate.

5.5.1.10 Sangli

All the cereals crops registered the significant declining trend, except the wheat and rabi jowar. The area of rice, kharif jowar and bajra declined with 0.758, 1.854 and 0.854 per cent per year. The area under wheat increased significantly by 4.270 per cent. All the pulse crops possessed the declining trend. The area of sugar cane increased with 5.822 per cent, while area of cotton , ground nut and sesamum declined with 5.622, 4.452 and 13.541 per cent per year respectively. The area of total cereals and total food grains declined significantly. Net and gross cropped area declined significantly. Shifts in the area were observed in the

crops like wheat, sugar cane, kharif jowar, bajra, cotton, ground nut and sesamum respectively.

5.5.1.11 Kolhapur :

The area of wheat, kharif and rabi jowar increased, but the increase was statistically significant in case of only wheat crop. Rice and bajra crop exhibited the significant declining for respective area. All the pulse crops registered the non significant declining trend. The area of cotton and ground nut decreased and on other hand the area of sugar cane increqsed constantly with the compound rate of 4.290 per cent per year. Highest positive growth rate was seen for area of wheat i.e. 7.992 per cent. The area of total cereals, total pulses and total food grains decreased through out the time period. Significant decline in gross and net cropped area was observed while double cropped area declined non significantly.

5.5.1.12 Solapur :

The area of wheat and kharif jowar increased significantly in the order of 6.192 and 10.498 per cent per year respectively. The area ofrice, rabi jowar and bajra declined significantly by 4.797, 1.047 and 2.367 per cent respectively. Gram and tur area increased, and the increase was significant for gram crop. Sugar cane area increased significantly whereas significant decline was observed in the area of cotton and ground nut. The

area under ground nut declined by 10.173 per cent. Significant decline was observed in the area of total cereals. Double and net cropped area decreased significantly.

5.5.1.13 Aurangabad :

Kharif jowar and bajra registered significant decrease and increase of 2.306 and 1.810 per cent respectively in area. All the selected pulse crops described the negative trend. The area of sugar cane increased but the increase was statistically not significant. The area of ground nut, cotton and sesamum declined significantly. Area under total cereals increased significantly while the area of total pulses decreased. The double cropped area increased but significant decline was observed for net and gross cropped area.

5.5.1.14 Parbhani :

All the cereal crops except rice have shown the increasing trend. The increasing trend was significant for the area of bajra and respective growth rate was 14.746 per cent respectively. The area under gram and tur increased significantly to the tune of1.038 and 1.271 per cent respectively. Sugar cane, cotton and sesamum has shown significant increase in their respective area. Area under ground nut declined significantly, and the decline was of the order 6.314 per cent. The area of

total cereals, total pulses and total food grains has shown significant increase. The net, double and gross cropped area increased at the significant rate of growth.

5.5.1.15 Beed :

The area under wheat, kharif jowar and bajra increased significantly with the rate of 2.296, 3.169 and 1.041 per cent respectively. Non significant decline in the area of rice was observed. Gram and tur exhibited the significant increases for their respective area, and it was 1.989 and 3.776 per cent per year. The area of cotton (8.237 per cent). Ground nut (8.574 per cent) and sesamum (4.370 per cent) declined significantly. Statistically significant increase was observed for the area of sugar cane. The area of total cereals and total pulses increased significantly. But the increase was Statistically not significant for the area of food grains. Double cropped area has shown decline while non significant increase was observed in net and gross cropped area.

5.5.1.16 Nanded :

The area of kharif jowar and rabi jowar exhibited significant increasing and declining trend respectively. The area of rabi jowar declined constantly with the rate of 3.056 per cent, while the area of kharif jowar increased with 0.428 per cent peer year. The area of rice and bajra decreased while that of wheat increased non significantly. Area of tur increased

significantly. The area of sugar cane, sesamum and ground nut increased, for the first two crops growth rates were significant, viz; 4.982 and 9.332 per cent respectively. Significant increase in the area of total pulses and total food grains was observed. Statistically significant increase was observed for net, double and gross cropped area. Double cropped area increased with 3.160 per cent yer year.

5.5.1.17 Osmanabad :

The crops like rice, kharif jowar and bajra expressed the significant growth rates of 0.898, 1.551 and 4.996 per cent per year respectively. The area of rabi jowar declined significantly (1.452 per cent). Gram and tur achieved the significant increaseing trends in area. The area of sugar cane and sesamum registered the significant increase where as cotton and ground nut had shown the significant decline of 6.138 and 4.556 per cent per year. The area under total pulses increased significantly. An increase of 6.497 per cent per year, was observed for the double cropped area. Net and gross cropped area also shown the increase in their respective area for later the increase was significant.

5.5.1.18 Buldhana :

All the selected cereal and pulse crops have exhibited the increasing trend for their respective area. The area of kharif jowar, bajra and tur increased

significantly by 1.254, 8.417 and 0.946 per cent respectively. Significant increasing trend in area was observed for cotton, sugar cane and sesamum crops, their area increased by 1.275, 2.008 and 3.053 per cent per year respectively. Area under ground nut decreased with the non significant rate. The area of total cereals, total pulses and total food grains achieved the significant increasing growth rates. Net, double and gross cropped area registered significant increasing growth rates, it was 9.479 per cent in the case of double cropped area.

5.5.1.19 Akola :

Area of kharif jowar and bajra increased significantly by 0.996 and 4.517 per cent per year respectively. The area under wheat and rice increased and decreased with the non significant rate. Increasing trend was observed for the area of gram and tur, for tur it was statistically significant (1.532 per cent). The area of sugar cane increased in the order of 4.434 per cent and with 0.148 per cent of cotton crop. The area of ground nut declined significantly, with the rate of 1.949 per cent, while sesamum has shown the significant increase in its area. Total cereals, total pulses and total food grains possessed significant increasing trend. The net, double and gross cropped area exhibited the significant upward trend. Double cropped area increased with the rate of 12.296 per cent per year.

5.5.1.20 Amravati :

All the cereals and pulse crops have shown the increasing trends, Rice, kharif jowar and bajra recorded the significant growth rates of 4.382, 0.858 and 4.094 per cent respectively. The area of gram, tur and wheat increased but non significantly. Sugar cane, ground nut and sesamum recorded the significant increasing growth rates of 5.766, 2.704 and 3.640 per cent per year respectively. The area of cotton declined for the time period. Significant increasing trend was observed for the area of total cereals, total pulses and total food grains. The net, gross and double cropped area registered significant increasing trend. An increase of 14.082 per cent per year was noticed for double cropped area.

5.5.1.21 Yavatmal :

The area of rice, kharif jowar and bajra increased significantly by 2.106, 0.463 and 3.330 per cent respectively. Wheat area increased with 1.563 per cent but it was statistically not significantly. The area of tur increased significantly while in the case of gram non significant decline was observed. The area of sugar cane and cotton increased significantly, with the rate of 8.549 and 0.991 per cent respectively. Ground nut and sesamum crops recorded the significant increasing trend. The area of total cereals, total pulses and total food grains increased significantly.

Net, double and gross cropped area achived the significant increasing growth rates. An increase of 0.534 per cent was recorded for double cropped area.

5.5.1.22 Wardha :

In the category of cereals, rice and kharif jowar exhibited the increasing growth rates but were statistically not significant. Wheat, rabi jowar and bajra registered the negative trend for their respective cropped area, and for bajra it was significant. The area of gram increased significantly with the rate of 0.474 per cent. The area of cotton and ground increased significantly by 0.793 and 16.650 per cent respectively, Significant decline was observed in the area of sesamum. Total cereals and total food grains registered significant increasing trend. The net, double and gross cropped area increased significantly.

5.5.1.23 Nagpur :

Rice has shown significant increase of 4.286 per cent in its area. The area of wheat, kharif jowar and rabi jowar declined at the non significant rate. Gram and tur area increased significantly by 2.612 and 0.215 per cent respectively. Decline in the area of sugar cane was observed. The area of cotton, ground nut and sesamum has shown significant positive growth rates of 1.124, 4.185 and 10.792 per cent per year. Total cereals, total pulses and total food grains recorded the increasing trend. Gross, double and net cropped

increased significantly. An increase of 6.208 per cent was observed for double cropped area in the district.

5.5.1.24 Bhandara :

Rice and wheat had shown the significant increasing trend. The area of rice and wheat increased by 0.728 and 0.806 per cent per year. Kharif jowar and rabi jowar exhibited decling trend, for kharif jowar it was significant (4.589 per cent). Gram has shown increasing trend while tur decling trend. The area of total cereals and total food grains has shown significant increasing trend. Statistically significant increasing growth rates of 3.391, 10.055 and 6.636 per cent per year were observed for the area of sugar cane, ground nut and sesamum respectively. The double cropped area has shown the non significant declining trend.

5.5.1.25 Chandrapur :

Rice and kharif jowar achieved the significant increasing growth rates of 0.923 and 2.429 per cent per year respectively for their area. The area of total cereals and total pulses has got the increasing trend. Significant increase in the area of cotton (3.479 per cent), ground nut (10.200 per cent) and sesamum (3.170 per cent) and decrease in the area of sugar cane (8.458 per cent) was observed. Net, double and gross cropped area exhibited significant increase. An increase of 1.835 per cent per year was noticed in double cropped area.

5.5.1.26 State :

All the selected cereals except rabi jowar registered the increasing trend. The area of rice, wheat and kharif jowar increased significantly with the rates of 0.365, 1.339 and 0.661 per cent per year respectively. Bajra has shown the non significant increase. Statistically significant decline of 0.654 per cent was observed in the area of rabi jowar. The area of gram and tur has got the increasing trend. Tur area increased significantly by 0.781 per cent. The area of sugar cane and cotton increased and decreased significantly, by 4.865 and 1.555 per cent per year respectively. Significant increase in the area of sesamum was noticed. The area under ground nut declined by 2.499 per cent and the decline was significant. The area of total cereals, total pulses and total food grains increased, for total pulses increase was significant. Net and gross cropped area has shown decline. The double cropped area increased significantly with the rate of 1.075 per cent per year.

The area under sugar cane increased with highest compound rate during the period of study in the state. The growth rates in Chandrapur and Nagpur districts were negative, as the area under sugar cane was much less. The highest growth rate in increase in the area of sugar cane crop was observed in Dhule

district, i.e. 12.495 per cent per year. The increase in the area of sugar cane was significant in almost all the districts except Aurangabad, wherein it was positive but not significant. Raigad and Wardha had no much sugar cane area.

Rice, wheat, kharif jowar, tur and seaamum area increased significantly at the state level, while rabi jowar, cotton and ground nut declined significantly, highest decline was in ground nut (2.499 per cent). In case of ground nut area decline was observed in most of the districts except those districts, which fall in Vidarbha region, where the growth rates were of increasing nature, as the area under ground nut was quiet low as compared to other districts.

5.5.2 Production and Productivity :

Growth analysis of production and productivity of various crops help in understanding the importance of each crop in the district and indicates the stage of progress. With the view in mind compound and linear growth rates of the selected crops for each district during the period of 1960-61 to 1977-78 were workedout on the basis of three yearly moving average and for simplicity compound growth rates are discussed in detail and presented in table 12.13. The results of the same for each district are presented in this section.

Table 12 : Compound growth rates of production of principal crops.

Sr. No.	Districts	Rice	Wheat	Kharif jowar	Rabi jowar	Total jowar	Bajra	Total cereals	Gram
1.	Thane	0.843	--	10.624*	--	10.624*	--	1.059	0.025
2.	Raigad	1.156*	--	--	--	--	--	1.277*	2.018
3.	Ratnagiri	3.437*	--	--	--	--	--	3.096*	--
4.	Nasik	1.406	5.808*	8 .592	(-) 2.653	1.839	0.359	1.457	0.724
5.	Dhule	(-) 0.652	5.478*	5.442	(-) 4.437*	(-) 0.584	2.240*	1.774	1.007
6.	Jalgaon	11.241*	9.133*	(-) 0.869	2.134	(-) 0.689	7.291*	2.064	11.310*
7.	Ahmadnagar	0.506	12.336*	28.399*	(-) 2.295	(-) 1.312	3.085*	1.435	0.921
8.	Pune	1.918	12.675*	5.350	(-) 0.125	0.625	0.290	1.717	0.073
9.	Satera	3.463*	4.979*	5.937*	(-) 2.061	(-) 1.947	(-) 2.478*	(-) 1.326	(-) 1.394
10.	Sangli	5.020*	8.321*	(-) 2.806	(-) 1.417	(-) 2.535	(-) 1.502	(-) 1.198	(-) 0.655
11.	Kolhapur	1.872	13.301*	0.787	2.827	0.814	(-) 4.078*	1.825	0.254
12.	Solapur	1.843	10.042*	13.270*	(-) 3.499*	(-) 3.155	1.802	(-) 1.518	3.453*
13.	Aurangabad	1.099	4.884*	(-) 1.170	(-) 2.565	(-) 2.195	(-) 0.126	(-) 0.402	0.151
14.	Parbhani	0.608	3.208	0.981	(-) 2.333	(-) 0.787	13.889*	0.799	0.872
15.	Beed	(-) 2.608	2.790*	3.193	(-) 2.867	(-) 0.826	4.141*	0.332	(-) 0.201
16.	Nanded	(-) 0.404	5.741*	(-) 1.305	(-) 4.131	(-) 1.773	(-) 1.129	(-) 0.860	(-) 1.810
17.	Osmanabad	0.754	4.696*	1.295	(-) 3.635	(-) 1.054	3.767*	0.074	0.892
18.	Buldhana	4.888*	4.426*	2.922	1.938	2.906	9.981*	3.192*	1.365
19.	Akola	2.193	5.039*	1.896	--	1.905	6.014*	2.395	1.553
20.	Amravati	5.002*	4.273*	2.440	--	2.4400	5.988*	2.985*	5.021*
21.	Yavatmal	4.457*	7.545*	2.914*	--	2.901*	5.045*	3.308*	0.316
22.	Wardha	13.749*	5.997*	1.873	(-) 5.814*	1.796	(-) 1.397	3.599*	0.659
23.	Nagpur	4.917*	2.569*	5.134	(-) 1.668	1.512	0.681	2.315	2.033
24.	Bhandara	2.160	4.313*	(-) 1.826	(-) 2.960*	(-) 2.835*	--	2.002	1.141*
25.	Chandrapur	3.350*	2.349*	3.909*	(-) 1.615	(-) 0.604	--	2.258*	2.040*
26.	State	2.304*	5.932*	1.677	(-) 2.464	--	1.806*	1.241	0.776

Table 12 : (Continued) :

Sr. No.	Districts	Tur	Total pulses	Total food grains.	Sugar cane	Cotton	Ground nut	Sesamum
1.	Thane	(-) 0.087	(-) 0.068	0.675	--	--	--	(-) 5.260*
2.	Raigad	2.049	(-) 1.752*	2.025	--	--	--	--
3.	Ratnagiri	0.012	(-) 1.382	2.981*	15.595*	--	(-) 1.662	(-)15.351*
4.	Nasik	0.186	1.804	1.510	8.693*	(-) 8.805*	0.120	(-)10.404*
5.	Dhule	2.216	3.879*	2.049	18.474*	(-) 0.857	(-) 1.243	(-) 5.971*
6.	Jalgaon	(-) 0.507	1.362	1.898	15.436	(-) 4.876*	0.923	(-) 5.406*
7.	Ahmadnagar	(-) 3.235	0.283	1.358	2.288*	(-)12.344*	(-) 4.396*	(-) 5.392*
8.	Pune	1.811	2.026	1.784	2.332*	(-) 1.865*	0.687	(-) 2.643*
9.	Satara	0.258	0.239	1.207	6.069*	5.081*	(-) 2.883*	--
10.	Sangli	0.066	0.904	(-) 0.930	5.650*	(-) 4.790*	(-) 5.366*	(-)15.720*
11.	Kolhapur	(-) 3.253*	(-) 1.515	1.723	5.381*	(-) 2.207*	(-) 1.473*	--
12.	Solapur	(-) 7.928*	(-) 1.212	(-) 1.257	4.479*	(-) 2.027*	(-) 9.711*	(-) 2.665*
13.	Aurangabad	1.975	(-) 0.756	(-) 0.285	5.051*	12.768*	(-) 6.611*	(-) 8.509*
14.	Parbhani	2.466*	1.510	0.638	3.643*	16.628*	(-) 7.227*	5.338*
15.	Beed	3.221	0.751	0.386	6.135*	6.844*	(-)11.161*	(-) 4.841
16.	Nanded	1.903	1.868	(-) 0.421	7.580*	16.308*	(-) 3.929*	6.042*
17.	Osmanabad	0.351	2.156	0.447	8.335*	7.748*	(-) 7.306*	(-) 1.556
18.	Buldhana	0.348	2.219	3.048*	9.121*	(-) 1.034	2.024	(-) 3.391*
19.	Akola	1.773	2.273	2.371	12.048*	0.045	1.476	3.057*
20.	Amravati	(-) 2.005	(-) 0.931	1.806	15.096*	(-) 1.146	5.502*	2.850*
21.	Yavatmal	(-) 1.413*	(-) 0.687	2.391*	17.025*	0.660	5.793*	1.103
22.	Wardha	0.420	0.910	2.034*	13.190*	1.994*	19.554*	(-) 5.188*
23.	Nagpur	(-) 1.027	(-) 0.802	1.925	11.034*	1.351*	4.545*	7.061*
24.	Bhandara	(-) 2.020	(-) 1.383	1.699	8.590*	--	16.774*	8.180*
25.	Chandrapur	(-) 3.355*	(-) 0.414	2.054*	(-) 4.591*	4.097*	--	2.690*
26.	State	(-) 0.465	0.732	1.268	5.308*	(-) 1.532*	(-) 2.443*	1.303

5.5.2.1 Thane :

In this district only kharif jowar showed the significant positive trend in production and productivity, but it covered very small proportion in area and has contributed very small amount of production. In the case of rice, production increased by 0.843 per cent per annum which was not significant, but the productivity of the same crop increased significantly to the tune of 1.316 per cent per annum. As regards the other crops no significant observations were made.

5.5.2.2 Raigad :

Production of rice in this district increased by 1.156 per cent per annum, which was statistically significant, but the productivity, though it was positive did not increased significantly. Productivity of tur also increased by about 2 per cent per annum, but the increase in the production was not significant (2.049). Average production of tur in this district was very much less and was of least importance in cropping pattern.

5.5.2.3 Ratnagiri :

Production of rice and sugar cane increased by 3.437 and 15.595 per cent per year respectively, and the productivity of these crops also increased significantly in the order of 2.203 and 6.209 per cent respectively. The production sesamum declined

significantly by 15.351 per cent. Other crops were of minor importance and did not show any difference either in production or productivity.

5.5.2.4 Nasik :

Production of wheat and sugar cane increased significantly. The growth rates of these crops were statistically significant for production and productivity. In both these crops rate of increase in production was higher than the productivity. Crops like bajra, tur, gram, total pulses, total food grains and ground nut showed the positive growth rates, but were statistically not significant. Increasing growth rates of 8.592 and 7.385 per cent per annum were secured for the production and productivity of kharif jowar, for productivity it was significant. Cotton and sesamum production declined significantly but the productivity of cotton increased by 1.429 per cent per annum, which was statistically not significant.

5.5.2.5 Dhule :

Production of wheat, bajra, total pulses and sugar cane increased significantly, with 5.478, 2.240, 3.879 and 18.474 per cent per year respectively. In case of rabi jowar and sesamum production declined significantly with 4.437 and 5.971 per cent respectively. The productivity of wheat, kharif jowar, tur and sugar cane increased significantly by 2.988, 5.281,

Sr. No.	Districts	Rice	Wheat	Kharif jowar	Rabi jowar	Bajra	Total cereals	Gram
1.	Thane	1.316*	--	12.515*	--	--	1.516*	1.497
2.	Raigad	0.855	--	--	--	--	0.894*	0.074
3.	Ratnagiri	2.203*	--	--	--	--	2.892*	--
4.	Nasik	2.004	4.671*	7.385*	2.429	0.395	1.654	0.576
5.	Dhule	1.806	2.988*	5.281*	(-) 0.619	1.470	1.777	0.884
6.	Jalgaon	2.647	3.550*	(-) 1.899	1.441	3.170*	(-) 0.155	1.994
7.	Ahmadnagar	2.635	7.739*	3.228	(-) 1.835	3.810*	1.400	(-) 3.194*
8.	Pune	2.925	8.433*	7.167*	0.107	0.514	1.470	2.385*
9.	Satara	2.188	2.674*	2.897*	(-) 1.703	(-) 0.334	1.550	1.402
10.	Sangli	3.933*	3.214*	(-) 1.286	(-) 1.295	(-) 0.365	(-) 0.436	0.660
11.	Kolhapur	3.267*	4.266*	0.213	3.548	0.389	4.214	1.540*
12.	Solapur	5.728*	2.746*	2.656	(-) 2.725	3.625*	(-) 0.887	(-) 1.709*
13.	Aurangabad	(-) 1.451	5.071*	(-) 0.181	(-) 3.482	(-) 1.067	(-) 1.425	0.665
14.	Parbhani	2.752	3.093	0.485	(-) 2.846	(-) 1.149	(-) 0.960	(-) 1.854*
15.	Beed	(-) 2.053	1.530	(-) 0.100	(-) 3.217	(-) 0.104	(-) 1.412	(-) 1.740
16.	Nanded	0.054	3.618*	(-) 1.322	(-) 0.798	(-) 0.831	(-) 0.666	0.476
17.	Osmanabad	(-) 0.846	4.032	(-) 1.632	(-) 2.179	(-) 1.411	(-) 0.617	(-) 0.752
18.	Buldhana	5.287	4.440*	0.539	(-) 0.675	1.486	1.991	0.670
19.	Akola	2.007	4.170*	0.819	--	1.433	1.306	0.956
20.	Amravati	0.363	3.793*	1.224	--	1.769	2.208	3.613*
21.	Yavatmal	2.257*	5.674*	2.418*	--	1.544	2.524*	0.431
22.	Wardha	5.531*	5.970*	2.418*	(-) 3.065*	1.344	2.377*	(-) 3.014*
23.	Nagpur	0.525	3.067*	2.860*	(-) 2.810*	(-) 2.810	2.146*	(-) 0.711
24.	Bhandara	1.458	3.341*	2.765	(-) 2.682*	--	1.470	(-) 3.527
25.	Chandrapur	2.390*	2.303*	1.100*	1.949	--	1.269	(-) 0.484
26.	State	2.092*	4.411*	0.993	1.092	1.315	(-) 0.333	0.065

Table 13 : (Continued) :

Sr. No.	Districts	Tur	Total pulses	Total food grains	Sugar cane	Cotton	Ground nut	Sesamum
1.	Thane	1.050	1.606*	1.561*	--	--	--	(-) 14.808
2.	Raigad	1.955	1.134	1.024*	--	--	--	6.444
3.	Ratnagiri	1.415	1.206*	3.020*	6.209*	--	(-) 4.086*	(-) 0.003
4.	Nasik	2.394*	0.335	1.500	4.803*	1.429	1.885	(-) 3.476
5.	Dhule	1.640*	0.946	1.455	5.893*	2.117	0.100	(-) 3.157
6.	Jalgaon	1.103	0.214	0.461	4.158*	(-) 0.934	1.083	(-) 0.241
7.	Ahmadnagar	(-) 0.151	1.652*	2.198	1. 470	4.783*	2.970*	0.131
8.	Pune	2.400*	1.875*	1.923	3.230*	0.966	(-) 0.557	0.743
9.	Satara	0.964	(-) 0.260	1.286	4.456*	1.433	2.157	109.617*
10.	Sangli	(-) 0.251	0.035	4.248*	2.481*	2.397*	1.157	1.146
11.	Kolhapur	0.238	0.316	2.231*	1.182*	0.507	(-) 0.611	(-) 8.430
12.	Solapur	(-) 8.014*	(-) 3.886*	(-) 1.256	2.3460*	2.940*	(-) 0.344	(-) 0.709
13.	Aurangabad	2.661	0.912	(-) 0.929	3.817*	18.155*	0.420	(-) 0.839
14.	Parbhani	1.091	(-) 0.234	(-) 0.629	2.100*	18.260*	(-) 1.058	(-) 1.294
15.	Beed	(-) 0.861	(-) 0.136	(-) 1.331	0.632	14.460*	(-) 4.509	1.520
16.	Nanded	(-) 0.753	(-) 0.636	(-) 1.165	2.277*	16.793*	(-) 3.711*	(-) 3.153
17.	Osmanabad	(-) 1.440	(-) 0.264	(-) 0.659	3.650*	14.795*	(-) 2.845*	(-) 2.976
18.	Buldhana	(-) 0.692	(-) 0.446	1.490	7.604*	(-) 0.834	3.475*	(-) 5.305*
19.	Akola	0.112	(-) 0.334	0.900	8.225*	(-) 0.134	2.982*	(-) 0.227
20.	Amravati	(-) 1.854	(-) 2.085	0.481	8.365*	0.012	2.665*	(-) 0.253
21.	Yavatmal	(-) 2.130*	(-) 1.634*	1.764*	7.809*	0.014	0.965	0.194
22.	Wardha	(-) 0.167	(-) 0.104	5.469*	14.191*	1.194	1.346*	(-) 0.283
23.	Nagpur	(-) 1.089	(-) 3.170	1.575	11.835*	1.653*	0.328	(-) 3.848*
24.	Bhandara	1.968*	(-) 1.087	1.315*	6.669*	--	4.385	(-) 1.690
25.	Chandrapur	(-) 3.498*	(-) 0.443	1.340*	4.112*	0.691	--	0.868
26.	State	(-) 1.272	1.002	0.927	1.574*	(-) 0.405	0.106	1.105

1.640 and 5.893 per cent per annum respectively. The positive growth rates were higher in production as compared with productivity. Only in rabi jowar non significant decline in productivity was observed. Decline in ground nut production and increase in its productivity was observed, both were statistically non significant.

5.5.2.6 Jalgaon :

Production of rice, wheat, bajra, gram and sugar cane increased significantly. The highest and lowest significant increasing growth rates of 15.436 and 7.291 per cent per year were seen in the production of sugar cane and bajra respectively. Rabi jowar, total cereals, total pulses and ground nut production increased but at statistically not significant rates production of kharif jowar, tur, cotton and sesamum declined and the decline was statistically significant in the case of cotton (4.376 per cent) and sesamum (5.406 per cent), while the productivity of wheat, bajra and sugar cane increased significantly to the tune of 3.550, 3.170 and 4.153 per cent per year respectively. The productivity of kharif jowar, total cereals and cotton declined, and it was statistically not significant. In remaining crops it increased with non significant growth rate.

5.5.2.7 Ahmadnagar :

Production of kharif jowar increased by 28.399 per cent per year, while its productivity increased with 3.228 per cent per year. The growth rate of production was statistically significant. At the initial years of the study, the production of kharif jowar was much less. Production of wheat, bajra and sugar cane has shown the significant increase, whereas the production of cotton, ground nut and sesamum declined with significant rate. Highest decline of 12.344 per cent per year was seen in case of cotton production. Productivity of wheat, bajra, total pulses, cotton and ground nut increased at the significant rate, significant decline of 3.194 per cent was observed for the productivity of gram crop. This district ranked first in the order of merit for the productivity of sugar cane but the increase in its productivity was statistically not significant. Decline in the productivity of rabi jowar and tur was noticed andit was found to be statistically not significant.

5.5.2.8 Pune :

Wheat and sugar cane production increased in the order of 12.675 and 2.332 per cent per year and was statistically significant. Only in cotton significant decline of 1.865 per cent was observed for its production whereas its productivity achieved the not significant

positive growth rate. This district was at the second place for cotton productivity. The production of rice, kharif jowar and bajra increased but the increase was not significant. Productivity of all the crops except ground nut increased and was significant in the case of wheat, kharif jowar, tur, gram, total pulses and sugar cane. Highest growth rate was observed in the case of wheat (8.433 per cent).

5.5.2.9 Satara :

Production of rice, kharif jowar, wheat, cotton and sugar cane increased in the order of 3.463, 5.937, 4.979, 5.081 and 6.069 per cent per year respectively. Significant decline was observed in the production of bajra and ground nut, which was 2.478 and 2.883 per cent respectively. The decline in the production of rabi jowar and gram was statistically not significant. Productivity of sugar cane, wheat and kharif jowar has exhibited significant increase in the order of 4.456, 2.674 and 2.897 per cent per annum respectively. The productivity of rabi jowar, bajra and tur declined and the decline was not significant. In the case of remaining crops non significant increase was observed in productivity.

5.5.2.10 Sangli :

Statistically significant increasing growth rates of 5.650, 8.231 and 5.026 per cent per year were

observed for the production of sugar cane, wheat and rice respectively. In addition with these crops cotton also has got the significant increasing trend for productivity. All the remaining crops except tur possessed negative growth rates in production and for cotton, ground nut and sesamum these were statistically significant. Highest decline of 15.720 per cent per year was seen for the production of sesamum, ground nut and cotton followed it. Highest growth rate of 3.933 per cent per year was seen for rice productivity. In the case of kharif and rabi jowar, bajra and tur declining trend in the productivity was seen and for all the crops it was statistically not significant.

5.5.2.11 Kolhapur :

Rice, wheat, gram, total food grains and sugar cane productivity (3.267, 4.266, 1.540, 2.231 and 1.182 per cent) increased significantly, however, the production of rice and gram did not increase significantly indicating there by decline in area. Production of wheat and sugar cane increased to the tune of 13.301 and 5.381 per cent per year. Statistically significant decling growth rates of 4.078, 3.253, 2.207 and 1.473 per cent per year were registered for the production of bajra, tur, cotton and ground nut respectively. Ground nut was the only crop which registered negative growth rate in productivity.

5.5.2.12 Solapur :

Production of wheat, kharif jowar, gram and sugar cane has got the significant positive values in growth rates viz; 10.042, 13.270, 3.453 and 4.479 per cent per year respectively. The production of rabi jowar, tur, cotton, ground nut and sesamum declined with the significant rates of growth and the respective values of the growth rates were 3.499, 7.928, 2.027, 9.711 and 2.665 per cent per year. Productivity of rice, wheat, bajra, sugar cane and cotton increased significantly by 5.728, 2.746, 3.624, 2.346 and 2.940 per cent per year respectively. The productivity of rabi jowar, tur, gram and ground nut declined, it was significant in case of tur (8.014 per cent).

5.5.2.13 Aurangabad :

Production of wheat (4.884 per cent) cotton (12.768 per cent) and sugar cane (5.051 per cent) increased significantly. Rice, gram and tur production increased but the increase was statistically non significant. All the remaining crops have shown decline in their respective production. Ground nut and sesamum production has got the significant declining growth rates of 6.611 and 8.509 per cent respectively. Both the production and productivity of bajra declined with the non significant rate. The productivity of wheat, gram, sugar cane and cotton increased and the increase was statistically

significant. Highest growth rate of 18.455 per cent per year was observed for cotton productivity. The average cotton productivity in this district was 40.621 Kgs of lint per hectare and which has got the highest value of coifficient of variation (96.294 per cent).

5.5.2.14 Parbhani :

Bajra, tur, cotton, sugar cane and sesamum production increased with the significant rate. Highest growth rate of 16.628 per cent was seen in cotton production. Rabi jowar and ground nut production declined, it was significant in the case of ground nut (7.227 per cent). Not significant increase in the production of rice, wheat, kharif jowar and gram was noticed. In the case of productivity only sugar cane and cotton possessed the significant increasing trend, it increased by 2.100 and 18.260 per cent per year. The productivity of rice, wheat , kharif jowar and tur increased but at the non significant rate. The average productivity of these crops was less than state average and has got the fluctuations of 30 to 45 per cent. Rabi jowar, bajra, gram and ground nut has shown declining trend in productivity and was significant for gram (1.854 per cent).

5.5.2.15 Beed :

Cotton and ground nut were the only crops,which showed significant positive and negative growth rates of 14.460 and 4.509 per cent for respective productivity.

The production of cotton increased in the order of 6.844 per cent whereas that of ground nut declined with 11.161 per cent per year significantly. The productivity of wheat and sugar cane increased but the increase was statistically not significant. All the remaining crops had shown the declining trend in productivity and for ground nut it was significant. The production of wheat, bajra and sugar cane has shown the significant increasing trend, wherein it declined in sesamum along with ground nut. The production of rice, rabi jowar and gram declined but not significantly.

5.5.2.16 Nanded :

The production of wheat, sugar cane, cotton and sesamum increased significantly by 5.741, 7.580, 16.308 and 6.042 per cent per year respectively. The productivity of these crops also increased and for cotton it has got the highest rate of increase (16.793 per cent). Production and productivity of ground nut declined significantly by 3.929 and 3.711 per cent per year. The production of all the remaining crops declined but the decline was statistically not significant. The productivity of rice and gram increased and of remaining crops decreased, both at not significant rate respectively.

5.5.2.17 Osmanabad :

Production of wheat, bajra, cotton and sugar cane increased significantly in the order of 4.096, 3.707,

7.748 and 8.335 per cent per annum at the compound rate respectively. Ground nut production declined significantly with 7.306 per cent per year. Rice, gram, kharif jowar, and tur production increased and of rabi jowar and sesamum decreased non significantly. The productivity of wheat, cotton and sugar cane increased by 4.035, 3.650 and 14.795 per cent per annum, for wheat it was statistically not significant. The ground nut productivity declined significantly by 2.845 per cent. The productivity of all the remaining crops declined at the not significant rate.

5.5.2.18 Buldhana :

Cotton and sesamum production declined with 1.034 and 3.391 per cent per year respectively, for second crop it was statistically significant. All the remaining crops had shown increasing trend in production and was significant for rice (4.888 per cent), wheat (4.426 per cent), bajra (9.981 per cent) and total cereals (3.192 per cent) respectively. The productivity of rabi jowar, tur and cotton declined but non significantly. All other crops registered positive growth rates in productivity and were statistically significant for rice (5.287 per cent), wheat (4.440 per cent), sugar cane (7.604 per cent) and ground nut (3.475 per cent) respectively. The average productivity of kharif jowar and cotton was just equal of state average.

5.5.2.19 Akola :

All the selected crops had shown the increasing trend in production. Wheat, bajra, sugar cane and sesamum possessed the significant growth rates of 5.039, 6.014, 12.048 and 3.057 per cent respectively. All the remaining crops production increased with not significant rate. The productivity of all the crops except cotton has shown increase. Increase in productivity was statistically significant in case of wheat (4.170 per cent), sugar cane (8.225 per cent) and ground nut (2.665 per cent). The production of cotton increased, whereas its productivity decreased, both at non significant rate indicating that increase in the cotton production was due to increase in the area. The average productivity of almost all the crops was below the state averages.

5.5.2.20 Amravati :

Production of rice , wheat, bajra, gram, sugar cane, ground nut and sesamum increased significantly by 5.002, 4.273, 5.988, 5.021, 15.096, 5.502 and 2.850 per cent respectively. The productivity of the same crops has shown increase and was significant in the case of wheat, gram, sugar cane and ground nut. Highest growth rate (8.365 per cent) was achieved for sugar cane. Tur and cotton production declined but the cotton productivity has shown increase of non significant rate. Productivity of rice and kharif jowar increased and the

increase was statistically not significant. The values of growth rates were higher in case production compared with the productivity.

5.5.2.21 Yavatmal :

Production of all the crops except tur has shown increasing trend. Production of rice, wheat, kharif jowar, bajra, gram, sugar cane and ground nut increased significantly. Highest increase was observed in the production of sugar cane (17.025 per cent per year), wheat followed it. Productivity of rice, wheat, kharif jowar and sugar cane increased with growth rates of 2.257, 5.674, 3.418 and 7.809 per cent respectively, Whichwere statistically significant. The productivity of tur declined significantly, Bajra, gram, cotton and ground nut productivity increased but the increase was statistically not significant. Average productivity of almost all the crops was below the state average.

5.5.2.22 Wardha :

Production and productivity of rice and wheat increased significantly. The growth rate, of increase were of higher degree in production as compared to the productivity. Significant decline in the production and productivity of rabi jowar was seen in the order of 5.814 and 3.064 per cent per year respectively. Productivity of gram decreased significantly but increase

in production was observed, it was due to increase in its area in this district. Statistically significant increasing growth rates of 1.994, 13.190, 10.554 and 1.194, 14.191 and 2.356 per cent were achieved for the production and productivity of cotton, sugar cane and ground nut respectively, it was statistically not significant in the case of cotton productivity.Significant decline in the sesamum production was seen. Higher values of growth rates in production were observed as compared the productivity. Significant increase in production and productivity was achieved in the aase of total cereals and total food grains.

5.5.2.23 Nagpur :

Production of all the crops, except rabi jowar and tur has shown increase. Production of rice, cotton, sugar cane, ground nut and sesamum increased with the significant rates of 4.917, 1.351, 11.034, 4.545 and 7.061 per cent respectively. The decline in the production of jowar and tur was statistically not significant. Productivity of wheat, kharif jowar, sugar cane and cotton increased significantly and the increase was 3.067, 2.961, 11.835 and 1.653 per cent per year respectively which implied that the increase in the production of these crops was mainly due to increased productivity. Productivity of tur, gram and rabi jowar declined and was statistically significant in case of rabi jowar (3.065 per cent).

5.5.2.24 Bhandara :

Wheat, gram, sugar cane, ground nut and sesamum production increased significantly. The highest and lowest growth rates were observed in the production of ground nut (16.774 per cent) and gram (1.141 per cent). The production and productivity of rice increased but at non significant rate. Significant decline in the production of rabi jowar (2.960 per cent) was seen. Productivity of wheat, kharif jowar and sugar cane has shown significant increase. Productivity of tur, gram and rabi jowar declined and the decline of 2.682 per cent per year was statistically significsnt for rabi jowar. The average productivity of rice in this district was 937.625 Kgs per hectare and was lower than the State average.

5.5.2.25 Chandrapur :

Production and productivity of rice, wheat and kharif jowar possessed the significant increasing growth rates of 3.350, 2.349, 3.909 and 2.390, 2.303 and 1.100 per cent per year respectively. In case of sugar cane production declined and productivity inclined significantly implying decline in the area. Statistically significant declining trend was observed for production and productivity of tur crop. Gram production increased significantly while its productivity declined. Increasing trends were obtained in the production and productivity of total cereals and total food grains.

5.5.2.26 State :

Production of wheat, rice, bajra and sugar cane has shown significant increasing trend. It increased by 5.932, 2.304, 1.806 and 5.308 per cent per annum respectively. Kharif jowar, gram and sesamum production increased but with the non significant rate. Cotton and ground nut production declined significantly with 1.532 and 2.443 per cent respectively. Statistically non significant decreased production of rabi jowar and tur was observed. Productivity of rice, wheat and sugar cane increased significantly, in the order of 2.092, 4.411 and 1.574 per cent per year respectively. Cotton and tur productivity declined and significantly for cotton, kharif and rabi jowar, bajra, gram and ground nut productivity increased at non significant rate of increase.

Production of kharif jowar increased with highest growth rate i.e. 28.399 per cent per year in Ahmadnagar followed by Solapur, Satara, Thane, Chandrapur and Yavatmal. At state level it increased with non significant rate i.e. 1.677 per cent while in the case of rabi jowar it declined by 2.464 per cent per annum. Rabi jowar production did not increased significantly in any district however it increased with non significant rates in Jalgaon, Kolhapur and Buldhana and significantly declined in Dhule, Solapur and Bhandara. In remaining districts the decline was not significant. Bajra production increased significantly at state level by 1.806 per cent

per annum, the highest growth rate was in Parbhani i.e. 13.889 per cent per year. Dhule, Jalgaon and Ahmadnagar are the major bajra growing districts. Wherein production increased significantly, while in case Aurangabad and Nasik which are also major bajra growing districts, in bajra production significant growth rate was not observed.

Gram production increased with non significant rates while tur production declined with non significant rate at the state level. In case of gram, Jalgaon recorded highest (11.310 per cent) growth rate, followed by Amravati, Solapur, Chandrapur and Nagpur, whilein case of tur production only Parbhani district recorded significant growth rate i.e. 2.466 per cent.

Cotton production increased mainly in Marathwada division. It increased by 12.768, 16.628, 6.844, 16.308 and 7.748 per cent in Aurangabad, Parbhani, Beed,Nanded and Osmanabad districts respectively. In remaining districts Satara, Wardha, Nagpur and Chandrapur recorded significant increase in cotton production, however the production at state level declined with significant rate of 1.532 per cent.

Ground nut production declined with significant rate i.e. 2.443 per cent at state level, with the negative significant growth rates in number of districts. Districts falling in Vidarbha region showed the positive growth in ground nut production. Sesamum production

increased with highest rate in Bhandara followed by Nagpur and Nanded.

Sugar cane production increased by 5.308 per cent per annum at the state level. Its production increased in almost all the districts significantly except Chandrapur wherein significant declining growth rate was (4.591 per cent) observed. The highest increase in sugar cane production was in Dhule i.e. 18.474 per cent per year.

Productivity of almost all the crops except tur and cotton increased in the state. It was statistically significant in case of rice, wheat and sugar cane i.e. 2.092, 4.411 and 1.574 per cent respectively.

Growth rates of wheat productivity were positive for all districts and were significant except Parbhani, Beed and Osmanabad districts. Pune district record the highest (8.433 per cent) growth rate. Rice productivity increased in all the districts except Aurangabad, Beed and Osmanabad districts. Productivity of rice crop in Solapur, Buldhana and Wardha increased by more than 5 per cent per year.

In the case of kharif jowar and rabi jowar productivity increased by about one per cent per annum at the state level. In Nasik and Pune districts the kharif jowar productivity increased by 7 per cent while in Dhule it was 5.281 per cent. The districts of

Marathwada region showed negative but non significant growth. While in case of rabi jowar no significant growth in productivity was observed in any district, on the other hand significant decline was observed in Wardha, Nagpur and Bhandara districts.

Per hectare production of bajra increased in Dhule, Jalgaon and Solapur districts, by more than 3 per cent which was statistically significant. At the state level it increased (1.315 per cent) non significantly.

Tur recorded negative but non significant trend while for gram stagnant productivity was observed at the state level.

Sugar cane productivity increased by 1.574 per cent at the state level and was significant.Productivity of sugar cane in various district recorded significant growth rates and were comparatively higher in Vidarbha region. The highest growth rate was (14.191 per cent) in Wardha. Ahmadnagar which is one of the major sugar cane growing district recorded positive but non significant growth rate.

In case cotton productivity, the districts of Marathwada region possessed significantly higher growth rates than the other districts. In Aurangabad and Parbhani the rate was more than 18 per cent, in Nanded it was to about 17 per cent, while in Beed and Osmanabad of was around 14 per cent.

Ahmadnagar also showed significant increase in cotton productivity by 4.783 per cent, followed by Sangli and Wardha. Remaining districts did not show significant changes in cotton productivity.

Ground nut productivity increased significantly in Vidharbha region and the growth rates in these districts were much higher than the other districts. Productivity of ground nut at the state level remain almost unchanged.

5.5.3 Irrigated area :

Irrigation helps in increasing the productivity of various crops on account of this activity of development gets accelerated. It is essential to study the changes in irrigated area of various crops in each district, so as to understand the contribution of irrigated area in agricultural development. Average area irrigated and percentage increase and decrease during the period of study are presented in table 1½.

The results of area under sugar cane are discussed under the section of growth analysis of area. Total area and irrigated area under sugar cane in the same.

5.5.3.1 Thane, Raigad and Ratnagiri :

Irrigated area in Thane, Raigad and Ratnagiri district was very small and most of the crops selected for study were not grown under irrigated condition in

these districts. In the case of Ratnagiri district area under irrigated rice was 3.215 per cent and it declined significantly by 2.469 per cent per year.

In remaining districts considerable irrigated area was present and hence the districtwise results are discussed as under.

5.5.3.2 Nasik :

Cotton, wheat, gram and rice shared 43.30, 26.20, 22.06 and 11.33 per cent area under irrigation out of the total cropped area of the same crops in the district. Wheat and sugar cane occupied 25.50 and 13.67 per cent of gross irrigated area. The average gross irrigated area was 9.85 per cent of the gross cropped area . Irrigated area under rice, wheat, bajra and ground nut as well as gross irrigated area increased significantly. The highest growth rate (35.157 per cent) was seen in bajra. In the case gram increase was non significant, while the irrigated area of cotton declined non significantly and it was 3.685 per cent per year.

5.5.3.3. Dhule :

Average gross irrigated area in this district was 8.167 per cent of gross cropped area. Wheat, cotton, sugar cane and rice contributed 50.79, 7.19, 7.51 and 6.01 per cent of gross irrigated area. Compound growth rates of irrigated area under rice, wheat, gram and

Table 14 : Compound growth rates of irrigated area under principal crops.

Sr. No.	Districts	Rice	Wheat	Khatif jowar	Rabi jowar	Bajra	Gram	Cotton	Ground nut	Total irrigated area
1.	Thane	--	--	--	--	--	--	--	--	3.441
2.	Raigad	--	--	--	--	--	--	--	--	6.449*
3.	Ratnagiri	(-) 2.469*	--	--	--	--	--	--	--	(-) 0.098
4.	Nasik	4.017*	9.207*	--	--	35.157*	5.926	(-) 3.685	20.141*	5.939*
5.	Dhule	6.916*	7.732*	--	--	--	13.884*	25.574*	--	6.003*
6.	Jalgaon	12.819*	12.222*	--	--	--	20.898*	8.399*	--	8.796*
7.	Ahmadnagar	3.092	10.174*	--	(-) 2.198*	4.411*	(-) 0.420	(-)13.502*	(-) 2.396	0.535*
8.	Pune	2.507	6.046*	(-)12.877*	1.226*	1.064	(-) 0.846	(-) 1.276	(-) 2.356	2.248*
9.	Satara	2.729*	0.345	(-) 2.130	(-) 2.101*	(-) 0.044*	(-) 3.858*	7.610*	(-) 8.620*	(-) 0.674
10.	Sangli	8.436*	1.942*	(-) 3.823*	(-) 0.100	(-) 0.689	(-) 3.280*	(-) 7.229*	0.799	1.522*
11.	Kolhapur	18.379*	3.250	--	--	--	7.187	--	--	5.238*
12.	Solapur	5.526*	2.801*	10.173*	(-) 3.412*	0.844	2.150	(-) 0.626	(-) 0.232	(-) 0.362
13.	Aurangabad	3.460*	5.082*	13.640*	(-) 1.968	43.735*	5.963*	13.471*	(-) 1.116	2.976*
14.	Parbhani	12.836*	14.424*	27.587*	2.549	29.909*	37.600*	23.895*	70.480*	10.573*
15.	Beed	(-) 4.097	(-) 2.969	13.090*	(-) 0.348	17.242*	3.279*	2.430	8.704	1.060
16.	Nanded	0.401	17.763	10.919*	(-) 4.410	19.840	17.257	--	39.138*	7.010*
17.	Osmanabad	13.230*	4.087*	55.945*	1.959*	12.737*	5.385*	(-) 4.643	42.732*	5.349*
18.	Buldhana	12.701*	3.846*	35.676*	(-) 3.271	(-) 35.678*	8.303*	14.127*	--	5.660*
19.	Akola	21.071*	30.203*	38.887*	--	--	10.537	15.722*	--	12.549*
20.	Amravati	25.614*	34.683*	--	--	--	21.241*	4.336	--	9.158*
21.	Yavatmal	14.729*	31.414*	--	--	--	14.351*	9.375*	--	12.474*
22.	Wardha	10.656*	22.040*	4.556	--	--	12.065*	5.110*	--	8.265
23.	Nagpur	1.666	12.041*	8.841	4.626	--	8.398*	6.483*	--	4.108*
24.	Bhandara	1.117	27.906*	--	(-) 5.798	--	--	--	--	1.293*
25.	Chandrapur	1.388*	12.823*	--	--	--	--	--	--	1.501*
26.	State	2.967*	7.749*	9.341*	(-) 0.815	5.066*	4.029*	1.869	4.103*	2.053*

cotton increased significantly. The highest and lowest growth rates of 25.574 and 6.916 per cent per year were seen in cotton and rice crop. Significant increasing trend was observed in gross irrigated area i.e. 6.003 per cent per year.

5.5.3.4 Jalgaon :

Average gross irrigated area in this district was 8.761 per cent of the gross cropped area. Irrigated area of wheat, rice and gram crop covered 64.39, 53.50 and 51.98 per cent of total area under each crop. Irrigated area of all the crops increased significantly. Irrigated area under rice, wheat, gram and cotton increased by 12.819, 12.222, 20.898 and 8.399 per cent per year respectively. Gross irrigated area increased to the tune of 8.796 per cent per year.

5.5.3.5 Ahmadnagar :

In this district 13.240 per cent of average gross cropped area was irrigated with all the sources of irrigation. Out of the total area in the crops of rice, wheat, kharif jowar, rabi jowar, bajra, gram, cotton and ground nut 11.780, 38.470, 5.76, 10.57, 2.82, 22.49, 42.92 and 10.43 per cent was under irrigation. The crops of rabi jowar, sugar cane and wheat contributed 36.13, 25.94 and 10.85 per cent of gross irrigated area. The irrigated area of wheat and

bajra increased significantly by 10.174 and 4.411 per cent, in the case rice, it increased with non significant rate. Rabi, jowar and cotton had shown significant decline in irrigated area. Non significant decline was observed in gram and ground nut.

5.5.3.6 Pune :

Irrigated area under wheat and rabi jowar increased significantly by 6.046 and 1.226 per cent per year respectively. In case of rice and bajra, increase was not significant. Kharif jowar, gram, cotton and ground nut had shown declining trend and was statistically significant in kharif jowar (12.877 per cent). Average gross irrigated area in this district was 11.64 per cent. Cotton and wheat covered 95.81 and 53.18 per cent under irrigation of the total cropped area of these crops.

5.5.3.7 Satara :

In this district 14.45 per cent area was irrigated with all the sources. Rabi jowar contributed 29.02 per cent of gross irrigated area, and was followed by sugar cane, rice and wheat, which contributed 12.95, 11.92 and 11.37 per cent in the gross irrigated area. Average area of 72.60, 44.14, 88.27 and 37.28 per cent was under irrigation for the crops of wheat, rice, cotton and gram respectively. Irrigated area of rice and cotton increased significantly whereas significant decline in the irrigated area of ground nut (8.62 per cent),

gram (5.258 per cent) and rabi jowar (2.101 per cent) was observed.

5.5.3.8 Sangli :

Gross irrigated area increased significantly by 1.522 per cent per year. The share of irrigated area of cotton, wheat, rice, gram and rabi jowar in their total area was 51.38, 46.52, 27.68, 14.25 and 8.08 per cent respectively. Rice and wheat irrigated area increased with significant rates of 8.436 and 1.942 per cent per year. Cotton, kharif jowar and gram had shown the significant declining growth rates of 7.229, 3.823 and 3.280 per cent per year respectively. Area under irrigated ground nut increased but it was statistically not significant, on the other hand non significant decline was observed in the case of rabi jowar and bajra.

5.5.3.9 Kolhapur :

Average gross irrigated area was 11.93 per cent of gross cropped area. Sugar cane covered 82.03 per cent of gross irrigated area. Rice, wheat, rabi jowar and gram covered 6.58, 58.06, 7.95 and 7. 46 per cent under irrigation out of their total cropped area. Irrigated area of rice, wheat and gram increased and increase was statistically significant in the case of rice (18.379 per cent). Gross irrigated area increased significantly by 5.238 per cent per year.

5.5.3.10 Solapur :

With all the available sources 11.42 per cent of gross cropped area was under irrigation. Cotton, wheat, rice, kharif jowar, gram, ground nut and bajra were grown under irrigated conditions to the extent of 67.51,52.45, 35.03, 26.52, 15.38, 10.53, 7.10 and 6.50 per cent respectively. Irrigated area of rice, wheat and kharif jowar increased significantly. Highest growth rate was seen in kharif jowar (10.173 per cent). Bajra and gram possessed non significant increasing trend. Irrigated area of cotton, ground nut and rabi jowar declined and was significant for rabi jowar (3.412 per cent). Gross irrigated area declined with non significant rate.

5.5.3.11 Aurangabad :

Irrigated area of all the crops except rabi jowar and ground nut increased. The increasing trend was significant in rice, wheat, bajra, gram and cotton. Highest and lowest increasing growth rates were observed in bajra (43.735 per cent) and rice (3.460 per cent) respectively. Gross irrigated area increased significantly by 2.976 per cent per year. The average gross irrigated area in this district was in the order of 6.27 per cent. Irrigated area under, rice, wheat, kharif jowar, rabi jowar, gram, cotton and ground nut, was 28.46, 21.98, 3.18, 6.78, 18.16, 3.69 and 0.36 per cent pf their respective average cropped area. Sugar cane covered 12.08 per cent of gross irrigated area.

5.5.3.12 Parbhani :

Average gross irrigated area in this district was 18.740 per cent of gross cropped area. All the crops were grown in small quantity under irrigated conditions. The irrigated area of rice, wheat, kharif jowar, bajra, gram, cotton and ground nut increased significantly. Highest growth rate was observed in ground nut i.e. 70.480 per cent per year. Rabi jowar has got the non significant increasing trend. Gross irrigated area increased by 10.573 per cent per year and it was statistically significant.

5.5.3.13 Beed :

In this district 6.82 per cent of gross cropped area was under irrigation. Cotton, wheat, rice, rabi jowar and gram crops were grown under irrigation on 83.53, 23.06, 15.73, 11.75 and 7.76 per cent of average cropped area of these crops. Irrigated area of kharif jowar, bajra and gram increased significantly by 13.090, 17.242 and 3.279 per cent per year. Ground nut and cotton area increased, but, non significantly. Rice, wheat and rabi jowar possessed the non significant declining trend. Gross irrigated area increased not significantly by 1.060 per cent per year.

5.5.3.14 Nanded :

Irrigated area of all the crops except rabi jowar has got the increasing trend. In case of only

ground nut significant trend was seen, it increased by 39.138 per cent per year. Irrigated area of rice, wheat and gram increased by 0.401, 17.763 and 17.257 per cent. Gross irrigated area increased by 7.010 per cent and it was statistically significant.

5.5.3.15 Osmanabad :

Gross irrigated area contributed 6.47 per cent of gross cropped area. Irrigated wheat, rice and rabi jowar were grown on 21.01, 13.00 and 12.09 per cent of average cropped area. All the crops except cotton registered significant increasing trend in irrigated area. Highest growth rate was seen in kharif jowar (55.945 per cent) and was followed by ground nut (42.732 per cent). Gross irrigated area increased to the tune of 5.349 per cent and was statistically significant.

5.5.3.16 Buldhana :

Only 2.36 per cent area was irrigated in this district. Irrigated area of rice, wheat, kharif jowar, gram and cotton increased significantly in the order of 12.701, 3.846, 35.676, 8.303 and 14.127 per cent per year respectively. Irrigated area of rabi jowar and bajra declined and for bajra it was significant. Gross irrigated area increased by 5.660 per cent per year and it was statistically significant.

5.5.3.17 Akola :

Low percentage of area was under irrigation. Irrigated area of rice, wheat, kharif jowar and cotton increased significantly in the order of 21.071, 30.263, 38.887 and 15.722 per cent per year. Gram has shown non significant increase. Gross irrigated area increased by 12.549 per cent and increase was significant.

5.5.3.18 Amravati :

Only near about 2.0 per cent area was covered under irrigation. All the crops possessed increasing trend for irrigated area. Irrigated area of rice, wheat and cotton increased significantly by 25.614, 34.683 and 15.722 per cent respectively. Gross irrigated area increased significantly by 9.158 per cent per year.

5.5.3.19 Yavatmal :

Irrigated area of rice, wheat, gram and cotton increased significantly with 14.729, 31.414, 14.351 and 9.375 per cent per year respectively. Near about 1.00 per cent area was under irrigation. Gross irrigated area increased significantly by 12.474 per cent per year.

5.5.3.20 Wardha :

Only 2.17 per cent of average gross cropped area was irrigated with all the available sources. Irrigated area of rice, wheat, gram and cotton increased significantly to the tune of 10.656, 22.040, 12.065 and

5.110 per cent respectively. Gross irrigated area increased significantly by 8.265 per cent per year.

5.5.3.21 Nagpur :

All the crops had shown increasing trend in irrigated area and it was statistically significant in case of wheat (12.041 per cent) gram (8.398 per cant) and cotton (6.483 per cent). Average gross irrigated area in this district was 6.026 per cent and it increased significantly by 4.108 per cent per year.

5.5.3.22 Bhandara :

With all the available sources of irrigation 26.05 per cent of average gross cropped area was under irrigation. Rice covered the major portion of it. Irrigated area of rice and wheat increased by 1.117 and 27.906 per cent per year, for rice it was statistically not significant. Rabi jowar has shown declining trend, Gross irrigated area increased significantly with 1.293 per cent.

5.5.3.23 Chandrapur :

Average gross irrigated area in this district was 15.296 per cent. Irrigated area of wheat and rice increased significantly by 12.823 and 1.388 per cent per year. Gross irrigated area also increased significantly to the tune of 1.501 per cent per year.

5.5.3.24 State :

The irrigated area increased significantly at

the state level, it increased with 2.053 per cent per year. The highest growth rate was observed forthe irrigated area of kharif jowar (9.341 per cent), wheat and bajra followed it with the growth rates of 7.749 and 5.066 per cent per year respectively. In the case of rabi jowar non significant negative rate was observed.

In case of wheat and sugar cane increasing significant growth rates were achieved inoreasingt all the districts. In case of rice, Ratnagiri and Beed registered negative growth rates and was significant for Retnagiri district. Parbhani district had the highest growth rate (37.600 per cent) for the irrigated area of gram. In case of districts of Amravati and Nagpur division significant increasing trends were achieved in the irrigated area of gram.

Aurangabad, Parbhani, Beed and the cotton growing districts of Vidharbha possessed the significant increasing growth rates for irrigated area of cotton. In the case of ground nut irrigated area, highest growth rate (70.480 per cent) was seen in Parbhani district, Osmanabad and Nanded followed it and had the values as 42.732 and 39.138 per cent respectively.

In all most all the districts gross irrigated area increased significantly. Non significant decline in gross irrigated area was seen in Ratnagiri, Pune and Kolhapur district.

5.5.4 Adoption of high yielding varieties :

Adoption of high yielding varieties, of different crops especially cereals, mainly started in the year 1965-66, but the increase in area under such varieties could be observed from the year 1970. In case of sugar cane almost all the area is under improved varieties, while data for high yielding varieties pertaining to cotton, ground nut and gram was not available on district and annual basis, therefore results of area of HYVs of rice, wheat, kharif jowar, rabi jowar and bajra are presented in this section in table 14.

5.5.4.1 Thane, Raigad and Ratnagiri :

Adoption of HYVs in Konkan districts viz; Thane, Raigad and Ratnagiri was mainly in rice crop. The highest growth rate in area of HYVs of rice was 22.576 per cent per year in Thane district and it was closely followed by Raigad and Ratnagiri district with growth rates of 21.934 and 19.341 per cent per year. All these growth rates were statistically significant.

5.5.4.2 Nasik :

Area under high yielding varieties, increased significantly in all the crops. Highest growth rate (54.206 per cent) was seen in kharif jowar. In case bajra the growth rate was 16.446 per cent per year.

5.5.4.3 Dhule :

Area under HYVs of kharif jowar, wheat, rabi

Table 15 : Compound growth rates of area under High yielding varieties.

Sr. No.	Districts	Rice	Wheat	Kharif jowar	Rabi jowar	Bajra	Total cereals
1.	Thane	22.576*	--	--	--	--	--
2.	Raigad	21.934*	--	--	--	--	--
3.	Ratnagiri	19.341*	--	--	--	--	--
4.	Nasik	24.260*	35.711*	54.206*	25.266*	16.446*	26.273*
5.	Dhule	8.185	39.432*	59.914*	32.544*	41.050*	37.730*
6.	Jalgaon	59.630*	79.399*	38.199*	55.210*	35.446*	44.726*
7.	Ahmadnagar	43.858*	52.967*	48.953*	16.479*	33.520*	41.738*
8.	Pune	34.720*	51.310*	62.800*	13.630	13.468	35.199*
9.	Satara	33.148*	57.983*	28.723*	8.631*	13.047	28.751*
10.	Sangli	32.992*	36.273*	37.880*	7.742*	22.080*	34.080*
11.	Kolhapur	30.766*	79.876*	46.750*	--	--	35.918*
12.	Solapur	30.250*	63.047*	32.397*	17.940*	20.174*	33.440*
13.	Aurangabad	13.202	76.751*	44.880*	14.906*	29.941*	43.800*
14.	Parbhani	63.540*	55.403*	42.681*	16.793	48.248*	41.630*
15.	Beed	85.760*	61.820*	53.893*	4.408	29.060	47.860*
16.	Nanded	138.860*	83.199*	30.895*	--	--	41.689*
17.	Osmanabad	20.250*	53.326*	55.316*	--	--	48.580*
18.	Buldhana	107.230*	45.719*	38.017*	--	--	33.370*
19.	Akola	106.800*	63.838*	39.050*	--	3.257	36.720*
20.	Amravati	88.185*	81.817*	60.777*	--	--	43.117*
21.	Yavatmal	121.430*	67.314*	5.850	--	--	3.813
22.	Wardha	130.155*	87.592*	14.220*	--	--	25.753*
23.	Nagpur	30.806*	60.307*	18.734*	--	--	30.640*
24.	Bhandara	30.460*	55.680*	--	--	--	33.821*
25.	Chandrapur	31.923*	64.233*	29.968*	--	--	35.431*
26.	State	26.600*	56.577*	40.663*	24.600*	27.849*	31.180*

jowar and bajra increased by 59.914, 39.432, 32.544 and 41.050 per cent respectively, and the increase was statistically significant. Rice has shown non significant increasing trend in area under HYVs. It was 8.185 per cent per year.

5.5.4.4 Jalgaon :

Adoption of HYVs of wheat increased by 79.399 per cent per year which was highest followed by rice, rabi jowar, kharif jowar and bajra. The lowest growth rate was observed in bajra which was 35.446 per cent. This was also statistically significant.

5.5.4.5 Ahmadnagar :

Statistically significant increasing trend was achieved for all the selected crops. The highest and lowest growth rates in the order of 52.967 and 16.479 per cent per year were seen for area under high yielding varities of wheat and rabi jowar.

5.5.4.6 Pune :

Area under HYVs of rice, wheat and kharif jowar increased significantly by 34.720, 51.310 and 62.800 per cent per year respectively. Increase in the area of rabi jowar and bajra was positive but it was statistically not significant.

5.5.4.7 Satara :

Rice, wheat, kharif jowar and rabi jowar possessed the statistically significant increasing trends

in area of HYVs of respective crops and growth rates were 33.148, 57.983, 28.723 and 8.631 per cent per year respectively. HYVs of bajra has shown non significant trend in area.

5.5.4.8 Sangli :

All the crops possessed the significant increasing growth rates in area under HYVs of respective crops. Highest growth rate was observed in kharif jowar (37.880 per cent), it was followed by wheat(36.273 per cent). The lowest growth rate of 7.742 per cent was obtained for rabi jowar.

5.5.4.9 Kolhapur :

Area under HYVs of rice, wheat and kharif jowar increased significantly. Increase in area was in the order of 30.766, 79.876 and 46.750 per cent per year respectively.

5.5.4.10 Solapur :

Significant increasing trend was observed in the area of HYVs of all the selected crops. Highest growth rate was seen in the case of wheat, i.e.63.047 per cent per year, kharif jowar followed it with the rate of increase of 32.397 per cent. Rabi jowar has got the lowest growth rate of 17.940 per cent per year.

5.5.4.11 Aurangabad :

Rice has shown statistically non significant increase of 13.202 per cent per year for area of the

HYVs while wheat, kharif and rabi jowar, and bajra exhibited significant increasing trend. Highest compound growth rate in the order of 76.751 per cent was seen in wheat.

5.5.4.12 Parbhani :

Area under HYVs of wheat, rice, kharif jowar and bajra registered significant increasing trend. Highest compound growth rate of 63.540 per cent per year was obtained for rice, wheat followed it, lowest value was obtained for rabi jowar, it was 16.793 per cent per year.

5.5.4.13 Beed :

Area under HYVs of rice, wheat and kharif jowar increased significantly. Highest compound growth rate was obtained for rice (85.76 per cent). Rabi jowar and bajra recorded the non significant increasing trend.

5.5.4.14 Nanded :

Rabi jowar and bajra covered very meagre area under HYVs. Area under HYVs of rice, wheat and kharif jowar increased by 138.76, 83.199 and 30.895 per cent per year.

5.5.4.15 Osmanabad :

Very meagre area of rice, rabi jowar and bajra was covered by their high yielding varities. Area under HYVs of wheat and kharif jowar increased significantly.

The respective increase was 53.326 and 55.316 per cent per year.

5.5.4.16 Buldhana :

Rice, wheat and kharif jowar exhibited significant increasing trend in area of HYVs. Highest compound growth rate, was observed in rice, which was 107.230 per cent per year.

5.5.4.17 Akola :

Statistically significant trend in high yielding varieties of rice, wheat and kharif jowar was obtained. Non significant increase was observed in bajra. Highest compound growth was seen in rice i.e. 106.800 per cent per year.

5.5.4.18 Amravati :

Area under high yielding varities of rice, wheat and kharif jowar increased significantly. The highest growth rate was observed for rice (88.185 per cent), wheat followed it with 81.817 per cent per year.

5.5.4.19 Yavatmal :

Rabi jowar and bajra covered very meagre area under HYVs. Rice and wheat registered significant increasing growth rates of 121.430 and 67.314 per cent respectively. Kharif jowar has got the non significant increasing trend.

5.5.4.20 Wardha :

Statistically significant increasing trend was observed for the HYVs of rice, wheat and kharif jowar. Highest and lowest growth rates were obtained for rice and kharif jowar, viz; 130.155 and 14.220 per cent per year.

5.5.4.21 Nagpur :

Kharif jowar, rice and wheat exhibited the positive compound growth rates of 18.734,30.806 and 60.307 per cent per year, and were statistically significant.

5.5.4.22 Bhandara :

Rice and wheat covered the major share of total area under HYVs. The area of wheat and rice increased significantly in the order of 55.680 and 30.460 per cent per year.

5.5.4.23 Chandrapur :

Rice, wheat and kharif jowar exhibited significant increasing trend in area of HYVs of respective crops. Increase was in the order of 31.923, 64.233 and 29.968 per cent per year.

5.5.4.24 State :

All the selected crops exhibited statistically significant increasing trend in area under HYVs of these crops. The increase was in the order of 56.577,40.663, 27.849, 26.600 and 24.600 per cent per year for wheat,

kharif jowar, bajra, rice and rabi jowar crop respectively.

5.5.5 Fertilizer consumption :

Use of fertilizer is the prerequisite condition for increasing the agricultural productivity and production, hence it is essential to examine utilization pattern of the fertilizers in various districts. Results of growth rates aree presented in table 15.

5.5.5.1 Thane :

The average consumption of Nitrogen, Phosphorus and Potash was 9.40, 1.00 and 3.63 Kgs per hectare. Statistically non significant increasing trend was observed for all the three components.

5.5.5.2 Raigad :

The per hectare consumption of Nitrogen, Phosphorus and Potash was 11.19, 1.00 and 4.55 Kgs per hectare. Increasing trend was observed for all the components and it was statistically significant for Nitrogen (9.653 per cent).

5.5.5.3 Ratnagiri :

Statistically non significant increasing trend was noticed for the consumption of Potash whereas the consumption of N and P declined non significantly. The average consumption of N,P and K was 7.08, 3.12 and 2.55 Kgs per hectare.

Table 16 : Compound growth rates of consumption of fertilizers and availability at per hectare.

Sr. No.	Districts	Compound growth rates				Per hectare availability in Kgs.			
		N	P	K	Total	N	P	K	Total
1.	Thane	2.794	26.931*	25.010	8.302*	9.40	1.00	3.63	14.03
2.	Raigad	9.653*	32.202*	8.469	13.271*	11.19	1.00	4.55	16.74
3.	Ratnagiri	(-) 0.106	(-) 3.228	18.780	2.156	7.08	3.12	2.55	12.75
4.	Nasik	10.020*	11.314*	14.679*	10.972*	6.63	2.33	1.89	10.85
5.	Dhule	10.931*	34.730*	47.520*	16.174*	9.06	2.92	2.37	14.35
6.	Jalgaon	10.680*	29.501*	47.130*	15.369*	9.58	2.70	2.25	14.53
7.	Ahmadnagar	14.693*	18.369*	39.530*	14.602*	7.43	2.07	1.82	11.32
8.	Pune	8.416*	13.364*	24.325*	8.909	3.04	2.39	1.77	12.20
9.	Satara	10.433*	16.866*	50.795*	13.972*	7.07	2.65	1.89	11.61
10.	Sangli	7.314	12.695	29.000*	9.817	7.43	2.90	2.29	12.62
11.	Kolhapur	8.477	23.407*	60.250*	13.056*	20.11	5.90	5.45	31.46
12.	Solapur	13.560*	13.495*	37.198*	8.430*	3.89	1.49	1.20	6.58
13.	Aurangabad	13.400*	19.646*	25.692*	13.306*	3.44	1.42	1.15	6.01
14.	Parbhani	18.865*	34.598*	40.237*	24.496*	3.60	1.40	1.58	6.58
15.	Osmanabad	15.020*	25.401*	26.000*	19.607*	3.16	1.29	1.23	5.68
16.	Nanded	16.879*	15.805	28.010*	18.740	4.31	1.75	1.54	7.60
17.	Beed	19.469*	36.089*	44.240*	22.974*	4.90	2.07	1.62	8.59
18.	Buldhana	11.220*	12.446*	19.185*	12.438*	5.64	2.03	1.81	9.57
19.	Akola	13.850*	16.286	15.957*	14.909*	4.89	1.68	1.62	8.19
20.	Amravati	17.185*	22.230*	17.550*	19.417*	5.51	2.04	2.01	9.56
21.	Yavatmal	13.530*	14.912	19.310*	14.687*	4.49	1.79	1.51	7.79
22.	Wardha	21.951*	29.070*	40.630*	25.081*	7.35	2.40	2.20	11.95
23.	Nagpur	25.582*	18.198*	27.557*	24.080*	7.23	2.47	2.18	11.88
24.	Bhandara	14.200*	11.681*	17.547*	14.575*	6.02	2.66	2.51	11.18
25.	Chandrapur	13.671*	22.330*	41.246*	17.624*	4.85	1.72	1.74	8.31
26.	State	12.329*	19.632*	31.512*	15.595*	6.88	2.20	2.17	11.05

5.5.5.4 Nasik :

The per hectare average consumption was 6.63, 2.33 andl.89 Kgs of N, P and K respectively. Statistically significant increasing trend was observed for all the three components. It increased by 10.02, 11.354 and 14.679 per cent per year respectively.

5.5.5.5 Dhule :

Nitrogenous fertilizers contributed 63.14 per cent in total consumption of fertilizers. Per hectare average consumption of N, P and K was 9.06, 2.92 and 2.37 Kgs. Significant increasing growth rates of 10.931, 34.730 and 17.520 per cent were achieved for the consumption of N, P and K.

5.5.5.6 Jalgaon :

The contribution of nitrogenous, phosphatic and potassic fertilizers was 65.95, 18.57 and 15.48 per cent in total consumption. The consumption of Potash was very meagre in the initial years of the introduction of fertilizers. The per hectare consumption of the N, P and K was 9.58, 2.70 and 2.25 Kgs. respectively. Consumption N, P and K increased by10.680, 29.502 and 47.130 per cent respectively, and was statistically significant.

5.5.5.7 Ahmadnagar :

Statistically significant increasing compound growth rates in the order of 14.963, 18.369 and 39.530

per cent per year were observed for the consumption of N, P and K respectively. The per hectare average consumption of N, P and K was 7.43, 2.07 and 1.82 per cent per year respectively.

5.5.5.8 Pune :

Major share of 66.07 per cent was shared by the Nitrogen in the total consumption. Significant increase was achieved for all and it was 8.416, 13.364 and 24.325 per cent per year respectively for N, P and K. The per hectare average consumption of N was 8.04 Kgs.

5.5.5.9 Satara :

Significant increasing trend was obtained for the consumption of N, P and K, it was 10.433, 16.866 and 50.795 per cent per year respectively. The average per hectare consumption of N, P and K was 7.07, 2.65 and 1.89 Kgs respectively.

5.5.5.10 Sangli :

Increasing trend was seen in the consumption of N, P and K. Consumption of N and P increased by 7.313 and 12.695 per cent per year and was statistically not significant. An increase of 29.00 per cent was significant of the consumption of Potash.

5.5.5.11 Kolhapur :

The per hectare average consumption of N,P and K was highest among all the district. The nonsumption of

Nitrogen, Phosphorus and Potash increased in the order of 8.477, 23.407 and 60.250 per cent respectively, for N it was not significant.

5.5.5.12 Solapur :

Consumption of N, P and K increased significantly by 13.650 and 37.198 per cent per year. The per hectare average consumption of N, P and K was 3.89, 1.49 and 1.20 Kgs respectively.

5.5.5.13 Aurangabad :

Nitrogen, Phosphorus and Potash contributed 57.31, 23.62 and 19.07 per cent of total fertilizer consumption. The consumption of N, P and K increased by 13.400, 19.646 and 25.692 per cent per year significantly. Per hectare availability of N, P and K was 3.44, 1.42 and 1.15 Kgs respectively.

5.5.5.14 Parbhani :

The share of Nitrogen, Phosphorus and Potash was 54.74, 21.26 and 24.00 per cent in total consumption. Per hectare average consumption of N, P and K was 3.60, 1.40 and 1.58 Kgs respectively. Statistically significant increasing compound growth rates were observed for the consumption of N, P and K, these were 18.865, 34.598 and 40.237 per cent per year.

5.5.5.15 Beed :

The per hectare average consumption of N,P and K was 4.90, 2.07 and 1.62 Kgs. The consumption of N,P and

K increased by 19.469, 36.089 and 44.240 per cent per year and was statistically significant.

5.5.5.16 Nanded :

Average consumption of N, P and K was 4.31, 1.75 and 1.54 Kgs per hectare. Increasing trend was observed in the consumption of N, P and K. It was significant in case of Nitrogen and Potash. The consumption of Phosphorus was increased with 15.805 per cent per year and was statistically non significant.

5.5.5.17 Osmanabad :

Consumption of Nitrogen, Phosphorus and Potash increased significantly in the order of 15.020, 25.401 and 26.000 per cent per year. The per hectare average consumption of N, P and K was 3.160, 1.290 and 1.230 Kgs respectively.

5.5.5.18 Buldhana :

The share of nitrogenous, phosphatic and potassic fertilizers was 59.56, 21.39 and 19.5 per cent of total consumption. Consumption of N, P and K increased by 11.220, 12.446 and 15.957 per cent per year and it was statistically significant.

5.5.5.19 Akola :

The per hectare average consumption of Nitrogen, Phosphorus and Potash was 4.89, 1.68 and 1.62 Kgs.

Statistically significant increasing trend was seen for all. Consumption of nitrogen was increased by 13.850 per cent per year.

5.5.5.20 Amravati :

The consumption of nitrogeneous, phosphatic and potassic fertilizers increased significantly to the tune of 17.185, 22.230 and 17.550 per cent per year. Per hectare average consumption of N, P and K was 5.551, 2.04 and 2.01 Kgs respectively.

5.5.5.21 Yavatmal :

Statistically significant increasing trend was seen for the consumption of N, P and K. The increase was 13.530, 14.912 and 19.310 per cent per year respectively. The per hectare consumption of N, P and K was 4.49, 1.79 and 1.51 Kgs respectively.

5.5.5.22 Wardha :

The average consumption of Nitrogen, Phosphorus and Potash was 4.49, 1.79 and 1.51 Kgs, per hectare. Statistically significant increasing trend was seen for all. Consumption of nitrogen increased by 21.951 per cent per year.

5.5.5.23 Nagpur :

Consumption of nitrogen, phosphorus and potash increased significantly, the case of nitrogen it was 25.582 per cent per year. The consumption of N, P and K

was 7.23, 2.47 and 2.18 Kgs. per hectare.

5.5.5.24 Bhandara :

Average per hectare consumption of N, P and K was 6.02, 2.16 and 2.51 Kgs per hectare. Significant increasing trend was seen in the consumption of N,P and K for nitrogen it was 14.200 per cent per year.

5.5.5.25 Chandrapur :

Statistically significant increasing growth rates of 13.671, 22.330 and 41.246 per cent were seen for N, P and K respectively. The average per hectare consumption of N, P and K was 4.85, 1.72 and 1.74 Kgs respectively.

5.5.5.26 State :

Statistically significant increasing trend was observed in the consumption of Nitrogen, Phosphorus and Potash. It was 12.329, 19.632 and 31.512 per cent respectively.

The consumption of Nitrogen, Phosphorus and Potash increased significantly at the significant rate at the state level, the respective growth rates were 12.329, 19.632 and 31.512 per cent. The major share was contributed by the nitrogen in total consumption of fertilizers in all the districts of Maharashtra State.

Ratnagiri was the only district where in the negative growth rates were observed for the consumption of

Nitrogen and Phosphorus. The significant increasing growth rates were observed for all the nutrients and all in all the district except in Sangli and Kolhapur districts. The per hectare consumption of the Nitrogen, Phosphorus and Potash was very meagre and did not have very significant impact for increasing the production level of different crops in the state.

5.5.6 Agricultural credit :

Short term credit through primary agricultural societies was considered for the study. Results are presented in table 16 and are discussed in following paragraphs.

5.5.6.1 Thane :

The average number of PAC societies were 563 and the average borrowers were 79,116. The average loans per borrower and perhectare worked out to Rs. 187.89 and Rs. 29.96 respectively. The significant increasing trend was achieved for loan advance, and increase of 12.325 per cent at compound rate was computed. The amount of loan outstandings and overdues were also at increasing rate. The average recovery was 42.7 per cent in the district.

5.5.6.2 Raigad :

The number of PAC societies has been increased to 485 in the year 1960-61 to 524 for the year 1977-78

Table 17 : Compound growth rates of loan advanced and availability of loan. (Figs.in 'Rs.')

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Sr. No.	Districts	Loan advanced	Av.No. of borrowers	Loan per borrower	Loan per hectare
1.	Thane	12.325*	79116	107.89	29.96
2.	Raigad	9.018*	81447	142.05	62.46
3.	Ratnagiri	7.470*	176411	37.48	18.15
4.	Nasik	8.006*	132330	511.41	73.43
5.	Dhule	5.301*	103587	366.36	51.44
6.	Jalgaon	5.525*	143540	337.09	56.88
7.	Ahmadnagar	11.439*	215842	512.08	85.30
8.	Pune	10.235*	147417	203.77	28.30
9.	Satara	3.225	162502	304.39	71.46
10.	Sangli	9.659	142017	956.88	210.93
11.	Kolhapur	11.119*	215326	427.77	222.52
12.	Solapur	4.909*	128978	305.97	33.39
13.	Aurangabad	13.073*	118728	754.88	67.55
14.	Parbhani	6.688*	115075	278.01	32.60
15.	Beed	7.991*	89161	250.59	29.03
16.	Nanded	2.518	95798	322.04	42.05
17.	Osmanabad	2.490	138599	314.51	39.52
18.	Buldhana	4.421*	101336	295.08	42.15
19.	Akola	10.996*	123659	267.15	42. 67
20.	Amravati	7.972*	104682	299.12	44.53
21.	Yavatmal	10.302*	110183	345.36	47.93
22.	Wardha	7.458	50301	307.99	36.38
23.	Nagpur	15.096*	71336	372.25	48.37
24.	Bhandara	0.571	110848	166.03	36.18
25.	Chandrapur	9.878*	95032	174.28	23.82
26.	State	7.712*	117730	330.30	58.20

the borrowers also increased from 56000 in 1960-61 to 92267 in the year 1977-78. Loans of Rs. 142.05 were advanced per borrower averagely. Significant increase was obtained for advances i.e. 9.018 per cent at compound rate. The average amount of Rs. 142.05 and Rs.52.46 was obtained for per borrower and per hectare respectively. The amount of loan outstanding and loans recovered deseribed the same trend as advances. The average recovery was 58.90 per cent.

5.5.6.3 Ratnagiri :

The average PAC societies and the borrowers were 737. An increase of 7.47 per cent at compound rate was achived for advances. The average loans of Rs.37.48 and Rs. 18.15 were achieved for per borrower and perhectare respectively. The 49.2 per cent loans were recovered averagely.

5.5.6.4 Nasik :

The average PAC societies and the borrowers were 977 and 1,32,330 for the study period. The loans of Rs. 511.41 and Rs. 73.43 were available for each borrower and per hectare respectively. The average recovery of the loans was 52.9 per cent. Statistically significant increasing trend was achieved forthe advancement of credit. In increase of 8.006 per cent was obtained at compound rate. The overdues and outstanding loans also increased over the base year ofthe study.

5.5.6.5 Dhule :

The average number of primary agricultural credit societies were 763 with the average borrowers of 1,03,587. The average loans of Rs. 366.66 and Rs.51.44 were disbursed for each borrower and per hectare of gross cropped area. Statistically significant increasing trend was obtained. An increase of 5.301 per cent at was ob ained for a advances of loans. The outstanding loans and overdues also increased overbase year.

5.5.6.6 Jalgaon :

The average primary agricultural credit societies and its borrowers were 872 and 1,43,540 respectively. Statistically significant increasing trend was achieved. The advances of loans increased with 5.225 per cent and was statistically significant. The average credit was facilitated per borrower and perhectare of Rs. 366.36 and Rs. 51.44 respectively. The average recovery was 38.45 per cent. The outstanding loans and overdues increased over base year.

5.5.6.7 Ahmadnagar :

The average number of primary agricultural credit societies and borrowers were 1,019 and 2,15,842. The loans outstanding and the overdues were increased over the initial years of the study. Statistically significant increasing trend was observed. An increase

of 11.439 per cent per year was obtained at compound rate for advances ofloans. The average loans of Rs. 512.08 and Rs. 85.30 were obtained for per borrower and per hectare respectively. The average recovery was 74.43 per cent.

5.5.6.8 Pune :

The average number of primary agricultural credit societies and theborrowers were 905 and 1,47,417 for the study period. The loans of Rs. 203.77 and Rs. 28.30 were obtained per borrower and per hectare respectively. Statistically significant increasing trend was achieved. An increase on 10.235 per cent per year at compound rate was obtained. The loans outstanding and the overdues were increased over the base year. The average recovery was 54.25 per cent.

5.5.6.9 Satara :

The average number of primary agricultural credit societies and the borrowers were 718 and 1,62,502 respectively. The loans of Rs. 304.39 andRs. 71.46 were obtained for each borrower and per hectare of gross cropped area. Statistically non significant increasing trend was registred for the advances. The amount of outstanding loans and overdues were increased with greater extent over base year. The average recovery was 48.22 per cent.

5.5.6.10 Sangli :

The average number of primary agricultural credit societies and its members were 527 andl,42,017. The amount of Rs. 956.88 and Rs. 210.93 was accounted for each borrower and per hectare respectively. The loans advanced were very meagre at the initial years of the study. An increasing trend was achieved but it was statistically non significant. The loans outstanding and the overdues were increased at latter years overthe base year. The average recovery was of 76.28 per cent.

5.5.6.11 Kolhapur :

The average loan of Rs, 427.77 and 222.52 was achieved for each borrower and per hectare of gross cropped area. Statistically significant increasing trend was achieved for the advances, with an increase of 11.119 per cent. The amount overstanding loans and overdues has shown the increase over base year, 78.67 per cent recovery was done averagely.

5.5.6.12 Solapur :

The average number of primary agricultural credit societies and the borrowers were 889 andl,20,978 for the study period. An amount of Rs. 305.97 and Rs. 33.39 was available at per borrower and per hectare of gross cropped area. Statistically significant trend was observed. The increased volume of outstanding loans and overdues was seen. Average recovery was of 64.91 per cent.

5.5.6.13 Aurangabad :

The average number of primary agricultural credit societies and the borrowers were 1110 and 1,10,728 respectively. The average amount of loans for each borrower and per hectare was Rs. 754.88 and Rs. 67.55 respectively. Statistically significant increasing trend was achieved for advance. An increase of 13.073 per cent was noticed. The laons outstanding and overdues showed an increase overbase year. Average recovery of loans was 57.25 per cent.

5.5.6.14 Parbhani :

The average number of primary agricultural credit societies and its borrowers were 1,108 and 1,15,075 The amount of Rs. 278.01 and Rs. 32.60 was distributed for each borrwer and theper hectare of gross cropped area. Statistically significant increasing trend was achieved. An increase of 6.688 per cent has been registered. The loans outstanding the overdues were increased with greater speed on an average 51.7 per cent loans were recovered.

5.5.6.15 Beed :

Agricultural credit was distributed with the help of 705 primary agricultural credit societies to the average number of 89,161 borrowers. The loans of Rs. 250.59 and Rs. 29.03 were credited for per borrower and

the per hectare of gross croped area. Statistically significant increasing trend was seen. An increase of 7.991 per cent per year has been achieved for advance of agricultural credit. The amount of outstanding loans and overdues were widened over the base year. The loans of 51.46 per cent were recovered averagely.

5.5.6.16 Nanded :

The average number of primary agricultural credit societies and its members were 937 and95,798. Statistically non significant increasing trend was observed. The volume of outstanding loans and loan overdues increased with greater speed overthe base year of the study. An amount of Rs. 322.04 and Rs. 42.05 was alloted at per borrower and per hectare level. The average recovery percentage was 44.13.

5.5.6.17 Osmanabad :

Agricultural credit was distributed to 1,38,599 borrowers through 1,014 primary agricultural credit societies. The average recovery percentage was only 48.00 resulted in widening the gulf of overdues and outstanding loans. The credit ofRs. 314.51 andRs.39.52 was credited averagely for per borrower and per hectare of gross cropped area.

5.5.6.18 Buldhana :

The average number of primary agricultural credit societies and borrowers were 582 and 1,01,336.

The average loans of Rs. 295.08 and Rs. 42.15 were disbursed for each borrower and per hectare of gross cropped area. Statistically significant increasing trend was achieved. An increase of 4.425 per cent at compound rate was registered forthe advances of loans. The outstanding loans showed an increase in the amount over the base year but the overdues declined as compared to base year. The average recovery was 62.19 per cent.

5.5.6.19 Akola :

In this district 842 primary agricultural credit societies were engaged for financing for agriculture. An amount ofRs. 267.15 and Rs. 42.67 was distributed at each borrower and per hectare of gross cropped land.Significant increasing trend was obtained. Increase of 10.996 per cent at compound rate was achieved. The loans outstanding and overdues showed an increase in the amount over the base year. The average recovery percentage was only 39.28.

5.5.6.20 Amravati :

The average number of primary agricultural credit societies were 698 in the district and they had the 1,04,682 members. An amount of Rs. 299.12 and Rs. 44.53 was obtained by the each borrower and per hectare. Significant increasing trend was seen. An increase of 7.978 per cent at compound rate was achieved for advances. The average recovery of loans was 66.70 per cent. The amount of loans outstanding and overdues increased with greater speed.

5.5.6.21 Yavatmal :

The average primary agricultural credit societies and the borrowers were 607 and 1,10,183. Each borrower has got an average amount of Rs. 345.36 and the amount at per hectare was Rs. 47.93. Statistically significant increasing trend was achieved. An increase of 10.302 per cent at compound rate was achieved for advances. The outstanding loans and overdues increased over base year. The average recovery was about 50.8 per cent.

5.5.6.22 Wardha :

Credit was advanced through 412 primary agricultural credit societies within 50,301 borrowers. The average loans of Rs. 307.99 and Rs. 36.38 were achieved at each borrower and per hectare. An increase of 7.458 per cent per year was obtained for advance of loans. The average recovery of the loans was 59.37 per cent.

5.5.6.23 Nagpur :

The average number of primary agricultural credit societies and the borrowers were 647 and7,13,336 respectively. The average loan of Rs. 372.25 and Rs. 48.37 was obtained by each borrower and per hectare respectively. The significant increasing trend was obtained. An increase of 15.096 per cent per year was achieved. The amount of loans outstanding and overdues

increased with greater speed. An average recovery was 66.28 per cent.

5.5.6.24 Bhandara :

Agricultural credit was distributed for 1,10,848 borrowers through 792 primary agricultural credit societies. Statistically non significant declining trend was observed. The loans outstanding increased over base year but the overdues showed the decrease in amount over base year. The average recovery of was 71.00 per cent.

5.5.6.25 Chandrapur :

The average number of primary agricultural credit societies and the borrwers were 1,205 and95,032 respectively. The amount of Rs. 174.28 and Rs. 23.82 was achieved by the each borrower and at per hectare respectively. Statistically significant increasing trend was achieved. An increase of 9.878 per cent per year was obtained. The amount of outstanding loans and overdues increased at the latter years over the base year with greater speed. The average recovery of loans was 54.00 per cent.

5.5.6.26 State :

Average total number of primary agricultural credit societies was 10959. Statistically significant increasing trend was observed for the loan advances. The overdues and amount of loan outstanding also increased over the time period.

Table 18 : Compound growth rates of Farm harvest prices.

Sr. No.	Districts	Paddy	Wheat	Jowar	Bajra	Tur	Gram	Cotton	Raw sugar	Ground nut	Sesamum
1.	Thane	9.665	--	9.321*	--	8.675*	2.423*	--	8.200*	--	10.734*
2.	Raigad	5.721*	--	--	--	7.962*	7.463*	--	--	--	10.708*
3.	Ratnagiri	13.782*	--	--	--	11.781*	--	--	12.499*	16.646*	12.765*
4.	Nasik	10.217*	8.030*	8.280*	7.358*	9.226*	9.267*	8.131*	9.137*	13.480*	12.114*
5.	Dhule	7.181*	7.065*	8.184*	7.368*	6.853*	8.080*	9.873*	7.478*	11.354*	9.989*
6.	Jalgaon	8.756*	6.806*	9.771*	8.735*	7.801*	7.733*	6.389*	7.958*	10.038*	9.262*
7.	Ahmadnagar	9.442*	7.493*	11.567*	7.400*	6.114*	8.344*	6.558*	9.382*	11.444*	9.989*
8.	Pune	8.517*	7.941*	5.654	6.844*	5.649*	11.887*	4.836*	9.639*	11.200*	5.774*
9.	Satara	11.302*	6.929*	10.121*	7.237*	8.163*	10.029*	7.364*	12.717*	10.577*	8.210*
10.	Sangli	12.186*	8.664*	9.359*	6.270*	10.270*	10.568*	7.228	10.755*	12.563*	8.930*
11.	Kolhapur	6.072*	9.050*	9.399*	6.703*	10.437*	9.368*	3.234*	11.075*	11.139*	8.216*
12.	Solapur	12.073*	8.780*	10.958*	8.070*	8.024*	9.792*	4.440*	9.798*	10.747*	9.748*
13.	Aurangabad	10.861*	9.020*	11.877*	10.601*	11.659*	10.752*	8.306*	13.005*	12.008*	11.193*
14.	Parbhani	11.652*	8.567*	10.944*	7.703*	10.531*	8.525*	10.076*	9.798*	10.676*	9.773*
15.	Beed	11.795*	8.271*	10.538*	9.896*	10.525*	9.571*	4.847	12.384*	11.432*	9.791*
16.	Nanded	12.604*	9.774*	12.715*	8.984*	11.033*	10.389*	8.359*	15.133*	8.755*	10.291*
17.	Osmanabad	7.389*	9.299*	8.805*	7.368*	9.527*	9.796*	7.367*	12.509*	12.029*	9.679*
18.	Buldhana	14.906*	6.290*	9.258*	7.665*	10.347*	8.433*	8.933*	10.342*	11.611*	10.185*
19.	Akola	14.357*	8.352*	4.749*	8.441*	12.369*	10.805*	5.414*	9.534*	14.522*	10.938*
20.	Amravati	15.251*	7.273*	11.391*	8.898*	10.637*	11.394*	6.068*	9.809*	13.064*	10.938*
21.	Yavatmal	15.417*	8.821*	10.227*	7.818*	9.634*	10.677*	6.183*	10.196*	9.127*	10.917*
22.	Wardha	9.351*	9.028*	9.730*	8.202*	7.766*	13.312*	2.385	8.156*	10.978*	11.112*
23.	Nagpur	11.376*	9.336*	10.299*	9.874*	11.874*	10.653*	5.833*	9.860*	12.950*	10.473*
24.	Bhandara	7.030*	8.154*	11.405*	9.874*	11.256*	9.499*	--	9.162*	12.016*	12.447*
25.	Chandrapur	7.433*	8.288*	9.281*	7.818*	11.500*	10.896*	3.242*	9.967*	9.870*	11.299*
26.	State	4.662*	4.510*	6.734*	4.235*	6.495*	5.878*	3.372*	6.752*	7.293*	6.721*

5.5.7 Farm harvest prices :

In agricultural production process farm harvest prices play an important role. Results of the farm harvest prices are presented in table 18.

It is revealed from the table 18, that in almost all the crops and in almost all the districts significant increasing trends were obtained for the farm harvest prices.

5.5.8 Functional analysis :

Functional analysis between per hectare income and the selected independent variables affecting on income was carried out with a view to understand effect of selected independent variables. The Cobb-Douglas type of function was used to estimate theelasticities of independent variables. In general, value of R^2 of this equation for each district was quiet high and was statistically significant in all the districts except Ahmadnagar, Pune, Sangli, Akola, Bhandara and Chandrapur. The high value of R^2 revealed that variations in the per hectare income, were explained by the independent variables to a greater extent. The results of the functional analysis are presented in table 19. District wise results are deseribed in following paragraphs.

5.5.8.1 Thane :

Increase in the food grain production, mainly

of rice by one per cent would increase the per hectare income by 0.6071 per cent. Coefficient of elasticity in gross cropped area was negative and non significant indicated that an increase in gross cropped area by one per cent would decline in per hectare income. The decline would be of 0.2746 per cent. In the case of irrigated area and area under high yielding variaties, the coefficients of elasticity were negative, viz; 1.1628 and 0.1852 per cent respectively.

5.5.8.2 Raigad :

Increase in gross cropped area and food grain production by one per cent would increase the per hectare income in this district. The respective elasticities of 1.5445 and 0.5160 per cent were significant. In the case of irrigated area the elasticity of parameter was positive but non significant, indicated small increase in the per hectare income, while due to increase only in the area under high yielding varieties by one per cent would cause the decline of 0.4032 per cent in per hectare income.

5.5.8.3 Ratnagiri :

In this district food grain production and sugar cane production affected significant increase in the per hectare income, the values of elasticity were 0.6485 and 0.3927 respectively. However negative elasticities of gross cropped area and irrigated area indicated that there is no much scope for increasing the per hectare

Table 19 : Income elasticities of selected variables.

Sr. No.	Districts	Intercept	Gross cropped area (X_1)	Food grain prod.(X_2)	Cotton prod.(X_3)	Sucar cane prod.(X_4)	Ground nut prod.(X_5)	Gross irri. area (X_6)	HYV area (X_7)	R^2	F
1.	Thane	3.6577	(-) 0.2746	0.6071*	-	(-) 0.0268	0.0162*	(-) 1.1628*	(-) 0.1852*	0.9171	12.6533**
2.	Raigad	(-) 2.3905	1.5445*	0.5160*	-	-	-	0.1368	(-) 0.1302*	0.7908	7.6514**
3.	Ratnagiri	15.4934	(-) 7.8614*	0.6485*	-	0.3927*	0.0088	(-) 0.4364*	0.0084	0.9505	21.9757**
4.	Nasik	(-) 4.8833	2.1345*	(-)0.4914*	0.0806*	(-) 0.3056*	0.3157*	1.7016*	(-) 0.0038	0.9491	21.3479**
5.	Dhule	(-)16.1282	8.8671*	(-)0.3856*	(-)0.0576*	0.3738*	0.5578*	(-) 0.2915*	0.0353	0.9597	27.2418**
6.	Jalgaon	1.6262	(-) 1.0825*	0.3514*	0.9398*	0.4822*	(-) 0.3139*	(-) 0.1907	0.0086	0.8720	7.7897**
7.	Ahmadnagar	5.3827	(-) 3.7947*	0.2137*	0.0971	(-) 0.2323*	1.6305	2.0213*	(-) 0.0122*	0.6475	2.0998
8.	Pune	(-) 4.1631	1.7238*	0.0095	(-)0.0937	(-) 0.2383*	0.1001*	1.5942*	(-) 0.0143*	0.7034	2.7111
9.	Satara	(-) 3.3535	2.0299*	1.0448*	0.5539*	0.0113	(-)1.3333*	0.3712	0.0293*	0.9038	10.7387**
10.	Sangli	1. 0838	2.8627*	(-)0.0631	0.2579	0.6458	(-)0.3345*	(-) 2.6409*	0.0529*	0.5293	1.6869
11.	Kolhapur	5.3721	(-) 2.6433	0.0038	(-)0.1183	(-) 0.0127	0.4465*	0.6514*	0.0227*	0.9197	13.0942**
12.	Solapur	3.2454	(-) 0.9379*	0.4567*	0.1122*	(-) 0.2004*	(-)0.0030	(-) 0.0039	0.0001	0.7394	3.2435*
13.	Aurangabad	8.5454	(-) 4.2353*	0.0958	(-)0.3031*	(-) 0.4836*	0.4830*	1.3678*	0.0709*	0.7173	2.9010*
14.	Parbhani	(-) 1.4352	1.2596*	0.7248*	0.2579*	(-) 0.3218*	(-)0.2427*	0.0385*	(-) 0.0331*	0.9719	30.6111**
15.	Beed	0.5152	(-) 0.3476	0.2019	0.0427	(-) 0.3661*	0.3729*	0.4972*	0.0313	0.7565	3.5111*
16.	Nanded	5.0778	(-) 2.6453*	0.3468*	0.1813*	(-) 0.2927*	0.1002*	0.7706*	(-) 0.0087	0.9712	38.6138**
17.	Osmanabad	7.4941	(-) 3.5245*	0.3357*	(-)0.2069*	(-) 0.1464*	0.4517*	0.3424*	0.0589*	0.9266	14.4436**
18.	Buldhana	3.9611	(-) 2.0458*	(-)0.0360	0.6994*	0.2155*	0.3039*	(-) 0.1217*	0.0035	0.8904	9.2937**
19.	Akola	(-) 7.9529	3.6279*	0.3499	1.2595	0.1881	(-) 0.0356	(-) 0.3908	(-) 0.0353	0.6084	2.4750
20.	Amravati	17.7800	(-) 9.2382*	0.2669*	0.7315*	0.1548*	0.1186*	0.0675	0.0030	0.8449	6.2273*
21.	Yavatmal	0.5700	(-) 0.1001	0.4080*	0.2286*	(-)0.2464*	0.0684*	0.3586*	(-) 0.0220	0.9168	12.6024**
22.	Wardha	9.8596	(-) 5.5184*	0.9290*	0.5318*	0.0006	0.0095	0.1017	0.0023	0.8908	9.3300**
23.	Nagpur	(-) 15.4485	8.9892*	0.0202	0.3145*	(-)0.1230*	0.2041*	(-) 0.6834*	(-) 0.0287	0.8988	10.1572**
24.	Bhandara	(-) 2.6620	5.3249*	0.2110*	--	0.2108*	0.0303	(-) 0.3872*	(-) 0.0013	0.3684	0.8751
25.	Chandrapur	0.2639	(-) 0.4381	0.1015	0.4137*	0.2011*	-	0.6063	(-) 0.0377*	0.5856	2.1201
26.	State	4.3518	(-) 0.2957*	0.3587*	0.1829	0.1827	(-) 0.1264	(-) 0.2988*	0.0615	0.9395	14.7024**

income with these two variables.

5.5.8.4 Nasik :

Increase in gross cropped area, cotton production, and irrigated area by one percent would increase the per hectare income by 2.1345, 0.806, 0.3157 and 1.7016 per cent respectively. This indicated that there is much scope to increase the per hectare income with these variables, whereas significant decline in per hectare income of 0.4914 and 0.3056 per cent would occure due to an increament of food grain production and sugar cane production by one per cent.

5.5.8.5 Dhule :

Per hectare income in this district has shown an increase by 8.8671, 0.3738, 0.5578 and 0.0353 per cent with an increase of one per cent increase in gross cropped area, sugar cane production, ground nut production and area under high yielding varieties. The coefficient of elasticity was significant for all the variables except last one. The significant negative coefficient of elasticity of food grain production, cotton production and irrigated area explained the decline in the per hectare income. The respective values of elasticity were 0.3856, 0.0576 and 0.2915.

5.5.8.6 Jalgaon :

In increase in the food grain production, cotton

production, sugar cane production and area under high yielding varieties by one per cent showed 0.3514, 0.9398, 0.4822 and 0.0086 per cent increase in the per hectare income respectively. On the other hand due to increase in the gross cropped area, ground nut production and irrigated area by one per cent resulted 1.0829,0.3139 and 0.1907 per cent decline in the per hectare income in this district.

5.5.8.7 Ahmadnagar :

Per hectare income in this district has positively and significantly influenced by food grain production, ground nut production and irrigated area. The elasticity of these variables was 0.2137, 1.6305 and 2.0213 respectively. In case of cotton production the coefficient of elasticity was positive but not significant. Significant decline at the rate of 3.447, 0.2323 and 0.192 per cent was with an increase by one per cent in gross cropped area, sugar cane production and area under high yielding varieties.

5.5.8. Pune :

Increase in the gross cropped area, food grain production, ground nut production and irrigated area by one per cent showed the increased per hectare income by 1.7238, 0.0095, 0.1001 and 1.5492 per cent respectively. This decline was statistically significant for all the

variables except food grain production. In the case of cotton production, sugar cane production and area under high yielding varieties decline of 0.0936, 0.2383 and 0.0143 per cent was observed, for cotton production it was not significant.

5.5.8.9 Satara :

Significant increase in per hectare income at the rate of 2.0299, 1.0448, 0.5539 and 0.0293 per cent was observed with an increament of one per cent in gross cropped area, food grain production, cotton production and area under high yielding varieties respectively. Sugar cane production and irrigated area possessed positive but non significant values for coefficient of elasticity which indicated much less scope for increase in the income. Ground nut production resulted significant decline in income to the extent of 1.333 per cent.

5.5.8.10 Sangli :

Increase in food grain production, ground nut production and irrigated area by one per cent caused the significant decline of 0.631, 0.3345 and 2.6409 per cent in per hectare income in this district. The decline was not significant in case of food grain production. On the other hand significant increase in the order of 2.8627, 0.2579, 0.6458 and 0.0592 per cent was seen with an increase of one per cent in gross cropped area, cotton

production, sugar cane production and area under high yielding varieties respectively. It was statistically not significant in case of cotton production.

5.5.8.11 Kolhapur :

Per hectare income showed increase in the order of 0.0038, 0.4465, 0.6514 and 0.0227 per cent due to increase in the food grain production, ground nut production, irrigated area and area under high yielding varieties by one per cent respectively. Increase was statistically significant for all the variables except food grain production. One per cent increase in gross cropped area, cotton production and sugar cane production caused the non significant decline by 2.6433, 0.1183 and 0.0127 per cent, which implied that there was not much decline due to these variables.

5.5.8.12 Solapur :

Per hectare income increased by 0.4567, 0.1122 and 0.0001 per cent with an increase of one per cent in food grain production, cotton production and area under high yielding varieties respectively. On the other hand per hectare income declined by 0.9379 and 0.2004 per cent due to increase in gross cropped area and sugar cane production by one per cent. The coefficient of elasticity was negative and non significant for ground nut production and irrigated area which implied not much decline in per hectare income due to these variable.

5.5.8.13 Aurangabad :

Per hectare income was declined by 4.2353, 0.5031, 0.4836 per cent with an increase by one per cant in gross cropped area, cotton production and sugar cane production and was statistically significant. In the case of ground nut production, irrigated area and area under high yielding varieties, the per hectare income increased by 0.4803, 1.3678 and 0.0709 per cant. The coefficient of elasticity of food grain production was positive and not significant indicated that there is less scope to increase the per hectare income with this variable.

5.5.8.14 Parbhani :

Increase in the gross cropped area food grain production, cotton production and irrigated area showed significant increase in the per hectare income. It was 1.2596, 0.7248, 0.2579 and 0.0385 per cent respectively, while it declined significantly due to the increase in the sugar cane production, ground nut production and area under high yielding varieties. Decline was in the order of 0.3118, 0.2427 and 0.331 per cent respectively.

5.5.8.15 Beed :

The elasticities of ground nut production and gross irrigated area were positively significant, while in case of sugar cane, it was negatively significant. The functional analysis implied that there is little scope to improve the agricultural income with food grain

production, cotton production, R^2 was found to be statistically significant.

5.5.8.16 Nanded :

In this district per hectare income showed significant decline by 2.6453, 0.2427 and 0.0087 per cent due to the increase of one per cent in gross cropped area, sugar cane production and area under high yielding varieties. Food grain production, cotton production, ground nut production and gross irrigated area caused an increase in the per hectare income by 0.3468, 0.1813, 0.1002 and 0.7706 per cent respectively.

5.5.8.17 Osmanabad :

The coefficient of elasticity of all the vairables were statisticaly significant. Per hectare income increased by 0.3357, 0.4517, 0.3424 and 0.589 per cent with one per cent increase in food grain production, ground nut production, irrigated area and area under high yielding varieties respectively. On the other hand significant decline in the per hectare income was caused due to the increase in gross cropped area, cotton production and sugar cane production. This decline was 3.5245, 0.2069 and 0.1464 per cent respectively.

5.5.8.18 Buldhana :

Cotton production, sugar cane production and ground nut production resulted to affect the per hectare

income by 0.6994, 0.2155 and 0.3039 per cent respectively and was statistically significant. The coefficient of elasticity for area under high yielding varieties was positive but not significant. Increase in the gross cropped and irrigated area showed significant decline in the per hectare income.

5.5.8.19 Akola :

Per hectare incomewas increased significantly by 3.6279 per cent with one per cent increase in gross cropped area. The coefficients of elasticity for food grain production. Cotton production and sugar cane production were positive but not significant. Ground nut production, irrigated area and area under high yielding varieties, had non significant but negative values for their respective elasticities.

5.5.8.20 Amravati :

Increase in food grain production, cotton, sugar cane and ground nut production by one per cent would increase the per hectare income significantly with the rate of 0.2669, 0.7315, 0.1548 and 0.1186 per cent respectively. Non significant positive elasiticities of irrigated area and area under high yielding varieties implied little scope in increasing per hectare income. Increase in gross cropped area showed decline in per hectare income.

5.5.8.21 Yavatmal :

Per hectare income was significantly influenced by 0.4080, 0.2286, 0.0684 and 0.3586 per cent due to one per cent increase in food grain production, cotton production, ground nut production and gross irrigated area. On the other hand significant decline in the order of 0.2461 and 0.0220 per cent was affected due to increase in the sugar cane production and area under high yielding varieties. Increase in the gross cropped area did not influenced much

5.5.8.22 Wardha :

Per hectare income was positively affected due to increase in the food grain production and cotton production. The other variables, like sugar cane production, ground nut production, irrigated area and area under high yielding varieties had the positive but not significant values. Increase in the gross cropped area had shown decline in the per hectare income.

5.5.8.23 Nagpur :

Gross cropped area, cotton production and ground nut production affected per hectare income significantly by 8.9892, 0.3145 and 0.2041 per cent respectively. The coefficient of elasticity for food grain production was positive but not significant. Significant decline in the per hectare income (0.1230,

0.6834, 0.0287 per cent) was caused due to increase in sugar cane production, irrigated area and area under high yielding varieties respectively.

5.5.8.24 Bhandara :

Per hectare income increased significantly (5.3249, 0.2110 and 0.2108 per cent) due to increase in gross cropped area, food gnain production and sugar cane production respectively, while increase was not significant for the ground nut production. Increased irrigated area caused the significant decline (3.3872 per cent) in per hectare income.

5.5.8.25 Chandrapur :

Increase in the cotton production and sugar cane production by one per cent showed significant increase (0.4137 and 0.2011 per cent) in per hectare income. Area under high yielding varieties and gross cropped area showed the decline in per hectare income viz; 0.0377 and 0.4381 per cent respectively on the increase of one per cent in above variable.

DISCUSSION

DISCUSSION

The obtained results are discussed and an attempt has been made to identify the appropriate reasons for the achieved results. Districtwise results are discussed in this chapter. For the sake of simplicity the supporting and contradictory studies are given in the last part of this chapter.

6.1.1 Thane :

The per hectare income declined continuously from first to third period. Over all rank was fourth and the average per hectare income was Rs. 593.16. In first, second and overall period the per hectare income was significantly superior over the state average. It declined due to the decline in area of the rice crop, eventhough the proportion of its area to gross cropped area increased as compared to earlier period.

On the basis of per capita income the ranking of this district was 24th in second, third and overall period, and 23rd in first period. The average per capita income declined throughout the time periods. The per capita income declined mainly due to the high population pressure and rapid industralization.

In this district rice contributed more than 96 per cent of gross income in all the classified time

periods. In third period other crops also contributed some share in total agricultural income.

Rice was the main crop covering 54.238 per cent of gross cropped area. In the total area of rice in the state, its contribution was about 11 per cent. The area under rice showed stability throughout the time period as the area variations were of lower degree, however area declined with not significant rate. Rice was the mainly cultivated as rain-fed crop. In some of the years, the essential pre mansoon and early mansoon rains were inadequate which affected the area under crop and the gross cropped area. Gross cropped area showed significant declining trend. The other reason may be the rapid urbanization and industrilization.

Thane district shared 15.412 per cent of total production of rice in the state and was placed second in ranking. The production of wheat, kharif jowar and sugar cane registered high growth rates as their production at initial years of the study were very meagre. The variations in the production of rice were more than 10 per cent. The increase in the production of rice was statistically not significant.

The productivity of rice showed significant increase and the variations in theproductivity of rice were more than 10 per cent. The productivity of rice increased mainly due to decline in the area.

This district receives high rainfall, hence the area under irrigation was very less. The area under high yielding varieties ofrice and other cereals covered only 29 per cent of the total area under these crops. The variations in the area of high yieldingvarieties were much.

The increasing rate of consumption of N, P and K was statistically not significant. Average consumption of N, P and K was 9.40, 1.00, 3.63 Kgs respectively, it was higher than some of districts ofthe state because of intensive cultivation of rice crop.

Amount of loan advanced increased significantly, and was small er than the average availability at state level.

The income elasticities were decreasing to the scale.

6.2 Raigad :

Per hectare income has shown increase in the second period as compared to first one, and went down in third period marginally. The rank obtained was 4th in first and third period, while third in second period. In first, second and overall period, the average per hectare income was significantly higher than the average per hectare income at state level. Increase in per hectare income was obtained due to the significant increase in the production.

The average percapita income of rural population declined through all the time periods. It declined from Rs. 79.30 in first period to Rs. 64.96 in third period. The per capita agricultural income declined mainly due to the increased population prossure and the industrilization in the district.

The dominating crop in the district was rice,Its overall income contribution was 98.99 per cent pf gross income. The contribution of rice declined by 2 per cent from first to third period, as the crops like wheat, jowar, gram and sesamum contributed some share in second and third period.

The cropping pattern in this district was centred around rice which ocvered on an average 67.02 per cent of gross cropped area.

Rice covered 10.15 per cent of the area in the state. High growth rates were seen in the area of wheat and kharif jowar as their area in the initial years was found to be ansent. Increase in the area of rice crop was statistically not significant.

Production of rice increased at the significant rate. Increased area and productivity pushed the significant increase in the production.

Low values of variations were observed in all the crops for their respective average yield. In case of gram it was highest. The productivity of rice dod

not fluctuated much. It has shown increase but at the non significant rate. Increase in the rice productivity was mainly due to the favourable climatic conditions and the adoption of new techniques of cultivation. The

The area under high yielding varieties described significant increase, but at the initial period much less area was under HYVs. High yielding variaties of rice covered nearly 33 per cent of cropped area of this crop in the district.

Irrigated area was of very small amount as this district receives very high rain fall, and most of the area is under hilly region.

6.3 Ratnagiri :

Per hectare income increased by Rs. 215.55 in second period as compared to first one. There was very small difference in the average per hectare income of first and third period. The sudden increase in the per hectare income was obtained on account of increased proportion of area under rice and introduction of sugar cane and sesamum on smaller proportion. In the second period there was inclusion of high yielding varieties.

On the basis of per capita income it was seen that this district ranked lowest in the state except in first period where its rank was 24th in the order.

The contribution of rice was stable during the various periods, which was more than 96 per cent. Amongst the other selected crops sugar cane contributed more than 2 per cent to the total agricultural income.

Rice covered about 39 per cent of gross cropped area in the district, its share in the state was 10.103 per cent. The other selected crops covered very meagre area. Production of fodder crops was found on considerable area in the district.

Sugar cane and sesamum showed high positive and negative growth rates respectively as their area at the initial years was too small. Rice has shown significant increase in its area under cultivation.

The increased use of fertilizers and other inputs along with other operations resulted into the significant increase in the production and productivity. However the rice crop was found to lesser stable in this district as compared to that of other districts of Konkan division. Sugar cane, ground nut and sesamum also showed a nature of more instability in their production and productivity, compared to other crops grown in the district.

Irrigated area in this district was not exceeding more than 4 per cent as it received high rain fall.

Area under high yielding varieties showed significant increasing trend, but the area variations

were of higher degree (73 per cent) because at the initial stage very small area was covered under HYVs.

The consumption of N, P and K has shown increasing trend and was statistically significant for N and P. Per hectare consumption of N was 7.08 Kgs and was higher than the state average. Higher consumption was mainly due to internsive cultivation of rice.

The co-operative movement was not as strengthed as some of the other districts in the state, though loan advanced increased significantly. The average availability of loan per hectare and per borrower was Rs. 52.46 and Rs. 142.05 was lower than state average.

The income elasticities were at the decreasing rate.

Districts belonging to Konkan area showed that, the major crops grown were rice and fruits, vegetables and fodder crops. However due to the data limitations fruits, vegetables and fodders could not be considered in the present study. Inclusion of these crops may change the economic picture of these district to some extent. In these three districts rice was the main stable crop and being cultivated thrice in a year in certain areas. High rainfall and peculiar topogrphy affected the irrigation facilities , which were much less. The consumption of fertilizers was little higher in Konkan district, compared to other districts due to the intensive cultiviation of rice.

6.4 Nasik :

Nasik was the district which stood in the first top ten ranks for the second and third period except for the first period, wherein the district went down to 17th rank. In all the time periods, the average per hectare income was at par with the state average. An increase in the per hectare income was observed due to the increased contribution from sugar cane, ground nut, wheat, jowar and rice. Though the proportion of contribution of bajra declined considerably, it did not affected the gross income in the district.

Average per capita agricultural income has shown a small decline (Rs. 8.43) in second period compared with the first one and then increased in third by Rs. 31.64. The ranking of per capita income increased from 19 (first period to 13 (third period) in the state. This increase was mainly contributed by the sugar cane and other cash crops in the district.

Sugar cane contributed the largest share (30.676 per cent) in gross income followed by bajra (26.087 per cent). Due to the increased sugar cane production in the district, during second period its contribution was highest. Eventhough the contribution of bajra declined during the study period, it was second important crop in the district. Ground nut contribution was almost constant while wheat and rice contributed

increasingly during the period. Increased area under irrigation might have affected in increasing production of sugar cane, wheat and rice.

The area of rice, bajra, cotton, tur and rabi jowar declined mainly due to the scanty rainfall and its uneven distribution in the district. The area under kharif jowar increased due to the adoption of several hybrids and high yielding varieties of kharif jowar. The area under wheat, rice and sugar cane increased mainly due to the availability of irrigation. Double cropped area showed decline which resulted in decline in the gross cropped area.

The variations in the production were of moderate size for all the crops and were lowest in bajra (18.532 per cent). Rabi jowar, cotton and sesamum production recorded negative growth rates. The production of rice, wheat, kharif jowar and bajra increased mainly due to the increased productivity of the crops.

Increase in the wheat productivity was mainly due to the shifting of rain fed wheat cultivation to irrigated ones. In sugar cane cultivated area, farmers grow wheat as rotational crop, which resulted higher productivity due to the more use of fertilizers also. Increase in the high yielding variaties area of jowar reflected in increasing the kharif jowar productivity, while sugar cane productivity increased with the effect of developed irrigation facility

Irrigated area of all the crops has shown increased, but in case of cotton it showed decline. Wheat occupied major protion of the gross irrigated area.

The area under high yielding variaties increased significantly but the variations were of very higher degree, as at the initial years the area under high yielding varieties was very small. Consumption, N,P and K was just corresponding with state average. Consumption of N, P and K showed statistically significant increasing trend.

Loan advanced per borrower and per hectare was Rs. 511.41 and Rs. 73.43. Loan advancing increased significantly. Availability of loan was greater than the state average.

For gross cropped area, cotton production, ground nut production and area under irrigation the income elasticities were positive and significant. The income elasticities were increasing return to the scale.

6.5 Dhule :

The average per hectare income was Rs. 352.74 for overall period and the rank was 9th in the order of merit. Decline in ranking in second period resulted the decline in per hectare income. In third period it increased to Rs. 499.79 and secured 6th rank in the state. In all the periods the average per hectare income was at par with the state level income. It increased mainly due

to the increased income from sugar cane and other crops like jowar, wheat, bajra and cotton. In this district the proportion of income from cash crops was more.

The average per capita income was declined in second period due to adverse climatic conditions during the period which significantly affected the decline in the gross income. The average per capita income in the district was at par with the per capita income at state level for all the periods.

Contribution of ground nut declined from 31.187 to 23.299 per cent in third period as compared to first period, mainly due to the reducting in area and decline in the production by 1.243 per cent. The income contribution of food grain crops did not show much changes in their shares. Slight decline in income contribtion of cotton was observed as its income was remained stable in all the periods, whereas the income contribution of sugar cane increased from 3.171 per cent in first period to 11.511 per cent in second and to 15.929 per cent in third period, this was due to increased area and production.

Bajra, rabi jowar and ground nut covered 20.432, 12.018 and 15.368 per cent of gross cropped area in the district. Ground nut and bajra covered 12.099 and 8.444 per cent area in the average total area of these crops in the state and achieved 2nd and 5th ranking respectively. Sugar cane and wheat showed higher variations in area, as

sudden increase was observed with the availability of irrigation facilities.

Significant increasing trends were observed for the area under wheat and sugar cane. This increase was obtained mainly due to the irrigation and sugar cane processing facilities.

Area shifts were seen in all the crops. For minimizing the risk in production the decreased area of the cereals was recovered by wheat and bajra. Rainfall in the months of June and July was below normal in some of the years under study which badly affected the area under kharif crops.

The production of kharif jowar increased due to the significant increase in its productivity possibly with the adoption of high yielding varieties. Production of cotton and ground nut almost remained stable due to the increased productivity though the respective area declined. Wheat, bajra and sugar cane production increased significantly mainly due to the significant increase in their respective productivity and area under the crop. Variations in the production of sugar cane and kharif jowar were of higher degree, in remaining crops they were of moderate size.

The varietions in the productivity were of higher degree in kharif jowar (44.832 per cent) as high yielding varieties and hybrids require more time to stabilize in

the region. The productivity of all the crops, except rabi jowar increased and was statistically significant in wheat, kharif jowar and sugar cane due to the irrigation and adoption of high yielding and hybrid varieties. Irrigation facilities helped in pushing up the average yields of the crops like rice, gram and ground nut.

Irrigated area of the selected crops increased significantly with the irrigation development programme. Gross irrigated area was about 8 per cent of gross cropped area in the district. Irrigated area under rice, wheat, gram, cotton and bajra showed significant increasing trend. Highest growth rate was seen for cotton i.e. 25.574 per cent. Variations in the irrigated area of bajra, gram, cotton and rabi jowar were higher as their initial area was very meagre. Wheat covered major irrigated area.

Fertilizer consumption increased significantly, and was greater than state average.

Credit facilities were of satisfactory nature in this district. Loan advancing increased significantly. Average amount available at per borrower was greater than state average while it was just short to the state average at per hectare level.

Income elasticities of gross cropped area sugar cane and ground nut production were positive and significant. Income elasticities were increasing return to the scale.

6.6 Jalgaon :

The district showed good performance in agricultural development. In attained second rank for overall period. For all the periods the average per hectare income was significantly higher than the state average income. Jowar and cotton being the major crops in the district, the changes in the production of these crops reflected the per hectare income also. Decline in per hectare income during second period was mainly due to drought conditions for some of the years.

The picture of per capita income was totally different. The ranks of this district were 12.21 and 19 in first, second and third period respectively. The average per capita income declined mainly due to the higher population pressure on land. The overall average per capita income was Rs. 134.08. In all the time periods the average per capita income was at par with the state average.

The contribution of cotton in gross income declined with the time periods, and on the other hand the contribution of jowar increased to 31.395 per cent in third period.

The contribution of ground nut was just the same. In this district cash crops shared the larger proportion of gross income in all the periods.

Cotton, kharif jowar, bajra and ground nut covered 25.099, 17.270, 10.198 and 9.509 per cent of gross

cropped area. Cotton and ground nut covered more than 8 per cent in the cropped area of there crops in the state.

Area under the crops of bajra, kharif jowar, rabi jowar increased mainly due to the adoption of HYVs and hybrids. Increqsed irrigation facilities exhibited decline in the area of wheat and sugar cane. Area shifts were seen in almost all the crops.

Production of rice, wheat, bajra, gram, sugar cane and ground nut increased with the increased productivity. The variations in the productivity were of higher degree. Production of kharif jowar and cotton decreased as their productivity showed decline.

Productivity of all the crops except kharif jowar and cotton, increased and was significant in the case of wheat, bajra and sugar cane. Variations in the productivity of all the crops were ofmoderate size, but in rice they were of higher degree (42 per cent) productivity increased mainly due to irrigation facilities.

Irrigation facility was limited to 8 per cent. Rice, wheat, gram and sugar cane were grown as irrigated crops on large extent. Major irrigated area was covered by wheat crop.

The area under HYVs of all the cereals showed significant increase with higher growth rates and were possessing the higher values of area variations. The respective growth rates for the area under high yielding

variaties of rice, wheat, kharif jowar, rabi jowar and bajra were 59.63, 79.39, 38.19, 55.21 and 35.45 per cent per year.

Consumption of N, P and K showed statistically significant increasing trend. Higher growth rate was observed in K as its consumption at initial years was very meagre. Average consumption of N, P and K was lesser than the recommendations, but was higher than the state average.

Credit facilities were at par with the state. Amount of loan advanced increased signific ntly. Availability at per borrower was greater than the state average, Whereas at per hectare it was just same with state average.

Income elasticities were increasing return to the scale.

6.7 Ahmadnagar :

The district placed on 8th position in the state for per hectare income in all the time periods. In all the time periods average per hectare income was at par with the average per hectare income at state level. In second period per hectare income was declined due to the lesser contribution of jowar, bajra and ground nut. In third period the share of wheat, jowar, bajra, ground nut and sugar cane increased as compared with first one.

In the case of per capita income, this district ranked second in overall basis. Ranking decreased from

first (first period) to third in second period. However the per capita income declined over a period to time, indicating increased population pressure on the agricultural income. The per capita income was significantly superior over the average income at state level.

Sugar cane contributed more than half of the agricultural income in this district, during second period highest contribution (60.8 per cent) was obtained. The another important crop was jowar which contributed 20.301 per cent to the gross income. The contribution of cash crops was more than the food crops.

On the basis of area under the crops in the state, for sugar cane, it was highest while for rabi jowar and bajra were second in the state.

Significant increasing trend was seen in the area of wheat and sugar cane mainly due to irrigation and co-operative sugar factories respectively whereas as the area under the crops like rice, rabi jowar, cotton, ground nut and sesamum declined significantly. Area of kharif jowar was meagre upto the year 1970-71, it increased rapidly since 1971-72, the increase was due to the HYVs. The area variations were of higher degree in case of cotton and kharif jowar, and in the remaining crops they were of moderate size. Area shift was seen in all the crops except rabi jowar. The area of rice might

have covered by the kharif jowar and that of rabi jowar by wheat in rabi season. Double cropped area declined significantly though the irrigation facilities have been increased. It showed increase in the annual crops like sugar cane.

Production of rabi jowar, tur and gram declined because of decline in area. In case of wheat, kharif jowar and sugar cane, it increased due to the improved irrigation facilities and adoption of HYVs in case of wheat and kharif jowar. Due to the changing climatic condition, variations in production, which , of higher degree were seen.

The productivity of all the crops except rabi jowar, tur and gram increased. In case of wheat, bajra, cotton and ground nut it increased significantly. Sugar cane productivity shown the non significant increase, as its initial years productivity was much higher. It increased from 91830 Kgs at basis year to 102950 Kgs per hectare as an average.

Out of the cropped area of the crops like wheat, cotton and bajra, 39.43 and 22 per cent was under irrigated condition. The irrigated area of rabi jowar, gram, cotton and ground nut declined and was replaced by the crops like wheat and sugar cane.

Area under high yielding variaties of all the selected cereal crops increased significantly and possessed

the higher variations in area. Proportion of HYVs to the cropped area of kharif jowar, wheat and rice was 68, 47 and 35 per cent respectively.

The consumption of the N, P and K and total consumption increased significantly. Consumption of N was greater than state average whereas it was shorter than state average for K and P.

The average number of borrowers was highest in the state. Loan advancing increased significantly. It increased with 11.439 per cent. The average availability of loan per borrower and per hectare was higher than the state average.

The income elasticities of food grain production and area under irrigation were positive and found to be statistically significant. The income elasticities were decreasing return to the scale.

6.8 Pune :

The average per hectare income was at par with the state income forall the periods . It increased continuously from first to third period. The increase obtained was mainly due to the increased income contribution of sugar cane, wheat and bajra. The another reason may be the significant decline in the gross cropped area. The overall ranking of this district was 12 and was same third period.

The overall per capita income was Rs. 130.96 and was 20th in the order of merit. The per capita income showed some decline in second period but increased in third period. Rise in per capita income was due to the higher increase in the gross income in the district as compared to the rate of rural population.

Highest income was shared by the sugar cane i.e. 29.741 per cent, followed by jowar, bajra and rice viz; 25.32, 17.64 and 9.38 per cent respectively. The contribution of rice, wheat and bajra increased in third period, while the crops like sugar cane, ground nut, tur and jowar did not exhibit much difference in their income contribution in various time periods, which indicated that crops like wheat, rice and bajra have better prospectus.

Rabi jowar, bajra and sugar cane covered larger area compared to other crops grown in the district.

Increasing trend was observed in case of area of wheat, ground nut and sugar cane and was statistically significant incase of wheat and sugar cane mainly due to increase in irrigation facilities. Lack of rains and high risks in cotton caused significant decline in the area. The area variations were of smaller degree in all the crops. Area shifts were seen in case of rice, wheat, kharif jowar, cotton, sugar cane, ground nut and sesamum. Double cropped area increased which showed higher increase in area of seasonal crops as compared to that to annual or parrinilas.

The proportion of bajra, rabi jowar and sugar cane production was about 11.9 and 7 per cent of the average production of these crops in the state. Increasing trend was observed in all the crops except rabi jowar, cotton and sesamum and was statistically significant in cotton. Significant increasing trend in production was observed in wheat and sugar cane due to the improved cultivation methods and increased irrigation facilities. The variations in the production of various crops were of moderate size and were least in bajra.

The variations in the productivity of rice, wheat and kharif jowar were of higher degree and were lowest in bajra. Average yields of rice, wheat, rabi jowar and bajra increased due to use of high yielding variaties and availability of irrigation. The productivity of kharif jowar increased mainly due to the area under HYVs while in case of cotton this increase was mainly due to the irrigated cotton.

The irrigated area in this district was about 12 per cent of gross cropped area. Irrigated rabi jowar covered 37 per cent of gross irrigated area. Wheat, cotton and gram were cultivated irrigated crops on about 53, 95 and 25 per cent of their total area in the district.

Area under HYVs of rice, wheat and kharif jowar increased significantly. The variations in the area of HYVs were of higher degree and were ranging from 63.68

per cent in rabi jowar to 139.41 per cent in kharif jowar.

Consumption of N, P and K and total fertilizers increased significantly. The growth rate was higher in the consumption of K was compared to N and P as its consumption was very low at the initial years. The average consumption of N and P was greater (8.04 and 2.39 Kgs per hectare) than the state average, while it was compareteively lesser than the state average in case of potassium.

Amount of loan advanced increased significantly, but the availability of loans per borrower and per hectare was lesser than the state average.

The income elasticities were increasing return to scale.

6.9 Satara :

Over a period time per hectare income and its ranking raised from Rs. 373.95 to Rs. 717.03 and from seven to second respectively. In first period the per hectare income was at par with the state. But in second, third and overall period it was significantly superior over state average. The better performance in per hectare income was due to increased sugar cane production.

Average per capita income also showed an increase in succeeding periods as compared to precceeding ones. The ranking of this district raised from 16 in first period to 5 in the third period, and was 5th in second period.

In second and third period, the average per capita agricultural income was significantly superior to the average per capita income at state level, which showed that the rate of agricultural production was higher than the rate of rural population.

The contribution of wheat, jowar and sugar cane in the total income increased, while the income contribution of ground nut declined from 50 per cent in first period to 37 per cent in third period. The contribution of sugar cane increased from 4 per cent in first period to 25 per cent in third period.

The barren land, land put to non agricultural was culturable wastes and permanent pastures increased within the time period, which resulted in the decline in gross cropped area. Rabi jowar, kharif jowar, bajra and ground nut were important area covering crops and covered 9.825, 6.674, 6.921 and 4.189 per cent of total cropped area of these crops in the state.

Significant increasing growth rates were observed in the area of wheat, kharif jowar and sugar cane. The variations in area of these crops were round about 20 per cent, showing there by the stability in area in recent years. Significant decline was observed in the area of bajra, rice, rabi jowar and cotton declined non significantly implied not much changes. The area under kharif jowar increased mainly due to the introduction of high yielding

varieties programme. In case of wheat and kharif jowar growth rates were higher, while in the area of sugar cane it was lower than the state, which showed that the sugar cane area was almost stable while better prospectus in future is seen for wheat and kharif jowar.

The production of ground nut in this district was 10.59 per cent of total production in the state, it declined by 2.883 per cent, while that of rice, wheat and kharif jowar production increased significantly with the adoption of high yielding varieties. The production of cotton, and sugar cane increased mainly due to irrigation and processing industries for latter respectively. The varietions in the production of these crops were higher than 30 per cent.

The productivity of all the crops except rabi jowar and bajra shown increasing trend. It was significant in wheat, kharif jowar and sugar cane showing there by better intensive cultivation of these crops.

Gross irrigated area was about 15 per cent of gross cropped area. Rabi jowar covered large area of the gross irrigated area but declining trend was observed while that of irrigated wheat it has shown increasing trend.

Area under high yielding varieties of all the cereals except bajra exhibited significant increasing trend, however the variations were of higher degree, which indicated that the area under these varieties are yet to be stabilized.

Per hectare consumption of N and P was higher than the state average. Significant increasing trends were obtained in the consumption of N, P and K and total fertilizer consumption.

Availability of credit facilities i.e. amount of loans, has shown significant increase, the average availability of loans per borrower and per hectare was Rs. 304.39 and Rs. 71.46 respectively. The first amount was lower than the state average while the availability at per hectare was higher than the state average.

Income elasticities were increasing return to the scale.

6.10 Sangli :

Overall per hectare income was Rs. 460.58 and stood 7th in the state. Perhectare income increased in all the time periods, but was at par with the state income. The increased contribution of sugar cane income resulted for an increase in per hectare income in this district.

The per capita income remained almost constant due to the proportional increase in the rural population which levelled the increase in the gross agricultural income. In all the periods the average per capita income was significantly superior over the state average per capita income.

In this district contribution of rice has declined in succeeding periods and that of sugar cane increased with

a greater speed. The contribution of jowar, tur, gram, cotton, ground nut and sesamum did not showed such differences. The sugar cane contribution increased mainly due to the opening of new factories and devotion of irrigation facilities towards this crop.

The land put to non agricultural uses was increased from 900 hectare in 1960-61 to 27000 hectares in 1977-78. In this district the cropping pattern was mainly based on the food crops, which covered 75 per cent of the gross cropped area. Kharif jowar, bajra, rabi jowar and ground nut covered 20.289, 18.013, 15.840 and 11.649 per cent of gross cropped area in the district, and sugar cane covered 8.65 per cent of total area of the crop in the state.

The area of kharif jowar, bajra, tur, cotton, ground nut and sesamum declined due to the uneven distribution of rainfall and less application of irrigation to these crops, whereas rice, wheat and sugar cane area increased significantly due to the irrigation facilities availble in the district. Variations in area were of comparatively higher degree in case of sesamum and cotton as their area declined steadily from the initial period of the study.

The positive growth rates in the area of rice, wheat, sugar cane and negative area growth rates of cotton and ground nut were higher than the growth rates at state level.

The average production of sugar cane, ground nut and kharif jowar secured 4th, 5th and 6th rank in the order.

The fluctuations in production were comparatively higher in rice, wheat, cotton and sesamum as compared to others in the district. The production of rice, wheat and sugar cane increased on the account of irrigation. Cotton, ground nut and sesamum production declined mainly due to significant decline in the area.

The productivity of rice and wheat increased due to the irrigation and use of high yielding varieties, while the productivity of cotton and sugar cane increased mainly due to irrigation. The productivity of these crops was almost stable.

On an average 10 per cent of gross cropped area was under irrigation. The irrigated area under rice, wheat and sugar cane incr ased significantly. Wherein of cotton and gram declined with the high values of variations, the area under HYVs of cereals showed significant increase.

The use of fertilizer showed increasing trends. The credit facilities were best in the state.

The income elastisties were increasing return to a scale.

6.111 Kolhapur :

Kolhapur was the most developed district in the state and ranked first on the basis of per hectare income. Agricultural development was due to mainly sugar cane, which shared 61 per cent of the agricultural income. Per

hectare income of this district was significantly superior over the state income as well as that of all the districts.

On the basis of per capita income ranking of this district raised from fifth to third with an exception of first in second period. This showed that inspite of the heavy pressure of population on land, per capita income increased, significantly. Per capita income was significantly superior over the average per capita income at state level in all the time periods.

Income contribution of various crops revealed that sugar cane was the most important crop which covered major share of the total income, followed by rice (15.60 per cent), ground nut (11.20 per cent) and jowar (9.80 per cent). However and the average contribution of rice, jowar and ground nut declined with small amount in third period as compared to first one due to the increased share of sugar cane.

The rain fall was sufficient to the crops in most of the years though was less than normal in the month of July and August.

Rice, ground nut, kharif jowar and sugar cane covered 22.687, 13.212, 11.805 and 9.727 per cent of gross cropped area in the district, their respective shares in the state were 7.001, 1.800, 5.007 and 20.868 per cent respectively which indicated the importance of these crops in the district.

The variations in the area covered by wheat, rabi jowar, cotton and sesamum were comparatively much wider than other crops in the district, since these crops were not traditional crops and covered very meagre area. Area of rice, bajra, tur and ground nut declined significantly, while it increased significantly in case of wheat and sugar cane. The increasing growth rate of wheat area was greater while of sugar cane was lesser than state. Negative area growth rates in cotton and ground nut were greater and lesser than state respectively.

Sugar cane, ground nut and rice contributed 23.022, 8.967 and 8.279 per cent of total production in the state and their ranking were 2nd, 4th and 6th respectively. Production of wheat and sesamum has got the wider fluctuations as their production at initial years was much less. The production of bajra, tur, and cotton showed significant decline due to the decrease in their respective area, and that of ground nut due to decline in area and productivity. Statistically significant increase was observed in the production of wheat and sugar cane due to increase in area and productivity of these crops.

Productivity of all the crops except in case of rice, wheat, gram and sugar cane. The increase in sugar cane was obtained due to irrigation and sugar factories and irrigation and use of HYVs in rice and wheat.

Nearly 80 per cent of gross irrigated area was covered by sugar cane. All the irrigated crops showed

increasing trend with respect to area.

The adoption of HYVs of wheat, rice and kharif jowar increased significantly with wider variations. The fertilizer consumption increased significantly.

In case of the availability of credit this district stood second in the state.

The income elasticities were decreasing return to scale.

6.12 Solapur :

The position of this district compared to others in the state for per hectare income remained almost stable towards lower side i.e. 22nd. The average per hectare income increased in third period as compared to earlier ones. Per hectare income was significantly lower than the state average in all the periods. Per hectare income increased mainly due to the increased income proportion of wheat and sugar cane.

The average per capita income declined continuously in all the periods, indicating there by higher pressure of population and reduction in gross cropped area. Average per capita income was at par with the state average for all the time periods.

The contribution of jowar and ground nut declined in second and third period. Whereas it increased in case of wheat and sugar cane. The decline was observed mainly due

to reduction in production. Fodd grains were dominating ones.

The rainfall distribution was uneven in this district. Rabi jowar covered 62 per cent of the gross cropped area. Rabi jowar, sugar cane and ground nut occupied 21.81, 6.83 and 5.93 per cent of total area of these crops in the state.

The area under rice, rabi jowar, bajra, cotton and ground nut declined significantly due to the uneven percipitation, while that of sugar cane. Gram, wheat and kharif jowar area increased significantly. Higher growth rates were observed in kharif jowar. An increase in area of under wheat, kharif jowar, gram and decline in cotton and ground nut area was with higher rates than the state.

Production of wheat, kharif jowar, gram and sugar cane increased with the improved irrigation availability. The production of rabi jowar, tur, cotton, ground nut and sesamum declined significantly mainly due to decrease in the areas.

Rice, wheat, bajra, sugar cane and cotton exhibited significant increasing trend in productivity. The productivity of rabi jowar, gram and ground nut showed decline.

The increasing growth rates in production of wheat and kharif jowar and in productivity of cotton and sugar cane were higher than the state.

Irrigated area in this district did not change much over a period of time. Rice and rabi jowar registered the significant declining growth rates in the irrigated area, wherein, the irrigated area under wheat and kharif jowar showed significant increase. The irrigated wheat, rice and kharif jowar occupied 52.45, 35.03 and 26.52 per cent of cropped area of these crops.

All the cereal crops under study exhibited significant positive growth rates for their area under HYVs. The values of growth rates and variations were much greater as their initial area were meagre. Almost all the area under kharif jowar was put under high yielding varieties.

Consumption of N, P and K and total fertilizers increased significantly and was lower than the state average.

Credit facilities also increased significantly, and were smaller than the state average.

Income elasticities were decreasing return to the scale.

6.13 Aurangabad :

Aurangabad was one of the least agriculturally developed district and was ranked 24th throughout the study period. The overall average per hectare income was Rs.217.03 and was increased to Rs. 275.17 in third period, due to higher income from crops like wheat, cotton and sugar cane. In all the time periods the per hectare income was significantly lower than the state average.

On the basis of per capita income the rank of the district raised from 17th (first period) to 14 (third period), however there was decline of per capita income by Rs. 12.63 which indicated the higher population presure. Per capita income was at par with the state average in all the periods.

Wheat, sugar cane and cotton improved their contributions to the gross income, while, income contribution of jowar and bajra declined due to the declined in the area and production respectively. The contribution of ground nut declined mainly due to the significant decline in the area and production.

The mansoon and post mansoon rainfall was uneven in number of years. The proportion of current fallow, non agricultural land and land put under miscelleneous uses was increasing showing there by less availability of land under plough. The cropping pattern was dominated by the food crops.

Area of kharif jowar declined significantly, whereas significant increase was seen in area of bajra. Area of cotton, ground nut and sesamum has shown decline. Gross cropped area declined significantly. Wheat, rabi jowar, bajra and sugar cane contributed 8.948, 9.594, 11.304 and 5.177 per cent in total area of these crops in the state. The positive growth rate in area ofbajra was higher,whereas negative growth rates in cotton and ground nut area were higher than the state.

Wheat, rabi jowar and bajra contributed 7.746, 01.704 and 10.152 per cent of average production of these crops in the state, and achieved 2nd, 3rd and 5th rank in the order of merit. Variations in the production of rice, wheat, kharif jowar, cotton and ground nut were of considerable extent. Wheat, cotton and sugar cane showed significant increasing trend in production, due to the increase in productivity. Ground nut and sesamum production declined on account of decreased area. Growth rate in the production of cotton was higher than the state. Productivity of wheat and sugar cane increased due to irrigation and HYVs and that of cotton due to the very less productivity at the initial years.

Irrigated area was about 7 per cent of gross cropped area, wheat, rabi jowar and sugar cane covered 21.218, 26.65 and 12.08 per cent. The area under irrigation of all the crops was not more than 25 per cent of the cropped area. Rice, wheat, kharif jowar, bajra, gram and cotton recorded the significant increasing trend for irrigated area.

Area under HYVs of all the cereals except rice showed significant increase. The area fluctuations were of greater extent as initial area was much less.

Average consumption of N, P and K was smaller than the state average. Statistically significant increasing growth rates were observed in the consumption of N,P and K. Higher growth rates were obtained as the initial consumption

was comparatively smaller credit facilities showed significantly increase. Average availability of loans per borrower and per capita was Rs. 754.88 and 67.55 and was higher than the state average.

Income elasticities were decreasing return to the scale.

6.14 Parbhani :

Per hectare income in this district was the lowest and almost remained constant upto second period and showed some increase in the last period, due to the better constribution of cotton. The average per hectare income was significantly lower than the state average in all the periods.

The ranking on the basis of per capita income was much higher and was further raised from 13th to 6th during the period of study. This showed that progress in agricultural income was better during recent years in this district. Per capita income in third period was significantly superior over the state average. The oppsite picture of per capita income was mainly due to increase in the agricultural income.

On account of increase in the proportion of income due to sugar cane and cotton, the contribution of jowar declined, and that of about the remaining crops, remained almost constant. The food crops were sharing major portion of the gross income.

The rainfall distribution was at satisfactory level. Cotton, rabi jowar and kharif jowar covered 23.346, 20.950 and 16.369 per cent of gross cropped area. Food grains covered major area in the district. Wheat, kharif jowar, rabi jowar and cotton occupied 6.208, 6.384, 6.179 and 9.084 per cent of cropped area of these crops in the state.

All the crops showed increasing growth rates in area except cotton and ground nut, which exhibited significant decline. Significant increasing trends in area were observed in rabi jowar, bajra, gram, tur, sugar cane and sesamum. In case of ground nut the area variations were of greater extent compared to the other crops in the district. The area growth rates of bajra, gram, tur, sesamum and ground nut were higher than the growth rates at state level.

Significant increasing growth rates were obtained in the production of bajra, tur, cotton, sugar cane and sesamum. The impact of HYVs was not assisting in better way for increasing the yields. The production of sugar cane and cotton increased significantly mainly due to the low productivity during initial years. The productivity of rice, wheat and kharif jowar increased with non significant rate.

Gross irrigated area was near about 18 per cent of the gross cropped area. All the irrigated crops showed significant increasing trend. The large shares of irrigated area were shared by wheat and sugar cane.

Area under HYVs of rice, wheat, kharif jowar and rabi jowar showed significant increasing trend, but the coverage of high yielding varieties was not on large extent.

Average consumption of N, P and K was below the state average. It showed statistically significant increasing growth rates. Near about 55 per cent consumption was of the nitrogen.

Advancing of loans showed statistically significant increasing trend. An amount of Rs. 278.01 and Rs. 32.60 was available at per borrower and per hectare respectively and was lower than the state average.

Income elasticities were statistically significant for all the independent variables, and were increasing return to the scale.

8.15 Beed :

Per hectare income has been declined from first to third period with slight increase in the second period. This has affected on the ranking which has declined from 20th to 23rd during the period. An average per hectare income was Rs. 240.94. The average per hectare income was significantly lower than the state average in all the periods.

On the basis of the per capita income also the ranking of this district was declined from 7 to 8. During initial as well as for overall period the per capita income was significantly higher than the state average and

was at par in other periods. These results showed that, there the agricultural development was not significant.

The income contribution of rice, wheat and gram did not showed much differences in their income shares in different time periods. Jowar, cotton, wheat and sugar cane showed increase in their respective contributions in different periods under study.

Rainfall distribution was quite changing in the time period. Especially the rainfall in the months of July and september was quite dissatisfactory. Rabi jowar, kharif jowar, bajra and cotton occupied 28.890, 10.865, 13.148 and 5.514 per cent of gross cropped area in this district. Food crops and non food crops were grown in the proportion of 0.77 : 0.23.

Significant increasing trends in area were obtained in the crops like wheat, kharif jowar, bajra, gram and sugar cane, whereas the area under cotton, ground nut and sesamum declined significantly due to the higher production risks. In all the crops area shifts were seen Rabi jowar contributed 6.584 per cent of average cropped area in the state and was 5th in ranking. The growth rates in the area of wheat, kharif jowar, bajra, gram, sugar cane, ground nut and sesamum were higher than at state level.

Rabi jowar, bajra and gram contributed 8.255, 6.017 and 8.073 per cent of average production of these crops in the state. Variations in the production of rice, bajra,

kharif jowar, tur, cotton, sugar cane and ground nut were considerably higher than the other crops in the district. Production of wheat, bajra, cotton and sugar cane increased significantly, this was obtained due to the irrigation facilities and HYVs of bajra. Production of ground nut declined significantly due to high risks. Production of bajra, cotton, ground nut and sugar cane possessed higher growth rates than state.

Productivity of cotton increased significantly as its productivity at initial years was very low. The productivity of ground nut declined mainly due to higher risks. In remaining crops only wheat and sugar cane prooved positive growth.

Irrigated area was about 7 per cent of gross cropped area. Higher growth rates in irrigated area of kharif jowar, bajra and ground nut were observed as the initial area was low. Nearly half of the irrigated area was covered by the rabi jowar.

HYVs of rice, wheat and kharif jowar, showed the significant increasing growth rates for their respective areas on the account of very low area at the initial years resulted in higher growth rates and variations. Rabi jowar and bajra recovered increasing but non significant trend for their area, indicating the very low fluctuations in the respective areas.

Out of total consumption of fertilizers 57 per cent was covered by the 'Nitrogen' only. Statistically significant increasing trends were obtained for N, P and K and total fertilizer consumption. Average consumption of N, P and K was below the state average.

Availability of loan advancing significantly with the rate of 7.99 per cent. An amount of Rs. 250.59 and Rs. 29.03 was available for per borrower and per hectare respectively. which was lower than the state average.

Income elasticities for ground nut production, area under irrigation, area under high yielding varieties and sugar cane production were statistically significant. The independent variables contributed 75.65 per cent significant contribution.

6.16 Nanded :

The district has showed better progress by raising its rank from 23rd to 17 for per hectare income. The average per hectare income was Rs. 250.92. The per hectare income was significantly lower during the earlier periods than the state average, and it had increased to the level which was at par with state in recent years. Per hectare income increased mainly due to increased income from cotton and sugar cane respectively.

Per capita income was at par with the state average in all the periods. The overall average per capita income was Rs. 132.46.

Income contribution of jowar declined from 52 per cent in first period to 41 per cent in third period, but in case of cotton and sugar cane it increased from 6 to 20 and 5 to 11 per cent respectively. This was obtained due to the significant increase in the production of these crops.

The rainfall in the months of june, july and october was some what satisfactory. Kharif jowar and cotton occupied 32.884 and 25.612 per cent of gross cropped area in the district, and covered 9.442 and 7.280 per cent in state.

Statistically significant increasing trends were observed in the area of crops like, kharif jowar, tur, sugar cane, ground nut and sesamum respectively. Significant declining trend was seen in only rabi jowar. Area shifts were seen in the crops like, rabi jowar, tur, sugar cane, ground nut and sesamum respectively.

Production of kharif jowar and cotton contributed 8.615 and 3.588 per cent of average production in the state. Production of wheat, cotton, sugar cane and sesamum increased significantly. In case of cotton, the increase was due to increase in productivity, while in case of wheat and sugar cane it was mainly due to the increase in the area. Production variations in rice, wheat, cotton and sugar cane were of higher extent as compared to other crops. Growth rates of cotton, sugar cane, ground nut and sesamum production were higher than the state.

Productivity of rice, wheat, sugar cane and cotton increased significantly except rice. Higher growth rate was observed in cotton as its initial productivity was very less. In case of cotton, ground nut and sugar cane the growth rates were higher than the state level.

Gross irrigated area was about 3 per cent of gross cropped area. Major irrigated area was covered by the crops like wheat and bajra and sugar cane. Irrigated area of wheat, bajra, gram and ground nut registered statistically significant increasing trend. Highest growth rate was observed in ground nut as the initial irrigated area of ground nut was very meagre.

Area under high yielding varieties of rice, wheat and kharif jowar recorded significant increasing growth rates. The initial area under high yielding varieties was meagre in all the crops, so the variations were of larger size.

Consumption of N and K showed significant increasing trend, whereas the increase in the consumption of P was statistically not significant. The average availability of N, P and K was smaller than the state average.

Income elasticities for all the vairables except area under HYVs were statistically not significant and were decreasing return to the scale.

6.17 Osmanabad :

The ranking of this district for average per hectare income declined from 12 to 21 from first to third period, though the per hectare income increased. In second period slight decline was observed. The overall average per hectare income was Rs. 292.19 and was 16th in ranking. In first and second period it was at par with state average and in third and overall period it was significantly lower than state. The results indicated that the growth of income was much lower than other districts. Per hectare income increased due to increase in wheat and usgar cane production.

Average per capita income showed decline due to high population pressure. Only in first period it was significantly higher over the state average, and in remaining periods it was at par with thestate average.

The contribution of jowar had declined in second period but again inclined to previous level in third period. The contribution of wheat and sugar cane increased with increase in production and declined in ground nut with decline in production.

Kharif jowar, rabi jowar, ground nut and tur occupied 20.144, 18.450, 10.499 and 6.897 per cent gross cropped area in the district. Wheat, kharif jowar and ground nut covered 6.650, 8.774 and 12.681 per cent in average area in state. Variations in the area were of small to medium size in all the crops except sugar cane, in which they were of

37 per cent. Declining trend in area was observed in rabi jowar, cotton and ground nut and was statistically significant due to adverse wheather conditions. Area of all the remaining crops increased significantly except of wheat. Area shifts were observed in all the crops. The growth rates in area of rice, kharif jowar, rabi jowar, bajra, tur, gram, cotton and sugar cane were higher than state.

Production of gram, ground nut, rabi jowar, wheat and kharif jowar secured first, second, fifth and seventh ranks and shared 14.277, 10.985, 8.293, 5.652 and 7.584 per cent of average production in the state. Cotton, sugar cane, wheat and bajra, production increased due to increase in productivity. Production of rabi jowar and ground nut declined significantly due to unfavourable seasons and higher risks.

Productivity of wheat, sugar cane and cotton increased significantly, for first two crops it was due to irrigation, and in case of cotton due to low productivity in initial years. All the remaining crops registered negative trends.

Irrigated area of all the crops except cotton increased significantly. Major irrigated area was occupied by rabi jowar, followed by wheat and sugar cane. Higher growth rates were seen in the area under HYVs of rice and kharif jowar whereas very less area was cultivated with the high yielding varieties of selected cereals.

Consumption of N,P, K and total fertilizers and had shown significant increasing trend. Average per hectare consumption of N, P and K was smaller than the state average.

Amount of loan advanced increased but with non significant rate. The average availability of loans per borrower and per hectare was Rs. 314.51 and 39.52 respectively, which was lower than the state average.

Income elasticities were significant for all the selected variables, and contributed 92 per cent variations. The income elasticities were decreasing return to the scale.

6.18 Buldhana :

The ranking of this district increased from 15 in first period to 13 in third period. The average per hectare income showed slight decrease in second period but was highest in third period. The overall average per hectare income was Rs. 306.02. In first and third period it was at par with the state average. The average per hectare income increased as the contributions of wheat, jowar, sugar cane and ground nut increased in gross income.

The average per capita income showed decline in third period. In all the periods it was at par with the state average. Decline in per capita income was mainly due to the high population pressure.

Income contribution of wheat and sugar cane increased mainly due to the adoption of new technology and jowar

contribution increased mainly due to large coverage, whereas ground nut showed increase, as it was a new crop to this district. The income contribution of cotton declined due to the decline in production.

The rainfall distribution was quite normal in the district. In this district most of the area was covered by the kharif crops. Kharif jowar and cotton covered 35.635 and 33.967 per cent of gross area in the district, and shared 9.935 and 9.475 per cent of average area in the state. The variations in the area were of morderate size. In case of cotton and kharif jowar these were of smaller size. Area of kharif jowar, tur, sugar cane, bajra and sesamum registered significant increasing trend. Higher growth rate was observed in bajra as its area at the initial years was very meagre. Significant decline in the area of cotton was seen due to the higher risk . The growth rates in the area of kharif jowar, bajra, tur, cotton and sesamum were higher than the state. Area shifts were seen in kharif jowar, rabi jowar, bajra, tur, cotton, sugar cane, ground nut and sesamum respectively.

Production of all the crops except cotton and sesamum showed an increasing trend. The production of cotton and sesamum declined mainly due to decline in productivity. The productive of kharif jowar and cotton contributed 10.192 and 10.536 per cent of average total production in the state. Growth rates in the production of kharif jowar, bajra, sugar cane and ground nut were higher than state.

Productivity of all the crops except rabi jowar, tur and cotton declined but the decline was statistically not significant indicating not much changes. Significant increasing trend in the productivity of rice, wheat, suger cane and ground nut was observed mainly due to irrigation and area under high yielding varieties of these crops.

Gross irrigated area in this district was near about 3 per cent of gross cropped area. Major area under irrigation was captured by the wheat crop. There was low percentage of use of irrigation in all the crops. Significant growth rates were observed for irrigated area.

Area under high yielding varieties of rice, wheat and kharif jowar recorded high growth rates as their initial coverage was low.

Average consumption N, P and K was 5.64, 2.03 and 1.81 Kgs per hectare which was shorter than the state average.

Loan advanced amount increased significantly, but the average availability of loans was below the state average.

Income elasticities were of increasing return to scale.

6.19 Akola :

The average perhectare income has shown increase in third period as compared to first period, for the first and third period the rank obtained was 18. The overall average per hectare income was Rs. 263.60 and 19th in the order of

merit. In second, third and overall period it was significantly lower than the state average. Increase in the per hectare income was obtained due to the increased income contributions from cotton and ground nut.

The per capita income and its ranking declined during the time periods. In first period per capita income was significantly higher than the state average while in remaining periods, it was at par with the state average.

The income contributions of rice, wheat, tur, sugar cane and ground nut increased in succeeding periods as compared to previous ones. Food crops were, sharing major contribution the gross income, though the cotton was major area covering crop.

The rainfall was quite normal. The kharif crops covered major area in the district. All the crops except rice and ground nut showed the increasing trend. Increasing trend was statistically significant in kharif jowar, bajra, sugar cane and sesamum. Gross cropped area registered significant increasing trend. Area variations were of smaller size, but in the area of rabi jowar they were of much higher as it was in stable crop in the district.

Production of all the crops showed increasing trend mainly due to increased productivity, but in case of cotton it was due to increase in area. In case of the production of wheat, bajra, sugar cane and sesamum the increasing growth rates were statistically significant.

Wheat and sugar cane productivity increased significantly, but the average productivity was lower than the state average.

Irrigated area was limited to about 5 per cent of gross cropped area. Wheat crop occupied major portion of the irrigated area. Significant increasing growth rates were obtained in the crops like rice, wheat, kharif jowar, cotton and gross irrigated area. The growth rates were higher as the initial area was comparatively lower.

Area under high yielding varieties recorded higher growth rates as well as higher variations. Kharif jowar covered near about 60 per cent area with high yielding varieties.

Near about 60 per cent of total fertilizers was covered by the nitrogen. Consumption of N,P and K and total fertilizers increased significantly. Average consumption of the N,P and K was far away from the state average, it may be due to the low irrigation facilities and less double cropped area.

Credit facilities i.e. loan advancing showed significant increasing trend. As per the consumption of fertilizers, the availability of credit was also far away from the state averages.

For only gross cropped area the income elasticity was statistically significant but the R^2 was not significant. Income elasticities were increasing return to scale.

6.20 Amravati :

The overall average per hectare income was Rs.318.13 and was 13th in the order. The average per hectare income increased in third period and was on the 11th rank. In first, third and overall period it was at par with the state average. Per hectare income increased mainly due to increased income contributions from jowar, tur and ground nut.

The per capita income declined in second period as compared to first and then increased in third period and was 4th in the order of merit. The overall average per hectare income was Rs. 181.72. In first, third and overall period the per capita income was significantly higher than the state average.

The income contribution of cereal crops increased.The income contribution from ground nut has shown increase in various time periods. Considerable decline in the cotton was observed, it was 53.75, 40.34 and 37.08 per cent in first, second and third period respectively. The observed decline was mainly due to higher production risks in cotton.

Kharif jowar and cotton covered 24.536 and 49.339 per cent of gross cropped area in the district. All the crops except cotton registered the increasing trends in the area and was significant in kharif jowar, rice, bajra, sugar cane, ground nut and sesamum. The variations were of medium size. In all the crops growth rates were higher than the state.

Production of all the crops increased mainly due to the increased area and productivity. Cotton production declined ude to the decline in the area. Growth rates in production of rice, bajra, gram, sugar cane, ground nut and sesamum were higher than the state. Cotton contributed 13.303 per cent of production in the state.

Productivity of all the crops increased, whereas decline was observed in tur, wheat, gram, sugar cane and ground nut exhibited statistically significant increasing trends mainly due to availability of irrigation particularly to these crops. Cotton productivity increased but at the non significant rate.

Irrigation facilities were limited and only 2 per cent of gross cropped area was under irrigation, wheat occupied large area under irrigation in this district. Rice, wheat and gram explained significant increasing trend. Variations in the irrigated area were of higher degree as the initial area was much less.

Area under high yielding varieties of rice, wheat and kharif jowar showed significant increase. Growth rate as well as variations were of much higher degree because of low coverage at the initial years of the study.

Consumption of N, P and K has shown statistically significant increasing growth rates. The average per hectare availability of N, P and K was 5.51, 2.04 and 2.01 Kgs which was lower than the state average.

Loan advancing through Primary Agricultural Credit Societies increased significantly, but it was lower than the state average.

Contribution of independent vairables was statistically significant, but the income elasticities were at decreasing return to the scale.

6.21 Yavatmal :

The overall average per hectare income was Rs.294.95 and was 15th in the state. Ranking of this district from 14 in first period to 16 in second and third period, but per hectare income increased in third period compared with first one, due to the increased income contributions from wheat, jowar, sugar cane and ground nut. In first and third period per hectare income was at par with state average, while in remaining periods it was significantly lower than the state average.

Per capita income declined in succeeding periods over the previous. In first and overall periods it was significantly higher than the state average where as in second and third period it was at par with the state average, indicated the comparatively lesser growth than the population increase.

The income contribution of wheat, jowar, ground nut, and sugar cane increased in subsequent periods. The contribution of cotton declined from 44.63 per cent in

first period to 35.91 per cent in second period and increased to 38.59 per cent in third period.

Kharif crops occupied major portion of the gross cropped area. Kharif jowar and cotton occupied 33.87 and 42.04 per cent of gross cropped area. Area of all the crops except rabi jowar and gram showed increasing trend and was statistically significant in all the except wheat. Area of rice, sugar cane and ground nut has got the higher growth rates than the state.

Production of all the crops except rabi jowar and tur, increased mainly due to the increase in the area and productivity. The declined productivity of tur resulted in decline in to production. The growth rates were significant in all the crops except gram, cotton and sesamum respectively.

Productivity of all the crops except tur showed increasing trend. The average productivity was jowar than the state average, though, it was statistically significant in rice, wheat, kharif jowar and sugar cane.

Irrigated area covered very low percentage of gross cropped area. Wheat covered the major irrigated area in the district, statistically significant increasing growth rates were obtained forall the irrigated crops. Variations in irrigated area were of higher degree as the irrigated area at initial period was very low.

Area under high yielding varieties of rice, wheat and kharif jowar showed increasing trend. Growth rates and the variations were of higher degree as other districts.

Consumption of N and K was statistically significant whereas the consumption of P was not significant. Average consumption of N, P and K 4.49, 1.79 and 1.51 Kgs per hectare which was far away from the state averages.

Credit facilities increased significantly. The amount of loan distributed at per borrower (Rs. 345.36) was higher than state average whereas it was lower than state average as per hectare availability.

Income elasticities were significant for all the independent vairables except gross cropped area. R^2 was statistically significant, and the income elasticities were at increasing return to scale.

6.22 Wardha :

The average per hectare income was declined in second period but again increased in third period. No much improvement was observed in ranking in various time periods. Overall average per hectare income was Rs. 284.55 and was 17th in the state. In first and third period per hectare income was at it was significantly lower than the state average in remaining periods. Increase in per hectare income was obtained due to higher income contributions from the cereal crops especially the jowar.

The ranking of the district remained same in first and third period, but the average per capita income has shown decline in third period compared with the first one. In all the periods the per capita income was at par with the state average indicating not much imppovement in per capita income.

Income contributions of rice, wheat and jowar had shown considerable increase in succeeding periods, while the contribution of cotton declined in second and third period compared with first one.

Rainfall distribution was quite abnormal in some of the years. Kharif jowar and cotton covered 29.538 and 40.202 per cent of gross cropped area in the district.Cotton, wheat and kharif jowar occupied 6.714, 4.258 and 4.935 per cent area of these crops in the state.

Area of rice kharif jowar tur, gram, cotton and ground nut exhibited increasing trends, and were significant in case of gram, cotton and ground nut. Higher growth rate was observed in thearea of ground nut due to the meagre area at the initial years of the study. Area of bajra declined significantly as it was not stable crop in the district. Growth rate in the area of gram was greater than the state.

Production of rabi jowar, bajra and sesamum explained the negative trends, while all the remaining crops registered the increasing trend. Due to the low production, higher growth rates were observed in the production of rice,

sugar cane and ground nut. Productions increased mainly due to the increase in the productivity.

Productivity of rabi jowar and gram declined significantly. While the productivity of rice, wheat, sugar cane and ground nut increased significantly due to the HYVs and irrigation.

Gross irrigated area was about 3 per cent of gross cropped area. Major irrigated area was covered by wheat, cotton followed it. Significant increasing trend were observed in the irrigated area of all the crops.

Area under high yielding varieties of rice, wheat and kharif jowar increased significantly, but the variations and growth rates were of higher degree.

Consumption of N, P and K and the credit facilities increased, these were inadequate as compared with the state averages.

Income elasticities were decreasing return to scale.

6.23 Nagpur :

Ranking of the district for the per hectare income did not showed much improvement, but the per hectare income increased by Rs. 100 in third period as compared to first one. In all the periods it was significantly lower than the average per hectare income at state level. Per hectare income increased mainly due to the higher income from rice, wheat and jowar.

No much difference was observed in average per hectare income in first and third period. The overall average per capita income was Rs. 134.47 and was 14th in the state. In all the periods it was at par with the state average.

Income contribution of rice, wheat and jowar increased mainly due to the area under high yielding varieties and increase in production. Contribution of cotton declined upto some extent.

Kharif jowar, cotton, wheat and rabi jowar, covered 28.477, 14.882, 13.074 and 9.811 per cent of cropped area in the state. Area under wheat, kharif jowar and sugar cane has shown not significant decline, indicating minimum changes in coverage while significant increase in the area of rice, gram, tur, cotton, ground nut and sesamum was observed and possessed higher growth rates than the state.

Production of all the crops increased except rabi jowar and tur which showed decline but at the non significant rate. Increase in the production was observed mainly due to increase in the productivity.

Productivity of rabi jowar showed significant decline, while wheat, kharif jowar, sugar cane, cotton showed significant increasing trend due to irrigation and adoption of HYVs.

Irrigated area was about 15 per cent of gross cropped area. Rice and wheat occupied large irrigated area. Increasing trends were achieved for all the crops for their respective growth rates.

Area under HYVs of rice, wheat and kharif jowar has got the higher values of variation and growth rates.

Consumption of N, P and K was greater than the state average. The per borrower credit availability was also higher than the state average, on the other hand per hectare availibility on loans was lower than the state average.

Income elasticities were increasing return to scale.

6.24 Bhandara :

Ranking of the district in case of per hectare income declined from 11 in first and second period to 14 in third period. In all the periods the income was at par with the average per hectare income at state level.

This district hold 22nd rank for average per capita income in all the periods. The average per capita income was significantly lower than the state average.

Rice contributed 80 per cent of gross income, wheat and jowar followed it and covered 6.09 and 4.76 per cent respectively.

Rice, wheat and rabi jowar covered about 56.7 and 7 per cent of gross cropped and area in this district. Significant increasing trends were observed in the area of rice, wheat, gram, ground nut, sugar cane and sesamum. Area shifts were seen in all the crops except rabi jowar.

Production of wheat, gram, sugar cane, ground nut and sesamum increased mainly due to the availability of irrigation.

Productivity of all the crops except rabi jowar and gram showed increasing growth rates.

In this district irrigated area was about 26 per cent of gross cropped area and was highest in the state. Almost all (93 per cent) the irrigated area was covered by the rice crop.

Area under high yielding varieties of rice and wheat showed significant increasing trend.

Consumption of N, P and K showed significant increasing trend. Average perhectare consumption of N, P and K was 6.02, 2.66 and 2.51 Kgs consumption of N and K was just near about the state average while, the average consumption of P was above the state average.

Credit facilities were inadequate as compared to the state averages.

Income elasticities were at increasing return to the scale.

6.25 Chandrapur :

Average per hectare income showed continuous increase in succeeding time periods, but there were no much differences in ranking. In third period the per hectare income was Rs. 348.96 and was 19th in the state. Increase in the per hectare income was seen due to increased income contributions of rice, wheat, jowar andcotton. In all the time periods it was significantly lower than the state averages.

On the basis of per capita income, this district was 21st in the state. In first and overall period it was at par with the state average, whereas in remaining period, it was significantly lower than the state average.

Rice contributed the major share i.e. 60 per cent of the gross income. Another important crop was the jowar which, contributed 19.80 per cent of gross income.

Rice and rabi jowar covered 32 and 24 per cent of gross cropped area. Gross cropped area in this district showed significant increase indicating the increase in reasonal crops. Area under all the crops except bajra and sugar cane increased. The coverage of bajra and sugar cane was meagre.

Production of rice, wheat, kharif jowar, gram, cotton, ground nut and sesamum increased due to the increased area and productivity.

Productivity of all the crops except tur has shown increasing trend. It was significant in rice, wheat, kharif jowar due to the adoption of high yielding varieties and of sugar cane and ground nut due to the irrigation.

Irrigated area was about 7 per cent. Rice covered 96 per cent of gross irrigated area.

Area under high yielding varieties of rice, wheat and kharif jowar has shown significant increasing growth rates.

Comsumption N, P and was indequate as it was below the state average.

Per hectare and per borrower credit availability below the Rs. 23.82 and Rs. 174.28 which was far away from the state averages.

Income elasticities were at increasing return to scale.

The supporting and contradictory are studies are mentioned below for the achieved results.

6.2 Agricultural income :

The average real per capita agricultural income of rural population showed decline in succeeding periods at the state level. It was Rs. 152.77 in first period, Rs.132.96 in second period, Rs. 149149 and Rs.143.77 in third and overall period respectively. Interdistrict variations in per capita income were found to be statistically significant in all time periods. Bose (1962) and Desi (1975) also calculated the agricultural income at constant prices and shown the side variations in per capita income in the districts of Bihar and in the various states of India respectively. In Maharashtra State it ranged between Rs. 222.54 in Kolhapur and Rs. 43.00 in Raigad district respectively. Kolhapur district had first rank in second, third and overall period, other than Kolhapur, Ahmadnagar, Satara, Sangli, Beed, Amravati, Yavatmal and Wardha districts were having significantly higher per capita income than the state average. Due to the high population pressure the districts of Konkan division. Bhandara and Chandrapur districts were classified as less developed districts as

compared to the state average. Per capita gross income (at constant prices) of Maharashtra State increased from Rs.409 in 1960-61 to Rs. 411.80 in 1971 (Surey notes, 1971).

In case of per hectare income the inter district variations were significant in all the periods. The per hectare agricultural real income at the state level was Rs. 357.55, Rs. 384.34, Rs. 471.88 and Rs. 399.66 in first, second, third and overall period. In all the periods Kolhapur ranked first and Parbhani district achieved last rank i.e. 25th for all the periods, their respective overall incomes were Rs. 1372.45 and Rs. 209.03. The districts of Konkan division were having significantly higher per hectare income than the state average, it was due to comparatively less area under plough and secondly the due to the intensive cultivation of rice crop. In all the districts of state except districts of Konkan an increase in the per hectare income was observed, as these districts responded the scope of implementation of new agricultural strategy. Per hectare income of Punjab state was higher in the country,(Dayal,1963) Sudan (1968) and Chowdhary et al.(1968) observed that the new agricultural technology has improved the agricultural income in Isreal and Uttar Pradesh respectively. In various districts of Maharashtra also the increased irrigation facility, use of chemical fertilizers, adoption of high yielding varieties etc. helped in improving the productivity level and also the per hectare income. In Uttar Pradesh new agricultural technology prooved better (Prased and

Chandwani, 1970; Garg and Singh, 1972), and siggh et al.1978). In Madhya Pradesh also the same type of phenomenon was observed (Shukla, 1971, and Marothia,1974). Due to the different types of cropping pattern existed in the various districts of Maharashtra State, significant differences in per hectare income were seen. In Rajasthan the modified cropping pattern helped in improving the farm income status of the farmers (Chauvan et al., 1974), whereas Desai(1977) concluded that on the event of shift in cropping pattern has uplifted the farm income, while Waghmare et al.(1979) noticed that there were no major changes in cropping pattern in Nanded district of Maharashtra state for the period 1960 to 1975, which exhibited very small changes in per hectare income.

6.3 Growth analysis :

Area under rice, wheat, kharif jowar, tur, sugar cane and sesamum increased significantly at the state level. With the adoption of high yielding varieties programme, increase in area was obtained in the crops like rice and kharif jowar, and due to irrigation and improved varieties of wheat and sugar cane increaments in cropped area were achieved. Tur being an important pulse crop and sesamum being one of the oil seed crop, their area showed increasing growth rates, whereas the area under rabi jowar declined mainly due to the uneven distribution of rains at the sowing and growth period of the crop and being the higher and

risk the area under cotton and ground nut declined at the significant rate. Wide disparities in the area of principal crops were seen in the states of Maharashtra and Uttar Pradesh by Shingarey and Waghmare (1968) and Tyagi and Avasthi(1972). Ratnagiri, Sangli, Osmanabad, Amravati, Yavatmal, Nagpur, Bhandara and Chandrapur districts responded to significant increase in the area of rice, in case of wheat, significant increasing growth rates were observed in the districts of Dhule, Jalgaon, Ahmadnagar, Pune, Satara, Sangli, Kolhapur, Solapur, Beed and Bhandara. Only in Yavatmal district significant increasing trend was seen for the area of kharif jowar. In the major bajra growing districts, Aurangabad possessed the significant positive growth rate, combinations of increase and decline in the area of gram and sesamum were observed in the districts of Maharashtra state, while in all the districts of Marathwada and Vidharbha region except Bhandara, significant increasing trends were registered for tur crop. In almost all the districts the area under sugar cane increased significantly, but that of cotton declined. In major ground nut growing districts ground nut area showed decline, in major ground nut growing states of India,decline in area was observed (Bose et al.,1971) in both cases it was mainly due to higher risks. A survey report (1973) and Sharma and Joshi (1973) reported the wide disparities in the area of principal crops in different states of India and Maharashtra State respectively. Potekar(1974) also

described the disparities in the area and production of principal crops in the districts of Marathwada region.The gross cropped area in Ratnagiri district, increased significantly, the same type of results were observed by Pawar and Borude (1978), while the results on the similar trends were observed Waghmare et al. (1979). Ryan and Asokan (1979) observed an increased in the area of wheat and decline in the area of pulse crops in India.

Production of rice, wheat, bajra, sugar cane increased significantly and that of cotton and ground nut declined significantly at the state level. Due to the improved irrigation facilities and adoption of high yielding and improved varieties of crops an increase in the production was achieved, whereas on account of higher risk, decline in the production was noticed. Sastri and Sharma (1959), Ahuja (1961), Ganguli (1964), Survey report (1975) and Abrham and Raheja (1967) observed an increase in the agricultural production in India in different plan periods. The obtained growth rates of production for the crops like sugar cane, cotton and ground nut were comparatively higher than the food grain crops except wheat, but comparatively low growth rates were obtained in the food grain production for the period of 1949-50 to 1970-71 over 1949-50 to 1964-65 at country level. Narain (1972). In almost all the districts the production of wheat and sugar cane have shown significant increase in the presence of irrigation. In the

districts of Marathwada and Vidharbha production of cotton and ground nut exhibited increasing trends respectively. Panse and Menon (1961) also observed increase, in the area and production index for the crops like rice, jowar, bajra, maize, ragi, wheat, barley, gram, tur, ground nut, sesamum, linseed, cotton, jute, sugar cane, potato, chilles and ginger, over the base year of 1956-57. No definate trend was seen in the production of sesamum. In the majority of the districts higher increase in the production or stagnancy in the production of tur was seen but it in the Survey report (1973) the overall decline in the area and production of pulse crops was reported, while in case of Gujarat in the early and late sixties positive growths were seen for the production of all the crops (singh and Prakash, 1972). Vyas (1975) reported significant increase in wheat production in India, but decline in production was seen in post HYV period in Maharashtra state (Bharambe 1979).

Productivity ofall the crops except tur and cotton showed an increase at the state level, while it was statistically significant in case of rice, wheat and sugar cane. Waghmare et al. (1979) also reported the same results for the crops at the state level. The total area under paddy has been increasing at the rate of 2 per cent per annum, while total production at the rate of 8 per cent. The effect of productivity which, increased at the rate of 3 per cent per annum in Tamil Nadu for the period of 1949-50 to 1961-62(Thiruvenkatchari and Swaminathan,1967).

In U.S. also significant increasing trends were seen for average yields of rice and wheat (Lin,1978), wide disparities in the average yields were seen (Singh and Sirohi 1974). In almost all the districts the average yields of wheat and sugar cane, possessed significant increasing trends, decline in the productivity of sugar cane in Rajasthan was seen (Acharya and Agrwal 1974), while the high yielding varieties of kharif jowar did not showed any significant impact for improving the average yields with greater extent. In majority of the districts rabi jowar has shown decline in its productivity. Unfavourable mansoon is the main causing factor for the productivity of both the jowar. Cotton has got significant increasing growth rates, for its productivity, in all the districts of Marathwada where the initial productivity of cotton was very low and in the districts like Ahmadnagar, Sangli, Solapur and Nagpur, wherein cotton cultivation under irrigated condition is being followed. In all the districts of vidharbha, ground nut being the newly introduced crop, showed increase in the productivity.

6.4 New agricultural technology :

Irrigated area, area under high yielding varieties and consumption of fertilizers have been included under the sub head, technology. Gross irrigated area increased significantly in Raigad, Nasik, Dhule, Jalgaon, Ahmadnagar, Pune, Sangli, Kolhapur, all the district of Marathwada except, Beed and all the districts of Vidharbha.

Increase in the gross cropped area was achieved in Uttar Pradesh with the availability of irrigations (Gard and Bhatia (1969). Irrigation has shown considerable impact on the yields of the crops in the state (Bhange 1953), whereas in recent years more area is being pulled under irrigation in Andhra Pradesh (Rao, Somesekhara, 1970). In Punjab and Uttar Pradesh irrigation facilities had some impact in agricultural development (Mann et al., (1968) and George et al.,1971) respectively. Wheat and rice covered major irrigated area, sugar cane and ground nut followed them, and except of ground nut, the remaining crops possessed significant increasing trends in production specifically, (Srinivasan 1947),and Apte and Mulla (1963) observed increase in production with efficient irrigation methods in Kerala State and Jalgaon district of Maharashtra respectively. In almost all the districts except, Beed, significant increasing growth rates were observed. In all the districts of Marathwada and Vidharbha region irrigated area under gram has shown significant increasing trends, and resulted in increased production. In Dholka district of Gujarat state also increase in the production was achieved with intensive irrigation (Patel and Patel 1976). Increase in the area under irrigated cotton was observed in the districts of Dhule, Jalgaon,

Satara, Aurangabad, Parbhani, Buldhana, Akola, Yavatmal, Wardha and Nagpur, use of irrigation and fertilizers explained 72 and 87 per cent variations in the production of cotton and sugar cane in Haryana state(Singh et al.,1974). Gross irrigated area increased significantly at the compound rate of 2.053 per cent per year at the state level, irrigation helped in minimising the risk in some of the crops in Rajasthan irrigation has uplifted the level of agricultural development (Charan 1974), Miglani et al.,1975) also observed some improvement in Indian agriculture in the presence of irrigation, and similar results were achieved by Panse and Singh (1966), Wychiffe and Vishwanath (1972) for India and Garg and Bhatia (1969) for Uttar Pradesh respectively. Rajmane et al.(1980) also supported that irrigation has got lion's share in agricultural development in Purna- Jayakwadi command area. The extent of irrigation with all the sources was limited. More efficient use of irrigation water must be taken (Batra and Easter 1975); Singh and Sirchi 1977). In general irrigation helped in minimising the uncertainty of cultivation of crops, in North India also irrigation has prevented famines to a certain extent (Gustafson and Reidinger 1971).

High yielding varieties programme was firstly launched in the year 1965-66 in the state. At the initial years the area under high yielding varieties of different crops was very small in all the districts of the state.

Especially the high yielding varieties of cereal crops proved better. Mexican wheat was found to be superior in all the respect in Uttar Pradesh (Bhalerao and Singh, 1971), but in Andhra Pradesh in kharif season the pace of progress of high yielding varieties programme was slackeying (Parthsarthy and Prasad,1971), whereas area under high yielding varieties of rice, wheat, kharif jowar, rabi jowar, and bajra increased significantly and possessed higher growth rates in almost all the districts. Improvement in the productivities of various crops was seen due to adoption of high yielding varieties in various districts. Thus Singh and Day (1973), Mellor and Lele (1974), Freeman (1975) have shown that in Indian agriculture, some improvement was seen with high yielding varieties programme. The variations obtained were of higher degree as the area at the first few years was very low. The spread of high yielding varieties was not on very large scale. Introduction of high yielding varieties in hilly region of north India had changed the mode of cultivation (Saikia et al., 1978).

On the event of commencement of new agricultural technology and adoption of high yielding varieties, the demand of chemical fertilizers went up, and resulted in increasing the consumption of chemical fertilizers per unit area. In all the districts the consumption of N,P and K

was increased significantly. The average consumption of fertilizers was far below the recommanded doses. Panse and Singh (1966) and Shingarey (1967) concluded that in Indian and in Japanese agriculture fertilizers made headway. In Kolhapur district the consumption of N, P and K was higher in state, and was followed by the districts of Konkan. The level of consumption of chemical fertilizers increased from 0.16 lakh tonnes in 1956-57 to 1.16 lakh tonnes in 1965-66 in Madhya Pradesh (Chourishi, 1973).

In general new agricultural technology has stimulated the agriculture in Maharashtra State, and enhanced the per hectare agricultural income in various districts of Maharashtra State. In contour bunded area in Maharashtra state showed an increase in the yield of crops grown (Kulkarni, 1969). In Taiwanese agriculture technical progress accounted for 57.4 per cent of the total in increase in agricultural output during 1952-1968, Chen (1976), Mikhailov et al. (1978) firmly stated that the most important factor in the agricultural development is the introduction of new technology.

Indian agriculture is sibsistence agriculture and it can not be pulled by farmers own funds in a better way. For improving the status of the agriculture, there must be aid finance from outside. In India number of financing institutions are engaged for financing for agriculture, among them, co-operatives had the lions share. In

Maharashtra State in all the districts the amount of loan advance increased significantly, and on the other hand the overdues also increased (Waghmare et al., 1978), and Kalyankar, 1979), but agricultural development would take place through increasing agricultural productivity, through financial assistance Rao (1950), Singhji (1963). Bose(1963), Singh and George (1968), Desai and Ramchandran (1974). Grant and Franklin (1977) indicated that agricultural credit in general and co-operative credit in particular are inadequate for getting the best results in terms of productivity. In Maharashtra State also, in general the credit availability was inadequate in majority of the districts, Agarwal and Kumawat (1974) found that credit helped in increasing the agricultural technology in Gujarat. Randhawa (1965), Jatar (1969); Athale et al. (1971) ; Prasad and Chadwani (1970) and Tewari and Sharma (1978) also observed that credit had improved the level of agricultural development in India. In Cuba also credit acelerated the agricultural development Auroi (1960). With the assistance of credit the new technology has done significant impact on agricultural development in India, kind (1973), Schluter (1975) and Patel (1978).

Statistically significant increasing growth rates were achieved for almost all the crops and all the districts. Prines play an important role in the agricultural sector, as the agricultural goods are perishable, the flow of agricultural produce come in large quantities at specific period at majority of places. Naidu (1950),

Bansil (1962), Shah (1967), Jaikrishna and Rao (1967), Mellor (1968), and George and Singh (1971) had the opinion that there should be the economic prices for the agricultural produce, which will be helpful for better agricultural development. Growth analysis of prices of principal crops showed significant increasing trends in almost all the districts. Foneska (1963), George (1965), and Broadway et al. (1976) reported that increased prices had significant impact on agricultural income, but Shulka and Misra (1979) stated that there was decline in the prices during first plan period but there after had the increasing trends. Increasing trends were observed in the farm harvest prices of principal crops in Marathwada region (Potekar et al., 1974).

SUMMARY

SUMMARY

7.1 Introductory :

The importance of agricultural development in general economic growth is streassed on the grounds that the contribution from agriculture is comparatively more in economic growth of the developing countries. In most of the developing countries 60 to 80 per cent population is engaged in agriculture and hearly half of the national income is achieved through this business. There are three primary advantages of agricultural development. It provides food and fibres to the growing population. It supplies capital and foreign exchange forthe economic growth, and it contributes to a direct increase in the rural welfare.

Development of agricultural sector in Indian conditions was confined to the specific loacl conditions. Wide range of disparities have been seen in the agricultural sector at regional and district level. An effective unit for drawing up an integrated plan and budget for agricultural development, however, is the district. Different programmes in the field of land development irrigation, input supplies, crop production etc. are being brought together into a single plan at this level. It is also at this level that co-ordination of inter sectoral plans is being made possible. Regional or interdistrict variations are in existance in agricultural sector in Maharashtra State and at all India level. For quantification of factors contributing to

agricultural development, the entitled study,"Agricultural Development in Various Districts of Maharashtra State".was under taken.

7.2 Selection of area :

Maharashtra state is divided in to nine agro-climatic zones, on the basis of climatic condition and soil type, and on the basis of administrative purpose it is divided in to seven divisions. In all 26 district were in Maharashtra state, and two districts are newly formed, viz; Jalna and Sindhudurg which are formed by spliting old Aurangabad and Ratnagiri districts respectively. In Greater Bombay there is very little agriculture, and importance is given towards industralization, so Greater Bombay was excluded from study and all the remaining districts were selected for the study which are.

Thane, Raigad, Ratnagiri of Konkan division, Nasik, Dhule and Jalgaon of Nasik division, Ahmadnagar, Pune and Solapur of Pune division, Satara, Sangli and Kolhapur of Kolhapur division, Aurangabad, Parbhani, Beed, Nanded and Osmanabad of Aurangabad division, Buldhana, Akola, Amravati and Yavatmal of Amravati division, and Wardha, Nagpur, Bhandara and Chandrapur of Nagpur division.

7.3 Selection of time period :

Maharashtra state came into existance on May 1,1960. Looking to the data availability at district level, the

time period of 18 years i.e. 1960-61 to 1977-78 was considered for study.

7.4 Identification of the indictors :

Per hectare and per capita agricultural incomes of rural population were supposed as the measurement of the agricultural development. Besides these the following were supposed as the contributory factors of agricultural development, they were, (i) area, production prices and productivity of principal crops, (ii) irrigated area under principal crops (iii) area under high yielding varieties of selected cereal crops, (iv) consumption of chemical fertilizers and (v) availability of short term credit through co-operatives.

7.5 Collection and analysis of data :

Published secondary data were collected from the Government publications. The data were processed for metric units, and prior to statistical analysis, three years moving averages were workedout forall the data, by which the cyclical fluctuations were eliminated. Suitable statistical methods were used for analysical purpose. For per hectare and per capita income the time period was classified into 3 sub periods viz ;

i) Pre HYV period (1960-61 to 1965-66)

ii) Commencement period of HYVs (1966-67 to 1972-73)

iii) Adoption period of HYVs (1973-74 to 1977-78) and overall period (1960-61 to 1972-78).

7.7 Results are summarized as below.

7.7.1 Thane :

In this district rice is the main crop, it covered 54.238 per cent of gross cropped area, its shares in the area and production in the state were (10.823 and 15.413) per cent respectively. On an average 99 per cent income was obtained through the rice crop. On the basis of per capita income this district was ranked 24th and was comparatively less developed with state average, whereas, the per hectare income was significantly superior over the state average in all the periods except in third period. The variations in the area, production and productivity of rice were of small degree. Significant increasing trend was observed for the productivity of rice, whereas the area and production showed non significant negative and positive growth rates respectively. Irrigation facility was very inadequate because of hilly area and very high rainfall. Area under high yielding varieties of rice showed significant trend and achieved an increase of 22.576 per cent per year, but the coverage of high yielding varieties was not on greater extent. Consumption of N, P and K increased during the time period and it was greater than the state average. Farm harvest prices of all the crops increased at significant rate. The availability of loans at per hectare and at per borrower was far below from the state average. The income elasticities were decreasing return to scale.

7.7.2 Raigad :

Per hectare income has shown increase in second and third period, and was significantly superior over state average in all the periods except third, whereas in all the periods, per capital income was significantly lower than the state average. Rice, the main crop occupied 67 per cent of gross cropped area and contributed 99 per cent of gross income, Area production and productivity of rice crop was almost stable during the period of time. Area, production and productivity of rice exhibited increasing trend and was statistically significant in productivity. Gross irrigated area was about six per cent of gross cropped area, but very meagre area was devoted towards selected crops.Statistically significant increasing growth rate was obtained for the area under high yielding varieties of rice. Coverage of high yielding varieties was not on greater extent. Consumption of chemical fertilizers was greater than the state average. Credit facility was very poor and inadquate, though there was significant increase in loan advancing. Significant trends were seen for the price of rice, tur, gram and sesamum. Income elasticities were increasing return to scale.

7.7.3 Ratnagiri :

Comparatively large area was occupied by the crops like small millets and fodders for the animals. Rice as single crop covered major area i.e. about 39 per cent gross

cropped area. The contribution of area and production of rice crop in the state was (10.104 and 11.506 per cent) respectively. Per hectare income, in third period it was at par and in remaining periods it was significantly superior over the state averages. No development was seen in the per capita income in any one period. Major income was from the rice crop. Significant increasing growth rates were registered for the area, production and productivity of rice crop. The variations in the area were very small but they were of considerable amount in production and productivity. Gross irrigated area and irrigated area of rice crops declined, and was significant for latter. Coverage of high yielding varieties was not exceeding than (30) per cent). Significant increasing trends with wider fluctuations was seen for the area of high yielding varieties of rice. Consumption of chemical fertilizers was slightly higher than the state average. Farm harvest prices of all the crops registered significant increasing trends. The credit facility was comparatively very poor. In come elasticities were of decreasing return to scale.

7.7.4 Nasik :

In all the time periods this district was at par with the state average for per hectare and per capita incomes. Average per capita and per hectare income showed increase in succeeding periods. Bajra covered 30.000 per cent of gross cropped area, wheat and ground nut with 9.695 and 6.013 per cent

followed it. Income contribution of bajra declined from 31.665 to 16.484 per cent from first to third period, whereas that of sugar cane, wheat and jowar it showed an increase. Variations in the area of kharif jowar, rabi jowar, cotton, sugar cane, ground nut and sesamum were of higher degree, while these were of moderate to higher size in all the crops except bajra, for their respective productions. Considerable variations in productivity were seen in all the crops except kharif and rabi jowar. Area increase was observed in wheat, kharif jowar, sesamum and sugar cane and was significant in sugar cane i.e. 4.966 per cent per year, and for all the remaining crops negative growth rates were observed, and for rice and cotton these were statistically significant. Rabi jowar, cotton and sesamum possessed negative trend for their production. In remaining crops, sugar cane and wheat showed significant increasing trends in the production. Productivity of all the crops registered increase over the base period and was statistically significant for wheat, kharif jowar, tur and sugar cane respectively. Irrigated area of all the crops except cotton and gram, increased significantly. With wide fluctuation area of high yielding varieties of selected cereals prossessed significant growth rates. Consumption of chemical fertilizers was just equal with state average, and the availability of credit per unit was above the state average. Statistically significant increasing growth rates were achieved for the farm harvest prices of all the crops. Income elasticities were increasing return to scale.

7.7.5 Dhule :

Per capita and per hectare income declined in second period and again increased in third period. This district was at par with state for per hectare and per capita incomes respectively. Bajra and ground nut covered 20.432 and 15.638 per cent of gross cropped area. In case wheat and sugar cane area variations were of higher degree. In the production of bajra, gram, tur and ground nut fluctuations were of moderate size. The fluctuations in the productivity were of moderate size in all the crops except rabi jowar, wheat and sugar cane registered significant increasing trends for all the selected indicators. Area under rice, cotton, ground nut and sesamum declined significantly and also the production. Productivity of all the crops except rabi jowar has shown significant increasing trend. Increasing growth rates were obtained for irrigated area, area under high yielding varieties and farm harrest prices of all the crops respectively. Consumption of N, P and K was above the state average and showed significant increasing trend. Credit availability was just touching to the state average. Income elasticities were increasing return to scale.

7.7.6 Jalgaon :

In Jalgaon district agricultural development has taken place as per hectare income was significantly superior over state average in all the periods except third but on

the basis of per capita income this district did not responded as per hectare income. In all the periods per capita income was at par with the state average. Cotton and kharif jowar covered 25.99 and 17.270 per cent of gross cropped area. Income contribution of these crops declined drastically and the income contribution of ground nut was just constant in all the periods, and that of wheat and jowar increased in succeeding periods. Average cropping intensity was 107.153 per cent. Minimum variations, were observed in the area of kharif jowar and tur whereas highest and comparatively of higher degree in area and production of rice respectively. In the production of sugar cane fluctuations were highest. Smaller flucluations were seen in the productivity of wheat, rabi jowar, gram and ground nut. Statistically significant increasing growth rates were obtained for the area of wheat, bajra, gram and sugar cane and also the gross cropped area while opposite type of growth rates seen for cotton. Rice, wheat, bajra, gram and sugar cane had shown significant increase, while significant decline was observed in the production of cotton and sesamum. Statistically significant increasing trends were achieved for the productivity of wheat, bajra and sugar cane. Significant increase was observed for the irrigated area, area under high yielding varieties and farm harvest prices of all the crops. Consumption of fertilizers was greater than the state average and increased

significantly. Availability of credit was greater than state average. Income elasticities were increasing return to scale.

7.7.7 Ahmadnagar :

The ranking of this district for all the periods for per hectare income was unchanged i.e. 8th. Average per hectare income was Rs. 387.02 and it was at par with the state average. The overall average per capita income was Rs. 214.95. In all the periods this district was at par with the state average. Rabi jowar and bajra covered 44.903 and 22.820 per cent of gross cropped area. Income contribution of sugar cane was 59 per cent of gross income, though it covered only 3.427 per cent of gross cropped area. Fluctuations in area, production and productivity of all the crops were of moderate size. Significant increasing growth rates in area were observed in wheat and sugar cane and declining in rice, cotton and ground nut. Production of wheat, kharif jowar, bajra, sugar cane increased and of cotton, ground nut and sesamum declined. Productivity of all crops except rabi jowar and gram increased. Gross irrigated area, has shown significant increasing growth, which covered about 13.240 per cent of gross cropped area. Irrigated area under rabi jowar, gram, cotton and ground nut described declining trend. Area of high yielding varieties of all crops increased significantly. Significant increasing trends were observed for farm harvest prices of all the crops.

Consumption of chemical fertilizers increased significantly, and at the per hectare availability of N, P and K was just higher than the state average. Average availability of credit at per hectare and per borrower was superior as compared to state average. Income elasticities were decreasing return to scale.

7.7.8 Pune :

Average per hectare income increased in succeeding periods. Overall average per hectare income was Rs.323.08 and was 12th in the order. Per capita income showed decline in second period, but increased to Rs. 150.29 in third period. Per hectare and per capita incomes were at par with state averages in all the periods. Rabi jowar and bajra occupied 37 and 16.685 per cent of gross cropped area respectively. Highest income contribution was shared by sugar cane, and it was followed by jowar and bajra. Fluctuations in the production and productivity were comparatively higher than the fluctuations in the area. Rice and cotton possessed declining growth rates, while wheat and sugar cane had increasing growth rates, both were statistically significant, area shifts were also seen in these crops. Production of wheat and sugar cane increased, and that of bajra, cotton and sesamum declined, significantly. Productivity of all the crops except ground nut has shown increasing trends. Wheat showed significant positive growth rates for its irrigated area.

Significant increasing trends were reported for almost all cereal crops, for their respective area under high yielding varieties. N, P and K had significant and per hectare availability was higher than the state average. Credit facility was of lower degree than the state average. Income elasticities were increasing return to scale.

7.7.9 Satara :

Rabi jowar, bajra and kharif jowar covered 20.602, 19.375 and 10.657 per cent of gross cropped area, but in first period the income contribution of ground nut was 50 per cent. Ground nut and sugar cane contributed more than 50 per cent of gross income. In second, third and overall period the per hectare income was significantly superior over state average, but in first and overall period it was at par with the state average for per capita income, and it was categorized in first group in second and third period for per capita income. Fluctuations in area were comparatively smaller than the production and productivity. Area of wheat and sugar cane increased significantly. Production of rice, wheat, kharif jowar increased and that of bajra, cotton and ground nut declined significantly. Productivity of wheat, kharif jowar and sugar cane increased significantly. Gross irrigated area declined non significantly. Area under high yielding varieties increased significantly. Coverage of high yielding varieties was 15 per cent. Farm harvest prices of all the crops increased

significantly. Consumption of chemical fertilizers showed significant increase over time period, and was higher than the state average. The amount advances of credit increased with non significant rate. The availability of loans at per hectare and per borrower was greater than the state average. Income elasticities were increasing return to scale.

7.7.10 Sangli :

This district was more developed on the basis of per capita basis and was at par with state average on the basis of per hectare income respectively. Continuous increase in the per hectare income was observed in all the time periods. Selected cereal crops occupied near about 60 per cent of gross cropped area, but the highest income was contributed by sugar cane (32.542 per cent). The fluctuations in production were of moderate to higher degree. Area and production of rice, wheat and sugar cane increased significantly, and area declined significantly in almost all the remaining crops. Area shifts were seen in those crops which had the either significant growths. Production of cotton, ground nut and sesamum declined significantly. Productivity of rice, wheat, gram, cotton, sugar cane and ground nut increased. Gross irrigated area increased significantly thought the significant decline in the irrigated area of kharif jowar, rabi jowar, bajra, gram and cotton was observed. Area under HYVs increased

significantly. Consumption of N, P and K was higher than state average, but the consumption of N and P aincreased non significantly. The credit facility was most superior compared to all the districts in the state. Income elasticities were increasing return to scale.

7.7.11 Kolhapur :

This district was on the top rank for per hectare and per capita income. Per hectare income was significantly superior overall the districts, and per capita income was significantly superior over state average. The overall per hectare and per capita incomes were Rs. 1372.45 and Rs.224.54 respectively. On an average 61 per cent of gross income was achieved from sugar cane only, but the highest area was covered by the rice crop. Rice, kharif jowar and ground nut were comparatively more stable crops. Comparatively higher fluctuation were seen in production, incase of productivity least fluctuations were achieved for sugar cane crop. Area of rice, bajra and ground nut declined significantly and that of rice , wheat and sugar cane increased at the significant rate. Area shifts were seen all the crops. Production of wheat and sugar cane increased significantly but it declined in case of bajra, tur, cotton, ground nut and sesamum. Productivity of all the crops except ground nut increased. Production of sugar cane increased with non significant rate. Significant increasing growth rates were achieved for irrigated area, area under high

yielding varieties and farm harvest prices of almost all the crops. The consumption and credit facilities were above the state average. Income elasticities were increasing return to scale.

7.7.12 Solapur :

Ranking i.e. 22nd for the per hectare income did not exhibited any improvement in any time period. Per hectare income increased from first to third period. This district was comparatively less developed according to per hectare income, and according to per capita income in was at par with the state. Continuous decline in the per capita income was observed. Rabi jowar covered about 62 per cent of gross cropped area. Larger proportion of income was achieved though jowar, but its contribution showed decline in second and third period, while the contribution of wheat and sugar cane increased in different time periods. Sugar cane contributed 27 per cent of gross income in the district. Area fluctuations were of greater extent for almost all the crops, except, rabi jowar, for which they were minimum. The fluctuations in production and productivity were also of considerable extent. Area of wheat, sugar cane and gram increased significantly and of kharif jowar and tur with non significant rate. Negative trends were observed for all the remaining crops, and significant for rice, bajra and ground nut. Significant declining growth rates for the production of rabi jowar, tur, cotton, ground nut and sesamum

were obtained. Productivity of all the crops except rabi jowar, gram, tur and ground nut had shown increasing trends. Gross irrigated area and irrigated area of rabi jowar declined significantly for latter. Area under high yielding varieties and farm harvest prices of all the crops increased significantly. Consumption of N, P and K registered significant increase, but the availability of N, P and K was below the state average. The availability of credit was also below the state average. Income elasticities were increasing return to scale, R^2 was found to be significant.

7.7.13 Aurangabad :

Rabi jowar, bajra and cotton occupied 24.729, 15.214 and 12.901 per cent of gross cropped area. Jowar contributed 35.453 per cent, bajra contributed 11.501 per cent of gross income, the shares of cotton and sugar cane were 7.303 and 18.067 per cent. Per hectare and per capita income had shown increase in the third period. The ranking did not show any significant improvement. In all the periods per hectare income was significantly lowerand per capita income, at per with the state average. Except of ground nut and sesamum fluctuations in the area were of smaller degree, whereas fluctuations in the production and productivity of all the crops were moderate size. In case of cropped area significant increasing trend was noticed only in bajra while in cotton, ground nut and sesamum it declined significantly. Area under wheat declined with non significant rate. Wheat,

sugar cane and cotton possessed significant increasing and ground nut and sesamum significant declining growth rates. Rice, kharif and rabi jowar and bajra exhibited decline in productivity and remaining crops showed increase. Irrigated area of almost all the crops registered significant increase. Area under high yielding varieties fof all the crops reported increase and also the farm harvest prices. The consumption of chemical fertilizers was below the state average, but the availability of credit was superior than the state average. Income elasticities were decreasing return to scale.

7.7.14 Parbhani :

Per hectare income and per capita income were significantly lower and at par with the state average in all the periods, except in third period per capita income was significantly superior. Jowar and cotton acquired 37 and 23 per cent of gross cropped area, and contributed 45 and 16 per cent in gross income. Fluctuations in the production and productivity of all the crops were comparatively more than that of area. Area of bajra, tur, gram, sugar cane and cotton inclined significantly, and it significantly declined in case of ground nut and sesamum. Production of bajra, sugar cane, sesamum and cotton registered significant increase, whereas ground nut exhibited declining trend. Productivity of sugar cane and cotton showed significant increase and gram showed significant decline. Irrigated

area, area under high yielding varieties and farm harvest prices of all the crops possessed significant increasing trends. The consumption was fertilizers increased significantly, but, the availability was far below from the state average. Availability of credit, was also of below the state average. Income elasticities were increasing return to scale, R^2 was found to be statistically significant.

7.7.15 Beed :

Rabi jowar, bajra and kharif jowar were the important area covering crops, which covered 28.890, 13.148 and 10.865 per cent of gross cropped area. Income contribution of jowar increased in third period, as compared to first, the overall income contributions of jowar and bajra were about 46 and 11 per cent of gross income, while that of sugar cane was 7 per cent. Area of cotton, ground nut and sesamum declined significantly, whereas it showed significant increase in the crops like, wheat, bajra, gram, tur and sugar cane. Area shifts were seen in almost all the crops accordingly. Production of wheat, bajra, sugar cane and cotton exhibited statistically significant increase while it declined in ground nut only cotton has got the significant increasing trend for productivity. Irrigated area was just stagnant. Significant increasing trends were observed in case of high yielding varieties of all the crops, but the coverage under these crops was not much. Consumption of N, P and K increased significantly but the availability of chemical fertilizers was below the state average. The credit

facility was in adequate when compared to state. As per the other districts, in this also prices proved the significant increased. R^2 was found to be significant, and the income elasticities were increasing. Beed district did not responded much for agricultural development, as per hectare income was significantly lower than the state average. In first and overall period per capita income was significantly superior and in remaining two periods it was at par with state average.

7.7.16 Nanded :

Major income contributing crops were jowar, cotton and sugar cane, which contributed 44.047, 12.528 and 10.448 per cent of gross income. Income contribution of jowar showed decline is subsequent period while sugar cane exhibited increase in subsequent periods. Kharif jowar and cotton were the major area covering crops. Comparatively higher fluctuations were seen in production and productivity of all the crops as compared to area. Significant area increase was noticed in the crops like, tur, sugar cane and sesamum, kharif jowar and cotton area was stagnent during the period of time. Production of wheat, sugar cane, cotton and sesamum possessed significant increasing growth rates. Jowar production declined. Wheat, sugar cane and cotton responded to significant increase in respective productivity. Significant increasing growth rates for area under high yielding varieties and area under irrigation were observed for almost all the crops. Consumption of chemical

fertilizers and availability of loans showed inadequacy. Farm harvest prices of all the crops hshowed significant increase. Per capita income was at par with state average and per hectare income significantly lower in all the period except third. R^2 was significant, and income elasticities were increasing return to scale.

7.7.17 Osmanabad :

In first two period, and in all the periods this district was at par for per hectare income, and per capita income respectively. Kharif jowar, rabi jowar and ground nut cummulatively covered 49.043 per cent of gross cropped area, and contributed 56.282 per cent of gross income their contributions were decling in succeeding periods, whereas that of wheat and sugar cane showed increase. Area of wheat, bajra, gram, tur, sugar cane and sesamum increased and of rabi jowar, cotton and ground nut declined significantly. Fluctuations in the area were comparatively smaller than productions and productivity. Area shifts were seen in almost all the crops. Production of wheat, bajra, cotton and sugar cane responded to significant increase and ground nut for significant decline, but the significant increase in productivity was in sugar cane and cotton. Irrigated area, area under high yielding varieties and farm harvest prices of all the crops possessed the significant increasing trends. The consumption of chemical fertilizers and amount of loan advanced increased significantly, but,

their availability was in adequate as compared to state averages. Income elasticities were increasing return to scale. R^2 was statistically significant.

7.7.18 Buldhana :

Per capita income and per hectare income declined and inclined in third period as compared to first one.In all the periods per capita income was at par and in first and third period. Per hectare income was at par with the state average while in second and overall period it was significantly lower than the state average. Kharif jowar and cotton covered large proportion of gross cropped area and contributed 73.695 per cent of gross income. Significant area increase was observed in bajra, tur, sugar cane,cotton and sesamum. Area shifts were seen in almost all the crops. An increase, in the production of all the crops, except cotton and sesamum, was observed on the other hand significant increase in the productivity was observed for wheat, sugar cane and ground nut. Irrigated area, area under high yielding varieties and farm harvest prices of almost all the crops exhibited significant increasing trends.Fertilizer consumption status was below the state average, same case was observed for credit. Income contribution of selected variables in per hectare income was statistically significant.

7.7.19 Akola :

Kharif jowar and cotton covered about 37 per cent of gross cropped area and contributed about 69 per cent of gross

income. In first period this district was at par and superior with state, for both i.e. per capita and per hectare income respectively, and for remaining periods it was at par and significantly lower than state average. Fluctuations in the area were comparatively smaller than the production and productivity. Tur, sugar cane and sesamum achieved significant positive growth rates, the area of cotton was stagnant. Production and productivity of all the crops showed increase, except negative trend was observed in cotton productivity. Area under high yielding varieties and area under irrigation and the farm harvest price of all the crops secured significant increasing trends. The availability of chemical fertilizers and credit facility were very far at the lower side of the state average. The contributions of selected parameters were statistically non significant.

7.7.20 Amravati :

Income contributions of various parameters were found to be significant. Per capita income was significantly superior to the state average in first, third and overall period, and per hectare income was at par and significantly lower to the state average in first, third and second and fourth period respectively. Cotton and kharif jowar covered large area, and contributed 65 per cent of gross income. Except of cotton all the crops had the increasing trends for their cropped area and production, but except of tur, an increase was observed in productivity of all the remaining crops. Irrigated area of selected crops and area under high

yielding varieties of selected cereals possessed higher positive growth rates. Consumption of N, P and K and amount of loan advanced increased significantly, but their availability at per hectare and per borrower for credit was below the state average. Income elasticities were increasing return to scale, and the selected variables of functional analysis contributed 84.49 per cent of total variation.

7.7.21 Yavatmal :

Highest income contribution was from cotton, jowar and tur followed it, the cumulative contribution was 85 per cent of gross income. These crops covered proportionately larger area. Per hectare income in first and third period was at par with state average, and in remaining periods it was significantly lower while in first and overall period per capita income was significantly superior to the state average, fluctuation in production and productivity were of higher degree in comparison with the area. All the crops except gram possessed increasing trends in area. Increasing trends were observed for production and productivity of all the crops. Significant increasing growth rates were registered for irrigated area under different crops, area under high yielding varieties of selected cereals, and farm harvest prices of all the crops. Consumption of N and K exhibited significant increasing growth rates, but the per hectare availability of N, P and K was below the state average. Availability of loans per

borrower (Rs. 345.36) was greater than state average but was lower than state average for loan per hectare. Income elasticities were increasing return to scale.

7.7.22 Wardha :

In first, second and third period per capita income was at par but in overall period it was significantly superior over state average, as well as in first and third period, the per hectare income was at par with the state average but for second and overall period this district was classified as less developed. Kharif jowar and cotton were major area covering and major income contributing crops. Significant increase in area was observed in gram, tur, cotton and ground nut crops, and double cropped area. Production of all the crops, except, rabi jowar, and sesamum increased. Productivity of gram and rabi jowar declined significantly, while increasing trends were seen for all the remaining crops. As per the other districts significant increasing trends were achieved for irrigated area, area under high yielding varieties and prices of all the crops. Availability of N, P and K at per hectare was just above the state average, but on the other hand availability of credit was inadequate. Income elasticities were increasing return to scale and selected variables contributed 89 per cent of total variation.

7.7.23 Nagpur :

On the basis of par hectare and per capita income, this district was less developed than the state average.

Increase and decrease was seen for per hectare and per capita income in third period compared to first. Kharif jowar, cotton, wheat and rabi jowar covered more than 60 per cent of gross cropped area and gross income respectively. Significant increase in the area was observed in the crops like, wheat, gram, tur, cotton, ground nut and sesamum. Production of all the crops except rabi jowar showed increasing trend, whereas in case of productivity wheat, kharif jowar, sugar cane and cotton exhibited significant increasing trend. Statistically significant increasing growth rates were registered for irrigation, area under high yielding varieties and prices of the selected crops. Consumption N, P and K and amount of loan advanced increased significantly. The availability of N, P and K at per hectare and credit per borrower was above the state average. The selected variables contributed near about 90 per cent of total variations.

7.7.24 Bhandara :

According to per capita income this district was less developed and according to per hectare income it was at par with the state average. Rice was the main area covering and income contributory crop. Fluctuations in the area were comparatively more as compared to production and prices. Significant increasing trends were observed in all the crops, except kharif jowar, rabi jowar and tur. In the crops area shifts were seen. Production of wheat, gram, sugar cane

Ground nut and sesamum increased while rabi jowar declined significantly. Productivity of all the crops except rabi jowar and gram possessed increasing growth rate. Percentage of irrigated area was highest in the state. Area under HYVs showed significant increase. N, P and K exhibited significant increasing trends for consumption, and the availability of N, P and K was just touching to the state average. Credit facility was inadequate as compared to state average.

7.7.25 Chandrapur :

This district was less developed district. Rice was the main area and income contributry crop. Area of all the crops except bajra and ground nut registered increasing growth rates, production of rice, wheat, kharif jowar, gram, cotton and sesamum increased significantly. Productivity of all the crops except increased except gram and tur. Area under irrigation, high yielding varieties and farm harvest prices of all the crops possessed significant increasing growth rates. Consumption of chemical fertilizers increased significantly, but the availability at per hectare was below the state average. Credit facility was in adequate. The selected variables contributed 58.56 per cent variation, which was statistically non significant.

7.7.26 State :

Per hectare income showed continuous increase in all the periods. Overall per hectare income was Rs. 399.66,

whereas per capita income declined in the second period and increased to Rs. 149.49 in third period, but it was lower than the per capita income in first (Rs.152.77) per iod. Larger area was covered by rabi jowar, kharif jowar and cotton.

Jowar contributed highest share of 23.725 per cent in gross income. Rice with 20.550 per cent followed it.The income contributions of cotton, sugar cane and ground nut were 15.510, 14.142 and 9.569 per cent of gross income. Significant increasing trends in area were observed in rice, wheat, kharif jowar, tur, sugar cane and sesamum, while the area of rabi jowar, cotton and ground nut declined significantly. Gross cropped and double cropped area declined and increased significantly. Rice, wheat, bajra and sugar cane exhibited significant increase for production. Cotton and ground nut production declined significantly, and that of rabi jowar and tur with non significant rate. Productivity of all the crops except tur and cotton increased and was significant for rice, wheat and sugar cane. Irrigated area, area under high yielding varieties and prices showed significant increase. The average consumption of fertilizers was very far from the recommandations. The average availability of loans per borrower and at per hectare was Rs. 334 and Rs. 59 only.

7.8 Conclusions :

Following broad conclusions were drawn from the entitled study:

1) In majority of districts the cropping pattern was mainly centred around food crops especially cereals.

2) Intensity ofcropping was not satisfactory.

3) In majority of the districts decreased area of cotton and rabi jowar has been replaced mostly by sugar cane and wheat respectively.

4) On account of high risk, the coverage of ground nut showed decline.

5) Increasing growth rates were achieved in all the respect for wheat and sugar cane.

6) Kharif jowar has not shown commandable pictures, especially in productivity.

7) Sugar cane has proved better.

8) High yielding vatieties have not shown significant impact.

9) In almost all the districts irrigation facility showed improvements.

10) Fertilizer consumption was inadequate as compared to recommended doses.

11) Credit afacility was improving but found to be inadequate.

12) Majority of the districts were less developed with the state on basis of per hectare income.

13) Per hectare income increased in post HYV period in almost all the districts.

14) High population pressure resulted in declined per capita income.

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