

Ad-hoc Study No.38

PERFORMANCE OF
HIGH YIELDING VARIETIES OF WHEAT
IN
MADHYA PRADESH

AGRO-ECONOMIC RESEARCH CENTRE
For MADHYA PRADESH
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1. The share of H.Y.V. Programme in the growth of output of cereals i.e. how much additional production was attributable to H.Y.V. and how much to other varieties.
2. What were the factors responsible for the deacceleration of the growth rates of area or yield or both under some of the H.Y.V. crops, particularly wheat, after 1971?
3. What were the different components of inputs to which the growth in yield over the last ten years could be attributed and to what extent?

It was also intended to examine the efforts made by the state Governments towards adaptive research.

The reasons for the variations in yields obtained by different cultivators were also to be revealed.

At the field level following aspects were to be covered :

- (a) Distribution of area under the crop among specific varieties.
- (b) Variability in H.Y.V. yields vis-a-vis yields of local varieties.
- (c) Farmer's views on H.Y.V.'s and local varieties and reasons for non-adoption of H.Y.Vs by some farmers.

1.2 Selection of Districts

There are 16 wheat districts* in the state. For the selection of two districts the criterion used was the percentage of H.Y.V. area to total area of wheat crop. Tikamgarh district had the highest percentage (74.56) of H.Y.V. area to wheat area followed by Gwalior district (59.45). Therefore, Tikamgarh and Gwalior districts were selected for the study. Incidentally, these two districts also have the highest percentage of irrigated wheat area to total wheat area. (Table 1.1)

TABLE 1.1

Wheat districts of Madhya Pradesh, 1974-75 (Area in thousand hectares)

S.No.	Wheat Districts	Wheat Area	H.Y.V. area of Wheat	%age of H.Y.V. area to Wheat	Irrigated area to Wheat	Percentage of irrigated wheat area to total wheat area
1.	Gwalior	69.3	41.2	59.45	36.4	52.53
2.	Datia	34.1	9.2	26.98	12.2	35.78
3.	Shivpuri	70.4	19.0	26.99	29.5	41.90
4.	Guna	128.3	6.6	5.14	7.1	5.53
5.	Tikamgarh	50.7	37.8	74.56	44.6	87.97
6.	Panna	52.1	8.6	16.51	6.8	13.05
7.	Satna	109.2	3.2	13.50	10.3	9.4
8.	Vidisha	209.6	4.5	2.15	2.4	1.15
9.	Sagar	219.7	11.2	5.10	11.2	5.10
10.	Damoh	92.6	8.7	9.39	8.9	9.61
11.	Jabalpur	123.0	19.8	19.10	13.9	11.30
12.	Indore	53.5	23.8	44.49	11.3	21.12
13.	Sehore	94.3	9.6	10.18	8.9	9.44
14.	Raisen	136.8	12.8	9.36	8.0	5.85
15.	Hoshangabad	122.6	16.4	13.38	17.3	14.11
16.	Narsinghpur	37.6	13.8	36.70	14.3	38.03

SOURCE :- Agricultural statistics, Madhya Pradesh 1976.
Directorate of Agriculture, M.P. Bhopal.

* A wheat district is one having 20 per cent or more of the gross cropped area under wheat.

1.3

Selection of Blocks

Data on the coverage of H.Y.V. were also collected for individual blocks. It was observed that in Tikamgarh district, Tikamgarh block had the highest (92.28) percentage of total wheat area under H.Y.V. and Palera block had the lowest (65.00) percentage. Therefore, in Tikamgarh district, Tikamgarh and Palera blocks were selected. In Gwalior district Dabra block having the highest ratio of adoption (84.00) and Bhandar block with the lowest ratio (23.43) were selected. (Table 1.2)

TABLE 1.2

Coverage of H.Y.V. of wheat in different blocks of selected districts, 1976-77

District/ Block.	Wheat area (Hectares)	H.Y.V. Area of wheat (Hectares)	Percentage of H.Y.V. area to total wheat area.
<u>Tikamgarh District</u>			
Niwari	9,913	6,543	66.00
Tikamgarh	11,956	11,033	92.28
Baldeoagarh	8,558	5,925	69.23
Palera	6,605	4,293	65.00
Jatara	9,136	8,222	90.00
Prithvipur	8,726	6,343	72.69
Total	54,894	42,622	77.64
<u>Gwalior District :</u>			
Ghatignon	9,426	4,009	42.54
Hurar	15,082	5,639	37.39
Bhitarwar	21,210	12,145	57.26
Dabra	16,750	14,070	84.00
Bhandar	16,780	3,931	23.43
Total	82,247	49,644	60.36

1.4 Selection of Villages

In each of the selected blocks two villages were purposively selected. Thus in Gwalior district the villages selected in Dabra block were Simaria and Janakpur and those in Bhandar block were Tigara Kalan and Chandrol. The selected villages in Tikamgarh district were Hira Nagar and Ganeshganj in Tikamgarh block and Palera Khas and Barhori Kalan in Palera block.

1.5 Selection of Farmers

For the selection of farmers the lists of farmers were prepared in the ascending order according to the area of operational holdings. The farmers in each list were grouped into six groups so that each group contained equal number of farmers. From each group two farmers were randomly selected so as to have twelve farmers per village. In addition, one farmer was selected from any of the selected pair of the villages of the block so as to have twenty five farmers per block.

Thus the total number of farmers selected for the study was 100.

1.6 Reference year

The data referred to the agricultural year 1976-77.

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CHAPTER II

HIGH YIELDING VARIETIES PROGRAMME IN MADHYA PRADESH

In Madhya Pradesh the H.Y.V. Programme was launched in 1966-67 alongwith the other States and the crops included were paddy, wheat, jowar, bajra and maize. These were the important crops of the State and together occupied about half of the gross cropped area of the State (Table 2.1)

Table 2.1 Area under different crops, Madhya Pradesh, 1966-67

Crop	Area ('000 ha)	Percentage of the gross cropped area
Paddy	4,177	22.79
Jowar	2,277	12.42
Wheat	2,126	11.59
Maize	550	3.00
Bajra	248	1.35
Total	9,378	51.15
Other Cereals & Millet	1,675	9.13
Gram	1,632	8.90
Other pulses	2,403	11.47
Oilseeds	271	1.48
Cotton	812	4.43
Other non-food crops	2,465	13.44
Gross cropped area	18,336	100.00

2.1 Coverage of the Programme

In the first year, the coverage of the programme was 57,700 hectares or only 0.32 percent of the gross cropped area of 1,83,35,800 hectares and 0.62 percent of the under the above mentioned crops. Paddy varieties had the largest coverage of 32,600 hectares or 56.50 percent of the H.Y.V. area of the programme and accounted for 0.78 percent of the area under the paddy crop. The high yielding varieties of maize were grown on 16,100 hectares accounting for 27.90 percent of the H.Y.V. area and repre-

sented 2.93 per cent of the area under the crop. Wheat varieties occupied 0.100 hectares or 14.04 per cent of the H.Y.V. area and 0.38 per cent of the total wheat area. The high yielding varieties of jowar and bajra occupied 600 and 300 hectares respectively. (Table 2.2)

Table 2.2 Area under H.Y.V. in Madhya Pradesh 1966-67

Crop	(Area-'000 ha)		
	Area under H.Y.V.P.	Percentage to total	Percentage of H.Y.V. area to area under crop.
Paddy	32.6	56.50	0.78
Jowar	0.6	1.04	0.03
Wheat	8.1	14.04	0.38
Maize	16.1	27.90	2.93
Bajra	0.3	0.52	0.12
Total	57.7	100.00	0.62

As regards the varieties, there was only one paddy variety viz. Taichung Native I whereas wheat had two varieties: Sanora 64 and Lerma rojo. In the case of maize, jowar and bajra few hybrid varieties were propagated.

Madhya Pradesh has six distinct crop zones and therefore the propagation of varieties of different crops was localised in the respective crop zones. Thus Taichung Native I was mainly grown in five districts viz. Balaghat, Raipur, Bilaspur, Durg and Seoni. The districts growing wheat varieties were Tikamgarh, Chhatarpur, Mandasaur, Shivpuri, Morena and Bilaspur. Hybrid varieties of maize were grown in Jhabua, Mandasaur, Sidhi, Dhar and Raipur districts whereas hybrid jowar varieties were concentrated in the districts of East Nimar, West Nimar and Guna.

During the last ten years (1966-67 to 1975-76) the programme made tremendous progress. Not only has the area changed but the varieties, the recommended doses and practices also changed considerably from year to year.

In the following paragraphs the progress and the performance of H.Y.V.P. over the years have been described.

As noted earlier, coverage in the first year of the programme was 57,700 hectares. It increased from year to year and spread over an area of 22,80,000 hectares in 1975-76, the last year of the reference period. In other words the coverage in the last year was about 40 times or 3,851.47 per cent higher as compared to the first year.

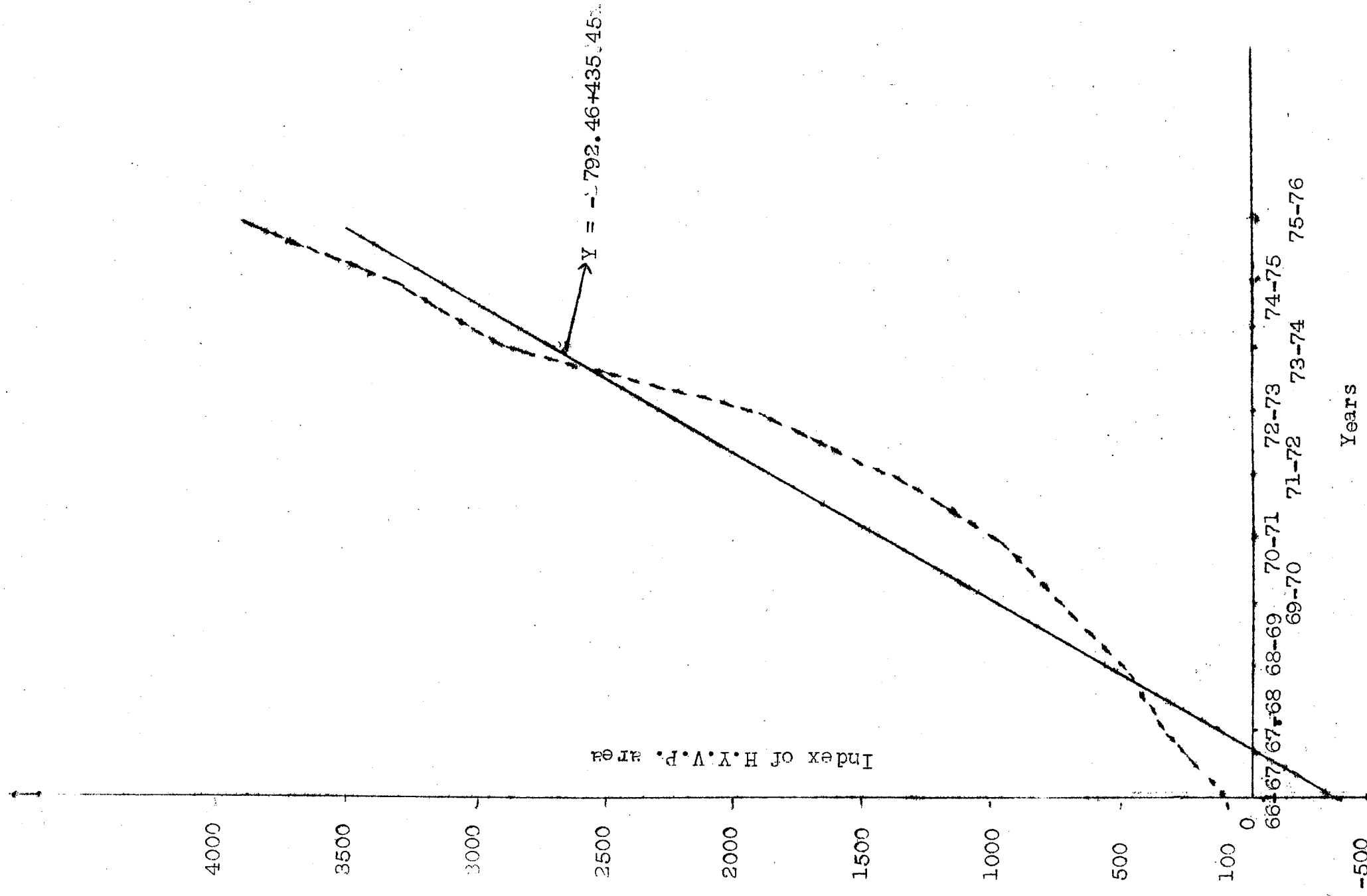
(Table 2.3)

Table 2.3 Index numbers of area under H.Y.V.P.,
Madhya Pradesh

Year	Area ('000 ha)	Index numbers (1966-67 = 100)
1966-67	57.7	100.00
67-68	181.1	313.86
68-69	257.1	445.58
69-70	421.6	730.68
70-71	562.7	975.22
71-72	802.0	1,389.95
72-73	1,100.5	1,908.32
73-74	1,675.2	2,903.29
74-75	1,908.0	3,306.76
75-76	2,280.0	3,951.47

The regression equation $y = a + bx$ was fitted to the data on the coverage of H.Y.V.P. where y stood for the expected value of index in a given year x . The equation obtained for the data was $y = -792.46 + 435.45 x$ indicating that the average rate of growth of area of high yielding varieties was 435.45 per cent over the ten year period (Fig. 2.1).

Fig 2.1 : Area under H.Y.V.P. in Madhya Pradesh



The share of the area under H.Y.V.P. to gross cropped area was 0.32 per cent in the first year of the programme. It increased from year to year and was 10.67 per cent in the last year. The share of the H.Y.V. area under H.Y.V. crops, on the other hand, increased from 0.62 per cent in 1966-67 to 21.16 per cent in 1975-76 (Table 2.4) See also appendix table A 2.1

Table 2.4 Coverage of the H.Y.V.P. in M.P. 1966-67 to 1975-76

year	Gross cropped area (All crops)	Total area under the HYV crop.	Area under H.Y.V.	Per cent. of HYV area to gross cropped area.	Percentage of HYV area to total area under the HYV crops
		(Paddy, wheat, jowar, Bajra & Maize.)	(Paddy, wheat, Jowar, Bajra & maize)	(% of col. 4 to 2)	(% of col. 4 to 3)
1966-67	18,335.8	9,378.0	57.7	0.32	0.62
1967-68	19,652.8	10,206.0	181.1	0.09	1.77
1968-69	19,912.2	10,529.0	257.1	1.20	2.44
1969-70	20,298.0	10,823.0	421.6	2.07	3.90
1970-71	20,561.0	10,777.0	562.7	2.73	5.22
1971-72	20,888.0	10,950.0	802.0	3.83	7.32
1972-73	20,743.0	10,896.0	1100.5	5.30	10.10
1973-74	21,212.0	10,697.0	1575.2	7.89	15.66
1974-75	20,743.0	10,257.0	1908.0	9.19	18.60
1975-76	21,356.7	10,776.0	2280.0	10.67	21.16

2.2 Coverage Under Different Crops

The expansion of area was not uniform for the selected crops. The variation was such that the area under paddy varieties increased by 3,427.60 per cent,

jowar 41,566.66 per cent, wheat 9,813.58 per cent, maize 240.56 per cent and bajra 8,900.00 per cent. (Table 2.5)

Table 2.5 Index numbers of area under HYVP for different crops, M.P. (1966-67 = 100)

Year	Paddy	Jowar	Wheat	Maize	Bajra
1966-67	100.00	100.00	100.00	100.00	100.00
67-68	279.75	3250.00	562.96	128.57	1366.67
68-69	373.00	4216.67	1013.58	126.09	2600.00
69-70	641.10	5316.67	1843.21	132.30	2966.00
70-71	846.62	9416.66	2481.48	131.06	2700.00
71-72	1226.99	13333.33	3580.25	124.22	4000.00
72-73	1525.76	20333.33	5390.12	191.30	4566.66
73-74	2458.28	30216.66	7803.70	249.07	6733.33
74-75	2760.73	35000.00	8950.62	310.56	7666.66
75-76	3227.60	41666.66	9913.58	310.56	9000.00

Thus it will be observed that the increase was highest in the case of jowar and lowest in the case of maize. The average rate of growth per annum was 4,695.26 per cent for jowar, 1,168.04 per cent for wheat, 914.95 per cent for bajra, 373.80 per cent for paddy and 23.99 per cent for maize (Table 2.6)

Table 2.6 Regression equations for area under HYVP of different crops

Crop	Regression equation
Paddy	$y = - 681.86 + 373.80x$
Jowar	$y = -9518.94 + 4695.26x$
Wheat	$y = -2260.27 + 1168.04x$
Maize	$y = + 48.42 + 23.99x$
Bajra	$y = - 862.24 + 914.95x$
Total H.Y.V.P.	$y = - 792.46 + 435.45x$

It is evident that the rate of growth of coverage of maize varieties has been very slow. The contribution of H.Y.V. area under this crop to H.Y.V. area under all

crops was also meagre. Actually, it decreased from 27.90 per cent in 1966-67 to 2.19 in 1975-76. (Table 2.7)

Table 2.7 Percentage of H.Y.V. area of a crop to total H.Y.V. area

Year	Paddy	Jowar	Wheat	Maize	Bajra	Total
1966-67	56.50	1.04	14.34	27.90	0.52	100.00
67-68	50.36	10.77	25.18	11.43	2.26	100.00
68-69	47.30	9.84	31.93	7.90	3.03	100.00
69-70	49.57	7.85	35.42	5.05	2.11	100.00
70-71	49.05	10.04	35.72	3.75	1.44	100.00
71-72	49.88	9.98	36.16	2.49	1.49	100.00
72-73	45.20	11.09	39.57	2.80	1.24	100.00
73-74	47.84	10.82	37.74	2.39	1.21	100.00
74-75	47.17	11.01	38.00	2.62	1.20	100.00
75-76	50.45	10.96	35.22	2.19	1.18	100.00

Similarly, the proportion of area under high yielding varieties to total area of the crop was low. It increased from 2.93 per cent in 1966-67 to only 7.70 per cent in 1975-76 (Table 2.8)

Table 2.8 Percentage of H.Y.V. area to total area of the crop

Year	Paddy	Jowar	Wheat	Maize	Bajra	Total
1966-67	0.78	0.03	0.38	2.93	0.12	0.62
67-68	2.19	0.78	1.72	3.50	1.44	1.77
68-69	2.82	1.07	2.73	3.44	3.22	2.44
69-70	4.80	1.43	4.46	3.63	3.84	3.90
70-71	6.30	2.59	5.91	3.57	3.65	5.22
71-72	8.84	4.07	7.91	3.35	6.06	7.32
72-73	10.94	5.48	13.32	4.94	6.12	10.10
73-74	17.64	8.90	19.31	6.43	9.22	15.66
74-75	19.89	9.98	25.00	7.61	12.71	18.60
75-76	25.07	12.63	23.89	7.70	13.64	21.16

In the case of bajra, although the rate of growth of area was high the H.Y.V. area itself was not much. It accounted for only 1.18 per cent of the total H.Y.V. area of the State at the end of the reference period. Secondly, the crop occupies an insignificant place in the State's cropping pattern with only 0.93 per cent of the gross cropped area under it.

Thus the important crops in the H.Y.V.

Programme were paddy, jowar and wheat. Paddy varieties occupied between 45 to 50 per cent of the total H.Y.V. area and the coverage has been consistently increasing. From a mere 0.78 per cent in 1966-67 the proportion of H.Y.V. area to total area of the crop increased to 25.07 per cent in 1975-76. Thus at the end of the ten year period $\frac{1}{4}$ of the paddy area was under high yielding varieties.

The contribution of wheat varieties was also significant. They contributed more than 30 per cent of the total H.Y.V. area during most of the years of the reference period. The coverage increased from year to year and formed as high as 26.00 per cent of the area of the crop in 1974-75. In the last year, however, it came down to 23.89 per cent.

Jowar was the third important crop in the programme and the contribution of area under H.Y.V. of the crop was about 10 per cent during the latter half of the reference period. The extent of adoption of H.Y.V. to total area under the crop has been consistently increasing and stood at 12.63 per cent in the last year of the reference period. (Tables 2.7 and 2.8).

2.3 Districts Covered

With the enlargement of the H.Y.V. coverage the number of districts included in the programme increased. Also, the districts changed from year to year with the change in the suitability or otherwise of the

varieties in different areas. As mentioned earlier, **only 5 districts were chosen for paddy** in the first year of the programme. In the last year of the reference period the number increased to 24. Again, the number of districts included in H.Y.V.P. of wheat increased from 6 in 1966-67 to 30. The number of districts growing hybrid jowar stood at 26 in 1975-76 as against 3 in 1966-67. (See appendix table A 2.2)

At the end of the reference year the area under H.Y.V. Programme was 22,80,000 hectares or 10.68 per cent of the gross cropped area of 2,13,56,000 hectares. It formed 21.16 per cent of the area under the five crops. Of the total H.Y.V.P. area paddy varieties accounted for 50.45 per cent and wheat, 35.22 per cent. Jowar constituted 10.96 per cent. Among the different crops the extent of coverage was highest in the case of paddy (25.07 per cent) followed closely by wheat (23.89 per cent). Jowar varieties accounted for 12.63 per cent of the total area under the crop. (Table 2.9)

Table 2.9 Area under H.Y.V.P. in Madhya Pradesh
1975-76 (Area - '000 ha)

Crop	Area under H.Y.V.P.	Percentage to total	Area under the crop	Percentage of H.Y.V. area to area under the crop
Paddy	1150.0	50.45	4588.0	25.07
Jowar	250.0	10.96	1980.0	12.63
Wheat	803.0	35.22	3361.0	23.89
Maize	50.0	2.19	649.0	7.70
Bajra	27.0	1.18	198.0	13.64
Total	2280.0	100.00	10,776.0	21.16

2.4 Share of H.Y.V. Programme in the Growth of Output of Cereals

In 1966-67 the production of cereals and millets in the State stood at 5,223 thousand tonnes. During the succeeding years it varied considerably from year to year. Thus in 1967-68 it increased to 8,535 thousand tonnes but decreased to 7,393 thousand tonnes in 1968-69. In the subsequent three years it increased from year to year so that it was 8,029 thousand tonnes in 1969-70, 8,931 thousand tonnes in 1970-71 and 9,282 thousand tonnes in 1971-72. In 1972-73 it decreased to 8,376 thousand tonnes but again increased and decreased alternately to be 9,461 thousand tonnes in 1975-76.

The production of crops included in the H.Y.V. Programme also followed a similar trend.

The total production of high yielding varieties, however, increased from year to year except in 1974-75. It was 180 thousand tonnes in 1967-68* and rose to 3,500 thousand tonnes in 1975-76. Also, the percentage contribution of the production of high yielding varieties to both cereals and millets; and H.Y.V. crops-increased consistently. In the former case it increased from 2.10 per cent in 1967-68 to 36.99 per cent in 1975-76. In the case of latter it increased from 2.26 per cent in 1967-68 to 39.78 per cent in 1975-76 (Table 2.10)

*Production figures for high yielding varieties were not available for 1966-67.

Table 2.10 Share of H.Y.V. Programme in the output of Cereals & Millets and H.Y.V. crops 1966-67 to 1975-76 (Figures in Thousand tonnes)

Year	Total Production of cereals & millets	Production of H.Y.V. crops	Percentage of H.Y.V. production on total	Percentage of H.Y.V. production on total cereals and millets
1966-67	5,223	4,963	2.10	2.26
1967-68	8,555	7,968	4.26	4.57
1968-69	7,393	6,891	6.65	7.18
1969-70	8,029	7,442	9.50	10.13
1970-71	8,931	8,372	11.15	11.84
1971-72	9,282	8,738	17.91	19.05
1972-73	8,376	7,875	25.31	27.10
1973-74	8,572	8,008	27.72	29.74
1974-75	7,787	7,259	36.99	39.78
1975-76	9,461	8,798		

The production of H.Y.V. crops (paddy, wheat, jowar, bajra and maize) was 7,968 thousand tonnes in 1967-68. In the subsequent 8 years it varied from year to year and was 8,798 thousand tonnes in 1975-76. Thus the net growth during the nine year period was 830 thousand tonnes. This was the result of the growth of 3,320 thousand tonnes in the case of high yielding varieties and a decrease in production to the tune of 2,490 thousand tonnes in the case of local varieties. In terms of percentages the net increase in the production was shared by high yielding varieties to the extent of 400.00 per cent, but this surplus was offset due to the deficit in the production of local varieties to the extent of 300.00 per cent. The growth of production from year to year has been given in table 2.11. It was observed that in 5 out of 8 years the growth was positive and in the remaining three years, negative.

In the years 1969-70, 70-71, 71-72 and 1975-76 the share of high yielding varieties to the growth was 39.74, 33.76, 51.09 and 87.13 per cent respectively. In these years the production of local varieties also recorded a positive growth. In the year 1973-74 the overall growth was positive but it was the result of the positive growth in the case of high yielding varieties and the negative growth in the case of local varieties. In terms of percentage the share of high yielding varieties was 503.76 per cent to total growth.

In the years 1968-69, 1972-73 and 1974-75 there was a negative growth. In 1968-69 and 1972-73 although the growth of high yielding varieties was positive the overall growth was negative due to high degree of negative growth in the case of local varieties. The year 1974-75 witnessed the negative growth of production with respect to both the high yielding and local varieties. (Table 2.11)

In the years 1968-69, 1972-73 and 1974-75 there was a negative growth. In 1968-69 and 1972-73 although the growth of high yielding varieties was positive the overall growth was negative due to high degree of negative growth in the case of local varieties. The year 1974-75 witnessed the negative growth of production with respect to both the high yielding and local varieties. (Table 2.11)

Table 2.11 Growth of output of H.Y.V.P. crops and share of H.Y.V. Varieties

: 18 :

Year	Production Increase(+) or H.Y.V.P. or decrease(-)	Percentage Production Increase(+) or H.Y.V. or decrease(-) Varieties	Local Increase(+) or decrease(-) Varieties	Percentage share of total Increase or decrease(-) H.Y.V. Local
1967-68	7,568	-	180	
1968-69	6,891	(-) 1,077	315	
1969-70	7,442	(-) 8.00	534	112.53
1970-71	8,372	(+) 530	848	60.26
1971-72	8,738	(+) 366	1,035	66.24
1972-73	7,875	(-) 863	1,500	48.91
1973-74	8,008	(+) 133	2,170	153.88
1974-75	7,259	(-) 749	2,150	403.76
1975-76	8,758	(+) 1,535	3,500	98.53
Total for the period	-	(+) 830	10.41	(-) 300.00
1967-68	-	-	-	400.00
1968-69	-	-	(+) 3,320	2,490
1969-70	-	-	-	-
1970-71	(-) 1,212	(-) 1,212	6,576	12.53
1971-72	(+) 332	(+) 332	6,908	35.74
1972-73	(+) 616	(+) 616	7,524	33.76
1973-74	(+) 179	(+) 179	7,703	51.09
1974-75	(-) 1,328	(-) 1,328	6,375	53.88
1975-76	(-) 537	(-) 537	5,838	503.76
Total for the period	(+) 198	(+) 198	5,258	87.13
1967-68	-	-	-	12.87
1968-69	-	-	-	12.87
1969-70	-	-	-	12.87
1970-71	-	-	-	12.87
1971-72	-	-	-	12.87
1972-73	-	-	-	12.87
1973-74	-	-	-	12.87
1974-75	-	-	-	12.87
1975-76	-	-	-	12.87
Total for the period	-	-	-	12.87

CHAPTER III

HIGH YIELDING VARIETIES PROGRAMME OF WHEAT

Wheat is an important crop of Madhya Pradesh.

It occupied 33,61,000 hectares out of the gross cropped area of 2,13,56,000 hectares in 1975-76. Thus it accounted for 15.74 per cent of the gross cropped area. The production of this crop was 27,50,000 tonnes or 22.91 per cent of the total food grain production of the state in 1975-76. The yield per hectare in that year was 854 kilogrammes.

3.1 Coverage

The crop occupied very important place in the H.Y.V. Programme of the state. The coverage in the initial year of the programme was only 8,100 hectares. It increased every year and reached the record level of 8,03,000 hectares in the last year (1975-76) of the reference period. Thus the coverage in the last year was about 100 times that of the first year or 9,813.58 per cent higher than the first year. The percentage of the area under high yielding varieties to total wheat area increased from 0.38 in 1966-67 to 26.00 in 1974-75. However, it lowered to 23.89 per cent in 1975-76 (Table 3.1)

Table 3.1 Area under high yielding varieties of wheat,
M.P.
(Area-thousand hectares)

Year	Area under wheat crop	Area under H.Y.V. of wheat	Percentage of area under high yielding varieties to wheat area
1966-67	2,126	8.1	0.38
1967-68	2,658	45.6	1.72
1968-69	3,011	82.1	2.73
1969-70	3,348	149.3	4.46
1970-71	3,403	201.0	5.91
1971-72	3,665	290.0	7.91
1972-73	3,277	436.6	13.32
1973-74	3,273	632.1	19.31
1974-75	2,788	725.0	26.00
1975-76	3,361	803.0	23.89

The distribution of the H.Y.V. area in the last year among different districts was such that 2 districts viz. Bhind and Morena shared more than 50,000 hectares each and 5 districts viz. Mandasaur, Gwalior, Tikamgarh, Indore and Chhatarpur shared between 25,000 to 50,000 hectares each. Another 14 districts contributed between 15,000 to 25,000 hectares and 9 districts, between 10,000 to 15,000 hectares. (Table A 2.2)

The percentage of area under high yielding varieties to total wheat area varied from district to district. Three districts viz. Bhind, Mandasaur and Sidhi had more than 80 per cent of the wheat area under high yielding varieties. Tikamgarh, had 70.43 per cent of the wheat area under high yielding varieties and another 4 districts viz. Gwalior, Raipur, Morena and Bilaspur had more than 50 per cent of such area (Table 3.2).

3.2 Trends in Area, Production and Yields of Wheat

Trends in area, production and yields of wheat were calculated with the first year of the H.Y.V.P. (1966-67) as a base year.

3.2.1 Area Under Wheat

The total area under wheat crop during 1966-67 was 21,26,000 hectares. It increased from year to year till 1971-72 when it was 36,65,000 hectares. After 1971-72 the area decreased during the succeeding three years. It was 32,77,000 hectares in 1972-73, 32,73,000 hectares in 1973-74 and 27,88,000 hectares in 1974-75.

Table 3.2 Percentage of H.Y.V. area to total wheat area in different districts, 1975-76

Name of the district	Percentage of H.Y.V. area to total wheat area
Bhind	89.14
Mandsaur	85.69
Sidhi	80.43
Tikamgarh	70.43
Gwalior	57.33
Raipur	56.20
Morena	56.10
Bilaspur	51.71
Balaghat	44.80
Khandwa	42.19
Indore	40.63
Ratlam	39.78
Narsimhapur	37.72
Shajapur	34.81
Chattarpur	33.08
Betul	32.55
Bastar	32.43
Ujjain, Chindwara, Rajgarh, Datia	20 to 30
Dhar, Shivpuri, Dewas, Durg.	
Rewa, Shahdol, Rajnandgaon, Mandla	
Panna, Hoshangabad, Jabalpur, Bhopal.	10 to 20
Saoni, Raisen, Sehore, Damoh,	
Sagar, Guna, Khar gone, Satna,	Below 10
Vidisha, Raigarh, Surguja, Jhabua.	

In 1975-76, however, it increased significantly and was 33,61,000 hectares. In terms of index numbers (1966-67 = 100) the area was 72.39 per cent higher in 1971-72. At the end of the reference period the area was 58.09 per cent higher. (Table 3.3)

Table 3.3 Area under wheat in Madhya Pradesh

Year	Area under wheat (thou- sand hectares)	Fixed Base Index		Chain Base Index	
		Index No.	Increase (+) Decrease (-)	Index No.	Increase (+) Decrease (-)
1966-67	2,126	100.00	-	100.00	-
67-68	2,658	125.02	25.02	125.02	25.02
68-69	3,011	141.63	15.61	113.28	13.28
69-70	3,348	157.48	15.85	111.19	11.19
70-71	3,403	160.07	2.59	101.64	1.64
71-72	3,665	172.39	12.32	107.70	7.70
72-73	3,277	154.14	- 18.25	89.41	- 10.59
73-74	3,273	153.95	- 0.19	99.88	- 0.12
74-75	2,788	131.14	- 22.81	85.18	- 14.82
75-76	3,361	158.09	26.95	120.55	20.55

The study of trend of area under wheat was made by fitting a curve to the index numbers. The equation ~~was~~ $y = a + bx$ where y stood for the expected value of area index corresponding to the given year. The regression equation fitted to the data is given below :

$$y = 124.38 + 3.82 x.$$

Thus the average rate of increase was 3.82. The line showing the expected values of y is drawn in Fig. 3.1

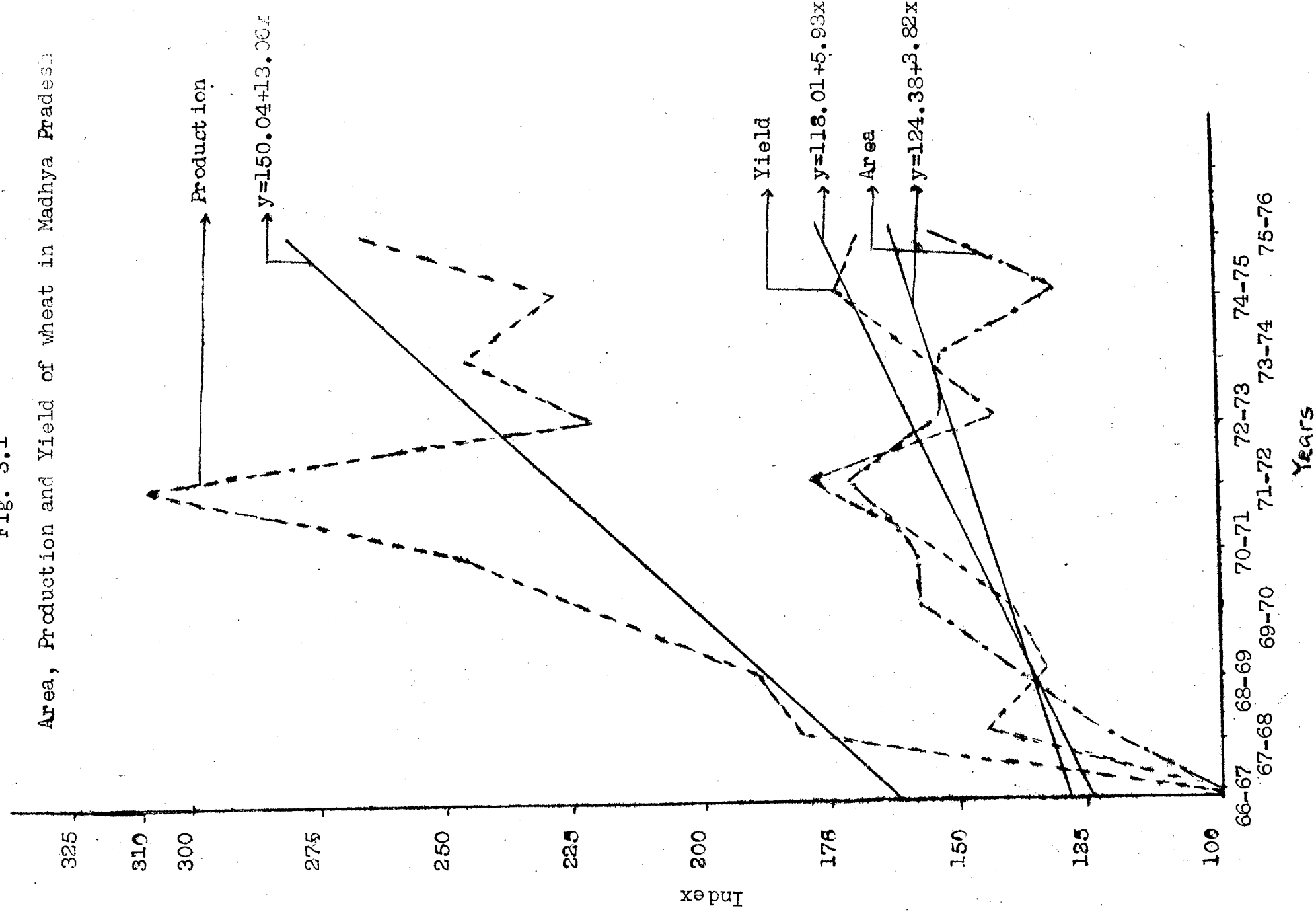
The rates of growth from year to year are also studied. These are obtained by chain base index numbers (Table 3.3). It was noticed that the rate was 25.02 in 1967-68. The rate of growth decreased in the subsequent three years and was 1.64 in 1970-71. In the year 1971-72 it rose to 7.70. However, in the three succeeding years the rate of growth was in the negative. The lowest rate of growth was in the year 1974-75 (-14.82). In the last year of the reference period the growth rate again raised and was 20.55. Thus it may be concluded that the growth rates declined during the years 1968-69 to 1970-71 and again during 1972-73 to 1974-75, the rates being negative in the latter period.

3.2.2 Production of wheat

The production of wheat during 1966-67 was 10,31,000 tonnes. It increased from year to year and was 31,89,000 tonnes in 1971-72. In the year 1972-73 it dropped to only 22,85,000 tonnes. In 1973-74 it again

Fig. 3.1

Area, Production and Yield of wheat in Madhya Pradesh



increased to 25,39,000 tonnes but again plunged to the level of 23,51,000 tonnes in 1974-75. In the last year of the reference period the production again registered an increase and was 27,50,000 tonnes. Thus it is observed that the production increased from year to year upto 1971-72. It crashed in 1972-73 and although it increased marginally during the remaining years it never touched the level which was attained in 1971-72. (Table 3.4)

The regression equation obtained was

$$y = 150.04 + 13.06x. \text{ (see Fig 3.1)}$$

Table 3.4 Production of wheat in Madhya Pradesh

Year	Production (Thousand tonnes)	Fixed Base Index 1966-67 = 100		Chain Base Index	
		Index Number	Increase(+) decrease(-)	Index Number	Increase(+) decrease(-)
1966-67	1,031	100.00	-	100.00	-
1967-68	1,881	182.44	82.44	182.44	82.44
1968-69	1,964	190.49	8.05	104.41	4.41
1969-70	2,293	222.41	31.92	116.75	16.75
1970-71	2,592	251.41	29.00	113.04	13.04
1971-72	3,189	309.31	57.90	123.03	23.03
1972-73	2,285	221.63	- 87.68	71.65	-28.35
1973-74	2,539	246.27	- 24.64	111.12	11.12
1974-75	2,351	228.03	- 18.24	92.60	- 7.40
1975-76	2,750	266.73	38.70	116.97	16.97

As regards rates of growth it was noted that the rate was highest in 1967-68. It dropped suddenly in 1968-69 and maintained a lower level till 1970-71. In 1971-72 the rate attained a considerably high level 23.03 but again lowered in 1972-73, (-28.35) this time the rate being in the negative. In 1973-74 the rate gained by some points but again registered a negative growth in 1974-75. It was 16.97 in 1975-76, the last year of the reference period. Evidently, the rate of growth decelerated to the maximum in 1972-73 and 1974-75.

3.2.3 Yield Per Hectare of Wheat

Yield per hectare of wheat was 505 kilogrammes in 1966-67. In the second year of the programme it rose to 737 kilogrammes. In the year 1968-69 it dropped to 680 kilogrammes but increased to 714 kg in 1969-70.

In 1970-71 the yield not only increased but was highest among all the preceding years. The year 1971-72 was the best year during the entire period as the yield was highest (907 kg) in that year. Thereafter the yields came down and fluctuated. The yield was 854 kg. in the last year of the reference period. (Table 3.5)

Table 3.5 Yield per hectare of wheat in Madhya Pradesh

Year	Yield (Kg. per hectare)	Fixed Base Index		Chain Base Index	
		Index number	Increase(+) decrease(-)	Index number	Increase(+) decrease(-)
1966-67	505	100.00	-	100.00	-
1967-68	737	145.94	45.94	145.94	45.94
1968-69	680	134.65	- 11.29	92.27	- 7.73
1969-70	714	141.39	6.74	105.00	5.00
1970-71	794	157.23	15.84	111.20	11.20
1971-72	907	179.60	22.37	114.23	14.23
1972-73	727	143.96	- 35.64	80.15	- 19.85
1973-74	809	160.20	16.24	111.28	11.28
1974-75	880	174.26	14.06	108.78	8.78
1975-76	854	169.11	- 5.15	97.05	- 2.95

The regression equation obtained for the data on index numbers of yield was $y = 118.01 + 5.93x$. The curve was fitted to the data. (Fig. 3.1)

The rate of growth was highest in 1967-68 and lowest in 1972-73. After the initial high rate of growth in 1967-68, the rate dropped and was negative in 1968-69. The rate recovered slowly and was 14.23 in 1971-72. Again, in 1972-73 it touched a record low level of (-) 19.85. Although the growth rate increased in 1973-74 the deacceleration was noticed in the remaining two years.

3.3 Deacceleration of growth Rates

The growth rates of area, production and yields were highest in 1967-68. The rates slumped in the year 1968-69.

In the case of area, the deacceleration of growth rates continued till 1970-71. In the year 1971-72 there was a marked increase in the rate.

In the case of production the increased and decreased rates alternated after 1968-69 and the rate was highest in 1971-72.

As regards yields the accelerated rates of growth continued till 1971-72 and the rate was highest in that year.

Thus the year 1971-72 symbolises peaks in the curves for area, production and yield. In the following year (1972-73) the rates of growth were lowest, (that too in the negative) among all the reference years for production and yield. In the case of area the lowest rate was recorded in 1974-75. The year 1973-74 was better as compared to the preceding year as the rates of growth were higher.

In 1974-75 and 1975-76 the rates of yields again deaccelerated. In the case of area and production the rates decreased in 1974-75 but again increased in 1975-76.

Thus it may be concluded that deacceleration of growth rates was more pronounced after 1971-72.

In the following paragraphs the factors that might have been responsible for this are examined.

3.4 Factors Responsible for Deacceleration

Two factors viz. rainfall and irrigation were visualised to be affecting the deacceleration of the growth rates of area. The factors supposed to be responsible for the deacceleration of the rates of yields were rainfall, irrigation, fertilizer etc.

In the following paragraphs the impact of these factors, if any, has been tested.

3.4.1 Rainfall

Although wheat is a rabi crop its germination and growth depend on the moisture in the soil which in turn depends on the rainfall received during the kharif and also in the rabi season. In the absence of a good rainfall the area under wheat gets reduced and the production decreases. A large proportion of wheat area in Madhya Pradesh is under haveli cultivation. In this type of cultivation, rain water is stored by constructing small bunds across the slopes during kharif season. Land is left fallow in kharif and wheat is sown in rabi. Thus the germination and growth of wheat in these areas totally depend on the quantum of rainfall received in kharif. Only in regions having high proportion of wheat area irrigated by assured sources the area under wheat, the production and productivity remain unaffected despite insufficient rains. Unfortunately, irrigated area forms only 23.50 per cent of the total wheat area in the state. Naturally the insufficient rains in a particular year affect wheat cultivation adversely.

In 1972-73 the total rainfall was far lower than the preceding three years. This seems to have resulted in lowering of the wheat area in that year. Similarly, rainfall was quite deficient in 1974-75 and this has probably resulted in shrinking of the area under wheat. (Table 3.6)

Table 3.6 Rainfall, area and production of wheat, Madhya Pradesh

Year	Rainfall (mm.)	Wheat area ('000 hectares)	Wheat production ('000 tonnes)
1966-67	798	2126	1031
1967-68	1181	2658	1881
1968-69	897	3011	1964
1969-70	1210	3348	2293
1970-71	1164	3403	2592
1971-72	1282	3665	3189
1972-73	934	3277	2285
1973-74	1312	3273	2539
1974-75	891	2788	2351
1975-76	1200	3361	2750

The coefficient of correlation between rainfall and wheat area was 0.69 and was significant at 5% level of significance. The coefficient of correlation between rainfall and wheat production was 0.70 and was also significant at 5% level. There also exists a high correlation between the area and production of wheat. The coefficient of correlation was 0.91.

3.4.2 Irrigation

It was thought if irrigation could be another factor responsible for lowering of wheat area. But it was noticed that the irrigated wheat area formed only 23.50 per cent of the total wheat area. Moreover, the data indicate that although the irrigated area of wheat increased from 6,52,000 in 1971-72 to 6,87,000 in 1972-73, the total wheat area decreased from 36,65,000 hectares

to 32,77,000. In the subsequent years also no significant relationship was noticed between the irrigated wheat area and the total wheat area. (Table 3.7)

Table 3.7 Irrigated area under wheat, M.P.
(Area-thousand hectares)

Year	Area under wheat	Irrigated area	Percentage of irrigated area to total wheat area
1966-67	2126	221	10.39
1967-68	2658	282	10.60
1968-69	3011	340	11.30
1969-70	3348	420	12.55
1970-71	3403	521	15.30
1971-72	3665	652	17.80
1972-73	3277	687	20.96
1973-74	3273	675	20.62
1974-75	2788	613	21.99
1975-76	3361	790	23.50

Thus variation in the irrigated area under wheat does not seem to be responsible for the variation/deacceleration of the wheat area and production.

3.4.3 Fertilizer

Fertilizer is a very important input in the production of wheat crop especially since the cultivation of high yielding varieties. It was hypothesised that inadequate use of this input might be responsible for the deacceleration of the growth rates of area and yield.

The hypothesis proved to be wrong. The average consumption of fertilizers in M.P. is too low to cause deacceleration of area and/yield. Out of the six wheat growing states of Punjab, Haryana, Uttar Pradesh, Rajasthan, Bihar and M.P. this state has per hectare consumption of fertilizers higher than Rajasthan only.

The position remained unchanged during all the years from 1971-72 to 1975-76 (Table 3.8)

Table 3.8 Consumption of fertilizers per unit of cropped area in wheat growing states (unit Kg/ha)

States	1971-72	1972-73	1973-74	1974-75	1975-76
Punjab	52.69	58.72	58.2	42.9	49.9
Haryana	16.62	19.00	22.8	14.5	18.6
Utter Pradesh	21.19	22.67	20.3	17.8	22.1
Rajasthan	4.97	4.06	4.4	3.5	4.8
Bihar	9.79	10.74	9.1	11.3	12.0
M.P.	5.79	6.56	6.7	4.8	5.5
All India	16.03	16.46	17.4	15.9	17.1

In the first year of the programme, the fertilizer consumption was only 1.11 Kg. per hectare. It increased from year to year upto 1973-74 when it was 6.82 Kg. per hectare. In 1974-75 and 1975-76 it was 4.83 and 5.30 Kg. respectively. (Table 3.9)

Table 3.9 Consumption of Fertilizers per hectare, M.P.
(Figures-Kilogrammes)

Year	N	P	K	Total
1966-67	0.77	0.30	0.04	1.11
1967-68	0.73	0.32	0.07	1.12
1968-69	1.05	0.45	0.09	1.59
1969-70	1.62	0.70	0.14	2.46
1970-71	2.50	1.24	0.22	3.96
1971-72	3.85	1.71	0.31	5.87
1972-73	4.41	1.83	0.35	6.59
1973-74	4.24	2.14	0.44	6.82
1974-75	3.04	1.44	0.35	4.83
1975-76	3.61	1.40	0.29	5.30

Data on fertilizer consumption was not available for wheat crop separately but for all the rabi crops taken together. Even assuming that the entire quantity

in the rabi season was applied to wheat crop alone, the rates of application came to more 17,21 and 23 kilogrammes per hectare during the years 1971-72, 1972-73 and 1973-74 respectively. In the last two years it further reduced to 21 to 20 kilogrammes per hectare. (Table 3.10)

Table 3.10 Consumption of Fertilizers in rabi season, M.P.

Particulars	1971-72	1972-73	1973-74	1974-75	1975-76
Quantity Consumed(Tonnes)	62,948	70,100	76,372	57,600	66,858
Area under Wheat(Hectares)	36,65,000	32,77,000	32,73,000	27,88,000	33,61,000
Quantity per Hectare(Kg.)	17	21	23	21	20

Obviously, a variation at this low level of consumption can not have any impact on the variation in acreage, production and yield of wheat. The recommended doses of fertilizer for different varieties are given in table 3.11.

Table 3.11 Recommended doses of fertilizers for wheat in M.P.
(Figures-Kg./per hectares)

Variety	N	P	K
H.Y.Varieties (Dwarf with Irrigation)	80	60	25
H.Y.Varieties (Tall with Irrigation)	50	30	15
Unirrigated	30	30	10

Moreover, the area under wheat did not vary according to fertilizer consumption. While the fertilizer consumption has increased from year to year from 1971-72 to 1973-74, the area decreased from 36,65,000 in 1971-72 to 32,77,000 and 32,73,000 hectares in the subsequent two years. Similarly, although the

fertilizer consumption decreased in the last year, the area under wheat increased. Thus fertilizer as an input, has not effected a change in the wheat area. This was also true with respect to production and yield.

3.4.4 Graded levy on Wheat

Another factor that might have been responsible is the graded levy on wheat cultivation enforced by M.P. Govt. for procurement. For fear of parting with the 'excessive stock' of wheat towards levy, as the farmers put it, the acreage of wheat was deflated while reporting. This, however, can not be substantiated by data.

3.4.5 Organic Manure

Since the last few years the farmers have been complaining about the shortage of organic manure. They have pleaded that since the land reserved for cattle grazing has been distributed to landless labourers, very little land is available for grazing. The number of cattle maintained by individual farmer is therefore decreasing affecting the quantity of manure produced and applied. However, secondary data on this aspect are not available to substantiate the reasoning.

3.4.6 Availability of Seed

Improved seed is an essential input in the H.V.V. Programme and in the first few years of the programme the seed supplied by the Agriculture Department formed the bulk of the seed used. But in the latter years the dependence of the farmers on the 'new' seed supplied by the Department lowered considerably. Farmers are not keen on changing the seed every three years or so nor do they depend on govt. agencies for this input.

Thus short supply of improved seed does not emerge as a factor for **deaccelerated** growth rates even for the limited (23.89 per cent) area under H.Y.V. of wheat.

Therefore, rainfall seems to be the dominant factor responsible for the deacceleration of growth rates of wheat.

Other factors mentioned above undoubtedly contribute to the production and yields. But the levels of their application during the past decade were too low to affect the production or yields in any given year.

CHAPTER IV

GROWTH IN YIELD AND INPUTS

One of the objectives of the study was to know the possible inputs to which the growth in yield of wheat over the last ten years could be attributed. It was also intended to estimate the extent of their linear effect.

The inputs that go into the production of a crop are seed, manure, fertilizers, pesticides, irrigation, labour etc., besides rainfall. However, data were not available for manures, pesticides and labour. Hence these factors were left out. As regards seed, the quantities of seed supplied to the farmers were not available. Therefore, the area covered under high yielding varieties was taken as one of the factors. The figures of fertilizer consumption per hectare were derived as narrated on page 31. As regards irrigation, the irrigated wheat area given in table 3.7 was assumed as another factor. Thus the inputs/factors considered for the exercise were i) rainfall ii) fertilizers iii) irrigation and iv) area under H.Y.V. The growth rates of each of these inputs were taken to be the independent variables while growth rate of yield of wheat (see table 3.5) was taken as the dependent variable. The multiple regression was followed.

The mean and standard deviations for the four factors and yield were as below :

<u>Particulars</u>	<u>Mean</u>	<u>Standard deviation.</u>	<u>Coefficient of variation</u>
Rainfall	9.01	31.81	353.95
Fertilizers	19.58	27.74	141.38
Irrigated area	16.02	14.09	87.95
Area under HYV	91.62	141.40	154.33
Yield	7.32	18.19	248.50

Similarly the simple correlation coefficients between different inputs and yield were as follows :

Rainfall	= 0.58
Fertilizers	= -0.42
Irrigated area	= 0.25
Area under HYV	= 0.76

Though it was clear that fertilizers and irrigation had poor correlation, the multiple regression was worked out which came to be;

$$y = 0.258 + 0.204x_1 + 0.024x_2 - 0.192x_3 + 0.085x_4$$

Where y stands for yield, x_1 for rainfall, x_2 for fertilizers, x_3 for irrigation and x_4 for area under HYV.

The multiple correlation coefficient was 0.565 which indicated that the variables were able to explain 32 percent of the variation in the growth rate of yield.

Omitting the two variables viz. fertilizers and irrigation, which had poor correlation with yield the regression equation came out to be,

$$y = -1.572 + 0.169 x_1 + 0.020 x_4$$

The multiple correlation coefficient with these two variables came to be 0.727. This brings an improvement in explaining the variation in y to 53 per cent.

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CHAPTER - V

ADAPTIVE RESEARCH IN MADHYA PRADESH

Before 1964, the adaptive research in the field of agriculture was undertaken by the Department of Agriculture of the State. With the formation of the Jawaharlal Nehru Krishi Vishwa Vidyalaya in 1964 the research activities were transferred to the Vishwa Vidyalaya. Thus, during the reference period (1966-67 to 1975-76) the research activities were entirely under the jurisdiction of the J.N.K. Vishwa Vidyalaya.

The State Department of Agriculture was left with only seed multiplication farms. The present chapter is devoted to the description of the research activities in the J.N.K.V.V. in regard to wheat.

5.1 Research Farms/Colleges and of the J.N.K.V.V.

The research work in the J.N.K.V.V. is carried out at 9 colleges and 17 research stations/sub stations (Table 5.1).

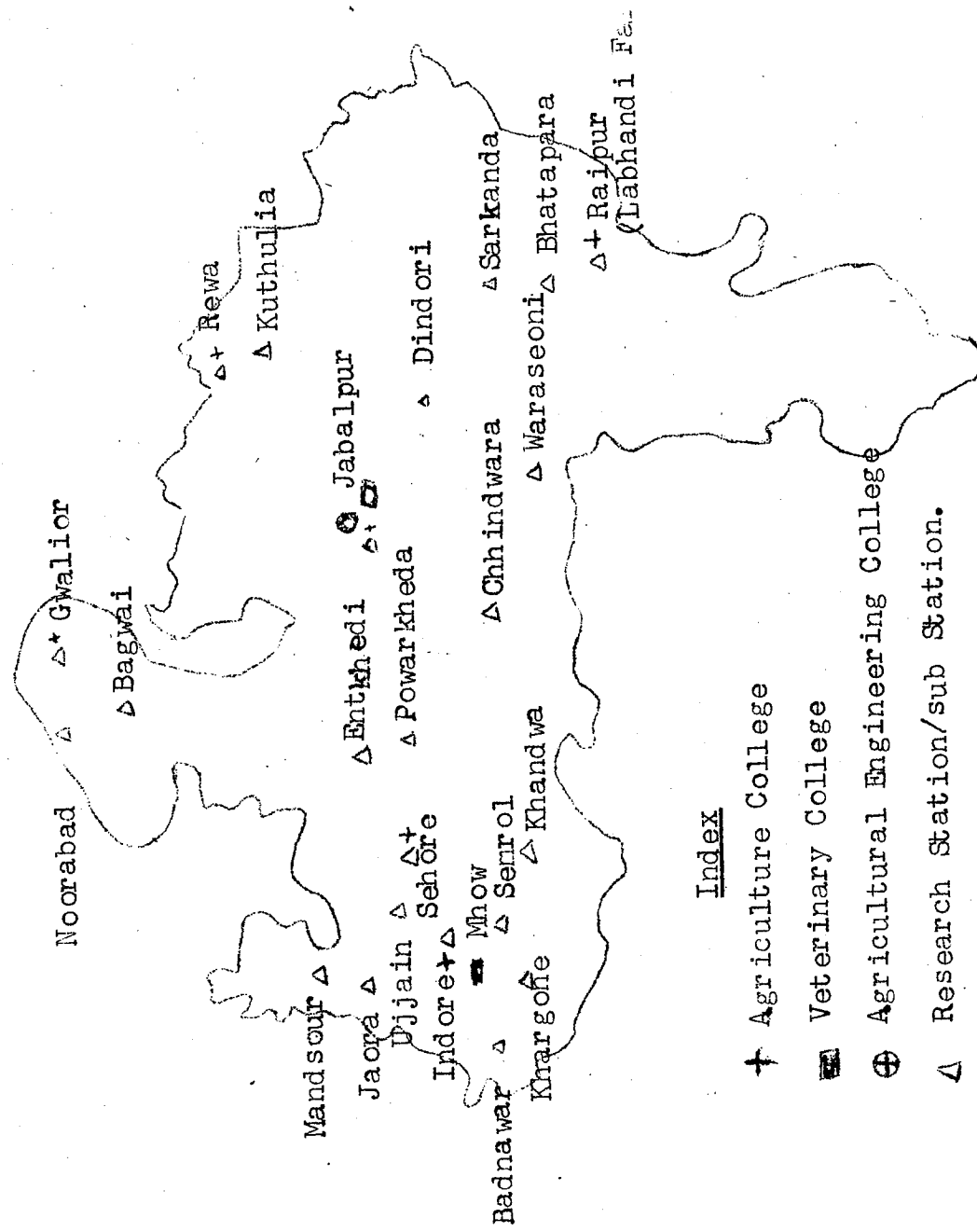
Table 5.1 Location of Colleges and research stations

S.No.	College Campuses	Research Station/Sub station
1.	Agriculture College, Jabalpur	Noorabad Gwalior distt.
2.	Agriculture College, Gwalior	Bagwai Gwalior distt.
3.	Agriculture College, Rewa	Kuthulia Rewa district
4.	Agriculture College, Sehore	Mandsour Mandsour district
5.	Agriculture College, Indore	Jaora Ratlam distt.
6.	Agriculture College, Raipur	Ujjain Ujjain district
7.	Veterinary College, Jabalpur	Badnawar Dhar district
8.	Veterinary College, Mhow	Semrol Indore distt.
9.	Agricultural Eng. Col. Jabalpur	Khargone Khargone district
10.	-	Khandwa Khandwa district
11.	-	Entkhedi Bhopal distt.
12.	-	Powarkheda Hoshangabad "
13.	-	Chhindwara Chhindwara distt.
14.	-	Dindori Mandla distt.
15.	-	Sarkanda Bilaspur distt.
16.	-	Bhatapara Raipur distt.
17.	-	Labhandi Raipur distt.

COLLEGES AND RESEARCH STATIONS

UNDER

JAWAHARLAL NEHRU KRISHI VISHWA VIDYALAYA



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✚ Agriculture College

■ Veterinary College

⊕ Agricultural Engineering College

△ Research Station/sub Station.

Madhya Pradesh being the largest state in the country it is imperative to conduct research on important crops for solving the regional problems. In view of the distinct agro-climatic regions, the research work on different crops is localised at particular centre and/sub centre (Table 5.2)

Table 5.2 Distribution of Centres and sub centres according to crops

Name of the Crop.	Main Centre	Sub-centre
1.	2.	3.
Paddy	Raipur	Jabalpur, Wareseoni, Rewa & Bagwai
Maize	Chhindwara	-
Wheat	Powarkheda	Jabalpur, Indore & Sagar
Jowar	Indore	Mandsour & Gwalior
Cotton	Indore	Badnawar, Khandwa, Ujjain & Morena
Millets	Gwalior	Dindori, Mandisour & Jabalpur
Groundnut	Khargone	-
Linseed	Raipur	-
Pulses	Jabalpur	Sehore
Sesamum	Jabalpur	-
Soybean	Jabalpur	-
Fodder crops	Jabalpur	Gwalior & Mhow
Sugarcane	Sehore	Jaura & Bagwai
Citrus	Khandwa	Noorabad
Mango, Guava	Rewa	Entkhedi, Bilaspur and Noorabad
Banana, Pine	Bilaspur	-
Betelvine	Chhatarpur	Jabalpur

Testing trials are done on several Vishwa Vidyalaya and State Government Farms. Very close coordination is maintained between the research activities of the J.N.K.V.V. and the Directorate of Agriculture for effective utilization of the research results.

5.2 Strategy of Agricultural Research

Agricultural research undertaken by the Vishwa Vidyalaya is mainly problem-oriented to make it more fruit-

ful and is integrated with teaching and extension programmes. In many of the Coordinated Research Projects, multi-disciplinary approach is the keynote. In view of the limited irrigation facilities in the state, the Vishwa Vidyalyaya research programme lays emphasis on research for rainfed areas.

In recent years, work on mission oriented fundamental research has also been carried out such as the use of solar energy, evolving varieties in cotton which would facilitate hybrid seed production, study of interaction of rhizobium strains with gram germplasm with a view to evolve varieties with high N fixing ability and also as an aid to develop rhizobium multiple strains culture suitable for large number of varieties.

In the case of fertilizer application the optimum N: P_2O_5 ratios at different levels of fertilizer use (low to medium) are being tested on paddy, wheat and sorghum. It has been clearly brought out that even if a farmer is unable to invest much on fertilizers, the proper balance between N: P_2O_5 would give high response per kilogram of nutrient. Such an approach is being tested in long term experiments because of residual effect of phosphatic fertilizers.

In several parts of the state, wheat and gram are sown in October. If monsoon recedes early, it becomes difficult to have sufficient soil moisture for rabi crops. Rainfed rabi crop is taken in moisture deficit conditions resulting in low productivity. If wheat and gram could be sown in September or when monsoon is about to recede, the rabi crop would suffer less from moisture stress. Thermo-insensitive varieties or thermal tolerance

of rabi varieties would greatly help in increasing productivity. Some promising varieties of wheat have been identified but the work is in progress to introduce disease resistance in such varieties.

Evolving a significantly high yielding variety takes several years and time lag is also inevitable in saturating the area with the improved variety. Further, due to economic factors, high inputs are not used. In certain areas where high yielding varieties have been introduced, there is a danger of losing valuable gene material. Indigenous germ plasm wherever possible is being collected in crops like bajra, small millets, niger, etc. But intense effort is necessary.

The work on triticales (man made cereal) is carried out in JNKVV. Success in improving grain quality has been achieved. Work for finding out suitable varieties is in progress.

Continual analysis of agricultural conditions, farming practices and problems is necessary to diagnose the more critical reasons for low productivity. Diagnostic work includes factors such as soil, weather, crop and resources. This along with natural resources inventory is considered very challenging and promising line of work and requires a multi-disciplinary approach of economists, agronomists, soil scientists, statisticians etc. This work is proposed initially in tribal districts and in districts where small change in development strategy would yield greater returns.

Once the diagnostic causes for low productivity are identified and improved technology is evolved on experimental stations. Operational research should help for refinement and large scale adaption of technology. Dry farming technology developed at Indore is being put in operation under Indo-UK Dry Farming Operational Research Project at Indore where stress is being laid on developing drainage conditions which are necessary during monsoon season and research for appropriate crop varieties. Lack of drainage in heavy clay soils has affected kharif productivity.

The research strategy has to take into consideration the existing farming systems and consider what changes can be brought about which would not only increase productivity but also be economically feasible. The improvement in productivity of utera crops in Chhattisgarh where *lathyrus*, linseed and other crops are taken in relay cropping with paddy, has great relevance. Similar is the case of wheat followed after transplanted paddy. Thus the work on farming systems instead of individual crops and fertilizer recommendations for cropping system rather than individual crop has to receive greater attention.

The productivity of pulse crops and several oilseed and crops like sesamum, niger/groundnut is low and considerable thinking is necessary to tackle this problem.

High yielding varieties except in wheat and maize have not spread to a large proportion of the cultivated area. Probe into this problem has revealed that farmers desire more stable variety with less fluctuations in yield rather than high yielding variety which gives vary-

ing performance from year to year due to variation in weather, insect diseases attack etc. Further, varieties which fit in the existing farming system like mixed cropping have better chances of acceptance. Thus, the Vishwa Vidyalaya has given importance to evolving stable varieties suited to agro-climatic situations (location specific varieties) and finding agronomic practices which cause less fluctuation. Regional Research Programme in a vast state like Madhya Pradesh has great relevance. In this regard, Kharif crop production technology in heavy clay soils is of paramount importance for Madhya Pradesh. Further, local popular varieties are chosen and new varieties based on the agronomic base of popular varieties are being developed. New varieties are, Narmada 112 (based on Hy-65) of wheat, JRI-15 series (based on Laloo-14), and Madhuri in paddy (based on Dubraj), Sorghum varieties based on Vidisha-60. etc.

5.3 Research work on wheat during 1975-76

The work done on the various Research Stations and sub-stations is published in the Annual Progress Reports.

In the following paragraphs the progress of work done for wheat crop in the last year of the reference period (1975-76) is noted.

Wheat research in this University is carried out under following two schemes :

1. Wheat Improvement Scheme,
2. All India Coordinated Wheat Improvement Project.

Powarkheda is the main Centre for both the schemes. The sub-station of the Wheat Improvement Station is at Jabalpur and the sub-stations of the All India Coordinated Wheat Improvement Project are located at Sagar and Indore. At Sagar the investigations are aimed at finding out frost occurrence and agronomic practices under rainfed conditions. At Indore Station the work is carried out on triticale.

The summary of work done at different station and sub-stations during 1975-76 is given below.

5.3.1 Wheat Improvement Scheme

A) Main Station-Powarkheda

- i) About 300 strains were sown in crossing block, 108 crosses were attempted during the season.
- ii) At Powarkheda, 5471 single plants and 435 bulks were selected out of 595 resistant crosses, while at Mahabaleshwar 1194 single plants and 31 bulks were selected out of 134 resistant crosses.
- iii) Six strains of T.durum and Four strains of T.aestivum were either superior or at par with control in preliminary trials under rainfed conditions.
- iv) Eight strains of T.durum and 18 strains of T.aestivum were superior to control in preliminary trials under irrigated conditions.
- v) Approximately 65.8 quintals of nucleus seed of Raj 911, Jayaraj, MP 195, HI 385, Narmada 4 and HD 1467 were produced for distribution.

- vi) Black and brown rusts appeared late in the season and no apparent damage to the crop was observed.
- vii) One hundred five strains were found to be resistant to black and brown rust out of the 296 strains of preliminary trials. One hundred fifty six strains from National Genetic Stock Nursery and forty six strains from plant pathological screening nursery were resistant to black and brown rusts. Data on diseases was recorded in all coordinated trials. Out of seventy two, eight strains were susceptible to yellow rust, as screened at Gwalior. MP 145, MP 224, MP 225, MP 231, MP 232, MP 233, MP 185 and MP 189 were observed as resistant varieties for loose smut at Jabalpur.
- viii) The losses in yield due to rusts in Kalyansona and Moti were recorded as 24.6% and 31.3% respectively.
- ix) No incidence of *Atherigona* was recorded. However other insects were recorded as minor pests of wheat.
- x) Twenty eight varieties out of IET(LF) were observed as less susceptible to brown wheat mite.
- B) Sub-Station - Jabalpur
- i) About 200 crosses were attempted in the crossing block.
- ii) Seven cultures viz. JWJ 1-5 x NP 839, HD 1467x JWJ 144, JWJ 5 x NP 839, HD 1467 x JWJ 1-5, HD 1467 x Sonalika, HD 1467 x JWJ 162, NP 839x

JWJ 84 were selected from progeny row trial for further testing under rainfed conditions. WH 101, HI 7710, HI 617 in Uniform Regional Trial, out yielded the check, while in National Trial no variety was found superior to the control. Among durum MACS 8 and MACS 484 gave better yields.

- iii) Six cultures from progeny row trial (HF) were selected for further testing.
- iv) Two strains from S.T. No.22 were selected on the basis of yield and grain characters for testing in coordinated trial under high fertility conditions.
- v) Four best JBRR cultures were selected for incorporation of disease resistance in existing varieties.
- vi) None of the variety could surpass the yield of Kalyansona in Uniform Regional Trial (High Fertility). In National Trial HI 601 and HP 1267 UPK - 1 have given higher yield than Kalyansona. In late sown trial J-150 and V.W.16 out-yielded the check.
- vii) Among durum JNK 4 W-194 gave better yield than Kalyansona.

Autumn Wheat and Triticale Research

Since the inception of the autumn research programme the weather condition had been varying from year to year considerably as follows:

1971	Extremely wet but rains	well distributed.
1972	Dry year	

1973 Continuous rains and therefore the programme could not be undertaken

1974 Average

1975 Wet having unfavourable distribution.

The weather conditions during 1975 were least favourable for autumn research. Heavy and continuous rains particularly between second week of August and September 14th (only 5 dry days) damaged the material. There were late rains in October which probably brought the rust inoculum as rust was observed early. Despite the above Hindi 62 performed well. Other promising varieties were NI 747-19, NI 917, N.P. 111-2-8, J 20, Rs 31-1-4, E 4740, Rewa CPS 5-5-2, N.P. 846, PKD 66, HY 1517, Chiza 331 and Raj 720.

Good rust resistance particularly to black rust is necessary in suitable autumn variety programme therefore would be concentrated on incorporating rust resistance from diverse sources in promising autumn varieties like Hindi 62 and NI 747-19.

5.3.2 All India Coordinated Wheat Improvement Project

A) Main Station - Powarkheda

No variety was superior to local check (Raj 911) in International Durum Yield Nursery. Gabo 125, Misri, D 67-2, Ciano-chris, L 176-3048, Maya II Arims x 2802 were selected for further breeding projects from P.O.N. Nursery. Approximately 888 single plants and bulks from spring x Winter material were selected for testing under rainfed condition and autumn sowing. One hundred seventy strains were resistant for rusts in National Genetic Stock Nursery. MP 283, J.L. x Anhinga 's', NP 404 x HI 7718, (MX 8xHD 4500)

x Hy 113, MPO 159 x HD 4519, JNK 6W 193, 194, 203 and 192 were selected from preliminary trials. JNK 6W 190, MACS 103, Raj 1459 were top yielding varieties in IET (IF). C 306 gave significantly higher yield to control in National Trial (IF) at all locations.

The crosses viz. UP 301 x HD 1593, (S 308 x Bonza) (Tob-8156'B') and MPO 124 x RAE-Tc⁴-Stw63/AA'S' in preliminary trials, MPO 215, JWS 74-12, JWS 73-9, HD 2236, HI 686 and VW 21 in IET WH 147, HI 601, J 40, MPO 190, VW 3 and NJK 4W 184 in U.R.T. were best varieties under high fertility conditions. HI 601 and HP 1267 were significantly superior to Kalyan sona in National Trial (HF).

Number of single plants & heads were selected from interspecific crosses to incorporate beneficial genes. Maximum yield was recorded by sowing of dwarf wheat on 15th November, which was superior to 28th Oct. Sowing Raj 911 & J 142 proved suitable varieties for all dates of sowing and for normal sowing Kalyan sona, Sonalika, J 40 & MPO 190 were found suitable. Highest yield (44.38 Q/ha) was recorded with six irrigations at different physiological stages, but it was statistically at par with 5 irrigations at physiological stages and irrigations at 0.9 of pan evaporation demand. This also confirms the last year's data. In the trial to identify varieties to give higher yields under limited water supply, the data is of limited value and need further experimentation. Under rainfed conditions MP 195 was found suitable for early sowing on 10th October. HI 335 HI 617, A 9-30-1 and HY 65 for 20th October sowing where as MACS 8, HI 385, HI 617 and Hy 65 for 30th October sowing. No agrochemical could help in increasing the productivity of rainfed wheat.

B) Sub-Station-Sagar

The frost and rust incidence did not occur. No variety in Initial Evaluation Trial and Uniform Regional Trial (Low Fertility) was superior to control. JWS 75-5, JWS-75-4, JL x Anhinga's' (M x 8 x HD 4500) x HY 119 and JNK 6W 195 were best strains in preliminary trials under rainfed conditions, and (S 308 x Bonza) (Tob x 8156B), Z-B-Lak x GO-120 (Gill's'), Gr's'-Gill's' Br-180-LK 162-229 x ID), (TME-To²) (Z-B x W), By² W-To x TACE-To) Gr's' and Fg's'-21503-AA's' under irrigated conditions. These will be further tested in co-ordinated trials.

5.4 Recommended Varieties

As a result of the intensive research on evolving new varieties and on the basis of adaptive research work certain varieties have been recommended by the Vishwa Vidyalaya for different agro-climatic regions of the state. (Table 5.3) Varieties for paddy, jowar, bajra and maize are also noted.

Table 5.3 Recommended Varieties for M.P.

Crop	Recommended Varieties
Paddy	Jaya, Cauvery (IET 355), Bala (CR 42-38-173) Ratna, Laloo 14, N-22, Cross 116, Safari 17, Norved, R-10, Kalimoonch-64, R-15, Cross-51.
Wheat	HY-11, HY 65 (HD 1467), HY 633, NP 839, Narmada 4 (PKD-4), Kalyansona, Sonalika, Chhoti-Lerma, Safed Larma, Sharbati Sanora, HY 34 & NP 404.
Jowar	CSH-1, CSH 2, CSH 3, Swarna, Vidisha 69-1, Gwalior 394, Gwalior 82.
Maize	Ganga 5, Ganga Safed, Ganga 101, Deccan, Ambar, Jawahar, Vijay, Sona Comp. H-1, CharDan Makka Safed-2.
Bajra	HB - 1.

Of these many have been released by the J.N.K.

Vishwa Vidyalyaya. (Table 5.4)

Table 5.4 Improved Varieties released by J.N.K.V.Vidyalyaya.

Crop	Variety	Year of release
Paddy	Safari 17	1966
	Norved	1965
	Kalimoonch-64	1965
	Anupama	1975
	Garima	1976
	Kranti	1976
Wheat	Jagriti	1976
	HY 633	1965
	Narmada -4	1971
	Narmada 112	1975
	Vidisha - 60	1970
Jowar		
Maize	Chandan-Safed Makka-2	1971
	Chandan-Makka-1	1973
	Chandan-Makka-3	1976

CHAPTER VI

SELECTED DISTRICTS & VILLAGES

As mentioned earlier Gwalior and Tikamgarh districts were selected for the study. A brief description of the selected districts and that of the selected villages is given below.

6.1 Gwalior District

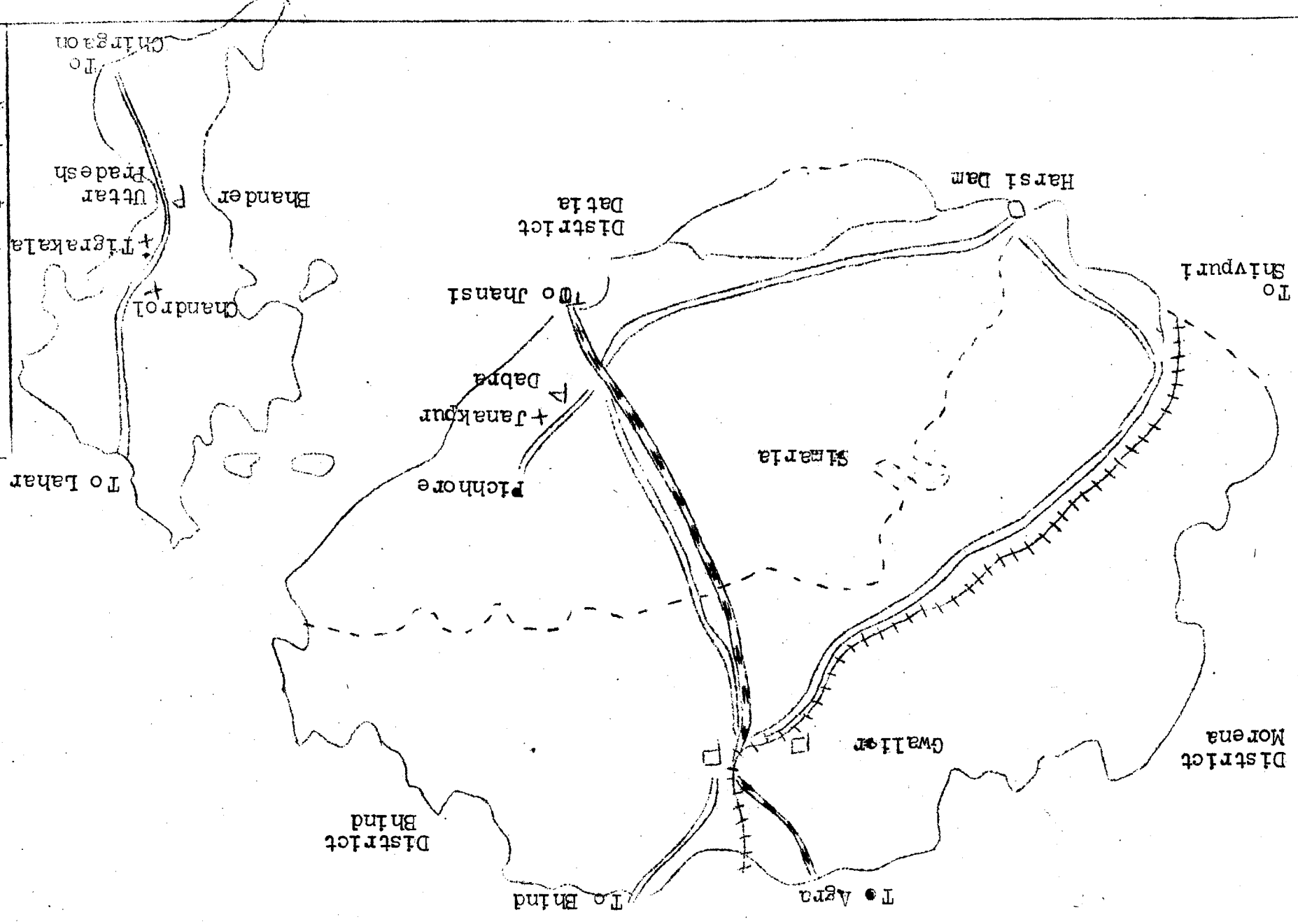
Gwalior is one of the northern districts of the state and is situated between latitudes $25^{\circ} 34' N$ and $26^{\circ} 21' N$ and longitude $77^{\circ} 40' E$ and $78^{\circ} 54' E$. It comprises of three tehsils viz. Gwalior, Dabra and Bhandar. The district is not compact as Bhandar tehsil lies separated by some enclaves of Datia district. The other two tehsils viz. Dabra and Gwalior, however, form a compact area. They are bounded by Morena district in the north and north-west, Bhind in north-east, Datia in the east and Shivpuri district in the west. To the north of Bhandar lies Bhind district, to the south east lies Jhansi district of U.P. and in the west, Datia district.

6.1.1 Physical Features

The western portion of the district is mostly a plateau which brings the Malwa plateau to an end. The highest hill feature being 443.18 metres in Sirkoli forest. This area is mostly hilly and has some good forest. The east-west tract is also somewhat hilly but otherwise fairly clearly marked from the plateau and like the western portion has some forest. The south-eastern portion is the area of plains of river Sindh in Dabra tehsil and Pahuji in Bhandar.

The Sindh river forms the south-eastern boundary of the district and is a perennial river. The area is

GWALIOR DISTRICT



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good for cultivation for the plains have fine deep soil. In the north-eastern portion we again have plains consisting of rivers, valleys of rivers Sankh, Sonrekha, Morar and Vaisali.

6.1.2 The Rivers and Tanks

All the rivers of the district join the Yamuna. The northern through the Chambal and the southern ones through the Sind. The important rivers of the district are the Sankh, the Sonrekha, the Morar, the Vaisali, the Nan, the Asan, the Chacchond, the Parbati and the Pahuj.

The important tanks and lakes of the district are 1) Harsi (2590.08 hectares) in Dabra tehsil; 2) Tigra (1944.58 hectares) in Gwalior tehsil; 3) Kaketo (783.19 hectares) in Debra tehsil; 4) Rama (350.06 hectares) in Gwalior and 5) Tekanpur (340.76 hectares) in Dabra tehsil.

6.1.3 Climate and Rainful

The district receives rains from westerly winds. The monsoon sets in from early July or the last week of June and continues till about early October. The average rainfall is 732 mm. per annum. In November the weather is pleasant. December and January are the coldest months when winter becomes severe and dry. February is again pleasant but towards the middle of March it begins to get warm and by the end of April and May the summer is at its worst. The mercury shoots upto 48.3°C.

6.1.4 The Population

According to 1971 Census the population of the district was 8,58,005 residing in 855 villages and 3 towns.

The urban population formed 54.63 per cent and rural population 45.37 per cent. The literacy percentage in the District was 33.89 per cent. Scheduled caste population formed 19.38 per cent of the total population and the scheduled tribes, 1.87 per cent. The number of electrified villages in the district, till 1976 was 133. (Table 6.1)

Table 6.1 Villages and population of Gwalior district

Particulars	Number	Percentage
Total population	8,58,005	-
Rural population	4,15,008	48.37
Urban population	4,42,997	51.63
Scheduled caste population	1,66,271	19.38
Scheduled Tribe population	16,072	1.87
Literate persons	2,90,758	33.89
Total No. of villages	855	-
Total No. of towns	3	-
No. of villages electrified.	133	-
No. of energised pupes	2,701	-

Of the total population 2,49,924 or 29.13 per cent were workers. Among workers 38.94 per cent were cultivators and 11.61 per cent were agricultural labourers (Table 6.2)

Table 6.2 Distribution of Workers, Gwalior district

Particulars	Number	Percentage
Cultivators	97,293	38.94
Agricultural labourers	29,623	11.61
Livestock, forestry fishing etc.	4,654	1.86
Mining and quarrying	630	0.25
Household industry	4,274	1.71
Other than household industry	34,722	13.89
Trade & Commerce	19,609	7.84
Construction	6,159	2.46
Transport, storage and communication	8,390	3.36
Other services	45,165	18.08
Total workers	2,49,924	100.00

6.1.5 Agriculture

In the following paragraphs various aspects of agriculture such as land utilisation, cropping pattern, irrigation etc. are described.

6.1.5.1 Land utilization

The total geographical area of the district is 522 thousand hectares. Of this 48.04 per cent was net sown area. Forests occupied another 20.94 per cent of the area and the land not available for cultivation constituted 17.36 per cent (Table 6.3)

Table 6.3 Land utilisation in Gwalior district, 1975-76

Particulars	Area (Thousand hectares)	Percentage
Net area sown	250.7	48.04
Forest	109.13	20.94
Land not available for cultivation	90.6	17.36
Cultivable waste land	31.6	6.05
Other uncultivated land excluding fallow land	27.8	5.33
Fallow land	11.9	2.28
Total geographical area	521.9	100.00

6.1.5.2 Operational Holdings

The operated area is distributed over 66 thousand operational holdings. One fourth of these comprise less than 1.00 hectare each. Another 33 per cent holdings are between the size of 1.1 hectares to 3.0 hectares. Ten per cent of the holdings belong to the size group of 3.1 to 4.0 hectares. Thus 68.6 per cent of the holdings occupy 4.0 hectares or less each. But these holdings account for only 27.4 per cent of the operated area explaining the imbalanced distribution of agricultural land (Table 6.4)

Table 6.4 Distribution of holdings and operational area according to size of holdings, Gwalior district

Size group	Number (thousand)	Percentage	Area (thousand hectares)	Percentage
Less than 0.5	8.2	12.4	2.2	0.8
0.5 - 1.0	8.4	12.7	6.1	2.3
1.1 - 2.0	12.9	19.5	18.9	7.1
2.1 - 3.0	9.2	13.9	22.7	8.6
3.1 - 4.0	6.7	10.1	22.9	8.6
4.1 - 5.0	5.1	7.7	22.5	8.5
5.1 - 10.0	10.6	16.0	75.7	28.6
10.1 - 20.0	3.9	5.9	52.6	19.8
20.1 - 30.0	0.7	1.1	17.2	6.5
30.1 - 40.0	9.2	0.3	6.6	2.5
40.1 - 50.0	0.1	0.1	3.6	1.4
Above 50.0	0.2	0.3	14.0	5.3
Total	66.2	100.0	265.0	100.00

6.1.5.3 Irrigation

Of the net sown area of 251 thousand hectares, 83 thousand hectares were irrigated. Thus the irrigated area formed 33.19 per cent of the net sown area. Most important sources of irrigation were canals and commanded 74.40 per cent of the irrigated area. Wells were next important and irrigated 20.07 per cent of the area (Table 6.5)

Table 6.5 Sources of irrigation, Gwalior district 1975-76

Source	Area (thousand hectares)	Percentage to total
Canals	61.9	74.40
Tanks	2.5	3.13
Wells	16.7	20.07
Others	2.0	2.40
Total	83.2	100.00

6.1.5.4 Cropping Pattern

Wheat was the most important crop of the district as it constituted 31.10 per cent of the cropped area. The second important crop was gram and accounted for 19.13 per cent of the gross cropped area. Jowar was third important and formed 13.74 per cent (Table 6.6)

Table 6.6 Cropping pattern, Gwalior district, 1975-76

Crop	Area (Thousand hectares)	Percentage
Paddy	18.6	7.02
Wheat	82.4	31.10
Jowar	36.4	13.74
Barley	2.1	0.79
Kodn-Kutki	-	-
Other cereals	3.3	1.24
Total cereals & Millet	142.8	53.89
Gram	50.7	19.13
Tur	11.0	4.15
Urd	0.4	0.15
Moong-moth	3.5	1.32
Lentil	5.9	2.23
Other pulses	3.5	1.32
Total Pulses	75.0	28.39
Groundnut	0.8	0.30
Sesamum	5.7	2.15
Rape & Mustard	4.7	1.77
Linseed	12.3	4.64
Other Oilseeds	8.5	3.21
Total Oilseeds	32.0	12.07
Sugarcane	5.0	1.89
Non-food crops	6.6	2.49
Total fruits & Vegetables	2.8	1.06
Total spices	0.6	0.23
Other crops	0.2	0.07
Gross Cropped area	265.0	100.00

6.1.5.5 Irrigated Crops

Wheat, paddy, gram, sugarcane, fruits, vegetables, tobacco and spices were important irrigated crops.

The entire area under tobacco, sugarcane and condiments and spices was irrigated. Paddy was irrigated to the extent of 97.69 per cent and fruits and vegetables, 92.86 per cent. Wheat was irrigated to the extent of 53.34 per cent (Table 6.7)

Table 6.7 Cropwise irrigated area, Gwalior district, 1975-76

Crop	Irrigated area (thousand hectares)	Percentage to total	Percentage of irrigated area to area of the crop
Paddy	18.17	21.86	97.69
Wheat	43.95	52.87	53.34
Barley	0.35	0.42	16.67
Maize	0.03	0.04	15.00
Other cereals	-	-	-
Total cereals	62.50	75.19	43.77
Gram	6.16	7.41	12.15
Other Pulses	1.94	2.33	7.98
Total Pulses	8.10	9.74	10.80
Rape & Mustard	0.79	0.95	16.81
Linseed	1.26	1.51	10.24
Other Oil seeds	0.15	0.18	1.76
Total Oil seeds	2.20	2.65	6.88
Sugarcane	5.04	6.06	100.00
Total fruits & vegetables	2.60	3.13	92.86
Tobacco	0.01	0.01	100.00
Total spices & condiments	0.60	0.72	100.00
Fodder crops	2.08	2.50	33.44
Total food crops	78.84	94.84	34.85
Non-food crops	4.29	5.16	11.00
Gross irrigated area.	83.13	100.00	31.37

6.1.5.6 High Yielding Varieties Programme of Wheat

Gwalior is one of the important wheat growing districts of the State and the area under high yielding varieties of this crop has been considerable. It increased

from 4,047 hectares in 1967-68 to 47,300 hectares in the last year of the reference period. In other words, the increase was eleven fold. Consequently the proportion of area under H.Y.V. to total wheat area increased from 5.13 per cent in 1967-68 to 57.33 per cent in 1975-76.

6.1.6 Selected Villages

The following four villages were selected in

Gwalior district.

Dabra block	1. Simaria
	2. Janakpur
Bhandar block	1. Tigara Kalan
	2. Chandrol

6.1.6.1 Simaria

The village is situated at a distance of 7 km. from Dabra towards Gwalior on Gwalior-Dabra road and is 35 km. away from the district headquarters. It has a primary school, middle school, cooperative bank branch, cooperative society, veterinary dispensary, fertilizer distribution centre and seed godown within its boundary. The village is also the headquarters of the Gramsevak, patwari and gram panchayat. For other facilities villagers go to Dabra. The nearest weekly market and cattle market are at Pichhore, 15 Km. away.

6.1.6.2 Janakpur

This village is located at a distance of 10 Km. from Dabra on Dabra-Pichhore road. The village is only 22 Km. away from Pichhore, an important town of the district. The distance between Gwalior town and the village is 52 Km. The village has a primary school and is the headquarters of the patwari.

All other facilities are available at Pichhore. The village comes under the jurisdiction of Chai gram-panchayat, (2 Km. away) and Dabra Nyaya Panchayat. Degree College, Commercial Bank, Land Development Bank and marketing society, are all at Dabra.

6.1.6.3 Tigra Kalan

Village Tigara Kalan is situated 5 Km. away from Bhandar on Bhandar-Lahar road. Lahar is a tehsil head-quarters of Bhind district. This being an all weather road villagers go to Bhandar, conveniently for most of their requirements. However, the nearest post office, V.L.W. Centre, Patwari H.Q. and gram panchayat, cooperative society, and marketing society are all located at Chandrol at a distance of 3 km. Sophta, another village 3 km. away, has fertilizers distribution centre, seed godown and plant protection centre, nearest to this village.

6.1.6.4 Chandrol

This village, like Tigara Kalan, is located on Bhandar-Lahar road 3 km. farther from Tigra Kalan. Thus the village is 8 km. away from Bhandar. Chandrol is an important village of the area and has post office, primary and middle schools, V.L.W. Centre, patwari H.Q., Gram Panchayat, Cooperative society and marketing society. For fertilizer, seed and plant protection equipments, the villagers, like those of Tigarakalan, go to Sophta, 1 km. away. For other necessities people go to Bhandar (see Table 6.8 also)

Table 6.8 Details regarding selected villages of Gwalior district
Dabra block

[illegible]

The description of Tikamgarh district and its villages follows.

6.2 Tikamgarh district

Tikamgarh district is located in the northern part of Madhya Pradesh, commonly known as Bundel khand. It lies between 24°26' and 25°40' North latitude and 78°26' and 79°26' East longitude. On the east, river Dhasan separates Tikamgarh from Chhatarpur district. On the north it is bounded by Banda and Jhansi districts of U.P. and on the south is Sagar district of Madhya Pradesh. The boundary of the district is of irregular shape with pointed projections in the north and south.

6.2.1 Physical Features

The district is generally an even plane and has a gentle slope towards north. It comprises a geographical area of 5,04,000 hectares of which 13.10 per cent is under forest. There are several lakes in the district and some of these are of considerable size. Most of these have been built by ex-rulers and are now being used for irrigation purposes.

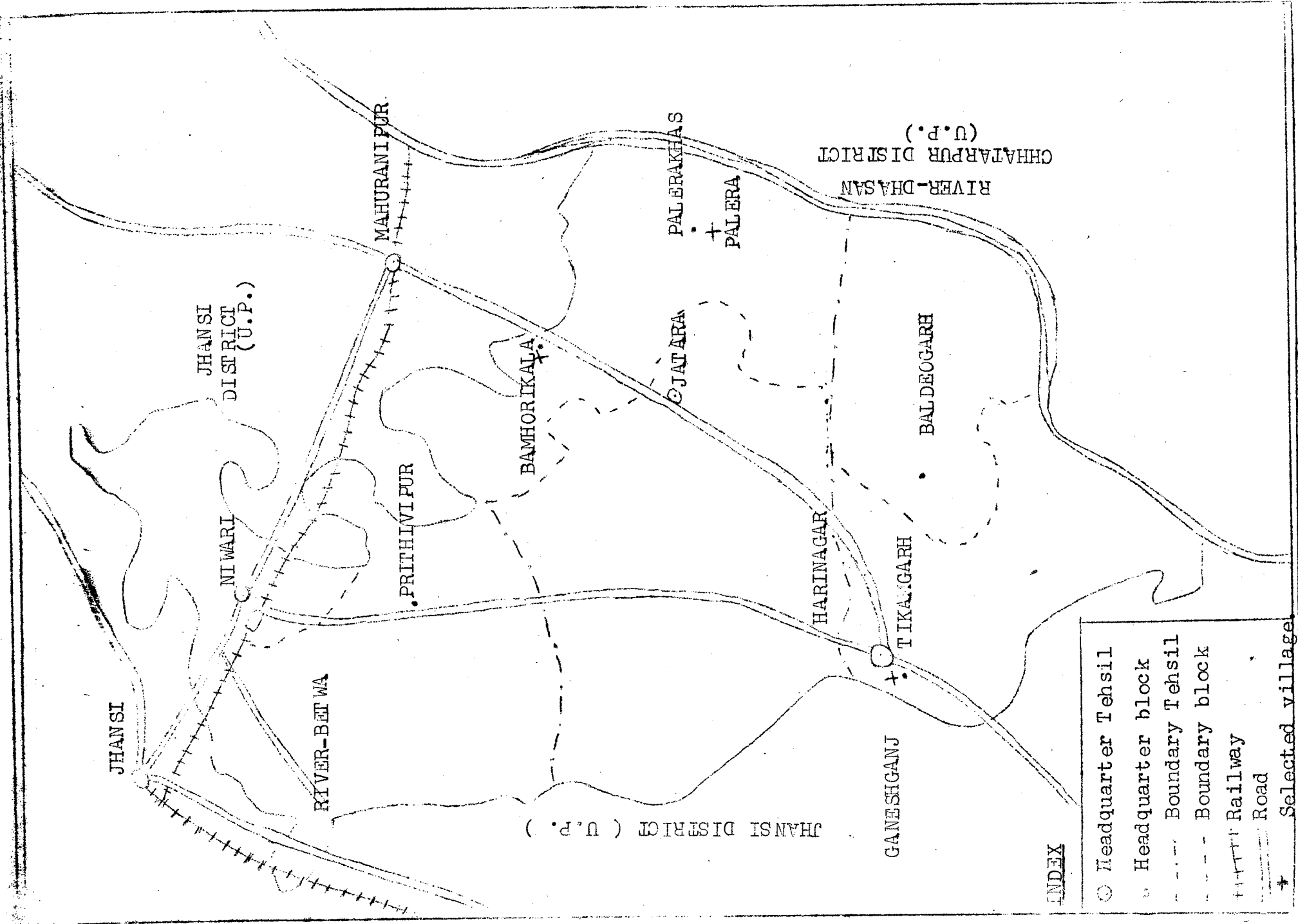
6.2.2 Climate

The climate is of extreme type. May and June are the hottest months. The rains commence from early July; August and September being the wettest months. Average rainfall of the district is 1,016 mm. December and January are the coldest months.

6.2.3 The Population

The population of the district was 5,68,885 as per the 1971 Census. The number of villages in the

TIKANGARH DISTRICT



INDEX

- Headquarter Tehsil
- Headquarter block
- - - - Boundary Tehsil
- - - - Boundary block
- + + + + Railway
- - - - Road
- * Selected village

district was 882. The district is essentially rural as 59.09 per cent of the population is rural. The literacy percentage of the population was 14.04. One fifth of the total population belonged to scheduled castes and 4.05 per cent belonged to scheduled tribes. Tikamgarh is the only town in the district and of the total villages in the district 131 were electrified (Table 6.9)

Table 6.9 Villages and population of Tikamgarh district

Particulars	Number	Percentage
Total population	5,68,885	-
Rural population	5,40,980	95.09
Urban population	27,905	4.91
Scheduled caste population	1,16,183	20.42
Scheduled Tribe Population	23,587	4.15
Literate persons	79,852	14.04
Total No. of villages	832	-
Total No. of towns	1	-
No. of villages electrified	131	-
No. of energised pumps	2,741	↓

Of the total population 1,99,416 or 35.05 per cent were workers. Cultivators formed the highest percentage (69.13 per cent) of the total workers and agricultural labourers, 18.42 per cent (Table 6.10)

Table 6.10 Distribution of workers, Tikamgarh district

Particulars	Workers Number	Percentage
Cultivators	1,37,870	69.13
Agricultural labourers	36,726	18.42
Livestock forestry fishing etc.	2,614	1.31
Mining and Quarrying	49	0.02
Manufacturing, Processing		
Servicing, Repairs, Household industry	6,545	3.28
Other than household industry	1,571	0.79
Construction	451	0.23
Trade and commerce	3,211	1.61
Transport storage and communication		
Other services	593	0.30
	9,786	4.91
Total workers	1,99,416	100.00

6.2.4 Agriculture

The population statistics have very clearly indicated that this district is rural in character and a very high percentage of its working force is engaged in agriculture. It will be useful to examine various aspects of its agriculture.

6.2.4.1 Land Utilisation

The geographical area of the district is 504 thousand hectares. Net sown area constituted 42.96 per cent and the uncultivated area, 16.13 per cent. Land not available for cultivation also formed significant percentage (14.47 per cent) Forests covered a relatively smaller percentage of land as compared to the state average (Table 6.11)

Table 6.11 Land Utilization in Tikamgarh district, 1975-76

Particulars	Area (thousand hectares)	Percentage
Net area sown	216.5	42.96
Other uncultivated land excluding fallow land land non available for cultivation	81.3	16.13
Forest	72.9	14.47
Cultivable waste land	64.7	12.84
Fallow lands	40.2	7.98
	28.3	5.62
Total Geographical area	503.9	100.00

6.2.4.2 Operational Holdings

Small size holdings predominated in the district. As high as 98 per cent of the total number comprised of 10.00 hectares or less of farm size. Holdings having farm size of 5.00 hectares and above constituted only 10.6 per cent of the total number. Thus 90 per cent of the holdings comprised less than 5.00 hectares each.

However these together accounted for only 62.0 percent of the area indicating the unequal distribution of operational area (Table 6.12)

Table 6.12 Distribution of holdings and operational area according to size of holdings, Tikangarh district

Particulars	Number (thousand)	Percentage	Area (thousand hectares)	Percentage
Less than				
0.5 -	21.7	20.1	6.0	2.3
0.5 - 1.0	17.8	16.5	13.0	5.0
1.1 - 2.0	24.6	22.8	37.3	14.4
2.1 - 3.0	16.3	15.1	42.3	16.4
3.1 - 4.0	9.7	9.0	33.6	13.0
4.1 - 5.0	6.3	5.9	28.2	10.9
5.1 - 10.0	9.3	8.6	64.4	24.9
10.1 - 20.0	1.9	1.8	23.7	9.2
20.1 - 30.0	0.2	0.2	5.0	1.9
30.1 - 40.0	-	-	11.3	0.5
40.1 - 50.0	-	-	11.0	0.4
Above 50.0	-	-	2.7	1.1
Totals	107.8	100.0	258.5	100.0

6.2.4.3 Irrigation

Of the net sown area of 217 thousand hectares ,

81 thousand hectares were irrigated bringing the percentage of irrigated area to 37.33. Not only the percentage of irrigated area was higher in the district the irrigation sources (wells) were of assured nature. This has brought the district in prominence in high yielding varieties programme of wheat. Sources other than wells were canals and tanks (Table 6.13)

Table 6.13 Sources of Irrigation, Tikangarh district, 1975-76

Source	Area (Thousand hectares)	Percentage to total
Canals	13.9	17.14
Tanks	5.9	7.27
Wells	58.7	72.38
Others	2.6	3.21
Total	81.1	100.00

6.2.4.4 Cropping Pattern

Wheat was the most important crop of the district and occupied 22.47 per cent of the cropped area. Jowar was another important crop occupying 15.07 per cent. Paddy was also an important crop constituting 9.59 per cent and gram was the only pulse crop of significant importance having 6.16 per cent area under it. (Table 6.14)

Table 6.14 Cropping Pattern, Tikamgarh district 1975-76

Crops	Area (thousand hectares)	Percentage
Paddy	25.7	9.59
Wheat	60.2	22.47
Jowar	40.4	15.07
Burley	13.8	5.15
Kodokutki	12.4	4.63
Other Cereals	22.9	8.54
Total Cereals & millets	175.4	65.45
Gram	16.5	6.16
Tur	1.2	0.45
Urd	12.3	4.59
Moong and moth	4.9	1.79
Lentil	4.9	1.83
Other pulses	0.6	0.22
Total pulses	40.3	15.04
Ground nut	0.3	0.11
Sesamum	11.3	4.21
Rape & mustard	0.1	0.04
Linseed	1.6	0.60
Other Oil seeds	1.1	0.41
Total Oilseeds	14.4	5.37
Sugarcane	0.8	0.30
Non food Crops	33.5	12.50
Total Fruits & vegetable	1.9	0.71
Total spices	1.5	0.56
Other - Crops	0.2	0.07
Gross Cropped area	268.0	100.00

6.2.4.5 Irrigated Crops

The important irrigated crops of the district were wheat, barley, fruits and vegetables, sugarcane, spices, and tobacco. Wheat formed 64.87 per cent of the total irrigated area and was irrigated to the extent of

87.29 per cent. Whereas, barley occupied 15.24 per cent of the irrigated area and as high as 89.49 per cent of its area was irrigated. Crops such as sugarcane, fruits and vegetables, tobacco and spices although constituted smaller percentage of the total irrigated area were very nearly fully irrigated individually. (Table 6.15)

Table 6.15 Cropwise irrigated area, Tikamgarh district, 1975-76

Particulars	Irrigated area(thousand hectares)	Percentage to total	Percentage of irrigated area to area of the crop
Paddy	2.1	0.26	0.82
Wheat	525.5	64.87	87.29
Barley	123.5	15.24	89.49
Maize	-	-	-
Other Cereals	2.9	0.36	1.27
Total cereals	654.0	80.73	37.29
Gram	64.0	7.91	38.79
Other Pulses	43.0	5.92	20.17
Total Pulses	112.0	13.83	27.79
Rape & mustard	0.8	0.10	80.00
Linseed	1.0	0.12	6.25
Other oil seeds	2.2	0.27	20.00
Total oil seeds	4.0	0.49	2.78
Sugarcane	8.7	1.07	100.00
Total Fruits	17.0	2.10	89.47
Vegetably	-	-	-
Tobacco	0.3	0.40	100.00
Total spices & condiments	14.0	1.73	93.33
Fodder Crops	0.1	0.01	Neg.
Total Food Crops	805.7	99.46	36.64
Non Food Crops	4.4	0.54	0.91
Gross Irrigated area.	810.1	100.00	30.23

6.2.4.6 High Yielding Varieties Programme of Wheat

Tikamgarh district has earned a good name as far as the H.Y.V.P. of wheat is concerned. In 1966-67 the area under H.Y.V.P. of wheat in the district was 4,047 hectares. It increased to 42,400 hectares in 1975-76 or a 10 fold increase in area.

6.2.5 Selected Villages

The villages selected in the district were following:

Tikamgarh block	-	1. Hira Nagar 2. Ganeshganj
Palera block	-	1. Palera Khas 2. Bamhori Kalan

6.2.5.1 Hira Nagar

The village is located at a distance of 10 km. from Tikamgarh town on Tikamgarh-Niwari road. It is quite a progressive village and has an easy access to another important village, Kari, only 3 km away. Kari has a middle school, higher secondary school, nyayapanchayat H.Q, nearest to this village. The post office, primary school, gramsevak H.Q, patwari H.Q, grampanchayat H.Q, cooperative society, veterinary dispensary, fertilizer distribution Centre, and seed godown are all located in the village itself. Weekly market is also held in the village. For other facilities the villagers go to Tikamgarh.

6.2.5.2 Ganeshganj

This village is nearest to Tikamgarh town and is located at a distance of 4 km. on Tikamgarh - Lalitpur road. The village has a primary school and patwari H.Q. Kundeshwar, another progressive village of the block, is situated at a distance of 2 km from Ganeshganj and has facilities like post office, middle school, gramsevak H.Q. grampanchayat H.Q, weekly market, cooperative society, fertilizer distribution Centre and seed godown. Therefore, the residents of the village have close contacts with Kundeshwar which has also the famous Shiv temple. Facilities other than the noted above are available at Tikamgarh.

6.2.5.3 Palera Khas

It is the largest among the selected villages. It is the H.Q. of the Development Block and therefore all the facilities except the College, Land Development Bank, Marketing Society and Cattle Market exist in the village itself. The nearest land development bank to this village is at Jatara which is 24 km. away. Marketing society is also located at Jatara. The Cattle market nearest to the village is at Mauranipur, 45 km. away.

6.2.5.4 Bamhori Kalan

This village is situated at a distance of 15 km. from Jatara, the tehsil H.Q., on Jatara-Mauranipur road. It is one of the progressive villages of the block and of a medium size. Facilities such as post office, primary school, middle school, gramsevak H.Q., patwari H.Q., grampanchayat H.Q., Nyayapanchayat H.Q., weekly market, Cooperative society, veterinary dispensary etc. exist in the village itself. For other necessities villagers go to Jatara (See Table 6.16).

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Table 6.16 Details regarding selected villages in Tikamgarh District

Particulars							
Tikamgarh block		Ganesh ganj		Palerakhas		Bamhorikala	
Place	Distance (km)	Place	Distance (km)	Place	Distance (km)	Place	Distance (km)
Block	10	Tikamgarh	4	Palera	0	Palera	20
Tehsil	10	Tikamgarh	4	Jatara	24	Jatara	15
Post Office	0	Kundeshwar	2	Palera	0	Bamhorl	0
Telegraph Office	10	Tikamgarh	4	Palera	0	Jatara	15
Police Station	10	Tikamgarh	4	Palera	0	Jatara	15
Hospital	10	Tikamgarh	4	Palera	0	Jatara	15
Primary School	0	Ganeshganj	0	Palera	0	Bamhorl	0
Middle School	3	Kundeshwar	2	Palera	0	Bamhorl	0
Higher Secondary School	3	Tikamgarh	4	Palera	0	Jatara	15
College	10	Tikamgarh	4	Navgaon	24	Jatara	15
V.L.W. Centre	0	Kundeshwar	2	Palera	0	Bamhorl	0
Patwarl Centre	0	Ganeshganj	0	Palera	0	Bamhorl	0
Gram Panchayat	0	Kundeshwar	2	Palera	0	Bamhorl	0
Nyaya Panchayat	3	Patha	14	Palera	0	Bamhorl	0
Weekly Market	0	Kundeshwar	2	Palera	0	Jatara	15
Cooperative Bank	10	Tikamgarh	4	Palera	0	Jatara	15
Nationalised Bank	10	Tikamgarh	4	Jatara	24	Jatara	15
Land Development Bank	10	Tikamgarh	4	Jatara	0	Jatara	15
State Bank	10	Tikamgarh	4	Palera	0	Bamhorl	0
Cooperative Society	0	Kundeshwar	2	Palera	24	Jatara	15
Marketing Society	10	Tikamgarh	4	Jatara	0	Bamhorl	0
Veterinary dispensary	0	Tikamgarh	4	Palera	0	Bamhorl	0
Cattle Market	0	Tikamgarh	4	Mauranipur	45	Mauranipur	12
Fertilizer Distribution	0	Kundeshwar	2	Palera	0	Bamhorl	0
Centre	0	-	-	Palera	0	Bamhorl	0
Seed Godown	0	Kundeshwar	2	Palera	0	Bamhorl	0
Plant Protection Centre	9	Tikamgarh	9	Palera	0	Bamhorl	0
Pacca Road	1	Ganeshganj	0	Palera	0	Bamhorl	0

CHAPTER VII

PERFORMANCE ON SELECTED FARMS

The present chapter is devoted to the findings on the selected farms. As has been noted earlier, 50 farms were selected in each of the selected districts of Gwalior and Tikamgarh. A brief description of the characteristics of the selected households precedes the main findings.

7.1 Characteristics of the Selected Households

Of the 50 selected households of Gwalior district¹⁶ had subsidiary occupation in addition to the main occupation of agriculture. The important subsidiary occupations were agricultural labour (5 households) and service (5 households). In Tikamgarh the number of households with subsidiary occupations was 14. In this district also agricultural labour was the principal subsidiary occupation (7 households). Sheep breeding, carpentry and bussiness were the subsidiary occupations of 2 households each. Service was the subsidiary occupation of the remaining household (Table 7.1)

Table 7.1 Distribution of households by subsidiary occupations

Subsidiary Occupation	Gwalior	Tikamgarh
Agricultural labour	6	7
Sheep breeding	1	2
House construction	1	-
Service	5	1
Priesthood	1	-
Basket making	1	-
Carpentry	-	2
Business	-	2
Profession	1	-
Total	16	14

Literacy percentage among the heads of the households of Gwalior district was 70 and that in Tikamgarh was 56. Among the literates, largest number belonged to the class with no formal education (Table 7.2)

Table 7.2 Literacy among the heads of the households

Particulars	Gwalior	Tikamgarh
Illiterate	15	22
Literate but no formal education	15	17
Upto Primary	6	3
Upto Middle	8	4
Upto High School	3	1
Upto Graduation	3	2
Upto Post Graduation	-	1
Total	50	50

The average size of the family among the households of Gwalior district was 7.7. The average size in Tikamgarh district was 7.22 (Table 7.3)

Table 7.3 Distribution of population of the selected households

Particulars	Gwalior	Tikamgarh	Total
Adult Males	112	100	212
Adult Females	109	103	212
Children	164	157	321
Male	94	86	180
Female	70	71	141
Total	385	360	745

The operated area of the 50 farms of Gwalior district was 229.47 hectares. Thus the average size of holding was 4.59 hectares. Whereas the average holding of Tikamgarh district was of 22.79 hectares. Irrigated area formed 60.22 per cent of the operated area in Gwalior district as against 68.66 per cent in Tikamgarh district. (Table 7.4)

Table 7.4 Details of operated area of the selected farms
(Area - Hectares)

Particulars	Gwalior	Tikamgarh	Total
Owned area	223.20	139.03	362.23
Leased out area			
Leased in area	6.27	0.69	6.96
Operated area	229.47	139.72	369.19
Average size	4.59	2.79	
Irrigated area	138.20	95.94	234.14
Percentage of Irrigated area to operated area	60.22	68.66	63.42

The farmers were also subjected to the questions on the period of participation in the H.Y.V. programme; the source of information; knowledge about the field demonstrations, agricultural fairs etc. It revealed that in Gwalior district only 4 out of 50 farmers had ever visited any agricultural fair and 3 farmers had seen the national demonstrations. Most of them saw the H.Y.V. crop in the village only. About 10 farmers had seen the crop before 1968-69 and the remaining saw it after 1968-69

On the other hand in Tikamgarh district 13 out of the 50 selected farmers had undergone informal training in agriculture at Kundeshwar Govt. Farm or elsewhere. Further, as many as 18 farmers reported to have participated in agricultural fair or visited the Govt. farms. On 6 farms demonstrations were layed out by the agricultural department. As regards knowledge of H.Y.V. it was noted that more than half of the total number of farmers had seen the H.Y.V. crop in 1968 - 69 or prior to that.

7.2 Crops Grown

Wheat was the most important crop on the selected farms and it occupied as high as 43.22 per cent of the gross cropped area. Its contribution was higher (49.72 per cent) in Gwalior district as compared to Tikamgarh district (34.31 per cent). Jowar was another important crop and formed 16.94 per cent of the cropped area on the selected farms. Comparatively it was more important in Tikamgarh district (23.62 per cent) than Gwalior district (12.07 per cent)

Paddy was next in importance claiming about 10 per cent of the cropped area : 13.47 per cent in Gwalior district and 5.65 per cent in Tikamgarh district.

Gram was the fourth important crop accounting for 9.96 per cent of the gross cropped area. The percentage of area covered by this crop was slightly higher in Gwalior district (11.04) than Tikamgarh district (8.47).

Among other crops pea, lentil and sugarcane were more important in Gwalior district whereas fikara (minor millet) and moong were important in Tikamgarh district (Table 7.5)

contd....

Table 7.5 Cropping pattern on selected farms

Crop	Gwalior		Tikamgarh		Total	
	Area (Hectares)	%	Area (Hectares)	%	Area (Hectares)	%
Paddy	31.87	13.47	9.76	5.65	41.63	10.18
Wheat	117.60	49.72	59.20	34.31	176.80	43.22
Jowar	28.54	12.07	40.78	23.62	69.32	16.94
Barley	6.40	0.17	3.49	2.02	3.89	0.95
Other millets	-	-	5.86	3.39	5.86	1.43
Total Cereals	178.41	75.43	119.09	68.99	297.50	72.72
& Millets						
Urd	0.82	0.35	19.57	11.34	20.39	4.98
Moong	0.47	0.20	4.68	2.71	5.15	1.26
Black Tur	-	-	2.38	1.38	2.38	0.58
Tur	0.52	0.22	-	-	0.52	0.13
Soybean	19.40	0.17	-	-	0.40	0.09
Lentil	6.27	2.65	4.08	2.36	10.35	2.58
Pea	7.69	3.25	-	-	7.69	1.88
Gram	26.11	11.04	14.62	8.47	40.73	9.96
Total Pulses	42.28	17.88	45.33	26.26	87.61	21.41
Til	-	-	2.83	1.64	2.83	0.69
Mustard	1.01	0.43	-	-	1.01	0.25
Linseed	3.08	1.30	3.11	1.80	6.19	1.52
Vegetables	-	-	2.17	1.26	2.17	0.53
Sugarcane	6.07	2.56	0.08	0.05	6.15	1.50
Fodder	5.67	2.40	-	-	5.67	1.38
Gross Cropped area	236.52	100.00	172.61	100.00	409.13	100.00

7.3 Area under Different Wheat Varieties

Of the total wheat area of 176.80 hectares 123.56 hectares (69.89 per cent) were under high yielding varieties. Among the various high yielding varieties Sonalika RR 21 and Sona were more popular. The variety ^{Sonalika} occupied as high as 49.21 per cent of the total wheat area in Tikamgarh and 32.69 per cent area in Gwalior. The variety RR 21 was cultivated in Gwalior only and occupied 15.14 per cent of the total wheat area. ^{Kalyan} Sona variety was cultivated in Tikamgarh only and formed 18.11 per cent of the area under wheat. Other varieties of some importance were HD1553 and Narmada-4 in Gwalior and Narmada-4 in Tikamgarh (Table 7.6).

Table 7.6 Area under different varieties of wheat, selected farms

Wheat varieties	Gwalior		Tikamgarh		Total	
	Area (Hectares)	%	Area (Hectares)	%	Area (Hectares)	%
Sonalika	38.44	32.69	29.13	49.21	67.57	38.22
RR 31	17.80	15.14	-	-	17.80	10.07
Kalyan sona	-	-	10.72	18.11	10.92	6.06
HD 1553	5.06	4.30	1.72	2.91	6.78	3.83
N.4	4.45	3.78	1.82	3.07	6.27	3.55
1593	3.23	2.75	-	-	3.23	1.83
227	2.43	2.07	0.40	0.68	2.83	1.60
281	2.83	2.41	-	-	2.83	1.60
Shera	1.42	1.21	0.51	0.86	1.93	1.09
Iarna	1.42	1.21	-	-	1.42	0.80
K. 68	1.01	0.86	0.40	0.68	1.41	0.80
327	-	-	0.40	0.68	0.40	0.23
AC	-	-	0.37	0.63	0.37	0.21
Total HYV	78.09	66.40	45.47	76.81	123.56	69.89
Local varieties	39.51	33.60	13.73	23.19	53.24	30.11
Total wheat	117.60	100.00	69.20	100.00	176.80	100.00

7.4 Recommended Inputs

The recommended practices given below are the results of the series of meetings and discussions between the scientists in the J.N.K.V.V. and the State, division and district level agricultural officers.

a. In the areas totally dependent on rainfall it is essential to conserve moisture in the soil. This can be done by constructing small contour bunds. It is also desirable to undertake deep ploughing once in three years. The land should be ploughed to a pulverised condition and levelled. If the soil is hard ploughing should be done after an irrigation. The levelling is essential for the even spread and control of irrigation water.

b. Seed should be treated with agrosan G.N. or Seroson.

c. It is also advisable to mix 25 kilogrammes of 10% B.H.C. powder per hectare in the soil at the time of harrowing.

d. The sowing time for areas having facilities for 2-3 irrigations is between 25th October and 15th November. The seed rate should be 100 to 125 Kg. per hectare and the row to row distance should be between 23-25 cm. In areas where adequate irrigation facilities are available the sowing should be done in the first half of November. However, sowing must be completed by 30th November.

e. In areas having facilities for 2-3 irrigations basal doses of 40 Kg N, 40 Kg P, and 20 Kg K per hectare be given. Additional 20 Kg N be given as top dressing at the time of first irrigation. In areas having adequate irrigation facilities a basal dose of 50 Kg N, 50 Kg P, and 30 Kg K, per hectare be given. This should be followed by top dressing of 25 Kg N at the time of first irrigation and another 25 Kg N at the second irrigation.

f. When facilities for two irrigations are available the first should be given at tillering and second at the pre-maturing stage. When sufficient irrigation water is available the first irrigation should be given 18-20 days after sowing. The second after 40-45 days, the third after 60-65 days, the fourth after 80-85 days the fifth 95-100 days and the last after 110-115 days.

g. Harvesting should be done as soon as the grains are ripe. Late harvesting may result in the shattering of grains.

7.5 Input Levels on Selected Farms

Gwalior District

In Gwalior, three farmers had given deep ploughing by iron plough about 3-4 years prior to reference year. Others ploughed the land by wooden plough only. Most of the farmers gave 2-3 ploughings. Harrowing was not given by those who ploughed the land more than 3 times. Others gave 3 harrowings and more. Leveller was used by 10 farmers only.

Nineteen farmers applied farm yard manure and the average quantity applied per hectare was 8 cart loads. None of the farmers treated the seed before sowing. Irrigation prior to sowing was given by half of the selected farmers and the average seed rate was 1.13 quintals per hectare.

It was noted that 62 per cent of the farmers used fertilizers. The fertilizers used were urea, super phosphate, muriate of potash, Gromor and diammonium phosphate. The basal dose consisted of 18 kg. N, 12 kg. P and 1 kg. K per hectare. As top dressing 29 kg. N were applied.

On 19 of the selected farms wheat was not irrigated at all and 1 farm gave only one irrigation. On 18 farms 2 irrigations were given and on 7 farms 3 irrigations were given. Four irrigations were given by only 4 farms and on only 1 farm facilities for 5 irrigations were available. Spraying or dusting was not done on any of the farms.

Tikamgarh District

In Tikamgarh district barring 2 farmers no one undertook deep ploughing. Seventeen farmers gave three ploughings and 15 farmers gave 2 ploughings. Harrowing was not done by half of the selected farmers and the land was levelled after giving repeated ploughings. The other half of the total number undertook harrowing to be followed by levelling by a wooden leveller.

Ten out of 50 farmers did not apply farm yard manure at all. For the remaining 40 farmers the quantity applied came to be 7.38 cart loads per hectare. As regards seed treatment it was noted that 3 farmers treated the seed with agrosan, 4 treated it with seroson and 3 mixed culture with the seed. As many as 36 of the selected farmers gave irrigation prior to sowing and the average seed rate was 1.14 quintals per hectare.

Seventy per cent farmers used fertilizers. The fertilizers were same as those used by Gwalior farmers. The average basal dose consisted of 26 kg N, 18 kg P and 7 kg K per hectare. In addition, 22 kg N were applied as top dressing. About the extent of irrigation it was observed that wheat was not irrigated on 11 farms. On one farm only one irrigation was given. Six farms irrigated the crop twice and eight farms could irrigate it three times. Five farms could give four irrigations and the remaining 19 farms gave 5 irrigations and more.

Like Gwalior farmers, spraying and dusting was not done by any farmer of this district.

7.6 Yields of H.Y.V. and Local Varieties

The average yield of high yielding varieties per hectare was 16.09 quintals : 13.85 quintals in Gwalior and 18.34 quintals in Tikamgarh. The yield of local varieties on the other hand was 8.97 quintals per hectare. Thus the yield of high yielding varieties was 79.38 per cent higher than the local varieties. In Gwalior district this percentage was 58.47 and in Tikamgarh district 100.66

(Table 7.7)

Table 7.7 Yields of high yielding and local varieties on the selected farms
(Yield-quintals per hectare)

District	Yield of local varieties	Yield of highyielding varieties	Difference of H.Y.V. yield over local varieties (Qtls)	Percentage
Gwalior	8.74	13.85	5.11	58.47
Tikamgarh	9.14	18.34	9.20	100.66
All farms	8.97	16.09	7.12	79.38

Yields of wheat during the previous years were also noted. This required stretching of memory on the part of the respondents and therefore the data were not very reliable. However, yields were reported to be higher by any where between 50 to 100 per cent in the case of individual farmers in all the previous years. Another point stressed by the selected farmers was that the yields of high yielding as well as local varieties were declining from year to year.

7.7 Yields on Government Farms and Farmers Fields

There is no State Government farm in Gwalior district. But there are three farms under the control

of J.N.K.Vishwa Vidyalaya. These are located at Gwalior Bagwai and Noorabad. None of them is a wheat farm. While Gwalior is the main Centre for millets and sub centre for jowar and fooder crops, Bagwai is the sub centre for paddy and sugarcane. Noorabad is a sub centre for citrus, mango and guava. In Tikamgarh district there are two State Government farms viz. Kundeshwar and Bamhori Barana. There is no JNKVV research centre or sub centre in the district. Among wheat varieties, Narmada-4,^{HD}1553 and Kalyan Sona were grown on both the farms. While varieties Raj 911, 1467, 1467 Fn and 1553 Fn were grown only on Bamhori Barana farm. varieties 1593, 1925 and NP 112 were grown on Kundeshwar farm only.

Data revealed that yields of Narmada-4,^{HD}1553 and Kalyan Sona were higher on Bamhori Barana farm than Kundeshwar farm (Table 7.8)

The selected farms grew only 4 out of the different varieties grown on the Govt. farms. They were : Kalyan Sona,^{HD}1553, N4 and 1593. It was observed that the yield of Kalyan Sona was higher on both the Govt Farms than the Farmers' fields. The yield of the variety^{HD}1553 was higher on Bamhori Barana farm than farmers' fields of both the districts. However, the yield of this variety was slightly lower on Kundeshwar farm than the farmers of Tikamgarh. In the case of Narmada 4 the yields on both the Govt. farms were lower than the farms of Tikamgarh district. The variety 1593 which was grown only on farms of Gwalior and on Kundeshwar farm did better on the latter (Table 7.9)

Table 7.9. Yield of wheat on Govt. farms and farmers' fields

Variety	Govt. farms		Farmers' Fields	
	Bamhori Barana	Kundeshwar	Gwalior	Tikamgarh
Kalyan Sona	26.34	24.71	-	19.97
1553	18.06	14.48	8.65	14.83
Narmada-4	11.12	4.20	10.50	13.59
1593	-	16.31	14.83	-

7.8 Farmers Views and Reasons for Adoption/Non Adoption

The farmers of both the districts were convinced about the superiority of the high yielding varieties over local varieties. They were also aware of the importance of the use of recommended practices.

However, there were strong limitations to the adoption of the recommended practices, particularly about the fertilizer doses. The first and the foremost limitation was irrigation. Not only sufficient number of irrigations were not possible but also it was not timely. Farmers felt very strongly against continuous and excessive use of fertilizers. Due to the diminishing rate of application of F.Y.M., which in turn was due to diminishing pasture land, farmers reduced the rate of fertilizer application.

Farmers also expressed that the seed should be changed after every two years and felt that the quality was deteriorating. The change of seed was however not possible for many reasons. A large number of the selected

Table 7.8 Input and output per hectare on Govt. Farms in Tikamgarh district, 1976-77

Particulars	Bamhorl Barana										Kundeshwar									
	Variety					Variety					Variety					Variety				
Seed rate (kg)	123.55	98.84	98.84	98.84	98.84	123.55	164.57	135.91	98.84	123.55	123.55	123.55	135.91	123.55	123.55	123.55	123.55	123.55	123.55	123.55
Basal dose (kg)N	24.71	49.42	24.71	24.71	24.71	49.42	49.42	49.42	49.42	34.59	79.03	79.03	79.03	79.03	79.03	79.03	79.03	79.03	79.03	79.03
P	37.07	74.13	37.07	37.07	37.07	74.13	74.13	74.13	74.13	24.71	59.31	69.19	61.78	24.71	49.42	37.07	24.71	49.42	37.07	24.71
K	19.77	37.07	19.77	19.77	19.77	37.07	37.07	37.07	37.07	22.24	32.12	37.07	39.54	19.77	29.65	19.77	19.77	29.65	19.77	19.77
Top dressing N	24.71	49.42	24.71	24.71	24.71	49.42	49.42	49.42	49.42	-	19.77	19.77	19.77	19.77	19.77	19.77	19.77	19.77	19.77	19.77
No. of Irrigations	2	5	3	3	3	5	5	5	5	-	4	5	2	2	5	2	2	5	2	5
Production (Qtls.)	11.12	12.85	10.87	12.85	12.85	26.56	26.56	26.56	26.56	4.26	16.31	19.15	14.48	17.30	24.71	11.12	12.85	10.87	12.85	11.12
By product	21.00	22.24	17.30	18.53	18.53	37.07	37.07	37.07	37.07	5.21	16.33	19.15	13.24	21.62	24.71	21.00	22.24	17.30	18.53	21.00

farmers complained that the prices of fertilizers were too high to use them profusely.

Thus, although the farmers were convinced about the qualities of high yielding varieties such as high yields, short duration, resistance to lodging, responsiveness to fertilizers, etc. the reasons for non adoption or partial adoption were mainly the inadequate and untimely irrigation and the resultant restrained use of fertilizers.

As the conditions/reasons varied between villages it was thoughtuseful to describe these village-wise.

Simaria Kalan

The wheat crop in the village was canal irrigated and irrigation was not available at a proper time. It was specially needed at presowing time. Due to non-availability of adequate irrigation local varieties were grown, There was shortage of farm yard manure. This was due to dwindling area under pastures. There was also a need for good quality seed. Farmers complained about the high prices of fertilisers and indicated this to be the reason for not using recommended doses. There was a section of farmers pleading that heavy application of fertilizers resulted in deterioration of soil fertility. Farmers were of the opinion that the seed be changed more often.

Janakpur

This village, like Simariya Kalan, received irrigation from Harsi canal. The Farmers opined that due to untimely and irregular water supply they were not able to apply recommended doses of fertilizers.

The other important reason was that the fertilizer prices were high. The wheat crop received only two irrigations. The villagers were of the opinion that the fertility of the land was poor, the reason being the repeated application of fertilizers without supplementing it by farm-yard manure. The villagers also felt that seed need be changed after every two years.

Chandrol

This village is bordering Uttar Pradesh and got irrigation water from a dam in that state. The water supply was both inadequate and untimely. The soil fertility was also poor. This village was therefore a single crop area. As many as 6 out of 13 farmers had never grown H.Y.V. due to these two reasons.

Tigra Kalan

This village, like Chandrol, got irrigation from a canal drawn from a dam in Uttar Pradesh. The water shortage was more severe in this village as it was farther downstream. A few fields were also infested by Kans and the soil was not fertile.

Hira Nagan

In this village wheat crop^{was} affected by hailstorm resulting in shrivelled grains. The village had no jungle nearby so the dung was used in place of firewood. This resulted in less quantity of manure. The farmers were aware of the usefulness of full dose of fertilizers and the use of green manure. But the shortage of irrigation discouraged the use of full dose and double cropping detracted the cultivation of green manure crop. The farmers

complained of the decreasing yield and attributed it to the poor seed quality. The farmers were convinced about usefulness of deep ploughing but were not able to undertake it due to high cost.

Ganeshganj

The wheat crop in this village was also affected by hailstorm. For irrigation the village depended on canal drawn from a tank, 5 km. away. In the reference year only 2-3 irrigations were possible and these were not timely. Due to this, the farmers spread the available quantity of fertilizers over larger area resulting in the lowering of the dose. The village had 32 hectares of pasture land. This was distributed for cultivation to the landless resulting in disincentive to domesticate cattle, the source of manure.

Palera Khas

This village was practically devoid of irrigation facilities. Mainly kharif crops were grown. In rabi season large tracts remained fallow. This was the reason for a very low off-take of fertilizers in the village. High yielding varieties of wheat were grown with farm yard manure only.

Bamhori Kalan

This was another village having negligible irrigation facilities. Many of the selected farmers, there^{varieties} fore, grew only local wheat. Others grew H.Y.V. without fertilizers. Some of them discontinued growing H.Y.V. for want of irrigation facilities.

Appendix Table A 2.1 Cropped area and H.Y.V. area under different crops, Madhya Pradesh 1966-67 to 1975-76

Area-thousand hectares									
1966-67									
67-68									
68-69									
Crop	Total area of the crop	Area under H.Y.V.	% of H.Y.V. to total area of the crop	Total area of the crop	Area under H.Y.V.	% of H.Y.V. to total area of the crop	Total area of the crop	Area under H.Y.V.	% of H.Y.V. to total area of the crop
Paddy	4177	32.6	0.78	4168	91.2	2.19	4312	121.6	2.82
Wheat	2126	8.1	0.38	2658	45.6	1.72	3011	82.1	2.73
Jowar	2277	0.6	0.03	2505	19.5	0.78	2374	25.3	1.07
Maize	550	16.1	2.93	591	20.7	3.50	590	20.3	3.44
Bajra	248	0.3	0.12	284	4.1	1.44	242	7.8	3.22
Total -	9378	57.7	0.62	10206	181.1	1.77	11529	257.1	2.44
Contd....Appendix Table A 2.1									
1969-70									
Crop	Total area of the crop	Area under H.Y.V.	% of H.Y.V. to total area of the crop	Total area of the crop	Area under H.Y.V.	% of H.Y.V. to total area of the crop	Total area of the crop	Area under H.Y.V.	% of H.Y.V. to total area of the crop
Paddy	4353	209.0	5.80	4383	276.0	6.30	4525	400.0	8.84
Wheat	3348	149.3	4.46	3403	201.0	5.91	3665	290.0	7.91
Jowar	2309	33.1	1.43	2178	56.5	2.59	1965	80.0	4.07
Maize	581	21.1	3.63	591	21.1	3.57	597	20.0	3.35
Bajara	232	8.9	3.84	222	8.1	3.65	198	12.0	6.06
Total	10823	421.6	3.90	10777	562.7	5.22	10950	802.0	7.32

Appendix Table A. 2.1 Contd.....

1972-73					
Crop	Total area	Area under	% of H.Y.V. to total area	Total area	Area under
	of the crop.	H.Y.V.		of the crop.	H.Y.V.
Paddy	4546	497.4	10.94	4544	801.4
Wheat	3277	436.6	13.32	3273	632.1
Jowar	2225	122.0	5.48	2037	181.3
Maize	624	30.8	4.94	624	40.1
Bajra	224	13.7	6.12	219	20.2
Total	10896	1100.5	10.10	10697	1675.2
15.66					
1973-74					
Crop	Total area	Area under	% of H.Y.V. to total area	Total area	Area under
	of the crop.	H.Y.V.		of the crop.	H.Y.V.
Paddy	4526	900.0	19.89	4588	1150.0
Wheat	2788	725.0	26.00	3361	803.1
Jowar	2105	210.0	9.98	1980	250.0
Maize	657	50.0	7.61	649	50.0
Bajra	181	23.0	12.71	198	27.0
Total	10257	1908.0	18.60	10776	2280.0
21.16					

Appendix Table A 2.1 Contd.....

1974-75					
Crop	Total area	Area under	% of H.Y.V. to total area	Total area	Area under
	of the crop.	H.Y.V.		of the crop.	H.Y.V.
Paddy	4526	900.0	19.89	4588	1150.0
Wheat	2788	725.0	26.00	3361	803.1
Jowar	2105	210.0	9.98	1980	250.0
Maize	657	50.0	7.61	649	50.0
Bajra	181	23.0	12.71	198	27.0
Total	10257	1908.0	18.60	10776	2280.0
21.16					

Appendix Table A 2.2 Area under H.Y.V.P. in different districts in 1975-76

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Paddy		Wheat		Jowar		Maize		Baajra	
Area in Name of the district		Area in Name of the district		Area in Name of the district		Area in Name of the district		Area in Name of the district	
Hectares		thousand hectares		thousand hectares		thousand hectares		thousand hectares	
1.	Raipur D.N.	321.5	Blind	74.7	Khar gone	29.7	Mandsaur	13.0	Morena
2.	Bilaspur	222.3	Morena	52.9	Mandsaur	25.7	Sarguja	4.7	Bhind
3.	Durg	141.0	Mandsaur	48.5	Dewas	20.9	Dhar	4.1	Khar gone
4.	Surguja	98.0	Gwalior	47.3	Khandwa	18.5	Khar gone	2.8	Jhabua
5.	Raigarh	82.6	Tikamgarh	42.4	Ujjain	17.6	Ratlam	2.8	Dhar
6.	Balaghat	74.7	Indore	26.9	Shajapur	17.3	Jhabua	2.6	Ujjain
7.	Rajnandgaon	64.3	Chhattarpur	26.9	Guna	15.4	Ujjain	2.5	Total
8.	Bastar	20.6	Shajapur	24.4	Ratlam	13.5	Indore	2.3	Total of others 1.4
9.	Seoni	15.1	Sidhi	22.6	Dhar	13.2	Gwalior	1.8	having less than one thousand hectares.
10.	Mandla	13.7	Rewa	22.3	Indore	10.2	Shivpur	1.5	Total
11.	Jabalpur	13.5	Jabalpur	22.2	Betul	9.8	Sidhi	1.5	one thousand hectares.
12.	Gwalior	10.3	Ujjain	21.2	Chhindwara	8.6	Raigarh	1.4	Total
13.	Satna	8.9	Betul	20.9	Narsinghpur	6.0	Dewas	1.4	Total
14.	Rewa	8.2	Chhindwara	20.7	Bhopal	5.9	Bilaspur	1.3	Total
15.	Shahdol	7.2	Shivpur	20.5	Raigarh	4.8	Guna	1.2	Total
16.	Bhind	6.5	Bilaspur	19.7	Sehore	4.3	Betul	1.2	Total
17.	Sidhi	6.4	Hoshangabad	19.2	Shivpur	4.2	Chhindwara	1.1	Total
18.	Damoh	4.2	Sarguja	17.5	Gwalior	3.1	Total	47.2	Total
19.	Narsinghpur	3.0	Dhar	15.8	Hoshangabad	2.9	Total	47.2	Total
20.	Chhindwara	2.9	Raipur	15.4	Vidisha	2.8	Total of others 2.8		hewing less than one thousand hectares
21.	Chattarpur	2.4	Narsinghpur	15.2	Datta	2.7			
22.	Morena	2.2	Ratlam	14.8	Raisen	2.6			
23.	Raisen	2.2	Raisen	14.0	Jhabua	2.5			
24.	Hoshangabad	2.0	Dewas	13.8	Jabalpur	1.5			
25.	Panna	1.9	Raigarh	13.4	Tikamgarh	1.3			

CHAPTER VIII

SUMMARY

The High Yielding Varieties Programme completed 10 years of operation in 1975-76. The Directorate of Economics & Statistics, Ministry of Agriculture & Irrigation thought it useful to evaluate its performance in the different states through various Agro-Economic research Centres. This Centre was asked to conduct the study for wheat crop. The objective was to know the share of H.Y.V. Programme in the growth of output of cereals, the factors responsible for the deacceleration of the growth rates and the components of inputs to which the growth in yield over the last ten years could be attributed. At the farmer's level, it was intended to know the distribution of area under the crop among specific varieties, the difference between the yields of high yielding and local varieties and the farmers views on the varieties and the reasons for non-adoption of H.Y.Vs.

On the basis of the available data, it was observed that H.Y.V. programme had resulted in a lot of better area in all other districts. In the case of two districts were selected, Gwalior and Tikamgarh districts which had the highest percentage of H.Y.V. area to total wheat area were selected for the study. In each district two blocks - one with the highest percentage of H.Y.V. area and the other with the lowest percentage had to be selected. Thus in Gwalior district Dabra (highest percentage of H.Y.V.) and Bhandar (lowest percentage of H.Y.V.) were

Appendix Table A. 2.1 Contd.....

1972-73					
Crop	Total area of the crop.	Area under H.Y.V.	% of H.Y.V. to total area of the crop.	Total area of the crop.	Area under H.Y.V.
Paddy	4546	497.4	10.94	4544	801.4
Wheat	3277	436.6	13.32	3273	632.1
Jowar	2225	122.0	5.48	2037	181.3
Maize	624	30.8	4.94	624	40.1
Bajra	224	13.7	6.12	219	20.2
Total	10896	1100.5	10.10	10697	1675.2
					15.66

73-74

Appendix Table A 2.1 Contd.....

1974-75					
Crop	Total area of the crop.	Area under H.Y.V.	% of H.Y.V. to total area of the crop.	Total area of the crop.	Area under H.Y.V.
Paddy	4526	900.0	19.89	4588	1150.0
Wheat	2788	725.0	26.00	3361	803.4
Jowar	2105	210.0	9.98	1980	250.0
Maize	657	50.0	7.61	649	50.0
Bajra	181	23.0	12.71	198	27.0
Total	10257	1908.0	18.60	10776	2280.0
					21.16

Appendix Table A 2.2 Area under H.Y.V.P. in different districts in 1975-76

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Paddy		Wheat		Jowar		Maize		Bajra	
Name of the Area in thousand district	Hectares	Name of the Area in thousand district	hectares	Name of the Area in thousand district	hectares	Name of the Area in thousand district	hectares	Name of the Area in thousand district	hectares
1. Raipur D.N.	321.5	Bhind	74.7	Khar gone	29.7	Mandsaur	13.0	Morena	13.0
2. Bilaspur	222.3	Morena	52.9	Mandsaur	25.7	Sarguja	4.7	Bhind	5.9
3. Durg	141.0	Mandsaur	48.5	Dewas	20.9	Dhar	4.1	Khar gone	4.2
4. Surguja	98.0	Gwalior	47.3	Khandwa	18.5	Khar gone	2.8	Jhabua	1.4
5. Raigarh	82.6	Tikamgarh	42.4	Ujjain	17.6	Ratlam	2.8	Dhar	1.1
6. Balaghat	74.7	Indore	26.9	Shajapur	17.3	Jhabua	2.6		
7. Rajnandgaon	64.3	Chhattarpur	26.9	Guna	15.4	Ujjain	2.5	Total	25.6
8. Bastar	20.6	Shajapur	24.4	Ratlam	13.5	Indore	2.3	Total of others 1.4	
9. Seoni	15.1	Sidhi	22.6	Dhar	13.2	Gwalior	1.8	having less than one thousand hectares.	
10. Mandla	13.7	Rewa	22.3	Indore	10.2	Shivpur	1.5	Total	27.0
11. Jabalpur	13.5	Jabalpur	22.2	Betul	9.8	Sidhi	1.5		
12. Gwalior	10.3	Ujjain	21.2	Chhindwara	8.6	Raigarh	1.4		
13. Satna	8.9	Betul	20.9	Narsinghpur	6.0	Dewas	1.4		
14. Rewa	8.2	Chhindwara	20.7	Bhopal	5.9	Bilaspur	1.3		
15. Shahdol	7.2	Shivpur	20.5	Raigarh	4.8	Guna	1.2		
16. Bhind	6.5	Bilaspur	19.7	Sehore	4.3	Betul	1.2		
17. Sidhi	6.4	Hoshangabad	19.2	Shivpur	4.2	Chhindwara	1.1		
18. Damoh	4.2	Sarguja	17.5	Gwalior	3.1	Total	47.2		
19. Narsinghpur	3.0	Dhar	15.8	Hoshangabad	2.9	Total of others 2.8			
20. Chhindwara	2.9	Raipur	15.4	Vidisha	2.8	nowing less than one thousand hectares			
21. Chattarpur	2.4	Narsinghpur	15.2	Datta	2.7	Total	50.0		
22. Morena	2.2	Ratlam	14.8	Raisen	2.6				
23. Raisen	2.2	Raisen	14.0	Jhabua	2.5				
24. Hoshangabad	2.0	Dewas	13.8	Jabalpur	1.5				
25. Panna	1.9	Raigarh	13.4	Tikamgarh	1.3				

Appendix Table A 2.2 Contd.....

Paddy			Wheat			Jowar		
Name of the district.	Area in thousand hectares.	Name of the district.	Area in thousand hectares.	Name of the district.	Area in thousand hectares.	Name of the district.	Area in thousand hectares.	Name of the district.
Shivpuri	26.	Sagar	12.1	Satna	1.2			
Betul	27.	Balaghat	11.2					
Shajapur	28.	Khandwa	10.8					
Tikamgarh	29.	Mandla	10.6					
Datta	30.	Sehore	10.4					
Sagar	31.	Total	708.4	Total of others having less than one thousand hectares	3.8	Total	246.2	Total
Total		1145.2	Total of others having less than one thousand hectares.		95.0	Total		250.0
Total		1150.0	Total		803.0			

CHAPTER VIII

SUMMARY

The High Yielding Varieties Programme completed 10 years of operation in 1975-76. The Directorate of Economics & Statistics, Ministry of Agriculture & Irrigation thought it useful to evaluate its performance in the different states through various Agro-Economic research Centres. This Centre was asked to conduct the study for wheat crop. The objective was to know the share of H.Y.V. Programme in the growth of output of cereals, the factors responsible for the deceleration of the growth rates and the components of inputs to which the growth in yield over the last ten years could be attributed. At the farmer's level, it was intended to know the distribution of area under the crop among specific varieties, the difference between the yields of high yielding and local varieties and the farmers views on the varieties and the reasons for non-adoption of H.Y.Vs.

On the basis of the available data, it was observed that Dabra with one variety was producing a much better than all other districts. The number of varieties cultivated were selected. Gwalior and Tikamgarh districts which had the highest percentage of H.Y.V. area to total wheat area were selected for the study. In each district two blocks- one with the highest percentage of H.Y.V. area and the other with the lowest percentage had to be selected. Thus in Gwalior district Dabra (highest percentage of H.Y.V.) and Bhandar (lowest percentage of H.Y.V.) were

blocks were selected . In Tikamgarh district the block with the highest H.Y.V. percentage was Tikamgarh and the one with the lowest H.Y.V. percentage was Palera. Those were selected for the study. In each of the selected blockstwo villages were purposively selected.

For the selection of farmers the list of farmers in a selected village was stratified in 6 groups having equal number of farmers and from each group 2 farmers were selected. In addition, one farmer was selected from any one of the pair of villages of a block so as to have 25 farmers in a block. Thus the total number of farmers for the study was 100. The reference year was agricultural year 1976-77 .

8.2 In M.P. the coverage of H.Y.V.P. of paddy, wheat, jowar, bajra and maize together was 57,700 hectares or only 0.32 per cent of the gross cropped area and 0.62 per cent of the area under the crops mentioned above. In the last year of the programme the area increased to 22,80,000 hectares or in other words the average rate of growth was 435 per cent for the ten year period.

The increase was highest in the case jowar and lowest in the case of maize. However the more important H.Y.V. crops were paddy, jowar and wheat.

In 1966-67 the total production of cereals and millets in the state was 5,223 thousand tonnes. It fluctuated during the reference year and was 9,461 thousand tonnes in 1975-76. The total production of high yielding varieties, however, increased from year to year except in 1974-75. The net growth in production of H.Y.V.

crops during the nine year period was 830 thousand tonnes. The net increase in the production was shared by high yielding varieties to the extent of 400.00 per cent, but this surplus was offset due to the deficit in the production of local varieties to the extent of 300.00 per cent.

8.3 Wheat is an important crop of the state and occupied 15.74 per cent of the gross cropped area. The production of this crop was 22.91 per cent of the total food production of the state. The coverage under the H.Y.V. of wheat :

in the first year of the programme was only 3,100 hectares. It reached a record level of 8,03,000 hectares in the last year (1975-76) of the reference period. Thus the coverage in the last year was about 100 times that of the first year.

The total area under the wheat crop during 1966-67 was 21,26,000 hectares. It increased to 33,61,000 hectares in 1975-76 . The average rate of increase was 3.82 percent. The production was 10,31,000 tonnes in 1966-67. In the last year of the reference period it was 27,50,000 tonnes. The average rate of growth was 13.06 per cent. The yield per hectare was 505 kilogrammes in 1966-67. In 1975-76 it stood at 854 kilogrammes per hectare. The average rate^{cf}/growth was 5.93 per cent.

The rates of growth for area, production and yield were highest in 1971-72. The deacceleration of growth rates was more pronounced after 1971-72. The rainfall was the dominant factor responsible for the deacceleration of growth rates of wheat.

8.4 In order to know the possible inputs to which the growth in yield of wheat over the last ten years could be attributed and to estimate the extent of their linear effect the multiple regression analysis was done. It was observed that growth in yield could be attributed mainly to rainfall and the area under high yielding varieties.

8.5 The research work in the state on wheat is done at different research stations by the J.N.Krishi Vishwa Vidyalaya, Jabalpur. During 1975-76 about 500 strains were sown in crossing blocks. The Vishwa Vidyalaya has evolved many important varieties of wheat for different agro-climatic regions of the State.

8.6 The villages selected in Gwalior district were Siaria and Janakpur in Dabra block and Tigara_kalan and Chandrol in Bhander blocks. From Tikamgarh district villages Hiranagar and Ganshganj were selected from Tikamgarh block and Palera Khas and Barhori Kalan were selected from Palera block.

8.7 On the selected farms, wheat occupied 43.22 per cent of the gross cropped area. The percentage was 49.72 for Gwalior and 34.31 for Tikamgarh. The high yielding varieties occupied 69.89 per cent of the total wheat area. Among the different high yielding varieties Sonalika, RR-21 and Kalyan Sona were more popular. Other popular varieties were HD 1553 and Narmada-4 in Gwalior and Narmada 4 in Tikamgarh.

In both the districts the levels of inputs were far lower than the recommended doses. The average yield of high yielding varieties per hectare was 16.09 quintals: 13.85 quintals in Gwalior and 18.34 quintals in Tikamgarh. The yield of local varieties, on the other hand, was 3.97 quintals per hectare.

It was noted that the yield of Kalyan Sona was higher on the Govt. farms than the farmers' fields. In the case of Narmada-4 the yields on both the Govt. farms were lower than the farmers fields of Tikamgarh district.

The farmers of both the districts were convinced about the higher yields of high yielding varieties over local varieties. They were also aware of the importance of using recommended doses and practices. However, there were serious limitations to adopting the recommended doses, particularly those of the fertilizers. The most important limitation was irrigation. Secondly, due to the diminishing rate of application of ^{the} F.Y.M. farmers had reduced the rate of fertilizer application.

Farmers expressed that the seed need be changed after every two years. They also complained about the high prices of fertilizers.
