Study No.111

PROBLEMS AND PROSPECTS OF OILSEED PRODUCTION IN MADHYA PRADESH

AGRO- ECONOMIC RESEARCH CENTRE FOR MADHYA PRADESH AND CHHATTISGARH
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.)

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PROJECT TEAM

Data collection

Dr. Deepak Rathi
Mr. C.K. Mishra
Mr. Arvind Dangi
Mr. S. C. Meena
Mr. Ravi Singh Chouhan
Mr. Dushyant Kumar

Tabulation & Compilation of Data

Mr. Dushyant Kumar
Mr. Arvind Dangi
Mr. S. C. Meena
Mr. Ravi Singh Chouhan

Interpretation and Report Writing

Dr. Hari Om Sharma
Dr. Deepak Rathi

Coordinator

Prof. Vijay Paul Sharma
Chairman
Centre for Management in Agriculture
Indian Institute of Management Ahmadabad

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PREFACE

The present study entitled "Problem and Prospects of Oilseed Production in Madhya Pradesh" has been assigned by the Directorate of Economics and Statistics Ministry of Agriculture Government of India to this centre under the close coordination of Centre for Management in Agriculture Indian Institute of Management Ahmadabad.

The study comprises 240 soybean grower of Chhindawara, Khandwa and Narsinghpur districts and 120 mustard growers of Mandla, Morena and Chhatarpur districts of Madhya Pradesh. The study reveals that oilseeds production has increased tremendously due to successful implementation of TMO and ISOPOM programme in the State. The cultivation of soybean and mustard was also found profitable over there competing crops i.e. maize and wheat. There is still tremendous scope for increasing yield of these crops in the State as farmers were found to harvest below the potential yield of the area under study.

The present study was conducted by Dr. H. O. Sharma and Dr. Deepak Rathi of this Centre. They have done field investigation, tabulation analysis, interpretation and drafting of the report. I wish to express my deep sense of gratitude to them and their team members namely; Mr. Arvind Dangi, Mr. C.K. Mishra, Mr. S.C. Meena, Mr. Dushyant Kumar and Mr. Ravi Singh Chouhan for their untiring efforts in bringing this innovative study to its perfect shape.

I extend heartfelt thanks to the Coordinator of this study Prof. Vijay Paul Sharma, Chairman, Centre for Management in Agriculture, Indian Institute of Management, Ahmadabad for providing valuable guidelines and time to time suggestions through e-mails for conducting the study successfully.

On behalf of the Centre, I express deep sense of gratitude to Dr. V.S. Tomar, Hon'ble Vice-Chancellor and chairman Advisory Body of AERC, Jabalpur, Dr. S.S. Tomar, Director Research Services, Dr. S.K. Rao Dean, Faculty of Agriculture, and Dr. P.K. Mishra, Director Instruction, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur for providing all facilities and valuable guidance during various stages in successful completion of this study of high importance.

I express sincere thanks to Shri Rameshwar Patel, Deputy Director of Agriculture, Khandwa; Shri J.S. Gurjar, Deputy Director of Agriculture, Chhindawara; Shri K.K. Tiwari, Deputy Director of Agriculture, Narsinghpur; Shri I.S. Baghel, Deputy Director of Agriculture, Chhatarpur; Shri K. S. Netam, Deputy Director of Agriculture, Mandla and Shri D.C. Sharma, Deputy Director of Agriculture, Morena and their field staff for providing not only secondary data but also extending great assistance in collection of field data from the selected respondents .

I hope the findings and suggestions made in the study would be useful to policy makers of the states and Govt. of India

Date : 31.05.2014 **(Hari Om Sharma)**
Place: Jabalpur Prof. & Director

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CHAPTER I

INTRODUCTION

India is among the largest vegetable oil economy in the world after USA, China, Brazil and Argentina. In the agriculture economy of India oilseeds are important next to food grains in terms of area, production and value. Currently, India accounts about 15 per cent of oilseeds area and 9 per cent of world oilseeds output, 11 per cent world edible oil consumption and protein meal and is the 4th largest edible economy in the world. This sector has also an important position in the Indian agricultural sector covering an area of about 27.22 million hectares, with total production of about 32.48 million tones with average productivity of 1193 kg/ha. in 2010-11 (GOI, 2011). This constitutes about 14.9 per cent of the gross cropped area in the country. Almost in different oilseeds grown in India the highest area occupied by soybean (35.27%) followed by rapeseeds and mustard (25.35%), groundnut (21.53%) and sunflower (3.42%). (Table 1.1) The oilseeds accounted for about 9.7 per cent (at 2004-05 prices) of the total value of output from agriculture in TE 2009-10 (CSO, 2011). About 14 millions farmers are engaged in production of oilseeds and another million in their processing. Oilseed contribute 12-13 percent dietary energy, account for about 1.2 per cent of national and 15 per cent of agriculture export.

Table 1.1: Share of different oilseeds in India (2010-11)

Oilseeds	Area		Production		Yield	
	Million ha	% to India	Million ton	% to India	Kg / ha	%change over India
Groundnut	5.86	21.53	8.26	25.43	1411	18.27
Rapeseed & Mustard	6.9	25.35	8.18	25.18	1185	-0.67
Soybean	9.6	35.27	12.74	39.22	1327	11.23
Sunflower	0.93	3.42	0.65	2.00	701	-41.24
Others	3.93	14.44	2.65	8.16	674	-43.50
India	27.22	100.00	32.48	100.00	1193	0.00

A wide range of oilseed crops are grown in different agro-climatic regions/States of the country. Almost 90 per cent production concentrated in Madhya Pradesh (24.48%), Rajasthan (20.10 %), Maharashtra (15.35 %), Gujarat (14.92%), Andhra Pradesh (6.09%), Karnataka (3.87%) and Uttar Pradesh (2.8%) (Table 1.2).

Table 1.2: Area, Production and Yield of Oilseeds in different states of India (2010-11)

States	Area		Production		Yield	
	Million ha	% to India	Million ton	% to India	Kg/ha	% change over India
Madhya Pradesh	7.03	25.83	8.04	24.48	1144	-4.11
Rajasthan	5.49	20.17	6.6	20.10	1202	0.75
Gujarat	2.89	10.62	4.9	14.92	1696	42.16
Maharashtra	3.62	13.30	5.04	15.35	1392	16.68
Andhra Pradesh	2.32	8.52	2.22	6.09	862	-27.75
Karnataka	1.62	5.95	1.27	3.87	784	-34.28
Uttar Pradesh	1.11	4.08	0.92	2.80	829	-30.51
0thers	3.14	11.54	4.07	12.39	1296	8.63
India	27.22	100.00	32.84	100.00	1193	0.00

Among the oilseeds, groundnut which was the most important crop in 1998-99 has lost its prime position to soybean in 2010-11 and is grown in Madhya Pradesh (52.35%), Maharashtra (33.91%) and Rajasthan (8.79%), accounting for about 95 per cent of total production in the country (Table 1.3).

Table 1.3: Area, Production and Yield of Soybean in different states of India (2010-11)

States	Area		Production		Yield	
	Million ha	% to India	Million ton	% to India	Kg/ha	% change over India
Madhya Pradesh	5.56	57.92	6.67	52.35	1200	-10.65
Rajasthan	0.77	8.02	1.12	8.79	1455	10.73
Maharastra	2.73	28.44	4.32	33.91	1582	21.37
Andhra Pradesh	0.13	1.35	0.22	1.73	1692	30.60
Karnataka	0.17	1.77	0.15	1.18	882	-37.30
0thers	0.24	2.50	0.26	2.04	1083	-20.45
India	9.6	100.00	12.74	100.00	1327	0.00

The second most important oilseed crop is groundnut, which is grown mainly in Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan, Karnataka and Maharashtra. The third major oilseed crop, mustard/rapeseed is grown in Rajasthan (53.42%), Haryana (11.49%), Madhya Pradesh (10.51%), Uttar Pradesh (8.8%), West Bengal (5.13%) and Gujarat (4.28%) (Table 1.4).

Table 1.4: Area, Production and Yield of Mustard in different states of India (2010 - 11)

States	Area		Production		Yield	
	Million ha	% to India	Million ton	% to India	Kg /ha	% change to India
Rajasthan	3.68	53.33	4.37	53.42	1188	-0.42
Madhya Pradesh	0.75	10.87	0.86	10.51	1147	-3.88
Haryana	0.5	7.25	0.94	11.49	1880	57.97
West Bengal	0.41	5.94	0.42	5.13	1024	-14.26
Uttar Pradesh	0.6	8.70	0.72	8.80	1200	0.59
Gujarat	0.22	3.19	0.35	4.28	1591	33.59
Assam	0.24	3.48	0.14	1.71	583	-51.48
Others	0.5	7.25	0.38	4.65	760	-36.54
India	6.9	100.00	8.18	100.00	1185	0.00

These three crops accounted for about 90 per cent of the total oilseeds production in the country. The other edible oilseeds are sunflower, sesame and safflower. Karnataka, Andhra Pradesh and Maharashtra are major sunflower producing states while West Bengal, Gujarat and Rajasthan are major sesame producing states.

India was self-sufficient in edible oilseeds and oils till the mid-60s and was a substantial export earner through export of oilseeds, meals, extractions and edible oils. With stagnation in production as well as rise in population, the oilseed production fell short of its demand in the early seventies. By the mid-80s, edible oils was the largest import item, constituting about 30 per cent of the total supply, next only to petroleum products despite the fact that the India had the world's second largest area under oilseeds. This was a matter of serious concern for the Government and a decision was taken to achieve self sufficiency in edible oilseeds by 1990s. The initial strategy to overcome stagnant oilseed production was to promote technological change in oilseed production and processing through centrally sponsored schemes. In May 1986, Government of India launched Technology Mission on Oilseeds (TMO) to increase production of oilseeds, reduce imports and achieve self sufficiency in edible oil. Oil Palm Development Programme (OPDP) was launched during 1991-92 with a focus on area expansion in Andhra Pradesh, Karnataka, Tamil Nadu, Orissa, Gujarat and Goa. During the Tenth Plan Integrated Scheme on Oilseeds, Pulses, Oil Palm and Maize (ISOPOM) was implemented by converging earlier schemes like Oilseeds Production Programme (OPP), Oil Palm Development Programme, National Pulses Development Programme (NPDP) and Accelerated Maize Development Programme (AMDP). Pulses component of ISOPOM has been merged with NFSM-pulses to intensify efforts for production of pulses from April 2010.

As a result of major initiatives in mid-1980s and protection to domestic industry from imports up to early 1990s, there was a significant progress in the production of oilseeds from mid-1980s to mid-1990s. Between TE 1985-86 and TE 1993-94, production of oilseeds increased from 12.1 million tones to over 20 million tones, largely due to improved yields. Average yield increased from 644 to 772 kg/ha during the corresponding period (GOI, 2010). An increase in area also contributed to higher production of oilseeds in the country. The area planted to all oilseeds increased from 18.9 million hectares in TE 1985-86 to about 26 million hectares in TE

1993-94. However, in pursuance of the policy of liberalization and globalization in the early 1990s, there were progressive changes in the trade policy in respect of edible oils. The edible oils which were in the negative list of imports were first decentralized partially in April 1994 with permission to import edible vegetable palm oil in under Open General License (OGL) at 65 per cent duty. This was followed by enlarging the basket of oils under OGL in March 1995, when all edible oils (except coconut oil, palm kernel oil, RBD palm steering), were brought under OGL import. With decentralization, import of edible oils under OGL started in 1994-95 and increased substantially during the subsequent years due to reduction in import duty and removal of quantitative restrictions (QRs) and other non-tariff barriers on all edible oils. Due to opening up of domestic markets, the production of oilseeds in the country remained stagnant at about 20 million tonnes during the 1990s but increased during the recent years and reached a level of about 27.5 million tonnes in TE 2010-11. The annual compound growth rate in oilseeds production was negative (-1.96%) between 1994-95 and 2000-01 but improved significantly (6.85%) during the 2000s. The average productivity increased from 872kg/ha in TE 2000-01 to 1042 kg/ha in TE 2010-11. However, the productivity levels of oilseeds in the country are still very low compared to world average and other countries. The yields remain low largely on account of dependence on dry-land farming. The production of oilseeds has not been able to keep pace with the demand for edible oils, which necessitated import of edible oils and India imports about half of its edible oil requirement.

Given the competing demands on agricultural land from various crops, the production of oilseeds can be increased only if productivity is improved significantly and farmers get remunerative and attractive prices, however, farmers face various constraints in oilseeds production. Most of oilseeds are grown under rain fed conditions and only 28 per cent of area under oilseeds is irrigated. Several biotic, a-biotic, technological, institutional and socio-economic constraints inhibit exploitation of the yield potential of crops and need to be addressed. Taking into account the changing policy environment, increasing demand, concerns about slow growth in domestic production and rising imports, the present study attempts to analyse performance and potential of major oilseeds grown in Madhya Pradesh i.e soybean and mustard, and identify major problems/ constraints facing the sector with following specific objectives.

1.2 Objectives of the Study

The specific objectives of the study are:

1. To examine trends and pattern of growth of soybean and mustard over time and across districts and identify the sources of growth in edible oilseeds output in the state.
2. To analyse the cost and profitability of Soybean and Mustard and their competing crops in the area under study.
3. To analyse yield gap and identify major constraints in the soybean and mustard cultivation and suggest policy options to increase oilseeds production and productivity in the country.

1.3 Role of Agriculture in the State Economy

Madhya Pradesh, in its present form, came into existence on November 1, 2000 following its bifurcation to create a new state of Chhattisgarh. The undivided Madhya Pradesh was founded on November 1, 1956. Madhya Pradesh, because of its central location in India has remained a crucible of historical currents from North, South, East and West.

Table 1.5: Location of Madhya Pradesh

S. No.	Particulars	
1	Number of Divisions	10
2	Number of Tehsils	342
3	Number of Blocks	313
4	Number of Villages	54,903
5	Latitude	21° 53` to22° 59`N
6	Longitude	76°47` to 78°44` E
7	Height from see means level	50-1200
8	No of districts	50
9	No. of Gram Panchayat	23,012
10	No. of electrified Villages	35910
11	Percentage of electrified villages to total Villages	65.41

Madhya Pradesh is situated in the heart of India between latitudes 21^0 -53' to 22^0 53' North and longitude 77^0 47' to 78 ^{0} 44' East. It is the second largest state after Rajasthan of Indian Union with a total geographical area of 307.56 thousand square Kilometers. In terms of population (72,597,565) it occupies 7^{th} position in India (2011). It has 10 commissionaire division (Chambal, Gwalior, Bhopal, Ujjain, Indore, Sagar, Rewa, Jabalpur, Hoshangabad and Shahdol) divided into 50 districts, 342 Tehsil, 313 block & 376 towns and 54,903 villages. (Table 1.5) It is abundantly rich in

minerals and bio resources with 27 per cent of land area under forests; it supports a wide variety of animal and plant life. The state has a rich history, culture and crafts.

The Physiography of the state exhibits a great deal of diversity with areas ranging from less than 50 meter above mean sea level to more than 1200 meter. The state falls under the catchments of Yamuna, Ganga, Narmada, Mahanadi and Godavari. On the basis of broad land features and different soil and rain fall pattern, the state could be classified in 5 physiographic regions and 11 agro-climatic zones (Table 1.6)

1. Northern low lying plains comprising Gwalior, Bhind and Morena districts and extend to Bundelkhand up to the west of Panna range and excludes certain parts of Rewa district between Panna and Kaymore hills of Baghelkhand.

2. The Malwa and Vindhyan Plateau comprises of Vidisha, Shivpuri, Datia, Guna, Ujjain and Mandsour districts and parts of Sehore, Raisen and Dewas districts. It consists of large undulating plains of black cotton soil dotted with flat-topped hills. It has also hilly Vindhyan Plateau situated in the north of Narmada Valley and to the south of the low-lying regions of Bundelkhand and Baghelkhand. It spared from east of Malwa plateau to Maikal and Dorea hills Satpura range.

Fig. 1.1: Agro-Climatic Zones of Madhya Pradesh

3. The Narmada Valley stretching from Jabalpur in the east up to Barwani district in the West. It is nearly 560 Km long and 48 Km wide and is walled on the north by the

Vindhya Range and on the south by Satpura range. It covers the districts of Jabalpur, Narsinghpur, Hoshangabad, Khandwa, Khargone, Barwani, Dhar, and some parts of Raisen, Sehore, and Dewas districts.

4. The Satpura range runs from West to East for about 640 Km through Khandwa, Betul, Chhindwara, Seoni, Mandla, Bilashpur and Sarguja districts. Its northern spurs go into Hosangabad and Narsinghpur districts and in the south an extensive spur of 160 Km covers entire Balaghat districts.

Table-1.6: Agro-Climatic Regions and covered Districts /Tehsils in Madhya Pradesh

(Area in Lakh ha)

Agro-Climatic Regions	Districts /Tehsils	Geographical Area	Percent to Geographical Area
1. Malwa Plateau	Indore, Dhar, (Dhar, Badnawar, Sardarpur tehsils) Shajapur, Mandsour, Neemuch, Ratlam, Ujjain, Dewas Rajgarh districts and Petlawad tehsil of Jhabua district	51.47	16.74
2.Vindhyan Plateau	Bhopal, Vidisha, Sehore (Sehore, Ashta, Ichhawar, Narsullaganj tehsils) Raisen (Raisen, Gairatganj, Begamganj, Silwani, Goharganj, Udaipura tehsils), Damoh, Guna (Chachora & Raghogarh tehsils) & Sagar districts	42.59	13.85
3.Central Narmada Valley	Hoshangabad (Seoni-Malwa, Hoshangabad, Sohagpur tehsils), Harda, Nasinghpur districts, Budhani and Barelli tehsil of Sehore and Raisen districts respectively	17.45	5.67
4.Satpura Plateau	Betul, Chhindwara districts	21.93	7.13
5.Jhabua Hills	Jhabua, Jobat, Alirajpur tehsils of Jhabua district & kukshi tehsil of Dhar district	6.88	2.24
6.Gird Region	Gwalior, Bhind, Morena, Shivpur-Kalan, Guna (Mungawali and Ashoknagar tehsils), Shivpuri (Shivpuri, Kalaras, Pohari tehsils)	31.85	10.36
7. Kymore Plateau	Jabalpur, Katni, Rewa, Panna, Satana, Sidhi, Seoni and Gopadbanas & Deosar tehsils of Sidhi district.	49.97	16.25
8.Bundel Khand Region	Tikamgarh, Chhatarpur, Datia districts, Karela, Pachore tehsil of Shivpuri and Guna tehsil of Guna district	22.82	7.42
9.Nimar Valley	Khandwa, Khargone, Barwani district, Manawar tehsil of Dhar district and Harda district	25.17	8.18
10.Northern Hills of Chhattisgarh	Shahdol, Umariya Mandla, Dindori district & Singrauli tehsil of Sidhi district	28.17	9.16
11.Chhattisgarh plain	Balaghat district	9.25	3.00
Madhya Pradesh		**307.56**	**100.00**

5. Madhya Pradesh also covers Balaghat and Shahdol districts of Chhattisgarh Plains and Northern Hills of Chhattisgarh zone respectively. The state is bordered on

the west by Gujarat, on the northwest by Rajasthan, on the northeast by Uttar Pradesh, on the east by Chhattisgarh, and on the south by Maharashtra.

The main soil types found in Madhya Pradesh are alluvial, deep black, medium black, shallow black, mixed red and black, mixed red and yellow and skeletal soils (Table 1.7).

Table 1.7: Soil types and districts covered in Madhya Pradesh.

Types of Soil	Districts covered
Alluvial Soil	Bhind, Morena and Gwalior
Deep Black Soil	Hosangabad and Narsinghpur
Medium Black Soil	Jabalpur, Sagar, Vidisha, Sehore, Damoh, Guna, Bhopal, Raisen, Rajgarh, Indore, Dewas, Ujjain, Mandsour, Shajapur, Ratlam, Dhar, Khargone and Khandwa
Shallow Black Soil	Betul, Chhindwara and Seoni
Red & Black Soil	Shivpuri, Rewa, Satna, Panna, Sidhi, Chattarpur, Tikamgarh, Datia and some parts of Guna district.
Red & Yellow Soil	Balaghat.
Gravelly Soil	Mandla.

The climate of Madhya Pradesh by virtue of its location is predominately moist sub humid to dry sub humid, semi arid to dry sub-humid and semi arid in East, West and Central plateau and hills respectively, according to agro-climatic regions of India. The seasons in Madhya Pradesh are as given below (Table 1.8).

Table 1.8: Seasons and their periods in Madhya Pradesh

Seasons	Period	
	From	To
Rainy	June	September
Post Monsoon	October	November
Winter	December	February
Summer	March	May

The annual rainfall received in the state varies from 800 mm. in the northern and Western regions to 1600 mm in the Eastern districts. In some years rainfall goes much below to the normal. The most of rainfall is received in the *Monsoon* season from June to September and about 10 per cent of the rainfall is received in the remaining months of the year.

The maximum temperature during extreme summer reaches as high as 47^0C and the minimum during winter dips up to 5^0C. The maximum normal temperature varies between 25 and 35^0C and minimum normal between 10^0 to 20^0C. The relative humidity ranges from 40 to 70 per cent throughout the year.

According to 2011 census the population of the state was 72,598 thousands comprises of 51.81 per cent of male and 48.19 per cent female. Over 1000 male there were only 930 females. The state had a rural background as the 72.40 per cent of total population lives in villages and rest 27.60 per cent in urban areas (Table 1.9).

Table 1.9: Population parameters of Madhya Pradesh (Census 2011)

(In Thousand)

S. No.	Particulars	Population	Percentage to total
1	Total Population	72,598	100
A	Male	37,613	51.81
B	Female	34,985	48.19
2	Sex ratio 1000 :	930	
3	Rural Population	52,538	72.4
4	Urban Population	20,060	27.6
5	Population of Schedule Caste* (*Census 2001)	91551	15.17
6	Population of Schedule Tribes* (*Census2001)	12233	20.27
7	Number of Literate persons	43,827	60.37
8	Number of Farmers	11038	18.32
9	Agriculture Labour	7401	12.23
10	Home Industry	1033	1.67
11	Other Workers	6322	10.45
12	Total Main Workers	19103	31.61
13	Marginal Workers	6691	11.07
14	Total Workers	25794	42.68
15	Non Workers	34554	57.16

The percentage of literacy was found only 60.37 per cent, Madhya Pradesh comes under tribal area 20.27 per cent of total population were belongs to scheduled tribes. The percentage of workers was 42.68 per cent of total population, while 57.16 per cent of total population belongs to non worker category. 31.61 per cent population classified under main worker category, while only 18.32 per cent were falls in farmers.

Table 1.10: Land use Classification of Madhya Pradesh (TE 2010)

S.No.	Particulars	Area (Lakh ha)	Percentage to Geographical Area
1	Geographical Area	307.56	100
2	Forest	85.89	27.93
3	Area not available for cultivation	33.89	11.02
4	Other non agricultural land (excluding fallow land)	13.58	4.42
5	Cultivable Waste lands	11.61	3.77
6	Fallow land	11.85	*3.85*
7	Net area sown	150.74	49.01
8	Double cropped Area	46.37	
9	Gross Area sown	197.11	
10	**Cropping Intensity (%)**	**130.76**	

The total geographical area of the State is 307.56 lakh ha in which 49.01 per cent land was found to be under cultivation (Table 1.10) and 11.02 per cent land not available for cultivation. The 4.42 per cent of total land was classified under cultivable waste land, while 3.38 per cent of total is in fallow land. The cropping intensity of the state was found to be 130.76 per cent. Wells (39.93%), tube wells (25.51%), canals (18.31%) and tanks (2.36%) are the major sources of irrigation in M.P. The state had 5,681 thousand hectare area under irrigation. (Table 1.11)

Table 1.11: Irrigation Status of Madhya Pradesh

S. No.	Sources	Net Irrigated Area	Percentage to total	Gross Irrigated Area	Percentage to total
1	Canal	1030	18.13	1076	18.31
2	Tanks	134	2.36	138	2.35
3	Tube-well	1449	25.51	1494	25.42
4	Well	2246	39.54	2347	39.93
5	Others	822	14.46	823	14.00
6	Total	5681	100.00	5878	100.00

Madhya Pradesh has rich diversity and occupied the space by nearly all the cereals (42%), pulses (23 %), oilseeds (35%) and others (2%) in its total food basket (i.e. 18694.5 thousand ha.)

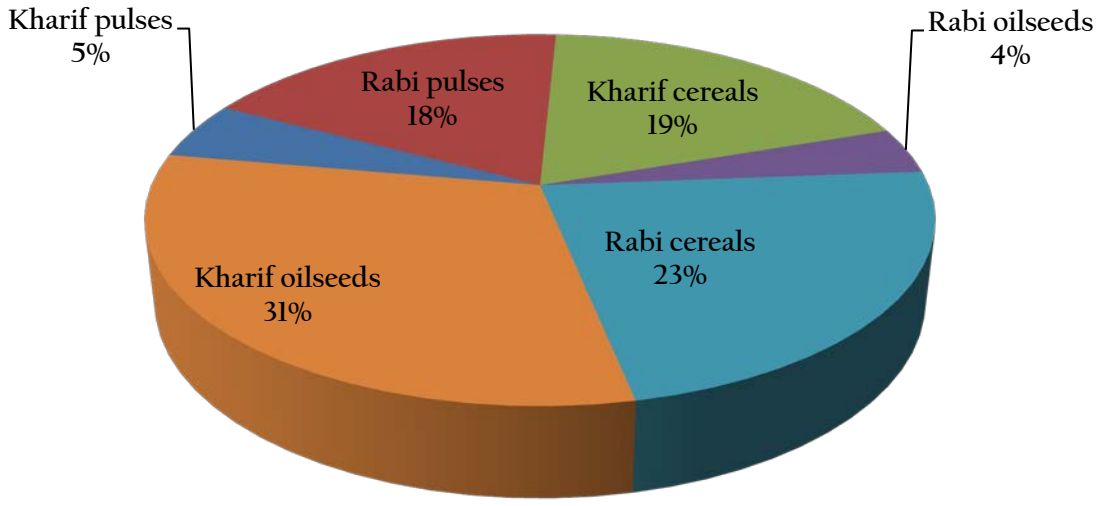

Fig 1.2: Percentage share of area of different food grains in Madhya Pradesh (TE 2010).

(Total 18694.5 thousand ha)

The wheat (53%), paddy (21%), jowar (7%), maize (11%), kodo kutki (4%) and bajra (3%) were found the main cereals (77296 thousand ha.) crops of the state. In pulses, chickpea, tur, lentil, peas, are the main pulse crops of the state.

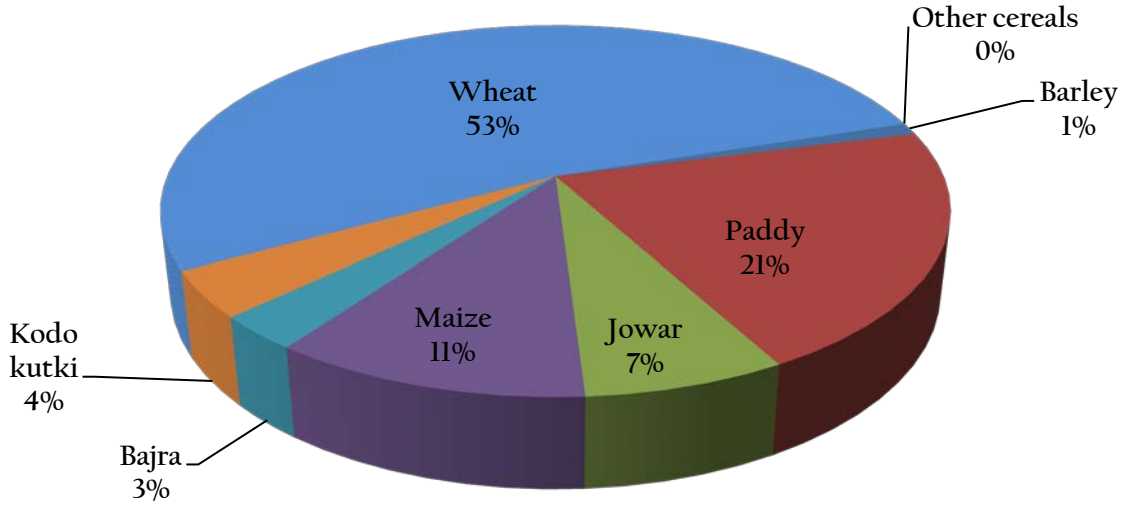

Fig 1.3: Percentage share of area of different Cereals in Madhya Pradesh (TE 2010).
(Total 7729.6 thousand ha)

Madhya Pradesh known for soybean production and about 55 per cent of total soybean area of the country exists in the state. Apart from soybean, the other crop like sesamum, linseed, groundnut, mustard and rape seed were the other oilseeds grown by the majority of the cultivators in the state.

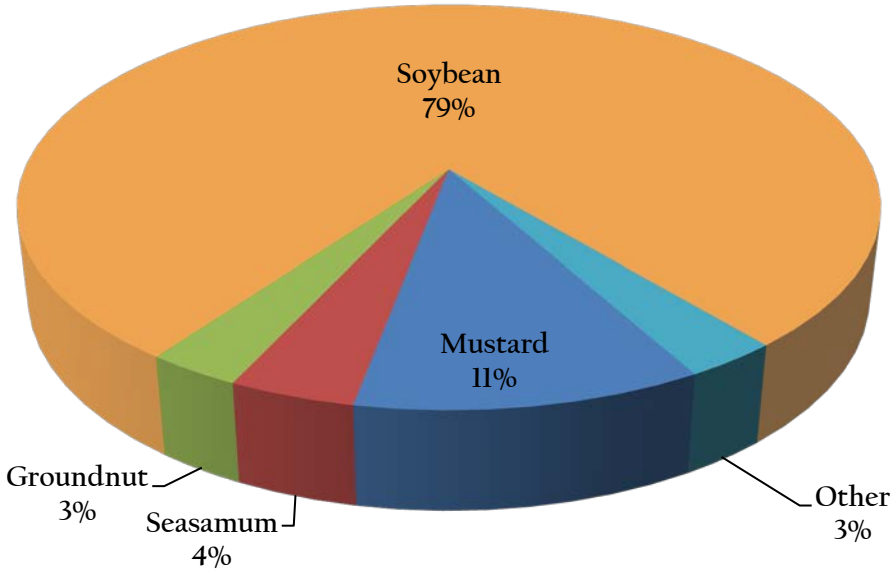

Fig 1.4: Percentage share of area of different Oilseeds in Madhya Pradesh (TE 2010).
(Total 6899.78 thousand ha)

In Madhya Pradesh economic activities has been shown structural changes over a period of time and primary sector is experiencing a decline in terms of share in Gross State Domestic Products (GSDP). The sectoral distribution GSDP of Madhya Pradesh state at constant rate and current rate (2004-05) along with percentage distribution presented in tables 1.12 and 1.13. The data presented in table 1.12 showed

that GSDP of Madhya Pradesh at constant rate (2004-05) has been increased from Rs. 11292689 in 2004-05 to Rs. 1359851 in 2007-08. Overall economy of Madhya Pradesh has increased by 5.31 per cent, 15.03 per cent and 20.42 per cent respectively in the year 2005-06, 2006-07 and 2007-08 over the year 2004-05. The primary, secondary and tertiary sector contributed 24.79 per cent, 29.18 per cent and 46.02 per cent respectively in GSDP of Madhya Pradesh (2007-08)

Table 1.12: Gross State Domestic Products of Madhya Pradesh at constant price (2004 - 05)

Particulars	2004 - 05	2005 - 06	2006 - 07	2007 - 08	Percentage change over 2004-05 in		
					2005 - 06	2006 - 07	2007 - 08
Agriculture (including animal husbandry)	2753979	2973694	3055971	3001998	7.98	10.97	9.01
Forestry & logging	342010	342784	336789	341840	0.23	-1.53	-0.05
Fishing	27841	27399	29628	27626	-1.59	6.42	-0.77
Primary Sector	**3123830**	**3343877**	**3422388**	**3371464**	**7.04**	**9.56**	**7.93**
Mining & quarrying	544934	549690	598917	665800	0.87	9.91	22.18
Manufacturing – Registering	760612	831841	1166644	1201646	9.36	53.38	57.98
Manufacturing - Un Registering	495117	513766	559692	603009	3.77	13.04	21.79
Construction	932423	1013164	1015929	1222070	8.66	8.96	31.06
Electricity, gas & water supply	332722	301425	405049	276044	-9.41	21.74	-17.03
Secondary Sector	**3065808**	**3209886**	**3746231**	**3968569**	**4.70**	**22.19**	**29.45**
Railways	198495	199365	246656	243531	0.44	24.26	22.69
Transport by other means & Storage	332432	359100	388945	422881	8.02	17.00	27.21
Communication	132886	158537	189582	222562	19.30	42.67	67.48
Trade, hotels and restaurants	1534159	1565089	1765516	1904838	2.02	15.08	24.16
Banking & Insurance	410720	485558	581573	655046	18.22	41.60	59.49
Real estate, ownership of dwellings and business services	923724	978980	1038278	1103997	5.98	12.40	19.52
Public administration	554567	558118	535024	558514	0.64	-3.52	0.71
Other services	1016068	1033436	1075419	1147169	1.71	5.84	12.90
Tertiary Sector	**5103051**	**5338183**	**5820993**	**6258538**	**4.61**	**14.07**	**22.64**
Total	**11292689**	**11891946**	**12989612**	**13598571**	**5.31**	**15.03**	**20.42**

Source: CMIE (www.ibef.org)

The share of primary sector in GSDP has been found to be decreased from 27.66 per cent (2004-05) to 24.79 per cent (2007-08), while the share of secondary sector and tertiary sector increased respectively from 27.15 per cent (2004-05) to 29.18 per cent (2007-08) and 45.19 per cent (2004-05) to 46.02 per cent (2007-08).

The share of agriculture sector has also been found to be decreased from 24.39 (2004-05) to 22.08 per cent (2007 - 08) GSDP of Madhya Pradesh. The contribution of agriculture, forestry, fishing, electricity, public administration, other services and real estate to GSDP has been found to be decreased, while mining and quarrying, manufacturing, construction, railways, transportation, communication, trade, hotel, restaurant, banking and insurance increased in the year 2007-08 over the year 2004-05.

Table 1.13: Percentage contribution of different sectors in Gross State Domestic Products at Constant Rate (2004-05)

Particulars	2004 - 05	2005 – 06	2006 - 07	2007 - 08
Agriculture (including animal husbandry)	24.39	25.01	23.53	22.08
Forestry & logging	3.03	2.88	2.59	2.51
Fishing	0.25	0.23	0.23	0.20
Primary Sector	27.66	28.12	26.35	24.79
Mining & quarrying	4.83	4.62	4.61	4.90
Manufacturing – Registering	6.74	6.99	8.98	8.84
Manufacturing - Un Registering	4.38	4.32	4.31	4.43
Construction	8.26	8.52	7.82	8.99
Electricity, gas & water supply	2.95	2.53	3.12	2.03
Secondary Sector	27.15	26.99	28.84	29.18
Railways	1.76	1.68	1.90	1.79
Transport by other means & Storage	2.94	3.02	2.99	3.11
Communication	1.18	1.33	1.46	1.64
Trade, hotels and restaurants	13.59	13.16	13.59	14.01
Banking & Insurance	3.64	4.08	4.48	4.82
Real estate, ownership of dwellings and business services	8.18	8.23	7.99	8.12
Public administration	4.91	4.69	4.12	4.11
Other services	9.00	8.69	8.28	8.44
Tertiary Sector	45.19	44.89	44.81	46.02
Total	100.00	100.00	100.00	100.00

Source: CMIE (www.ibef.org)

1.4 Importance of Oilseeds in State Agriculture

The yield of oilseeds in Madhya Pradesh (1144 kg/ha.) was found to be 4.11 percent less as compared to India (1193 kg/ha) even then Madhya Pradesh is a leading state contributed 24.48 per cent of total oilseed production of India. State also possesses 25.83 per cent of total India's acreage of oilseed. Soybean and mustard are the major oilseeds crop of Madhya Pradesh occupied nearly 55 and 10 per cent of total production of India. India reaches self sufficiency in vegetable oil which term as yellow revolution with significant and remarkable contribution of Madhya Pradesh

especially through production of soybean and mustard. As a consequence the production of Mustard and soybean has more than double by 253.53 thousand tonnes (1990s) to 701.2 thousand tonnes (2010s) and 920.7 thousand tones (1990s) to 4657.35 thousand tones (2010s) respectively. The flakes left after soybean oil extracted (De-oiled cake) is process further as it contained about 53 per cent protein which forms the basis of a variety of soybean product. This de-oiled cake (Soya milk) competing in foreign market especially in south East Asia, Far East and other countries. In the same line mustard de-oiled cake also used as cattle feed in local condition to rich in milk with saturated fats. Madhya Pradesh oilseeds contribute nearly 17 per cent in state agriculture GDPs.

1.5 Problems in Oilseeds Production

Madhya Pradesh is a leading state of India in terms of area and production of oilseeds and famous as Soya States in the country due to serious efforts made by of the government and successful implication of TMO and ISOPOM programme. The production programme of oilseeds helped in production increased tremendously. Madhya Pradesh still has tremendous potential to increase yield of soybean and mustard, though the potential yield of these crops is far from the actual yield, which farmer harvested at his farm. The production of oilseeds increased if government in testified their efforts to remove the constraints which farmers faced at the time of cultivation of oilseeds. The specific problems in production of oilseeds in Madhya Pradesh are as follows:

1. Hazard of weather: 60 per cent of oilseeds are grown under ascertained rain-fed condition.
2. Low seed replacement ratio: Due to lack of availability of high yielding varieties at the time of sowing.
3. Ineffective technological dissemination module: Due to this there is lack of availability of technical knowledge of recent package of practices of oilseeds specially, integrated pest management, integrated plant nutrient management, inter cropping etc.
4. Inefficient input market: Due to this there is lack of availability of superior inputs viz. fertilizer, plant protection chemicals etc. at time.
5. Lack of machines and implements: Which suits to oilseeds production recently farmer bound to use seed drill/ harvester/combiner which were prepared for cereals (wheat) instead of oilseeds (soybean/mustard). Ridge and furrow

method of sowing found suitable in heavy rain condition in cultivation of soybean but due to unavailability of specific machinery cultivators not in position to adopt this particular method of sowing.

6. Poor oil extraction technology: Due to this there is found low efficiency of processing. The extraction of oil in the village Ghanis leave considerable amount of oil in the cake especially in mustard. Several of mills have very outdated and inefficient, processors still using traditional method of processing.
7. Lack of managerial skill: Farmers are not able to make farm and contingent plan for adverse climatic condition. They not maintained record of their farm operations etc.

1.6 Organization of the Report

The study comprises five chapters, Chapter I include role of agriculture in State economy, importance of oilseeds in state agriculture, problems in oilseeds production, objectives of the study and organisation of the study. Coverage, sampling design and methodology has been discussed in Chapter II. In Chapter III, overview of oilseeds sector including current status, growth behaviour, changes in cropping patter and variability in area, production, productivity and prices were discussed in detail. Problems and prospects of oilseeds production in relation to their production, retention and marketed surplus pattern, comparative economics of oilseeds and competing crops, access to improved technology and markets, marketing pattern, sources of technology and market information, oilseeds supply response and acreage allocation model, perceived constraints and suggestion for improving production and productivity were dealt in Chapter IV and summary, conclusion and policy implications were covered in Chapter V followed by references and annexure tables.

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CHAPTER II

COVERAGE, SAMPLING DESIGN AND METHODOLOGY

The study was based on both primary and secondary data pertaining to major edible oilseeds of Madhya Pradesh i.e. Soybean and Mustard. The secondary data related to area, production and productivity of these oilseeds were taken into consideration for detail study. In order to comprehend the behavior of the oilseeds crops in the context of different policy regimes, a disaggregated analysis of time series data covering time periods between 1951- 52 to 2009 -10 and classified them in to 1951-52 to 1960 – 61, 1961 – 62 to 1970 -71, 1971 – 72 to 1980 – 81, 1981 – 82 to 1990 – 91, 1991 – 92 to 2000 – 01 and 2001 – 02 to 2009 - 10. Apart from the detailed crop-wise analysis of growth patterns and sources of growth of edible oilseeds also considers for this, the growth of oilseeds was observed during 1980s, 1990s, 2000s and overall from 1981 – 82 to 2009 – 10. The time series data has been collected district wise for the above period related to soybean mustard to analyse the variability, growth of oilseeds and their competing crops i.e. maize and wheat. In order to identify profitability, yield gap and major constraints in edible oilseeds production in the state, primary data from the household growing oilseed in major producing districts were collected and analysed.

2.1 Coverage and Sampling Design

The multistage, purposive sampling method was used to select the districts, blocks, villages and farm households. At first stage, all the districts were classified into two categories i.e. high area districts and low area districts considering area more than the mean and area less than the mean respectively for a particular crop. One district in each category i.e. having high area high yield (HAHY), high area low yield (HALY) and low area high yield (LAHY) have been selected for the study.

Table 2.1: Classification of districts according to area and yield.

Area	Yield	
	High	***Low***
High	High area - High yield **(HH)**	High area – Low yield **(HL)**
Low	Low area – High yield **(LH)**	Low are – Low yield **(LL)**

Hence, Chhindwara (HAHY), Khandwa (HALY) and Narshingpur (LAHY) have been selected for soybean (Table 2.2), while Morena (HAHY), Chhatarpur (HALY) and Mandla (LAHY) selected for mustard (Table 2.3) in Madhya Pradesh (Fig. 2.1).

Table 2.2: Classification of different district according to area & yield of soybean (TE 2011).

Area – 000'ha and Yield – kg/ha

S.No.	DISTRICTS	AREA	YIELD
High area districts (Area more than mean)			
1	**UJJAIN**	**431.70**	**1189.00**
2	**SHAJAPUR**	**331.40**	**932.00**
3	**SAGAR**	**321.80**	**776.00**
4	**DEWAS**	**296.10**	**1204.00**
5	**SEHORE**	**284.50**	**1197.00**
6	**RAJGARH**	**277.40**	**982.00**
7	**MANDSAUR**	**255.90**	**845.00**
8	**DHAR**	**250.30**	**1323.00**
9	**INDORE**	**226.00**	**1394.00**
10	**HOSHANGABAD**	**206.70**	**1090.00**
11	**RATLAM**	**197.60**	**1193.00**
12	**BETUL**	**194.10**	**1047.00**
13	**VIDISHA**	**180.30**	**1005.00**
14	**HARDA**	**167.90**	**1395.00**
15	**GUNA**	**162.40**	**1161.00**
16	***KHANDWA***	***152.30***	***708.00***
17	***CHHINDWARA***	***144.60***	***1498.00***
18	**RAISEN**	**128.30**	**1197.00**
19	**NEEMUCH**	**120.30**	**759.00**
20	**SEONI**	**110.10**	**977.00**
21	**DAMOH**	**108.70**	**773.00**
	Mean	**105.88**	**835.51**
Low area districts (Area less than mean)			
22	SHIVPURI	103.20	502.00
23	BHOPAL	96.10	1246.00
24	*NARSINGHPUR*	*63.00*	*1293.00*
25	KHARGONE	53.60	755.00
26	ASHOKNAGAR	48.50	1075.00
27	SATNA	46.70	469.00
28	JHABUA	40.60	715.00
29	TIKAMGARH	32.90	436.00
30	CHHATARPUR	31.90	298.00
31	BARWANI	29.70	416.00
32	REWA	22.70	548.00
33	GWALIOR	17.00	1202.00
34	SHEOPUR KALAN	15.40	1021.00
35	BURHANPUR	14.30	595.00
36	JABALPUR	5.60	628.00
37	DINDORI	5.40	635.00
38	PANNA	4.50	502.00
39	MANDLA	2.50	717.00
40	SHAHDOL	2.40	566.00
41	ANUPPUR	1.80	331.00
42	KATNI	0.70	335.00
43	DATIA	0.40	455.00
44	UMARIA	0.20	607.00
45	MORENA	0.20	1291.00
46	BALAGHAT	0.10	1092.00
47	SIDHI	0.10	427.00
48	SINGROLI	0.0	0.0
49	BHIND	0.0	0.0
50	ALIRAJPUR	0.0	0.0
	M.P.STATE	**5349.5**	**1199**

Table 2.3: Classification of different district according to area and yield of Mustard (TE 2011)

Area – 000'ha and Yield – kg/ha

S.No.	DISTRICTs	AREA	YIELD
High area districts (Area more than mean)			
1	**BHIND**	**170.3**	**1407.7**
2	***MORENA***	***152.6***	***1416.7***
3	**SHIVPURI**	**65.4**	**779.3**
4	**GWALIOR**	**62.9**	**1120.0**
5	**SHEOPUR KALAN**	**61.8**	**1217.7**
6	**MANDSAUR**	**33.8**	**930.3**
7	**TIKAMGARH**	**33.0**	**459.7**
8	**NEEMUCH**	**21.6**	**961.0**
9	**DINDORI**	**20.2**	**538.7**
10	***CHHATARPUR***	***17.9***	***319.3***
11	**DATIA**	**17.1**	**637.0**
	Mean	**16.4**	**797.7**
Low area districts (Area less than mean)			
12	*MANDLA*	*15.2*	*1180.3*
13	ANUPPUR	9.2	325.3
14	GUNA	9.0	841.3
15	UMARIA	7.8	412.7
16	BALAGHAT	5.1	988.7
17	SHAJAPUR	4.9	1024.3
18	SINGROLI	4.8	599.7
19	PANNA	4.8	577.3
20	ASHOKNAGAR	4.7	910.3
21	RATLAM	4.6	1178.3
22	SHAHDOL	3.9	429.7
23	SIDHI	3.8	488.3
24	JABALPUR	3.4	877.0
25	REWA	2.9	458.3
26	SATNA	2.6	376.7
27	RAJGARH	2.3	832.7
28	UJJAIN	2.1	859.7
29	KATNI	2.0	487.3
30	DEWAS	1.2	1158.0
31	SEONI	1.1	832.3
32	VIDISHA	0.9	830.7
33	DAMOH	0.7	1042.7
34	SAGAR	0.6	773.0
35	RAISEN	0.5	1055.7
36	CHHINDWARA	0.4	742.3
37	BETUL	0.3	940.3
38	INDORE	0.2	1039.3
39	SEHORE	0.2	971.7
40	DHAR	0.2	718.3
41	BHOPAL	0.1	951.0
42	HOSHANGABAD	0.1	972.0
43	NARSINGHPUR	0.1	1165.7
44	KHARGONE	0.1	607.7
45	BARWANI	0.0	250.0
46	ALIRAJPUR	0.0	0.0
47	JHABUA	0.0	0.0
48	KHANDWA	0.0	0.0
49	BURHANPUR	0.0	0.0
50	HARDA	0.0	0.0
	M.P.STATE	**757.4**	**1084.0**

In second stage one block has been selected on the basis of maximum area in respective crops in each selected for the study. In third stage three villages were selected randomly in each selected block for the study. In the last stage a list of all the farmers of the selected villages was prepared in ascending order and classified them into marginal (less than 1 ha), small (1-2 ha), medium (2-4ha) and large (above 4 ha) according to their size of farms, and 20 farmers in each category were be selected randomly for soybean and 10 farmers to each category were selected for mustard. Thus study covers 240 soybean growers and 120 mustard growers of different size of farmers of different districts of Madhya Pradesh (Table 2.4). The study ensures the adequate coverage of major agro-climatic regions of the state. Appropriate analytical techniques were used to identify and prioritize major constraints facing oilseed production in the state.

Table 2.4: Number of respondents in Selected Crops

Particulars	**Districts**	**Talukas/ Blocks**	**Villages**	***Sample Size (HHs)***	***Total Sample Size***
Soybean					
HAHY	1. Chhindwara	Chaorai	Simariya, Lahagdua, Chandanwada	80	240
HALY	2. Khandwa	Pandhana	Pipalod Khurd, Rustampur, Gokul Goan	80	
LAHY	3. Narsinghpur	Kareli	Jova, Midali, Rakai	80	
Rapeseed & Mustard					
HAHY	1. Morena	Morena	Ajnoda, Alapur, Dongarpur	40	120
HALY	2. Chhatarpur	Rajnagar	Palgawan, Chhodan, Bamitha	40	
LAHY	3. Mandla	Mandla	Semarkhapan, Revada, Tuiyapani	40	
Grand Total				**360**	**360**

2.2 Sources of data

The primary data of the study collected from sample respondent of different location of the study. The required secondary data were collected on different aspects of the study from the Department of Agricultural Statistics. All India Coordinated Research Project on Improvement of Soybean, Department of Farmers' Welfare and Agriculture Development from their published records. The secondary data were also recorded from the different internet websites (www.mpkrishi.org, www.sopa.org, www.landrecord.org etc.).

2.3 Tools of Data Collection

A pre tested interview schedule was used for collection of required data from the respondents which was provided by the Coordinating Centre (Centre for Management in Agriculture, Indian Institute of Management, Ahmadabad, Gujarat) and tested in light of the

Madhya Pradesh condition. The interview schedule having all the information about the sample farmer viz. socio economic status, land ownership pattern, terms of lease, sources of irrigation, cropping pattern, average yield of major crops operational cost and returns received by farmer from cultivation of soybean, maize, mustard and wheat. The information related to marketing pattern technology, market information and constraints faced by the farmers in cultivation of these crops were also recorded from the farmers by survey with personal contact.

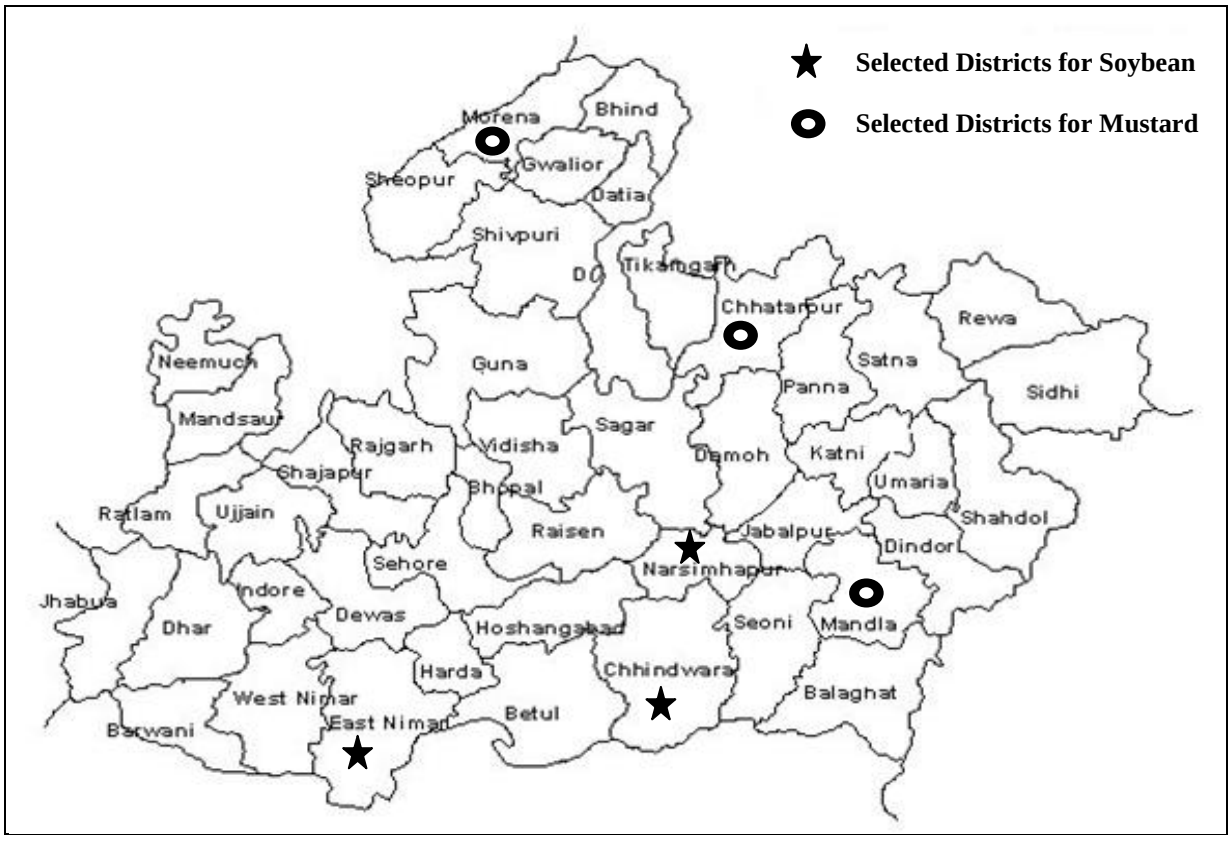

Fig. 2.1: Map showing selected districts in Madhya Pradesh

2.4 Year of the study

The primary data pertained to the year 2010 – 11, whereas secondary data were pertained to years from 1951 – 52 to 2009 – 10.

2.5 Conceptual Framework and Theoretical Model of the Study

The concepts which were used in the report are as follows.

i) Gross State Domestic product (GSDP) = C + G + I + N

where:

"C" is equal to all private consumption, or consumer spending, in a nation's economy

"**G**" is the sum of government spending

"**I**" is the sum of all the country's businesses spending on capital

"**NX**" is the nation's total net exports, calculated as total exports minus total imports. (NX = Exports - Imports)

ii) **Per Capita Gross State Domestic product** = GSDP/Total Population of the State

iii) **Primary Sector:** The primary sector of the economy is the sector of an economy making direct use of natural resources. This includes **agriculture,** forestry and fishing, mining, and extraction of oil and gas. This is contrasted with the secondary sector, producing manufactured and other processed goods, and the tertiary sector, producing services. The primary sector is usually most important in less developed countries, and typically less important in industrial countries.

iv) **Secondary Sector:** The secondary sector of the economy includes those economic sectors that create a finished usable product and hence depend on primary sector industries for the raw materials. This sector includes mining, manufacturing and construction. The secondary sector contributes 24% of the share in Indian economy.

v) **Tracery Sector:** The secondary sector of the economy includes those economic sectors that create a finished usable product and hence depend on primary sector industries for the raw materials. This sector includes mining, manufacturing and construction. The secondary sector contributes 24% of the share in Indian economy.

vi) **Experimental yield:** Average Yield of crop obtained during 2010 – 11 at research station located in the study area.

vii) **Potential yield:** Maximum farm yield obtained by the sample farmer in the study area.

viii) **Cropping Intensity** : $\frac{\text{Gross Cropped area}}{\text{Net cultivated area}} \times \mathbf{100}$

ix) **Marginal Farmer** : Farmer have less than one hectare of land

x) **Small Farmer** : Farmer has less 1.00 to 2.00 hectares of land

xi) **Medium Farmer** : Farmer has 2.01 to 5.00 hectares of land

xii) **Large Farmer** : Farmer has more than 5 hectares of land

xiii) **Total Operational Cost:** Cost includes value of seed, fertilizer and manures, insecticides and pesticides, irrigation expanses on human, machine and bullock labour and interest on working capital

xiv) **Gross Income** : Value of main and by product

xv) **Net Income** : Gross income – Total operational cost

xvi) **Cost of Production per quintal** : $\frac{\text{Total Operational Cost}}{\text{Yield}}$

xvii) **Benefit cost ratio** : $\frac{\text{Gross income}}{\text{Total operational cost}}$

xviii) **Yield gap I** : Experimental yield – Potential farm yield

xix) **Yield gap II** : Potential farm yield – Actual Farm yield

xx) **Absolute change** : Current year – Base year

xxi) **Relative change** : $\frac{\text{Current year} - \text{Base year}}{\text{Current year}} \times 100$

xxii) **Regression Coefficient** b : $\frac{\sum(x-\bar{x})(y-\bar{y})}{\sum_{(y-\bar{y})}{}^{2}}$

xxiii) **Standard Deviation** : $\frac{\sqrt{\sum(x-\bar{x})^2}}{n-1}$

xxiv) **Coefficient of Variance** : $\frac{SD}{Mean} \times 100$

xxv) **Simple Growth Rate (%)** : $\frac{b}{\bar{Y}} \times 100$

xxvi) **Compound Growth Rate** : $Anti\log b - 1 \times 100$

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CHAPTER III

OVERVIEW OF OILSEEDS SECTOR: CURRENT STATUS AND GROWTH BEHAVIOR

This chapter deals with the changes in cropping pattern shifting area in major crops and crop groups along with factors underlying changes in cropping pattern, growth, trends and variability in area, production and productivity of major oilseed crops of Madhya Pradesh i.e. soybean and mustard vis-à-vis competing crops viz. maize and wheat, and variability in annual prices of soybean and mustard.

3.1 Changes in Cropping Pattern in Madhya Pradesh:

The changes in cropping pattern have been observed in last 5 decades by considering TE average of 1973-74, 1983-84, 1993-94, 2003-04 and 2009-10 and presented in table 3.1. It is observed from the data that total cropped area under different crops in M.P. has been found to be increased from 15.84 million (TE 1973-74) to 19.64 (TE 2009-10), showed 23.99 per cent change in TE 2009-10 over the year TE 1973-74. The area under all the crops has been found to be increased during these periods except area under groundnut, other oilseeds and other crops.

As regards the different categories of crops although the area under all the categories has been found to be increased, but tremendous increase was observed in the area under total oilseed, which was increased from 1.59 million ha (TE 1973-74) to 6.68 million ha (TE 2009-10). The contribution of total oilseeds and total pulses in total cropped area was found to be increased from 10.00 (TE 1973-74) to 34.01 per cent (TE 2009-10), and 20.58 (TE 1973-74) to 23.63 per cent (TE 2009-10), while the contribution of total cereals to total cropped area was found to be decreased from 8.65 (TE 1973-74) to 7.63 per cent (TE 2009-10). The area under total food grains to total cropped area was also found to be decreased from 75.25 (TE 1973-74) to 62.47 per cent (TE 2009-10).

The contribution of area of soybean, mustard and sugarcane to total cropped area were found to increased from 1.98 (TE 1983-84) to 26.63 per cent (TE 2009-10), 1.07 (TE 1973-74) to 3.72 per cent (TE 2009-10) and 0.25 (TE 1973-74) to 0.31 per cent (TE 2009-10) respectively, while the share of area of rice, groundnut, other oilseeds and cotton to total cropped area found to decreased from 9.03 (TE 1973-74) to 8.35 per cent (TE 2009-10), 2.71 (TE 1973-74) to 1.07 per cent (TE 2009-10), 6.25 (TE 1973-74) to 2.60 per cent (TE 2009-10) and 4.10 (TE 1973-74) to 3.16 per cent (TE 2009-10). The contribution of area of wheat (about 20%) to total cropped area was found to be stagnated during the last 5 decade (Table 3.1).

Table 3.1: Changes in area under crops to total cropped during different periods in Madhya Pradesh
(TE1973-74 to TE 2009-10)

Crops	***Area (million ha)***				
	TE 1973-74	***TE 1983-84***	***TE 1993-94***	***TE 2003-04***	***TE 2009-10***
Rice	1.43	1.51	1.53	1.72	1.64
Wheat	3.3	3.48	3.78	3.73	4.09
Total cereals	8.65	8.98	8.26	7.71	7.63
Total pulses	3.26	3.87	3.59	4.3	4.64
Total food grains	11.92	12.87	12.4	12.01	12.27
Groundnut	0.43	0.3	0.23	0.21	0.21
Rapeseed and Mustard	0.17	0.23	0.58	0.47	0.73
Soybean	0	0.33	2.83	4.24	5.23
Other oilseeds	0.99	0.91	1.05	0.44	0.51
Total oilseeds	1.59	1.77	4.69	5.36	6.68
Cotton	0.65	0.58	0.5	0.55	0.62
Sugarcane	0.04	0.04	0.03	0.04	0.06
Other crops	1.64	1.26	0.54	0	0
Total cropped area	**15.84**	**16.63**	**18.16**	**17.97**	**19.64**
Percent to Total/Gross Cropped Area					
	TE 1973-74	***TE 1983-84***	***TE 1993-94***	***TE 2003-04***	***TE 2009-10***
Rice	9.03	9.08	8.43	9.57	8.35
Wheat	20.83	20.93	20.81	20.76	20.82
Total cereals	54.61	54.00	45.48	42.90	38.85
Total pulses	20.58	23.27	19.77	23.93	23.63
Total food grains	75.25	77.39	68.28	66.83	62.47
Groundnut	2.71	1.80	1.27	1.17	1.07
Rapeseed and Mustard	1.07	1.38	3.19	2.62	3.72
Soybean	0.00	1.98	15.58	23.59	26.63
Other oilseeds	6.25	5.47	5.78	2.45	2.60
Total oilseeds	10.04	10.64	25.83	29.83	34.01
Cotton	4.10	3.49	2.75	3.06	3.16
Sugarcane	0.25	0.24	0.17	0.22	0.31
Other crops	10.35	7.58	2.97	0.00	0.00

Hence, it is clear that the area of oilseeds particularly soybean increased tremendously which was might be due to shift of the area of cotton, groundnut, other cereals, other oilseeds etc. to soybean in Madhya Pradesh.

These changes in area were also observed in different districts of Madhya Pradesh and it was found that the area under total food grains decreased in all the districts except in Betul (2.76%), Damoh (27.71%), Datia (50.36%), Dhar (10.02%), Dewas (8.02%), Narsinghpur (12.38%), Panna (13.41%), Raisen (11.01%), Rewa (0.90%), Sagar (10.31%), Satna (0.87%), Sehore (12.27%), Seoni (23.98%), Ujjain (10.36%) and Vidisha (11.53%) districts in the year TE 2009-10 as compared to TE 1993-94. The area under total pulses has been found to be increased in all the districts of Madhya Pradesh in the year TE 2009-10 as compared to the year TE 1993-94, except Balaghat (-14.37%), Bhind (-57.61%), Chhindwara (-10.56%), Dhar (-7.36%), Gwalior (-41.39%), Hosangabad (-39.49%), Jhabua (-1.49%), Khandwa (-40.83%), Khargone (-38.69%), Mandsaur (-54.80%), Morena (-12.63%) and Ratlam (-

32.35%) districts. The area under total cereal has been found to be decreased in all the districts expect Damoh (104.83%), Datia (38.24%), Dewas (21.01%), Gwalior (69.19%), Hoshangabad (77.41%), Indore (49.15%), Jhabua (66.31%), Khandwa (17.59%), Mandsaur (100.69%), Morena (29.69%), Raisen (70.34%), Ratlam (53.59%), Shahdol (28.32%) and Shajapur (53.59%) districts (Table 3.2) during the same period. As regards to major cereal grown by cultivators, the area under rice found to decreased in Bhind (-69.40%), Bhopal (-52.10%), Chattarpur (-72.22%), Dewas (-55.56%), Dhar (-73.33), Guna (-34.48%), Indore (-100.00%), Jhabua (-46.82%), Khandwa (-56.36%), Khargone (-72.30%), Mandla (-31.94%), Mandsaur (-100.00), Narsinghpur (-1.15%), Rajgarh (-87.72%), Ratlam (-21.13%), Sagar (39.22%), Shahdol (-45.52%), Shajapur, (-88.46%), Tikamgarh (-77.38%), Ujjain (100.00%) and Vidisha (-40.00%) districts, while increased in other districts (Table 3.2) during the same period.

Table 3.2: Net changes in absolute and relative terms of TE 2009-10 over TE 1993-94 for major crops

Districts	Rice		Wheat		Maize		Total Cereals		Total Pulses		Total Food Grain	
	A	R	A	R	A	R	A	R	A	R	A	R
Balaghat	61.60	23.05	1.90	12.75	-0.23	-5.19	-43.95	-15.65	-5.82	-14.37	-2.75	-0.86
Betul	18.33	67.99	65.10	67.25	24.87	122.70	-81.10	-33.62	12.13	18.91	8.45	2.76
Bhind	-14.67	-69.40	-21.73	-11.49	0.00	0.00	-22.65	-14.41	-50.35	-57.61	-48.60	-19.98
Bhopal	-0.40	-52.17	26.63	25.82	0.20	7.50	39.85	48.42	0.78	1.95	-13.65	-11.13
Chhaterpur	-10.83	-72.22	-83.67	-37.17	0.03	4.55	-87.30	-42.57	60.50	55.25	-8.75	-2.78
Chhindwara	2.00	14.56	187.43	186.44	42.00	88.67	-90.95	-33.23	-8.37	-10.56	-17.40	-4.91
Damoh	1.17	3.47	12.20	11.15	-0.30	-12.86	170.25	104.83	109.82	100.08	75.40	27.71
Datia	2.63	987.50	106.90	97.63	1.17	140.00	24.05	38.24	9.18	16.62	56.30	50.36
Dewas	-0.33	-55.56	96.27	74.24	-1.27	-10.56	30.65	21.01	58.38	104.13	20.35	10.02
Dhar	-2.20	-73.33	252.73	177.81	-24.27	-29.65	-65.90	-28.82	-7.10	-7.36	25.40	8.02
Guna	0.13	-34.48	85.43	-33.89	1.47	-22.45	-288.90	-91.09	110.07	64.69	31.30	-57.78
Gwalior	17.37	71.86	-76.27	-30.51	0.10	100.00	86.00	69.19	-22.03	-41.39	-26.70	-15.00
Hoshangabad	18.03	118.91	760.03	116.30	-0.53	-57.14	165.90	77.41	-57.30	-39.49	82.15	-18.21
Indore	-0.10	-100.00	48.97	33.27	-5.23	-41.64	56.15	49.15	14.43	29.00	-0.05	-0.03
Jabalpur	14.97	-46.82	30.87	-16.60	-0.93	-49.05	-173.80	-49.69	76.58	53.08	61.85	-30.88
Jhabua	-1.10	-28.37	11.43	-9.74	21.63	-16.41	140.55	66.03	-1.62	-1.49	-48.10	-33.54
Khandwa	-10.40	-56.36	59.90	55.80	7.07	80.18	33.30	17.59	-27.98	-40.83	-89.60	-49.01
Khargone	-4.27	-72.30	133.30	78.33	8.30	-54.11	-112.1	-34.62	-40.83	-38.69	-103.10	-58.84
Mandla	26.70	-31.94	-2.60	-50.34	3.13	-45.53	-26.45	-6.92	44.20	81.25	41.25	-43.70
Mandsour	-0.03	-100.0	35.13	-18.38	-57.7	-69.71	264.50	100.69	-95.30	-54.80	-197.10	-66.38
Morena	8.83	-88.54	15.67	-32.62	-0.67	-100.0	51.00	29.69	-3.17	-12.63	57.95	-9.96
Nasinghpur	-0.13	-1.15	28.70	19.46	0.17	38.46	-1.10	-1.27	36.32	19.66	33.50	12.38
Panna	1.90	6.16	-10.33	-11.67	-0.37	-14.10	-23.30	-14.75	62.57	88.58	30.30	13.41
Raisen	14.77	340.77	61.13	29.95	0.93	37.84	126.75	70.34	41.42	21.90	42.75	11.56
Rajgarh	-3.33	-87.72	21.37	26.97	12.43	33.07	-60.10	-31.95	25.00	32.98	-24.25	-8.88
Ratlam	-0.50	-21.13	92.23	81.84	0.30	0.58	70.60	53.59	-29.82	-32.35	-29.35	-13.82
Rewa	28.07	47.95	-32.80	-19.44	-0.47	-29.79	-214.90	-66.48	18.63	19.94	3.75	0.90
Sagar	-2.67	-39.22	-33.33	-15.48	-0.93	-21.37	0.00	0.00	150.35	101.31	44.20	10.31
Satana	4.50	13.65	-59.27	-30.66	-0.23	-23.33	-147.65	-47.98	80.82	107.56	3.35	0.87
Sehore	1.93	90.63	84.57	53.64	5.80	67.44	-17.00	-11.33	36.35	43.74	28.80	12.27
Seoni	33.63	34.59	46.33	99.57	2.80	31.82	-115.85	-49.54	41.03	80.67	68.70	23.98
Shahdol	34.93	-45.52	-0.90	-63.47	0.33	-66.33	116.10	28.32	10.92	21.52	0.50	-61.50
Shajapur	-0.77	-88.46	23.63	16.83	12.17	42.49	98.45	53.59	29.75	31.25	-21.75	-7.76
Shivpuri	2.70	65.85	-68.33	-28.14	1.53	5.96	-45.85	-23.12	2.43	2.77	-46.05	-15.96
Sidhi	24.13	22.94	15.77	-10.93	10.83	-46.06	-96.55	-30.44	12.25	15.73	*26.15*	*-10.93*
Tikamgarh	-15.97	-77.38	-105.93	-45.24	0.33	12.20	-20.30	-11.34	40.07	58.81	-20.70	-8.38
Ujjain	-0.03	-100.00	56.30	26.86	0.43	5.99	-87.45	-51.50	33.95	33.12	27.15	10.36
Vidisha	-0.27	-40.00	4.43	1.60	-2.27	-31.92	-156.60	-58.20	135.22	65.22	55.25	11.53
State	250.33	22.10	315.37	835.29	52.03	6.62	-719.5	-8.71	917.82	25.56	201.75	1.70

Cont.....

Table 3.2: Net changes in absolute and relative terms of TE 2009-10 over TE 1993-94 for major crops

District	Groundnut		R&M		Soybean		Total oilseeds		Cotton		S Cane		GCA	
	A	R	A	R	A	R	A	R	A	R	A	R	A	R
Balaghat	0.47	466.67	-0.03	-0.97	126.83	73.46	-6.23	-19.34	0.00	0.00	0.13	16.67	-37.33	-10.09
Betul	0.07	1.20	0.23	700.00	66.73	35.60	62.92	39.99	0.33	34.48	3.47	200.00	48.30	9.45
Bhind	0.00	0.00	77.73	87.08	38.53	20.91	51.70	45.79	0.00	0.00	0.03	0.00	44.33	12.18
Bhopal	0.20	100.00	0.03	25.00	248.43	187.50	25.57	36.40	0.00	0.00	-0.10	-33.33	18.17	8.26
Chhaterpur	5.67	333.33	5.63	67.60	131.67	86.66	31.43	45.18	0.00	0.00	-0.13	-36.36	-88.93	-20.08
Chhindwara	-0.17	-0.66	0.23	175.00	72.57	55.17	24.88	14.17	19.27	196.60	3.73	153.42	56.85	9.77
Damoh	-0.97	-76.32	0.00	0.00	112.17	50.27	21.85	31.58	0.00	0.00	-0.87	-92.86	74.07	20.86
Datia	4.30	0.00	3.70	37.00	142.10	47.73	24.85	104.85	0.00	0.00	3.17	593.75	59.30	41.76
Dewas	-0.13	-17.39	0.53	1600.00	38.83	65.30	127.92	75.32	-6.40	-15.80	-1.27	-70.37	126.67	25.23
Dhar	-11.5	-74.41	0.03	50.00	58.67	225.35	44.03	21.05	50.50	77.45	0.53	160.00	162.00	23.93
Guna	-0.40	-80.00	6.87	248.19	26.80	25.78	146.30	142.18	0.00	0.00	1.60	1200.00	84.47	11.81
Gwalior	-1.13	-82.93	-23.63	-30.65	225.47	244.19	-20.78	-21.69	0.00	0.00	1.13	77.27	-66.60	-22.58
Hoshangabad	0.03	33.33	-0.10	-42.86	102.13	53.81	98.70	36.53	-16.37	-80.10	1.87	933.33	217.50	30.85
Indore	-0.03	-11.11	0.37	0.00	127.93	199.38	37.17	19.78	-0.03	-100.0	-0.57	-85.00	91.93	21.84
Jabalpur	0.10	0.00	0.03	0.96	135.33	57.23	-34.07	-55.51	0.00	0.00	-0.07	-100.00	-32.27	-5.37
Jhabua	-7.03	-38.29	-0.53	-100.00	0.83	1.08	18.90	46.21	17.67	106.21	0.00	0.00	-78.80	-16.42
Khandwa	-16.6	-83.28	0.00	0.00	40.57	26.85	101.37	137.85	-17.47	-12.53	1.30	82.98	-96.22	-18.68
Khargone	-40.0	-78.43	0.07	200.00	34.87	29.51	37.40	51.09	65.33	35.57	1.07	64.00	-83.32	-11.40
Mandla	0.00	0.00	-7.23	-32.39	-0.10	-100.0	7.53	8.33	0.00	0.00	-1.63	-100.00	-41.28	-7.36
Mandsour	-16.2	-92.56	-11.07	-23.22	-0.33	-50.00	190.95	75.59	-0.17	-23.81	-0.30	-100.00	-188.22	-23.59
Morena	-0.60	-81.82	-89.73	-37.93	164.73	214.78	-9.95	-3.75	0.00	0.00	-0.50	-38.46	83.12	17.24
Nasinghpur	0.10	0.00	0.15	0.00	6.20	208.99	-9.27	-10.11	0.00	0.00	22.67	1079.37	73.53	19.10
Panna	0.07	200.00	1.63	79.03	30.43	168.45	-12.47	-44.74	0.00	0.00	0.00	0.00	1.57	0.58
Raisen	0.20	200.00	0.17	125.00	10.53	478.79	7.73	6.06	0.00	0.00	0.40	57.14	48.65	9.23
Rajgarh	-2.80	-70.59	1.73	866.67	81.03	437.23	113.12	66.33	-1.77	-100.0	0.00	0.00	6.05	1.14
Ratlam	-0.57	-62.96	1.03	20.81	-20.77	-80.60	63.67	44.51	13.40	73.76	-0.33	-100.00	-33.18	-6.93
Rewa	0.00	0.00	0.80	39.34	5.57	506.06	5.07	12.91	0.00	0.00	0.00	0.00	-34.73	-7.28
Sagar	-1.37	-53.95	-0.33	-34.48	16.50	153.25	131.62	100.98	0.00	0.00	-0.53	-57.14	77.38	12.46
Satana	0.10	0.00	0.47	24.56	26.77	135.41	9.90	19.68	0.00	0.00	0.07	100.00	-32.53	-7.23
Sehore	0.00	0.00	0.00	0.00	14.47	15.34	89.08	42.67	-4.27	-96.24	-1.40	-47.73	130.97	24.76
Seoni	-3.13	-41.05	0.77	209.09	-0.03	-25.00	8.07	6.25	0.00	0.00	0.97	414.29	25.17	5.47
Shahdol	-0.20	-60.00	-11.60	-75.49	21.47	188.86	-2.95	-4.70	0.00	0.00	0.00	0.00	-69.70	-12.65
Shajapur	-2.20	-57.39	3.33	285.71	1.27	3.79	99.98	41.95	-0.63	-100.0	0.13	100.00	-24.27	-3.98
Shivpuri	26.37	56.22	16.97	44.18	129.33	340.95	119.00	89.61	0.07	0.00	0.43	92.86	-18.08	-3.66
Sidhi	-2.30	-95.83	-1.33	-21.16	63.83	320.77	1.02	2.25	0.00	0.00	0.00	0.00	-27.88	-5.96
Tikamgarh	14.00	545.45	14.60	273.75	-1.23	-12.80	15.32	21.18	0.00	0.00	0.00	0.00	-75.30	-20.35
Ujjain	-0.10	-27.27	1.63	168.97	1.37	43.62	99.80	29.45	-0.13	-57.14	-0.20	-66.67	201.17	29.03
Vidisha	-1.20	-72.00	-0.90	-47.37	-0.07	-20.00	94.57	119.35	0.00	0.00	0.17	250.00	148.08	24.93
State	-27.1	-11.59	128.10	21.93	2281.43	76.38	6526.95	139.12	126.23	25.12	34.93	130.19	936.30	4.97

A= Absolute change in '000 ha; Relative change R= in percentage in TE 2009-10 to TE 1993-94

The area under wheat has been found to be increased in all the districts in TE 2009-10 over the year TE 1993-94, except Bhind (-11.45%), Chhatarpur (-37.17%), Guna (-33.89%), Gwalior (-30.51%), Jabalpur (-16.60%), Jhabua (-9.745), Mandla (-50.34%), Mandsaur (-18.38%), Morena (-32.62%), Panna (-11.67%), Rewa (-19.44%), Sagar (-15.48%), Satna (-30.66%), Shahdol (-63.47%), Shivpuri (-28.14%), Sidhi (-10.93%) and Tikamgarh (-45.24%) districts (Table 3.2).

The area under maize was found to be decreased in all the districts except Betul (122.10%), Bhopal (7.00%), Chhatarpur (4.55%), Chhindwara (88.67%), Datia (140.00%), Gwalior (100.09%), Khandwa (80.18%), Narsinghpur (38.46%), Raisen (37.84%), Rajgarh (33.07%), Ratlam (0.58%), Sehore (67.44%), Seoni (31.82%), Shajapur (42.49%), Shivpuri (5.96%), Tikamgarh (12.20%) and Ujjain (5.99%) districts (Table 3.2) during the same period.

The area under total oilseeds was found to be increased in all the districts in TE 2009-10 over the year TE 1993-94 except in Balaghat (-19.34%), Gwalior (-21.69%), Jabalpur (-55.10%), Morena (-3.75%), Narsinghpur (-10.11%), Panna (-44.74%) and Shahdol (-4.70%). As regards different oilseeds are concerned in different districts the area of Soybean was found to be increased in all the districts in TE 2009-10 over the year TE 1993-94, except Mandla (-100.00%), Mandsaur (-50.00%), Ratlam (-80.60%), Seoni (-25.00%), Tikamgarh (-12.00%), and Vidisha (-20.00%), while the area of groundnut decreased in almost all the districts except Balaghat (466.67%), Bhopal (100.00%), Chhatarpur (33.33%), Hoshangabad (33.33%), Panna (200.00%), Rewa (200.00%), Shivpuri (50.22%) and Tikamgarh (545.45%) districts (Table 3.2) during the same period.

The area under mustard also increased in all the districts except Balaghat (-0.97%), Gwalior (-30.65%), Hoshangabad (-42.80%), Jhabua (-100.00%), Mandsaur (-23.22%), Morena (-37.93%), Sagar (-34.48%), Shahdol (-75.49%), Sidhi (-21.16%) and Vidisha (-47.37%) in the year TE 2009-10 over the year TE 1993-94 (Table 3.2).The area under total oilseeds, total pulses and total food grains was found to be increased 126.33 per cent, 25.56 per cent and 170.00 per cent in the year TE 2009-10 over the year TE 1993-94, while the area under total cereals was found to be decreased by -8.71 per cent in M.P. in this period.

Amongst different crop grown in M.P. the area under rice, wheat , maize, mustard, soybean, cotton and sugarcane found to be increased by 22.10, 835.29, 6.62, 21.93, 76.38, 25.12 and 130.19 per cent respectively in the year TE 2009-10 over the year TE 1993-94, while the area under groundnut was found to be decreased by -11.59 per cent in Madhya Pradesh.

The area, production and productivity of total oilseeds showed increasing trends over different periods. The area under oilseed increased from 1682.20 thousand ha (TE 1951-52) to 6033.44 (TE 2009-10), while the production of total oilseeds increased from 463.4 thousand t (TE 1951-52) to 5694.66 thousand t (TE 2009-10) and productivity from 285 kg/ha (TE 1951-52) to 934 kg/ha (TE 2009-10) respectively (Table 3.3).

Table 3.3: Average Area, Production, and Yield of Total Oilseeds in M.P.: 1951-52 to 2009-10

Particulars	1951-52 to 1960-61	1961-62 to 1970-71	1971-72 to 1980-81	1981-82 to 1990-91	1991-92 to 2000-01	2001-02 to 2009-10
Area (000 hectare)	1628.2	1850.1	1559.4	2524.84	5221.4	6033.44
Production (000 tonne)	463.4	547.1	546.81	153.39	4533.4	5694.66
Yield (kg/ha)	285	296	349	577	870	934

As regards to the changing share of area and production of total oilseeds is concern, it was observed that the area of total oilseeds has been found to be increased in all the major oilseeds growing districts in the year TE 2009-10 over the year TE 1993-94 except Morena (-5.17%), while the production of total oilseed increased in all the districts. The maximum increase in area was found in Guna (148.36%) followed by Vidisha (138.54%), Khandwa (37.94%) and Sagar (114.37%), while maximum increase in production was observed in Vidisha (236.21%) followed by Guna (191.59%), Hoshangabad (187.62%), Sagar (149.07%) and Khandwa (146.38%) in the year TE 2009-10 over the year TE 1993-94(Table 3.4). The area and production of soybean in Madhya Pradesh increased by 42.18 and 67.20 per cent respectively in the year TE 2009-10 over the year TE 1993-94.

Table 3.4: Changing Shares of area and production of Oilseeds in TE 2009-10 as compared to TE 1993-94 in Major oilseeds Producing Districts in Madhya Pradesh

District	*Area*		*Production*	
	A Change	**R Change**	**A Change**	**R Change**
Bhind	59.67	52.85	78.5	83.81
Chhindwara	23.73	13.52	110.4	79.68
Dewas	131.70	77.55	160.3	81.20
Dhar	50.33	24.06	133.7	62.69
Guna	152.67	148.36	176.7	191.59
Hoshangabad	105.07	38.88	277.4	187.62
Indore	37.97	20.20	103.4	46.79
Khandwa	101.43	137.94	76.9	146.38
Mandsour	191.53	75.82	1.3	3.08
Morena	-5.17	-1.95	37.5	13.92
Raisen	4.53	3.55	87.5	127.29
Rajgarh	117.57	68.94	154.3	116.19
Ratlam	66.23	46.31	59.0	34.17
Sagar	149.07	114.37	116.8	149.07
Sehore	84.93	40.68	207.8	124.40
Seoni	8.43	6.53	37.3	42.31
Shajapur	103.13	43.27	177.1	112.98
Shivpuri	126.53	95.28	100.4	97.14
Ujjain	105.77	31.21	142.1	33.25
Vidisha	109.77	138.54	128.5	236.21
Other District	254.07	88.02	308.3	29.00
State	1978.97	42.18	2674.7	67.20

The changing shares of area under oilseeds in different district of Madhya Pradesh during the periods TE 1993-94 (Fig. 3.1)and TE 2009-10 (Fig. 3.2) shows that the per cent area under oilseeds found to be increased by 2% in Guna and Mandsaur districts, 1% in Shivpuri , Khandwa, Rajgarh, Sagar and Vidisha districts. It remained constant in Sehore, Ratlam, Ujjain, Hoshangabad, Dewas, Shajapur, Dhar, Bhind, Mandsaur, Raisen and Seoni districts, while decreased in Morena (-2%), Indore (-1%), Chhindwara (-1%), and other districts (-2%).

As regards to the changing share of total production of oilseeds in major districts of Madhya Pradesh during the periods TE 1993-94 (Fig. 3.3) and TE 2009-10 (Fig. 3.4), it was found that the per cent area under oilseeds production increased by 2% in Guna, Hosangabad, Vidisha and Sehore districts and 1% in Bhind, Chhindwara, Khandwa, Rajgarh, Sagar and Shajapur districts. It remained constant in Dewas, Dhar, Mandsour, Raisen, Seoni and Shivpuri districts, while decreased in Indore (-1%), Morena (-2%), Ratlam (-1%), Ujjain (-2%) and other districts (-6%).

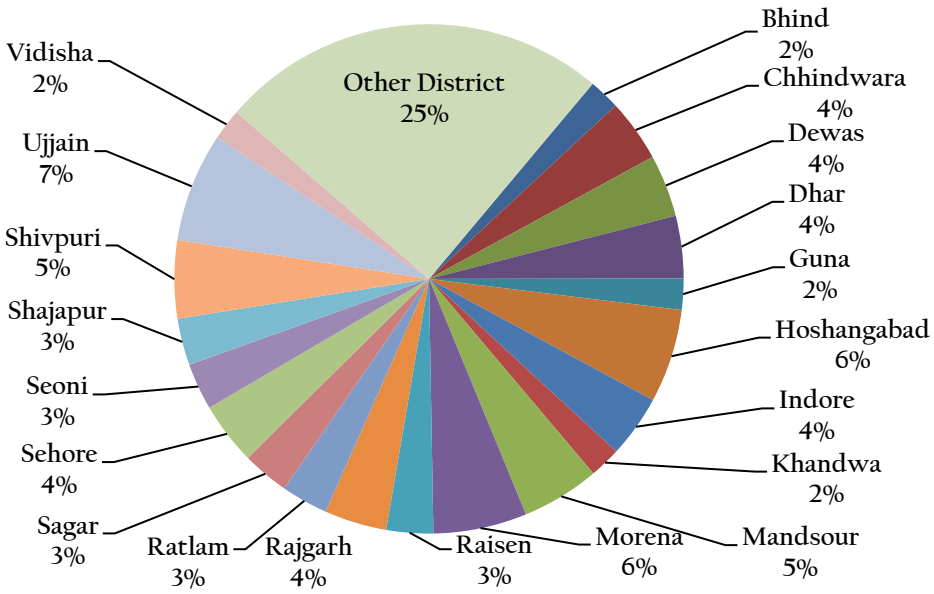

Fig. 3.1: Shares of area of total oilseeds in major districts of Madhya Pradesh in 1993-94

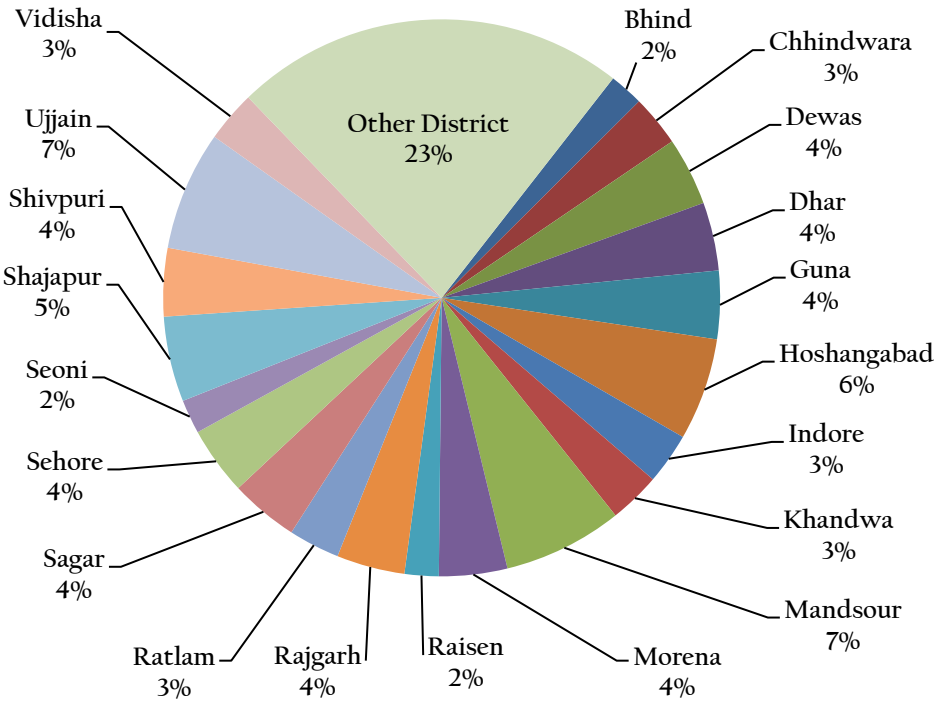

Fig. 3.2: Shares of area of total oilseeds in major districts of Madhya Pradesh in 2009-10

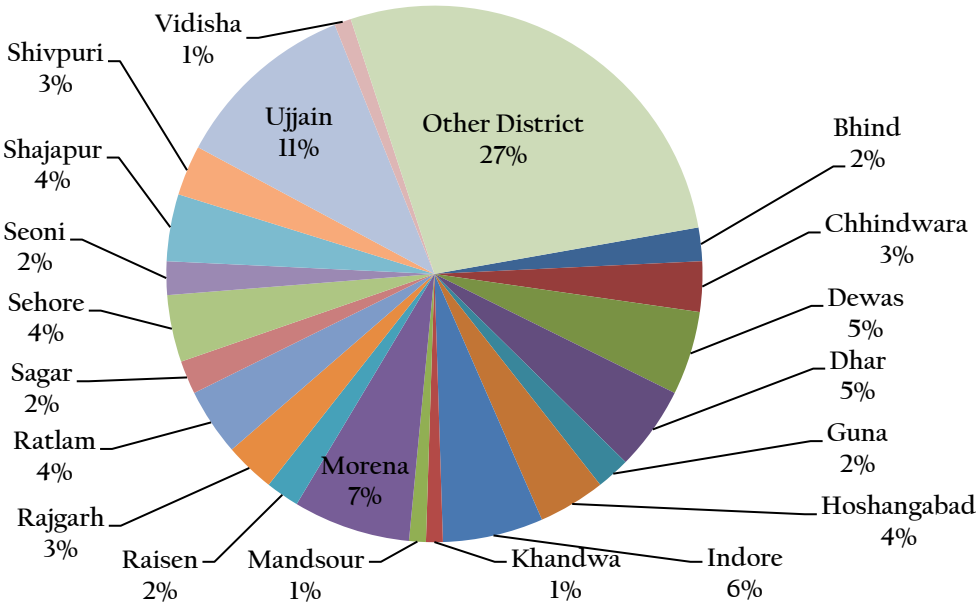

Fig.3.3: Share of Production of total oilseeds in major districts of Madhya Pradesh in 1993-94

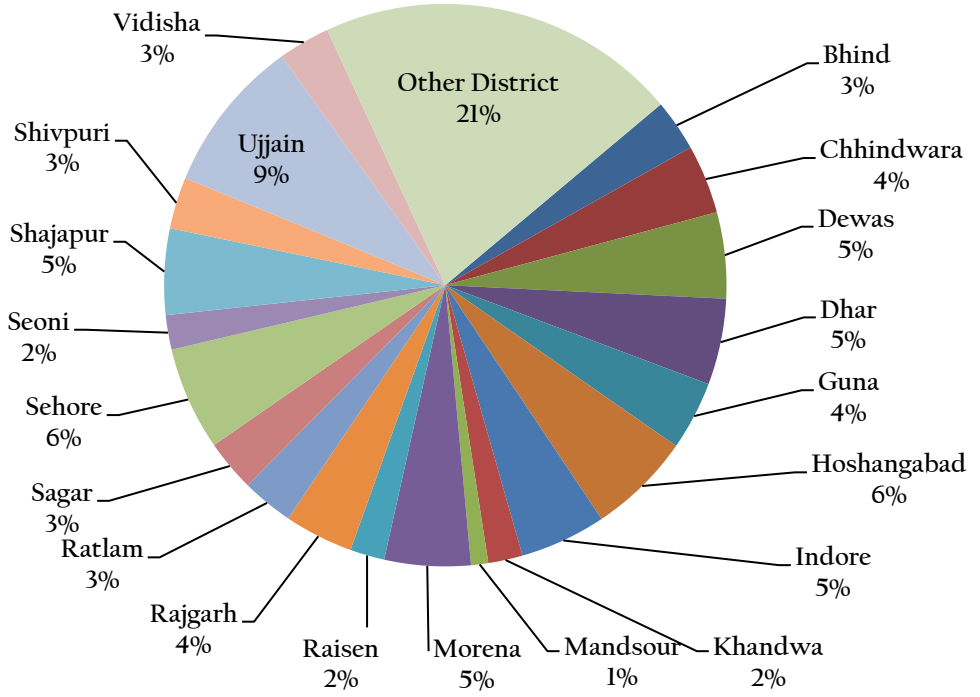

Fig. 3.4: Share of Production of total oilseeds in major districts of Madhya Pradesh in 2009-10

Amongst different major oilseeds cultivated in Madhya Pradesh the total area covered in soybean was found maximum (79.10%) followed by rapeseed & mustard (10.7%), sesame (3.8%), groundnut (3.1%), linseed (1.7%) and niger (1.6%). Similarly production of soybean also recorded maximum (79.07%) followed by rapeseed & mustard (10.66%), sesame (3.77%), groundnut (3.08%), linseed (1.68%) and niger (1.58%). It is also clear from the data that the acreage as well as production of major oilseeds was found maximum in Kharif (88%) and Rabi (12%).

Table 3.5 Share of Selected Oilseeds: TE 2009-10

Oilseeds	Area (%)	Production (per cent)		Oil content of seeds (per cent)
		Oilseeds	Oil	
Groundnut	3.1	3.08	107.34	47
Soybean	79.1	79.07	1057.65	18
Rapeseed-Mustard	10.7	10.66	212.40	29
Sesame	3.8	3.77	49.98	49
Sunflower	0.0	0.00	0.05	50
Safflower	0.0	0.00	0	30
Niger	1.6	1.58	9.6	40
Castor seed	0.0	0.02	0.26	46
Linseed	1.7	1.68	17.87	40
Total oilseeds	100.0	100.00	1455.15	
Kharif	87.4	87.42		
Rabi	12.6	12.58		

The maximum oil content has been reported in sunflower (50%) followed by sesame (49%), groundnut (47%), castor seed (46%), niger & linseed (40%), safflower (30%), rapeseed & mustard (29%) and soybean (18%).

The changes occurred in share of oilseeds acreage in TE 2009-10 as compared to TE 1993-94 in the Madhya Pradesh have been analysed and presented in (Table 3.6).

Table 3.6: Share of Major Oilseeds Acreage in the State: TE 1993-94 and TE 2009-10

Unit – 000 ha.

Oilseeds	***TE 1993-94***	***TE 2009-10***
Groundnut	233.9 (4.99)	205.86 (3.08)
Rapeseed-mustard	584.36 (12.46)	712.50 (10.66)
Sesame	195 (4.16)	251.66 (3.77)
Soybean	2830.86 (60.34)	5282.33 (79.07)
Sunflower	21.94 (0.47)	0.15 (0.00)
Safflower	N (0)	N (0)
Niger	N (0)	105.66 (1.58)
Castor seed	N (0)	1.33 (0.02)
Linseed	280.73 (5.98)	112 (91.68)
Total Oilseeds	4691.66 (100.00)	6680.99 (100.00)

Figures in parentheses show the crop's per cent share in total oilseed area

It is evidenced from the data that the areas of all the major oilseeds except groundnut, linseed, and sunflower was found to be increased. The area of total oilseeds increased from 4691.66 (TE 1993-94) to 6680.99 (TE 2009-10) th ha. The maximum increase was noticed in

case of soybean (2830.86 to 5282.33 th. ha.) and minimum in castor seed (0 to 0.02 th ha.). The fall in area was maximum in linseed (280.73 to 112 th. ha) and minimum in sunflower (21.94 to 0.15 th. ha). The contribution of area of soybean to total area of oilseeds has been found to be increased from 60.34 per cent (TE 1993-94) to 79.07 (TE 2009-10), while the contribution of all other oilseeds found to be decreased during the same period. Hence, increase in area under total oilseeds in Madhya Pradesh was due to increase in soybean area in the state during the period under reference.

The share of different oilseeds in total oilseeds production in TE 2009-10 as compared to TE 1993-94 in Madhya Pradesh have also been analyzed and presented in table 3.7.

Table 3.7: Share of Major Oilseeds Production in the State: TE 1993-94 and TE 2009-10

Unit – 000tonne

Oilseeds	***TE 1993-94***	***TE 2009-10***
Groundnut	215.63 (5.42)	228.4 (3.25)
Rapeseed-mustard	497.26 (12.49)	732.4 (10.41)
Sesame	47.1 (1.18)	102 (1.45)
Soybean	2830.67 (71.12)	5875.86 (83.54)
Sunflower	7.9 (0.20)	0.1 (0.0)
Safflower	N (0)	N (0)
Niger	N (0)	24 (0.34)
Castor seed	N (0)	0.56 (0.01)
Linseed	93.37 (2.35)	44.67 (0.64)
Other Oilseeds	288.22 (7.24)	26.01 (0.37)
Total Oilseeds	3980.15 (100)	7034.00 (100)

As regards to the contribution of production of oilseeds to total oilseeds the share of production of soybean and sesame found to be increased from 71.12 (1993-94) to 83.54 per cent (2009-10) and 1.18 to 1.45 per cent (2009-10) respectively, while decreased in other oilseeds. The production of groundnut also decreased in per cent term but in absolute term it has shown increasing trend. The production of total oilseeds increased drastically from 3980.15 (TE 1993-94) to 7034.00 (TE 2009-10) th. tonne. The maximum increase was noticed in case of soybean (2830.67 to 5875.86 th. tonne) and minimum in castor seed (0 to 0.56 th tonne). The fall in production was maximum in linseed (93.37 to 44.67 th. ha) and minimum in sunflower (7.9 to 0.1 th. ha).

3.2 Selected Oilseeds for the detailed Study:

Soybean and mustard have been selected for in depth study for Madhya Pradesh as these crops contributed a remarkable production in the oilseeds production basket of the state as well as for the country.

3.2.1 Soybean

In India soybean is being grown in area of 96.73 lakh hectares with, the production of 97.20 lakh tones. The average productivity of the crop is 1020.67 kg/ha, which seems to be lower when compared with the productivity of this crop in other soybean growing countries of the world. However, when the productivity was computed in terms of per day productivity, India's productivity level for soybean is not that much lower as visible in terms of percentage of per unit area, because maturity period is very much lower (90days) as compared to other countries (180days). Madhya Pradesh being "Soya-State" accounts for 54.96 per cent of area and 57.62 per cent of production of soybean in the country with an average productivity of 1052 kg/ha. Maharashtra state stands second in terms of soybean production in the country sharing 31.28 per cent of acreage and 28.57 per cent production, Rajasthan the third important state in terms of soybean production (7.02%) in the country. These three state together accounts for more than 92 per cent of area and production of the soybean in the country (Table 3.8).

Table 3.8: Present status of soybean crop in India (Average TE- 2010)

Name of State	Area sown (Lakh hacts)	Percentage to Total	Yield (Kg/ ha)	Percentage to Total	Total production (Lakh tones)	Percentage to Total
Madhya Pradesh	53.17	54.96	1051.67	103.04	56.01	57.62
Maharashtra	30.26	31.28	988.33	96.83	28.57	29.39
Rajasthan	7.24	7.48	940.67	92.16	7.02	7.22
Andhra Pradesh	1.74	1.80	1055.00	103.36	1.66	1.71
Karnataka	2.22	2.30	1021.67	100.10	2.08	2.14
Chhattisgarh	1.23	1.27	950.00	93.08	1.27	1.31
Rest of India	0.88	0.91	936.67	91.77	0.60	0.62
Grand Total	96.73	100.00	1020.67	100.00	97.20	100.00

Soybean was found to be introduced in late seventies in M.P. The average area, production and yield of soybean in Madhya Pradesh w.e.f 1981-82 - 1990-91 to 2001-02 – 2009-10 have been presented in Fig 3.5 and (Table 3.9).

Table 3.9: Average Area, Production, and Yield of Soybean in the State: 1951-52 to 2009-10

	1951-52 to 1960-61	1961-62 to 1970-71	1971-72 to 1980-81	1981-82 to 1990-91	1991-92 to 2000-01	2001-02 to 2009-10
Area (000' ha)	-	-	-	1156.06	3674.9	4681.32
Production (000' t)	-	-	-	920.7	3606.98	4657.35
Yield (kg/ha)	-	-	-	796	981.52	994.88

An elucidated drastic increase in area, production and yield of soybean was observed in Madhya Pradesh during the period from 1991-92 to 2000-01 over the period 1981-82 to1990-91, even after 1991-92 to 2000-01 the trend of increase in area, production and yield remained continued but at slower rate.

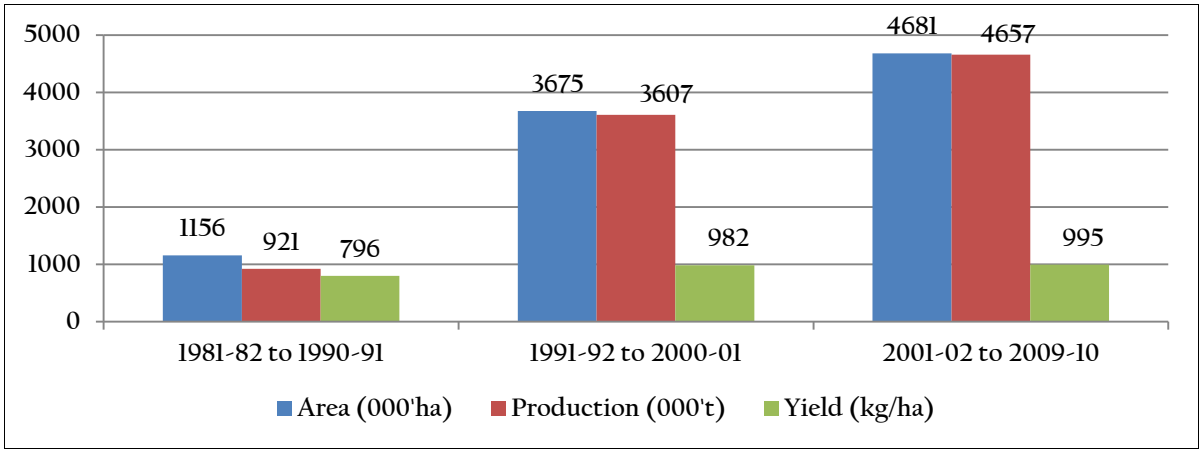

Fig. 3.5: Average Area, Production, and Yield of Soybean in Madhya Pradesh from 1951-52 to 2009-10

The comparative share of major districts in area under soybean in the state has been presented in table 3.9 for the period of TE 1983-84 to TE 2009-10. The comparative share of major districts in area under soybean in the state has been presented in table 3.9 for the period of TE 1983-84 to TE 2009-10.

Table 3.10: Share of Major Districts in Area under Soybean in the State: TE 1983-84 and TE 2009-10

Districts	share in state (TE)				share in edible oilseed in District (TE)			
	1983-84	1993-94	2003-04	2009-10	1983-84	1993-94	2003-04	2009-10
Betul	9.74	5.06	3.67	3.64	65.89	96.02	87.97	84.87
Chhindwara	5.54	3.96	2.35	2.90	38.66	67.31	65.47	76.79
Dewas	9.34	5.78	6.32	5.68	95.13	91.09	99.30	99.33
Dhar	6.06	6.28	5.41	4.83	33.73	89.63	97.42	97.96
Guna	1.16	2.57	3.72	4.58	15.87	74.54	96.30	94.47
Hosangabad	12.73	7.92	8.32	7.06	51.90	87.19	99.65	99.07
Indore	10.35	6.17	5.14	4.23	75.97	98.07	99.57	98.64
Mandsour	0.74	4.44	7.23	7.23	6.14	52.45	92.91	85.77
Raisen	5.29	3.48	1.85	2.48	53.04	81.44	92.42	98.92
Rajgarh	4.15	5.09	6.00	5.38	41.13	89.09	99.26	98.44
Ratlam	1.47	4.40	3.92	3.87	40.39	91.96	98.68	97.53
Sagar	1.63	3.09	3.77	6.03	21.01	70.84	92.55	98.94
Sehore	6.60	6.35	5.85	5.54	61.22	90.91	99.09	99.40
Shajapur	7.20	7.47	7.31	6.36	45.78	93.61	99.21	98.18
Ujjain	7.90	9.97	9.33	8.35	55.37	87.84	99.49	98.91
Vidisha	1.23	2.15	2.84	3.65	23.56	80.98	97.22	96.53
Other District	8.87	15.83	16.98	18.18	4.73	84.83	46.45	43.41
State	100.00	100.00	100.00	100.00	26.35	84.83	81.27	78.98

Source: GOI, various sources.

Soybean is concentrated mainly in Betul, Chhindwara, Dewas, Dhar, Guna, Hoshangabad, Indore, Mandsaur, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain

and Vidisha districts of Madhya Pradesh. All these districts contributed 81.82 per cent of total soybean area of Madhya Pradesh (TE 2009-10) during different period of the study. Amongst the different districts the share of area was found to be highest in Hoshangabad (12.73%) followed by Indore (10.35%), Betul (9.74%), Dewas (9.34%), Ujjain (7.90%) and Shajapur (7.20%) districts in TE 1983-84, while Ujjain (8.35%) was found the leading district followed by Mandsaur (7.23%), Hoshangabad (7.06%), Shajapur (6.36%), Sagar (6.03%) and Dewas (5.68%) district in TE 2009-10. The share of major districts in area under soybean varies from 0.41 (Mandsaur) to 12.73 (Hoshangabad), 2.15 (Vidisha) to 9.97 (Ujjain), 1.85 (Raisen) to 9.33 (Ujjain) and 2.48 (Raisen) to 8.35 (Ujjain) percentage during the TE 83-84, TE 93-94, TE 03-04 and TE 09-10, respectively. The share of soybean in edible oilseed acreage in the state fluctuated between 6.14 (Mandsaur) to 95.13 (Dewas), 52.45 (Mandsaur) to 98.07 (Indore), 65.47 (Chhindwara) to 99.68 (Ratlam) and 76.79 (Chhindwara) to 99.40 (Sehore) percentage in the TE 1983-84, TE 1993-94, TE 2003-04 and TE 2009-10, respectively.

The share of area of soybean in different districts of Madhya Pradesh in TE 2009 – 10 as compared to TE 1993-94 is presented in Fig 3.3. it is observed that the area of soybean was found to be increased in Guna (2%), Mandsaur (3%), Sagar (3%) and Vidisha (2%) districts, while decreased in Dhar (-1%), Indore (-2%), Ujjain (-2%), Raisen (-1%), Hoshangabad (-1%), Betul (-1%), Shajapur (-1%) and Chhindwara (-1%). The area of soybean found stagnate in Sehore, Rajgarh, Dewas, Ratlam and other districts of Madhya Pradesh during the period.

The share of production of soybean in different districts of Madhya Pradesh has been found to be decreased in year TE 2009-10 over the year TE 2003-04, TE 1993-94 and TE 1983-84 in all the districts except Ujjain, Vidisha, Mandsaur, Guna, Rajgarh and Ratlam districts, while the share of soybean as compared to total oilseed production has been found to be increased in all the districts as well as in Madhya Pradesh except other districts during the same period (Table 3.11).

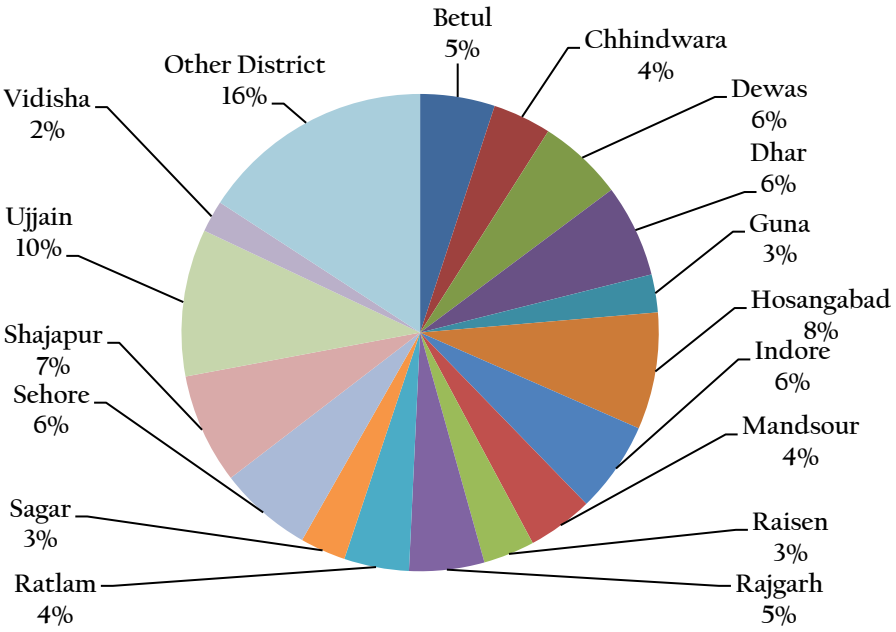

Fig. 3. 6: Share of area of soybean in major districts of Madhya Pradesh (TE 1993-94)

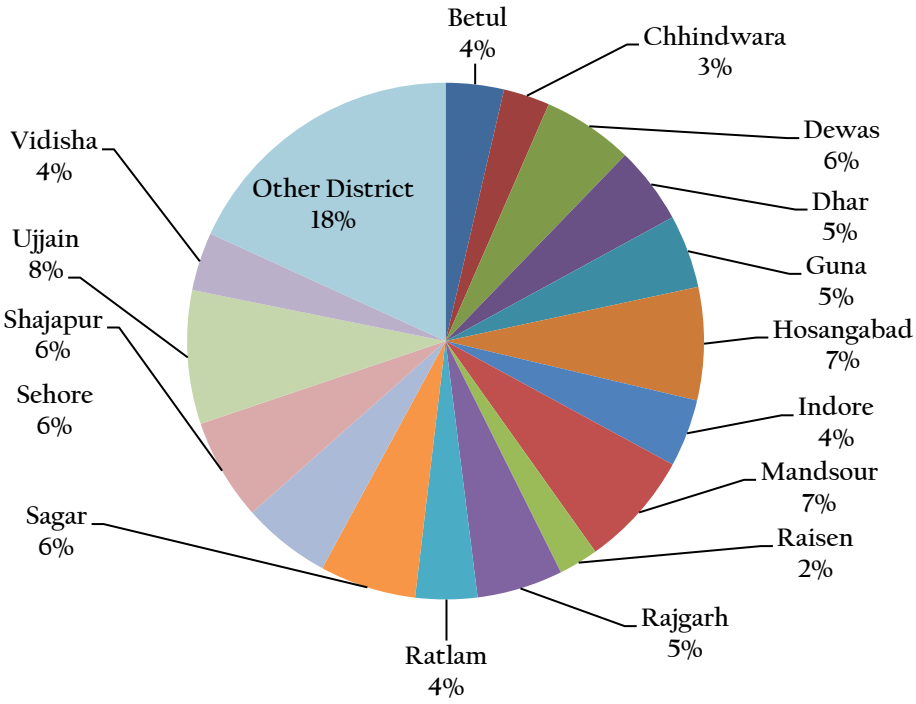

Fig. 3. 7: Share of area of soybean in major districts of Madhya Pradesh (TE2009-10)

The share of major districts in production under soybean in the state has been presented in table 3.11 for the period of TE 1983-84 to TE 2009-10.

Table 3.11: Share of Major Districts in Soybean Production in the State: TE 1983-84 and TE 2009-10.

Districts	share in state (TE)				share in edible oilseed in District (TE)			
	1983-84	1993-94	2003-04	2009-10	1983-84	1993-94	2003-04	2009-10
Betul	7.84	4.32	3.45	3.72	37.96	77.73	91.73	81.31
Chhindwara	9.19	8.03	2.74	3.87	45.99	91.32	74.61	75.04
Dewas	8.84	5.65	8.78	6.41	64.53	94.15	99.62	95.00
Dhar	6.23	7.10	6.04	6.21	24.87	96.14	97.94	81.62
Guna	1.08	1.94	3.40	4.50	10.52	53.29	96.98	93.69
Hosangabad	12.98	7.40	9.60	8.01	37.91	77.49	99.70	81.86
Indore	11.16	7.14	5.62	6.10	58.69	91.44	99.68	89.09
Mandsour	0.70	4.57	6.73	5.55	4.13	51.17	93.15	90.92
Raisen	4.68	3.22	1.78	2.58	33.64	71.41	94.37	93.80
Rajgarh	4.11	3.04	4.84	4.76	29.19	50.39	94.90	97.01
Ratlam	1.43	4.20	3.31	3.48	28.24	83.13	98.18	88.51
Sagar	1.78	2.47	3.16	4.31	16.42	53.61	95.45	88.79
Sehore	6.52	5.97	7.57	6.74	43.35	81.00	99.08	91.11
Shajapur	7.20	6.56	5.91	5.30	32.77	77.93	99.09	99.55
Ujjain	7.42	10.67	7.87	10.28	37.23	89.12	99.54	89.43
Vidisha	1.08	1.87	2.92	3.60	14.79	66.81	97.13	82.33
Other District	7.75	15.46	16.28	14.57	2.96	25.31	30.11	40.87
State	100.00	100.00	100.00	100.00	18.87	60.34	71.09	76.33

The per cent share of major districts in production under soybean varies from 0.70 (Mandsaur) to 12.98 (Hoshangabad), 1.87 (Vidisha) to 10.67 (Ujjain), 1.78 (Raisen) to 9.60 (Hoshangabad) and 2.58 (Raisen) to 10.28 (Ujjain) percentage during the TE 83-84, TE 93-94, TE 03-04 and TE 09-10, respectively. The share of soybean in production of edible oilseed in the state fluctuated between 4.13 (Mandsaur) to 64.53 (Dewas), 50.39 (Rajgarh) to 96.14 (Dhar), 74.61 (Chhindwara) to 99.70 (Hoshangabad) and 75.04 (Chhindwara) to 99.55 (Shajapur) percentage in the TE 83-84, TE 93-94, TE 03-04 and TE 09-10, respectively.

The share of production of soybean in different district of Madhya Pradesh in 2009 – 10 (Fig. 3.9) as compared to 1993-94 (Fig. 3.8) and revealed that the production of soybean was found to be increased in Guna (2%), Khandwa (2%), Mandsaur (1%), Sagar (2%), Hoshangabad (1%), Sehore (1%), Rajgarh (2%) and Vidisha (2%) districts, while decreased in Dhar (-1%), Indore (-1%), Ujjain (-1%), Shajapur (-2%), Ratlam (-1%) and Chhindwara (-4%) districts. The area of soybean was found stagnate in Betul, Dewas, Raisen and other districts of Madhya Pradesh. The share of production of soybean in total production of Madhya Pradesh has been found to be decreased in year 2009-10 over the year 2003-34, 1993-94 and 1983-84 in all the districts except Ujjain, Vidisha, Mandsaur, Guna, Rajgarh and Ratlam districts, while the share of soybean as compared to total oilseed production has been found to be increased in all the districts as well as in Madhya Pradesh except other districts during the same period.

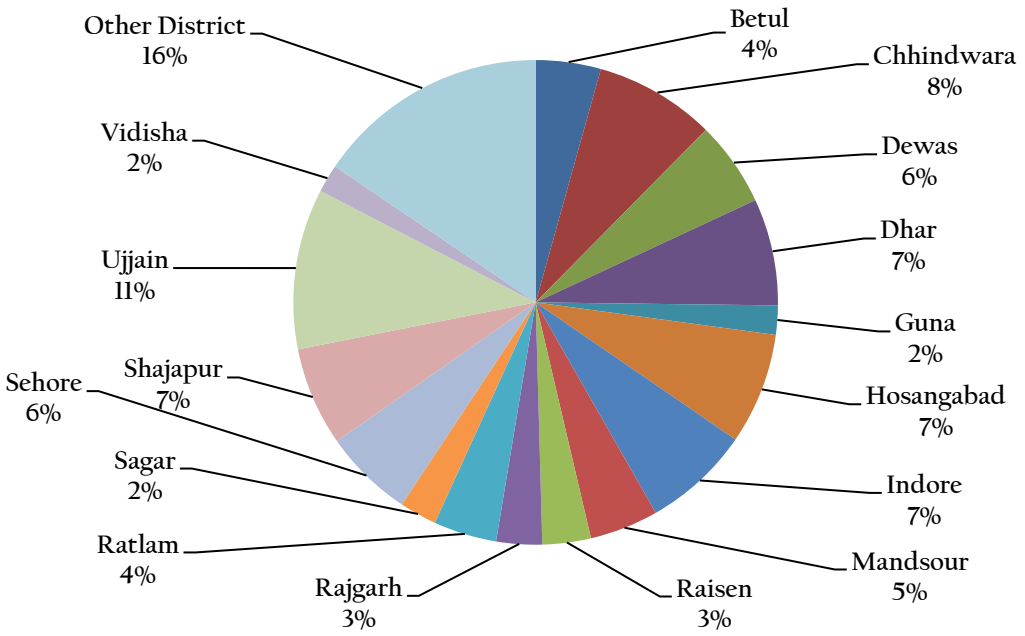

Fig. 3. 8: Share of production of soybean in major districts of Madhya Pradesh (TE 1993-94)

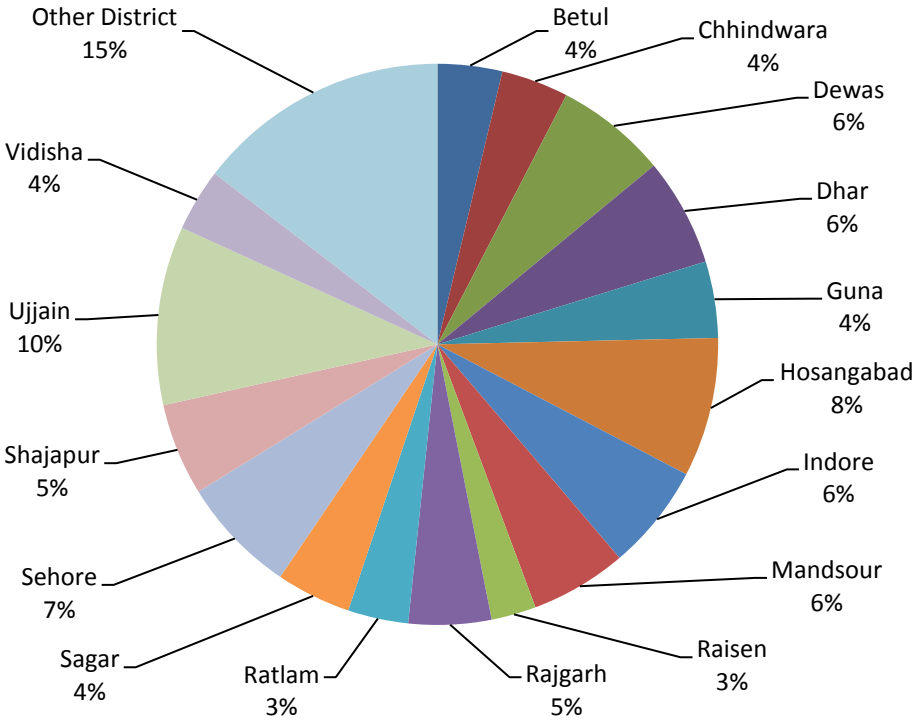

Fig. 3. 9: Share of production of Soybean in major districts of Madhya Pradesh (TE2009-10)

3.2.2. Mustard

Madhya Pradesh is one of the major mustard producing state in India and Occupy 5th rank in the production of mustard. The area of mustard crop was 605.1 thousand hectares with the production and productivity of 701.2 thousand tonnes and 1159 kg/ha, respectively.

The trend of average area, production and yield of Mustard in the state w.e.f 1951-52 - 1960-61 to 2001-02 – 2009-10 have been presented in table 3.12.

Table 3.12: Average Area, Production, and Yield of Mustard in the State: 1951-52 to 2009-10

Particulars	1951-52 to 1960-61	1961-62 to 1970-71	1971-72 to 1980-81	1981-82 to 1990-91	1991-92 to 2000-01	2001-02 to 2009-10
Area (000 hectare)	135.3	148	172.08	320.78	596.83	605.1
Production (000 tone)	49.9	47.5	74.63	253.53	503.38	701.2
Yield (kg/ha)	369	321	434	790	843	1159

An elucidated gradual increase in area, production and yield of mustard in Madhya Pradesh during the period 1951-52 - 1960-61 to 1971-72 – 1980-81 and 1991-92 - 2000-01 to 2001-02 – 2009-10. The drastic increase in area (from 172.08 to 320.78 to 596.83 th. ha.) during 1980s, 1990s and 2000 respectively,

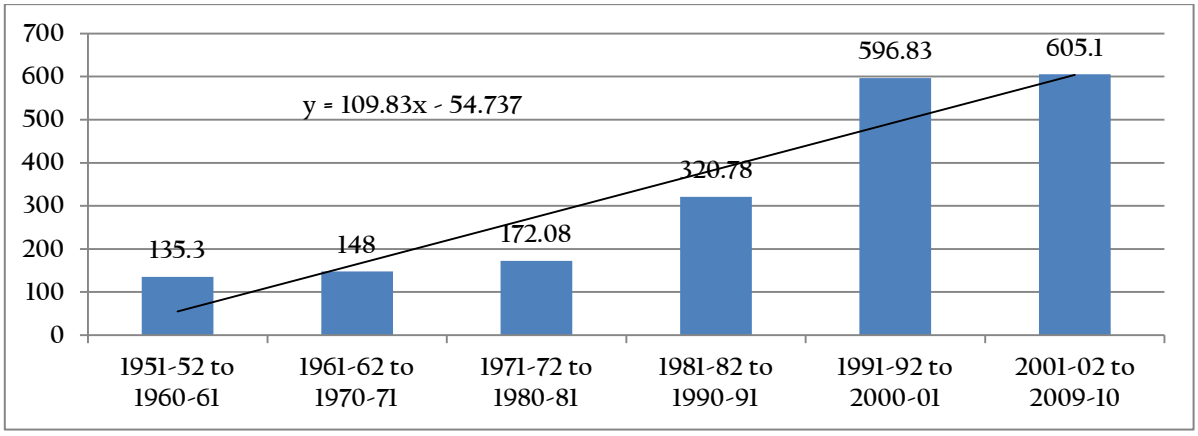

Fig 3.10: Trend of Area (000'ha) of Mustard in Madhya Pradesh

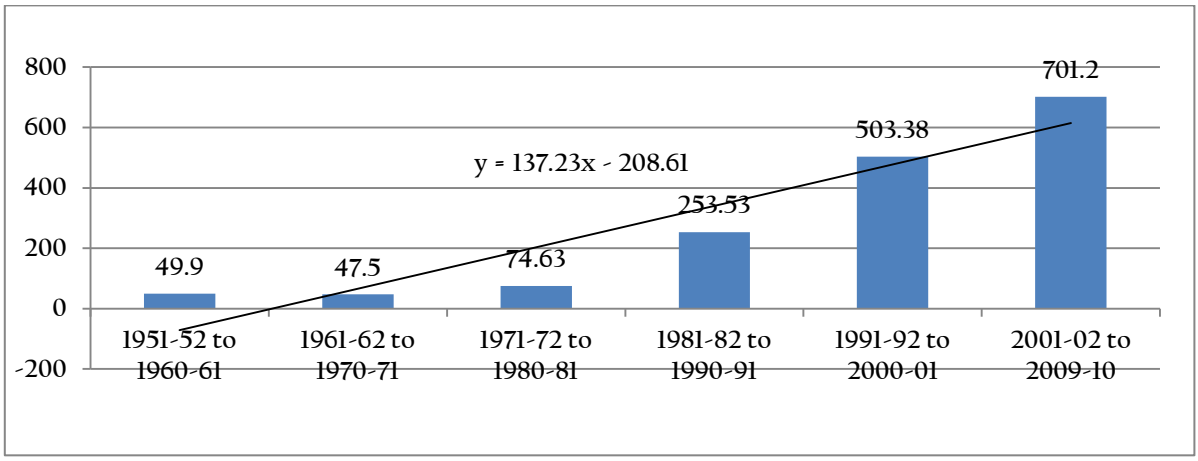

Fig. 3.11: Trend of Production (000't) of Mustard in Madhya Pradesh

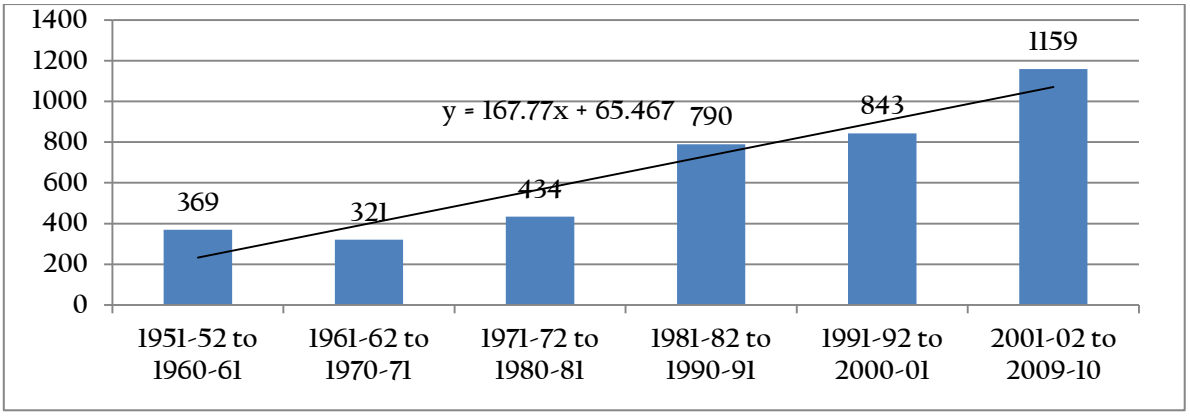

Fig 3.12: Trend of Yield (Kg/ha) of Mustard in Madhya Pradesh

The production (74.63 to 253.53 to 503.38 th tonnes) and yield (434 to 790 to 843 kg/ha) were recorded increasing trend during the period 1971-72 – 1980-81 to 1991-92 - 2000-01.

The area, production and yield of mustard have been found to be increased with the magnitude of 109.83 thousand ha/decade (Fig.3.10), 137.23 thousand t /decade (Fig.3.11) and 167.77 kg/ha/decade (Fig.3.12) during the period from 1951-52 to 2009-10. The area of mustard found to be concentrated in Bhind, Gwalior, Mandla, Mandsaur, Morena and Shivpuri districts. These five districts contributed nearly 85 per cent to 90 per cent of area and production of mustard in Madhya Pradesh (2009-10).

The per cent share of major districts in area under mustard in the state and share of mustard in edible oilseed acreage in the district have been presented in table 3.13 from the period of TE 1983-84 to TE 2009-10 in 10 years interval.

Table 3.13: Share of Major Districts in Area under Mustard in the State: TE1983-84 and TE2009-10

Districts	share in state (TE)				share in edible oilseed in District (TE)			
	1983-84	1993-94	2003-04	2009-10	1983-84	1993-94	2003-04	2009-10
Bhind	13.73	15.28	23.45	23.44	67.20	79.07	88.59	97.04
Gwalior	3.53	13.19	7.47	7.50	20.97	80.45	75.43	71.24
Mandla	11.11	3.82	7.49	4.56	34.84	24.69	45.35	33.13
Mandsour	0.39	8.16	3.15	8.38	1.59	18.87	4.14	13.47
Morena	44.74	40.48	35.08	31.27	77.81	89.27	78.26	87.37
Shivpuri	1.77	6.57	4.97	7.77	8.78	28.92	12.94	21.99
Other District	22.61	12.02	17.87	15.00	3.94	1.93	1.68	2.14
State	100.00	100.00	100.00	100.00	13.16	12.46	7.61	10.92

Source: GOI, various sources

The percent share of area of mustard was found to be increased in Shivpuri (1%), Bhind (9%), Mandla (1%), and Other districts (3%), while decreased in Morena (-9%), Gwalior (-5%) in the year TE 2009-10 (Fig 3.14) as compared to TE 1993 – 94 (Fig 3.13).

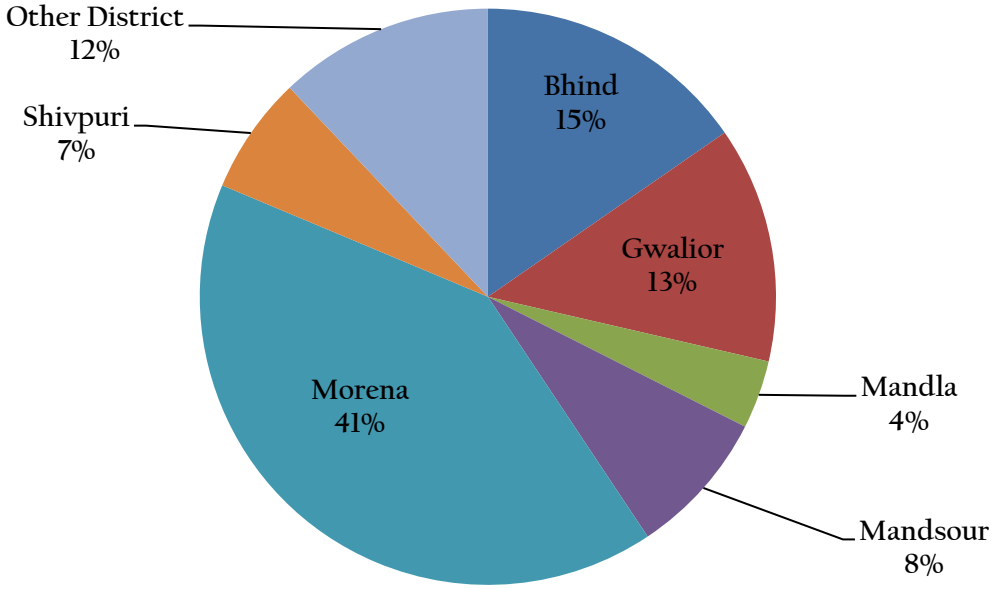

Fig. 3. 13: Share of area of mustard in major districts of Madhya Pradesh (TE 1993-94)

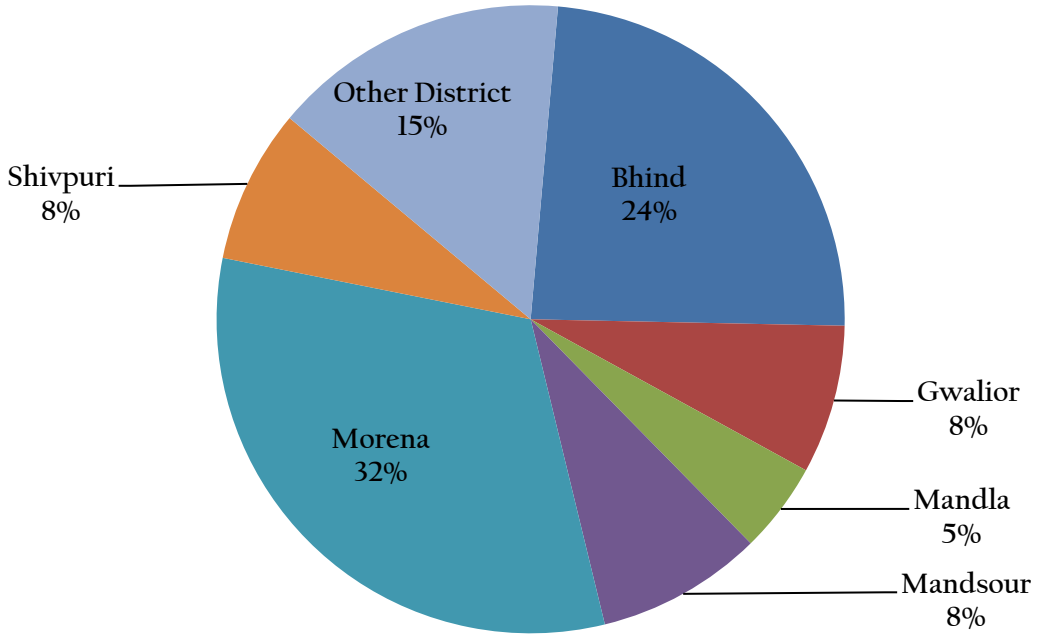

Fig. 3.14: Share of area of mustard in major districts of Madhya Pradesh (TE2009-10)

The share of area of mustard in different major districts of Madhya Pradesh was found to be varies from 0.39 (Mandsaur) to 44.74 (Morena), 3.82 (Mandla) to 40.48 (Morena), 3.15 (Mandsaur) to 35.08 (Morena) and 4.56 (Mandla) to 31.27 (Morena) percentage during the TE 1983-84, TE 1993-94, TE 2003-04 and TE 2009-10, respectively. The share of mustard in edible oilseed acreage in the district fluctuate between 1.59 (Mandla) to 77.81 (Morena), 18.87 (Mandsaur) to 89.27 (Morena), 4.140 (Mandsaur) to 88.59

(Bhind) and 13.47 (Mandsaur) to 97.04 (Bhind) percentage and in the state 13.16, 12.46, 7.61 and 10.92 percentage in the TE 1983-84, TE 1993-94, TE 2003-04 and TE 2009-10, respectively (Table 3.13). Amongst the different districts area of mustard was found to be highest in Morena (31.27%) followed by Bhind (23.44%), Mandsaur (8.38%), Shivpuri (7.77%), Gwalior (7.50%) and Mandla (4.56%) districts (2009-10). The trend of share of area of mustard in different period of study was also observed and found that the share of area of mustard was found to be increased in Bhind, Gwalior, Mandsour and Shivpuri, while decreased in Mandla, Morena and Other districts in different districts of Madhya Pradesh

The share of major districts in production under mustard in the state and share of mustard in edible oilseed production in the district have been presented in table 3.14 for the period of TE 1983-84 to TE 2009-10.

Table 3.14: Share of Major Districts in Mustard Production in the State: TE1983-84 and TE2009-10

Districts	share in state (TE)				share in edible oilseed in District (TE)			
	1983-84	1993-94	2003-04	2009-10	1983-84	1993-94	2003-04	2009-10
Bhind	8.98	17.01	27.81	26.76	91.92	84.90	83.97	91.70
Gwalior	4.76	14.09	7.13	7.05	54.58	95.69	64.96	78.78
Mandla	9.92	2.46	5.21	3.06	57.24	27.22	54.77	51.44
Mandsour	0.32	7.86	2.76	7.52	1.43	13.65	3.65	13.93
Morena	66.27	52.30	44.57	39.48	84.85	90.82	69.17	94.32
Shivpuri	1.46	4.77	3.51	5.40	11.90	21.56	8.88	19.43
Other District	8.30	1.51	8.99	10.74	2.01	0.23	0.72	1.44
State	100.00	100.00	100.00	100.00	18.70	11.74	6.78	11.01

The share of major districts in production under mustard varies from 0.32 (Mandsaur) to 66.27 (Morena), 2.46 (Mandla) to 52.30 (Morena), 2.76 (Mandsaur) to 44.57 (Morena) and 3.06 (Mandla) to 39.48 (Morena) percentage during the TE 1983-84, TE 1993-94, TE 2003-04 and TE 2009-10, respectively. The share of mustard in production of edible oilseed in the district fluctuate between 1.43 (Mandsaur) to 91.92 (Bhind), 13.65 (Mandsaur) to 95.69 (Gwalior), 3.65 (Mandsaur) to 83.97 (Bhind) and 13.93 (Mandsaur) to 94.32 (Morena) percentage and in the state 18.70, 11.74, 6.78 and 11.01 percentage in the TE 1983-84, TE 1993-94, TE 2003-04 and TE 2009-10, respectively.

The per cent share of production of mustard was found to be increased in Bhind (10%), Mandla (1%), and Other districts (9%), while decreased in Morena (-13%), Gwalior (-7%) in the year TE 2009-10 as compared to TE 1993 - 94 It was found stagnate in Shivpuri and Mandsaur districts of Madhya Pradesh (Fig 3.15 & 3.16).

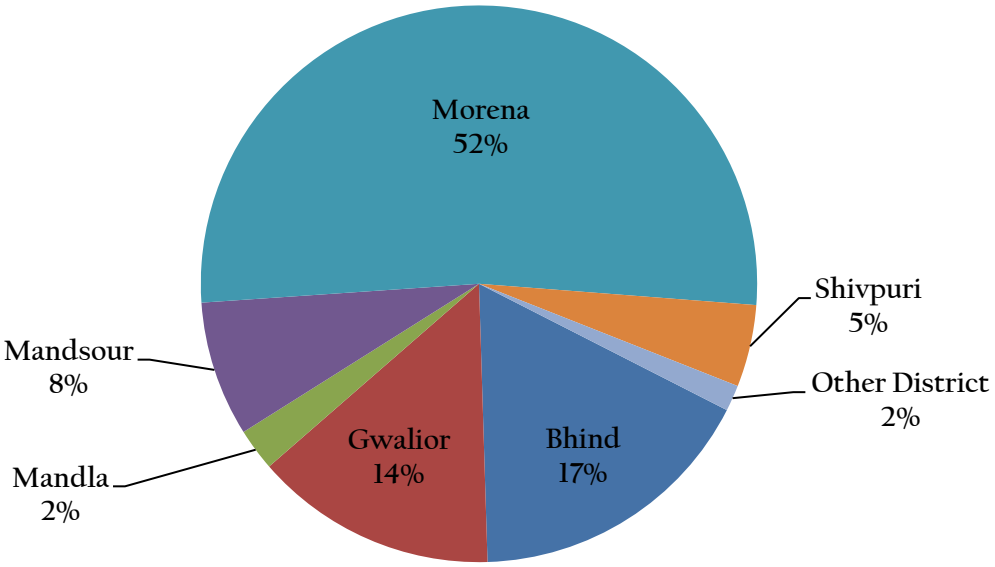

Fig. 3. 15: Share of production of mustard in major districts of Madhya Pradesh (TE 1993-94)

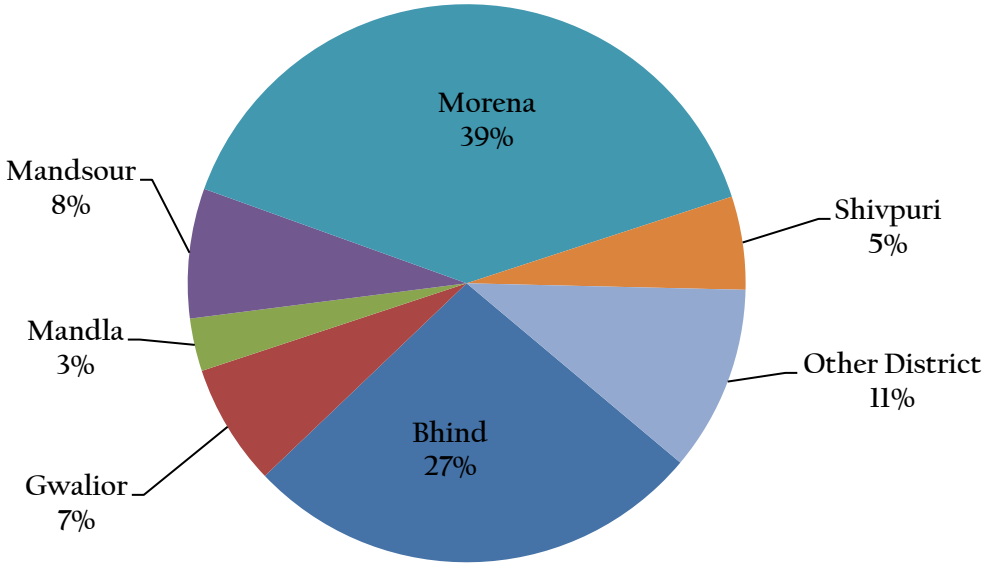

Fig. 3. 16: Share of production of mustard in major districts of Madhya Pradesh (TE2009-10)

3.3 Growth Trends in Area, Production and Yield of Selected Oilseeds

The growth trends (simple and compound annual growth rates) in area, production and yield of soybean and mustard (major oilseeds of the state) have been computed and the classification of districts according to growth (significant positive, significant negative, positive stagnant and negative stagnant) in area, production and yield for the periods 1980s, 1990s, 2000s and 1981-82 to 2009-10 are presented in this sub head.

3.3.1 Soybean

The growth in area of soybean was found to be positive and significant in all the periods and in all the major soybean growing districts of Madhya Pradesh except in Raisen and Betul (1990s) and Indore and Sehore (2000s), where it was found to be positive and stagnate. In Chhindwara the growth of area of Soybean was found to be negative and stagnate in 1990s (Table 3.15).

Table 3:15 Classification of districts according to growth in area of Soybean in M.P.

Particulars	1980s	1990s	2000s	1981-82 to 2009-10
Significant Positive Growth in Area	Betul, Chhindwara, Dewas, Dhar, Guna+Ashoknagar, Hosangabad+Harda, Indore, Mandsaur+Nimach, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha	Dewas, Dhar, Guna+Ashoknagar, Hosangabad+Harda, Indore, Mandsaur+Nimach, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha	Betul, Chhindwara, Dewas, Dhar, Guna+Ashoknagar, Mandsaur+Nimach, Raisen, Rajgarh, Ratlam, Sagar, Shajapur, Ujjain, Vidisha	Betul, Chhindwara, Dewas, Dhar, Guna+Ashoknagar, Hosangabad+Harda, Indore, Mandsaur+Nimach, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha
Significant Negative Growth in Area	–	–	–	–
Positive Stagnant Area	–	Raisen, Betul	Indore and Sehore	–
Negative Stagnant Area	–	Chhindwara	–	–

The classification of districts according to growth in production of soybean was also observed and presented in table 3.16. The growth in production of soybean was found positive and significant in all the districts and in all periods except in Dhar (1990s), Hoshangabad (1990s & 2000s), Raisen (1990s), Ujjain (1990s) and Sehore (2000s), where it was found positive but non-significant. In Madhya Pradesh only in Betul the growth in production of soybean was found to be negative but non-significant in 1990s.

Table 3:16 Classification of districts according to growth in production of Soybean in M.P.

	1980s	1990s	2000s	1981-82 to 2009-10
Significant increase in production	Betul, Chhindwara, Dewas, Dhar, Guna+Ashoknagar, Hosangabad+Harda, Indore, Mandsaur+Nimach, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha	Dewas, Guna+Ashoknagar, Indore, Mandsaur+Nimach, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Vidisha	Betul, Chhindwara, Dewas, Dhar, Guna+Ashoknagar, Indore, Mandsaur+Nimach, Raisen, Rajgarh, Ratlam, Sagar, Shajapur, Ujjain, Vidisha	Betul, Chhindwara, Dewas, Dhar, Guna+Ashoknagar, Hosangabad+Harda, Indore, Mandsaur+Nimach, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha
Significant decline in production	_	Chhindwara	_	_
Positive trend but statistically non-significant	_	Dhar, Hosangabad+Harda, Raisen, Ujjain,	Hosangabad+Harda, Sehore,	_
Negative trend but statistically non-significant	_	Betul	_	_

As regard to the productivity of soybean is concerned in the different periods and in different major soybean growing districts (Table 3.17) the districts like Chhindwara, Vidisha, Indore, Ujjain, Sehore, and Dhar were found in High productivity districts as in these districts the yield of soybean was recorded above the average yield of all India, while districts like Betul, Dewas, Guna, Hosangabad, Mandsour, Raisen, Ratlam, Sagar, Shajapur and Rajgarh were under Low productivity districts in the period1980s. In all these districts the growth in productivity was found to be positive and significant in Chhindwara, Vidisha, Indore and Ujjain districts; positive and stagnate in Sehore, Dhar Betul, Dewas, Guna, Hosangabad, Mandsour, Raisen, Ratlam, Sagar and Shajapur, negative and stagnate in only Rajgarh district in period 1980s. (Table 3.17)

In 1990s Dewas, Chhindwara, Indore, Ratlam, Mandsour, Raisen, Ujjain and Betul Betul were found in High productivity districts, whereas Vidisha, Sehore, Shajapur, Hosangabad, Dhar and Sagar were found under low productivity districts. Amongst all these districts the growth in productivity of soybean was found to be positive and significant only in Dewas and Vidisha; negative and significant in Chhindwara; negative and stagnate in

Betul and positive and stagnate in Indore, Ratlam, Mandsour, Raisen, Ujjain, Sehore, Shajapur and Hosangabad districts. (Table 3.17)

Table 3:17 Classification of districts according to growth in yield of Soybean in M.P.

Particulars	Significant increase in yield	Significant decline in yield	Stagnant yield with positive sign	Stagnant yield with negative sign
1981-82 to 1990-91				
High Productivity (> All India)	Chhindwara, Vidisha, Indore, Ujjain	–	Sehore, Dhar,	
Low Productivity	–	–	Betul, Dewas, Guna+Ashoknagar, Hosangabad+Harda, Mandsaur+Nimach, Raisen, Ratlam, Sagar, Shajapur	Rajgarh,
1991-92 to 2000-01				
High Productivity	Dewas,	Chhindwara	Indore, Ratlam, Mandsaur+Nimach, Raisen, Ujjain	Betul
Low Productivity	Vidisha	–	Sehore, Shajapur, Hoshangabad+Harda,	Dhar, Sagar
2001-02 to 2009-10				
High Productivity	Dhar, Indore, Chhindwara		Sehore, Dewas	
Low Productivity	Ujjain, Raisen, Betul, Vidisha, Guna+Asholnagar		Hoshangabad+Harda, Rajgarh, Ratlam, Sagar, Mandsaur+Nimach	
1981-82 to 2009-10				
High Productivity	Sehore, Dewas, Indore, Dhar, Ujjain		Betul	Chhindwara
Low Productivity	Raisen, Vidisha, Guna+Asholnagar, Hoshangabad+Harda, Rajgarh, Shajapur, Ratlam		Mandsaur+Nimach, Sagar	

In 2000s the districts Dhar, Indore, Chhindwara, Sehore, Dewas come under high productivity districts, where as Ujjain, Raisen, Betul, Vidisha, Guna, Hosangabad, Raigarh, Ratlam, Sagar, and Mandsour found in low productivity districts. In this period none of the districts showed negative growth in productivity of soybean. The districts like Dhar, Indore, Chhindwara, Ujjain, Raisen, Betul, Vidisha and Guna recorded positive and significant growth, while Sehore, Dewas, Hosangabad, Raigarh, Ratlam, Sagar, and Mandsour districts showed positive and stagnate growth of soybean in Madhya Pradesh. (Table 3.17)

In 2010s the districts Sehore, Dewas, Indore, Dhar, Ujjain, Betul, and Chhindwara comes under high productivity districts, while Raisen, Vidisha, Guna, Hosangabad, Rajgarh, Shajapur, Ratlam, Mandsour, and Sagar were under low productivity districts. In all these districts none of the districts recorded significant decline yield of soybean in Madhya Pradesh. The Districts like Sehore, Dewas, Indore, Dhar, Ujjain, Raisen, Vidisha, Guna, Hoshangabad, Rajgarh, Shajapur and Ratlam showed significant increased in yield of soybean in Madhya Pradesh, while districts like Betul, Mandsaur and Sagar showed positive and stagnate, and Chhindwara showed negative and stagnate yield of soybean in 2010s in Madhya Pradesh. (Table 3.17)

3.3.2 Mustard:

The growth in area of mustard was found to be positive and significant in the periods 1980s and in 1981-82 to 2009-10 in all the major mustard growing districts of Madhya Pradesh. In 1990s the growth of area of mustard was found to be positive and significant only in Mandla district while found positive and stagnate, negative and significant, and negative and stagnate in Bhind and Shivpuri districts, Morena district and Gwalior and Mandsour districts respectively. In 2000s the growth in area of mustard was found positive and significant in Bhind and Shivpuri and positive and stagnate in rest of the major mustard growing districts of M.P. viz. Gwalior, Mandla, Mandsour and Morena.

Table 3:18 Classification of Districts according to Growth in area under Mustard

	1980s	1990s	2000s	1981-82 to 2009-10
Significant Positive Growth in Area	Bhind, Gwalior, Mandla+Dindori, Mandsour+Nimuch, Morena+Sheopur Kalan, Shivpuri	Mandla+Dindori,	Bhind, Shivpuri	Bhind, Gwalior, Mandla+Dindori, Mandsour+Nimuch, Morena+Sheopur Kalan, Shivpuri
Significant Negative Growth in Area	–	Morena+Sheopur Kalan,	–	–
Positive Stagnant Area	–	Bhind, Shivpuri	Gwalior, Mandla+Dindori, Mandsour+Nimuch, Morena+Sheopur Kalan,	–
Negative Stagnant Area	–	Gwalior, Mandsour+Nimuch,	–	–

The growth in production of mustard was found to be positive and significant in the periods 1980s and in overall period (1981-82 to 2009-10) in all the major mustard growing districts of Madhya Pradesh. In 1990s the growth in area of mustard was found to be positive and stagnate in Bhind, Mandla, Mandla, Morena and Shivpuri districts, while found

negative and and significant in Gwalior and Mandsaur districts. In 2000s the growth in production of mustard was found positive and significant in Bhind, Gwalior, Morena and Shivpuri, while found positive but non-significant in Mandla and Mandsaur.

Table 3.19 Classification of Districts according to Growth in Production under Mustard

	1980s	1990s	2000s	1981-82 to 2009-10
Significant increase in production	Bhind, Gwalior, Mandla+Dindori, Mandsour+Nimuch, Morena+Sheopur Kalan, Shivpuri	–	Bhind, Gwalior, Morena+Sheopur Kalan, Shivpuri	Bhind, Gwalior, Mandla+Dindori, Mandsour+Nimuch, Morena+Sheopur Kalan, Shivpuri
Significant decline in production	–	–	–	–
Positive trend but statistically non-significant	–	Bhind, Mandla+Dindori, Morena+Sheopur Kalan, Shivpuri	Mandla+Dindori, Mandsour+Nimuch,	–
Negative trend but statistically non-significant	–	Gwalior, Mandsour+Nimuch	–	–

As regard to the productivity of mustard is concerned in the different period and in different major mustard growing districts (Table 3.20) In period 1980s the districts like Morena and Gwalior were found in High productivity districts as in these districts the yield of mustard was recorded above the average yield of all India, while districts like Bhind, Mandsaur, Mandla and Shivpuri were under Low productivity districts. In all these districts the significant increase in growth in productivity was found in Morena, Bhind and Mandsaur; Stagnate with positive sign in Mandla and Shivpuri and found stagnate with negative sign in Gwalior.

In period 1990s the only Morena was found in High productivity districts while all other mustard growing districts like Bhind, Mandsaur, Mandla, Shivpuri, Gwalior and Mandsaur were found under Low productivity districts. None of the district in this period showed positive and significant growth in productivity of mustard in M.P. The growth in productivity was found stagnate with positive sign in Morena and Bhind, while found stagnate with negative significant in Mandla, Shivpuri, Gwalior and Mandsaur.

Table 3.20: Classification of Districts according to Growth in Productivity under Mustard

	Significant increase in yield	Significant decline in yield	Stagnant yield with positive sign	Stagnant yield with negative sign
1981-82 to 1990-91				
High Productivity (> All India)	Morena+Sheopur Kalan	–	–	Gwalior
Low Productivity	Bhind, Mandsour+Nimuch,	–	Mandla+Dindori, Shivpuri	–
1991-92 to 2000-01				
High Productivity	–	–	Morena+Sheopur Kalan	–
Low Productivity	–	–	Bhind	Mandla+Dindori, Shivpuri, Gwalior, Mandsour+Nimuch
2001-02 to 2009-10				
High Productivity	Morena+Sheopur Kalan, Bhind	–	–	–
Low Productivity	Gwalior	–	Shivpuri, Mandsour+Nimuch, Mandla+Dindori	–
1981-82 to 2009-10				
High Productivity	Morena+Sheopur Kalan	–	–	–
Low Productivity	Bhind, Mandsour+Nimuch, Shivpuri,	–	Mandla+Dindori	Gwalior

In period 2000s the districts like Morena and Bhind were found in High productivity districts, while districts like Gwalior, Shivpuri, Mandsaur and Mandla were under Low productivity districts. In all these districts the growth in productivity significantly increased in Morena, Bhind and Gwalior, while found stagnate with positive sign in Shivpuri, Mandsaur and Mandla districts and found stagnate with negative sign in Gwalior district.

In overall period (1981-82 to 2009-10) only Morena come in High productivity district, while all other major mustard growing districts *viz.* Bhind, Mandsaur, Shivpuri, Mandla and Gwalior were under low productivity districts. Amongst all these districts the significant increase in yield of mustard was found in Morena, Bhind, Mandsaur and Shivpuri, while found stagnate with positive sign in Mandla and with negative sign in Gwalior.

3.4 Variability in Area, Production and Yield of Soybean and Mustard vis-à-vis competing crops maize and wheat

The variability in area, production and yield of Soybean and Mustard vis-à-vis competing crops maize and wheat was observed during different period of the study i.e. 80s, 90s, 2000s and 80s – 2000.

3.4.1 Soybean vis-à-vis maize

The variability in area, production and yield of soybean and its competeting crops maize has been observed during 80s, 90s, 2000 and 80s – 2000.

3.4.1.1 Area

The variability in area of soybean and its competing crop i.e. maize observed during 1980s, 1990s, 2000 and overall period 1980s – 2000, which revealed that variability in area of these crops was found more in 1980s as compared to 1990s and 2000 in all the major soybean growing district of Madhya Pradesh (Table 3.21).

During 1980s amongst all major soybean growing district the variability was found maximum in Mandsaur (100.90%) followed by Ratlam (85.71%), Guna (82.99%), Vidisha (70.66%), Sagar (67.19%), Ujjain (59.40%) and Shajapur (54.16%). 1990s the variability in area of soybean was found between 6.38 per cent (Indore) to 35.07 per cent (Betul), while in 2000 it ranged between 2.04 per cent (Indore) to 35.83 per cent (Sehore). In overall period it ranged between 36.08 per cent (Indore) to 76.41 per cent (Mandsaur).

Table 3.21: Variability in area of soybean and its competing crop maize in major Soybean producing districts of M. P. (%)

S. No.	Districts	Soybean Area CV				Maize Area CV			
		80s	90s	2000s	80s-2000s	80s	90s	2000s	80s-2000s
1	Betul	52.91	35.07	9.56	41.27	3.88	17.36	16.56	42.23
2	Chhindwara	41.36	17.43	19.11	41.87	10.93	11.77	8.02	37.43
3	Dewas	35.94	18.21	4.73	45.91	17.87	24.31	71.54	40.59
4	Dhar	50.41	13.4	4.58	46.71	7.07	9.26	13.41	11.14
5	Guna+Ashoknagar	82.99	24.14	21.04	70.48	6.94	6.96	12.31	16.36
6	Hosangabad+Harda	34.19	26.77	2.85	48.57	12.98	16.63	21.02	19.78
7	Indore	37.94	6.38	2.04	36.08	8.51	18.74	30.25	23.05
8	Mandsaur+Nimach	100.9	33.97	9.82	76.41	9.61	14.01	9.15	25.98
9	Raisen	48.26	34.79	31.39	46.17	6.69	13.2	20.19	29.52
10	Rajgarh	63.82	19.16	4.79	51.59	11.27	7.47	5.54	21.35
11	Ratlam	85.71	14.03	9.34	60.96	10.27	7.84	12.57	13.63
12	Sagar	67.19	30.46	33.02	71.07	6.48	4.99	14.92	11.24
13	Sehore	52.84	12.03	35.83	50.39	8.14	15.67	58.27	74.75
14	Shajapur	54.16	14.37	3.27	47.42	9.43	10.19	4.93	27.93
15	Ujjain	59.4	15.85	5.94	49.28	60.89	32.62	31.09	78.82
16	Vidisha	70.66	32.76	23.08	69.45	43.14	13.89	8.52	50.76
	Average	**58.67**	**21.80**	**13.77**	**53.35**	**14.63**	**14.06**	**21.14**	**32.79**

As regards to the competitive crop of soybean i.e. Maize the average variability in all the districts was also found to be more in period of 2000s (21.14%) as compared to in period of 1990s (14.06%) and 1980s (14.63%). In over all period it was found to be 32.79 per

cent and ranged between 11.14 per cent (Dhar) to 78.82 per cent (Ujjain) in major soybean producing districts of M.P. The variability in area of soybean was found more as compared to the variability in area of maize in all the periods except 2000s.

3.4.1.2 Production

The variability of production of soybean was also found more in case of soybean as compared to its competitive crop i.e. maize in all the periods and in all the major soybean producing districts of M.P. The variability in production of soybean was found to be more in 1980s (77.02%) as compared to 1990s (37.56%) and 2000s (32.41%). In overall period (1980s-2000s) it was found to be 67.90 per cent and ranged between 55.20 per cent (Indore) to 89.92 per cent (Guna). During 1980s it ranged between 17.47 per cent (Hoshangabad) to 59.12 per cent (Chhindwara), while in the period of 1990s and 2000s it ranged between 13.63 per cent (Indore) to 50.77 per cent (Rajgarh) and 17.30 per cent (Indore) to 100.21 per cent (Ratlam).

Table 3.22: Variability in production of soybean and its competing crops maize in major Soybean producing districts of M. P.

(%)

S. No.	Districts	Soybean Production CV				Maize production			
		80s	90s	2000s	80s-2000s	80s	90s	2000s	80s-2000s
1	Betul	64.24	27.54	28.24	54.32	32.15	37.28	14.54	57.33
2	Chhindwara	74.93	58.39	45.65	59.29	62.54	29.95	21.80	52.75
3	Dewas	67.63	31.32	13.34	62.15	30.06	32.42	29.88	43.35
4	Dhar	68.43	41.19	24.96	65.28	30.47	22.29	44.83	33.69
5	Guna+Ashoknagar	94.01	43.97	38.19	89.92	38.99	29.91	27.80	33.63
6	Hosangabad+Harda	45.5	41.3	30.44	68.51	24.00	31.21	38.96	39.35
7	Indore	59.38	20.17	28.3	52.2	31.91	20.13	37.98	30.61
8	Mandsaur+Nimach	122	51.75	21.91	82.69	37.89	30.33	36.51	32.65
9	Raisen	69.74	44.52	44.07	63.4	21.06	21.03	25.84	41.23
10	Rajgarh	62.6	47.83	31.18	71.45	30.89	52.99	30.20	48.97
11	Ratlam	114.85	40.17	34.75	75.69	41.80	24.48	67.45	48.77
12	Sagar	71.56	36.16	41.12	76.52	19.18	14.84	32.01	22.71
13	Sehore	74.42	22.22	43.79	65.99	33.25	25.36	38.35	71.48
14	Shajapur	64.3	25.29	22.55	55.9	33.39	27.77	42.45	48.33
15	Ujjain	86.23	31.49	37.63	64.74	32.19	37.45	56.78	53.78
16	Vidisha	92.51	37.66	32.47	78.33	13.19	23.26	69.29	47.63
	Average	**77.02**	**37.56**	**32.41**	**67.90**	**28.72**	**18.75**	**10.93**	**22.05**

The variability in production of maize was found to be more in period of 1980s (28.72%) as compared to 1990s (18.75%) and 2000s (10.93%). In overall period (1980s to 2000s) it was found to be 22.05 per cent and ranged between 22.71 per cent (Sagar) to 71.48 per cent (Sehore). The variability of production of soybean was found to be more than maize in all the major soybean growing districts and in all the period of the study.

Table 3.23: Variability in productivity of soybean and its competing crops maize in major Soybean producing districts of M. P.

(%)

S.No.	Districts	Soybean Yield CV				Maize yield			
		80s	90s	2000s	80s-2000s	80s	90s	2000s	80s-2000s
1	Betul	17.97	23.29	20.82	28.63	31.99	18.69	24.72	38.29
2	Chhindwara	48.36	55.81	31.83	49.24	59.12	22.4	17.65	70.7
3	Dewas	40.02	18.62	11.25	31.2	20.6	15.73	55.53	41.47
4	Dhar	23.05	38.31	21.45	32.96	26.38	20.25	31.98	33.9
5	Guna+Ashoknagar	26.53	33.03	26.26	32.99	35.6	29.28	38.04	36.02
6	Hosangabad+Harda	25.72	26.92	30.65	33.95	17.47	18.34	26.85	33.03
7	Indore	23.66	16.26	27.59	27.32	31.72	16.22	17.3	26.17
8	Mandsaur+Nimach	29.24	30.67	21.84	34.95	35.52	23.48	26.19	44.86
9	Raisen	26.6	26.72	17.28	29.72	18.14	22.9	27.37	41.99
10	Rajgarh	22.3	35.95	30.51	33.01	30.4	50.77	38.8	40.31
11	Ratlam	31.87	31.23	32.17	36.37	37.02	23.05	100.21	75.03
12	Sagar	17.6	18.23	21.69	18.71	18.94	13.63	37.22	26.07
13	Sehore	22.85	13.22	17.43	25.62	32.33	23	32.1	34.79
14	Shajapur	18.12	15.22	21.36	20.62	31.77	24.41	47.12	37.18
15	Ujjain	28.42	23.63	34.24	31.57	31.35	16.42	19.44	28.97
16	Vidisha	34.19	9.81	11.79	21.77	31.58	19.63	42.91	43.89
	Average	**27.28**	**26.06**	**23.64**	**30.54**	**30.62**	**22.39**	**36.46**	**40.79**

3.4.1.3 Productivity

The variability in the productivity in soybean and maize in different major soybean producing districts in Madhya Pradesh was also observed in different periods of the study and found that the variability in productivity of soybean was found to be more in period of 1980s (27.28%) as compared to 1990s (26.06%) and 2000 (23.64%). In overall period it was found to be 30.54 per cent and ranged between 18.71 per cent (Sagar) to 49.24 per cent (Chhindwara). As regards to different districts are concerned in 80s the maximum variability in yield of soybean was found in Chhindwara i.e. 48.36 per cent in 1980s, 55.81 per cent 1990s and 34.24 per cent in 2000s.

The variability of yield of maize was found to be more than the variability in yield of soybean in the period 1980s, 2000s and overall period (1980s to 2000s) and found less than the variability in the yield of soybean in 1990s amongst different major soybean producing districts the variability in the yield of maize was ranged between 17.47 per cent (Hoshangabad) to 59 .12 per cent (Chhindwara). In 1990s it was found between 15.73 per cent (Dewas) to 50.77 per cent (Rajgarh), while in 2000 it was ranged between 17.30 per cent (Indore) to 100.21 per cent ((Ratlam). In overall period (1980s to 2000s) it was found between 26.07 per cent (Sagar) to 70.70 per cent (Chhindwara).

3.4.2 Mustard vis-à-vis Wheat

The variability in area, production and yield of Mustard and its competing crop Wheat have also been observed during the periods 1980s, 1990s, 2000 and 1980s – 2000.

3.4.2.1 Area

The variability in area of Mustard and its competing crop i.e. Wheat observed during the periods 1980s, 1990s, 2000 and overall period 1980s - 2000 and revealed that variability in area of mustard was found more in 1980s as compared to 1990s and 2000 in all the major Mustard growing district of Madhya Pradesh (Table 3.24).

Table 3.24: Variability in area of mustard and its competing crop Wheat in major Mustard producing district of M.P.

(%)

S.No.	Districts	Mustard Area CV				Wheat area CV			
		1980s	1990s	2000s	1980s-2000	1980s	1990s	2000s	1980s-2000
1	Bhind	31.73	17.03	19.37	49.74	5.55	13.61	8.82	12.32
2	Gwalior	72.93	26.22	29.23	51.34	5.58	9.20	11.53	10.53
3	Mandla+Dindori	12.89	19.61	8.14	17.24	13.38	26.40	35.55	30.99
4	Mandsour+Nimuch	132.9	39.19	48.65	75.9	25.83	22.32	21.49	26.87
5	Morena+Sheopur Kalan	26.87	10.48	18.76	23.92	8.94	16.90	6.97	20.62
6	Shivpuri	70.61	15.41	40.53	62.48	21.15	7.49	16.18	19.15
	Average	57.99	21.32	27.45	46.77	5.10	11.18	7.02	11.14

The average variability in area of mustard was found to be more in 1980s (57.99%) as compared to 1990s (21.32%) and 2000s (27.45%). In overall period (1980s to 2000s) the variability in area of mustard in different major mustard growing district was found to be 46.77 per cent and ranged between 17.24 per cent (Mandla) to 75.90 per cent (Mandsaur). In 1980s the variability in area of mustard was ranged between 12.89 per cent (Mandla) to 132.90 per cent (Mandsaur), while in 1990s and 2000s it was between 10.48 per cent (Morena) to 39.19 per cent (Mandsaur) and 8.14 per cent in (Mandla) to 48.65 per cent (Mandsaur) respectively.

As regards to the variability in wheat in different major mustard growing districts in Madhya Pradesh here also the variability in area of wheat was found to be more in 2000s (35.55%) as compared to 1990s (26.40%) and 1980s (25.83%). In overall period it was found to be 11.14 per cent and ranged between 10.53 per cent (Gwalior) to 30.99 per cent (Mandla+Dindori). It is also clear from the data that the variability in area of mustard was found to be more than the variability in area of wheat in all the major mustard growing districts of Madhya Pradesh. The variability of area of mustard as well as area of wheat in

Mandsaur district was found to be more in all the periods of the study amongst different major mustard growing districts of Madhya Pradesh.

3.4.2.2 Production

The average variability in production of mustard was found to be more in 1980s (78.13%) as compared to 1990s (31.68%) and 2000s (37.35%). In overall period (1980s to 2000s) the variability in production of mustard in different major mustard growing district was found to be 60.48 per cent and ranged between 34.75 per cent (Morena) to 84.05 per cent (Mandsaur). In 1980s the variability in production of mustard was ranged between 43.36 per cent (Morena) to 145.81 per cent (Mandsaur), while in 1990s and 2000s it was between 19.31 per cent (Shivpuri) to 45.28 per cent (Mandla) and 12.68 per cent in (Mandla) to 53.34 per cent (Mandsaur) respectively.

Table 3.25: Variability in production of mustard and its competing crop Wheat in major Mustard producing districts of M.P.

(%)

S.no.	Districts	Mustard Production CV				Wheat production CV			
		1980s	1990s	2000s	1980s-2000	1980s	1990s	2000s	1980s-2000
1	Bhind	57.12	25.66	38.89	73.09	20.57	19.758	23.59	22.09
2	Gwalior	83.56	37.01	43.41	58.55	22.59	15.048	22.28	25.77
3	Mandla+Dindori	49.04	45.28	12.68	37.56	24.32	40.922	9.28	29.69
4	Mandsour+Nimuch	145.81	44.8	53.34	84.05	25.73	34.426	39.66	40.43
5	Morena+Sheopur Kalan	43.36	18.02	27.18	34.75	24.64	16.293	14.36	22.37
6	Shivpuri	89.91	19.31	48.62	74.87	31.65	10.96	27.73	29.35
	Average	78.13	31.68	37.35	60.48	24.92	22.90	22.82	28.28

As regards to the variability in production of wheat in different major mustard growing districts in Madhya Pradesh here also the variability in production of wheat was found to be more in 1980s (24.92%) as compared to 2000s (22.82%) and 1990s (22.90%). In overall period it was found to be 28.28 per cent and ranged between 22.37 per cent (Morena) to 40.43 per cent (Mandsaur). It is also clear from the data that the variability in production of mustard was found to be more than the variability in production of wheat in all the periods of the study and also in all the major mustard growing districts of Madhya Pradesh. The variability of production of mustard as well as the variability production of wheat in Mandsaur district was found to be more in all the periods of the study and amongst different major mustard growing districts of Madhya Pradesh except during 1990s.

3.4.2.3 Productivity

The average variability in productivity of mustard was also found to be more in 1980s (33.06%) as compared to 1990s (18.14%) and 2000s (18.77%). In overall period (1980s to

2000s) the variability in productivity of mustard in different major mustard growing district was found to be 29.04 per cent and ranged between 19.47 per cent (Morena+Sheopur Kalan) to 41.84 per cent (Gwalior). In 1980s the variability in productivity of mustard was ranged between 20.68 per cent (Morena) to 62.88 per cent (Gwalior), while in 1990s and 2000s it was between 7.63 per cent (Shivpuri) to 34.67 per cent (Mandla) and 11.78 per cent in (Mandla) to 24.86 per cent (Bhind) respectively.

Table 3.26: Variability in productivity of mustard and its competing crop Wheat in major Mustard producing district of M.P.

(%)

S. No.	District	Mustard Yield CV				Wheat yield CV			
		1980s	1990s	2000s	1980s-2000	1980s	1990s	2000s	1980s-2000
1	Bhind	27.13	15.39	24.86	34.47	28.3	13.69	15.36	20.26
2	Gwalior	62.88	20.72	20.71	41.84	26.42	12.11	14.98	25.42
3	Mandla+Dindori	38.48	34.67	11.78	30.58	27.46	32.96	5.42	25.58
4	Mandsour+Nimuch	25.55	13.86	18.08	24.93	36.82	24.18	49.97	55.41
5	Morena+Sheopur Kalan	20.68	16.55	16.09	19.47	35.06	12.01	16.06	24.4
6	Shivpuri	23.61	7.63	21.08	22.95	26.18	6.94	16.07	19.21
	Average	33.06	18.14	18.77	29.04	30.04	16.98	19.64	28.38

As regards to the variability in productivity of wheat in different major mustard growing districts in Madhya Pradesh here also the variability in productivity of wheat was found to be more in 1980s (30.04%) as compared to 2000s (19.64%) and 1990s (16.98%). In overall period it was found to be 28.38 per cent and ranged between 19.21 per cent (Shivpuri) to 55.41 per cent (Mandsaur). It is also clear from the data that the variability in productivity of mustard was found to be more than the variability in productivity of wheat in all the periods of the study and also in all the major mustard growing districts of Madhya Pradesh except in 2000s in which the variability in productivity of mustard was less than the variability in productivity of wheat.

3.5 Variability in Annual Prices of Selected Oilseeds and their Competitive Crops:

The variability in annual prices of selected oilseeds (soybean & mustard) and their competitive crops (Maize & Mustard) during the period of last 10 years i.e. 2001-02 to 2010-11 have also been observed for selected districts and for Madhya Pradesh.

3.5.1 Soybean:

The rate of soybean has been found to be increased from Rs. 943/q (2001-02) to Rs. 1879/q (2010-11) showed Rs.99.15/q change in 2010-11 over the year 2001-02 with the variation of 27.31 percent during the period, while the price of maize increased from Rs. 424/q (2001-02) to Rs. 922/q (2010-11) with the variation of 24.66 per cent. The variation in

rate was found more in case of soybean (27.31%) as compared to maize (24.66%) (Table 3.27). The rate of soybean was found maximum in the year 2008-09 (Rs 2133/q) and minimum in the year 2001-02 (Rs 943/q), while in case of maize the rate was found more in 2010-11 (Rs 922/q) and minimum in the year 2001-02 (Rs 424/q).

Table 3.27: Variability in Annual Prices of Soybean Vs Maize in Selected districts of M.P.

Years	Soybean	Maize
2001-02	943	424
2002-03	1269	820
2003-04	1313	637
2004-05	1362	454
2005-06	1111	868
2006-07	1197	661
2007-08	1585	714
2008-09	2014	880
2009-10	2133	861
2010-11	1879	922
Δ 2010-11 over 2001-02	**99.15**	**117.37**
Standard Deviation	**404.38**	**178.57**
Coefficient of Variance (%)	**27.31**	**24.66**
Regression Coefficient	**113.48**	**39.74**

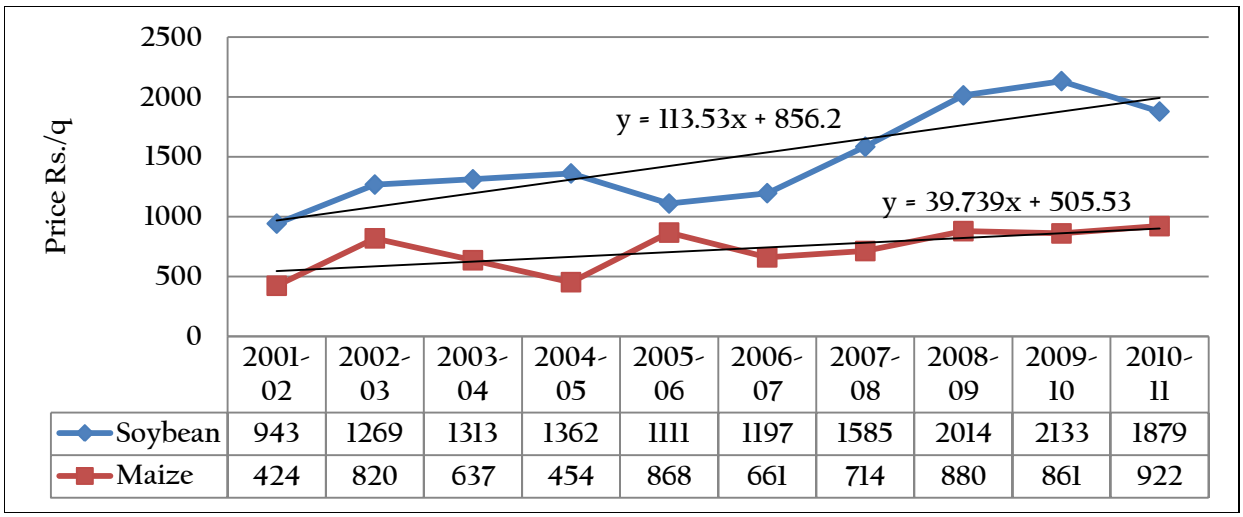

Fig. 3.17: Trend of price of Soybean & Maize in M.P.

3.5.2 Mustard:

The price of wheat as well as mustard showing increasing trend over the period 2001 - 02 to 2010 -11. As regards to variation in price of mustard it was observed that the variation in price of mustard (77.74%) was found less as compared to wheat (32.06%) but the rate of change in price per year is concerned the price of mustard (Rs111.69/q/year) increased more as compared to wheat (Rs. 71.88/q/year).

Table 3.28: Variability in Annual Prices of Mustard Vs Wheat in Selected districts of M.P.

Year	Wheat	Mustard
2001-02	610	1221
2002-03	621	1403
2003-04	639	1512
2004-05	656	1598
2005-06	713	1536
2006-07	954	1519
2007-08	984	1999
2008-09	1078	2454
2009-10	1165	2137
2010-11	**1124**	**2042**
Δ 2010-11 over 2001-02	**84.30**	**67.22**
Standard Deviation	**26.65**	**22.41**
Coefficient of Variance (%)	**32.06**	**77.74**
Regression Coefficient	**71.88**	**111.69**

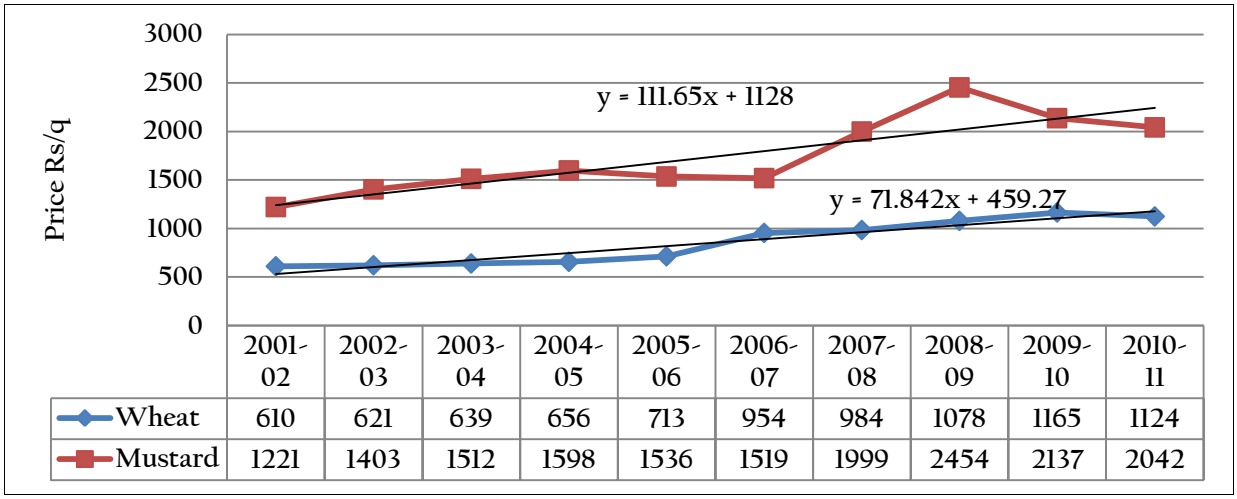

Fig. 3.18: Trend of price of Mustard & Wheat in M.P.

3.6 Factors Underlying Changes in Cropping Pattern

Cropping pattern is governed by various factors such as price of input and output, agro-climatic conditions, market forces and technological development along with irrigated potential in the area, which determine their makeup. Oilseeds are mainly grown in rain-fed areas in the states these crops are best suited to soils of Madhya Pradesh. The oilseed production preferred by the farmers as more profitable over the other crops and due to low input cost technologies the most of the marginal and small farmers who are having rain-fed areas and marginal lands prefer oilseeds instead of cereal and pulses crops in their cropping pattern. The de oiled cake by product of oilseeds also remunerative and generate extra income (Mustard) which leads to enhance the profitability of the farmers in general and contribute significant role in the state economy (Soybean) in particular having tremendous export potential. There are various other soybean by products available in the market which fetches very good price in the international market leading to enhance export earnings and fulfilling the demand.

CHAPTER IV

PROBLEMS AND PROSPECTS OF OILSEED PRODUCTION: AN EMPIRICAL ANALYSIS

The main features of sample households, their land ownership pattern, cropping pattern, production, retention and marketed surplus pattern of major oilseeds (soybean & mustard) state Madhya Pradesh were explained in this chapter. The comparative economics/profitability of soybean & mustard *vis-a-vis* competing crops (Maize & Wheat), access to improved technology, markets and marketing pattern along with sources of technology and market information of both the oilseeds were also covered in this chapter. Constraints in cultivation of Soybean & Mustard and suggestions for improving production and productivity of oilseeds were also dealt in detail in this chapter.

4.1 SOYABEAN

4.1.1 Main Features of Sample Soybean Growers

The main features of sample soybean grower includes socio economic status, land use pattern, terms of leased land, irrigation facilities, cropping pattern and average yield obtained by an average soybean grower related to different size of farms (marginal, small, medium and large).

4.1.1.1 Socio-economic Status:

The socio-economic status of sample HHs related to different size of farms were recorded under different indicators such as age, main occupation, education, average family size, social groups and head of HHs and presented in table 4.1. The data shows that the average age of the respondents at overall level was found to be 48 years and almost all the households across all the size of holdings doing crop farming only 11 and 66 percent household involved themselves as farm labour and other services respectively at overall level. The 45 percent of the marginal farmers and 10 percent small farmers were involved themselves as farm labour, while none of the farmer from the medium and large categories found to be involved as farm labour. In others occupations 70, 70, 65, 55 percent of the households have other occupations in large, medium, small and marginal categories respectively. On an average at overall level an average HH passed 8 years in the school. The years in school was found highest in case of large farm family (11 years) followed by medium (8 years), small (7 years) and marginal (5 years) farm family.

Table 4.1: Socio-economic Status of sample soybean growers

Indicators	Marginal	Small	Medium	Large	All Farms
Age (years)	47.2	46.5	48.32	50.1	48.03
Main Occupation (%)					
Crop farming	100	100	100	100	100
Service	0	0	0	0	0
Farm Labour	45	10	0	0	11
Others	55	65	70	70	66
Education (years of schooling)	5	7	8	11	8
Average Family Size (no)	5	5	7	10	7
Male	3	3	4	6	4
Female	2	2	3	4	3
Social Groups					
General	3 (5)	6 (10)	12 (20)	24 (40)	11.25 (18.75)
SC/ST	6 (10)	9 (15)	5 (8.33)	0 (0)	20 (8.33)
OBC	51 (85)	45 (75)	43 (71.66)	36 (60)	175 (72.91)
Others	-	-	-	-	-
Head of household (%)					
Male	95	90	95	100	95
Female	5	10	5	0	5

The average family size was recorded as 7 at overall level it was found highest in case of large (10 members) followed by medium (7 members) and marginal and small (5-5 member) farmers. The average male female ratio at overall farms was found 4 : 3. Among the total HHs the maximum number of respondents were from OBC category (72.91%) followed by General (18.75%) and SC/ST's (8.33%). The maximum number of General categories farmers were found in case of large farmers and the number of General category farmers increases as size of category increases, while in case of SC/ST's and OBC the maximum number of farmers were found from the marginal and small categories. It is also observed from the data that in 95 percent cases the male members were found as head of household, while in 5 percent cases female were found as head of household.

4.1.1.2 Land Ownership Pattern

The land ownership pattern of sample HHs is presented in Table 4.2. In the land ownership, the data on total owned land, area in the cultivation, leased in land, leased out land and total operational holdings were recorded across all the categories of the farmers. In all the indicators the area under irrigated and un-irrigated condition were also recorded.

Table 4.2: Land ownership pattern on sample soybean growers (ha)

Indicators	Marginal	Small	Medium	Large	All Farms
1. Total owned land					
Irrigated	0.58	0.94	3.54	8.85	3.48
Un-irrigated	0.35	0.69	0.88	3.31	1.31
2. Area under cultivation					
Irrigated	0.58	0.94	3.54	8.85	3.48
Un-irrigated	0.35	0.48	0.88	3.31	1.26
3. Leased-in land					
Irrigated	0	0.04	0.26	0.63	0.23
Un-irrigated	0	0	0.04	0.00	0.01
4. Leased-out land					
Irrigated	0	0	0	0	0.00
Un-irrigated	0	0	0	0	0.00
5. Total Operational holding (2+3-4)					
Irrigated	0.58	0.98	3.80	9.49	3.71
Un-irrigated	0.35	0.48	0.92	3.31	1.27
Total Operational holding	**0.93**	**1.47**	**4.73**	**12.79**	4.98

The land ownership pattern of the sample HHs showed that at overall level the irrigated and un-irrigated land owned was 3.48 and 1.31 hectare respectively. On an average land owned by the marginal, small, medium and large farmers found to be 0.58, 0.94, 3.54 and 8.85 hectare irrigated and 0.35, 0.69, 0.88 and 3.31 hectare un-irrigated land, respectively. The area owned by the sample HHs was found to be cultivated by the cent per cent farmers. The 0.04, 0.26 and 0.63 irrigated area was found to be leased-in under small, medium and large categories, respectively, 0.04 ha un-irrigated land was leased-in by the medium farmers only. Leasing out land was not found in practice. The total operational area of marginal, small, medium and large categories was found to be 0.58, 0.98, 3.80 and 9.49 ha under irrigated and 0.35, 0.48, 0.92 and 3.31 under un-irrigated situations, respectively. Total operational holding was found to be 0.93, 1.47, 4.73 and 12.79 ha under above mentioned categories and at overall level it was 4.98 ha.

4.1.1.3 Terms of Lease

The terms of lease for fixed money, fixed produce, share cropping and others along with incidence of lease in terms of percent area leased and percent of households leasing in were recorded and terms of lease (rent/amount) was also recorded and presented in Table 4.3. In all only 4.00 per cent of the sample farmers lease-in land for fixed money at overall level, while 6.00 per cent of medium followed by large (5.00%) and small (3.00%) HHs obtained leased in land for fixed money basis i.e. Rs. 10613.28 per ha, Rs. 12350.00 and Rs.12350.00 per ha per year respectively.

Table 4.3: Terms of lease

Farm Size	Incidence of lease (%)		Terms of Leasing (%)				Terms of Lease (Rent/amount)	
	% area leased-in	% HHs leasing in	For fixed money	For fixed produce	Share Cropping	Others	Fixed money	Fixed produce
Marginal	0	0	0	0	0	0	0	0
Small	3	2	100	0	0	0	12350	0
Medium	6	8	100	0	0	0	10613.3	0
Large	5	21	100	0	0	0	12350	0
All farms	4	8	75	0	0	0	8828.32	0

4.1.1.4 Sources of Irrigation

Area under irrigation the total cropped area along-with various sources of irrigation such as surface water, ground water, tanks and others were recorded across all size of categories and at overall level and presented in Table 4.4.

Table 4.4: Sources of Irrigation in different size of farms of soybean growers

Indicators	Marginal	Small	Medium	Large	All Farms
Area under irrigation (% to total cropped area)	45.99	51.95	46.65	70.66	53.82
Sources of irrigation (%)					
Surface	40	30	15	13	24.5
Groundwater	60	70	85	87	75.5
Tanks	0	0	0	0	0
Others	0	0	0	0	0

Major sources of irrigation in the area under study were found to be ground water (75.5%) and surface water (24.5%). Out of total cropped area, 53.81 per cent of area was found under irrigation. The maximum area under irrigation was found under large farmers (70.66%), while in other categories it was found to be almost 50 per cent.

4.1.1.5 Cropping Pattern

The cropping pattern of sample households in various seasons *(Kharif, Rabi* and summer) and their major crops along with irrigated and un-irrigated area under the crop or crop groups and vegetables were recorded and presented in Table 4.5.

At overall level in *Kharif* season 4.17 ha area was recorded to be cultivated, out of this 59.90 per cent area was irrigated. The major crops grown in Kharif season were Soybean (66.05%) followed by Cotton (14.25%), Maize (8.32%), Rice (2.88%), Groundnut (0.89 %), others (1.31%). The area under pulses was found 6.30 per cent. In Rabi season, total area cultivated was 4.05 ha and area under irrigation was 73.70 per cent.

Table 4.5: Cropping Pattern of sample soybean growers in different size of farms

(ha)

Season/Crop	Marginal	Small	Medium	Large	All Farms
Rice	**Kharif Crops**				
Irrigated	0.01	0.03	0.10	0.28	0.11
Un-irrigated	0.00	0.01	0.02	0.12	0.04
Total	0.01 (1.76)	0.04 (3.13)	0.12 (2.70)	0.40 (3.94)	0.14 (2.88)
Maize					
Irrigated	0.03	0.04	0.31	0.66	0.26
Un-irrigated	0.03	0.04	0.19	0.20	0.12
Total	0.06 (7.28)	0.08 (6.25)	0.50 (11.26)	0.86 (8.48)	0.38 (8.32)
Pulses					
Irrigated	0.01	0.20	0.08	0.24	0.13
Un-irrigated	0.01	0.01	0.05	0.11	0.05
Total	0.02 (2.43)	0.21 (16.41)	0.13 (2.93)	0.35 (3.45)	0.18 (6.30)
Oilseeds					
Groundnut					
Irrigated	0.00	0.01	0.05	0.10	0.04
Un-irrigated	0.00	0.00	0.02	0.02	0.01
Total	0.00 (0.00)	0.01 (0.78)	0.07 (1.58)	0.12 (1.18)	0.05 (.89)
Soybean					
Irrigated	0.28	0.44	0.64	1.93	1.07
Un-irrigated	0.31	0.33	1.48	4.38	1.63
Total	0.59 (71.56)	0.77 (60.16)	3.12 (70.27)	6.31 (62.23)	2.70 (66.05)
Others					
Irrigated	0.01	0.01	0.09	0.10	0.05
Un-irrigated	0.00	0.00	0.01	0.00	0.00
Total	0.01 (1.21)	0.01 (0.78)	0.10 (2.25)	0.10 (0.99)	0.06 (1.31)
Cotton	0.13 (15.77)	0.16 (12.50)	0.40 (9.01)	2.00 (19.72)	0.67 (14.25)
Total Kharif irrigated	0.47 (57.55)	0.89 (69.53)	2.67 (60.14)	5.31 (52.37)	2.34 (59.90)
Total Kharif un-irrigated	0.35 (42.45)	0.39 (30.47)	1.77 (39.86)	4.83 (47.63)	1.84 (40.10)
Total Kharif	0.82 (100) ((50.75))	1.28 (100) ((50.20))	4.44 (100) ((50.80))	10.14 (100) ((45.47))	4.17 (100) ((49.31))

Cont.....

Rabi Crops					
Wheat					
Irrigated	0.42	0.52	2.70	4.19	1.96
Un-irrigated	0.12	0.18	0.63	2.19	0.78
Total	0.54 (69.23)	0.70 (56.91)	3.33 (81.62)	6.38 (63.11)	2.74 (67.72)
Pulses					
Irrigated	0.15	0.37	0.42	2.15	0.77
Un-irrigated	0.08	0.15	0.21	1.06	0.38
Total	0.23 (29.49)	0.52 (42.28)	0.63 (15.44)	3.21 (31.75)	1.15 (29.74)
Vegetables	0.01 (1.28)	0.01 (0.81)	0.10 (2.45)	0.23 (2.27)	0.09 (1.71)
Other rabi crops	0.00 (0.00)	0.00 (0.00)	0.02 (0.49)	0.29 (2.87)	0.08 (0.84)
Rabi irrigated	0.58 (74.36)	0.90 (73.17)	3.24 (79.41)	6.86 (67.85)	2.90 (73.70)
Rabi un irrigated	0.20 (25.64)	0.33 (26.83)	0.84 (20.59)	3.25 (32.15)	1.16 (26.30)
Total rabi	0.78 (100) ((48.01))	1.23 (100) ((948.24))	4.08 (100) ((46.68))	10.11 (100) ((45.34))	4.05 (100) ((47.07))
Summer crops	0.00	0.00	0.20	2.00	0.55
Sugarcane	0.02	0.04	0.02	0.05	0.03
Summer crops & sugarcane	0.02 ((1.23))	0.04 ((1.57))	0.22 ((2.52))	2.05 ((9.19))	0.58 ((3.63))
Gross cropped area	1.62 ((100))	2.55 ((100))	8.74 ((100))	22.30 ((100))	8.80 ((100))
Cropping intensity	174.80	173.97	184.92	174.30	177.00

Figure in the parenthesis shows percentages to respective season's while in double brackets show percentages to gross cropped area.

Major crops grown in this season were Wheat (67.72%) followed by vegetables (1.71%), others (0.84%). The area under pulses was found 29.74 per cent and gram was found to be a main crop under pulses. The area in summer season and sugarcane was found to be 0.58 ha. The gross cropped area and cropping intensity were found to be 8.80 ha and 177.00 per cent respectively.

Gross cropped area under marginal, small, medium and large size groups was recorded as 1.62, 2.55, 8.74 and 22.30 respectively and cropping intensity was 174.80, 173.97, 184.92 and 174.30 per cent respectively.

4.1.1.6 Average yield of major crops

The average yield of major crops and crop groups grown in *Kharif*, *Rabi* and summer under irrigated and un-irrigated situations was noted and presented in Table 4.6. it is observed from the data that at overall level in *Kharif* season the yield of rice, maize,

groundnut, soybean and pulses was found to be 40.54, 23.90, 12.24, 11.73 and 14.45 q/ha under irrigated situation while these were found to be 19.98, 16.31, 5.99, 11.21 and 9.84 q/ha under un-irrigated situation respectively. The yield of cotton and vegetables was found to be 26.37 and 161.50 q/ha. In Rabi season the yield of wheat and pulses under irrigated and un-irrigated situation was found to be 50.85 & 14.98 and 33.63 & 9.46 q/ha respectively. The yield of vegetables was recorded 161.50 q/ha, while yield of sugarcane was found to be 134.27 q/ha.

Table 4.6: Average yield of major crops on sample households (q/ha)

Season/Crop	Marginal	Small	Medium	Large	All Farms
Kharif					
Rice					
Irrigated	38.88	42.23	38.88	42.18	40.54
Un-irrigated	0.00	27.67	24.42	27.85	19.98
Maize					
Irrigated	19.50	24.72	26.53	24.83	23.90
Un-irrigated	13.58	16.78	19.61	15.26	16.31
Pulses					
Irrigated	12.33	14.72	16.13	14.63	14.45
Un-irrigated	8.72	10.40	8.24	12.00	9.84
Oilseeds					
Groundnut					
Irrigated	0.00	15.95	16.13	16.88	12.24
Un-irrigated	0.00	7.20	8.90	7.88	5.99
Soybean					
Irrigated	10.44	11.35	12.11	13.00	11.73
Un-irrigated	10.46	10.36	12.07	11.95	11.21
Cotton	24.95	26.23	28.22	26.08	26.37
Vegetables	30.67	32.17	42.31	35.86	35.25
Rabi					
Wheat					
Irrigated	47.64	48.86	53.55	53.36	50.85
Un-irrigated	32.13	32.43	34.35	35.60	33.63
Pulses					
Irrigated	13.63	14.37	16.03	15.87	14.98
Un-irrigated	8.85	8.43	11.00	9.57	9.46
Vegetables	150.00	176.67	169.48	149.84	161.50
Summer crops	9.50	9.86	11.32	10.44	10.28
Sugarcane	0.00	0.00	282.24	254.86	134.27

4.1.2 Production, Retention and Marketed Surplus Pattern of Oilseeds

The production, retention and marketed surplus pattern of soybean across all the categories were depicted in Table 4.7. data reveled that the production of soybean was found to be 6.21, 7.16, 23.88 and 77.36 quintals per farm in case of marginal, small, medium and large categories, respectively, out of which 76.05, 71.25, 66.14 and 63.45 per cent of total production

was found to be sold in the average price of Rs. 2865, 2877, 2908 and 2959 per quintal respectively in the above mentioned categories.

Table 4.7: Production, retention and sale pattern (q) of Soybean in different size of farms

Category	Kharif Oilseed Soybean			
	Production	Retention	Sold	Price (Rs/q)
Marginal	6.21 (100)	1.49 (23.95)	4.72 (76.05)	2865
Small	7.16 (100)	2.06 (28.73)	5.11 (71.27)	2877
Medium	23.88 (100)	8.08 (33.86)	15.79 (66.14)	2908
Large	77.36 (100)	28.27 (36.55)	49.09 (63.45)	2959
All farms	28.65 (100)	9.98 (34.81)	18.68 (65.19)	2903

Figure in parenthesis shows percent to production

As the size of farms increases the retention for seeds increased while quantity sold decreased. At overall level the quantity of soybean produced, retained and sold in the market was 28.65 quintals, 9.98 quintals (34.81%) and 18.68 quintals (65.19%) at the average rate of Rs. 2903.00/q.

4.1.3 Comparative Economics

The comparative profitability and profitability *vis –a-vis* risk in soybean have also been considered for soybean and its competitive crop i.e. maize.

4.1.3.1 Profitability of Soybean vis-à-vis Maize

The per ha total operational cost, yield, price, cost of cultivation/ha, cost of production/q, net income and benefit cost ratio have been computed for soybean vis-à-vis maize presented in Table 4.8.

Soybean has competition with maize in the study area, net income of soybean in case of marginal, small, medium, large and overall categories of the farmers was recorded as Rs. 18388.92/-, 18179.57/-, 19783.84/-, 20454.74/- and 19201.77/- per ha, while in case of maize this was recorded as Rs. 8560.52/-, 14710.54/-, 16315.04/-, 13370.40/- and 13,239.13/- per hectare, respectively. Soybean was found more profitable than its competing crop maize. The Benefit: Cost ratios obtained under soybean cultivation were 2.37, 2.19, 2.14, 2.13 and 2.21, while in case of maize, the ratios recorded were 1.82, 2.24, 2.31, 2.03 and 2.16 among above mentioned categories, respectively.

Table 4.8: Profitability of Soybean *vis –a-vis* Maize (Rs/ha)

Cost items	Marginal	Small	Medium	Large	All Farms
Soybean					
Operational costs					
Seed	2747.08	2870.45	3008.21	3172.76	2949.63
Fertiliser & manure	2559.79	3054.45	3421.19	3404.93	3110.09
Insecticides & pesticides	1919.25	2343.33	3261.00	3500.67	2756.06
Human labour					
Family	642.50	600.00	705.00	732.50	670.00
Hired	228.00	648.00	930.00	1257.00	765.75
Machine labour	2343.50	2497.16	2638.74	2746.48	2556.47
Bullock labour	- -	- -	- -	- -	- -
Irrigation	- -	- -	- -	- -	- -
Harvesting & threshing	2260.83	2391.67	2397.50	2273.33	2330.83
Interest on working capital	84.02	94.70	107.35	108.63	98.67
1. Total Operational Costs	12784.98	14499.76	16468.98	17196.30	15237.50
Yield (Quintals)	10.57	11.02	11.90	12.35	11.46
Price	2865.50	2877.21	2908.44	2959.33	2902.62
2. Value of main-product	30287.43	31755.54	35219.11	36556.00	33454.52
3. Value of by-product	886.47	923.79	1033.70	1095.03	984.75
Net Income (2+3) – (1)	18388.92	18179.57	19783.84	20454.74	19201.77
Cost of production/q	1209.38	1316.17	1383.95	1392.41	1325.48
Cost of production/ha	12784.98	14499.76	16468.98	17196.30	15237.50
B:C Ratio	2.37	2.19	2.14	2.13	2.21
Maize					
Operational costs					
Seed	461.27	451.49	517.37	554.39	496.13
Fertiliser & manure	2792.43	2878.63	3007.56	3153.90	2958.13
Insecticides & pesticides	1195.00	1203.16	1325.92	1340.00	1266.02
Human labour					
Family	922.50	947.37	906.12	779.69	888.92
Hired	627.00	862.11	1006.53	1086.47	895.53
Machine labour	1175.63	2289.47	2502.95	2718.60	2171.66
Bullock labour	- -	- -	- -	- -	- -
Irrigation	- -	- -	- -	- -	- -
Harvesting & threshing	1970.00	2010.53	2030.61	2064.29	2018.86
Interest on working capital	13.002	14.06	15.78	17.09	14.99
Total Operational Costs	9156.83	10656.81	11312.85	11714.43	10710.23
Yield (Quintals)	15.89	20.55	22.49	19.90	19.71
Price	1048.50	1163.16	1163.47	1192.24	1141.84
Value of main-product	16665.63	23905.96	26165.94	23723.24	22615.19
Value of by-product	1051.72	1461.40	1461.95	1361.59	1334.16
Net Income	8560.52	14710.54	16315.04	13370.40	13239.13
Cost of production/q	576.09	518.51	503.03	588.73	546.59
Cost of production/ha	9156.83	10656.81	11312.85	11714.43	10710.23
B:C Ratio	1.82	2.24	2.31	2.03	2.16

The yield of soybean obtained under marginal, small, medium, large and overall categories was 10.57, 11.02, 11.90, 12.35, and 11.46 q/ha and cost of production to obtain a quintal of soybean was recorded as Rs. 1209.38/-, 1316.17/-, 1383.59/-, 1392.41/- and 1325.48,

respectively. In case of maize, the yield obtained was 15.89, 20.55, 22.49, 19.90 and 19.71 per hectare and the cost of production was recorded as Rs. 576.09/-, 518.51/-, 503.03/-, 558.73/- and 546.59/- per quintal, respectively among above mentioned categories. The cost of cultivation per hectare in case of soybean was documented as Rs. 12784.89/-, 14499.76/-, 16468.98/-, 17169.30/- and 15237.50/- while in case of maize it was Rs. 9156.83/-, 10656.81/-, 11312.85/-, and 11714.43/- and 10710.23/- respectively among the categories mentioned above.

4.1.3.2 Profitability vis-à-vis risk in soybean production

The acreage variability, yield, price and net income risk have been calculated for soybean and maize crops and presented in Table 4.9.

In soybean, acreage variability, yield, price and net income risk at overall level was found to be 50.25, 16.33, 14.99 and 15.66 per cent, while in case of maize it was found to be 122.29, 19.66, 8.17 and 13.92 per cent, respectively. The maximum variability was found in case of area in both the crops and yield risk in case of maize. At overall more price and net income variability was found in soybean as compared to maize, while the acreage variability was found to be more in maize (122.29%) as compare to soybean (50.25%). This was found true for all the categories of farms with minor variation.

Table 4.9: Profitability vis-à-vis Risks[1] in Soybean production

Indicators	Marginal	Small	Medium	Large	All Farms
Main Crop	**Soybean**				
Acreage variability	30.65	66.27	68.62	35.44	50.25
Yield Risk	17.67	15.36	18.48	13.81	16.33
Price Risk	13.83	22.11	10.80	13.21	14.99
Net Income Risk	15.75	18.73	14.64	13.51	15.66
Main Competing Crop	**Maize**				
Acreage variability	170.47	165.61	72.61	80.45	122.29
Yield Risk	23.90	20.69	15.15	18.89	19.66
Price Risk	7.16	5.87	8.71	10.95	8.17
Net Income Risk	15.53	13.28	11.93	14.92	13.92

Among different size of holdings, the acreage variability, yield, price and net income risk of soybean were found maximum in medium (68.62%), medium (18.48%), small (22.11%) and small (18.73%) and minimum in large (35.44%), large (13.81%), medium (10.80%) and large (13.51%) categories. In case of maize the maximum acreage variability, yield, price and net income risk were found in marginal (170.47%), marginal (23.90%), large (10.95%) and large

[1] *Compute coefficient of variation of area, yield, price and net income of main oilseeds and main competing crops*

(14.92%) and minimum in medium (72.61%), medium (15.15%), small (5.87%), medium (11.93%) as compared to other categories.

4.1.4 Improved Technology and markets for Soybean

Accesses to improved technology, market and yield gap analysis was also done for soybean.

4.1.4.1 Access to improved Technology and markets for Soybean

The data on access to improved technology such as use of HYV, source of seed, use of recommended doses of fertilizers and awareness about minimum support price, rate of soybean and maize under MSP, price realization and marketing problems were analyzed for all the category and presented in Table 4.10

Table 4.10: Access to Improved Technology and Markets (%)

Particulars	Marginal	Small	Medium	Large	All Farms
Use of HYV					
Yes	100	100	100	100	100
No	0	0	0	0	0
Area under HYV (% to total area under oilseeds)					
Source of Seed					
Own	90.00	86.66	73.33	70.00	70.00
Market purchased	10	13.33	26.66	30	20.00
Use of recommended doses of fertilizers					
Yes	40	46.66	48.33	55	47.50
No	38.33	33.33	30	20	30.42
Don't know	21.66	20	21.66	15	19.58
Awareness about MSP					
Yes	71.66	75	78.33	83.33	77.08
No	28.33	25	21.66	16.66	22.91
MSP (Rs/q) – 2011-12					
Soybean	1650	1650	1650	1650	1650.00
Maize	980	980	980	980	980.00
Price realization					
≥MSP	100	100	100	100	100
<MSP	0	0	0	0	0
Marketing problems					
Yes	16.66	15	13.33	11.66	14.16
No	83.33	85	86.66	88.33	85.83

All the respondents reported that they have access to improved technology such as use of HYV, 70 per cent reported that they use their own seed while 20 per cent reported that seed was purchased from other sources, 47.50 per cent of the sample farmers were using recommended doses of fertilizers, 30 per cent were not using the recommended doses of fertilizers while 20 per cent did not know about the recommended doses of fertilizers. The 77 per cent respondents reported to have awareness about Minimum Support Price (MSP) and almost all the farmers knew about the prevailing rates of soybean i.e. Rs. 1650/q. All the

respondents were realizing price equal to or greater than the MSP. Only 14 per cent farmers reported that they were facing the problem of marketing of soybean. As regards to different categories of farmers all the parameters regarding accesses to improved technology and markets were found to be almost same except sources of owned seeds which was found 90 per cent in case of small farmers, while 70 per cent in case of large farmers.

4.1.4.2 Yield Gap Analysis

The yield gap analysis was done and Yield gap I and II were computed and presented in Table 4.11. It is observed from the data that was found 10.00 quintals/ha (35.71%) yield gap due to the soil and climatic conditions, while 4.54 quintals/ha (28.38%) of yield gap was found due to several agro-socio-economic and technological constraints prevails in the different locations of the under study. These yield gaps I & II were found to same in the all size of farms with minor variations.

Table 4.11: Yield Gap Analysis

Yield	Marginal	Small	Medium	Large	All Farms
1. Experimental Farm Yield	28.00	28.00	28.00	28.00	28.00
2. Potential farm Yield	18.00	18.00	18.00	18.00	18.00
3. Actual Farm Yield	10.57	11.02	11.90	12.35	11.46
Yield Gap I (1-2)	10 (35.71)	10 (35.71)	10 (35.71)	10 (35.71)	10 (35.71)
Yield Gap II (2-3)	5.43 (33.93)	4.98 (31.15)	4.10 (25.63)	3.65 (22.81)	4.54 (28.38)

Figure in parenthesis shows percent to

4.1.5 Marketing Pattern of Soybean

The marketing pattern of soybean shows the agency to whom sold (% share) price received (Rs. /q) and average distance to sale point. The data presented in Table 4.12 across all the categories. The marketing pattern of soybean indicates that almost 50 per cent of the HHs used to sell their produce to local village traders and remaining 50 per cent sell their produce to Government agency (Regulated market).

However inverse relationship was observed across different categories of respondents in terms of selling of soybean to local village traders and to regulated market. Data shows that marginal, small, medium and large farmers sell their 82, 77, 22, 17 per cent of produce to local village traders while 18, 23, 78 and 75 per cent of produce was sold to regulated market, respectively. The price received (Rs/q) was found to be higher across all the categories if farmers sell their produce to regulated market as compared to local village trader. It was

found that Rs. 2482, 2490, 2565 and 2935 per quintal were received by the marginal, small, medium and large farmers, respectively when they sell their produce to local village trader and Rs. 3248, 3274, 3309, 3335 per quintal were received by the above mentioned categories, respectively when the soybean sold to the government agency.

Table 4.12: Sale Pattern of major oilseeds

Particulars	Marginal	Small	Medium	Large	All Farms
Agency to whom sold (% share)					
Local village trader	81.66	76.66	21.66	16.66	49.16
Processing mill	0.00	0.00	0.00	0.00	0.00
Government agency (Regulated Market)	18.33	23.33	78.33	75.33	48.84
Commission agent	0.00	0.00	0.00	0.00	0.00
Private company (contract arrangement)	0.00	0.00	0.00	0.00	0.00
Others (ITC soya Chuopal)	0.00	0.00	0.00	8.00	2.00
Price Received (Rs/q)					
Local village trader	2482.5	2490.5	2565.5	2935.5	2618.5
Processing mill					
Government agency(Regulated Market)	3248.5	3274.5	3309.5	3335.5	3292
Commission agent	0.0	0.0	0.0	0.0	0.0
Private company (contract arrangement)	0.0	0.0	0.0	0.0	0.0
Others (ITC soya Chuopal)	0.0	0.0	0.0	3348.78	3348.78
Average Distance to sale point (km)	15	18.3	17.7	18.5	17.37

It is also observed from the data that 8per cent of large farmers were found to sell their produce to ITC soya chuopal at an average rate of Rs. 3348.78. At overall level price received by the government agency was found to be 26 per cent higher than the price received by the local village trader. Average distance to sale point was almost 17 kms.

4.1.6 Sources of Technology and Market Information

Sources of technology like seeds, extension services and market information were gathered by the farmers and presented in Table 4.13.

The technology and market information were received through various sources. The 46 per cent of the farmers reported that they use their own seeds, 21 per cent farmers purchase seed from the fellow farmers, 22 per cent purchase it from the market and 11 per cent purchase seeds through State Department of Agriculture.

Table 4.13: Sources of Technology and market information (%)

	Marginal	Small	Medium	Large	All Farms
Seeds					
Own	60.00	43.33	40.00	40.00	45.83
Fellow farmer	30.00	20.00	18.33	16.66	21.25
State Dept. of Agri.	5.00	6.66	20.00	13.33	11.25
ICAR/SAU/KVK					
Commission agent/ Ahrtiya					
Market	5.00	30.00	21.66	30.00	21.67
Others (specify)					0.00
Extension Services					0.00
State Dept. of Agri.	31.66	41.66	51.66	53.33	44.58
Private company	18.33	20.00	28.33	26.66	23.33
Input dealer	50.00	38.33	20.00	20.00	32.08
SAU/ICAR/KVK					
Others (specify)					
Market Information					
Radio/TV					
Print media	38.33	41.66	50.00	51.33	45.33
Fellow farmer	51.66	45.00	30.00	28.66	38.83
APMC mandi	10.00	13.33	20.00	20.00	15.83
Commission agent/ Ahrtiya					
Private company					
Others (specify)					

Almost 45, 32 and 23 per cent farmers reported that they received extension services from State Department of Agriculture, input dealer and private companies, respectively. The majority of farmers get market information from the print media (45%) followed by fellow farmer (39%) and APMC mandi (16%).

4.1.7 Constraints in Cultivation of Soybean

Constraints in cultivation of soybean were recorded from the respondents. The constraints faced by the respondents were technological, agro-climatic factors, institutional, economic and post harvest, marketing & value addition. Under technological constraints non availability of suitable varieties, poor seed germination, lack of irrigation facilities, incidence of diseases, incidence of insects pests, weeds infestation and poor quality of soils were recorded. In case of agro-climatic factors, drought at critical stages of crop growth, excessive rains, extreme variations in temperature, poor pod/grain setting, and risk of crop failure / yield variability due to biotic and abiotic stresses were covered. Regarding economic constraints, high-input cost (diesel, fertilizers & agrochemicals), shortage of human labour, low and fluctuating prices, price risk-fear of glut leading to low price, oilseeds less profitably compared with other crops and oilseeds more risky compared with other crops were recorded.

Institutional constraint such as problem of timely availability of seed, non availability of other inputs, poor quality of inputs, lack/poor extension services, non availability of institutional credit, inadequate knowledge about disease and pest management, irregular supply of power/ electricity, lack of awareness of improved oilseeds technologies were noted. Poor marketing system and excess of markets, lack of information about prices and markets, exploitation by markets intermediaries, lack of processing facilities in the area, lack of appropriate transport means, inadequate storage facilities, poor road infrastructure and high transportation costs were also recorded under post harvest, marketing and value addition. Constraints reported by sample respondents are presented in Table 4.14. At overall level under technological constraints the maximum number of respondents was reported that incidence of insect pests faced by them as reported by 139 farmers followed by non availability of suitable varieties (120) and incidence of disease (120), problem of weed infestation (113).

Under the constraint of agro climatic factors draught at critical stages of crop growth was minor as reported by 152 farmers and again the minor ones of excessive range was also reported by 119 farmers, 181 farmers reported that extreme variation in temperature is not a constraints for them. 92 and 85 farmers reported the moderate one of poor pod/grain setting and risk of crop failure/yield variability due to biotic and a-biotic stresses, respectively.

In case of economic constraint 179 farmers reported at moderate range i.e. high input cost (diesel, fertilizers, agro chemicals) followed by low and fluctuating prices of the produce (137), oil seeds are more risky compared with other crops and price risk i.e. fear of glut leading to low price (98). 102 farmers reported minor ones were less profitability of oil seeds compared with other crops. There was no problem of shortage of human labour as reported by 92 farmers.

Under the institutional constraints at moderate ranged and reported by the majority farmers were irregular supply of power/electricity, non availability of other inputs (112) and poor extension services, while the minor ones were untimely availability of seeds, poor quality of inputs were reported by 105 and 106 farmers respectively. There were no constraint regarding lack of awareness of improved oil seeds technologies, inadequate knowledge of disease and pest management were reported by 153, 133, 116 farmers respectively.

Post harvest, marketing and value addition related constraints inadequate storage facilities and high transportation cost (96) were the main constraints reported by numbers of respondents.

Table 4.14 Constraints in cultivation and marketing of Soybean in different size of farms (% HH)

Constraints[1]	*Marginal 60*				*Small 60*				*Medium 60*				*Large 60*				*All Farms*			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Technological																				
Non-availability of suitable varieties	3.33	16.67	50.00	30.00	5.00	28.33	53.33	13.33	26.67	23.33	33.33	16.67	6.67	13.33	63.33	16.67	10.42	20.42	50.00	19.17
Poor crop germination	31.67	25.00	30.00	13.33	30.00	20.00	35.00	15.00	23.33	26.67	41.67	8.33	3.33	46.67	33.33	16.67	22.08	29.58	35.00	13.33
Lack of irrigation facilities	83.33	10.00	3.33	3.33	83.33	13.33	1.67	1.67	75.00	18.33	3.33	3.33	90.00	5.00	3.33	1.67	82.92	11.67	2.92	2.50
Incidence of diseases	16.67	8.33	58.33	16.67	8.33	11.67	63.33	16.67	25.00	41.67	25.00	8.33	3.33	20.00	53.33	23.33	13.33	20.42	50.00	16.25
Incidence of insect pests	5.00	5.00	20.00	70.00	1.67	13.33	46.67	38.33	13.33	3.33	10.00	73.33	5.00	8.33	36.67	50.00	6.25	7.50	28.33	57.92
Weeds Infestation	3.33	13.33	33.33	50.00	1.67	5.00	68.33	25.00	6.67	15.00	61.67	16.67	13.33	53.33	25.00	8.33	6.25	21.67	47.08	25.00
Poor quality of soils	76.67	16.67	3.33	3.33	83.33	8.33	5.00	3.33	81.67	11.67	5.00	1.67	90.00	5.00	3.33	1.67	82.92	10.42	4.17	2.50
Agro-climatic Factors																				
Drought at critical stages of crop growth	16.67	65.00	16.67	1.67	20.00	50.00	16.67	13.33	20.00	66.67	8.33	5.00	8.33	71.67	16.67	3.33	16.25	63.33	14.58	5.83
Excessive rains	13.33	63.33	16.67	6.67	6.67	71.67	20.00	1.67	33.33	58.33	6.67	1.67	70.00	5.00	13.33	11.67	30.83	49.58	14.17	5.42
Extreme variations in temperature	70.00	15.00	8.33	6.67	85.00	8.33	5.00	1.67	65.00	31.67	1.67	1.67	81.67	11.67	5.00	1.67	75.42	16.67	5.00	2.92
Poor pod/grain setting	13.33	50.00	33.33	3.33	16.67	25.00	50.00	8.33	16.67	55.00	16.67	11.67	26.67	13.33	53.33	6.67	18.33	35.83	38.33	7.50
Risk of crop failure/yield variability due to biotic & a biotic stresses	5.00	25.00	41.67	28.33	10.00	26.67	56.67	6.67	23.33	43.33	20.00	13.33	20.00	50.00	23.33	6.67	14.58	36.25	35.42	13.75
Economic																				
High-input cost (diesel, fertilizers, agrochemicals)	3.33	15.00	66.67	15.00	1.67	5.00	90.00	3.33	1.67	3.33	81.67	13.33	3.33	1.67	60.00	35.00	2.50	6.25	74.58	16.67
Shortage of human labor	66.67	20.00	3.33	10.00	63.33	21.67	13.33	1.67	20.00	25.00	50.00	5.00	3.33	5.00	35.00	56.67	38.33	17.92	25.42	18.33
Low and fluctuating prices	5.00	16.67	51.67	26.67	6.67	8.33	66.67	18.33	6.67	10.00	66.67	16.67	3.33	6.67	43.33	46.67	5.42	10.42	57.08	27.08
Price risks – Fear of glut leading to low price	3.33	85.00	6.67	5.00	5.00	70.00	23.33	1.67	6.67	3.33	68.33	21.67	10.00	13.33	65.00	11.67	6.25	42.92	40.83	10.00
Oilseeds less profitable compared with other crops	5.00	23.33	56.67	15.00	10.00	56.67	26.67	6.67	11.67	40.00	38.33	10.00	23.33	50.00	15.00	11.67	12.50	42.50	34.17	10.83
Oilseeds more risky compared with other crops	8.33	13.33	71.67	6.67	5.00	20.00	63.33	11.67	15.00	25.00	53.33	6.67	10.00	23.33	40.00	26.67	9.58	20.42	57.08	12.92

Institutional																				
Problem of timely availability of seed	25.00	56.67	13.33	5.00	30.00	40.00	21.67	8.33	15.00	33.33	48.33	3.33	13.33	45.00	25.00	16.67	20.83	43.75	27.08	8.33
Non-availability of other inputs	10.00	31.67	45.00	13.33	3.33	30.00	53.33	13.33	13.33	38.33	43.33	5.00	8.33	35.00	45.00	11.67	8.75	33.75	46.67	10.83
Poor quality of inputs	23.33	46.67	20.00	10.00	26.67	63.33	6.67	3.33	20.00	23.33	53.33	3.33	6.67	43.33	40.00	10.00	19.17	44.17	30.00	6.67
Lack/Poor extension services	5.00	23.33	65.00	6.67	8.33	25.00	58.33	8.33	10.00	46.67	35.00	8.33	25.00	45.00	20.00	10.00	12.08	35.00	44.58	8.33
Non-availability of institutional credit	16.67	3.33	30.00	50.00	8.33	13.33	25.00	53.33	23.33	50.00	20.00	6.67	33.33	41.67	21.67	3.33	20.42	27.08	24.17	28.33
Inadequate knowledge about disease and pest management	53.33	26.67	18.33	1.67	58.33	20.00	15.00	6.67	23.33	11.67	48.33	16.67	58.33	36.67	3.33	1.67	48.33	23.75	21.25	6.67
Irregular supply of power/electricity	66.67	26.67	5.00	1.67	63.33	28.33	5.00	3.33	55.00	30.00	10.00	5.00	70.00	20.00	6.67	3.33	3.33	26.25	6.67	63.75
Lack of awareness of improved oilseed technologies	66.67	16.67	13.33	3.33	53.33	30.00	11.67	5.00	50.00	38.33	10.00	1.67	51.67	41.67	5.00	1.67	55.42	31.67	10.00	2.92
Post-harvest, Marketing and Value-addition																				
Poor marketing system and access to markets	78.33	15.00	5.00	1.67	78.33	13.33	5.00	3.33	68.33	18.33	10.00	3.33	63.33	30.00	5.00	1.67	72.08	19.17	6.25	2.50
Lack of information about prices and markets	20.00	66.67	10.00	3.33	25.00	63.33	10.00	1.67	30.00	58.33	10.00	1.67	60.00	30.00	6.67	3.33	33.75	54.58	9.17	2.50
Exploitation by market intermediaries	20.00	63.33	13.33	3.33	30.00	58.33	6.67	5.00	56.67	36.67	5.00	1.67	70.00	20.00	8.33	1.67	44.17	44.58	8.33	2.92
Lack of processing facilities in the area	83.33	13.33	1.67	1.67	75.00	16.67	5.00	3.33	56.67	40.00	1.67	1.67	25.00	56.67	11.67	6.67	60.00	31.67	5.00	3.33
Lack of appropriate transport means	3.33	16.67	33.33	46.67	8.33	13.33	30.00	48.33	41.67	30.00	20.00	8.33	71.67	23.33	3.33	1.67	31.25	20.83	21.67	26.25
Inadequate storage facilities	78.33	16.67	3.33	1.67	75.00	18.33	3.33	3.33	58.33	36.67	3.33	1.67	46.67	50.00	1.67	1.67	2.08	2.92	30.42	64.58
Poor road infrastructure	25.00	46.67	20.00	8.33	30.00	50.00	13.33	6.67	25.00	51.67	20.00	3.33	36.67	56.67	5.00	1.67	29.17	51.25	14.58	5.00
High transportation costs	5.00	20.00	46.67	28.33	8.33	23.33	50.00	18.33	35.00	45.00	18.33	1.67	20.00	71.67	5.00	3.33	17.08	12.92	30.00	40.00

The minor ones were lack of information about prices and markets (131) followed by poor road infrastructure (123), exploitation by market intermediaries (107) and There were no constraints related to poor marketing system and excess to markets, , lack of processing facilities in the area, exploitation by market intermediaries reported by 173, 155, 144, 106 farmers respectively.

4.1.8 Suggestions for improving Production and Productivity of Soybean

Ensure regular supply of electricity (100%), proper storage facility at village level (75%), establishment of more regulated market or purchase centre (84%), strengthen of extension and market intelligence services (91%), ensure availability of high yielding variety seeds and other quality inputs on time and at remunerative rate (84%) , stabilization of prices (50%) by ensuring knowledge of future trading (56%) and strengthen of crop insurance facilities by working out indemnity losses at the village level (56%) and suitable machinery and implements has to be developed suited to soybean cultivation viz. seed cum fertilizer drill, ridge and furrow implement, harvester, combiner etc as the prevailing implements and machineries suited to wheat instead of soybean (84%) were some of the suggestions reported by majority of respondents of the study area. These suggestions are found to be same under different categories of farmers with minor variation.

Table 4.15: Suggestions for improving production and productivity of soybean (%)

Suggestions	*Marginal*	*Small*	*Medium*	*Large*	*All Farms*
1. Strengthen of extension & market intelligence services	83	90	93	97	91
2. Ensure availability of high yielding variety of seed and other quality inputs	73	80	90	93	84
3. Proper storage facilities at village level	60	53	90	97	75
4. Stabilization of prices	40	47	53	60	50
5. Regular supply of electricity	100	100	100	100	100
6. Establishment of more regulated market/purchase centre	70	86	83	97	84
7. Ensure knowledge about future trading	40	70	53	60	56
8. Strengthen crop insurance facilities	53	60	70	40	56
9. Suitable machinery and implements has to be developed suited to soybean cultivation viz. seed cum fertilizer drill, ridge and furrow implement, harvester, combiner etc.	70	83	86	97	84

4.2 MUSTARD

4.2.1 Main Features of Selected Mustard Growers:

The main features of sample mustard growers includes socio economic status, land use pattern, terms of leased land, irrigation facilities, cropping pattern and average yield obtained by an average soybean grower related to different size of farms (marginal, small, medium and large).

4.2.1.1. Socio-economic status of Sample mustard growers:

An average age of the respondents at overall level was found to be 47 years and almost all the households across all the size of holdings doing crop farming only 21.25 and 56.25 percent households involved themselves as farm labour and in other services, respectively at overall level.

Table 4.16: Socio-economic Status of sample Mustard Growers

Indicators	Marginal	Small	Medium	Large	All Farms
Age (years)	48	45	47	49	48
Main Occupation (%)					
Crop farming	100	100	100	100	100.00
Service	0	0	0	0	0.00
Farm Labour	50	35	0	0	21.25
Others	45	40	70	70	56.25
Education (years of schooling)	6	8	9	11	9
Average Family Size (no)	6	8	5	7	6.50
Male	3	4	3	4	3.50
Female	3	4	2	3	3.00
Social Groups					
General	5	10	15	35	16.25
SC/ST	25	15	5	0	11.25
OBC	70	75	80	65	72.50
Others					
Head of household (%)					
Male	90	95	98.33	100	95.83
Female	10	5	1.66	0	4.17

The 50 percent of the marginal farmers and 35 percent small farmers were involved themselves as farm labour, while none of the farmer from the medium and large categories was involved as the farm labour. In others occupation 70, 70, 40, 45 percent of the households have other occupations in large, medium, small and marginal categories

respectively. On an average at overall level generally respondents passed 9 years in the school. The years in schooling was found highest in case of large farmers (11 years) followed by medium (9 years), small (8 years) and marginal (6 years) farmers. The average family size was recorded as 6 at overall level it was found highest in case of large and small (4 members) followed by medium and marginal (3 farmers) farmers. The male female ratio was found 1 : 1. Among the respondents the maximum number of respondents were from OBC category (72.50%) followed by General (16.25%) and SC/ST's (11.25%). The maximum number of General categories farmers was found in case of large farmers and the number of General category farmers decreases as size of farm is decreases. While in case of SC/ST's and OBC the maximum number of farmers were found from the marginal and small categories. In 95.83 percent cases the male members were found as head of household while in rest 4.17 percent cases female were found as head of household (Table 4.16).

4.2.1.2 Land Ownership Pattern

The land ownership pattern of the sample farmers showed that at overall level the irrigated and un-irrigated land owned was 2.56 and 1.48 ha respectively. On an average land owned by the marginal, small, medium and large farmers were 0.48, 0.86, 2.23 and 6.68 ha irrigated and 0.38, 0.57, 1.74 and 3.23 ha un irrigated land, respectively. The area owned by the sample respondents was found to be cultivated by the cent per cent farmers.

Table 4.17: Land ownership pattern on average sample Mustard Growers (ha)

Indicators	Marginal	Small	Medium	Large	All Farms
1. Total owned land					
Irrigated	0.48	0.86	2.23	6.68	2.56
Un-irrigated	0.38	0.57	1.74	3.23	1.48
2. Area under cultivation					
Irrigated	0.47	0.86	2.23	6.68	2.56
Un-irrigated	0.38	0.56	1.74	3.23	1.48
3. Leased-in land					
Irrigated	0.47	0.53	2.4	0.3	0.93
Un-irrigated	0.33	0.75	1.29	0	0.59
4. Leased-out land					
Irrigated	0	0	0	0	0.00
Un-irrigated	0	0	0	0	0.00
5. Total Operational holding (2+3-4)					
Irrigated	0.94	1.39	4.63	6.98	3.49
Un-irrigated	0.71	1.31	3.03	3.23	2.07
Total Operational holding	1.65	2.7	7.66	10.21	5.56

The 0.47, 0.53, 2.4 and 0.3 ha irrigated area was found to be leased-in under marginal, small, medium and large categories, respectively, whereas 0.33, 0.75 and 1.29 ha un-irrigated land was leased-in by the marginal, small and medium farmers. Leasing out land was not found in practice in the area under study. The total operational area of marginal, small, medium and large categories was found to be 0.94, 1.39, 4.63 and 6.98 ha under irrigated and 0.71, 1.31, 3.03 and 3.23 ha under un-irrigated situations, respectively. Total operational holding was found to be 1.65, 2.70, 7.66 and 10.21 ha under above mentioned categories and at overall level it was found 5.56 ha (Table 4.17).

4.2.1.3 Terms of Lease

At over all level only 13.75 per cent of the sample farmers lease-in land for cultivation on terms of leasing for fixed money. The 16.67 per cent of large farmers lease in maximum land followed by medium (15%), marginal (13.33%) and small (10%) farmers used to lease in land for fixed money. The rent for leased in land was found to be Rs. 16667.00 per ha in the area under study (Table 4.18).

Table 4.18: Terms of lease

Farm Size	Incidence of lease (%)		Terms of Leasing (%)				Terms of Lease (Rent/amount)		
	% area leased-in	*% HHs leasing in*	*For fixed money*	*For fixed produce*	*Share Cropping*	*Others*	*Fixed money*	*Fixed produce*	
Marginal	51.47	13.33	100	0	0	0	10250	0	0
Small	29.78	10	100	0	0	0	16466	0	
Medium	52.89	15	100	0	0	0	18216	0	0
Large	4.55	16.67	100	0	0	0	21736	0	0
All farms	34.67	13.75	100	0	0	0	16667	0	0

4.2.1.4 Irrigation sources

Major sources of irrigation in the area under study were found to be ground water (61.56%) and surface water (38.25%). Out of total cropped area, 61.75 per cent of area was found under irrigation. The maximum area under irrigation was found in large farms (68.43%), while in other categories it was found to be almost 60 per cent (Table 4.19).

Table 4.19: Irrigation Sources

Indicators	Marginal	Small	Medium	Large	All Farms
Area under irrigation (% to total cropped area)	55.29	61.64	60.89	68.43	61.56
Sources of irrigation (%)					
Surface	55	42	33	23	38.25
Groundwater	45	58	67	77	61.75
Tanks	0	0	0	0	0
Others	0	0	0	0	0

4.2.1.5 Cropping Pattern

The cropping pattern of sample households in various seasons (Kharif, Rabi and Summer) and their major crops along with irrigated and un irrigated area under the crop or crop groups and vegetables were recorded and presented in Table 4.20.

Table 4.20: Cropping Pattern of sample Mustard Growers *(ha)*

Season/Crop	Marginal	Small	Medium	Large	Overall
Kharif					
Rice					
Irrigated	0.01	0.02	0.23	0.60	0.22
Unirrigated	0.08	0.22	0.74	1.08	0.53
Total	0.09 (10.38)	0.24 (16.95)	0.97 (24.29)	1.68 (15.30)	0.74 16.73
Maize					
Irrigated	0.07	0.08	0.46	0.62	0.31
Unirrigated	0.06	0.02	0.14	0.19	0.10
Total	0.12 (14.50)	0.10 (7.31)	0.60 (15.01)	0.81 (7.37)	0.41 (11.05)
Coarse Cereals					
Irrigated	0.00	0.08	0.17	0.41	0.16
Unirrigated	0.14	0.09	0.10	0.26	0.15
Total	0.14 (16.80)	0.17 (12.30)	0.27 (6.68)	0.67 (6.11)	0.31 (10.47)
Pulses					
Irrigated	0.01	0.13	0.54	0.73	0.35
Unirrigated	0.06	0.03	0.09	0.33	0.13
Total	0.08 (8.87)	0.16 (11.15)	0.63 (15.74)	1.06 (9.61)	0.48 (11.34)
Oilseeds					
Soybean					
Irrigated	0.37	0.59	0.99	4.44	1.59
Un-irrigated	0.02	0.13	0.53	2.27	0.74
Total	0.39 (45.48)	0.71 (50.85)	1.51 (37.78)	6.71 (61.15)	2.33 (48.82)
Vegetables	0.03	0.02	0.02	0.05	0.03
	(3.96)	(1.44)	(0.51)	(0.46)	(1.59)
kharif irrigated	0.49	0.92	2.40	6.85	2.67
	(57.69)	(65.46)	(60.11)	(62.38)	(61.41)
kharif un irrigated	0.36	0.48	1.60	4.13	1.64
	(42.31)	(34.54)	(39.89)	(37.62)	(38.59)
Total kharif	0.85	1.40	4.00	10.98	4.31
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
	((49.63))	((50.74))	((54.68))	((54.87))	((52.48))

Cont.....

Season/Crop	Marginal	Small	Medium	Large	Overall
Rabi					
Wheat					
Irrigated	0.33	0.55	1.09	5.30	1.82
Un-irrigated	0.07	0.10	0.16	0.11	0.11
Total	0.40 (46.79)	0.65 (47.82)	1.24 (37.44)	5.40 (59.86)	1.93 (47.98)
Pulses					
Irrigated	0.02	0.07	0.17	0.59	0.21
Un-irrigated	0.04	0.15	0.81	0.77	0.44
Total	0.06 (7.03)	0.22 (16.24)	0.98 (29.40)	1.35 (15.01)	0.65 (16.92)
Oilseeds					
Rapeseed& Mustard					
Irrigated	0.13	0.25	0.48	0.98	0.46
Un-irrigated	0.22	0.22	0.60	1.22	0.56
Total	0.35 (40.06)	0.47 (34.48)	1.08 (32.56)	2.20 (24.36)	1.02 (32.86)
Vegetables	0.02	0.02	0.02	0.07	0.03
	(2.65)	(1.47)	(0.60)	(0.78)	(1.38)
Other rabi crops	0.03	0	0	0	0.01
	(3.47)	0.00	0.00	0.00	(0.87)
Irrigated rabi	0.50	0.89	1.75	6.93	2.52
	(57.78)	(65.45)	(52.90)	(76.76)	(63.22)
Un-irrigated rabi	0.36	0.47	1.56	2.10	1.12
	(42.22)	(34.55)	(47.10)	(23.24)	(36.78)
Total rabi	0.86	1.36	3.32	9.03	3.64
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
	((50.37))	((49.26))	((45.32))	((45.13))	((47.52))
Gross Cropped Area	1.72	2.77	7.32	20.01	7.95
	((100))	((100))	((100))	((100))	((100.00))
Cropping Intensity %	146	143	134	199	156

Figures in brackets show percentage to respective season while in double brackets show percentage to gross cropped area

At overall level in Kharif season 4. 31 ha area was recorded to be cultivated; out of this 61.41 per cent area was irrigated. The major crops grown were Soybean (48.82%) followed by Rice (16.73%), Pulses (11.34%), Maize (11.05%), Coarse Cereal (10.47%) and Vegetables (2.67%). In Rabi season, total area cultivated was 3.64 ha and area under irrigation was 63.22 per cent. Major crops grown in this season were Wheat (47.98%) followed by Rapeseed and Mustard (32.86%), Pulses (16.92%), Vegetables (1.38%) and others (0.87%). The gross cropped area and cropping intensity were found to be 7.95 ha and 156 per cent respectively.

Gross cropped area under marginal, small, medium and large size groups was recorded as 1.72, 2.77, 7.32 and 20.01 ha respectively and cropping intensity was 146, 143, 134 and 199 respectively.

4.2.1.6 Average yield of major crops

The average yield of major crops and crop groups grown in Kharif, Rabi and summer seasons under irrigated and un-irrigated situations was noted and presented in Table 4.21.

Table 4.21: Average yield of major crops on sample Mustard Growers

(q/ha)

Season/Crop	Marginal	Small	Medium	Large	All Farms
Kharif					
Rice					
Irrigated	22.23	25.94	26.51	20.61	23.82
Un-irrigated	21.24	20.13	18.38	18.92	19.67
Maize					
Irrigated	17.10	21.82	19.28	15.29	18.37
Un-irrigated	13.49	10.87	12.51	13.10	12.49
Coarse Cereals					
Irrigated	0.00	22.23	22.81	16.07	15.28
Un-irrigated	22.36	20.61	19.58	15.97	19.63
Pulses					
Irrigated	6.67	6.71	6.93	8.34	7.16
Un-irrigated	6.26	6.59	6.67	6.26	6.44
Oilseeds					
Soybean					
Irrigated	15.71	14.13	14.42	12.21	14.12
Un-irrigated	11.53	14.41	14.66	10.75	12.84
Vegetables	50.06	69.16	77.39	65.67	65.57
Rabi					
Wheat					
Irrigated	25.19	25.43	27.94	29.30	26.97
Un-irrigated	10.03	13.17	12.76	13.83	12.45
Pulses					
Irrigated	9.47	10.04	12.72	13.03	11.32
Un-irrigated	5.87	5.83	6.14	5.14	5.74
Oilseeds					
Rapeseed & Mustard					
Irrigated	12.19	12.58	12.86	12.22	12.46
Un-irrigated	8.14	5.48	5.99	5.82	6.36
Vegetables					
Irrigated	121.34	140.49	144.53	132.39	134.69
Un-irrigated	0.00	31.49	44.62	27.10	25.80

At overall level in Kharif season the yield of rice, maize, coarse cereals, pulses, soybean and vegetables was found to be 23.82, 18.37, 15.28, 7.16, 14.12 and 65 q/ha under irrigated situation and 19.67, 12.49, 19.63, 6.44 and 12.84 q/ha under un-irrigated situation respectively. In Rabi season the yield of wheat, pulses and rapeseed and mustard under irrigated and un-irrigated situation was found to be 26.97, 11.32 & 12.46 and 12.45, 5.74 & 6.36 q/ha, respectively. The yield of vegetables was 134.69 q/ha and 25.80 q/ha respectively under irrigated and un-irrigated situation.

4.2.2 Production, Retention and Marketed Surplus Pattern of Mustard

The production, retention and marketed surplus pattern of Mustard across all the categories were depicted in Table 4.22.

Table 4.22: Total production, retention and sale pattern of *Mustard* (q)

Size of farms	Production	(%)	Retention	(%)	Sold	(%)	Price (Rs/q)
Marginal	7.89	100.00	2.51	31.82	5.38	68.18	2810
Small	10.95	100.00	4.80	43.83	6.15	56.17	2927
Medium	21.93	100.00	7.28	33.18	14.66	66.82	3009
Large	46.24	100.00	12.00	25.95	38.94	84.22	3535
All farms	21.75	100.00	6.65	33.70	16.28	68.85	3070

The production of mustard was found to be 7.89, 10.95, 21.93 and 46.24 quintals in case of marginal, small, medium and large categories, respectively, out of which 68.18, 56.17, 66.82 and 84.22 per cent of total production was sold at prices of Rs. 2810, 2927, 3009 and 3535 per quintal in the above mentioned categories, respectively. At overall level, the quantity of mustard produced, retained and sold in the market was 21.75 q, 6.65q (38.70%) and 16.28q (68.85%) and sold at the average rate of Rs. 3070/q.

4.2.3. Comparative Economics

The profitability of mustard and its competing crop wheat have been presented in Table 4.23. Total operational cost, yield, price, cost of cultivation/ha, cost of production/q, Net income and B: C ratio have been computed for the purpose of comparison of profitability of mustard vis-à-vis wheat.

Mustard has competition with wheat in the study area, net income of mustard in case of marginal, small, medium and large and overall categories of the farmers was recorded as Rs. 18314.25/-, 16777.49/-, 18293.32/-, 15872.26/- and 17314.33/- per hectare, while in case of wheat it was Rs. 21449.62/-, 24561.80/-, 28318.99/-, 26305.82/- and 25409.06/- per hectare, respectively. It shows that the wheat is some what more profitable than its competing crop mustard. The B:C ratios obtained under mustard cultivation were 2.63, 2.59, 2.70, 2.33 and 2.56 and in case of wheat, the ratios recorded were 2.06, 1.90, 1.81, 1.75 and 1.88 among above mentioned categories, respectively, which clearly indicate that wheat is more profitable than its competing crop mustard, although remarkable difference was noticed between these two crops.

Table 4.23: Profitability of Major Oilseeds and Competing Crops *(Rs/ha)*

Cost items	**Mustard**				
	Marginal	Small	Medium	Large	Overall
Operational costs					
Seed	218.98	276.74	235.87	405.79	284.35
Fertilizer & manure	1574.34	1625.13	1707.67	1643.41	1637.64
Insecticides & pesticides	949.59	839.80	636.24	1358.50	946.03
Human labour					
Family	2239.51	1557.93	1357.99	1480.66	1659.02
Hired	219.57	174.82	990.85	924.26	577.38
Machine labour	2582.63	2545.04	2283.36	2377.54	2447.14
Bullock labour	461.56	269.96	255.23	270.63	314.35
Irrigation	520	721	652	523	604.00
Harvesting & threshing	2067.80	2169.90	2367.08	2526.46	2282.81
Interest on working capital	35.75	33.60	34.60	37.98	35.48
1. Total Operational Costs	10869.75	10213.91	10520.90	11548.23	10788.20
Yield (Quintals)	10.17	9.03	9.43	9.02	9.41
Price	2810	2927	3009	2987	2933.18
2. Value of main-product	28564.44	26429.48	28363.44	26938.84	27574.05
3. Value of by-product	619.56	561.93	450.78	481.65	528.48
Net Income (2+3) – (1)	18314.25	16777.49	18293.32	15872.26	17314.33
Cost of production/q	1069.30	1131.20	1116.12	1280.33	1149.24
Cost of production/ha	10869.75	10213.91	10520.90	11548.23	10788.20
B. C. ratio	**2.63**	**2.59**	**2.70**	**2.33**	**2.56**
Wheat					
Operational costs					
Seed	2075.46	2215.02	2429.77	2807.57	2381.95
Fertilizer & manure	770.64	1028.84	1953.32	2097.52	1462.58
Insecticides & pesticides	0.00	832.39	806.87	1175.72	703.74
Human labour					
Family	1862.98	2048.12	1702.95	1513.44	1781.87
Hired	236.71	670.23	1172.96	1664.31	936.05
Machine labour	2810.76	3317.24	3272.86	3445.72	3211.65
Bullock labour	205.83	32.93	88.21	101.07	107.01
Irrigation	981	890	900	883	913.50
Harvesting & threshing	2871.38	2954.50	3220.50	3350.97	3099.34
Interest on working capital	38.99	46.16	51.31	56.23	48.17
Total Operational Costs	11853.74	14035.44	15598.74	17095.54	14645.87
Yield (Quintals)	17.61	19.30	20.35	21.56	19.71
Price	1385	1385	1385	1385	1385
Value of main-product	24395	26736	28184	29866	27295.42
Value of by-product	8907.99	11861.29	15733.28	14535.47	12759.51
Net Income	21449.62	24561.80	28318.99	27305.82	25409.06
Cost of production/q	1217.76	1272.37	1391.61	1266.28	1287.01
Cost of production/ha	11853.74	14035.44	15598.74	17095.54	14645.87
Benefit Cost ratio	2.06	1.90	1.81	1.75	1.88

The yield of mustard obtained under marginal, small, medium, large and overall categories was 10.17, 9.03, 9.43, 9.02 and 9.41 q/ha and cost of production to obtain a quintal of mustard was recorded as Rs. 1069.30/-, 1131.20/-, 1116.12/-, 1280.33/- and 1149.24/-, respectively. In case of wheat, the yield obtained was 17.61, 19.30, 20.35, 21.56 and 19.71 per hectare and the cost of production was recorded as Rs. 1217.76/-, 1272.37/-, 1391.61/-, 1261.28/- and 1287.01/- per quintal, respectively among above mentioned categories. The cost of cultivation per hectare in case of mustard was documented as Rs. 10869.75/-, 10213.91/-, 10520.90/-, 11548.23/- and 10788.20/- while in case of wheat it was Rs. 11853.74/-, 14035.44/-, 15598.74/-, 17095.54/- and 14645.87/-, respectively among different the categories mentioned above.

4.2.4 Profitability vis-à-vis risk in soybean production

The acreage variability, yield, price and net income risk have been calculated for mustard and wheat crops and presented in Table 4.24.

Table 4.24: Profitability vis-à-vis Risks[2] in Oilseeds production

Indicators	Marginal	Small	Medium	Large	All Farms
Mustard					
Acreage variability	40.99	49.49	63.12	53.15	51.69
Yield Risk	49.49	53.02	51.03	55.56	52.28
Price Risk	6.60	12.43	10.84	9.25	9.78
Net Income Risk	28.05	32.72	30.94	32.41	31.03
Wheat					
Acreage variability	58.32	64.62	80.42	61.23	66.14
Yield Risk	37.32	29.00	33.99	39.27	34.89
Price Risk	0.00	0.00	0.00	0.00	0.00
Net Income Risk	18.66	14.50	16.99	19.63	17.45

In mustard, acreage variability, yield, price and net income risk at overall level was found to be 51.69, 52.28, 9.78 and 31.03 per cent, while in case of wheat it was found to be 66.14, 34.89, 0.00 and 17.45 per cent, respectively. The variability in price of wheat was not found in the study area as all the HHs found to be sold their product at cooperative societies at minimum support price of Rs 1385/q. The maximum variability was found in case of area followed by yield and net income in both the crops. The yield and net income risk was found more in mustard as compared to wheat while, acreage variability was found more in wheat as compared to mustard. The results on these aspects were found same in different size of farms with minor variation.

[2] *Compute coefficient of variation of area, yield, price and net income of main oilseeds and main competing crops*

4.2.5 Improved Technology and Markets for Oilseeds

Access to improved technology and market and yield gap analysis has been done for mustard.

4.2.5.1 Access to improved technology and markets for Oilseeds

The data on access to improved technology such as use of HYV, source of seed, use of recommended doses of fertilizers and awareness about minimum support price, rate of soybean and maize under MSP, price realization and marketing problems were analysed for all the category and presented in Table 4.25.

Table 4.25: Access to Improved Technology and Markets (%)

	Marginal	Small	Medium	Large	All Farms
Use of HYV					
Yes	66.67	70.00	76.67	86.67	75.00
No	33.33	30.00	23.33	13.33	25.00
Area under HYV (% to total area under oilseeds)					
Source of Seed					
Own	76.67	66.67	50.00	33.33	56.67
Market purchased	23.33	33.33	50.00	66.67	43.33
Use of recommended doses of fertilizers					
Yes	33.33	43.33	66.67	86.67	57.50
No	66.67	56.67	33.33	13.33	42.50
Don't know					
Awareness about MSP					
Yes	100	100	100	100	100.00
No	0	0	0	0	0.00
MSP (Rs/q) – 2011-12					
Mustard	2500	2500	2500	2500	2500.00
Wheat	1385	1385	1385	1385	1385.00
Price realization					
≥MSP	100	100	100	100	100.00
<MSP	0	0	0	0	0.00
Marketing problems					
Yes	16.67	16.67	13.33	10.00	14.17
No	83.33	83.33	86.67	90.00	85.83

At overall level 75 per cent farmers reported that they have access to improved technology such as use of HYV, 56.67 per cent reported that they use their own seed while 43.33 per cent reported that seed was purchased from the other sources, 57.50 per cent of the sample farmers were using recommended doses of fertilizers, while 42.50 per cent were still not using the recommended doses of fertilizers. The 75.83 per cent respondents reported to have awareness about Minimum Support Price (MSP) and almost all the farmers knew about the declared rates of mustard and wheat i.e. Rs. 2500 and 1385/q. All the respondents were reported to realizing price equal to or greater than the MSP and they were found to aware about minimum support price.

The maximum percentage of large farmers (86.67%) using HYV, followed by medium (76.67%), small (70.00%) and marginal (67.67%). The large farmer also found to be purchase more seed from market and use of recommend dose of fertilizers as compared to other size of categories.

4.2.6 Yield Gap Analysis

The yield gap analysis was done and Yield gap I and II were computed and presented in Table 4.26. It is observed from the data that there was found 60 percent yield gap I due to the soil and climatic conditions, while only 27 per cent of yield gap II was found due to several agro-socio-economic and technological constraints prevails in the different locations of the area under study. These yield gaps I & II was found to same in the all size of farms with minor variations.

Table 4.26: Yield Gap Analysis

Yield	Marginal	Small	Medium	Large	All Farms
1. Experimental Farm Yield[1]	25	25	25	25	25
2. Potential farm Yield	24.7	24.7	24.7	24.7	24.7
3. Actual Farm Yield	8.62	8.66	5.52	6.4	7.3
Yield Gap I (1-2)	0.3 (1.2)	0.3 (1.2)	0.3 (1.2)	0.3 (1.2)	0.3 (1.2)
Yield Gap II (3-2)	16.08 (65.10)	16.04 (64.94)	19.18 (77.65)	18.3 (74.09)	17.4 (70.45)

Figure in parenthesis show percent yield gap

4.2.7 Marketing pattern of Mustard

The marketing pattern of mustard covered data on agency to whom sold (% share), price received (Rs/q) and average distance to sale point. The data presented in Table 4.27 across all the categories.

Table 4.27: Sale pattern of major oilseeds

Agency to whom sold (% share)	Marginal	Small	Medium	Large	All Farms
Local village trader	84.65	70.15	25.53	18.87	49.8
Processing mill					
Government agency	15.35	29.85	74.47	81.13	50.2
Commission agent					
Private company (contract arrangement)					
Others					
Price Received (Rs/q)					
Local village trader	2710	2731	2882	3423	2936.5
Processing mill					
Government agency	3030.00	3049.00	3192.00	3647.00	3229.50
Commission agent					
Private company (contract arrangement)					
Others					
Average Distance to sale point (km)	15	15.3	17.7	17.5	16.375

The marketing pattern of mustard indicates that almost 50 per cent of the respondents used to sell their produce to local village traders and remaining 50 per cent sell their produce to Government agency (Regulated market). However inverse and positive relationships were observed across different categories of respondents in terms of selling of mustard to local village traders and to regulated market, respectively. Data shows that marginal, small, medium and large farmers sell their 85, 70, 26, and 19 per cent of produce to local village traders while 15, 30, 74 and 81 per cent of produce was sold to regulated market, respectively. The price received (Rs/q) was found to be higher across all the categories if farmers sell their produce to regulated market as compared to local village trader. It was found that Rs. 2710, 2731, 2882 and 3423 per quintal were received by the marginal, small, medium and large farmers, respectively when they sell their produce to local village trader and Rs. 3030, 3049, 3192, 3647 per quintal were received by the above mentioned categories, respectively when the mustard sold to the government agency. At overall level price received by the government agency was found to be 10 per cent higher than the price received by the local village trader. Average distance to sale point was almost 16 kms.

4.2.8 Sources of Technology and Market Information

Sources of technology like seeds, extension services and market information were gathered by the farmers and presented in Table 4.28.

Table 4.28: Sources of Technology and market information (%)

	Marginal	Small	Medium	Large	All Farms
Seeds					
Own	56.67	50.00	46.67	40.00	48.34
Fellow farmer	33.33	30.00	20.00	10.00	23.33
State Dept. of Agri.	5.00	11.67	20.00	23.33	15.00
ICAR/SAU/KVK	0.00	0.00	3.33	6.67	2.50
Commission agent/ Ahrtiya	0.00	0.00	0.00	0.00	0.00
Market	5.00	8.33	10.00	20.00	10.83
Others (specify)	100.00	100.00	100.00	100.00	
Extension Services					
State Dept. of Agri.	21.67	36.67	41.67	43.33	35.84
Private company	28.33	20.00	28.33	26.67	25.83
Input dealer	50.00	38.33	20.00	20.00	32.08
SAU/ICAR/KVK	0.00	5.00	10.00	10.00	6.25
Others (specify)					
Market Information					
Radio/TV					
Print media	36.67	43.33	50.00	53.33	45.83
Fellow farmer	53.33	45.00	35.00	26.67	40.00
APMC mandi	10.00	11.67	15.00	20.00	14.17
Commission agent/ Ahrtiya	0.00	0.00	0.00	0.00	0.00
Private company	0.00	0.00	0.00	0.00	0.00
Others (specify)	0.00	0.00	0.00	0.00	0.00

The technology and market information were received through various sources. The 48 per cent of the farmers reported that they use their own seeds, while other farmers purchase seeds from the fellow farmers (23%), through State Deptt. of Agriculture (15%) and from the market (11%). Almost 36, 32 and 26 per cent farmers reported that they received extension services from State Deptt. of Agriculture, input dealer and private company, respectively. Farmers used to gather market information from the print media (46%) followed by fellow farmer (40%) and APMC mandi (14%).

4.2.9 Perceived Constraints in Cultivation of Mustard

Constraints in cultivation of mustard were recorded from the respondents. The constraints faced by the respondents were technological, agro-climatic factors, institutional, economic and post harvest, marketing & value addition. Under technological constraints non availability of suitable varieties, poor crop germination, lack of irrigation facilities, incidence of diseases, incidence of insect pests, weeds infestation and poor quality of soils were recorded. In case of agro-climatic factors, drought at critical stages of crop growth, excessive rains, extreme variations in temperature, poor pod/grain setting, and risk of crop failure / yield variability due to biotic and a biotic stresses were covered. Regarding economic constraints, high-input cost (diesel, fertilizers & agrochemicals), shortage of human labour, low and fluctuating prices, price risk-fear of glut leading to low price, oilseeds less profitably compared with other crops and oilseeds more risky compared with other crops were recorded. Institutional constraint such as problem of timely availability of seed, non availability of other inputs, poor quality of inputs, lack/poor extension services, non availability of institutional credit, inadequate knowledge about disease and pest management, irregular supply of power/ electricity, lack of awareness of improved oilseeds technologies were noted. Poor marketing system and excess of markets, lack of information about prices and markets, exploitation by markets intermediaries, lack of processing facilities in the area, lack of appropriate transport means, inadequate storage facilities, poor road infrastructure and high transportation costs were also recorded under post harvest, marketing and value addition. Constraints reported by sample respondents are presented in Table 4.29.

Table 4.29: Constraints in cultivation of mustard (% HH)

Constraints	*Marginal 30*				*Small 30*				*Medium 30*				*Large 30*				*All Farms 120*			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Technological																				
Non-availability of suitable varieties	3.33	16.67	66.67	13.33	6.67	16.67	63.33	13.33	16.67	23.33	43.33	16.67	6.67	13.33	63.33	16.67	8.33	17.50	59.17	15.00
Poor crop germination	33.33	26.67	26.67	13.33	33.33	20.00	30.00	16.67	23.33	40.00	26.67	10.00	16.67	46.67	33.33	3.33	26.67	10.83	29.17	33.33
Lack of irrigation facilities	83.33	10.00	3.33	3.33	80.00	13.33	3.33	3.33	73.33	16.67	6.67	3.33	90.00	3.33	3.33	3.33	3.33	10.83	4.17	81.67
Incidence of diseases	16.67	16.67	50.00	16.67	10.00	26.67	46.67	16.67	26.67	26.67	40.00	6.67	16.67	20.00	40.00	23.33	17.50	22.50	44.17	15.83
Incidence of insect pests	3.33	6.67	20.00	70.00	3.33	13.33	46.67	36.67	13.33	3.33	10.00	73.33	3.33	10.00	36.67	50.00	5.83	8.33	28.33	57.50
Weeds Infestation	3.33	50.00	33.33	13.33	3.33	63.33	23.33	10.00	6.67	60.00	16.67	16.67	13.33	53.33	23.33	10.00	6.67	24.17	56.67	12.50
Poor quality of soils	76.67	16.67	3.33	3.33	83.33	10.00	3.33	3.33	80.00	13.33	3.33	3.33	90.00	3.33	3.33	3.33	82.50	10.83	3.33	3.33
Agro-climatic Factors																				
Drought at critical stages of crop growth	16.67	50.00	16.67	16.67	20.00	50.00	13.33	16.67	16.67	66.67	13.33	3.33	13.33	66.67	16.67	3.33	16.67	58.33	15.00	10.00
Excessive rains	13.33	63.33	16.67	6.67	6.67	70.00	20.00	3.33	30.00	60.00	6.67	3.33	70.00	3.33	13.33	13.33	30.00	49.17	14.17	6.67
Extreme variations in temperature	70.00	13.33	10.00	6.67	83.33	6.67	6.67	3.33	63.33	30.00	3.33	3.33	80.00	10.00	6.67	3.33	74.17	15.00	6.67	4.17
Poor pod/grain setting	13.33	50.00	33.33	3.33	16.67	23.33	50.00	10.00	16.67	53.33	16.67	13.33	26.67	13.33	53.33	6.67	18.33	35.00	38.33	8.33
Risk of crop failure/yield variability due to biotic & a biotic stresses	6.67	23.33	40.00	30.00	10.00	26.67	56.67	6.67	23.33	43.33	20.00	13.33	20.00	50.00	23.33	6.67	15.00	35.83	35.00	14.17
Economic																				
High-input cost (diesel, fertilizers, agrochemicals)	3.33	23.33	60.00	13.33	3.33	10.00	83.33	3.33	3.33	3.33	80.00	13.33	3.33	6.67	60.00	30.00	3.33	10.83	70.83	15.00
Shortage of human labor	53.33	16.67	20.00	10.00	63.33	20.00	13.33	3.33	20.00	23.33	50.00	6.67	3.33	6.67	33.33	56.67	35.00	16.67	29.17	19.17
Low and fluctuating prices	3.33	16.67	53.33	26.67	6.67	6.67	66.67	20.00	6.67	10.00	66.67	16.67	3.33	6.67	43.33	46.67	5.00	10.00	57.50	27.50
Price risks – Fear of glut leading to low price	3.33	86.67	6.67	3.33	3.33	70.00	23.33	3.33	6.67	3.33	70.00	20.00	10.00	13.33	66.67	10.00	5.83	43.33	41.67	9.17
Oilseeds less profitable compared with other crops	6.67	23.33	56.67	13.33	10.00	56.67	26.67	6.67	10.00	40.00	40.00	10.00	23.33	50.00	13.33	13.33	12.50	42.50	34.17	10.83
Oilseeds more risky compared with other crops	6.67	13.33	73.33	6.67	6.67	20.00	63.33	10.00	13.33	26.67	53.33	6.67	10.00	23.33	40.00	26.67	9.17	20.83	57.50	12.50

Institutional																				
Problem of timely availability of seed	33.33	50.00	13.33	3.33	30.00	40.00	23.33	6.67	16.67	33.33	46.67	3.33	13.33	43.33	26.67	16.67	23.33	41.67	27.50	7.50
Non-availability of other inputs	13.33	26.67	46.67	13.33	3.33	30.00	53.33	13.33	13.33	40.00	43.33	3.33	6.67	36.67	46.67	10.00	9.17	33.33	47.50	10.00
Poor quality of inputs	23.33	46.67	20.00	10.00	26.67	63.33	6.67	3.33	20.00	23.33	53.33	3.33	6.67	43.33	40.00	10.00	19.17	44.17	30.00	6.67
Lack/Poor extension services	6.67	20.00	66.67	6.67	6.67	26.67	60.00	6.67	10.00	46.67	33.33	10.00	26.67	43.33	20.00	10.00	12.50	34.17	45.00	8.33
Non-availability of institutional credit	16.67	3.33	30.00	50.00	6.67	13.33	26.67	53.33	20.00	53.33	20.00	6.67	33.33	40.00	23.33	3.33	19.17	27.50	25.00	28.33
Inadequate knowledge about disease and pest management	53.33	26.67	16.67	3.33	60.00	20.00	13.33	6.67	23.33	13.33	46.67	16.67	56.67	36.67	3.33	3.33	48.33	24.17	20.00	7.50
Irregular supply of power/electricity	66.67	26.67	3.33	3.33	63.33	26.67	6.67	3.33	53.33	30.00	10.00	6.67	70.00	20.00	6.67	3.33	4.17	25.83	6.67	63.33
Lack of awareness of improved oilseed technologies	63.33	20.00	13.33	3.33	53.33	30.00	13.33	3.33	53.33	33.33	10.00	3.33	53.33	40.00	3.33	3.33	3.33	30.83	10.00	55.83
Post-harvest, Marketing and Value-addition																				
Poor marketing system and access to markets	76.67	16.67	3.33	3.33	80.00	13.33	3.33	3.33	66.67	20.00	10.00	3.33	63.33	30.00	3.33	3.33	71.67	20.00	5.00	3.33
Lack of information about prices and markets	26.67	60.00	10.00	3.33	23.33	63.33	10.00	3.33	30.00	56.67	10.00	3.33	60.00	30.00	6.67	3.33	35.00	52.50	9.17	3.33
Exploitation by market intermediaries	20.00	63.33	13.33	3.33	30.00	56.67	10.00	3.33	56.67	36.67	3.33	3.33	70.00	20.00	6.67	3.33	44.17	44.17	8.33	3.33
Lack of processing facilities in the area	80.00	13.33	3.33	3.33	73.33	16.67	6.67	3.33	53.33	40.00	3.33	3.33	26.67	53.33	13.33	6.67	58.33	30.83	6.67	4.17
Lack of appropriate transport means	6.67	13.33	33.33	46.67	10.00	13.33	30.00	46.67	40.00	30.00	20.00	10.00	70.00	23.33	3.33	3.33	31.67	20.00	21.67	26.67
Inadequate storage facilities	70.00	16.67	3.33	10.00	70.00	23.33	3.33	3.33	60.00	33.33	3.33	3.33	46.67	46.67	3.33	3.33	5.00	30.00	3.33	61.67
Poor road infrastructure	23.33	46.67	20.00	10.00	30.00	50.00	13.33	6.67	26.67	50.00	20.00	3.33	36.67	56.67	3.33	3.33	29.17	50.83	14.17	5.83
High transportation costs	6.67	20.00	46.67	26.67	10.00	23.33	50.00	16.67	33.33	46.67	16.67	3.33	20.00	70.00	6.67	3.33	17.50	12.50	30.00	40.00

Amongst all these different type of constraints; lack of irrigation facilities, incidence of insect pest (technical), irregular supply of electricity (institutional), inadequate storage facilities and high transportation cost (post harvest marketing and value addition) were found to be savior constraints as reported by 98, 69, 76, 74 and 48 number of respondents, while non availability of suitable variety of seeds, incidence of diseases and weed infestation (Technical), high input costs, low and fluctuated prices, mustard risky over wheat (economical) non availability of other inputs, quality of input and poor extension services (institutional) were found to be moderate constraints in cultivation and marketing of mustard in the area under study.

4.2.10 Suggestions for improving Production and Productivity of Mustard

Regular supply of electricity, proper storage facility at village level, establishment of more regulated market or purchase centre, strengthen of extension and market intelligence services, ensure availability of high yielding variety seeds and other quality inputs on time, stabilization of prices by ensuring knowledge of future trading and strengthen of crop insurance facilities by working out indemnity losses at the village level were found to be some suggestions as reported by majority of respondents of the study area. These suggestions are found to e same under different size of farmers with minor variation.

Table 4.30: Suggestions for improving production and productivity of mustard *(%)*

Suggestion	***Marginal***	***Small***	***Medium***	***Large***	***All Farms***
Strengthen of extension & market intelligence services	70	83	93	97	86
Ensure Availability of high yielding variety of seed and other quality inputs	80	93	73	93	85
Proper storage facilities at village level	80	83	90	97	88
Stabilization of prices	40	47	53	60	50
Regular supply of electricity	100	100	100	100	100
Establishment of more regulated market/purchase centre	70	83	93	97	86
Ensure knowledge about future trading	40	47	53	60	50
Strengthen crop insurance facilities	47	60	53	40	50

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CHAPTER V

CONCLUDING REMARKS AND POLICY SUGGESTIONS

A wide range of oilseed crops are grown in different states of the country. Among the oilseeds, groundnut which was the most important crop in TE 1998-99 has lost its prime position to soybean in TE 2008-09 and is grown in Madhya Pradesh, Maharashtra and Rajasthan, accounting for about 95 per cent of total production in the country. The second most important oilseed crop is groundnut, which is grown mainly in Gujarat, Andhra Pradesh, Tamil Nadu, Rajasthan, Karnataka and Maharashtra. The third major oilseed crop, mustard/rapeseed is grown in Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh, Gujarat and West Bengal. These three crops accounted for about 87 per cent of the total oilseeds production in the country. The other edible oilseeds are sunflower, sesame and safflower. Karnataka, Andhra Pradesh and Maharashtra are major sunflower producing states while West Bengal, Gujarat and Rajasthan are major sesame producing states.

Madhya Pradesh is a leading state of India in terms of area and production of oilseeds and recognized as Soya State in the country. It becomes possible only due to the serious efforts made by the scientists and the government resulting into tremendous increase in oilseed production. Amongst different major oilseeds cultivated in Madhya Pradesh the total area covered in soybean was found maximum (79.10%) followed by rapeseed & mustard (10.7%), sesame (3.8%), groundnut (3.1%), linseed (1.7%) and Niger (1.6%). Similarly production of soybean also recorded maximum (79.07%) followed by rapeseed & mustard (10.66%), sesame (3.77%), groundnut (3.08%), linseed (1.68%) and Niger (1.58%). Madhya Pradesh still has tremendous potential to increase yield of oilseeds particularly soybean and mustard in the state though, the potential yield of these crops is far from the actual yield which farmer harvest. It can be achieved provided government should take serious efforts to remove constraints faced by the farmers during the cultivation of oilseeds crops. Keeping above facts in mind the present study has been undertaken with following specific objectives:

5.1 Specific Objectives

1. To examine trends and pattern of growth of soybean and mustard over time and across districts and identify the sources of growth in edible oilseeds output in the state.

2. To analyse the cost and profitability of Soybean and Mustard and their competing crops in the area under study.
3. To analyse yield gap and identify major constraints in the soybean and mustard cultivation and suggest policy options to increase oilseeds production and productivity in the country.

5.2 Data base and Methodology

The study was based on both primary and secondary data pertaining to major edible oilseeds of Madhya Pradesh i.e. Soybean and Mustard. The secondary data related to area, production and productivity of these oilseeds were taken into consideration for detail study. In order to comprehend the behavior of the oilseeds crops in the context of different policy regimes, a disaggregated analysis of time series data covering time periods between 1951- 52 to 2009 -10 and classified them in to 1951-52 to 1960 – 61, 1961 – 62 to 1970 -71, 1971 – 72 to 1980 – 81, 1981 – 82 to 1990 – 91, 1991 – 92 to 2000 – 01 and 2001 – 02 to 2009 - 10. Apart from the detailed crop-wise analysis of growth patterns and sources of growth of edible oilseeds also considers for this, the growth of oilseeds was observed during 1980s, 1990s, 2000s and overall 1981 – 82 to 2009 – 10. The district wise time series data on area, production and yield of soybean & mustard have been collected for the above periods related to soybean and mustard to analyse the growth and variability of oilseeds in area, production and yield of selected crops with their competing crops i.e. maize and wheat. In order to identify profitability, yield gap and major constraints in edible oilseeds production in the state, primary data from the household growing oilseed in major producing districts were collected and analysed. A multistage, purposive sampling method was used to select the districts, blocks, villages and farm households. At first stage, all the districts were classified into two categories i.e. high area under the districts and low area under the districts considering area more than the mean (State Average) and area less than the mean (State Average) respectively for a particular crop. The one districts is have been categories into three category viz high area high yield (HAHY), high area low yield (HALY) and low area high yield (LAHY) categories one district from each category has been selected for the study. Hence, Chhindwara (HAHY), Khandwa (HALY) and Narsinghpur (LAHY) have been selected for soybean, while Morena (HAHY), Chhatarpur (HALY) and Mandla (LAHY) were selected for mustard in Madhya Pradesh. In second stage one block in each selected district has been selected on the basis of maximum area of respective crops in the district. In third stage three villages were selected in each selected block for the study. In the last stage a list of all the farmers of the selected villages was prepared in ascending order and classified them into

marginal (less than 1 ha), small (1-2 ha), medium (2-4ha) and large (above 4 ha) size of holdings. 20 farmers in each category were being selected for soybean and 10 farmers in each category were selected for mustard. Thus, study covers 240 soybean growers and 120 mustard growers of selected districts of Madhya Pradesh. Regression co-efficient, linear and compound growth, mean, percentage analytical techniques were employed to analyze collected data along with identification and prioritization major constraints facing oilseed production in the state. A pre tested interview schedule was used for collection of required data from the respondents of the study.

5.3 Major Findings

The following results have been drawn from the analysis of time series data:

The area under total oilseed increased from 1.59 million ha (1973-74) to 6.68 million ha (2009-10) in Madhya Pradesh. The contribution of total oilseeds and total pulses in total cropped area was found to be increased from 10.00 per cent (1973-74) to 34.01 per cent (2009-10), and 20.58 per cent (1973-74) to 23.63 per cent (2009-10) respectively. While, the contribution of total cereals to total cropped area was found to be decreased from 54.61 per cent (1973-74) to 38.85 per cent (2009-10). The area under total food grains to total cropped area was also found to be decreased from 75.25 per cent (1973-74) to 62.47 per cent (2009-10).

As regards to the contribution of area of soybean and mustard to total cropped area were found to be increased from 1.98 per cent (1983-84) to 26.63 per cent (2009-10) and 1.07 per cent (1973-74) to 3.72 per cent (2009-10) respectively, while the share of area of rice, groundnut, other oilseeds and cotton to total cropped area found to be decreased from 9.03 to 8.35 per cent, 2.71 to 1.07 per cent, 6.25 to 2.60 per cent and 4.10 to 3.16 per cent during the period 1973 – 74 to 2009 - 10. Hence, it is clear that the area of oilseeds particularly soybean increased tremendously which might be due to shift of the area of cotton, groundnut, other cereals, other oilseeds etc. to soybean in Madhya Pradesh.

The area, production and productivity of total oilseeds showed increasing trends over different periods. The area under oilseed increased from 1682.20 thousand ha to 6033.44, while the production of total oilseeds increased from 463.4 to 5694.66 thousand t and productivity from 285 kg/ha to 934 kg/ha respectively during the period 1951-52 to 2009 – 10.

The per cent area under oilseeds found to be increased by 2% in Guna and 3% Mandsaur districts, 1% in Shivpuri , Khandwa, Rajgarh, Sagar and Vidisha districts. It

remained constant in Sehore, Ratlam, Ujjain, Hoshangabad, Dewas, Shajapur, Dhar, Bhind, Mandsaur, Raisen and Seoni districts, while decreased in Morena (-2%), Indore (-1%), Chhindwara (-1%), and other districts (-2%).The oilseeds production increased by 2% in Guna, Hosangabad, Vidisha and Sehore districts and 1% in Bhind, Chhindwara, Khandwa, Rajgarh, Sagar and Shajapur districts. It remained constant in Dewas, Dhar, Mandsour, Raisen, Seoni and Shivpuri districts, while decreased in Indore (-1%), Morena (-2%), Ratlam (-1%), Ujjain (-2%) and other districts (-6%) during the period between 1993-94 to 2009-10.

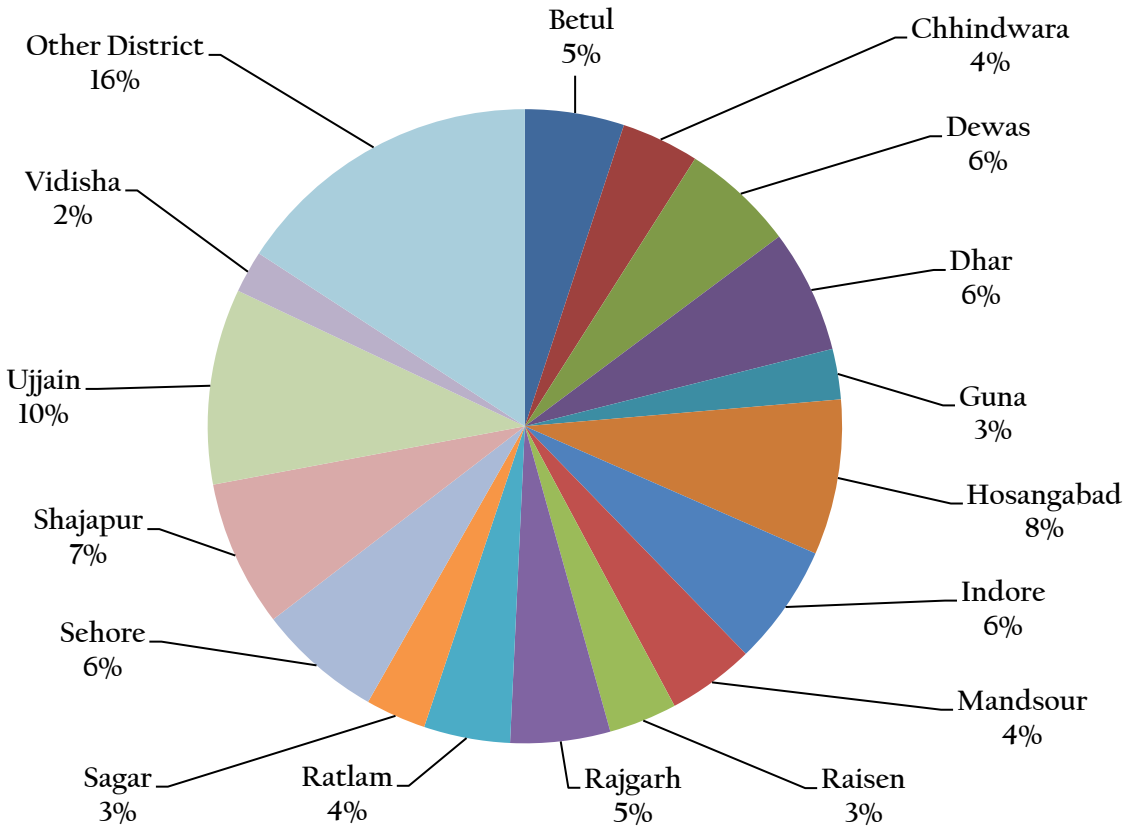

Fig. 5.1: Share of area of soybean in major districts of Madhya Pradesh (TE 1993-94)

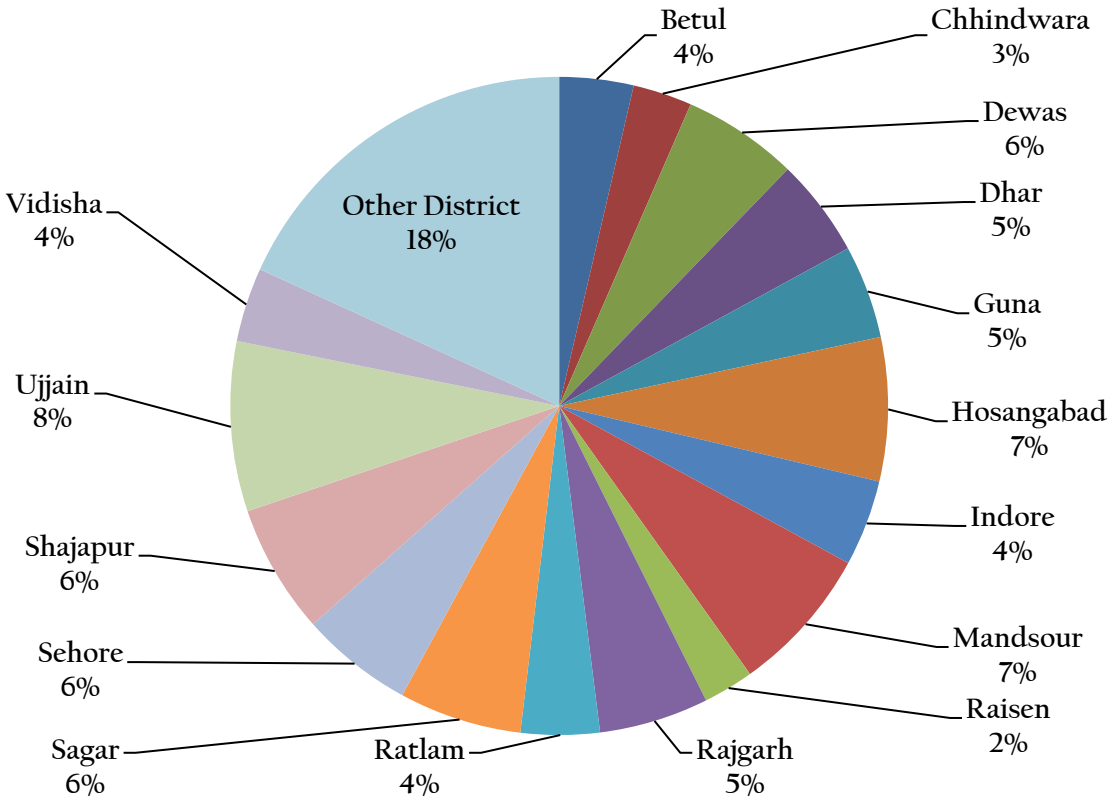

Fig. 5.2: Share of area of soybean in major districts of Madhya Pradesh (TE2009-10)

Madhya Pradesh being "Soya-State" accounts for 54.96 per cent of area and 57.62 per cent of production of soybean in the country with an average productivity of 1052 kg/ha. Maharashtra stands second in terms of soybean production in the country sharing 31.28 per cent of acreage and 28.57 per cent production, Rajasthan the third important state in terms of soybean production (7.02%) in the country. These three states together accounts for more than 92 per cent of area and production of the soybean in the country Soybean is concentrated mainly in Betul, Chhindwara, Dewas, Dhar, Guna, Hoshangabad, Indore, Mandsaur, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain and Vidisha districts of Madhya Pradesh. All these districts contributed 81.82 per cent of total soybean area of Madhya Pradesh. The area of soybean was found to be increased in Guna (2%), Mandsaur (3%), Sagar (3%) and Vidisha (2%) districts, while decreased in Dhar (-1%), Indore (-2%), Ujjain (-2%), Raisen (-1%), Hoshangabad (-1%), Betul (-1%), Shajapur (-1%) and Chhindwara (-1%). The area of soybean found stagnate in Sehore, Rajgarh, Dewas, Ratlam and other districts of Madhya Pradesh during the period 1993-94 to 2009 - 10.

The production of soybean was found to be increased in Guna (2%), Khandwa (2%), Mandsaur (1%), Sagar (2%), Hoshangabad (1%), Sehore (1%), Rajgarh (2%) and Vidisha

(2%) districts, while decreased in Dhar (-1%), Indore (-1%), Ujjain (-1%), Shajapur (-2%), Ratlam (-1%) and Chhindwara (-4%) districts.

The area and production of soybean in Madhya Pradesh increased by 42.18 per cent and 67.20 per cent respectively in the year 2009-10 over the year 1993-94.

The growth of area of soybean was found to be positive and significant in all the periods and in all the major soybean growing districts of Madhya Pradesh except in Raisen and Betul (1990s) and Indore and Sehore (2000s), where it was found to be positive and stagnate. In Chhindwara the growth of area of Soybean was found to be negative and stagnate in 1990s The growth of production of soybean was found positive and significant in all the districts and in all periods except in Dhar (1990s), Hoshangabad (1990s & 2000s), Raisen (1990s), Ujjain (1990s) and Sehore (2000s), where it was found positive but non-significant. In Madhya Pradesh only in Betul the growth of production of soybean was found to be negative but non-significant in 1990s.

In Madhya Pradesh The districts Sehore, Dewas, Indore, Dhar, Ujjain, Betul, and Chhindwara comes under high productivity districts, while Raisen, Vidisha, Guna, Hosangabad, Rajgarh, Shajapur, Ratlam, Mandsour, and Sagar were under low productivity districts. In all these districts none of the districts recorded significant decline in yield of soybean in Madhya Pradesh. The districts like Sehore, Dewas, Indore, Dhar, Ujjain, Raisen, Vidisha, Guna, Hoshangabad, Rajgarh, Shajapur and Ratlam showed significant increased in yield of soybean in Madhya Pradesh, while districts like Betul, Mandsaur and Sagar showed positive and stagnate, and Chhindwara showed negative and stagnate yield of soybean in 2010s in Madhya Pradesh.

The variability in area of these crops was found more in 1980s as compared to 1990s and 2000 in all the major soybean growing district of Madhya Pradesh During 1980s amongst all major soybean growing district the variability was found maximum in Mandsour (100.90%) followed by Ratlam (85.71%), Guna (82.99%), Vidisha (70.66%), Sagar (67.19%), Ujjain (59.40%) and Shajapur (54.16%). During 1990s the variability in area of soybean was found between 6.38 (Indore) to 35.07 per cent (Betul), while in 2000 it ranged between 2.04 (Indore) to 35.83 per cent (Sehore). In overall period it ranged between 36.08 (Indore) to 76.41 per cent (Mandsour).

The variability of production of soybean was also found more in case of soybean as compared to its competitive crop i.e. maize in all the periods and in all the major soybean producing districts of M.P. The variability in production of soybean was found to be more in

1980s (77.02%) as compared to 1990s (37.56%) and 2000s (32.41%). In overall period (1980s-2000s) it was found to be 67.90 per cent and ranged between 55.20 per cent (Indore) to 89.92 per cent (Guna). During 1980s it ranged between 17.47 per cent (Hoshangabad) to 59.12 per cent (Chhindwara), while in the period of 1990s and 2000s it ranged between 13.63 per cent (Indore) to 50.77 per cent (Rajgarh) and 17.30 per cent (Indore) to 100.21 per cent (Ratlam) respectively.

The variability in the productivity in soybean and maize in different major soybean producing districts in Madhya Pradesh was also observed in different periods of the study and found that the variability in productivity of soybean was found to be more during 1980s (27.28%) as compared to 1990s (26.06%) and 2000s (23.64%). In overall period it was found to be 30.54 per cent and ranged between 18.71 per cent (Sagar) to 49.24 per cent (Chhindwara). As regard to different districts is concerned the maximum variability in yield of soybean was found in Chhindwara i.e. 48.36 per cent in 1980s, 55.81 per cent 1990s and 34.24 per cent in 2000s.

The variability in yield of maize was found to be more than the variability in yield of soybean in the period 1980s, 2000s and overall period (1980s to 2000s) and found less than the variability in the yield of soybean in 1990s. Amongst different major soybean producing districts the variability in the yield of maize was ranged between 17.47 (Hoshangabad) to 59 .12 per cent (Chhindwara). In 1990s it was found between 15.73(Dewas) to 50.77 per cent (Rajgarh), while in 2000s it ranged between 17.30 (Indore) to 100.21 per cent ((Ratlam). In overall period (1980s to 2000s) it was found between 26.07 (Sagar) to 70.70 per cent (Chhindwara).

Madhya Pradesh is also one of the major mustard producing state in India and occupies 5th rank in the production of mustard. The area of mustard was 605.1 thousand hectares with the production and productivity of 701.2 thousand tonnes and 1159 kg/ha. The area of mustard found to be concentrated in Bhind, Gwalior, Mandla, Mandsaur, Morena and Shivpuri districts. These five districts contributed nearly 85 per cent to 90 per cent of area and production of mustard in Madhya Pradesh (2009-10).

The area under mustard also increased in all the districts except Balaghat (-0.97%), Gwalior (-30.65%), Hoshangabad (-42.80%), Jhabua (-100.00%), Mandsaur (-23.22%), Morena (-37.93%), Sagar (-34.48%), Shahdol (-75.49%), Sidhi (-21.16%) and Vidisha (-47.37%) in the year 2009-10 over the year 1993-94

The share of area of mustard was found to be increased in Shivpuri (1%), Bhind (9%), Mandla (1%), and Other districts (3%), while decreased in Morena (-9%), Gwalior (-5%) in the year TE 2009-10 as compared to TE 1993 - 94. The share of production of mustard was found to be increased in Bhind (10%), Mandla (1%), and Other districts (9%), while decreased in Morena (-13%), Gwalior (-7%) in the year 2009-10 as compared to 1993-94 It was found stagnate in Shivpuri and Mandsaur districts of Madhya Pradesh.

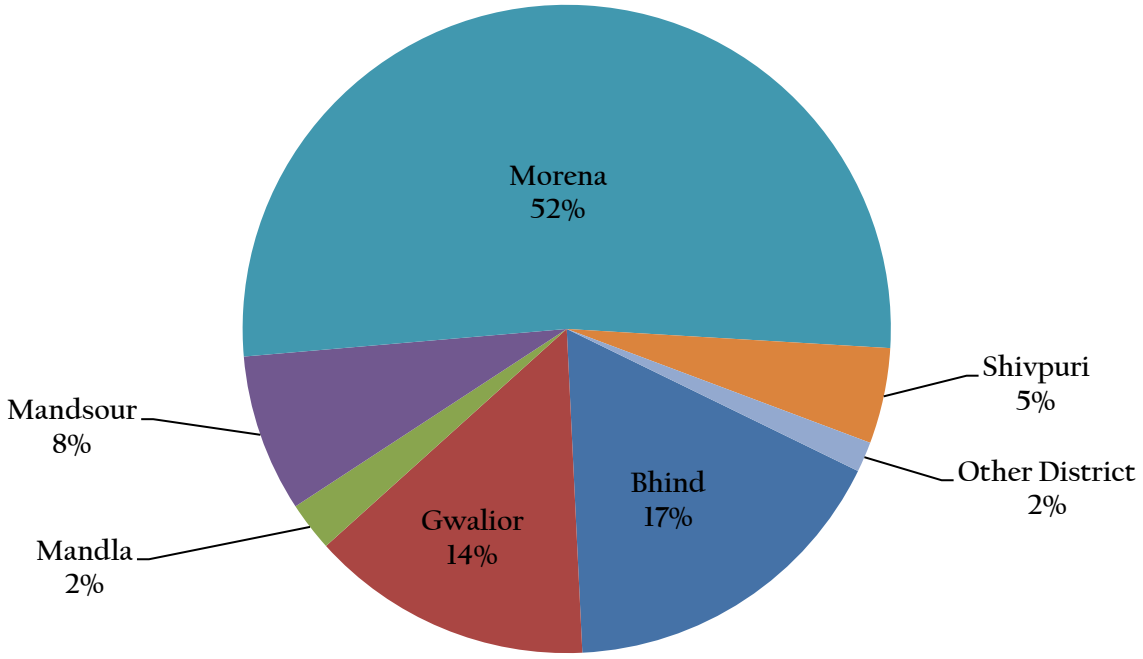

Fig.5.3: Share of production of mustard in major districts of Madhya Pradesh (TE 1993-94)

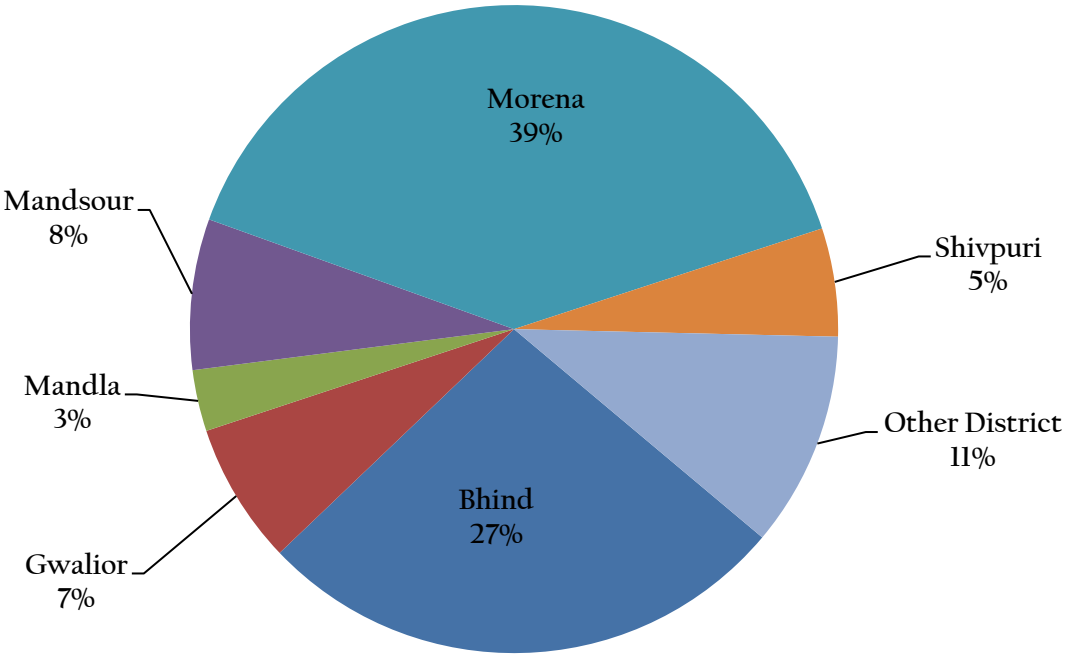

Fig.5.4: Share of production of mustard in major districts of Madhya Pradesh (TE2009-10)

The growth in area of mustard was found to be positive and significant in the periods 1980s and in 1981-82 to 2009-10 in all the major mustard growing districts of Madhya Pradesh. In 1990s the growth of area of mustard was found to be positive and significant only in Mandla district, while found positive and stagnate, negative and significant, and negative and stagnate in Bhind and Shivpuri districts, Morena district and Gwalior and Mandsour districts respectively. In 2000s the growth of mustard was found positive and significant in Bhind and Shivpuri and positive and stagnate in rest of the major mustard growing districts of M.P. viz. Gwalior, Mandla, Mandsour and Morena. The growth of production of mustard was found to be positive and significant in the periods 1980s and in overall period (1981-82 to 2009-10) in all the major mustard growing districts of Madhya Pradesh. In 1990s the growth of area of mustard was found to be positive and stagnate in Bhind, Mandla, Morena and Shivpuri districts, while found negative and significant in Gwalior and Mandsaur districts. In 2000s the growth of production of mustard was found positive and significant in Bhind, Gwalior, Morena and Shivpuri, while found positive but non-significant in Mandla and Mandsaur. Morena comes under in High productivity district, while all other major mustard growing districts *viz.* Bhind, Mandsaur, Shivpuri, Mandla and Gwalior were under low productivity districts. Amongst all these districts the significant

increase in yield of mustard was found in Morena, Bhind, Mandsaur and Shivpuri, while found stagnate with positive sign in Mandla and with negative sign in Gwalior.

The variability in area of mustard was found more in 1980s as compared to 1990s and 2000 in all the major Mustard growing district of Madhya Pradesh The average variability in area of mustard was found to be more in 1980s (57.99%) as compared to 1990s (21.32%) and 2000s (27.45%). In overall period (1980s to 2000s) the variability in area of mustard in different major mustard growing district was found to be 46.77 per cent and ranged between 17.24 (Mandla) to 75.90 per cent (Mandsaur). In 1980s the variability in area of mustard was ranged between 12.89 (Mandla) to 132.90 per cent (Mandsaur), while in 1990s and 2000s it was between 10.48 (Morena) to 39.19 per cent (Mandsaur) and 8.14 (Mandla) to 48.65 per cent (Mandsaur) respectively.

The variability in area of mustard was found to be more than the variability in area of wheat in all the major mustard growing districts of Madhya Pradesh. The variability of area of mustard as well as area of wheat in Mandsaur district was found to be more in all the periods of the study amongst different major mustard growing districts of Madhya Pradesh.

The average variability in production of mustard was found to be more in 1980s (78.13%) as compared to 1990s (31.68%) and 2000s (37.35%). In overall period (1980s to 2000s) the variability in production of mustard in different major mustard growing district was found to be 60.48 per cent and ranged between 34.75 (Morena) to 84.05 per cent (Mandsaur). In 1980s the variability in production of mustard was ranged between 43.36 (Morena) to 145.81 per cent (Mandsaur), while in 1990s and 2000s it was between 19.31(Shivpuri) to 45.28 per cent (Mandla) and 12.68 (Mandla) to 53.34 per cent (Mandsaur) respectively. As regards to the variability in production of wheat in different major mustard growing districts in Madhya Pradesh here also the variability in production of wheat was found to be more in 1980s (24.92%) as compared to 2000s (22.82%) and 1990s (22.90%). In overall period it was found to be 28.28 per cent and ranged between 22.37 (Morena) to 40.43 per cent (Mandsaur). It is also clear from the data that the variability in production of mustard was found to be more than the variability in production of wheat in all the periods of the study and also in all the major mustard growing districts of Madhya Pradesh. The variability of production of mustard as well as the variability in production of wheat in Mandsaur district was found to be more in all the periods of the study and amongst different major mustard growing districts of Madhya Pradesh except during 1990s.

The variability in productivity of mustard was found to be more than the variability in productivity of wheat in all the periods of the study and also in all the major mustard growing districts of Madhya Pradesh except in 2000s in which the variability in productivity of mustard was less than the variability in productivity of wheat.

The cropping pattern of any area governed by various factors such as price of input and output, agro-climatic conditions, market forces and technological development along with irrigated potential in the area, which determine their makeup. Oilseeds are mainly grown in rain fed areas in the states. These crops are best suited to soils of Madhya Pradesh. The oilseed production preferred by the farmers as it is more profitable over the other crops and due to availability of low input cost technologies. The most of the marginal and small farmers who are having rain fed areas and marginal lands prefer oilseeds instead of cereal and pulses crops in their cropping pattern. The de oiled cake a by product of oilseeds generate extra income which leads to enhance the profitability of the farmers in particular and contribute significant role in the state economy in general it is also having tremendous export potential (Soybean). The technological advancement i.e. evolution of new high yielding varieties/hybrid, production and marketing technology are also influence farmer to grow oilseed instead of other crops.

The findings drawn from the primary data collected from the respondents are as under:

The average oilseed grower of study area had 6-7 members in his family, which constitute 3-4 male and 3 female. The maximum number of respondents was found to be related to Other Backward Class followed by General and Schedule Caste /Schedule Tribe groups. In 95 per cent cases males were found to be head of the family and the average educational level of the respondent was found up to 8^{th} to 9^{th} standard. Average HH was found to operate 5.56 (mustard grower) and 4.98 ha (soybean grower) of land out of which 3.71 ha and 3.49 ha land was found under irrigation by ground water followed by surface water. Leasing out of owned cultivated land was not found in practice, although 8 to 13 percent of respondents found to cultivate crops on leased in land on fixed money basis which was ranged between Rs. 8800 to 16700/ha/year.

The majority of soybean growers cultivated soybean followed by cotton, maize, rice in kharif and wheat followed by gram, coarse cereals in rabi crop season, while the majority of mustard growers cultivated coarse cereals followed by pulses, soybean, rice in kharif and mustard followed by wheat, pulses in rabi crop season. In both the cases the cropping intensity of their farm was found to be around between 160 to 180 per cent reveals that

almost 60 to 80 per cent of areas of their farm under double cropping. As regards to yield poteital of different crops are concern it was noticed from the study that wheat gave highest yield potential in the area under study followed by rice, maize, gram, soybean and mustard.

The cultivation of soybean was found to be more profitable over its competitive crop (maize) as an average soybean grower got return of Rs.2.21 as compared to maize (Rs.2.16) over an investment of Rs. 1.00. The majority of cultivators preferred to cultivate soybean over the maize because of low yield risk in cultivation of soybean as compared to maize.

The cultivation of mustard was also found some what more profitable as compared to wheat (competitive crop) as an average mustard grower received more income (Rs.2.56) as compared to wheat (Rs.1.88) from investment of Re.1.00. The cultivation of wheat is preferred by the mustard growers because of low yield risk, low price risk and low net income risk in cultivation of wheat over the main crop (mustard).

All the oilseeds growers were found to use HYVs seeds of soybean as well as mustard although 70 -75 per cent respondents were using their owned seeds. About 50 -60 per cent respondents were found to applying recommended dose of fertilizers. All were attentive with Minimum Support Price (which was locally called as "society rate") and majority of them sold their produce above the society rate. The majority (85 to 90 %) of respondents reported that they were not faced any problem in the marketing of their oilseed produce.

As regards to yield gap between experimental, potential and actual farm yield of soybean and mustard are concerned, there is found a yield gap of 4.54 q between actual yield (11.46 q/ha) and potential yield (16 q/ha). In case of mustard also yield gap I was found to be only 1.2 per cent between experimental yield (25 q/ha) and potential yield (24.7 q/ha) of mustard and 70.40 per cent between actual yield (7.3 q/ha) and potential yield (24.7q/ha) of mustard.

As for as marketing of oilseeds are concerned the majority of oilseeds growers whether related to soybean or mustard found to sell their produce to local village traders followed by regulated market (wholesaler). The 8 per cent of large farmers were found to sell their soybean grains to ITC soya choupal. None of the respondents sold their produce directly to processing plant, commission agent etc. The results of the study also revealed that as the size of farm increase the percentage share sell to regulated market increase, while percentage share sold to local village trader decreases and only large farmers were found to be sold their soybean grains to ITC soya choupal.

As regards to the input and extension services, the majority of respondents reported that the major source of HYVs seeds was fellow farmer followed by State Department of Agriculture. The majority of them also reported that the State Department of Agriculture followed by input dealer was the major sources of extension services.

As for as the constraints in cultivation of oilseeds are concerned the majority of oilseeds growers reported that incidence of insect pest and diseases, weeds infestations, and non availabilities of desired HYVs of seeds were the some particular and important technical constraints in the cultivation of oilseeds in the area under study.

High price of inputs particulally insecticides, weedicide, fertilizers etc., low /fluctuating prices, more yield and income risk over cereals, shortage of human labours on peak operational periods (field preparation, intercultural operations harvesting, threshing etc.) were found to be serious and important economic constraints exist in the area under study.

The majority of respondents also reported irregular supply of power /electricity as serious and important constraints under institutional constraints and lack and inadequate storage facilities, high transportation cost, serious and important constraints related to post harvest, marketing and value additions constraints in oilseeds.

5.4 Policy Suggestions

It is clear from the above conclusions that, the production of soybean has increased not only by area expansion and increase in yield but other factors also contribute such as;

(i) Creating awareness among the masses about the economic nutritional and health benefits of soybean and its products by using print electronic media.

(ii) Training in manufacture and marketing of soy based food products and machinery for individual groups and entrepreneurs.

(iii) By providing technical support to the potential entrepreneurs through project report, consultancy and service support.

(iv) Strong political will and positive government policies to encourage production and utilization of soybean through fiscal incentives like soft loan and tax rebate / concessions.

(v) The Research and Industry linkage to refine the product and modify the technology, with time, for better efficiency and output. For all these to happen

there must be a commitment and missionary zeal by those involved in soybean production and value chain. It is in the interest of mankind. By doing all these efforts People are becoming conscious and there by demand of specialty foods is likely to increase.

(vi) As Soybean has tremendous potential to be transformed into a number of foods suiting to the requirements of diabetics' lactose intolerant and cancer & CVD patients. Moreover, the daily use of soybean in the diet would provide a better nutrition at low cost. Awareness on this aspect, among masses, is need of the hour.

(vii) The utilization pattern of soybean in near future may be as (i) Direct food of soybean in the form of flour and dairy analogs. (ii) Partial defecting of soybean using mechanical expression aided with extrusion pretreatment to produce physically refined oil and protein rich edible flour. (iii) Solvent extraction of soybean using superior technology to produce oil and edible grade soy meal (iv) Value added food products from soy meal for domestic markets (v) Industrial application of soybean and it's by products in pharmaceutical plastics pants printing, etc.

(viii) The strategy should be the complete utilization of soybean and its products in the domestic market specially, the soy meal in food feed and pharmaceutically industry. Some of the option are production of protein rich edible defected soy flour to be used in wheat and chickpea flours for higher contents and better nutritional quality; high and cost effects poultry, aqua and cattle feed soy protein constraints isolate and hydro sates to be used in food formulation for infants, children, adult and agreed person. In this way the problem of mal nutrition in poorer will be solved, but due to free competition in the market the soybean growers will also get the remunerative price for their product and cultivation of soybean will tremendously increased in the country.

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COORDINATOR'S COMMENTS ON THE DRAFT REPORT

1. Title of the Draft Study Report Examined: Problems and Prospects of Oilseeds Production in Madhya Pradesh

2. Date of Dispatch of the Draft Report: July 23, 2013

3. Date of Dispatch of Comments: May 22, 2014

4. Comments on the Objectives of the study: The report addresses some of the important concerns related to cultivation of soybean and mustard in Madhya Pradesh. The main objectives of the study are to examine the temporal and spatial trends and patterns of growth of soybean and mustard production across districts of Madhya Pradesh and to analyze relative profitability of soybean and mustard with their competing crops in the study area. The study also identifies major constraints in soybean and mustard cultivation in the State and suggests policy options to increase oilseeds production and productivity. The objectives listed in the study are quite comprehensive.

5. Comments on Methodology: The study is based on both primary and secondary sources of data. In order to analyze growth and variability of oilseeds acreage, production and yield, district wise time series data have been used. For identifying profitability, yield gap and major constraints in selected oilseeds, primary data has been used using appropriate sampling technique for selection of districts, blocks, villages and sample households. The study uses simple analytical tools like growth rates and coefficient of variation for estimating acreage, production and yield growth patterns and variability. It would have been better if authors had used standard classification for farm size categorization to have valid comparison among various states. The rationale for selecting districts in HH, HL, LH categories should have been clearly mentioned. Section 2.5 on 'Conceptual framework and theoretical model of the study' needs to be written properly.

6. Comments on the Presentation, Get up etc.: The report has been presented in five chapters. The first chapter discusses the role of agriculture, importance of oilseeds in the state economy, problems in oilseeds production and lists objectives of the study. Coverage, sampling design, and methodology used in the study have been discussed in chapter 2. Chapter 3 provides an overview of oilseeds sector in the state and discusses the current status and growth behaviour of area, production, productivity and prices of major oilseeds. The next chapter focuses on the problems and prospects of oilseeds production in the state based on household data collected oilseeds producers. The chapter discusses main feature of sample households, land ownership pattern, cropping pattern and crop yield. Production, retention and marketed surplus pattern, comparative economics of selected oilseeds vis-à-vis competing crops, access to improved technology and markets and marketing pattern, sources of technology and market information are also discussed in the chapter. The main constraints in cultivation of oilseeds and farmers' suggestions for improving production and productivity of oilseeds have also been discussed in the chapter. The last chapter presents the summary, concluding observations and policy implications of the study. Grammatical and spelling errors at different places should be corrected and some of the charts given in the report e.g. on page 29-30 need proper editing and presentation. Table 4.14 should present percentages or index rather than absolute numbers.

Overall View on Acceptability of the Report: The report may be accepted for publication and authors may wish to address some of the points suggested above.

ACTION TAKEN REPORT ON COORDINATOR'S COMMENTS ON THE DRAFT REPORT

1. Title of the Draft Study Report Examined: Problems and Prospects of Oilseeds Production in Madhya Pradesh

2. Date of Dispatch of the Draft Report: July 23, 2013

3. Date of Dispatch of Comments: May 22, 2014

4. Comments on the Objectives of the study: No Action Needed.

5. Comments on Methodology: Suggestions incorporated in the final reports.

6. Comments on the Presentation, Get up etc.: Suggestions incorporated in the final reports.

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