CHANGES IN CROPPING PATTERN: A DISTRICT LEVEL ANALYSIS 1979-82 TO 1989-92

Dissertation submitted to the Jawaharlal Nehru University
in partial fulfilment of the requirements
for the award of the Degree of

MASTER OF PHILOSOPHY

RAJEEV RANJAN SHRIVASTAVA

CENTRE FOR THE STUDY OF REGIONAL DEVELOPMENT
SCHOOL OF SOCIAL SCIENCES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI-110067
INDIA
2000

जवाहरलाल नेहरू विश्वविद्यालय
JAWAHARLAL NEHRU UNIVERSITY
Centre for the Study of Regional Development
School of Social Sciences
New Delhi-110067

21 July, 2000

CERTIFICATE

I Rajeev Ranjan Shrivastava certify that, the dissertation entitled **"Changes in Cropping Pattern: A District Level Analysis, 1979-82 to 1989-92"** submitted by me for the degree of **Master of Philosophy** is my bonafide work and may be placed before the examiners for evaluation.

Rajeev R. Srivastava
(Rajeev Ranjan Shrivastava)

forwarded by

(Dr. Sucharita Sen)
Supervisor

(Prof. Harjit Singh)
Chairperson

Gram : JAYENU Tel. : 6107676, 6167557 Telex : 031-73167 JNU IN Fax : 91-011-6165886 & 6198234

TO MY PARENTS

ACKNOWLEDGEMENTS

I owe my teacher and supervisor Dr. Sucharita Sen a debt of gratitude for her invaluable suggestions and guidance in a very dearly manner with a great patience. I am equally grateful to Prof. M.H. Qureshi with whom I had several rounds of discussions about my research work. His longstanding research experience provided the stimulus for my thought to take a proper shape.

My thanks are due to staff of JNU Library, for their help in providing statistics. I am grateful to Ms. Pingla Bisht, computer Programming Assistant, Ms. Sir Kaur , Sr. Technical Assistant & Dr. Madan Mohan, Technical Assistant CSRD, for their cooperation in data analysis and final print outs.

I am extremely grateful to Mr. Vijay Kumar Baraik, Senior Research fellow for his guidance and help to prepare maps for this work.

I also have no words to extend my heartiest thanks to all my friends especially Rajnish, Ajay, Rajendra, Binod and Sunil for their never ending help encouragement and suggestions.

Last but not least, I am indebted to my family members, specially my parents, and my brothers, who have always been a source of inspiration in my academic persuit.

Rajeev R. Srivastava

(RAJEEV RANJAN SHRIVASTAVA)

CONTENTS

List of Tables

List of Figures

Figures

CHAPTER 1

1.1 INTRODUCTION:-

Cropping pattern is an important indicator of a farmer's decision making ability which witnesses dynamism over space and time in response to the changes in factors which determine the latter. Cropping pattern expresses the shares of different crops in the farmer's total cultivated area in an agricultural year. Even though such shares are analysed with respect to gross cropped area, the dynamics of cropping pattern changes are rooted in seasonal changes within various competing crops. For example:- the decline in kharif paddy would hardly lead to increase in area under rabi wheat or mustard. However relative increase of yield or/ and price of wheat may result in increase in area under wheat and reduction in area under mustard, both of which are grown in rabi season. Thus, any cropping pattern changes would be brought about within seasons by changes in the farmer's decision. This in turn would be reflected in the shares under various crops with respect to total cultivated area.

Crops that can replace another crop in the same season may be termed as competing crops. A farmer may shift to a competing crop due to a host of reasons which may be termed as the determinants of cropping pattern changes. The important ones are relative yield, relative price, stability of production of crop, availability of irrigation facilities etc. This type of effect can be termed as replacement effect, where one crop replaces another.

A dynamics different from the above mentioned one that also lead to cropping pattern changes may be termed as the extension effect. Such an effect results in a new crop being cultivated in areas, which were not cultivated in the past. Usually such a change in the kharif season is as a result of bringing marginal land in to

cultivation and in the rabi/summer season from increase in cropping intensity possibly due to expansion of irrigation facility.

Nature with its diverse physical characteristics - relief, drainage, soil, climate and natural vegetation provides different environments for agriculture. It is widely believed that physical environment determines the guidelines for the agricultural practices. Agriculture in different physiographic units like flood plains, foothills, valleys etc. usually are different in significant ways. The important physical factors that guide a farmer to adopt certain crops are soil texture, moisture content of the soil, duration and intensity of solar radiation etc. However with technological advancements the rigidities posed by the environment has been relaxed to a large extent. It has been observed that the variation in cropping pattern occurs primarily due to the difference in climatic pattern rather than soil conditions (KHW Klages, 1948). The influence of climate in agriculture is reflected in most parts of any country where technological and infrastructural facilities are less developed.

E. Ahmed (1980) has observed the relationship between irrigation and cropping pattern in great detail. Increases in irrigation facility tend to weaken the climate- cropping pattern link in agriculture. Man by his technological advancement, can ameliorate the physical limits. The cultivation of rice in Punjab, Haryana and Rajasthan testifies this fact. Nevertheless, in different parts of the world, the physical environment reduces the choice of crops, either by prohibiting the growth of certain plants or by reducing their yield per unit area (Husain, 1996). In those areas where physical diversities are less, cropping patterns are less diversified for ex:- Rajasthan and Brahmaputra valley where farmers mostly grow bajra and rice respectively. The black soil is ideal for cotton in Maharashtra and Gujarat, while loamy soil is ideal for wheat in the states of Punjab, Haryana and western Uttar Pradesh.

Besides geo-climatic conditions, the factors, which are responsible for the cropping pattern of a region, are socio-cultural, economic and technological factors. The government policies enunciated form time to time also, influence the changing cropping pattern of a region. The specific socio-cultural factors like land tenancy, size of holdings and fragmentation of land holdings etc. impose restrictions on the cropping pattern of a region. If the land holdings are large then farmers are likely to allocate land towards risky but more remunerative crops (Husain, 1996). The age-old tradition of sticking to a particular crop also affect the cropping pattern of a region. For ex :- turmeric in Bihar is grown by a particular caste and even if its production becomes profitable other castes would not readily grow it due to restrictions posed by tradition. Thus the socio-cultural factors affects the cropping pattern of a region.

The price policy also affect the cropping pattern of a region. If government announces large increases in the support price of a particular crop then farmers may switch over to that crop. The increase of oilseed prices due to TMO is a case in point. The technological breakthrough in a particular crop, which results increase in yield, may lead the farmers to grow that particular crop. Area shifts towards wheat, rice and oilseeds can be traced back to yield increase of wheat and rice due to green revolution and oilseeds due to the technology mission on oilseeds.

1.2 STATEMENT OF PROBLEM:-

For a country like India food security continues to be of paramount importance. Our population has already touched the billion mark and still continue to grow at a rate more than 1.8% per annum. Although the foodgrain productivity registered reasonably satisfactory growth rate in the recent past, high degree of uncertainties are associated with our agriculture.

TABLE 1.1

INDIA:FOOD GRAINS PRODUCTION

YEAR	FOOD GRAINS PRODUCTION (MILLION UNITS)	YIELD (Kg/ha)
1950-51	50.82	522
1960-61	82.00	710
1970-71	108.4	872
1980-81	129.6	1023
1986-87	143.4	1128
1987-88	140.3	1173
1990-90	176.4	1380
1991-92	168.3	1382
1996-97	199.4	-
1997-98	193.12	1561

Source :- Economic survey, Agri news

The adverse agricultural performances in the recent past in 1987-88, 1991-92 and 1997-98 may be observed form the table 1.1. Formulation of sound agricultural policies is of utmost importance due to continuing increase of demand for foodgrains. Kumar and Mathur (1996) have observed that demand for food grains would be 213 mt in 2001 and 235 mt in 2006. Increase in crop output can be obtained by the following four components: -

- Increase in net cropped area
- Increase in yield.
- Increase in cropping intensity
- Change in cropping pattern/replacing low value crops by high value crops.

Increase in the net cropped area has limited possibilities in case of India since growth of additional cultivable land at a given period of time can not match the growth in the population.

Table 1.2

INDIA NCA AND POPULATION GROWTH RATE

YEAR	NCA Growth Rate (%)	Pop. Annual Exponential GR (%)
1951-61	1.2	-
1961-71	-	1.96
1971-81	-	2.20
1981-91	-	2.22
1961-98	0.18	2.11

Source :- Indian Agriculture Statistics, Provisional Population Tables

Increase in the yield in the country has tapered off after the spread of green revolution. Some of the states have already reached their peak in terms of yield. So, unless there is a fresh technological breakthrough, the scope of increase in production of foodgrains from yield increase is limited.

TABLE 1.3

ALL INDIA YIELD GROWTH RATE

Crops	60-65 to 70-73	70-73 to 80-83
Rice	1.05	1.60
Wheat	6.26	2.66
Coarse Cereals	0.96	1.88
Pulses	0.89	-0.15
Food grains	1.82	1.86
Rapeseed & Mustard	2.84	0.94

Source :- Bhalla G.S. & Singh S. 1997

The potentials existing in terms of changes in the cropping pattern, however, are yet to be exploited fully. In the decades of eighties, green revolution has had a better regional spread in terms of its coverage of eastern and central India (Bhalla G.S. & Singh S. 1997). Extension in area under high value crops present an achievable alternative to farmers in near future.

Cropping pattern changes represents choice or decision of farmers. While yield may be influenced by factors outside the farmer's control, cropping pattern or area allocation under various crops provides us with a lot of insight into farmer's responsiveness to socio- economic and technological changes.

Crop combination region, which can be said to be a more scientific and better indicator of cropping pattern, helps us regionalise a country on the basis of cropping pattern changes. Such a regionalization would be an important aid in policy formulation as it would help us identify regions showing similar changes in response to a host of socio-economic, technological and political factors. Similar price policy on technological improvements like assured water supply may lead to specialization in one region and diversification in another. It is hardly necessary that all parts of a state show similar changes in cropping pattern in response to changes in their determinants. Such changes may be governed to a large extent by the given agro-climatic parameters of a region and the available infrastructure as irrigation, transport network, regulated markets etc. Regions showing similar changes in cropping pattern would require similar infrastructure and hence similar policies for development to

sustain these changes in cropping pattern. The basis for policies of this kind can be provided by studies such as this.

Due to some important changes in the policies for the agricultural sectors in India during the eighties, it is imperative to study the changes in cropping pattern at the district level. Since all the regions and districts of a state may not respond similarly, this would provide a foundation to assess the supply responsiveness of various agro-ecological regions of the country.

1.3 OBJECTIVE OF THE STUDY :-

The objectives of this study includes

(1) To analyse the changes in agricultural polices since Independence and its possible impact on cropping pattern in recent years.

(2)To compare the state – level changes in the crop-combination regions between 1979-82 to 1989-92.

(3)To analyse the district level changes in the crop combination regions between 1979-82 to 1989-92 and compares it with 1961-64 regions, worked out by Majid Husain.

(4)To asses the role of agro climatic region in crop specialization and crop diversification in all the regions of the country.

(5)To critically evaluate the crop combination methods of Weaver and Rafiullah.

1.4 DATE BASE :-

Data for this study has been obtained from secondary sources. The major sources are the reports published by :-

(1) Directorate of Statistics and economics, Department of agriculture and cooperation, Ministry of agriculture , Govt. of India.

(2) Ministry of Finance, Economic Division, Govt. of India.

(3) Fertilizer Association of India

(4)The census of India.

1.5 METHODOLOGY :-

For state level and district level crop combination regions, Weaver's least square method has been used in the study. However, the other important method of Rafiullah (maximum positive deviation method) has also been used in two states to critically evaluate both the methods. The details of both these methods are dealt extensively in chapter 5 of this study.

1.6 LIMITATION OF THE STUDY :-

The latest comprehensive report prepared by the directorate of Economics and Statistics is of 1991-92 period. This data fails to capture the most recent changes due to liberalization and globalization policies. Data for 1979-82 period for the states of West Bengal is not available. Hence 1982-85 data has been used to show the crop combination regions of first period.

Planning Commission and Agro climatic regional planning unit (ARPU) have categorized all the states in to different agro climatic zones, and inspite of recommendation suggested for the regions, cropping pattern has not been brought out clearly. Therefore comparing the actual and potential cropping patterns initially visualized of, could not be carried out. Factors of cropping pattern changes have not been discussed in details. Seasonal breakup in to kharif and rabi season cropping pattern has not been worked out.

1.7 DESIGN OF THE STUDY :-

The present study has been organized in to six chapters. The first chapter deals with statement of the problem, objective of the study, date base, limitations of the study and a brief review of the literature. The second chapter deals with the agricultural policies since independence and its impact on cropping pattern. The third chapter deals with state level changes of crop combination regions between two time periods. The fourth chapter deals with district level changes in the crop combination regions and the role of agro-climatic region in this respect. The fifth chapter critically evaluates two methods of crop combination regions. The sixth and last chapter summarizes the findings of the study.

1.8 REVIEW OF LITERATURE:-

A chronological and chorological study of phenomenon gives a proper understanding of its evolution. Geographers generally identify regions based on physical and cultural characteristics. But as the development of agriculture took place there seems to arise a need for delimitation of homogeneous agricultural region. Agricultural regions, in fact, is a device for selecting and investigating regional groupings of the complex agricultural phenomena found on the earth surface.

Weaver (1954) for the first time introduced the term crop-combination regions in geography. According to him, only rarely does a crop assume a position approximating absolute isolation. Cultivated plants are grown in combinational associations, and any successful attempt to understand the geographic patterns of crop land use must eventually move up to this level of description and analysis.[1] Before Weaver the general tendency was to demarcate rice region, wheat region, maize

[1] WEAVER J.C. (1954), "Crop Combination Region in the middle west". The Geographical review, vol. 44, No.2, p. 175.

region etc., on the basis of most dominant crop. But Weaver's crop combination region enabled geographers to group crops more accurately for better planning purposes. Other methods as discussed by scholars have been discussed in chapter 5 of this study.

1.8.1 PAST AGRICULTURAL POLICIES :-

Krishnaji (1973) studies in detail about the wheat price movement and its impact on the farmers of the country. He observed that the rapid rise in the production of wheat following the record crop of 1967-68 did not bring about a significant fall in wheat price. Wheat procurement and movement restrictions have been examined in great details. And Krishnaji has found that both these instruments have been used to further a policy that favours the large farmers, particularly in Punjab & Haryana regions. [2] Prabha (1980) has critically analyzed the movements restriction policy of the government of Tamil Nadu. The results suggest that procurement from the producer is an effective method of procurement. Zonal restrictions are essential and being effectively implemented in the states, and non-price factors influence procurement more than price factors.[3]

Krishnaji (1990) in a separate study is of the view that price policy reflects the responses of governments, but prices are not determined by policies alone the market and some non-market factors unrelated to policy also influence their movements. Krishnaji has also observed that the green revaluation has exacerbated inter regional inequalities in the production of food grains. Productivity increase have

---

[2] Krishna Ji N- U 973)", Wheat price movement : an analysis'' EPW. Vol. 8 No. 26 pp A- 42 – A 52.
[3] Prabha T (1980) , "Movement Restrictions, Procurements and Market Price; A case study of Tamilnadu, ''EPW, Vol . 18 No. 26 pp A 52-! 56.

been largely confined to wheat in the north west while the public distribution system is restricted mainly to the urban area has failed to protect rural poor.[4]

Gulati & Sharma (1990) are of the view that movements in cost of production largely influence procurement prices and lagged open market prices with occasional bonanzas emanating from non-economic considerations. Procurement prices have a decisive influence on current market price formation with other factors like stocks with government having only marginal roles.[5] The volume of procurement is significantly affected by the level of output and difference between procurement and open market prices showed strong correlation between output and procurement.

Rao (1992) has argued about PDS and procurement policy of government. He observed that PDS is operated with the food grains purchased by the government to prevent their prices from declining below an acceptable level. These purchases are made at procurement prices which are always higher than the minimum support prices.[6] He also observed that the major beneficiaries of the procurement-cum- PDS policy are large and medium farmers and urban areas particularly the larger cities. Tyagi (1990) has argued that under the present system, the poor in any state having meager PDS operation may actually be worse off than they would be under free conditions.

---

[4] KRISHNA JI (1990), " Agricultural Price Policy: A survey with Reference to Indian Food grain Economy," EPW, Vol 25, No. 26.

[5] GULATI & SHARMA P.K. (1990), "Prices, Procurement and Production: An Analysis of wheat and Rice, "EPW, pp A 36-A-45

[6] Rao. V.M. (1992),"Fixing Agricultural Prices : Issues and Experiences, " EPW Vol 27, No. 13, pp639-645.

1.8.2 AGRICULTURAL DEVELOPMENT AND CROPPING PATTERN CHANGES:-

Chakrabarti (1981), has analysed time series data of food-grain production between 1949-50 to 1975-76. He observed that the above mentioned period have three distinct segments, with second segment being a stagnant period. The first and the third segments show the same growth pattern. The three time segments that Chakrabarti has analysed are , 1949-50 to 1960-61, 1958-59 to 1966-67 and 1964-65 to 1975-76. He observed that with the introduction of high yielding varieties with associated improved critical inputs, an instant vertical jump in the growth rate from stagnancy in segment II took place at the beginning of the segment III. All that has been achieved through technological breakthrough in the field of food grains production such as the green revolution programme, is that we have regained the growth pattern that was prevailing prior to the stagnancy period i.e. prior to 1958-59.[7]

Dev (1985) in the study of performance of all crops at district level in late 1970's has observed that some of the high growth and most of the negative growth districts in the period 1962-65 to 1970-73 have shifted to medium growth in the period 1962-65 to 1975-78. His conclusions are mainly drawn form the empirical evidence across growth classes. He observed that the technological and demographic forces operate against negative growth regions and it operates in favour of very high and high growth regions. Increase in yield through technological factors was offset by population growth in low and very low growth regions.[8] Rich regions are becoming relatively richer in terms of output per capita as well as output per area.

---

[7] CHAKRABARTI S. (1981), " In search of growth pattern for food grains production in India," EPW Vol. 17, No-52, ppA 22-126

[8] DEV S.M. (1985) , " Direction of change in performance of All crops : A Look at the level of Districts and Agro –climatic regions "EPW. Vol. 20, No-51 & 52, p.A. –136.

Though poor regions have not become poorer, they have remained relatively poor in terms of output per area.

Bhalla & Tyagi (1989) have studied the spatial pattern of agricultural growth in the country, taking 19 major crops which account for 82 to 90 percent of both area and value of output in the different states. They observed interesting cropping pattern changes in terms of area allocation between broad groups like food grains, oilseeds, commercial crops and the rest of the corps at all India level. Total area under food grains was 66.7% of the gross cropped area during 1962-65 and it went to 67% in 1980-83. Within food grains, wheat which accounted for only 9% of area in 1962-65 went up to 12.2% in 1970-73 period and 13.9% by 1980–83. This is because wheat cultivation became relatively more profitable after the adoption of new seed- fertilizer technology during the mid-sixties. The increase was much larger in the states of Punjab, Haryana, Uttar Pradesh and Bihar. They observed that the area under pulses in general and gram in particular has been declining continuously. With the spread of irrigation, cultivation of gram has given way to wheat because there has been no breakthrough in technology in the case of gram[9]. Area under gram has declined from 6.1% to 4.5% between 1962-65 to 1980-83. Area under oilseeds does not see any major change during the above mentioned period. In case of commercial crops area under sugarcane has registered a slight increase specially in Tamil Nadu, Maharashtra, Karnataka and Uttar Pradesh.

During the period between 1962-65 and 1980-83, nearly half of the increase in value of output of the 19 major crops was accounted by wheat alone. There seems to be marginal decline in all the coarse cereals namely jowar, ragi and barley. The

---

[9] BHALLA G S. & TYAGI D.S. (1989)," Special Pattern of Agricultural Development in India ," EPW Vol. 24, No. 25 pp.A 46-A55.

authors have come to the conclusion that with the introduction of high-yielding seed-fertilizer technology during the mid –sixties, regional differences in the yield level of agricultural output have further accentuated.

Mrathunjaya and kumar (1989) have extensively examined the change in input use, productivity, cost of production, profitability and employment . They have also explained the cropping pattern changes and the ways to control the imbalances in the cropping pattern.

They are of the view that low relative profitability is a strong enough factor to induce farmers not to allocate land to certain crops like coarse grains and pulses. The cropping pattern changes revealed that the increase in area under different crops was strongly linked with decline in cost of production at constant factor prices.[10] They have observed that increase in area under paddy and wheat are due to the technological breakthrough in these crops combined with price support, market infrastructure, subsistence requirement, and yield risks. The decline in share of coarse cereals is due to their competition from superior cereals like rice and wheat. Maize has fared well within coarse cereals due to its adoption in agro based industries. Decline of area under sugar-cane after 1983 has been explained on account of crisis being faced by the sugar industry. Decline of area under cotton has been explained by water logging and land salinisation problems faced by the farmers alongwith the development of irrigation.

Vani & Vyasulu (1996) in their district level analysis of three major cereal crops in Karnataka have found that rice form on important crop in 17 distincts; ragi and jowar in nine disticts of the state. Rice productivity was found to be high in the

[10] Marathunjaya & Kumar P. (1989), "Crop Economics and cropping pattern changes",EPW Vol. 24, No. 51-52, pp A159 to A165.

districts of Chitradurga , Mysore, Mandya and Raichur. The yield per hectare in the case of jowar crop was found to be high in Chitradurga, Dharwad and Bellary disticts. Chitra durga and Shimoga disticts showed higher yield per hectare for ragi crop as compared to other districh.[11] The inter- district variation was found to be higher after green revolution implying uneven adoption of green revolution across districts.

Bhalla & Singh (1997) have analyzed state level data on area and output of 43 crops for the 30 years from 1962-65 to 1992-95. It revealed that there was a marked acceleration in the growth rate of agricultural output in India during 1980-83 to 1992-95 as compared to earlier periods. This period was also characterized by important cropping pattern changes away form coarse cereals towards rice and wheat on the one hand and towards oilseeds on the other.

They observed that new technology introduced during the mid –1960s failed to diversify the cropping pattern since it was primarily confined to wheat and rice. But important cropping pattern changes within foodgrains at all India level as well as at the state level took place. There was a substantial increase in area under wheat at the cost of pulses. The southern as well as the central region showed a small increase in their share of area under pulses, the area under oil seeds marginally increased in the southern region and remained constant in the central regions.[12]

Area under foodgrains went down primarily due to decline in the share of area under coarse cereals on one hand and on the other hand area under wheat and rice actually noted a significant increase. The shift from coarse cereal to oil seeds mainly

---

[11] VANI B.P. & VYASULU V. (1996), "Growth, Variability & Immutability of there major cereal crops in Karnataka; A district level analysis form 1955-56 to 1989-90, " EPW Vol. 91, No. 26 pp. A 4-A83

[12] BHALLA G.S & SINGH G. (1997),"Recent Developments in India Agriculture: A State level Analysis, " pp A2 A18.

observed in soyabeans, sunflower, rapeseed & mustard and groundnut. This was made possible primarily as a result of increase in relative profitability both because of notable increase in yield and hefty increase in the administered prices of oilseeds relative to coarse cereals. But area under oilseeds declined in Punjab, quite contrary to the other states of the region. It was due to decline in area under repeseed and mustard. Area under oilseeds did not register any increase in the eastern region.

1.8.3 OILSEEDS & PULSES :-

Despite the fact that oilseeds account for more than 15% of the country's gross sown area, it has fallen short of our requirements. Dipankar & Subramanian (1986) have observed that between 1960 and 1980, India switched from being a net exporter of edible oils to the world's largest importer. Between 1950 and 1980 a structural break occurred in the growth in area and output of groundnut. It was due to the result of a deceleration in the growth in area and output.

Dipankar & Subramanian have observed that groundnut prices have shown greater variability within the year which is reflected in the change in the seasonal index of pre and post 1970 periods. Imports of edible oil appears to have had a destabilizing impact on domestic prices primarily because the volume of domestic and imports have moved towards the same direction at a given point of time. The correlation coefficient between imports and domestic production of groundnut is positive and significant at +0.71.[13]

Singh & Dhaliwal (1993) have dealt in detail about the circumstances under which Government of India was forced to adopt technology mission on Oilseeds. They observed that production performance have improved in the period

---

[13] PUKAYASTHA D. & SUBRAMANIAN. (1986) "Price and Income Stabilisation Issues in the Indian groundnut Market," EPW, Vol 21, No.-8 pp 353-358.

between 1976-77 to 1990-91 as compared to the earlier period 1965-66 to 1975-76 in case of groundnut, rapeseed and mustard, castor and sesamum but it deteriorated for linseed.[14] With the success of TMO groundnut, accounted mainly for growth in area under oilseeds in Andhra Pradesh, Maharashtra and Karnataka, sesamum in Gujarat, Karnataka, Maharashtra, Orissa, Punjab, Rajasthan and West Bengal while rape & mustard mainly accounted for growth in Rajasthan, Haryana and Gujarat.

Kaushik (1993) has examined the growth and instability of crop output in India in general and oilseeds in particular. He observed that the magnitude of fluctuations depends on the nature of crop production technology, its sensitivity to weather, economic environment, availability of material input and many other factors[15]. Kaushik believes that the area brought under irrigation was diverted to the production of foodgrains and resulted in the neglect of oilseed crops. The fluctuations in the price of groundnut vis-à-vis those of its competing crops like paddy and wheat further contribute to the instability in groundnut production.

Kumar (1993) has observed the serious decline in the per capita net availability of pulses form 69 gram/day in 1961 to 39.7 gram/day in 1991[16] . In case of pulses neither area under it nor the productivity has increased over the time. Kumar has also dealt in detail about the changing pattern in the cultivation of pulses by size group holdings. He has emphasized upon the need for a mission like TMO to boost the pulse productivity and area in the country.

---

[14] SINGH A.J. & DHALIWAL S., (1993), "Production preference potentials & Prospect for oilseeds in India", IJAE,Vol. 48, No. 3 pp 357-365.

[15] KAUSHIK K.K., (1993), "Growth & Instability of oilseeds Production," IJAE, Vol. 48.No-3 pp 334-338.

[16] KUMAR B.L. (1993) , "Changing pattern in the cultivation of pulses by Size groups of holding ", IJAE, Vol. 48 No. –3, pp 339-344.

1.8.4 FUTURE AGRICULTURAL POLICIES :-

It is very essential for a country like India to have sound agricultural policies to meet its domestic as well as export needs.

Kumar and Mathur (1996) have studied this aspect in the demand supply perspective for the ninth-five year plan. They say that the earliest gains from the green revolution have already been realised and future growth in production can only be input based in most of the regions of the country. Based on the estimates to production for 2020 (Rosefrant et.al. 1995), it is expected that there would be a deficit of 63.7 million tonnes of wheat in South Asia, China, South east Asia., West Asia and North Africa. Kumar & Mathur are of the view that India can easily capture 5% of this potential wheat market. In addition to this India has the potential for exporting cotton, vegetables, fruits and marine products. India can aim to export 0.24 mt cotton, 1.9 mt vegetables, 1.1 mt fruits, and 0.37 mt marine products in the year 2001.[17]

Spread of input in the new areas where the existing level of application is relatively low will contribute to the increase in the productivity per unit of input as well as ensuring more equitable distribution of benefits. Yield improvement for the low yield states, where current yield level is below the required national average is must to achieve our goal. Emphasis should be given to yield improvement in paddy in the states of Bihar, Orissa, W. Bengal and Uttar Pradesh. For wheat we must focus an Uttar Pradesh, Madhya Pradesh, Bihar and Rajasthan while for pulses focus should be on Madhya Pradesh , Gujarat, Maharashtra, Rajasthan Andhra Pradesh, Karnataka and Uttar Pradesh. But without area expansion and irrigation the task of attaining self- sufficiency in pulses seems to be difficult.

---

[17] KUMAR P & MATHUR V.C. (1996). "Agriculture in future: Demand Supply Perspective for the Ninth Five Year Plan," EPW, Vol. 31, No.39, pp A131-A139.

The introduction of palm cultivation for oil production may release the pressure on traditional oilseeds crops to meet the future edible oil demand. Rainfed areas, account for 70% of India's cultivated area play a key role in meeting future food needs, in generating employment and in promoting national economic growth. Creating infrastructure in less developed area, improving watershed development for raising yields of rainfed crops, widening of seed revolution to cover oilseeds, pulses fruit and vegetables, improvement of agricultural credit and technological upgradation of post harvest handling are areas which need more attention.

CHAPTER – 2

MAJOR POLICY CHANGES IN AGRICULTURAL SECTOR

As soon as India became independent, one of the major commitments of government was to get freedom from hunger. Memories of Bihar- Bengal famine was still fresh. The problem became more complicated due to the partition in 1947 as food grain shortage was further intensified due to the loss of about 20 million acres of irrigated land on account of partition of the country.[1] Since Indian economy heavily depends on agriculture there was an urgent need for a national policy in this respect. Keeping these things in mind government of India put special emphasis in agricultural sector by changing and modifying its policies according to the needs. Chopra(1999) has divided major agricultural policies under four broad headings :-

2.1 Pre Green Revolution period

2.2 Green revolution period

2.3 Post green revolution period

2.4 Liberalization and globalization period

2.1 PRE GREEN REVOLUTION PERIOD :-

It mainly covers the policies between the period of 1951 to 1965. This was the time when old practices of zamindari system and feudal, semi feudal systems were still operating in the country. Legislation were enacted and enforced to abolish these system by the state government.

[1] CHOPRAK (1999) (Unpublished), "Agricultural Policy in India and Implication for population displacement 1947-1999. SICI-CIDA Project-page 1.

The objective of the first five year plan was not only to increase agricultural production but also bring about all-round development in rural life. Its main emphasis was on long term projects and the full advantage of this planning was to be realized after a period of fifteen to twenty years. Formulation and implementation of various schemes related to agriculture, irrigation and power were assigned to the state government, while the central government was to coordinate and provide general assistance. Besides these, Community Development Programme (1952), Bhoodan movement (1951), Gramdan movement (1952) etc. were also implemented. These programmes were intended to minimise the inequalities in terms of land distribution.

The Second Five Year plan (1956-61) gave main emphasis in the package program which in other words can be defined as improving agricultural practices is selected districts through improved varieties of seed, fertilizers, agricultural implements etc. It also has the provision for technical advice, credit and storage for the products (Husain , 1996). This progrmme was called intensive agricultural district program (IADP).

The third five year plan period was between 1961-66. In this period the crop yield was very low for almost all food grains (see table 2.1)

TABLE 2.1

YIELDS OF IMPORTANT CROPS

Crop	Yields (kg/hectare) 1960-61
Rice	1013
Wheat	851
Rapeseed/mustard	467
Ground nut	745
Food Grains	710
Jowar	533
Pulses	549

SOURCE : ECONOMIC SURVEY

Keeping these facts in mind a strategy was adopted to increase agricultural production with the help of modern inputs like new seeds, fertilizers, pesticides, agricultural machinery and equipment and irrigational facilities.

As large amounts of foreign reserve was being spent on the import of foodgrains to feed the growing population of India. It forced the government of India to work out something concrete on this front so that a permanent solution could be found out of this chronic problem.

A team of experts sponsored by the ford foundation was invited by the Government of India in the latter half of second five year plan to suggest ways and means to increase the agricultural production and productivity. The team after intensive study submitted its report entitled 'India's food crisis and steps to meet' in april 1959. The report suggested intensive efforts for increasing agricultural production and productivity in selected regions of the country with maximum stress on modern inputs like fertilizer, credit, marketing facilities, irrigation facilities etc.

On the recommendation of this committee the government introduced intensive development programme in seven districts of seven selected states in 1960 and the programme was termed as Intensive Area Development Programme (IADP). A district selected under IADP was required to possess qualities such as assured water supply, minimum incidence of hazards (like floods etc.) well, developed village institution and maximum potentialities for increasing agricultural production within a short period of time. In October 1965, the programme was extended in 114 districts

2.1 GREEN REVOLUTION PERIOD :-

The new high- yielding variety of wheat developed in Mexico by Prof. Norman Borlaug and his associates was successfully introduced in India . The new agricultural technique put in to practice for, the first time in India in the kharif season of 1966 and

was termed as high yielding varieties programme (HYVP). The programme was introduced in the form of a package since its success depended on regular supply of water, fertilizer, HYV seeds, pesticides and insecticides. Initially it was implemented in a total area of 1.89 million hectares in 1990-91, which went up to 63.9 million hectares, which was almost 35% of the gross cropped area.

The "high yielding variety and the hybrid seeds" programme were undertaken for major cereals like wheat & rice to a large extent & marginally for some coarse cereals like maize, jowar and bajra. It helped India to transform it form an importer of agricultural commodities to an agriculturally self sufficient country. The impact of new technology could have been wide ranging if all regions, and all farmers were in a position to adopt it simultaneously. But this package being cost intensive, infrastructure-specific & crop-specific its spread was restricted to the richer farmers & better developed region.

2.3 POST GREEN REVOLUTION PERIOD :-

This was the period of spread of technology. In the late seventies and early eighties rice and wheat technology expanded in eastern Uttar Pradesh and central Andhra Pradesh districts, bringing them at par with the north-western parts of India. In eighties, however the most significant gain was achieved when the new technology spread to the eastern and central states in India. This development can be termed significant in the sense that a shift towards foodgrains may be expected in many of the districts belonging to these regions within the period of our study. The north western and southern states having largely saturated the growth options in terms of foodgrains, are expected to diversify to higher value crops (Bhalla & Singh 1997).

In the fifth five year plan (1974-79), agriculture was the most vital sector. In this five year plan the main emphasis was on the exploitation of ground water and

surface water, intensification in application of new technology in the agriculture sector, the extension mechanism and programmes to regulate and ensure the supply of inputs . Also in this five year Command Area Development Programme (CADP), Minimum Needs Programme (MNP), Food For Work Programme, Desert Devlopment Progremme (DDP) etc. were introduced. In the sixth and seventh five year plans different rural development and community specific programmes were continued. The prime objective under the seventh plan was to reduce instability in agriculture and reduce inter-regional, inter-class and inter-crop disparities.[2] Special programmes for rice and oilseeds started, and attention was given to dry farming and to the less developed states. It resulted in increase in yield and this is corroborated by the increase in fertilizer consumption during the eighties at a faster rate in the eastern and western regions than in the northern and southern regions (see table 2.2).This is expected to have bearing on cropping pattern changes in our study.

TABLE 2.2

CONSUMPTION OF FERTILIZERS

Regions	1962-65 (kg.hec)	1980-83
NW Region	4.29	91.02
Eastern Region	2.63	26.07
Central Region	1.72	19.93
Southern Region	8.34	55.88
All India	4.33	42.62

Source :- Bhalla G.S. & Gurmail S. EPW article, 1997.

Green revolution technology spread to the new area like coastal Andhra Pradesh, Tamil Nadu, Eastern Uttar Pradesh, West Bengal, Bihar and Central India. The acceleration of growth in the highly populated but agriculturally

[2] CHOPRAK. OP CIT . P 37

stagnant states of eastern India was a development of major significant.[3] In the states of western and central region, a shift in the cropping pattern from low value coarse cereals to oilseeds is expected because of sharp increase both in administered prices of oilseeds as well as in their yields (see table 2.3).Thus foodgrains & oilseeds are expected to increase at the cost of low value/low yield crops.

TABLE 2.3

YIELD OF IMPORTANT CROPS

(kg/hectare)

Crop	1960-61	1970-71	1990-91	1996-97
Rice	1013	1123	1740	1882
Ground nut	745	834	904	1138
Rapeseed/ Mustard	467	594	904	1017
Wheat	551	1307	2281	2679
Jowar	533	466	814	956
Bajra	286	622	658	-

Source :- economic survey 1998-99

2.3.1 TECHNOLOGY MISSION ON OILSEEDS :-

Despite the fact that oilseeds account for more than 15% of the country's gross cropped area (see table 2.4), indigenous production has fallen short of requirements. India became a major importer of edible oil in the last decade. The

[3] BHALLA GS & SINGH S. (1997), "Recent Development in Indian Agriculture; A state level analysis ", EPW Vol 3 p.

TABLE 2.4

AREA UNDER FOODGRAINS AND OILSEEDS

Gross cropped area (million hectares)

Year	1960-61	1970-71	1980-81	1990-91
Food Grains	115.6	124.3	126.7	127.8
Oil Seeds	13.8	16.6	17.6	24.1

Source :- economic survey 1998-99

annual import of edible oil averaged 1.30 million tonnes valued at Rs. 801.17 crores during 1985-86 (Singh & Dhaliwal, 1993). Keeping these things in mind government of India created in May 1986, a Technology Mission on Oil seeds (TMO) which suggested a four pronged strategy to improve oilseeds production. The four strategies were.[4]

- to improve oil seeds crop technology
- post harvest technology
- to strengthen services to the farmers
- ensure remunerative price to the farmers

Technology mission also designated the National Dairy Development Board as the market intervening Agency for Procurement of oilseeds and oil for building a buffers stock, so as to ensure an incentive price to the farmers and release the same during the lean season at moderate prices to the consumers. Further oilseeds producers were provided with all necessary incentives for adoption of improved technology for increasing production.

During the seventh plan two centrally sponsored schemes, namely National Oilseeds Development Project (NODP) and Oilseeds Production Thrust

[4] SINGH A.J. & DHALIWALS. (1993), "Production performance, potentials and prospects for oilseeds in India, IJAE," Vol. 48, No. 3, p-357.

Project (OPTP) were being operated by the technology mission. Both these programmes were merged into a single scheme named Oilseeds Production Programmes (OPP) during 1990-91. The scheme provides assistance to the tune of 75:25 sharing between government of India and state governments, except for a production of foundation seeds where central assistance was 100% (Singh & Dhaliwal 1993).

Right now the strategies currently adopted for increasing oilseeds production under this programmes are increasing production and availability of seeds, distribution of seed minikits, distribution of plant protection chemicals and equipments and improved farm implements, organizing front line demonstration of improved technology on farmers field and distribution of rhizobium culture for ground nut and soyabean.

Earlier the programme was implemented in the potential oilseeds producing states. For ground nut, special emphasis was given in the states of Andhra Pradesh, Gujarat, Karantaka, Orissa and Tamil Nadu. For rapeseed and mustard emphasis was laid on Assam, Gujarat, Haryana, Orissa, Punjab, Rajasthan and West Bengal. For linseed Bihar, Madhya Pradesh, Punjab and Uttar Pradesh were selected.

Although the production performance of total oilseeds improved, it was mainly due to improvement in growth in acreage. Growth in yield for most oilseeds decelerated, and were also quite unstable. The increasing tendency of yield instability in the case of oilseeds can be attributed to the fact that oilseeds are grown mostly in the unirrigated areas and dependent on rain.[5]For this reason , the yield performances of Rabi oilseeds as a group is significantly better than kharif oilseeds

[5] KAUSHIK K.K., (1993), "Growth and Instability of oilseeds production," IJAE, Vol. 48, No. 3, P

2.3.2 PROCUREMENT PRICES :-

Besides other steps, government of India every years announces uniform procurement prices for all crops. It ensures adequate supplies of food-grains to the consumers at a reasonable price and prevents unduly favourable terms of trade for prosperous agricultural regions and big farmers. The main objective of agricultural price policy are to ensure:-

- ❖ reasonable prices for the growers
- ❖ reasonable prices of the grains released from public distribution system, and
- ❖ reasonable prices in the open market.

Procurement or minimum support price is one of the determinants of cropping pattern. High procurement price and better growth rate helps the farmers to think about future cropping patterns of the field.

TABLE 2.5

MINIMUM SUPPORT PRICE /PROCUREMENT PRICE OF MAJOR CROPS

YEAR 1992-83 AND 1992-93

(Rs. Per quintal)

	Commodities	1982-83	1992-93	Compound Annual Growth Rate
1.	Paddy	122	270	8.2
2.	Wheat	151	330	8.13
3.	Jawar	118	245	7.5
4.	Bajra	118	245	7.5
5.	Maize	118	260	8.2
6.	Tur	215	700	12.5
7.	Gram	235	640	10.5
8.	Ground nut	295	750	9.7
9.	Safflower	-	720	-
10	Soyabean (Yellow)	245	525	7.9
11.	Mustard	151	330	7.9
12.	Cotton (H4)	527	950	6.06
13	Sunflower	250	800	12.3

SOURCE :- ECONOMIC SURVEY 1998-99

From table 2.5 it is clear that maximum growth rate in the procurement price has occurred among oilseeds and pulses. The least gainers are jowar and bajra. Naturally a shift towards oilseeds, pulses and cereals (other than jowar, bajra and ragi) would be observed. Inspite of increase in procurement price shift towards pulses is not visible in India probably due to poor yield rates.

2.4 LIBERALISATION AND GLOBALISATION PERIOD :-

Liberalisation process in Indian economy started with the new economic policy in 1991. It gave emphasis on encouraging foreign export and allowing foreign investment in a large scale. As it was realized that enlarged public sector under mixed economy can not deliver sustainable growth, hence private investment were encouraged and public expenditure were reduced to reduce fiscal deficit (Chopra 1999). Although there were not any specific program for the agricultural sector yet the vast agricultural sector can not remain insulated form the on going changes.

Reduction in government expenditure in agricultural sector mean reducing government subsidies on food, fertilizer and other inputs and also rationalizing procurement by the government for the Public Distribution System (PDS) and utilizing the stocks only for the vulnerable groups. (Chopra , 1999). Reduction of government's expenditure in agricultural sector would probably result farming business unviable for marginal and small farmers.

2.5 RELEVANCE OF POLICY CHANGES TO THE PRESENT STUDY :-

The post green revolution period which was the period of spread of technology is the most relevent period for our study. In this period technology expanded in eastern Uttar Pradesh, coastal Andhra in the early eighties. But in late eighties the most

significant gain was achieved when it spread to eastern and central states in India. These are the potential food grain suppliers of future since most of the north western and southern districts have largely saturated their growth options.

As Bhalla and Singh (1997) have rightly observed that having saturated their growth options these districts are expected to diversify towards higher value crops. High value crops may be like fruits, vegetable, flowers and other horticultural crop. It would be possible only if eastern and central region would generate sufficient amount of foodgrains. It would also depend on the generation of adequate surpluses through higher investment in rural infrastructure and scientific research to include a number of high yielding variety crops.

Earlier studies have shown that because of changes in relative profitability and low yield, cheaper coarse cereals, pulses and oilseeds were rapidly being displaced by high productivity and higher relative value wheat and rice in Punjab, Haryana, Himachal Pradesh and Uttar Pradesh. Except these states oilseeds have gained in almost all other regions of India.

Area under wheat has increased substantially during this period in West Bengal at the cost of pulses. But area under pulses and coarse cereals have increased in Orissa. There was a substantial decline in the share of coarse cereals in the southern region and central region. Area under pulses have increased in central and southern region. But the area under oilseeds marginally increased in the southern region and remained almost constant in central region.

In this period expected changes in cropping pattern may be more specialization for northern states particularly Punjab, Haryana, Western Uttar Pradesh and coastal district of Andhra Pradesh. Most of the districts of southern as well as central India where irrigation facilities is not so developed more diversification is expected during

the study period.New crops are expected to emerge in crop combination regions. In eastern India where rice is monocrop in the majority of districts is expected to show the similar trends in this period also.

State level analysis may fail to capture the minor shifts taking place in a pocket of state. But district level analysis will capture all dimensions of change and this would be significant for future planning and policy makers. Agro- climatic factors of one district may not be similar to the another district of a state. This would result in a change in cropping pattern of districts. Districts having similar climatic conditions are expected to behave similarly in terms of cropping pattern. Hence the influence of agro climatic region has also been discussed our analysis.

CHAPTER - 3

CHANGES IN CROPPING PATTERN BETWEEN 1979-82 TO 1989-92

A STATE LEVEL ANALYSIS

3.1 INTRODUCTION :

Significant changes took place in the cropping pattern of India during the late eighties. At the state level share of area under wheat and rice registered significant gain in Punjab and Haryana . In eastern region West Bengal & Bihar have registered substantial increase in the area under wheat. A substantial decline in the share of coarse cereals in southern and central region was also observed . Area under oilseeds has increased in both these regions .

All India changes in Cropping pattern would become more relevant if the changes are explained vis-à-vis agro-climatic variations in the country. India is a country of great geographical diversity. The variation in its terrain , temperature, rainfall and soils closely influences the cropping pattern and other related agricultural activities. Moreover ,the response to any policy change is, along with other factors ,also dependent on the agro-climatic parameters.

For better planning and other development of agriculture the planning commission and the National Remote sensing Agency (NRSA) have divided the country in to 15 agro- climatic regions. In the delineation of agro- climatic regions, both physical attributes of the region and the social-economic characteristics have been taken in to consideration.

. 3.2 Objective : In this chapter the following would be attempted:

- To analyse the changes in crop combination at state level between 1979-82 to 1989-92 .
- To study the association of agro –climatic regions and such changes.

3.3 METHODOLOGY :- To estimate the crop combination region Weaver's method of least square method has been used . This method has been discussed in details in the chapter 5 of this study.In this method all crops having more than 1 % of the gross cropped area of that region have been considered.

3.4 AGRO CLIMATIC REGIONS AND CROPPING PATTERN:-

Even though agro-climatic regions do not coincide with administrative boundaries ,it is possible to classify states broadly in to specific agro-climatic zones. Here the rainfall characteristics and the soil characteristic of that agro Climatic region have been analyzed individually .

TABLE 3.1

AGRO CLIMATIC REGIONALISATION

S. No	Agro Climatic Zone	State	R.F. Characteristics	Soil Characteristic	Crop Combination 1979-82	Crop Combination 1989-82
1	Southern Plateau and Hills	Andhra Pradesh	-	Red Soil	17 crop region R (30), J (10), GN (11) ,OP (9), OC (4) B (4) Ct (3) , Mz (2) Rg (2) , Cs (2) , Tu (1), , SC(1), Se (i) To (1), Ch (1) M (1), FC(1)	17 crop region R (33) , GN (19) , OP (9) , J (9) , Ct (5) Tu (2) , Cs (2) Mz (2) , B (1) Ch (1) , SC(1) M, (1) To, (1) OC(1), Se (1) Rg (1) , FC (1)
		Karnataka	-	-	10 Crop region J (19), R (11) , Rg (11) Ct (10) , OP (10) GN	8 Crop regionJ (21) GN (12), R (11), Rg (10) OP (9) ,Ct

					(8) B (6) , OC (3) , Tu (3) W (3)	(6) , Tu (4) B (4) .
		Tamil Nadu	-	-	13 crop region R (40) , GN (14) , J (10) , OP (7) , B (5) , OC (5) , Ct (3) , Rg (3), SC (3), Co (1) , FC (1) , Se (1) , Ch (1)	14 crop region R (32) , GN (16) , OP (11) , J (9) , B (4) Ct (4) , SC (4) FC (3) , Co (2) Rg (3) , OC (2) , Se (2) , To 1) , Ta (1) ,
2	WEST TERN HIMALAYA N REGION	Himac hal Prades h	-	Podsolic soils , mountain meadow soils and hilly brown soils	3 crop region W (40), Mz (32), R (10)	2 crop region W (42) , Mz (35) .
3.	Lower Ganga Plain	West Bengal	High	Alluvial Soil	Mono crop region R (78)	Mono crop region R (76)
4	Middle	Bihar	High 100-150	Alluvial soil	12 crop	9 Crop

	gangetic plain	Platea u area	c.m annual rainfall		region R (53) W (16) , OP(10) , Mz (8) , G (1), Rg (1), J (1) OC (1), Pt (1) , SC (1) , B (1) M (1)	region R (55), W (20) , OP, (9) , Mz (7), G (1) , Pt, (1) , SC (1) , J (1), RM (1).
5	Upper Gangetic plain	Uttar Prades h	65-120 c.m. annual rainfall	Alluvial soil	14 crop region W (33) R, (22) , SC (6) , G (6) , Mz (5) , B (4) , Op (4) , FC (3) , Br (3) , J (2) , Tu (2) , OC (1) , RM (1) , Pt (1)	13 crop region W (36), R (23) , SC (7) , OP (5) , G (5) , Mz (4) , FC (4) , B (3) , RM (3) , J (2) , Tu 9 2) Br (1) , Pt (1).
6	Trans gangetic Plain	Punjab	50 -85 c.m. annual rainfall	-	10 crop region W (44) R, (19) , FC (10)	4 Crop region W (45) , R (27)

					Ct (10) , Mz (5) , G (3) , SC (1), Br (1)	, Ct 910) , FC 910)
		Harya na	50-85 c.m. annual rainfall	-	**4** crop region W (28) , B (16) , G (14) , FC (12) , R (9) , Ct (6)	7 crop region W (33) , R (11), B (11) , FC , (10) , RM (9) , G (9) , Ct (9)
7	Eastern Plateau and hills	-	-	-	-	
8	Central Plateau & Hills	Madhy a Prades h	50 -100 c.m annual rainfall	South western part having Black soil	8 Crop region R (23) , W (16) , J (11) , P (11) , G (9) , OC (7) , FC (4) , Mz (3)	15 crop region R (25) , W (17) , G (11) , OP (10), J (7) , OC (5) , Mz (4) , FC (4) Ct (2) , RM (2) , Tu (2) ,

						Li (2) , GN (1) , SC (1) , NS (1)
9	Western Plateau & Hills	Mahar ashtra	50-75 c.m. rain annual rainfall	Black soil	14 crop region J (34) , Ct (13) , OP (8) ,B (8) , R (7) , Co (5) , FC (4) , GN (9) , Tu . (4) , Sf (2) , G (2) , SC (1) , Li (1) , Rg (1)	15 crop region J (30), Ct (13) , B (9) , OP (8) , R (8), Tu 5) , GN (4) ,W (4) , FC (3) , G (3) , SC (2) , Sf (1) , Se (1), Li (1) , Rg (1)
10	East coast plains & Hills	Orissa	Over 100 c.m. annual rainfall	Alluvial soils	2 crop region R (58), OP (22)	2 Crop region R (55) , OP ((23)
11	West coast plain & plain Hills	Kerala	-	-	13 Crop region R (31) , Co (26) , Ta	12 crop region Co (32), R (21)

					99) , Ru (8) , Ct (7) , BP (4) , Bt (2) , M (2) Cf (2) ,Cd (2) , Bn (1) , T (1) , OP (1)	, Ru (15) , BP (6) , Ta (5) , Cs (4) , Cf (2) , M (2) , Bn (2) , Bt (2) , Cd (1) , T (1) .
12	Gujarat plain & Hills	Gujarat	Coastal part receiving over 100 c.m. rainfall, while interiors are dry.	Black and alluvial soil	8 crop region GN (21) , Ct (15) , B (14) , J (10) , FC(8), W (6) , R (5) , OP (4)	12 crop region GN (19) , B (14) , Ct (11) , FC (10) , J (6) , R (6) , W (5) , Tu (4) , OP (4), Mz (3) , Cs (3) , RM (3) ,
13	Western Dry region	Rajasthan	40 cm average annual rainfall	Mostly sandy soil	7 crop region B (28) , FC (16) , W (11), OP (10) , G (9) ,	8 crop region B (27) , FC (14) , RM , (10) , OP (10) , W (10)

					J (5) , Mz (5)	G (7) , M z (5) , J (4) .

Source :- Agro climate details : M Husain 1996 & planning Commission report.

For abbreviations see the appendics.

From **Table 3.1,** it may be observed that wherever there is alluvial soil and more than 100 c.m. rainfall is recorded rice is traditionally the most dominant crop. In Maharashtra and Gujarat presence of black soil helped cotton to become a dominant crop. In Rajasthan where rainfall is very scanty, and irrigation limited in its western part, fodder crop and jowar are the dominant crop. .

3.5 MAJOR CHANGES FROM 80'S :- As far as the number of first crop is concerned there is no significant change at the state level between two time periods. All the crops like rice, wheat , ground nut jowar etc. which were number one in the first time period are still number one in the second time period (1989-92) . But when we see the changes in number of crops in the crop combination estimates then Karnataka (from 10 to 8), Tamil Nadu (from 13 to 14) Himachal Pradesh (from 3 to 2) Bihar (from 10 to 9) , Uttar Pradesh (from 14 to 13) , Punjab (from 10 to 4) , Madhya Pradesh (from 8 to 15) , Maharashtra (from 14 to 15) , Kerala (from 13 to 12), Gujarat (from 8 to 12) , Rajasthan (from 7 to 8) , are showing significant changes. Andhra Pradesh, West Bengal and Orissa have similar number of crops in their crop combination region in both the periods. It is clear from the table that mostly dry states have move towards diversification in the latter period of analysis, while humid states have largely moved towards specialisation, Punjab is an exception. Which has moved clearly towards

specialisation . such a shift , however ,can be explained by a very high percentage of area irrigated.

3.6CHANGES IN AREA SHARES:

Change in the number of crops in the estimated crop combination does not reveal the entire dynamics of change . Changes in area shares under various crops (first five) have been analysed for better understanding..

TABLE 3.2

CHANGES OF AREA UNDER FIRST FIVE CROPS

S. No.	State	1979 –89	1989-92
1	Andhra Pradesh	R (30) , J (10), GN (11), OP (9), OC (4)	R (33), GN (19) , OP (9) , J (9) , Ct (5)
2	Bihar	R (53) W (16) , OP (10) Mz (8), G (1)	R (55) , W (20) , OP (9) , Mz (7), G (1)
3	Gujarat	GN (21) , Ct (15) , B(14) , J (10) , FC (8)	GN (19) , B (14) , Ct (11) , FC (10) , J (6) ,
4	Haryana	W (28) , B (16) , G (14), FC (12),R (9) ,	W (33) , R (11) , B (11) , FC (10) , RM (9)
5	Himachal Pradesh	W (40) , Mz (32) , R (10) , OP (4) , Br (4)	W (42) , Mz (35) , R (9) , OP (4) , Br (3)
6	Karnataka	J (19) , R (11) , Rg (11)	J (21) , GN (12) , R (12) ,

		, Ct (10) , OP (10)	Rg (10) OP (9)
7	Kerala	R (31) , Co (26) , Ta (9) Ru (8) , Cs (5)	Co (32) , R (21), Ru (15) , BP (6) , Ta (5) ,
8	Maharashtra	J (34) , Ct (13) , OP (8) , B (8) , R (7)	J (30) , Ct (13) , B (9) , OP (8) , R (8)
9	Madhya Pradesh	R (23) , W (16) , j (11) , OP (11) , G (9)	R (25) , W (17) , G (11) ,OP (10) , (7)
10	Orissa	R (58) , OP (22) , Rg (4) , OC (3) , Se (2)	R (55) , OP (23) , GN (4) , Se (4) , Rg (3)
11	Punjab	W (44) , R (19) , FC (10) , Ct (10) , Mz (5)	W (45) , R (27) , Ct (10) , FC (10) , Mz (2)
12	Rajasthan	B (28) , FC (16) , W (11) , O P (10) , G ((9)	B (27) , FC (14) , RM (10) , OP (10) , W (10)
13	Tamil Nadu	R (40) , GN (14) , J (10), OP (7) , B (5) ,	R (32) , GN (16) , OP (11) , J (9) , B (4)
14	Uttar Pradesh	W (33) , R (22) , SC (6) G (6) , Mz (5)	W (36) R (23) , SC (7) , OP , (25). G (5)
15	West Bengal	*R (78) , Ju (7) , W (5) , RM (3) , Pt (2)	R (6) , Ju (6) , RM (5) , W (3) , OP (3)

Source: Calculated from data, Indian Agricultural Statistics.

* 1 st period for west Bengal relate to 1982-85 due to non availability of data.during 1979-82 .

In Andhra Pradesh area under rice has increased from 30 % to 33% during the 1989-92 period. Area under jowar has gone down and it has become number four crop in the state from its position of second crop in the first period. Area under ground -nut has considerably increased from 11% to 19 % in the latter period. Cotton has figured in the first five crops replacing other cereals in the second period. Increase in support price and technology mission on oilseeds may be the reason for such kind of change in the state.

In Bihar the top five crops namely RWOPMzG maintain similar rankings in both the periods. Slight increase in area under rice (from 53% to 55%) and wheat (16% to 20%) may be observed due to late adoption of high yielding variety and new technology in the state .

In Gujarat ground nut, Cotton, bajra, jowar and fodder crop are first five important crop. Ground nut has gone down from 21 % 19 % during second period. It is to be noted that between 1980-81 to 1990-91 gross cropped area has gone down by 0.56% in the states (Indian agricultural statistics 1982 and 1991). Area under cotton has also gone down in the state from 15% to 11%.Inspite of comparatively high profitability ,area under cotton in Gujarat shows continuous decline probably due to water logging and salinisation problem faced by formers along with development of irrigation. (P. Kumar & Marathyunjaya 1989).

In Haryana ,area under wheat and rice has gone up mainly at the cost of coarse cereals like bajra which lost its number two position in the state . Rape – mustard has become more significant , replacing gram from the top five crops in the state,.

Himachal Pradesh has remained WMgROPBr region in both the periods, slight increase in area under wheat and maize has been observed in the second period of the study .

A very significant change has been observed in Karnataka . Ground- nut which was earlier number six crop occupying only 8 % of the gross cropped area has become number two crop during second period of study. This trend show that the state has responded well to technology mission on oilseeds. Rice has maintained a similar area share in both the periods under study. Jowar has remained as number one crop in the state. Area under cotton has gone down in the state like the adjoining state of Gujarat . The state has become JGNRRgOP , region which was earlier JR Rg Ct OP region.

Kerala has a distinctive cropping pattern different from rest of India. Here along with rice, coconut, spices and rubber are significant in the cropping pattern. Area under rice has considerably gone down in the state . But the decline in rice is accompanied by increase in area under coconut, rubber and black pepper .

Maharashtra has shown changes in the rankings of crops . From JCt OPBR it has become JCt BOPR in the latter period . Area under jowar and bajra has gone down considerably in the state. The loss in area under coarse cereal has been accompanied by increase of area under tur and gram. Jowar during Rabi season and bajra during

Kharif season in the state has been replaced by gram and tur respectively. Jowar and cotton have remained as number one and number two crop in the state.

In Madhya Pradesh, gram has gained relatively ,while jowar has lost out. Chhatisgarh region of the state receives good amount of monsoon rainfall which led rice to become number one crop in the state. Here agro -climatic factors dominate in agriculture. Area under rice has also increased in the state over two periods under consideration .

In Orissa, the climatic factors dominate the agricultural scenario in the state . Alluvial Soil and high rainfall presents an ideal condition for rice cultivation. Pulses other than tur and gram as a group is the second most important crop occupying around 22% of the gross cropped area. Area under pulses and oilseeds like ground nut and sesamum has increased during second period of study. Previous research indicate that this is due to bringing more and more area under cultivation like marginal lands, uplands etc. (P. Kumar and Mrathyunjaya , 1989) in the state .

The agro.- climatic condition of Punjab is ideally suitable for dry crops as the state receives only around 50-60 c.m. of annual rainfall.However technological break and infrastructure support base have made it the most developed agricultural state in the country. Area under wheat and rice has increased at the cost of coarse cereals .

Rajasthan , which was earlier seven crop region has become eight crop region in the second period. Significant change observed in the states is that rape & mustard , which was not present in the crop combination estimate in the first period,

has become number three crop in 1989-92 period occupying 10% of the gross cropped area.

Tamil Nadu has also lost some area under coarse cereals and gained some area under ground nut .Rice still number one crop in the state has, however, lost considerable area under it in the second period of study, while groundnut & other pulses as a group has gained considerably. In crop sequence, number three position of jowar has been replaced by other pulses in the second period of the study .

Uttar Pradesh possesses diverse agro- climatic features . The eastern part bordering Bihar receives a good amount of annual rainfall and rice dominates in this region. Western part has similar climatic conditions as Punjab and Haryana, and this region has wheat as the most dominant crop . Area under wheat and rice has increased during the second period of the study. Gram , Other Pulses and Sugar cane have also become more significant in some pockets.

In West Bengal, climatic condition is suitable for rice and jute. But during the second period of study rape & mustard have gained considerably, as a share of total cropped area. In fact it has replaced wheat from third position in the states.

3.7 STATES MOVING TOWARDS SPECIALISATION: - Six out of fifteen states are moving towards specialization . The state moving towards specialization are Uttar Pradesh, Kerala, Himachal Pradesh, Karnataka ,, Bihar & Punjab . It is possible due to improvement in irrigation facilities in these states. Assured water supply for the whole year enables the farmers to move towards specialisation . Within these states ,Punjab and to some extent Bihar show a shift towards clear specialisation from 10 to 4

crops & 12 to 9 crops respectively. Out of the six states that have shifted towards specialisation, three states (Punjab,Bihar and Uttar Pradesh) have wheat & rice occupy the first 2 ranks in the cropping pattern. The strength of both have improved due to expansion of irrigation under these crops. In Himachal, it is wheat & maize that have gained. The two southern states have specialised due to further expansion in area under oilseeds i.e., groundnut in Karnataka & coconut in Kerala . Thus, it is either the effect of further spread of green revolution or the impact of TMO that have led to specialisation in these states. Although Punjab has continental climatic conditions extensive , irrigation by canals taken out from Sutlej , Beas and other rivers has enabled it to move towards spcialisation.

TABLE.3.3

STATES MOVING TOWARD SPECIALISATION

S. No	State	Changes between 78-82 to 89-92
1	Bihar	12 to 9
2	Himachal Pradesh	3 to 2
3	Karnataka	10 to 8
4	Kerla	13 to 12
5	Punjab	10 to 4
6	Uttar Pradesh	13

Source: Calculated from data, Indian Agricultural Statistics.

3.8 STATES MOVING TOWARDS DIVERSIFICATION : Six out of fifteen states have moved towards diversification . The states moving towards diversification are Tamil Nadu, Haryana, Rajasthan, Maharashtra , Gujarat and Madhya Pradesh. Greater parts in these states falls under dry climatic condition with around 50 -100 c.m. annual rainfall. Aravalli Malwa uplands streches over Madhya Pradesh and Rajasthan. Annual rainfall is not high and irrigation facilities are not developed , hence farmers

grow large number of crops in these region. Large part of Maharashtra falls under the rainshadow area of the western- ghat . Therefore, it receives only 50-75 c.m. of annual rainfall. In the drought prone areas of state the variability of rain fall is also very high. Irrigation facilities are limited to some pockets in these states . Thus in prevailing uncertain climatic conditions farmers, may move towards diversification.

Inspite of assured irrigation and better infrastructure facilities in Haryana diversification has taken place in the state. The region has diversified from 6 to 7 crop region that is due to the inclusion of rape & mustard in the second period (89-92) of the study. It may be noted that as in specialising , northern states, the area under both wheat & rice have shown increase. But substantial increase in area under oilseeds along with this have resulted in diversification.

The States of Gujarat and Tamil Nadu are also similar to the other states of this region. A large part of the states falls under dry climatic conditions . coastal parts of Gujarat and Tamil Nadu receives around 100 c.m of annual rainfall but as we move towards interior the amount of rainfall goes on decreasing. In these states also farmers are moving towards diversification.

TABLE 3.4

STATES MOVING TOWARDS DIVERSIFICATION

S. No	State	Changes between 79-82 to 89-92
1	Tamil Nadu	13 to 14
2	Haryana	6 to 7
3	Madhya Pradesh	8 to 15
4	Maharashtra	14 to 15
5	Gujarat	8 to 12
6	Rajasthan	7 to 8

Source: Calculated from data, Indian Agricultural Statistics.

3.9 STATES SHOWING NO CHANGE :-_ After analyzing states moving towards specialisation and diversification there are three more states namely Andhra Pradesh, Orissa and West Bengal which are showing no change in their crop combination regions. Almost all the crops which were present during the first period of analysis are also present during the second period of analysis but crop percentages have changed. These are more clearly illustrated in the following table:

TABLE 3.5

PERCENT CHANGE WITHIN MAJOR CROPS BETWEEN 79-82 TO 89 TO 92

ANDHRA PRADESH

S.NO.	Crops	Change (between 79 to 82 to 89 -92)
1	Rice	30 to 33
2	Ground nut	11 to 19
3	Jowar	10 to 9
4	Cottan	3 to 5
5	Bajra	4 to 1

Source: Calculated from data, Indian Agricultural Statistics.

These changes are again attributed to the success of TMO and increase in support price of cotton . The improvement in yield and productivity of rice may be the reason behind increase in gross cropped area of rice.

Orissa is a two crop combination region and there is no change in the second period also . But area under rice has reduced from 58 % to 55 % and area under other pulses has increased from 22 % to 23 % during the second period of study .It may be that pulses other than tur and gram are replacing ragi and other cereals (except rice and wheat) in the state .

West Bengal is a mono crop region. Rice is cultivated in almost 78% of the gross cropped area. The percentage of rice has gone down by 2 % during 1989 -92 period . Area under wheat , pulses , and rape.- mustard has gone up in the state. It may be due to improvement of irrigation facilities and bringing more and more area under non-kharif season in the state.

3.10 CONCLUSION The state level analysis reveals that extension effect and replacement effect both are the cause for changes in the cropping pattern in states . While the states like Orissa and west Bengal phenomena can be explained on the basis of extension effect where more and more areas are being brought under non- khanif season crop . The cause for change in southern and north western parts of the India can be explained by replacement effect . Replacement effect is dominant in these regions and coarse cereals are being replaced by rice , wheat in the Punjab , Haryana , Western U.P and by oilseeds in rest of the country. Both extension and replacement effects are assisted by development of infrastructural facilities and the government policies .

CHAPTER- 4

CHANGES IN CROPPING PATTERN : DISTRICT LEVEL ANALYSIS

1979-82 TO 1989-92

4.1 INTDODUCTION:-

The all India level analysis of crop combination regions for two-time period (1979-82 and 1989-92) reveals significant changes in the latter period. The change between 60's to early 80's was that proportion of area under wheat registered a phenomenal increase. Area shares under pulses and coarse cereals recorded a notable decline but there was hardly much change in the share of area under rice at the all India level.

But the most significant change between 1979-82 to 1989-92 was that while area under rice and wheat in gross cropped area has shown some increase coarse cereals and pulses have lost heavily. On the other hand oilseeds, sugarcane and cotton have registered substantial increase in their shares in gross cropped area.

For analytical purposes the whole of the country has been divided in to five regions. The five regions are northern, eastern, southern, western and central regions, the northern region includes the states of Haryana, Himachal Pradesh, Punjab, Uttar Pradesh and Rajasthan. The eastern region includes Bihar, Orrisa and West Bengal. Southern region includes Andhara Pradesh, Karnataka, Kerala and Tamil Nadu, while western region includes the states of Gujarat and Maharashtra. The central region has only one state and that is Madhya Pradesh. This chapter: -

(1) attempts an agricultural regionalisation of India derived from district level crop combination analysis.

(2) Brings out changes in crop combination regions between 1979-82 and 1989-92.

(3) Compare the changes with 1961-64 crop combination region, already done by M. Husain.

4.2 METHOLOGOY :-

Since the study done by M. Husain is based on Weaver's Method, to make a continuity in 1961-64 work and just to make the results comparable Weaver's method has been used. Here two time periods of 1979-82 and 1989-92 have been selected to show the major shift in the cropping pattern due to subsequent changes in agricultural policies, technologies etc. The first period of 1979-82 attempts to capture the crop-combination region after the spread of new HYV technique to the other areas of the country and second period of 1989-92 examines the cropping pattern after spread of green revolution to eastern and central India and policy impact of technology mission on oilseeds. The latter period was also determined by the latest data available for cropping pattern at the district level state excluded are Jammu & Kashmir North-Eastern state and Goa due to lack of data availability.

4.3 NORTHERN REGION :-

From table 4.1 and detailed district level crop-combination it appears that in north India, which is represented by Haryana, Himachal Pradesh, Pubjab, Uttar Pradesh and Rajasthan, there is a dominance of 2 to 5 crop combination regions. Out of 114 districts in the region, 22% of the districts have gone for specialization; 37% of the districts have moved toward diversification and 41% of the districts show no change between the two time periods. Punjab is the most specialized state in the region. This part of India which is popularly termed as wheat producing region has undergone a major shift towards rice in the late 80's and early 90's. In the northern region wheat is the most dominant crop and

TABLE 4.1

NUMBER OF CROPS ACCORDING TO CROP COMBINATION REGIONS

NORTHERN REGION

	HARAYANA		HP		PUN.		U.P.		RAJASTHAN		NORTHERN REGION	
	I	II	I	II	I	II	I	II	I	II	I	II
No.of Dis.	12	12	12	12	12	12	52	52	26	26	114	114
1Crop	-	-	-	1 (8)	-	1(8)	-	-	-	-	-	2(2)
2 Crop	2(17)	2(17)	6 (50)	7 (58)	2(17)	7(58)	9(17)	11(21)	2(8)	2(8)	21(18)	29(25)
3 Crop	1 (8)	-	4 (33)	3 (25)	4(33)	2(17)	11(21)	13(25)	6(23)	5(19)	26(23)	23(20)
4 Crop	1 (8)	3 (25)	-	-	3(25)	2(17)	8(15)	12(23)	3(11)	3(11)	15(13)	20(17)
5 Crop	3 (25)	2 (17)	-	1 (8)	-	-	2(4)	1(2)	3(11)	5(19)	8(7)	9(8)
6 Crop	1 (8)	1 (8)	-	-	-	-	-	-	3(11)	2(8)	4(4)	3(3)
7 Crop	2 (17)	-	-	-	1(8)	-	1(2)	-	2(8)	4(15)	6(5)	4(4)
8 Crop	-	2 (17)	1 (8)		1(8)	-			2(8)	1(4)	4(4)	3(3)
9 Crop	-	1 (8)	1 (8)		-	-			1(4)	1(4)	2(2)	2(2)
10 Crop	-	-	-	-	-	-	1(2)	1(2)	2(8)	-	3(3)	1(1)
11 Crop	2 (17)	1 (8)	-	-	1(8)	-	5(10)	3(6)	1(4)	3(11)	9(8)	7(6)
12 Crop	-	-	-	-			6(12)	5(10)	-	-	6(5)	5(4)
13 Crop	-	-	-	-			6(12)	2(4)	-	-	6(5)	2(2)
14 Crop	-	-	-	-			3(6)	2(4)	1(4)	-	4(4)	3(3)
15 Crop	-	-	-	-			-	1(2)	-	-	-	1(1)

Source:-Calculated from data, Indian agricultural statistics.

I = 1979-82 PERIOD, II = 1982-92 PERIOD

FIGURE IN ( ) SHOWS % OF THE TOTAL NO. OF DISTRICTS

Is being cultivated as number one crop in around 58% of the district. Jowar and bajra are clearly being replaced in this region (see table 4.2 and 4.3)

TABLE 4.2

SHIFTS TOWARDS SPECIALISATION/ DIVERSIFICATION IN NORTHEN REGION BETWEEN 1979-82 TO 1989-92 (% OF DISTRICTS).

Sl.No	States	Specialization	Diversification	No change
1.	Haryana	50 %	42%	8%
2.	H.P.	25%	17%	58%
3.	Punjab	75%	8%	17%
4.	Uttar Pradesh	31%	17%	52%
5.	Rajasthan	31%	31%	38%
6.	Northern Region	22%	37%	41%

Source:-Calculated from data, Indian agricultural statistics.

TABLE 4.3

FIRST RANKING CROPS IN NORTHERN REGION

(% OF DISTRICTS)

States	Rice		Wheat		Jowar		Bajra		Maize		S. cane		G. Nut	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II
Haryana	-	-	67	75	-	-	17	17	-	-	-	-	-	-
HP	-	-	75	67	-	-	-	-	8	17	-	-	-	-
Punjab	0	8	100	91	-	-	-	-	-	-	-	-	-	-
UP	23	19	71	73	-	-	-	-	-	-	-	4	-	-
Rajasthan	-	-	-	-	15	11	46	38	19	19	-	-	-	-
Northern Region	11	10	58	58	4	3	13	11	5	6	-	2	-	-

Source:-Calculated from data, Indian agricultural statistics.

I = 1979-82, II = 1989-92

4.3.1 HARYANA :-

Agro -Climatic Regional Panning unit (ARPU) of Planning Commission has divided the entire state of Haryana in to three regions for planning purpose based on topography, rainfall and soil. They are foothills of Shivalik, plains and arid zone. State receives between 320 to 900mm annual rainfall and climate can be termed as semi arid to extreme arid.Soil of the state is mainly alluvial in nature.

Haryana can be termed as mostly 2-5 crop region (see appendices A iv for detail) where wheat, rice, bajra, cotton and gram predominates. The analysis of 1979-82 and 1989-92 reveals a shift toward specialization of crops in Ambala and Karnal which have good amount of rainfall. But in Hissar and Gurgoan where rainfall is less and climate is extreme arid crops are moving towards diversification. Comparison between 79-82 to 89-92 reveals that out of 12 district of the state 50% have moved towards specialization and 42% have moved toward diversification (see table 4.2).

Wheat is number one crop in almost all the districts except Bhiwani and Narnaul where this position has been occupied by bajra. Area under rice has increased considerably in the recent years and the crop has become number two crops in most of the districts. Almost 70% of the gross cropped area is irrigated and the source of irrigation are Eastern Yamuna canal and Bhakra Canal. Rohtak is the most diversified crop region having 11- crops during the 2nd period of analysis.

Overall in the state, there has been substantial increase in the area under rice and wheat. Such a change is indicative of break through of biochemical technology combined with price support, market and agricultural infrastructure. Huge losses in the area under gram can be observed in the state but this is more or less compensated by a four fold increase in the area under tur. Increase in the area under cotton can probably be associated with the high profitability of the crop. Share of area under mustard and repeseed has increased by two and half times at cost of coarse cereals as its area as percentage of gross cropped area has been continuously declining. WRCt, WRMzJ are the dominant crop combinations.

4.3.2 HIMACHAL PRADESH :-

The state has been divided in to two agro- climatic regions. They are the western humid zone of Bilaspur, Chamba, Hamirpur, Kangra, Kullu, Shimla, Sirmaur, Solan and Una districts having brown alluvial soil with 1300 mm of annual rainfall. The second region is dry temperate zone of Kinnaur, Lahul & Spiti districts having mountain soil with annual rainfall around 800 mm in the region.

It is a land of valleys and mountains, springs and stream channels. Main rivers of the region are Ravi, Beas, Sutluj etc. Table 4.2 reveals that out of 12 districts of the state 25 % of the districts have gone for specialization, 17% have moved towards

diversification and 58% of the districts are showing no change in their crop combination regions. Table 4.1 reveals that most of the districts fall in 2-3 crop region with wheat , maize and bajra are the major crop. Detailed crop combination region (see appendices A v). shows that all the districts have wheat as number one crop, except Chamba, Solan and Lahul/Spito. Maize in number one crop in Chamba and Solan districts.

Interestingly potato has become number one crop in Lahul/Spiti occupying around 43% of GCA in the first period which goes down to 33% in the second period. In this district other pulses which was number one crop in 61-64 period has become number two crop in 1989-92 period. Shimla has become the most specialized district due to its shift from 9 crop region (79-82 period) to 1 crop region (89-92 period). Wheat seems to be replacing all other crops of the district. Comparison with 1961-64 result show very little change in the crop combination regions. The western agro-climatic region has wheat as the most dominant crop. WMz is the most dominant crop combination in the state.

4.3.3 PUNJAB :-

Punjab is agriculturally the most developed state of the country. There are three distinct agro- climatic regions in the state. The sub humid part of northern region having 1150 mm annual rainfall with clay loam soils. The semiarid central part having rainfall around 650 mm and with loamy soil. The arid southern part having only 375 mm of annual rainfall with sandy & loamy soil. In the state the net sown area is about 83.5% of the total reported area. In spite of insufficient rainfall, presence of large number of irrigation projects, like upper Bari Doab, Sirhind Canal, Bhakra-

Nangal Dam, Sutluj - Beas link, Pong Dam, Thein dam etc. have contributed to the available irrigation facility is the state.

Notable change between 1979-82 to 1989-92 is that the state has become more specialised in the latter period (see appendices A xi). Most of the districts of the state are 2-4 crop regions in both periods. Wheat which was earlier number one crop in the state is still number one crop in all but one district of the state (see table 4.3). In the 1989-92 period Patiala has become mono crop rice producing region. This can be termed as a significant change because rice has become number one crop in the arid part of the state. A rapidly reducing water table in the region is the big problem here and sustainability of crop is in question. In 61-64 wheat was number third crop in Patiala, and maize was occupying number one position. From table 4.2 it is clear that 75% of the districts have moved towards specialization and only 8% of the districts have moved towards diversification.

Such a large scale adoption of rice cultivation in semi arid Punjab can be explained by a very high percentage of net area under irrigation (more than 85%). Such a move by farmers got strengthened through very high yield achievements of the crop through assured water supply and high fertilizer consumption (290 kg/hectare) presence of large number of irrigation projects have added to the area under irrigation. Other notable changes in the state are gain in area under cotton and losses in the area under gram.

Thus changes in the cropping pattern of the Punjab plain in due to a shift towards food irrigated crop (rice,wheat and maize) spread in to the rainfall deficit area.

Pulses other than gram along with the other rainfed crops like jowar, bajra and barly have registered a decline in their area. The spatial pattern of change in the crop

specialization generally corresponds with the pattern of availability of water (M.A.Qazi & F.K. Mohammed, 1984). The districts relatively well placed in terms of water supply show a strong tendency toward specialization, while those deficient in water are characterized by diversification of crops. The 1961-64 crop combination region also confirm a dominant trend of specialization. The semi arid districts of Amritsar, Ludhiana, Patiala. Jullandher & Kapurthala have gone towards specialization over the past three decades. Hoshiarpur which falls under sub humid climate where ground water utilization is least, has shown no change in the number of crops in the crop combination analysis. The state has become 4 crop combination region (1989-92)from 10 crop combination regions (1979-82). Rice has become number two crop in all the districts except Bhatinda, Faridkot and Hoshiarpur. WRCt is the most dominant crop combination in the state.

4.3.4 UTTAR PRADESH :-

The state has been divided in to eight sub regions. There are as follows:-

AGRO CLIMATIC REGIONS OF UTTAR PRADESH

Region	ACRP Region	Districts	Rainfall mm	Climate	Soil Type
1	Western Hill	Dehradun, Chamoli, Uttar Kashi, Tehri, Pauri, Pithorgarh, Almora, Naintital	1675	Humid	Red loam and brown forest soils.
2	North eastern plains	Bahraich, Basti,Deoria, Gonda, Gorakhpur.	1214	Moist Subhumid to Dry Subhumid	Sandy loam to loam calcareous clayey Deep Alluvial.
3	Easter plains	Azamgarh, Ballia, Faizabad, Gazipur, Jaunpur, Varansai	1025	Dry sub humid to moist sub humid	Light Alluvial Calcareous clay.
4	Vindhyan	Mirzapur	1134	- do -	Sandy loam Red yellow

					clay.
5	Central Plains	Allahabad, Fatehpur, Unnao, Rae Bareily, Lucknow, Hardoi, Sitapur, Kheri, Pilibhit, Pratapgarh, Sultanpur, Bara Banki.	979	Dry sub Humid to semi arid.	Alluvium calcareous sandy loam.
6	North western plains	Bareliy, Bijnor, Bulandshahr, Ghaziabad, Meerut, Moradabad, Rampur, saharanpur, shahjanpur, Muzaffarpur.	907	- do -	Loan to silty loam
7	South western plains	Budaun, Agra, Ferozabad, Aligarh, Mathura, Mainpuri,Etah, Etawah, Kanpur, Farrukhabad.	721	Semi arid	Alluvium calcareous clay
8	Budelkhand	Jalaun, Jhansi, Hamirpur, Banda, Lalitpur.	902	Dry sub humid to dry arid.	Coarse loamy sand, red and black.

Source:- ARPU working paper,1994

Table 4.1 reveals that most of the districts like other districts of northern region falls under 2-4 crop region. Table 4.2 reveals that out of the 52 districts of the state nearly 30% of the districts have moved towards specialization and only 17% of the district have moved towards diversification. Nearly 50% of the districts have not registered change in terms of number of crop combination. Diversification is mainly observed in the Bundelkhand region and in the districts like Jhansi and Hamirpur. This region is agroclimatically dry with sub humid to dry arid climate regions with annual rainfall of about 900 mm. A shift towards diversification in such an agro climatic region probably indicate that farmers in these districts are moving towards a more stable croping pattern in terms of their production trend.

North Western plains covering the district of Bareily, Bijanor, Bulandshahr , Ghaziabad, Merrut, Muradabad, Rampur, Saharanpur, Shahjahanpur and Muzaffarnager have similar agro-climetic and socio- economic characters like Punjab and Haryana. The region is dry sub humid to semi arid region having loam to silty loam soil . This region shown similarity with Punjab and Haryana. This is

reflected form the fact the most of the districts in the this region have moved towards specialization

Table 4.3 indicates that around 70% of the districts have wheat as number one crop in the state. Around 20% of the districts have rice as the primary crop. Sugarcane has become number one crop in Muazaffarnagar and Merrut (1989-92 period) replacing wheat which was earlier the first ranking crop in these district. Hamirpur in Bundelkhand region experiences a cropping pattern trend different from other districts with gram as the first crop in both periods of our study. Balia and Gorakhpur have registered a change from rice to wheat as number one crop. Opposite is the case in Sultanpur and Barabanki where rice has become number one crop instead of wheat during 1989-92 period.

J.C. kuniyal in 1988 has observed that there in complete absence of monoculture in the terai region. Irrigational facilities besides favorable natural conditions and nutritive soil elements are responsible for the emergence of well marked RW (Rice – Wheat) region in the terai belt. This is confirmed from the crop combination analysis of our study.

When the 1961-64 crop combination result is compared with 1979-82 and 1989-92 results, it appears the most of the north western, central plain and Uttranchal districts reveal trends of specialization. Most of the south western plains and Bundelkhand districts having comparatively low rainfall in the state are moving towards diversification. Share of area under cereals and some pulses show a decline in the districts which are moving towards specialization and this trends is common to many parts of the country. The most dominant crop combination regions is WMzFC or WSCR in the western part RW or RWMz in the eastern part of the state.

4.3.5 RAJASTHAN :-

Rajasthan can be broadly classified in to five agro climatic regions :-

AGRO CLIMATIC REGIONS OF RAJASTHAN

ACRP Region	Districts	Rainfall (mm)	Climate	Soil Type
North Arid	Ganganager	360	Arid	Calcareous Alluvial, desert
Southern Plains	Banswara, Dungarpur, Pali, Sirohi Bhilwara, Udaipur, Chittorgarh	550	Semi arid	Clay loam, silty loam, sandy loam
Eastern Plains	Bundi, Kota, Ajmer, Tonk, Jaipur, Alwar, Bharatpur, S.madhopur, Dholpur	550	Semi-arid (drier-half)	Clay loam. Loamy sand to silty loam and clay.
Southern Plateau	Jhalawar	874	Semi –arid (wetter-half)	Medium black
West Arid	Barmer, Bikaner, Churu, Jaisalmer, Jalore, Jhunjunu , Jodhpur, Nagore, Sikar	395	Arid to extrme arid	Desert, clay

Source:- ARPU working paper,1994

Nearly 90% of rainfall is received during kharif period. The frequency of years with large negative deviations form normal rainfall is high often leading to drought in the states.

From table 4.1 it is clear that the districts in the state mostly falls under 2 to 8 crop combination regions. Table 4.2 reveals that equal number of districts are moving towards specialization and diversification (31% each) and the remaining 38% show no change in the number of crop combination regions over the study period (1979-82 to 1989-92 period)

Given the ecological setting of the state drought resistant coarse cereals under standably occupy positions of dominance in the state. This is demonstrated by the fact that 46% of the districts having bajra, 19% of the districts having maize and 11% of the districts having jowar as the first raking crop (1989-92 period, table 4.3)

Huge gains in the area under oilseeds have been reported in the latter period (89-92 period) of the this increase in mainly due to the increase is area under rapeseed & mustard and sesamum . This increase can be linked with the increase in the administered price of oilseeds and success of TMO in the state. Area under cotton has also gone up due to high profitability of the crop as a result of introduction of improved variety of the crop, unlike most other states, the area under coarse cereals have remained constant between the two time period. Slight decline in area under arhar, gram and rice have also been reported from the state.

From table 4.3 and detailed crop combination regions of Rajasthan (see the appendices A xii) it is clear that Alwar, Bhartpur, Sirohi and Sawai Modhopur have Rapessed & mustard as number one crop (1989-92 period).

Maize in number one crop (89-92 period) in Udaipur, Dungapur, Chittorgarh and Banswara due to relatively high rainfall and availability of some irrgational project in this part of the state. Ganganagar which falls under arid climatic conditions has gram as major crop. It has similar climatic character with the Ferozepur district of Punjab where gram in one of the important crops. Rest of the districts have either jowar or bajra as number one crop. BFCOP is the most dominant crop combination in drier part of the state while the eastern districts have MzRW or RMzBW crop combinations.

When we compare 1961-64 crop combination results with 1979-82 and 1989-92 results, and find that most of the districts have moved towards diversification. Rape & mustard, sesamum, ground nut, fodder crop and cotton are the new crops making their presence in the crop combination regions.

4.4 EASTERN REGION :-

The region consists of the states of Bihar, Orissa and West Bengal. Although in the beginning the region was agriculturally not so developed but there are sufficient evidences to show that this region has been a late adopter of HYV technology. It achieved appreciably high growth rates in the period under study.

Table 4.4 reveals that the entire region can be categorized between 1 to 4 crop combination regions with one or two exceptions of more diversified crop combination region. Out of a total of 61 districts more than 50% of the districts show no change in both number and crop content of estimated crop combination regions between two time periods under study. Nearly 28% of the districts in this regions have moved towards specialization while only 20% of the districts have moved towards diversification (see table 4.5)

Infrastructure is not so developed when compared with other parts of the country, Rainfed agriculture with a substantial area share of rice is common to almost 98% of the districts (see table 4.6).

TABLE 4.4

NUMBER OF DISTRICTS ACCORDING TO CROP COMBINATION REGIONS - EASTERN REGION

	BIHAR		ORISSA		W.BENGAL		ESTERN REGION	
	I	II	I	II	I	II	I	II
No.of Dis.	31	31	13	13	17	17	61	61
1Crop	3 (10)	5 (16)	4 (31)	2 (15)	13 (76)	11 (65)	20 (33)	18 (29)
2 Crop	3 (10)	7 (22)	5 (38)	7 (54)	-	-	8 (13)	14 (23)
3 Crop	9 (41)	9 (41)	-	-	3 (18)	1(6)	12 (20)	10 (16)
4 Crop	5 (16)	4 (13)	-	-	-	-	5 (8)	4 (6)
5 Crop	1 (3)	-	-	-	-	3 (18)	1 (2)	3 (5)
6 Crop	-	-	-	-	-	1 (6)	-	1 (2)
7 Crop	-	2 (6)	1 (8)	-	-	-	1 (2)	2 (3)
8 Crop	2 (6)	2 (6)	-	1 (8)	-	1 (6)	2 (3)	4 (6)
9 Crop	4 (13)	1 (3)	-	-	1 (6)	-	5 (8)	1 (2)

10 Crop	3 (10)	-	-	1 (8)	-	-	3 (5)	1 (2)
11 Crop	-	-	1 (8)	-	-	-	1 (2)	-
12 Crop	-	1 (3)	-	2 (15)	-	-	-	3 (5)
13 Crop	1 (3)	-	1 (8)	-	-	-	2 (3)	-
14 Crop	-	-		-	-	-		-
15 Crop	-		1(8)	-	-	-	1 (2)	-

Source:-Calculated from data, Indian agricultural statistics.

I = 1979-82 PERIOD

II = 1989-92 PERIOD

TABLE 4.5

SHIFTS TOWARDS SPECIFICATION /DIVERSIFICATION IN EASTERN REGION BETWEEN 1979-82 TO 1989-92 (%) OF DISTRICTS)

	STATES	SPECIALI-SATIN	DIVERSIFICATION	NO CHANGE
1	Bihar	45%	6%	48%
2	Orissa	15%	46%	39%
3	West Bengal	6%	23%	71%
	Eastern region	28%	20%	52%

Source:-Calculated from data, Indian agricultural statistics.

TABLE 4.6

FIRST RANKING CROPS IN EASTERN REGION

(% OF DISTRICTS)

	STATES	RICE		WHEAT		JOWAR		BAJRA		MAIZE	
		I	II	I	II	I	II	I	II	I	II
1	BIHAR	97	97	-	-	-	-	-	-	3	3
2	ORISSA	100	100	-	-	-	-	-	-	-	-
3	W.BENGAL	100	100	-	-	-	-	-	-	-	-
	EASTERN REGION	98	98	-	-	-	-	-	-	2	2

Source:-Calculated from data, Indian agricultural statistics.

In Bihar only one district i.e., Begusarai has maize as the most dominant crop. In Orissa and West Bengal all the districts have rice as the most dominant crop in both the period of study (1979-82 and 1989-92). In this region area expansion has taken place by bringing more and more area under non Kharif cultivation. The region receives most of its rainfall during monsoon season and is extensively covered by alluvial soil.

4.4.1 BIHAR:-

The states can be broadly divided in to two phsiographic units, plains and plateau. The topography is mainly plains in the north sloping towards south east with big rivers like Ganges, Ghaghra, Gandak, and Kosi which frequently causes floods during kharif. The plain can be subdivided in to North Bihar Plains and South Bihar Plain. South Western Bihar is a plateau region and called as Chhotanagpur hills.

The plain of Bihar enjoys favourable climatic condition and grow a wide variety of crops. Annual average rainfall is about 1250 mm. in plain and 1400 mm in plateau region. Dry to moist sub humid climate prevails in the plain and moist sub humid to dry sub humid in the hill and plateau region. There are large variation in soils, ranging from red and yellow sandy to loamy in the plateau and sandy loam to clay in the plans.

Table 4.4 reveals that entire state falls mostly between 1 to 4 crop combination regions with some districts particularly in the southern parts of the state showing multi crop combination and more diversified states. Particularly Hazaribagh and Palamau are the districts that have relatively diversified cropping pattern.

Changes between 1979-82 to 1989-92 towards specialization has been observed in the northern districts of eastern and western Champaran, Saran, Siwan,

Gopalganj, Bhojpur, and Darbhanga. This region comes under dry to moist sub humid climatic conditions with annual rainfall of 1275 mm. A large number of irrigation projects like Kosi, Gandak and Son falls in this district. These two reasons may be attributed towards large scale specialization in the region. Some southern district like Dhanbad, Singhbhum , Ranchi and Santal Pragana have rice as mono crop combination region. These districts falls under moist sub humid climate and have more than 1300 mm of rainfall occurring mostly during kharif period. This may be the reason behind adopting mono crop cultivation of rice. Out of the 31 districts in Bihar, thirty districts have rice as the number one crop (see appendices Aii) with the exception of Begusarai where maize is the number one crop and rice occupies third position after wheat.

Area under wheat has increased substantially due to arrival of new technology in the late 80's and area under mustard is seen to be increasing with the decrease of area under coarse cereals and pules. In the northern part, rice and wheat seems to be replacing other crop wherever specialization is taking place and in the southern part rice, maize seems to be replacing other corps. In the northern part RWOP or RWMZ is the most dominant crop combination regions and in the southern part it is either rice as mono crop or RMZ as the most dominant crop combination in the state.

Comparison of 1961-64 result with 1979-82 and 1989-82 reveals a shift towards diversification in Hazaribagh, Plamau and Purnea districts. Other districts have more or less retaind similar number of crops in their crop combination regions. Changes between 60's and 80's and 80's and 90's are not consistent. In districts like Hazaribagh and Muzaffarpur between 60's to 80's there is diversification and between 80's to 90's there is specialization of crops.

4.3.2 ORISSA :-

The state forms part of two agro-climatic zone. For purpose of state level panning, they are grouped in to five regions showing district rainfall, climate and soil characteristic.

AGRO ACLIMATIC REGIONALIZATION OF ORISSA

Region	ACRP Region	Districts	Rainfall (mm)	Climate	Soil Type
1.	Inland	Balangir Dhenkanal Sambalpur	1271	Dry subhumid	Medium to deep Black, Red and yellow
2.	Northern Plateau & Hills	Keonjar, Mayurbhanj Sundargadh	1436	Moist to dry subhumid	Red sandy Red and Yellow
3.	S.W. Hills	Kalahandi Koraput Phulbani	1338	- do -	- do -
4.	Coastal	Baleshwar Cuttack, Puri	1287	Moist subhumid	Deltaic and coastal alluvial
5.	Ganjan	Ganjam	1128	Dry subhumid	Red loamy coastal alluvial

Source:- ARPU working paper,1994

From table 4.4 it is clear that the state is generally 1 to 2 crop combination region. Rice is the first ranking crop in all the district (table 4.6). Unlike the neighboring state of Bihar only 12% of the districts indicate a shift towards specialization and more than 45% of the districts are moving towards diversification. This trend is in variance with the general changes (see table 4.5) observed in eastern India. It may be noted that a substantial part of the state falls under dry agro-climatic zones and this may be the basis for the above mentioned trend.

Bolangir, Phulbani, Keonjhar and Koraput districts have multi crop combination estimates. These districts are situated on western and interior regions of the state where climate becomes continental with marked extremities.Utilisation of

ground water in this district is very low ranging between 1.9 to 2.6% (ARPU working paper ,no.5,1991).Adoption of large number of crops in their crop combinations in these districts has been observed. Area under tur has increased form less than 1% 1 1979-82 period to more than 2% in the 1989-92 period. Similarly area under pulses (except tur and gram) has also gone up by more than 1% during the period under study. This is purely due to expansion effect. In Orissa increase in area under pulses and oilseeds was due to increase in gross cropped area made possible by bringing more area under cultivation such as marginal lands, uplands etc. (Kumar & Mrathyunjaya, 1989). In case where there has been a shift towards sesamum, nizer seed, tur, groundnut and maize are emerging as new crops.

Comparison with 1961-64 result reveals that all the districts have moved towards diversification in 70's. Sambalpur, Mayurbhanj and Sundergrah districts were mono crop in 60's and they have maintained their status in 70's also.

4.3.2 WEST BENGAL :-

The state has been divided in to six agro climatic regions. These are as follows :-

AGRO CLIMATIC REGIONS OF WEST BENGAL

Region	ACRP Regions	Districts	Rainfall mm	Climate	Soil Type
1.	Barind	West Dinajpur, Maldah.	2641	Per humid to humid	Brown hills
2.	Alluvial	Nadia, Burdwan, Hoogli Howrah Midnapur, Murshidabad	1446	- do -	Deltaic alluvial
3.	Coastal	N. 24 Parganas S. 24 Parganas	1607	- do -	- do -
4.	Rarh and Eastern Plateau	Birbhum, Bankura Purulia	1302	- do -	Red loamy
5.	Terai	Jalpaiguri, Coochbehar	2809	Humid to per humid	Alluvial, red loamy
6.	Hills	Darjeeling	264	Per humid to	Brown hill

				humid	soils

Source:- ARPU working paper,1994

Table 4.4 and detailed crop combination regions of West Bengal (refer to the appendices xv) reveals that most of the districts in the state falls under the category of mono crop combination region. There is no change in the crop combination status between the two time periods for more than 70% of the districts. Around 23% of the districts have moved towards diversification and only 6% of the districts have moved towards specialization (table 4.5). Rice is the first ranking crop in all the seventeen districts of the state (table 4.6).

Irrigation facilities is better developed as compared to the rest of the eastern region. Around 54% of the gross cropped area was irrigated at the end of the terminal period of research. It was around 24% in 80's (Bhalla G.S. and Singh G. 1997).

Area under rice has increased slightly in the state. But area under pulses, specially gram and coarse cereal have gone down.

When we compare 1961-64 crop combination regions with 1982-85 and 1989-92 crop combination regions then we find that majority of the mono crop rice regions in the earlier period have retained the same status in the latter period. But districts like Nadia, Murshidabad, Malda and Jalpaiguri have shown clear diversification between the last three decades. In these districts rape & mustard maize and other pulses (except tur and gram) have emerged as new crops in the crop combination regions.

4.5 SOUTHERN REGION :-

This region consists of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. Large parts of the region have highly diversified cropping pattern with the estimated crop combination number going up to fifteen in some cases. The impact of green revolution was felt much earlier in this region as compared to the eastern and central parts of the country. Also technology mission on oilseeds of 1986 dramatically

changed the oilseeds production scenario in the region. Around 33% of the gross cropped area have become irrigated in the terminal period under study, which was around 29% in 1979-82 period (Bhalla G.S. & Singh G., 1997). But due to water disputes of Krishna and Kaveri rivers a large potential of irrigation and power production lie unutilized affecting the agricultural development of the region adversely.

Out of total of sixty eight districts in the region, nearly 30% districts in the region, nearly 30% districts have moved towards specialisation and 35% districts have moved toward diversification

TABLE 4.7

NUMBER OF DISTRICTS ACCORDING TO CROP COMBINATION

REGIONS SOUTHERN REGION

	Andhra Pradesh		Karnataka		Kerela		Tamil Nadu		Southern Region	
	I	II	I	II	I	II	I	II	I	II
No. of Dis.	23	23	19	19	11	11	15	15	68	68
1 Crop	1 (4)	2 (9)	1 (5)	1 (5)	-	-	2 (13)	-	4 (6)	3 (4)
2 Crop	1 (4)	2 (9)	1 (5)	1 (5)	2 (18)	2 (18)	2 (13)	3 (20)	6 (9)	8 (12)
3 Crop	1(4)	1(4)	1 (5)		2 (18)	2 (18)	1 (7)	-	5 (70	3 (4)
4 Crop	2 (9)	3 (13)	1 (5)	2 (10)	2 (18)	1 (18)	1 (7)	1 (7)	6 (9)	8 (12)
5 Crop	5(22)	2 (9)	1 (5)	2(10)	2 (18)	1 (9)	1 (7)	-	9 (13)	5 (70
6 Crop	1 (4)	1 (4)	3 (16)	3 (16)	-	1 (9)	1 (7)	2 (13)	5 (70	7 (10)
7 Crop	-	-	3 (16)	2 (10)	1 (9)	-	1 (7)	-	5 (7)	2 93)
8 Crop	-	1(4)	1 (5)	-	1 (9)	-	-	1 (7)	2 (3)	2 (3)
9 Crop	4 (17)	2 (9)	1 (5)	2 (10)	-	1 (9)	-	-	5 (7)	5 (17)
10 Crop	1 (4)	3 (13)	2 (10)	1 (5)	-	-	1 (7)	2 (13)	4 (6)	6 (9)
11 Crop	1 (4)			1 (5)	-	-	-	-	1 (1)	1 91)
12 Crop	4 (17)	4 (17)	2 (10)	2 (10)	1 (9)	1 (9)	1 (7)	1 (7)	8 (12)	8 (12)
13 Crop	-	1 (4)	1 (5)	-	-	1 (9)		1 (7)	1 (1)	3 (4)
14 Crop	-	-	1 (5)	1 (5)	-	-	3 (20)	4 (27)	4 (6)	5 (7)
15 Crop	2 (9)	1 (4)	-	1 (5)	-	-	1 (7)	-	3 (4)	2 (3)

Source:-Calculated from data, Indian agricultural statistics.

I = 1979-82 period

II = 1989-92 period

Figure in ( ) shows % of the total number of districts

Around 40% of the districts have rice as the most dominant crop. Jowar is the dominant crop in around 16% of the districts (1989-92 period). Ground nut's dominance as number one crop is increasing as it has become number one crop in 12% of the districts (1989-92 period), which was true for only 4% of the districts in 1979 -82 period (see table 4.9)

Table 4.8

SHIFTS TOWARDS SPECIALISATION/ DIVERSIFICATION IN SOUTHERN REGION : BETWEEN 1979-82 TO 1989-92 (% OF DISTRICTS)

	STATE	SPECIALISATION	DIVERSIFIC-ATION	NO CHANCE
1.	A.P.	39%	44%	17%
2.	Karnataka	26%	26%	48%
3.	Kerala	27%	27%	46%
4.	T.N.	20%	40%	40%
	Southern Region	29%	35%	35%

Source:-Calculated from data, Indian agricultural statistics.

TABLE 4.9

FIRST RANKING CROPS IN SOUTHERN REGION

(%OF DISTRICTS)

	State	Rice		Wheat		Jowar		Bajra		Maize		G. Nut	
		I	II	I	II	I	II	I	II	I	II	I	II
1.	Andhara Pradesh	48	69	-	-	39	9	-	-	-	-	9	22
2.	Karnataka	21	16	-	-	26	37	-	-	-	-	0	0.5
3.	Kerala	45	18	-	-			-	-	-	-	-	-
4.	T.N.	73	53	-	-	7	13	-	-	-	-	7	20
	Southern Regions	45	43	-	-	18	16	-	-	-	-	4	12

Source:-Calculated from data, Indian agricultural statistics.

4.5.1 ANDHRA PRADESH :-The state may be divided in three broad segments :- coastal Andhra, Rayalaseema and Telangana. The state also has three climatic zones :-sub-humid,arid & semi arid. Mean annual rainfall varies from 570 mm in Anantpur district of Rayalaseema to 1161 mm in Vijaynagar district in coastal Andhra. The coastal districts have sub humid climate and is characterized by alluvial soil. Rayalaseema has the districts of Chittor, Cuddapah, Kurnool and Anantpur and falls under semi arid climate. Red sandy and black soils are found extensively in this region. Telengana region is semi arid in nature and has red sandy soil. Mehaboobnagar, Adilabad, Khammam, Nalgonda, Ranga Reddy, Medak, Nizamabad etc. districts falls under this region.

From table 4.7 it appears that the state has highly diversified crop combination regions. Mono crop is very rare in the state and all forms of crop combinations ranging from one to fifteen are present in the state. From table 4.8 it is clear that 44% districts of the state are moving towards diversification and 39% of the districts are moving towards specialization. The remaining 17% of the district show no change in the number of crop combination regions.

From table 4.9 it is clear that importance of rice is increasing in the state. From the first ranking crop in 50% of the district in the 1979-82 period it has become number one crop in 70% of the district in 1989-92 period. Jowar is loosing its importance rapidly, which is evident from the fact that it was the first ranking crop in only 10% of the districts in the terminal period as compared to 40% of the districts a decade ago. Ground nut is another crop beside rice which is growing in importance, as it was the first ranking crop in only 9% of the districts in 1979-82 period and this has been true in 22% of the districts in 1989-92 period. Dramatic increase in area

under ground nut to the tune of 70% attributed to both sharp increase in the administered prices and yield increase of the crop. The state thus seems to have responded well to the technology mission on oilseeds launched in the latter half of 80's. Pulses and cotton have also gained in significance in the state. Price policy and improved variety of cotton seem to be the main factors behind the increase in area under cotton in the state (Kumar & Mrathyunjaya, 1989).

The changes in crop combination regions from 1960 onwards are most striking in case of three districts. West Godavari district has moved towards diversification as it was entirely mono crop combination region in 60's and 80's but has become a 10 crop combination region in the early nineties. Just reverse in the case of Krishna and Anantpur district which have changed its status from 9 to 1 and 11 to 1 crop regions respectively between 80's and 90's. Interestingly when compared with the sixties trend, it may be observed that between, early sixties and seventies - these two districts had moved towards diversification. Changes in the other districts are more moderate. Except Chittor and Guutur districts all have moved towards diversification.

Ground nut, cotton, tur other pulses and maize are the new crops emerging in districts shifting towards diversification. The most dominant combination are RJGN in the Telengana region, GNRT in Rayalaseema region, and ROPGN in coastal region of the state.

4.5.2 KARNATAKA:-

ARPU has divided the state in to four agro climatic regions. The Northern dry region consists of Bellary, Belgaum, Bidar, Bijapur, Dharwar, Gulberga districts. This region gets around 690 mm annual rainfall and has black and red soil. Central, southern and Northern dry regions all three have semi-arid climatic. Central region receives around

680 mm of annual rainfall. Southern region covering the districts of Mandya, Mysore, and Hassan get more than 700 mm annual rainfall and has red loamy soil. The fourth region is called hill and coastal region and covers the districts of Uttar Kanada, Dakshin Kanada, Kodagu Chickmagalur and Shimoga districts. It receives more than 2000-mm annual rainfall and soil of this region is alluvial and lateritic.

Table 4.7 and detailed crop combination region (see the appendices A vi) of Karnataka reveals that this state is also characterized by highly diversified cropping pattern as the other states of the region. Only exception is Uttar Kanada district which experiences mono crop combination. From table 4.8 it is clear that out of 19 district of the state 26% district are moving towards diversification, another 26% are moving towards specialization. The remaining 48% of the total districts show no change in the number of crop combination region.

From table 4.9 it is clear that jowar is gaining importance in the state. All the districts like Belgaum, Bellery, Bidar, Bijapur, Dharwad, Gulberga and Raichur falling under dry northern region have jowar as number one crop. These districts receive comparatively less rainfall with respect to the other parts of the state. Area under coarse cereals has increased slightly in the state. This is mainly due to the increase in area under jowar and maize in the state. Hill districts of kodagu and Chickmagalur receiving more than 2000 mm of annual rainfall is suitable for the cultivation of coffee. Coffee is therefore the number one crop in these districts . Ground nut which was an insignificant crop in 1979-82, has become a major crop in Chitradurga district. Gains in the area under rice is probably due to spread of non-Kharif rice crop due to increase in irrigation facilities in the districts of the state. All these districts falls under semi arid region of the state.

Comparison with 1961-64 result reveals that diversification has taken place in almost all the districts. In Tumkur a shift towards specialization has been observed while is kodagu there has been change in the number of crop combination region. However, there is a change in the crop content. Rice having receded to the number two position in eighties and nineties as compared to number one in sixties. Groundnut, tus, sesamum, gram and maize are the new crops emerging in the diversifying district of the state.

Jowar is number one crop in the state. Ground nut occupies second position followed by rice. Area under cotton has gone down in the state unlike the trend in the other southern states. This is probably due to salinisation and water logging problem faced by farmers with the development of irrigation (P. kumar & Mruthyunjaya, 1989) in the state.

4.5.3 KERALA :-

ARPU has divided Kerala in to three agroclimatic regions. Coastal midland covers districts of Thiruvananthapuram, Cannanore, Kasargod & Quilon. This region receives around 3000 mm annual rainfall and has coastal alluvial, sandy soil. The second region midland covers Pathanamthitta, Kottayam and Palghat districts. This region has clay loam soil and receive more than 2300 mm annual rainfall. The third region covering districts of Idduki and Wynad falls under hill region and receives around 2500 mm of annual rainfall. Entire state falls under humid to per humid climate.

Form table 4.7 it appears that most of the districts in the state fall in the category between 2 to 5 crop combination regions. There are some districts having more than 5 crop combination region. There is complete absence of mono crop

region in the state form table 74.8 it in evident that 27% of the districts are moving towards specialization another 27% are moving towards diversification while 46% show no change in the crop combination region between the two time periods (1979-82 and 1989-92) .From detailed crop combination region of kerala (see appendices A vii) it becomes apparent that coconut is the number one crop (1989-92 period). Notable increase in the area under coconut (around 30% increase from 1979-82 period) has been observed. Rice which was number one crop in around 45% of the district in 1979-82 period (see table 4.9) has clearly reduced its dominance in 27% of the districts. Coconut is number one crop in seven out of eleveen districts of the state. Kerala has a distinctive cropping pattern different from any other state of India. This difference may be summed up as :-

(i) A Clear dominance of tree crops

(ii) Importance of perennials and annual crops, rice being the only important seasonal crop.

Here Rubber, spices, coconut dominate in the cropping pattern. Rice is number one crop in only Palghat and Ernakulam districts (1989-92 period). Cardomom is number one crop in Idduki and rubber is number one in Kottayam district in the last period under study.

Comparison with 1961-64 period reveals that all the districts have moved towards specialisation between 60's and 80's except Palghat district. From 80's to 90's most of the districts show no change except Cannanore, which has moved towards specialisation. This trend has bearing to the distinctive cropping pattern of kerala as the dominance of perennial crop acts as a chief factor in any change in the cropping patterns of the state. The new crops emerging in the crop combinations are tapioca,

bettlenut, black pepper and banana. Most dominant crop combination in the state in CoRRu in the midland and CoTaRuR in the coastal region.

4.5.4 TAMIL NADU :-

The state has been divided in to seven agro climatic by ARPU. The seven regions and its characteristics can be summed up as follows :-

AGRO CLIMATIC REGIONS OF TAMIL NADU

Region	ACRP Region	Districts	Rainfall (mm)	Climate	Soil Type
1.	North Region	Dharmapuri Salem	865	Semi arid	Red loamy & Sandy loam
2.	Central Region	Coimbatore, Madurai Truchirapalli	841	Semi arid to dry sub humid	Red and Black deltaic alluvial
3.	North East Coastal Region	Chengalpattu, Madras North Arcot, South Arcot	1036	Semi arid	Red loamy sandy Coastal alluvial
4.	Delta	Thanjavur	1113	Semi arid to dry sub humid	Deltaic alluvial Red loamy
5.	South East Region	Kamarajar, Rammanathpuram Tirunelveli ,P.M.Linga m	780	Semi arid	Red and black Coastal Alluvial
6.	South Region	Kanykumari	3127	Dry sub humid and per humid	Red loamy, laterite Coastal alluvial
7.	Hills	Nilgiri	2226	Per humid	Red loamy,

	Region				mixed red and black.

Source:- ARPU working paper,1994

From table 4.7 it is clear that Tamil Nadu has a varied crop combination across the districts. The number of crop combination region ranges from one to 15 across the districts in the first period of study. There is, however, no mono crop combination region during the second period of study. From table 4.8 it is clear that out of the 15 districts of the state 20% districts have moved towards specialization 40% districts have moved towards diversification and the other 40% of the districts show no change in the number of crop combination regions.

From table 4.9 it appears the rice as the most dominant crop is loosing its importance in the state. During 1989-92 period it was major crop in only 53% of the district as compared to 75% of the districts a decade ago. Jowar has lost its number one position in two percent of districts. Ground nut as in other southern states, is gaining in area in the state. It was number one crop in only 4% of the district in 1979-82 period but became number one in 12% of the districts in 1989-92 period. Area under arhar, ground nut and cotton has increased during the terminal period of study. But decline in area under coarse cereals and rice has been reported from the state. However, rice is still number one crop in the state followed by ground nut as the second ranking crop. Nilgiri district has tea as the first ranking crop. It comes under the hill region and the annual rainfall here is more than 2200 mm, which aids in growing tea extensively in the regions.

Comparison with 1961-64 result reveals that Ramanathpuram and Tirunelveli districts have moved towards diversification. Both there districts falls under semi arid climate region and the lowest amount of rainfall (around 780 mm) and this may be a factor in a shift towards diversification. All the regions except Thanjavur district

falling under semi arid climate have moved towards diversification. Thanjavur which was earlier ROSGNRg regions (1961-64) became mono crop in 80's and 2 crop region with ROP as the crop combination in 90's. In case of diversification the new crops that are emerging are sugar cane, castor, sesamum, maize and banana. In Nilgiri district diversification in the 90's led to inclusion in rice, black pepper and cardmom in its crop combination region.

In the semi arid region of the state RGNJ or RCtGN are the most dominant crop combination. In the central region of the state RJGN or JGNOP are the dominant crop combination. Southern region of Kanya Kumari receiving more then 2200 mm of rainfall has RcoRu crop combination during both 80's and 90's.

4.6 CENTRAL REGION :-

This region is represented by state of Madhya Pradesh. There exists a lot of diversity in terms of physical parameters in the state. The chief physical features are the northern plain, the Satpura hills, the Malwa Plateau, the Narmada Plain, the Chhattisgarh plain and the Bastar Plateau region. The western region receives moderate amount of rainfall but the southern region receives around 100-125 cm of the annual rainfall.

4.6.1 MADHYA PRADESH :-

ARPU has divided the state in the twelve distinct region on the basis of physical characteristics, rainfall and soil group. These are as follows :-

AGRO CLIMATIC REGIONS OF MP

Reg-ion	ACRP Region	District Region	Rainfall (mm)	Climate	Soil

1.	Chhatisgadh Plain	Durg, Bilaspur, Balaghat, Raipur, Rajnandgaon.	1271	Dry subhumid	Medium to deep black & yellow
2.	Northern Hills	Raigadh, Surguja, Shadol.	1436	Moist subhimid to dry subhumid	Red & Yellow
3.	Bastar Plateu	Bastar	1338	-do-	Red & Yellow
4.	Bundlekhand	Chhatarpur, Datia Tikamgadh	700	Dry subhumid	Mixed red & black
5.	Chhatisgadh	Mandla	1570	Moist sub humid	Red & Yellow
6.	Keymore Plateau & Satapura Hill	Jabalpur, Panna, Satna, Rewa, Sidhi, Seoni	1100	Dry sub humid	Medium black
7.	Vindhya Plateau	Bhopal, Damoh, Raisen, Sagar, Sehore, Vidisha.	1130	-do-	Shallow to medium black
8.	Satpura Plateau	Betul, Chhindwara, Narsingpur	1220	- do-	Shallow to medium black
9.	Central Narmada Valley	Hoshangabad,	1300	-do-	Deep balck
10.	Gird	Morena, Bhind, Gwalior, Guna, Shivpuri.	670	Semi-arid	Medium black alluvial.
11.	Jhabua hills	Jhabua	988	-do-	Medium to deep black
12.	Malwa and Nimar plateau	Indore, Dhar, Ujjain, Ratlam, Dewas, Mandsaur, Rajgadh, Shajapur, Khandwa, Khargone.	874	-do-	-do-

Source :- ARPU working paper, 1994

TABLE 4.10

NUMBER OF DISTRICTS ACCORDING TO CROP COMBINATION

REGIONS CERNTAL REGION

MADHYA PRADESH

	I	II

No. of Dis.	45	45
1 Crop	2 (4)	2 (4)
2 Crop	4 (9)	5 (11)
3 Crop	3 (7)	2 (4)
4 Crop	5 (11)	10 (22)
5 Crop	5 (11)	4 (9)
6 Crop	3 (7)	1 (2)
7 Crop	3 (7)	5 (11)
8 Crop	4 (9)	6 (13)
9 Crop	6 (13)	2 (4)
10 Crop	3 (7)	2 (4)
11 Crop	4 (9)	3 (7)
12 Crop	1 (2)	3 (7)
13 Crop	2 (4)	-
14 Crop	-	-
15 Crop	-	-

Source :-Calculated from data, Indian Agricultural Statistics

I – 1979-82 Period
II – 1989-92 Period
Figures in ( ) shows % of the total no. of districts

Table 4.10 reveals that the region has highly diversified crop combination. The number of crop combination varies between 1 to 12 crop combinations across the states. But majority of the districts can be categorized between 2 to 9 crop combination regions during the periods of 1979-82 and 1989-92. During 1989-92 period ten districts of the state have 4 crop combination regions.

From table 4.11 it is apparent that out of the 45 districts of the state , 33% are moving towards specialization, 24% are moving towards diversification and nearly 40% of the districts are showing no change in terms of crop combinations. More than 40% of the districts have wheat as number one crop in both the periods under study (1979-82 and 1989-92). Rice has remained more or less stable during both the periods of study. Some drier districts have jowar as number one crop. But from table

4.12 it is clear that its importance is declining as it has lost its prime position in around 7% of the districts in 1989-92 period.

Table 4.11

SHIFT TOWARDS SPECILISATION / DIVERSIFICATION IN CENTRAL REGION :{ BETWEEN 1979-82 TO 1989-92 (% OF DISTRICTS)

STATE	SPECILISATION	DIVERSIFICATION	NO CHANGE
1) Madhy Pradesh/ Central Region	33%	24%	42%

Source:-Calculated from data, Indian agricultural statistics.

Table 4.12

FIRST RANKING CROPS IN CENTRAL REGION

(%OF DISTRICTS)

STATE	RICE		WHEAT		JOWAR		MAIZE	
	I	II	I	II	I	II	I	II
1) Madhya Pradesh / Central Regions	22	24	42	42	18	11	-	04

Source:-Calculated from data, Indian agricultural statistics.

Among the coarse cereals Jowar's importance is declining while Maize's importance is increasing as it is now number are crop in around 4% of the districts (1989-92 period), while it was not a major crop in even a single district of the state in 1979-82 period.

In the Chattisgrah Plain where rainfall is comparatively higher than the northern and western ports of the state, rice is clearly the first ranking crop and in Balaghat and Raigarh district it has figured as their mono crop combination during

both the periods of analysis. This region is the bordering and neighboring region of Orissa and South Bihar where rice is the most dominant crop as it possesses the similar climatic characteristics. On the north western part of the state bordering Rajasthan including the districts of Ujjain, Rajgarh and Shajapur, jowar is the laeding crop. Rainfall of around 800 mm (annual) being expressed in terms of semi arid climatic condition may be the reason for this type of crop combination in this region. In the deep black soil region of Eastern and Western Nimar Cotton is the most dominant crop. Narsinghpur has gram as the most dominant crop. Rest of the state has wheat as the first ranking crop and occupies number one position.

Linseed, niger seed, rape & mustard, seamum and pulses (tur) are the new crops in the diversifying districts. Jowar and bajra are the two crops which went out of the crop combinations in the specializing districts in the latter periods.

When we compare 1961-64 crop combinations with 1979-82 crop combination region then most of the districts in the state are moving towards diversification. Between 1979-82 and 1989-92, around one third of the district in the state moved towards specialization. ROC is the most dominant crop combination in the Chhattisgarh region, while in other parts WG or JG or WR are the dominate crop combinations.

4.7 WESTERN REGION :-

Maharashtra and Gujarat represents this region. This region is also highly varied is terms of numbers of crop combinations, where all combinations between 1 to 15 exist within the districts. Jowar is number one crop in this region but its importance as number one crop is declining as it in evident from table 4.15. There seems to be no

change regarding the position of rice and ground nut as the leading crop in various districts of the western regions. 33% of the districts moved towards diversification. While 33% of the district in the region shifted towards specialization, during the period of study.

4.7.1 GUJARAT :-

The state has been divided in seven agro climatic regions on the basis of topography rainfall and soils. Southern hills covering the districts of Bulsar and Dangs receive highest amount of rainfall as compared to rest of the state. This region has deep black, coastal alluvial soil and receives around 1800 mm of annual rainfall.

Semi arid region covering the district of Surat and Bharuch receives around 974 mm of average annual rainfall. This comes under southern Gujarat agro climatic region and has deep black soil.

Middle Gujarat agro climatic region covers the district of Baroda, Kheda and Panch Mahals. This is a semi arid region having medium black soil with 904 mm annual rainfall.

Ahmedabad, Banaskantha, Gandhinagar, Mehsana, Sabarkantha falls under North Gujarat agro climatic regions. The regions has gray brown coastal alluvium soil having around 735 mm of annual rainfall.

The drier and arid region of Kutch falls under North west arid agro climatic region. It receives only 340 mm of annual rainfall.

North Saurashtra agro climatic regions covers the districts of Amreli , Rajkot, Bhavnagar, Jamnagar & Surendra Nagar districts. It is a semi arid region having medium black calcareous soils and receives around 537 mm annual rainfall.

Junagadh district falls under south Saurashtra agro climatic region. It has a dry sub humid climate with around 844 mm of annual rainfall. The region has coastal alluvium medium black soil.

Table 4.13 reveals that the state has highly diversified crop combination. It varies between 1 to 13 crop combination regions but large number of districts falls under 4 to 8 crop combination regions. In the latter period of study (1989-92) Junagarh has become mono crop region. Baring Junagarh monocropping is completely absent in the state.

Table 4.14 reflects that out of the 19 districts of the state 37% of the districts are moving towards specialization , 31% of the district are moving towards diversification while 31% of the districts show no change in the number of crops in their crop combination regions during the study period.

Groundnut is the most dominant crop and occupies number one position in the state (table 4.15). Among coarse cereals

TABLE 4.13

NUMBER OF DISTICTS ACCORDING TO CROP COMBINATION REGIONS WESTERN REGION

	GUJARAT		MAHARASHTRA		WESTERN REGION	
	I	II	I	II	I	II
NO. OF DIS.	19	19	26	26	45	45
1 Crop	-	1 (5)	2 (8)	3 (11)	2 (4)	4 (9)
2 Crop	1 (5)	1 (5)	3 (11)	1 (4)	4 (9)	2 (4)
3 Crop	1 (5)	-	2 (8)	4 (15)	3 (6)	4 (9)
4 Crop	2 (10)	2 (10)	-	2 (8)	2 (4)	4 (9)
5 Crop	1 (5)	1 (5)	1 (4)	2 (8)	2 (4)	3 (6)
6 Crop	4 (21)	4 (21)	2 (8)	1 (4)	6 (13)	5 (11)
7 Crop	2 (10)	2 (10)	1 (4)	-	3 (6)	2 (4)
8 Crop	5 (26)	4 (21)	-	-	5 (11)	4 (9)

9 Crop	-	-	2 (8)	1 (4)	2 (4)	1 (2)
10 Crop	-	-	2 (8)	2 (8)	2 (4)	2 (4)
11 Crop	1 (5)	2 (10)	7 (27)	5 (19)	8 (18)	7 (16)
12 Crop	1 (5)	2 (10)	3 (11)	2 (8)	4 (9)	4 (9)
13 Crop	1 (5)	-	1 (4)	2 (8)	2 (4)	2 (4)
14 Crop	-	-	-	-	-	-
15 Crop	-	-	-	1 (4)	-	1 (2)

Source:-Calculated from data, Indian agricultural statistics.

TABLE 4.14

SHIPTS TOWARDS SPECIALISTION/ DIVERSIFICATION IN WESTERN REGION BETWEEN 1979-82 TO 1989-92

(%OF DISTRICTS)

	States	Specialization	Diversification	No change
1.	Gujarat	37%	31%	31%
2.	Maharastra	31%	34%	34%
	Western Region	33%	33%	33%

Source:-Calculated from data, Indian agricultural statistics.

TABLE 4.15

FIRST RANKING CROPS IN WESTERN REGION (% OF DISTRICTS)

	States	Rice		Jowar		Bajra		Maize		G. nut	
		I	II	I	II	I	II	I	II	I	II
1.	Gujarat	-	-	5	-	21	21	5	10	26	26
2.	Maharastra	23	23	54	50	4	4	-	-	-	-
	Western Region	13	13	33	29	11	11	2	4	11	11

Source:-Calculated from data, Indian agricultural statistics.

Jowar seems to be loosing its prominence in the state. From detailed crop combination region of the state (see appendices A iii) it appears that cotton is also loosing its dominance in two districts. In the 1979-82 period cotton was number one crop in 5 districts of the state but after a decade (1989-92) cotton is number one in

only 3 districts. Sugar cane is number one crop in Surat district which is supported by high proportion of area under irrigation in this district. A remarkable change has been observed in Sabarkantha district. Cotton was number one crop in 1979-82 period occupying around 24% of the gross cropped area. But in 1989-92 period its share in given cropped area has gone down to 5% and it has how become number 7 crop in the district. Maize now become number one crop in this district in the latter period of the study. Banaskantha, Gandhi Nagar and Mehsana falling under arid to semi arid climatic region have jowar as number one crop. This regions receives around 735 mm of annual rainfall also have lack of irrigational facilities.

Between 1961-64 and 1979-82 diversification has taken place in almost all the districts of the state. But between 1979-82 and 1989-92 period, a number of district show no change Junagarh being an exception. It was 8 crop region in 79-82 period and has become a mono crop – ground nut region in 1989-92 period. GNB or GNCt are the dominant crop combination in Saurashtra region. In the interior and north eastern districts MzR or BJ are the most dominant crop combination. Sesamum, castor, rape & mustard and tur seemes to have gained considerably over the first period. In the specializing districts cotton and jowar is being replaced by oilseeds and pules. In the state.

4.7.2 MAHARASHTRA :-

ARPU has divided the stage in six agro climatic regions. Eastern vidarbha region which falls under dry sub humid climate covers the districts of Bhandara, Chandrapur and Gadhchroli. The region receives around 1271 mm of annual rainfall and has sandy loam to clayey soil.

Kolhapur, Nashik, Pune and Satara comes under the agroclimatic region of Western Hills and plain. It receives around 8988 mm average annual rainfall and has medium to deep black soil.

The driest region of the state is known as scarcity region, it covers the districts of Ahmed nagar, Dhule, Sangli and Solapur. It receives only 600 mm of annual rainfall. The soil of the region is generally sandy loam in nature.

Semi arid climate is also found in central plateau region. Akola, Amravati, Aurangabad, Beed, Buldana, Jalgaon, Latur Osmanabad and Parbhani districts belong to this region. The region has deep black clayey soil and receiver around 874 mm annual rainfall.

Dry sub humid climate is found in Nagpur, Nanded, Wardha and Yawatmal districts of central Vidharbha agro climatic region. It receives around 1040 mm annual rainfall.

Konkan agro climatic region comes under humid to per humid climatic conditions with very high annual rainfall of 3640 mm. Greater Bomaby, Raigad, Ratnairi, Sindhudurg and Thane districts comes under this region. The region has coastal alluvial soil.

Table 4.13 reveals that most of district have diversified crop combination in the state. Out of the 26 districts of the state 31% shifted towards specialization. While 34% moved towards diversification.

Jowar is the number one crop in almost 50% of the total districts, hence it is also the number one crop in the entire state. Rice is the first ranking crop in around 23% of the districts (see table 4.15). Cotton is number two crop in the state. Increase in area under ground nut and safflower can be explained by drastic increase in

administered price of these two crops. Increase in area under pulses seems to be due to expansion effect in the rabi season.

The Konkan ragion has humid to perhumid climate with around 3640 mm annual rainfall. This region, therefore, is very suitable for rice crop. Ratnagiri, Raigad, Chandrapur, and Greater Bombay have rice as the first ranking crop. Amravati, Wardha and Akola of central plateau region have cotton as the first ranking crop. Nasik is the only district in the entire state having bajra as number one crop. All other districts have jowar as the most dominant crop.

Comparison with 1961-64 results show diversification in a majority of cases over two periods of study. Bhandara seems to be an exception which has become monocrop region (1989-92 period) from 7 crop combination region (in 1961-64 and 1979-82 period) Sholapur demonstrates unique trend in the sense that the district was monocrop cotton region in 1961-64 period but it has become mono crop jowar region in 1989-92 period. JB or JCt are the dominant crop combination in large part of the state. Konkan region has RFC or rice as mono crop combination regions. Jowar and wheat is being replaced by sesamum, ground nut and safflower in the diversifying districts. Gram and sugar cane are also the new crops emerging in diversifying districts.

TABLE 4.16

NUMBER OF DISTRICTS ACCORING TO CROP COMBINATION REGIONS

INDIA

	61-64	79-82	89-92
No. of Dis.	296	333	333
1 Crop	34	28 (8)	29 (9)
2 Crop	89	43 (13)	58 (17)
3 Crop	23	49 (15)	42 (13)
4 Crop	38	33 (10)	46 (14)

5 Crop	28	25 (7)	24 (7)
6 Crop	30	18 (5)	17 (5)
7 Crop	23	18 (5)	15 (4)
8 Crop	25	17 (5)	19 (6)
9 Crop	11	20 (6)	11 (3)
10 Crop	6	15 (4)	12 (4)
11 Crop		23 (7)	18 (5)
12 Crop		19 (6)	23 (7)
1 3Crop		13 (4)	7 (2)
14 Crop		8 (2)	8 (2)
15 Crop		4 (1)	4 (1)

Source :- Calculated from data, Indian Agricultural Statistics

Figures in ( ) shows % of the total no. of district 61-64 figures has been taken form M. Husain's work.

4.8 SUMMARY :-

District level regional study of the country gives us the clear picture of crop combination regions of India. Table 4.16 reveals that the country has highly diversified cropping pattern with the estimated crop combination number going up to 15 in some cases. But around 50% of the districts have 2-5 crop combination regions during 1979-82 and 1989-92 period. Mono crop regions have gone up slightly (by 1 %) in the latter period of study.

TABLE 4.17

SHIFTS TOWARDS SPECIALISATION/DIVERSIFICATION IN INDIA BETWEEN 1979-82 TO 1989-92 (% OF DISTRICTS)

	SPECIALISATION	DIVERSIFICATION	NO CHANGE
INDIA	33%	26%	41%

Source:-Calculated from data, Indian agricultural statistics.

TABLE 4.18

FIRST RANKING CROPS IN INDIA

(% OF DISTRICTS)

RICE		WHEAT		JOWAR		BAJRA		MAIZE		S.CANE		G. NUT	
I	II	I	II	I	II	I	II	I	II	I	II	I	II
36	35	25	26	12	8	6	5	2	3	0	0.6	2	4

I = 1979-82 period II = 1989-92 period

Source:-Calculated from data, Indian agricultural statistics.

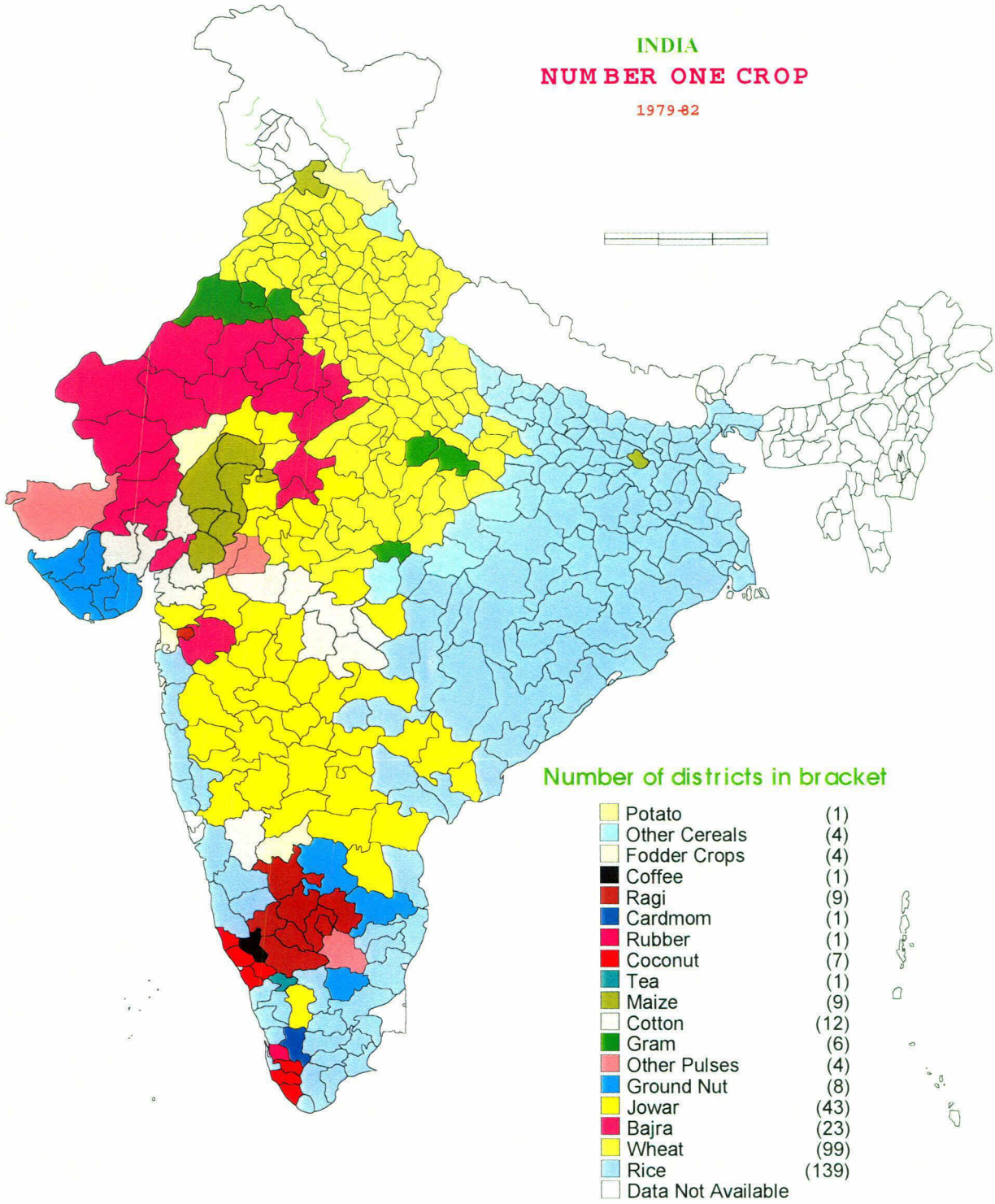
Table 4.17 reveals that out of 333 districts in the country 33% of the districts are moving towards specialization, 26% of the districts are moving towards diversification and the remaining 41% of the districts show no change in the number of crop combination regions.

Table 4.18 reveals that rice is the number one crop in the country. Its dominance has gone down marginally in the second period of study. It is still number one crop in 35% of the districts which was 36% in 1979-82 period.

From figure 4.1 it is clear that rice in number one crop in the entire eastern and coastal belt in peninsular India. Figure 4.2 depicts the picture of 1989-92 peirod. The surprise inclusion of Patiala as rice mono crop region is of great significance. But the sharp decline in the ground water table in this region posses a great threat to the sustainability of this trend. Figure 4.1 also reveals the dominance of wheat in the north-western part of the country. But clear decline in wheat region in this part in visible in figure 4.2. clear intrusion of wheat region is also visible is between rice regions of eastern Uttar Pradesh.

Jowar and bajra are clearly being replaced by other crops. Figure 4.1 shows extensive jowar region in the state of Maharashtra and Madhya Pradesh. But figures 4.2 shows clear replacement of jowar with groundnut in a number of district in 1989-

Fig 4·1


INDIA
NUMBER ONE CROP
1979-82
Number of districts in bracket
Potato (1)
Other Cereals (4)
Fodder Crops (4)
Coffee (1)
Ragi (9)
Cardmom (1)
Rubber (1)
Coconut (7)
Tea (1)
Maize (9)
Cotton (12)
Gram (6)
Other Pulses (4)
Ground Nut (8)
Jowar (43)
Bajra (23)
Wheat (99)
Rice (139)
Data Not Available

92 peiod. Sugar cane which was not a dominant crop in 1979-82 period has become dominant crop in some districts of Uttar Pradesh.

Coastal districts of kerala shows the dominance of coconut. Its share is also increasing at all India level. Coffee, Tea and rubber dominant districts are also clear from figure 4.2 in and around kerala and Tamil Nadu.

In the entire eastern rice dominant region Begusarai is the only district having maize as number one crop. Potato is number one crop in Lahul / Spiti district of Himachal Pradesh.

M. Husain's study of 1961-64 gives details about the first ranking crop of that period. Comparison of some of the important crop will enable us to understand the nature of change more clearly. His study, however, is based on only 286 districts as compared to 333 district of the present study of India.

TABLE 4.19

FIRST RANING CROPS OF INDIA (no. of District)

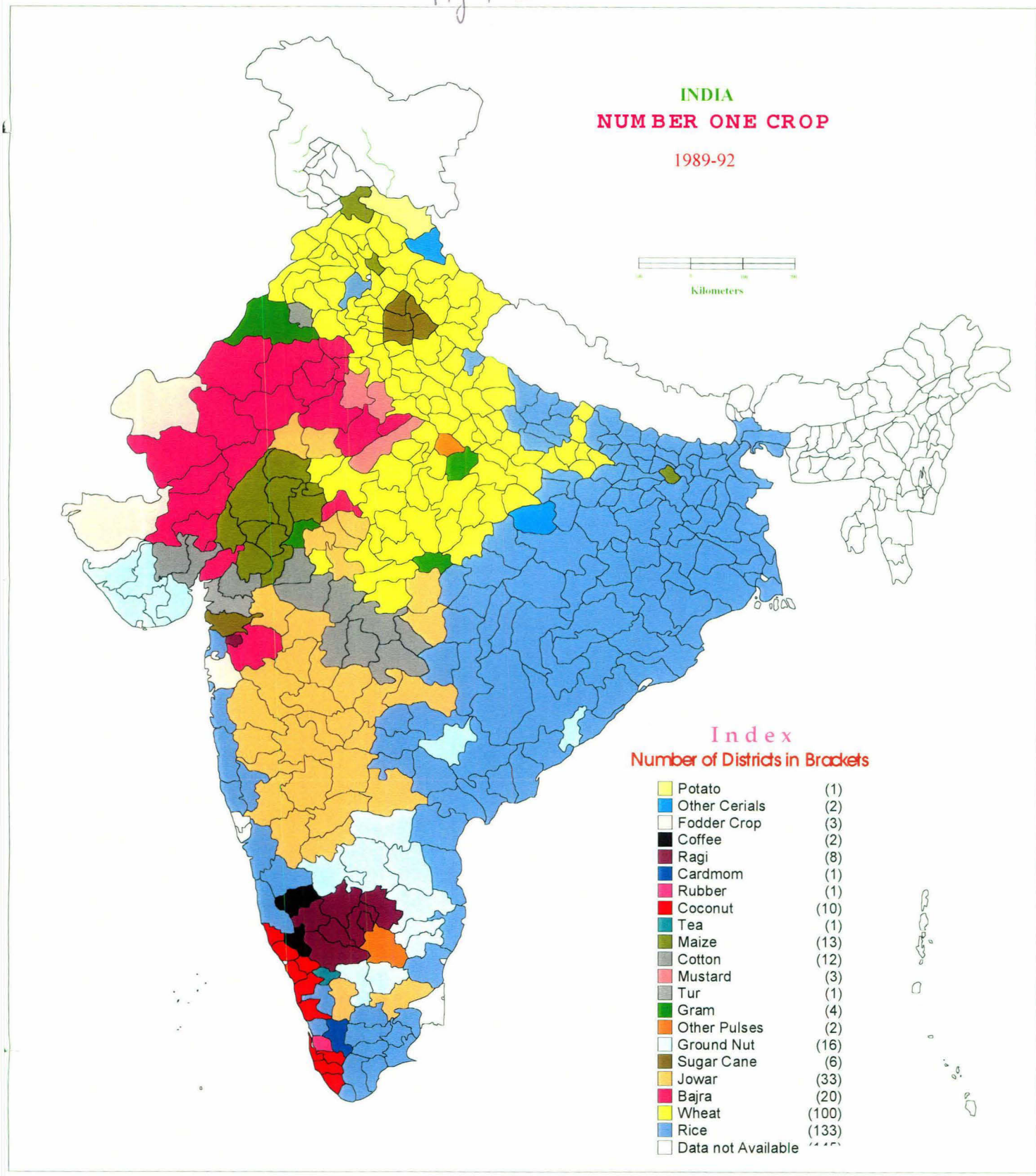
Crops	1961-64	1979-82	1989-92
Rice	119 (40%)	120 (36%)	116 (35%)
Wheat	84 (28%)	83 (25%)	87 (26%)
Jowar	37 (12%)	40 (12%)	27 (8%)
Bajra	21 (7%)	20 (6%)	17 (5%)
Maize	9 (3%)	7 (2%)	10 (3%)
S. Cane	10 (3%)	0 (-)	2 (0.6:%)
G. Nut	6 (2%)	7 (2%)	13 (4%)
Total Districts	296 (95%)	333 (83%)	333 (81%)

Figures in ( ) shows the percentage of the total number of districts.

SOURCES :- 1961-64 figure has been taken from M. Husain's work others calculated from Indian Agricultural Statistics.

Although the number of districts are different in 1961-64 and 1979-82 periods, yet they confirm the general trend as observed in 1979-82 and 1989-92 periods. Only exception seems to be in the case of sugar cane, which was number one in 10 district

Fig 4.2


INDIA
NUMBER ONE CROP
1989-92
Kilometers
Index
Number of Districts in Brackets
Potato (1)
Other Cerials (2)
Fodder Crop (3)
Coffee (2)
Ragi (8)
Cardmom (1)
Rubber (1)
Coconut (10)
Tea (1)
Maize (13)
Cotton (12)
Mustard (3)
Tur (1)
Gram (4)
Other Pulses (2)
Ground Nut (16)
Sugar Cane (6)
Jowar (33)
Bajra (20)
Wheat (100)
Rice (133)
Data not Available

in 1961-64 period. Out of these 10 districts, 9 were in Maharashtra. But in 1979-82 and 1989-92 period sugar cane was not a dominant crop in any district. Instead jowar,bajra and rice have become dominant crops in the state.

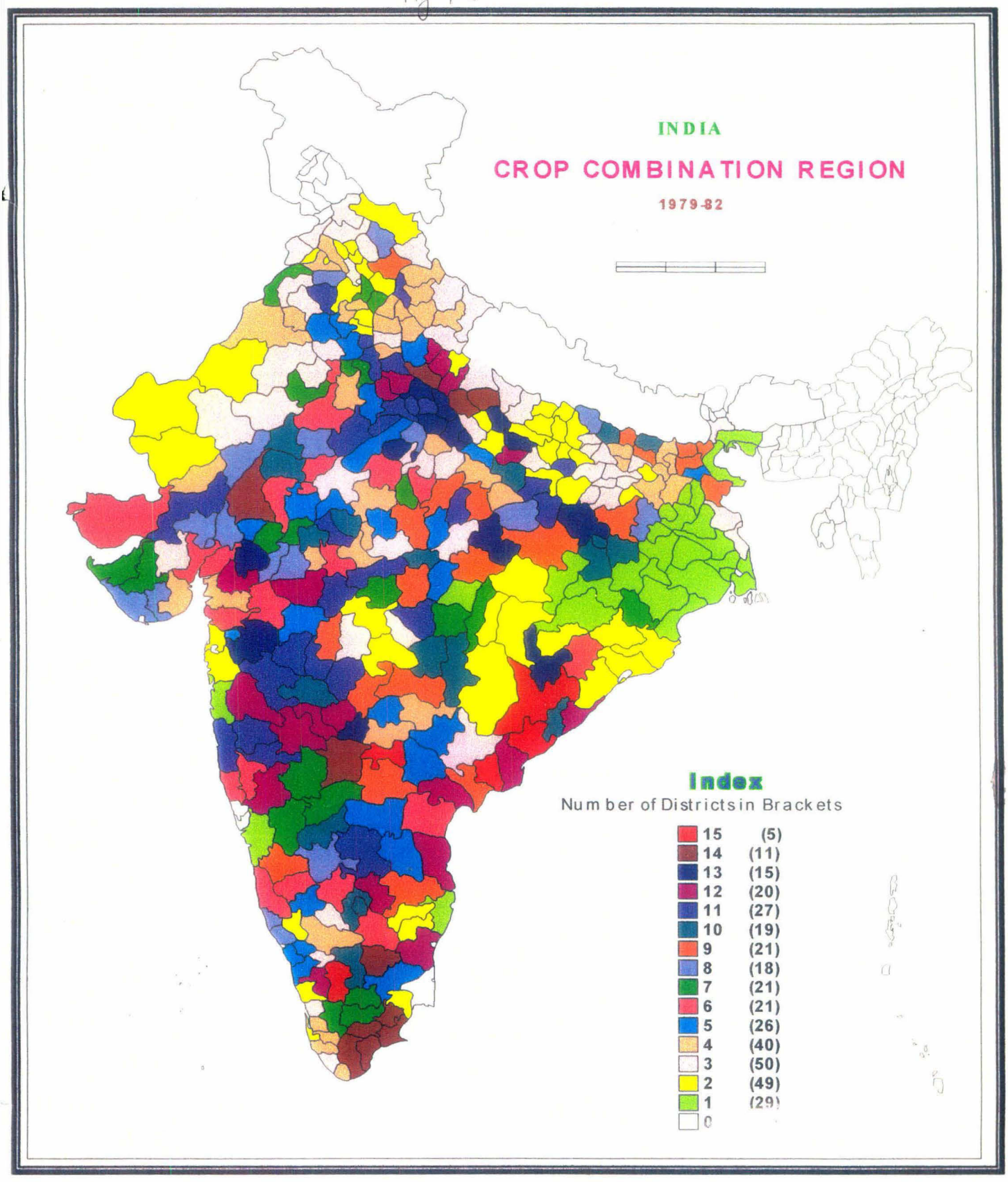
Figure 4.3 and 4.4 shows the crop combination regions of 1979-82 and 1989-92 period. Except in the eastern region of Bihar and Orissa and some districts of Rajasthan, most of the districts show diversified crop combination. The southern and central districts of the country are most diversified. Movement towards specialization can be observed in figure 4.4 (in case of Punjab). Orissa and W.Bengal largely remain mono crop rice region during the entire period under study.

Between 1979-82 and 1989-92, 110 districts have moved towards specialization and 87 districts have moved towards diversification 1961-64 result (by Husain) reveals that around 50% of the districts falls under 1-3 crop combination regions. During 1979-82 period 50% of the districts falls under 1-5 crop combination region. In 1989-92, 50% of the districts fall under 1-4 crop combination region. Broadly, therefore, it may be stated that diversificatin took place between sixties and eighties, while there was a shift towards specialization between eighties & nineties.

Figures 4.5 reveals about the diversification and specialization trends in the country between 1979-82 to 1989-92 period. It also gives some light on the emerging regions out of crop combination estimates. Most of the humid and extreme arid districts show no change during the study period.

Around 44% of the districts show no change in their crop combination regions between the two times periods. Here any change between 1 to 4 degrees has been considered less responsive change and more than 4 degree change has been considered as more responsive changes. Around 39% of the districts show less

Fig 4.3


INDIA
CROP COMBINATION REGION
1979-82
Index
Number of Districts in Brackets
15 (5)
14 (11)
13 (15)
12 (20)
11 (27)
10 (19)
9 (21)
8 (18)
7 (21)
6 (21)
5 (26)
4 (40)
3 (50)
2 (49)
1 (29)
0

responsive change and around 16% of the districts are showing more responsive changes.

Western part of Rajasthan Uttaranchal region Uttar Pradesh, eastern Uttar Pradesh, entire West Bengal, coastal Orissa, Andhra Pradesh, Karnataka and Bundelkhand region of Madhya Pradesh show no change in terms of number of crops in their combinations.

High degree of specialization is observed in some district of Punjab, Andhra Pradesh and Bihar. High degree of diversification is observed in some districts of Tamil Nadu, Orissa and two districts of Uttar Pradesh.

4.8.1 REGIONALISATION :-

District level crop combination analysis has enabled us to regionalise India in to following regions

AGRICULTURAL REGIONALISATION

Crops	Crop combination 1979-82	Regions	Changes in 1989-92
Rice	Mono 2-4 >4	All district of West Bengal, South Bihar, and parts of Orissa. North Bihar, coastal Kerala. Parts of Madhya Pradesh, Konkan region, Coastal Tamil Nadu and Andhra Pradesh.	Emergence of rice region in the semi-arid region of Patiala (Punjab) and Nalgonda, Khamam of Andhra Pradesh.
Wheat	2-4 >4	Most districts of Punjab, Haryana, Himachal Pradesh and Western Uttar Pradesh. Central Uttar Pradesh, Northern and Central Madhya Pradesh.	Spread of wheat in the eastern part of Uttar Pradesh
Bajra	2-4 5-9	Western & Southern Rajasthan Eastern districts of Rajasthan and bordering districts of Madhya Pradesh.	- -
Jowar	5-15	Central, Southern and eastern Maharashtra	-

Fig 4.4

INDIA
CROP COMBINATION REGION
1989-92

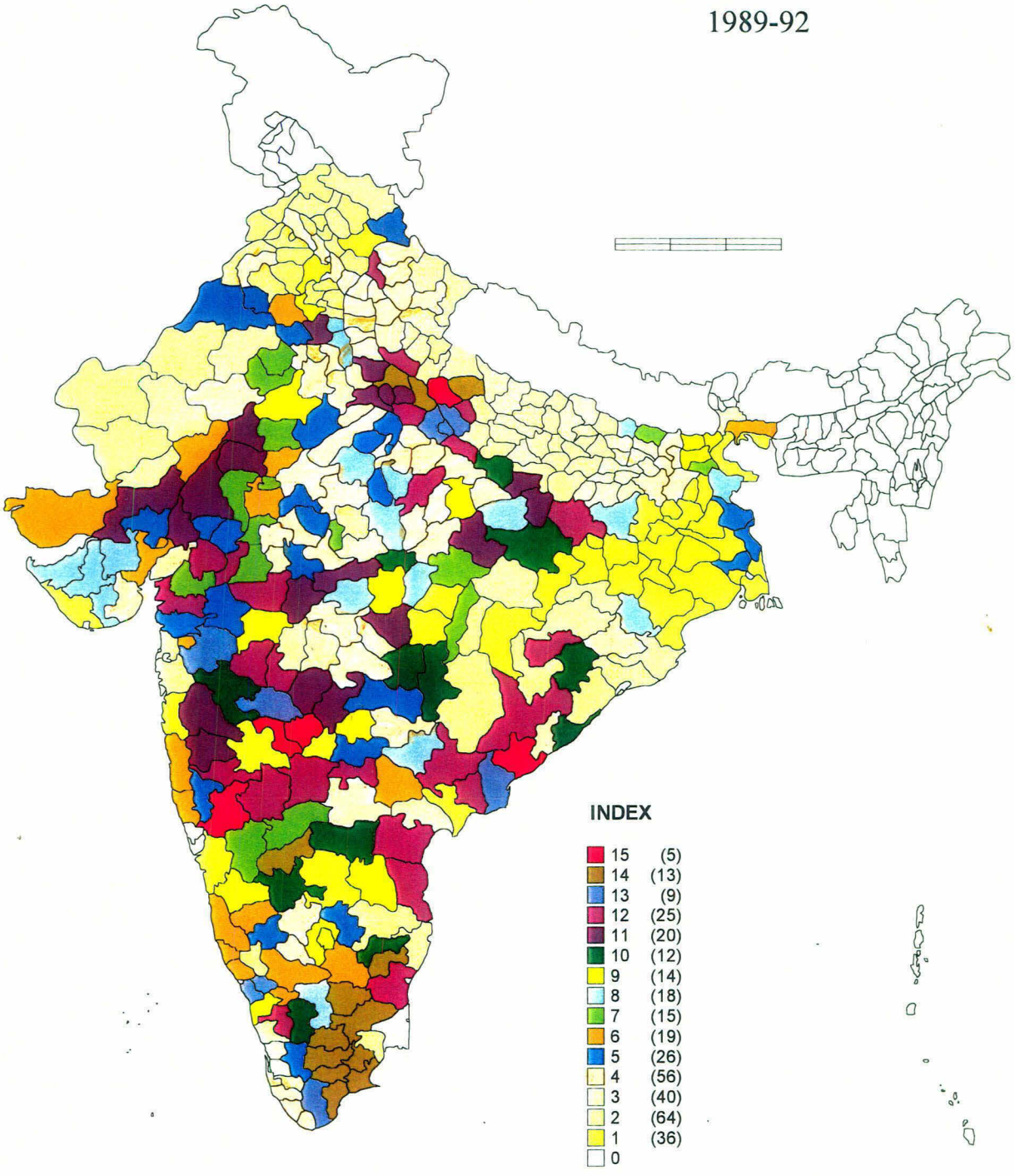
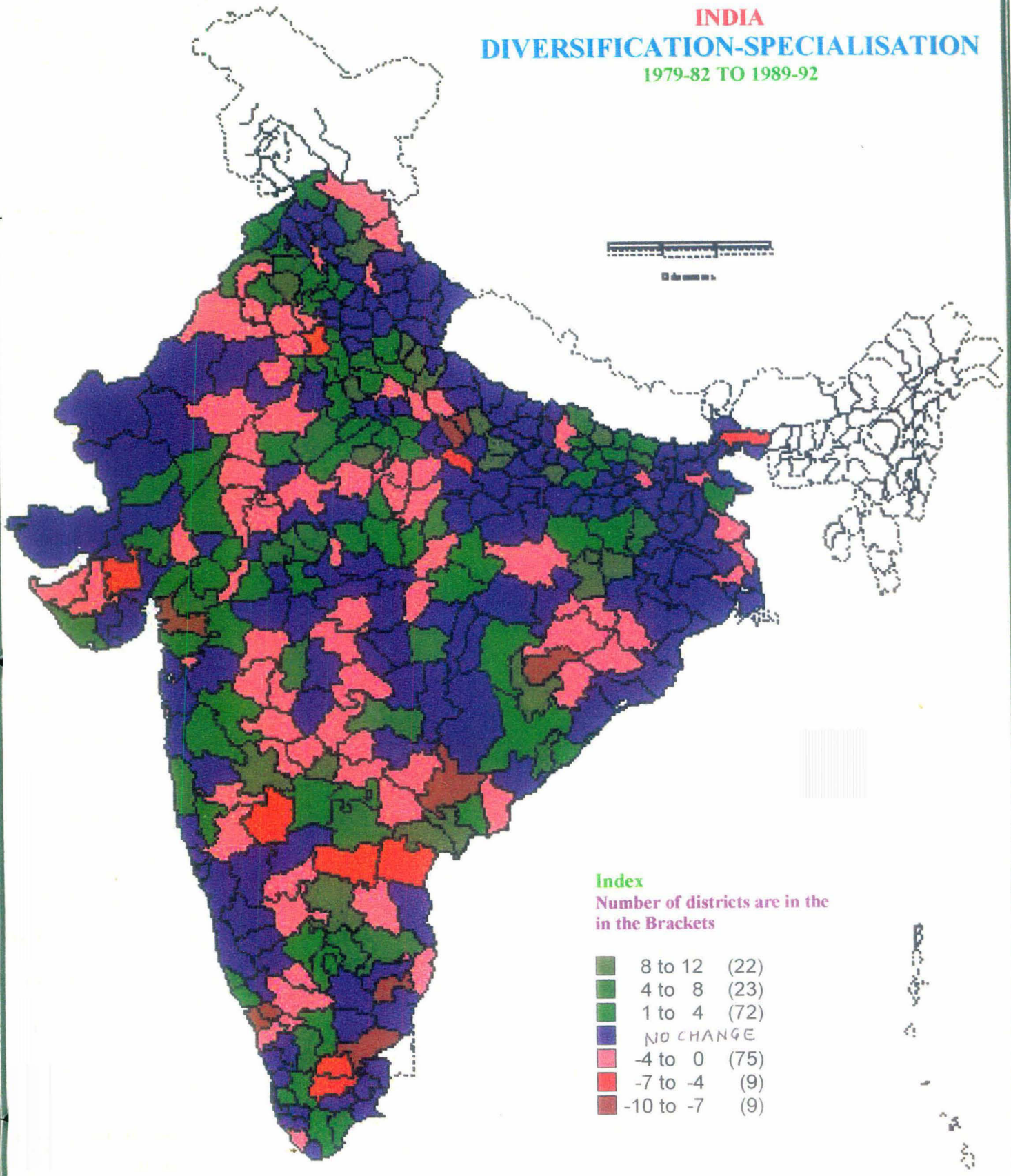


Fig 4.5

INDIA
DIVERSIFICATION-SPECIALISATION
1979-82 TO 1989-92



		and Western region of Andhra Pradesh, North-Western part of Madhya Pradesh	
Ragi	3-8	South and south eastern part of Karnataka	-
Maize	10-15	Southern Rajasthan	-
Cotton	2-12	North Central Maharashtra and Central Gujarat	-
Ground nut	2-8	Western Gujarat	Southern Andhra Pradesh, South-West Andhra Pradesh, North eastern Tamil Nadu

Source :- Calculated from data, Indian Agricultural Statistics.

From the regionalisation table it appears that rice, wheat and ground nut have made significant gains in the latter period of study. Although rice and wheat are high input crops, their rate of return is also high. This is one of the most important reason forshifts towards these crops. Jowar, bajra, and ragi are low input crops, with very low return. Naturally farmers would prefer to those crops which has high return. Cotton is very high input based crop, but risk associated with this crop is very high, farmers are generally reluctant to shift towards this crop. Thus clear shifts towards rice, wheat and groundnut regions during study period has been observed. Coarse cereal regions has declined considerably during study period.

CHAPTER – 5

CRITICAL REVIEW OF WEAVER'S AND RAFICULLAH'S METHODS:-

5.1 INTRODUCTION :-

J.C. WEAVER was the first to introduce the concept of crop combination in geography. Before weaver general practice of regionalisation in agriculture geography was just on the basis of first crop, i.e. regions got defined as the wheat, corn or maize regions, ignoring the strengths of other crop. But this type of regionalisation can not capture the characteristics of that particular region fully because it does not consider second, third, fourth etc. crops Regionalisation is widely understood to lay a basis for sound planning but the above mentioned regioalisation may not deliver its objects.

The demarcation of India into rice region or wheat region (as it generally happens in cropping pattern method of demarcation) does not explain the fact that very often wheat region also has a close second crop of rice or that a wheat region is very often also associated with crops such as gram barley, mustard, lentil, peas etc. Hence for a comprehensive and clear understanding of the agricultural mosaic of an agroclimatic region and for the planing and development of its agriculture a systematic study of crop combinations is of great significance. In the recent years the concept of crop combination has engaged the attention of geographers and agricultural land use planners.

Weaver for the first time in his work of "Crop combination regions in the middle west" explained the concept of crop combination. He stated that just as the definition and interpretation of a geographic pattern of soils without reference to vegetation or of vegetation without reference to climate constitute only a partial structure of integrated understanding, similarly observations concerning one particular

crop without reference to its immediate cultivated crop can illuminate only a limited segment of cropland use. A crop rarely assumes a position in absolute isolation. Characteristically cultivated plants are grown in combinational associations and any attempt to understand the geographic pattern of crop land use must eventually move up to this level of description and analysis (Weaver J.C, 1954)

Since crops are always grown in combination, its study in totality becomes significant. The distribution map of individual crops are very useful for planners. But it is even more important in the sense that the integrated assemblage of the various crops grown in an areal unit helps the planners to plan for future more precisely. The basic significance of crop combination regions are as follows :-

- First, a knowledge of the character and extent of crop combinations is essential to an adequate understanding of the geography of the individual crops that hold variable positions within them.
- Second, the crop combination region is in itself an integrative reality that demands definition and distributional analysis.
- Third, such a region is essential if one wishes to build still more complex structure to valid agricultural regions.

5.2 OBJECTIVE :-

Objective of this chapter is to compare the differences in regions derived from Weaver's and Rafiullah's methods in case of two states :- one showing specialized and other showing diversified cropping pattern Punjab & Gujarat respectively.

5.3 METHODOLOGY :-

There are a number of methods applied to delineate the crop combination regions which are discussed here. But major emphasis has been given to Weaver's and Rafiullah's method.

- The first method for the demarcation of crop combination region is the arbitrary choice method i.e. the first crop only, the first two crops only or the first three crops only etc. But this method is not rational as this method excludes the other crops growing in the area without any consideration of their percentage weightage in the total cropped area.
- The second method is developed in terms of variable based on certain difference which are relative and not absolute. This method being based on statistical approach is more accurate, reliable and scientific as it gives better objective groupings of crops of a regions.

Out of the many approaches to combinational study, Weaver's method used in crop combination has been applied largely by geographers. Some have followed this method in their analysis like Scott 1957, Bennett 1961 & Coppock 1964. Others have shown its weakness like Rafiullah 1956 & Hoag 1969 and still others have tried to present and use it after suitable modification like Doi 1959, 1970; Thomas 1963; Ahmad and Siddiqui 1967. Husain 1976 & Jasbir Singh 1977.

5.3.1 WEAVER'S METHOD :-

In this method percentage of total harvested cropland occupied by each crop and that held more than 1% of the total cultivated land is taken in to consideration. Weaver calculated deviation of the real percentages of crops (occupying over 1% of the

cropped area) for all the possible combinations in the component areal units against a theoretical standard. The theoretical base curves for the standard measurement was employed as follows :-

For Mono culture = 100% of the total crop land in one crop.

For 2 Crop combination = 50% in each of two crops

For 3 Crop combination = 33.3% in each of three crops.

For 4 Crop Combination = 25% in each of four crops.

For 5 Crop combination = 20% in each of five crops

Similarly,

For 10 crops combination = 10% in each of ten crops

Similarly for every crop combination TBC was obtained by simply dividing 100 with the number of crops.For determining minimum deviation the standard deviation method was used :-

S.D. = $\checkmark \Sigma d^2/n$

Where d is the difference between the actual crop percentages in a given area are and the appropriate percentage in the theoretical curve and n is the number of crops in a given combination.To make it more simpler,$D = \Sigma d^2/n$,has been used in the study.

5.3.2 DOI'S METHOD :-

Weaver's technique was susequently modified by Doi (1959), Doi's technique used to be considered to be the easiest for combination analysis prior to the application of computer programming facilities. The Doi's formula may be expressed as :-

(Σd^2)

The combination having the lowest (Σd^2) will be the crop combination. But here it is not required to calculate (Σd^2) for each combination but the crop combination is actually established by one sheet table, which represents the critical value for various elements at higher ranks. The use of one sheet table requires only the summing up of actual percentage under different crops instead of finding the differences between actual percentages and theoretical distribution.

5.3.3 RAFIULLAH'S METHOD :-

It is also known as maximum positive deviation method. Weaver's method includes all or most of the crops in the series by which the resultant combination become overagenralized, Rafiullah in 1956 developed a new method in his work "A New Approach to the functional classification of Towns".

According to Rafiullah the theoretical base curve (TBC) is just half to that of Weaver's theoretical base curve. For ex:-

For mono culture = 50% of the total crop land in one crop.

For 2 crop combination = 25% in each of two crops.

For 3 crop combination = 16.6% in each of three crops.

For 4 crop combination = 12.5% in each of four crops.

For 5 crop combination = 10% in each of five crops

Similarly,

For 10 crop combination = 5% in each of ten crops.

The technique developed by Rafiullah may by expressed as follows :-

$$d = \checkmark \Sigma Dp^2 - Dn^2 / N^2$$

where d is the deviation

Dp is the positive differences and

Dn is the negative difference,from the medium value of the theoretical curve value of the composition and ,N is the number of functions or crop in the combination.

To make it simpler the under root sign may be ignored and the formula becomes

$$d = \Sigma Dp^2 - Dn^2 / N^2$$

In the maximum position deviation method, unlike the standard deviation method the differences of actual values are calculated from the middle value of the theoretical standard and thus this method given the desired critical combination.

It generally arrives at crop combination having lesser number of crops as compared to Weaver's method. It discards the crops which occupies very low percentage in the gross cropped area.

5.4 CRITICAL REVIEW :-

District and state level analysis of crop combination region, using Weaver's methodology reveals that this method includes crops which are having area as less as 1% of the gross cropped area in to the estimated crop combination regions. Except in some exceptional cases where valuable crops are being grown, every where including the crops having 1% of the gross cropped area lead to over generalisation and tends to weaken the analysis. In some cases the least square value decline till the bottom of analytical table that leads to inclusion of all crops considered for the estimation of the crop combination set up. The technique therefore, gives most unwieldy combinations for the units of high crop diversification.

Looking at the inherent weakness of Weaver's method which in many cases tends to include all or most of the crops in the series by which the resultant combination become overgeneralized, Rafiullah (1956) developed a new divination

method in his work "A new approach to the functional classification of towns" (Huasain , 1996). Weaver's method gave emphasis on least or minimum deviation from the theoretical base curve (TBC). In Weaver's method TBC was 100% for monoculture, 50% for 2 crop combination region, 33.3% for 3 crop combination region and so on. Weaver tested the minimum deviation from TBC for each crop and the deviation of the actual percentage from the theoretical curve in this case gave the desired crop combination regions.

In Rafiullah's method to arrive at d. or the deviation Dp or the positive deference and Dn the negative difference from the median value of the theoretical curve value is estimated. Here instead of taking the TBC, the median value is used, hence for mono culture deviations are calculated from the base of 50% , for 2 crop combination region from 25% for the first 2 crops, for 3 crop combination region from 16.6% for the first 3 crops and so on. In the maximum position deviation method of Rafiullah unlike the standard deviation method, the difference of actual value and calculated from the middle value of the theoretical standard and thus the method gives the desired combination..

According to some scholars the statistical technique advocated by Rafiullah is more accurate,objective and scientific and therefore is quite popular for the delineation of crop combination regions. This technique has the capacity to handle the diversified cropping pattern or structures.In general, the crop combinations demarcated on this basis of statistical technique provides a sound base for agricultural planning and development (Husain , 1996)

It therefore becomes important to compare results achieved by both methods. For this purpose, a state which is specialized i.e. Punjab and one which is diversified i.e. Gujarat, has been selected.

From table 5.1 and 5.2 which shows a comparison between number of crops in the crop combination regions of the two methods, it is clear that in most cases positive deviation method includes lesser number of crop in combination and thus avoids the inclusion of insignificant crop from the combination with a few exception.

From table 5.1 it is clear that during 1979-82 period the comparison reveals that out of 19 districts of Gujarat, Rafiullah's method result is identical for only two districts namely Baroch and Kutch, while it is showing lesser number of crops in 16 district and greater number of crops in only one districts i.e., Bulsar. In case of Banaskantah and

TABLE 5.1

GUJARAT CROPPING PATTERN

1979-92

	DISTRICTS	NO. OF CROPS		MAXIMUM % OF CROPS INCLUDED BY BOTH	CROPPING PATTERN
		WEAVER	RAFIULLAH		
1	AMEDABAD	6	4	40%	Ct (29) W(17) J (14) B (11) R (10) FC (8) Cs (2)
2	BANASKANTHA	11	3	27%	B (37) FC (17) J (11) OP (7) RM (7) Cs (6) W (5) Ct (3) OC (1) Mz (1) Se (1)
3	BARODA	12	4	33%	Ct (32) Tu (12) J (12) R (10) FC(6) To(5) Mz(4) OC(4) B(3) GN(2) OP(2) W(2)
4	BAROACH	4	4	36%	Ct(25) J(23) Tu (21) FC(8) W(5)
5	BULSAR	2	3	22%	FC(36) R(34) OP(8) J(6)
6	DANGS	5	3	60%	Rg(37) OC(22) R(14) OP(13) FC(12)

7	GANDHIN AGAR	8	3	33%	B(33) Cs(16) W(11) FC(11) J(7) Ct(5) OP(5) R(5) Tu(3)
8	KAIRA	6	5	42%	B(24) R(21) To(15) W(9) Ct (8) FC(6) OC(3)
9	MEHSANA	8	4	36%	B(27) J(14) Ct (12) W (10) RM(9) Cs(6) FC(6) R(5) OP (3)
10	P.MAHAL	13	4	31%	Mz(31) R(20) OC(3) Ct(7) GN(5) G(5) W(4) B(4) Tu(3) OP(3) Rg(2) FC(2) J(1)
11	SABRARKANTA	8	5	41%	Ct(24) Mz(18) GN(12) B(11) W(8) OP(5) FC(5) R(4) Tu (3)
12	SURAT	6	5	45%	J(25) FC(16) R(15) SC(11) Tu(8) Ct(8) GN(5)
13	AMRELI	8	2	25%	GN(59) B (13) J(8) W(5) Ct(5) FC(3) Se(1) SC(1)
14	BHAVANGAR	4	3	37%%	GN(37) B(19) J(15) Ct(13) FC(5)
15	JAMNAGAR	7	2	28%	GN(67) B (9) J(8) W(5) FC(3) Ct(3) RM(1)
16	JUNAGARH	8	2	25%	GN(65) FC(9) W(6) B(6) Ct(5) J(3) SC(1) G(1)
17	KUTCH	6	6	67%	OP(23) B(17) FC(14) J(13) Ct(11) GN(10) Cs(4)
18	RAJKOT	7	2	29%	GN(55) Ct(17) B(8) W(7) J(7) FC(3) SC(1)
19	SURENDRA NAGAR	13	2	25%	Ct (56) J(15) B(13) GN(4)
	GUJARAT	8	6	40%	GN(21) Ct(15) B(14) J(10) FC(8) W(6) R(5) OP(4) Mz(3)

Source:-calculated from data,Indian agricultural statistics

Baroda which are showing 11 and 12 crop combinations regions respectively by Weaver's method, maximum positive deviation method is showing only 3 and 4 crop combination regions respectively. Thus Rafiullah's method avoids the inclusion of insignificant crops having area between 1-5% of the gross cropped area, similarly for Panch Mahal district while Rafiullah's method estimates it as a 4 crop region,

Weaver's method categorises it as a 13 crops region i.e. here all crops are considered for the analysis.

Table 5.2 reveals that the minimum % of crops included by both weaver's and Rafiullah's method varies from 22% (for Bulsar) to 67% (for Kutch) during 1979-82 period. Most of the districts have included 30% to 45% of the crops in this period. Dangs districts has included around 60% of crops in its combination by both the methods.

In the 1989-92 period out of 19 districts of Gujarat again two districts namely Kaira and Surat are showing similar number of crops and other two districts namely Bulsar and Junagarh are showing 1 crop more than the Weaver's crop combination analysis (see table 5.2) But in 15 districts, maximum positive deviation method is showing lesser number of crops

TABLE 5.2

GUJARAT CROP COMBINATION REGIONS

1989-92

		1989-92 No. Of Crops		Minimum % of crops included by both
		Weaver	Rafiullah	
1.	AMEDABAD	6	4	44%
2.	BANASKANTHA	11	3	27%
3.	BARODA	7	4	33%
4.	BAROACH	12	3	25%
5.	BULSAR	2	3	29%
6.	DANGS	6	3	50%
7.	GANDHINAGAR	6	5	50%
8.	KAIRA	4	4	29%
9.	MEHSANA	7	5	50%
10.	P.MAHAL	12	4	33%
11.	SABRARKANTHA	11	6	46%
12.	SURAT	5	5	50%
13.	AMRELI	8	2	25%

GUJARAT
CROP COMBINATION REGIONS
1979-82

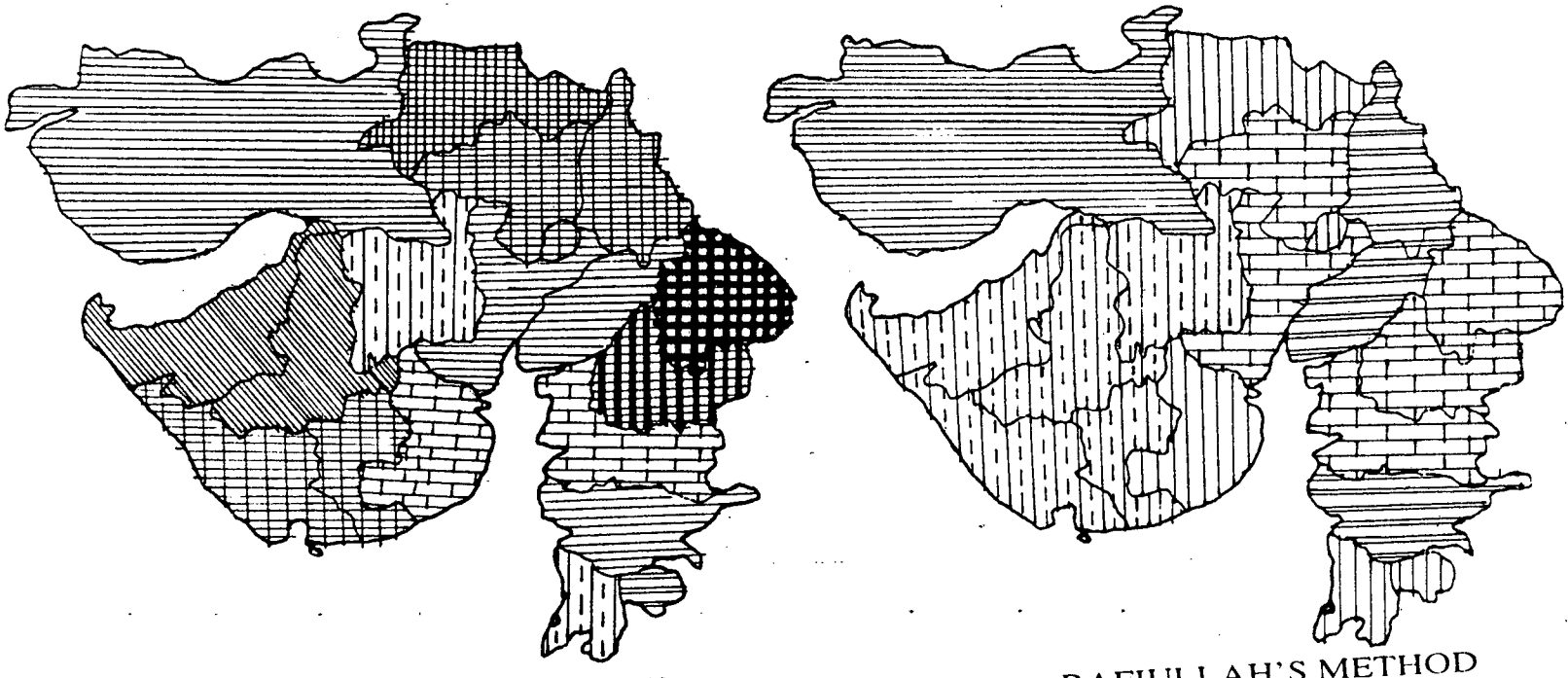


Fig 5·1

GUJARAT

CROP COMBINATION REGIONS

1989-92

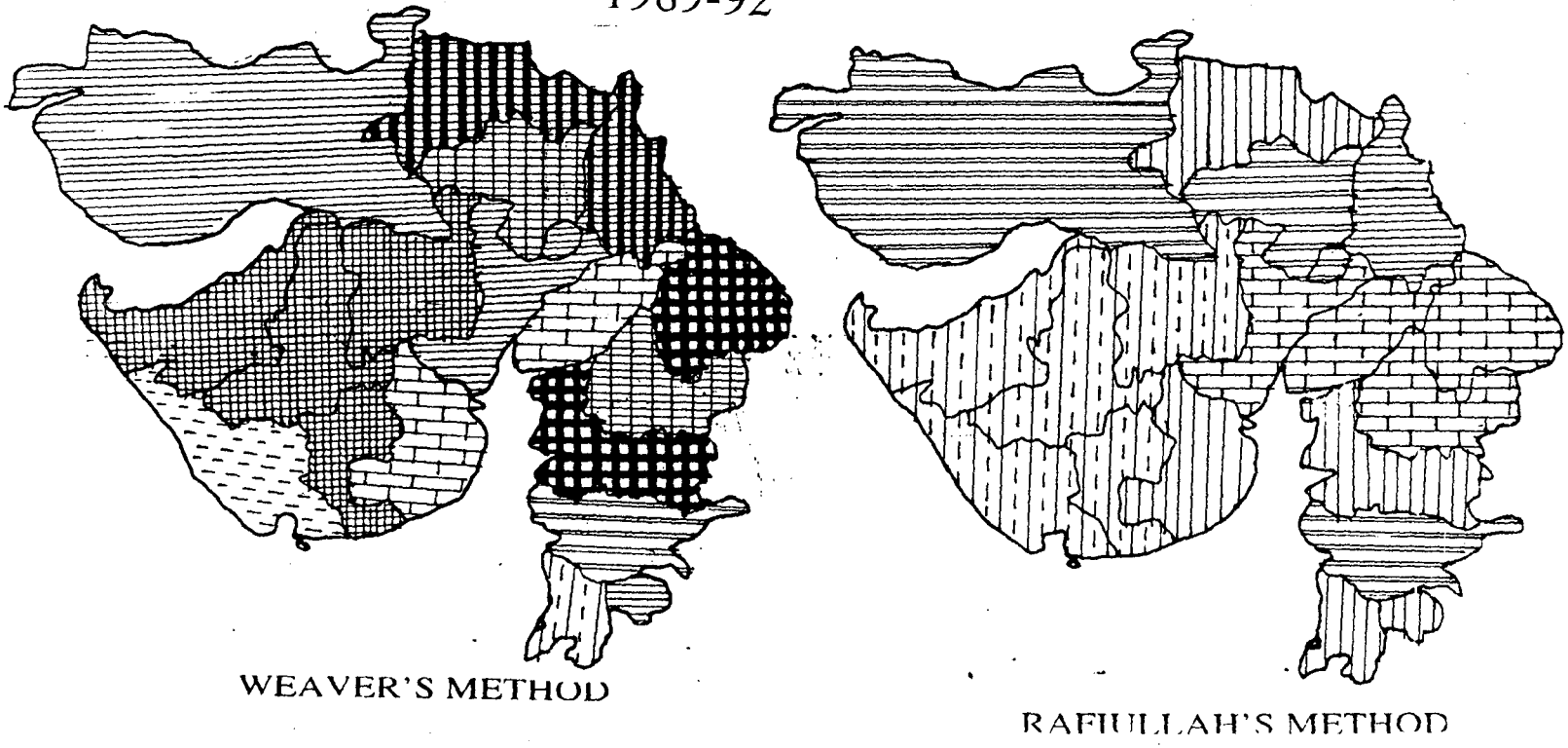


Fig 5.2

14.	BHAVANGAR	4	3	37%
15.	JAMUNAGAR	8	2	25%
16.	JUNAGARH	1	2	12%
17.	KUTCH	6	5	50%
18.	RAJKOT	8	2	25%
19.	SURENDRA NAGAR	8	2	25%
	GUJARAT	12	7	43%

Source:-calculated from data,Indian agricultural statistics

In case of Bauskantha and Baroach where as weaver's method is showing 11 and 12 crops respectively, Rafiullah's method has only 3 crops in the crop combination analysis. Similarly for Panch Mahal and Sabarkantha, while weaver's methods categories the districts as 12 and 11 crops respectively, this method puts it as 6 and 5 crop combination region respectively. Thus Rafiullah's method restricts the entry of less significant crops.

As state level according to weaver's method the state is estimated as 8 crop region (1979-82 period) and 12 crop region (1989-92 period). But maximum positive method has led to inclusion of only 6 crops in the earlier period and 7 crops in the latter period.

Table 5.2 also reveals that minimum % of crops included by both the methods varies from 12% (for Junagarh) to 50% (for Dangs, Gandhinagar, Surat and Kutch). Sabakantha district also includes a bit higher i.e. 46% of crops in its crop combination analysis by both the methods. Junagarh is mono crop combination region according to Weaver's method during 1989-92 period. It may be the reason for inclusion of just 12% of crops is its crop combination analysis.

TABLE 5.3

PUNJAB CROPPING PATTERN

1979-82

Sr. No.	Districts	1979-82 No of Crops		Minimum % of crops includes by both	CROPPING PATTERN
		Weaver	Rafiullah		
1.	HOSHIARPUR	4	2	22%	W (45) Mz (21) R(11) FC(11) G(4)
2.	JALANDHAR	4	2	25%	W(49) R(18) Mz(12) FC(11) Pt(3)
3.	LUDHIANA	8	2	25%	W(48) R(18) Mz(11) FC(9) GN (5) Ct(3) Tu(1) SC(1)
4.	FEROZEPUR	7	2	29%	W(46) R(23) Ct(23) FC(8) G(5) RM(2) Gu(1)
5.	AMTRISAR	3	3	43%	W(45) R(29) FC(15) RM(4)
6.	GURDASPUR	3	3	43%	W(38) R(29) Mz(15) FC(8)
7.	KAPURTHALA	2	3	40%	W(48) R(33) FC(10) GN(4)
8.	BHATINDA	3	3	37%	W(36) Ct(31) G(14) FC(7)
9.	PATIALA	2	2	25%	W(45) R(31) FC(10)
10.	SANGRUR	11	3	27%	W(44) Ct(14) R (13) FC(10) Mz(5) G(3) B(2) GN (2) Br(1) Gu(1) RM(1)
11.	ROOPNAGAR	3	3	43%	W (35) FC(27) Mz(17) R(10)
12.	FARIOKOT	4	2	20%	W(43) Ct(23) R(10) FC(9) G(5)
	PUNJAB	10	2	20%	W(44) R(19) FC(10) Ct(10) Mz (5) G(3) RM(1) GN(1) SC(1) Br(1)

Source:-calculated from data,Indian agricultural statistics

Table 5.3 shows the comparison between the number of crops in crop combination analysis in different districts of Punjab. Here also maximum deviation method of Rafiullah excludes insignificant crops. During 1979-82 period out of 12 districts of Punjab 5 districts namely Amaritsar, Gurdaspur, Bhatinda, Roopnagar and Patiala have similar number of crops in both the method. Only Kapurthala includes one additional crop as compared to weaver's method. The remaining six districts include lesser number of crops as compared to weaver's method. In case of Ludhiana and

Ferozapur where as Weaver's method has included 8 and 7 crops respectivley, maximum positive method of Refiullah has led to inclusion of only two crops. In case of Sangrur district , Weaver's method include all crops having more than 1% of the gross cropped area but Rafiullah's method has led to inclusion of only 3 crops and thus leading to exclusion of less significant crops.

During 1979-82 period minimum % of crops included by both the methods varies between 20% (for Faridkot) to 43% (for Amritsar and Gurdaspur). Hoshiarpur district include only 22% of crops in its crop combination region.

TABLE 5.4

PUNJAB CROP COMBINATION REGIONS

1989-92

		1989-92 no. of crops		Minimum % of crops included by both
		Weaver	Rafiullah	
1.	HOSHIARPUR	4	3	43 %
2.	JALANDHAR	2	3	33%
3.	LUDHIANA	2	2	29%
4.	FEROZEPUR	3	2	33%
5.	AMTRISAR	2	2	40%
6.	GURDASPUR	2	2	29%
7.	KAPURTHALA	2	3	40%
8.	BHATINDA	2	2	29%
9.	PATIALA	1	1	33%
10.	SANGRUR	2	2	50%
11.	ROOPNAGAR	4	3	43%
12.	FARIDKOT	3	2	29%
	PUNJAB	4	2	25%

Source:-calculated from data,Indian agricultural statistics

During 1989-92 period, out of 12 district 6 districts namely Ludhiana, Amritsar, Gurdaspur, Bhatinda, Patiala, and Sangrur are showing similar number of crops by

both the methods of analysis (see table 5.4). Jalandhar and Kapurthala are showing more crops (1 crop more) in Rafiullah's method of analysis. Remaining four districts namely Hoshiarpur, Ferozepur, Roopnagar and Faridkot are showing lesser number of crops (in Refiullah's method) in their crop combination analysis.

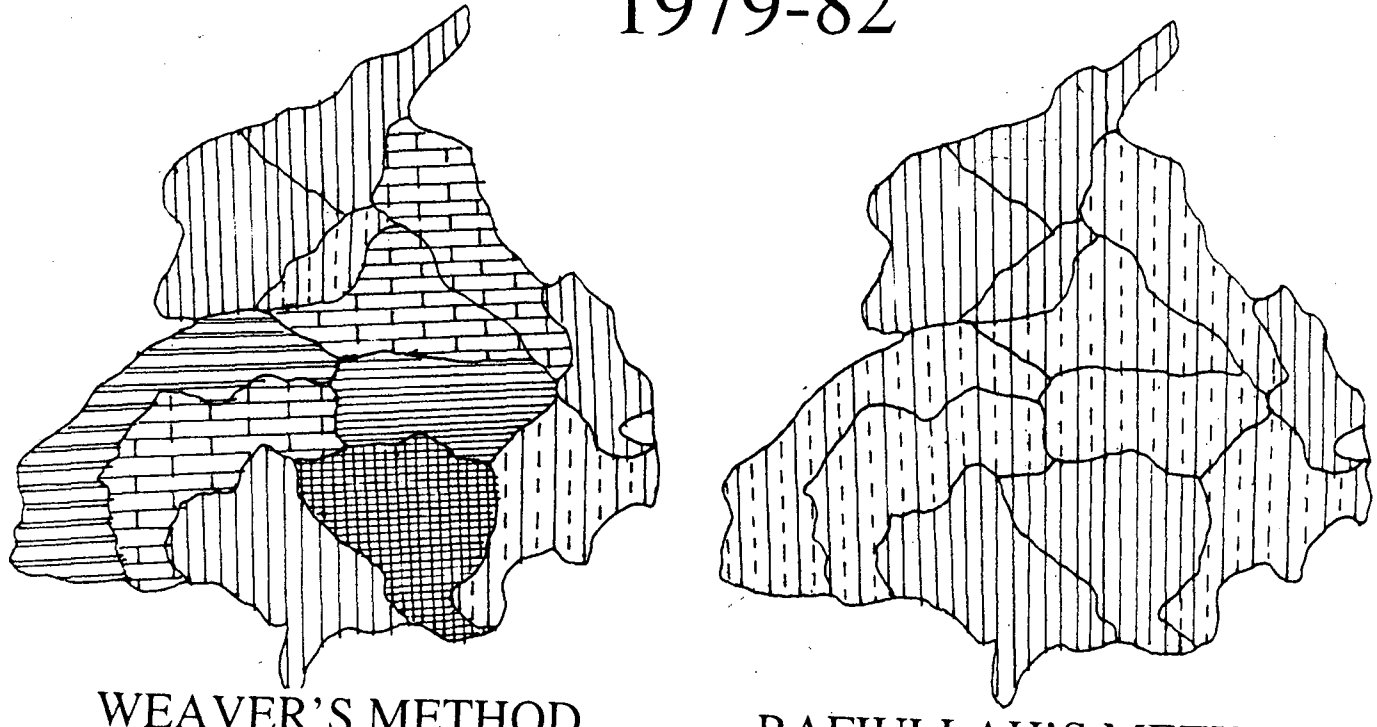
During this period minimum % of crops included by both the methods varies between 25% (for Punjab state) to 43% (for Hoshiarpur and Roopangar). In Patiala district which is mono crop rice region by both the method 33% of crops are included in crop combination analysis.

After the analysis of Gujarat and Punjab we find that the analysis of more specialized state of Punjab has revealed more similarities (in around 50% of district) between these two methods of analysis. But in case of a more diversified cropping pattern in Gujarat, only 10% of the districts show similar results. So in a diversified state Weaver's method exaggerates the degree of diversification.

From table 5.1 Sabarkantha is a 8 crop combination region (1979-82 period).Here last crop included in the combination is rice having 4% of the gross cropped area. Next crop is tur with heaving more than 3% of the gross cropped area. It has been rejected by Weaver's method. But in other cases Weaver's method has led to inclusion of crops having 1% of the gross cropped area. Here rejection of tur cannot be justified.

Rejection of crops in Rafiullah's method is more arbitrary. For ex:- Bulsar district is 3 crop region according to Rafiullah's method (1979-82 period). Here FC (36), OP (8) have been included but J (6) has been rejected Instead of it, FC (36) R(34) would have formed a better combination region similarly in Gandhinagar B(33) Cs(16)W(11)combination region, here FC (11) has been rejected by this method. Although W and FC both have almost equal area in this district.

PUNJAB
CROP COMBINATION REGIONS
1979-82



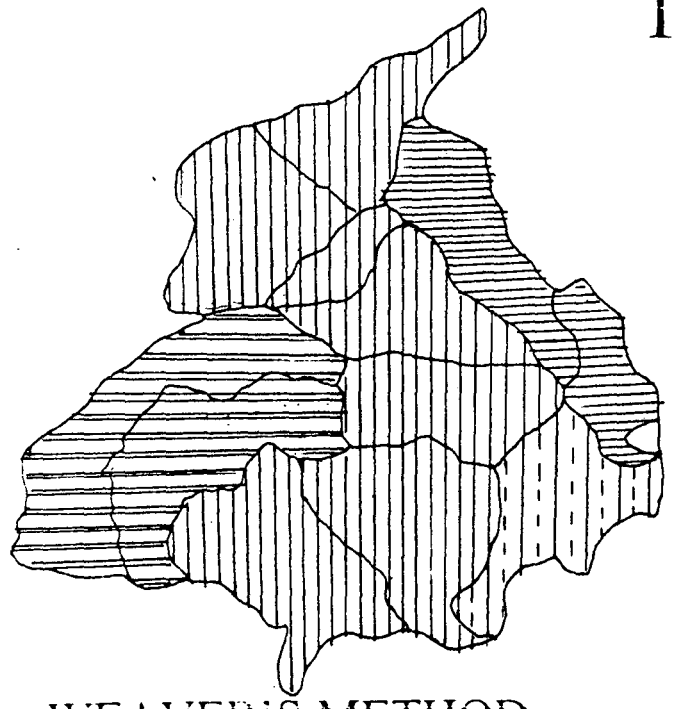
WEAVER'S METHOD

RAFIULLAH'S METHOD

TWO
THREE
FOUR
SEVEN
EIGHT
ELEVEEN
D N A

Fig 5.3

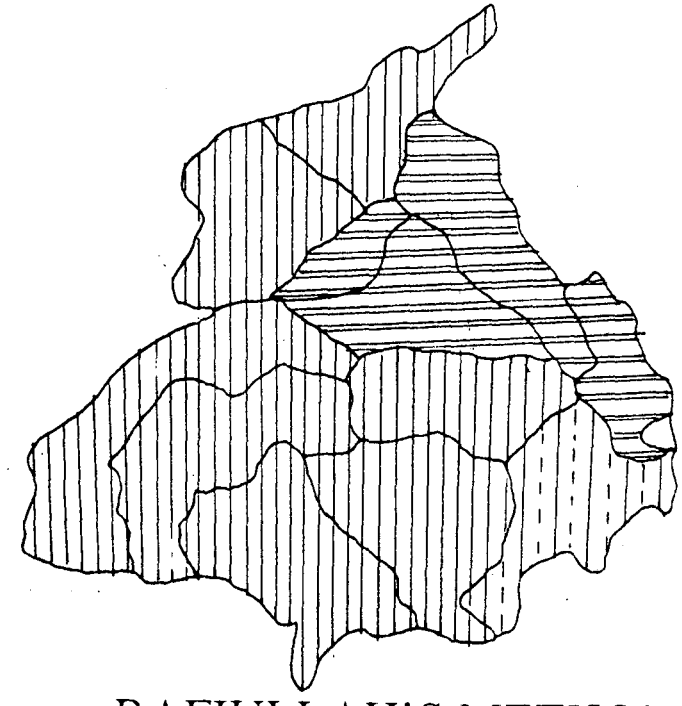
PUNJAB
CROP COMBINATION REGIONS
1989-92



WEAVER'S METHOD

MONO

TWO



RAFIULLAH'S METHOD

THREE

FOUR

D N A

Fig 5.4

Similarly in Surat district the crop combination is J(25) FC(16) R(15) SC (11) Tu (8), Here Rafiullah's method led to rejection of Ct (8) crop. Although Tu and Ct both have almost equal area in Surat. Similarly in Jamnagar district the crop combination in GN (65) FC (9). Rafiullah's method has led to rejecter of 3rd crop having an area of more than 8% of the gross cropped area.

In case of more specialized state like Punjab (see table 5.3) there are fewer anomalies. In Ferozepur district crop combination is W (46), R(23). Here maximum positive deviation method of Rafiullah leads to rejection of Ct(23) crop. Although rice and cotton both have almost equal area in this district.

5.5 CONCLUSION :-

After analysis of Punjab and Gujarat it was realised that both the methods have their drawbacks as well as their specialties. On the one hand Weaver's method exaggerates the degree of diversification on a more diversified state, Refiullah's method leads to rejection of crops from crop combination region having almost similar area in a number of district. In those districts where valuable crops are being grown as a small percentage of gross cropped area, Rafiullah's method may leads to rejection of all these valuable crops. Proper planning for development can not be done entirely by depending upon Rafiullah's method. Other aspects should be considered for better planning and result. Weaver has accepted the inclusion of almost all the crops in Weaver's method of analysis in his article itself. He stated that a special crop occupying say 3% of total harvested cropland might not be included by the deviation formula in the combination designation. He has given an example where percentages ran C(35), O(30), H(28), V(3), here the vegetable crop would not be included but in a region with percentages C(57), O(20), M(10), W(5), V(3) the vegetables would be

drawn in the combination. Cases where there is a substantial difference between number one and number two crop, rest of the crops even having 1% area may well be included in the crop combination region. The consistent tendency of the formula in such circumstances is to show the lowest deviation for a crop occupying as much as 1% of the total harvested Cropland .

CHAPTER – 6

CONCLUSION

6.1 SUMMARY AND FINDINGS:-

Changes in crop combination regions may be of two types first is the change in the number of crops and second is the change in the contents of the crop. Both these changes may cause specialization or diversification in a region. Specialization is a phenomenon, which would in many cases is observed if the region has more developed infrastructure and it leads to rejection of a number of in significant crops from the crop combination regions. Diversification, could be adopted both out of a choice of a more remunerative cropping pattern or for avoiding risk arising out of dependence on too few crops. It would lead to emergence of a large number of crops in the crop combination regions.

Significant changes took place in the cropping pattern in India during the late eighties. Punjab and Haryana have registered significant gain in the area under rice and wheat. In the eastern region West Beangal and Bihar to some extent have registered significant gain in the area under wheat. Area under oilseeds specially ground nut, rape and mustard, sesamum and safflower have registered significant gains in the country. A substantial decline in the share of coarse cereals in southern as well as central regions of the country has been observed.

At state level six states, namely Bihar, Himachal Pradesh, Karnataka, Kerala, Punjab and Uttar Pradesh have moved towards specialization between 1979-82 to 1989-92 period. Six other states which have moved towards diversification are Tamil Nadu, Haryana, Madhya Pradesh, Maharashtra, Gujarat and Rajasthan. Andhara

Pradesh, Orissa and West Bengal indicate no change as far as number of crops in their crop combination.

Any move towards specialization or diversification is associated with movement of crops. But it has been observed that degree of movements (i.e. of crops, say from 4 to 10 crop regions) varies from one region to other. For the convenience of analysis any change involving less than 3 degrees movement has been termed as less responsive movement and more than 3 degrees movement has been termed as more responsive movement. The fifteen states can be categorized as follows:-

Table 6.1

RESPONSIVENESS OF STATES (1979-82 TO 1989-92)

STATES INDICATING	MORE RESPONSE	LESS RESPONSE	NON RESPONSIVE STATES
No change	-	-	Andhra Pradesh, Orissa, West Bengal
Specialization	Punjab, Bihar	Himachal Pradesh, Karnataka , Kerala, Uttar Pradesh.	-
Diversification	Madhya Pradesh, Gujarat	Tamil Nadu, Haryana, Maharashtra, Rajasthan	-

Source :- calculated from data, Indian Agricultural Statistics

For both Punjab and Bihar, the changes have been significantly towards foodgrains rice in case of Punjab and wheat in case of Bihar have shown the greatest increases. For Bihar such a move clearly indicates shift of HYV technology to eastern India. In Punjab the change is a continuing one from the last decade.

Madhya Pradesh and Gujarat both have moved towards diversification. Large parts of these states falls under semiarid climatic condition and agricultural

infrastructure is relatively less developed, hence they are more responsive towards diversification.

Three states Andhra Pradesh, Orissa and West Bengal which are non responsive towards change have their own reasons. Orissa and West Bengal fall in the humid / per humid climatic zones. The single largest source of irrigation in both the states are canal irrigation. Here the mode of water distribution is a "field-to-field" system, where all the field in the command canal gets flooded. The only crop that can be cultivated under this circumstances is paddy and hence these two states have a relatively inflexible cropping pattern. 14 out of 23 districts of Andhra Pradesh falls under sub humid climatic condition and rest of the districts have sub humid climatic condition. Thus diversification and specialization both in the state may be the reason the overall non-responsiveness during the study pried.

TABLE 6.2

CHANGES IN FIRST/SECOND/FIRST & SECOND RANKING CROPS IN STATES (1979-82 TO 1989-92)

SL.NO.	STATES	REPLACEMENT OF FIRST/SECOND/BOTH CROPS	
1.	Andhra Pradesh	Second Crop	J to CN[1]
2.	Bihar	No change	-
3.	Gujarat	Second crop	Ct to B[2]
4.	Haryana	Second crop	B to R3
5.	Himachal pradesh	No crop	-
6.	Karnataka	Second crop	R to CN[4]
7.	Kerala	First, Second both	R to Co[5]. Co to R
8.	Maharashtra	No change	
9.	Madhya Pradesh	No change	-
10.	Orissa	No change	-
11.	Punjab	No change	-
12.	Rajasthan	No change	-
13.	Tamil Nadu	No change	-
14.	Uttar Pradesh	No change	-

15.	West Bengal	No change	-

Source – calculated from data, Indian Agricultural Statistics

NOTE :-

1) GN was third ranking crop in 79-82 and J has become number 3 crop in 89-92.
2) B was third ranking crop in 79-82 and Ct has become number 3 crop in 89-92
3) R was no. 4 crop in 79-82 and B was become no. 3 crop in 89-92.
4) GN was no. 6 crop in 79-82 and R has become no. 3 crop in 89-92.
5) R was number one crop in 79-82 and coconut has become number one crop in 89-92 pushing R at number 2 position.

5 out of 15 states have shown changes in the ranking of first/second crops during the study period. These states are Andhra Pradesh, Gujarat, Haryana, Karnataka and Kerala. In Karnataka and Andhra Pradesh ground nut has become number 2 crop replacing rice and jowar respectively. In Haryana bajra has been replaced by rice as number 2 crop. Huge loss of area under cotton has resulted in its replacement with bajra as second ranking crop in Gujarat. Kerala is the only state where first and second ranking crops have interchanged their place. Here coconut has become number one crop replacing rice during that second period of analysis.

Significant changes in term of percentage (among first ranking crops) has been observed in Haryana, Maharashtra and Tamil Nadu. 5% increase in the gross cropped area in wheat has been observed in Haryana. In Maharashtra there is a decline of 4% in jowar and in Tamil Nadu the decline is of 8% in rice has been observed during 1989-92 period.

Area under pulses has slightly increased in Orissa, Tamil Nadu and Uttar Pradesh. But in all other states it has either lost or remained almost constant during study period.

6.2 DISTRICT LEVEL ANALYSIS: -

District level analysis of al the states have revealed a mixed trend. Punjab appears to be the state that has been most responsive in the shift towards specialization and Orissa towards diversification at the district level.

TABLE 6.3

NUMBER OF DISTRICTS MOVING TOWARDS

SPECIALIZATION/DIVERSIFICATION

(1979-82 TO 1989-92)

SL.NO.	STATES	SPECIALIZATION	DIVERSIFI CATION	NO CHANGES
1.	A.P.	9 (39%)	10 (43%)	4 (17%)
2.	BIHAR	14 (45%)	2 (6%)	15 (48%)
3.	GUJARAT	7 (37%)	6 (31%)	6 (32%)
4.	HARYANA	6 (50%)	5 (42%)	1 (8%)
5.	H.P	3 (25%)	2 (17%)	7 (58%)
6.	KARNATAKA	5 (26%)	5 (26%)	9 (47%)
7.	KERALA	3 (27%)	3 (27%)	5 (45%)
8.	M.P.	15 (33%)	11 (24%)	19 (42%)
9.	MAHARASHTRA	8 (30%)	9 (35%)	9 (35%)
10	ORISSA	2 (15%)	6 (46%)	5 (38%)
11.	PUNJAB	9 (75%)	1 (8%)	2 (17%)
12	RAJASTHAN	8 (31%)	8 (31%)	10 (38%)
13.	T.N.	3 (20%)	6 (40%)	6 (40%)
14.	U.P.	16 (31%)	9 (17%)	27 (52%)
15	W.B.	1 (6%)	4 (23%)	12 (71%)

Source : Calculated from data :- Indian agricultural statistics,

West Bengal, followed by Himachal Pradesh and Uttar Pradesh have the maximum proportion of districts that have shown no change.

IMPORTANT NEW CROPS EMERGING :-

District level analysis revealed that some of the important new crop emerging are groundnut, seasmum, safflower, rape & mustard, linseed and coconut among oilseeds. Rubber, black pepper along with coconut are the new emerging crops in Kerala. Mustard has mainly gained in Rajasthan, Gujarat, West Bengal, Bihar and Uttar Pradesh. Groundnut has emerged in the crop combination regions in Andhra Pradesh, Karnataka, Tamil Nadu and Mahdya Pradesh. Linseed has become more significant in Madhya Pradesh and safflower in Maharashtra.

The chief loosing crops are jowar and bajra throughout India. Besides these two, area under pulses (gram and tur) has also gone down in almost all the states with the exception of Orissa, Tamil Nadu and U.P.In Orissa area under pulses has gone up possible due to brining more and more area under cultivation (marginal lands and uplands). Gram seems to have lost more than tur among the pulses.

IMPACT OF IRRIGATION :-

The cropping pattern would become more market oriented with the increase in area under irrigation, since all the additional output due to irrigation increase is not likely to be absorbed by the farmers for their self consumption. For raising non-food grains like sugarcane and vegetables irrigation is a necessity. With the development of irrigation, commercial crops of cotton, sugarcane etc. are likely to be benefited.

The advent of HYV seeds for cereal crops has tilted the scales in favour of cereal crops to the extent that irrigation has become a must for these new variety crops. This fact has been proved by the experience of Pubjab and haryana, where share of foodgrains has perceptibly risen with rapid expansion in irrigation.

In the eastern India where filed-to-field irrigation system of distributing water below the final outlet has left with no other option for farmers than to grow paddy throughout the growth period. If farmers are given field channels that provide them individuals access to point, a much more flexible & remunerative crop pattern might emerge under this system of irrigation. Thus the system design and the policy adopted for sharing limited water in an egalitarian manners, influences the final cropping pattern of a region.

6.3 POLICY IMPLICATIONS :-

Our study has revealed that rice has become number one crop in many of the semi arid districts of the country. Is has also come out that area under pulses is either declining or has become stagnant in the country. Keeping these things in mind government has to look upon these problem so that it may not create any problem in the future for agriculture. Some policy implication which seriously need government's attention are:-

(i) This study shows that rice has become a more significant crop in a large number of districts in the country. Notably, many of these districts falls in the semi arid region of the country for ex:- Patiala in Punjab, Khamam and Nalgonda in Andhra Pradesh are districts where rice has moved to number one position. This performance of rice crop in directly as a result of the development of irrigation. Studies indicate that sustainability of rice in these areas is in question. Thus, it emerge that policy mechanisms that are available to the government to influence cropping pattern changes (as procurement price, extension work) should probably applied in these cases.

Similarly sugar cane has becomes number one crop in semi arid districts of western Uttar Pradesh and Surat district of Gujarat. Both rice and sugar cane are water intensive crops and although initial returns from these crops are high, long-run benefits seem to in doubt. It needs immediate attention from the government so that sustainabilites of such cropping pattern change may be maintained. Since in these district replenishment rate of water is less then the exploitation rate, this aspect should get attention of the policy makers.

(ii) The success associated with rice and wheat is due to adoption of high yielding variety (HYV) seeds in the country. But the success of this is in turn associated with assured supply of water. In a country where a large portion falls under semi-arid climate, any drought for two or more years in continuation may lead to crop failures especially for the HYVs area. Thus not only the extent, but quality of water supply of these regions need immediate attention.

(iii) Area under pulses has declined in a number of states. It has been observed inspite of very high compound growth rate in the procurement price of pulses. Shortage of pulses has led its market prices to go up. The only cheap source of protein available for poor people is becoming out of reach for these people. Government has to seriously think about this problem and some alternative should be looked in to.

(iv) It has been realized by the study that TMO has been by and large successful across districts. This indicates that a package of policy variables as procurement price, supply of inputs to boost technology adoption and extension work together can significantly influence cropping

pattern changes. This experience can be gainfully utilized with respect to pulses and coarse cereals. Along with this a dimension of research funds towards these crops would ensure development of HYV for these crops.

(v) Food corporation of India (FCI) invests a large amount every year for storage to maintain the buffer stock for rice and wheat. A large amount of government's subsidy is diverted to this end. This study indicate that a continuing increase of area under wheat and rice can be expected in future. In context can be expected in future. In context of rising costs for maintaining buffer stocks – this is a matter of concern.

On the other hand these are the two crops in which India has competitive advantage in trade (NCEAR, 1994).. The complex problem of increasing area share of wheat and rice should be looked in to from this context.

6.4 FUTURE RESEARCH QUESTIONS: -

Some research questions emerge from the study that needs to be probed further.

(i) **Seasonal Analysis:-** To understand the dynamics of cropping pattern changes, there is a need to carry out a seasonal analysis of such changes. The identification of competing crops would emerge from such an analysis, which would have important being on policy decision.

(ii) **Determinants Of Cropping Pattern Changes** :- Factors responsible for cropping pattern changes are yield relative yield, price and relative price.

Increase in yield of all important crops needs to be studied more deeply. Changes in the relative yields between two competing crops may lead to change in cropping pattern of a region.

Increase in procurement price may not lead to shift in cropping pattern but relative increase in procurement prices followed by market prices may lead to shifts in cropping patterns. This phenomenon has been observed in case of ground nut, safflower and cotton.

Farmers receptivity to technological policy variables would be extremely important in explaining micro-level cropping pattern changes. This aspect, however, can only by studied only through a primary level survey.

APPENDICS
DETIALED DISTRICT LEVEL CROP COMBINATION REGIONS
A (i) ANDHRA PRADESH

S.No	Districts	1961-64	1979-82	1989-92
1.	SRIKAKULAM	9-Crop region ROP Me Rg OSGNBJSC	12- Crop region R (54), OP(11), Me (8), GN (8), Rg (6), B (2), Co (1), Ca (1), Se (1), M (1), SC (1), J (1).	10. Crop Region R (52), OP (6), GN(12), Me(5), Rg (4), Ca (2), Co (2), M(1), B(1), SC (1).
2.	VISHAKHAPATNAM		15- Crop region R (26), B (17), Rg (9) OP (9), SC (6), GN (6), Se (5), OC (4), J (3), M(2), N(2), Mz (1), Ca (1), Ch(1), Tu (1)	15-Crop region R(28), B (9), Rg (9), GN (8), SC (8), OC (6), OP(6), Se (5), NS(4), Ca (3), M (3), Mz (2), Tu (1), Ch (1), J (1).
3.	EAST GODAVARI	2 Crop region ROS	12 - Crop Region R (63), M (9), OP (6), co (4), SC (3), Se (2), B (2), FC (1), GN (1), Ta (1), J (1), To (1).	13 Crop Region R (57), OP (15), co (4), Tu (4), Ca (2), Ma (2), To (2), SC (2), B (1), Ta (1), Se (1), FC (1), GN (1).
4.	WEST GUDAVARI	Mono Crop region R	Mono Crop region R (75)	10. Crop region R (68), OP (9), to (4), ca (4), M (4), SC (4), GN (1), Co (1), FC (1), Ch (1).
5.	VIZIANGRAM		10- Crop region R (38), Me (20), GN (13), OP (7), Rg (6), B (3), Se (3), M (3), OC (2), SC (1).	4 – Crop region GN (40), R (25), M (11), OP (9).

6.	KRISHNA	2 Crop region R OP	9. Crop Region R (52), B (20), OP (9), C (4), Tu (4), Me (2), Ct (2), Mz (2), Rg (1).	Mono Crop region R (86).
7.	GUNTUR	7 Crop region RJOPBOSG NCh	12 - Crop region R (45), OP (14), Ct (13), FC (6), J (3), OC (3), GN (3), B (2), Ch (2), Se (2), Tu (1), To (1).	3 Crop region R(45), OP (20), Ct (16).
8.	PRAKASAM		6 Crop region J (19), R (17), OC (15), To (9), B (8), Ct (7).	12 Crop region R (22), GN (11), J (8), To (8), FC (7), Ct (7), B (5), OP (5), Cs (5), OC (4), Ch (4), Tu (3).
9.	NELLORE	3 Crop region RJB	12- Crop region R (58), J (12), GN (5), To (4), OP (3), B (3), Rg (2), C (2), Ch (1), FC (1), OC (1), Se (1).	12 - Crop region R (59), GN (10), Ct (7), J (3), OP (3), Ch (2), C (2), To (2), SC (1), Se (1), FC (1), B (1).
10.	KURNOOL	6-Crop region JCt OSGNRB	5 - Crop region J (26), GN (18), OC (18), Ct (12), R (10).	10 -Crop region GN (37), J (18), R (9), Ct (9), OC (9), Cr (3), G (3), To (3), Tu (3), B (2).
11.	ANANTPUR	6-Crop region OSGNJOPB	11- Crop region GN (41), OC (15), J (11), R (7), OP (6), B (5), Cr (3), Rg (3), Ct (2), Tu (2), C (1).	Mono Crop region GN (77).
12.	KUDDAPAH	5-Crop region JGNOSRB	5- Crop region J (28), GN (24), R (16), OC (9), B (6I.	9 - Crop region GN (62), R (17), J (7), Tu (2), M (2), Cr (2), B (1), Ct (1), 4 (1),

13	CHITTOR	5-Crop region ROSGNBRG	9 - Crop region GN (45), R (24), Rg (8), B (4), SC (4), OP (3), M (3), J (3), OC (2).	2 - Crop region GN (58), R (21).
14.	HYDERABAD	6-Crop region JOSROPGRg	2-Crop region FC (50), R (41)	2- Crop region R (49), FC (47).
15.	NIZAMABAD		5-Crop region R (40), Mz (17), J (15), SC (10), OP (7).	9 - Crop region R (45), Mz (18), SC (10), J (8), OP (7), Ct (3), Tr (2), GN (2), Ch (1).
16.	MEDAK	4 - Crop Region JROPOS	4-Crop region J (34), R (21), Mz (13), OP (10).	5-Crop region R (29), J (27), Mz (15), OP (9), SC (8).
17.	MEHBOOBNAGAR	3-Crop region RJOS	9-Crop region J (34), GN (16), R (15), OP (8), Cs (7), OC (5), B (4), Rg (3), Tu (3).	4- Crop region J (50), GN (20), R (16), Cs (12).
18.	RANGAREDDY		15-Crop region J (39), R (15), OP (10), Cs (6), Tu (6), Rg (3), Sf (3), Mz (2), B (2), GN (2), G (1), Se (1), Ch (1), Cr (1), W (1).	12-Crop region R (34), J (19), Tu (10), Cs (9), OP (7), Ct (5), GN (3), Rg (3), Mz (1), Ch (1), Sf (1), G (1).
19.	NALGONDA	5-Crop region JROSBOP	5-Crop region R (30), J (20), Cs (15), B (15), OP (9).	6-Crop region R (37), Cs (19), GN (13), J (8), B (6), Tu (2).

20.	WARANGAL	3 -Crop region RJOSOP	5-Crop region J (28), R (23), OP (20), Mz (8), GN (7).	8 - Crop region R (33), GN (18), Ct (10), J (6), Ch (5), Mz (4), Se (4).
21.	KHAMMAM	2-Crop region RJ	3-Crop region J (41), R (21), OP (18).	12 - Crop region R (34), OP (17), J (9), GN (7), Ct (6), Tu (6), Ch (5), M (5), To (2), Se (1), Mz (1), FC (1).
22.	KARIMNAGAR	5 - Crop region RJOPOSMZ	4 - Crop region R (31), OP (22), Mz (18), J (17).	4-Crop region (43), OP (16), Mz (15), GN (11).
23.	ADILABAD	9- Crop region JOSOPCT RTUMZCh	9 - Crop region J (39), Ct (21), R (11), OP (10), Tu (5), Se (5), Mz (3), Ch (1), FC (1).	5-Crop region J (34), Ct (29), R (12), Tu (8), OP (7).
24.	ANDHRAPRADESH		17-Crop Region R (30), J (10), GN (11), OP (9), OC (4), B (4), Ct (3), Mz (2), Rg (2), Cs (2), TU (1), SC (1), To (1), Ch (1), M (1), FC (1).	17-Crop region R (33), GN (19), OP (9), J (9), Ct (5), Tu (2), Cs (2), Mz (2), B (1), Ch (1), SC(1), M (1), To (1), OC (1), Se (1), Rg (1), FC (1).

1961-64 figures has been taken from Majid Husain's work.

A (ii) BIHAR

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	PATNA	2 -Crop region R OP	3- Crop region R (43), OP (26), W (19).	3- Crop region R (40), OP (25), W (23).
2.	NALANDA		3- Crop region R (51), W (22), OP(15)	3- Crop region R (49), W (28), OP (14).
3.	GAYA	2-Crop region ROP	2-Crop region R (58), W (18), OP (11)	3-Crop region R (59), W (22), OP (11).
4.	NAWADA		2-Crop region R (58), W (24),	2- Crop region R (55), W (30),
5.	AURANGABAD		3-Crop region R (52), W (24), OP (15)	3-Crop region R (56), W (21), OP (15).
6.	BHOJPUR		3-Crop region R (46), W (29), OP (12)	2-Crop region R (47), W (33)
7.	ROHTAS		2-Crop region R (51), W (30).	2- Crop region R (52), W (33).
8.	SARAN	4 - Crop region OP MzSCT	3-Crop region R (34), W (34), M (17)	2- Crop region R (37), W (37)
9.	SIWAN		3-Crop region R (35), W (33), Mz (14)	2-Crop region R (37), W(36).
10.	GOPALGANJ		3 -Crop region R (40), W (20), Mz (12)	2-Crop region R (53), W(35).
11.	EAST CHAMPARAN		10-Crop region R (53), W (20), Mz (6), OP (6), SC(3), B (3), M (1), Pt (1), Li (1), RM (1).	2 - Crop region R(53), W (27).
12.	WEST CHAMPARAN		8-Crop region R (58), W(19), SC(9), OP(4), Mz(2), M (2), B(1), Pt (1).	3-Crop Region R (50), W (22), SC(15)

13.	MUZAFFARPUR	2-Crop region R OP	4-Crop region R(47), W (18), Mz (12), OP (11).	3- Crop region R (49), W (22), OP (14)
14.	VAISHALI		4-Crop region R (35), W (22), Mz (16), OP (11).	4- Crop region R (33), W (27), Mz (15), OP (12).
15.	SITAMARHI		9- Crop region R (61), OP (13), W (13), Mz (3), M (2), Rg (1), SP (1), SC (1), Pt (1).	8- Crop region R (61), W (17), OP (10), Mz (3), SC (2), M (1), Pt (1), Rg (1).
16.	DARBHANGA	10-Crop region ROPMZW Rg BSC GtuOS	9-Crop region R (52), W (16), OP (13), Rg (5), Mz (4), M (2), G (1), SC (1), Pt (1).	3-Crop region R (53), W (23), OP (10)
17.	MADHUBANI		10 - Crop Region R(60), W (11), OP(9), Rg (7), M (3), Mz (1), G (1), Li (1), Pt (1), Sp (1).	7- Crop region R (67), W(15), OP (8), M (2), Rg (2), Pt (1), SC (1).
18.	SAMASTIPUR		3-Crop region R (30), Mz (25), W (21).	3- Crop region R (32), W (22), Mz (22).
19.	BEGUSARAI		2- Crop region Mz (39), W (37)	3-Crop region Mz (42), W (30), R (13).
20.	MONGHYR	5 Crop region BMzOPG US	4- Crop region R (40), W (22), Mz (17), OP (13).	4- Crop region R (52), W (17), Mz (13), OP (11).
21.	BHAGALPUR	7 Crop region RMzOPG WBros	4- Crop region R (43), Mz (17), W (15), OP (12).	4- Crop region R (52), W (17), Mz (15), OP (10).
22.	SANTHAL PARGANA	2- Crop region ROP	Mono Crop region R (76)	Mono Crop region R (78)

23.	SAHARSA	7- Crop region ROPMzJ uW Rg	4- Crop region R (40), OP (17), W (14), Mz (13).	4- Crop region R (41), W (18), OP (18), Mz (10).
24.	PURNEA	2 -Crop region Rju	9- Crop region R (55), J (14), W (10), OP (8), Mz (5), Me (1), RM (1), Li (1), Pt (1).	9-Crop region R (54), W (15), J (12), OP (5), Mz (5), RM (2), Pt (1), Li (1), Me (1).
25.	KATIHAR		5- Crop region R (45), W (14), Mz (10), OP (10), J (9).	7- Crop region R (66), W (12), J (7), Mz (5), OP (5), Pt (1), RM (1).
26.	HAZARIBAGH	2 -Crop region RMz	9- Crop region R (63), Mz (11), OP (7), Rg (5), Pt (3), W (3), NS (2), G (1), SC (1).	8- Crop region R (66), Mz (10), Pt (5), OP (5), W (4), Rg (2), NS (2), G (1).
27.	GIRIDIH		8-Crop region R (65), Mz (11), Rg (8), OP (5), W (3), Pt (2), B (1), NS (1).	Mono Crop region R (74)
28.	DHANBAD	Mono Crop Reg R	Mono Crop region R (85)	Mono Crop region R (92).
29.	RANCHI	2 Crop region R OP	10 - Crop region R(65), OP (9), Rg (7), OC (6), NS (4), W (1), Mz (1), SP (1), Tu (1), Pt (1).	Mono Crop region R (75)
30.	PALAMAU	7 - Crop region ROPGOS MZB Tu	13-Crop Region R (32), Mz (17), OP (10), OC (8), W (6), Tu (4), G (4), Se (4), B (3), RM (1), Rg (1), NS (1), Pt (1)	12- Crop region R (39), Mz (12), OP(11), W (8), Tu (5), G (4), Se (4), OC (4), B (4), Pt (2), RM (1), Rg (1).

31	SINGBHUM	Mono Crop region	Mono Crop region R (92)	Mono Crop region R (96)
32.	BIHAR		12 Crop region R (53), W (16), OP (10), Mz (8), G(1), Rg (1), J (1), OC (1), Pt (1), SC (1), B(1), M (1)	9 Crop region R (55), W (20), OP (9), Mz (7), G (1), Pt (1), SC (1), J (1), RM (1).

1961-64 figures has been taken from Majid Husain's work.

Note: - (i) figures of Godda, Deogher, Dumka, Sahibgung have clubbed to make figures of Santhal Pragana

(ii) Gaya & Jahanabad with Gaya

(iii) Saharsha & Madhepura with Saharasa

(iv) Munger & Khagaria with Munger

(v) Purnia, Araria & Kishenganj with Purnia.

A(iii) GUJARAT

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	AHMADABAD	9 Crop region Ct JGNBOPRTU G Rg	6- Crop region Ct (29), W (17), J (14), B (11), R (10), FC (8).	6 -Crop region Ct(27), FC (16), B (14), R (14), W (10), J (7).
2.	BANASKANTHA	9 Crop region BJMz OP WCtGNRg	11-Crop region B (37), FC (17), OP (7), RM (7), Cs (6), W (5), Ct (3), OC(1), Mz (1), Se (1).	11- Crop region B(36), RM (15), J (10), Gu (8), Cs (8), OP (6), W (4), FC(3), Ct (2), Mz (1), SC(1).
3.	BAROADA		12 - Crop region Ct (32), Tu (12), J (12), R (10), FC (6), To (5), Mz (4), OC(4), B(3), GN (2), OP (2), W (2)	7- Crop region Ct (26), Tu (19), J (10), R (9), Mz (7), FC (7), To (5).
4.	BAROACH	2-Crop region CtJ	4- Crop region Ct (25), J (23), Tu (21), FC (8)	12- Crop region Tu (38), Ct (15), J (14), FC (8), W (5), R (4), OP (2), BN (2), GN (2) B(1), SC (1), Mz (1).
5.	BULSAR	9- Crop region ROPCt RJT UgNSCG	2-Crop region FC (36), R (34)	2 Crop region R (37), FC (36).

6.	DANGS	4- Crop region ROPRGTu	5- Crop region Rg (37), OC (22), R (14), OP (13), FC (12)	6- Crop region Rg (35), R (17), OC (16), OP (12), Tu (9), FC (8).
7.	GANDHINAGAR		8-Crop region B (33), Cs (16), W (11), FC (11), J (7), Ct (5), OP(5), R (5).	6-Crop region B (24), Cs (17), FC (14), W (14), R (10), RM (10).
8.	KAIRA	8-Crop region BRCt GNWRGTuOP	6-Crop region B (24), R (21), To (15), W (9), Ct (8), FC (6).	4- Crop region B (28), R (18), To (17), W (11)
9.	MEHSANA	5-Crop region JCtGNWB	8-Crop region B (27), J (14), Ct (12), W (10), RM (9), Cs (6), FC (6), R (5).	7 - Crop region B (23), RM (16), Ct (11), J (10), FC (10), Cs (9), W (9).
10.	PANCHMAHALS		13 - Crop region Mz (31), R (20), OC (8), Ct (7), GN (5), G (5), W (4), B (4), Tu (3), OP(3), Rg(2), FC (2), J (1).	12- Crop region Mz (34), R (23), W (6), Tu (6), B (5), G (5), OP(4), OC (3), GN (3), Ct (2), FC (2), J (1).
11.	SABARKANTHA	4 Crop region GNCtMzR	8-Crop region Ct (24), Mz (18), GN (12), B (11), W (8), OP (5), FC (5), R (4).	11 - Crop region Mz (21), B (11), OP (11), Cs (10), W (10) , Tu (7), Ct (5), FC (4), GN (4), J (4), R (3).

12.	SURAT	6 Crops region CtJR GNOPB	6- Crop region J (25), FC(16), R (15), SC (11), Tu (8), Ct (8)	5- Crop region SC (23), J (20), R (16), FC (13), Tu (11).
13.	AMRELI	5 -Crop region GNBJWSC	4 - Crop region GN (37), B (19), J (15), Ct (13).	4 - Crop region GN (35), B (21), Ct (13), J (12).
14.	BHAVNAGAR	2 - Crop region BGN	4 - Crop Region GN (37), B (19), J (15), Ct (13).	4 - Crop region GN (35), B (21), Ct (13), J (12).
15.	JAMNAGAR	2 - Crop region GNJ	7 Crop region GN (67), B (9), J (8), W (5), FC (3), Ct (3), RM (1).	8 Crop region GN (59), FC (16), B (9), Ct (3), W (3), Se (3), G (1), RM (1).
16.	JUNAGARH	2 - Crop region GNJ	2- Crop region GN (65), FC (9), W (6), B (6), Ct (5), J (3), SC (1), G (1).	Mono-Crop region GN (67)
17.	KUTCH	4- Crop region GNJOPB	6- Crop region OP (23), B (17), FC (14), J (13), Ct (11), GN (10).	6- Crop region FC (26), OP (16), B (15), GN (10), Gu (9), Ct (8).
18.	RAJKOT	2-Crop region GNJ	7- Crop region GN (55), Ct (17), B (8), W (7), J (7), FC (3), SC (1).	8 - Crop region GN (52), Ct (12), FC (11), B (9), W (5), Se (2), Cs(1), OP (1).

19.	SURENDRA NAGAR	2 - Crop region Ctj	3- Crop region Ct (56), J (15), B (13)	8- Crop region Ct (49), B (15), FC (14), GN (5), J (4), Se (4), W (3), OP (2).
20.	GUJARAT		8- Crop region GN (21), Ct (15), B (14), J (10), FC (8), W(6), R(5), OP (4).	12- Crop region GN (19), B (14), Ct (11), FC(10), J (6), R (6), W (5), Tu (4),OP (4), Mz (3), Cs (3), RM (3).

1961-64 figures has been taken from Majid Husain's work.

A (iv) HARYANA

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	AMBALA	7- Crop region WGMZ RSC OPGN	7-Crop region W (32) R(18), FC (12), B (10), SC (8), G (6), OP (4).	4-Crop region. W (39), R (26), FC (13), Mz (8),
2.	KURUKSHETRA		2-Crop region W(44), R (33),	2 - Crop region W (43), R (40)
3.	KARNAL	4 -Crop region WMZ GR	2-Crop region W (45), R (31)	2 - Crop region W (47), R (99)
4.	ROHTAK		5-Crop region W (30), B (20), G (14), FC (10), J (9)	11- Crop region W (37), RM (15), J(10), B(9), FC (7), G (5), SC (5), Tu (2), Ct (2), R (1), Br (1).
5.	SONEPAT		11-Crop region W (50), B (8), FC(8), R (8), SC (5), G (3), Ct (1), RM (1), Mz (1),	8 -Crop region W (54), R (13), FC (10), J (5), SC (5), Tu (5), RM (3), B (2).
6.	HISSAR	2 - Crop region BG	5 -Crop region G (23), W (19), Ct (19), FC (14), B (13).	6- Crop region W (28), Ct (25), G (12), FC (10), RM (9), B (8).
7.	SIRSA		4-Crop region G(30), W(19), Ct(19), FC(15)	5-Crop region. Ct(29), W(28), G(15), RM(9), FC(9)

8.	BHIWANI		3-Crop region. B(42), G(28), FC(13)	5-Crop region. B(31), G(30), RM(12), W(10), FC(10)
9.	GURGAON	5-Crop region. WGNJOSB	7-Crop region. W(35), B(25), FC(10), B(8), J(7), RM(6), G(6).	4-Crop region. W(33), RM(22), B(20), FC(9).
10.	FARIDABAD		11-Crop region. W(44), B(17), FC(10), J(8), Br(7), SC(2), RM(2), OP(2), G(1), Tu(1), Mz(1),	8-Crop region. W(49), FC(15), B(8), RM(8), J(8), SC(4), Tu(3), Br(2).
11.	JIND		5-Crop region. W(29), B(10), G(17), FC(11), R(8).	9-Crop region. W(40), B(12), R(11), Ct(11), FC(9), G(5), RM(5), SC(3), J(1).
12.	NARNAUL		6-Crop region. B(43), W(18), G(12), FC(11), Br(6), RM(6).	4-Crop region. B(38), RM(24), G(14), W(13).
13.	HARYANA		6-Crop region. W(28), B(16), G(14), FC(12), R(9), Ct(6).	7-Crop region. W(33), R(11), B(11), FC(10), RM(9), G(9), Ct(9).

1961-64 figures has been taken from Majid Husain's work.

A (v) HIMACHAL PRADESH

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	BILASPUR		2 - Crop region W (42), Mz (41)	2 –Crop region W (46), Mz (46)
2.	CHAMBA	2 - Crop region Mz W	3- Crop region Mz (43), W (28), B (8)	3- Crop region Mz (44), W (31), B (6)
3.	HAMIRPUR	3 - Crop region WJG	2- Crop region W (46), Mz (39)	2- Crop region W (47), Mz (46).
4.	KANGRA		3- Crop region W (42), Mz (24), R (18)	3-Crop region W (44), Mz (27), R (18)
5.	KINNAUR	4- Crop region BrWMzRg	3- Crop region OC (46), B (20), W (14)	5- Crop region OC (33), B (19), P (15), OP (11), W (8).
6.	KULLU		8- Crop region W (38), Mz (30), B (9), OC (7), OP (6), R (3), Pt (2), RM (1)	2 – Crop Region W (40), Mz (33).
7.	LAHUL/ SPITI	2-Crop region OPB	2-Crop region Pt (43), B (31)	3- Crop region Pt (33), OP (29), B (25).
8.	MANDI	3- Crop region WMzR	3- Crop region W (41), Mz (28), R (17	3-Crop region W (44), Mz (32), R (14).
9.	SHIMLA	2- Crop region Mz W	9- Crop region W (32), Mz (20), P (9), OC (8), Pt (7), B (7), R (5), OP (4), R (3).	Mono -Crop region W (71).
10.	SIRMAUR	3- Crop region WMzR	2- Crop region W (40), Mz (34)	2- Crop region W (41), Mz (35)
11.	SOLAN		2- Crop region W (37), Mz (36).	2- Crop region) Mz (41), W (38)

12.	UNA		2 - Crop region W - (43), Mz (38)	2- Crop region W (47), Mz (41)
13.	HIMACHAL PRADESH		3- Crop region W (40), Mz (32), R (10)	2 – Crop region W (42), Mz (35)

1961-64 figures has been taken from Majid Husain's work.

A (vi) KARNATAKA

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	BANGALORE	2- Crop region RRg	10- Crop region Rg (58), OP (13), R (9), GN (4), FC (3), Mz (3), OC (2), Co (2), Tu (1), M (1).	9- Crop region Rg (59), OP (13), R (8), GN (6), Co (3), FC (3), M (1), Mz (1), Tu (1).
2.	BELGAUM	7 - Crop region JGNCTBR OPW	12- Crop region J (21), GN (13), B (8), OP (7), W (6), R (6), Ct (6), Mz (5), SC (5), FC (4), OC (3), To (3).	15- Crop region J (26), SC (11), GN (10), Ct (8), Mz (7), R (6), B (6), OP (5), W (4), FC (2), To (2), G (2), Sf (1), Tu (1), Ch (1).
3.	BELLARY	6- Crop region CtJRGNIP B	10- Crop region FC (24), J (19), Ct (14), OC (9), GN (5), Rg (5), B (4), OP (4), R (4). Mz (2).	14-Crop region J (25), OC (20), Ct (14), GN (11), R (16), Rg (4), Mz (3), OP (3), B (3), Tu (2), Cr (1), Sf (1), Se (1), SC (1).
4.	BIDAR	7 - Crop region JOPGGNT uOSR	13- Crop region J (31), OP (16), Tu (9), G (6), B (6), Se (4), OC (4), NS (4), W (5), SC (3), R (3), GN (2), Ct (2).	11- Crop region J (29), OP (23), Tu (10), G (8), SC (5), R (5), Se (4), B (3), NS (3), GN (2), W (2).
5.	BIJAPUR	3- Crop region JBCt	7- Crop region J (35), Ct (16), B (15), GN (7), W (7), OP (6), Sf (3)	12 - Crop region J (42), B (12),GN (10),OP(9), Mz (4), W (4), Sf (3), G (3), SC (2), Tu (2), Ct (2), Li (1).
6.	CHICMAGLUR	6 - Crop region RPRgJOPC fCt	6-Crop region R (23), CF (23), W (19), OP (8), J (8), Co (8).	6- Crop region Cf (24), Rg (21), R (19), OP (10), Co (9), J (7).

7.	CHITRADURGA	7- Crop region JRGOPCT BGNTu	8- Crop region Rg (21), J (15), OC (11), R (9), OP (9), GN (7), Ct (7), B (5).	10- Crop region GN (24), Rg (10), J (13), R (8), OP (6), Ct (6), Co (5), Mz (4), OC (3), B (2).
8.	D. KANNADA	Mono Crop region R	6- Crop region R (64), Ca (12), Co (7), Bt (6), OP (5), Ru (2).	6- Crop region R (57), Ca (15), Co (7), Bt (7), OP (7), Ru (4).
9.	DHARWAR		7- Crop region Ct (22), J (22), GN (10), W (10), OP (7), R (7), Ch (6).	7 Crop region J (22), Ct (17), GN (12), OP (9), Ch (7), R (7), W (6).
10.	GULBARGA	2 - Crop region GNJ	14 - Crop region J (27), Tu (14), B (12), Ct (9), OP (7), GN (6), Sf (4), OC (3), G (2), Li (2), W (2), Se (2), Me (1), R (1)	12- Crop region J (31), Tu (22), GN (11), OP (8), B (7), Sf (4), G (4), Se (3), W (2), OC (1), R (1), Me (1).
11.	HASAN	6-Crop region RRJOPcFC t	5- Crop region Rg (36), OP (17), R (16), Co (10), Cf (9),	5- Crop region Rg (40), R (15), OP (3), Co (12), Cf (9).
12.	KODAGU	2- Crop region RCF	2- Crop region Cf (45), R (32)	2- Crop region Cf (53), R (32).
13.	KOLAR	9 - Crop region RgGNROP Tu BSCOSJ	12- Crop region Rg (42), GN (15), OP (13), R (9), OC (3), Ru (3), M (2), Mz (2), FC (2), B (1), J (1), SC (1).	5- Crop region Rg (33), GN (28), R (13), OP (17), M (6).
14.	MANDYA	5- Crop region RGOPJRGN	3- Crop region Rg (30), OP (26), R (22)	4- Crop region Rg (33), R (25), OP (18), SC (9).
15.	MAYASORE	5 - Crop region RgROPJSe	4- Crop region Rg (24), OP (24), J (18), R (13).	6- Crop region Rg (21), OP (18), R (17), J (15), Ct (7), GN (5).

16.	RAICHUR	2- Crop region Ct J	7- Crop region J (26), Ct (25), GN (11), B (8), OP (8), R (7), OC (5).	7- Crop region J (28), GN (15), R (12), B (11), Ct (9), OP (5), Tu (4).
17.	SHIMOGA	2- Crop region RRG	9- Crop region R (57), Rg (13), J (9), OP (4), GN (3), Ch (3), Bt (3), Ct (3), SC (2).	9 - Crop region R (49), Ct (11), Rg (10), J (7), GN (5), SC (5), OP (5), Bt (3), Ch (1).
18.	TUMKUR	7- Crop region RgOPRCh JTuB	6- Crop region Rg (33), OP (16), GN (16), R (9), Co (8), OC (8), J (4)	4- Crop region Rg (33), GN (32), OP (10), Co (9).
19.	U. KANADA		Mono -Crop region R (86)	Mono - Crop region R (70).
20.	KARNATAKA		10 Crop region J (19), R (11), Ct (10), OP (10), GN (8), B (6), OC (3), Tu (3), W (3)	8- Crop region J (21), GN (12), R (11), Rg (10), OP (9), Ct (6), Tu (4), B (4).

1961-64 figures has been taken from Majid Husain's work.

A (vii) KERALA

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	TRIVANDRAM		3 - Crop region Co (36), Ta (27), R (15)	4- Crop region Co (45), Ta (18), Ru (12), R (11).
2.	QUILON	6 - Crop region TCt SCOP Tu Rg	4- Crop region Co. (31), Ta (22), R (18), Ru (13)	4 - Crop region Co (38), Ta (16), Ru (16), R (15)
3.	ALLEPPEY	3- Crop region SCRgOP	2- Crop region R (42), Co. (31)	2- Crop region Co (44), R (33)
4.	KOTTAYAM	6 - Crop region TCt SC OP Tu Rg	4- Crop region Ru (29), Co (25), R (16), Ta (12).	3- Crop region Ru (50), Co (22), R (12)
5.	IDUKKI		7 - Crop region Cd (30), T (16), Co. (11), Ru (11), BP (7), Ta (7), R (5).	5 -Crop region Cd (22), BP (20), Ru (20), T (13), Co (19).
6.	ERNAKULAM	6- Crop region TCf SC OP Tu Rg	3- Crop region R (43), Co (28), Ru (9).	3- Crop region R (29), Co (29), Ru (27).
7.	TRICHUR		2 - Crop region R (52), Co (25).	2- Crop region Co (41), R (37)
8.	PALGHAT	7- Crop region OPCf Ch T Rg SC Tu	12- Crop region R (62), Co (7), Ca (4), Ta (4), GN (3), OP (3), SC (3), Ru (3), Ct (2), M (1), BN (1), Cd (1).	12 - Crop region R (51), Co (12), Ru (8), GN (4), Ta (3), Ct (3), Ca (3), SC (3), M (2), OP (2), BN (2), Cd (1).

9.	MALAPURAM		5- Crop region R (36), Co (26), Cs (9), Ru (8), Ta (8)	9- Crop region Co (41), R (22), Ru (8), Cs (7), Bt (5), Ta (4), M (3), BP (3), BN (2).
10.	KOZIKODE		5- Crop region Co (37), R (18), Cf (13), Ru (8), BP (7)	13 - Crop region Co (37), Cf (18), BP (12), R (9), Ru (5), M (3), Bt (2), BN (2), T (1), Ta (1), Cd (1), Cs (1)
11.	CANNANORE	7 - Crop region OPCt Ch TRg SC Tu	8- Crop region Co (23), R (21), Cs (21), BP (8), Ta (5), Ru (5), Bt (4), Cf (3)	6- Crop region Co (37), Cs (16), Ru (11), BP (10), R (9), Bt (6).
12	KERALA		13- Crop region R (31), Co (26), Ta (9), Ru (8), Cs (5), BP (4), Bt (2), M (2), Cf (2), Cd (2), BN (1), T (1), OP (1).	12 - Crop region Co (32), R (21), Ru (15), BP (6), Ta (5), Cs (4), Cf (2), M (2), BN (2), Bt (2), Cd (1), T (1)

1961-64 figures has been taken from Majid Husain's work.

Note :- (i) Figures of Waynad has been clubbed with Kozikode

A (viii) MADHYA PREAESH

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	RAIPUR	2- Crop region R OP	2- Crop region R (69), OP (20).	2- Crop region R (75), OP (16).
2.	DURG	3-Crop region R WOP	2- Crop region R (55), OP (27)	2- Crop region R (55), OP (24),
3.	RAJNANDGAON		7 - Crop region R (45), OC (17), OP (15), Li (9), G (5), W (3), Tu (3)	7 - Crop region R (49), OC (15), OP (12), G (10), Li (6), W (2), Tu (2).
4.	BASTAR	2 – Crop region R O P	2- Crop region R (64), OC (19),	2 - Crop region R (67), OC (17).
5.	BILASPUR	2- Crop region R O P	2- Crop region R (70), OP (14)	2- Crop region R (68), OP (18)
6.	SARGUJA	10 Crop region ROP Mz OS GB WtuJRg	9- Crop region R (53), OC (17), OP (9), Mz (7), Ns (4), RM (4), W (2), Br (1), Se (1)	10- Crop region R (54), OC (14), OP (7), Mz (7), NS (4), RM (4), W (3), Tu (1), Br (1), Se (1).
7.	RAIGARH	2- Crop region ROP	Mono-Crop region R (70).	Mono - Crop region R (74).
8.	JABALPUR	4- Crop region WRGOP	3- Crop region W (31), R (27), G (17).	4 - Crop region W (30), R (27), G (15), OP (11).
9.	BALAGHAT	2- Crop region ROP	Mono -Crop region R (69)	Mono -Crop region R (68)

10.	CHINDWARA	7- Crop region JWOSGOPGNTu	9 - Crop region OC (16), J (15), OP (15), W (13), NS (8), Tu (5), G (5), Mz (5), R (5)	9 - Crop region J (16), OC (16), W (15), Mz (9), OP (8), NS (7), Tu (6), GN (6), G (4).
11.	SEONI	6 - Crop region WROPOSGJ	5- Crop region R (24), W (20), OC (17), OP (11), G (7).	8 - Crop region R (27), W (21), OC (15), OP (8), G (6), NS (4), Li (4), J (3).
12.	MANDLA	7- Crop region RW OS OP Mz GN Tu	9- Crop region OC (28), R (28), W (15), NS (7), Mz (6), RM (5), OP (4), G (3), Li (1).	7- Crop region R (30), OC (24), W (14), NS (7), Mz (6), OP (6), RM (6).
13.	NARSINGHPUR	5- Crop region WJOPG Tu	10- Crop region G (34), OP (22), W (12), Tu (6), J (6), R (5), OC (4), Se (3), FC (1), SC (1).	10- Crop region G (42), W (18), OP (15), Tu (6), J (4), R (4), Se (3), OC (2), SC (1), FC (1).
14.	SAGAR	2- Crop region WOP	9- Crop region W (45), G (16), OP (11), PC (11), J (5), R (3), Li (2), OC (1), GN (1).	8- Crop region W (48), G (18), OP (11), FC (9), Li (4), J (3), R (2), GN (1).
15.	DAMOH	2- Crop region R W	5- Crop region W (34), R (17), G (16), OP (11), J (6).	4- Crop region W (30), G (19), R (17), OP (14).

16.	PANNA	3- Crop region WRG	11- Crop region W (34), R (23), G (12), Li (6), OC (4), J (4), OP (3), Se (3), Br (3), Tu (2), Mz (1).	4- Crop region W (31), R (22), G (18), Li (7).
17.	TIKAMGARH	6- Crop region WJGRBrO P	6- Crop region W (24), J (14), OC (13), FC (12), R (10), OP (9)	8- Crop region w (30), FC (12), OP (12), J (9), G (9), R (8), OC (6), Se (6).
18.	CHHATTAR PUR		9- Crop region W (25), G (13), FC (10), OC (9), J (9), Br (8), OP (7), R (5), Se (4).	12 - Crop region W (29), G (16), FC (10), OP (8), J (7), Se (7), OC (5), R (4), Br (3), Li (3), Tu (2), RM (2)
19.	REWA	4- Crop region WRGOP	4- Crop region W (28), R (27), G (12) OC (11).	4- Crop region W (32), R (26), G (14), OC (8).
20.	SIDHI	10 Crop region RBWGOP Mz Tu JOS RGU	8- Crop region OC (23), R (20), Br (11), G (9), W (8), Mz (6), Tu (6), Se (5).	8- Crop region OC (21), R (20), W (12), G (18), Mz (7), Br (6), Tu (6), Se (5).
21.	SATNA	3- Crop region WRG	9- Crop region W (41), R (21), G (9), OC (7), Li (4), Br (4), Tu (4), J (3), OP (3).	9 - Crop region w (44), R (20), G (11), Li (5), OC (5), OP (3), Tu (3), J (2), Br (1).
22	SHAHDOL	9 - Crop region RWOPOS MzGBr TuJ	13- Crop region R (43), OC (18), W (9), Mz (5), OP (4), NS (3), RM (2), Se (2), G (2), Tu (2), Li (1), Br (1), J (1).	11- Crop region R (43), OC (17), W (11), Mz (6), OP (4), RM (3), NS (3), Tu (2), G (2), Se (2), Li (1).
23	INDORE	3-Crop region WJG	4- Crop region W (20), G (19), J (19), FC (11).	4- Crop region W (33), G (21), J (17), FC (14).
24.	DHAR	6- Crop region WGNJOSG MZ	8- Crop region OP (15), W (14), J (13), MZ (11), Ct (10), G (10), FC (7), GN (7).	7- Crop region Ct (17), Mz (17), W (16), J (12), OP (9), G (8), FC (8).

25.	JHABUA	3- Crop region WJU	8- Crop region OP (23), MZ (21), OC (9), J (9), R (8), G (6), Ct (6), GN (6).	12- Crop region Mz (24), OP (23), J (7), R (6), GN (5), Ct (5), OC (), W (4), B (4), FC (3), Tu (1).
26.	W. NIMAR	8-Crop region Ct J OP GN RW Tu G	12 - Crop region Ct (25), J (25), OP (14), GN (7), Mz (6), W (5), B (4), Tu (3), R (2), FC (1), G (1), G (1), Ch (1).	12 - Crop region Ct (28), J (26), OP (10), W (7), GN (7), Mz (6), B (3), Tu (3), R (1), Ch (1), FC (1), G (1).
27.	E. NIMAR		11- Crop region Ct (32), J (26), OP (13), R (7), W (5), GN (3), Tu (3), OC (3), BN (1), G (1), FC (1).	11- Crop region Ct (32), J (24), OP (11), W (7), R (6), GN (4), Tu (3), BN (3), G (2), OC (2) FC (1).
28.	UJJAIN	2- Crop region WJ	10 - Crop region J (36), G (16), W (14), FC (10), OP (5), Mz (4), Ct (4), Tu (3), Li (3), GN (2).	4- Crop region J (29), G (24), W (23), FC (14).
29.	MANDSAUR	8- Crop region JGNWMz Go PCt B	5- Crop region J (24), G (20), OP (15), MZ (15), FC (8),	6- Crop region Mz (20), OP (14), J (14), G (12), FC (11), W (8).
30.	RATLAM	6- Crop region J W Ct G Mz GN	7- Crop region J (18), G (17). OP (13), Mz (12), FC (12), W (9), Ct (8).	7- Crop region G (17), Mz (17), FC (16), W (12), J (12), OP (10), Ct (8).
31.	DEWAS	4- Crop region J W Ct G	6-Crop region J (35), W (15), FC (12), Ct (11), G (9), Tu (5).	5- Crop region J (27), W (18), Ct (17), FC (14), G (11).
32.	SHAJAPUR	3- Crop region W JU	11- Crop region J (36), G (13), W (11), FC (8), Ct (8), GN (5), Mz (4), Tu (4), OP (4), R (1), Ch (1).	4- Crop region J (29), G (22), W (16), FC (16).

33.	MORENA	5- Crop region GBJWOP	5- Crop region W (25), RM (20), B (18), G (14), J (7).	3- Crop region RM (47), W (21), B (15).
34.	BHIND	6-Crop region GWBJ Br OP	8- Crop region W (24), G (22), B (12), OP (9), RM (8), J (7), Br (6), Tu (5).	5- Crop region W (25), RM (20), G (14), OP (11), B (10).
35.	GWALIOR	4- Crop region WGN JR	13- Crop region W (33), G (16), J (14), R (10), OP (5), Tu (4), SC (1), Se (1), B (1), Br (1).	5- Crop region W (36), RM (21), G (15), J (6), OP (6).
36.	SHIVPURI	4- Crop region JWGMZ	6- Crop region W (21), J (18), FC (13), G (11), OP (8), Mz (8)	8- Crop region W (24), G (13), FC (13), GN (11), J (10), Mz (6), OP (6), RM (5).
37.	GUNA	2- Crop region WJ	4- Crop region J (29), W (25), G (17), FC (10).	4-Crop region W (29), G (26), J (18), FC (9).
38.	DATIA	4- Crop region WJOPG	3- Crop region W (34), G (25), J (20)	4- Crop region W (37), G (31), OP (9), J (8).
39.	BHOPAL		4- Crop region W (46), G (18), J (13), FC (13).	7- Crop region W (51), G (23), FC (10), J (6), OP (4), Mz (2), Tu (1).
40.	SEHORE	2- Crop region WJ	4- Crop region W (31), J (16), FC (15), G (13).	4- Crop region W (35), G (19), FC (16), J (8).
41.	RAISEN	2- Crop region WG	5- Crop region W (46), G (21), J (12), OP (8), FC (6).	2- Crop region W (45), G (31).
42.	VIDISHA	2- Crop region WG	5- Crop region W (46), G (21), J (12), OP (8), FC (6).	2- Crop region W (45), G (31).
43.	BETUL	8- Crop region J WG OP Tu GN ROS	7- Crop region J (19), OC (18), W (16), R (9), OP (8), Tu (7), G (6).	8- Crop region W (19), J (18), OC (18), R (8), OP (7), G (6), Mz (5), Tu (5).

44.	RAJGARH	2- Crop region WJ	10- Crop region J (38), FC (15), G (9), Mz (7), W (7), Ct (6), OP (4), Tu (4), GN (4), R (2)	5- Crop region J (31), FC (18), G (14), W (12), Mz (8).
45.	HOSANGABAD	5 - Crop region WGN JOP Ct TuR Mz G	11-Crop region W (30), G (12), J (9), Ct (8), Se (8), OP (6), Tu (6), Li (5), FC (5), OC (3), R (2).	11- Crop region W (37), G (23), Ct (7), FC (6), Tu (5), Li (4), J (3), Se (3), OP (2), R (2), OC (2).
46.	MADHYAPRADESH		8- Crop region R (23), W (16), J (11), OP (11), G (9), OC (7), FC (4), Mz (3),	15- Crop region R (25), W (17), G (11), OP (10), J (7), OC (5), Mz (4), FC (4), Ct (2), RM (2), Tu (2), Li (2), GN (1), Se (1), NS (1).

1961-64 figures has been taken from Majid Husain's work.

A (ix) MAHARASHTRA

S.No	DISTRICTS	1961-64	1979-82	1989-92
1.	GREATER BOMBAY		Mono - Crop region FC (76).	3- Crop region R (47), Co (31), FC (21).
2.	RAIGAD		Mono- Crop region R (73).	Mono Crop region R (72).
3.	NASIK	9 – Crop region BCt JWOP GNRgRG	13 - Crop region B (34), J (11), W (11), FC (8), OP (8), GN (5), Rg (5), R (4), SC (2), OC (2), G (2), O (2), NS (1).	13- Crop region B (39), W (8), J (7), OP (6), GN (5), Rg (5), G (4), FC (4), R (4), SC (4), O (2), NS (2), OC (2).
4.	JALGAON	5- Crop region Ct RO P GN B	5- Crop region J (27), Ct (22), OP (10), B (10), GN (7).	9- Crop region J (26), Ct (18), OP (12), B (11), Se (7), GN (6), BN (4), G (4), W (3).
5.	PUNE	2- Crop region SC J	12- Crop region J (44), FC (15), B (15), R (4), OP (4), W (3), GN (3), Sf (2), G (2), SC (2), Rg (1), O (1).	11- Crop region J (42), B(7), FC (12), R (4), W (4), GN (3), SC(3), Sf (3), OP (3), G (2), O (1).
6.	SANGLI	2- Crop region SCJ	11- Crop region J (37), B (15), FC (11), OP (8), GN (7), W (5), SC (4), R (3), G (2), Tu (2), Sf (1).	12- Crop region J (42), B (15), OP (8), GN (8), SC (5), FC (4), W (3), G (3), R (2), Tu (2), Sf (1), Mz (1).
7.	KOLHAPUR	8- Crop region RGNJRg OP Tu Mz G	6- Crop region R (23), FC (19), SC (11), GN (11), J (10), Rg (9).	5- Crop region R (23), FC (16), GN (15), SC (15), J (10).

8.	PARBHANI	2- Crop region SCJ	11- Crop region J (37), Ct (21), OP (13), Sf (6), W (5), Tu (4), G (2), Li (2), R (2), GN (1), Me (1).	11- Crop region J (34), Ct (24), OP (11), Tu (6), Sf (6), W(4), GN (3), R (2), Li (1), Se (1).
9.	NANDED		9- Crop region J (45), Ct (22), OP (7), W (6), Tu (5), R (5), GN (2), G (2), Ch (2).	11- Crop region J (36), Ct (32), OP (7), Tu (5), R (4), W (3), GN (2), SC (2), G (1), Se (1), Ch (1).
10	BULDANA	2- Crop region Ct J	9- Crop region J (34), Ct (29), OP (11), W (6), Sf (6), Tu (4), GN (3), G (1), B (1).	3- Crop region Ct (33), J (26), OP (15).
11.	AMRAVATI		2- Crop region Ct (48), J (26).	4- Crop region Ct (45), J (22), Tu (10), OP (9).
12.	WARDHA	2- Crop region Ct SC	3- Crop region Ct (42), J (30), W (8).	3- Crop region Ct (40), J (23), Tu (12).
13.	BHANDARA	7- Crop region OP J WR Tu G Mz	7- Crop region R (62), OP (12), Li (8), W (6), J (6), G (2). Tu (1).	Mono - Crop region R (72)
14.	THANE	2- Crop region SCR	2- Crop region R (54), FC (29),	2- Crop region FC (43), R (43).
15.	RATNAGIRI	2- Crop region SCR	11- Crop region R (30), FC (21), Rg (10), SC (8), GN (7), J (7), OC (3), OP (3), W (2), G (1), Ch (1).	6- Crop region R (32), FC (16), GN (10), SC (9), Rg (8), J (6).
16.	DHULIA	5-Crop region JGNBCt Rg	6- Crop region J (26), B (17), OP (14), GN (12), Ct (18), W (6).	5- Crop region J (20), B (20), OP (14), GN (13), Ct (9).

17.	AHMEDNAGAR	2- Crop region JB	11- Crop region J (50), B (17), F.C. (6), SC (5), Sf (5), W (5), OP (4), G (1), Tu (1), GN (1), Ct (1).	11- Crop region J (44), B (25), W (6), SC (4), SF (4), FC (4), OP (3), GN (2), G (2), Tu (1).
18.	SATARA	2- Crop Region SCJ	11- Crop region J (39), B (14), FC (10), GN (9), OP (7), R (5), W (3), SC (3), G (1), Rg (1), Ct (1).	11 - Crop region J (35), B (17), GN (11), OP (7), SC (6), FC (6), R (5), W (3), G (1), Rg (1), Tu (1).
19.	SHOLAPUR	Mono Crop region Ct	12- Crop region J (63), OP (6), B(6), Tu (5), Sf (4), W (3), G (2), GN (2), SC (1), FC (1), Mz (1), Ct (1)	Mono Crop region J (67)
20.	AURANGABAD		11- Crop region J (35), Ct (17), OP (14), Sf (6), W (6), B (5), Tu (4), G (2), Li (2), GN (1), R (1),	12- Crop region J (31), Ct (19), OP (11), B (7), Sf (6), Tu (6), W (4), G (3), GN (3), Li (1), SC (1), R (1)
21.	BEED	8- Crop region JOPGNBCt WGTu	10- Crop region J (44), B (16), OP (7), W (6), SF (5), Ct (4), Tu (4), Li (4), G (3), GN (2),	13- Crop region J (41), B (19), OP (17), Tu (6), Sf (4), GN (3), Ct (3), W (3), FC (2), SC (2), G (2), Li (2), Se(1).

22.	OSMANABD	3- Crop region JCt GN	12- Crop region J (44), B (9), OP (8), Tu (6), W (5), Sf (4), Li (4), G (4), Ct (3), GN (3), NS (1), R (1).	15- Crop region J (40), B (10), Tu (9), OP (9), GN (4), Sf (3), G (3), W (3), Ct (3), SC (2), Li (1), Se (1), R (1), NS (1), FC (1).
23.	AKOLA	2- Crop region Ct R	3- Crop region Ct (41), J (31), OP (11).	3- Crop region Ct (37), J (29), OP (15).
24.	YEVATMAL	2- Crop region Ct SC	2- Crop region Ct (44), J (33).	4- Crop region Ct (47), J (24), Tu (9), OP (8).
25.	NAGPUR	9- Crop region J WCT Tu R G GN BMz	11- Crop region J (29), Ct (15), W (14), R (9), Li (6), Tu (6), Ch (5), OP (3), Se (3), GN (2), G (2).	11- Crop region J (29), Ct (13), Tu (11), W (9), R (7), Li (5), G (5), GN (4), Ch (4), OP (4), Se (2).
26.	CHANDRAPUR		10 - Crop region R (35), J (28), OP (9), W (5), Ct (5), Se (5), Li (5), Ch (1), G (1), Tu (1).	10 -Crop region (39), J (21), OP (9), Ct (8), Li (5), Se (4), W (3), TU (2), Ch (1), G (1).
27.	MAHARASHTRA		14- Crop region J (34), Ct (13), OP (8), B (8), R (7), W (5), FC (4), GN (3), Tu (3), Sf (2), G (2), SC (1), Li (1), Rg (1).	15- Crop region J (30), Ct (13), B (9), OP (8), R (8), Tu (5), GN (4), W (4), FC (3), G (3), SC (2), Sf (2), Se (1), Li (1), Rg (1).

1961-64 figures has been taken from Majid Husain's work.

Note: -

(i) Figures of Sindhudurg are clubbed with the figures of Ratnagiri

(ii) Jalna with Aurangabad

(iii) Latur with Osmanabad

(iv) Gadhchiroli with Chandrapur.

A (x) ORISSA

S.No	DISTRICTS	1961-64	1979-82	1989-92
1	BALASORE		Mono Crop region R(77)	Mono Crop region R(74)
2	BOLANGIR		2-Crop region R(58).OP(19)	12 Crop region R(45), OP(26), Se(8), GN(6),Tu(2),RM (2), Ch(1), Rg(2), G(1), O(1), W(1),SP(1)
3	Cuttack		2-Crop region R(52), OP(28)	2-Crop region R(55), OP(28)
4	DENIKANAL	Mono Crop region R	2-Crop region R(52),OP(22)	2-Crop region R(41), OP(30)
5	GANJAM	Mono Crop region R	2-Crop region R(44), OP(35)	2-Crop region R(41), OP(32)
6	KALAHANDI	Mono Crop region R	13-Crop region R(42), OP(22),OC(8),Rg(4), Rm(3), Se(3)Mz(2),Li(2),Tu(2), Cs(2), G(1), Ch(1), GN(1)	2-Crop region R(44), OP(32)
7	KEONJHAR	Mono Crop region R	7-Crop region R(69), OP(14), Ns(2)Mz(5), Rm(1), Rg (1), OC(1)	8-Crop region R(61), OP(15), Ns(7), Mz(5), RM(2), Tu(2), Se(2), GN(1)

8	KORAPUT	Mono Crop region R	15-Crop region R(39), Rg(12), OP(11), NS(8), OC(7), Mz(5), Se(2), Tu(2), RM(2), J(1), Cs(1), Ch(1), Sp(1), To(1), G(1)	12-Crop region R(41),OP(15), Rg(12), NS(8), Mz(5), Se(4), OC(3), Tu(3), RM(1), J(1), Ch(1), To(1)
9	MAYURBHANJ	Mono Crop region R	Mono-Crop region R(84)	Mono-Crop region R(70)
10	PHULBANI	Mono Crop region R	11-Crop region R(31),OP(18),NS(8), RM(7), Rg(6), Mz(6), Tr(5),OC(5), Se (4), Tu (2) Ch(2)	10-Crop region R(37),OP(20), Ns(10), R(37), Mz(7),Tr(4), Tu(4), Se(3), Rg(1), OC(1),
11	PURI	Mono Crop region R	2-Crop region R(56), OP(33)	2-Crop region R(63), OP(28)
12	SAMBALPUR	Mono Crop region R	Mono Crop region R(75)	2-Crop region R(67), OP(16)
13.	SUNDAR GARH	Mono Crop region R	Mono Crop region R (72)	2 - Crop region (R (52), OP (16).
14.	ORISSA		2-Crop region R(58), OP(22)	2-Crop region R(55), OP(23)

1961-64 figures has been taken from Majid Husain's work.

A (xi) PUNJAB

S.No	DISTRICTS	1961-64	1979-82	1989-92
1	HOSHIARPUR	4-Crop region WMzGR	4-Crop region W(43), Mz(21), R(11), FC(11)	4-Crop region W(42), Mz(19), R(16), FC(14)
2	JALANDHAR	8-Crop region WGMz SCCtGNROP	4-Crop region W(49),R(18), Mz(12), FC(11)	2-Crop region W(43), R(31)
3	LUDHIANA	6-Crope region WMzGCt SC Br	8-Crop region W(48), R(18), Mz(11), FC(9),GN(5), G(3), Tu(1), SC(1)	2-Crop region W(45), R(38)
4	FEROZPUR	4-Crope region WRCtG	7-Crop region W(46), R(23), Ct(23), FC(8), G(5), RM(2), Gu(1)	3-Crop region W(45), R(26), Ct(16)
5	AMRITSAR	8-Crop region WRMz GCt OSBOP	3-Crop region W(45), R(29), FC(15)	2-Crop region W(46), R(37)
6	GURUDASPUR	2-Crope region RW	3-Crop region W(38), R(29), Mz(15)	2-Crop region W(44), R(37)

7	KAPURTHALA	7-Crop region WGMzRSC OPGN	2-Crop region W(48), R(33)	2-Crop region W(41) R(35)
8	BHATINDA	4-Crop region WCt BG	3-Crop region w(36), Ct(31), G(14)	2-Crop region W(43), Ct(33)
9	PATIALA	10 Crop region GMzRCtWS COSBrOPB	2-Crop region W(45), R(31)	Mono Crop region R(77)
10	SANGRUR	4-Crope region WCtBG	11-Crop region. W(44), G(14),R(13), FC(10), Mz(5), G(3), B(2), GN(2), Br(1), Gu(1), Rm(1)	2-Crop region. W(47), R(34)
11	ROOPNAGAR		3-Crop region W(35), FC(27), Mz(17)	4-Crop region W(42), R(17), Mz(15), FC(14)
12	FARIDKOT		4-Crop region W(43),Ct(23), R(10), FC(9)	3-Crop region W(44), Ct(25), R(15),)
13.	PUNJAB		10- Crop region (W44), R(19), FC(10), Ct (10), Mz (5), G (3), RM(1), GN(1), SC(1), Br (1).	4- Crop region W (45), R (27), Ct (10), FC (10).

1961-64 Figures has been taken from Majid Hussain's work.

A(xii) RAJASTAN

S.No	DISTRICTS	1961-64	1979-82	1989-82
1	AJMER	7-Crop region JMzWGBr BOP	10-Crop region J(27), W(14), Mz(13), B(10), G(8), Br(6), GN(5), Ct(4), FC(3), OP(3)	11-Crop region J(27), B(17), OP(10), Mz(9), W(8), Se(6), G(4), RM(3), Br(3), FC(2), Ct(2)
2	ALWAR	5-Crop regionWGN JOSB	4-Crop region B (28), W(21), F.C(15), G(14)	4-Crop regionRM(32), B(25), W(17), G(9)
3	BANSWARA	6-Crop region WRGWCtGN	7-Crop region Mz(31), R(16), G(11), W(11), OP(9), Ct(7), OC(5)	5-Crop region Mz(34), W(16), R(14), G(12), OP(9)
4	BARMER	Mono Crop region B	2-Crop region B(68), FC(25)	2-Crop region B(64), FC(29)
5	BHARATPUR	5-Crop region WJOPGTu	5-Crop region B(32), W(22), RM(12), G(9),FC(8)	3-Crop region RM(49), B(16), W(16)
6	BIKANER	2-Crop region BOP	3-Crop region OP(35), B(32), FC(28)	3-Crop region FC(33), OP(29), B(23)

7	BUNDI	4-Crop region JWGMz	6-Crop region Q(29), J(17), Mz(12), G(12), R(8), F.C(6)	6-Crop region W(27), RM(17), Mz(14), J(10), G(9), FC(6)
8	BHILWARA	7-Crop regionMzW BRCt GGNJ	10-Crop region Mz(36), W(17), Ct(7), B(7), J(6), FC(6), GN(6), G(5), Se(3), OP(2)	11-Crop region Mz(31),N(17), Se(7), J(6), OP(6), G(5), Br(5), FC(4), GN(4), RM(4), Ct(4)
9	CHITTORGARH	5-Crop region WMzJGNCt	6-Crop region Mz(25), W(17), G(150, J(11), OP(10)GN(6)	7-Crop region Mz(27), W(16), RM(13), GN(11), OP(8), G(7), J(6)
10	CHURU	2-Crop region BOP	3-Crop region(B(24), OP(31), FC(24)	3-Crop region B(30), OP(28), FC(28)
11	DUNGARPUR	4-Crop region WMzGR	5-Crop region Mz(32), R(20), W(16), OP(10), G(6)	5-Crop region Mz(30), R(20), W(15), OP(14),G(8)

12	GANGANAGAR		4-Crop region G(32), FC(26), W(14), Ct(14)	5-Crop region G(24),Ct(21), W(17), R,(14), FC(14)
13	JAISALMER	Mono Crop region B	2-Crop region B(70), FC(28)	2-Crop region FC(51), B(48)
14	JAIPUR	6-Crop region WBMzOPG Br	6-Crop region B(27), W(19), G(10), FC(10), OP(9), B(9)	9-Crop region B(32), W(16), RM(14), FC(8), OP(6), G(5), B(5), GN(3), J(3)
15	JALORE	2-Crop region BW	4-Crop region B(47), FC(22), RM(12), W(7)	3-Crop region B(51), FC(19), RM(13)
16	JHALAWAR	3-Crop region JBrMz	5-Crop region J(41), Mz(16), G(12),W(10), OP(7)	5-Crop region J(28), Mz(24), W(13), G(13), OP(10)
17	JHUNJHUNU	2-Crop region BOP	3-Crop region B(47), OP(18),FC(16)	7-Crop region B(47), FC(16), OP(15),RM(7) G(6), W(5), Br(1)

18	JODHPUR	2-Crop region BOP	3-Crop region B(53), FC(19), OP(16)	3-Crop B(51),FC(18), OP(115)
19	KOTA	3-Crop region WJG	3-Crop region J(32), W(26), G(16)	4-Crop region W(22), RM(20), J(18), G(16)
20	NAGAUR	3-Crop region BOPJ	3.Crop region B(42), FC(20),OP(17)	4-Crop region B(40), OP(21), FC(14), Se(11).
21	PALI	8-Crop region BJWBrMzO PGCh	8-Crop region FC(16), B(16), W(15), Se(13), RM(8), J(7), Mz(6), G(4),	6-Crop region B(21), Se(20), J(13), RM(13), FC(9), W(8)
22	SAWAI MADHOPUR	6-Crop region GWBJBrOP	11-Crop region B(28), W(21), J(12), g(10), GN(5), RM(4), FC(4), Br(4), OP(4), Li(2), Se(1)	5-Crop region B(27), RM(27),W(16) G(8), J(8)

23	Sikar	2-Crop region BOP	7-Crop region B(45), OP(20), FC(15), W(6), G(6), Br(4), RM(2)	7-Crop region B(45), FC(20), OP(14), W(7), G(5), RM(4), Br(2)
24	SIROHI	8-Crop region BWMZ OPJBrOSG	9-Crop region OP(18), W(16), Mz(14), FC(9), B(9), RM(7), OC(6), SC(6), G(4)	8-Crop region RM(15), B(14), Mz(14), W(11), OP(9), FC(8), Se(7), Cr(6)
25	TONK	6-Crop region GWBJBrOP	8-Crop region J(31), W(26), G(12), B(7), Mz(6), Br(6), GN(5), FC(3)	7-Crop region J(25), RM(19), W(16), G(8), B(8), GN(5), Mz(4).
26	UDAIPUR	10-Crop region MzWBRgR CtJGNOPS C	14-Crop region Mz(44), W(16), Br(7), OP(6), G(5), R(3), J(3), FC(3), Se(1), Ct(1), SC(1), GN(1), OC(1), RM(1)	11-Crop region Mz(46), W(18, OP(6), G(5), Br(5), J(4), RM(3), R(3), FC(2), Se(2), GN(2)
27	RAJASTAN		7-Crop region B(28), FC(16), W(11), OP(10), G(9), J(5), Mz(5)	8-Crop region B(27), FC(14),RM(10), OP(10), W(10), G(7), Mz(5), J(4)

1961-64 Figure has been taken from Majid Hussain's work

A(xiii) TAMILNADU

S.No	Districts	1961-64	1979-82	1989-92
1	CHENGALPATTU	2-Crop region RGN	Mono Crop region R(78)	2-Crop region R(68), GN(20)
2	S.ARCOT	2-Crop region	12-Crop region R(41), GN(20), B(11), OP(5), OC(4), SC(4), J(3),Se(2), Cr(2), Rg(2),Ta(1), Ct(1)	12-Crop region R(30), GN(23), B(12)OP(9), SC(5), Se(4), Cr(5), Ta(3), J(2), OC(1), Rg(1), Ct(1)
3	N.ARCOT	7-Crop region RGNJRgOPTuB	2-Crop region R(36), GN(35)	10-Crop region GN(40), R(23), OP(6), Tu(6), SC(6), J(6), B(3), Rg(3), Co(2), OC(2).
4	SALEM	6- Crop region RgJGNROPB	14- Crop region GN(24), J(16), R(15), OP(6), Rg(6), Ta(5), B(5), OC(4), Ct(4), SC(3), TU(2), FC(1),Cr(1), Se(1)	14- Crop region GN(24), J(13), OP(12), R(10), FC(18), Ta(6), Tu(4), Rg(13), Ct(3), B(2), OC(2), Cr(2), SC(1), Se(1).

5	DHARMAPURI		6- Crop region OP(18), Rg(18), OC(15), J(12), R(11), GN(11)	6- Crop region OP(18), Rg(16), GN(13), OC(12), R(10), J(9)
6	COIMBATORE	6-Crop region JRCfGNOPB	15- Crop region J(35), GN(11), OP(11), F(9), SC(5), Co(5), Ct(3), Mz(3), T(2), OC(2), B(2), G(1), Rg(1), Tu(1), Tr(1)	10-Crop region J(26), GN(15), W(13),OP(11), R(6), FC(6), Ct(5), Mz(4), SC(4), T(3)
7	PERIYAR		10- Crop region R(22), J(18),GN(17), SC(6), B(6), OP(6), Rg(6), Se(4), FC(3), Ct(3)	8-Crop region GN(20), R(20), FC(19), J(8), OP(7), SC(4), Rg(4), Se(3)
8	THIRUCHIRAPPALLI	Mono Crop region R	5-Crop region R(27), J(21), B(12), OC(9), GN(9)	14-Crop region J(23), R(18), GN(13), B(10), OP(4), Cr(40, Se(3), SC(3), OC(3), Cr(3), Ct(2), Br(2), Tu(2), Ch(2)
9	PUDUKOTTAI		2-Crop region R(58), GN(22)	2-Crop region R(45), GN(25)

10	THANJAVUR	4-Crop region ROSGNRg	Mono-Crop region R(75)	2-Crop region R(62), OP(22)
11	MADURAI	2-Crop region RJ	7-Crop region R(27), J(20), GN(10),Ct(7), OC(7), OP(7), B(3)	14-Crop region R(25), J(19), GN(12), OP(10), Ct(7), OC(4), Co(3), B(3), SC(3),Ct(2), M(2), Tu(1), Mz(1), Se(1)
12	RAMNATHPURAM	7-Crop region RCtBGNRgJOP	14-Crop region R(49), Ct(8), FC(6), OC(6), B(5), GN(4), Ch(3), OP(3), Rg(3), J(2), SC(1), Cr(1), Co(1), Se(1)	14-Crop region R(50), Ct(11), GN(6), OP(5), FC(3), Ch(3), B(3), SC(2), Co(2), Rg(2), J(2), Se(1), OC(1), Cr(1)
13	TIRUNELVELI	3-Crop region RCtB	14-Crop region R(31), Ct(15), B(11), OP(8), FC(7), J(5), CH(4), OC(3), Cr(2), SC(2), GN(2), BN(2), Co(1), Rg(1)	13-Crop region R(29), Ct(16), OP(14), FC(7), B(6), GN(3), J(3), Ch(3), SC(3), BN(3),Cr(3), Co(2), SC(2)
14	THE NILGIRIES	2-Crop region TCf	3-Crop region T(56), Cf(18), Pt(14)	6-Crop region T(70), Cf(15), Pt(6), R(3), BP(2), Cd(1)
15	KANKYA KUMARI	2-Crop region ROP	4-Crop region R(47), Co(15), Ru(12), Ta(12)	4-Crop region R(41), Co(15), Ru(12), Ta(12)

16	TAMILNADU		13-Crop region R(40), GN(14), J(10), OP(7), B(5), OC(5), Ct(3), Rg(3), SC(3),Co(1), FC(1), Se(1), Ch(1)	14-Crop region R(32), GN(16), OP(11), J(9), B(4), Ct(4), SC(4), FC(3), Co(2), Rg(2), OC(2), Se(2), Tu(1), Ta(1)

1961-64 figures has been taken from Majid Husain's work.

Note:- (i) figure of Pasumpon Thevar Thirumagar, Kamraja & Ramanathpuram are clubbed together with the figure of Ramnathpuram

(ii) Madurai & Dindigal Anna as Madurai

(iii) Thirunelveli Kathabonam & Chidambranar as Tirunelveli

(iv) N.Arcot Ambedkar & Tiruvanamalai Sambuvyar as N.Arcot.

(v) Chengai Anna in the New Name of district Chengelpattu

A(xiv) UTTAR PRADESH

S.No	DISTRICTS	1961-64	1979-82	1989-92
1	MUZAFFAR NAGAR	5 –Crop region RWSCMgG	4-Crop region W(32), SC(28), R(16), FC(15)	4-Crop region SC(36), W(29), FC(15), R(12)
2	BULAND-SAHAR		11-Crop region W(39), Mz(21), SC(10), FC(9), Br(4), B(3), OP(3), R(2), G(1), Pt(1), M(1)	4-Crop region W(35), Mz(23), FC(12),SC(17)
3	MEERUT		3-Crop region W(34), SC(31), FC(18)	3-Crop region SC(34) W(31), FC(21)
4	GAZIABAD		4-Crop region w(37), SC (16), FC(16), Mg(13)	4-Crop region W(35), FC(22), Se(18), Mz(11)
5	ALIGARH	6-Crop region BWOPMzGCh	12-Crop region W(35), B(17), OP(10), Mz(9), Br(8), FC(4), R(2), G(2), RM(2), SC(2), Tu(1), Ct(1)	11-Crop region W(37), B(14), RM(9), Mz(9), Br(6), OP(6), FC(6), Tu(3), SC(2), R(2), G(1)
6	MATHURA	4-Crop region WSCBG	12-Crop region W(41), B(18), Br(9), FC(8), OP(5), RM(4), SC(4), G(2), Ct(1), Tu(1),J(1), Mz(1)	4-Crop region W(40), RM(23), B(11), FC(11)
7	AGRA	5-Crop region BGWBrTu	11-Crop region W(34), B(21), RM(8), R(7), G(5), Br(5), Mz(5), FC(3), OP(2), Tu(2), Pt(1)	11-Crop region W(34), RM(20), Br(14), R(8),Mz(4), FC(4), Br(3), G(3), Pt(2), OP(2), Tu(1)

8	ETAH	6-Crop region WBMzOP GBr	13-Crop region W(34), B(19), Mz(10), OP(10), R(6), Br(4),G(3), Tu(1), RM(1), GN(1), Pt(1), SC(1), FC(1)	14-Crop region W(37), B(15), Mz(11), OP(8), R(6), Br(3), RM(3), G(3), FC(2), SC(1), Pt(1), Tu(1), M(1), To(1)
9	BARELY	5-Crop region WRGOPB	12-Crop region W(34), R(26), Sc(9), FC(4), GN(3), G(3), OP(3), B(3), Mz(2), Tu(1), M(1)	3-Crop region W(35), R(28), Sc(14)
10	BADAUN		14-Crop region W(36), B(18), GN(8), R(8), Mz(5), G(4), OP(4), Sc(3), J(1), Tu(1), Pt(1), Br(1), FC(1), RM(1)	12-Crop region W(44), B(17), R(9), Mz(5), OP(3), Sc(3), GN(3), G(3), RM(2), Pt(2), J(1), FC(1)
11	SAHJAH ANPUR	5-Crop region WRGOPB	12-Crop region W(40), R(26), G(6), Sc(6), OP(4), B(4), FC(3), J(2), Tu(1), RM(1), Mz(1), Pt(1).	3-Crop region W(41), R(27), SC(9)
12	PILIBIT	5-Crop region RWSCMz G	2-Crop region R(38), W(37)	2-Crop region R(39), W(38)
13	MORAD ABAD	8-Crop region WRSCBRg GNOPTu	5-Crop region W(38, SC(17), R(16), FC(17), B(7),	4-Crop region W(40), SC(19), R(16), FC(10)
14	RAMPU R	5-Crop region RWSCMz G	12-Crop region W(36), R(26), SC(9), J(6), Mz(5), FC(5), G(2), B(1), Ch(1), RM(1),OP(1), Tu(1)	2-Crop region W(38), R(35)

15	FARUKHABAD	8-Crop region WMzGJGNOPBrB	13-Crop region W(34), Mz(21),Pt(9), R(8), B(5), G(5), K(3), R,(2), Br(2), SC(2), OP(2), Tu(1), GN(1)	14-Crop region W(34),Mz(19), Pt(12), R(7), G(4), RM(4), OP[(3), B(2), J(2), SC(2), Br(1), Tu(1), FC(1), To(1)
16	ETAWAH		13-Crop region W(28), R(17), B(14), G(7), RM(6), Mz(6), Br(4), OP(4), Tu(3), Pt(2), FC(1), J(1), SC(1).	12-Crop region W(33), R(17), B(13), RM(6), G(5), Mz(5), OP(5), Br(3), Tu(3), Pt(2), FC(1), J(1)
17	KANPUR	7-Crop region OPJWRTuGMz	13-Crop region w(30), R(14), G(11), RM(7), J(7), Mz(6), Br(5), B(4), OP(3), Tu(3), FC(1), Pt(1), SC(1)	13-Crop region W(33), R(14), G(11), RM(7),OP(6), J(5), Mz(5), Tu(4), Br(4), Fc(2), B(2), Pt(1), SC(1)
18	FATEHPUR	6-Crop region RBrGOPWMz	5-Crop region w(26), R(23), G(15), J(9), Br(7),	12-Crop region W(33), R(21), G(14), J(7), Tu(5), Br(3), RM(2),SC(2), OP(2), FC(2), B(1), Se(1)
19	ALLAHABAD	7-Crop region RGBrWBOPJ	10-Crop region W(29), R(27), G(11) B(9), Br(6), J(4), Tu(4), OP(3), Pt(1), FC(1)	10-Crop region W(40), R(27), G(8), B(6),Tu(3), J(3), Br(2), OP(2)
20	JHANSI	3-Crop region WJG	3-Crop region W(32), G(25), J(20)	4-Crop region W(29), G(28), OP(19), J(10)
21	HAMIRPUR	3-Crop region WJG	3-Crop region G(35), W(29), J(18)	4-Crop region G(30), W(20), OP(17), J(12)

22	BANDA	4-Crop region WRJG	4-Crop region G(30), W(29), R(13), J(13)	4-Crop region W(31), G(27), J(13), R(12)
23	VARANASI	8-Crop region RBrWGOPTuSCB	2-Crop region R(35), W(33)	2-Crop region R(36), W(35)
24	MIRZAPUR	4-Crop region WRGOP	11-Crop region R(31), W(22), OC(11), G(7), Br(7), Tu(4), OP(4),Li(3), Mz(3), B(2),J(1)	11-Crop region R(32), W(26), OC(9), G(6), Br(5), Tu(4), OP(4), Li(3), Mz(3), B(2), J(1)
25	JAUNPUR	4-Crop region RBrMzOP	3-Crop region W(35), R(25), Mz(14)	3-Crop region W(41), R(28), Mz(12)
26	GAZIPUR	4-Crop region RBrOPG	11-Crop region R(34), W(31), G(6), OP(5), Br(4), SC(4), B(4), Tu(3), FC(2), J(1), Pt(1)	2-Crop region W(38), R(33)
27	LALITPUR		7-Crop region W(29), J(22), G(11), OP(9), Mz(7), OC(7), R(5)	5-Crop region W(30), G(24), J(12), OP(11)Mz(8)
28	JALAUN	2-Crop region WG	4-Crop region W(28), G(28), OP(17), J(7)	3-Crop region OP(35), G(23), W(21)
29	BALIA	6-Crop region RBRgOPWMz	2-Crop region R(36), W(39)	2-Crop region W(39), R(36)
30	GORAKHPUR	8-Crop region RWOPBrSCChMzG	2-Crop region R(43), W(39)	2-Crop region W(42), R(42)

31	DEORIA	5-Crop region RWSCOP Ch	2-Crop region R(38), W(36)	3-Crop region R(38), W(37), SC(15)
32	BASTI	8-Crop region RWOP BrSCCh MzG	2-Crop region R(45), W(33)	2-Crop region R(48), W(39)
33	LUCKN OW	2-Crop region RW	2-Crop region W(39), R(33)	12-Crop region W(41), R(26), M(6), OP(5), J(3), G(3), Pt(3), Tu(2), Mz(2), FC(2), B(1), Br(1)
34	UNNAO	6-Crop region RWBRgMz J	3-Crop region W(36), R(32), Mz(10)	13-Crop region W(43), R(21), Mz(8), G(3), J(3), OP(3), Br(3), Tu(2), GN(2), RM(2), M(1), FC(1), Pt(1)
35	RAEBARE LI	8-Crop region RWBrOPG JTuB	2-Crop region R(38),W(36)	2-Crop region W(41), R(35)
36	SITAPUR	6-Crop region WRGBrScO P	14-Crop region W(29), R(26), Sc(7), G(6), OP(5),GN(4),Mz(3), Br(3),OC(3)J(2),M(2), FC(1), B(1)	14-Crop region W(32), R(24), Sc(12), OP(6), Mz(4),Tu(3), G(2), J(2), GN(2), M(2), RM(2), Br(1), FC(1), OC(1)

37	HARDOI	8-Crop region WGROPB RGNJMz	14-Crop region W(40), R(15), Mz(6), G(6), GN(5), OP(5), Br(4), J(3), SC(3), Tu(2), B(2), RM(1), Pt(1), FC(1)	15-Crop region W(41), R(15), Mz(9), G(4), OP(4), J(4), SC(3), GN(3), RM(2), Br(2), Tu(2), Pt(1), FC(1)M(1), B(1)
38	KHERI	5-Crop region RWSCMz G	3-Crop region W(29), R(28), SC(17)	3-Crop region W(29), R(27), SC(25)
39	FAIZABA D	7-Crop region OPJWRTu GMz	2-Crop region R(38), W(34)	2-Crop region R(39), W(38)
40	GONDA	9-Crop region WMzOPG RBrSCOS Ch	3-Crop region R(38), W(31), Mz(11)	3-Crop region R(37), W(32), Mz(10)
41	BAHRAIC H	5-Crop region RMzOPW G	3-Crop region R(35), W(29), Mz(17)	3-Crop region R(33), W(28),Mz(18)
42	SULTANP UR	7-Crop region OPJWRTu GMz	14-Crop region W(29), R(26), SC(7), G(6), OP(5),GN(4), Mz(3), Br(3), OC(3), J(2), Tu(2), M(2), FC(1), B(1)	2-Crop region R(38), W(35)
43	PRATAPG ARH		12-Crop region W(38), R(23), Tu(7),Br(6), B(6), OP(5), G(5), J(2), Pt(2), OC(1), FC(1), Mz(1)	2-Crop region W(40), R(34)

44	BARABANKI	4-Crop region WRGOP	13-Crop region W(39),R(27), G(8), OP(4), SC(3) FC(2), Pt(2), Tu(2), Mz(2), OC(2), J(2), Br(1), OP(1)	2-Crop region R(37), W(34)
45	NAINITAL	8-Crop region WRSCMZ GOSOP Rg	3-Crop region W(36), R(34), SC(10)	3-Crop region W(37), R(34), SC(14)
46	ALMORA		4-Crop region W(34), Rg(23), R(21), OC(13)	4-Crop region W(34), Rg(24), R(21), OC(11)
47	PITHORA GARH		3-Crop region W(34), R(27), Rg(17)	3-Crop region W(33), R(28), Rg(15)
48	CHAMOLI		3-Crop region W(33), R(27), Rg(23)	3-Crop region W(33), R(27), Rg(23)
49	U.KASHI		4-Crop region W(32), R(21), OC(20), Rg(17)	4-Crop region W(30), R(23), OC(17), Rg(14)
50	TEHRI GARHWAL		4-Crop region W(32), Rg(22), OC(21), R(14)	4-Crop region W(33), OC(22), Rg(17), R(15)
51	GARHWAL		4-Crop region W(28), Rg(26), R(19), OC(16),	4-Crop region W(29), Rg(22), R(17), 0C(17)
52	DEHRADUN	2-Crop region RW	11-Crop region W(33), R(20), Mg(14), SC(7), Rg(5), OP(5), OC(4), FC(3), Br(2), Pt(1), T(1)	12-Crop region W(34), R(16), Mz(15), SC(7), Rg(4), OP(4), OC(4), FC(4), Br(2), RM(2), Pt(1), M(1)

53	UTTAR PRADESH		14-Crop region W(33),R (22),SC(6), G(6), Mz(5), B(4), OP(4), FC(3), Br(3), J(2), Tu(2), OC(1), RM(1), Pt(1)	13-Crop region W(36), R(23), SC(7), OP(5), G(5), Mz(4), FC(4), B(3), RM(3), J(2),Tu(2), Br(1), Pt(1)

1961-64 has figures has been taken from Majid Husain's work.

Note: (i) figures of Hardwar, Saharanpur, & Bijnor have been clubbed with figures of Muzaffar Nagar.

(ii) Sidharatha Nagar with Basti

(iii) Sonbhadra with Mirzapur

(iv) Mahrajganj with Gorakhpur.

(v) Kanpur Dehat with Kanpur.

(vi) Firozabad & Mainpuri with Agra.

(vii) Mau & Azamgarh with Ballia.

A(xv) WEST BENGAL

S.No	DISTIRCTS	1961-64	1982-85	1989-92
1	DARJEELING	4-Crop region RTMzRg	3-Crop region R(36), Mz(30), T(19)	3-Crope region R(37), T(22), Mz(20)
2	W.DINAJPUR	2-Crop region Rju	Mono-Crop region R(72)	Mono-Crop region R(75),
3	NADIA	4-Crop region RjuGMe	3-Crop region R(44), Ju(24), W(12)	5-Crop region R(49), Ju(21), OP(10), RM(9), W(7)
4	HOWRAH	Mono-Crop region R	Mono-Crop region R(88)	Mono-Crop region R(89)
5	BIRBHUM	Mono-Crop region R	Mono-Crop region R(85)	Mono-Crop region R(82)
6	MIDNAPUR(W)	Mono-Crop region R	Mono-Crop region R(94)	Mono-Crop region R(89)
7	JALPAIGURI	2-Crop region RT	Mono-Crop region R(72)	6-Crop region R(66), T(16), Ju(9), W(3), RM(2), Pt(1)

8	MALDA	2-Crop region ROP	9-Crop region R(65), W(8), Ju(8), G(3), OP(3), RM(3), Br(3), Mz(2), Li(1)	8-Crop region R(61), OP(12), W(9), RM(7), Ju(6), G(1), Mz(1), Br(1)
9	24-PARAGANAS(N)	Mono-Crop region R	Mono-Crop region R(75),	Mono-Crop region R(76)
10	24-PARAGANAS(S)	Mono-Crop region R	Mono-Crop region R(96)	Mono-Crop region R(93)
11	HOOGHLY	2-Crop region Rju	Mono-Crop region R(77)	5-Crop region R(68), Pt (16), Ju(7), Se(5), RM(2)
12	BANKURA	Mono-Crop region R	Mono-Crop region R(91)	Mono-Crop region (87)
13	MIDNAPUR(E),	Mono-Crop region R	Mono-Crop region R(92)	Mono-Crop region R(90)
14	COOCH-BIHAR	2-Crop region Rju	Mono-Crop region R(71)	Mono-Crop region R(71)
15	MURSHIDABAD	2-Crop region ROP	3-Crop region R(52), W(18), Ju(15)	5-Crop region R(54), Ju(15), W(14), RM(8), OP(6)

16	BURDWAN	Mono-Crop region R	Mono-Crop region R(85)	MONO-Crop region R(83)
17	PURULIA	Mono-Crop region R	Mono-Crop region R(90)	Mono-Crop region R(89)
18	WEST BENGAL		Mono-Crop region R(78)	Mono-Crop region R(76)

1961-64 figure has been taken from Majid Husain's work.

Here 82-85 period is the first period
since data of 79-82 period is Not available.

Abbreviations

R =Rice
W =Wheat
B = Bajra
J =Jowar
SC=Sugar cane
Ct=Cotton
Cs=Castor
GN=Ground Nut
FC=Fodder Crop
To=Tobbaco
Tu=Tur
G =Gram
OP=Other pulses
(except Tur & Gram)
OC=Other Cereals
Ch=Chillies
Se=Sesamum
M =Mango
Me=Mesta
Mz=Maize
Ta=Tapioca
C =Citrus
Cr= Coriander
Tr= Turmeric

Sf=Safflower
Ca= Cashew
Pt=Potato
Li= Linseed
RM=Rape Mustard
SP=Sweet Potato
Ju=Jute
NS=Nizer Seed
Gu=Guar
BN=Banana
P=Pome fruit
O=Onion
Br=Barley

Cf=Coffee
Bt=Bettlenut
Ru=Rubber
OP=Opium
T =Tea
Co= Coconut
Cd= Cardamom
BP= Black Pepper
OS = Oil Seeds

BIBLIOGRAPHY

BOOKS

BHALLA G.S. & TYAGI D.S. (1989), Patterns in Indian Agricultural Development; A district Level Study, ISID, New Delhi.

DANTAWALA et.al., (1986), Agricultural Development Since Independence, Oxford & IBH , New Delhi.

DHAWAN B.D. (1988), Irrigation in India's Agricultural Development Sage Publication, New Delhi.

GHOSH S.P. (ed.) (1991), Agro –Climatic Zone Specific Research, ICAR, New Delhi.

HUSAIN M., (1982), Crop Combination in India, A Study, concept Pub., New Delhi.

HUSAIN M., (1996), Systematic Agriculture Geography, Rawat Publications, Jaipur.

JOHNSTON R.J. (ed. 1995), The Dictornary of Human Geography, Oxford, Blackwill Publisher Ltd.

NCEAR (1994) "Export Competitiveness of selected Agricultural Commodities". National Council of applied Economic Research New Delhi.

SEN B., (1974), The Green Revolution in India; A Perspective, Wiley Eastern, New Delhi.

SING G.B. (1979), Tansformation of Agriculture, Vishal Pub; Kurukshetra.

SINGH J., (1984), Agricultural Geography, Tata MC- Grew Hill Pub., N. Delhi.

SINGH R.L. (ed.), (1991), India a Regional Geography, National Geographical Society of India, Varanasi.

SINGH. J. & DHILLON S.S., (1974), Agricultural geography, Tata MC-Grew Hill Pub Co., New Delhi.

ARTICLES

BASU S. (1984), " Impact of DVC irrigation in changing the landuse and cropping patter of the lower demoder valley," Geographical Review of India,Vol. 46, No. 4, PP 70-78.

BHALLA G.S. & SINGHG (1997), "Recent Development in Indian Agriculture, " EPW, March – 29.

BHALLA G.S. & TYAGI D.S. (1989), "Spatial Pattern of Agricultural Development in India, " EPW June Vol. 24, No. 25, PP A-46 to A55.

CHAKRABARTI S. (1982), "In search of growth pattern for foodgrain production in India, "EPW, Dec. 25, Vol. 17, No. 52, PP A 122 to A126.

CHAKRABORTY S.C. (1981)," Crop Combination Regions of Eastern India," Geographical Review of India, Vol. 43, No. 2 , PP ...

CHOPRA K. (1999) (unpublished), Agricultural Policy in India and Implications for Population displacement, 1947 –1999, SICI-CIDA Project, JNU, New Delhi.

DEV M.S. (1985), "Direction of change in Performance of all crops in Indian Agriculture in late 1970's A Look at the level of districts and Agro –Climatic Regions," EPW, Dec 21, Vol. 20, No 51 and 52,PP.

GULATI A. & SHARMA P.K. (1990), " Price, Procurement and Production; An analysis of wheat and Rice," EPW, March 31,Vol... No... PP. A-36 to A-45.

GUPTA J.P. (1978), "Crop combination Regions of the upper Ganga Khadar, Up." The Geographers Vol. 25. No. 2, PP ...

JODHA N.S. & SINGH R.P. (1992), "Crop rotation in traditional forming system in selected areas of India", EPW, Marach 37, Vol. No. PP A-28 to A-35.

JODHA N.S. (1996), "Ride the rest or resist the change ? Response to Emerging Trends in Rainfed forming Research in India," EPW, July 16, Vol. 31, No. 28, PP 1876 to 1880.

KASHYAP S.P. & MATHUR N. (1999), " Ongoing changes in policy Environment and form sectors, Role of Agro-Climatic Regional Planning Approach, "EPW, June 26, Vol No. PP A105-A112.

KAUSHIK K.K. (1993), " Growth & Instability of Oilseed Production," IJAE, Vol. 48. No. 3, PP 334-338.

KRISHNAJI N. (1973),"What Price Movements; An analysis", EPW, June 30 Vol. 8, No. 26, PP A-42 to A-51.

KRISHNAJI N. (1990),"Agricultural Price Policy, A survey with Reference to Indian foodgrain Economy," EPW, June 30, Vol. 25, No. 26, PP A-54 to A-63.

KRISHNASWAMY K.S. (1994), "Agriculture Development under the new Economic Region", EPW, June 25, Vol,. 29, No. 26. Pp

KUMAR B.L. (1993), " Changing Pattern in the Cultivation of pulses by size groups of Holdings." IJAE. Vol. 48, No.3 , PP 339-344.

KUMAR P. & MRATHYUNJAYA (1989)," Crop Economies and Cropping Pattern Changes", EPW, Dec 23, Vol 24, No. 51-52, PP A159-A165.

KUMARP & MATHUR V.C. (1996), " Agriculture in future; Demand – Supply Perspective for the Ninth Five year plan, EPW, Sep 28, Vol. 31 No. 39, pp.

KURUSAKI T. (1999)," Agriculture in India and Pakistan, 1990-95 Productivity and Crop Mix," EPW, Dec. 25, Vol. .. No. PP A-160 to A-168.

MANDAL C. & MANDAL D.K. ( ) , " Agro-climatic Database for eographical Research in Agriculture," Geographical Review of India, Vol. 60 , No. 3, PP 310-342.

MISHRA P. & BHATTACHARYA R.N. (1983), "Cropping pattern in Alwar District," Geographical Review of India, vol. 45, No. 1 , PP

PALANIVEL T. (1995) "Aggregate supply Response in Indian Agriculture: Some Empirical Evidence and Policy Implication," Indian Economic Review, vol. 30, No. 2, pp 251-263.

PRABHAT. (1983), " Movement Restrictions, Procurement and market price: A case study of Tamil Nadu", EPW, June 25,, Vol. 18, No. 26, Pp A 53 to A61.

PURKAYASTHA D. & SUBRAMAVINAN A. (1986), " Price and Income Stabilisation issues in the Indian Ground nut market, Epw, Feb 22, Vol. 21, No. 8, pp 353-359.

RAO C.H.H. (1974), "Socio- Political Factor and Agricultural Policies," EPW, Vol. 9, No. 32-34, PP 1285-1292.

RAO V.M. (1992), "Fixing Agricultural Price: Issues and Experiences, Review: Agriculture Price Policy In India by A.S. Kahlon & D.S. Tyagi", EPW, March 28, Vol. 27, No. 13, PP 639-645.

REDDY V.R. & DESHPANDE R. S. (1992), "Input Subsidies: Whither the direction of policy changes?" IJAE, July-Sep. Vol. 47, No. 3, PP 349-355.

SHARMA P.K. (1992), "Agricultural Policy in the light of new Trade and Industrial Policy, IJAE, July-Sep, Vol. 47, No.3, PP 343 – 347.

SINGH A.J. & DHALIWAL S. (1993), "Production performance potentials & Projects for oilseeds in India," IJAE, Vol. 48, No.3, PP 357-365.

SINGH J (1979), " A Spatio- Temporal Analysis of cropping patterns and crop association in Punjab," National Geographical journal of India, Vol. 25, No. 3 &4. PP.

SINGH R.I. PRASAD V. & DNGAN S.M. (1992),"Indian Agricultural Policy in the context of New Trade and Industrial Policy," IJSE, July-Sep. Vol. 47, No. 3, PP 357-362

VANI B.P. & VYASULU V. (1996), "Growth, variability & Insatiability of three major cereal crops in Karnataka; A district level analysis from 1955-56 to 1989-90," EPW, June 29. Vol. 31, No. 26, PP A74-A83.

VITTAL N. (1986), "Intersectoral Terms of Trade in India: A Study of concept and method, " EPW, Dec 27, Vol. 21, No. 52, PP A147-A162.

VYAS V.S. (1994), "Agriculture policies for the Nineties: issues and Approaches", EPW June 25, Vol. 29, No. 26 pp A-54 to A-63.

WEAVER J.C. (1954), " Crop Combination Regions in Middle West, "Geographical Review. Vol. 44, PP 176-181.

(1998) MARGIN, Review of the Indian Economy. Jan-Mar. Vol. 30.No. 2,PP 1-

GOVERNMENT REPORTS

AGRI NEWS (1998), April-June, Ministry of Agriculture, Govt. of India New Delhi.

AGRI NEWS (1999), April-June, Ministry of Agriculture, Govt. of India New Delhi.

AREA, PRODUCTION & YIELDS OF Principal crop in India. (Various Issues) Ministry of Agriculture New Delhi.

ARPU WORKING PAPER NO. 5, (1991), Agro –Climatic Regional Planing, At State level, Planning Commission, Ahmedabad, India.

ARPU WORKING PAPER NO. 8, (1994), Agro –Climatic Regional Planing, At State level, Planning Commission, Ahmedabad, India.

Census of India, 1981, Series 1, Pt II A (I), General population Tables.

Census of India, 1991, Series 1, Pt II A (I), General population Tables.

ECONOMIC SURVEY, (1998-93), Govt. of India, Ministry of Finance, Economic Division, New Delhi.

ECONOMIC SURVEY, (1998-99), Govt. of India, Ministry of Finance, Economic Division, New Delhi.

FAI (1992), Fertilizer Statistics. The FAI, New Delhi.

Indian Agricultural statistics, Vol. II, (District Wise) 1982-83 to 1984-85. Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New Delhi.

Indian Agricultural statistics, Vol. II, (District Wise) 1988-89 to 1989-90. Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New Delhi.

Indian Agricultural statistics, Vol. II, (District Wise) 1990-91. Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New Delhi.

Indian Agricultural statistics, Vol. II, (District Wise) 1991-92, Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New Delhi.

Indian Agricultural statistics, Vol. II, (District wise), 1977-78 to 1981-82, Directorate of Economics & Statistics, Ministry of Agriculture, Government of India, New Delhi.

Planning Commission, (1956), Second Five year Plan, 1956, N. Delhi , Planning commission Govt. of India.

Planning Commission, (1961), Third Five year Plan, 1961-66, N. Delhi , Planning commission Govt. of India.

Planning Commission, (1992), Eighth Five year Plan, 1992-97, Vol. I, Objectives, Macro-Dimension, Policy Framework and Resources, Govt. of India New. Delhi.