Ad-hoc Study No.42

ECONOMICS OF SOYBEAN CULTIVATION
(A Study in Indore District of Madhya Pradesh)

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CHAPTER I

INTRODUCTION

1.1 Native Growers of Soybean

The soybean is native of China, and it is one of the oldest crops grown by man. Its cultivation is an old phenomenon in countries like Japan, Korea, and Mangolia and now its cultivation has been very successful in some other countries namely the United States and Brazil.

1.2 New Areas of Its' Cultivation

In many parts of world including India its cultivation is a new phenomenon and is still in the preliminary stage of development. Soybean is a valuable food. It is widely used in China, Japan, Korea, United States and United Kingdom. Now-a-days it is used in most of the countries of the world as an article of food.

1.3 Soybean - Utility and Food Value

Soybean(Glycinemax) has a moderately high oil content (about 20 per cent, and is a rich sourse of protein, about 40 per cent. Protein of soybean is called complete protein, because it supplies in sufficient amounts, the kind of amino-acids required by the body for building and repairs of tissues. The protein of soybean is easily digestible and it is much alike to the protein of meat.

1.4 Cultivation of Soybean in India

1.4.1 Scope - Indian dietaries are deficient in proteins and fats of high biological value. It is also deficient in vitamins and mineral salts of calcium, phosphorus and iron. In the case of vegetarians the diet contains excessive amount of starch and carbohydrates, which by their very bulk lower down the coefficient of digestibility. Thus the growth of soybean cultivation is considered important in India where a majority of the population is vegetarian and suffers from protein deficiency. It is also very useful for the development of body by keeping it free from various diseases. Soybean being the most nutritious food item, it is extremely essential to expand its cultivation as well as its consumption by the people of our country.

1.4.2 Indigenous Variety (Kali-tur)

In India an indigenous variety of soybean generally called black soybean has been under cultivation for several decades, in parts of Madhya Pradesh under the name of 'kalitur' and in the hills of Kumaon and Garhwal regions of the Himalayas under the name of 'Bhati' but on a very limited scale.

1.4.3 Progress in Cultivation of Soybean

As it evident from Table 1.1, Madhya Pradesh and Uttar Pradesh have made consistently good progress in coverage of soybean but area under this

Table 1.1 Area under soybean in different states in India (in Hectares)

State	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78*	1978-79*"
Madhya Pradesh	7,690	16,050	25,260	39,710	54,380	80,659	1,40,000	2,32,562
Uttar Pradesh	5,890	15,060	20,460	25,370	37,960	46,531	54,000	68,690
Maharashtra	18,160	1,310	1,060	480	320	N.A.	N.A.	N.A.
Gujarat	580	1,270	580	820	N.A.	N.A.	N.A.	N.A.
Karnataka	-	-	-	170	170	148	981	1,139
Bihar	-	-	-	-	-	-	-	671
West Bengal	-	-	-	-	-	N.A.	1,000	N.A.
Himachal Pradesh	-	-	-	-	-	-	-	106
All India	32,320	33,690	47,360	66,550	92,830	1,27,338	1,95,981	3,03,168

Sources :- *Estimates 1) Compiled from the information received from (1) Directorate of Agriculture, Government of Madhya Pradesh & Uttar Pradesh (II) Directorate of Oilseeds Development, Government of India, Hyderabad

*" 2)" Developing Appropriate Production Technology - A case of Soybean in MadhyaPradesh" by D.P.Motiramani, K.L.Rabbod and R.C.Kakhive, Agricultural Situation in India Nov. 1979 Page - 526

+ 3) Soybean Marketing Information, J.N.K.V.V.No.21-22, 1979.

crop is still very insignificant. The percentage of area under soybean to net area sown in the country works out to be 0.25 per cent for 1978-79. However it's area is growing year after year. Its area in 1978-79 was about 93.80 per cent more than the area in 1971-72.

1.4.4 All India Coordinated Project

Looking to the growing importance of this crop in our country an "All-India Co-ordinated Soybean Research Project', (A.I.C.S.R.P.) was initiated in 1967 to give fillip to research in soybean. In the early research efforts the work was confined on genetic base of imported cream coloured soybean to identify varieties suited to different agro-climatic conditions. In this country as a result of intensive research efforts, alongwith production technology the yellow varieties of soybeans like Bragg were recommended for large scale cultivation.

1.4.5 Future Prospects

The future of soybeans in India depends upon economic considerations as well as on its adaptation to climate, soil and other natural conditions. Adoption by farmers will depend upon their judgements about soybean's suitability and profitability in comparision with crops and land uses with which soybeans competes. In forming those judgements farmers will be influenced not only by relative profitability but also by how well soybeans fit into their cropping systems and by their needs for food and forage crops for direct consumption on their farms.

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1.5 The Present Study

1.5.1 Background The present study is an effort to highlight some of the problems connected with the production, marketing and consumption of soybean with special reference to Madhya Pradesh. Soybean is becoming very popular during Kharif season because of its high protein content, high yields and because it is also comparatively free from any major pests and disease so far. The progress of soybean cultivation, marketing and processing and utilisation in M.P. can be seen in Table 1.2.

The Agro-Economic Research Centre for M.P., Jawahar Lal Nehru Krishi Vishwa Vidyalaya, Jabalpur undertook this research study at the instance of the Ministry of Agriculture and Irrigation, Government of India, New Delhi, mainly with a view to determine the economics of soybean cultivation vis-a-vis other crops. Other related problems connected with production, marketing and demand for soybean were also covered.

1.5.2 Objectives

The specific objectives of this study are -

(1) To determine the relative profitability of soybean production vis-a-vis other crops,

(2) To identify the major problems faced by farmers in the cultivation of soybean,

(3) To study the mode of utilisation and disposal of soybean.

Table 1.2 Indicators of soybean development in Madhya Pradesh

	Indicator	1971-72	1977-78
1.	Area under soybean (hactare)	7690	1,40,000
2.	Number of of markets reporting arrival of soybeans	1	More than 20
3.	Arrival of soybeans at Indore market (V)	5555	1,25,144
4.	Number of soya-processing plants*	-	6
5.	Processing capacity ** (in tons/ day)	-	400
6.	Export of Soymeal (tons)	-	More than 25,000

* Refers to Oilseed plants, processing soybeans. They are versatile and process soybeans besides other oilseeds. They have installed additional equipments to process soybeans.

** On seed basis in three shifts a day

Ref. " Developing Appropriate Production Technology - A case of soybean in Madhya Pradesh" by D.P.Motiramani, K.L.Rathod and B.C.Kashiv, Agricultural situation in India, Nov.1979 page 527.

1.5.3 Methodology

1.5.3.1 Selection of District

The available information on coverage of soybeans in the State of Madhya Pradesh, from 1975-76 to 1977-78 is given in Table 1.3. The soybean area is mainly concentrated in western part of Madhya Pradesh (Map 1.1). The proportion of soybean area in the cropping pattern of five major soybean growing districts of M.P. (Table 1.4) shows that for the last three consecutive years, Indore district had the highest percentage of area under soybean in the State. Thus, Indore district being most prominent district with regards to soybean cultivation it was selected for the study.

1.5.3.2 Selection of Tehsils and Villages

For the selection of tehsils/blocks, officials of the State Agriculture Department and the Indo-British Dry Land Farming Project were consulted. On their advice Indore and Depalpur tehsils having good number of soybean growers were selected. Further on the advice of the officials one village of each tehsil was selected within the operation area of Dry Land Farming Project and the other from the villages outside the Project area. Accordingly, two villages in Indore tehsil/block namely Jamburdi Hapsi (covered under Indo-British Dry Land Farming Project)and Hatod (out of the area of operation) and two villages in Depalpur tehsil/block namely Agar (covered under Improvement of Productivity of Rainfed Areas of M.P. State Plan) and Betma (out of the area of operation) were selected. Thus four villages were selected for the study.

Table 1.3 Area under soybean

(in thousand hectares)

District	1975-76	1976-77	1977-78	
Chhindwara	0.2	0.2	0.2	
Seoni	0.1	0.1	0.2	
Mandla	-	-	0.1	
Narsinghpur	-	0.1	0.1	
Jabalpur Division	0.3	0.4	0.6	
Sagar	0.1	0.1	0.3	
Damoh	-	-	0.1	
Tikamgarh	-	0.1	0.1	
Sagar Division	0.1	0.2	0.5	
Indore	11.4	15.4	21.5	II
Dhar	2.0	2.5	6.9	V
Jhabua	0.2	0.5	1.0	
Khargone	0.3	0.3	0.8	
Khandwa	-	0.1	0.3	
Indore Division	13.9	18.8	30.5	
Ujjain	5.5	7.0	10.9	IV
Mandsaur	0.1	0.1	0.4	
Ratlam	0.5	0.7	1.9	
Dewas	15.4	19.7	24.4	I
Shajapur	5.9	8.4	12.2	III
Ujjain Division	27.4	35.9	49.8	
Gwalior	-	0.1	0.1	
Guna	-	-	0.1	
Gwalior Division	-	0.1	0.2	
Bhopal	-	0.1	0.2	
Sehore	1.2	2.1	-	
Raisen	0.1	0.1	0.5	
Vidisha	-	0.1	0.4	
Betul	0.1	0.4	2.5	
Rajgarh	0.3	1.4	3.8	
Bhopal Division	1.7	4.2	7.4	
Hoshangabad Division	0.1	0.3	1.5	
M.P. State	43.5	59.9	90.5	

Source : Agricultural Statistics, 1978, M.P. Bhopal

Table 1.4 Proportion of soybean area of top five districts of M.P. (1975-76 to 1977-78)

(in thousand hectares)

District	1975-76			1976-77			1977-78		
	Area of Soybean	Gross cropped Area	Percentage	Area of Soybean	Gross Cropped Area	Percentage	Area of Soybean	Gross Cropped Area	Percentage
Dewas	15.4	370.4	4.16	19.7	372.9	5.28	24.4	379.4	6.43
Indore	11.4	285.1	4.00	15.4	290.8	5.30	21.5	297.6	7.22
Shajapur	5.9	449.2	1.31	8.4	450.2	1.87	12.2	451.4	2.70
Ujjain	5.5	492.5	1.12	7.0	499.7	1.40	10.9	502.6	2.17
Dhar	2.0	536.9	0.37	2.5	539.1	0.46	6.9	555.6	1.24

Source: Agricultural Statistics, 1978, M.P.,Bhopal.

1.5.3.3 Selection of Sample Farmers

For the selection of sample farmers, list of farmers of each village was obtained and the farmers were arranged in ascending order of their proportion of area under soybean to their total operated area. Then the farmers were grouped into five groups so as to have equal number of farmers in each group. From each group three participant farmers were selected so as to have 15 participant farmers per village. For the selection of non-participants, the farmers were listed in the ascending order of their operated area. Grouping was done as in the case of participant farmers. From each group two farmers were selected so that the sample included 10 non-participant farmers per village. Thus the sample comprised 60 participant and 40 non-participant farmers selected from four villages in two tehsils/blocks of the district.

1.5.4 Data Collection

The data collected in this study was of two kinds.

I. Primary data. During the course of survey all information about the sample households regarding education of the head, family size, occupations , their incomes from sources other than agriculture, land holdings, cropping pattern, production and productivity of various crops including soybean, input costs, marketing and consumption pattern of soybean was collected in schedules designed for the study.

II. Secondary Data

All the secondary data regarding of selected district, Tehsils/blocks and villages was collected from following sources :

A. Department of Agriculture, Govt. of M.P., Bhopal

B. Directorate of Economics and Statistics, Govt of M.P., Bhopal

C. Jawahar Lal Nehru Krishi Vishwa Vidyalaya, Jabalpur

D. Marketing Federation, Bhopal

1.5.5 Reference Period : The reference year of the study was 1979-80.

* * * * *

CHAPTER II

SOYBEAN - RESEARCH AND DEVELOPMENT PROGRAMME

2.1 Background

Soybean has been traditionally grown for many centuries in the northern hills and several scattered pockets of the country and has occupied important place in human diet in these regions. However its cultivation has remained confined mainly in the States of Madhya Pradesh and Uttar Pradesh. The local variety 'black soybean' commonly known as 'kalitur' is low yielding and disease susceptible. Due to its poor yields, late maturity and high pod shattering, its cultivation did not spread to other parts of India.

2.2 Development of Yellow Varieties

Systematic efforts made in 1965 at Jabalpur and Pantnagar Agricultural Universities established the merits of 'yellow seeded' soybean varieties primarily developed in U.S.A. Thereafter the need for co-ordinated research approach was felt to utilize the maximum yield potential of soybean under Indian conditions.

Encouraged by the excellent performance and immense yield potential of yellow soybean varieties at Jabalpur and Pantnagar, the Indian Council of Agricultural Research launched an All India Coordinated Research Project on Soybean in 1967. The two special centres were kept at Jabalpur and Pantnagar and three other centres at Parbhani, Bangalore and New Delhi. Twelve sub centres were also established in the different agro-climatic zones of the country.

2.3 Soybean in Madhaya Pradesh

Table 2.1 Target area of soybean for the year 1979-80 in different states of India.

State	Target Area (in hectares)	Percentage to total area
1. Madhya Pradesh	4,00,000	73.19
2. Uttar Pradesh	1,37,000	25.16
3. Karnataka	3,000	0.55
4. Bihar	3,000	0.55
5. Himachal Pradesh	3,000	0.55
India	5.46,000	100.00

Source.- Soybean Marketing Information J.N.Krishi Vishwa Vidyalaya Jabalpur, No.21-22,1979

2.3.1 Area - It could be seen that the major area under soybean in India was confined to the states of Madhya Pradesh and Uttar Pradesh. The state of Madhya Pradesh alone had 73.19 per cent of the total area under soybean followed by Uttar Pradesh (25.16 per cent).

2.3.2 Commercial Stage of Production

The commercial stage of soybean production started from 1971 onwards. Madhya Pradesh made considerably good progress in coverage of this crop. The area under soybean in this state increased from 600 hectares in 1969-70 to 4,14,341 hectares in 1979-80 and the production increased from 600 tonnes to 2,48,604 tonnes (Table 2.2).

Table 2.2 Area and Production of Soybean in Madhya Pradesh

(Base year 1971-72 = 100)

Year	Area (in hectares)	Index	Production (in tonnes)
1969-70	600	7.80	600
1970-71	2000	26.02	2000
1971-72	7687	100.00	7687
1972-73	16050	208.78	16050
1973-74	25264	328.63	25264
1974-75	37000	481.30	37000
1975-76	55506	722.02	55506
1976-77	89000	1157.71	89000
1977-78	136000	1769.09	136000
1978-79	232562	3025.17	232562*
1979-80	414341	5389.75	248604

2.3.3 Target of Area

The proposed target of area for soybeans in the state for year 1980-81 is 600 thousand hectares. Its division wise breakup is given in Table 2.3. It could be seen that the 85.16 per cent of total soybean area of the state is covered by only three divisions viz. Ujjain (38.00), Bhopal (28.00) and Indore (19.16).

2.3.4 Major Soybean Growing District

The major districts under soybean cultivation are given in Table 2.4. Seventy five per cent of the total

Note - Production estimated @ 1 Tonne per hectare

* Production is estimated @ 6 Qtls. per hectare as 1979-80 was a drought year.

Source: Directorate of Agriculture, M.P. Bhopal

Table 2.3 Target Area under Soybean in Different Divisions of Madhya Pradesh, 1980-81

Division	Target Area (in hectares)	Percentage to total
Ujjain	2,28,000	38.00
Bhopal	1,68,000	28.00
Indore	1,15,000	19.16
Sagar	27,000	4.50
Hoshangabad	24,000	4.00
Jabalpur	17,400	2.90
Gwalior	11,000	1.83
Rewa	4,500	0.75
Morena	2,200	0.37
Durg	1,500	0.25
Raipur	700	0.12
Bilaspur	700	0.12
Madhya Pradesh	6,00,000	100.00

soybean area of the state is confined in only 11 districts. Ujjain district is at the top, it shares 15.00 per cent of the total area followed by Dewas (10.83 per cent) and Indore (8.33 per cent) which together share more than one third of the total soybean area in the state.

2.3.5 Coverage under Yellow and Black Varieties

Since the introduction of soybean programme in 1967, there has been spectacular growth in soybean area in the state. Still [illegible]80 per cent of total area under soybean is reported to be covered under black soybean

Table 2.4 Target area of soybean in different Districts of Madhya Pradesh, 1980-81

Districts	Target Area (in hectares)	Percentage to total area
Ujjain	90,000	15.00
Dewas	65,000	10.83
Indore	50,000	8.33
Shajapur	45,000	7.50
Betul	36,000	6.00
Sehore	35,000	5.83
Vidisha	30,000	5.00
Dhar	25,000	4.17
Raisen	25,000	4.17
Rajgarh	25,000	4.17
Hoshangabad	24,000	4.00
Other districts	1,50,000	25.00
Madhya Pradesh	6,00,000	100.00

(locally known as 'kalitur') while the remaining twenty per cent is covered with improved yellow varieties. Though development efforts were directed only towards promotion of exotic yellow varieties, the linear growth rate of black and yellow soybean in Madhya Pradesh during 1971-72 to 1979-80 was 35.47 and 6.33 respectively (Table 2.5). Their trend of increase is shown in Graph 2.1.

Graph 2.1 Area under yellow and black varieties of soybean from 1971-72 to 1979-80

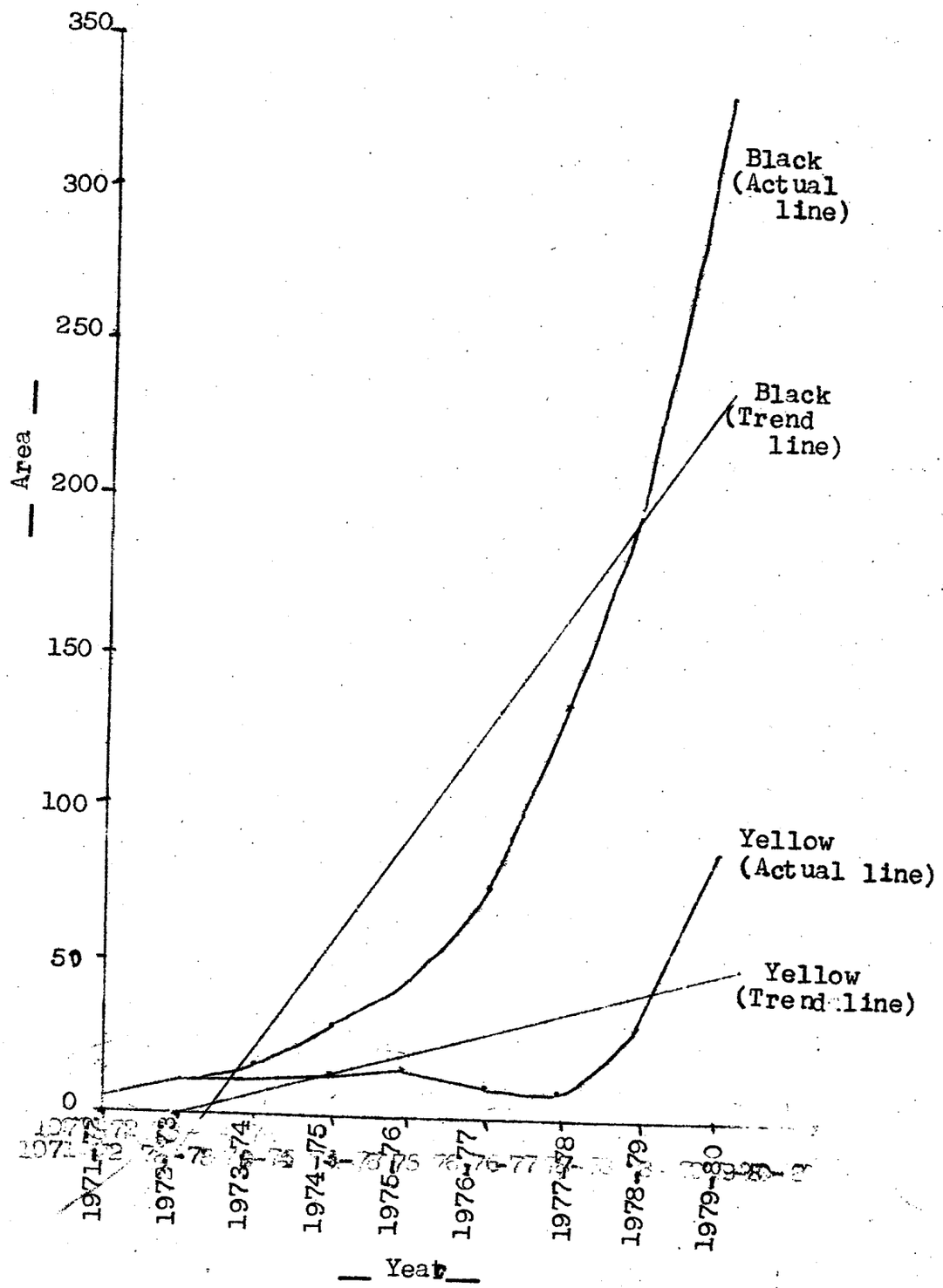

Table 2.5 Area of yellow and Black soybean in Madhya Pradesh, 1971-72 to 1979-80

Year	Area under Soybean		
	Black (Hect.)	Yellow (Hect.)	Total (Hect.)
1971-72	2,727	4,963	7,690
1972-73	8,025	8,025	16,050
1973-74	15,156	10,104	25,260
1974-75	27,797	11,913	39,710
1975-76	40,785	13,595	54,380
1976-77	72,593	8,066	80,659
1977-78	132067	7,033	1,40,000
1978-79	202,715	29,847	2,32,562*
1979-80	3,27,922	86,419	414341*
Linear Growth Rate+	3235.47	6.33	42.76

Note : 1. Variations in total area of soybean given in col.4 of this table and col.2 of table 2.2 occurs on account of difference of sources from which data have been obtained.

2. The area under black and yellow soybeans are not separately recorded. The broad estimates are made on the basis of field observation made by the field staff of the State Government.

Ref:- "Developing Appropriate Production Technology- A case of soybeans in Madhya Pradesh " by D.P.Motiramani, K.L.Rathod and R.C.Kashive Agricultural Situation in India, Nov.1979, Vol, No.7 page 527.

* Directorate of Agriculture, M.P. Bhopal

\+ Average Growth rate calculated from the area rounded into thousand hectares.

2.4 Varietal Characteristics

The black soybean has small seed and hence needs lower seed rate, about 30-40 kg/hectare as compared to 100 kg/hectare for yellow and possess excellent storage capacity and germination rate under field condition. It has however certain drawbacks such as low yield potential, longer duration and high percentage of grain shattering even before full maturity. Table 2.6 highlights some of the differences between indigenous black and improved yellow soybean.

Table 2.6 Differences between indigenous black and yellow soybean in terms of certain characteristics

Characteristic		Black (Kalitur)	Yellow (Bragg)
1. Potential yield (based on research trails in kharif season at Jabalpur (Q./ha.)			
	1969	N.T.	33.82
	1970	N.T.	23.78
	1971	N.T.	32.50
	1972	14.31	28.19
	1973	18.46	17.07*
	1974	26.58	28.34
	Mean	19.78	27.29
2. Maturity (days)		115-120	105
3. Seed size (100 seed wt. in grammes)		9.66	18.27
4. Seed rate (kg./ha)		30-40	100
5. Bio-chemical composition			
	Protein %	38.05	37.07
	Oil %	18.05	21.55
	Methionine in Protein %	1.43	1.40
	Tryptophan protein %	0.37	0.38
Glycin in protein fraction		59.77	64.14

N.T. No. Trial.

* The low yield of yellow soybean could be partly attributed to unfavourable climatic condition during 1973

Ref.:- "Developing Appropriate Production Technology-A case of soybeans in Madhya Pradesh" by D.P.Motiramani, K.L.Rathod and R.C.Kashive, Agricultural Situation in India, Vol. XXXIV

2.5 Research on Soybeans in M.P.

2.5.1 Improvement of Soybean-New varieties with their potential

Soybean was in cultivation in the State somewhere in 1880 in the name of Kalitur (black soybean) and was confined to Malwa Plateau and the districts of Seoni, Betul and Chhindwara. According to the literature available, some fodder types viz. the SB-8, SB-5, SB-72 [illegible] were evolved but they were all late maturing with a very poor yield potential. The local types available in Seoni, Chhindwara and Betul were late maturing (130-140 days), trailing, bushy types with heavy foliage while the Malwa types were mid late (130 days) and semitrailing and erect with poor yields.

Kalitur is very widely in cultivation because of its low input technology, cost of seed and fertilizers and keeping quality under ordinary storage conditions. It has got many shortcoming like.

(1) fetching of less market price being black seeded,

(2) late maturity,

(3) susceptibility tc shattering and

(4) low responses to fertilizers,

However, being small seeded, it is better in emergence thus ensuring better germination and population.

2.5.2 Introduction of U.S. varieties

The improvement work started by the introduction of some U.S. soybean varieties and experiments were conducted at JNKVV, Jabalpur and UPAU, Pantnagar in 1964-65. Two varieties viz. Clark-63 and Bragg were released. However, due to poor germination and viability, Clark-63 went out of cultivation and Bragg remained confined to Seoni and Chhindwara districts only.

2.5.3 Improvement of selections

Soybean improvement work started with the problems of introduction of Bragg and Clark-63. The problems encountered in these varieties were tried to be overcome by selection. For this, various lines were evaluated from the germplasm collection for adaptability, earliness of maturity and resistance to various diseases and pests and ultimately to the yield.

JS - 2 : JS-2 was selected from the material Tehri-Garhwal. This is a very widely adopted variety suitable for different agro-climatic zones of M.P.. It is a determinate, semidwarf with flowering in 39-42 days. It is highly tolerant to blight desease. It is also tolerant to stemfly and girdle beetle. Under good management, it has got a yield potential of about 35 q/ha.

Due to some problems in kalitur as late maturity, black colour, shattering etc. a need has been felt since long to recommend any variety to cultivators with smaller seed size, yellow colour non-shattering and with a shorter duration than kalitur along with the resistance to pests and deseases. The yields should also be better than kalitur with minimum management conditions along with good keeping quality and germination stand.

JS-75-1 : A variety JS-75-1 has been selected from the location collection. It pertains all the good qualities of kalitur and evercomes all its shortcomings. It matures in about 115 days, a week earlier than kalitur.

The seed is shining yellow, small (seed wt. 10 gms/100) having an excellant keeping quality and germination (more than 90 %). It has got yield of 2,500 kg/ha. This also thrives well under drought and late sown conditions. The performance is also fair in broadcasting. The shattering as well as diseases are also low comparatively. The incidence of girdle beetle and stemfly is also low.

2.5.4 Hybridization

In order to overcome the shortcoming of the previous varieties as Bragg, JS-2, kalitur and other recommended varieties of the State like Ankur, Ph-1 etc. the hybridization programme was initiated during 1978. Large number of promising progenies were identified in 1972 on the basis of different desirable traits like germination, maturity, seed size, resistance to diseases and pests and ultimately the yield. Some promising were tested in All India Coordinated Project (Varietal trials) and some in minikit trials, in different agro-climatic conditions of the State. JS-72-44 performed better than other varieties for continuously two years, i.e. 1976-77 and 1977-78 in different locations.

JS-72-44

This variety is derived from a cross between D60-7965 x EC7034. It is determinate (50 cm ht.) which becomes bushy later. It flowers in 40-42 days and matures in 102-106 days. Flowers are purple in colour. The seeds are yellow, round, medium in size (100-seed wt. = 14 gms). The field emergence is 70 per cent under ordinary conditions. JS-72-44 has surpassed the previous other varieties in yield. The average yield over all locations and years is 172 q/ha in coordinated

and 21 qts. in minikit trials. At Jabalpur, it has shown its potential upto 34.5 q/ha. The other promising varieties are JS-72-184, JS-72-185 giving an average of 2015 and 1928 kgs/ha respectively.

2.5.5 Improvement work in kalitur

Due to large increase in acerage of kalitur in the State and the unexplored potentials, a need has been felt to carry out improvement in kalitur. The undesirable characters of kalitur are shattering, lodging, excess foliage, late maturity and black seed coat ultimately lowering the market value. Besides this, its excellent performance in all adverse situations with low management conditions is an attraction.

In order to improve kalitur a large number of crosses were made with JS-2, cocker stuart, Bragg and other varieties. The progenies of the crosses were selected on the basis of seed colour and other desirable traits. Some of them are:-

Yellow types : JS-76-154, 171, 217, 225, 219, 227, 229, 233, 237, 239, 245, 254, and 255.

Black types: JS-76-188, 191, 194, 198, 201, 204, 211, 213, and 235.

The most promising JS-76-254 (yellow) and JS-76-191 (black) have been promoted to All India Coordinated Trial for Central Zone.

2.6 Agronomy of Soybean

With improved technology, soybean can be successfully grown in many parts of India with potential farm scale yield levels well above 10 quintals per acre.

2.6.1 Soil

Soybean grows best on fertile, moisture retentive and well drained soils with a soil pH ranging from 6.5 K 7. They grow better than many other kharif crops viz. mung, urd, maize, jowar on soils that are low in fertility and poorly drained. In medium and deep soil of high clay content where groundnut is not grown due to difficulties in harvesting, soybean can be grown.

2.6.2 Seed bed

Seed bed preparation for soybean is similar to that of other kharif crops. Seed beds which are rough, cloddy and weedy will cause problem in chemical weed control.

2.6.3 Planting

Appropriate time based upon experiments appears to be end of June to first week of July i.e. with commencement of monsoon rains.

Dry sowing i.e. the time when monsoon breaks at Bombay announced through forecast has given good yields of soybean. The dry sowing is good in the areas/lands where soybean have been grown previously. Secondly after sowing, there should be atleast 50 to 75 m.m. of rains. Local showers or very small amount of rain after dry sowing will effect germination

The best temperature for germination and growth is about 30°C.

Sowing beyond 15th July, will reduce the yield considerably. For small seed dry sowing may be beneficial. On an average dry sowing gives 17 and 50% increased over onset of monsoon and late sowing respectively.

After dry sowing if enough rains are not received, one irrigation will give good stand.

2.6.4 Seedrate

Seeding rate depends on seed size, planting time and germination of seed. When stands are poor, weeds are a great problem. If the stand is not good top yields can not be harvested. If the sowing is delayed, the seedrate can be increased by 25 per cent.

2.6.5 How to plant

The row width for planting of soybean will depend on length of growing season, growth type of varieties and fertility level of the soil. Erect plant types respond to reduced row spacing. Similarly narrow row spacing is advisable if soils are low in fertility status (usually with an average farmer) or if soybean is sown late due to weather.

Higher yields ranging from 0.8 to 2 q/ha were obtained with narrow row spacing of 30 cm over 45 cm row spacing under normal planting date.

2.6.6 How deep to plant

Shallow seeding 2 to 3 cm in good moisture soil is preferable. Under dry sowing also the seed should not be sown deep.

Planting soybean deep, is in an attempt to find moisture, is dangerous. Poor stand often result from a combination of deep planting and a soil that has been compacted by heavy rains immediately after sowing.

2.6.7 Method of planting

The planting method will depend on the soil type and rainfall. Generally the farmers plant their crop in lines on flat beds. In heavy soils with excessive rains, the planting in lines on raised beds intercepted by ditches and checker board (sowingin both direction gave higher yields i.e. 1 ½ Q. and 4 ½ Q/ha over line sowing and broadcast sowing respectively.

2.6.8 Weed control

The weeds grow along with the crop and this results heavy weed-crop competition during early stages of growth, thereby reducing crop yield and greatest contribution to production costs.

The farmers resort to manual weeding which undoubtly accomplishes thejob effectively. Many a times, continuous rain does not permit mechanical weed control at proper time which results in luxurient growth of weeds. With the shifting to narrow row sowing practice, it is difficult to cultivate and one has to look for weedicides.

Lasso and Tok E-25 @ 2 litres/ha as pre-emergence spray were found to be most effective in controlling weeds and increasing yield by 7 to 8 Q/ha over no weeding.

Recently new herbicide viz Basalin for soybean has come into the market and has given higher yields with effective control of weeds.

The chemical herbicide Basalin is a pre-plant spray i.e. before sowing soybean, and mixed with soil throughly. Basalin spray has given 1 to 1.7 Q/ha higher yield than hand weedings. Lasso, Tok E-25 and Basalin herbicides control the weeds Cyperus spp., Echinochoa, Colonum, Elensine Indica and many other grasses.

2.6.9 Irrigation

Irrigation of soybean is not a common practice as it is grown during rainy season. Monsoon in India is however, so eratic that crop suffers due to either excess or deficiency of moisture.

Soybean toleratesdry soil conditions before they bloom, but drought during pod formation/pod filling stage seriously reduces yield upto 40% and also seed quality.

If irrigation is available, one irrigation either be at pod formation or pod filling stage can/given as increase yield of 60 to 80% in case of Bragg and 20% in JS-2 over no irrigation during drought year. During 1979, one irrigation increased the yield by 35 to 40 % for JS-2

2.6.10 Fertilizer requirement

Studies have shown that 3366 kg/ha crop is made up of appro. 7854 kg of dry matter. The nutrients which are currently of primary concern are required in the amounts of about 314 kg Nitrogen, 34.50 kg P and 101 kg of K besides essential elements viz Ca, Mg, S, Cl and other.

Whenever the soil cannot supply the plant nutrient requirement, fertilizers have to be added to the soil to supplement the nutrient supply.

Nitrogen - Nitrogen requirement of soybean plants is met by symbiotically fixed nitrogen. The activity of the nitrogen fixing bacteria increases from about third week after sowing through late bloom to early pod set and then decreases to near zero at the green bean stage of growth.

Experimental results have indicated that under inoculated condition higher doses of N fertilizer gave increased yield comparable to inoculated soybean under new site. The Bragg variety had responded to higher dose i.e. 40 to 60 kg. of Nitrogen application whereas indegenous varieties Kalitur, JS-2 and Ankur did not respond to nitrogen application.

Response to phosphorus is in between 40 to 80 kg P205/ha in sites with low available P in soil. The varieties like Kalitur and JS-2 responded to P application slightly. A dose of 40 kg P205/ha may be enough for these two varieties.

Wheat taken after soybean produced 31% higher yield over kharif fallow. Soybean - wheat rotation showed an economy of fertilizer by 60 kg N over fallow wheat rotation under irrigated condition.

2.6.11 Inter cropping and multiple cropping

There is considerable scope for increasing the yield per unit area per unit time through mixed and multiple cropping of soybean with other crops.

Soybean should be considered to be better suited for inter and multiple cropping as compared to other legumes because its per day productivity is much higher.

On the basis of experiments conducted at JNKVV it is clear that mixed/inter cropping of soybean with other crops viz. kodo, jowar, maize and cotton in the ratio of 1:1 or 2:2 (alternate rows) gave the highest gross return. Similarly soybean as an intercrop with arhar was more profitable as compared to other legumes viz. mung or urid.

In multiple cropping experiments soybean-wheat-Chari (green fodder) or soybean - wheat - bhindi grown under scientific management in quick succession gave more production per hectare with higher net income as more production per hectare with higher net income as compared to other sequences like paddy-wheat- cowpeas; jowar-wheat-moong (Baisakhi) or maize-wheat-moong (Baisakhi).

Secondly, wheat after soybean gave 3 to 5½ Q/ha extra yield as compared to wheat sown after other crops.

2.7 Genefal Control of Insects

The recommendations are

1) Out of the several soil, foliar and combinations of soil and foliar insecticides tested at Jabalpur, it was found that an application of lindane granules in the soil @ 20 kg. a.i./ha followed by two or four spray treatments (beginning 21 to 30 days of germination) with monocrotophos (Nuvacron) (0.04 %), endosulfan (Thiodan)(0.07 % concentration) or dimethoate (Rogor) (0.03 %) will give a healthy crop. Other granules like phorate (Thimet) and Disyston @ 2.0 kg and 1.0 kg. a.i. /ha can also be used in place of lindane granule. The stemfly infestation of soybean was also reduced t some

extent, although its elimination was not possible.

2) Lindane dust @0.5 kg or 1.0 kg. a.i./ha in the soil furrows before sowing followed by 3 to 4 sprays of ethyl parathion 46.7 e.c.at 0.02 per cent concentration proved to be the best in checking the general infestation of insects on soybean including the stemfly to some extent. A complete elimination of the stemfly was, however, not possible.

3) The infestation of soybean by the girdle beetle, oberea brevis, was effectively checked by sprav of endosulfan (Thiodan) 35 e.c.,methyl demeton (Metasystox) 30 e.c. and dimethoate (Rogor) 30 e.c. in 0.05,0.03 and 0.03 per cent concentrations. Endosulfam was significantly more effective than monocrotophos (Nuvacron) 40 e.c. and trichlorophon (Dipterex) 80 s.p. used in 0.04 and 0.3 per cent concentrations.

4) The leaf-miner, stomopteryx subsecivella zeller could be effectively controlled only when its larvae were in the early first and second instars,because the late instars were resistant to the action of chemicals. In the replicated experiments, tests with dust of BHC, lindane, dieldrin, ethyl parathion and sprays of carbaryl, dimethoate, phosphamidon, endosulfan, endrin, methyl demeton, fenitrothion, showed that fenitrothion e.c. and carbaryl w.p. in 0.05% and 0.2 % concentrations and ethyl parathion (2.0%) dust at the rate of 20 kg/ha were highly effective, giving 96 to 100 per cent mortality of the early instars of the learvae and about 20 per cent mortality of the full grown larvae which were highly resistant to the toxic action of the chemicals.

Table 2.7 Biochemical and Nutritional Aspects

Contents	Soybean		
	Black	Yellow	
	Kalitur	Bragg	JS-2
Biochemical evaluation :			
Protein %	38.05	37.07	40.10
Oil %	18.05	21.55	21.30
Methionine in protein%	1.43	1.40	1.80
Trypophan protein %	0.37	0.38	0.24
Glycinin protein % fraction	59.77	64.14	58.02
Mineral Composition (mg/100 g of seeds)			
Calcium	311	387	428
Phosphorus	594	571	616
Potassium	900	1150	1150
Iron	8	9.33	6.66
Ascorbic acid (mg/100 mg)			
72 hrs after sprouting	16.01	6.66	5.51
96 hrs after sprouting	42.48	7.57	8.25
Trypsin inhibitor activity :			
u moles of tyrosine/mg of protein	86.37	77.40	48.00
Fatty acid composition of soybean oil			
Plamitic (16.0)	10.5	11.8	11.2
Staric (18:0)	4.1	5.3	5.5
Oleic (18:1)	23.0	24.4	34.8
Linoleic (18:2)	55.1	52.4	44.0

Source : Gupta A.K. and Motiramani, D.P. Black Soybean (Kalitur) in Perspective (Biochemical and Nututional Aspects) JNKVV, 1976 (Mimeo)

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CHAPTER III

INDORE DISTRICT

Indore district is the smallest district in the state barring Datia. It has derived its importance from Indore town which is an important centre of commerce, trade and industry and is also the biggest city in the state. The district falls in the Malwa Plateau known for its salubrity of climate and richness of soil.

3.1 Physical Features

The district lies between 22°25' north latitude and 75°00' east longitude. The district is surrounded by the districts of Dewas on the east, Ujjain on the north, Dhar on the west and Khargon on the south (Map 3.1). Nature has been bountiful and has showered her blessings on Malwa in the form of a rich soil, a moderate climate and adequate rainfall. The soil in the district is generally black. It is sticky, cracks only after two showers and retains moisture for a long time.

3.2 Climate

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

The average rainfall in the district is 978 mm. January is the coldest month. After February temperature rises progressively and in May-June which are comparatively hotter months varies between 40°c to 42°c, the maximum temperature in these months is 45°c. But inspite of the high temperature during the day the nights are pleasant.

3.3 Land Utilization

The district occupies an area of 3,83,000 hectares which is mostly a plain tract and as high as 67.62 per cent of the area was under cultivation in 1977-78. Another important aspect was the lower proportion of forest area i.e. 13.58 per cent. Area under non-agricultural uses was reported 32.38 per cent which also included 2.35 per cent cultivable waste (Table 3.1).

Table 3.1 Land Utilization, 1977-78

Particulars	Area ('ooo hectares)	Percentage
A Area under Non-Agricultural Uses		32.38
(1) Forest	52	13.58
(2) Land put to other uses	25	6.53
(3) Barren and uncultivated land	3	0.78
(4) Permanent pastures	35	9.14
(5) Culturable waste land	9	2.35
B Area under Agricultural Uses		67.62
(1) Fallow Land	3	0.78
(2) Net area sown	256	66.84
Total Area	383	100.00

3.4 Irrigation

The district had a slightly higher perecentage i.e. 13.20 of gross irrigated area (of gross cropped area) than the overall state average of 10.4. An important feature about irrigation was that 76.08 per cent area was irrigated by wells -an assured souree of irrigation. Another 15.01 per cent was irrigated by rivers and nallahs (Table 3.2).

Table 3.2 Area irrigated by sources, 1977-78

Source	Area ('000 hectares)	Percentage
Wells	29.9	76.08
Rivers & Nallahs	5.9	15.01
Tanks	1.8	4.58
Canals	1.7	4.33
All	39.3	100.00

The rivers of the district fall into one main system viz. that of the Chambal with its affluents, namely the Ghambir and the Kshipra with its tributaries like the Khan and the Saraswati. These offer excellent sources of irrigation water.

3.5 Crops

The Malwa region in which Indore district falls, being characterised by an annual average rainfall of 978 mm. and heavy black soils is predominantly a mono-crop area. The important crops of the district were wheat, gram, jowar, soybean and tur and these accounted for 25.94, 17.17, 14.68, 7.23 and 5.38 per cent of the gross cropped area respectively in 1977-78.

Dairy farming was an important enterprise in the district and, therefore, a considerable proportion of area (10.09 per cent) was under fodder crops (Table 3.3).

3.6 Soybean Area

As mentioned earlier, Indore district has the largest proportion of area under soybean in the state. The area of soybean in the district has been consistently increasing year after year from 1973-74 to 1979-80 (Table 3.4). Averge annual groth rate of area in the district was 4.96.

Table 3.3 Cropping pattern and Irrigation, 1977-78

Crop	Area '000 hect.	Percentage	Irrigated Area '000 hect.	Percentage	Percentage of irrigated area to the area of the crop
Wheat	77.2	25.94	21.6	54.96	27.97
Jowar	43.7	14.68	-	-	-
Maize	9.5	3.19	0.2	0.51	2.10
Other cereals	1.0	0.34	-	-	-
Total cereals	131.4	44.15	21.8	55.47	16.59
Gram	51.1	17.17	3.5	8.91	6.85
Soybean	21.5	7.23	-	-	-
Tur	16.0	5.38	-	-	-
Moong & Moth	6.4	2.15	-	-	-
Urd	5.7	1.92	-	-	-
Other Pulses	2.7	0.91	0.8	2.03	29.62
Total Pulses	103.4	34.75	4.3	10.94	4.16
Linseed	8.9	2.99	Negligible	-	-
Ground-nut	3.2	1.08	-	-	-
Other oilseed	0.2	0.06	-	-	-
Total oilseed	12.3	4.13	0.1	0.25	0.81
Total fruits & vegetables	7.4	2.48	6.0	15.28	81.08
Spices	2.9	0.97	1.4	3.56	48.27
Sugarcane	7.3	2.46	5.3	13.49	72.60
Cotton	2.9	0.97	Negligible	-	-
Fodder crops	30.0	10.09	0.1	0.25	0.33
Other crops	-	-	0.3	0.76	-
All crops	297.6	100.00	39.3	100.00	13.20

Table 3.4 Area under soybean in Indore district, 1973-74 to 1979-80

Year	Area (in thousand hectares)
1973-74	3.3
1974-75	7.1
1975-76	11.4
1976-77	15.4
1977-78	21.5
1978-79	31.9
1979-80	33.0

Tehsilwise distribution of the area under this crop shows that highest concentration of area was in Depalpur and Indore tehsils and these two tehsils covered 67.10 per cent area and 55.56 per cent soybean growers of the district (Table 3.5).

Table 3.5 Tehsilwise area under soybean in Indore district, 1978-79

Tehsil	Area (hectares)	Percentage	Cultivators	
			No.	Percentage
Indore	7,811	24.48	4,500	25.00
Depalpur	13,600	42.62	5,500	30.56
Mhow	5,500	17.23	4,700	26.11
Sawer	5,000	15.67	3,300	18.33
Total	31,911	100.00	18,000	100.000

3.7 Irrigated Crops

Wheat, gram, sugarcane, fruits, vegetables and spices were the important irrigated crops. Wheat accounted for 54.96 per cent of the gross irrigated area and it was irrigated to the extent of 27.97 per cent. Gram occupied 8.91 per cent of the gross irrigated area but it was irrigated to the extent of 6.85 per cent only. Proportion of irrigated area to total cropped area in the case of sugarcane, fruits and vegetables and spices was 72.60, 81.80 and 48.27 per cent respectively.

3.8 Agricultural Development Projects

Two projects namely, "Improvement of Productivity of Rainfed Areas of Madhya Pradesh (State Plan)" and "Indo-UK Dry Farming Project" were started in Indore district during July 1971 and October, 1974 respectively. Their main objective was to bring about an all sided development of farming. The Projects seek to increase land productivity by adoption of advance technology for land improvement, soil and water conservation, crop husbandry, animal husbandry and exploitation of underground water etc. Several measures have been taken under these programmes to improve the productivity ofthe farms. Main features of these projects are :-

1. Change in varieties of already popular crops - Sorghum CSH - 5. Introduction and popularisation of high yielding and improved varieties of wheat (Kalyan sona, RR-21, Narmada -4, Narmada - 112) and gram in Rabi.
2. Introduction of new crops and their varieties :- Soybean -T-49, JS-2 and Ankoor and maize-chandan-3 and Ganga-5 for Kharif.
3. Replacement of kharif fallow by growing crops.
4. Efforts to increase double cropping.
5. Increase in the use of fertilizers.

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CHAPTER IV

CHARACTERISTICS OF SAMPLE FARMERS

4.1 Literacy

Educational standard attained by the head of the household was enquired into considering it important because the head of the household is the decision maker and if he is educated, his participation in the developmental activities and the adoption of new innovations becomes quicker and easier. The literacy percentage among participants was higher than the non-participants, the figures being 88.33 and 70.00 per cent respectively (Table 4.1).

Table 4.1 Details of educational levels of the heads of the sample households

Educational level		Number of Households		
		Participants	Non-participants	Total
Primary		28	21	49
Middle		15	5	20
High School		4	1	5
Intermediate		1	-	1
Graduate		3	-	3
Post Graduate		2	1	3
Total	" No.	53	28	81
Literate	" %	88.33	70.00	81.00
Total	" No.	7	12	19
Illiterate	" %	11.67	30.00	19.00

4.2 Demographic Features

The data relating to population of the sample households only for participants was collected in terms of two broad categories i.e. adult and children, the former group included all except children below 14 years. Nearly two third i.e. 62.01 per cent per cent were reported as adult and among them 87.09 per cent returned as workers.

On an average a household comprised 8.12 members and 5.05 of them were workers.

4.3 Family Size

Both adult males and females were engaged in economic activities. The adult male workers were 2.25 per household, whereas, female adult workers were 2.13 per household. The percentage of workers in the total population was 62.22 (Table 4.2.).

Table 4.2 Details of family size and number of workers among sample households (Participants)

Population Classification	Number	Average Size Per Household
A Total Family Members	487	8.12
i) Adult Male	155	2.58
ii) Adult Female	147	2.45
iii) Children	185	3.08
B) Workers	303	5.05
i) Adult Male	135	2.25
ii) Adult Female	128	2.13
iiii) Children	40	0.66

4.6.4 Occupation

Agriculture was the mainstay of the sample farmers. Information regarding subsidiary occupation was also collected and discussed here to present their distinctiveness. Out of 60 households surveyed, 31 or 51.66 per cent were engaged in some subsidiary occupation including 11 engaged engagedinin business, 8 in service, 7 in dairy, 4 in agricultural labour and 1 in profession. Among subsidiary occupations, 'profession' fetched highest income per household of Rs. 8,400 and agricultural labour, the lowest i.e. Rs.410. The average income from subsidiary occupations was Rs. 3,953 per household (Table 4.3).

Table 4.3 Income from subsidary occupations followed by sample households (Participants)

Occupations	No.of H.H.	Total Income (Rs.)	Average Income Per Household (Rs.)
Business	11	53,600	4,873
Service	8	43,500	5,438
Dairy	7	15,390	2,199
Agricultural Labour	4	1,640	410
Profession	1	8,400	8,400
All	31	1,22,530	3,953

4.5 Land holdings

The cultivated area per household among participants was 7.17 hectares, while among non-participants it was 4.09 hectares. The size of land holding per household in respect of area owned, area cultivated and area irrigated was also much larger among the former as compared to the latter (Table 4.4).

4.6 Cropping Pattern

Soybean and jowar returned as most important crops during kharif season which covered 18.39 per cent and 17.35 per cent area of gross cropped area respectively. Jowar-arhar and jowar-soybean combinations shared 2.45 per cent and 1.77 per cent area respectively. Sugarcane, maize and groundnut shared only 2.33 per cent, 2.24 per cent and 0.42 per cent of the gross cropped area respectively. The percentage of kharif area to gross cropped area was 44.20 per cent. During rabi season wheat and gram were the two most important crops and shared 33.94 per cent and 16.31 per cent area of gross cropped area respectively. The cropping pattern of the sample farmers was more or less similar to that of Indore district (4.5).

Table 4.4 Area operated by the sample farmers in different size groups

(Area in hect.)

Size Groups Hect.	PARTICIPANTS				NON-PARTICIPANTS			
	No. of H.H.	Area owned	Area cultivated	Area irrigated	No. of H.H.	Area owned	Area cultivated	Area irrigated
Up to 2.00	8	15.04 (1.88)	10.59 (1.32)	9.78 (1.22)	16	22.52 (1.41)	20.74 (1.30)	5.26 (0.33)
2.01 - 4.00	14	42.12 (3.01)	35.98 (2.57)	15.70 (1.12)	11	38.59 (3.51)	28.67 (2.81)	11.53 (1.05)
4.01 - 8.00	15	68.89 (4.59)	79.01 (5.27)	20.08 (1.34)	6	31.97 (5.33)	32.78 (5.46)	3.64 (0.61)
8,01 -12.00	12	109.20 (9.10)	117.05 (9.75)	35.34 (2.95)	3	27.11 (9.04)	25.09 (8.36)	2.83 (0.94)
12.01 & above	11	274.65 (24.97)	137.27 (17.02)	37.23 (3.38)	4	60.71 (15.18)	56.25 (14.06)	-
All	60	509.90 (8.50)	429.90 (7.17)	118.13 (1.97)	40	180.90 (4.52)	163.53 (4.09)	23.26 (0.58)

(Figures in brackets denote average land per household)

Table 4.5 Cropping pattern of the sample households (participants)

Crops	Area (hect.)	Percentage
Wheat	162.46	33.94
Jowar	83.06	17.35
Maize	10.74	2.24
Total Cereals	256.26	53.53
Gram	78.09	16.31
Soybean	88.03	18.39
Urd	4.45	0.93
Moong	0.81	0.17
Pea	0.91	0.19
Total Pulses	172 .29	35.99
Jowar + Arhar	11.72	2.45
Jowar + Soybean	8.48	1.77
Mixed Crops	20.20	4.22
Linseed	10.91	2.28
Groundnut	2.00	0.42
Total Oilseed	12.91	2.70
Sugarcane	11.16	2.34
Cotton	0.40	0.08
Total Fruits, Vegetables & Spices	5.46	1.14
All Crops	478.68	100.00

4.7 Soybean Cultivation

The proportion of soybean area to gross cropped area has inverse relation with the size groups. The percentage was 32.98 in the smaller size group and it decreased with the increase of size of holdings and was 14.40 in the largest group (Table 4.6).

Out of total soybean area, black variety of soybean covered 61.98 per cent whereas the yellow soybean 38.02 per cent. Among the yellow soybean varieties prominent were T-49 and JS-2 which shared 24.71 and 5.96 per cent of total soybean area (Table 4.7).

Table 4.6 Area of soybean in different size groups of sample farms

Size Groups (Hect.)	Gross cropped Area	Area under soybean	Percentage of area under soybean to gross cropped area
Up to 2.00.	18.68	6.16	32.98
2.01 - 4.00	45.33	12.95	28.57
4.01 - 8.00	95.85	21.65	22.59
8.01 -12.00	117.92	18.34	15.55
12.01 & above	200.90	28.93	24.40
Total	478.68	88.03	18.39

Table 4.7 Varietywise area under soybean according to size groups of holdings

(Area in hectares)

Size Groups (Hect.)	Varieties of Soybean					Total Soybean Area
	Black	Yellow				
	Black	T-49	JS-2	Others	Total	
Up to 2.00	2.83 (45.94)	2.12 (34.42)	1.21 (19.64)	-	3.33 (54.06)	6.16 (100.00)
2.01 - 4.00	8.50 (65.64)	2.43 (18.76)	-	2.02 (15.60)	4.45 (34.36)	12.95 (100.00)
4.01 - 8.00	13.76 (63.56)	5.87 (27.11)	1.21 (5.59)	0.81 (3.74)	7.89 (36.44)	21.65 (100.00)
8.01 -12.00	11.87 (64.72)	2.83 (15.43)	-	3.64 (19.85)	6.47 (35.28)	18.34 (100.00)
12.01 - & above	17.60 (60.84)	8.50 (29.38)	2.83 (9.78)	-	11.33 (39.16)	28.93 (100.00)
Total	54.56 (61.98)	21.75 (24.71)	5.25 (5.96)	6.47 (7.35)	33.47 (38.02)	88.03 (100.00)

(Figures in brackets denote percentage to total soybean area.)

4.8 Soybean Production

The average soybean production was 9.93 quintals per farm. It increased with the increase in the size of farms. The average yield of soybean was 677 kgs. per hectare but it has no relationship with the size of farms as the yield varied between 587 to 777 kgs./hectare on different size groups of farms (Table 4.8).

Table 4.8 Varietywise production of soybean in different size groups

(in quintals)

Size Groups (Hect.)	Production					Total Soybean Production	Average Production per Farm	Yield (Kgs.)
	Black	Yellow						
		T-49	JS-2	Other	Total			
Up to 2.00	14.00	22.00	10.00	-	32.00	46.00	5.75	747
2.01- 4.00	46.50	18.50	-	11.00	29.50	76.00	5.43	587
4.01- 8.00	80.00	50.00	7.00	7.00	64.00	144.00	9.60	665
8.01-12.00	98.50	26.00	-	18.00	44.00	142.50	11.88	777
12.01 & above	104.50	66.00	17.00	-	83.00	187.50	17.05	648
Total	343.50	182.50	34.00	36.00	252.50	596.00	9.93	677

Variety T-49 performed best among all the varieties with the yield of 839 kgs. The yield of JS-2 was 647 kgs. and that of black soybean 629 kgs. The performance of T-49 was consistently superior in all the size groups(Table 4.9).

Table 4.9 Varietywise yield of soybean in different size groups

(in kgs.)

Size Groups	Yield		
	Black	Yellow	
		T-49	JS-2
Up to 2.00	494	1037	826
2.01 - 4.00	547	761	-
4.01 - 8.00	581	851	578
8.01 -12.00	829	918	-
12.01 & above	593	776	600
Total	629	839	647

CHAPTER V

ECONOMICS OF SOYBEAN CULTIVATION

To study the economics of soybean cultivation a comparative study of the cost of cultivation of soybean black and yellow and other competitive crops of the region viz. maize, jowar, urd, groundnut and cotton has been taken into account and the results obtained have been subjected to discussion in this chapter.

5.1 Cost Concepts

The cost concepts and the allied terms are explained below.

The total cost also termed as operational cost included the actual or estimated value of material inputs estimated value of family human and bullock labour together with actual cost of hired human and bullock labour. It also included interest on working capital calculated at the normal interest rate for six months.

Gross output was derived by adding the values of main and by-products calculated at the rates at which the farmers sold the marketable surplus.

Net return was obtained by subtracting the operational cost from gross return. It was equivalent to farm business income.

5.2 Cost of Cultivation

Comparative study of the costs of 5 selected crops with soybean-black and yellow had revealed that groundnut involved the highest cost of Rs. 956.45 per hectare followed by yellow soybean Rs. 853.30, cotton Rs. 726.50. The urd had the lowest cost of cultivation of Rs. 586.45 per hectare. Black soybean, maize and jowar ranged between Rs. 600 and Rs. 670 per hectare (Table 5.1).

Table 5.1 Per hectare value of inputs used for selected crops

Item of cost	Groundnut	Yellow Soybean	Cotton	Black soybean	Maize	Jowar	Urd
Seed	254.00	137.50	36.40	73.60	27.00	16.00	88.00
Manure	60.00	60.00	37.50	35.00	45.00	30.00	-
Fertilizer	126.00	135.00	169.50	80.60	114.35	120.75	81.10
Insecticide/ Pesticide	36.00	23.00	33.35	14.40	21.60	22.50	26.45
Material Input	476.00	355.50	276.75	203.50	207.95	189.25	145.55
Human Labour	240.60	260.75	264.00	248.60	220.25	208.00	250.00
Bullock Labour	204.15	210.35	165.00	200.40	200.00	195.60	180.00
Labour & Bullock Charges	444.75	471.10	429.00	449.00	420.25	403.60	430.00
Interest on working Capital	35.70	26.70	20.75	15.25	15.60	14.20	10.90
Total Operational Cost	956.45	853.30	726.50	667.75	643.80	600.05	586.45

5.3 Break up of the Cost

Material inputs included seed, manure, fertilizers and insecticides/pesticides . Irrigation was not included as all the crops studied were kharif crops mostly grown rainfed . The proportion of material cost was highest, 49.77 per cent, in the case of groundnut followed by yellow soybean 41.66 per cent and cotton 38.09 per cent (Table 5.2).

Table 5.2 Percentages of per hectare value of inputs used for selected crops.

Items of Cost	Ground-nut	Soybean Yellow	Cotton	Soybean black	Maize	Jawar	Urd
Seed	26.56	16.11	5.01	11.01	4.19	2.64	6.48
Manure	6.27	7.03	5.16	5.24	6.99	4.94	-
Fertilizer	13.17	15.82	23.33	12.07	17.76	19.89	13.83
Insecticide Pesticide	3.77	2.70	4.59	2.16	3.36	3.71	6.51
Material Inputs	49.77	41.66	38.09	30.48	32.30	31.18	24.82
Human Labour	25.16	30.56	36.34	37.23	34.21	34.26	42.63
Bullock Labour	21.34	24.65	22.71	30.01	31.07	32.22	30.69
Labour & Bullock Charges	46.50	55.21	59.05	67.24	65.28	66.48	73.32
Interest on Working Capital	3.73	33.13	2.86	2.28	2.42	2.34	1.86
Total Operational Cost	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The cost of material inputs in groundnut was augmented due to high price of seed and higher rate per hectare. In the case of yellow soybean the cost of seed and fertilizer have increased the material cost. Remaining crops except urd had little variation in pergentage of material inputs which ranged between 30 to 40 per cent.

Fertilizer was the other major constituent of material inputs. Cotton showed the highest percentage of operational cost on fertilizers (23.33 per cent) followed by jowar (19.89 per cent) and maize (17.76 per cent).Remaining crops had marginal variation in the proportion of operational cost invested on fertilizers which ranged from 12 to 16 per cent.

Other constituents of material inputs were manure and insecticides/pesticides. All the crops studied except urd had little variation in the operational cost on manure and insecticides/pesticides which ranged from 5 to 8 per cent in respect of former and 2 to 5 per cent for the latter. In the case of urd manure was not at all used.

Material inputs which were mainly purchased inputs, were the major constituents of cash costs. It was thus obvious that the cultivation of groundnut, yellow soybean and cotton were relatively more capital intensive and involved higher cash expenses as compared to that of maize, jowar, black soybean and urd.

Among all the crops studied, human and bullock labour particularly the family labour or owned bullock labour constituted the major part of the operational cost except groundnut. Urd returned with the highest proportion of operational cost on labour and bullock charges [illegible] Groundnut had the lowest operational cost on labour and bullock charges i.e. 46.50 per cent but its material cost was highest.

5.4 Net Return Per Hectare

Per hectare net returns calculated for selected crops have indicated that yellow soybean was the most profitable kharif crop. It had a net return of Rs. 770.60 per hectare followed by cotton Rs. 604.25 and groundnut Rs. 593.55. It was also observed that black soybean was more profitable than jowar, urd and maize. Per hectare net return from black soybean was Rs. 490.50 as compared to Rs.470.95 for jowar, Rs. 323.95 for urd and Rs. 309.30 for maize (Table 5.3).

Table 5.3 Net return per hectare for selected crops

Crops	Gross Output	Operational Cost	Net Return
Groundnut	1550.00	956.45	593.55
Yellow Soybean	1623.90	853.30	770.60
Cotton	1330.75	726.50	604.25
Black Soybean	1158.25	667.75	490.50
Maize	953.10	643.80	309.30
Jowar	1078.00	607.05	470.95
Urd	910.40	586.45	323.95

During the reference year there were no rains after middle of August, therefore, the kharif crops suffered. Soybean yields also decreased due to drought during the pod filling stage.

As discussed earlier the cultivation of yellow soybean was relatively more capital intensive and involved higher cash investments as compared to that of black soybean. Analysis of cost and return, in terms of cash expenses showed that the cash expenditure per hectare on the cultivation of yellow and black soybean was 41.66 and 30.48 per cent respectively of the total cost. Though the returns over cash expenditure continued to be more on yellow soybean, the cost benefit ratio in terms of cash input and output widened significantly in favour of black soybean, the ratio being 1:4.6 for yellow and 1:5.7 for black soybean. This is why the black soybean was finding more favour with the majority of the farming community.

5.5 Marketing of Soybean

The production of soybean on sample farms was 596 qtls. and more than 90 per cent of this was reported as marketable surplus (Table 5.4).

Table 5.4 Disposal of soybean production by size of the farm.

Size Groups (Hect.)	Production (in qtls.)	Sold (in qtls.)	Retained (in qtls.)
Up to 2.00	46.00	42.75 (92.93)	3.25 (7.07)
2.01- 4.00	76.00	65.05 (85.59)	10.95 (14.41)
4.01- 8.00	144.00	129.25 (89.76)	14.75 (10.24)
8.01.12.00	142.50	127.00 (89.12)	15.50 (10.88)
12.01-& above	187.50	175.25 (93.47)	12.25 (6.53)
Total	596.00	539.30 (90.49)	56.70 (69.51)

(Figures in brackets indicates percentages.)

Under the price support scheme, the National Agricultural Cooperative Marketing Federation (NAFED) procured about 346 qtls. It was 64.25 per cent of total quantity marketed. The remaining 35.75 per cent was sold to traders (Table 5.5).

Table 5.5 Marketing of soybean by size of farm

Size Groups (Hect.)	Quantity Sold (in qtls.)	To Whom Sold	
		Marketing Society (qtls.)	Trader (in qtls.)
Up to 2.00	42.75	25.25 (59.06)	17.50 (40.94)
2.01- 4.00	65.05	45.50 (69.95)	19.55 (30.05)
4.01- 8.00	129.25	76.00 (58.80)	53.25 (41.20)
8.01-12.00	127.00	48.50 (38.19)	78.50 (61.81)
12.01-& above	175.25	151.25 (86.31)	24.00 (13.69)
Total	539.30	[illegible] (64.25)	[illegible] (35.75)

(Figures in brackets indicates percentages.)

The average price of soybean received was Rs.168.55 per quintal (Table 5.6). The market prices of soybean ruled below the support price viz. Rs. 175 per quintal. It was due to the fact that about 36 per cent of the produce was sold to other agencies and the Cooperative Marketing Federation offered the price of Rs. 175 per quintal only for Fair Average Quality (FAQ).

Table 5.6 Quantity sold and average price received by the farmers

Size Groups (Hect.)	Sales		Average Price per Qtls. (Rs.)
	Qty. (qtls.)	Value (Rs.)	
Up to 2.00	42.75	7320.00	171.23
2.01-4.00	65.05	11039.00	169.70
4.01-8.00	129.25	21950.00	169.83
8.01.12.00	127.00	20570.00	161.97
12.01 & above	175.25	30018.00	171.29
Total	539.30	90897.00	168.55

The quantity of soybean retained by the sample farmers was 56.70 qtls, of which 43.30 qtls. i.e. 76.37 per cent was meant for seed and 13.40 qtls. i.e. 23.63 per cent for other uses i.e. domestic consumption or cattle feed (Table 5.7).

Table 5.7 Utilization of retained quantity by size of farm

Size Groups (Hect.)	Retained (qtls.)	Utilization	
		Seed (qtls.)	Consumption to cattle feed (in qtls.)
Up to 2.00	3.25	2.75 (84.62)	0.50 (15.38)
2.01- 4.00	10.95	10.80 (98.63)	0.15 (1.37)
4.01- 8.00	14.75	10.25 (69.49)	4.50 (30.51)
8.01.12.00	15.50	9.25 (59.68)	6.25 (40.32)
12.01 & above	12.25	10.25 (83.67)	2.00 (16.33)
Total	56.70	43.30 (76.37)	13.40 (23.63)

(Figures in brackets indicares percentages)

5.6 Experience of Farmers

During the survey both participant and non-participant farmers were approached to solicit their experience about the different aspects of soybean cultivation and its uses. Results on this have been very interesting. Some of the important glimpses are highlighted in this chapter.

5.6.1 Participant Farmers

It was reported by the participant farmers that all of them had been growing soybean since last five years. Out of the 60 sample farmers, as many as 31 started growing it on the motivation of Extension Workers of Agriculture Department and 2 did it on the attraction of neighbours. It is very interesting that 27 farmers started soybean cultivation of their own interest.

Further, in the cultivation of the crop 22 faced no problem, whereas, 12 farmers were confronted with the problems at germination and 14 at nodulation stage. Pests and insects and plant diseases worried 8 farmers while 4 farmers were disheartened by the poor yield.

The yield estimations in the normal conditions were also reported byt the farmers on the basis of their experience. Among the sample farmers, 8 were generally getting yield up to 5 qtls. per hectate, 10 farmers between 5 & 7.5 qtls., 26 farmers between 7.50 & 10 qtls. & 16 farmers between 10 & 15 qtls. It means that about 70 per cent farmers were getting yield more than 7.50 qtls. per hectare.

Crop rotation followed by 28 farmers in

relation to soybean was soybean-wheat and 21 farmers followed soybean-gram. Eleven farmers took no crop after soybean.

As regards the domestic uses of soybean, 44 farmers had never used it for domestic consumption. It was only 16 farmers who used soybean in winter season and 8 of them sonsumed it as mixture of 10 kgs. wheat and 1 kg. soybean flour for chapatis and remaining 8 used it as bullock feed.

5.6.2 Non-Participant Farmers

Among the non-participants as many as 37 or 92.50 per cent farmers were well aware that their village brethren were growing soybean and were earning profits. They were very much interested in soybean cultivation but were unable to do so due to insufficient land and dire need of cereals for family consumption. To fulfil their desire 10 of them took soybean crop once but could not continue it due to above reasons.

To sum up, both participant and non-participant farmers were interested in soybean cultivation due to its profitability. The latter group was unable to materialise its willingness for one reason or the other while the former was reaping the cream of benefits from soybean.

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CHAPTER VI

EXPANDING HORIZONS OF SOYBEAN CULTIVATION AND RELATED PROBLEMS

Present chapter deals with the ex expansion of soybean cultivation, marketing and processing and utilization of soybean in Madhya Pradesh.

6.1 Yellow Soybean Vs. Black Soybean

The yellow soybean has following advangages :-

1) Higher yield
2) Higher market price
3) Higher net return per hectare

The advantages of black soybean are :-

1) Less capital intensive
2) Simple production technology
3) Higher input-output ratio
4) More resistance to adverse climatic conditions
5) Lower seed rate which makes resowing possible in the event of crop failure
6) About 100 per cent germination
7) Needs lesser guarding after sowing

Considering the above factors the farmers have adopted black soybean in preference to yellow soybean.

6.2 Soybean Vs. Groundnut

Since groundnut is widely grown in parts of Central India both for food and oil, the question arises whether soybean would find a market in competition. In this connection the following considerations should be noted.

1) Soybean has a much greater variety of uses than groundnut. Although the latter has larger oil percentage, soybean oil has more commercial uses than groundnut oil.

2) Soybean contains more proteins than groundnut.

3) Soybean is better adopted to varying conditions of soil and climate than groundnut.

4) Soybean enriches the soil, whereas groundnut takes many nutrients out of it.

5) Soybean is easier and less expensive to grow than groundnut.

6) Soybean suffers little from irregular rains whereas groundnut at times faces partial or nearly total crop failure.

6.3 Soybean Marketing

A crop introduced on a commercial scale must serve the intended market. From the standpoint of commercial production, soybean can be considered a "new" crop in India. Extensive trials during the past decade indicate that particularly in North Central India, soybean yields are high enough to warrant cultivation on a large scale. Soybean can be cultivated as a cash crop to replace low value crops such as local jowar, maize, millets and pulses. Land yielding now left fallow during the kharif season can also be sown under soybean.

About 70 per cent of the total arrival in the markets was immediately after the harvest period i.e. November to January. The important markets which reported moderate to high arrival of soybean are as follows :-

Soybean Markets In India

State	District	Name of the Market
Madhya Pradesh	Ujjain	Ujjain, Tarana, Badnagar Mahidpur, Unel
	Indore	Indore, Mhow
	Dewas	Dewas, Sonkatch

State	District	Name of the Market
	Shajapur	Shajapur, Agar
	Seoni	Seoni
	Ratlam	Ratlam
	Dhar	Dhar
	Sehore	Sehore, Nasurullaganj
Uttar Pradesh	Haldwani, Rishikesh, Orai, Budaun, Bareilly, Rampur	
Himachal Pradesh	Kangra	Paalampur, Kangra Maranda, Nagrola Nurpur, Jawali
	Una	Una, Amb.Gagret
	Hamirpur	Hamirpur, Nadaun

Among all these Ujjain, Indore, Mhow, Dewas, Sonkatch in M.P. and Haldwani in U.P. serve as major markets. The states like Gujerat, Maharashtra, Punjab, Orissa and Bihar also grow soybean but do not have any regular market.

Seybean is basically a commercial crop. The success of soybean greatly depends on how the industry takes up this crop for commercial uses. The scarce edible oil situation in the country and favourable export markets of soymeal may push up the price level of soybean.

6.4 Price Support Plan

The National Agricultural Cooperative Marketing Federation of India (NAFED) has drawn up an operational plan for the largest ever price support operations with regard to soybean, groundnut and sunflower.

The Government of India had announced uniform support price of Rs.175 per quintal for all the three oilseeds for the 78-79 season whereas in the 1977-78 support prices of FAQ soybean, groundnut & sunflower were Rs.145, Rs.160 & Rs.165 per quintal respectively. The support price for groundnut for 1979-80 was raised to Rs.190 per quintal while that for soybean and sunflower it was kept unchanged at Rs.175 per quintal.

The price support operations were entrusted to NAFED which made purchase arrangements on support price within the state through the State level Cooperative Marketing Federation that would procure the stocks from the mandies through the local primary marketing societies.

The grade specifications and support price of soybean (black and yellow) prescribed by Govt. of India and circulated by NAFED are given below :-

Special Characteristics	Maximum limits of tolerance (as % weight) for		
	FAQ	One grade below FAQ	Two grade below FAQ
1) Foreign matter	1	2	3
2) Damaged weevilled and discoloured kernels	2	3	5
3) Split or cracked kernels	5	7	10
4) Moisture	12	12	12
Rate perquintal (Rs.)	175	172	166.70

Note - Moisture in excess of 12% and upto 14 % will be discounted at full value. Stocks beyond 14 % moisture contents will not be accepted.

The 1978-79 arrivals and prices of soybean reported in Indore mandi were as fallow :-

Month	Arrivals (qtls.)	Price (Rs./qtls.)
October	21,293	166
November	15,061	166
December	20,105	170
January	32,061	175
February	12,731	170
March	9,371	175

Soybean prices were reported lowest during the harvest season in the month of October and November when it contained larger moisture percentage and heavy arrivals of supply in the mandi. Thereafter the prices started marginally increasing and were highest (Rs.175) in the month of March.

6.5 Soybean Processing

The increased production of soybean has brought into light the need of its processing. The success of the soybean industry in India will depend upon, to a large extent, on the effectiveness and economy of soybean processing operations. The most important operation is processing for oil and meal.

The economics of processing of soybean for oil and meal involves following considerations :-

1) Yield and quality of the oil and meal,
2) Investments in processing facilities and risk of loss.
3) Processing costs
4) Costs of transportation.

These factors are involved in the decision making on location type and size of processing units.

A fundamental problem of the industry lies in generation of the confidence, basic to full growth of the industry. On the one hand, cultivators are reluctant to produce soybean unless assured and dependable market and a remunerative price are guaranted to them. On the other hand, processors want evidence that adequate and regular crop production will develop before they establish expensive processing units. Although some measures have been taken to alleviate the problem expansion of the industry has been limited due to the lack of the mutual confidence.

The farmers adjacent to soybean processing plants or those having large marketable surplus may deal directly with soya processing firms. Soybean processing plants are located

at Indore, Dewas, Khandwa and Sehore. Four new processing plants are coming up at Dewas, Shajapur, Itarsi and Sehore to meet the increasing requirement. The quantity exported as indicated in table 6.1 brings about the fact that the two mahor soybean processing firms in M.P. viz. General Foods Pvt. Ltd. Indore and Vippy Solvex Products Pvt. Ltd. Dewas had exported 24,748 tons (about 58 %) out of 42,024 tons of soya meal export from India during 1978-79. About 79 per cent of total export of soya meal was done by the processing firms located in Madhya Predesh (Table 6.1).

Table 6.1 Firmwise Export of Soybean from India, 1978-79

State/Firm	Quantity of soybean export (in tons.)
Madhya Pradesh	
General Foods (P) Ltd, Indore	14915
Vippy Solvex Products (P) Ltd. Dewas	9833
Manding Ka oil Mills, Khandwa	3831
Malwa Vanaspati & Chemicals, Indore	1482
Premier Extraction Pvt. Ltd, Indore	1514
Bhandari Crop Fidds. Indore	818
Jagmanek S.L. Plant, Sehore	481
Sri Krishna oil Mills, Indore	390
Sub Total	33264 (79 %)
Other States	
Jayant Extraction Industries Jamnager, Gujerat	2413
Schokhi Industries	1255
Others	5092
Sub Total	8760 (21 %)
Total	42024 (100 %)

Source :- The Soybean Processors Association of India. The preliminary estimates based on Members Returns and Daily list of Exports from Bombay port. The figures in brackets are percentage of total.

The price of Rs.175 per qtl. did not provide incentive to the processing industries to process on large scale (Table 6.2).

Table 6.2 Processing Cost and Return*

Items	Rs. Per Quintal
1. Cost of Soybean (ex-site)	175.00
2. Add expenses upto factory	
a) Sale tax and mandi tax as 5%	8.75
b) Cost of packing, transport & other incidentals	10.00
3)) Manufacturing expenses	25.00
Total cost	218.75
4) Recoveries (ex-factory level)	
a) Oil 15 % as Rs.700 per qtl.	112.00
b) Meal 65% as Rs.145.50 per qtl.	94.58
c) Hulls/chari 14 % as Rs.50 per qtl.	7.00
Total returns	213.58
Per qtl. loss	5.17

Further the processing firms also face larger F.O.B. (Free on board) cost which also did not promote export to a sufficient level (Table 6.3).

* Source : Ibid 61

Table 6.3 Break-up of F.O.B. cost per ton of Soya Meal Export from Indore to Shipment at Bombay*

S.No.	Item	Cost Rs.
1.	Loading at factory (Labour Charges)	7.00
2.	Transportation from factory to railway St.	10.00
3.	Average freight upto Bombay as 30% goods by road transport (Rs.90-100 per tons)	80.00
4.	Unloading at Bombay railway st.	4.00
5.	Godown Charges at port	16.00
6.	Loading Charges at port	5.00
7.	Lorry freight from godown to docks (ship)	9.00
8.	Clearing and forwarding at port as Rs.4-6 per tons	5.00
9.	Port trust fee (by Govt.)	3.00
10.	Service and facilities expenses (like analysis, weightment, issue of various documents needed for export)	5.00
11.	Commission and brokerage	20.00
12.	Other expenses (including shortage of Goods 2 %)	15.00
13.	Interest on capital (for a period of one month)	15.00
	Total :	194.00
	Export duties (if levied)	125.00

Note : The cost includes all possible expenses that the firm has to incur if it decides to route export through means and channel specified in the cost structure given above. To the extent some of the expenses are minimised or eliminated, the F.O.B. cost of exporting soya meal would decrease. The freight charges upto Bombay could be reduced by about Rs.20 per ton if the transport is made solely through rail. The necessity of storage in the godown could be reduced/eliminated

* Source : Ibid 61

eliminated through timely despatch and receipt of goods at the port. Likewise the cost of some other items could be reduced.

6.6 Recommendations of the Expert Committee on Soybean Processing -

The Expert Committee on soybean processing set up under the Chairmanship of Dr. M.S. Swaminathan, has made the following recommendations :-

1. That the agricultural extension agencies at the Centre as well as in States should be requested to disseminate information regarding the support price among the farmers particularly in Madhya Pradesh and Utter Pradesh and organise training camps in soya cultivation to educate the farmers about the proper methodology of cultivation of soya to obtain maximum yield per hectare.
2. That the cultivation of soya should also be propagated in Himachal Pradesh and hilly areas all along the Himalaya border which is quite suitable for its cultivation as soya crop is a low volume high value crop.
3. Agro-industrial complexes particularly in Madhya Pradesh should pay more attention to this crop and that cultivation, processing and marketing of soybean should be effectivity integrated as soya is a suitable crop for this purpose.
4. That a research programme for development of products from soybean for low income groups and for mass consumption should be taken up and the products developed should be linked with supplementary feeding programme.
5. That for stabilization of soya cultivation in the country we should be in a position to have long term contracts with E.E.C. and other countries for export of commercial soya cake for animal feed.

6. And finally, soya cultivation and its integration with processing and marketing should be encouraged.

6.7 The Industry Needs Research Support

The necessity of problem-oriented research to facilitate speedy expansion of newly emerging soybean industry in India needs no emphasis. The black variety of soybean presently forms major base of processing materials for the industry in India. The black soybean is expected to maintain its predominant position in future as well. The problems thus faced by the industry in processing of black soybean and marketing its products need immediate solutions.

One of the problems faced by the soybean processing industry pertains to dehulling of black soybean. Inspite of intensive care, some blackish fine particles of hulls are sometimes left in the final meals which affect the appearance and market prospects of Indian soy meal abroad. The recovery of whole meal from black soybean is reported to be 65-68% compared to that of 79.2 from yellow soybeans in U.S.A. The less recovery of whole soybean meal affects the economic returns of the industry and its ability to pay better price to soybean growers. It is thus necessary to evolve suitable machinery, especially for efficient dehulling, to overcome processing problems inherent in the existing black varieties of soybeans in India. The research is also needed to evolve black varieties of soybean amenable to efficient dehulling and maximum recovery of meals.

One of the complaints of the industry also pertains to the fact that the Indian meals (generally made from black soybeans) are not able to fetch premium price for its extra proteins in the international markets. The Indian soy meal has 54% protein compared to 44 % protein generally recognised as international standard of soy meal (made from

yellow soybeans. On the contrary, the prices of Indian soy meal (with higher protein content and other qualities similar to that of other exporters abroad) are generally less by 2-3 dollars a ton, in the international markets. The industry attributes this to the lack of supportive research evidence on the effectiveness of Indian soy meal made from black soybean as animal feed so as to counteract some of the unhealthy elements of competition in the international markets. It is widely felt by the industry that though the effectiveness of soy meal made from yellow soybeans in raising poultry and animal production have been fully established and recognised, the effectiveness of Indian soy meal (black soybean) remains a matter of opinion at present. It would be thus necessary to undertake comprehensive research aimed at detail composition analysis and effectiveness of soybean meal of black vis-a-vis yellow soybean in raising the poultry and animal production. The studies should also recommend what needs to be done to improve the quality of Indian soy meal.

6.8 Consumer Preferences for Soybean

Being the most nutritious food item, it is extremely essential to expand the cultivation to popularise the consumption of soybean. Soybean meal and soybean oil are the principal products derived from the crushing of soybean by either hydraulic or screw press or by solvent extraction. The meal is processed to obtain a product suitable for mixed feed or direct feeding to livestock, and is available in meal, granule, pellet or cake form.

Soy meal is the most important high protein supplement for balancing livestock and poultry feed. It is generally recognized that the diet of an average Indian lacks in proteins and vegetable oils. Soybean can be of great help

CHAPTER VII

SUMMARY AND CONCLUSIONS

7.1 INTRODUCTION

Soybean is a native of China but it is grown for many centuries in India, in the name of black soybean, particularly in the northern hills of Uttar Pradesh and Madhya Pradesh, where it is popularly known as 'Bhati' and 'Kalitur' respectively. The cultivation of black soybean could not spread to other parts of the country due to its low yield, susceptibility to diseases, long maturity, risky growth and high pod shattering. In view of its dietary importance systematic efforts for the development of yellow seeded soybean varieties (developed in USA) were started from 1965 at Jabalpur Agricultural Universities Jabalpur and Pantnagar. Excellent performance and immense yield potential shown by the yellow soybean varieties at Jabalpur and Pantnagar encouraged the ICAR to start an All India Coordinated Research Project of soybean in 1967. Two special centres and 12 subcentres of soybean were started in different agro-climatic zones of the country.

Commercial cultivation of soybean started from 1971-72 when it was grown on an area of 32,320 hectares. The area increased to 3,03,168 hectares in 1978-79 mainly in 5 states namely Madhya Pradesh, Uttar Pradesh, Karnataka, Bihar and Himachal Pradesh. Among these States Madhya Pradesh alone raised soybean crop on 2,32,562 hectares (76.71 per cent) followed by Uttar Pradesh 68,690 hectares (22.65 per cent).

Madhya Pradesh also made remarkable progress in production of soybean. It was 7,687 tonnes in 1971-72 and increased to 2,32,562 tonnes in 1978-79.

7.2 OBJECTIVES OF THE STUDY

In view of commendable progress of soybean in Madhya Pradesh both in terms of area and production, the present study was undertaken to study the economics of soybean cultivation and the related problems connected with its production and marketing.

7.3 METHODOLOGY

Soybean cultivation in M.P. was concentrated in five districts viz. Dewas, Indore, Shajapur, Ujjain and Dhar. Among these Indore district returned with the largest proportion of soybean area to the gross cropped area of the district. Thus Indore district, the most prominent soybean growing district in the State was selected for the study.

For the selection of tehsils/blocks and villages the officials of agricultural department and concerned agricultural schemes were consulted. Among the four tehsils, Indore and Depalpur which had largest area under soybean were selected. From each tehsil, two villages were selected on the basis of acreage and number of soybean growers. In Indore tehsil the sample village Jamburdi Hapsi was covered under Indo-British Dry Land Farmning Project and Hatod was out of the area of the project. Similarly in Depalpur tehsil the sample village Agar was covered under the Improvement of Productivity of Rainfed Area Programme of M.P. State and village Betma was out of the purivew of that Project.

[illegible] separate lists [illegible] and [illegible] farmers

1967, there has been spectacular growth in its area

For the selection of farmers from four sample villages separate lists for soybean growers and non-growers were obtained for each village and the farmers were arranged in the ascending order on the basis of proportion of area under soybean. The soybean growers of each village were divided into five groups each having equal number of farmers and three soybean growers were selected from each group at random. Similar method was adopted for the selection of two non-soybean growers from each group. Thus 15 participant and 10 non-participant farmers were selected from each village. The sample comprised 100 farmers : 60 participants and 40 non-participants.

Survey method was adopted for the collection of primary data with the help of interview schedules. The reference year was 1979-80.

7.4 FINDINGS

1. Since the introduction of soybean programme in 1967, there has been spectacular growth in its area and production in Madhya Pradesh. Black soybean (Kalitur) was more popular and covered about 80 per cent of the area under soybean crop. The linear growth rate of black and yellow soybean (exotic yellow varieties) in the State during 1971-72 to 1979-80 was 35.47 and 6.33 respectively.

2. The area under soybean in Indore district was 3.3 thousand hectares during 1973-74 and it went up ten times i.e. 33 thousand hectares during subsequent six years ending 1979-80.

3. In Madhya Pradesh it is included in the pulse crop and it covered second largest (nearly 21 per cent)

area as a single pulse crop, first being gram with 51.1 thousand hectares (17 %) in 1977-78.

4. Soybean is mainly grown as a kharif crop and it is a cash crop. It is grown as a mixed crop with jowar or arhar.

5. On the selected farms soybean covered 21.16 per cent of the gross cropped area which included 1.77 per cent as a mixed crop with jowar. It ranked second in area first being wheat with 33.94 per cent.

6. Soybean showed different relationship with the size of holdings and its proportion was higher on the small size groups of holdings.

7. The participant farmers raised soybean crop on 38.03 hectares. Sixty two per cent of this area was under black soybean which was more popular as compared to exotic yellow varieties such as T-49 and JS-2.

8. The total production of soybean on the participant farms was 596 qtls. which included 343.50 qtls. of (57.63 per cent) black soybean.

9. Average yield of soybean was 677 kgs. per hectares. The average yield for black soybean 629 kgs. Among yellow soybean it was 839 kgs. for T-49 and 647 kgs. for JS-2 per hectares. Due to the drought conditions the average yield of soybean was low as compared to the other years.

10. The economics of soybean cultivation was studied with its comptetive crops viz.maize,jowar,groundnut, cotton and urd. Yellow soybean returned with an output value of Rs.1623.90 per hectare. The cost was Rs.853.30 and the net return was Rs. 770.60, which was the highest net return among all the crops.

Black soybean occupied the middle position among these crops. Its per hectare output value was Rs.1158.25, cost Rs.667.75 and net return Rs. 490.50. The groundnut and cotton crops occupied positions in between yellow and black soybean whereas maize, jowar and urd remained below the black soybean in terms of net return per hectare.

11. Disposal of soybean production has indicated that more than 90 per cent of the total production was sold.

12. National Agricultural Cooperative Marketing Federation (N A F A D) purchased most of the soybean production under price support scheme. Farmers marketed 346 qtls. of soybean and 64.25 per cent of it was sold to the NAFED. The remaining 35.75 per cent was sold to the traders.

13. The price of the soybean varied between Rs.161.97 and Rs.171.23 per quintal which can not be said to be attractive price.

14. The disposal of soybean production has indicated that it has not yet achieved success to win the consumer preference for its consumption. It is grown as a commercial crop and production is offered for sale in the market primarily for its commercial uses in processing industries.

15. Although the cultivation of soybean has increased in the State vigorously the markets have not come up to match the situation. There are very few markets in the State which are concentrated in particular region. The 16 soybean markets are located in 8 districts

of Malwa region and Ujjain, Indore, Mhow, Dewas and Sonkatch were the major markets in the State.

16. In the absence of consumer preference the marketing of soybean was limited to the markets and the purchasing agencies specified above. Due to this, crop did not fetch competitive price.

17. The increased production of soybean has brought into light the need for its processing and 8 processing industries have come up in the soybean growing districts of Indore, Dewas, Sehore and Khandwa. Among these units General Foods (P) Ltd. Indore and Vippy Solvex Products (P) Ltd. Dewas were the main industrial units. They also exported soybean products to other countries.

18. The processing of soybean needs considerable cost which was reported to be Rs. 218.75 per quintal.

19. The expert committee under the chairmanship of Dr. M.S.Swaminathan made suitable recommendations in respect of various problems of soybean cultivation, marketing and processing so as to stabilize the soybean cultivation in the country.

20. Soybean cultivation, processing and local consumption ~~consumption~~ need research support to solve the confronting problems.

21. Local consumption is an important aspect due to the nutritious value of soybean and deficient diet of the people.

7.5 SUGGESTIONS

Some suggestions with regard to soybean cultivation and processing are given below :

A. TO STIMULATE PRODUCTION :

1. Supply of needed quantity of good seed and inoculum to the prospective growers should be assured and arranged in time.
2. The incentive price should be fixed and announced well before the growing season.
3. Effective training in soybean cultivation should also be given.
4. Credit, fertilizers, insecticides, etc. should be made easily available and if necessary should be subsidised.
5. Marketing structure should be strengthened.

B. TO ENCOURAGE PROCESSING AND CONSUMPTION :

1. Plant development be expedited by relaxing restrictions on licensing, essential imports of special equipments etc. and by helping in getting needed capital.
2. Low cost soy protein products be used in public feeding, food fortification and other public-supported nutrition programmes.
3. Nutrition eduction in schools and health centres etc. be expanded.
4. Standards for soybean products and reinforced foods containing soybean products should be established and enforeed to reduce adulteration, misleading advertising etc.