Ad-hoc Study No.53

STUDY OF
FERTILISER CONSUMPTION
IN
MADHYA PRADESH

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I N T R O D U C T I O N

Fertiliser is an important input in agriculture. With the introduction of high yielding varieties in the sixties the fertiliser consumption in the country increased tremendously as the new varieties were highly responsive to fertiliser use. With the introduction of new technology for dryland agriculture the fertiliser use has increased even in the unirrigated areas. The production of fertilisers within the country is not enough to meet the increasing consumption and therefore the imports are resorted to. However, the demand of fertilisers is not uniform in all the states. It also varied with the crop seasons and the type of crops grown.

Further, there is a consistent demand from the farmers that the prices of fertilisers be reduced to arrest the increasing cost of cultivation. Their plea is that the prices of inputs like fertilisers have increased more than the proportionate increase of prices of foodgrains.

Ministry of Agriculture & Rural Development, Government of India constituted a high level committee to study the fertiliser consumption prices under the Chairmanship of Mr. G.V.K. Rao.

In the meeting of the officers-in-charge of the Agro-Economic Research Centres, the Institutes and the ADRT Unit, Bangalore, held on 16th & 17th September, 1985, it was decided that all the ten Agro-Economic Research Centres and the ADRT Unit, Bangalore, would undertake the study on "The use of Fertilisers". The study was to be conducted by utilising the data collected under the "Comprehensive Scheme for studying the cost of cultivation of principal crops" in the respective states.

1.1 Objective

The objective of the study was to know the use of fertilisers cropwise and regionwise.

1.2 Methodology

1.2.1 The Data

As mentioned earlier, data collected under the Comprehensive Scheme for studying the cost of cultivation of principal crops was to be used. It was felt that the data would be adequate enough to meet the Committee's needs and there was no need of extra field work.

For the present study data collected for Madhya Pradesh by the Department of Agricultural Economics & Farm Management Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur were used.

1.2.2 Schedules

The schedules which were subjected to analysis were following.

A. Village Schedule

1. Form-I General Condition of Cultivation in the village.
2. Village Form V.D. Prices of Important Agricultural Produce.
3. The form relating to inputs at the village level.

B. Compilation Forms

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C.F.3.1 Land Owned

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However, village schedule 3 and compilation forms C.F.8.2, 11.1 and 11.2 were not available.

1.2.3 Reference Year

The reference years of the data was 1983-84

1.2.4 Method of Tabulation

The data for individual farms were available in different schedules. The data were subsequently compiled in compilation sheets for each cluster of villages.

These were, thereafter, tabulated for the districts, zones and the state as a whole.

1.2.5 The Sample size

During 1983-84 the number of farmers included in the survey was 431. They were spread in 40 tehsils of 33 districts. While 26 districts had one tehsil each in the sample, 7 districts, namely, Mandsaur, Ujjain, Dhar, Khandwa, Khargone, Dewas and Shajapur had two tehsils in the sample.

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C H A P T E R-II

FERTILISER CONSUMPTION IN INDIA AND MADHYA PRADESH

There has been a consistent growth in the consumption of fertilisers in the country since the beginning of the planning era in 1951-52, with the exception, however, of two years viz. 1960-61 and 1974-75 registering a negative rate of growth.

The data on fertiliser consumption reveals that the average rate of growth per annum in terms of percentage has been declining even though the average rate per annum in absolute terms has been increasing continuously. (Table 2.1)

Table 2.1 Consumption of fertiliser nutrients (N+P+K) in 1955-56, 1965-66, 1975-76 & 1984-85

Year	Consumption ('000 tonnes)	Average change per annum over previous quoted year	
		In absolute terms ('000 tonnes)	Average rate of growth (percent)
1955-56	130.8	-	-
1965-66	784.6	65.4	50.0
1975-76	2,893.7	210.9	27.0
1984-85	8,373.8	608.9	21.0

Source- Fertiliser News, Vol.38 No.8 pp.81

2.1 Fertiliser Consumption in India

If we consider the fertiliser consumption during the six year period prior to the reference year it is observed that there was deceleration in fertiliser consumption during the four years from 1979-80 to 1982-83. The year 1979-80 recorded the lowest rate of growth of 2.7 per cent over the previous year. It may be recalled that the year 1979-80 witnessed the severest drought of the century. The country, during the following 3 years viz.1980-81 to 1982-83 continued to reel under the poor weather conditions.

Besides the poor crop seasons, there was a steep increase in prices of fertilisers in June, 80 and July, 81. Thus the growth rates were low during this period due to twin reasons of bad weather and high prices of fertilisers. The year 1981-82 was an exceptional year when the consumption recorded 10 per cent growth rate despite aberrant weather conditions and increase in fertiliser prices, because of various factors like introduction of Block Delivery Scheme, improved product availability and intensification of promotion campaigns which seemed to have played an important role during this year.

With each year, area under irrigation and HYV increasing successively, the growth rates set at higher levels even during unfavourable weather conditions. The year 1983-84 witnessed a big quantum jump in fertiliser consumption with a growth rate of 20.4 per cent over the previous year because of a number of favourable factors like good weather, increase in area under irrigation and H.Y.V., increased product availability, reduction in fertiliser prices, improved profitability in fertiliser use supported by other promotional and extension measures like intensification of IFPC and NAIF. (Table 2.2)

Table 2.2 Growth of consumption of fertiliser nutrients (N+P+K) during 1978-79 to 1983-84 and major factors thereof

Year	Percent change in consumption over the previous year	Major Factors							
		Weather	Area under irrigation	Area under H.Y.V.	Excise duty	Availability	Fertiliser prices	Input output price relationship	Promotion campaign
1978-79	19.4	good	Increased	Increased	Reduced	-	-	Improved	Increased
1979-80	2.7	poor	-- do --	Decreased	-	Inadequate domestic production	-	-- do --	-
1980-81	5.0	poor	-- do --	Increased	Withdrawn	Very heavy imports	Steep increase	Worsened	-
1981-82	10.0	poor	-- do --	-- do --	-	Increase in imports and increase in domestic production	Further increased	-- do --	Block Delivery System Introduced
1982-83	5.3	poor	-- do --	-- do --	-	Increase in domestic production Diminished imports	-	Improved	Further Improved
1983-84	20.4	good	-- do --	-- do --	-	Marginal increase in domestic production and nominal increase in imports	Reduced	-- do --	-- do --

Source : Fertiliser News Vol.38 No.8 p.83

2.2 Fertiliser Consumption in M.P.

Madhya Pradesh is the biggest state of the country and agriculture is the chief occupation of the people. However, in the matter of fertiliser consumption the state is far behind the other states. In 1983-84 the total fertiliser consumption in the country was 7,710.1 thousand tonnes. The share of this state was 315.0 thousand tonnes or only 4.08 per cent of the country's consumption.

It ranked tenth among 19 states. Only 4 states, of substantial size, viz. Bihar, Rajasthan, Kerala and Orissa ranked lower to M.P. (Table 2.3)

Table 2.3 Consumption of N.P.K. fertilisers in different states, 1983-84

(Figures- thousand tonnes)

Rank	State	Consumption of N.P.K.	Percentage to total
1.	Uttar Pradesh	1642.9	21.31
2.	Punjab	991.7	12.86
3.	Andhra Pradesh	908.6	11.78
4.	Maharashtra	642.0	8.33
5.	Tamil Nadu	586.8	7.61
6.	Gujrat	502.3	6.51
7.	Karnataka	487.2	6.32
8.	West Bengal	369.2	4.81
9.	Haryana	326.1	4.23
10.	Madhya Pradesh	315.0	4.08
11.	Bihar	292.3	3.81
12.	Rajasthan	209.7	2.72
13.	Kerala	129.5	1.68
14.	Orissa	103.0	1.33
15.	Himachal Pradesh	19.1	0.25
16.	Assam	17.3	0.22
17.	Jammu & Kashmir	16.5	0.21
18.	Manipur	4.4	0.06
19.	Meghalaya & Tripura	6.2	0.08
20.	Others	140.3	1.80
	Total :-	7,710.1	100.00

Source : Fertiliser News Vol.30 No.8 page 116

Not only the total consumption of fertilisers was low but also the consumption per unit of gross cropped area was quite low in M.P. While the average consumption of N.P.K. was 44.9 kg. per hectare for the country, that for this state was only 14.6 kg. per hectare. Thus the state ranked 15th among the 21 states of the country by this criterion. (Table 2.4)

Table 2.4 Consumption of plant nutrients per hectare of gross cropped area

(Figures kg/hectare)

Rank	State	Consumption per hectare (kg)
1.	Punjab	149.3
2.	Tamil Nadu	86.7
3.	Andhra Pradesh	69.2
4.	Uttar Pradesh	68.3
5.	Haryana	59.2
6.	Gujarat	46.9
7.	Karnataka	45.4
8.	Kerala	45.4
9.	West Bengal	45.2
10.	Jammu & Kashmir	36.7
11.	Maharashtra	31.8
12.	Bihar	26.6
13.	Manipur	21.0
14.	Himachal Pradesh	19.3
15.	Madhya Pradesh	14.6
16.	Orissa	13.1
17.	Meghalaya	11.9
18.	Rajasthan	11.8
19.	Tripura	9.6
20.	Assam	5.3
21.	Nagaland	1.8
	All India	44.9

Source : Agricultural Statistics, M.P., 1984, pp.249

It was, however, noted that the consumption of fertilisers in the state increased from year to year. While it was only 2.96 thousand tonnes in 1956-57 it increased to 315.00 thousand tonnes in 1983-84 (See Appendix table A 2.1)

During the last ten years (base 1974-75= 100) it recorded an increase of 217.73 per cent. Except for the year 1979-80 which, as observed earlier, happened to be a very poor crop year all over the country, the consumption of fertilisers increased from year to year.

The percentage change in consumption over the previous year for the ten year period indicated a somewhat similar trend to that observed for the country as a whole. The highest percentage increase was observed in 1983-84. Similarly the lowest (rather negative growth) percentage was recorded in 1979-80. (Table 2.5)

Table 2.5 Growth of Fertiliser consumption in M.P., 1974-75 to 1983-84

Year	Fertiliser consumption (thousand tonnes)	Index (Base 1974-75=100	% change inconsumption over the previous year
1974-75	99.14	100.00	-
1975-76	113.12	114.10	14.10
1976-77	136.53	137.71	20.69
1977-78	159.09	160.47	16.52
1978-79	192.59	194.26	21.06
1979-80	159.64	161.02	(-) 17.11
1980-81	198.05	199.77	24.06
1981-82	238.27	240.34	20.31
1982-83	243.39	245.50	2.15
1983-84	315.00	317.73	29.42

The proportion of nitrogen, phosphorus and potash was 9:5:1 in 1983-84. It was 8:4:1 in the preceding four years (1979-80 to 1982-83) and 9:4:1 in 1978-79. During the three years viz. 1975-76 to 1977-78 the proportion of N and P slightly increased so that it was 13:5:1, 12:5:1 and 12:5:1 respectively. In 1974-75 the proportion was 9:4:1 (Table 2.6) (See also appendix table A 2.1)

Table 2.6 Nutrientwise consumption of fertilisers in M.P., 1974-75 to 1983-84

(Unit- thousand tonnes)

Year	N	P	K	Total	NPK Ratio
1974-75	62.46	29.50	7.18	99.14	9:4:1
1975-76	77.04	29.98	6.10	113.12	13:5:1
1976-77	90.66	38.59	7.28	136.53	12:5:1
1977-78	99.69	49.49	9.91	159.09	12:5:1
1978-79	121.44	57.78	13.37	192.59	9:4:1
1979-80	96.98	49.94	12.72	159.64	8:4:1
1980-81	122.31	59.76	15.98	198.05	8:4:1
1981-82	145.18	73.97	19.12	238.27	8:4:1
1982-83	147.97	77.10	18.32	243.39	8:4:1
1983-84	189.00	105.00	21.00	315.00	9:5:1

The seasonwise consumption of fertilisers showed that in 1983-84, of the total consumption of 315.00 thousand tonnes, 210.64 thousand tonnes was in rabi and the remaining 104.36 thousand tonnes was in kharif. Thus rabi crops shared about 2/3 quantity and the kharif crops, the 1/3. (Table 2.7)

Table 2.7 Seasonwise consumption of fertilisers in M.P., 1983-84

Season	Consumption in thousand tonnes	Percentage to total
Kharif	104.36	33.13
Rabi	210.64	66.87
Total	315.00	100.00

The proportion of consumption in rabi varied between 57 in 1979-80 to 72 in 1976-77. It was more than 60 in most of the years (Table 2.8)

Thus rabi crops were more important than kharif crops as far as the consumption of fertilisers was concerned.

Similar proportion was observed in individual N P K nutrient consumption also (see appendix table A 2.2)

2.3 Fertiliser Consumption in Different Districts

As mentioned earlier the total consumption of fertilisers was 315.00 thousand tonnes in the state in 1983-84. There are 45 districts varying in size in the state. The average consumption per district came to 7 tonnes. Mathematically a district on an average contributed 2.22 per cent to the total consumption of the state. There were 18 districts which contributed 2.22 per cent and more to the total consumption. The remaining 27 districts contributed less than 2.22 per cent (Table 2.9)

However, since the districts differed in size and the cropped area, more pertinent criterion was "fertiliser consumption per hectare of cropped area". It has been mentioned earlier (Table 2.4) that the average fertiliser consumption per hectare of cropped area in M.P. was only 14.6 kg. as against the average of 44.9 kg. for the country and that this state stood 15th among the 21 states according to that criterion. It was further observed that the distribution of the districts was quite skewed even with a very low consumption rate. Morena district topped the list with 46.10 kg. It was the only district with consumption higher than the country's average. Incidentally, Morena was the sole district in the State with a consumption of more than 40 kg. per hectare. Ratlam, Tikamgarh and Indore were the only three districts with consumption ranging between 30 to 40 kg. Ujjain, Dewas, Bhind,

Table 2.8 Seasonwise consumption of fertilisers, M.P., 1975-76 to 1983-84

(Figures- thousand tonnes)

Season	1975-76		1976-77		1977-78		1978-79		1979-80		1980-81		1981-82		1982-83		1983-84	
	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%
Kharif	46	41	38	28	48	40	57	29	69	43	69	35	100	42	94	39	105	33
Rabi	67	59	99	72	111	60	136	71	91	57	129	65	138	58	149	61	210	67
Total :	113	100	137	100	159	100	193	100	160	100	198	100	238	100	243	100	315	100

Table 2.9 Districtwise fertiliser consumption, M.P. 1983-84 (Unit- Tonnes)

S.No.	District	Fertiliser consumption	% to total	S.No.	District	Fertiliser consumption	% to total	S.No.	District	Fertiliser consumption	% to total
1.	Raipur	22025	7.19	16.	Panna	1577	0.51	31.	Dewas	10488	3.42
2.	Durg	8534	2.79	17.	Tikamgarh	10921	3.57	32.	Shajapur	5743	1.87
3.	Rajnandgaon	5030	1.64	18.	Chhatarpur	4635	1.51	33.	Morena	19873	6.49
4.	Raipur	1178	0.39	19.	Rewa	6749	2.20	34.	Bhind	8713	2.84
5.	Bilaspur	13063	4.26	20.	Sidhi	1033	0.34	35.	Gwalior	6936	2.26
6.	Surguja	2509	0.82	21.	Satna	6756	2.21	36.	Shivpuri	3105	1.01
7.	Raigarh	6946	2.28	22.	Shahdol	937	0.32	37.	Guna	1914	0.62
8.	Jabalpur	7971	2.60	23.	Indore	10212	3.33	38.	Datia	1677	0.55
9.	Balaghat	5142	1.68	24.	Dhar	14375	4.69	39.	Bhopal	2850	0.93
10.	Chhindwara	5791	1.89	25.	Jhabua	2805	0.92	40.	Sehore	4317	1.41
11.	Seoni	863	0.28	26.	Khargone	15838	5.17	41.	Raisen	4869	1.59
12.	Mandla	1183	0.39	27.	Khandwa	7295	2.38	42.	Vidisha	3258	1.06
13.	Narsinghpur	4[illegible]	1.45	28.	Ujjain	13088	4.27	43.	Betul	4303	1.40
14.	Sagar	4[illegible]	1.53	29.	Mandsaur	16442	5.3[illegible]	44.	Raigarh	2765	0.90
15.	Damoh	1396	0.46	30.	Ratlam	13497	4.41	45.	Hoshangabad	8511	2.80

Dhar, Khargone, Bhopal, Gwalior, Mandsaur and Hoshangabad were the 9 districts which had consumption between 20 to 30 kg. per hectare. Of the remaining 32 districts 16 had consumption between 10 to 20 kg. and another 16 had less than 10 kg.. each.

This clearly indicates the low level of consumption in a large majority of the districts. (Table 2.10)

Tatle 2.10 Districtwise consumption of fertiliser per hectare of cropped area, M.P. 1983-84

Rank	District	Fertiliser consumption in kg.per hectare of cropped area	Rank	District	Fertiliser consumption in kg.per hectare of cropped area
1.	Morena	46.10	22.	Bilaspur	12.55
2.	Ratlam	35.63	23.	Chhatarpur	12.21
3.	Tikamgarh	35.49	24.	Raigarh	12.16
4.	Indore	33.48	25.	Shajapur	11.85
5.	Ujjain	25.38	26.	Raisen	11.48
6.	Dewas	25.24	27.	Durg	11.12
7.	Bhind	25.02	28.	Sehore	10.90
8.	Dhar	24.31	29.	Chhindwara	10.43
9.	Khargone	23.23	30.	Betul	9.48
10.	Bhopal	22.80	31.	Sagar	8.59
11.	Gwalior	22.80	32.	Rajnandgaon	7.79
12.	Mandsaur	21.53	33.	Shivpuri	7.25
13.	Hoshangabad	21.39	34.	Jhabua	6.98
14.	Raipur	16.77	35.	Panna	6.50
15.	Khandwa	16.16	36.	Vidisha	6.41
16.	Satna	15.84	37.	Rajgarh	6.37
17.	Rewa	15.59	38.	Damoh	4.56
18.	Balaghat	14.66	39.	Surguja	4.17
19.	Jabalpur	14.33	40.	Guna	3.25
20.	Narsinghpur	13.97	41.	Sidhi	2.44
21.	Datia	12.76	42.	Mandla	2.23
			43.	Seoni	2.12
			44.	Shahdol	1.75
			45.	Bastar	1.38

2.4 Regionwise Consumption of Fertilisers

The State of M.P. has 45 districts and these are categorised into 12 agro-climatic regions (Table 2.11)

Table 2.11 Agro-climatic regions of Madhya Pradesh

S.No.	Agro-climatic Region	No.of Districts	Namesof the Districts
1.	Chhattisgarh plain including Balaghat district	6	Durg, Rajnandgaon, Bilaspur, Raigarh, Raipur & Balaghat
2.	Bastar plateau	1	Bastar
3.	Northern Hill region of Chhattisgarh	3	Surguja, Mandla & Shahdol
4.	Kymore Plateau and Satpura hills	6	Jabalpur, Seoni, Panna, Rewa, Sidhi, & Satna
5.	Vindhya Plateau	6	Sagar, Damoh, Bhopal, Sehor, Raisen, Vidisha
6.	Central Narmada Valley	2	Narsinghpur & Hoshangabad
7.	Gird region	5	Gwalior, Shivpuri, Guna, Morena and Bhind
8.	Bendelkhand	3	Tikamgarh and Datia
9.	Satpura Plateau	2	Chhindwara & Betul
10.	Malwa Plateau	8	Indore, Dhar, Ujjain, Ratlam, Mandsaur, Dewas, Shajapur and Rajgarh
11.	Nimar Plateau	2	Khargone and Khandwa
12.	Jhabua Hills	1	Jhabua
	Total	45	

It was observed that the fertiliser consumption was highest in Malwa plateau. This region shared 28.31 per cent of the total consumption of the state. The Chhattisgarh plain came second sharing 19.84 per cent. The Gird region constituted 13.23 per cent of the state's consumption of fertilisers. The lowest fertiliser consumption was in Jhabua and Bastar regions, the two predominantly

tribal regions of the state. However, the consumption of fertilizers per district was highest in Nimar plateau where it was 11,566.50 tonnes. The second position was claimed by Malwa plateau with the consumption of 10,826.25 tonnes per district. Chhattisgarh plain and Gird region claimed third and fourth positions with 10,130.00 and 8,108.20 tonnes per district. The lowest consumption per district was in Bastar plateau (Table 2.12).

Table 2.12 Regionwise fertiliser consumption in M.P.

S.No.	Agro-climatic Region	Total Fertiliser Consumption (Tonnes)	Percentage to total	Fertiliser consumption per district (Tonnes)
1.	Chhattisgarh plain including Balaghat district	60,780	19.84	10,130.00
2.	Bastar plateau	1,178	0.38	1,178.00
3.	Northern Hill region of Chhattisgarh	4,679	1.53	1,559.67
4.	Kymore Plateau and Satpura hills	24,949	8.14	4,158.17
5.	Vindhya Plateau	21,364	6.97	3,560.67
6.	Central Narmada Valley	12,950	4.23	6,475.00
7.	Gird region	40,541	13.23	8,108.20
8.	Bundelkhand	17,233	5.62	5,744.33
9.	Satpura Plateau	10,084	3.29	5,042.00
10.	Malwa Plateau	86,610	28.31	10,826.25
11.	Nimar Plateau	23,133	7.55	11,566.50
12.	Jhabua Hills	2,805	0.91	2,805.00

Thus it was observed that Malwa plateau, Chhattisgarh plain, Gird region and Nimar plateau were the important four regions of the state as far as the fertiliser consumption was concerned.

As pointed out earlier, the size of the districts and therefore, that of the agro-climatic regions varied considerably. Further, the proportion of cropped area to total area also varied from district to district and region to region. Therefore, it was felt that a criterion of fertiliser consumption per hectare of gross cropped area could better explain the extent of variation between different regions.

The highest per hectare consumption was in Malwa Plateau (21.40 kg) This comprises cotton jowar tract with black cotton soil. It also includes opium growing districts of Mandsaur and Ratlam and other wheat growing districts. The second highest consumption was in Bundelkhand region (20.62 kg.) It may be mentioned that this region comprises Tikamgarh and Chhatarpur districts well known for high yielding wheat cultivation. Nimar plateau followed closely being third highest, with 19.76 kg.of consumption per hectare. This region is famous for the cultivation of cotton, jowar and wheat. Gird region came fourth by this criterion having the consumption of 19.13 kg.of fertilisers per hectare. Central Narmada Valley (15.82 kg.) and Chhattisgarh plain (13.08 kg.) were other two important regions of fertiliser consumption. The lowest fertiliser consumption was, of course, recorded by Bastar plateau(1.35 kg) and second to lowest by Northern Hill Region of Chhattisgarh (2.72 kg.) (Table 2.13)

Table 2.13 Regionwise fertiliser consumption per hectare of cropped area

S.No.	Agro-Climatic Region	Total fertiliser consumption (Tonnes)	Cropped area (thousand hectares)	Fertiliser consumption per crop hectare in kg.
1.	Chhattisgarh plain including Balaghat district	60,780	4,645.1	13.08
2.	Bastar plateau	1,178	870.2	1.35
3.	Northern Hill region of Chhattisgarh	4,679	1,720.7	2.72
4.	Kymore Plateau and Satpura hills	24,949	2,560.3	9.74
5.	Vindhya Plateau	21,364	2,402.3	8.89
6.	Central Narmada Valley	12,950	818.6	15.82
7.	Gird region	40,541	2,118.8	19.13
8.	Bundelkhand	17,233	835.9	20.62
9.	Satpura Plateau	10,084	1,027.9	9.81
10.	Malwa Plateau	86,610	4,047.7	21.40
11.	Nimar Plateau	23,133	1,170.7	19.76
12.	Jhabua Hills	2,805	409.8	6.84

2.13 Regionwise Consumption in Kharif and Rabi Seasons

The cropping pattern of the state is dominated by food crops and among them paddy and wheat are most important. It is, therefore, natural that the fertilisers are applied mainly to these two crops. It would have been interesting to study the consumption of fertilisers among these crops, besides other food and commercial crops. However, secondary data on fertiliser consumption for different crops are not available. The data available are broadly for two seasons, kharif and rabi. Although some summer crops are also grown in the state, the data on fertilisers applied to these are not available separately and are grouped under rabi crops.

As mentioned in para 2.2 (Table 2.7) the proportion of fertilisers applied during rabi was 66.87 per cent and that in kharif 33.13 per cent for the state as a whole.

Chhattisgarh plain, Bastar plain and Jhabua hills are the regions growing mainly kharif crops. This is reflected in the larger proportion of fertilisers applied during kharif season. Northern hill region of Chhattisgarh, Satpura plateau, Malwa plateau and Nimar plateau represent a nearly balanced combination of kharif and rabi crops. Therefore, the proportion of fertiliser application in these regions is nearly equal for kharif and rabi seasons, with a slightly higher proportion in rabi. The remaining five regions, namely, Kymore plateau, Vindhya plateau, Central Narmada Valley, Gird region and Bundelkhand are chiefly rabi crop areas, (mainly wheat) and therefore, the proportion of fertilisers applied in rabi was very significantly higher in these regions. (Table 2.14).

Table 2.14 : Percentage of fertiliser consumption by crop seasons in different agro-climatic regions of M.P.

Agro-climatic region	Kharif(%)	Rabi(%)
1. Chhattisgarh plain including Balaghat district	48.65	51.35
2. Bastar plateau	54.58	45.52
3. Northern Hill region of Chhattisgarh	39.52	60.48
4. Kymore Plateau and Satpura hills	6.25	93.75
5. Vindhya Plateau	15.85	84.15
6. Central Narmada Valley	25.10	74.90
7. Gird region	10.15	89.85
8. Bundelkhand region	0.68	99.32
9. Satpura Plateau	46.98	53.02
10. Malwa Plateau	46.29	53.71
11. Nimar Plateau	46.32	53.68
12. Jhabua Hills	51.34	48.66

2.5 Nutrientwise consumption of fertilisers in different Regions

The ratio of nitrogen, phosphorus and potash for the state as a whole was 9:5:1 (Table 2.6)

Among the different agro-climatic regions the proportion of N was highest (25) in Jhabua Hills, the ratio of NPK being 25:5:1. The proportion was lowest (5) in Nimar plateau with a ratio of 5:2:1. As regards phosphorus the highest proportion (10) was observed in Kymore plateau and Satpura Hills with the ratio of 13:10:1. It was lowest (2) in Nimar plateau with a ratio of 5:2:1. (Table 2.15)

The ratio of NPK in a particular region depends among other factors, on the type of soil, fertility level, rainfall/irrigation and types of crops grown. It is, therefore, not possible to make any comment on the balanced or imbalanced use in a particular region in the absence of micro level data on the above mentioned factors.

Table 2.15 : Ratio of NPK in different agro-climatic regions of M.P

Agro-climatic region	Ratio of NPK
1. Chhattisgarh plain including Balaghat district	12:5:1
2. Bastar plateau	7:3:1
3. Northern Hill region of Chhattisgarh	10:6:1
4. Kymore Plateau and Satpura hills	13:10:1
5. Vindhya Plateau	10:9:1
6. Central Narmada Valley	9:8:1
7. Gird region	13:5:1
8. Bundelkhand region	10:6:1
9. Satpura Plateau	9:3:1
10. Malwa Plateau	7:4:1
11. Nimar Plateau	5:2:1
12. Jhabua Hills	25:5:1

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CHAPTER-III

THE USE OF FERTILIZERS ON THE SELECTED FARMS

3.1 Introduction

As mentioned in the opening chapter, the data collected under the cost of cultivation scheme was used for this study. This chapter is devoted to the analysis of the same.

It may, however, be mentioned that the use of data collected in the C.C. Scheme has limitations as far as this study is concerned. Firstly, the data in the scheme were not collected to study the fertiliser use, and therefore, the sample of farms does not represent the low fertiliser consumption areas and high fertiliser consumption areas, which ought to have been that way. Further, the sample of farms for such a study should have been of two categories viz. those applying fertilisers and others not applying it. The sample could further be stratified into farms applying fertilisers for different crops. This was not possible with the available data.

As far as the data collection is concerned the data on inputs as well as output should have been for the areas on which fertilisers were applied and those which we call 'control'

If this would have been done analysis could have shown the results on fertilised area/crops against those without fertilisers.

Fertiliser is a costly input and the farmers have many difficulties about its prices, availability, reliability about the quality etc. The probe on these would have been possible only if we could have selected the regions/districts/area and farmers with the precise objective of studying the problems of fertiliser consumption. This has completely eluded us with this kind of sample for primary data.

3.2 Area Owned

The total area owned by the selected cultivators was 2,761.220 hectares or 6.407 hectares per cultivator. Of the total owned area of 2,761.220 hectares, 2,355.423 hectares or 85.31 per cent was under field crops. Another 13.81 per cent was uncultivated area and 0.45 per cent was under gardens and orchards (Table 3.1).

Table 3.1 Area owned by selected cultivators

Particulars	Area (Hectares)	Percentage to total
Area uncultivated	381.391	13.81
Land leased out	12.000	0.43
Area under gardens and orchards	12.406	0.45
Area under field crops	2,355.423	85.31
Total :	2,761.220	100.00

3.3 Irrigation

As mentioned above, the total area of the selected cultivators was 2,761.220 hectares. Of this 381.391 hectares were uncultivated. Thus the cultivated area was 2,379.829 hectares. Of this 556.722 hectares or 23.39 per cent was irrigated and the remaining 76.61 per cent, unirrigated. (Table 3.2)

Table 3.2 Irrigation on the farms of selected cultivators

Particulars	Land leased out		Area under gardens & orchards		Area under field crops		Total	
	Hect.	%	Hect.	%	Hect.	%	Hect.	%
Irrigated	-	-	12.406	100.00	544.316	23.11	556.722	23.39
Unirrigated	12.000	100.00	-	-	1811.107	76.89	1823.107	76.61
Total :	12.000	100.00	12.406	100.00	2355.423	100.00	2379.829	100.00

3.4 Value of Assets Owned

Assets included land, farm buildings, wells, tubewells and other irrigation structures, irrigation equipments, implements and machinery, draught animals, breeding animals, calves and heifers and other animals.

The value of land formed the highest (89.17) percentage of the total value of all assets taken together. Livestock formed 3.76 per cent and farm buildings, 3.66 per cent (Table 3.3) (See also appendix table A 3.1)

Table 3.3 Value of assets on the selected farms

Particulars	Value	Percentage to total
Land	4,59,31,339.00	89.17
Livestock	19,36,528.00	3.76
Farm buildings	18,87,846.00	3.66
Wells & Tubewells	9,41,820.00	1.83
Irrigation equipments	3,90,259.00	0.76
Implements & machinery	4,24,554.00	0.82
Total :	5,15,12,146.00	100.00

3.5 Labour Use

The labour requirement on the selected farms consisted of human labour, animal labour and machine labour. The human labour was categorised as family labour, attached labour and hired labour. In the case animal labour and machine labour the categories were two : owned and hired.

Since fertiliser was not an important input on the selected farms its application did not require a significant amount of

either, human labour, animal labour or machine labour. Of the total human labour required for all operations, that required for fertiliser application formed only 1.65 per cent. The percentage of animal labour required for application of fertilisers was still lower (0.97 per cent) and that of machine labour most insignificant (0.09 per cent) (Table 3.4)

Table 3.4 : Labour used in all operations and that in the application of fertilisers

Particulars	All operations (Hrs.)	Only fertiliser application (Hrs.)	Percentage of fertiliser application to all operations
Human labour			
a) Family labour	5,53,692	9,370	1.69
b) Attached labour	1,46,688	4,862	3.31
c) Camal labour	4,07,342	4,084	1.00
Total Human labour	11,07,722	18,316	1.65
Animal labour			
a) Owned	2,89,409	2,743	0.95
b) Hired	11,546	174	1.51
Total Animal labour	3,00,955	2,917	0.97
Machine labour			
a) Owned	26,837	28	0.10
b) Hired	5,162	-	-
Total :	31,999	28	0.09

The insignificant amount of labour spent on fertiliser application is also reflected in the proportion of wages paid for fertiliser application to total wages paid. In the case human labour the percentage was 1.32. In the case of animal labour the percentage was 1.16. In the case of machine labour no hired labour was used for fertiliser application. (Table 3.5)

Table 3.5 Wages paid for all operations and for fertiliser application only

Particulars	Total wages paid (Rs.)	Wages paid for fertiliser application (Rs.)	% of wage paid for fertiliser application to total wages paid
Human labour	3,16,011	4,184	1.32
Animal labour	26,392	305	1.16
Machine labour	68,626	-	-

3.6 Fertilisers and the other Material Cost

The material inputs on the selected farms included seed, organic manures, fertilisers, insecticides and pesticides and irrigation charges. The total cost per hectare on these inputs came to Rs.271.48. Of this the highest proportion was on seed (62.32 per cent). Fertiliser was the second important item and constituted 27.63 per cent of the total material cost. Organic manures contributed 9.30 per cent (Table 3.6)

Table 3.6 Value of material inputs on selected farms

Material inputs	Value per hectare of gross cropped area (Rs.)	Percentage
Seed	169.19	62.32
Fertilisers	75.01	27.63
Organic manures	25.25	9.30
Insecticides Pesticides Fungicides	1.20	0.44
Irrigation charges	0.83	0.31
Total	271.48	100.00

3.7 Fertilisers and other cash expenses

In addition to material inputs as mentioned above, cash (or kind) expenses were also incurred on items like human labour, animal labour and machine labour (see table 3.5) Besides these, expenditure was also incurred on items like land revenue, taxes and cess. The total expenditure on these items came to Rs.423.76 per hectare of gross cropped area.

It may be mentioned that since the objective is not of calculating the cost of farms as a whole or that of a crop, the items in which imputed costs are involved have been omitted for this study. Thus the items such as family labour, owned bullock labour and rent on owned land have not been taken into account.

Of the total cost of Rs.423.76 per hectare of cropped area nearly forty per cent (39.92) was accounted by seed. The second important item was human labour and constituted 26.67 per cent of the total cost. Fertilisers came third and formed 17.70 per cent of the total cost. Manure and machine labour accounted for about 6 per cent each (Table 3.7).

Table 3.7 Fertilisers and other cash expenses

Item of Input	Expenditure per hectare of cropped area	%
Human labour	113.00	26.67
Animal labour	9.44	2.23
Machine labour	24.54	5.79
Seed	169.19	39.92
Manure	25.25	5.96
Fertilisers	75.01	17.70
Insecticides	1.20	0.28
Irrigation charges	0.83	0.20
Land Revenue	4.28	1.01
Taxes & Cesses	1.02	0.24
Total :	423.76	100.00

3.8 Fertiliser Use by Crops

The gross cropped area on the selected farms was 2,909.458 hectares. Wheat was the most important crop and contributed nearly 30 per cent (29.30) to the gross cropped area. Jowar, paddy and gram were other important crops. Individually they contributed only half of the area of wheat. Their contribution was 15.79, 14.96 and 13.21 per cent respectively. Soybean was the only other crop contributing more than 5 per cent (5.20) to the gross cropped area (Table 3.8)

Table 3.8 Cropping pattern on the selected farms

Crop	Area	Percentage to total
Paddy	435.382	14.76
Wheat	846.482	29.30
Jowar	459.276	15.79
Maize	144.502	4.97
Kodo Kutki	30.792	1.06
Bajra	24.250	0.83
Barley	8.543	0.29
Total cereals and millets	1949.227	67.00
Gram	384.525	13.21
Urd	95.653	3.29
Lentil	23.033	0.79
Tur	11.743	0.40
Moong	22.590	0.78
Other Pulses	14.488	0.50
Total pulses	552.032	18.97
Soybean	151.331	5.20
Groundnut	65.480	2.25
Sunflower	20.720	0.71
Linseed	30.498	1.05
Others	21.463	0.74
Total Oilseeds	289.492	9.95
Cotton	105.827	3.64
Fodder	12.880	0.44
Gross Croped Area	2909.458	100.00

The quantity of fertilisers used came to 51,944 kg. Thus the quantity applied, per farm was 121 kg. and per hectare of gross cropped area, 17.85 kg. This is about 3 kg. more than the state average of 14.6 kg.

Not entire gross cropped area was fertilised. Out of the gross cropped area of 2,909.458 hectares, only 876.155 hectares were fertilised. Thus the percentage of fertilised area to gross cropped area was 30.11. The quantity of fertilisers per hectare of area on which they were applied came to 59.29 kg. (Table 3.9)

Table 3.9 Fertiliser application on the selected farms

Item	Particulars
No.of farms	431
Gross cropped area	2909.458
Area on which fertilisers were applied	876.155
Percentage of fertilised area to gross cropped area	30.11
Quantity of fertiliser applied(kg.)	51944
Quantity per farm (kg.)	121
Quantity per hectare of gross cropped area (kg.)	17.85
Quantity per hectare of area on which fertiliser was applied (kg.)	59.29

The crops fertilised were paddy, wheat, jowar & maize among cereals; gram, urd & lentil among pulses; soybean, groundnut and sunflower among oilseeds; besides cotton and berseem. Wheat was the most important crop as far as the fertiliser use was concerned. It shared 34.49 per cent of the total area fertilised. Paddy was second important, although it shared only half the area (16.76 per cent) shared by wheat. Jowar shared 13.16 per cent. Gram shared 8.02 per cent and soybean, 7.33 per cent. (Table 3.10)

Table 3.10 Crops and Area fertilised

Crop	Fertilised Area	% to total
Paddy	146.883	16.76
Wheat	302.073	34.49
Jowar	115.342	13.16
Maize	64.105	7.32
Total cereals	628.403	71.73
Gram	70.292	8.02
Urd	36.177	4.13
Lentil	0.405	0.05
Pea	0.490	0.06
Tur	0.312	0.03
Total pulses	107.676	12.29
Soybean	64.229	7.33
Groundnut	37.650	4.30
Sunflower	8.009	0.91
Total oilseeds	109.888	12.54
Cotton	29.188	3.33
Fodder	1.000	0.11
Total	876.155	100.00

Among the crops fertilised, groundnut was fertilised to the extent of 57.50 per cent. Pea was fertilised to the extent of 50.00 per cent. However, it was noted that the crop occupied a very insignificant acreage (0.980 hectare)

Among the crops having considerable area, wheat was fertilised to the extent of 35.69 per cent and paddy, 33.74 per cent. Jowar was fertilised to the extent of 25.11 per cent. Maize and urd were other crops fertilised to a considerable extent of 44.36 and 37.82 per cent respectively, although they covered a comparatively smaller area. (Table 3.11)

The total quantity of fertilisers used on the selected farms was 51,944 kg. This included 27,885 kg. of nitrogen, 18,657 kg. of phosphorus and 5,402 kg. of potash. Thus the ratio of NPK came to 5:3:1. This, for the state as a whole was 9:5:1. Thus, although the proportion of N:P was nearly the same on the selected farms as that of the state as a whole, the proportion of K was quite high on the selected farms.

Of the total quantity of 51,944 kg. applied on the selected farms as high as 55.61 per cent was for wheat alone. Paddy shared 10.09 per cent and jowar and maize claimed 7.01 and 7.44 per cent respectively.

Table 3.12 also indicates that wheat shared far larger proportion of fertiliser applied than its share in the cropping pattern. While its share in the cropping pattern was 29.30 per cent its share in the quantity applied was as high as 55.61 per cent. This speaks of its importance as far as fertiliser use is

Table 3.11 Proportion of area fertilised to total area under the crop.

Crop	Total Area (Hectares)	Area fertilised (Hectares)	% of area fertilised to total area
Paddy	435.382	146.883	33.74
Wheat	846.482	302.073	35.69
Jowar	459.276	115.342	25.11
Maize	144.502	64.105	44.36
Other cereals	63.585	-	-
Total cereals	1949.227	628.403	23.24
Gram	384.525	70.292	18.28
Urd	95.653	36.177	37.82
Lentil	23.033	0.405	1.76
Pea	0.980	0.490	50.00
Tur	11.743	0.312	2.66
Other pulses	36.098	-	-
Total pulses	552.032	107.676	19.51
Soybean	151.331	64.229	42.44
Groundnut	65.480	37.650	57.50
Sunflower	20.720	8.009	38.65
Other Oil seeds	51.961	-	-
Total Oil seeds	289.492	109.888	37.96
Cotton	105.827	29.188	27.58
Fodder	12.880	1.000	7.76
Total other crops	118.707	30.188	25.43
Total	2909.458	876.155	30.11

concerned. Maize was another such crop. Its share in the cropping pattern was 4.97 per cent but its share in the total fertiliser consumption was 7.44 per cent. Urd (3.29 and 4.89 per cent) and groundnut (2.25 and 3.14 per cent) were other crops sharing larger percentage in fertiliser quantity than their shares in cropping pattern. Paddy, jowar, and gram, although were important crops shared a lower percentage in fertiliser quantity than their contribution in the cropped area (Table 3.12)

Table 3.12 Contribution of crops to cropped area and share in total fertiliser consumption

Crop	Gross cropped area (Hectares)	% to total	Fertiliser used (kg.)	% to total fertiliser used
Paddy	435.382	14.76	5239	10.09
Wheat	846.482	29.30	28884	55.61
Jowar	459.276	15.79	3641	7.01
Maize	144.502	4.97	3867	7.44
Other cereals	63.585	2.18	-	-
Total Cereals	1949.227	67.00	41631	80.15
Gram	384.525	13.21	2684	5.16
Urd	95.653	3.29	2539	4.89
Lentil	23.033	0.79	13	0.03
Pea	0.980	0.04	12	0.02
Tur	11.743	0.40	10	0.02
Other pulses	36.098	1.24	-	-
Total pulses	552.032	18.97	5258	10.12
Soybean	151.331	5.20	2058	3.97
Groundnut	65.480	2.25	1633	3.14
Sunflower	20.720	0.71	90	0.17
Other Oil seeds	51.961	1.79	-	-
Total oilseeds	289.492	9.95	3781	7.28
Cotton	105.827	3.64	1249	2.40
Fodder	12.880	0.44	25	0.05
Total	118.707	4.08	1274	2.45
Total All Crops	2909.458	100.00	51944	100.00

In order to measure the relative importance of different crops in relation to fertiliser application, the quantities applied per hectare of gross cropped area and per hectare of area on which fertilisers were applied were calculated. By both the criteria wheat topped the list. The quantity applied per hectare of cropped area was 34.kg.and that applied per hectare of area fertilised came to 96 kg. This, of course, is much below the average of many states, as mentioned in the opening chapter only. It also, falls too much short of the recommended dose. The second important crop, by these criteria, is urd. It received 27 kg.per hectare of cropped area and 70 kg.per hectare of fertilised area. Maize also received attention. The quantity applied per hectare of cropped area and per hectare of fertilised area was 27 kg.and 60 kg. respectively. In the case of groundnut the figures were 25 kg.and 43 kg.respectively. Paddy, pea, soybean and cotton are the only other crops worth mentioning in this respect (Table 3.13)

Table 3.13 Use of fertilisers in different crops

Crop	Gross croped area (Hectares)	Area fertilised (Hectares)	Quantity of fertilisers (kg.)	Quantity per hectare of gross cropped area (kg.)	Quantity per hectare of area on which fertiliser used (kg)
Paddy	435.382	146.883	5239	12	36
Wheat	846.482	302.073	28884	34	96
Jowar	459.276	115.342	3641	8	32
Maize	144.502	64.105	3867	27	60
Other cereals	63.585	-	-	-	-
Total cereals	1949.227	628.403	41631	21	66
Gram	384.525	70.292	2684	7	38
Urd	95.653	36.177	2539	27	70
Lentil	23.033	0.405	13	1	32
Pea	0.980	0.490	12	12	24
Tur	11.743	0.312	10	1	32
Other pulses	36.098	-	-	-	-
Total pulses	552.032	107.676	5258	10	49
Soybean	151.331	64.229	2058	14	32
Groundnut	65.480	37.650	1633	25	43
Sunflower	20.720	8.009	90	4	11
Other oilseeds	51.961	-	-	-	-
Total oilseeds	289.492	109.888	3781	13	34
Cotton	105.827	29.188	1249	12	43
Fodder	12.880	1.000	25	2	25
Total	118.707	30.188	1274	11	42
Total all crops	2909.458	876.155	51944	18	59

Of the total quantity of 51.944 kg. kharif crops received 20,236 kg. and rabi crops, 31,708 kg. Thus rabi crops received 61.04 per cent and the kharif, 38.96 per cent. This is close to the state average of 66.87 and 33.13 per cent respectively. (Table 3.14)

The kharif crops fertilised were paddy, jowar, maize, tur, soybean, groundnut, cotton and fodder. The rabi crops fertilised included wheat, gram, urd, lentil, pea and sunflower.

Table 3.14 Seasonwise consumption of fertilisers on the selected farms

Season	Consumption in kg.	Percentage to total (%)	State's average (Table 2.7) (%)
Kharif	20,236	38.96	33.13
Rabi	31,708	61.04	66.87
Total	51,944	100.00	100.00

3.9 Fertiliser Use by Regions

As mentioned earlier, this state has 12 agro-climatic regions. However, the sample did not represent two regions viz. The Bastar plateau and the Jhabua Hills. Moreover, the sample was not uniformly spread in the remaining ten regions as the sampling was not based on agro-climatic regions. While Central Narmada Valley was represented by 10 farmers only, the Malwa Plateau had a sample of 134 farms. Due to variation in the number of sample farms the gross cropped area in different regions varied. Since there exist variation in fertiliser application between region to region the proportion of area fertilised did vary in different regions. Therefore the criteria used for comparison of regions were three: fertiliser used per farm, fertiliser used per cropped area and fertiliser used per hectare of area on which fertiliser was used.

On the basis of all the three criteria Kymore plateau and Satpura Hills region topped the list. It had 285.71 kg. of fertiliser consumption per farm, 49.95 kg. per hectare of gross cropped area and 183.60 kg. per hectare of area on which fertilisers were used. The second in the list was Bundelkhand region with 193.10 kg. per farm, 23.19 kg. per hectare of cropped area and 99.88 kg. per hectare of area on which fertilisers were used. The other two regions in the order of importance were Malwa plateau and Nimar plateau. (Table 3.15)

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Table 3.15 Fertiliser Use by Agro-Climatic Regions

Agro-climatic region	No.of sample farmers	Gross cropped area (Hectares)	Area fertilised (Hectares)	Quantity of fertiliser used(kg.)	Fertiliser per farm (kg.)	Fertiliser per gross cropped area(kg.)	Fertiliser per hectare of fertilised (kg.) area
1. Chhattisgarh plain including Balaghat district	41	234.108	98.568	3939	96.07	16.83	39.96
2. Bastar Plateau	-	-	-	-	-	-	-
3. Northern Hill Region of Chhattisgarh	32	220.357	14.030	79	2.47	0.35	5.63
4. Kymore Plateau and Satpura Hills	52	297.462	80.921	14857	285.71	49.95	183.60
5. Vindhya Plateau	31	209.503	46.394	2224	71.74	10.62	47.94
Sub-Total	156	961.430	239.913	21099	-	-	-

Continued....

Table 3.15 .. continued....

Agro-climatic Region	No.of sample farmers	Gross cropped area (Hectares)	Area fertilised (Hectares)	Quantity of fertiliser used (kg.)	Fertiliser per farm (kg.)	Fertiliser per gross cropped area (kg.)	Fertiliser per hectare of fertilised area (kg.)
6. Central Narmada Valley	10	59.070	2.492	47	4.7	0.80	18.86
7. Gird region	40	160.171	24.779	1195	29.88	7.46	48.23
8. Bundelkhand	20	166.551	38.666	3862	193.10	23.19	99.88
9. Satpura Plateau	32	240.303	82.137	2494	77.94	10.38	30.36
10. Malwa Plateau	134	1056.191	386.681	18768	140.06	17.77	48.54
11. Nimar Plateau	39	265.742	101.487	4479	114.85	16.85	44.13
12. Jhabua Hills	-	-	-	-	-	-	-
Sub-total	275	1948.028	636.242	30845	-	-	-
Total	431	2909.458	876.155	51944	120.52	17.85	59.29

CHAPTER-IV

SUMMARY AND CONCLUSIONS

4.1.1 Of the various inputs in agriculture fertiliser is very important. With the spread in the area under High Yielding varieties, which were highly responsive to high doses of fertilisers, the consumption of fertilisers increased sharply. With the new techniques of dryland agriculture, the fertiliser consumption in the rainfed areas also increased. However, the demand varied from state to state and within the state it varied from region to region. In order to assess the consumption of fertilisers in different states and also among the various regions within the states the Directorate of Economics & Statistics, Ministry of Agriculture, Govt.of India, asked all the Agro-Economic Research Centres and Institutes to conduct a study on "The use of Fertilisers" in the respective states.

4.1.2 The objective of the study was to know the use of fertilisers cropwise and regionwise. The data collected under the "Comprehensive Scheme for studying the cost of cultivation of Principal Crops" in the respective states were used for this study. No separate survey was undertaken. The reference year was 1983-84. The data collected in various schedules and compilation forms were tabulated for districts, agro-climatic regions and for the state as a whole. The sample size was 431 farmers spread in 40 tehsils of 33 districts.

4.2.1 The fertiliser consumption in the country has been increasing since the beginning of the planning era in 1951-52, with the exception of two years, viz. 1961-62 and 1974-75. It was noted that the average rate of growth per annum in terms of

percentage has been declining even though the average rate per annum in absolute terms has been increasing continuously. During the six year period preceeding the reference year there was deceleration in fertiliser consumption during the four years from 1979-80 to 1982-83. The year 1979-80 recorded the lowest rate of growth of 2.7 per cent over the previous year. This was the result of poor crop season and high prices of fertilisers. There was a big quantum jump in fertiliser consumption in 1983-84 with a growth rate of 20.4 per cent over the previous year. The favourable factors were, good weather, increase in area under high yielding varieties, reduction in fertiliser prices, and other promotional factors.

4.2.2 Madhya Pradesh is the biggest state of the country. However, the fertiliser consumption in the state is much below that of other states. In 1983-84 the total fertiliser consumption in the country was 7,710.1 thousand tonnes. Of this the share of M.P. was only 4.08 per cent. It ranked tenth among 19 states. Besides low total fertiliser consumption, the consumption per hectare of gross cropped area was also very low in M.P. While the average per hectare consumption in the country was 44.9 kg., that of this state was only 14.6kg. The state ranked 15th by this criterion.

4.2.3 Although the consumption was at a low level it increased from year to year. While it was only 2.96 thousand tonnes in 1956-57 it rose to 315.00 thousand tonnes in 1983-84. During the last ten years (base 1974-75=100) it recorded an increase of 217.73 per cent. The fertiliser consumption increased from year to year except in 1979-80. The percentage change in consumption over

the previous year was highest in 1983-84 and lowest (rather negative growth) in 1979-80.

4.2.4 The proportion of nitrogen, phosphorus and potash was 9:5:1 in 1983-84. It was 8:4:1 in the years 1979-80 to 1982-83 and 9:4:1 in 1978-79. During 1975-76 to 1977-78 it was 13:5:1, 12:5:1 and 12:5:1 respectively. In 1974-75 it was 9:4:1. Of the total consumption rabi crops shared 2/3 and the kharif crops, 1/3.

4.2.5 As mentioned earlier, the total consumption for the state was 315.00 thousand tonnes or 7 thousand tonnes per district. With 45 districts in the state, the contribution per district came to 2.22 per cent. However, the variation among the districts was such that 18 districts contributed 2.22 per cent and more and the remaining 27 districts contributed less than 2.22 per cent each. By the criterion of consumption per hectare ofcropped area Morena district topped the list with 46.10 kg. It was the only district with the consumption higher than the country's average and also one with consumption of more than 40kg. among all the districts of the state. Among other districts Ratlam, Tikamgarh and Indore had consumption between 30 to 40 kg. Ujjain, Dewas, Bhind, Dhar, Khargone, Bhopal, Gwalior, Mandsaur and Hoshangabad were the 9 districts which had consumption between 20 to 30 kg.

Of the remaining 32 districts, 16 had consumption between 10 to 20 kg. and another 16 had less than 10kg. each. This clearly indicated two things: Firstly, the consumption in different districts was quite low and secondly, it was quite skewed even at the low level of consumption.

4.2.6 Madhya Pradesh has 12 agro-climatic regions. The highest fertiliser consumption was in Malwa region which shared 28.31 per cent of the state's total consumption. The Chhattisgarh plain was second highest sharing 19.84 per cent and Gird region came third with a share of 13.23 per cent. The consumption was lowest in two tribal regions viz. Jhabua and Bastar. The consumption per district was highest in Nimar region with an average of 11,566.50 tonnes. The second position was claimed by Malwa plateau (10,826.25 thousand tonnes) and the third by Chhattisgarh plain (10,130.00 thousand tonnes)

4.2.7 The highest per hectare consumption was in Malwa plateau (21.40 kg). The second highest consumption was in Bundelkhand region (20.62 kg). Nimar plateau was third with a consumption of 19.76 kg. per hectare. The lowest fertiliser consumption was, of course, in Bastar plateau (1.35 kg.) and second lowest in Northern Hill Region of Chhattisgarh (2.72 kg.)

4.2.8 The secondary data on fertiliser consumption was not available for different crops. The data were available broadly for two seasons; kharif and rabi. The data on summer crops were grouped under rabi. As mentioned earlier the proportion of fertilisers applied during rabi was 66.87 and that in kharif, 33.13 per cent. The proportion varied from region to region. Thus Chhattisgarh plain, Bastar plain and Jhabua hills had larger proportion of fertiliser consumption in kharif season than rabi season. Northern Hill region of Chhattisgarh, Satpura plateau, Malwa plateau and Nimar plateau had about equal proportion in kharif and rabi season, with a slightly higher proportion in rabi. The remaining five regions, namely, Kymore plateau, Vindhya Plateau,

Central Narmada Valley, Gird region and Bundelkhand had a very significantly higher proportion of fertilisers in rabi season than kharif season.

4.2.9 As indicated earlier the ratio of nitrogen, phosphorus and potash for the state as a whole was 9:5:1. Among the different agro-climatic regions the proportion of nitrogen was highest (25) in Jhabua hills, with the ratio of NPK as 25:5:1. The proportion of nitrogen was lowest in Nimar plateau with the NPK ratio at 5:2:1. With regard to phosphorus the highest proportion was observed in Kymore plateau and Satpura Hills, the ratio of NPK being 13:10:1. The proportion was lowest in Nimar plateau where the ratio was 5:2:1.

4.3.1 The data collected under the cost of cultivation Scheme was used in this study. The data had many limitations as far as this study was concerned. Firstly, the data in the C.C. Scheme was not collected to study the fertiliser use and, therefore, the sample of farms did not represent the low fertiliser consumption areas and high fertiliser consumption areas. This would have been done if a separate sample would have been drawn. The sample farms would also have been of two categories: those applying fertilisers and those not applying them. The stratification would have been further made to study fertiliser use in major crops. This could not be done with the available data. The data collection would also be different for areas fertilised and those not fertilised. The present data does not throw light on these aspects. The data was not available for fertiliser prices in different regions and at different selling points, the availability of fertilisers, the quality of fertilisers etc.

4.3.2 The total area owned by the selected farmers was 2,761.220 hectares or 6.407 hectares per cultivator. Of the total area 85.31 per cent was under field crops. Since the uncultivated area was 381.391 hectares the cultivated area came to 2,379.829 hectares. Of this 23.39 per cent was irrigated and the remaining 76.61 per cent, un-irrigated. Of the total value of assets, land formed 89.17 per cent, livestock 3.76 per cent and farm buildings, 3.66 per cent. Since fertiliser was not an important input on the selected farms its application required very little of human labour and animal or machine labour. Thus fertiliser application required only 1.65 per cent of the total human labour, 0.97 per cent of the animal labour and only 0.09 per cent of the machine labour. Similarly out of the total wages paid for human labour those for fertiliser application formed 1.32 per cent. Animal labour wages paid for fertiliser application formed 1.16 per cent of the total animal labour wages.

4.3.3 The material inputs on the selected farms were seed, organic manures, fertilisers, insecticides and pesticides and irrigation charges. The total cost per hectare on these items was Rs.271.48. Of the total cost seed formed 62.32 per cent and fertilisers, 27.63 per cent. Besides material inputs the expenditure was also incurred on items like human labour, animal labour and machine labour. Other items were land revenue, taxes and cess. The total expenditure per hectare of the gross cropped area on these items was Rs.423.76. Among these items also, seed was the major item constituting 39.92 per cent. The second item

of importance was human labour and constituted 26.67 per cent. Fertiliser was third in order of importance and contributed 17.70 per cent to the total cost.

4.3.4 The gross cropped area on the selected farms was 2,909.458 hectares. Wheat was the most important crop and contributed 29.30 per cent to the gross cropped area. Jowar, paddy and gram contributed 15.79, 14.96 and 13.21 per cent respectively. The quantity of fertilisers used was 51,944 kg. or 121 kg.per farm. The quantity applied per hectare was 17.85kg. or about 3 kg. more than the state average.

The area fertilised formed 30.11 per cent of the gross cropped area. Thus the quantity of fertilisers per hectare of area on which they were applied was 59.29 kg. Wheat was the most important crop as far as the fertiliser use was concerned. It shared 34.49 per cent of the total area fertilised. Paddy shared only 16.76 per cent and jowar shared 13.16 per cent. Groundnut was fertilised to the extent of 57.50 per cent. Pea was fertilised to the extent of 50.00 per cent However, pea occupied a very insignificant acreage of 0.980 hectare. Among the crops occupying considerable area wheat was fertilised to the extent of 35.69 per cent and paddy 33.74 per cent. Jowar was fertilised to the extent of 25.11 per cent. Maize and urd were fertilised to the extent of 44.36 and 37.42 per cent respectively, although, these two crops occupied a comparatively smaller area.

4.3.5 The ratio of NPK on the selected farms was 5:3:1 as against the state average of 9:5:1. Thus, although the proportion of N:P was nearly the same on the selected farms as that of

the state as a whole, the proportion of K was quite high on the selected farms. Of the total quantity of 51,944 kg.55.61 per cent was for wheat alone. Paddy shared 10.09 per cent and jowar and maize claimed 7.01 and 7.44 per cent respectively. Wheat shared larger proportion of fertiliser than its share in the cropping pattern. While it shared 29.30 per cent in the cropping pattern, it shared 55.61 per cent in the fertiliser quantity. The other such crops which shared larger percentage in the fertiliser quantity than the percentage in cropping pattern were maize, urd, and groundnut. However, their area was quite small. Paddy, jowar and gram, althcugh important fertilised crops, shared a lower percentage in fertiliser quantity than their share in cropping pattern.

4.3.6 By both the criteria of "quantity applied per hectare of cropped area" and "quantity applied per hectare of area on which fertilisers were applied" wheat emerged to be the most important. The quantity applied by these two criteria for wheat came to 34kg. and 96 kg. respectively. The second important crop by these criteria was urd with fertiliser quantity applied being 27 kg. and 70 kg. respectively. For maize the figures were 27 kg. and 60 kg.respectively. As in the case of state as a whole, rabi crops on the selected farms shared much higher percentage (61.04) than the kharif crops (38.96).

4.3.7 Madhya Pradesh has 12 agro-climatic regions. However, the sample did not represent two regions viz. Bastar plateau and Jhabua hills. Moreover, the sample did not represent other regions uniformly. While the Central Narmada Valley was [illegible]

represented by 10 farmers only, the Malwa plateau had a sample of 134 farms. In order to eliminate the variation in sample size between different regions, the criteria used for comparison were : fertiliser quantity per farm, per cropped hectare and per hectare on which fertiliser was used. On the basis of all the three criteria, Kymore plateau and Satpura Hills region topped the list. It had the fertiliser consumption of 285.71 kg. per farm, 49.95 kg. per hectare of gross cropped area and 183.60 kg. per hectare of area on which fertiliser was applied. The second high fertiliser consumption region was Bundelkhand with the figures of 193.10 kg. per farm, 23.19 kg.per hectare of cropped area and 99.88 kg. per hectare of area on which fertilisers were applied. Malwa plateau and Nimar plateau were other two important regions from the point of view of fertiliser application.

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Appendix table A.2.1 Nutrientwise consumption of fertilisers, 1956-57 to 1983-84

(Unit thousand tonnes)

Year	N	P	K	Total	NPK Ratio
1956-57	2.35	0.61	-	2.96	4:1:0
1957-58	5.47	0.30	-	5.77	18:1:0
1958-59	5.38	0.64	-	6.02	8:1:0
1959-60	5.38	0.51	-	5.85	10:1:0
1960-61	5.14	0.66	-	5.80	8:1:0
1961-62	6.25	1.08	-	7.33	6:1:0
1962-63	7.24	1.70	-	8.94	4:1:0
1963-64	9.36	2.68	-	12.04	3:1:0
1964-65	14.60	4.94	-	19.02	3:1:0
1965-66	14.58	7.36	-	21.94	2:1:0
1966-67	14.15	5.52	0.72	20.39	20:8:1
1967-68	14.31	6.26	1.44	22.01	10:4:1
1968-69	20.88	8.95	1.80	31.63	12:5:1
1969-70	32.88	14.13	2.76	49.77	12:5:1
1970-71	51.37	25.50	4.48	81.35	11:6:1
1971-72	80.75	36.31	6.57	123.63	12:5:1
1972-73	91.25	37.97	7.55	136.77	12:5:1
1973-74	90.42	45.33	9.28	145.03	10:5:1
1974-75	62.46	29.50	7.18	99.14	9:4:1
1975-76	77.04	29.98	6.10	113.12	13:5:1
1976-77	90.65	38.59	7.28	136.53	12:5:1
1977-78	99.69	49.49	9.91	159.09	12:5:1
1978-79	121.44	57.78	13.37	192.59	9:4:1
1979-80	96.98	49.94	12.72	159.64	8:4:1
1980-81	122.31	59.76	15.98	198.05	8:4:1
1981-82	145.18	73.97	19.12	238.27	8:4:1
1982-83	147.97	77.10	18.32	243.39	8:4:1
1983-84	189.00	105.00	21.00	315.00	9:5:1

Appendix table A-2.2 Seasonwise consumption of different nutrients of fertilisers, M.P. 1975-76 to 1983-84

Nutrient/ Season	1975-76		1976-77		1977-78		1978-79		1979-80		1980-81		1981-82		1982-83		1983-84	
	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%	Th. tonnes	%
NITROGENOUS																		
Kharif	34	44	24	26	29	29	34	28	39	40	40	33	59	41	53	36	58	31
Rabi	43	56	67	74	71	71	88	72	58	60	82	67	86	59	95	64	129	69
Total:	77	100	91	100	100	100	122	100	97	100	122	100	145	100	148	100	187	100
PHOSPHATIC																		
Kharif	10	33	12	31	16	33	19	33	24	48	23	38	32	43	32	42	34	35
Rabi	20	67	27	69	33	67	39	67	26	52	37	62	42	57	45	58	64	65
Total :	30	100	39	100	49	100	58	100	50	100	60	100	74	100	77	100	98	100
POTASSIC																		
Kharif	2	33	2	29	3	30	4	31	6	46	6	37	9	47	9	50	9	43
Rabi	4	67	5	71	7	70	9	69	7	54	10	63	10	53	9	50	12	57
Total :	6	100	7	100	10	100	13	100	13	100	16	100	19	100	18	100	21	100
Total N P K																		
Kharif	46		38		48		57		69		69		100		94		105	
Rabi	67		99		111		136		91		129		138		149		210	
Total :	113		137		159		193		160		198		238		243		315	

Appendix Table A 3.1 Value of assets on the selected farms

Particulars	Value(Rs.)	% to total value of assets
A. Land		
Land leased out		
A) Irrigated	1,20,000.00	0.23
B) Unirrigated	23,68,497.00	4.60
Uncultivated land	1,15,850.00	0.22
Garden and orchards		
Area under field crops		
A) Irrigated	2,72,04,665.00	52.82
B) Unirrigated	1,61,21,027.00	31.30
Total	4,59,31,039.00	89.17
B. Farm Buildings		
House for keeping cattle	1,62,490.00	0.31
House for storage	2,83,269.00	0.55
House for other farm use	2,300.00	0.00
Cattle Shed	11,74,902.00	2.28
Storage Shed	2,46,140.00	0.48
Others	19,045.00	0.04
Total	18,87,846.00	3.66
C. Wells and tube wells		
Masonry Kachcha wells	2,98,489.00	0.58
Masonry Pacca wells	5,81,761.00	1.13
Masonry other wells	16,000.00	0.03
Tubewells	45,570.00	0.09
Total	9,41,820.00	1.83
D. Irrigation Structures		
Pumping sets	3,18,750.00	0.62
Persian wheel	1,135.00	0.00
Pipes	2,750.00	0.00
Oil engines	39,164.00	0.08
Electric motors	31,000.00	0.06
Total	3,90,859.00	0.76
E. Implements & Machinery		
Hand operated	28,313.00	0.05
Bullock drawn	2,11,641.00	0.41
Machinery	1,84,700.00	0.36
Total	4,24,654.00	0.82
F. Live stock		
Draughts Animals	9,06,345.00	1.76
Milch Animals	7,95,476.00	1.54
Breeding Animals	69,850.00	0.14
Calves & heifers	1,60,335.00	0.31
Other Animals	4,522.00	0.01
Total	19,36,528.00	3.76
Gross Total	5,15,12,146.00	100.00