Ad-hoc Study No.47

CONSTRAINTS OF INCREASING RICE PRODUCTION

(A Study conducted in Blocks under Pilot Programme of increasing rice production in Madhya Pradesh)

S.K. DUBEY

M.L. MANN

AGRO-ECONOMIC RESEARCH CENTRE
FOR MADHYA PRADESH

JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA
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P R O J E C T T E A M

PROJECT LEADER

S.K. DUBEY
(Research Officer)

CHIEF ASSOCIATES

M.L. MANN	:	Junior Research Investigator
SHRIKANT UPADHYE	:	Junior Computor (Participated in field investigation also)

OTHER ASSOCIATED STAFF

B.S. PATEL	:	Junior Research Investigator
C.K. MISHRA	:	Junior Computor

STENCILLING

A.S. KHAN

MIMEOGRAPHING

ROHINI PRASAD

C O N T E N T S

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CHAPTER-I

INTRODUCTION

1.1 An Asian Crop

Rice is predominantly an Asian Crop, ninety three per cent, being produced and consumed in South Asian countries, extending from the Indo-Pakistan sub-continent to Japan. Inspite of the large acreage under rice in Asia, most of the countries of this continent are deficient in rice. While Thailand, Japan, China, Burma, India and Pakistan have exportable surplus, most of the remaining Asian countries viz. Indonesia, Korea (Republic), Malaysia, Sri Lanka, Bangladesh, Hongkong, Iraq, Saudi Arabia and Iran are deficient and have to import rice (Table 1.1)

Table 1.1 Major rice producing, exporting and importing countries of the World, 1980.

Area-Million hectares
Production-Million tonnes

Country	Acreage		Production		Export	Import
	Area	%	(Qty.)	%	(Qty.)	(Qty.)
China	34.1	23.78	142.3	35.85	1.3	-
India	39.5	27.54	79.8	20.11	0.5	-
Indonesia	9.0	6.28	29.8	7.51	-	2.0
Bangladesh	10.3	7.18	20.8	5.24	-	0.7
Thailand	9.1	6.34	17.4	4.38	2.8	-
Burma	5.0	3.48	13.1	3.30	0.6	-
Japan	2.4	1.67	12.2	3.07	0.7	-
Brazil	6.2	4.32	9.6	2.42	-	-
U.S.A.	1.3	0.91	6.6	1.66	3.0	-
Phillipines	3.5	2.44	7.8	1.96	-	-
Korea(Republic)	1.2	0.84	4.9	1.23	-	0.8
Pakistan	2.0	1.39	4.8	1.21	1.0	-
Eastern Europe and U.S.S.R.	-	-	-	-		1.0
Western Europe						0.6
Iran						0.5
Iraq						0.4
Saudi Arabia						0.4
Hongkong						0.3
Malaysia						0.2
Sri Lanka						0.2
Other Countries	19.8	13.83	47.8	12.06	2.0	4.8
World	143.4	100.00	396.9	100.00	11.9	11.9

Ref: Bulletin on Food Statistics 1981-82.
Source: FAO Food outlook.

1.2 Situation in India

1.2.1 Importance of the crop

India is the second largest producer of rice though it ranks first in area among the rice growing countries of the world (Table 1.1). Rice is the most important crop in this country and accounts for about 23 per cent of the gross cropped area and about 41 per cent of the total foodgrains production.

1.2.2 Low Growth Rate of Production

Inspite of being the most important crop rice has not shown a satisfactory increase in production. Linear growth rate of rice production during 1967-68 to 1980-81 was only 2.53 per cent as compared to 7.78 per cent for wheat, 2.75 per cent for total foodgrains and 2.72 per cent for all crops taken together. Compound growth rate of production for rice and wheat for the same period was 2.20 and 5.65 per cent per annum respectively (Table 1.2)

Table 1.2 Linear and compound growth rates of production of rice wheat and total foodgrains in India (1967-68 to 1980-81)

Crop/Crop groups	Linear growth rate (per cent)	Compound growth rate (per cent)
Rice	2.53	2.20
Wheat	7.78	5.65
Food Grains	2.75	2.39
Non-Food Grains	2.64	2.34
All Crops	2.72	2.37

Source : Indian Agriculture in Brief (Nineteenth Edition) Table 1.74 and 1.75 pages 120 and 121

1.2.3 Low Productivity

Though, the country crossed the plateau in rice production, which did not move beyond 53 to 54 million tonnes range during the years 1979-80 to 1982-83, and a record achievement of 57 million tonnes was estimated for the year 1983-84, there were a number of constraints impending the improvement in rice production. The main problem of rice crop is its low productivity particularly in the major rice growing states. "These states have a very low yield of paddy production, and excepting West Bengal, have a growth rate below the national average*. A total of 54 million tonnes of rice is produced in the country, out of which only 25.5 million tonnes come from-Assam, West Bengal, Bihar, Orissa, Uttar Pradesh and Madhya Pradesh. If these states attain the yield level of national average, they can give 9 million tonnes of rice more every year** Therefore, unless a significant dent is made on this problem it would not be possible to increase the rice output at a faster rate, as the scope for increasing area under rice is quite limited.

1.3 Special Programme for Rice

Recently, a special programme to increase rice production in six eastern states viz. Assam, West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh and Orissa has been prepared. The programme envisage optimisation of the production of rice in the above mentioned six states keeping in view their location specific conditions and constraints. Initially a pilot programme for increasing rice production was launched in 50 selected blocks of these states from the kharif, 1984 itself.

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* Yojna Vol.28, No.11 June 16-30, 1984
** Ibid

In the above context micro-level studies to identify the bottlenecks and their remedies were proposed. The Directorate of Economics and Statistics, Ministry of Agriculture, Government of India directed the Agro-Economic Research Centre for Madhya Pradesh, to conduct such a study in the rice growing eastern districts of Madhya Pradesh. The study was taken up in the light of the directives received from the Directorate.

1.4.1 Objective

The objective of the study was to identify the constraints in increasing rice production in the rice growing eastern districts of Madhya Pradesh, particularly in the blocks selected under the pilot programme of increasing rice production.

1.4.2 Coverage

The study was conducted in four out of the nine selected blocks in which the pilot programme of increasing rice production was launched in Kharif, 1984 (Table 1.3)

1.4.3 Sample

In each selected block under study (Table 1.3) a single village or a cluster, (of two or three villages) was selected in consultation with the local officials. From each selected village or cluster 15 farmers were selected by stratified random sampling. Thus the sample comprised 60 farmers selected from the four villages or clusters of four blocks in four districts of rice growing area in M.P.

Reference Year

Reference year of the study was kharif 1983 season of which field work was conducted in September, 1984.

Table 1.3 Rice zone districts, pilot blocks and the blocks selected for study, in M.P.

Rice Zone districts of M.P.	Districts selected for crash programme of rice production	Blocks selected for pilot programme	Blocks selected for the study
Balaghat	Balaghat	Waraseoni	Waraseoni
Bastar	Bastar	Charma	-
Bilaspur	Bilaspur	Masturi	Masturi
Durg	Durg	Balod	-
Mandla	-	-	-
Raigarh	Raigarh	Sarangarh	-
Raipur	Raipur	Fingeshwar Dhamtari	Fingeshwar
Rajnandgaon	Rajnandgaon	Rajnandgaon	Rajnandgaon
Shahdol	Shahdol	-	-
Sidhi	Sidhi	-	-
Surguja	Surguja	Sitapur	-

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C H A P T E R-II

RICE IN INDIA

2.1 Importance of the Crop

Rice is the staple food of nearly three fourths of the population in India. The traditional use of rice in the Hindu religious ceremonials associated with birth, marriage and funeral indicates its intimate association with the life of our people. Rice alone forms 47 per cent of total cereals and 43 per cent of total foodgrains supplies available in the country. It not only forms the mainstay of the diet of majority of people but also bears a large influence on their life and economic condition. The crop is cultivated in more than 40 million hectares, which comes to 31 per cent of the gross cropped area and its production forms 41 per cent of total foodgrains production in the country.

2.2 Distribution

Rice is cultivated in almost all the states of India, extending from the river delta regions of the South to the higher altitudes of 1,000 to 1,500 metres above sea level in the Kashmir Valley in the North. But it is mostly concentrated in the river valleys, deltas and low lying coastal areas of north-eastern and south-eastern parts of the country i.e. the states of Assam, West Bengal, Bihar, Orissa, Andhra Pradesh, Tamil Nadu, Uttar Pradesh and Madhya Pradesh. These states together share 82 per cent of total rice area and contribute 75 per cent of total rice production in the country.

2.3 Statewise Contribution- Area and Output

The percentage of rice area to the gross cropped area was more than 50 per cent in Assam, West Bengal, Orissa, Manipur and Tripura. It was between 47 to 50 per cent in Bihar, Nagaland and Meghalaya. Agricultural economy of these states is heavily.

Table 2.1 Statewise, percentage of rice area and relative share in area and output of rice in India.

State	Percentage of rice area to total cropped area in each state (1978-79) Per cent	Percentage share of states in all India total 1979-80 to 1981-82	
		Area (Per cent)	Out put (Per cent)
Andhra Pradesh	30.3	9.0	14.2
Assam	67.7	5.5	4.4
Bihar	49.0	13.4	9.0
Gujrat	4.4	1.2	1.2
Haryana	8.3	1.2	2.3
Himachal Pradesh	10.2	0.2	0.2
Jammu and Kashmir	27.1	0.7	1.0
Karnataka	9.8	2.8	4.5
Kerala	27.7	2.0	2.5
Madhya Pradesh	22.1	12.0	6.5
Maharashtra	7.5	3.8	4.4
Manipur	75.1	0.4	0.5
Meghalaya	47.5	0.3	0.3
Nagaland	48.7	0.3	0.2
Orissa	52.8	10.5	8.0
Punjab	15.9	3.0	6.7
Rajasthan	1.2	0.4	0.3
Tamil Nadu	35.9	6.3	10.4
Tripura	77.7	0.7	0.7
Uttar Pradesh	21.2	13.0	9.3
West Bengal	60.5	12.7	12.8
Sikkim	15.4	-	-
Union Territories	40.0	0.6	0.6
ALL INDIA	23.1	100.0	100.0

Ref: Indian Agriculture in Brief(19th Edition)Pages 242,266&268

deperdent on rice crop. The other states where rice is a fairly important crop are Andhra Pradesh and Tamil Nadu where the percentage of rice area to gross cropped area was above 30 per cent. The crop is fairly important in Jammu and Kashmir where it accounted for 27 per cent of its gross cropped area. In Madhya Pradesh and Uttar Pradesh rice accounted for 22 and 21 per cent of their total cropped area respectively. The crop is relatively much less important in the western states of Gujarat, Maharashtra and Rajasthan.

Examining the relative share of individual states in the total area and production of rice in the country it was observed that Bihar, Uttar Pradesh, West Bengal, Madhya Pradesh and Orissa shared more than 10 per cent of area, each (Table 2.1)

These states together shared 61.6 per cent of rice area and 45.6 per cent of total rice production in the country. Andhra Pradesh shared only 9 per cent of total rice area but contributed 14.2 per cent to total rice production, which was highest among all the states. The area share was more than 5 per cent in two other states viz. Assam and Tamil Nadu.

In the output share, Andhra Pradesh, West Bengal and Tamil Nadu accounted for more than 10 per cent each, whereas Uttar Pradesh, Bihar, Orissa, Punjab and Madhya Pradesh accounted between 5 to 10 per cent each. The output share was less than 5 per cent in other states. It is worth noting here that the share of Andhra Pradesh and Tamil Nadu was less than 10 per cent in area but more than 10 per cent in output, whereas the reverse holds true in the case of Madhya Pradesh, Bihar Uttar Pradesh and Orissa.

The comparison of area and output shares of rice reveals that the share of output was higher than the share of area in Andhra Pradesh, West Bengal, Tamil Nadu, Punjab, Karnataka, Maharashtra, Haryana, Jammu and Kashmir, Kerala and Manipur. This implies that in these states the per hectare yield of rice was higher than the all India average. On the other hand the output share was relatively smaller than the area share in Assam, Bihar, Madhya Pradesh, Orissa, Uttar Pradesh, Rajasthan and Nagaland. This implies that the yield performance of rice in these states was relatively lower than the average for the country. The area and output shares were almost equal in Gujarat, Himachal Pradesh, Meghalaya and Tripura.

2.4 Statewise Productivity of Rice

The statewise average yield of rice given in table 2.2 reveals that Punjab had the highest yield level of 2,766 kg. per hectare followed by Haryana (2,308 kg/hect.), Andhra Pradesh (2,245 kg/hect) and Tamil Nadu (2,104 kg/hect). The other states which had higher yield levels than the country's average of 1,245 kg. per hectare were, Karnataka, Jammu and Kashmir, Kerala, Manipur, Maharashtra, West Bengal and Meghalaya.

The important rice growing states having very poor yields of rice are Assam (995 kg/hect), Bihar (833 kg/hect) and Madhya Pradesh (813 kg/hect). Yield level of rice in Orissa (1,058 kg/hect) and Uttar Pradesh (1,066 kg/hect) were also below the all India level (Table 2.2)

Table 2.2 Statewise average yield of rice in India (1979-80 to 1981-82)

(yield in form of paddy)

State/ Union Territory	Yield (Kg.hect)	State/ Union Territory	Yield (Kg hect)
Andhra Pradesh	2,245	Manipur	1,473
Assam	995	Meghalaya	1,251
Bihar	833	Nagaland	966
Gujrat	1,199	Orissa	1,058
Haryana	2,308	Punjab	2,766
Himachal Pradesh	1,018	Rajasthan	804
Jammu Kashmir	1,984	Tamil Nadu	2,104
Karnataka	2,007	Tripura	1,224
Kerala	1,600	Uttar Pradesh	1,066
Madhya Pradesh	813	West Bengal	1,252
Maharashtra	1,419	All India	1,245

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CHAPTER-III

SITUATION IN MADHYA PRADESH

3.1 Size

Madhya Pradesh is the biggest state of the country sharing 14.54 per cent of the total geographical area. Net area sown in the state was highest. It was 187.98 lakh hectares forming 13.18 per cent of the net area sown in the country in 1977-78. Farming in this vast state is carried out under diverse edaphic and socio-economic conditions. The state is divided into several Agro-climatic zones with vast differences in soils, topography, altitudes, water supply and climatic conditions. It r esults in great variations in farming patterns followed and productivity obtained in different parts of the state.

3.2 Crop Zones

Madhya Pradesh comprises of three crop zones viz. rice, wheat and jowar crop zones. Jowar crop zone is also known as cotton-jowar zone because the major jowar growing districts also grow cotton. Some of the districts are, however, major with regard to more than one crop, thus the districts of Panna, Satna, Rewa, Jabalpur, and Seoni are major with regard to the areas of both rice and wheat. Similarly the districts of Morena, Bhind, Gwalior, Datia, Shivpuri, Guna, Tikamgarh, Chhatarpur, Chhindwara and Betul are major from the view point of area of both jowar and wheat.

Thus, the state is broadly divided into five crop zones. (Map 1)

(1) Rice Zone - Sidhi, Shahdol, Surguja, Mandla, Bilaspur, Raigarh, Balaghat, Rajnandgaon, Durg, Raipur and Bastar

(2)	Rice-Wheat Zone -	Panna, Satna, Rewa, Jabalpur and Seoni
(3)	Wheat Zone -	Vidisha, Sagar, Damoh, Sehore, Bhopal, Raisen, Hoshangabad and Narsinghpur
(4)	Cotton-Jowar Zone -	Mandsaur, Ratlam, Rajgarh, Ujjain, Shajapur, Jhabua, Dhar, Indore, Dewas, Khandwa and Khargone
(5)	Jowar- Wheat Zone -	Morena, Bhind, Gwalior, Datia, Shivpuri, Guna, Tikamgarh, Chhatarpur, Betul and Chhindwara

3.3 Cropping Pattern

Cropping pattern of the state is foodgrains oriented. As much as 82.22 per cent of the gross cropped area in the state was occupied by foodgrain crops. Of this, again, 59.87 per cent area was under cereals and 22.35 per cent under pulses. The important crops grown in the state are: rice, wheat, jowar, kodon-kutki, gram, linseed and cotton. The percentages of area under these crops were rice 22.29 per cent, wheat 15.20 per cent and jowar 10.35 per cent (Table 3.1)

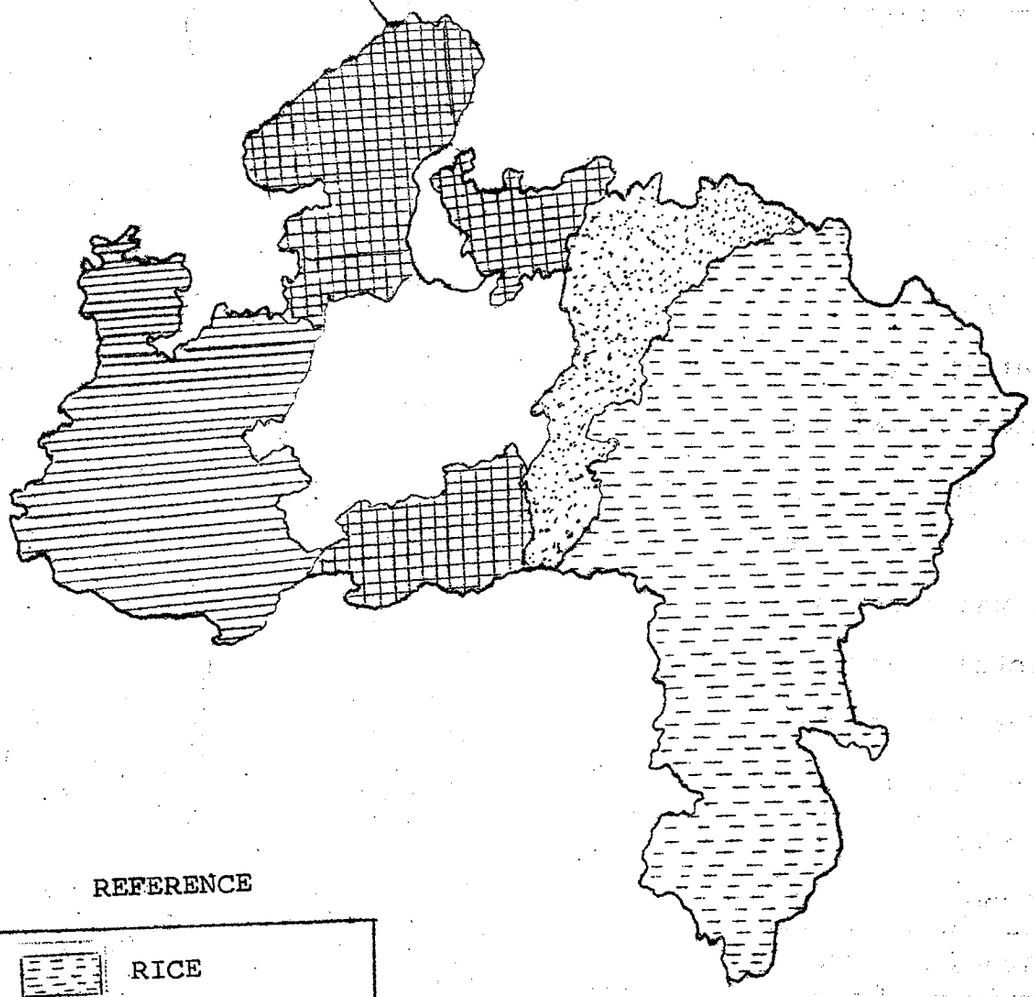
3.4 Rice Area

3.4.1 Spread

Rice crop occupied largest proportion i.e. 22.29 per cent of gross cropped area in the state. Its area is concentrated towards the south eastern districts which are contiguous and comprise the rice zone of the state. The most important influence for the concentration of rice cultivation in these districts is

MAP 1

CROP ZONES
OF
MADHYA PRADESH



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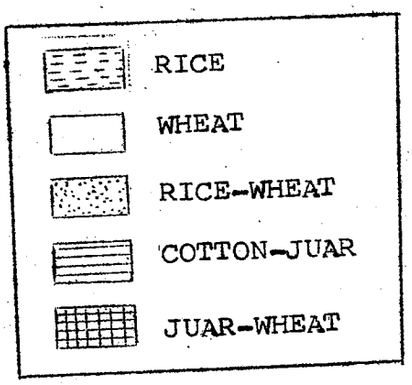

Table 3.1 Cropping pattern of Madhya Pradesh, (1981-82)

Crop/Crop category	Area (thousand hectares)	Percentage to total area of all crops
Rice	4,849.6	22.29
Wheat	3,305.8	15.20
Jowar	2,252.0	10.35
Maize	788.2	3.62
Bajra	174.3	0.80
Barley	180.9	0.83
Kodon-Kutki	1,180.3	5.43
Sawan	137.6	0.63
Other cereals and millets	156.1	0.72
Total cereals	13,024.8	59.87
Total pulses	4,863.5	22.35
Total Foodgrains	17,888.3	82.22
Total Oilseeds	2,045.3	9.40
Cotton	613.60	2.82
Other crops	1,209.31	5.56
Gross cropped Area	21,756.3	100.00

the relatively high rainfall in the area. In its study on Cropping Pattern in Madhya Pradesh, National Council of Applied Economic Research revealed that in most parts of these districts the rainfall received is more than 160 cms. Since rice is a kharif crop the rainfall received between July and October season is more important for its growth. It was found that there is a positive and significant rank correlation between districts which receive more rainfall during these months and those with a larger proportion of the cropped area under rice. The crop dominates in

the rice zone districts and shares fairly well in the rice-wheat zone.

The rice zone districts shared 80.61 per cent of total rice area and contributed 80.23 per cent of total rice production in the state. The adjoining crop zone i.e. rice-wheat zone shared 10.15 per cent of total rice area and the remaining 9.24 per cent rice area spread all over the remaining 29 districts of the state.

3.4.2 Extent of cultivation

The percentage of rice area to gross cropped area was highest in Bilaspur district (65.82 per cent) closely followed by Raigarh (65.58 per cent) and Balaghat (63.91 per cent). The other districts having more than 50 per cent of gross cropped area under rice were Bastar(60.56 per cent) and Raipur (51.88 per cent). These five districts together shared 52.80 per cent of total rice area in the state. Only two districts of rice zone viz. Mandla (25.79 per cent) and Sidhi (19.46 per cent) had less than 40 per cent of gross cropped area under rice.(Table 3.2)

The percentage of rice area in the district to total rice area in the state was highest in Raipur (16.55 per cent) followed by Bilaspur (13.64 per cent) Bastar (13.37 per cent) Raigarh and Durg (both sharing 7.37 per cent of rice area each). Sidhi district again stood lowest with only 1.77 per cent of total rice area in the state (Table 3.2)

Table 3.2 District-wise percentages of rice area and output and the yield index (Percentages derived on 3 years average 1977-78 to 1979-80)

(For yield index MP yield of rice-725 kg/hect base= 100)

Districts	Area		Output	Yield	
	Percent to gross cropped area in the distt.	Percent to total rice area in M.P.	Percent to total rice output in MP	Yield kg/hect	Yield index (MP=100)
1. Balaghat	63.91	4.71	6.18	943	130
2. Bastar (Jagdalpur)	60.56	10.37	11.62	824	113
3. Betul	8.20	0.76	0.78	608	83
4. Bhind	5.17	0.38	0.79	1,217	167
5. Bhopal	1.01	0.03	0.02	473	65
6. Bilaspur	65.82	13.64	14.33	759	104
7. Chhatarpur	7.94	0.42	0.39	553	76
8. Chhindwara	4.99	0.55	0.41	444	61
9. Damoh	17.06	1.08	0.76	415	57
10. Datia	1.14	0.03	0.01	319	43
11. Dewas	1.00	0.08	0.05	409	56
12. Dhar	2.42	0.29	0.23	486	67
13. Durg	42.28	7.37	4.55	776	107
14. Guna	0.72	0.09	0.07	480	66
15. Gwalior	9.65	0.55	1.01	1,085	149
16- Hoshangabad	2.50	0.23	0.30	767	105
17. Indore	0.25	0.02	0.01	430	59
18. Jabalpur	25.46	2.79	2.24	583	80
19. Jhabua	9.66	0.70	0.37	317	43
20. Khandwa	7.15	0.70	0.75	648	89
21. Khargone	2.84	0.40	0.29	435	59
22. Mandla	25.79	2.63	1.78	488	67
23. Mandsaur	0.17	0.02	0.02	494	68
24- Morena	1.51	0.13	0.21	1,196	164
25- Narsinghpur	5.45	0.32	0.39	744	102
26. Panna	23.75	1.16	0.51	310	42
27. Raigarh	65.58	7.37	8.04	775	106
28. Raipur	51.88	16.55	20.40	892	123
29. Raisen	1.40	0.12	0.09	473	65
30. Rajgarh	2.27	0.21	0.14	408	56
31. Rajnandgaon	43.04	5.41	3.35	748	103
32. Ratlam	1.76	0.13	0.09	416	57
33. Rewa	26.01	2.47	1.42	411	56
34. Sagar	2.93	0.32	0.27	492	67
35. Satna	21.60	1.87	0.77	290	39
36. Sehore	1.83	0.14	0.12	522	71
37. Seoni	22.96	1.88	2.02	779	107
38. Shahdol	40.31	4.26	3.35	558	76
39. Shajapur	1.41	0.41	0.11	479	66
40. Shivpuri	3.09	0.25	0.22	515	71
41. Sidhi	19.46	1.77	1.05	422	58
42. Surguja (Ambikapur)	48.65	6.37	5.58	627	86
43. Tikamgarh	10.33	0.59	0.35	355	48
44. Ujjain	0.11	0.01	0.01	417	57
45. Vidisha	0.35	0.04	0.02	361	65
All M.P.	22.35	100.00	100.00	725	100

3.5 Output share

Raipur alone shared 20.40 per cent of total output of rice in the state and stood first in this regard. The other districts and their percentage share were : Bilaspur (14.33 per cent), Bastar (11.62 per cent), Raigarh (8.04 per cent), Balaghat (6.18 per cent) and Surguja (5.58 per cent). All these districts individually shared more than 5 per cent of the total output of rice. The first nine districts belonged to rice zone, and the tenth and eleventh positions were secured by Jabalpur and Seoni districts of rice-wheat zone. Mandla and Sidhi districts of rice zone stood twelfth and fourteenth while Rewa of rice-wheat zone was thirteenth (Table 3.2) The eleven rice zone districts together shared 80.23 per cent of total rice output in the state.

3.6 Rice Yield

The top ranking three districts according to the yield index of rice in the state, were Bhind (167), Morena (164), and Gwalior (149). Conventionally these districts are not considered as rice growing districts of the state. These districts shared only 1.06 per cent of rice area and 2.01 per cent of rice production in the state.

Among the important rice growing districts Balaghat had the highest yield index i.e. 130 followed by Raipur (123), Bastar (113) Durg and Seoni (107), Raigarh (106) and Bilaspur (104). Only 13 districts of the state had higher yield index than the base (i.e. yield of the state 725 kg per hectare taken equivalent to 100). Among the rice zone districts too, four districts: Surguja, Shahdol, Mandla and Sidhi had their yield indices below 100 (Table 3.2).

3.7 Growth Rates

Average annual growth rates of area, output and productivity of rice in the rice zone districts of the state for the period 1950-51 to 1981-82 given in table 3.3 show that area growth rates were highest in Bastar, while output and productivity growth rates were highest in Mandla district.

Table 3.3 Linear growth rates of area, output and productivity of rice in Rice Zone districts of Madhya Pradesh. (1950-51 to 1981-82)

Districts	Linear growth rate		
	Area (Per cent)	Output (Per cent)	Productivity (Per cent)
Balaghat	0.62	2.64	1.78
Bastar	1.88	1.01	(-)0.06
Bilaspur	0.45	0.06	0.53
Durg (Durg & Rajnandgaon)	0.98	1.28	1.72
Mandla	1.72	4.01	2.75
Raigarh	0.53	0.78	0.44
Raipur	0.72	1.47	0.97
Shahdol	0.73	2.84	1.87
Sidhi	1.04	0.31	(-)0.93
Surguja	0.72	0.45	0.12
All M.P.	0.95	1.33	0.53

Area and output growth rates were positive in all the districts but productivity growth rates were negative in Sidhi and Bastar. In four districts i.e. Sidhi, Bastar, Surguja and Raigarh the productivity growth rates were lower than the average growth rate of the state. Similarly, in six districts viz. Bilaspur, Sidhi, Surguja, Raigarh, Bastar and Durg, (Durg and Rajnandgaon combined) growth rates of output were less than the state growth rate.

Thus, the performance of rice crop in the rice zone districts was not uniform. The percentage of area devoted to rice crop, productivity per unit of area and growth rates of area, output and productivity had considerable variations.

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CHAPTER-IV

SELECTED AREA AND SAMPLE

4.1 Agro-Climatic Regions

Madhya Pradesh is divided into five crop zones. "The five crop zones represent only broad divisions. If we examine topography, soil types and climatic parameters of a particular crop zone, we are struck by the fact that it is hardly a homogeneous area"*

A Technical Committee, constituted by the Indian Council of Agricultural Research alongwith the representation of Department of Agriculture and the Agricultural University of Madhya Pradesh, divided the state into twelve agro-climatic regions shown in Map2 and details given in Appendix.

The rice crop zone has been delineated into three homogeneous agro-climatic regions. These regions are-

Region I - Chhattisgarh plains including Balaghat district

Region II - Bastar Plateau

Region III - Northern hill region of Chhattisgarh

4.2 Selected Region

The first agro-climatic region i.e. Chhattisgarh plains including Balaghat district, is the most important rice growing tract of this state. Fifty three per cent of total rice crop of the state is grown in this region alone. This region includes the districts of Balaghat, Rajnandgaon, Durg, Raipur, Bilaspur, together with the kanker tahsil of Baster, Raigarh, Sarangarh and Gharghoda tahsils of Raigarh district (Table 4.1)

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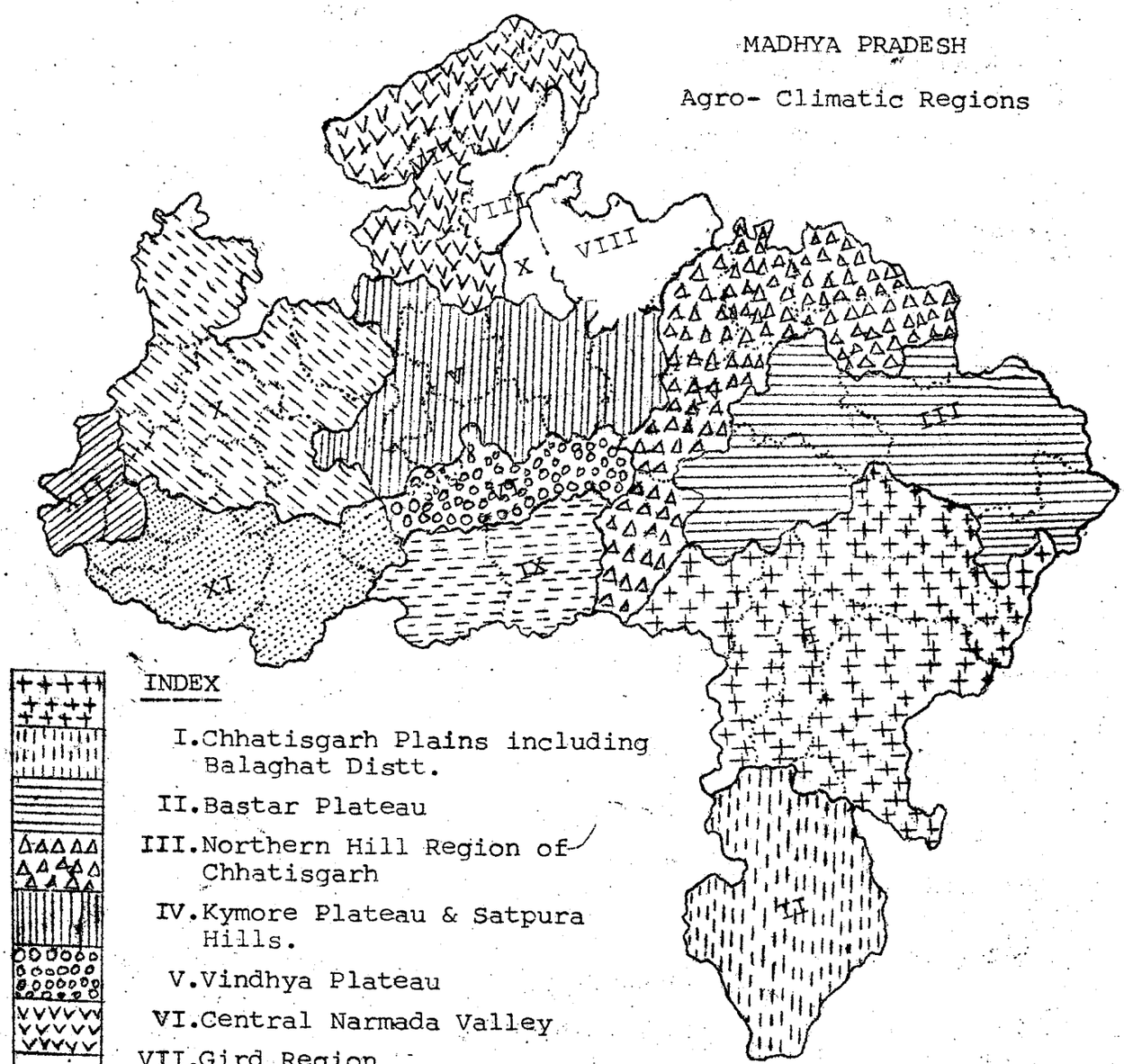
*National Agricultural Research Project- Focus on Location- Specific Research, Directorate of Research Services, J.N. Agricultural University, Jabalpur(M.P.)

Map-2

MADHYA PRADESH

Agro- Climatic Regions



INDEX

I. Chhatisgarh Plains including Balaghat Distt.
II. Bastar Plateau
III. Northern Hill Region of Chhatisgarh
IV. Kymore Plateau & Satpura Hills.
V. Vindhya Plateau
VI. Central Narmada Valley
VII. Gird Region
VIII. Bundelkhand Region
IX. Satpura Plateau
X. Malwa Plateau
XI. Nimar Plateau
XII. Jhabua Hills

Table 4.1 Area, output and productivity of rice in the three agro-climatic regions of rice zone in M.P.

Particulars	Region I	Region II	Region III
Gross cropped Area(Hect.)	43,92,300	20,33,900	6,87,800
Rice Area "	25,30,700	8,06,100	4,14,400
Percentage of rice area to gross cropped area(%)	57.6	39.6	60.3
Percentage of rice area to total rice area in the state(%)	53.4	17.0	8.7
Production of rice(Tonnes) (Paddy)	27,12,200	6,50,400	3,76,400
Productivity (kg/Hect)	1,070	806	905

4.3 Agro-climatic Conditions of the Region

4.3.1 Rainfall

Normal annual rainfall in the region varies from 1,200 mm to 1,600 mm. Eighty five to ninety per cent rainfall occurs during rainy season i.e. from June to September. Though the rainfall is higher in magnitude its distribution is eratic leading to high intensity rainfall altering with periods of moisture stress. The coefficient of variation of rainfall ranges between 13.50 per cent in Bastar to 30.53 per cent in Raigarh (Table 4.2)

4.3.2 Soils

Four broad groups of soils viz. Bhata (Tikara), Matasi, Dorsa and Kanhar occur in the region. Heavy textured Dorsa and Kanhar soils are at lower elevations and occupy about 15 and 30 per cent of the total area of the region respectively. Matasi soils are light textured and have low fertility. They occupy about 25 to 30 per cent of area. Bhata soils represent about 25 per cent of the area. Being least fertile a large area under Bhata soils is lying as culturable waste.

Table 4.2 Rainfall characteristics of the districts included in Region-I- (Chhattisgarh Plains and Balaghat)

District	Normal Annual Rainfall (in m.m.)	Rainfall in Rainy Season (June to Sept.) Rainfall (in m.m.)	Rainfall in Rainy Season (June to Sept.) Percentage to total rains (%)	Coefficient* of variation in Rainfall (%)
Balaghat	1,623.2	1,447.4	89.17	26.18
Bastar+	1,532.2	1,311.5	85.59	13.50
Bilaspur	1,391.7	1,219.3	87.61	25.37
Durg (including Rajnandgaon)	1,270.1	1,096.2	86.31	23.75
Raigarh+	1,619.7	1,413.2	87.25	30.53
Raipur	1,384.9	1,227.0	88.59	25.54

*Ref: "Inter-District Comparison of Agricultural Development in M.P., Agro-Economic Research Centre for M.P. Jabalpur (Mimeographed)

+Districts only partly included in the Region

The districtwise index ratings of soils prepared by Shome and Raychaudhari* on the basis of certain factors (viz. Character of soil fertility, topography, texture, of soils structure, degree of climatic suitability, salinity, stoniness and tendency to erode) reveals that soils of Bastar and Balaghat are most superior. Next comes Raipur and the remaining districts of Durg, Bilaspur, and Raigarh too stand above the overall state index (Table 4.3)

*Rating of soils of India- K.B. Shome and S.P. Raychaudhari, Proceedings of the National Institute of Science of India, Vol.26 A (Supplement I) 1960.

Table 4.3 Soil Characteristics of the districts included in Region I

District	Soil Fertility Index	Nutrient Status of Soils		
		Nitrogen	Phosphorus	Potash
Balaghat	72.7	Medium	Low	High
Bastar	77.0	Low	Low	High
Bilaspur	57.6	Low	Low	High
Durg (including Rajnandgaon)	57.6	Low	Low	Very High
Raigarh	57.6	Low	Low	Very High
Raipur	61.2	Very Low	Low	Medium

On the basis of districtwise soil fertility status of the soils of Madhya Pradesh, determined from the analytical results of a large number of soil samples, the state has been divided into seven categories+. Details of the districts included in the selected region are as given below :

Bilaspur and Bastar soils are medium in nitrogen and available potassium and low in available phosphorus.

Balaghat soils are medium in nitrogen, low in available phosphorus and high in available potassium.

In Durg (Durg and Rajnandgaon both) and Raipur, soils are low in nitrogen and available phosphorus, whereas medium in available potassium.

In Raigarh, fertility status of the soils show that soils are poor in nitrogen and available phosphorus whereas high in available potassium.(Table 4.3)

+ Information on Soils of Madhya Pradesh' By S.S. Khanna, D.P. Motiramani and S.M. Gorantiwar, J.N. Agricultural University, Jabalpur (Mimeographed).

4.3.3 Irrigation

About sixty to ninety eight per cent of the net area sown in different districts of this region is under rainfed agriculture. The proportion of net irrigated area to net area sown varied from 1.5 per cent in Bastar to 41.2 per cent in Balaghat district (Table 4.4). Raipur (32.1 per cent). Durg (26.5 per cent) and Bilaspur (18.3 per cent) are the other districts where the percentage of irrigated area is more than the state proportion of 12.8 per cent.

The area of rice crop irrigated was 47.9 per cent in Balaghat followed by Durg (41.3 per cent) and Raipur (35.6 per cent). In Bastar district 98.3 per cent of rice crop was rainfed. (Table 4.4)

Table 4.4 Percentage of irrigated area in the districts of Region I, (1981-82)

District	Percentage of net irrigated area to net area sown	Percentage of rice area irrigated
Balaghat	41.2	47.9
Bastar	1.5	1.7
Bilaspur	18.3	21.6
Durg	26.5	41.3
Raigarh	3.4	3.0
Raipur	32.1	35.6
Rajnandgaon	8.4	14.9
Madhya Pradesh	12.8	17.0

4.4 Sample

Within the region (i.e. Chhattisgarh plains including Balaghat district), the districts and the blocks selected for the study were :

District	Block
1. Balaghat	Waraseoni
2. Rajnandgaon	Rajnandgaon
3. Raipur	Fingeshwar
4. Bilaspur	Masturi

In Waraseoni block of Balaghat district a cluster of three villages- Medhki, Jadgaon and Duke and in Fingeshwar block of Raipur district, Fingeshwar, Purena and Binori villages were selected. In the other two block i.e. Rajnandgaon (district-Rajnandgaon) and Masturi (district Bilaspur) single villages, Mohad and Limtera were selected on the advice of local officials. In each block a sample of 15 farmers was drawn from the cluster or single village by stratified random sampling method. The constitution of the sample was as given below :

Table 4.5 Distribution of farmers in the sample

Size Group (hect.)	Balaghat	Bilaspur	Raipur	Rajnandgaon	Total
Below 1 hect.	4	5	5	5	19
1-2 "	5	5	3	2	15
2-4 "	3	2	4	4	13
4 and above	3	3	3	4	13
All farmers	15	15	15	15	60

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CHAPTER- V

PERFORMANCE OF SELECTED FARMS

5.1 Size and Ownership

As already stated the sample of the study comprised 60 farms.

The average size of farms was 2.84 hectares. Thirty nine i.e. 65.00 per cent of the selected farms were below the average size and their operated area was 25.88 per cent. The remaining 35.00 per cent farms which operated 74.12 per cent area were 21 and their operated area varied from 2.80 hectares to 12.80 hectares. Leased-in land formed 9.97 per cent of the total operated area on the selected farms. The average size of farms varied from 0.55 hectares in the lowest group (below 1 hectare), to 7.71 hectares in the largest size group of 4 hectares and above. (Table 5.1)

Table 5.1 Size and ownership of selected farms in different holding size groups

Size Group (hectares)	No.of farms	Owned land (Hect)	Leased-in land (Hect.)	Total Operated land(hect)	Average Size (Hect.)
Below 1 hect.	19 (31.66)	10.54	-	10.54 (6.18)	0.55
1-2 "	15 (25.00)	20.96	0.81	21.77 (12.77)	1.45
2-4 "	13 (21.67)	33.80	4.05	37.85 (22.21)	2.91
4 hectares and above	13 (21.67)	88.14	12.14	100.28 (58.84)	7.71
All farms	60 (100.00)	153.44	17.00	170.44 (100.00)	2.84

Note: Figures in parentheses are percentages to total

5.2 Soil Types

The major soil types which occured on the farms were Kanhar, Matasi, Dorsa and Bhata. Kanhar soils occupied 36.84 per cent of total operated area. Next came Matasi with 33.23 per cent followed by Dorsa (29.48 per cent). Bhata soils shared least area i.e. only 0.45 per cent (Table 5.2)

Table 5.2 Area of sample farms under different soil types

Soil type	Area(Hectares)	Percentage
Kanhar	62.79	36.84
Matasi	56.64	33.23
Dorsa	50.25	29.48
Bhata	0.76	0.45
Total	170.44	100.00

5.3 Area Irrigated

The percentage of irrigated area on the sample farms was 84.80. Out of the 60 farms 38 (63.34 per cent) were fully irrigated, 17 (i.e. 28.33 per cent) were partly irrigated and the remaining 5 (8.33 per cent) were totally unirrigated (Table 5.3)

Table 5.3 Irrigated area on sample of farms.

Category	No.of farms	Operated Area (Hect.)		
		Irrigated	Unirrigated	Total
Fully Irrigated	38 (63.34)	105.47 (61.88)	-	105.47 (61.88)
Partly Irrigated	17 (28.33)	39.07 (22.92)	22.43 (13.16)	61.50 (36.08)
Unirrigated	5 (8.33)	-	3.47 (2.04)	3.47 (2.04)
All Farms	60 (100.00)	144.54 (84.80)	25.90 (15.20)	170.44 (100.00)

Note: Figures in parentheses are percentages to total number in column 2 and percentages to total operated area in other columns.

Canals were the major source of irrigation, sharing 57.55 per cent of total irrigated area. Wells were next in importance irrigating 29.02 per cent area. Tanks irrigated 7.27 per cent area and the remaining 6.15 per cent was irrigated by other sources (Table 5.4)

Table 5.4 Area irrigated by different sources

Source of irrigation	Area Irrigated (Hect.)	Percentage to total irrigated area
Canal	83.17	57.55
Wells	41.95	29.02
Tanks	10.52	7.27
Other sources	8.90	6.15
All sources	144.54	100.00

5.4 Rice Cultivation

5.4.1 Rice Area

Rice was the major crop grown on the selected farms. It occupied 92.76 per cent of total operated area in the kharif season. Out of the total rice area (158.10 hectares), 87.20 per cent was irrigated and the remaining 12.80 per cent was unirrigated.

5.4.2 Systems of Cultivation

There are three principal systems of rice cultivation viz. dry, semi-dry and wet. The main features of these systems of cultivation are similar in all the rice growing areas, with local variations in the method of sowing and other cultural operations.

The area under the dry system of cultivation is, however, rather limited. But there are large areas under the semi-dry system. In irrigated areas wet system is more common. Under the dry system the seed is sown in the wake of the pre-monsoon showers or even earlier in the dry soil, in anticipation of rains. This system is locally called as KHURRA. On our sample farms only 9.06 per cent of rice area was sown under this system.

In the semi-dry system (locally called BATAR) the preparatory cultivation is the same as that adopted for the dry system. Usually, in July-August, when the monsoon is active, the rain water is impounded in the fields and the young rice crop of five to six weeks is ploughed crosswise with about two inches of standing water in the field. This practice is known as BIASI. Thirty six per cent of the total rice area on the sample farms was sown under this system.

Under the wet system-which is mostly adopted in irrigated areas-either the sprouted seeds are broadcasted in the puddled soil (LEYHEE) or the seedlings are transplanted. On our sample farms transplanting was done on 53.71 per cent of the total rice area.

Table 5.5 Rice area on sample farms under different systems of rice cultivation and methods of sowing

(Area- hectares)

System of cultivation	Method of sowing			All Farms
	Broadcasting	Sowing behind the plough	Trans-planting	
Dry	14.32	-	-	14.32 (9.06)
Semi-dry	56.12	0.81	-	56.93 (36.00)
Wet	1.94	-	84.91	86.85 (54.94)
All Farms	72.38 (45.78)	0.81 (0.51)	84.91 (53.71)	158.10 (100.00)

Note : Figures in parentheses are percentages.

The system of rice cultivation adopted by farmers of different holding size groups given in table 5.6 reveals that all the three systems i.e. dry, semi-dry and wet were adopted on the farms of biggest size group. Dry system of cultivation was not adopted by the farmers of any other size group. On smaller farms semidry system was more common than wet system while wet system was most common on big farms.

Table 5.6 Distribution of rice area under different system of cultivation in different holding size groups.

Size group (Hectares)	System of cultivation					
	Dry		Semi-dry		Wet	
	Area	P.C.	Area	P.C.	Area	P.C.
Below 1 Hect.	-	-	6.10	10.71	4.40	5.11
1-2 Hectare	-	-	12.57	22.08	9.00	10.36
2-4 "	-	-	18.43	32.38	19.42	22.36
4 hectares and above	14.32	100.00	19.83	34.83	53.99	62.17
All farms	14.32	100.00	56.93	100.00	86.85	100.00

5.4.3 Method of Sowing

As regards the methods of sowing adopted by the farmers, since the percentage of irrigated area on the sample farms was quite high transplanting of seedlings was adopted on 53.71 per cent of total rice area. Broadcasting was still very common and adopted on 45.78 per cent area. On smaller farms broadcasting was more common (covering 68.60 per cent of rice area), while on the bigger farms transplanting was done on 60.34 per cent area as compared to 39.66 per cent area sown by broadcasting method. Other methods of sowing were not at all common.

Table 5.7 Rice area on sample farms sown by different methods of sowing.

Size-groups (Hectares)	Area sown by different methods						Total Rice Area
	Broadcast		Behind the plough		Transplant		
	Area	P.C.	Area	P.c.	Area	P.C.	
Below 1 hect.	7.23	68.60	-	--	3.31	31.40	10.54 (100.00)
1-2 hectares	11.76	54.52	0.81	3.76	9.00	41.72	21.57 (100.00)
2-4 "	18.43	48.69	-	-	19.42	51.31	37.85 (100.00)
4 hectares and above	34.96	39.66	-	-	53.18	60.34	88.14 (100.00)
All farms	72.38	45.78	0.81		84.91	53.71	158.10 (100.00)

5.4.4 Crop Substitution

Cropping pattern of the sample farms was almost rigid. Except in one case where kodon(a kharif crop) was replaced by rice, no crop substitution was done on any farm during the past five years.

5.4.5 Varietal Changes and Varieties Grown

There had been some varietal changes in rice cultivation during the past five years. In 36 cases i.e. on 60.00 per cent farms some varietal changes occured. Out of the 36 cases, in 15 cases the changes occured in favour of Safri-17. Kranti, an improved variety recommended for the area occupied the second place, replacing other varieties in 9 cases. The other changes occured in favour of Mahsuri, Ratna, Jaya, Patel 85. Luchai-16 and I.R.-36. (Table 5.8)

Table 5.8 Varietal changes of rice on sample farms

Rice variety	No.of cases of varietal changes	Verities replaced
Safri-17	15	Gurmatia, Phalgun, Kranti Banko, Luchai, Safri(local)
Kranti	9	Luchai, Padma, Mani, Safri, Parmal
Mahsuri	5	Gurmatia, Safri, Phalgun, Luchai
Ratna	2	Gurmatia, Safri
Jaya	2	Safri (local)
Patel 85	1	Phalgun
Luchai-16	1	Luchai (Deshi)
I.R.-36	1	Phalgun

Safri-17 was the most important variety on the selected farms. Next in importance were Mahsuri, Luchai-16 and kranti among improved varieties while Gurmatia was the most common local variety. (Table 5.9)

5.4.6 Use of Manures and Fertilizers

Farm yard manure was the only organic manure applied on the sample farms. It was applied on 51 farms and the area of application was 113.25 hectares i.e. 71.63 per cent of total rice area on the sample farms. Intensity of manuring i.e. the quantity applied per hectare, was 59.58 quintals per hectare on the area of application and 42.68 quintals per hectare on total rice area.

Table 5.9 Varietywise distribution of rice area on sample farms

Improved Varieties			Local Varieties		
Variety	Area (Hect.)	Per cent	Variety	Area (Hect)	Per cent
Safri -17	54.59	34.52	Gurmatia	15.95	10.09
Mahsuri	22.29	14.10	Asamchuri	4.04	2.55
Luchai-16	13.55	8.58	Dubraj	2.08	1.32
Kranti	11.61	7.34	Kantha Banko	1.62	1.02
Patel-85	8.15	5.16	Phalgun	1.21	0.77
Surekha	5.67	3.59	Sela	1.01	0.64
I.R.-36	3.04	1.92	Moni	0.95	0.60
Ratna	2.83	1.79	Bramha Luchai	0.81	0.51
Jaya	2.33	1.47	Bangoli	0.81	0.51
Asha	1.62	1.02	Bajrangbali	0.61	0.39
Kaveri	1.01	0.64	Parmal	0.40	0.25
			Chinnur	0.40	0.25
			Chattri	0.30	0.19
			Others	1.23	0.78
Total	126.68	80.13	Total	31.42	19.87
			Total rice area	158.10	100.00

Fertilizers were applied on 54 sample farms. The area of application was 151.78 hectares i.e. 96.00 per cent of total rice area on the sample farms. The intensity of fertilizer application was 2.19 quintals per hectare on the area of application and 2.10 quintals per hectare on total rice area. The rates of application of different nutrients i.e. N.P. and K were 44.70 kg. per hectare N (Nitrogen), 31.89 kg. per hectare P (Phosphorus) and 19.30 kg. per hectare K (Potash).

5.4.7 Pesticides

Total number of farmers who used any pesticide for rice crop was 30 i.e. 50.00 per cent. The area in which pesticides were used was 131.33 hectares (i.e. 83.07 per cent) of total rice area on the sample farms. The value of pesticides used per hectare, calculated for the area of application was Rs.96.17 and for the total rice area was Rs.79.88.

The attitude of the farmers towards the use of pesticides revealed that, 7 farmers (11.66 per cent) used it regularly, 40 farmers (66.67 per cent) used it in the case of emergency and 13 (21.67 per cent) never used the pesticides.

5.4.8 Water Management

The water management problem has been examined under two heads i.e.(i) problem of irrigation and (ii) problem of drainage, although both are interlinked.

The percentage of area irrigated on the sample farms was 84.80, while the percentage of irrigated rice area to total rice area, was 87.20. Thus, there was no problem of availability of irrigation, but the nature of irrigation as well as the method of irrigation were not very dependable and correct. Lack of effective control on irrigation was the major problem. Mostly the irrigation was of protective type and when the monsoons failed it was of little help. The farmers were not careful in regard to water control and drainage system. Under the existing water control system in which the irrigation water runs over the fields, the water continously flows from field to field and the water can not be drained out of the field at any time.

Out of the 60 farmers of our sampke, only 19 i.e. 31.67 per cent had full water control facility and the area benefitted was 19.97 per cent of total operated area. The remaining forty one farms i.e. 68.33 per cent suffered from the water control problem. On the total area of 136.46 hectares of these 41 farms, 56.36 hectares i.e. 33.04 per cent had full water control, 53.55 hectares i.e. 31.41 per cent had partial water control while the remaining 26.55 hectares i.e. 15.58 per cent had no water control.

Table 5.10 Distribution of farms and area according to water management conditions.

Category of farms	No.	Area (Hect.)	Percentage
A. Farms on which water control was possible for each individual field	19	33.98	19.97
B. Farms on which water control was not possible for total area			
(a) Area having full control	-	56.36	33.04
(b) Partial control	-	53.55	31.41
(c) No control	-	26.55	15.58
Total of B Category	41	136.46	80.03
*All Farms (A+B)	60	170.44	100.00

5.4.9 Output and Productivity

As indicated earlier the percentage of area under improved rice varieties and local varieties was 80.13 and 19.87 per cent respectively. The total output (in the form of paddy) was 4,378.30quintals. It included 3,573.74 quintals i.e. 81.62 per cent of improved varieties and 804.56 quintals of 18.38 per cent of local varieties. Overall productivity of rice of sample farms was 2,769.33 kg. per hectare. The productivity of improved

varieties was 2,821.08 kg. per hectare and of local varieties 2,560.66 kg. per hectare. The productivity of rice sown by broadcast was 2,605.80 kg. per hectare and the transplanted rice yielded 2,908.19 kg. per hectare. (Table 5.11)

Table 5.11 Area, output and productivity of rice on sample farms according to method of sowing

Method of sowing	Area (Hect.)	Output (Quintals)	Productivity (kg/Hectate)
A. Broadcasting			
a) Improved variet	53.91	1420.24	2634.48
b) Local varieties	18.69	471.56	2523.06
Total of A	72.60	1891.80	2605.80
B. Transplanting			
a) Improved varieties	72.77	2153.50	2959.32
b) Local varieties	12.73	333.00	2615.87
Total of B	85.50	2486.50	2908.19
Total of A & B	158.10	4378.30	2769.33
Total of Improved varieties	126.68	3573.74	2821.08
Total of Local varieties	31.42	804.56	2560.66

The productivity of improved varieties of rice (in the form of paddy) on irrigated land, was 2,956.43 kg. per hectare and on unirrigated land 1,952.58 kg per hectare. Similarly in the case of local varieties the productivity on irrigated land was 2,640.61 kg. per hectare and on unirrigated land 1,843.17 kg. per hectare. (Table 5.12)

Table 5.12 Area, output and productivity of rice on sample farms according to irrigation

Irrigated/ Unirrigated	Area (Hectares)	Output (Quintals)	Productivity (kg./hectare)
A. Irrigated			
Improved varieties	109.60	3240.24	2956.43
Local varieties	28.27	746.50	2640.61
Total of A	137.87	3986.74	2891.67
B. Unirrigated			
Improved varieties	17.08	333.50	1952.58
Local varieties	3.15	58.06	1843.17
Total of B	20.23	391.56	1935.54

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CHAPTER- VI

CONSTRAINTS OF RICE PRODUCTION

Having presented the performance of sample farm with regard to the cultivation of rice crop, it would be appropriate to mention the features which act as constraints in increasing the rice production. However, before discussing the actual constraints it would be worthwhile to mention that the districts and the blocks in which the study was conducted were among those selected for introducing pilot programme of increasing rice production in the state. The selection of these blocks for the pilot programme was based on their good potentialities of increasing rice production. Thus, the blocks from which the sample was drawn were good blocks of the rice growing area and the selected villages too represented the good rice growing conditions. Therefore, the results derived from the sample may mitigate the seriousness of some of the constraints which might be more dominant in less favourable situations found elsewhere.

Inspite of the wide disparities in the proportion of rice area, the percentage of irrigated area, percentage of rice area irrigated, use of fertilizers and the productivity of rice on the sample farms and the districts or the state the constraints determined in the study would be found applicable in the overall rice growing area of the state.

6.2 Constraints

The special features of rice cultivation of the area, which act as constraints to increase rice production are discussed below.

6.2.1 Cultivation of Traditional or Local Varieties

An important constraint in increasing the rice output

is the cultivation of traditional or local varieties. The local varieties grown are mostly of the indica group of Oryza sativa species grown all over the tropics. They are low yielding and can not generally stand heavy fertilizer application, which induces a rank vegetative growth in them, resulting in lodging.

Japonicas- another group of Oryza sativa species, grown in sub-tropical and warm temperate regions- in their own habitat are higher yielding than the indicas. They are short statured, comparatively non-lodging and highly responsive to heavy fertilization. Earlier, the japonica rices, when introduced in India, proved a failure as the plants showed very poor growth and tillering. It also gave a setback to the high yielding varieties programme with the result that even today the adoption of high yielding varieties of rice has not reached the desired level. The proportion of high yielding varieties of rice to total rice in Madhya Pradesh was 25.43 per cent in 1981-82.

It may be observed that though the percentage of area under improved varieties was 80.13 per cent on the sample farms, Safri-17 (an improved local variety) alone covered 34.52 per cent area. The coverage of Safri-17 is not considered under high yielding varieties though it is better than local varieties. Other local varieties shared 19.87 per cent of total rice area.

The local varieties which belong to the indica group are hardy and adopt to the local conditions and some of them carry genes of resistance to some of the major diseases. In the existing water control system- where the water is allowed to flow continuously from field to field and the water can not be drained out of the field at anytime the high yielding varieties suffer on account of waterlogging whereas the local varieties sustain the standing water.

These are the reasons on account of which the farmers continue to grow local varieties in considerable part of the holding and inspite of the best efforts of the extension agencies the high yielding varieties of rice have not been adopted to the desired extent.

6.2.2 Broadcast Method of Sowing

The broadcast method of sowing rice is fairly common. It is an exception rather than a rule in the other main rice growing countries. In Burma, for example, only about 5 per cent of the total rice area is under broadcast rice and the bulk of rice crop in other South-Asian countries is produced from transplanted seedlings. On our sample farms 45.78 per cent of total rice area was sown broadcast.

The practice of broadcasting is to a large extent responsible for the comparatively low yields owing to the inadequate preparation of the soil, particularly where the seeds are sown with the first shower of rain in the land which has inadequate moisture. Average yield of rice (in the form of paddy) on our sample farms was 2,605 kg. per hectare for the rice crop sown broadcast and 2,908 kg. per hectare for the transplanted crop.

In order to increase the average yield per hectare a change in the method of sowing is desirable. However, the shift from bradcasting method to transplanting of seedlings required active participation of the farmer who had to build bunds in the fields, change the water management system and use much larger amount of labour.

6.2.3 Water Control System

The existing water control system in which the irrigation water runs over the rice fields, thereby supplementing the natura

supply of water from rainfall, run-off and flooding is of protective nature. The farmers have little control over the supply of water to the fields. If there is too much of rain there is no way for the farmer either to prevent additional irrigation water from entering the fields, or to facilitate the drainage of excess water. The total farm land of our sample farms- which was irrigated to the extent of 84.80 per cent had full water control on 53.01 per cent area, partial control on 31.41 per cent area and no control on 15.58 per cent area.

In the natural water conditions generally found in the area, important management decisions of the farmers continue to be directed by water conditions beyound their control. They have to adjust the methods of farming to the existing water system of the area. It seems plausible, therefore, that the management decisions relating to the selection of variety, system of cultivation, and method by sowing have direct bearing with the water management problem.

6.2.4 Low and Unbalanced Fertilizer Use

On our sample farms 54 farmers had used fertilizers in the rice crop. The average quantity of fertilizer application was 210 kg. per hectare, though 56 per cent of the farmers applied lower quantities. The proportion of N, P_2O_5 and K_2O on the sample farms was :

N	-	44.70 kg.per hectare
P_2O_5	-	31.89 " " "
K_2O	-	19.30 " " "

These results do not show the magnitude of unbalanced nature but if the average quantity of fertilizer consumption in

the area is considered the seriousness of the problem becomes quite apparent. The total consumption of fertilizers during kharif 1981-82 divided by the rice area alone (assuming that whole quantity was applied to the rice crop) gave the following rates of consumption.

Balaghat district	9 kg. per hectare
Bilaspur district	10 kg. per hectare
Raipur district	21 kg. per hectare
Rajnandgaon district	9 kg. per hectare

The farmers of these districts were generally not habituated to the application of full recommended doses of fertilizers. They usually reduced the doses of fertilizers and though they had their own explanations for it, e.g. uncertainty of rains, lack of assured irrigation, loss of fertilizers due to run off etc. it definitely reduced the production of the crop.

6.2.5 Lack of Plant Protection Measures

Under the biophysical conditions of the area there is great attack of insects, pests and wide range of weed flora, on account of which regular use of recommended insecticides, pesticide and weedicides is quite necessary. Inspite of it the use of plant protection measures was not common. The analytical results of our sample reveal that only 11.66 per cent farmers used some pesticides regularly, 66.67 per cent used it in the case of emergency and the rest 13.67 per cent never used it.

6.2.6 Lodging of the Crop

The local varieties are tall varieties which tend to lodge with larger application of nitrogen. The lodging of the crop is a serious problem affecting rice production. There is 60 per cent loss in yield when the crop lodges at the pre-flowerin

stage. The loss is reduced as the lodging is delayed. At the ripening stage the loss is about 18 per cent. Thus, the lodging of the crop comes in the way of increased production.

Almost all local varieties coming from the indica group are weak-strawed and are prone to lodging when heavily manured. With the present drive for intensive cultivation, there is need for growing non-lodging and stiff-strawed varieties which can make full use of heavy manuring.

6.2.7 Wild Rice Menace

In the rice zone of Madhya Pradesh the rice fields are infested with wild rice locally called Karga. As it is not distinguished from the cultivated one until ears appear, considerable loss in yield occurs. In some areas loss in yield due to wild rice in the cultivated fields has been estimated to be 10 per cent.

In order to control this menace purple-leaved rice varieties have been evolved (e.g. rice variety R 2270).

6.3 Steps Suggested

For the application of new technology of modern agriculture i.e. agriculture in which farmers make substantial use of inputs which are developed or produced outside the agricultural sector of the economy, transformation of the system in order to create the conditions necessary for the application of new technology are necessary. With the present emphasis on the intensive cultivation of rice and increasing the use of fertilizers there is a need for adoption of such steps which may help in increasing rice production in the area. Some of the steps suggeste in this direction are given below :

1. Water management is the most important problem facing the growth of rice output. It has got two aspects (i) problem of irrigation (ii) problem of drainage, although both are inter-linked.

The main constraint to the growth of output is low extent of irrigation. The adequate and timely supply of water to the rice fields is important not only for increasing output and productivity of rice but also for helping adoption of its new technology.

In the absence of efficient field distribution system the irrigation water flows from field to field and hence a lot of water is wasted and nutrients applied to the rice crop are lost.

As in the case with irrigation, drainage facilities are very poor for the rice fields. It is very difficult to drain off rice fields in low lying areas. In the case of nitrogen top dressings it is essential to drain off the rice field one or two days before applying the fertilizer, but under the poor drainage conditions it becomes difficult.

Thus, for increasing the rice production improvement in water management conditions is the foremost step.

2. Increasing the area of high yielding varieties of rice is equally important. At present a large proportion of rice area is under local varieties or the improved strains of local varieties. There is a need for adoption of such strains which, besides being high yielding, also respond well to heavy manuring so that the full benefit of the high level of fertilizers can be realised.

In this regard, either, it should be made obligatory on the part of the farmers or they should be encouraged through some sort of incentives to grow only high yielding varieties of rice by transplanting method on entire land which has assure irrigation facility.

The choice of varieties under different situations are limited, therefore, drought resistant and multiple resistant varieties to different diseases and pests should be evolved.

3. Thus, for increasing rice production and productivity per hectare it is necessary to increase-

(a) area of high yielding varieties of rice

(b) area under transplanted rice

(c) application of fertilizers in balanced doses

(d) plant protection measures

(e) irrigated rice area and its drainage facilities.

Implementation of such steps should be backed by-

(a) organised extention programme

(b) adequate financial support and

(c) strong legal measures.

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CHAPTER- VII

SUMMARY AND CONCLUSIONS

India is the second largest producer of rice, and ranks first in terms of area among the rice growing countries of the world. Rice accounts for 23 per cent of the gross cropped area and 41 per cent of total foodgrains production in this country.

Inspite of being the most important crop in India, rice has not shown a satisfactory increase in production. The main problem of rice crop is its low productivity, particularly in the major rice growing states of Assam, West Bengal, Bihar, Orissa, Uttar Pradesh and Madhya Pradesh. A special programme envisaged optimisation of rice production in these states. Initially a pilot programme was launched in 50 selected blocks of these states, from kharif, 1984.

In the above context micro-level studies to identify the bottlenecks and remedies were proposed. The present study was taken up in the rice zone districts of Madhya Pradesh.

The objective of the study was to identify the constraints in increasing rice production. The study was conducted in four out of the nine selected blocks in which the pilot programme of increasing rice production was launched.

The sample of the study formed 60 farmers selected equally from the four selected blocks viz. Waraseoni (Balaghat district) Rajnandgaon (Rajnandgaon district), Fingeshwar (Raipur district) and Masturi (Bilaspur district). Fifteen farmers were selected in each block, from a single village or a cluster, by stratified random sampling. Reference year was kharif, 1984.

In Madhya Pradesh rice accounted for 22 per cent of the gross cropped area. Relative share of the state in total rice area and total rice production of the country was 12 per cent and 6.5 per cent respectively. The output share was smaller than the area share indicating that the yield of rice in the state was relatively lower than the average for the country. The average yield of rice (in the form of paddy) in the state was only 813 kg. per hectare as compared to 1,245 kg.per hectare for the country.

Rice cultivation in the state is concentrated in the south eastern districts which form the rice crop zone. The rice zone districts shared 80.61 per cent of the total rice area and contributed 80.23 per cent of the total rice production in the state.

Rice zone has been delineated into three homogenebus agro-climatic regions. Most important of them is the region named as Chhatisgarh plains including Balaghat district. Fifty three per cent of the total rice area in the state is shared by this region. Normal annual ranifall of the districts in this region varied from 1200 mm. to 1600 mm. and the coefficient of variation was between 13.50 and 30.53 per cent. Area of irrigated rice crop was 47.9 per cent in Balaghat district, 35.6 per cent in Raipur, 21.6 per cent in Bilaspur and 14.9 per cent in Rajnandgaon district.

The sample of the study comprised 60 farmers. Average size of the farms was 2.84 hectares. The major soil types were Kanhar, Matasi, Dorsa and Bhata. The percentage of irrigated area was 84.80. Canals were the major source of irrigation sharing 57.55 per cent of the total irrigated area. Rice crop occupied

92.76 per cent of the total operated area in kharif season. Out of the total rice area 87.20 per cent was irrigated. Fifty five per cent of the rice crop was sown under wet system of cultivation and 36 per cent under semi dry system. The remaining rice area was cultivated by dry system of cultivation. As regards the method of sowing 46 per cent of the rice crop was sown by broadcasting method and 54 per cent by transplanting.

Some varietal change in rice cultivation occured on the sample farms in the past five years. Out of the 36 cases of change, in 15 cases the change occured in favour of Safri-17 variety. Kranti occupied the second place replacing other varieties in 9 cases.

Safri-17 was the most important variety grown on the sample farms farms. It occupied 34.52 per cent area. All the improved varieties together shared 80.13 per cent of the total rice area. Among the local varieties Gurmatia was the most important occupying 10.09 per cent area.

Fertilizers were applied on 54 sample farms with an average of 2.10 quintals per hectare on the total rice area. The rate of application for N,P and K was 44.70, 31.89 and 19.30 kg. per hectare.

Attitude of the farmers towards the use of pesticides was not encouraging. Only Seven farmers used it regularly, 40 in the case of emergency and 13 never used it.

Nineteen farms i.e. 31.67 per cent had full water control facility and the rest suffered on this account. Out of the total area of sample farms 53.01 per cent area had full water control, 31.41 per cent partial control and 15.58 per cent area had no water

control.

The total output of rice (in the form of paddy) on the sample farms was 4378.30 quintals. It included 3,573.75 quintals i.e. 81.62 per cent of the improved varieties of rice. Average yield of improved varieties was 2,821.98 kg. per hectare and of local varieties 2,560.66 kg. per hectare. Productivity of improved and local varieties on irrigated land was 2,956.43 and 2,640.61 kg. per hectare while on unirrigated land it was 1952.58 and 1843.17 kg. per hectare respectively.

The variation in productivity of rice with regard to the method of sowing was 2,959.32 and 2634.48 kg.per hectare for transplanted and broadcasted of improved varieties. In the case of local varieties the average yield was 2615.87 kg. for transplanted crop and 2,523.06 kg. for the broadcasted crop.

The constraints of increasing rice production derived from the results on the sample farms may mitigate seriousness of some of the constraints because the sample studied was drawn from good blocks of the rice growing area and also good villages of the blocks.

An important constraint in increasing rice output is the cultivation of traditional or local varieties of rice which are low yielding and generally do not withstand heavy fertilizer application. The percentage of area under improved varieties of rice was 80.13 on the sample farms but safri-17, an improved local variety which is not considered high yielding, alone covered 34.52 per cent area. Other local varieties shared 19.87 per cent area.

The broadcasting method which is fairly common is another reason for low yields. In order to increase the average yield change in the method of sowing is desirable.

The shift from broadcasting to transplanting method required active participation of the farmer who had to build bunds, change his water management system and required larger amount of labour.

Existing water control system, in which the irrigation water runs from field to field and the farmer has little control over it, is defective. The management decisions relating to the selection of variety, system of cultivation and method of sowing have direct bearing on the water management problem.

Low and unbalanced fertilizer use is also one of the constraints in increasing the rice production. The results of the analysis of data of sample farms do not show the magnitude of this problem but if the average quantity of fertilizer consumption in the area is considered the seriousness of the problem becomes quite apparent. It varied from 9 kg.per hectare in Rajnandgaon to 21 kg. per hectare in Raipur district. The farmers were not habituated to the application of full recommended doses of fertilizers.

Regular use of recommended insecticides, pesticides and weedicides is quite necessary, but the same was not common. Only 11.66 per cent farmers used some pesticides regularly, 66.67 per cent used it in the case of emergency and the rest 13.67 per cent never used it.

The lodging of rice crop is a serious problem affecting rice production. All local varieties are weak strawed and are prone to lodging when heavily manured.

Wild rice menace also exists. In some areas loss in yield due to wild rice was estimated to be 10 per cent.

For the application of new technology of modern agriculture, transformation of the system is necessary. Some of the steps suggested in this direction are:

Adequate and timely supply of water to the rice fields is important.

Improvement in water management conditions is the foremost step.

Increasing the area of high yielding varieties of rice is equally important. Either it should be made obligatory on the part of the farmers or they should be encouraged through some sort of incentives to grow only high yielding varieties by transplanting method on all such land which has got assured irrigation facility.

Thus it is necessary to increase-

(a) area of high yielding varieties of rice,
(b) area under transplanted rice,
(c) application of fertilizers in balanced doses,
(d) plant protection measures,
(e) irrigated rice area and its drainage facilities.

Implementation of such steps should be backed by-

(a) organised extension programme,
(b) adequate financial support and
(c) strong legal measures

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APPENDIX

Agro-Climatic Regions of Madhya Pradesh

RICE ZONE

Region I	Chhattisgarh Plains including Balaghat district
Region II	Bastar Plateau
Region III	Northern Hill Region of Chhattisgarh

RICE-WHEAT ZONE

Region IV	Kymore plateau and Satpura Hills

WHEAT ZONE

Region V	Vindhyan Plateau
Region VI	Central Narmada Valley

JOWAR & WHEAT ZONE

Region VII	Gird Region
Region VIII	Bundelkhand Region
Region IX	Satpura Plateau

COTTON JOWAR ZONE

Region X	Malwa Plateau
Region XI	Nimar Valley
Region XII	Jhabua Hills

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