Ad-hoc Study No.55

EVALUATION OF SPECIAL PROJECT ON SOYBEAN IN INDORE DISTRICT, M.P.

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CHAPTER-I

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

1.1 Importance of Soybean

Indian diet is deficient in proteins and fats of high biological value. It is also deficient in vitamins and mineral salts like calcium, phosphorus and iron. In the case of vegeterians, the diet contains excessive amount of starch and carbohydrates. Their bulk lowers down the coefficient of digestibility. Soybean is considered as a remedy to this erratic phenominon of Indian dietary system. Soybean has an oil content of nearly 20 per cent, and is also rich in protein (about 40 per cent). Protein of soybean is said to be the complete protein because it supplies in sufficient amounts, the kinds of amino acids required by the body for building and repairs of tissues. The protein of soybean is easily digestible and is much like the protein of meat. The consumption of soybean is very useful for the development of the body for keeping it free from various diseases. Thus the soybean cultivation in India is considered not only important but necessary being the most nutritious food item.

1.2 Oilseed Development Programme

To help the state governments in their efforts to achieve the targetted production of nine cultivated oilseeds including groundnut, rapeseed, mustard, soybean, sunflower, safflower, sesamum, niger and linseed, the Govt.of India sponsored the National Oilseeds Development Project. The seventh plan envisages to increase the production of these nine oilseeds to 170 lakh tonnes as against the targetted production of 130 lakh tonnes in the terminal year (1984-85) of the sixth plan.

1.3 Centrally Sponsored National Oilseeds Development Project

This was proposed to be continued during 1985-86 with financial assistance from the Govt.of India. This project consisted of two parts.

a) Special Projects

b) Intensive Oilseeds Development Programme

1.3.1 Special Projects

The special projects are based on area specific approach adopted through the implementation of the projects in respect of groundnut in Gujarat and soybean in Madhya Pradesh. The projects helped considerably in increasing the production of these two oilseeds. Therefore, in 1984-85 this approach was extended to the cultivation of rapeseed, mustard and sunflower. The special projects in respect of groundnut, rapeseed, mustard and sunflower were also continued during 1985-86.

The various special projects for 1985-86 were as follows:

(a) Project for Intensive Cultivation of Groundnut

(b) Project for pure crop of rapeseed-mustard

(c) Project for soybean cultivation

(d) Project for sunflower cultivation.

1.3.2 Intensive Oilseeds Development Programme

It was proposed that areas not covered by the special projects, based on specific area approach, should be brought under the development programmes in respect of sesamum, niger, safflower, linseed and castor. This programme also covered groundnut, soybean, rapeseed and mustard and sunflower in these areas like other oilseed crops. The intensive oilseed development programme envisaged the increase in area, improvement in the cultivation standards and the productivity.

Besides Special Projects and Intensive Oilseeds Development Programmes, following aspects were given due importance.

(a) Production of Seed-Breeder's and Foundation Seed

(b) Market support

(c) Distribution of Seed and Fertiliser minikits.

(d) Special Component Plan for Scheduled Caste and Scheduled Tribes.

1.4 Area Targets under Centrally Sponsored National Oilseeds Development Project

The total target area under the two types of programmes aggregated to 122.70 lakh hectares.

Under the special projects the total target area was fixed at 80.80 lakh hectares. Out of this, 46 lakh hectares was under groundnut, 20 lakh hectares under rapeseed-mustard, 10 lakh hectares under soybean and 4.80 lakh hectares under sunflower.

The total target area under the Intensive oilseed Development Programme was 41.90 lakh hectares. It included 11.00 lakh hectares under kharif groundnut, 8.45 lakh hectares under sesamum and 5.30 lakh hectares under linseed (Table 1.1)

Table 1.1 Area targets under National Oilseeds Development Project, 1985-86

(Figures- lakh hectares)

Particulars	Target area (lakh hectares)
1. Special Projects	
a) Project for intensive cultivation of groundnut	
i) Kharif	32.00
ii) Rabi	14.00
Total groundnut :	46.00
b) Project for pure crop of rapeseed mustard	20.00
c) Project for soybean cultivation	10.00
d) Project for sunflower cultivation	4.80
Total Special Projects :	80.80
2. Intensive Oilseed Development Programme-	
a) Kharif groundnut	11.00
b) Rabi/Summer groundnut	1.30
c) Sesamum	8.45
d) Linseed	5.30
e) Rapeseed-mustard	3.60
f) Soybean	0.50
g) Sunflower	0.75
h) Safflower	4.50
i) Niger	4.00
j) Castor	2.50
Total for Intensive Oilseed Development Programme	41.90
Grand Total :	122.70

1.5 Production Targets under Centrally sponsored National Oilseeds Development Project

Oilseeds production target for the year 1985-86 was 136 lakh tonnes. Of this the target for kharif crops was 78.00 lakh tonnes and that for rabi crops, 58.00 lakh tonnes (Table 1.2)

Table 1.2 National oilseed development project production target for 1985-86

(Figures lakh tonnes)

Crop	Production target
Groundnut	54.00
Sesamum	6.30
Soybean	9.00
Sunflower	2.45
Niger	2.00
Castor	4.25
Total Kharif	78.00
Groundnut	21.00
Mustard	26.20
Sunflower	1.10
Safflower	5.20
Linseed	4.50
Total Rabi	58.00
Total Oilseeds	136.00

1.6 Targets for Distribution of Seed and Fertiliser Minikits

Under the minikit distribution programme it was proposed to distribute 5,56,600 seed minikits and 1,09,220 fertiliser minikits. Of the 5,56,600 seed minikits 3,49,800 were of kharif crops and 2,06,800 of rabi crops. The largest number of seed minikits (1,35,000) were meant for soybean. Of the 1,09,220 fertiliser minikits 65,230 were for kharif crops and 43,990 for rabi crops. The largest number of 29,000 fertiliser minikits were for rapeseed and mustard followed by those for soybean (25,000) (Table 1.3).

Table 1.3 Target of distribution of seed and fertiliser minikits, 1985-86

Crop	Seed minikits	Fertiliser minikits
Kharif		
Groundnut	37,000	11,000
Sesamum	52,000	10,000
Soybean	1,35,000	25,000
Sunflower	85,800	11,230
Niger	40,000	8,000
Total Kharif	3,49,800	65,230
Rabi		
Groundnut	27,600	1,300
Rapeseed mustard	94,000	29,000
Sunflower	25,200	4,690
Safflower	60,000	9,000
Total Rabi	2,06,800	43,990
Grand Total	5,56,600	1,09,220

1.7 Financial Outlay

The total cost of the project was estimated at about Rs.3,800 lakhs. However, due to a budgetary ceiling the expenditure was to be restricted to Rs.3,000 lakhs.

Of the total financial outlay 65.11 per cent was for special projects and 17.90 per cent for Intensive oilseed development programme. Due to budgetary ceiling the proportion on these reduced slightly to 63.38 and 17.42 per cent. Another item with the reduced proportion was "Assistance to NAFED." In the case of other items there was no budgetary ceiling (Table 1.4)

Table 1.4 Financial outlay and budgetary ceiling under different oilseed programmes

(Figures- Rs.lakhs)

Particulars	Estimated cost		Budgetary ceiling	
	(Rs.lakhs)	% to total	(Rs.lakhs)	% to total
1. Special Projects				
a) Project for intensive cultivation of groundnut	1,658.650	43.69	1273.830	42.46
b) Project for pure crop of rapeseed and mustard	322.700	8.49	247.820	8.26
c) Project for soybean cultivation	329.250	8.67	255.270	8.51
d) Project for sunflower cultivation	162.040	4.26	124.450	4.15
Total of Special Projects	2,472.640	65.11	1901.370	63.38
2. Intensive oilseeds development programme	680.400	17.90	522.630	17.42
3. Expenditure on the staff provided by the state Govt.	183.320	4.82	183.320	6.11
4. Expenditure on staff at the headquarters	12.680	0.33	12.680	0.42
5. Assistance to ICAR for production of Breeder's Seed and Foundation Seed	200.000	5.26	200.000	6.67
6. Assistance to NAFED for market support	250.000	6.58	180.000	6.00
Total	3,799.040 OR 3,800.000*	100.00	3,000.000*	100.00

* These figures include 50 lakhs each towards the special component plan for scheduled castes and scheduled tribes.

1.8 Soybean Development Projects

It was observed that Soybean Development Projects were part of the Oilseed Development Programme and that these were implemented both as Special Projects and Intensive Oilseed Development Programme. The target area under this crop was 10.00 lakh hectares out of 80.80 lakh hectares under special projects and 0.50 lakh hectares out of the total area of 41.90 lakh hectares under the Intensive Oilseed Development Programme. The production target of soybean was set at 9.00 lakh tonnes out of the total target of 136.00 lakh tonnes for all the oilseeds taken together. Soybean seed minikits to be distributed numbered 1,35,000 and fertiliser minikits targetted for distribution numbered 25,000. Further, out of the total outlay of Rs.3,799.040 lakhs for all oilseeds, Rs.329.250 lakhs was for special project for soybean. Provision was also made for soybean programme under Intensive Oilseed Development Programmes. (Table 1.5)

Table 1.5 Targetted contribution of soybean programme in the National Oilseed Development Project

Item	National Oilseed Development Project	Soybean Project
1. Target area (lakh hectares)		
a) Special Project	80.80	10.00
b) Intensive Oilseed Development Programme	41.90	0.50
2. Target Production (lakh tonnes)	136.00	9.00
3. Seed minikits (No)	5,56,000	1,35,000
4. Fertiliser minikits (No)	1,09,220	25,000
5. Financial Outlay (Rs.lakhs)	3,799.040	329.250 (Special project) 680.400*

* Intensive Oilseed Development Project for all crops including soybean. Separate figures for soybean are not available.

1.8.1 Items of Financial Outlay

Of the amount of Rs.329.250 lakhs earmarked for special project of soybean cultivation, one third (30.37 per cent) was meant for seed subsidy. Subsidy on plant protection chemicals and seed minikits were to get 15.19 per cent of the total outlay each. Fertiliser minikits accounted for 12.14 per cent of the total outlay. (Table 1.6)

Table 1.6 Financial outlay for different items for special project of soybean cultivation

(Figures-Rs. lakhs)

Item	Amount	%
1. Seed subsidy	100.000	30.37
2. Rhyzobium culture		
a) Strengthening of laboratories	14.250	4.33
b) Subsidy on distribution	15.000	4.55
3. Plant Protection		
a) Subsidy on plant protection equipments	12.500	3.80
b) Subsidy on plant protection chemicals	50.000	15.19
4. Subsidy on farm implements	12.500	3.80
5. Demonstrations	22.500	6.83
6. Seed Minikits	50,000	15.19
7. Fertiliser Minikits	40.000	12.14
8. Seed Storage godowns	1.500	0.46
9. Transport vans	6.000	1.82
10. Training & Publicity	5,000	1.52
Total	329.250	100.00

Similarly, out of the amount of Rs.680.400 lakhs earmarked for the Intensive Oilseed Development Programme, one third (32.47 per cent) was for plant protection measures. Other items of importance were fertiliser minikits (17.87 per cent), seed subsidy (15.83 per cent) and demonstrations (15.09 per cent) (Table 1.7).

Table 1.7 Financial outlay on Intensive Oilseeds Development Programme, 1985-86

(Figures.Rs.lakhs)

Item	Amount	%
1. Seed Subsidy	107.675	15.83
2. Plant Protection		
a) Plant Protection equipments	33.825	4.97
b) Plant Protection measures	220.950	32.47
3. Subsidy on implements	43.875	6.45
4. Demonstrations	102.675	15.09
5. Seed minikits	49.800	7.32
6. Fertiliser minikits	121.600	17.87
Total	680.400	100.00

1.9 Oilseed Development Programme in M.P.

Madhya Pradesh is an important oilseeds growing state and its participation in the programme in 1985-86 was planned to be substantial. Thus out of the target area of 122.70 lakh hectares for the country as whole, M.P. had 15.20 lakh hectares or 12.39 per cent. Again, out of the total production target of 136.00 lakh tonnes for the country, M.P. had 14.43 lakh tonnes or 10.61 per cent. As regards seed minikit distribution the target for M.P. was 1,23,500 out of the total target of 5,56,600 for the country. In the case of fertiliser minikit distribution the target set for M.P. was 22,784 out of the total target of 1,09,220 for the country.

As far as the total outlay is concerned the amount for Madhya Pradesh was Rs.369.143 lakhs of the total amount of Rs.3,799.04 lakhs for all the states taken together. Similarly, the amount of budgetary ceiling for this state came to Rs.288.670 lakhs of the total amount of Rs.3,000 lakhs for all the states (Table 1.8).

Table 1.8 Targetted contribution of M.P. in the National Oil seed Development Programme

Item (1)	India (2)	M.P. (3)	% of col.3 to 2 (4)
Area (lakh hectares)	122.70	15.20	12.39
Oil seed Production (lakh tonnes)	136.00	14.43	10.61
Seed minikits	5,56,600	1,23,500	22.19
Fertiliser minikits	1,09,220	22,784	20.86
Total outlay (Rs.lakhs)	3,799.04	369.143	9.72
Budgetary Ceiling(Rs. lakhs)	3,000.00	288.670	9.62

1.9.1 Soybean Programmes in M.P.

As indicated earlier soybean programmes in the country were of two types viz. Special project for Soybean Cultivation and Intensive Oilseed Development Programme of soybean. The target area under these was 10.00 and 0.50 lakh hectares respectively. Of the 10.00 lakh hectares, M.P. was alloted the major target of 7.50 lakh hectares. Uttar Pradesh was to cover 2.00 lakh hectares and Rajasthan, the remaining 0.50 lakh hectares. The target of 0.50 lakh hectares of soybean under the Intensive Oilseed Development Programme was allocated among the states of Bihar (0.20 lakh ha.), Gujarat, Himachal Pradesh and Maharashtra (0.10 lakh ha. each).

With regard to the production target of soybean it was noted that of the total of 9.00 lakh tonnes M.P. was alloted 7.00 lakh tonnes. The state was also to share largest numberof seed and fertiliser minikits of soybean. Of the 1,35,000 seed minikits and 25,000 fertiliser minikits the state was to distribute 93,750 and 15,000 minikits respectively.

As regards the financial outlay it was noted that for the special project for soybean cultivation an amount of Rs.329.250 lakhs was earmarked. Of this the share of M.P. was decided at Rs.239.875 lakhs. The budgetary ceiling on expenditure for this state was fixed at Rs.185.23 lakhs (Table 1.9).

The proportion of financial outlay on different items was similar to that for the country as a whole. Seed subsidy, subsidy on plant protection chemicals, seed minikits and fertiliser minikits were important items (Table 1.10).

Table 1.9 Targetted contribution of M.P. in Soybean programmes

Item (1)	India (2)	M.P. (3)
Special Project		
Area (lakh hectares)	9.00	7.00
Outlay (Rs.lakhs)	329.50	239.875
Budgetary Ceiling (Rs.lakhs)	255.270	185.23
Intensive Oilseed Development Programme		
Area (lakh hectares)	0.50	-
Production (lakh tonnes)	9.00	7.00
Seed minikits (No.)	1,35,000	93,750
Fertiliser minikits (No.)	25,000	15,000

Table 1.10 Financial outlay for different items for special project of soybean in M.P.

(Figures Rs.lakhs)

Item	Amount	%
1. Seed Subsidy	75.000	31.27
2. Rhyzobium culture		
A. Strengthening of laboratories	5.750	2.40
B. Subsidy on distribution	11.250	4.69
3. Plant Protection		
A. Subsidy on plant protection equipment	9.375	3.91
B. Subsidy on plant protection chemicals	37.500	15.63
4. Subsidy on farm implements	9.375	3.91
5. Demonstrations	16.875	7.03
6. Seed Minikits	37.500	15.63
7. Fertiliser Minikits	30.000	12.51
8. Seed Storage godowns	1.500	0.63
9. Transport vans	2.000	0.83
10. Training & Publicity	3.750	1.56
Total	239.875	100.00

The financial outlay on Intensive Oilseeds Development Programme for this state was Rs.87.10 lakhs. The break up of financial outlay among various items was similar to that for the country, with only marginal variation. Thus plant protection measures claimed nearly one third (32.03 per cent) and seed subsidy, nearly 20 per cent (19.86 per cent). Fertiliser minikits claimed 14.43 per cent and demonstrations, 13.66 per cent. (Table 1.11).

Indore district of the state has taken big strides in the soybean cultivation. During the last decade the district covered largest area under soybean in most of the years. Moreover, in 1984-85 and 1985-86 Indore district was selected for the intensive oilseed development programme of soybean in the state. Therefore, Ministry of Agriculture, Govt.of India suggested that Indore district be selected for the study on "Evaluation of Impact of Special Project for soybean cultivation in M.P."

Table 1.11 Financial outlay on Intensive Oilseeds Development Programme, M.P., 1985-86

(Figures Rs. lakhs)

	Item	Amount	%
1.	Seed Subsidy	17.300	19.86
2.	Plant Protection		
	A. Plant Protection Equipments	4.875	5.60
	B. Plant Protection measures	27.899	32.03
3.	Subsidy on implements	7,248	8.32
4.	Demonstrations	11.895	13.66
5.	Seed Minikits	5.315	6.10
6.	Fertiliser Minikits	12.568	14.43
	Total	87.100	100.00

1.10 Objectives of the study

(i) To study the adoption of cultivation technology through soybean minikit programme.

(ii) To study the identification of suitable varieties.

(iii) To study the impact of the programme on the production of Soybean.

(iv) Farmers reactions about the soybean development programme.

(v) To indicate the policy issues raised and to make suggestions.

1.11 Sample Design

Indore district comprises 4 tehsils viz. Indore, Mhow, Sawer and Depalpur. Of these, two tehsils, Indore and Mhow were selected on the basis of their participation in the Soybean Development Programme, in consultation with district officials.

In each tehsil 50 farmers were selected to have a total sample of 100 farmers. Of the 50 farmers in a tehsil 30 were participants and 20 non-participants. A participant farmer is one who was provided with a seed minikit by the department. The non-participant is one who was not provided any input by the department. Thus the sample comprised 60 participant and 40 non-participant farmers.

1.12 Reference year

The reference year of the study was 1985-86.

1.13 The Data

Both secondary and primary data were collected in schedules designed for the purpose.

The secondary data were collected from the journals of the J.N.K.Vishwa Vidyalaya, the Directorate of Agriculture, M.P. and the office of the Deputy Director of Agriculture, Indore.

The primary data were collected by interviewing the farmers. The survey method was used for the investigation.

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CHAPTER-II

SOYBEAN CULTIVATION IN MADHYA PRADESH

Soybean is one of the oldest crops grown. It is a native of China and its cultivation is quite old in the countries like China, Japan and Mongolia. Soybean cultivation has become an important phenomenon in many parts of the world and it is very successfully grown in U.S.A., Brazil and India.

In India soybean is grown for many centuries by the name Bhati in northern hill areas and as Kalitur in Central India. Its cultivation remained confined mainly to these two areas which are presently under Uttar Pradesh and Madhya Pradesh states. With the development of new varieties, soybean cultivation was extended to many states particularly Maharashtra, Gujarat, Karnataka, Bihar, West Bengal and Himachal Pradesh. However, soybean crop is still a legacy of U.P. and M.P. as these states together covered 96.53 per cent of the total area under this crop.

2.1 Coverage of Soybean in M.P.

During 1982-83 Madhya Pradesh had 5,84,100 hectares of area under Soybean. Thus it contributed 76.05 per cent to the total soybean acreage of the country. Uttar Pradesh contributed 20.48 per cent (Table 2.1) The state is therefore rightly called the soybean state.

Soybean crop by the name of Kalitur is grown in certain pockets of Malwa plateau since many decades. With the introduction of new varieties its cultivation was started as a commercial crop and found ready acceptance among the farmers. Consequently the area

under soybean crop started increasing year after year and it influenced the area under other kharif crops, particularly groundnut and jowar. Area under soybean crop in 1969-70 was only 600 hectares. It increased to 43.5 thousand hectares by 1975-76.

Table 2.1 Area under soybean in different states, 1982-83

State	Area (Hactares)	Percentage to total
Madhya Pradesh	5,84,100	76.05
Uttar Pradesh	1,57,200	20.48
Gujarat	11,000	1.44
West Bengal	600	0.08
Himachal Pradesh	400	0.05
Other States	14,000	1.90
Total	7,67,900	100.00

During the last 11 years starting from 1975-76, the area under soybean cultivation increased more than 24 times i.e. from 43.5 thousand hectares to 1,047 thousand hectares. Production of soybean in 1975-76 was 19.8 thousand tonnes which increased nearly 40 times with 783.1 thousand tonnes of production in 85-86. Per hectare yield increase during this period was 64.40 per cent. (Table 2.2)

Table 2.2 Area, production and yield of soybean in Madhya Pradesh, 1975-76 to 1985-86

Year	Area		Production		Yield	
	Thousand hectares	Index	Thousand tonnes	Index	Kg/ha.	Index
1975-76	43.5	100.00	19.8	100.00	455	100.00
1976-77	59.9	137.70	26.6	134.34	444	97.58
1977-78	90.5	208.04	42.5	214.65	469	103.08
1978-79	198.6	465.55	86.8	438.38	437	96.04
1979-80	261.7	601.61	89.7	453.03	343	75.38
1980-81	288.8	548.96	96.9	489.39	406	89.23
1981-82	307.3	706.44	235.1	1187.37	765	168.13
1982-83	457.7	1052.18	279.7	1412.62	611	134.28
1983-84	613.8	1411.03	461.6	2331.31	752	165.27
1984-85	986.0	2266.66	769.5	3886.36	780	171.43
1985-86	1047.0	2406.90	783.1	3955.05	748	164.40

2.1.1 Major Soybean Growing Districts

Malwa region is the homeland of soybean in M.P. although it is grown in almost all the 45 districts of the state. The Malwa districts are Indore, Dhar, Ujjain, Dewas, Shajapur, Sehore and Raisen. Soybean cultivation has also made significant progress in Betul, Chhindwara, Raigarh and Narsinghpur districts. These eleven districts, in 1985-86, covered 70.36 per cent of the 1047 thousand hectares under soybean. As regards production these 11 districts contributed as high as 70.76 per cent. (Table 2.3)

Table 2.3 Major Soybean growing district of Madhya Pradesh, 1985-86

S.No.	District	Area (thousand hectares)	Production (thousand tonnes)	Yield (Kg per hectare)
1.	Indore	88.2	58.6	664
2.	Dhar	74.4	49.8	669
3.	Ujjain	99.6	65.4	656
4.	Dewas	76.3	50.7	664
5.	Shajapur	91.7	67.3	734
6.	Sehore	70.9	48.6	685
7.	Raisen	40.3	30.7	762
8.	Betul	71.8	45.8	644
9.	Rajgarh	49.2	38.1	774
10.	Chhindwara	51.2	78.5	1553
11.	Narsinghpur	23.1	20.6	892
Total for 11 districts		736.7	554.1	-
Total for M.P.		1047.0	783.1	748
% of total of 11 districts to total of M.P.		70.36	70.76	-

2.2 Recommended Cultural Practices

Credit goes to Government farm, Adhartal, Jabalpur for introducing research on the varietal development of soybean as early as in 1935-36. This effort was discontinued in 1953-54 due to the non-availability of an early variety. With the establishment of Jawaharlal Nehru Agricultural University at Jabalpur, research efforts on soybean were revived in 1965 with a few indigenous and exotic varieties. Research results obtained at the Adhartal Farm, Jabalpur by the University scientists identified two American varieties, Bragg and Clark- 13 having favourable adaptability under agro-climatic conditions prevailing in Mahakaushal and Malwa regions. The state Agriculture department also tried these varieties on the farmers' fields and provided feedback to the scientists on the germination problem which was not allowing acceptance among the farmers. The main objective of soybean research work was to evolve high yielding short duration non-shattering varieties with higher percentage of germination and resistance against the diseases. The local varieties lacked all these characteristics. Therefore, research was concentrated on yellow varieties. The efforts of the scientists in the Jawaharlal Nehru Krishi Vishwa Vidyalaya have yielded ideal agronomical practices as well as new varieties. There are summarised below.

Soil The crop can be cultivated in all types of soils except very sandy ones. Black soils with good drainage system are ideal for the crop. In the waterlogged fields drainage channels at a distance of 6 metres may be useful. Drainage problem is mainly encountered in the areas of heavy rains and heavy soils.

Presowing Practices : Two ploughings or 3 harrowings are recommended after the previous crop is harvested. This ensures weed free soil with proper texture.

Varieties and Seed Rate :

The soybean varieties can be grouped into three on the basis of period of maturity. The varieties recommended and the seed rates suggested are as follows.

Variety	Seed rate (Kg/ha)
Early maturing	
J.S.2	90 to 100
Punjab 1	70 to 80
Medium maturing	
Bragg	90 to 100
Ankur	70 to 80
Gaurav	70 to 80
Durga (J.S.72)	70 to 80
J.S. 75-46	70 to 80
J.S. 75-205	60
Late maturing	
Type 49	50
Kalitur	25 - 30
Nari	

Sowing :

Timely sowing results in higher production. The proper sowing time is from the onset of monsoon (second or third week of June) to the first week of July. Late sowing results in lower yields. This can be compensated by increasing the seed rate. Sowing is done by hoe or Nari plough. The line to line distance should be between 30 to 45 cm. and plant to plant distance should be between 5 to 8 cm. The depth of sowing should be 2 to 3 cm. and not more.

Seed Treatment :

Seed should be treated with equal proportion of therum and captan @ 3 grammes per kilogramme of seed. Alternatively, Diathem M-45 @3grammes per kilogramme of seed should be mixed.

Seed innoculation :

For higher yields seed should be treated with Rhyzobium culture @ 5 grammes of culture per kologramme of seed. The seed treated with culture should not be exposed to sun and the sowing should be done immediately.

Directions for Initiating the Cultivation of soybean in a new field

1. It is observed that nodule formation in soybean crop is absent or less when it is grown for the first time in a new field. Therefore, the quantity of culture applied should be doubled. It is advisable to grow kalitur or variety JS 76-205 for one or two years in these fields. The yellow varieties can be grown subsequently.

2. If the rhyzobium culture is not available, the soil of the field, from surface to 15 cm. deep, in which soybean has been cultivated since last 2-3 years, be mixed with the soil in question. The rate of application of such soil should be 1 quintal per hectare.

3. In the field, which does not have enough nodules and on which soybean crop was not cultivated in the previous year, 20 kg of nitrogen be applied. The fertiliser should be mixed with phosphatic and other fertilisers.

4. The fields in which soybean crop has been grown during the previous 2-3 years may not be applied rhyzobium culture.

5. The seedlings sprouting after about 3 days after sowing need protection froms birds. This should be done till the first normal leaves come out.

Manures and Fertilisers

Farm Yard Manure or Compost @ 25 to 30 cartloads/hectare be applied after every 2-3 years. If the soil tests indicate deficiency in phosphorus or if the soil testing has not been done, 80 kg.of phosphorus/hectare be applied. If the soil has enough phosphorus, 40 kg.of phosphorus/hectare be applied. In the case of kalitur 40 kg.of phosphorus per hectare should be applied. If the soil is deficient in potash 20 kg of potash per hectare be applied.

The above mentioned fertilisers should be mixed in the soil at the time of last herrowing or should be dibbled 5 cm. deeper than the seed placement.

Mixed Cropping

Soybean can also be sown mixed with maize, jowar, cotton, arhar or kodo.

Two rows of soybean and two rows of either maize, jowar cotton or kodo or three rows of soybean and one row of arhar help both the mixed crops. In Malwa area soybean and maize can be mixed @ 10 kg.of kalitur with 2-3 kg.of maize.

Weeding and Interculture

First weeding should be done 20 - 25 days after sowing with either hand tool or harrow. Subsequent weedings should be undertaken as and when needed so that the field remains weedfree for 40 - 45 days after sowing. Weed control can be done with weedicides.

Basalene (50%) @ 2000 ml. in 500 litres of water per hectare be sprayed. This should be done before germination. After the spray the field should be ploughed so that the weedicide is properly mixed in the soil. This should be followed by weeding at an interval of 30 to 45 days.

Plant Protection Measures

Soybean crop needs protection against some insect pests and diseases.

Table 2.4 Plant protection measures to be followed for soybean

Insect Pest/ Disease	Plant Protection measures to be followed
Stem Fly	Spraying of methyl parathion 50 E.C. or Nuacron @ 625 ml./hectare
Girdle beetle	Spraying of Indosulfon 35 E.C. @ 1125 ml./ ha or Methyl dimeton 25 E.C. @ 750 ml./ha or Dimethoate 35 @ 750 ml./ha.
Jassids, Thrips & bugs	Spraying of Phosphomedon 250 to 300 ml. in 750 litres of water/ha. Dusting of paratheon 2% @ 25 Kg./ha
Leaf miner	Spraning of Methyl paratheon 50 E.C. 625 ml/ha or Nuacron 625 ml/ha. or Qunalphos 25 E.C. 750 ml./ha.
Leaf rollers	Spraying of Qunalphos 25 E.C. 750 ml/ha or Indosulphon 25 E.C. 1125 ml./ha or Monocrotophos 40 E.C. 625 ml./ha or Dusting of Methyl parathion @ 25 kg/ha.
Pod/Seed rot	Spraying of Zineb or dithem M 45 @ 25 grams/ litre of water at an interval of 10 to 12days
Yellow mosaic	Spraying of metacystox and endosulphon in equal quantity @ 1 litre in 1000 litres.

Irrigation :

Normally there is no need of irrigation in soybean. But if there is scanty rainfall or if the rainfall has stopped since

the first week of September, or if the soil is sandy, one irrigation at the stage of seed formation should be given.

Harvesting :

Harvesting should be done when the pods mature fully, Maturity means brown colouring of the 90 to 95 per cent of the pods. In the case of variety J.S.2 which has a tendency of shattering, harvesting should be done a bit earlier when 85 to 90 per cent of the pods change the colour. Kaliture also tends to shatter and therefore, harvesting should be done when some pods turn brown.

The harvested crop should be adequately dried in the sun. The threshing should be done like any other pulse crop. The pods should not be hammered hard as this results in lower germination. The seed should be cleaned, dried and stored in dry gunny bags or drums.

Crop Rotation :

1. In the case of irrigated soils soybean should be followed by wheat. This rotation gives more yield of wheat than wheat after kharif fallow.

2. Soybean - Wheat - bhindi (lady's finger)

3. Soybean - Wheat - Fodder

4. In unirrigated scils early maturing varieties of soybean should be followed by wheat, barley or gram or linseed.

5. In Malwa area soybean should be followed by safflower or kusum.

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C H A P T E R-III

TARGETS & ACHIEVEMENTS IN M.P. AND INDORE DISTRICT

In this chapter the achievements under soybean development programmes in the state and that in (selected) Indore district are compared with the targets set. The data for the state is the pooled data for all the 45 districts and that of Indore district comprise all the tehsils. The secondary data were collected from Bhopal and Indore Offices of the Directorate of Agriculture.

The description at the state level follows.

3.1 Targets and Achievements in the State

Against the target of 15.20 lakh hectares under different oilseeds, the achievement was 27.37 lakh hectares or 80.07 per cent more than the target area. In the case of soybean, against the target area of 7.50 lakh hectares the achievement was 10.47 lakh hectares or 39.60 per cent more than the target. In the case of production of oilseeds the achievement (13.74 lakh tonnes) fell short slightly (4.78 per cent) against the target (14.13 lakh tonnes). In the case of soybean, however, the production (7.83 lakh tonnes) surpassed the target (7.00 lakh tonnes) by 11.86 per cent (Table 3.1).

Table 3.1.: Targets and achievements of area and production of oilseeds in M.P., 1985-86

S.No.	Crop	Area (lakh hectares)			Production (lakh tonnes)		
		Target	Achie-vement	%of achie-vement over target	Target	Achie-vement	% of Achie-vement over target
1.	Rapeseed- mustard	1.50	3.48	232.67	2.20	1.92	87.27
2.	Soybean	7.50	10.47	139.60	7.00	7.83	111.86
3.	Groundnut	2.10	2.85	136.19	2.50	1.68	67.20
4.	Sesamum	1.00	2.59	259.00	0.48	0.57	118.75
5.	Niger	1.50	2.17	144.67	0.50	0.47	94.00
6.	Linseed	1.60	5.79	361.88	1.75	1.26	72.00
	All oilseeds	15.20	27.37	180.07	14.43	13.74	95.22

It may be noted that the year 1985-86 was a drought year and, therefore, the achievement of this order should be termed remarkable.

As regards the distribution of seed minikits, it was observed that the achievement was slightly more than the target. The performance of the state in the fertiliser minikit distribution was still better. The number of fertiliser minikits distributed was four times that of the target. In the case of soybean, against the target of 15,000 minikits the achievement was as high as 73,196 or 387.97 per cent higher than the target. (Table 3.2)

Table 3.2 Target and achievement of seed and fertiliser minikit distribution in M.P., 1985-86

Crop	Seed minikits (number)			Fertiliser minikits (Number)		
	Target	Achievement	% of achievement over target	Target	Achievement	% of achievement over target
1. Rapeseed-mustard	6,350	13,733	216.27	1,500	N.A.	
2. Soybean	93,750	220,626	235.33	15,000	73,196	487.97
3. Groundnut	2,200	7,345	333.86	2,100	7,094	337.81
4. Sesamum	6,200	4,429	71.44	1,184	6,338	535.30
5. Niger	15,000	7,685	51.23	3,000	4,609	153.63
6. Linseed	N.A.	N.A.		N.A.	N.A.	
ALL Oilseeds	1,23,500	2,53,618	205.36	22,784	90,837	398.68

The outlay for the National Oilseed Development Programme in M.P. was Rs.369.14 lakhs. Against this the expenditure was Rs.335.53 lakhs. In other words the expenditure was 90.89 per cent of the outlay or it fell short by 9.11 per cent of the outlay. In the case of soybean, however, the expenditure was slightly more than the outlay. While the outlay was Rs.239.87 lakhs, the expenditure was Rs.242.47 lakhs This compares very well with the other programmes indicating that utmost attention was paid to soybean programme. (Table 3.3)

Table 3.3 Financial outlay and expenditure in M.P. on N.O.D.P. 1985-86

(Figures- Rs. in lakhs)

S.No.	Item of outlay/Expenditure	Outlay Rs.	Expenditure Rs.	Expenditure % of expenditure to outlay
1.	Special project for pure crop of Rapeseed Mustard	24.19	18.60	76.87
2.	Special Project for soybean cultivation	239.87	242.47	101.08
3.	Intensive Oilseed Development programme	87.10	66.89	76.80
4.	Existing staff of State	17.97	7.57	42.13
	Total	369.14	335.53	90.89
	Budgetary Ceiling	288.67		

The break up of outlay for soybean programme indicated that the most important item was seed subsidy which accounted for 31.27 per cent. Subsidy on plant protection chemicals and seed minikits shared an equal percentage of 15.63. Fertilizer minikits came fourth. The break up of expenditure, however, indicated a great variation from what was planned. While no expenditure was incurred on items of strengthening of laboratories of rhyzobium culture, subsidy on plant protection equipments, seed storage godowns and transport vans, it fell short of outlay in the case of items such as seed subsidy, subsidy on plant protection chemicals, subsidy on farm implements, demonstrations and training and publicity.

In the case of two items viz. subsidy on the distribution of rhyzobium culture and fertiliser minikits the expenditure equalled the outlay.

The main thrust was on the distribution of seed minikits. While the outlay on this item was Rs.37.50 lakhs, the expenditure was Rs.143.22 lakhs or 281.92 per cent higher than outlay. (Table 3.4)

3.2 Targets and Achievements in Indore District

In Indore district the total outlay on N.O.D.P. was Rs.2,41,445. The expenditure slightly surpassed the outlay (Rs.2,45,307.20.) Special Project on Soybean Cultivation accounted for 82.73 per cent of the total outlay on N.O.D.P. While the outlay on this programme was Rs.1,99,745.00 the expenditure was Rs.1,96,362.00 or just 1.69 per cent less than the outlay. (Table 3.5)

Table 3.4 Outlay and expenditure on different items, Special Project of Soybean Cultivation, M.P. 1985-86

S.No.	Item	Outlay (Rs. lakhs)	%	Expenditure (Rs. lakhs)	% of expenditure to outlay
1.	Seed subsidy	75.01	31.27	22.00	29.33
2.	Rhizobium Culture				
	a) Strengthening of laboratories	5.75	2.40	-	-
	b) Subsidy of distribution	11.25	4.69	11.25	100.00
3.	Plant Protection				
	a) Subsidy on plant protection equipments	9.37	3.91	-	-
	b) Subsidy on plant protection chemicals and operational charges	37.50	15.63	12.60	33.60
4.	Subsidy on farm implements	9.37	3.91	4.00	42.67
5.	Demonstrations	16.87	7.04	14.40	85.33
6.	Seed minikits	37.50	15.63	143.22	381.92
7	Fertilizer minikits	30.00	12.51	30.00	100.00
8.	Seed storage godowns	1.50	0.62	-	-
9.	Transport vans	2.00	0.83	-	-
10.	Training & Publicity	3.75	1.56	1.00	26.67
	Total	239.87	100.00	242.47	101.08

Table 3.5 Outlay and expenditure on the centrally sponsored National Oilseed Development Project in Indore district in 1985-86

(Rs. lakhs)

S.No.	Item	Outlay		Expenditure		% of Expenditure to outlay
		Rs.	%	Rs.	%	
1.	Special Project of Pure crop of Rapeseed Mustard	1,800.00	0.75	1,800.00	0.73	100.00
2.	Special Project on soybean cultivation	1,99,745.00	82.73	1,96,362.00	80.05	98.31
3.	Intensive oilseed Development Programmes	10,000.00	4.14	17,812.20	7.26	178.12
4.	Existing staff of the state	29,900.00	12.38	29,333.00	11.96	98.10
	Total outlay	2,41,445.00	100.00	2,45,307.20	100.00	101.60

The proportion of different items was also similar in the amounts of outlay and expenditure. It may be added that both the figures of outlay and expenditure are exclusive of rhyzobium culture and seed minikits. The entire expenditure on these items was borne by the Directorate of Agriculture, Govt.of M.P., Bhopal.

Among the remaining items the percentage of expenditure to outlay was 101.02 for plant protection and 100.00 per cent for subsidy on farm implements. The percentage was also very high (98.93) in the case of fertiliser minikits (Table 3.6).

Table 3.6 Outlay and Expenditure on Special Project on soybean cultivation in Indore district, 1985-86

S.No.	Item	Outlay		Expenditure		% of Expenditure to outlay
		Rs.	%	Rs.	%	
1.	Seed subsidy	20,000.00	10.01	16,900.00	8.61	84.50
2.	Rhyzobium Culture	Paid by Directorate of Agriculture M.P.Bhopal				
3.	Plant protection	95,700.00	47.91	96,682.00	49.24	101.02
4.	Subsidy on farm Implements	28,795.00	14.42	28,795.00	14.66	100.00
5.	Demonstrations	12,000.00	6.00	11,175.00	5.69	93.13
6.	Seed minikits	Paid by Directorate of Agriculture MP Bhopal				
7.	Fertilizer minikits	41,000.00	20.53	40,560.00	20.65	98.93
8.	Training and Publicity	2,250.00	1.13	2,250.00	1.15	100.00
	Total	1,99,745.00	100.00	1,96,362.00	100.00	98.31

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C H A P T E R- IV

CHARACTERISTICS OF INDORE DISTRICT

4.1 Location

Indore district is situated in the Malwa plateau which is well known for its salubrity of climate, richness of soil and soybean cultivation in the state. Formerly it was a part of Holkar state and the Indore city was the capital of the state till it was merged in the Indian Union after independence. Indore district has assumed importance due to Indore city which is an important centre of education, commerce, trade and industries.

Indore is the smallest district in the state except Datia and Bhopal. It lies between $22^{o}.25$ and $23^{o}.25$ north latitudes and $75^{o}.00$ and $76^{o}.25$ east longitudes. It is surrounded by Ujjain district in the north, Dewas district on the east, West Nimar (Khargon) district on the South and Dhar district on the west.

4.2 Area, Villages, Tehsils and Blocks

Indore district occupied an area of 3,910 square k.m. which is less than one per cent (0.88 per cent) of the total geographical area of the state. It ranks 42nd among the 45 districts in area but occupied 12th position on the basis of population. The district has 644 villages and 5 cities. The district is divided into 4 tehsils and blocks for administrative and developmental purposes. These tehsils and blocks are Indore, Mhow, Sawer, and Depalpur (Table 4.1).

Table 4.1 Tehsil wise area and villages, Indore district

Tehsil	Area (000' hect.)	%	Villages	%
1. Indore	103	26.89	164	25.46
2. Mhow	104	27.16	162	25.16
3. Sawer	76	19.84	147	22.82
4. Depalpur	100	26.11	171	26.56
Total :	383	100.00	644	100.00

4.3 Population Characteristics

As per census 1961, there were 7,53,594 persons in Indore district. This figure increased to 10,25,150 in 1971 and 14,09,473 in 1981. It meant a growth rate of 36.03 per cent during 1961-71 and 37.48 per cent during 1971-81, whereas,the state figures were much lower being 28.67 (1961-71) and 25.27 per cent (1971-81) respectively.

In the census 1981, there returned 14,09,473 persons and among them 65.94 per cent were residing in the urban areas and the remaining 34.06 per cent persons in rural areas.

There were 2,20,371 or 15.63 per cent scheduled caste man and 66,816 or 4.74 per cent scheduled tribesmen.

There were 4,52,091or 32.07 per cent workers and among them 19.27 per cent were cultivators, 16.47 per cent agricultural labourers and 64.26 per cent workers engaged in other trades.

Indore district had 38.23 per cent literates in its population in 1961 and this proportion increased to 43.49 per cent in 1971 as against the state figure of 22.14 per cent. Among males there were 54.69 per cent literates and among females 30.77 per cent were so. (Table 4.2)

The higher literacy attainment is attributed to the larger proportion of urban population.

4.4 Physical Features

Indore district is a plain tract. The soil of the district is black. It is sticky, cracks after two showers and retains moisture for a long time. Nature has been bountiful and has showered her blessings on Malwa tract in the form of rich black soil, a moderate climate and adequate rainfall.

Table 4.2 Characteristics of population, 1981, Indore district

Particulars	Persons	Percentage
Total Population	14,09,473	100.00
(1) Rural	4,80,045	34.06
(2) Urban	9,29,428	65.94
(3) Scheduled Castes	2,20,371	15.63
(4) Scheduled Tribes	66,816	4.74
(5) Workers	4,52,091	32.07
a) Cultivators	87,115	19.27
b) Agri.labourers	74,477	16.47
c) Other workers	2,90,499	64.26
(6) Literates (1971)	4,45,888	43.49
Male	2,98,268	54.69
Female	1,47,620	30.77

The Chambal, Gambhir and Kshipra are the three main rivers in the district.

4.5 Climate

The climate of the district is neither too hot in summer nor too cool in winter. The district enjoys an agreeable climate. The summer season starts from March and continues up to the middle of June, after which the monsocn breaks and continues till September. October and November constitute the post monsoon season and December to February is the cold season.

The average rainfall of the district is 980 m.m. January is the coldest month. After February the temperature rises progressively and in May & June which are comparatively

hotter months it reaches to 40°C. The maximum temperature in these months is 45°C. But inspite of the high temperature during the day, the nights are pleasant.

4.6 Land Utilization

The total geographical area of the district was 383.1 thousand hectares. Of this 68.73 per cent area was under agricultural uses and the remaining 31.27 per cent was under non-agricultural uses. Forests covered 13.62 per cent of the geographical area and the culturable waste constituted 1.46 per cent. Area under agricultural uses was 263.3 thousand hectares including 0.94 per cent fallow land. Net area sown accounted for 67.79 per cent of the total geographical area. Area sown more than once was 74.6 thousand hectares or 28.72 per cent of net area sown (Table 4.3)

Table 4.3 Land Utilization, 1983-84, Indore district

S.No.	Particulars	Area (thousand hectares)	Percentage
1.	Total geographical area	383.1	100.00
2.	Area under Non-agricultural uses	119.8	31.27
	i) Forest	52.2	13.62
	ii) Land put to non-Agri. uses	27.1	7.07
	iii) Barren and uncultivable land	2.7	0.70
	iv) Permanent pastures & Grazing Lands	32.1	8.38
	v) Land under Misc. trees, crops and groves	0.1	0.03
	vi) Culturable waste land	5.6	1.46
3.	Area under Agricultural uses	263.3	68.73
	i) Fallow land	3.6	0.94
	ii) Net Area sown	259.7	67.79
4.	Double cropped area	74.6	28.72
5.	Total cropped area	334.3	128.72
6.	Net Irrigated area	64.8	24.95
7.	Gross Irrigated area	65.9	19.71

4.7 Irrigation

In respect of irrigation facilities and the area irrigated, Indore district is not very well placed. Out of 259.7 thousand hectares of net area sown only 64.8 thousand hectares or 24.95 per cent was irrigated. Though the percentage was higher than the state average of 14.4 it was lower than the districts like Tikamgarh, Morena, and Balaghat where the percentage of irrigation was as high as 44.5.

The main source of irrigation was wells which irrigated as high as 75.12 per cent of the total irrigated area. Rivers and Nalas irrigated only 17.15 per cent. The rivers of the district fall into one main system viz.the chanbal. (Table 4.4)

Table 4.4 Area Irrigated by Sources, 1983-84 Indore district.

Source	Area ('000 hectares)	Percentage
Wells	49.5	75.12
Rivers & Nalas	11.3	17.15
Tanks	3.1	4.70
Canals	2.0	3.03
Total	65.9*	100.00

4.8 Crops Grown

The kharif crops occupied 53.27 per cent of gross cropped area of 334.3 thousand hectares. Rabi crops covered 46.73 per cent. Another feature was that the food crops covered 68.59 per cent of the gross cropped area. The main crops of the district were wheat, (24.11 per cent) jowar, (14.57 per cent) gram, (16.03 per cent) and soybean (19.29 per cent).

To fulfil the need of dairy farming which was an important enterprise in the district, farmers were raising fodder crops on a considerable area. Thus fodder crops covered 8.70 per cent of the gross cropped area. (Table 4.5)

4.9 Irrigated Crops

Among the irrigated crops wheat occupied 72.77 per cent of the gross irrigated area and area under it was irrigated to the extent of 51.24 per cent. Gram accounted for 11.70 per cent of the gross irrigated area, whereas, it was irrigated to the extent of 14.36 per cent. The entire area under Sugarcane was irrigated but formed only 6.99 per cent of the gross irrigated area. Area under fruits and vegetables was irrigated to the extent of 87.27 per cent and covered 12.46 per cent of the gross irrigated area. Spices were irrigated to the extent of 75 per cent but comprised 2.78 per cent of the gross irrigated area. (Table 4.5)

Table 4.5 Cropping pattern and Irrigation, Indore district 1983-84

Crop	Area ('000 hect.)	Percentage of irrigated	Irrigated Area ('000 hect.)	Percentage of irrigated	Percentage to irrigated area to the area of the crop
Wheat	80.6	24.11	41.3	72.77	51.24
Jowar	48.7	14.57	-	-	-
Maize	9.6	2.87	0.1	0.15	1.04
Other cereals	0.4	0.12	0.1	0.15	25.00
Total Cereals	139.3	41.67	41.5	63.07	29.79
Gram	53.6	16.03	7.7	11.70	14.36
Arhar	11.1	3.32	-	-	-
Moong & Moth	3.5	1.05	-	-	-
Urd	2.8	0.84	-	-	-
Other Pulses	2.9	0.87	1.4	2.13	-
Total Pulses	73.9	22.11	9.1	13.83	
Linseed	9.6	2.87	-	-	-
Groundnut	1.1	0.33	-	-	-
Soybean	64.5	19.29	-	-	-
other oil seeds	0.1	0.03	-	-	-
Total OilSeeds	75.3	22.52	-	-	-
Total fruits & Vegetables	9.4	2.81	8.2	12.46	87.27
Spices	2.0	0.60	1.5	2.78	75.00
Sugarcane	4.6	1.38	4.6	6.99	100.00
Cotton	0.2	0.06	-	-	-
Fodder crop	29.1	8.70	0.5	0.76	1.72
Other crops	0.5	0.15	0.4	0.61	80.00
All crops	334.3	100.00	65.8	100.00	19.68

4.10 Soybean Cultivation in the district

Indore district is called the homeland of soybean specially since the introduction of yellow varieties. Soybean cultivation has become quite popular and it has become the crop of every type of farmers. During 1975-76 the area under soybean was 11.4 thousand hectares and in 11 years (till 1985-86) it increased 8 times. There was a spurt in the area since 1982-83 with the introduction of new high yielding varieties as well as incentive schemes. The district was included under the special project for the development of the soybean cultivation. Production of soybean also made remarkable progress during 1975-76 to 1985-86. In the year of 1975-76 the production of soybean was 5.3 thousand tonnes and it increased 11 times. Proportionate increase in production was higher than that of the increase in area. This was due to the excellent achievements in the cultivation technology since 1981. The yield in 1981-82 (814 kg per ha) nearly doubled that of 1980-81. The highest yield of 870 kg per hectare was reported in 1984-85. The yield in 1985-86 was low due to adverse monsoon conditions. (Table 4.6)

Table 4.6 Area, production and yield of soybean in Indore district

Year	Area		Production		Yield	
	Thousand hectares	Index	Thousand tonnes	Index	kg per hectare	Index
1975-76	11.4	100.00	5.3	100.00	465	100.00
1976-77	15.4	135.09	6.9	130.19	448	96.34
1977-78	21.5	188.60	9.7	183.02	452	97.20
1978-79	30.8	270.18	13.8	260.38	446	91.91
1979-80	35.7	313.16	12.7	239.62	355	76.34
1980-81	31.1	278.95	14.2	256.92	446	95.91
1981-82	39.3	344.74	32.0	603.77	814	175.05
1982-83	51.3	450.00	32.6	615.09	636	136.77
1983-84	64.5	565.79	47.5	896.23	736	158.28
1984-85	87.5	767.54	76.2	1437.74	870	187.10
1985-86	88.2	773.68	58.6	1105.66	664	142.80

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C H A P T E R- V

CHARACTERISTICS OF SAMPLE FARMS

5.1 Selection of Sample Farms

Under the Centrally Sponsored Scheme of Soybean Cultivation 1,000 minikits were distributed in Indore district during 1986-87. In Indore and Depalpur blocks 300 minikits eac were distributed, whereas, in Sawer and Mhow blocks, 200 minikit each were distributed. Indore and Mhow blocks were selected for the study on the advice of the Departmental Officials. From each block 50 farmers including 30 minikit recipients and 20 non-recipients were selected. In all 100 farmers were selected and among them 60 farmers were minikit recipients and 40 non-recipients.

A minikit contained treated seed of soybean (Gourav JS-72-44) and rhyzobium culture. This seed was meant for 0.10 hectare. These minikits were mainly given to the marginal and small farmers who received special attention under the programme.

. Recipient farmers were scattered over a large number of villages with 2-3 each village. In Indore block there were more than 30 minikit recipients in Kanadia village which was selected as sample from that block. In Mhow block, villages, Mohgaon, Bhagora and Chouradia had 20,10 and 8 minikit recipients respectively. Therefore, 30 sample recipients and 20 non-recipient farmers were selected from these villages. (Table 5.1)

The minikit recipient farmers will hereafter be termed as participants and the non-recipients, non-participants.

Table 5.1 Villages and selected farmers and population

Block	Villages	Farmers			Population		Total	
		Participant	Non-participant	Total	Participant	Non-participant		
Indore	Kanadia	30	20	50	192	133	325	51.42
	Sub total	30	20	50	192	133	325	51.42
Mhow	Mohgaon	17	11	28	106	77	183	28.96
	Bhagora	8	6	14	38	38	76	12.03
	Chouradia	5	3	8	24	24	48	7.59
	Sub total	30	20	50	168	139	307	48.58
Grand Total		60	40	100	360	272	632	100.00

Population

5.2 Village wise Sample Households and population

Out of 100 sample households, 50 households belonged to Kanadia village of Indore block. In Mhow block 28 belonged to Mhowgaon, 14 to Bhagora and 8 households to Chouradia village. Among the 60 participants, 30 returned from Kanadia, 17 from Mhowgaon, 8 from Bhagora and 5 households from Chouradia village.

Sample households had a population of 632 persons and among them 360 persons or 56.96 per cent belonged to participants and the remaining 272 persons or 43.04 per cent to non-participants. On an average a sample household had 6.3 persons but among the participants this figure was 6 and among non-participants, 6.8 (Table 5.1).

5.3 Castewise breakup of Sample Farmers

Sample farmers represented 15 caste groups which included scheduled castes 2, backward castes 9, and other castes 4 .Balai and Chamar were scheduled castes. The backward caste group comprised Gari, Malviya, Vairagi, Kosta, Khati, Kunbi, Anjana, Mali and Lodhicastes. 'Other'caste group households belonged to Thakur, Kalota, Maheshwari and Brahmin castes. There returned 4 households from scheduled castes, 32 households from backward castes and 64 households from other caste groups. In the population, scheduled castes comprised 22 persons or 3.48 per cent, backward castes, 200 persons or 31.64 per cent and the other castes returned 410 persons covering 64.88 percent of the total population (Table 5.2).

Table 5.2 Caste and Tribe of sample farmers

Caste	No.	%	Population	%
Scheduled Castes				
1. Balai	3	3.00	15	2.37
2. Chamar	1	1.00	7	1.11
Sub- Total	4	4.00	22	3.48
Backward castes				
3. Gari	1	1.00	17	2.69
4. Malviya	1	1.00	5	0.79
5. Vairagi	1	1.00	11	1.74
6. Kosta	1	1.00	8	1.26
7. Khati	9	9.00	55	8.70
8. Anjana	9	9.00	48	7.59
9. Kunbi	6	6.00	36	5.70
10. Mali	3	3.00	15	2.37
11. Lodhi	1	1.00	5	0.79
Sub- Total	32	32.00	200	31.64
Other castes				
12. Thakur	17	17.00	106	16.77
13. Kalota	40	40.00	251	39.72
14. Brahmin	6	6.00	45	7.12
15. Maheswari	1	1.00	8	1.27
Sub - Total	64	64.00	410	64.88
ALL	100	100.00	632	100.00

5.4 Population by Age and Sex

There returned 340 or 53.80 per cent males and 292 or 46.20 per cent female in the population. The population was dominated by adults belonging to the age group 15-59 years. They numbered 374 forming 59.18 per cent of the total population. More than one third of the total population was constituted by children upto 14 years of age. There were a few (39) in the group of persons above 60 years (Table 5.3)

Table 5.3 Population by age and sex

Age group	Male		Female		Total	
	No.	%	No.	%	No.	%
0-14	113	33.24	106	36.30	219	34.65
15-59	202	59.41	172	58.91	374	59.18
60 & above	25	7.35	14	4.79	39	6.17
All	340 (53.80)	100.00	292 (46.20)	100.00	632	100.00

5.5 Literacy Among Sample Households

All the heads of the households were males. Of them 14 were illiterate and 5 were able to read and write only. Of those who received formal education 28 heads of households received it upto primary level 25 were educated upto middle school (VIII class) and another 25 were higher secondary passed. There were 3 graduate heads of households (Table 5.4).

Table 5.4 Literacy among the heads of households

Literacy Standard	Indore Block	Mhow Block	Total
Illiterate	11	3	14
Able to read and write	2	3	5
Primary School	17	11	28
Middle school	12	13	25
Higher Secondary School	8	17	25
Graduation and above	-	3	3
Total	50	50	100

In the total population 41.04 per cent were illiterate, and the remaining 58.96 per cent literate. In this category 1.18 per cent were able to read and write, 24.53 per cent were educated upto primary level, 15.80 per cent upto middle school level, 15.09 per cent upto higher secondary level and the remaining 2.36 per cent graduates.

The percentage of literates was quite higher among males than females. The percentage of males in different classes of literacy was also higher than the females. (Table 5.5)

Table 5.5 Literacy in the sample household population

(Figures percentage)

Literacy Standard	Male %	Female %	Total %
Illiterate	13.08	76.47	41.04
Able to Read and write	2.10	-	1.18
Primary School	31.65	15.51	24.53
Middle School	23.63	5.88	15.80
Higher Secondary School	25.32	2.14	15.09
Graduation and above	4.22	-	2.36
Total	100.00	100.00	100.00

5.6 Land Operated

The selected farmers were grouped into four classes according to size of holdings. These were : Marginal farmers with less than one hectare each and small farmers with area between 1 to 4 hectares each. The medium size farmers were owning land between 4 to 10 hectares and the large farmers owned more than 10 hectares each.

Of the hundred selected farmers, 17 were marginal farmers operating 4.48 per cent of the total area and 61 farmers were small farmers contributing 42.62 per cent of the operated area. Nineteen farmers were medium sized farmers occupying 40.70 per cent of the operated area. The large farmers numbered only 3 but shared 12.20 per cent of the total area of the selected farms.

Small farmers dominated both the participant and non-participant groups. Among participant farmers marginal farmers formed second largest group, whereas, among non-participants, medium sized farmers formed second group.

While the average size of operated area was 2.23 hectares on the sample farms it was 1.39 hectares for participants and 3.51 hectares for non-participants. (Table 5.6)

It will thus be observed that the participants were small size farmers and rightly so because the minikits were mainly distributed among marginal and small farmers.

Table 5.6 Distribution of selected farms and area operated

Particulars	No.of farms	% to total	Area (Hactares)	% to total
Participants				
1. Marginal	16	26.67	9.257	11.14
2. Small	38	63.33	52.825	63.54
3. Medium	6	10.00	21.052	25.32
4. Large	-	-	-	-
Total Participants	60	100.00	83.134	100.00
Non-participants				
1. Marginal	1	2.50	0.750	0.53
2. Small	23	57.50	42.445	30.22
3. Medium	13	32.50	69.945	49.82
4. Large	3	7.50	27.283	19.43
Total Non-participants	40	100.00	140.423	100.00
Total				
1. Marginal	17	17.00	10.007	4.48
2. Small	61	61.00	95.270	42.62
3. Medium	19	19.00	90.997	40.70
4. Large	3	3.00	27.283	12.20
Total All farms	100	100.00	223.557	100.00

5.7 Crops Grown

The gross cropped area on the selected 100 farms was 330.38 hectares. Of this 2/3 (65.98 per cent), was occupied by kharif crops and 1/3 (34.02 per cent) by rabi crops. The proportion of area under kharif and rabi crops was similar on both the categories of farms viz. participants and non-participants.

Soybean was the most important crop on the selected farms occupying one third (33.01 per cent) of the gross cropped area. Its proportion on the participant farms was 29.93 per cent and that on the non-participant farms, 34.78 per cent.

The second important group of crops was that of soybean mixed with either maize, jowar or arhar. This group occupied 23.49 per cent of the gross cropped area on the selected farms. Its proportion on the participant farms was 28.33 per cent and that on non-participant farms, 20.75 per cent.

Among the rabi crops only wheat and gram were important. While wheat occupied 18.96 per cent on the selected farms its proportion on the participant and non-participant farms was 17.10 and 20.03 per cent respectively. Gram accounted for 9.01 per cent on the selected farms. Its proportion on the participant farms was 6.76 and that on non-participants, 10.29 (Table 5.7).

Table 5.7 Crops grown on sample farms

(Area in Hectares)

Crop	Participants		Non-participants		Total	
	Area	%	Area	%	Area	%
Kharif						
1. Soybean	35.79	29.93	73.30	34.78	109.08	33.01
2. Maize	1.88	1.58	0.81	0.38	2.69	0.81
3. Jowar	5.24	4.38	13.82	6.56	19.06	5.77
4. Arhar	1.38	1.15	-	-	1.38	0.42
5. Soybean + Maize/ Jowar/ Arhar	33.87	28.33	43.74	20.75	77.62	23.49
6. Jowar Arhar	0.87	0.73	0.50	0.23	1.37	0.42
7. Vegetables	-	-	1.21	0.57	1.21	0.37
8. Sugarcane	-	-	2.83	1.34	2.83	0.86
9. Fodder crops	-	-	2.73	1.30	2.73	0.83
Total kharif	79.03	66.10	138.94	65.91	217.97	65.98
Rabi						
1. Wheat	20.46	17.10	42.21	20.03	62.66	18.96
2. Gram	8.08	6.76	21.69	10.29	29.77	9.01
3. Pea	-	-	1.21	0.57	1.21	0.37
4. Vegetables	8.33	6.97	2.34	1.11	10.67	3.23
5. Sugarcane	1.22	1.02	4.22	2.00	5.45	1.65
6. Fodder crops	2.45	2.05	0.20	0.09	2.65	0.80
Total Rabi	40.54	33.90	71.87	34.09	112.41	34.02
Gross area	119.57	100.00	210.81	100.00	330.38	100.00

5.8 Irrigated Crops

During 1986-87 Malwa region witnessed long pauses of rains during the kharif season and the region passed through the drought conditions throughout the year. Thus, those who had irrigation sources could save their crops to have an average yield, other wise, agriculture was badly affected in the region and it also adversely affected the area under rabi crops. Thus the crops during both kharif and rabi remained mainly dependent on irrigation.

Of the gross cropped area of 330.38 hectares 227.55 hectares or 68.87 per cent were irrigated. Soybean was the most important irrigated crop and occupied about 1/3 (34.67 per cent) of the gross irrigated area. Another ¼ (25.94 per cent) of the irrigated area was under wheat. Soybean mixed with other crops occupied 17.10 per cent of the irrigated area and gram occupied 10.70 per cent. (Table 5.8)

Among different crops the extent of irrigation differed between the participant and non-participant farms. Thus soybean mixtures were irrigated to the extent of 29.67 per cent in the case of participant farms, whereas these were irrigated to the extent of 65.96 per cent in the case of non-participant farms. Similarly, While gram was irrigated to the extent of only 43.07 per cent on participant farms it was irrigated to the extent of 96.26 per cent on the non-participant farms. In the case of pure crop of soybean and wheat, however, the extent of irrigation on both the categories was about equal.

It will thus be observed that on both the categories of participant and non-participant farms, soybean and mixtures of

Table 5.8 Irrigated crops, selected farms, Indore district

Crop	Participants		% of irrigated area to gross cropped area	Non-participants		% of irrigated area to gross cropped area	Total		% of irrigated area to gross cropped area
	Area	% to total		Area	% to total		Area	% to total	
Soybean	24.87	36.47	69.49	54.02	33.90	73.70	78.89	34.67	72.32
Maize	0.22	0.32	11.70	0.81	0.51	100.00	1.03	0.45	38.29
Jowar	1.09	1.60	20.80	1.89	1.18	13.67	2.98	1.31	15.63
Soybean + Maize/Jowar/ Arhar	10.05	14.74	29.67	28.85	18.11	65.96	38.90	17.10	50.11
Vegetable	-	-	-	1.21	0.76	100.00	1.21	0.53	100.00
Sugarcane	-	-	-	2.83	1.78	100.00	2.83	1.24	100.00
~~Chari~~ Fodder crops	-	-	-	0.71	0.44	26.01	0.71	0.31	26.01
Total kharif	36.23	53.13	45.84	90.32	56.68	65.01	126.55	55.61	58.06
Wheat	18.83	27.62	92.03	40.19	25.22	95.21	59.01	25.94	94.17
Gram	3.48	5.10	43.07	20.88	13.10	96.26	24.36	10.70	81.83
Pea	-	-	-	1.21	0.76	100.00	1.21	0.53	100.00
Vegetables	8.33	12.21	100.00	2.34	1.47	100.00	10.67	4.69	100.00
Sugarcane	1.22	1.79	100.00	4.22	2.65	100.00	5.45	2.40	100.00
Fodder crops	0.10	0.15	4.08	0.20	0.12	100.00	0.30	0.13	11.32
Total Rabi	31.96	48.87	78.84	69.04	43.32	96.06	101.00	44.39	89.85
All Crops	68.19	100.00	57.03	159.36	100.00	75.59	227.55	100.00	68.88

soybean were important in kharif season, whereas, wheat and gram were the important crops of rabi season.

As regards irrigation also, the most important crops were soybean and mixtures of soybean and wheat and gram. While soybean occupied 34.67 per cent of the irrigated cropped area, soybean mixtures occupied 17.10 per cent. Wheat accounted for nearly one fourth (25.94 percent) of the irrigated area and gram 10.70 per cent. Among the two categories of participant and non-participant farms the percentage was similar. However the percentage of irrigated cropped area to gross cropped area varied considerably between two categories of farms. While non-participant farms had 75.59 per cent of their cropped area irrigated, the participant farms had only 57.05 per cent.

Soybean crop was irrigated to the extent of 72.32 per cent.

5.9 Yields of Major Crops

Since the reference year 1986-87 was a drought year the yields obtained for different cropswere much lower than that of the normal year. On the unirrigated farms the yields were affected more severely.

The yield difference between irrigated and unirrigated crops was very wide in the case of maize and wheat. While the irrigated maize yielded 1165 Kg. per hectare, the unirrigated one yielded only 494 Kg. Similarly irrigated wheat yielded 1559 Kg. per hectare as against only 808 Kg per hectare on unirrigated areas.

Soybean and gram showed little difference in yields in irrigated and unirrigated areas. Soybean yield was 992 Kg per hectare on irrigated area as against 914 on unirrigated area. Gram yield was also slightly higher (813 Kg) on irrigated area as compared to unirrigated area (763 Kg) (Table 5.9).

The yield per hectare on non-participant farms was much higher than that of participant farms. This was due to two reasons. Firstly, the non-participant farms had a much higher proportion of irrigated area and secondly they enjoyed the economy of larger size of farms. They were better equipped and had larger investments.

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Table 5.9 Yield of different crops (Kg/hectare)

Crop	Participants			Non-participant			Total		
	Irrigated	Un-irrigated	Both	Irrigated	Un-irrigated	Both	Irrigated	Un-irrigated	Both
Soybean	886	714	834	1040	1027	1037	992	914	970
Maize	909	494	542	1234	-	1234	1165	494	751
Jowar	459	761	698	635	536	550	570	594	591
Wheat	1476	772	1420	1597	841	1561	1559	808	1515
Gram	776	615	684	819	1604	848	813	763	804

C H A P T E R-VI

CULTIVATION OF SOYBEAN BY SAMPLE FARMERS

6.1 Awareness About Soybean

Formerly the farmers of this district grew Kalitur (black soybean) as a mixed crop and not as a monocrop. It was grown by a limited number of farmers on a limited area mixed with arhar, and jowar. Its cultivation was conditioned by its long duration, low yield and lack of demand in the market.

Introduction of yellow varieties of soybean created interest among the farmers due to higher yield, better quality of grain and marketability. But these still suffered from the long duration thereby not allowing second crop in rabi season, and shattering habit of the beans. However, as early as in 1974-75, 3 farmers out of 100 sample farmers became aware and developed interest in the cultivation of yellow soybean. By 1977-78, the number of such farmers increased to 16. The scientists in the Jawaharlal Nehru Krishi Vishwa Vidyalaya developed new varieties of soybean which were suitable to the area, had medium duration, lesser shattering habit and had higher yield. Punjab Agricultural University also released some soybean varieties. Market facilities were also expanded.. Thus there had been influx of soybean varieties, facilities of soybean cultivation and marketing avenues between 1978-79 and 1980-81. Thus, nearly 87 per cent farmers became fully aware about the soybean cultivation. During the three years from 1978-79 to 1980-81, 71 farmers out of 100 were fully aware about the utility of soybean crop and by 1983-84 all the farmers became aware of the soybean cultivation.

6.2 Starting of Soybean Cultivation

Only 2 farmers started growing soybean crop on an average area of 0.62 hectare in 1974-75 and there had been addition of

3 farmers every year till 1977-78. In 1978-79, 6 more farmers started growing soybean and in 1979-80 7 more farmers followed. Gaurav variety (72-44) attracted the farmers in large numbers and during 1980-81 and 81-82, 63 farmers joined the trail of soybean growers with an average coverage of 1.45 and 1.24 hectares. At the end of 85-86 all the sample farmers became soybean growers. (Table 6.1)

Table 6.1 Awareness and cultivation of soybean, sample farmers

(Area - Hectares)

Year	No.of farmers becoming aware of soybean	Farmers cultivating soybean for the first time		Average Area
		No.	Area	
1974-75	3	2	1.25	0.62
1975-76	3	3	3.23	1.08
1976-77	4	3	2.81	0.94
1977-78	6	3	3.00	1.00
1978-79	28	6	8.69	1.45
1979-80	16	7	9.16	1.31
1980-81	27	26	37.82	1.45
1981-82	6	37	45.80	1.24
1982-83	4	7	5.46	0.78
1983-84	3	1	0.75	0.75
1984-85	-	-	-	-
1985-86	-	5	2.12	0.42
Total	100	100	-	-

6.3 Soybean Varieties Sown, 1981-82 to 1985-86

During the last 5 years the sample farmers raised 7 varieties of soybean. These varieties included Gaurav (72-44), Punjab-1, 71-05, Ankur, Brag, JS-2 and Kalitur. During 1981-82, 87 sample farmers cultivated soybean and among them 40 farmers sowed Gaurav, 17 farmers Punjab-1, 11 farmers Ankur and 1 farmer JS-2. There were 18 farmers who cultivated local variety Kalitur. In the next year (1982-83) there was shifting towards Gaurav and Punjab-1 varieties which were grown by 52 and 23 farmers out of 94 soybean cultivating farmers respectively. During the third year (1983-84) more shifting occurred towards the Gaurav variety which was grown by 70 farmers out of 95 farmers. This shifting continued till 1985-86 when the number of farmers growing Gaurav variety increased to 76 in 1984-85 and 82 in 1985-86.

The change in the varieties during the last 5 years was due to higher yield, boldness and good quality of grain, shorter duration and lesser shattering. Gaurav (72-44) developed by J.N.K.V.V. Scientists at Jabalpur possessed all these favourable characteristics. Gaurav is a medium duration variety allowing wheat as second crop in rabi, had good quality of grain, higher yield rate, lesser shattering, resistance to diseases and above all it was most suited to the agro-climatic conditions of the region. Consequently, it attracted the largest number of farmers and became the most commonly grown variety of soybean. Punjab-1 was another variety sown by farmers next to Gaurav. It was grown due to its non-shattering habit. (Table 6.2)

Table 6.2 Number of farmers growing different varieties during the last 5 years.

Variety	1981-82	1982-83	1983-84	1984-85	1985-86
Gaurav(72-44)	40	52	70	76	82
Punjab-1	17	23	14	12	9
71-05	-	1	1	3	7
Ankur	11	9	6	2	-
Brag	-	-	1	1	1
J.S.2	1	1	1	1	1
Kalitur	18	8	2	-	-
Total	87	94	95	95	100

6.4 Area Under different varieties, 1981-82 to 1985-86

During 1981-82 the sample farmers raised soybean on an area of 136.07 hectares which gradually increased and was 185.86 hectares in 1985-86, an increase of 36.59 per cent. In 1981-82 41.22 per cent of the area under soybean was under Gaurav (72-44) followed by 29.14 per cent under Punjab-1, 16.74 per cent under Ankur, 10.67 per cent under Kalitur and 2.23 per cent under JS-2. During the subsequent years, Gaurav variety was most predominent. Area covered by this variety increased every year and the proportion of other varieties decreased. By 1985-86, Gaurav variety was sown on an area of 137.44 hectares or 73.96 per cent out of total area of 185.86 hectares under soybean. During 1985-86 farmers did not grow Ankur and Kalitur at all. Punjab-1 was next important to Gaurav . It was preferred due to its non-shattering habit and medium duration. It covered 17.31 per cent of the area under soybean. (Table 6.3)

Table 6.3 Area under different soybean varieties during the last 5 years

(Area- hectares)

Variety	1981-82	1982-83	1983-84	1984-85	1985-86
Gaurav 72-44	56.09 (41.22)	83.04 (54.20)	128.14 (76.60)	131.83 (76.72)	137.44 (73.96)
Punjab-1	39.65 (29.14)	37.70 (24.61)	16.28 (9.73)	21.38 (12.44)	32.20 (17.32)
71-05	-	1.00 (0.65)	1.00 (0.60)	5.62 (3.27)	11.30 (6.07)
Ankur	22.78 (16.74)	21.51 (14.04)	16.64 (9.95)	1.87 (1.09)	-
Brag	-	-	0.40 (0.24)	8.09 (4.71)	1.00 (0.54)
J.S.2*	3.03 (2.23)	3.03 (1.98)	3.03 (1.81)	3.03 (1.76)	3.92 (2.11)
Kalitur	14.52 (10.67)	6.93 (4.52)	1.80 (1.07)	-	-
Total	136.07	153.21	167.29	171.82	185.86

6.5 Importance of Soybean in Kharif Crops

Soybean is mainly a kharif crop. During 1985-86 the sample farmers raised kharif crops on 217.97 hectares and of this 185.86 hectares or 85.27 per cent was under soybean. It was grown as pure crop on 107.60 hectares (49.36 per cent) and as mixed crop with maize, tur or jowar on 78.26 hectares (35.90 per cent). Soybean dominated the scene among all categories of farmers and it covered 89.81 per cent of kharif area among small farmers followed by 84.49 per cent among large farmers, 84.31 per cent among marginal farmers and 80.88 per cent area among the medium size farmers.

Among the participant farmers soybean was much more popular as compared to the non-participant farmers. The participants alloted 88.14 per cent of the kharif area for soybean. As against this, the non-participant group alloted 83.63 per cent area under soybean.

Thus soybean has become the most popular crop to be sown in kharif and it has replaced the area under all other crops as it covered more than 80 per cent area among all the categories of the farmers. (Table 6.4)

Table 6.4 Importance of soybean in kharif crops, 1985-86

Category of farm	Pure crop of Soybean	Mixed crop of soybean	Total area of soybean	Total kharif crops	% of Soybean to kharif
Participants					
Marginal	7.00	0.69	7.69	9.26	83.04
Small	24.84	19.08	43.92	49.72	88.33
Medium	3.95	14.10	18.05	20.05	90.02
Large	-	-	-	-	-
Sub-total	35.79	33.87	69.66	79.03	88.14
Non-participants					
Marginal	0.75	-	0.75	0.75	100.00
Small	22.63	16.30	38.93	42.52	91.56
Medium	29.43	24.04	53.47	68.39	78.18
Large	19.00	4.05	23.05	27.28	84.49
Sub-total	71.81	44.39	116.20	138.94	83.63
Both					
Marginal	7.75	0.69	8.44	10.01	84.31
Small	47.46	35.38	82.84	92.24	89.81
Medium	33.39	38.14	71.53	88.44	80.88
Large	19.00	4.05	23.05	27.28	84.49
Sub-total	107.60	78.26	185.86	217.97	85.27

6.6 Cultivation of Soybean as Pure and Mixed crop

Formerly the Kalitur (local variety) was sown as mixed crop. Now the cultivation of this local variety has shrunk to the minimum and the yellow varieties have taken over. These are grown both as pure crop as well as mixed crop. Inter cropping has not yet been adopted by the farmers inspite of the repeated recommendations of the scientists and the extension workers.

During 1985-86, soybean was grown on an area of 185.86 hectares and of this 107.60 hectares or 57.89 per cent area was exclusively under soybean and 78.26 hectares or 42.11 per cent was sown as mixed crop with maize, jowar and arhar. Among the participant farmers the proportion under single and mixed cropping was almost equal being 50.44 per cent and 49.56 per cent respectively. In the case of non-participants the area under single cropping was larger (62.36 per cent) as against mixed cropping (37.64 per cent) (Table 6.5)

Table 6.5 Soybean as pure and mixed crop in 1985-86

(Area- Hectares)

Single/Mixed	Participants		Non-participants		Both	
	Area	%	Area	%	Area	%
Single	35.13	50.44	72.47	62.36	107.60	57.89
Mixed	34.52	49.56	43.74	37.64	78.26	42.11
Total	69.65	100.00	116.21	100.00	185.86	100.00

6.7 Area Irrigated under Soybean

Since soybean is a kharif crop it is mainly an unirrigated crop. But 1985-86 was a draught year in Malwa region. Rainfall started very late and did not continue long. Hence soybean was sown late after a long wait for rains. When the rains did not occur in time, the farmers having irrigation facilities cultivated soybean as irrigated crop. Similarly, when the crop started drying up, the farmers also did irrigation to protect the crop. Due to this irrigation played a very important role in raising the soybean crop in 1985-86. If the rains occur properly in Malwa region, the irrigation is not required to raise a soybean crop.

Of the 185.86 hectares of soybean, 117.76 hectares or 63.36 per cent was irrigated and 36.64 per cent depended on rains. Among the participants the percentage of area irrigated and un-irrigated were almost equal being 50.11 per cent and 49.89 per cent respectively. In the case of non-participants, irrigated area was 71.30 per cent and un-irrigated 28.70 per cent. It was so as non-participants included a sizable number of large farmers who had irrigation facilities.

Under the irrigated area, soybean was grown as single crop on 66.96 per cent area and on 33.04 per cent, as mixed crop. Un-irrigated crop included 42.21 per cent as single crop and 57.79 per cent as mixed crop.

Under the single cropping irrigation was done on 73.28 per cent while under mixed cropping soybean was irrigated to the extent of 49.72 per cent (Table 6.6)

Table 6.6 Area Irrigated under Soybean crop

(Area-Hectare)

Particulars	Irrigated		Un-irrigated		Both	
	Area	%	Area	%	Area	%
PARTICIPANTS						
Single	24.84	35.67	10.29	14.77	35.13	50.44
Mixed	10.06	14.44	24.46	35.12	34.52	49.56
Total	34.90	50.11	34.75	49.89	69.65	100.00
NON-PARTICIPANTS						
Single	54.01	46.48	18.46	15.88	72.47	62.36
Mixed	28.85	24.82	14.89	12.82	43.74	37.64
Total	82.86	71.30	33.35	28.70	116.21	100.00
BOTH						
Single	78.85 (73.28)	42.43 (66.96)	28.75 (26.72)	15.47 (42.21)	107.60 (100.00)	57.89
Mixed	38.91 (49.72)	20.93 (33.04)	39.35 (50.28)	21.17 (57.79)	78.26 (100.00)	42.11
Total	117.76	63.36 (100.00)	68.10	36.64 (100.00)	185.86	100.00

6.8 Area Under different varieties of Soybean

Among the varieties grown by the sample farmers Gaurav (72-44) was sown on an area of 137.44 hectares or 73.95 per cent of 185.86 hectares of area under soybean. It was preferred as it was non-shattering, medium duration, disease resistant and high yielding variety. Punjab-1 variety was also popular as it possessed more or less similar characteristics as that of 72-44. This variety was grown on 17.32 per cent area. Other varieties included JS-2 and Brag which were grown on a very small area (2.65 per cent).

A new variety 71-05 also found place among the farmers and it covered 11.30 hectares or 6.88 per cent area. Gaurav (72-44) was adopted by both participants and non-participant farmers and covered 78.23 per cent and 71.39 per cent of the soybean area respectively. Punjab-1 came next and covered 11.21 per cent area among participants and 20.99 per cent among the non-participant farmers. Newly introduced variety 71-05 covered 9.00 per cent among participants and 4.33 per cent among the non-participants. (Table 6.6 A).

Table 6.6 A Area under different varieties of Soybean

(Area-Hectare)

Variety	Participants		Non-participants		Both	
	Area	%	Area	%	Area	%
72-44	54.48	78.23	82.96	71.39	137.44	73.95
Punjab-1	7.81	11.21	24.39	20.99	32.20	17.32
7105	6.27	9.00	5.03	4.33	11.30	6.08
JS-2	1.09	1.56	2.83	2.43	3.92	2.11
Brag	-	-	1.00	0.86	1.00	0.54
Total	69.65	100.00	116.21	100.00	185.86	100.00

6.9 Area Irrigated under different Varieties of Soybean

Both J.S-2 and Brag were entirely irrigated and newly introduced variety, 7105 was irrigated to the extent of 95.58 per cent. Punjab-1 and Gaurav (72-44) were also irrigated to the extent of more than 60 per cent (Table 6.7)

Table 6.7 Area Irrigated under different varieties of soybean

(Area-Hect.)

Variety	Irrigated		Un-irrigated		Total	
	Area	%	Area	%	Area	%
Gaurav(72-44)	82.56	60.07	54.88	39.93	137.44	100.00
Punjab-1	19.48	60.50	12.72	39.50	32.20	100.00
7105	10.80	95.58	0.50	4.42	11.30	100.00
JS-2	3.92	100.00	-	-	3.92	100.00
Brag	1.00	100.00	-	-	1.00	100.00
Total	117.76	63.36	68.10	36.64	185.86	100.00

6.10 Varieties sown as single and mixed crop

Among the 5 varieties of soybean Brag and JS-2 were sown as single crop. The newly introduced variety 71-05 was grown on 11.30 hectares and of this 10.30 hectares or 91.15 per cent was sown as single crop. Gaurav(72-44) was sown on 76.88 hectares (55.94 per cent) as single crop and on 60.56 hectares (44.06 per cent) under mixed cropping. Punjab-1 variety was sown under mixed cropping as well as single cropping. Thus Gaurav and Punjab-1 variety were preferred for mixed cropping. (Table 6.8)

6.11 Crops sown as mixed crops with Soybean Varieties

Maize, jowar and arhar (tur) were sown as mixed crops with soybean. Seeds of these crops were mixed with soybean for sowing in the same line. Intercropping by line sowing was not practised. Mixedcropping was adopted on 78.26 hectares and of this maize was used as mixedcrop on 53.87 hectares or 68.84 per cent area. Jowar was sown as mixedcrop on 30.04 per cent area. One farmer used jowar and arhar as mixedcrops with soybean on 1.12 per cent area of the mixed-crop.

Table 6.8 Varieties Sown as single and mixed crops

(Area-Hect.)

Variety	Single		Mixed		Both	
	Area	%	Area	%	Area	%
72-44	76.88	55.94	60.56	44.06	137.44	100.00
Punjab-1	15.50	48.14	16.70	51.86	32.20	100.00
7105	10.30	91.15	1.00	8.85	11.30	100.00
JS-2	3.92	100.00	-	-	3.92	100.00
Brag	1.00	100.00	-	-	1.00	100.00
Total	107.60	57.89	78.26	42.11	185.86	100.00

Maize was used as mixed crop with all the 3 varieties and it was a mixed-crop with Gaurav on 37.67 hectares, with Punjab-1 on 15.20 hectares and with 71-05 on 1.00 hectare. Jowar was sown as mixed-crop with 2 varieties : on 22.01 hectares, (28.12 per cent) with Gaurav and on 1.50 hectares (1.92 per cent) with Punjab-1. Arhar and jowar together were used as mixed crops with Gaurav on a small area of 0.88 hectare (1.12 per cent)

Among the soybean varieties Gaurav was major crop for all the mixed crops and it was sown with maize on 37.67 hectares, with jowar on 22.01 hectares and with both jowar and Arhar on 0.88 hectares. Punjab-1 was sown with jowar only on 1.50 hectares (1.92 per cent) and 71-05 with maize on 1.00 hectare (1.28 per cent) (Table 6.9).

Table 6.9 Mixed cropping of soybean

Mixed crops	Area Hectares			
	Irrigated	Un-irrigated	Total	%
1. 7244 + Maize	24.71	12.96	37.67	48.14
2. Punjab-1 + Maize	10.83	4.37	15.20	19.42
3. 7105 + Maize	0.75	0.25	1.00	1.28
4. 7244 + Jowar	2.62	19.39	22.01	28.12
5. Punjab-1 + Jowar	-	1.50	1.50	1.92
6. 7244 + Jowar + Arhar	-	0.88	0.88	1.12
Total	38.91	39.35	78.26	100.00

6.12 Variety, Area, Yield of Soybean Minikits

Every participating farmer was given 10 kg. seed of Gaurav (72-44) along with the required quantity of rhyzobium culture. This seed was to be grown on one tenth of a hectare. Accordingly 60 participant farmers were expected to cover 6 hectares but covered 7.15 hectares by using lower seed rate. Since the minikit and control plots were not laid by the Rural Agricultural Extention Officers, the farmers used their own estimation to cover area under minikits and demarcated it. But they did not demarcate the control plot and assumed the remaining area of the field as control plot which was also sown under the same variety. Seed supplied to them under minikit programme was a treated one and they also inoculated it by using rhyzobium culture. They also used recommended doses of fertilizers and adopted the recommended practices of ploughing, sowing, line to line and plant to plant distances, and timely inter-culture operations. But nobody used insecticides and pesticides. They harvested the crop at the correct stage.

Seed in the minikits was sown under irrigated and unirrigated conditions on 3.61 and 3.54 hectares respectively. On an average, a farmer obtained a yield of 907 kg.per hectare from the minikit plot. This, for irrigated area was 1,016 kg. per hectare and for unirrigated area, 797 kg.per hectare. As against this, the yield of same variety sown on other parts of the field was 836 kg.per hectare: 912 kg. per hectare for irrigated area and 625 kg. per hectare for unirrigated area. These figures were lower than the yield obtained from the minikit plots (Table 6.10)

Table 6.10 Yields of Minikit variety on Minikit plots and other fields of participant Farmers

(Fig.kg. per ha.)

Particulars	Irrigated area	Unirrigated area	Average
Minikit Plots	1016	797	907
Other area	912	625	836

6.13 Yieldsof Different Soybean Varieties

6.13.1 Yields on Participant Farms

Participant farmers mainly sowed Gaurav variety. Other varieties were Punjab-1, 71-05 and JS-2. Gaurav variety was largely preferred due to its charming medium duration and non-shattering habit. It also allowed rabi crop like gram and wheat on the same field. The average yield for all the varieties was 844 kg.per hectare : 887 kg.on irrigated area and 740 kg.on unirrigated area.

Among different varieties the highest yield of 1,009 kg. per hectare was obtained for JS-2 which was sown only on small area

of 1.09 irrigated hectares Punjab-1 was next with 933 kg. followed by Gaurav, 836 kg. and 71-05 with 683 kg.per hectare. Under irrigated condition average yield per hectare was 1,009 kg.for JS-2 followed by 912 kg. for Gaurav, 905 kg. for Punjab-1 and 697 kg. for 71-05 variety. Under unirrigated conditions the yields obtained for different varieties were quite lower as against the yields obtained from irrigated plots. Punjab-1 recorded highest yield of 968 kg.per hectare for unirrigated plots. As compared to this the yield obtained from Gaurav was 625 kg. and from 71-05 it was further lower (400 kg.per hectare). (Table 6.11)

6.13.2 Yield on Non-participant farms

It may be indicated that the non-participant farmers generally were medium and large farmers and had their own irrigation facilities while the participant farmers were dependent on others and had to pay high irrigation charges. Further, the non-participant farmers were in a capacity to arrange the inputs and labour in a better way than the participant farmers who were either small or marginal farmers. Soybean was treated as an input and labour intensive crop to be managed with much care. Hence the non-participant farmers had an upper hand in irrigation and in the management of both inputs and the labour needed to obtain the desirable yield from soybean crop as compared to the participant farmers. This has been fully reflected in the yields obtained from the different varieties of soybean as against the participant farmers. In short, the non-participants mainly raised soybean crop under irrigated conditions to the extent of nearly 75 per cent. They also used fertilizers in a large measure and also did interculture operations quite efficiently to keep the crop weed free which was a must to obtain higher yield. Owing to all these factors the non-participant

Table 6.11 Yields of different varieties of soybean sown as pure crop on participant and non participant farms.

Variety	Participants			Non-participants			Average(Both)		
	Irrigated	Un-irrigated	Average	Irrigated	Un-irrigated	Average	Irrigated	Un-irrigated	Average
72-44(Gaurav)	912	625	836	1113	1054	1098	1063	797	1032
Punjab-1	905	968	933	900	1042	963	902	944	955
71-05	697	400	683	676	-	676	687	400	680
JS-2	1009	-	1009	1237	-	1237	1173	-	1173
Brag	-	-	-	400	-	400	400	-	400
Average	887	740	844	1041	1051	1043	992	940	978

farmers on an average received 1,043 kg.per hectare, more or less similar under irrigated and unirrigated conditions, the figures being 1,041 kg.and 1,051 kg.per hectare respectively. An unusual feature observed among the non participants was the higher yield on unirrigated fields. It was so because these fields were nearer to the village and contained most fertile land. Among the different varieties, they received highest yield of 1,237 kg.per hectare for JS-2 followed by Gaurav, 1,098 kg. and Punjab-1, 963 kg. Brag gave the lowest yield of 400 kg. and variety 71-05 did better and gave 676 kg.of yield. Again, under irrigated condition the yield rate was higher. The non-participant farmers obtained higher yields of different varieties specifically Gaurav, Punjab-1, and JS-2 varieties as against the participant farmers, who even could not get equivalent yield from the minikit plots. (Table 6.12).

6.13.3 Average yield from soybean on participant & Non-participant farms

Both participant and non-participant farmers received on an average yield of 978 kg. per hectare and this figure in the case of irrigated fields was 992 kg. and on unirrigated fields, 940 kg. per hectare. Among the different varieties the average yield of JS-2 was highest with 1,173 kg. followed by Gaurav, 1,032 kg. and Punjab-1 with 955 kg.per hectare. Brag returned with lowest yield of 400kg. per hectare, while, newly introduced variety 71-05 yielded 680 kg. per hectare. Under irrigated condition JS-2 gave 1,173 kg., Gaurav, 1,063 kg. Punjab-1, 902 kg., 71-05, 687 kg., and Brag 400 kg. Both Brag and JS-2 were grown only as irrigated crops. Under un-irrigated conditions punjab-1 gave best performance with 944kg. per hectare followed by Gaurav 797 kg. and 71-05 variety gave lowest yield of 400 kg. per hectare. (Table 6.11).

Table 6.12 Yield on Participant and Non-participant under mixed cropping of soybean varieties (yield – Kg per hectare)

Variety	Participants			Non-participant			Average		
	Irrigated	Un-irrigated	Average	Irrigated	Un-irrigated	Average	Irrigated	Un-irrigated	Average
72-44 + Maize (Gaurav)	850	449	633	1284	921	1210	1157	611	970
72-44 + Jowar	-	330	330	496	1104	921	496	572	563
72-44 + Jowar + Arhar	-	455	455	-	-	-	-	455	455
Punjab-1 + Maize	939	-	939	1184	801	1056	1136	801	1039
Punjab-1 + Jowar	-	400	400	-	-	-	-	400	400
71-05 + Maize	267	400	300	-	-	-	267	400	300
Average	825	381	511	1182	960	1107	1090	600	843

6.14 Yields of soybean varieties under Mixedcropping

Both participant and non-participant farmers practised mixed cropping of soybean with maize, jowar or arhar. Under mixed-cropping they received on an average 843 kg. yield per hectare. In the case of irrigated crops this yield was 1,090 kg. and under unirrigated conditions 600 kg.per hectare. Gaurav variety was largely used for mixed-cropping and it gave a yield of 970 kg. per hectare with maize and its yield in irrigated conditions was 1,157 kg. and in unirrigated condition 611kg. per hectare. When this variety was sown with jowar its yield went down radically to 563kg. and on irrigated farms to 496 kg. and to 572 kg. on unirrigated fields. This variety was also sown as mixed crop with jowar and arhar under unirrigated conditions and its yield was only 455 kg. per hectare.

Punjab-1 sown with maize provided an average yield of 1,039 kg. the highest, and its yield on irrigated plots was 1,136 kg. and on unirrigated fields, 801 kg.per hectare. When this variety was mixed with jowar its yield moved downwards to 400 kg. on unirrigated fields.

Newly introduced variety 71-05 did not perform well under mixedcropping either irrigated or unirrigated. It was sown with maize and the average yield obtained was 300 kg. which was 400 kg. in the case of unirrigated crops and on irrigated plots, 267 kg.per hectare.

The participant farmers obtained a yield of 511 kg.per hectare under mixedcropping and this on irrigated plots was 825 kg. and on unirrigated plots, 381 kg.per hectare. Gaurav variety sown with maize by participant farmers provided 633 kg. yield which was 850 kg.on irrigated area and 449 kg.on unirrigated fields. With jowar

and with jowar and arhar it was grown under unirrigated conditions and it provided unattractive yield of 330 Kg. and 455 Kg. per hectare respectively. Punjab-1 was sown irrigated with maize and it gave 939 Kg. of yield. With jowar it was sown unirrigated and its yield was 400 Kg.per hectare. Participants also tried 71-05 variety under mixedcropping with maize but they did not obtain good yield as compared to Gaurav and Punjab-1. Its average yield was 300 Kg. : 400 Kg. on unirrigated plots and 267 Kg. on irrigated fields.

The non-participant farmers used Gaurav and Punjab-1 for mixedcropping with maize or jowar and they obtained better yields. On an average they produced 1,107 Kg.of soybean under mixedcropping and on irrigated fields they obtained 1,182 Kg. per hectare and on unirrigated plots, a lower yield (960 Kg. per hectare). Gaurav did better under mixedcropping with maize. Its yield with maize was 1,210 Kg. on an average. On irrigated fields it was 1,284 Kg.and on unirrigated fields, 921 Kg. per hectare. Its performance with jowar was also better. It gave 921 Kg.of yield. On un-irrigated plots it 1,104 Kg..On irrigated plots its yield was lower (495 Kg.per hectare). Punjab-1 also did well under mixedcropping with maize. It provided 1,056 Kg. of an average yield: 1,184 Kg.on irrigated plots and 801 Kg. on unirrigated fields.

Maize was grown on most fertile land and applied F.Y.M. almost every year. The crop allowed sufficient light and air to the under neath crop. It is also intercultured atleast 2-3 times to keep it weed free. It is also harvested much earlier. Due to all these reasons soybean crop provided much higher yield under mixedcropping with maize as compared to a pure crop. As against this it failed miserably with jowar which is densely populated and

tall crop and leaves very little chance for underneath crop for light and air. It reduced all this to a bare minimum when grown as irrigated one. Thus it affects the soybean crop production much even in irrigated conditions. Under unirrigated conditions its plant population and height are less which help the soybean to increase its yield as compared to sown with it under irrigated conditions. On account of this yield of soybean sown with jowar under unirrigated condition was higher as compared to the irrigated area. (Table 6.12)

6.15 Cultivation Practices Adopted for Soybean by Sample Farmers

6.15.1 Presowing Operations (Ploughing/Harrowing)

Clod breaking was done before the onset of monsoon like every year in the month of June, but ploughing and harrowing operations were done with the onset of rains which were done late this year. Out of the 100 sample farmers 54 farmers did ploughing and harrowing 2 times, 37 farmers 3 times, and 9 farmers 4 times. The frequency of these operations depended on the soil. However, these operations were repeated till the field became free of weeds and clods which was very necessary to make the soil pulvarised for the healthy growth of soybean plants.

Among the participant farmers 35 did ploughing and harrowing 2 times and 25 farmers 3 times. In the group of 40 non-participant farmers, 19 did 2 ploughings or harrowings, 12 did it 3 times and 9 farmers repeated ploughing or harrowing 4 times. However, for soybean cultivation 2-3 times ploughing and harrowings are recommended which were followed by the farmers.

6.15.2 Sowing Dates

It was recommended that sowing of soybean should be completed between the last week of June and first week of July. Since rains were delayed no one could do sowing during the last week of June. There were only 7 farmers who could [illegible] moisture in the first week of July and did sowing on such fields. In the second week of July sowing was completed by 18 farmers and the largest number of 57 farmers did sowing in the third week of July. Remaining 18 farmers could do sowing in the 4th week of July.

Among the participant farmers, 6 farmers did sowing during first and second week of July and 47 farmers did sowing in the third week and remaining 7 farmers in the last week of July. Out of 40 non-participant farmers 5 did sowing in first week, 14 in the second week, 10 in the third week and 11 farmers in the last week of July.

6.15.3 Method of Sowing Adopted

Line sowing was adopted for soybean crop. For this they used specially made seed cum fertilizer drill, called Dufan and Tifan which provide sowing of two and three rows respectively. These drills provides dibbling of fertilizers 3-5 c.m. beneath the seed which is put at 2 to 3 c.m. depth. These drills also kept 30 to 45 c.m. row to row distance.

Dufan was most common and it was used by 89 farmers including 54 participant and 35 non-participant farmers. Only 11 farmers used tifan seed drill and among them 6 belonged to the participant farmers. For mixedcropping, seed of soybean and maize or jowar were mixed and were sown with line sowing method. Inter cropping was not adopted by any farmer.

6.15.4 Seed Treatment

Theerum, Kaptan and Diathem M 45 were known to most of the farmers but only 3 farmers including one from participant and 2 from non-participant group, treated the seed with the mixture of Theerum. Moreover, the seed supplied under minikit programme was already treated one. Thus, the soybean seed sown on other fields was almost untreated.

6.15.5 Seed Inoculation

Inoculation of seed sown on other fields was done by 20 farmers by using rhyzobium culture and among these 5 farmers were participants and 15, non-participant farmers.

6.15.6 Manure and Fertilizer Application

Farm yard manure was applied by 67 farmers including 36 participant and 31 non-participant farmers. Manure was kept in small heaps here and there before the on set of rains. After first shower sufficient to plough the fields the manure was spread all over the field first and then ploughings and harrowings were done to mix it with the soil.

As per the recommendations, 80 to 100 kg. per hectare of mixture of N.P.K. with 12:32:16 ratio prepared by IFFCO was to be applied by farmers of Indore district. As against this farmers applied 50 kg.per hectare. IFFCO mixture or 50 kg.of DAP 18:46.

There were 12 farmers including 7 participants and 5 non-participants who did not apply fertilizers at all. IFFCO mixture of 12:32:16 was used @ 50 kg.per hectare by 75 farmers and among them 47 were participant farmers. Small group of 13 farmers applied DAP (18:46) @ 50 kg.per hectare and among them 10 belonged to the non-participant farmers. This fertilizer was applied just before sowing as basal dose. Apart from this 22 farmers including

12 participant and 10 non participants also used urea for top dressing after the first weeding.

6.15.7 Seed Rate Adopted

Seed rate recommended for Gaurav (72-44) was between 70 to 80 kg. per hectare. This variety was sown by 70 farmers including 40 participant and 30 non-participants. Among them only 20 farmers adopted the recommended seed rate of 70-80 kg. per hectare. There were 14 farmers who used lower seed rate and among the 4 farmers used less than 60 kg. seed rate and 10 farmers kept seed rate between 60-70 kg. per hectare. Higher seed rate was applied by 36 farmers and among them 13 farmers used seed rate between 80-90 kg., 10 farmers between 90-100 kg. and another 13 farmers used seed rate above 100kg. per hectare.

Recommended seed rate for Punjab-1 was also between 70 to 80 kg. per hectare. This was sown by the 20 farmers and 7 of them maintained the recommended seed rate, 5 used lower seed rate and 8 farmers kept the higher seed rate including 4 farmers between 80 to 90 kg., 2 farmers between 90-100 kg. and another 2 farmers kept seed rate above 100 kg. per hectare. Newly introduced variety of 71-05 was sown by 11 farmers and 2 of them used the recommended seed rate of 70-80 kg. per hectare, 2 farmers used lower seed rate of 60-70 kg. per hectare, and 7 farmers used higher seed rate including 4 farmers between 80-90 kg. and 3 farmers between 90-100 Kg. per hectare.

JS-2 was sown by 2 farmers and one of them used recommended rate of 90-100 Kg. per hectare and the other farmer used lower seed rate between 70-80 Kg. per hectare. Brag variety was sown by one farmer only and he used recommended seed rate between 90-100 Kg. per hectare. (Table 6.13)

Table 6.13 Variety wise seed rate followed by the sample farmers

Seed rate (Kg per hectare)	Participant farmers				Non-participant farmers					Both				
	72-44	Punjab-1	71-05	JS-2	72-44	Punjab-1	71-05	JS-2	Brag	72-44	Punjab-1	71-05	JS-2	Brag
Below 60	2	1	-	-	2	-	-	-	-	4	1	-	-	-
60 - 70	7	1	2	-	3	3	-	-	-	10	4	2	-	-
70 - 80	5	1	-	1	15	6	2	-	-	20	7	2	1	-
80 - 90	9	2	2	-	4	2	2	-	-	13	4	4	-	-
90 - 100	8	2	1	-	2	-	2	1	1	10	2	3	1	1
100-& Above	9	1	-	-	4	1	-	-	-	13	2	-	-	-
All	40	8	5	1	30	12	6	1	1	70	20	11	2	1

6.15.8 Interculture operations

No one from among selected farmers used weedicides. They practised hand weeding and harrowing with Daura to eradicate the weeds. Weeding operations were started 15 days after sowing and were stopped 40-45 days after flowering started.

All the selected farmers did three weedings which included either two hand weedings and one harrow weeding or two harrow weedings with daura and one hand weeding. There were 32 farmers who did first weeding from 15 to 20 days and remaining 68 farmers did it from 20 to 25 days. Second weeding was done from 30 to 35 days and last weeding from 40 to 45 days. Since the rains were scanty and there had been long pauses of rains, the farmers did not find any difficulty in weeding the crop in time. During the reference year the farmers could do timely weedings.

6.15.9 Plant Protection

Forty eight farmers reported that their soybean crop was attacked by the stemfly but only 17 of them took measures by using Nuwacron and of these 10 farmers were participants. Girdle beetle attack was reported in 6 cases and 3 farmers applied Indosulphon to control them. Jassids, leafminer and black beetle were also noticed by 6 farmers but they did nothing to control them. Other farmers did not feel the necessity for plant protection.

6.15.10 Harvesting

Early maturing varieties like Punjab-1 and JS-2 were harvested between 90 to 95 days by 13 farmers. Remaining varieties like Gaurav 71-05 and Brag were harvested between 100 and 110 days. Actually, 36 farmers harvested after 100 days, 35 farmers after 105 days and 16 farmers after 110 days.

6.15.1 Drying of crop

For easy threshing it was recommended that the crop should be dried for 8-10 days before it is taken up for threshing purposes. There were 57 farmers who dried the crop for 3-4 days, 38 farmers between 5 to 9 days and 5 farmers dried crop for more than 10 days. Threshing was done with the help of threshers.

6.16 Crop Taken After Soybean

After soybean 30 farmers including 19 participants and non-participants took wheat, 18 farmers including 5 participant and 13 non-participants took gram. Fodder crop was taken by 35 farmers who included 23 non-participants. There were 3 farmers who raised sugarcane and 14 farmers took vegetable crops in the soybean plots. Among vegetable growers 5 were participant and 9 non participant farmers. Thus the adoption of early and medium duration soybean varieties, had enabled the farmers to take wide range of rabi crops after the harvesting of soybean crop.

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CHAPTER- VII

PARTICIPATION, OPINIONS AND SUGGESTIONS OF FARMERS ON SOYBEAN PROJECT

Participation, opinions and suggestions of the sample farmers were saught on the different activities of soybean project with special reference to the distribution of various inputs, plant protection measures, implements, storage, demonstrations, publicity, training and such other activities carried out under the special project on soybean. Among these the farmers acknowledged their participation in distribution of seed minikits, rhyzobium culture, different publicity media and demonstrations. None of them was benefited with the distribution of plant protection chemicals and instruments, seed treatment chemicals and instruments distribution of fertilizers, storage facilities, cultivation implements, training camps and visits to other areas. Thus present discussion is limited to the distribution of seed minikits, rhyzobium culture, publicity and demonstrations in which the sample farmers actually participated and had been able to form their opinions and to give suggestions to gain benefits in the near future.

7.1 Participation and opinions of Participant Farmers

7.1.1 Knowledge about the Programme

The participant farmers were asked when they came to know about the activities of the special project on soybean. A vast majority of 75 per cent farmers informed that they could know about this when Rural Agriculture Extension Officer approached them to supply them 10 kg. treated seed packet along with a packet of rhyzobium culture in the year 1985-86. He informed them about the venue and date of lifting the seed packets and culture. He also told about the area to be covered under the 10 kg. seed packet as well as some of the cultivation practices like method of sowing,

row to row distance, depth of seed and the fertilizer doses. Among the remaining 25 per cent farmers, 6.67 per cent farmers came to know about this project in 1983-84 and 18.33 per cent in 1984-85. One of the farmers also obtained seed minikit during 1983-84.

7.1.2 Opinions and Suggestions about seed Minikits

(a) Opinions

Seed packet contained 10 kg. treated seed of Gaurav(72-44) medium duration variety of soybean to be sown on 0.10 hectare area. All the farmers liked the seed and 25 per cent of them indicated that it had better germination than the local seed of the same and other varieties. A large section of 50 per cent farmers acknowledged that minikit seed provided higher yield and its grains were of better quality to be kept for next years seed. Besides better germination and higher yields the 15 per cent farmers told that seed supplied under seed minikit also proved disease resistant and matured in time to allow the rabi crop on the same field. There were 10 per cent farmers who could not indicate any special characteristics of the seed packet but told very categorically that it was a good seed. All the farmers indicated that minikit helped them in the selection of variety to be adopted next year.

(b) Suggestions

It was suggested by 15 per cent farmers that a composit minikit should be supplied and it should include treated seed, rhyzobium culture and the fertilizers. This would enable them to test the variety fully and production achieved after full dose of culture and fertilizers. A small group of 11.67 per cent farmers

suggested that it should be a composit kit of treated seed, culture and fertilizers and its quantity should be sufficient at least for one acre so that they may get the production sufficient for the next year's seed requirements. A vast section of 53.33 per cent farmers desired that the quantity of seed in the packet must be increased and 33.33 per cent categorically suggested that minikit quantity be increased for one acre area and the remaining 20 per cent farmers stressed that the quantity should be sufficient for one hectare. Their opinion was that the production obtained from the present minikit only helps them in the selection of variety but not in seed multiplication as the production obtained from 10 Kg. seed is too little as compared to the seed needed for next year. However, 20 per cent farmers were satisfied with the present size of minikit and did not offer any suggestion.

7.1.3 Opinions and suggestions about Rhyzobium Culture Packet

(a) Opinions :-

The participant farmers who were supplied rhyzobium culture to inoculate the minikit seed at the time of sowing liked the inoculation of seed and 76.67 per cent of them opined that it helped in the better germination of seed while remaining 23.33 per cent farmers were of the view that it kept the crop healthy through out and increased the production.

(b) Suggestions :-

Seed inoculation with rhyzobium culture was hailed by all the farmers and all of them desired that its distribution should not be restricted to seed minikits but it should also be supplied for non-minikit seed holders free of cost. As it helps both in the germination and production, 43.33 per cent farmers suggested that

rhyzobium culture should be supplied free of cost for total seed to be sown by them every year while 38.33 per cent restricted their suggestion to one hectare and 18.34 per cent to one acre. A section of 60 per cent farmers also suggested that rubber gloves should be given to the farmers and if possible small size culture mixers be made available in the villages by the block during the sowing period of the soybean.

7.1.4 Opinion and suggestions about publicity media

Publicity media which the farmers came across were radio talks, visuals like banners and boards, posters and pamphlets, leaflets, film shows, training camps and farmers fairs and personal contacts through neighbours, relatives, friends, and agricultural extension workers. Among the sample farmers 96.67 per cent took benefit of radio talks given by the experts of Agriculture department and the J.N. Agricultural University and 38.33 per cent also had chances to see the films screened by these two institutions. Banners, posters, pamphlets etc. attracted the attention of 58.33 per cent farmers. There were 10 per cent farmers who were given demonstrations on their farms during the previous years. Personal contacts with extension workers, friends, relatives and neighbourers also helped 95 per cent farmers. Farmers quoted more than two sources of information.

(a) Opinion on Publicity

It was the general opinion of the farmers that various publicity media particularly the radio talks, film shows and T.V. programmes were much beneficial with particular reference to the selection of varieties and plant protection measures against the pests, insects and the diseases. They could also see how to treat

and how to inoculate the seed before sowing. A section of 41.66 per cent farmers acknowledged that they could know about the different varieties, insects and pests and the diseases through the publicity media. Another 26.66 per cent farmers told that they got practical knowledge and guidance through the publicity media and the remaining 31.68 per cent farmers earned knowledge about the improved varieties and the improved methods of soybean cultivation.

(b) Suggestions on publicity

It was suggested that film shows in the villages should be organized particularly at the time of sowing and as and when the crop is attacked by pests, insects and diseases. New varieties and new plant protection measures be shown during these shows. Radio and T.V. talks should be made more frequent during the tenure of soybean crop to provide timely guidance. Demonstrations and trainings should also be given to a larger extent to cover more farmers. It will be much beneficial if the pamphlets containing the latest information are distributed among the farmers in advance of the sowing of the crop.

7.1.5 Opinions about soybean project as a whole

Present soybean project was hailed by all the participant farmers by saying that they could get better seed through minikit. In addition, 40 per cent also opined that they had been able to know about new varieties and improved methods of cultivation and plant protection through the activities of this project. About 46 per cent added that they could multiply seed for next year through the minikits and remaining 13.34 per cent farmers felt happy that the project provided them timely knowledge and guidance about the

new varieties, seed treatment, seed inoculation, diseases and such other aspects of the soybean cultivation.

All the farmers strongly supported the project by indicating its various benefits and utility and the role played by the project in the development of soybean cultivation in Indore district.

7.1.6 Suggestion on soybean project

Farmers made following suggestion to make the present project more useful

1. Minikit should include seed, rhyzobium culture and fertilizers and it should be for a larger number of farmers if not for every one every year.

2. Size of the composit minikit be increased to make it sufficient for at least one acre.

3. More demonstrations and training camps be held to accommodate larger number of farmers.

4. Minikits and information about new varieties and new methods of cultivation should be provided in advance so that the farmers may make use of new variety and technology during the current season of soybean crop. It will be better if the detailed pamphlets be given to the farmers and for this purpose a meeting might be called at the panchayat level to inform the farmers about the new developments of soybean cultivation.

5. There should be timely supply of seed, fertilizers and plant protection measures.

6. Radio and T.V. talks should be regular features during the tenure of crop to provide timely guidance.

7. Soil testing facility should be extended so that fertilizer application can be done accordingly.

8. Agricultural extension office should pay regular visits to the fields to advise the farmers on the spot.

9. This project should be continued for coming years and it should increase its support to the farmers to supply more inputs and to larger number of farmers by way of minikits every year

7.2 Opinions and Suggestions of Non-participant farmers

7.2.1 Knowledge and participation about soybean project

Among the non-participants 25 per cent had knowledge about the soybean project and its activities well before 1985-86. There were 7.5 per cent farmers who came to know in 1982-83, 10 per cent in 1984-85 and 35 per cent in 1985-86.

There were 5 per cent farmers who got the seed minikits in 1984-85 and 37.5 per cent received minikits during 1986-87 when data for present study was collected. However 27.50 per cent farmers among the non-participants did not get any benefit from the soybean project till the data for this study was collected in 1986-87.

7.2.2 Reasons for Non-participation in 1985-86

Since minikits were to be supplied to the small and marginal farmers, 52.50 per cent farmers could not receive minikits due to their large holdings. Twenty five per cent farmers had no knowledge about the minikit distribution, 5 per cent farmers got information very late and 17.50 per cent farmers were interested

to obtain the minikits but their names were not included in the lists.

7.2.3 Non-participants also liked the soybean project and 60 per cent of them mentioned that it is a good programme and it helped in seed multiplication of new varieties and also provided information about the improved methods of cultivation. There were 15 per cent farmers who opined that the minikits helped in the selection of suitable variety. A section of 25 per cent farmers did not give their opinion having no prior knowledge about the project.

7.2.4 Suggestions of Non-participants

Among the non-participants 75 per cent farmers expressed their suggestions and 10 per cent of them told that the minikits should be given to all the farmers every year as it would help them in the seed multiplication every year. Forty per cent farmers opined that minikits should be for one acre and it should also include fertilizers. A section of 25 per cent farmers stressed on the timely supply of the minikits along with pamphlets containing information about different varieties, seed rates, plant protection measures and other improved methods of cultivation.

It was the general contention of the farmers that the project should be continued for many more years and it should cover more farmers. Minikits should be a composit kit of seed, rhyzobium culture and fertilizers and its size should be sufficient atleast for one acre.

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CHAPTER-VIII

SUMMARY AND CONCLUSIONS

8.1 Scybean Development Programme

Scybean is thought to be the true remedy to the eratic phenominon of Indian dietary system. It possesses a moderately high oil content and complete protein, as its protein supplies sufficient amino-acid required by the body for building and repairing of tissues. The protein of soybean is easily digestible and it is similar to the protein of meat. Therefore soybean cultivation in India is very important.

To help the State Governments in their efforts to achieve the speedy increment in the area and production of soybean, the Government of India sponsored the National Oil-seed Development Project to improve both cultivation and production technology in the country. These projects were based on area specific approach adopted for the implementation of the special projects in respect of groundnut in Gujrat and soybean in M.P. These projects provided encouraging results in the sphers of area, production and cultivation technology. On this basis the Govt.of India sanctioned a special project for the extention of soybean cultivation in Madhya Pradesh, Uttar Pradesh and Rajasthan in 1984-85 and these projects were continued during 1985-86. A total outlay of Rs.329.25 lakhs was provided for the development of soybean and of this Rs.239.87 lakhs or 72.85 per cent was allocated for M.P. alone.

The special project for the extention of soybean cultivation in M.P. was sanctioned for Indore district. Distribution of minikits was the main medium adopted to popularise the new soybean variety as well as new cultivation technology. It was envisaged that

farmers belonging to the weaker sections including marginal farmers, small farmers and the farmers belonging to the scheduled castes and scheduled tribes be accomodated in this programme to the maximum. Both seed and fertiliser minikits were distributed during 1985-86.

The Directorate of Economics and Statistics, Ministry of Agriculture, Govt.of India, asked this centre to conduct a study on "Evaluation of the special project on soybean cultivation in Indore district".

8.1 Objectives of the study

(i) To study the adoption of cultivation technology through soybean minikit programme

(ii) To study the identification of suitable varieties

(iii) To study the impact of the programme on the production soybean

(iv) Farmers reactions about the soybean development programme

(v) To indicate the policy issues raised and make suggestions

8.1.2 Sample

Indore district is the homeland of soybean, therefore, it was selected for the special project on the Extention of soybean cultivation in M.P. by the Government of India in 1984-85. Under this project 1,000 minikits were distributed in 4 blocks including 300 minikits each in Indore and Depalpur blocks and 200 minikits each in Sawer and Mhow blocks. For the present study Indore and Mhow blocks were selected in consultation with the officials of Agriculture Department. From each block 50 farmers including 30 seed minikit recipients and 20 non-recipients were selected. Thus the study had a sample of 100 farmers including 60 participant recipients and 40 non-recipient farmers.

8.1.3 Collection of Data and Reference Year

Data were collected from both primary and secondary sources with the help of structured schedules. Besides, group discussions were held with the farmers and the officials to highlight the different aspects of soybean cultivation. Primary data were collected from the selected farmers and secondary data, from the state govt. offices located at Bhopal, Indore, and Mhow. The year 1985-86 was taken as a reference year for the present study. Data were collected during the two months of January & February, 1986.

8.2 Soybean Cultivation in M.P.

8.2.1 Area and Production

Madhya Pradesh is called the soybean state of the country. Presently it covers more than 75 per cent of the total area under soybean in the country. During the last 11 years from 1975-76 to 1985-86, the area under soybean in M.P. increased more than 24 times i.e. from 43.4 thousand hectares to 1,047 thousand hectares. Similarly production went up nearly 40 times with the figure of 783.1 thousand tonnes in 1985-86 as against 19.8 thousand tonnes in 1975-76. Per hectare yield was 455 kg. in 1975-76 and it increased by 64.40 per cent with 748 kg/hectare in 1985-86.

Although soybean is grown all over M.P. the Malwa region is supposed to be the homeland of soybean. Malwa region comprised Indore, Dhar, Ujjain, Dewas, Shajapur, Sehore and Raisen districts. Now, soybean cultivation has also made significant progress in Betul, Rajgarh, Chhindwara and Narsinghpur districts. These eleven districts are termed as the soybean growing districts and covered 70.36 per cent of the 1,047 thousand hectares under soybean

in the state in 1985-86. These districts produced 554.1 thousand tonnes or 70.76 per cent of the total production of 783.1 thousand tonnes during the same year.

8.2.2 Recommended Practices

Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur has since many years, been conducting varietal and agronomic trials to bring pefection to the cultivation of soybean in the state. It has come out with varieties for different agro-climatic regions and also ideal cultural practices.

8.3 Targets and Achievements in M.P. & Indore District

8.3.1 Targets & Achievements in the State

Against the target of 15.20 lakh hectares under different oilseeds in 1985-86 the achievement was 27.37 lakh hectares or 80.07 per cent more than the targetted area. In the case of soybean, the target was 7.50 lakh hectares and it was actually grown on 10.47 lakh hectares which was 39.60 per cent more than the target.

Production target of oilseeds was fixed at 14.13 lakh tonnes while achievement was 13.74 lakh tonnes or it fell short by 4.78 per cent. However, in the case of soybean the production was 7.83 lakh tonnes which surpassed the target of 7 lakh tonnes by 11.86 per cent.

For all oilseeds taken together 1,23,500 seed minikits were to be distributed in 1985-86. As against this 2,53,618 seed minikits were distributed which were more than double the target. Progress in the case of soybean was still better as 2,20,626 minikits were distributed as against the target of 93,750 minikits. Thus distribution of soybean minikits was 235.33 per cent more than the target.

Total outlay for oilseed development in the state was fixed at Rs.369.14 lakhs and of this Rs.335.53 lakhs or 90.89 per cent were actually spent in 1985-86. Situation in the case of soybean was different. The total outlay for special project for soybean cultivation was Rs.239.87 lakhs, while, Rs.242.47 lakhs or 101.08 per cent were actually spent in the state.

8.3.2 Targets and Achievements under Special Project on Soybean Cultivation in Indore District

Indore district was alloted a total outlay of Rs.2,41,445 under different oilseeds development programmes and of this Rs.1,99,745 or 82.73 per cent were alloted for the special project on soybean cultivation. As against this the actual expenditure in 1985-86 was Rs.1,96,362 or 1.69 per cent less than the target.

Expenditure on the special project included 8.61 per cent seed subsidy, 49.24 per cent on plant protection, 14.66 per cent on farm implement subsidy, 5.69 per cent on demonstrations, 20.65 per cent on fertilizer minikits and 1.15 per cent on training and publicity. Apart from this, payments for rhyzobium culture and seed minikits were made by the State Agriculture Department.

8.4 Indore District

Indore is one of the smallest districts of the state. It occupies of 3,910 sq.km. and comprise 644 villages and 5 cities. It has 4 tehsils and blocks only 34.06 per cent of the district population is rural. The main crops of the district were wheat jowar, gram and soybean (19.29 per cent). Wheat gram and sugarcane were irrigated crops of the district.

8.5 The selected Farms :

Of the selected 100 farmers 17 were marginal, 61 small

farmers, 19 medium farmers and only 3 large farmers. The participant farmers were mainly small farmers.

Soybean was the most important crop occupying one third (33.01 per cent) of the gross cropped area. Soybean mixtures occupied another 23.49 per cent. Among rabi crops only wheat (18.96 per cent) and gram (9.01 per cent) were important.

Among irrigated crops soybean and wheat were most significant.

8.6 Soybean Cultivation on Sample Farms

Seed minikits were largely distributed to the weaker sections. Among the 60 participant farmers, 26.67 per cent were marginal farmers, 63.33 per cent small farmers and 10 per cent medium size farmers owning land between 4 to 10 hectares. No large farmer was given seed and fertilizer minikits under this programme.

8.6.1 Awareness and Cultivation of Soybean

Formerly the farmers grew kalitur as mixed crop with arhar and jowar on a very limited area. Introduction of yellow varieties of soybean evinced the interest among the farmers but it still sufferred due to the long duration and shattering habit. The development of varieties which were of medium duration, non-shattering and high yielding by the Scientists of J.N. Agricultural University, Jabalpur during 1978-81 brought about redical changes in the outlook of the farmers and by the end of 1983-84 all the farmers became fully aware about the utility of soybean cultivation.

Cultivation of yellow soybean was started first by 2 farmers out of 100 farmers on a tiny area of 1.24 hectares in 1974-75. Till 1979-80 the area under soybean remained limited due to the long duration, shattering habit and lack of marketing

facilities. Introduction of medium duration, non-shattering and high yielding varieties like Gaurav (72-44) along with good marketing facilities attracted the large number of farmers to become soybean growers. Till 1981-82, 63 farmers out of 100 became soybean growers with an average area of 1.45 hectares each. At the end of 1985-86 all farmers were proficient soybean growers.

8.6.2 Soybean As Major Kharif Crop

Hitherto, soybean has become a major kharif crop. During 1985-86 sample farmers raised kharif crops on 217.97 hectares and of this 185.86 hectares or 85.27 per cent were covered under soybean. Soybean was grown as main crop in kharif by all the farmers. It covered 89.81 per cent of the kharif area among small farmers, 84.49 per cent among large farmers, 84.31 per cent among marginal farmers and 80.88 per cent among the medium size farmers.

Soybean was grown both as pure crop and mixed crop with maize, jowar and arhar. It was grown as pure crop on 49.36 per cent area and as mixed crop with maize, jowar and arhar on 35.90 per cent area. Soybean covered larger area, 88.14 per cent of the total kharif area, among participants as against non-participants who covered 83.63 per cent kharif area under this crop.

8.6.3 Identification of Suitable Varieties

During the last 5 years (1981-82 to 1985-86) the sample farmers raised 7 soybean varieties namely Gauray, Punjab-1, Ankur, Brag, JS-2 and Kalitur. In 1981-82 Gaurav was sown by 40 farmers, Punjab-1 by 17 farmers, Ankur by 11 farmers, JS-2 by 1 farmer and Kalitur by 18 farmers. In the next year (1982-83) shift occurred towards Gaurav and Punjab-1 which were grown by 52 and 23 farmers respectively. During the third year, shifting was towards Gaurav

variety and it continued thereafter and it was grown by 82 out of 100 in 1985-86.

Choice of variety among the farmers was marked by the higher yield, boldness and shine of grain, good price, shorter duration allowing rabi crops like wheat, gram, or linseed in the same plot, and lesser shattering habit. All these characteristics were possessed by the Gaurav variety developed on Adhartal Farm by the Scientists of J.N. Agricultural University, Jabalpur. Therefore, the farmers grew Gaurav variety very commonly. The variety developed by Punjab Agricultural University called Punjab-1 also possessed some of these traits.

Distribution of seed minikits of Gaurav variety, demonstrations and adaptive trials conducted under different schemes specially under special project on soybean cultivation also convinced the farmers about the promising characteristics of Gaurav variety.

The selected farmers generally grew Gaurav variety and a few of them also cultivated Punjab-1. Both the varieties were preferred mainly due to medium duration, and lesser shattering habit. During 1985-86, soybean was grown on 185.86 hectares by the sample farmers, and of this, 73.95 per cent was under Gaurav, 17.32 per cent under Punjab-1 and the remaining 8.73 per cent under other varieties of soybean.

8.6.4 Performance of Soybean Varieties

The reference year 1985-86 was a drought year and Malwa region faced severe drought conditions. This had adverse effect on the cultivation of soybean crop and its production was badly

hit as compared to normal years. Gaurav variety seed was distributed in minikits. Per hectare yield obtained from minikit plots was 1,016 kg.for irrigated area and 797 kg.for unirrigated plots. As against this, yield of this variety on other areas of the same farmers was much lower, the figures being 912 kg.for irrigated and 625kg.for unirrigated area.

Average yield of soybean was 978 kg/hectare and this figure was 992 kg on irrigated and 940 kg.on unirrigated fields. The average yield for all the varieties for participants was 844 kg.per hectare: 887 kg.on irrigated area and 740 kg.on unirrigated area. The non-participant farmers on an average received 1,043 kg.per hectare, more or less similar under irrigated and unirrigated conditions. The figures being 1051 Kg. and 1,041 kg.per hectare respectively. It was so because non-participant farmers were in a capacity to arrange the inputs and labour in a better way than the participant farmers who were either small or marginal farmers.

Among different varieties the highest yield of 1,173 kg./hectare was obtained from JS-2 followed by Gaurav, 1,032 kg/hectare. Brag gave the lowest yield of 400 kg/hectare.

Under mixed cropping the average yield of soybean was 843kg. and it was 1,090 kg.under irrigated and 600 kg under unirrigated conditions.

Among different varieties used for mixed cropping with maize, jowar and arhar, Gaurav proved most promising with maize and it gave a yield of 970 kg/hectare. Under irrigated conditions the yield was much higher (1,157 kg/hectare) as compared to unirrigated conditions (611 Kg.). Production of this variety was much lower when sown with

jowar and arhar. Its yield with jowar went down to 563 kg/hectare. Punjab-1 also fared well with maize with an average yield of 1,039 kg/hectare.

For mixed cropping, Gaurav variety and maize crop were thought most suitable and most profitable by the farmers. Mixed cropping was done on 78.26 hectares and of this 53.87 hectares or 68.84 per cent was done with maize. In this area Gaurav variety was sown with maize on 37.67 hectares or 48.14 per cent area used for mixed cropping.

8.6.5 Cultivation Practices Adopted

Farmers of Indore district were quite conversant with soybean cultivation. They are well aware about different recommended practices of soybean.

Farmers in 1985-86 completed soil breaking operations before the onset of monsoon and before sowing they made the fields free from clods and weeds. They made the soil pulverised by doing 2-3 ploughings and harrowings.

They were aware about the fact that sowing of soybean must be completed by the first week of July. But this year they could complete the sowing till the last week of July due to delayed monsoon.

They adopted line sowing method and kept recommended row to distance and depth of seed with the help of specifically made seed cum-fertilizer drill called Dufan and Tifan.

Minikit seed was treated one. Besides, 3 farmers including one paticipant and 2 non-participants also treated the seed with Theerum. Seed inoculation with rhyzobium culture was done by 20

farmers including 15 non-participant farmers.

Most of the farmers used self produced seed and they generally adopted 10 to 20 per cent higher seed rate due to ungraded seed. For example, Gaurav variety was sown by 70 farmers and among them 36 used higher seed rate, 20 farmers recommended seed rate and 14 farmers used lower seed rate between 55 and 70kg as against 70-80 kg/hectare recommended for the variety.

Fertilizers were not applied by 12 farmers at all. As per the recommendations 80 to 100 kg/hectare mixture of NPK with a ratio of 12:32:16 was to be applied. As against this most of the farmers used 50kg. mixture of IFFCO or 50 kg/hectare DAP (18:46). IFFCO Mixture was used by 75 farmers and DAP by 13 farmers.

All the farmers weeded soybean crop three times to keep it weed free. They started first weeding after 15 days of sowing and completed third weeding before the crop became 40-45 days old. No weedicides were used. They adopted either manual weeding or with the help of specially made harrow called Daura.

Soybean crop was infested with insects and pests and also some of the diseases. A few farmers adopted plant protection measures.

Harvesting was done when crop was sufficiently ripe. No one did early or late harvesting. After drying the crop for 8-10 days they did threshing with the help of threshers.

8.6.6 Crops taken after soybean

After soybean, 30 farmers took wheat, 18 farmers took gram, 35 farmers grew fodder crops, 14 farmers took vegetables and 3 farmers took sugarcane. This became possible due to the

sowing of medium duration soybean varieties mainly Gaurav and Punjab-1.

8.7 Opinions and Suggestions of the Farmers

8.7.1 Opinions

The soybean project was appreciated by all the farmers especially the seed minikit distribution programme. Forty farmers told that they knew about new suitable varieties and improved methods of cultivation from RAEO, 46 farmers had a chance to multiply good variety seed by themselves with the minikit seed and 14 farmers felt that the project provided them timely knowledge and guidance about different cultivation practices, new varieties and plant protection measures. All of them were in favour of the continuance of the project for ever.

8.7.2 Suggestions

Farmers suggested that (a) a composit kit should be supplied and it should include seed, rhyzobium culture, fertilizers and some chemicals to control the common-diseases and insects (b) minikit should be supplied in time, (c) its size be increased to one acre area (d) information about new varieties and methods of cultivation be provided in advance, (e) minikit should be given every year to the poor farmers, and (f) this project should also organize T.V. programmes, films etc. Farmers training camps and frequent field visits of the extension workers should be organised. All these will provide them more practical knowledge and guidance.

8.7.3 Issues Raised

During the field investigation the farmers indicated that soybean crop had become a main kharif crop and it is grown by all farmers, but it faced many problems.

(i) After Garrav and Punjab-1 the scientists have not been able to evolve a more promising variety which was greatly needed. It should be resistant to diseases, short duration and higher yielding.

(ii) Soybean production failed to maintain an upward trend in terms of per hectare yield.

(iii) Soybean had become a labour intensive and input intensive crop which an average farmer was not in a position to undergo. Labour had become quite expensive and it was not easily available.

(iv) Fodder cultivation, particularly jowar had become more profitable with less inputs and labour. Prices of fodder were also attractive. Therefore, some of the soybean area was being used for growing fodder crops.

(v) Soil and crop both have become disease infested. Insects & pests attacks are a regular feature. Farmers had adopted a pessimistic outlook to control them due to labour and cost of plant protection measures.

Suggestions

(i) Still higher yielding varieties are needed which should be resistant to diseases and should be of shorter duration.

(ii) Weedicides should be popularized to overcome the labour problem.

(iii) Plant protection measures may be carried out by the Agriculture Department and nominal charges may be changed from the farmers.

(iv) It will be better if in addition to seed and fertilizer minikits, minikits for plant protection be distributed or farmers should be given a composit minikit which may include seed, fertilizers and plant protection chemicals.

(v) Number of seed minikits should be increased so that a sizable number of farmers from weaker sections may get it.

(vi) Minikit must be supplied in advance so that farmers may select plot for minikit in the best field. It will help the farmer in obtaining the convincing results from the minikit variety.

(vii) Extension workers may visit farmers fields very frequently to help them on the spot.

(viii) More T.V. programmes and film shows be organised and current problems of diseases and cultivation practices be shown and talked about during the tenure of the crop.

(ix) Farmers training camps and visits to research farms are greatly needed.

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