Study No. 76

ECONOMICS OF PULSES PRODUCTION AND INDENTIFICATION OF CONSTRAINTS IN RAISING THEIR PRODUCTION IN MADHYA PRADESH

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MAY, 1999

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INTRODUCTION

1.1 Background

The New Agricultural Technology (NAT) introduced during the mid-sixties has increased the production of foodgrains from 72.3 million tonnes in 1965-66 to 191.0 million tonnes in 1994-95. However, it did not make uniform impact on all the crops. Production of rice & wheat increased substantially, while it was almost stagnant in pulses. The productivity of rice increased from 862 kg/ha in 1965-66 to 1,921 kg/ha in 1994-95 and that of wheat increased from 827 kg/ha to 2,553 kg/ha during the same period. But the productivity of pulse crops increased from 438 kg/ha to 609 kg/ha only during the same period. (Table 1.1.)

Table 1.1 Growth rates of area, production and yield of foodgrains and pulses in India 1950-51 to 1994-95

Crop		1950-51 to 1965-66 (Pre green revolution)	1966-67 to 1980-81 (Green revolution)	1981-82 to 1994-95 (Post green revolution)
Rice	Area	1.39***	0.81***	0.52***
	Production	3.75***	2.70***	3.72***
	Yield	2.32***	1.88***	3.18***
	Coverage of irrigation	1.14***	0.64***	1.09***
Wheat	Area	2.35***	3.43***	0.64***
	Production	3.85***	6.58***	3.63***
	Yield	1.47***	3.05***	2.97***
	Coverage of irrigation	0.31	3.34***	1.61***
Total Foodgrains	Area	1.24***	0.51***	- 0.35**
	Production	2.99***	2.82***	2.84***
	Yield	1.74***	2.30***	3.21***
	Coverage of irrigation	0.84***	2.26***	2.06***
Total pulses	Area	1.49*	0.39	- 0.22
	Production	1.63**	0.25	1.07
	Yield	0.13	- 0.13	1.28
	Coverage of irrigation	- 0.37	- 1.48	2.97***

Note : 1. Coverage of irrigation is from 1981-82 to 1992-93
2. ***, **, * indidate significant at 1,5 and 10 per cent levels respectively.

Source : Computed from GOI (1996), Agricultural Statistics at a Glance, Ministry of Agriculture, New Delhi.

In fact, the production and productivity of pulses were almost stagnant over the last four decades (Table 1.1). As a result of stagnant production and continuous growth of population, the per capita availability of pulses fell drastically. Despite many promotional schemes for the increasing pulses production during the different plan periods, the production of the 1990's was almost the same as it was in the early 1960s. Non-availability of good high yielding varieties, as in the case of paddy and wheat, was one of the main reasons for slow growth in pulses production.

1.2 Scenario of Pulses

India is the largest producer of pulses in the world, both in quantity and quality. India produces 75 varieties of pulses. It produces 40 to 80 per cent of the global production of pulses like gram, arhar, lentil, pea, cowpea, mung and urad. Grain legumes grown, almost exclusively in India, are moth, lathyrus (khesri or lakh), kulthi, etc. However, one of the world's most widely grown grain legume, the fieldbean is of limited importance in India, i.e., in the Himalayan region and in Satara district of Maharashtra.

The area under pulses in India 1995 was 24 million hectares or 35.45 per cent of the world area.

The production of pulses in India in 1995 was 14.8 million tonnes. It formed 26.46 per cent of the world production of 55.9 million tonnes. In that year the yield was 595 kg. per hectare as against world average of 796 kg. per hectare. India's yield lagged far behind that of other countries. (Table 1.2)

Table 1.2 Area, production & productivity of pulses in major producing countries, 1995

S.No.	Country	Area ('000 hectare)		Production ('000 tonnes)		Yield (Kg./hectare)
1.	World	70,317	(100.00)	55,997	(100.00)	796
2.	India	24,925	(35.45)	14,820	(26.46)	595
3.	China	4,553	(6.47)	5,511	(9.84)	1,211
4.	Brazil	5,060	(7.19)	2,941	(5.25)	581
5.	France	700	(0.99)	3,502	(6.25)	5,003
6.	Australia	2,045	(2.91)	2,381	(4.25)	1,164
7.	Nigeria	2,220	(3.16)	1,850	(3.30)	833
8.	Canada	1,248	(1.77)	2,090	(3.73)	1,674
9.	Turkey	1,887	(2.68)	1.824	(3.26)	967
10.	U.S.A.	885	(1.26)	1.530	(2.73)	1,729
11.	Ukraine	1,075	(1.53)	1,518	(2.71)	1,412
12.	Russian Fed.	1,727	(2.45)	1,435	(2.56)	831
13.	Maxico	2,151	(3.06)	1,428	(2.55)	664
14.	Pakistan	1,524	(2.17)	781	(1.39)	513
15.	Egypt	179	(0.25)	380	(0.68)	2,122
16.	Argentina	207	(0.29)	277	(0.49)	1,340
17.	Bangladesh	714	(1.01)	517	(0.92)	724
18.	Indonesia	397	(0.56)	504	(0.90)	1,269
19.	Iran	1,010	(1.44)	730	(1.30)	723
20.	Japan	72	(0.10)	113	(0.20)	1,579
21.	Thailand	527	(0.75)	441	(0.79)	836
22.	Spain	309	(0.44)	211	(0.37)	683
23.	Italy	106	(0.15)	184	(0.33)	1,735

Note : 1. Total may not tally as many countries are not included.
2. Figures in brackets denote percentages to total

Source : FAO Production Yearbook, 1995, FAO, Rome

The share of pulses production in the overall foodgrains basket has declined from 16.5 per cent in 1950-51 to 7.1 per cent in 1995-96 (G.O.I. 1997). The cereal : pulses production ratio has moved consistently against pulses from 8.2:1 to 11.5:1 during the period.

Once a net exporter, India is presently one of the largest importers of pulses. The data for the latest five years shows that pulses constitute the biggest (19.60 per cent) or about 1/5th share of agricultural imports followed by sugar (16.69 per cent), cashew nuts (15.77 per cent) and vegetable oils (13.55 per cent) (Table 1.3). Pulses are imported on a more or less regular basis, because our domestic production is chronically short of domestic demand.

Table 1.3 Commodities composition of India's agricultural imports

(Unit : $ Million)

Commodity	1990-91	1991-92	1992-93	1993-94	1994-95	5 year average	percent share
Pulses	263.8	104.3	115.5	180.8	182.7	169.42	19.60
Sugar	5.3	0.3	0.1	0.1	715.5	144.26	16.69
Cashew nuts	73.8	109.0	129.9	153.9	215.0	136.32	15.77
Vegetables oils	179.6	101.3	57.6	53.1	194.2	117.16	13.55
Fruit & nuts	60.0	40.9	65.2	69.4	99.2	66.94	7.74
Wheat	13.5	0.0	245.2	40.1	1.5	60.06	6.95
Cereal preparation	48.5	66.3	62.9	35.0	30.2	48.58	5.62
Cotton raw & waste	0.0	0.0	74.8	5.9	161.8	48.5	5.61
Raw hides& skins	0.0	18.8	21.7	30.7	40.4	22.32	2.58
Natural rubber	42.5	12.1	16.1	17.5	7.9	19.22	2.22
Rice	21.8	4.5	25.3	17.6	2.7	14.38	1.66
Spices	0.0	0.0	0.0	24.1	17.6	8.34	0.96
Milk & cream	1.9	3.3	15.5	5.3	1.9	5.58	0.65
Oil seed	3.6	3.9	3.7	2.2	1.8	3.04	0.35
Vegetables & animals fats	0.3	0.4	0.5	0.5	0.7	0.48	0.06
Total	714.6	465.1	834.0	636.2	1673.1	864.6	100.00

Source : Foreign Trade statistics of India, May 1996, Centre for Monitoring Indian Economy Pvt. Ltd., Mumbai.

The crisis of pulses is gradually firing up its grip on increase in demand, due to growth in population and introduction of protein based food industries. There is a need to check pulses import which drained much needed foreign exchange. To bridge the gap of 20 lakh tonnes* between demand and supply of pulses, India needs manifold increase in pulse production.

1.3 Nutritional and Agronomical Importance of Pulses

Pulse crops are important both from nutritional and agronomical points of view. From nutritional point of view, pulses are the primary and cheapest sources of vegetable protein for the poor and the vegetarians who constitute majority of Indian population. It is cheaper than animal protein. Protein content of different pulses varies from 20 to 40 per cent which is two to three times more than the cereal grains (wheat and rice) and offers the most practical means of eradicating malnutrition. It is also a good source of minerals like calcium, phosphorus, iron, copper and molybdenum and also rich in vitamins such as thiamine, riboflavin, nicotinic acid, ascorbic acid, and carotene, etc.*1 From the agronomic point of view, pulse crops increase the soil fertility through the nitrogen fixing bacteria present in the root nodules. Further, due to deep root system pulses can utilize the limited available moisture very efficiently than many other crops. Pulse crops are also helpful to increase the source of income of the farmers by way of intercropping, frequency and crop intensity.

1.4 Reasons for Deceleration in Pulses Cultivation

While the traditional cropping pattern almost always included a pulse crop either as a mixed crop or in rotation, the commercialisation of agriculture has encouraged the practice of sole cropping. Cereal shortage of the mid-sixties and the green revolution accompanied with changes in the infrastructure and incentives including input supplies and price support systems in favour of major cereals altered the traditional cropping pattern

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* दालों के उत्पादन एवं खपत के बीच 20 लाख टन की कमी- नवभारत, जबलपुर 30·8·1997

*1 H.S. Sekhon, J.S. Brar and P.S. Phul- "Nutritional Quality of pulses". Status of Pulses in Punjab, PAU Ludhiana, pp.36-37.

against pulses. With decades of emphasis on research as well as production of superior cereals coupled with a near total neglect of rainfed areas, pulses were driven out of not only the irrigated areas, but also the rainfed farming and were relegated to the marginal lands. Further more, the weak infrastructural support for input supply, credit and marketing in the rainfed areas, the traditional home of pulses also adversely affected the prospects for pulses. A vicious circle of low input use and low output thus got built in. Lack of processing and marketing facilities in pulses also contributed its share to the woes of pulse growers.

1.5 Availability of Pulses

The increasing shortages of pulses, resulted in more & more imports. Normally an average person needs 47 gms of pulses per day. According to FAO and WHO estimates, 1 gm. of protein per capita per day for each kilogram body weight is required for proper growth of the body. However, in India the per capita availability of pulses is declining from year to year due to increasing population and nearly stagnant production. The per capita net availability of foodgrains increased from 468.7 gm./day in 1961 to 510.1 gm./day in 1991. However, the availability of pulses declined from 69 gm/day in 1961 to 41.6 gm/day in 1991 and further to 34.8 gm/day in 1996(Table 1.4).

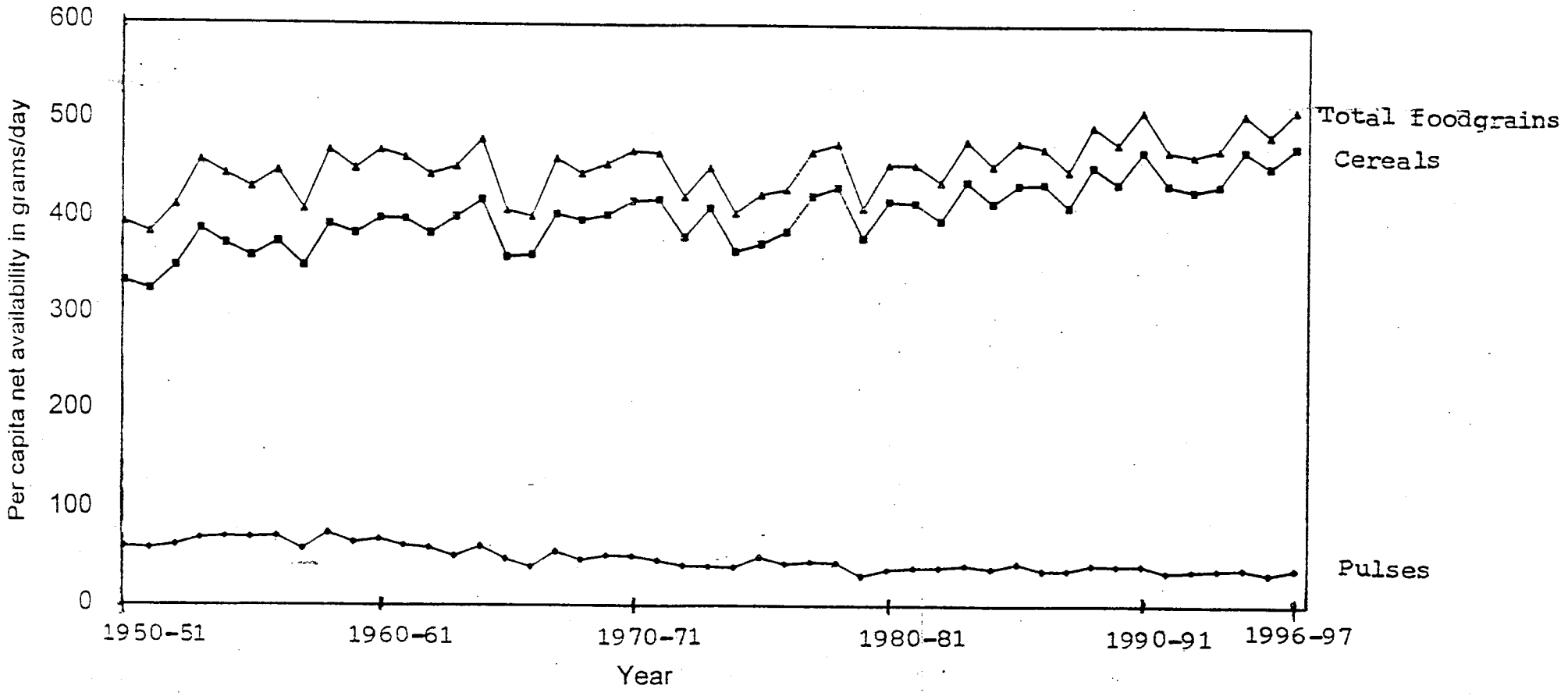
Table 1.4 per capita net availability of cereals and pulses in India

(Figures-grams/day)

Year	Cereals	Pulses	Total
1951	334.2	60.7	394.9
1961	399.7	69.0	468.7
1971	417.6	51.2	468.8
1981	417.3	37.5	454.8
1990	435.3	41.1	476.4
1991	468.5	41.6	510.1
1992	434.5	34.3	468.8
1993	427.9	36.2	464.1
1994	434.0	37.2	471.2
1995	468.5	38.1	506.6
1996	465.0	34.8	498.0

Source : Government of India, 1997

Figure
Percapita Net Availability of Cereals, Pulses and Total Foodgrains in India: 1950-51 to 1996-97.



It is evident from the table that the net per capita availability of pulses in India has never reached the recommendation of FAO and WHO (80 gm/capita/day) in the last 50 years. The highest per capita availability so far reached was 71.8 gm/day in 1956-57 and thereafter it has been falling continuously. Even if we take into account the recommendation of Indian Council of Medical Research (ICMR) (i.e. 43 gm/capita/day), the results are not encouraging. Out of 47 years (between 1950-51 and 1996-97), only in 26 years we could reach the requirement of 43 gm/capita/day or more and in the remaining 21 years, the average per capita availability was below the recommended level of ICMR (Table 1.5).

Table 1.5 Classification of years based on the per capita/day availability of pulses in India

Below 43 grams/day	43-50 grams/day	50.1-60 grams/day	60.1-70 grams/day	70.1-80 grams/day	Above 80 gms/day
1967,1973, 1974-1975, 1980,1981, 1982,1983, 1984,1985, 1987,1988, 1989,1990, 1991,1992, 1993,1994, 1995,1996, 1997.	1966,1969, 1972,1977, 1978,1979, 1986.	1952,1958, 1963,1964, 1968,1970, 1971,1976.	1951,1953, 1954,1960, 1961,1962, 1965.	1955,1956, 1957,1959.	Nil

Note : Year 1951 corresponds to 1950-51 and so on for subsequent years.

Source: GOI (1998), Economic Survey : 1997-98, Ministry of Finance, Government of India, New Delhi

1.6 Pulses Development Programmes

To meet the growing needs of the country, the pulse production programmes were initiated with different developmental strategies during different plan periods.

Major Strategies/Programmes Introduced for Pulses Development During Different Plan Periods

Third Plan (1961-62 to 1965-66)

1. All India Coordinated Pulse Research Project initiated.
2. All India Coordinated varietal trials were taken up.
3. Breeding of suitable varieties for fitting into multiple cropping
4. Breeding of uniformly ripening varieties
5. Breeding of suitable varieties of urad for mixed cropping in north India
6. Breeding of diseases resistant varieties.

Fourth Plan (1969-70 to 1973-74)

1. Intensive Pulses District Programme (IPDP) was initiated
2. Adoption of package of practices involving use of improved seeds, phosphatic fertilisers, rhizobium culture and plant protection campaigns
3. Outside the area of IPDP, minikit programme for major pulse crops introduced
4. Extension of pulses area by catch cropping, inter-cropping and mixed cropping with cereals, millets, cotton, groundnut and sugarcane, etc.

Fifth Plan (1974-75 to 1978-79)

1. IPDP continued and further intensified
2. Research programme on pulses stepped up by All India Coordinated Research Programme
3. Breeding of varieties suitable as catch crops to replace monsoon fallows
4. Standardization of techniques for fertiliser application
5. Development of pest control schedules and suitable bacterial culture

6. Development of more effective agronomic practices.

7. Special importance on processing of pulses and modernisation of dal milling industry

Sixth Plan (1980-81 to 1984-85)

1. Introduction of pulse crops in irrigated farming

2. Bringing additional area under short duration varieties of urad, moong, etc., in rice-fallows by utilising the residual moisture in rabi season and in summer season with irrigation after oilseeds, sugarcane, potato and wheat

3. Multiplication and use of improved pulse seeds

4. Use of phosphatic fertilisers and rhizobium culture

5. Improved post harvest technology

6. Organisation of "pulse crop village" in various blocks both in irrigated and rainfed areas

Seventh Plan (1985-86 to 1989-90)

1. Introduction of pulses in irrigated farming

2. Bringing additional area under short duration varieties of moong and urad in rice fallows in the rabi season and as a summer crop where irrigation facilities are available

3. Inter cropping of arhar, moong and urad with other crops

4. Multiplication and use of improved seeds

5. Adoption of plant protection measures

6. Use of fertilisers and rhizobium culture

7. Remunerative prices relative to competing crops

8. Centrally sponsored National Pulses Development Programme (NPDP)

Eighth Plan (1992-93 to 1996-97)

1. Many programmes introduced in the seventh plan were allowed to continue in the Eighth plan

2. Pulse crops brought under Technology Mission in 1990-91

3. Pulses production was intensified by taking up NPDP and the special food grain production programme on pulses

The proposed strategy for increasing production and productivity of pulses under NPDP (1996-97) is given below

1. a) Bringing additional area under non-conventional cropping systems, like introduction of short duration arhar varieties into irrigated cropping system in northern and central India in sequence with wheat. Introduction of summer pulses (urad, moong, cowpea) in irrigated area after the harvest of rabi crops, substitution of upland crops like rice, jowar, maize, bajra and diverting these areas under short duration pulses in eastern and southern states. Introduction of rabi pulses in rice-fallow areas, inter-cropping of arhar, moong, and urad with jowar, bajra, maize, cotton, groundnut and soybean etc., Introduction of rabi arhar in Bihar, W.Bengal, Orissa, Eastern U.P., Gujarat & A.P. Introduction of rabi rajma in U.P., Bihar, M.P., Orissa, Maharashtra & W.Bengal.

b) Summer Pulse Campaign

2. Adoption of improved production technology

1) The full recommended package of practices should be popularised and adopted on a much larger area for each pulse crop

2) Adopt inter cropping practices for increasing pulses production

3. Breeding of suitable and uniformly ripening varieties including disease resistant varieties, adoption of plant protection measures, organisation of 'pulses crop village' in various blocks, use of fertilisers and rhizobial culture, remunerative prices relative to competing crops, etc. were taken up since Fourth Five Year Plan (1969-70 to 1973-74) period. But these measures could not make any significant impact on the production of pulses.

Since pulse crops are important in terms of protein content as well as low cost nutriticus diet for the poor people, much attention has been given to study the factors which hinder the growth of area and productivity of pulses or constraints.

1.7 Reasons for the Slow Growth of Pulses

Several studies have been conducted on pulses. These have offered many reasons for the stagnant area and production of pulse crops. The main reasons are as follows.

Pulse crops are predominantly grown in rainfed areas where moisture/stress is enormous and hence the production and productivity are lower. Some studies showed that since these are grown mainly in the rainfed areas, farmers are reluctant to use quality inputs such as fertilisers, pesticides etc. Some argue that because of non availability of good high yielding varieties as in the case of wheat and rice, farmers are reluctant to grow pulse crops in fertile areas. Farmers mainly use owned seeds, untreated and of worn out varieties. These have poor response to yield increasing inputs. Though the absolute price of pulses is relatively higher than many competing crops, the total profit is less owing to low productivity. Development of groundwater irrigation has also induced the farmers to cultivate remunerative crops instead of pulses as groundwater is costly input. Farmers generally allot poor lands in terms of soil quality and irrigation facilities for growing pulse crops. Since these are grown on poor lands, farmers seldom give importance to supervisory works such as weeding and timely application of fertilizers and hence the productivity is low. Adoption of plant protection measures such as weeding, application of rhizobium culture, application of pesticides, etc. are not taken seriously for pulses cultivation. Generally pulses are susceptible to pests, diseases and weather fluctuations and involve a lot of risk.

Unlike in rice and wheat, importance is not given to study the problems and constraints relating to pulses production by using field level data. Most of the studies relating to pulses have been carried out by using macro level data either state level or regional level. Macro level data can be useful to

understand the trends in area and production, but one can not understand the reasons for less adoption of yield increasing inputs and the problems in cultivating pulse crops. Lower productivity and lower use of inputs are field level problems and these can be studied only by field level information.

In this connection, the Ministry of Agriculture, Government of India asked the Agro-Economic Research Centres to study the constraints and opportunities for pulse production in the respective states. The Agro-Economic Research Centre for M.P., Jabalpur has taken up this study in Madhya Pradesh.

1.8 Objectives of the Study

The present study on "Economics of Pulses Production and Identification of Constraints in Raising their Production in Madhya Pradesh" is taken up with the following objectives.

1) To find out the socio-economic characteristics of the farmers who cultivate pulse crops

2) To analyse the input use pattern of pulse crops

3) To analyse the relationship between the use of inputs and output.

4) To find out the factors which affect the growth of pulses area and productivity

5) To find out the economics of production of different pulse crops grown under irrigated and rainfed conditions as compared to other predominant crops of the area in different seasons.

6) To identify factors responsible for diversion of area from pulses to other crops and the extent of diversion and its result.

7) Possibilities and extent of diversification and expansion of area under pulses by way of multiple cropping, intercropping, etc. both under rainfed and irrigated systems.

8) Identify reasons for non/partial adoption of improved production technology and sub optimal use of inputs like improved seed, phosphatic and sulphur rich fertilisers and other micro-nutrients, plant protection chemicals and other inputs.

9) To suggest various measures (financial and non financial) for increasing production and productivity of pulses.

10) Factors responsible for large gap between purchase price from farmers (very low) and sale price to consumers (very high) of pulses.

11) To explore the possibility of contract cultivation of pulses within the country and suggest most suitable areas to undertake this for different pulse crops.

Due to non availability of data on some of the above objectives no observations could be made/conclusions drawn.

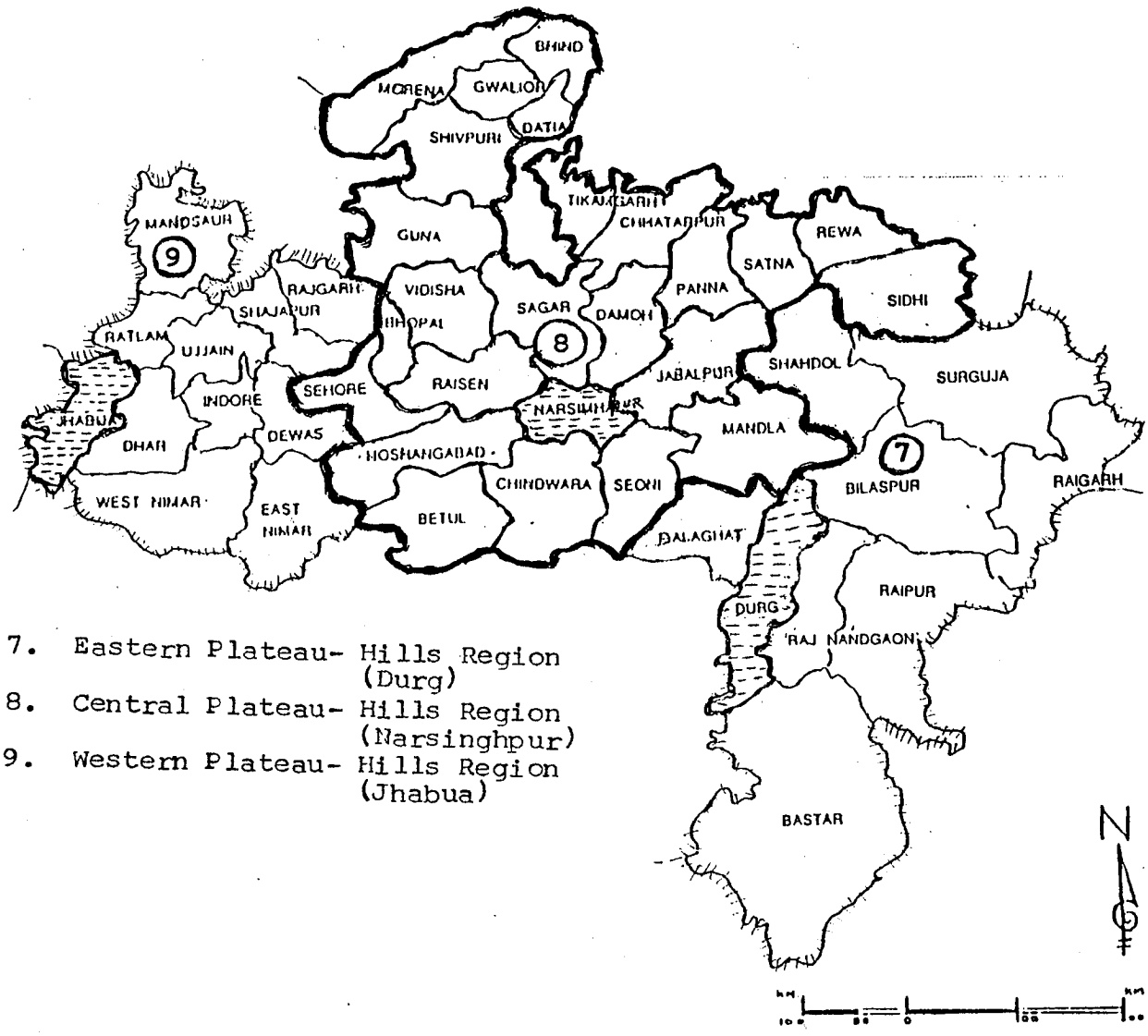
1.9 Methodology

1.9.1 Design of the study

Out of the three agro-climatic zones forming Madhya Pradesh, the district of Durg from the agro-climatic zone VII, i.e.,'Eastern Plateau & Hills Region', district Narsinghpur from the agro-climatic zone VIII, i.e. Central Plateau & Hills Region' and district Jhabua from agro-climatic zone IX, i.e. 'Western Plateau & Hills Region' were selected for field work as the area under pulse crops was highest in these districts among the districts of the respective three zones.

Zone No.	Selected district	Selected pulse crops		
		Kharif	Rabi	Summer
VII	Durg	arhar, urad	teora (lakh), gram	moong
VIII	Narsinghpur	arhar, moong	gram, pea	moong
IX	Jhabua	urad, arhar	gram, kulthi	moong

AGRO-CLIMATIC ZONES AND SELECTED DISTRICTS
OF MADHYA PRADESH



7. Eastern Plateau- Hills Region (Durg)
8. Central Plateau- Hills Region (Narsinghpur)
9. Western Plateau- Hills Region (Jhabua)

From each selected district 5 blocks were selected and from each block one village was selected. The entire selection procedure was done in consultation with the Deputy Director of Agriculture of the concerned district. Finally, from each of the selected villages, lists of category-wise pulse growers, viz., marginal, small, semi-medium, medium and large farmers were prepared with the help of respective Senior Agricultural Development Officers of the block.

The selected villages are listed below.

District	Block	Village
Durg	Bemetara	Dooda
	Saja	Padumsara
	Nawagarh	Murta
	Berala	Hadgaon
	Dondi-lohara	Jhitia
Narsinghpur	Chawarpatha	Deori
	Chichali	Magarmuha
	Gotegaon	Mahgua
	Kareli	Sagari
	Narsinghpur	Dhoovgarh
Jhabua	Alirajpur	Kund
	Udaigarh	Pratap Falya
	Jobat	Handi
	Petlavad	Amarholi
	Bhabara	Ditya Ka Falia

A sample of 10 pulse growers from each village was randomly selected from the referred list by adjusting the available size classes. In this way, a total of 150 pulse growers, comprising 50 from each of the districts, were selected for the study. The farmers have been divided into five size groups according to the size of land holding viz., Marginal (upto 1.00 ha), small (1.01 to 2.00 ha), Semi-medium (2.01 to 4.00 ha), medium (4.01 to 10.00 ha) and large (above 10.00 ha.)

1.9.2 Reference Period

The reference year of the study was agricultural year 1996-97, viz. crop season rabi 1996, summer 1997 and kharif 1997.

The field work was started after the harvest of kharif crop 1997.

1.9.3 Data Collection and Method of Analysis

Both primary as well as secondary data were collected. Primary data was collected from sample farmers and secondary data was collected from various agricultural statistics, published by Ministry of Agriculture, Govt. of India and Directorate of Agriculture, Govt. of Madhya Pradesh, Bhopal.

Published and unpublished literature was also consulted. Besides these, the data from dal mill owners of selected districts for the year 1996 (January to December) were collected to understand the factor responsible for large gap between purchase price from farmers and sale price to consumers of pulses.

1.9.4 Statistical Tools

For calculating the trend and growth rates of area, production and productivity of various pulse crops at National level and state level, the exponential trend model was fitted from the regression analysis method (least square technique).

$$y = a\, b^{x}$$

$$\text{Log } y = \text{Log } a + x \text{ Log } b$$

y = dependent variable (area, production & productivity)

a = intercept

b = regression coefficient (slope of the line)

x = independent variable (time)

Exponential Trend

The exponential trend gives directly a constant rate of change from observation to observation (year to year). It is compound in nature. In this function ($y = ab^{x}$)*, If 'b' is a

* Croxton, Frederick E. and Dudley, J. Cowden, "Applied General Statistics", Prentice Hall of India (Pvt) Ltd. New Delhi, 1964

positive number greater than one, the trend is upward and the amount of change is undergoing a constant percentage of increase. If 'b' is a positive number smaller than one, the trend is downward and the amount of change shows a constant percentage of decrease. The significance (Best fit) of a particular model was judged by the student's 't' test.

't' test

$$t = \frac{|b|}{SE(b)}$$

Where, b = regression coefficient
SE (b) = standard error of 'b'

Compound growth rate

$$y = ab^x$$

$$\text{Log } y = \log a + x \text{ Log } b$$

$$\text{C.G.R.}(\%) = (b-1) \times 100$$

where, b= Antilog of log b

The compound growth rate represent a uniform rate of change from year to year.

Coefficient of Variance

The extent of variability in area, production and yield of pulses was measured by the coefficient of variation (C.V.) It measures the magnitude of variability for the given (time series data) period of time.

$$CV\ (\%) = \frac{\sigma}{\bar{x}} \times 100$$

Where, σ = Standard deviation
$\bar{x}$ = Arithmatic Mean

$$\sigma\ (S.D.) = \sqrt{\frac{\Sigma y^2 - \frac{(\Sigma y)^2}{n}}{n}}$$

Where, y = area, production & yield
n = number of observations (years)

Contribution of area & yield towards change in production

It is well known that the production of a crop is a function of the area and yield. For computing the contribution

of area and yield towards change in production (increase/ decrease) between two trienniums, the formula given by (Sharma 1977) was used.

Decomposition Model (Sharma 1977)

$$\Delta P = \Delta YAo + \Delta AYo + \Delta Y\Delta A$$

$$Pn-Po = \frac{(Yn-Yo)\ Ao}{Pn-Po} + \frac{(An-Ao)\ Yo}{Pn-Po} + \frac{(Yn-Yo)\ (An-Ao)}{Pn-Po}$$

Change in Production = Yield Effect + Area effect + Interaction effect (Area x yield)

Where, production, area and yield are denoted by P,A & Y in the first triennium (o) and last triennium (n).

1.9.5 Cost Concepts Used :

Cost means Cost A2. Costs were calculated with the help of standard cost concept method, as is used by the Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India.

The items included in Cost A2 are :

Cost A2 = Cost A1 + rent paid for leased-in land.

Cost A1 includes, value of hired human labour, hired bullock labour, owned bullock labour, owned machinery labour, hired machinery charges, seed (both farm produced and purchased), fertilisers, manures (owned and purchased), insecticides & pesticides, depreciations on farm buildings, implements & machinery, irrigation charges, land revenue & other taxes, interest on working capital and miscellaneous expanses.

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CHAPTER-II

PULSES DEVELOPMENT IN INDIA AND MADHYA PRADESH

India is the largest grower and producer of pulses in the world as it ranks first in both production and area under pulses. In 1995 India accounted for 35 per cent of the area and 26 per cent of production in the world. Despite being the largest producer, the pulses productivity is one of the lowest (595 kg/ha.) in the world. France ranks first in the case of productivity of pulses in the world (5,003 kg./ha.) followed by Netherland (4,041 kg), Switzerland (4000kg), England (3,162 kg.), U.S.A.(1,729 kg.), Canada (1,674 kg.) and China (1,211 kg.), whereas the world average is 796 kg. per hectare. India's yield lags far behind the global standards. (Table 2.1).

Table 2.1 Yield of pulses in some countries, 1995

S.No.	Country	Yield (Kg./ha)
1.	France	5,003
2.	Netherland	4,041
3.	Switzerland	4,000
4.	England	3,162
5.	Germany	2,859
6.	Egypt	2,122
7.	Italy	1,735
8.	U.S.A.	1,729
9.	Canada	1,674
10.	Japan	1,579
11.	Argentina	1,340
12.	China	1,211
	World	796

Source : FAO- Production Year Book, 1995

India grows a variety of pulse crops. No other country in the world grows such a large number of varieties.

2.1 Status of Pulses in India

In 1951-52, 96,960 thousand hectares of land was cultivated under foodgrains. By 1992-93 the area increased to 1,23,000 thousand hectares, and has since remained fairly stable. The area under pulses increased from 18,780 thousand hectares to 22,360 thousand hectares during the corresponding period. During 1995-96, pulses were cultivated on 23,920 thousand hectares. In relative terms, area under pulses has been hovering around 19 per cent of the total area under foodgrains (Table 2.2).

Table 2.2 Trends in area, production and yield of pulses in India

(Area- '000 ha.)

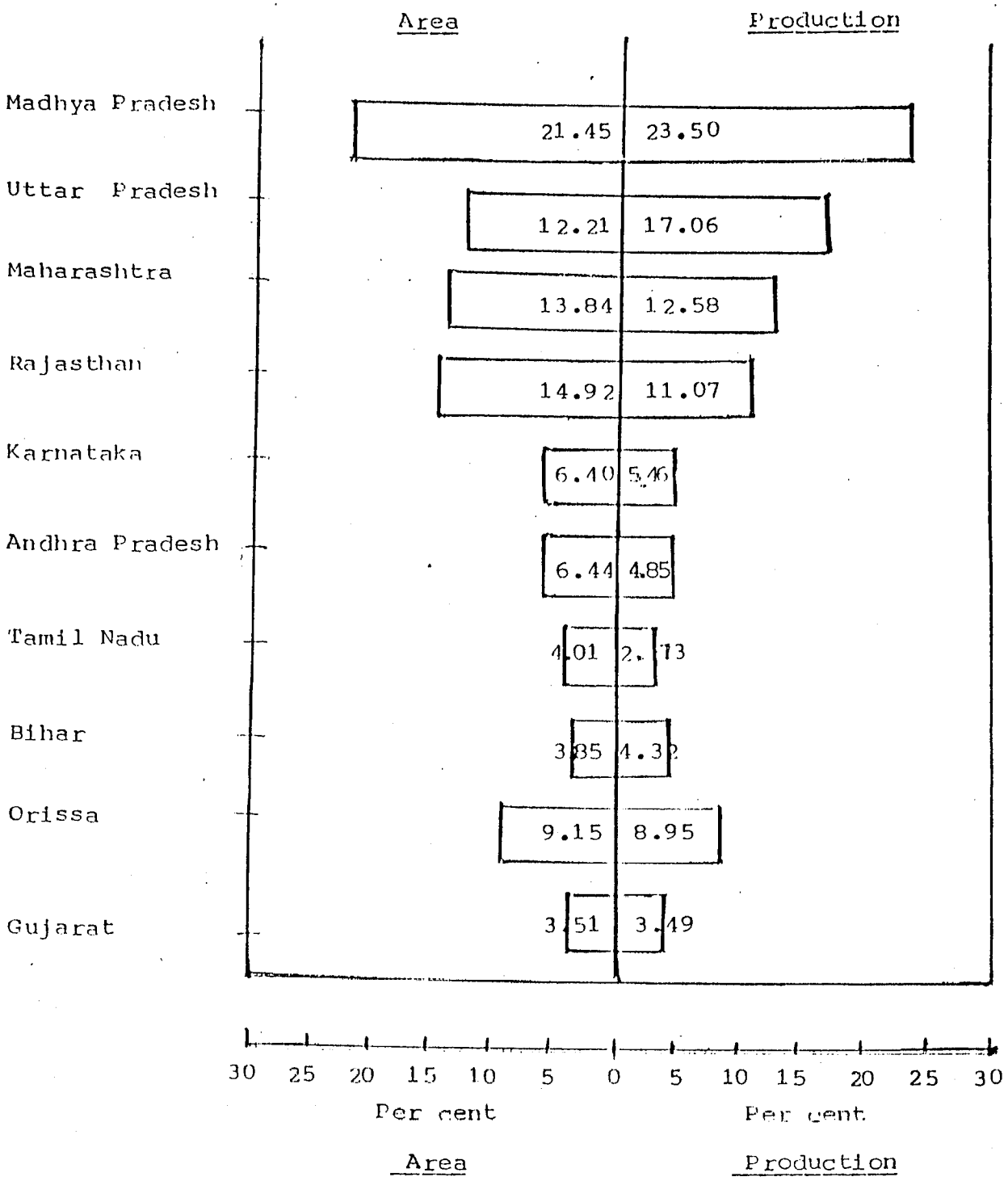
Year	Area under pulses	Area under food-grains	% of pulse area to total foodgrains area	Pulse Production ('000 tonnes)	Yield (kg./ha)
1951-52	18,780	96,960	19.37	8,420	448
1956-57	23,320	1,11,155	20.98	11,550	495
1961-62	24,240	1,17,215	20.68	11,760	485
1966-67	22,120	1,15,328	19.18	8,350	377
1967-68	22,650	1,21,448	18.65	12,100	534
1968-69	21,260	1,20,453	17.65	10,420	490
1969-70	22,020	1,23,569	17.82	11,690	531
1974-75	22,030	1,21,111	18.19	10,020	455
1977-78	23,500	1,27,509	18.43	11,970	510
1980-81	22,460	1,26,680	17.73	10,630	473
1985-86	24,420	1,27,987	19.08	13,360	547
1990-91	24,662	1,27,850	19.29	14,265	578
1991-92	22,542	1,21,850	18.50	12,014	533
1992-93	22,360	1,23,000	18.16	12,815	573
1993-94	22,250	1,22,725	18.13	13,305	598
1994-95	23,030	1,23,684	18.62	14,040	610
1995-96	23,920	1,23,426	19.38	13,190	552

Source : Government of India, 1997

The highest area and production of pulses were recorded during 1990-91, whereas, the highest yield was 610 kg./ha during 1994-95.

* Singh, R.P., K. Sathees Babu and Roshan Lal (1998) "Pulses Production in India : Emerging Trends and Food Security Concerns" Paper presented at "National Symposition on Management of Biotic and Abiotic stresses in pulse crops" organised by Indian Society of Pulses Research & Development and I.I.P.R.Kanpur(U.P.) in 1998.

Statewise area and production of total pulses
(Major pulse growing states)
(for the year 1995-96)



Percentage figures denotes the share of each state to all India total.

2.2 Status of Pulses in Different States of India

So far as the pulses production scenario in the different states of the country is concerned, Madhya Pradesh is the largest producer of pulses. During 1995-96 the total area under pulses in the country was 23,920.0 thousand hectares. Madhya Pradesh accounted for 5,130 thousand hectares or 21.45 per cent of the total area under pulses in the country and its share in total production was 3,100 thousand tonnes or 23.50 per cent of the country's production. The average productivity level was also much higher (604 kg/ha) in Madhya Pradesh as compared to the national average of 552 kg/ha. The other major pulse growing states in the country were Rajasthan (3,570.0 thousand hectares), Maharashtra (3,310.0 thousand hectares), Uttar Pradesh (2,920.0 thousand hectares), Orissa (2,190.0 thousand hectares), Karnataka (1,530.0 thousand hectares) and Andhra Pradesh (1,540 thousand hectares). These contributed more than 1,000 thousand hectares each. Other States with considerable area were Tamil Nadu, Bihar, Gujarat, Haryana and West Bengal. Madhya Pradesh, Uttar Pradesh, Maharashtra, Rajasthan and Orissa are the major pulse producing areas, accounting for about 72 per cent of pulses area in the country and 73 per cent of the total production. Unfortunately, the productivity of pulses in these major states is much below the national average with the exception of Uttar Pradesh & Madhya Pradesh.

The highest productivity of pulses is in Haryana (972 kg/ha), which accounts for 1.80 per cent acreage of pulses. The coverage of pulse area under irrigation was highest in Haryana (28 per cent), followed by Uttar Pradesh (26.2 per cent), Madhya Pradesh (15.7 per cent), Rajasthan (9.1 per cent) and Gujarat (8.9 per cent). At the national level this figure was 11.2 per cent for 1993-94 (Table 2.3).

2.3 Development of Pulses in Different Periods

There have been significant temporal variations in the growth rates in area, production and yield of pulses in India. There was decline in the acreage during the pree green revolution period (1960-61 to 1966-67). The period of rapid growth was from 1977-78 to 1984-85 and period of slow growth was from 1984-85 to 1994-95.

Table 2.3 Statewise area, production and productivity of total pulses during 1995-96

State	Area ('000 ha.)	Share in national area	Production ('000 tonnes)	Share in national production	Productivity (kg./ha.)	Percentage coverage under irrigation (1993-94)
Madhya Pradesh	5,130	21.45	3,100	23.50	604	15.7
Uttar Pradesh	2,920	12.21	2,250	17.06	770	26.2
Maharashtra	3,310	13.84	1,660	12.58	503	6.3
Rajasthan	3,570	14.92	1,460	11.07	409	9.1
Orissa	2,190	9.15	1,180	8.95	537	6.8
Bihar	920	3.85	570	4.32	620	1.7
Andhra Pradesh	1,540	6.44	640	4.85	416	0.7
Haryana	430	1.80	420	3.18	972	28.0
Karnataka	1,530	6.40	720	5.46	474	3.9
Gujarat	840	3.51	460	3.49	543	8.9
Tamil Nadu	960	4.01	360	2.73	374	5.7
West Bengal	200	0.84	130	0.98	641	1.7
Others	380	1.60	240	1.82	-	-
All India	23,920	100.00	13,190	100.00	552	11.2

Source : Government of India, 1997

Increase in pulses acreage was experienced during the initial green revolution period (1966-67 to 1977-78). Positive growth rates in yield were observed during the post green revolution period, with the highest during the period of rapid growth (1.74) (1977-78 to 1984-85). The production growth rates were also positive during the post green revolution period, indicating that the growth in output during this period was a contribution of growth in yield. In fact, the negative growth in acreage during the period from 1977-78 to 1994-95 could not pull down the output level due to growth rates in yield.

The growth rates in the area of gram, the major rabi pulse crop, have been negative in the period of rapid growth, while a negative growth in output was experienced in arhar, the major kharif pulse in the period of slow growth (Table 2.4).

Table 2.4 Compound growth in area, production and yield of pulses (All India)

(% per annum)

Period	Total pulses			gram			arhar		
	A	P	Y	A	P	Y	A	P	Y
pre-green revolution Decline (1960-61 to 1966-67)	-1.49	-6.96	-5.56	-3.67	-9.78	-6.35	1.12	6.25	7.29
Initial green revolution (1966-67 to 1977-78)	0.64	0.95	0.31	0.04	1.16	1.12	0.09	2.15	2.06
Post-green revolution period (1977-78 to 1984-85)	-0.14	1.60	1.74	-1.21	0.84	0.37	3.08	4.99	1.86
Period of slow growth (1984-85 to 1994-95)	-0.01	1.01	1.02	-0.14	1.14	1.28	1.05	-0.60	-1.63

While the yield of gram has been improving over the years, the yield of arhar is exhibiting negative growth rates which shall be a matter of concern from the food security point of view because arhar is the major pulse consumed in India. On the other hand, the amplitude of fluctuations in the production as well as yield of pulses in the country has been declining over the time period (Table 2.5). This has been true for both gram and arhar. This augurs well from the angle of food security because for maintaining supply, stability is one of the major components of national food security.

2.3 Demand and Supply Projections for Pulses in India

Some of the studies have projected demand and supply conditions upto the year 2000-2001 and some others have estimated upto the year 2006-2007. The projected results also varied due to difference in methodology followed by different authors. Bhushan and Sobti (1992) have projected the demand and supply for pulses for the period from 1994-95 to 2000-2001. It may be seen from table 2.6 and figure 2.2 that the requirement for pulses for 1994-95 as per physiological norms

Table 2.5 Instability in area, production and yield of pulses (All India)

(C V %)

Period	Total pulses			gram			arhar		
	A	P	Y	A	P	Y	A	P	Y
Pre-green revolution (1960-61 to 1966-67)	3.39	13.66	11.31	6.90	18.12	12.86	2.46	19.05	19.41
Initial green revolution (1966-67 to 1977-78)	4.19	12.68	12.58	5.65	15.18	12.38	3.96	14.07	14.04
Period of rapid growth (1977-78 to 1984-85)	2.44	10.82	9.48	6.39	14.60	11.77	7.27	13.96	7.59
Period of slow growth (1984-85 to 1994-95)	3.96	7.56	5.88	9.74	15.27	8.74	5.25	8.53	9.32

set by ICMR (Normatic Demand Model) works out to 14.32 million tonnes for which production requirement is estimated at 17.66 million tonnes, but the projected supply comes to only 14.50 million tonnes indicating a huge gap (3.16 million tonnes) between demand & supply. By the turn of the century (2000-2001) production of 19.77 million tonnes would be required to meet the consumption requirement of about 16.04 million tonnes, but the projected supply of pulses comes to only 16.30 million tonnes indicating a gap of 3.47 million tonnes between demand and supply (Table 2.6).

Table 2.6 Demand and supply projection for pulses for 2001 AD

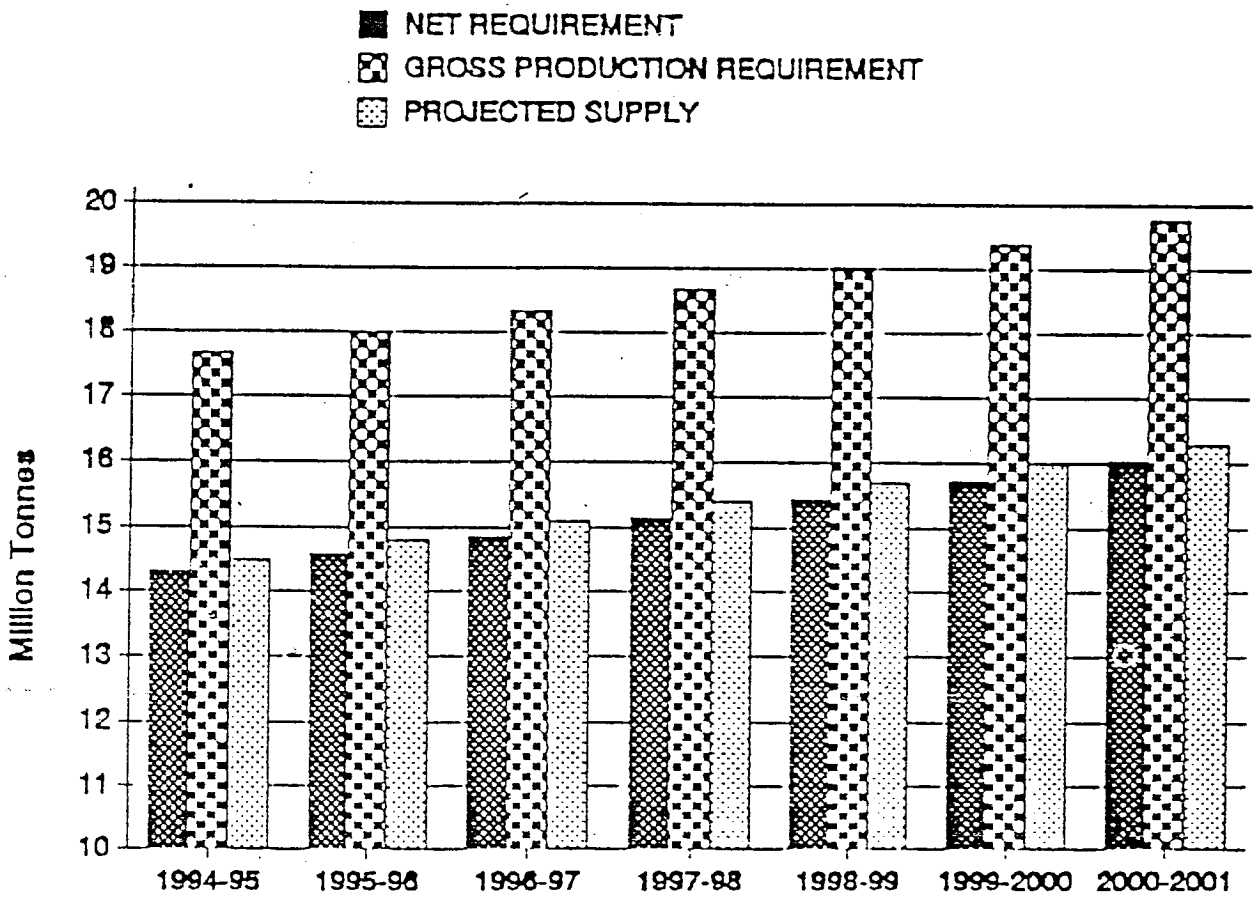
(Figures Million tonnes)

Year	Normatic Demand Model		Projected supply	Gap
	Net requirement	Gross production requirement		
1	2	3	4	(3-4)
1994-95	14.32	17.66	14.50	3.16
1995-96	14.60	17.99	14.80	3.19
1996-97	14.87	18.33	15.10	3.23
1997-98	15.16	18.68	15.40	3.28
1998-99	15.40	19.03	15.70	3.33
1999-2000	15.74	19.40	16.00	3.40
2000-2001	16.04	19.77	16.30	3.47

Note : Normatic demand model is based on physiological need @ 43 grams/day/person and 12.5 per cent retail level and production level wastage etc.

Source: Bhushan, B. and Sobti, R.(1992) "Pulses- present status and prospects". Yojana, (36) 3, July, pp. 18-22.

Figure . . The demand and supply projections for 2001 A.D.



2.4 Area, Production and Productivity of Total Pulses in India

The area under pulses in India was 22,833 thousand hectares in 1982-83. Thereafter the area fluctuated between 22,737 thousand hectares to 24,428 thousand hectares till 1986-87. In 1987-88 it abruptly dropped to 21,273 thousand hectares. Thereafter the acreage ranged between 22,250 thousand hectares to 24,662 thousand hectares. The area was 23,166 thousand hectares in 1994-95.

The production of pulses was 11,857 thousand tonnes in 1982-83. It fluctuated between 1983-84 to 1994-95 and was 14,116 thousand tonnes in 1994-95.

The productivity of pulses was 519 kg/ha. in 1982-83. It fluctuated between 1983-84 to 1994-95 and was 609 kg/ha in 1994-95 (Table 2.7).

Table 2.7 Area, production and yield of total pulses in India and Madhya Pradesh

Years	India (1982-83 to 1994-95)			Madhya Pradesh(1982-83 to 1996-97		
	Area ('000 hectares)	Production ('000 tonnes)	Yield (Kg./ hectare)	Area ('000 hectares)	Production ('000 tonnes)	Yield (Kg./ hectares)
1982-83	22,833	11,857	519	5,139	2,608	507
1983-84	23,542	12,893	548	4,982	2,702	542
1984-85	22,737	11,963	526	4,844	2,343	484
1985-86	24,428	13,361	547	5,149	2,610	507
1986-87	23,156	11,707	506	4,775	2,494	522
1987-88	21,273	10,962	515	4,713	2,532	537
1988-89	23,146	13,849	598	4,630	2,824	610
1989-90	23,415	12,858	549	4,543	2,505	551
1990-91	24,662	14,265	578	5,019	3,104	618
1991-92	22,542	12,014	533	4,534	2,792	616
1992-93	22,360	12,815	573	4,752	2,898	610
1993-94	22,250	13,305	598	4,880	3,264	669
1994-95	23,166	14,116	609	5,195	3,654	703
1995-96	NA	NA	NA	5,176	3,097	598
1996-97	NA	NA	NA	5,024	3,544	705

Source : 1) Area and production of principal crops in India; Ministry of Agriculture, Govt. of India, New Delhi, 1994-95.

2) Agricultural Statistics, Directorate of Agriculture, Govt. of M.P., Bhopal (M.P.)

3) Agricultural Statistics, Published by Land Record Office, Gwalior (M.P.)

2.5 Area, Production and Productivity of Pulses in Madhya Pradesh

Madhya Pradesh has earned an important place in the country's map as it ranked first both in terms of area and production of pulses. The area under pulses in 1982-83 was 5,139 thousand hectares but decreased in subsequent two years. It again increased to 5,149 thousand hectares in 1985-86. Thereafter it varied between 4,534 thousand hectares (1991-92) and 5,195 thousand hectares (1994-95). However, it decreased to 5,176 thousand hectares in 1995-96 and to 5,024 thousand hectares in 1996-97.

The production of pulses in Madhya Pradesh fluctuated between 2,343 thousand tonnes (1984-85) and 3,654 thousand tonnes (1994-95). In the base year (1982-83) it was 2,608 thousand tonnes and in the current year (1996-97) it was 3,544 thousand tonnes.

The yield of pulses per hectare was 507 kg.in 1982-83 and 705kg. (highest) in 1996-97. It was lowest in 1984-85 (484 Kg.) (Table 2.7).

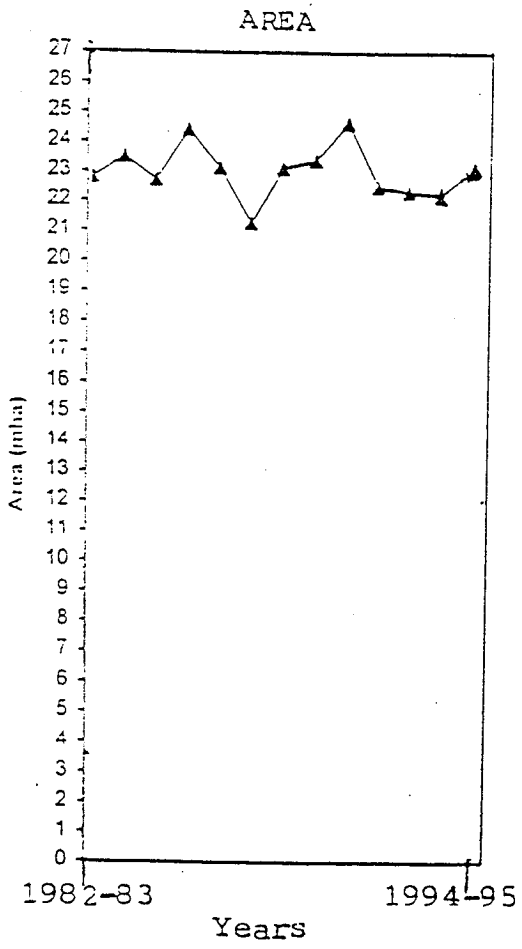
In India the area under pulses was 22,592 thousand hectares in the triennium ending 1994-95. Of this, 51.5 per cent area was under rabi pulses such as gram, pea, lentil, teora, urad, moong and kulthi and 48.5 per cent was under kharif pulses like arhar, urad, moong moth and kulthi. In Madhya Pradesh, out of 5,132 thousand hectares of pulses area, rabi pulses occupied 80.8 per cent and kharif pulses occupied 19.2 per cent area. The same trend was observed in the case of pulses production. The yield of pulses is higher (669 kg/ha) in Madhya Pradesh as compared to national average (594 kg/ha.) (Table 2.8).

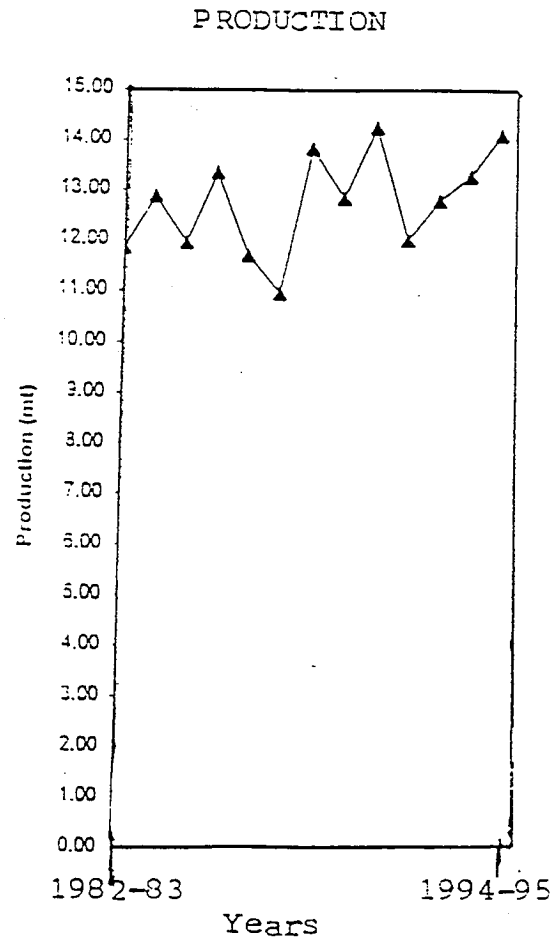
Table 2.8 Area, production and yield of pulses (season wise) in India and Madhya Pradesh

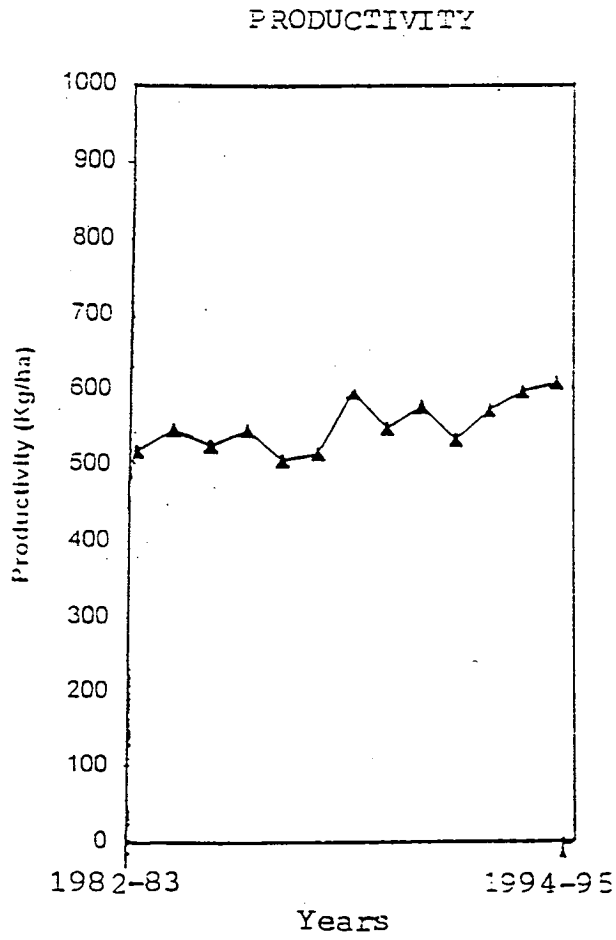
Crop season	India (T.E. 1994-95)			Madhya Pradesh (T.E.1996-97)		
	Area ('000 hectare)	Production ('000 tonnes)	Yield (Kg./ hectare)	Area ('000 hectare)	Production ('000 tonnes)	Yield (Kg./ hectare)
Kharif	10,961 (48.5)	5,284 (39.4)	482	983 (19.2)	440 (12.8)	448
Rabi	11,631 (51.5)	8,128 (60.6)	699	4,149 (80.8)	2,992 (87.2)	721
Total	22,592 (100.00)	13,412 (100.00)	594	5,132 (100.00)	3,432 (100.00)	669

Note : Figures in brackets represent the percentage to total.

AREA, PRODUCTION AND PRODUCTIVITY OF TOTAL PULSES IN INDIA
(1982-83 to 1994-95)

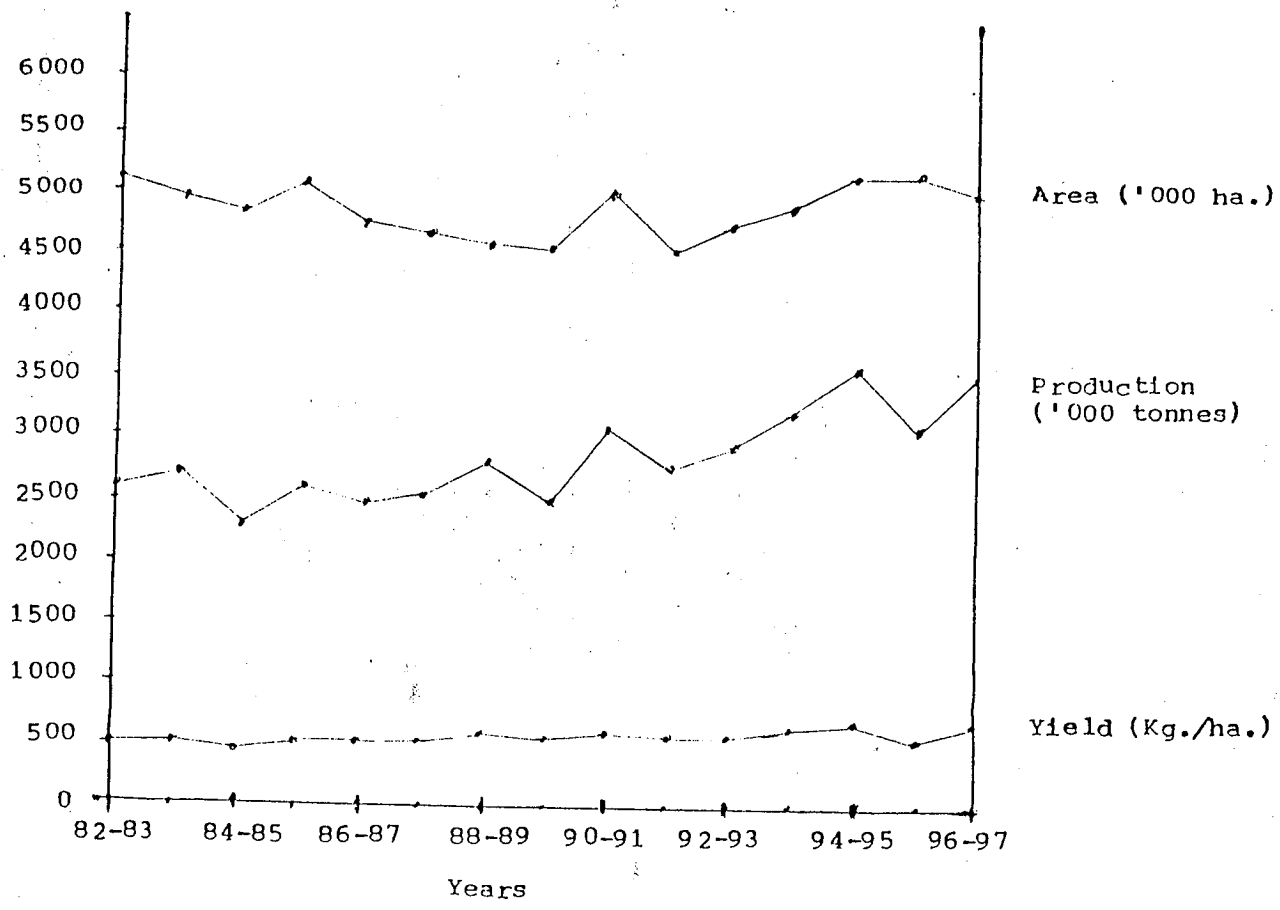






AREA, PRODUCTION AND YIELD OF TOTAL PULSES IN MADHYA PRADESH

(1982-83 to 1996-97)



2.6 Trends in area, in different pulses

Gram is the major pulse crop of the country as well as the state of Madhya Pradesh. In India gram occupied first position in area followed by moong-moth, arhar, urad, kulthi, teora, lentil and pea. The relative change in area was highest (52.02 per cent) in the case of pea followed by lentil (20.84 per cent), arhar (12.55 per cent), urad (6.29 per cent) and moong-moth (2.56 per cent), between two trienniums. Gram, teora and kulthi showed negative change (decrease) in area. The total pulses areaalso decreased at national level by 1.93 per cent. In Madhya Pradesh the area of pulses increased from 4,988 thousand hectares to 5,132 thousand hectares during the two trienniums. Thus, the net increase was 144 thousand hectares or 2.88 per cent. This increase was due to increase in the area under gram, lentil and pea. Other pulse crops showed a declining tendency between two trienniums (Table 2.9).

Table 2.9 Changes in area of different pulses in India and Madhya Pradesh between two trienniums.

Pulse crop	India				Madhya Pradesh			
	T.E. 84-85	T.E. 94-95	Absolute change ('000 hectare)	Relative change (%)	T.E. 84-85	T.E. 96-97	Absolute change ('000 hectare)	Relative change (%)
Gram	7,155 (31.06)	6,691 (29.62)	-464	-6.04	2,190 (43.90)	2,637 (51.38)	447	20.41
Moong moth	4,371 (18.97)	4,483 (19.84)	112	2.56	224 (4.49)	122 (2.38)	-102	-45.53
Arhar	3,100 (13.46)	3,489 (15.44)	389	12.55	499 (10.00)	368 (7.17)	-131	-26.25
Urad	2,891 (12.55)	3,073 (13.60)	182	6.29	770 (15.44)	513 (9.99)	-257	-33.38
Kulthi	1,925 (8.36)	1,116 (4.94)	-809	-42.02	186 (3.73)	140 (2.73)	- 46	-24.73
Teora	1,177 (5.11)	932 (4.12)	-245	-20.81	679 (13.61)	676 (13.17)	- 3	- 0.44
Lentil	974 (4.23)	1,177 (5.21)	203	20.84	296 (5.93)	480 (9.35)	184	62.16
Pea	446 (1.94)	678 (3.00)	232	52.02	122 (2.44)	181 (3.53)	59	48.36
Total pulses	23,037 (100.00)	22,592 (100.00)	-445	- 1.93	4,988 (100.00)	5,132 (100.00)	144	2.88

Note : 1) Figures in brackets represent the percentage to total.

2) Relative change (change between two trienniums)

2.7 Trends in Production in Different Pulses

In India, the change in production of total pulses between two trienniums was 1,174 thousand tonnes or an increase of 9.59 per cent. The highest absolute change between two trienniums was observed in the case of gram (334 thousand tonnes) followed by urad (304 thousand tonnes), pea (262 thousand tonnes), lentil (258 thousand tonnes) and moong moth (127 thousand tonnes). The change was lowest in the case of arhar (20 thousand tonnes). In kulthi, it was negative. In relative terms, pea registered highest increase in production (75.94 per cent) followed by lentil (49.33 per cent), urad (27.19 per cent), teora (16.33 per cent), moong-moth (8.50 per cent) and gram (6.86 per cent) between two trienniums.

In Madhya Pradesh, the production of pulses increased from 2,551 thousand tonnes to 3,432 thousand tonnes during the two trienniums. Thus, the net increase was 881 thousand tonnes or 34.53 per cent. This increase was mainly due to the increase in production of gram, teora, lentil & pea. Other pulse crops showed decrease in production. Gram registered highest production increase. The relative change in production was highest in the case of lentil (89.17 per cent) followed by pea (86.84 per cent), teora (67.00 per cent) and gram (54.84 per cent), between two trienniums. The highest decrease in production was observed in the case of moong-moth (39.06 per cent) followed by arhar, urad and kulthi (Table 2.10).

Table 2.10 Changes in production of different pulses in India and Madhya Pradesh between two trienniums

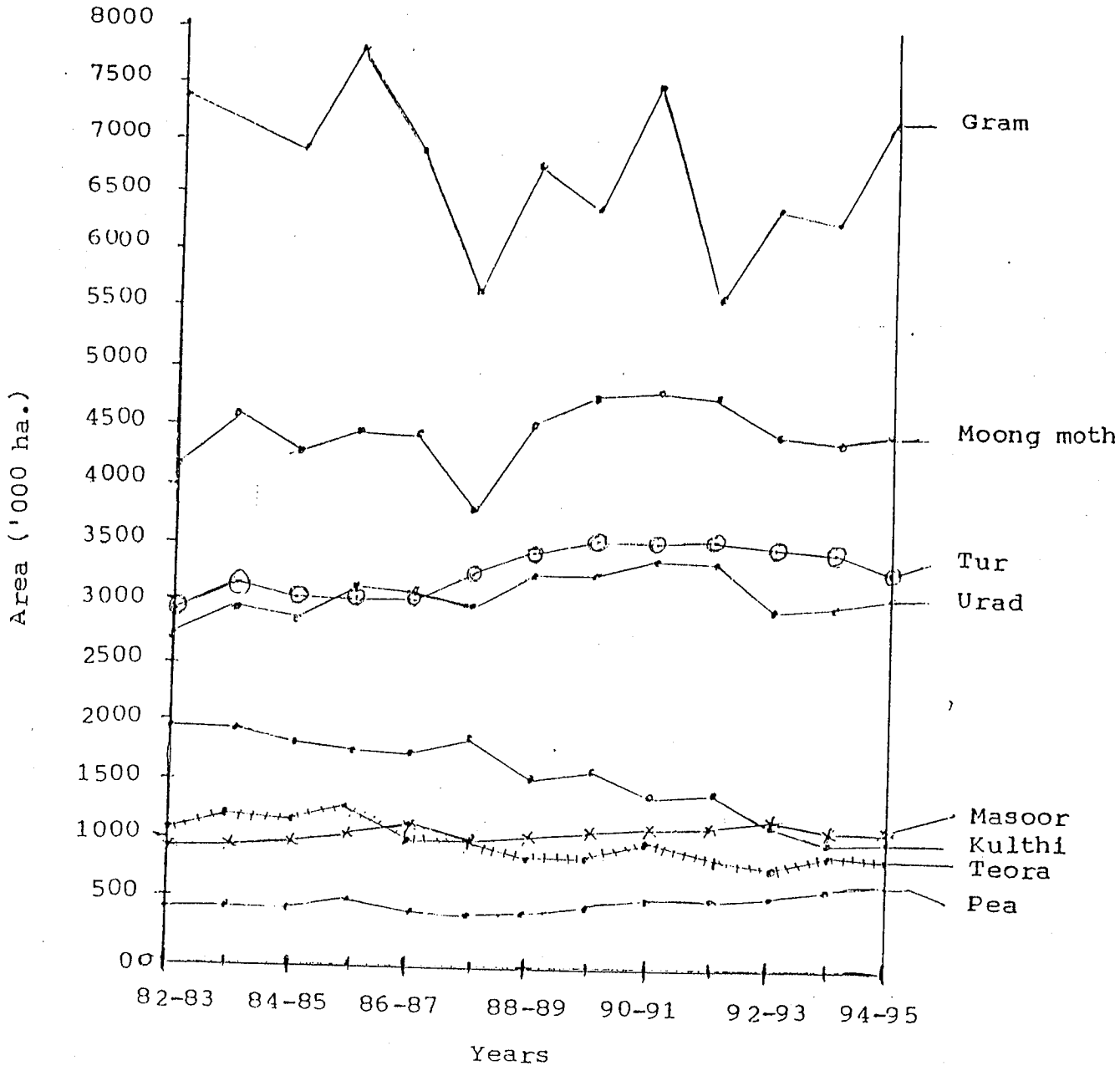
(Figures-'000 tonnes)

Pulse Crops	India				Madhya Pradesh			
	T.E. 84-85	T.E. 94-95	Absolute change ('000 tonnes)	Relative change (%)	T.E. 84-85	T.E. 96-97	Absolute change ('000 tonnes)	Relative change (%)
Gram	4,868 (39.78)	5,202 (38.79)	334	6.86	1,457 (57.11)	2,256 (65.73)	799	54.84
Arhar	2,383 (19.47)	2,403 (17.92)	20	0.84	415 (16.27)	307 (8.94)	-108	-26.02
Moong moth	1,494 (12.21)	1,621 (12.09)	127	8.50	64 (2.51)	39 (1.14)	- 25	-39.06
Urad	1,118 (9.13)	1,422 (10.60)	304	27.19	202 (7.92)	167 (4.86)	- 35	-17.33
Kulthi	676 (5.52)	448 (3.34)	-228	-33.73	50 (1.96)	43 (1.25)	- 7	-14.00
Lentil	523 (4.27)	781 (5.82)	258	49.33	120 (4.70)	227 (6.61)	107	89.17
Teora	490 (4.00)	570 (4.25)	80	16.33	200 (7.84)	334 (9.73)	134	67.00
Pea	345 (2.82)	607 (4.52)	262	75.94	38 (1.49)	71 (2.07)	33	86.84
Total	12,238 (100.00)	13,412 (100.00)	1,174	9.59	2,551 (100.00)	3,432 (100.00)	881	34.53

Note : Figures in brackets represent the percentage to total

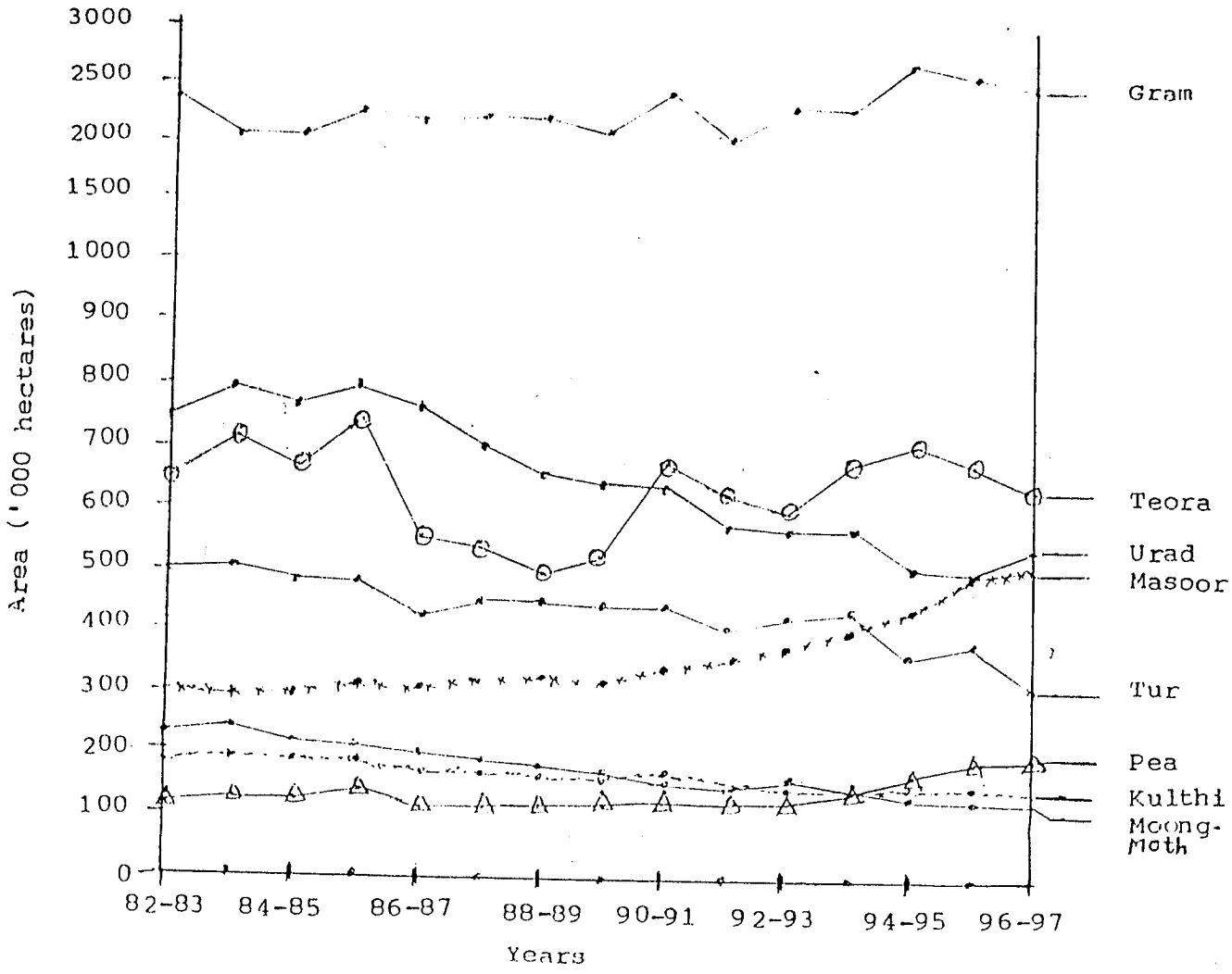
TRENDS IN AREA OF MAJOR PULSES IN INDIA

(1982-83 to 1994-95)



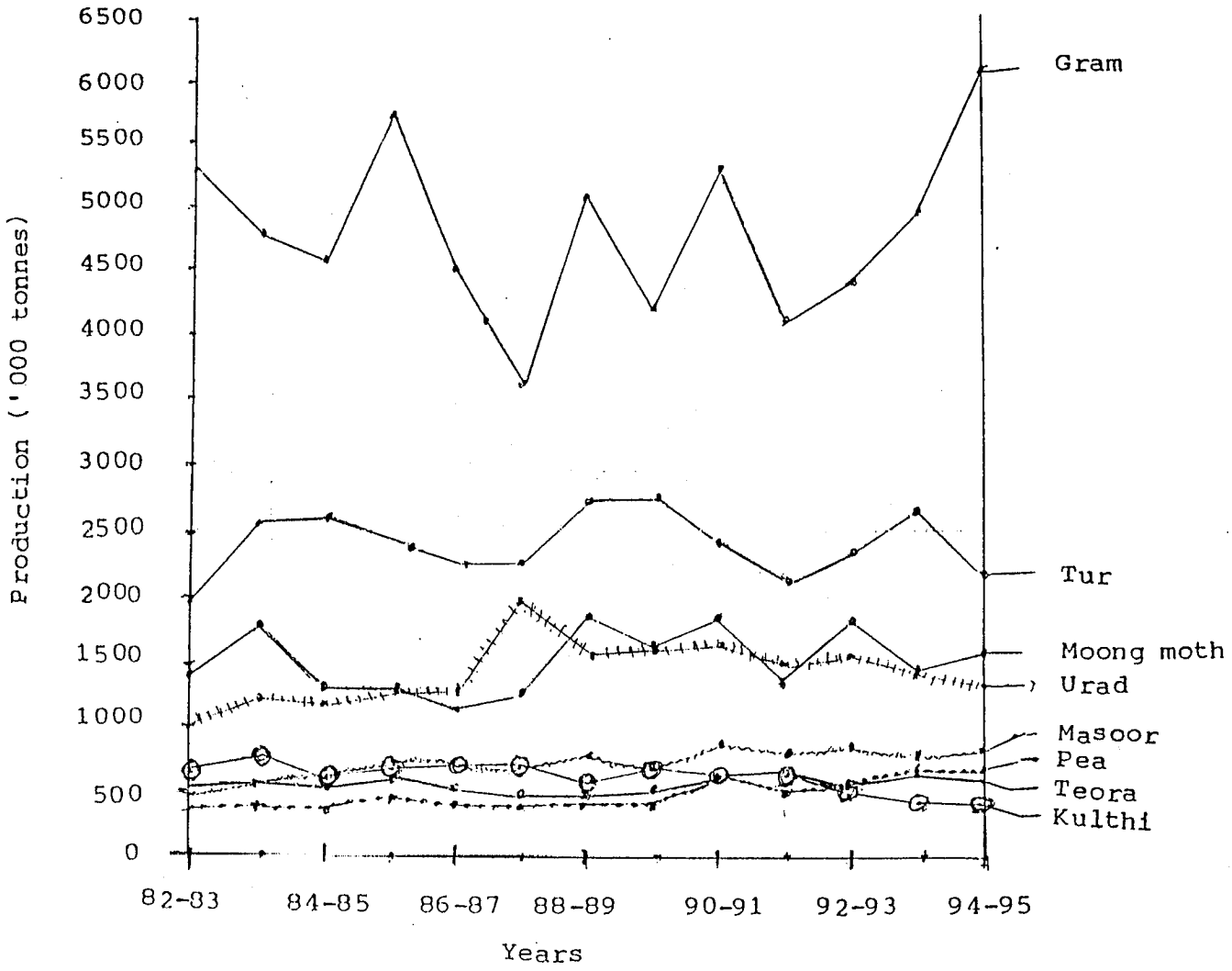
TRENDS IN AREA OF MAJOR PULSES IN MADHYA PRADESH

(1982-83 to 1996-97)



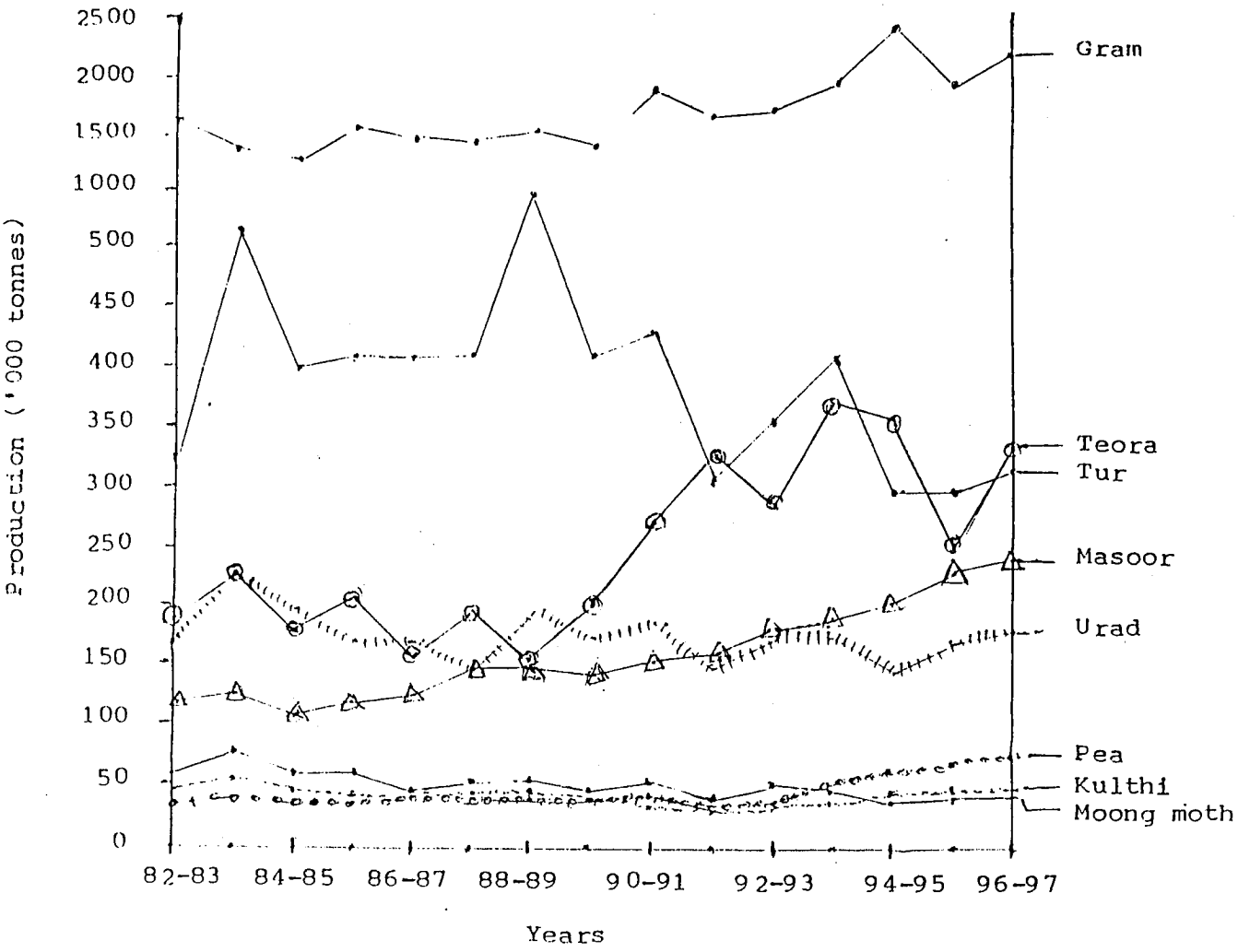
TRENDS IN PRODUCTION OF MAJOR PULSES IN INDIA

(1982-83 to 1994-95)



TRENDS IN PRODUCTION OF MAJOR PULSES IN MADHYA PRADESH

(1982-83 to 1996-97)



2.8 Trends in Productivity in Different Pulses

In India the yield of gram increased by 14.26 per cent between two trienniums. The yield of teora registered highest percentage increase (47.11) among all the pulses, whereas, the yield of arhar decreased by 10.40 per cent.

In Madhya Pradesh, the highest percentage increase in yield (68.03) was noticed in teora and lowest (0.24) in arhar. There was no decline in yield of any crop (Table 2.11).

Table 2.11 Change in yield of different pulses in India and Madhya Pradesh between two trienniums

(Figures - Kg./ha)

Pulse crops	India				Madhya Pradesh			
	T.E. 84-85	T.E. 94-95	Absolute change (kg./ha)	Relative change (%)	T.E. 84-85	T.E. 96-97	Absolute change (kg./ha)	Relative change (%)
Gram	680	777	97	14.26	665	855	190	28.57
Arhar	769	689	- 80	-10.40	832	834	2	0.24
Teora	416	612	196	47.11	294	494	200	68.03
Urad	387	463	76	19.64	262	325	63	24.04
Moong-moth	342	362	20	5.85	286	320	34	11.89
Kulthi	351	401	50	14.24	269	307	38	14.13
Pea	774	895	121	15.63	311	392	81	26.04
Lentil	537	664	127	23.65	405	473	68	16.79
Total pulses	531	594	63	11.86	511	669	158	30.92

The overall picture regarding area, production and yield of pulses showed that in India the area of gram decreased by 6.48 per cent, but the production and yield increased by 6.86 and 14.26 per cent respectively between two trienniums. The area and production of arhar increased by 12.55 and 0.84 per cent respectively, whereas its yield decreased by 10.40 per cent. In the case of teora although there was a decline (20.81 per cent) in area, its production (16.33 per cent) and yield (47.11 per cent) showed increase. The crops like lentil, pea, urad and moong-moth showed positive change in area, production and productivity.

In Madhya Pradesh, all the pulse crops had declined area except lentil, pea and gram. In the case of production, lentil registered highest increase (89.17 per cent) followed by pea, teora and gram during two periods. So far as the yield of different pulse crops is concerned, all the crops showed increase in yield in Madhya Pradesh as well as in India except arhar. Teora registered highest increase in yield in India and in Madhya Pradesh but the area showed negative trend.

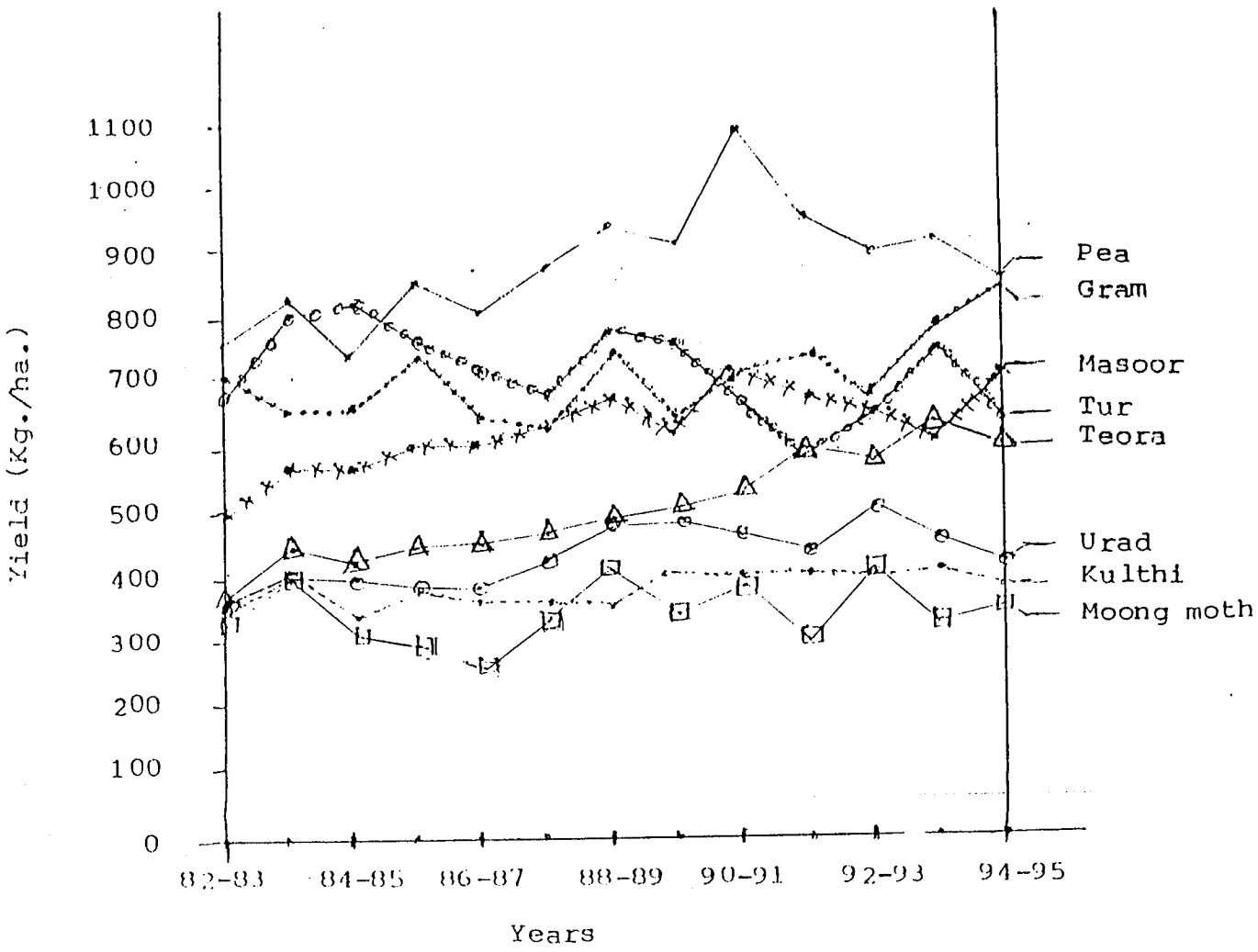
2.9 Growth rates and variability in area, production and productivity of pulse crops in India and in Madhya Pradesh

In India the growth rates of area (4.09 per cent) and production (5.92 per cent) of pea were observed to be highest and highly significant among all pulse crops, whereas, in the case of yield it was highest (4.03 per cent) in teora. As far as variability is concerned, the highest variation in area was observed in kulthi (19.34 per cent) followed by pea (18.15 per cent), teora (12.02 per cent) and gram (9.34 per cent). In the case of production, the variation in production during 13 years was observed highest in pea (23.28 per cent) followed by moong-moth (20.10 per cent), Urad (17.92 per cent), Kulthi (15.93 per cent), Lentil (15.78 per cent), gram (14.12 per cent), teora (11.16 per cent) and arhar (9.57 per cent). Variability in yield was highest (15.20 per cent) in teora, followed by moong moth, urad, pea, lentil, arhar and gram. In the case of total pulses, the variation in area, production and yield was lowest.

In Madhya Pradesh, the growth rate of area was highest in the case of lentil (3.90 per cent) followed by pea (2.86 per cent), gram (1.22 per cent) and teora (0.12 per cent). Moong-moth, urad, kulthi and arhar registered negative growth rates in area during 15 years period. In the case of production, very high growth rate (highly significant) was observed in teora (5.36 per cent), lentil (5.32 per cent), pea (4.96 per cent) and gram (3.44 per cent). It was negative in the case of moong-moth, arhar, kulthi and urad. In the case of yield, all the pulse crops registered positive growth rates. It was highest in the case of teora (4.28 per cent) followed by urad (2.45 per cent), gram (2.18 per cent), pea (1.83 per cent), kulthi (1.37 per cent), lentil (1.34 per cent), moong-moth (0.56 per cent) and arhar (0.03 per cent). The variation in area was observed

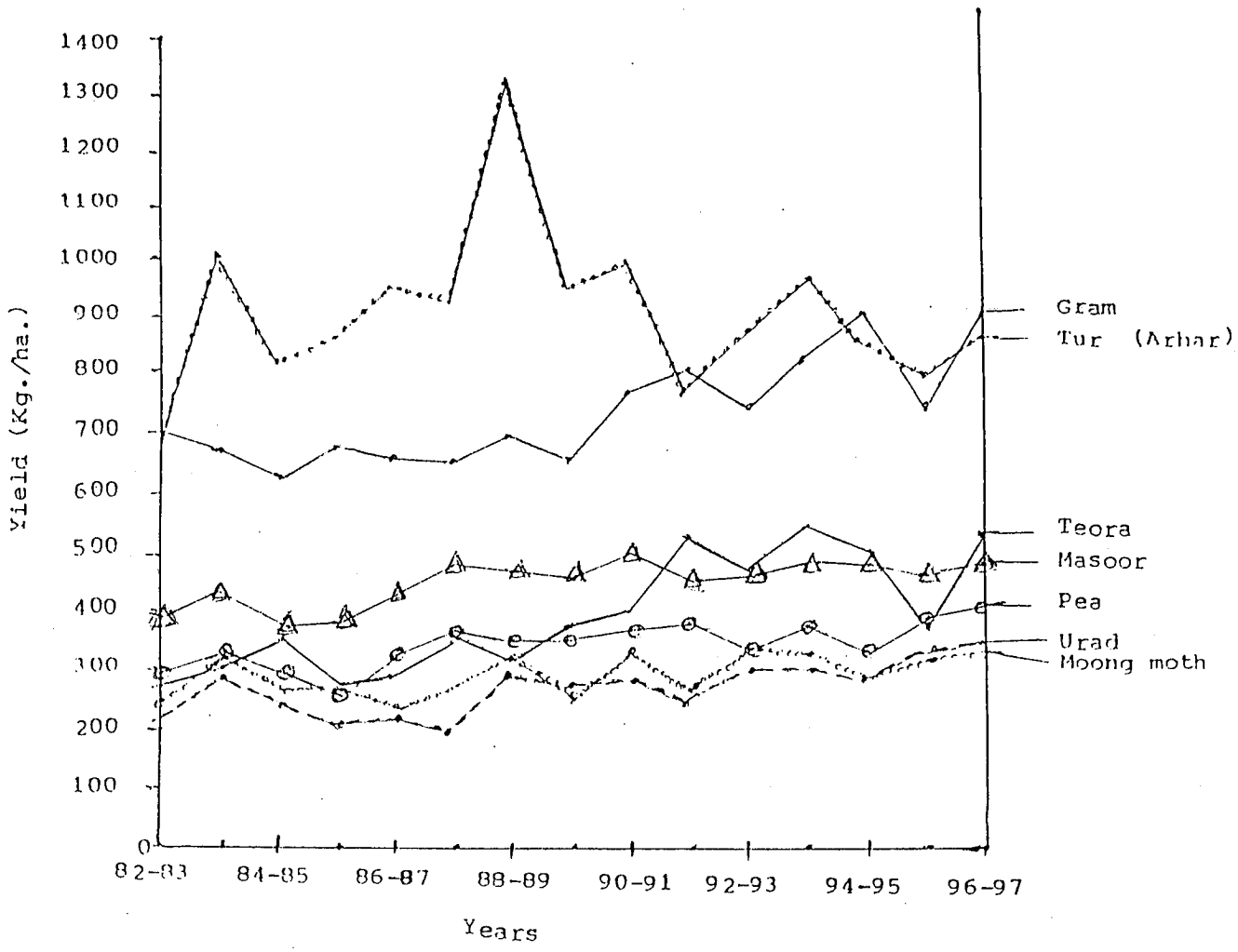
TRENDS IN YIELD OF MAJOR PULSES IN INDIA

(1982-83 to 1994-95)



TRENDS IN YIELD OF MAJOR PULSES IN MADHYA PRADESH

(1982-83 to 1996-97)



highest in the case of moong-moth (21.80 per cent) followed by 19.32 per cent in pea, 19.28 per cent in lentil, 15.44 per cent in urad, 11.45 per cent in teora and 10.39 per cent in kulthi during 15 years period. Variation in production was highest in the case of teora (28.13 per cent) followed by pea (27.90 per cent), lentil (24.22 per cent), arhar (19.84 per cent), moong moth (19.67 per cent), gram (18.79 per cent), urad (11.72 per cent) and kulthi (9.51 per cent). The variation in yield was observed highest in the case of teora (22.67 per cent) followed by arhar (20.85 per cent), urad (14.46 per cent), gram (11.75 per cent), moong-moth (11.56 per cent), pea (10.68 per cent and kulthi (9.47 per cent) (Table 2.12).

Table 2.12 Compound growth rates (%) and variability in area, production and yield of pulses in India & Madhya Pradesh

(Figures percentages)

Pulse Crop	India (1982-83 to 1994-95)			Madhya Pradesh (1982-83 to 1996-97)		
	Area	Production	Yield	Area	Production	Yield
Gram	- 0.94 (9.34)	0.29 (14.12)	1.24* (8.64)	1.22** (8.19)	3.44*** (18.79)	2.18*** (11.75)
Arhar (Tur)	1.39*** (6.40)	0.15 (9.57)	-1.23 (9.25)	- 2.21*** (10.18)	- 2.18* (19.84)	0.03 (20.85)
Teora (Lakh)	- 2.37** (12.02)	1.57 (11.16)	4.03*** (15.20)	0.12 (11.45)	5.36*** (28.13)	4.28*** (22.67)
Urad	0.835* (6.30)	2.54* (17.92)	1.94** (10.08)	- 3.43*** (15.44)	- 1.00* (11.72)	2.45** (14.46)
Moong-moth	0.569* (8.60)	1.44* (20.10)	0.858 (15.0)	-4.04*** (21.80)	- 3.49*** (19.67)	0.56 (11.56)
Kulthi	- 5.11*** (19.34)	- 3.60*** (15.93)	1.35** (6.98)	-2.35*** (10.39)	- 1.01* (9.51)	1.37* (9.47)
Pea	4.09*** (18.15)	5.92*** (23.28)	1.74** (10.00)	2.86** (19.32)	4.96*** (27.90)	1.83** (10.68)
Lentil (Masoor)	1.81*** (7.53)	4.08*** (15.78)	2.22*** (9.64)	3.90*** (19.28)	5.32*** (24.22)	1.34** (7.63)
Total pulses	- 0.15 (3.73)	0.95* (7.63)	1.09** (5.97)	0.074 (4.50)	2.47*** (13.27)	2.39*** (11.71)

Note : Figures in bracket denotes coefficient of variance
*** Significant at 1 per cent level
** Significant at 5 per cent level
* Significant at 10 per cent level

Comparing the growth rates of pulses in Madhya Pradesh with the country's, one can see that growth rates of production and yield are highly significant in M.P. for the period 1982-83 to 1996-97, whereas the growth rates are simply significant for India. The coefficient of variation is higher for Madhya Pradesh indicating the more fluctuations than the aggregates figures for the country. The compound growth rate for the country's area is negative for the period 1982-83 to 1994-95 which clearly reflects the short fall of pulses and forcing the country to import pulses.

2.10 Decomposition of Change in Production

An analysis of trends in area, production and productivity of pulse crops indicated the general pattern of growth and the direction of change in production for a given pattern of changes in area and productivity. But this does not evaluate the exact contribution of area and yield to production. Therefore, an attempt was made to determine the extent of the relative contribution of area, yield and their interaction which are responsible for the increased/decreased values of production of different pulse crops between two trienniums. For India, gram registered highest increase in production (334 th. tonnes) followed by urad (304 th.tonnes), pea (262 th. tonnes), lentil (258 th. tonnes), moong-moth (127 th. tonnes), teora (80 th. tonnes) and arhar (20 th. tonnes) between two trienniums. In the case of gram, contribution of yield was 208 per cent towards change in production. In the case of arhar and pea, area was the main factor responsible for increase in production, whereas, in the case of teora, urad, moong-moth and lentil, yield was the main factor responsible for increase in production. The decrease in the production (228 thousand tonnes) of kulthi was mainly due to 124 per cent decrease in the area between two periods. In Madhya Pradesh gram (799 thousand tonnes), teora (134 thousand tonnes), lentil (107 thousand tonnes) and pea (33 thousand tonnes) registered an increase in the production between two trienniums. In the case of gram and teora, yield was the main factor and in case of lentil and pea area was the main factor responsible for increase in production. In the case of total pulses at both the levels (National and State), the change in production was observed positive. In both the cases yield was the main factor responsible for increase in the production (Table 2.13).

2.11 Technology Mission of Pulses Development Programme in Madhya Pradesh

Technology Mission has been implementing the Centrally sponsored National Pulses Development Project (NPDP) since the mid eighties in the country. The programme is designed to supplement the efforts of the state Governments for increasing the production and productivity of various pulses crops grown in the states. The programme includes enhancing production and productivity of six major pulse crops i.e. gram, arhar, moong, urad, pea and lentil.

Table 2.13 Relative contribution of Area and yield towards change in production of pulses during two trienniums

Pulse crops	India				Madhya Pradesh			
	Change in production over base trienniums ('000 tonnes)	Relative contribution (%)			Change in production over base trienniums ('000 tonnes)	Relative contribution (%)		
		Area	Yield	Inter-action		Area	Yield	Inter-action
Gram	334	- 95	208	- 13	799	37	52	11
Arhar	20	1,496	-1,240	-156	-108	101	- 1	0
Teora (Lakh)	80	- 128	288	- 60	134	-0.7	101	-0.3
Urad	304	23	72	5	- 35	193	-139	46
Moong-moth	127	30	68	2	- 25	117	- 30	13
Kulthi	- 228	124	- 42	18	- 7	176	-101	25
Pea	262	68	21	11	33	56	30	14
Lentil (Masoor)	258	42	48	10	107	69	19	12
Total Pulses	1,174	- 21	124	- 3	881	8	89	3

Under NPDP emphasis is laid on all components which will help in increasing the production and productivity of pulses. Supply of seed, demonstrations of new technology including front line demonstrations, IPM demonstrations, supply of minikits, sprinklers, improved farm implements, rhyzobial and PSB cultures and extension support are some of the major components of the programme. In Madhya Pradesh, NPDP was introduced in 1985-86 and the implementation was started in 1986-87.

The National Pulses Development Programme was launched in the state with the financial aid of the Government of India. Under this scheme, 75 per cent of the expenditure is to be incurred by the Central Government and the remaining 25 per cent by the State Govt. In Madhya Pradesh, NPDP is implemented in 44 districts. The financial outlay for this programme was Rs.733.33 lakhs in the year 1996-97. The Share between the Government of India and State Government was Rs.550.00 lakhs and Rs.183.33 lakhs respectively.

Table 2.14 Componentwise physical target and final allocation of National Pulse Development Programmes in Madhya Pradesh, 1996-97

S. No.	Components	(Units)	Physical Targets	Final allocation (Rs.lakh)
1.	Seed village	(Qtls)	34,000	68.00
2.	Distribution of Certified Seed	(Qtls)	18,323	55.00
3.	Purchase of Breeders Seed and Production of Foundation Seed	(Qtls)	18,500	74.00
4.	Distribution of Seed Minikits	(Nos)	-	74.00
5.	Organisation of Block Demonstration	(Hect.)	17,272	190.00
6.	Pheromone traps demonstrations	(Nos.)	1,000	5.00
7.	IPM Demonstrations	(Hect.)	1,333	20.00
8.	Distribution of farm implements	(Nos.)	3,800	57.00
9.	Dal Processors	(Nos.)	150	6.00
10.	Storage Bins	(Nos.)	400	6.00
11.	Rhizobium culture/PSB	(Hect.)	25,320	6.33
12.	Micro-nutrients	(Hect.)	1,000	1.00
13.	Opening of retail Outlets	(Nos.)	20	1.00
14.	Sprinkler sets	(Nos.)	1,260	170.00
	Total			733.33

Source : Directorate of Agriculture, Govt. of Madhya Pradesh, Bhopal

Out of the 733.33 lakhs, the highest allocation (Rs.190.00 lakhs) was towards organisation of block demonstrations Rs.170 lakhs for sprinkler sets, Rs.74.00 lakh each for purchase of breeders seed and production of foundation seed and distribution of seed minikits, Rs.68.00 lakhs for establishing seed villages, Rs.57.00 lakhs for distribution of farm implements and Rs.55.00 lakhs for distribution of certified seeds (Table 2.14).

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CHAPTER III

PULSES DEVELOPMENT IN SELECTED DISTRICTS

For the purpose of field level study Durg, Jhabua and Narsinghpur districts of Madhya Pradesh were selected.

A brief description of the districts would be useful.

3.1 Durg District

Durg district is located in the north- eastern part of the state and is a part of Chhattisgarh region and comes under zone-7 (Eastern Plateau and Hills Region) of the all India agro-climatic regions. District extends between latitudes $20^{\circ}23'$ and $21^{\circ}23'$N and longitudes $80^{\circ}46'$ and $81^{\circ}58'$E. It is surrounded by Bilaspur district in the north, by Raipur district in the east, by Rajnandgaon district in the west and by Bastar district in the south.

Durg district occupied an area of 8,702 sq.km. and had a forest area of 11.45 per cent of the total geographical area. The density of population per sq.km. was 281. The total population included 51 per cent males and 49 per cent females. It had 65 per cent rural population and 35 per cent urban population. The district had 12.80 per cent scheduled castes population and 12.43 per cent scheduled tribes population. The literacy percentage of the district was 47.89 (1991 census). The district had higher literacy among males (74.06 per cent) than females (42.78 per cent). It was 50.37 per cent for rural population and 73.53 per cent for urban population.

District population had 42.37 per cent main workers of the total population. Among the workers 43.25 per cent were cultivators and 25.03 per cent agricultural labourers.

Agriculture in the district is mainly dependent on rainfall which though high in magnitude (1,286.3 mm) is erratic and uneven in distribution leading to higher intensity of rainfall alternating with periods of moisture stress. A topo-sequence of four broad groups of soils viz. bhata (tikara), matasi, dorsa and kanhar occur in the district.

In 1993-94 the fertiliser consumption in the district was 32.25 kg/ha. The number of primary, middle and higher secondary schools per lakh population was 85, 24 and 9 respectively.

Nearly three fourths area of the district was under agricultural uses. The cropping intensity was 144.43 per cent, and the irrigation intensity was 109.86 per cent. Only 28.7 per cent of the gross cropped area of the district was irrigated. (Table 3.1)

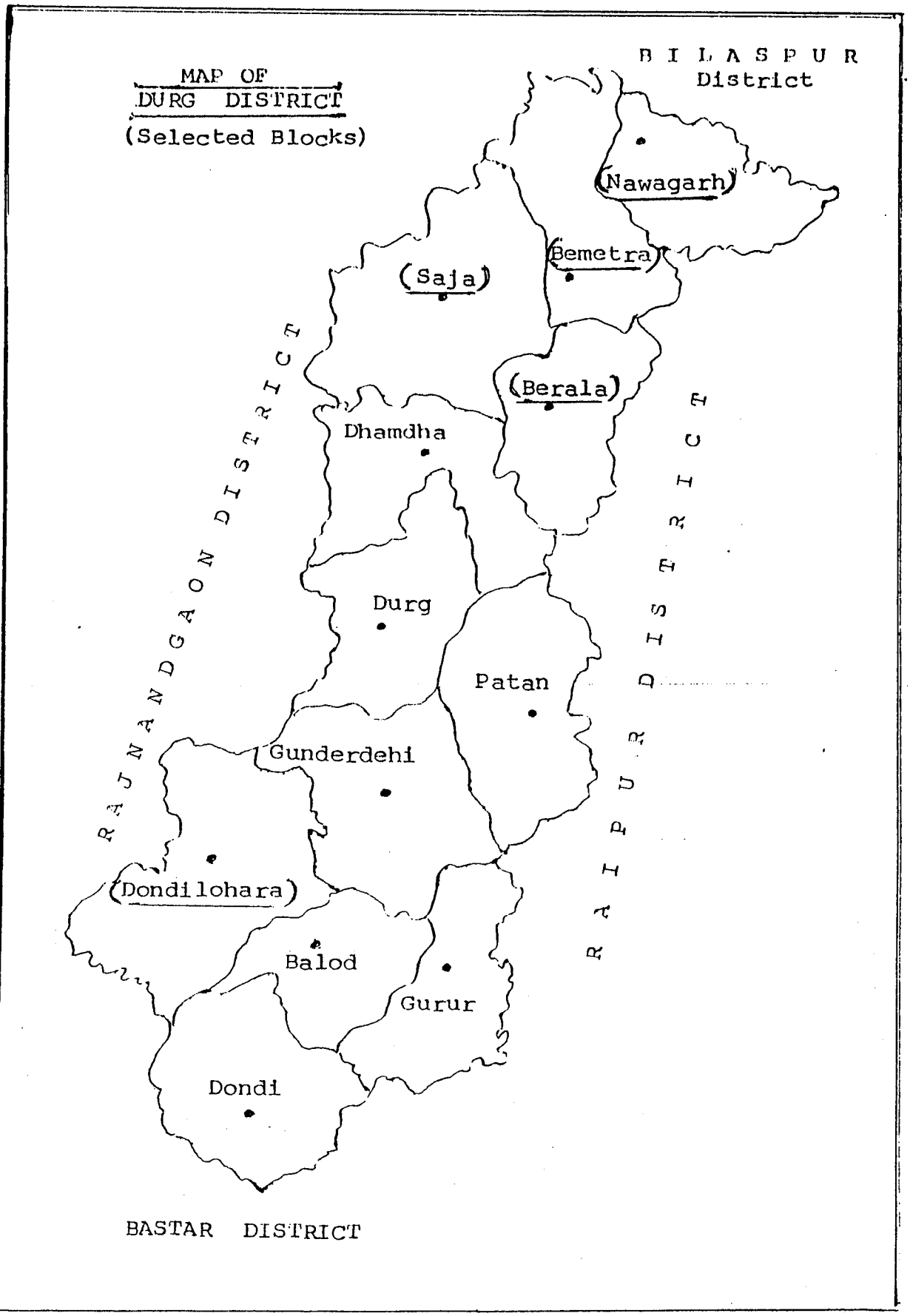
The important crops of the district were paddy (52.62 per cent), teora (23.35 per cent), gram (8.00 per cent), linseed (4.93 per cent) and wheat (2.21 per cent). Cereals dominated the cropping pattern occupying 57.23 per cent followed by pulses (34.15 per cent), oilseeds (6.38 per cent) and fruits & vegetable (1.87 per cent), of the gross cropped area (Table 3.2).

3.2 Jhabua district

The district lies in the extreme western part of the state between $22^{\circ}0'$ and $23^{\circ}3'$ north latitudes and $73^{\circ}0'$ and $75^{\circ}0'$ east longitudes and is in entirety subregion of Madhya Pradesh. It forms part of zone-9(Western Plateau & Hills region) of the all India zonal classification. Its boundaries meet the borders of Gujarat, Maharashtra and Rajasthan states. The district is bounded by Banswara district of Rajasthan in the north west, Panchmahal and Baroda districts of Gujarat in the west, Dhulia district of Maharashtra and Khargone district of Madhya Pradesh in south, Dhar district in the east and Ratlam district in the north-east. It forms part of Indore division. Jhabua town is the district headquarters and is situated on the state highway No.22 (Bhopal-Indore-Dhar-Jhabua-Ahmedabad). The nearest railway station is Meghnagar (W.Rly),18 km. away from Jhabua town.

Jhabua is a tribal district of Madhya Pradesh. The fields are undulating, slopy , light and stoney in most parts. The soils are poor and not well suited for cultivation. The water retention capacity of the soils is very poor. Early withdrawal of monsoon rains and soil and water run-off are the important constraints in crop production.

The two main rivers are Mahi and the Anas. The main source of income is agriculture. In kharif season farmers grow maize,


MAP OF
DURG DISTRICT
(Selected Blocks)
BILASPUR
District
Nawagarh
Bemetra
Saja
Berala
Dhamdha
Durg
Patan
Gunderdehi
Dondilohara
Balod
Gurur
Dondi
RAJNANDGAON DISTRICT
RAIPUR DISTRICT
BASTAR DISTRICT

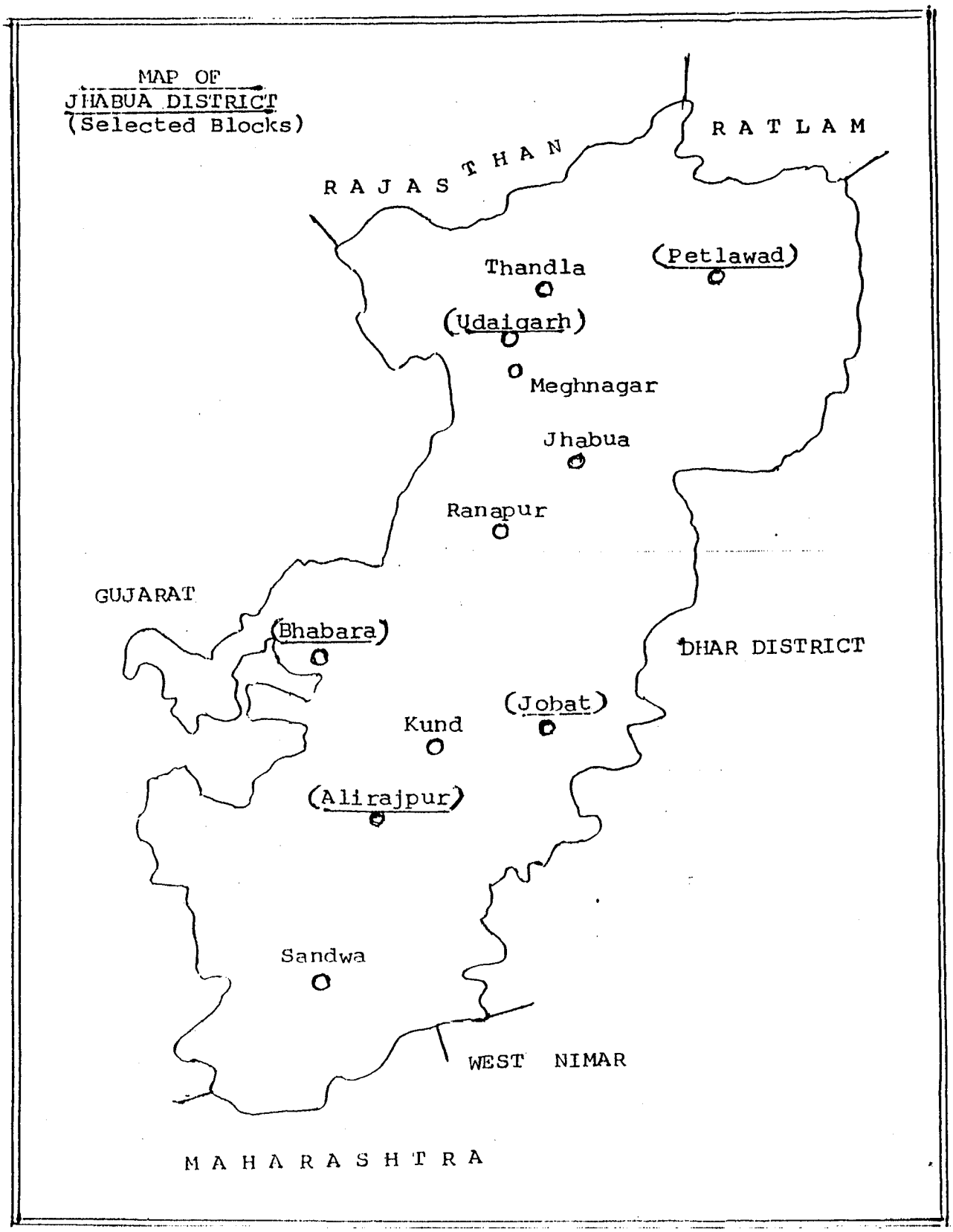

MAP OF
JHABUA DISTRICT
(Selected Blocks)
RAJASTHAN
RATLAM
Thandla
(Petlawad)
(Udaigarh)
Meghnagar
Jhabua
Ranapur
GUJARAT
(Bhabara)
DHAR DISTRICT
(Jobat)
Kund
(Alirajpur)
Sandwa
WEST NIMAR
MAHARASHTRA

Table 3.1 Main features of selected districts, Madhya Pradesh

S. No.	Particulars	Unit	Durg	Jhabua	Narsinghpur
1.	Location				
	1) Latitudes		$20^{\circ}23'$ to $21^{\circ}23'$ N	$22^{\circ}0'$ to $23^{\circ}3'$ N	$22^{\circ}45'$ to $23^{\circ}15'$ N
	2) Longitudes		$80^{\circ}46'$ to $81^{\circ}58'$ E	$73^{\circ}0'$ to $75^{\circ}0'$ E	$78^{\circ}38'$ to $79^{\circ}38'$ E
2.	Geographical area	Sq.Km. (1996-97)	8,702	6,757	5,136
3.	Forest area (Percentage to geographical area)	%	11.45	19.13	26.53
4.	Density of population	Per sq.km.	281	167	153
5.	Male population (Percentage to total popn)	Per cent	51	51	52
6.	Female population (Percentage to total popn.)	Per cent	49	49	48
7.	Rural population (Percentage to total popn.)	Per cent	65	91.32	85.13
8.	Urban population (Percentage to total popn.)	Per cent	35	8.68	14.87
9.	Scheduled Castes (Percentage to total popn.)	Per cent	12.80	3.06	16.59
10.	Scheduled tribes (Percentage to total popn.)	Per cent	12.43	85.67	12.90
11.	Percentage of main workers to total population	Per cent	42.37	39.30	36.08
12.	Percentage of cultivators to total main workers	Per cent	43.25	84.10	39.81
13.	Percentage of agricultural labourers to total main workers	Per cent	25.03	5.90	38.88
14.	Percentage of literacy to total population	Per cent	47.89	14.54	45.33
15.	Percentage of literate Males	Per cent	74.06	20.15	68.44
16.	Percentage of literate Females	Per cent	42.78	8.79	41.59
17.	Percentage of rural Literates	Per cent	50.37	10.42	51.37
18.	Percentage of urban Literates	Per cent	73.53	57.82	79.30
19.	Fertiliser consumption (1993-94)	(kg./ha.)	32.25	19.24	33.73
20.	Pre-Primary & Primary Schools	(Per lakh population)	85	116	91
21.	Middle Schools	" "	24	17	21
22.	Higher Secondary Schools	" "	9	4	9
23.	Irrigation intensity(96-97)	Per cent	109.86	102.07	102.15
24.	Cropping intensity (96-97)	Per cent	144.43	127.50	135.44
25.	Percentage of irrigated area to gross cropped area	(1996-97)	28.7	15.35	36.09

Table 3.2 Cropping pattern, Durg district, Madhya Pradesh, 1996-97

(Area-thousand hectares)

Crop	Area	Percentage
Paddy	422.9	52.62
Jowar	0.3	0.04
Maize	0.1	0.01
Wheat	17.8	2.21
Barley	-	-
Other small millets	18.9	2.35
Total cereals	460.0	57.23
Gram	64.4	8.00
Urad	8.8	1.09
Moong-moth	0.7	0.08
Kulthi	1.2	0.15
Teora	187.7	23.35
Pea	0.7	0.08
Lentil	6.4	0.80
Arhar	4.8	0.60
Other pulses	-	-
Total pulses	274.5	34.15
Total foodgrains	734.5	91.38
Sugarcane	0.1	0.01
Spices	2.2	0.27
Fruits & vegetables	15.0	1.87
Total food crops	751.8	93.53
Groundnut	0.8	0.10
Sesamum	1.9	0.24
Soybean	7.9	0.98
Rapeseed & mustard	0.6	0.07
Sunflower	0.3	0.04
Safflower	0.2	0.02
Linseed	39.6	4.93
Castorseed	-	-
Other oilseeds	-	-
Total oilseeds	51.3	6.38
Total fibres	-	-
Total drugs	-	-
Total fodder	0.2	0.02
Other nonfood crops	0.5	0.07
Total nonfood crops	52.0	6.47
Gross cropped area	803.8	100.00

jowar, cotton, groundnut, urad, moong and lesser millets like kodo, whereas, in rabi season, wheat, gram and castor are grown, Ninety per cent of the area is sown during kharif and 10 per cent in rabi. Small and marginal farmers move for wage earning in the surrounding villages after sowing in kharif season and come back only to harvest the crops. A cooperative system of group work known as 'Halma' is popular among the farmers. The work includes ploughing, weeding, harvesting, etc.

Crop raising is very difficult in the hilly areas of Jhabua district. Still, more than 50 per cent of the total geographical area is under cultivation. The area under forest is 19.13 per cent. Of the total population 85.67 per cent belonged to scheduled tribes, 3.06 per cent to scheduled castes and the remaining 11.27 per cent to other castes. The district was rural in character as 91.32 per cent of the population resided in villages. The literacy percentage of the district was 14.54. Among rural population it was lower (10.42 per cent) than the urban population (57.82 per cent). The literacy percentage among females was much lower (8.79 per cent) than males (20.15 per cent).

The rural character of the district can also be noted from the occupational distribution of workers. As high as 84.11 per cent of the total workers were cultivators. Another 5.90 per cent workers were agricultural labourers and 'other' workers formed 9.59 per cent.

The climate is arid to sub -arid with an annual average rainfall of 800 mm. The rainfall is erratic and annual variation in rainfall is a regular feature. The consumption of fertilisers is very low (about 19 kg/hectare). The cropping intensity was 127.50 per cent and irrigation intensity was 102.07 per cent. Of the net cropped area only 19.17 per cent was irrigated (Table 3.1)

Maize was the single important crop occupying 22.81 per cent of the gross cropped area. Urad, gram and kulthi were important pulses occupying 18.37, 9.74 and 4.79 per cent area respectively. Among oilseeds, soybean (5.99 per cent) and groundnut (3.59 per cent) were the major crops. Fodder and cotton occupied 3.55 per cent and and 3.25 per cent respectively. Wheat, paddy, jowar and bajra were

also important cereals of the district. Cereals dominated the cropping pattern (48.01 per cent) followed by pulses (34.60 per cent) and oilseeds (10.04 per cent). Non food crops occupied 16.84 per cent of the gross cropped area. (Table 3.3)

3.3 Narsinghpur district

Narsinghpur district lies almost in the central part of the state and is situated between 22°45' and 23°15'N latitudes and 78°38' and 79°38'E longitudes. It is surrounded by seven districts including Sagar in the north, Raisen in the north-west, Damoh in the north-east, Seoni in the south-east, Jabalpur in the east and Chhindwara in the south and south-west. It is a part of Zone VIII (Central Plateau & Hills Region).

Narsinghpur district had an area of 5,136 sq.km. and forest area of 26.53 per cent of the total geographical area. The density of population per sq.km. was 153. Of the total population, rural population was 85.13 per cent and urban population was 14.87 per cent. The population belonging to scheduled castes and scheduled tribes was 16.59 and 12.90 per cent respectively. The proportion of main workers in this district was 36.08. The workers were mainly engaged in agricultural activities and returned as cultivators and agricultural labourers. These two categories accounted for nearly 80 per cent of the main workers.

The literacy percentage of the district was 45.33. Among rural population it was lower than the urban population. The literacy percentage among females was lower (41.59) than the males (68.44).

The average rainfall in the district was 1,300.8 m.m. The consumption of fertilisers in the district was 33.73 kg/ha. The number of primary, middle and higher secondary schools per lakh population was 91, 21 and 9 respectively.

Nearly 58 per cent of the district area was under cultivation. The cropping intensity was 135.44 per cent. The intensity of irrigation in the district was 102.15 per cent. Of the gross cropped area 36.09 per cent was irrigated (Table 3.1).

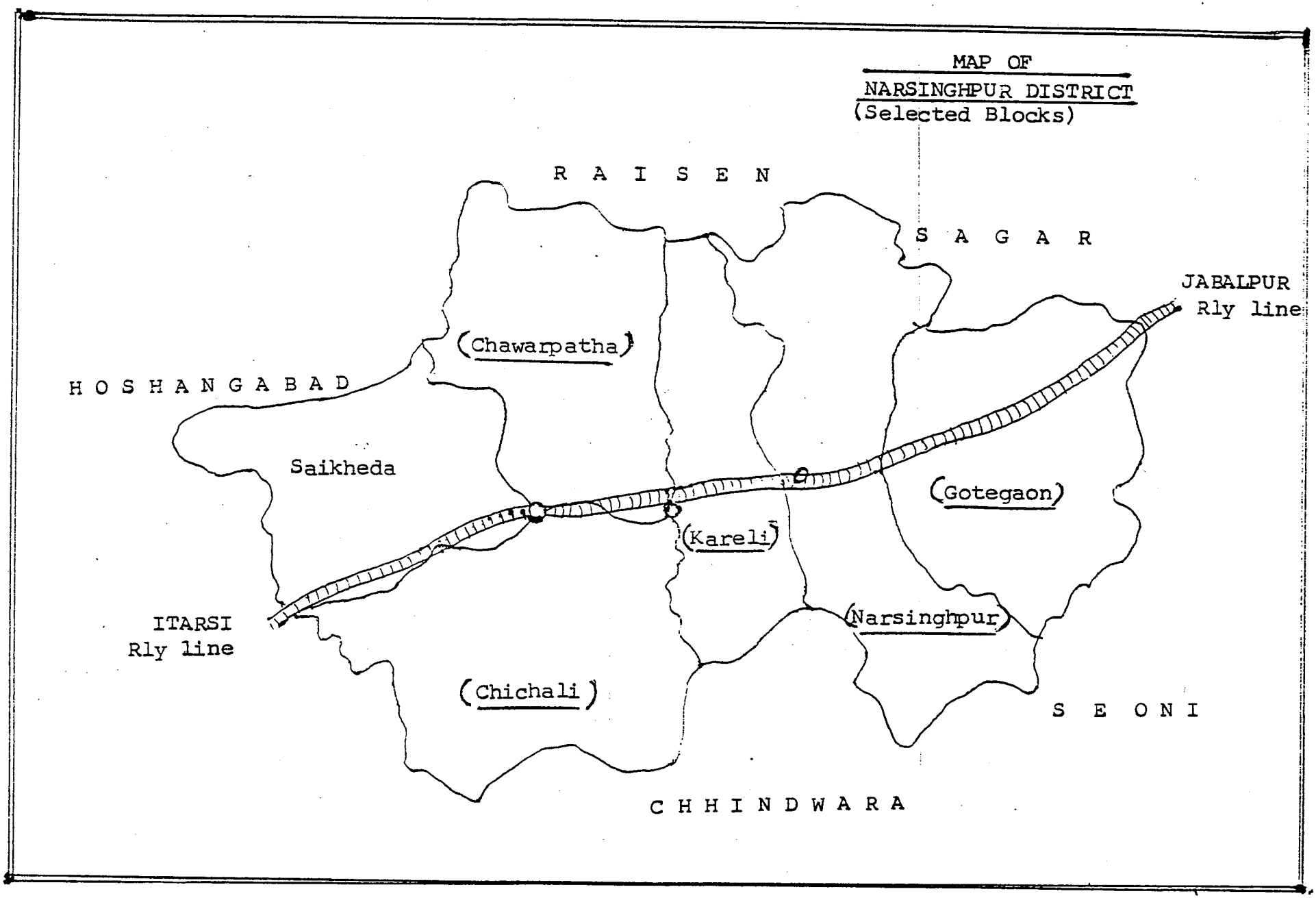

MAP OF
NARSINGHPUR DISTRICT
(Selected Blocks)
R A I S E N
S A G A R
JABALPUR
Rly line
(Chawarpatha)
H O S H A N G A B A D
Saikheda
(Gotegaon)
(Kareli)
ITARSI
Rly line
(Narsinghpur)
(Chichali)
S E O N I
C H H I N D W A R A

Table 3.3 Cropping pattern, Jhabua district, Madhya Pradesh, 1996-97

(Area - thousand hectares)

Crop	Area	Percentage
Paddy	27.2	5.93
Jowar	19.7	4.29
Maize	104.7	22.81
Wheat	44.4	9.67
Barley	0.4	0.09
Bajara	17.6	3.83
Other small millets	6.4	1.39
Total cereals	220.4	48.01
Gram	44.7	9.74
Urad	84.3	18.37
Moong-moth	1.8	0.39
Kulthi	22.0	4.79
Teora	-	-
Pea	0.3	0.07
Lentil	-	-
Arhar	4.4	0.96
Other pulses	1.3	0.28
Total pulses	158.8	34.60
Total foodgrains	379.2	82.61
Sugarcane	-	-
Spices	1.2	0.26
Fruits & vegetables	1.3	0.29
Total food crops	381.7	83.16
Groundnut	16.5	3.59
Sesamum	0.1	0.02
Soybean	27.5	5.99
Rapeseed & mustard	-	-
Sunflower	-	-
Safflower	-	-
Linseed	-	-
Castorseed	2.0	0.44
Other oilseeds	-	-
Total oilseeds	46.1	10.04
Total fibres	14.9	3.25
Total drugs	-	-
Total fodder	16.3	3.55
Other nonfood crops	-	-
Total nonfood crops	77.3	16.84
Gross cropped area	459.0	100.00

Pulses dominated the cropping pattern occupying 44.94 per cent of the gross cropped area.

Oilseeds and cereals occupied second and third positions with 29.90 per cent and 21.48 per cent of the gross cropped area respectively. Among cereals wheat occupied 16.46 per cent. Among pulses, gram was the major crop and occupied 30.30 per cent area. Other important pulses were lentil (3.60 per cent), pea (5.05 per cent) and arhar (4.28 per cent). Soybean was most important oilseed crop occupying 28.16 per cent. Sugarcane was another important crop and occupied 2.06 per cent area (Table 3.4).

Among three districts, percentage of forest area was highest in Narsinghpur district followed by Jhabua & Durg. Density of population was highest in Durg. Rural population was highest in Jhabua district (91.32 per cent) followed by Narsinghpur and Durg districts. Percentage of population of scheduled tribes was maximum (91.32)in Jhabua district followed by Narsinghpur (85.13) and Durg (65.00). The percentage of main workers was highest in Durg district. The proportion of cultivators was highest (84.11) in Jhabua district and the proportion of agricultural labourers was highest (38.88 per cent) in Narsinghpur district. Literacy percentage was highest in Durg district followed by Narsinghpur and Jhabua districts. Consumption of fertilisers (in kg/ha) was highest in Narsinghpur. Both cropping intensity and irrigation intensity were highest in Durg district followed by Narsinghpur and Jhabua districts. The proportion of irrigated area to net cropped area was highest (47.85 per cent) in Narsinghpur district followed by Durg and Jhabua districts.

Cereals dominated the cropping pattern of Durg district whereas, in Narsinghpur district, pulses (gram) dominated. In Jhabua district, maize (22.81 per cent) and urad (18.37 per cent) dominated the cropping pattern.

3.4 Districtwise Cropped area and Irrigated area

In Durg district the major crop grown was rice followed by gram, wheat & fruits & vegetables. Of the crops grown rice was

Table 3.4 Cropping pattern, Narsinghpur district, Madhya Pradesh, 1996-97

(Area--thousand hectares)

Crop	Area	Percentage
Paddy	8.7	2.16
Jowar	6.4	1.59
Maize	0.4	0.10
Wheat	66.2	16.46
Barley	-	-
Other small millets	4.7	1.17
Total cereals	86.4	21.48
Gram	121.9	30.30
Urad	1.9	0.47
Moong-moth	2.5	0.62
Kulthi	-	-
Teora	2.4	0.60
Pea	20.3	5.05
Lentil	14.5	3.60
Arhar	17.2	4.28
Other pulses	0.1	0.02
Total pulses	180.8	44.94
Total foodgrains	267.2	66.42
Sugarcane	8.3	2.06
Spices	0.6	0.15
Fruits & vegetables	2.7	0.67
Total food crops	278.8	69.30
Groundnut	--	--
Sesamum	4.4	1.09
Soybean	113.3	28.16
Rapeseed & mustard	1.2	0.30
Sunflower	0.5	0.13
Niger	0.7	0.17
Linseed	0.2	0.05
Castorseed	-	-
Other oilseeds	-	-
Total oilseeds	120.3	29.90
Total fibres	0.1	0.02
Total drugs	-	-
Total fodder	3.1	0.77
Other nonfood crops	-	-
Total nonfood crops	123.5	30.70
Gross cropped area	402.3	100.00

irrigated to the extent of 51.84 per cent and fodder 51.33 per cent. Fruits & vegetables were irrigated to the extent of 44.96 per cent and fibres, 37.18 per cent. Wheat and rape-mustard was irrigated to the extent of 33.41 per cent and 25.00 per cent respectively. Among cereals & pulses, the position of pulses was very poor in respect of irrigation. The percentage of irrigated area was 0.36.

In Jhabua district, gram was the major pulse crop. The other important crops were wheat, rice, soybean, fodder and fibres. Of the crops grown wheat was irrigated to the extent of 95.73 per cent. Gram was irrigated to the extent of 41.75 per cent and spices, 38.83 per cent. Rapeseed-mustard, fibres and fruits & vegetables were irrigated to the extent of 99.9 per cent, 26.74 per cent, and 67.74 per cent respectively.

Narsinghpur district was the major pulse growing district of Madhya Pradesh, where total pulses occupied area double that of the area of total cereals. Gram occupied highest area followed by soybean and wheat. Wheat was irrigated to the extent of 93.50 per cent. Gram was irrigated to the extent of 40.06 per cent and rape-mustard 25.00 per cent. Spices were irrigated to the extent of 50.00 per cent, whereas, fruits & vegetables were irrigated to the extent of 60.00 per cent.

It can be observed that even though Durg district occupied first position as regards area under pulses, Narsinghpur district had higher percentage of irrigated area showing that its production would be more stable than other two districts. Also total area under cereals in Narsinghpur district is half of the area under pulses which shows that Narsinghpur district is rightly termed as pulses district of the state (Table 3.5).

3.5 Area, Production and Yield of Pulses in the Last Decade

3.5.1 Durg District

Teora was the major pulse followed by gram, urad, lentil and arhar. The area under teora increased from 129.1 thousand hectares to 199.8 thousand hectares or 54.70 per cent increase during the last ten years.

Table 3.5 Districtwise cropped area and irrigated area under crops (1995-96)

(Thousand hectares)

Crops	Durg			Jhabua			Narsinghpur		
	Cropped area	Irri-gated area	% of irri-gated area to area under crop	Cropped area	Irri-gated area	% of irri-gated area to area under crop	Cropped area	Irri-gated area	% of irri-gated area to area under crop
Rice	424.60	220.151	51.84	27.80	0.023	0.08	9.00	-	-
Wheat	17.90	6.00	33.41	34.80	33.30	95.73	60.40	56.50	93.50
Total cereals	463.40	226.20	48.81	210.14	38.98	18.55	92.00	58.00	63.00
Gram	67.00	0.89	1.33	37.40	15.60	41.75	129.80	52.00	40.06
Tur	5.30	0.001	0.02	4.20	0.004	0.10	16.70	-	-
Other pulses	216.50	0.144	0.07	109.70	0.081	0.07	42.50	-	-
Total pulses	289.00	1.039	0.36	151.25	15.69	10.37	189.00	55.00	29.10
Rape-mustard	0.40	0.10	25.00	0.029	0.028	99.90	0.20	0.05	25.00
Soybean	4.65	0.28	5.90	25.96	0.561	2.16	100.00	4.50	4.50
Spices	2.03	0.23	11.30	1.025	0.398	38.83	0.60	0.30	50.00
Fibres	0.078	0.029	37.18	15.07	4.03	26.74	0.08	-	-
Fodder	0.226	0.116	51.33	15.60	0.097	0.62	3.80	0.35	9.21
Fruits and Vegetables	14.369	6.461	44.96	1.03	0.70	67.74	2.50	1.50	60.00
Total	817.50	234.90	28.73	438.90	60.60	13.81	394.50	141.90	35.97

The production also exhibited similar tendency with slight variations. The yield pattern during the period showed that there was instability in yield and fluctuated over the years. In the case of gram the area increased from 56.3 thousand hectares in 1986-87 to 67.0 thousand hectares or an increase by 19.00 per cent in 1995-96. The production fluctuated between 29.3 thousand tonnes in 1988-89 to 47.9 thousand tonnes in 1994-95. Of course, a slight decrease (33.3 thousand tonnes) was observed in the year 1995-96. During this period there was quite a fluctuation in yield per hectare. It ranged between 473 kg. in 1988-89 and 724 kg. in 1994-95. In the last year (1995-96) the yield per hectare was very low (497 kg.).

In the case of urad, the area declined during the last 10 years. On the other hand, yield showed an increasing trend and production was more or less stagnant.

Lentil showed increase in area, production and yield, whereas, in the case of arhar all the three components showed decreasing trend during the last 10 years (Table 3.6)

3.5.2 Jhabua District

Urad was the major pulse crop of this district followed by kulthi, gram and arhar. Total pulses showed increasing trend in area, production and yield during the last 10 years. In 1986-87, 108.2 thousand hectares of land was cultivated under pulses. By 1995-96, it increased to 151.2 thousand hectares or an increase of 39.5 per cent. The production under pulses increased from 31.3 thousand tonnes in 1986-87 to 55.3 thousand tonnes in 1995-96. In other words the increase was 76.7 per cent. During the same period the yield of pulses increased from 289 kg/ha to 366 kg/ha., an increase by 26.6 per cent.

During the last 10 years, positive trend was observed in area, production and yield of urad. Similar trend was observed in the case of gram. Gram is gaining importance in this district. Very little change was observed in the case of kulthi during the last 10 years. In the case of arhar, a significant decrease was observed in area, production and yield during the 10 year period. (Table 3.7 and graph).

3.6 Area, production and yield of pulses in Durg District, Madhya Pradesh

Area - '000 Hect.
Production- '000 Tonnes
Yield - Kg./ Hect.

Years	Gram			Urad			Teora		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1986-87	56.3	37.4	664	21.2	2.9	136	129.1	40.0	310
1987-88	63.5	36.8	580	19.5	2.9	148	123.5	47.0	381
1988-89	61.9	29.3	473	9.7	1.4	144	88.5	20.1	227
1989-90	63.8	33.3	522	8.7	1.3	149	112.4	30.6	272
1990-91	65.6	37.6	573	11.5	2.0	173	172.5	65.7	381
1991-92	63.5	43.8	690	10.4	2.1	201	175.0	100.1	572
1992-93	61.2	38.3	626	11.6	2.3	198	171.8	71.7	417
1993-94	59.9	41.0	684	9.5	2.5	263	190.6	92.7	486
1994-95	66.1	47.9	724	11.2	2.0	178	195.9	90.9	464
1995-96	67.0	33.3	497	8.2	1.8	219	199.8	55.7	279

Years	Lentil			Arhar			Total Pulses		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1986-87	4.3	1.1	256	7.9	8.9	1126	221.5	90.9	410
1987-88	4.2	0.8	190	8.5	9.5	1118	221.4	97.6	441
1988-89	4.0	1.0	250	5.3	6.6	1245	171.5	58.9	343
1989-90	4.1	1.0	244	8.3	7.6	915	198.9	74.2	373
1990-91	4.6	1.1	239	5.8	6.2	1069	262.1	113.1	431
1991-92	4.7	1.5	319	6.9	7.1	1029	262.6	155.2	591
1992-93	4.8	1.3	270	6.9	7.1	1029	258.6	121.2	469
1993-94	5.5	1.6	291	5.4	6.1	1130	276.5	144.4	522
1994-95	6.5	1.7	261	4.7	4.1	872	286.8	147.1	513
1995-96	6.0	1.7	283	5.3	4.0	755	288.8	97.1	336

Source : "Agricultural Statistics"- Ministry of Agriculture, Government of Madhya Pradesh, Bhopal (M.P.)

Table 3.7 Area, production and yield of pulses in Jhabua District, Madhya Pradesh

Area - '000 Hect.
Production- '000 Tonnes
Yield - Kg./ Hect.

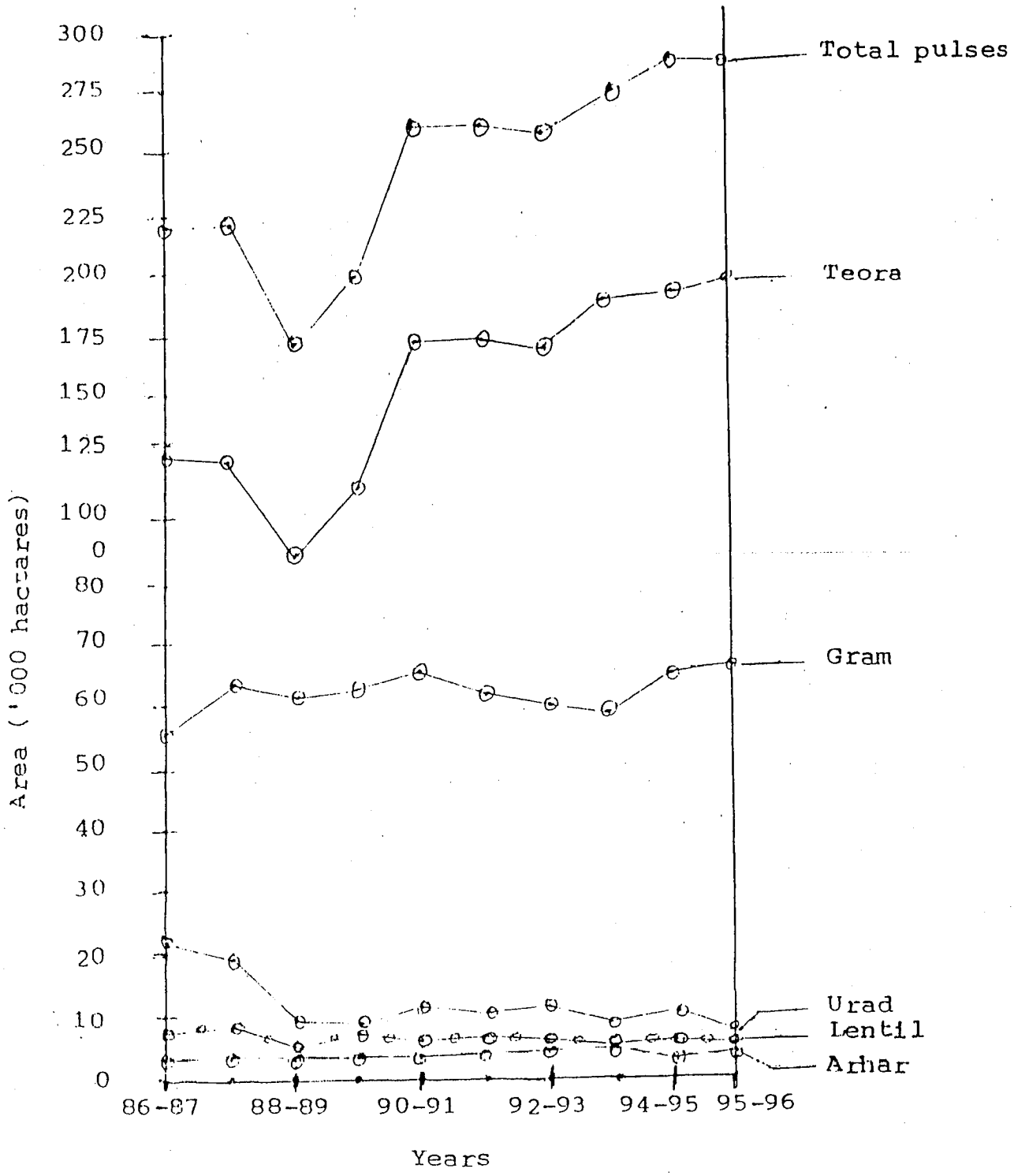
Years	Gram			Urad		
	Area	Production	Yield	Area	Produ-ction	Yield
1986-87	13.3	6.7	504	54.6	13.1	240
1987-88	15.7	6.5	414	46.7	5.6	120
1988-89	23.9	15.4	644	48.3	15.1	313
1989-90	22.5	13.4	596	55.3	14.4	260
1990-91	31.6	18.6	588	58.4	16.1	275
1991-92	17.2	10.5	610	63.2	15.1	239
1992-93	88.4	55.2	625	74.7	25.1	336
1993-94	66.7	42.9	643	79.8	24.7	309
1994-95	64.2	45.5	708	81.4	25.6	314
1995-96	37.4	19.5	521	83.2	26.5	318

Years	Kulthi			Arhar			Total Pulses		
	Area	Produ-ction	Yield	Area	Produ-ction	Yield	Area	Produ-ction	Yield
1986-87	32.0	7.4	231	5.2	3.3	635	108.2	31.3	289
1987-88	31.2	3.8	122	9.1	3.2	352	103.0	18.1	176
1988-89	27.6	8.5	308	9.5	8.2	863	114.6	51.5	449
1989-90	30.2	8.6	285	9.3	5.1	548	118.7	42.4	357
1990-91	30.5	8.7	285	8.0	5.9	738	131.3	50.0	380
1991-92	30.0	5.7	190	5.7	2.5	438	188.7	54.7	290
1992-93	26.9	8.7	323	5.3	3.4	641	199.0	93.5	470
1993-94	26.5	8.5	320	5.1	3.2	627	182.1	80.4	442
1994-95	25.1	7.8	311	6.4	3.7	578	180.2	83.4	463
1995-96	23.3	6.6	283	4.2	1.8	429	151.2	55.3	366

Source : "Agricultural Statistics"- Ministry of Agriculture, Government of Madhya Pradesh, Bhopal (M.P.)

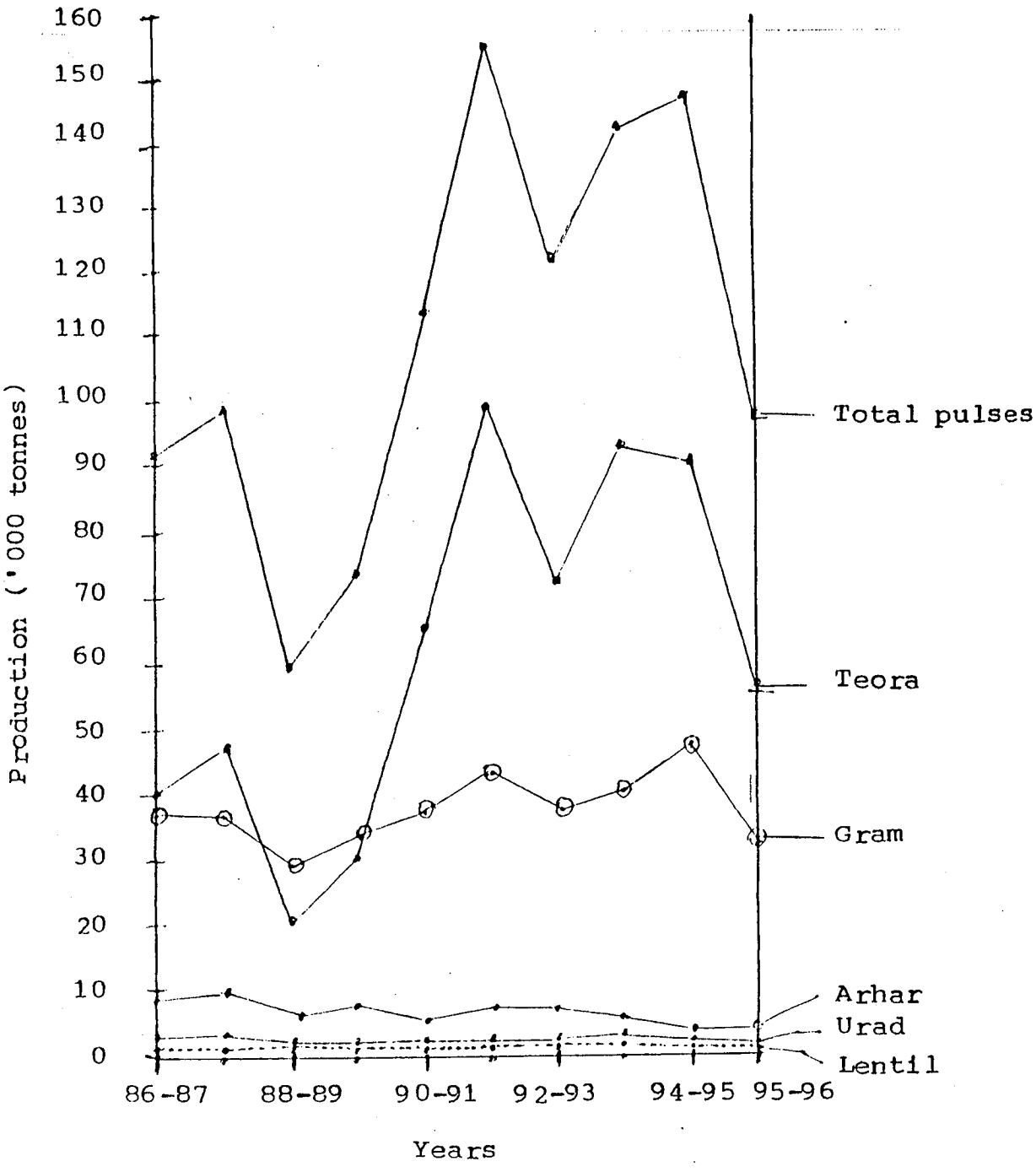
AREA OF PULSES IN DURG DISTRICT

(1986-87 to 1995-96)



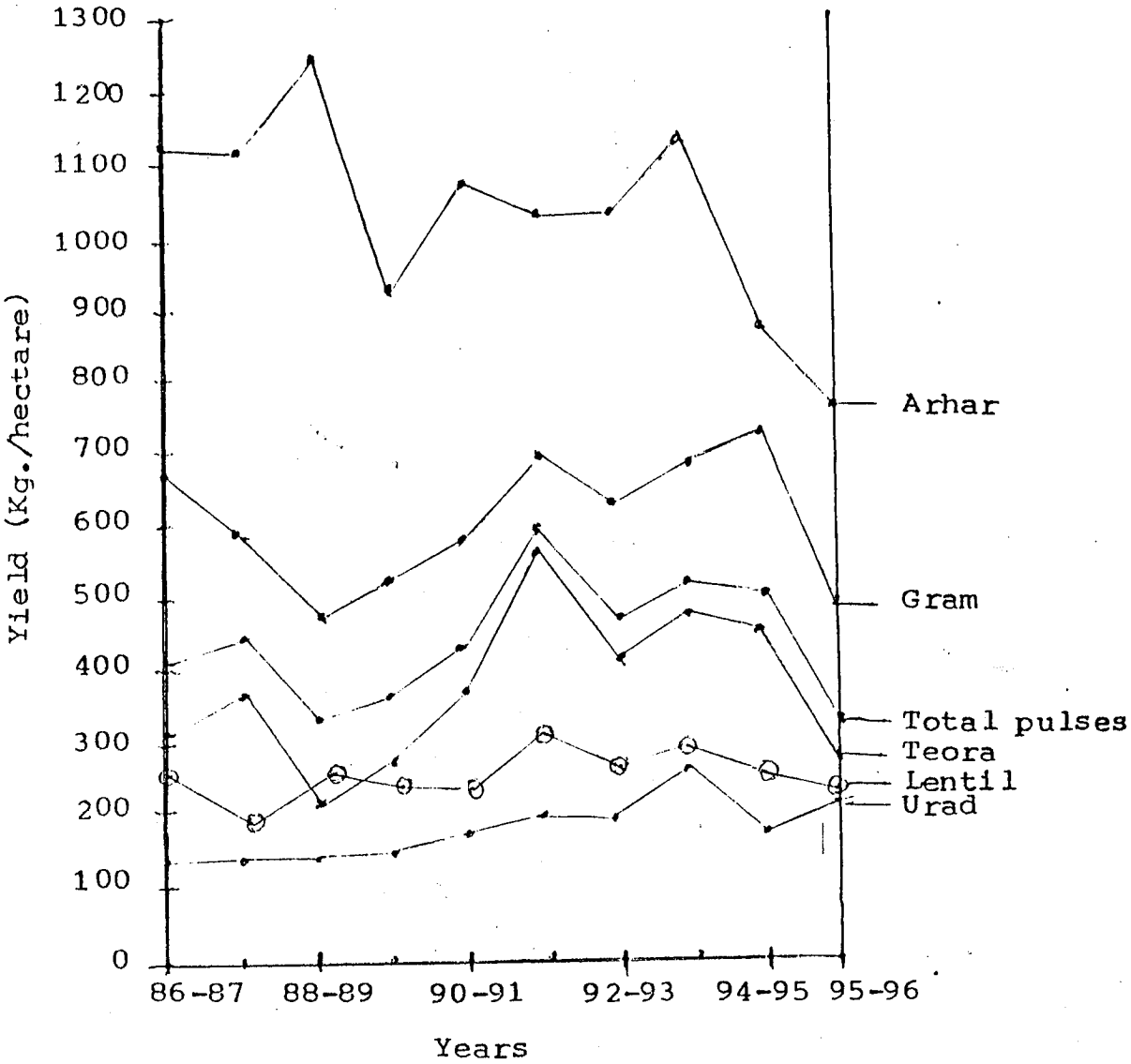
PRODUCTION OF PULSES IN DURG DISTRICT

(1986-87 to 1995-96)



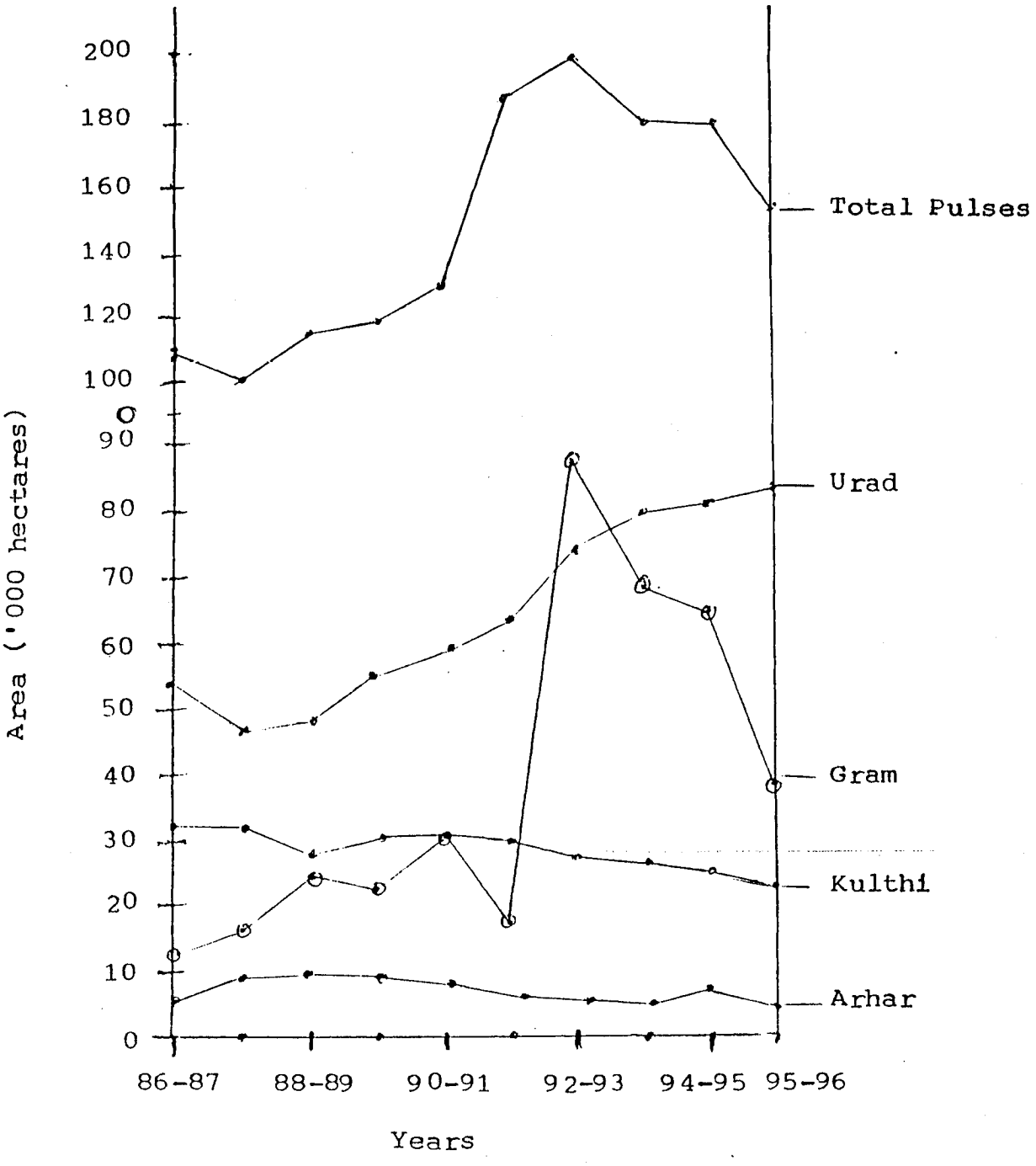
YIELD OF PULSES IN DURG DISTRICT

(1986-87 to 1995-96)



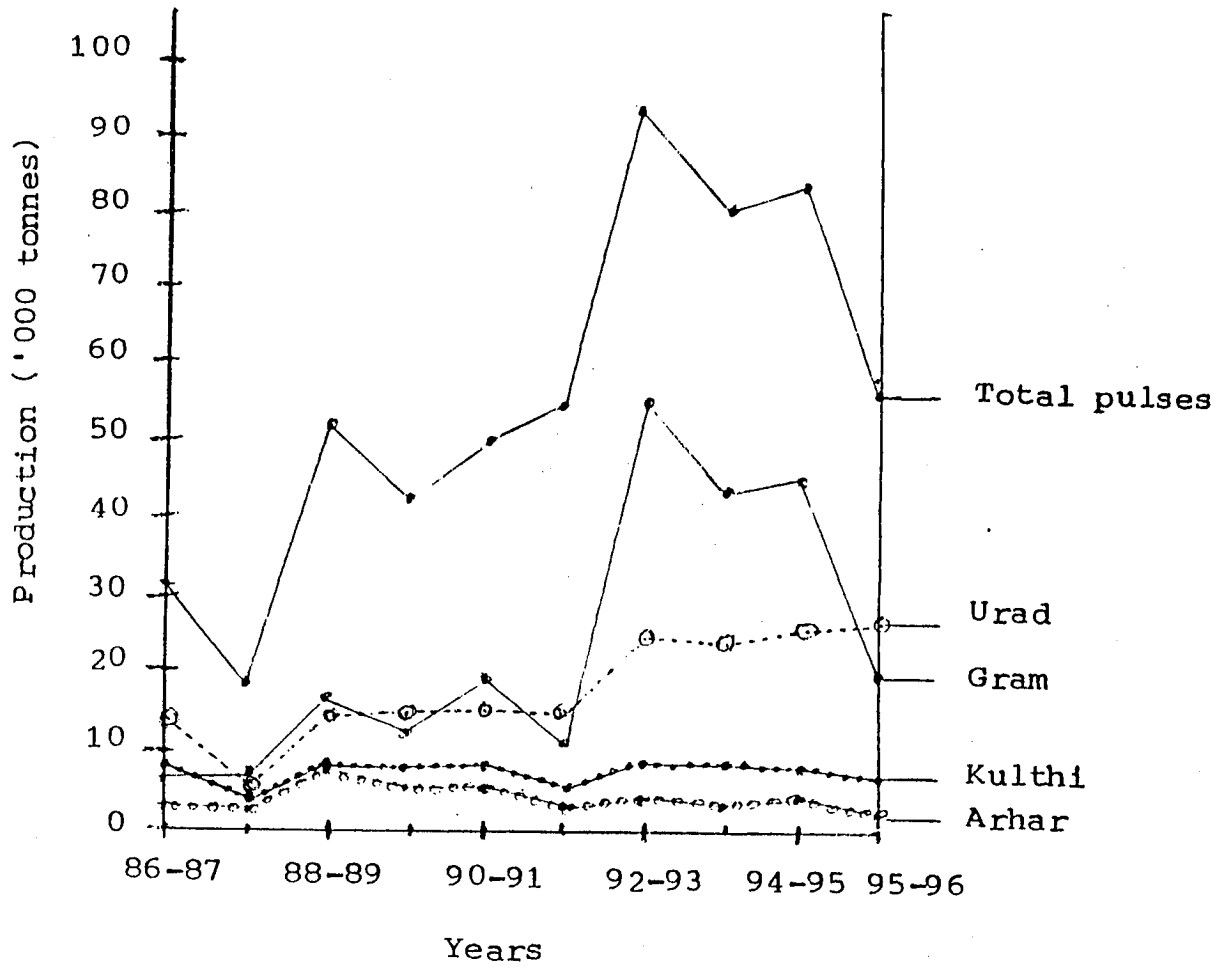
AREA OF PULSES IN JHABUA DISTRICT

(1986-87 to 1995-96)



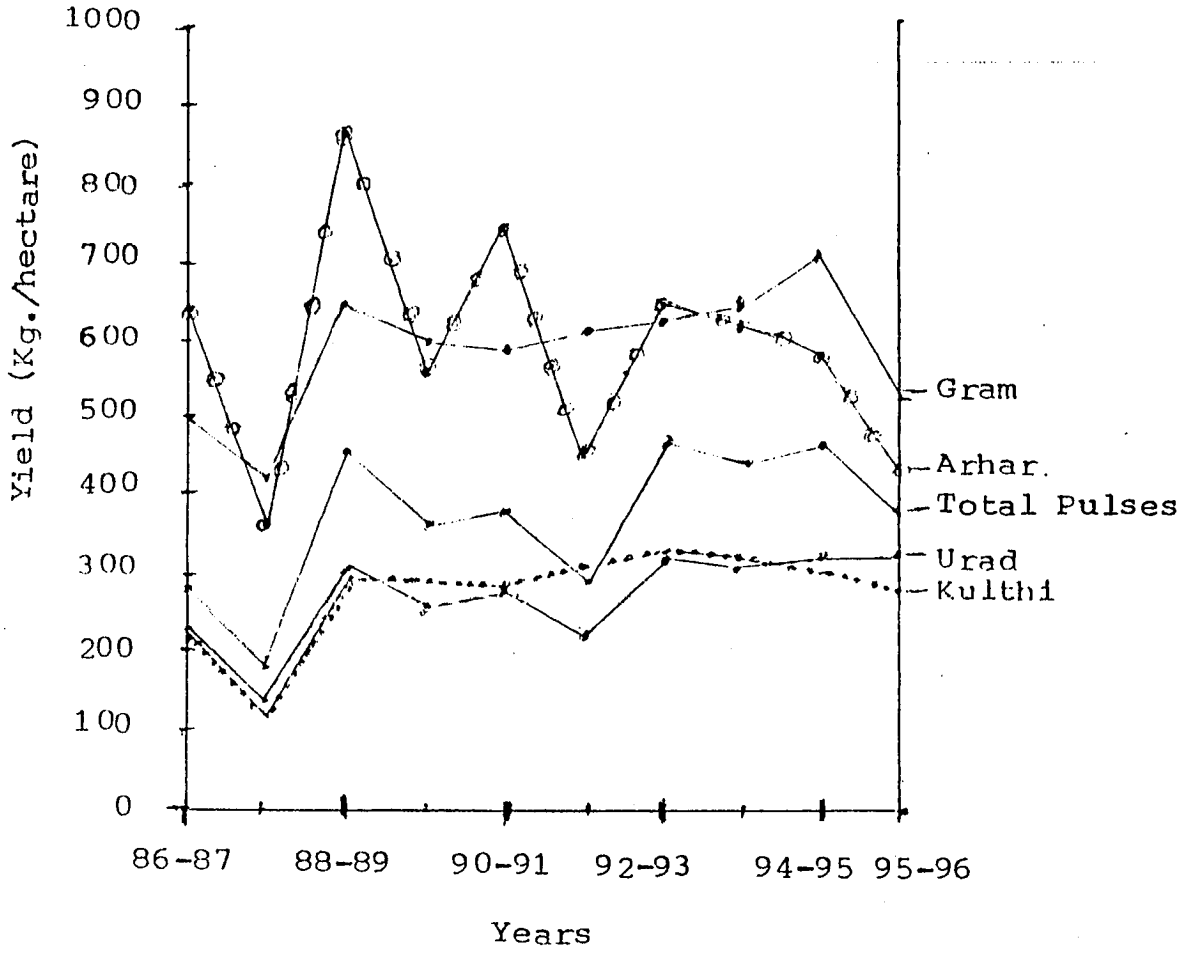
PRODUCTION OF PULSES IN JHABUA DISTRICT

(1986-87 to 1995-96)



YIELD OF PULSES IN JHABUA DISTRICT

(1986-87 to 1995-96)



3.5.3 Narsinghpur District

The area of total pulses in Narsinghpur district was 184.8 thousand hectares in 1986-87. It was 189.1 thousand hectares in 1995-96 or an increase of 2.3 per cent. Thus area under total pulses during the last 10 years was stagnant. The production of pulses increased from 149.2 thousand tonnes(1986-87) to 184.8 thousand tonnes (1994-95) or 23.8 per cent increase. But in 1995-96 it decreased to 118.5 thousand tonnes. Yield also showed a positive trend from 807 kg./ha to 976 kg./ha upto 1994-95. In the last year (1995-96) it dipped to 627 kg/ha.

Among different pulses gram ranked first followed by pea, arhar, lentil and moong-moth. Upto 1994-95, the area, production and yield of gram increased significantly. In 1995-96 the area, production & yield of gram decreased suddenly due to natural calamities. The area, production and yield showed decreasing trend in the case of pea during the last 10 years. The area, production and yield of arhar decreased marginally during the same period. The area and production of lentil showed significant increase during 10 years. Marginal decrease was observed in the case of yield. The area, production and yield of moong-moth during the last 10 years showed decreasing trend (Table 3.8 and graph).

3.6 Area, Production and Yield of Pulses in Two Trienniums

An attempt was made to determine the magnitude of changes in area, production and yield of important pulse crops measuring the absolute and relative changes at two point of time series, i.e. triennium ending 1988-89 and triennium ending 1995-96.

3.6.1 Durg District

Teora was the most important pulse crop. It showed the highest absolute increase in area, production and yield. Arhar showed decrease in area, production and yield in both absolute and relative terms. Urd showed 42.86 per cent and 12.50 per cent decrease in the area and production respectively. But an increase of 53.15 per cent was observed in yield, which was highest in pulses in Durg district. Lentil showed positive change in area, production and yield.

Table 3.8 Area, production and yield of pulses in Narsinghpur District, Madhya Pradesh

Area - '000 Hect.
Production- '000 Tonnes
Yield - Kg./ Hect.

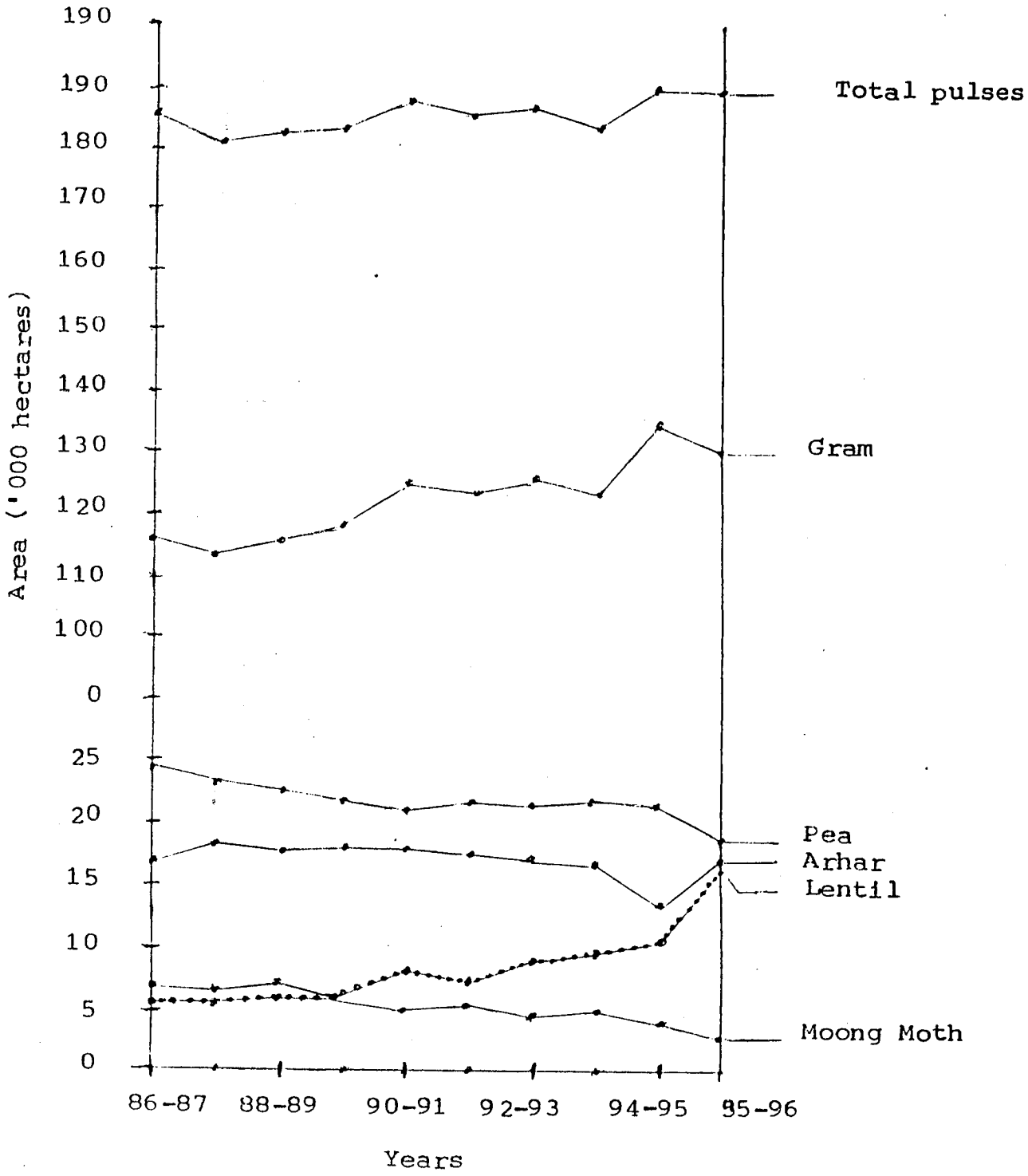
Years	Gram			Moong-Moth			Pea		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1986-87	115.8	96.1	830	7.0	3.5	500	24.9	9.9	398
1987-88	113.1	92.3	816	6.8	3.5	515	23.7	10.0	422
1988-89	115.5	87.0	753	6.9	3.3	478	23.1	8.4	364
1989-90	118.7	89.6	755	5.8	3.0	517	22.1	9.7	439
1990-91	124.4	122.2	902	5.3	3.0	566	21.3	8.8	413
1991-92	123.6	122.1	988	5.6	2.6	464	21.7	6.4	295
1992-93	125.6	123.1	980	4.9	2.5	510	21.7	6.5	299
1993-94	122.9	125.9	1024	5.1	2.5	490	22.0	9.0	409
1994-95	134.0	146.1	1091	4.0	1.7	425	21.6	7.9	366
1995-96	129.8	81.5	628	2.7	1.3	481	18.4	4.8	260

Years	Lentil			Arhar			Total Pulses		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1986-87	5.6	2.7	482	17.2	29.0	1686	184.8	149.2	807
1987-88	5.7	2.8	492	18.6	29.6	1591	181.1	147.3	813
1988-89	6.1	2.7	443	18.0	36.9	2050	182.3	146.9	806
1989-90	6.1	3.1	508	18.2	27.9	1532	182.6	146.4	802
1990-91	7.9	4.1	519	18.1	28.6	1580	187.1	171.3	915
1991-92	7.4	3.0	405	17.7	25.2	1424	185.3	166.3	897
1992-93	8.9	3.9	438	17.1	24.6	1438	186.1	166.2	893
1993-94	9.5	4.8	505	17.0	25.9	1523	183.6	174.5	950
1994-95	10.5	4.9	467	13.6	19.1	1404	189.4	184.8	976
1995-96	16.5	5.3	321	16.7	22.7	1359	189.1	118.5	627

Source : "Agricultural Statistics"- Ministry of Agriculture, Government of Madhya Pradesh, Bhopal (M.P.)

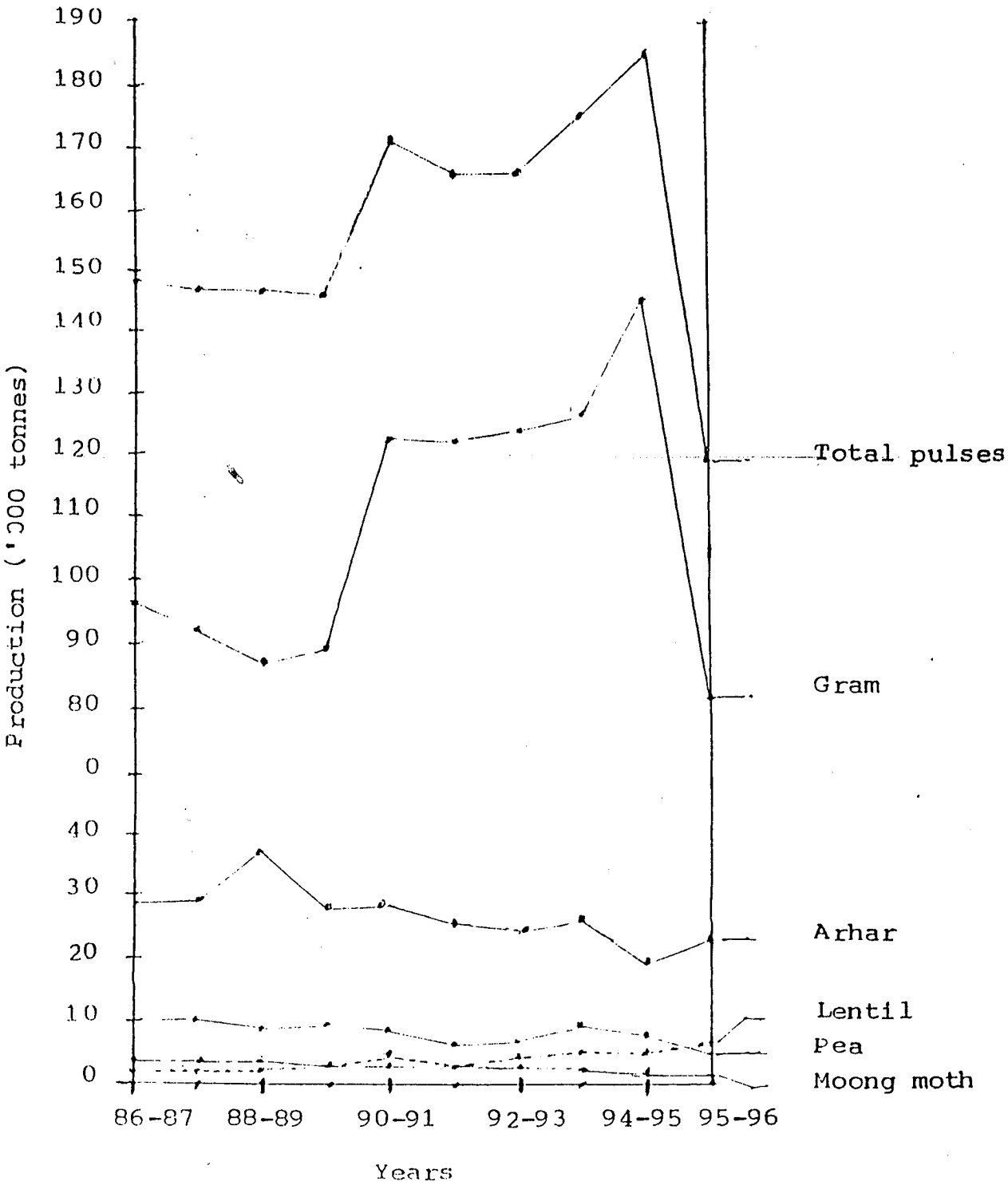
AREA OF PULSES IN NARSINGHPUR DISTRICT

(1986-87 to 1995-96)



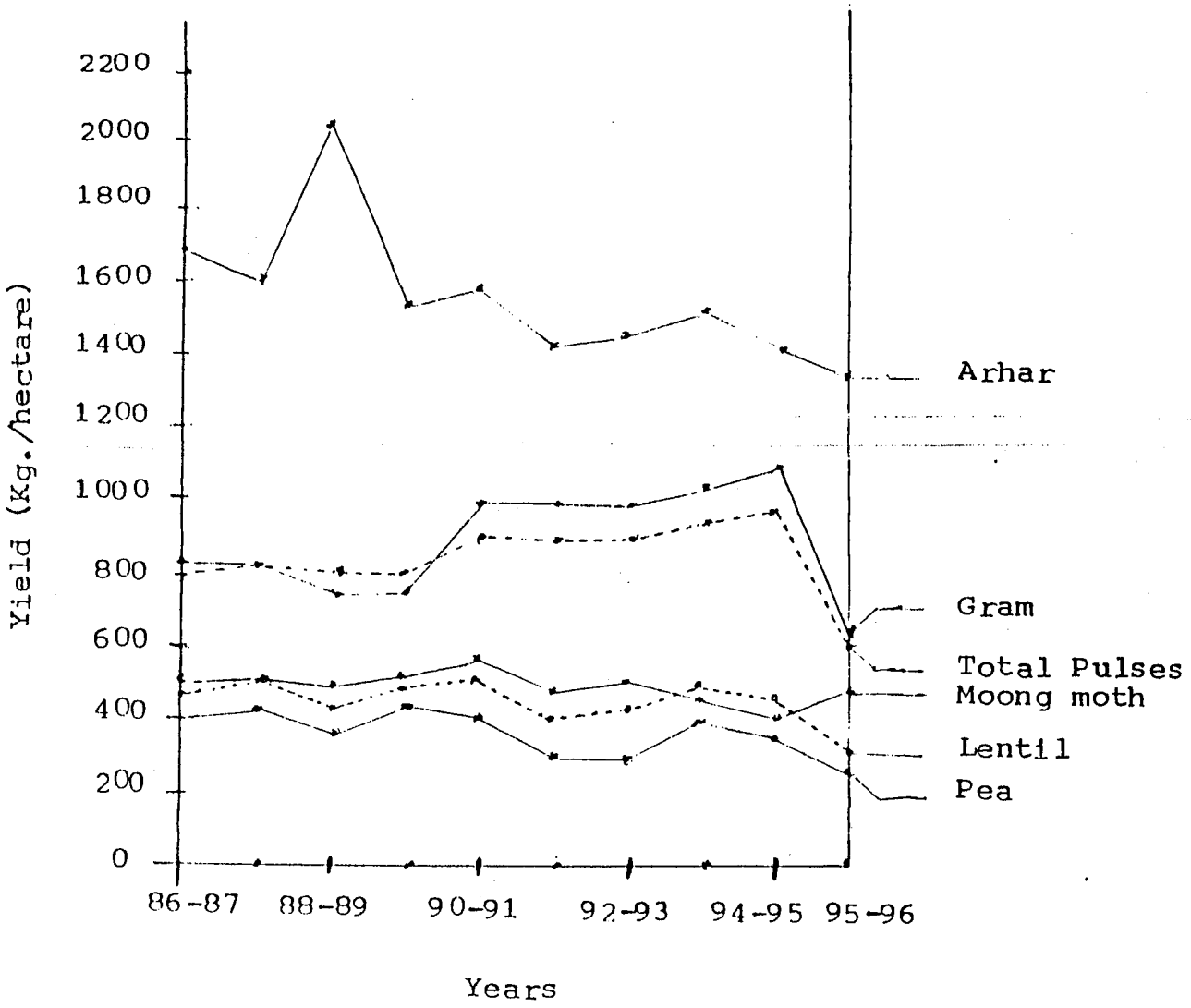
PRODUCTION OF PULSES IN NARSINGHPUR DISTRICT

(1986-87 to 1995-96)



YIELD OF PULSES IN NARSINGHPUR DISTRICT

(1986-87 to 1995-96)



In relative terms, gram showed 6.10, 17.97 and 11.25 per cent increase in area, production and yield respectively. The total area under pulses increased by 38.67 per cent, whereas, production and yield increased by 56.97 per cent and 13.15 per cent respectively (Table 3.9).

3.6.2 Jhabua District

Gram and urad showed increase in area, production and yield, whereas, arhar showed decrease in area, production and yield. In the case of kulthi the area decreased by 17.49 per cent, whereas, the production and yield increased by 15.15 per cent and 39.45 per cent respectively. The area under total pulses registered an increase of 57.64 per cent, whereas, production and yield registered an increase of 117.26 per cent and 37.86 per cent respectively between two trienniums (Table 3.10).

3.6.3 Narsinghpur District

In Narsinghpur district, the total area under pulses increased by 4.7 thousand hectares between two trienniums, indicating an increase of 2.57 per cent. The production also increased to the tune of 11.5 thousand tonnes, or 7.78 per cent. The yield of pulses increased by 41.00 kg/ha. (5.07 per cent). Gram was the major pulse crop of the district and registered an increase of 12.28, 28.32 and 14.39 per cent respectively in area, production and yield between two trienniums. Pea, arhar, and moong-moth showed decrease in area, production and yield. Except gram the yield of all the pulse crops showed negative change. The highest relative increase in area (110.34 per cent) and production (85.18 per cent) was observed in the case of lentil, whereas, the yield showed decrease by 11.83 per cent (Table 3.11).

3.7 Compound Growth Rates and Variability in Area, Production and Yield

To find out the annual rate of change, compound growth rates have been worked out for pulse crops of the selected districts for area, production and yield during the period 1986-87 to 1995-96. Variability represents the yearly fluctuations in area, production and yield of pulses.

Table 3.9 Area, production and yield of pulses, Durg district, in two trienniums

(TE 1988-89 and TE 1995-96)

Pulse Crops	Area('000 ha.)				Production ('000 tonnes)				Yield(Kg./ha.)			
	T.E. 88-89	T.E. 95-96	Absolute change ('000 ha)	Relative change (%)	T.E. 88-89	T.E. 95-96	Absolute change ('000 tonnes)	Relative change (%)	T.E. 88-89	T.E. 95-96	Absolute change (Kg./ha.)	Relative change (%)
Gram	60.6	64.3	3.7	6.10	34.5	40.7	6.2	17.97	569	633	64	11.25
Urad	16.8	9.6	- 7.2	-42.86	2.4	2.1	- 0.3	-12.50	143	219	76	53.15
Teora	113.7	195.4	81.7	71.85	35.7	79.7	44.0	123.25	314	408	94	29.94
Lentil	4.2	6.0	1.8	42.86	1.0	1.7	0.7	70.00	238	283	45	18.91
Arhar	7.2	5.1	- 2.1	-29.17	8.3	4.7	- 3.6	-43.37	1153	921	-232	-20.12
Total pulses	204.8	284.0	79.2	38.67	82.5	129.5	47.0	56.97	403	456	53	13.15

Table 3.10 Area, production and yield of pulses, Jhabua district, in two trienniums

(TE 1988-89 and TE 1995-96)

Pulse Crops	Area('000 ha.)				Production ('000 tonnes)				Yield(Kg./ha.)			
	T.E. 88-89	T.E. 95-96	Absolute change ('000 ha)	Relative change (%)	T.E. 88-89	T.E. 95-96	Absolute change ('000 tonnes)	Relative change (%)	T.E. 88-89	T.E. 95-96	Absolute change (Kg/ha.)	Relative change (%)
Gram	17.6	56.1	38.5	218.75	9.5	35.9	26.4	277.89	540	640	100	18.52
Urad	49.9	81.5	31.6	63.33	11.2	25.6	14.4	128.57	224	314	90	40.18
Kulthi	30.3	25.0	- 5.3	-17.49	6.6	7.6	1.0	15.15	218	304	86	39.45
Arhar	7.9	5.2	- 2.7	-34.18	4.9	2.9	- 2.0	- 40.82	620	558	- 62	-10.00
Total pulses	108.6	171.2	62.6	57.64	33.6	73.0	39.4	117.26	309	426	117	37.86

Table 3.11 Area, production and yield of pulses, Narsinghpur district, in two trienniums

(TE 1988-89 and TE 1995-96)

Pulse Crops	Area('000 ha.)				Production ('000 tonnes)				Yield(Kg./ha.)			
	T.E. 88-89	T.E. 95-96	Absolute change ('000 ha)	Relative change (%)	T.E. 88-89	T.E. 95-96	Absolute change ('000 tonnes)	Relative change (%)	T.E. 88-89	T.E. 95-96	Absolute change (Kg./ha.)	Relative change (%)
Gram	114.8	128.9	14.1	12.28	91.8	117.8	26.0	28.32	799	914	11.5	14.39
Moong-moth	6.9	3.9	- 3.0	-43.48	3.4	1.8	- 1.6	-47.06	493	461	-32.0	- 6.49
Pea	23.9	20.6	- 3.3	-13.81	9.4	7.2	- 2.2	-23.40	393	349	-44.0	-11.19
Lentil	5.8	12.2	6.4	110.34	2.7	5.0	2.3	85.18	465	410	-55.0	-11.83
Arhar	17.9	15.8	- 2.1	-11.73	31.8	22.6	- 9.2	-28.93	1,776	1,430	346.0	-19.48
Total pulses	182.7	187.4	4.7	2.57	147.8	159.3	11.5	7.78	809	850	41.0	5.07

3.7.1 Durg District

It is evident from the table that rates of growth of area, production and yield of arhar were negative. The decrease recorded was 4.75, 7.88 and 3.28 per cent per annum respectively. Teora, lentil and gram showed positive rates of growth in area, production and yield. Teora registered highest growth rates in area (7.72 per cent) and production (11.67 per cent) per annum which were statistically significant. Urad showed highest rate of growth per annum (5.98 per cent) in yield, whereas, area and production registered negative growth rates. In the case of total pulses, the area, production and yield have been increasing with annual compound growth rates of 4.56,6.07 and 1.44 per cent respectively(Table 3.12).

3.7.2 Jhabua District

Urad and gram were major pulse crops of Jhabua district. The rates of growth of area, production and yield of total pulses were 6.99, 13.23 and 5.84 per cent per annum respectively, which were statistically significant. The highest growth rate was observed in area (18.34 per cent) and production (21.43 per cent) of gram and yield (6.14 per cent) of urad . Arhar registered negative growth rates in area, production and yield. In the case of kulthi, the growth rate of area (2.95 per cent) was negative and significant but the growth rate was positive in the case of production (2.04 per cent) and yield (5.31 per cent) (Table 3.12).

3.7.3 Narsinghpur District

In this district, three crops, namely, arhar, moong and pea registered negative growth rates in area, production and yield. Only gram showed positive growth rates in area (1.64 per cent), production (2.78 per cent) and yield (1.13 per cent). Lentil also showed positive and significant growth rates in area (11.03 per cent) and production (8.35 per cent) but negative (2.44 per cent) growth rate in yield. The rate of growth per annum for area, production and yield for total pulses was 0.37 per cent, 0.44 per cent and 0.08 per cent respectively.

Overall picture shows that gram and total pulses registered positive growth rates in area, production and yield in all the three

Table 3.12 Compound growth rates and variability in area, production and yield of pulses in selected districts of Madhya Pradesh (1986-87 to 1995-96)

(Figures- Percentages)

Pulse crops		Durg			Jhabua			Narsinghpur		
		Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Gram	CGR	0.93*	1.86*	0.92	18.34**	21.43**	2.59*	1.64***	2.78*	1.13
	CV	4.83	13.52	13.78	64.68	71.61	13.69	5.15	19.02	15.94
Urad	CGR	-6.88**	-1.34	5.98***	7.00***	13.60**	6.14*	-	-	-
	CV	35.03	24.58	21.00	20.63	36.43	22.14			
Teora	CGR	7.72**	11.67**	3.65*	-	-	-	-	-	-
	CV	23.85	42.51	27.26						
Lentil	CGR	5.06***	7.96***	2.75*	-	-	-	11.03***	8.35***	-2.44*
	CV	16.63	24.15	12.61				37.26	25.52	12.44
Arhar	CGR	-4.75**	-7.88***	-3.28**	-5.61*	-6.57*	-1.03	-1.77*	-4.47**	-2.75**
	CV	20.26	25.11	13.34	28.02	44.22	24.76	7.77	16.73	12.13
Kulthi	CGR	-	-	-	-2.95***	2.04	5.31*	-	-	-
	CV				9.62	20.79	23.40			
Moong moth	CGR	-	-	-	-	-	-	-8.27***	-9.26***	-1.09*
	CV							23.79	25.94	7.16
Pea	CGR	-	-	-	-	-	-	-2.19***	-5.50**	-3.41*
	CV							7.35	20.25	15.98
Total pulses	CGR	4.56**	6.07	1.44	6.99**	13.23**	5.84*	0.37**	0.44	0.08
	CV	15.32	27.75	17.68	23.77	40.05	24.43	1.45	11.57	11.26

Note : *** Significant at 1% level
** Significant at 5% level
* Significant at 10% level

selected districts, whereas, arhar registered negative growth rates in area, production and yield in all the three districts(Table 3.12).

Coefficient of variation (C.V.) is the important tool for the stability analysis. It can be seen from table 3.12 that coefficient of variation of area, production and yield of total pulses in Narsinghpur district is lower as compared to Durg and Jhabua districts. It shows that Narsinghpur district is more stable than other two districts.

The growth rates of area and production of gram in all the three districts are positive. The growth rates of yield were positive and significant in Jhabua but non significant in Durg and Narsinghpur. The C.V. of area (4.83 per cent) and production (13.52 per cent) of gram in Durg district is lowest followed by Narsinghpur and Jhabua district.

In the case of urad (Durg & Jhabua districts) and teora (only Durg district) very high fluctuations were observed in area, production & yield during the ten years period.

In the case of lentil in Durg and Narsinghpur districts, the yield was more stable than area and production.

The growth rates of area, production & yield of arhar in all the three districts are negative. On the other hand, the amplitude of fluctuations in area, production and yield of arhar in Narsinghpur district is lower than the other two districts. It means area, production and yield of arhar in Narsinghpur district is more stable.

In the case of kulthi, area was more stable than production & yield in Jhabua district.

In the case of moong-moth, yield was more stable than area and production, whereas, in pea the area was more stable than yield and production in Narsinghpur district.

Another important aspect is that compound growth rate of total pulses for area is highly significant for all the three districts showing that farmer's preference for the pulses. But the growth rates for production and yield in Durg and Narsinghpur districts are non-significant which show the ample scope to increase the yield of pulses in these two districts(Table 3.12).

3.8 Contribution of area and yield in production

An analysis of growth and trend in area, production and yield of pulses has indicated the general pattern of growth and the direction of change in production for a given pattern of changes in area and yield. But this does not evaluate the exact contribution of area and yield to production. Therefore, an attempt was made to determine the extent of the relative contribution of area and yield and their interaction which are responsible for the increased/decreased value of production between two trienniums.

3.8.1 Durg District

In Durg district, teora registered highest increase in production (44.0 thousand tonnes) followed by gram (6.20 thousand tonnes) and lentil (0.70 thousand tonnes) between two trienniums. Arhar and urad registered decrease in production between two trienniums. In the case of teora, area (59 per cent) was the main factor responsible for increase in production followed by yield (24 per cent) and interaction effect (17 per cent).

The increase in the production of gram was mainly due to the increase in yield (62 per cent) between two trienniums. The contribution of area was 34 per cent. Area was the main factor responsible for the decrease in production of arhar and urad. In total pulses 47.0 thousand tonnes increase in the production was observed. The main factor responsible for this increase was area (68 per cent) followed by yield (23 per cent) and interaction effect (9.00 per cent). (Table 3.9)

3.8.2 Jhabua district

In Jhabua district, highest increase in production (39.4 thousand tonnes) was observed in the case of total pulses between two trienniums. The main contributor was area (50 per cent) followed by yield (32 per cent) and interaction effect (18 per cent). Among pulses highest increase in production was observed in gram (26.4 thousand tonnes) followed by Urad and Kulthi. Arhar registered decrease in production by 2.0 thousand tonnes between two trienniums. In this district, the contribution of area was more in all the pulse crops except kulthi, where the increase in production (1.0 thousand tonnes) was mainly due to increase in yield by 260 per cent. The contribution of other two factors (area and interaction) was negative.

3.8.3 Narsinghpur district

Gram was the major pulse crop of the district and registered highest increase in production (26.0 thousand tonnes) between two trienniums followed by total pulses (11.5 thousand tonnes) and lentil (2.3 thousand tonnes). Other pulse crops (arhar, pea and moong-moth) registered decrease in the production. In the case of gram, yield (51 per cent) was the main contributor followed by area (43 per cent) and interaction (6 per cent). In the case of lentil, the contribution of area was 129 per cent. The contribution of other two factors was negative. The contribution of yield (65 per cent) was highest in the case of total pulses, whereas, area contributed only 33 per cent.

Overall picture shows that in the case of Durg and Jhabua districts, change in production of pulse crops was mainly due to area effect, (except gram in Durg district and kulthi in Jhabua district) whereas, in the case of Narsinghpur district contribution of yield was more in most of the pulses. (Table 3.13)

3.9 Technology Mission on Pulses Development Programme in Selected Districts

Information was made available by the offices of the Deputy Directors of Agriculture, Durg, Jhabua and Narsinghpur on the physical & financial targets of the components of the National Pulses Development Project (NPDP) for the five years (1992-93 to 1996-97).

3.9.1 Physical Targets and Achievements of National Pulse Development Programmes

The component wise total physical targets and achievements of National Pulses Development project in five years (1992-93 to 1996-97) shows that in Durg district the percentage of achievements to target was highest in the case of PSB culture (9,159.66 per cent) followed by farm implements, storage bins, rhizobium culture, plant protection implements and distribution of certified seeds. In the case of other components, the achievement was less than the target or in other words the percentage of achievements to target was less than 100. It was lowest in block demonstrations (23.54 per cent).

Table 3.13 Relative contribution of Area & Yield towards change in production of pulses between two trienniums

(TE 1988-89 and TE 1995-96)

Pulse Crops	Durg				Jhabua				Narsinghpur			
	Change in production over base trienniums ('000 tonnes)	Relative share(%)			Change in production over base trienniums ('000 tonnes)	Relative share(%)			Change in production over base trienniums ('000 tonnes)	Relative share(%)		
		Area	Yield	Inter-action		Area	Yield	Inter-action		Area	Yield	Inter-action
Gram	6.2	34	62	4	26.4	79	7	14	26.0	43	51	6
Urad	- 0.30	343	-425	182	14.4	49	31	20	-	-	-	-
Teora(lakh)	44.0	59	24	17	-	-	-	-	-	-	-	-
Lentil (Masoor)	0.70	61	27	12	-	-	-	--	2.3	129	-14	-15
Arhar (Tur)	- 3.6	67	46	- 13	- 2.0	84	24	- 8	- 9.2	41	67	- 8
Kulthi	-	-	-	-	1.0	-115	260	-45	-	-	-	-
Moong.moth	-	-	-	-	-	-	-	-	- 1.6	92	14	- 6
Pea	-	-	-	-	-	-	-	-	—2.2	59	48	- 7
Total pulses	47.0	68	23	9	39.4	50	32	18	11.5	33	65	2

In Jhabua district, the percentage of achievement was highest (418.66 per cent) to target in the case of PSB culture followed by micro-nutrients (365.00 per cent), farm implements (231.05 per cent), distribution of certified seeds (150.11 per cent), sprinkler sets (118.57 per cent) & rhizobium culture (105.99 per cent). In the case of training, achievement was equal to the target (100 per cent). In other components the percentage was less than 100. It was lowest in the case of plant protection implements (11.54 per cent).

In Narsinghpur district the percentage of achievement to the target was maximum (497.83 per cent) in the case of farm implements followed by PSB culture (318.84 per cent), distribution of certified seeds (212.31 per cent), Rhizobium culture (139.09 per cent) and distribution of seed minikits (101.56 per cent).

In the case of IPM demonstrations it was 100 per cent. In the case of plant protection implements (95.25 per cent), sprinkler sets (90.79 per cent), pheromone traps (81.25 per cent), the achievement was lower than target. It was lowest in the case of foundation seeds (11.16 per cent) (Table 3.14).

3.9.2 Financial Achievements of National Pulses Development Project

In Durg district the financial achievement of National Pulses Development Project (NPDP) during five years shows that the percentage of allocation to the allotment received was 85.52 per cent. This percentage was highest in the year 1996-97 (99.92 per cent) and lowest (68.91 per cent) in the year 1994-95.

In Jhabua district, the total allocation to the total allotment in five years was 91.23 per cent. This was highest in the year 1995-96 (101.61 per cent) and lowest (64.96 per cent) in 1994-95.

In Narsinghpur district the percentage of total allocation to total allotment was 83.83 per cent. It was highest (99.07 per cent) in 1995-96 and lowest in 1992-93 (48.11 per cent)(Table 3.15).

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Table 3.14 Componentwise physical targets and achievements of National Pulses Development Project (NPDP) in five years (1992-93 to 1996-97)

S. No.	Components	Units	Durg			Jhabua			Narsinghpur		
			Total (1992-93 to 1996-97)			Total (1992-93 to 1996-97)			Total (1992-93 to 1996-97)		
			Target	Achieve-ment	% of achieve-ment to target	Target	Achieve-ment	% of achieve-ment to target	Target	Achieve-ment	% of achieve-ment to target
1.	Seed Minikits	No.	5477	4220	77.05	4416	4340	98.28	8086	8212	101.56
2.	Research Minikits	Hect.	-	-	-	-	-	-	2305	1879	81.52
3.	Block Demonstration	Hect.	960	226	23.54	1036	735	70.94	1968	891	45.27
4.	Trainings	No.	-	-	-	5	5	100.00	-	-	-
5.	Seed villages	Qtls	1245	-	-	918	-	-	1826	-	-
6.	Foundation seed	Qtls	789	-	-	592	-	-	673	75.10	11.16
7.	Certified Seed	Qtls	2045	2751.04	134.52	1802	2705	150.11	2536	5384.11	212.31
8.	Plant Protection Implements	No.	210	549	261.43	52	6	11.54	442	421	95.25
9.	Plant Protection Management	Hect.	406	-	-	150	54	36.00	3178	756.10	23.79
10.	Farm Implements	No.	444	3154	710.36	483	1116	231.05	600	2987	497.83
11.	Sprinkler sets	No.	52	34	65.38	70	83	118.57	76	69	90.79
12.	Pheromone traps	No.	74	25	33.78	73	32	43.83	64	52	81.25
13.	IPM Demonstrations	Hect.	120	-	-	59	20	33.89	74	74	100.00
14.	Dal Processors	No.	15	-	-	15	-	-	17	-	-
15.	Storage bins	No.	50	154	308.00	-	-	-	-	-	-
16.	Rhyzobium cultures	No.	16700	47589	284.96	58340	61838	105.99	47850	66554	139.09
17.	PSB cultures	No.	300	27479	9159.66	6000	25120	418.66	10000	31884	318.84
18.	Micro-nutrients	No.	150	-	-	40	146	365.00	-	-	-
19.	Retail Outlets	No.	2	-	-	2	-	-	-	-	-

Table 3.15 National Pulses Development Project (NPDP)
Financial achievements during (1992-93 to 1996-97) five years

(Units in Rs.)

Years	Durg			Jhabua			Narsinghpur		
	Allotment received	Final allocation	% of allocation to allotment	Allotment received	Final allocation	% of allocation to allotment	Allotment received	Final allocation	% of allocation to allotment
1992-93	3,50,000	3,42,765	97.93	-	-	-	3,65,000	1,75,592	48.11
1993-94	7,39,000	7,03,408	95.18	16,99,000	16,75,121	98.59	18,10,300	14,95,377	82.60
1994-95	10,61,000	7,31,108	68.91	12,89,000	8,37,389	64.96	16,79,000	16,08,752	95.82
1995-96	8,00,000	5,88,751	73.59	11,59,000	11,77,655	101.61	8,61,000	8,53,006	99.07
1996-97	10,88,000	10,87,152	99.92	13,45,000	13,20,289	98.16	13,59,977	9,60,118	70.60
Total	40,38,000	34,53,184	85.52	54,92,000	50,10,454	91.23	60,75,277	50,92,845	83.83

CHAPTER IV

RESULTS AND DISCUSSION

4.1 Introductory

This chapter is based on the findings of the field investigation carried out for sample farms. As mentioned earlier schedules specifically developed for the study were canvassed and information collected and tabulated. It may be mentioned that the three districts selected belonged to three agro-climatic zones of the state well apart from each other. These were located in different agro-climatic settings and were different in respect of soil types, size of holdings, crops grown, irrigation intensity and sources, socio-economic background, etc. It was therefore, thought fit to present the results of field investigation individually for each of the selected districts.

The outline for the analysis of data collected from sample household was similar for the three selected districts. The items studied included workforce, operated holdings, irrigation status and sources, crops grown, details of pulse crops grown, input output analysis, disposal of produce, farmers' knowledge and opinion, etc.

4.2 Durg District

The description for Durg district follows

4.2.1 Workers

The number of workers per family was 3.80. The number generally decreased with the size of farms. It ranged between 2.50 on large size group and 4.21 on small size group (Table 4.1).

Table 4.1 Details of family members, Durg district, M.P.

Size group	Total No. of members	No. of families	No. per family	No. of workers	Workers per family
Marginal	71	12	5.92	42	3.50
Small	106	14	7.57	59	4.21
Semi-medium	94	12	7.83	47	3.92
Medium	68	10	6.80	37	3.70
Large	19	2	9.50	5	2.50
Total	358	50	7.16	190	3.80

4.2.2 Operated Area

The operated area per holding was 2.64 hectares. The system of leasing out area was uncommon on the selected farms as only 1.12 per cent of the area owned was leased out. No farm had leased in land. The distribution of land among different size groups was quite skewed as although marginal and small farms were higher in number (52.00 per cent) the area under control of these farms was quite low (18.34 per cent). On the other hand 24 per cent of farms belonging to medium and large categories commanded as high as 58.17 per cent of the area (Table 4.2).

Table 4.2 Operated area, selected farms, Durg district, M.P.

(Hectares)

Size group	Owned cultivated land	Leased out land	Leased in land	Operated area	No.of holdings	Percentage to total
Marginal	5.66	-	-	5.66 (4.30)	12	24.00
Small	18.50	-	-	18.50 (14.04)	14	28.00
Semi-medium	31.76	0.81	-	30.95 (23.49)	12	24.00
Medium	55.20	-	-	55.20 (41.89)	10	20.00
Large	22.26	0.81	-	21.45 (16.28)	2	4.00
Total	133.38	1.62	-	131.76 (100.00)	50	100.00
Average per holding	2.67	0.03	-	2.64	-	-

Note - figures in brackets- percentages to total

4.2.3 Irrigated Area and Sources of Irrigation

It was noted that the percentage of irrigated area increased with the size of holdings. While the percentage of irrigated area was only 3.53 on the marginal size group it increased with the size of holdings and was 32.07 on the large size group. Of the different irrigation sources, wells commanded largest percentage (66.64) followed by canals (27.98).

It was noted that large farms had higher percentage of area commanded by assured sources like wells than the small farms. (Table 4.3)

Table 4.3 Irrigation by sources, Durg district, M.P.

(Area - Hectares)

Size group	Un-irriga-ted	Irrigated					Operated land
		Wells	Tanks	Canals	Others (Nallah)	Total	
Marginal	5.46 (96.47)	-	-	0.20 (100.00)	-	0.20 (100.00)	
Small	15.33 (82.86)	1.31 (41.33)	-	1.05 (33.12)	0.81 (25.55)	3.17 (100.00)	
Semi-medium	25.30 (81.74)	3.63 (64.25)	-	2.02 (33.75)	-	5.65 (100.00)	
Medium	42.08 (76.23)	7.46 (56.86)	0.81 (6.17)	4.85 (36.97)	-	13.12 (100.00)	55.20
Large	14.57 (67.93)	6.88 (100.00)	-	-	-	6.88 (100.00)	21.45
Total	102.74 (77.98)	19.28 (66.64)	0.81 (2.79)	8.12 (27.98)	0.81 (2.79)	29.02 (100.00)	131.76

Note - Figures in brackets denote percentages to operated area

4.2.4 Cropping Pattern 1995-96 and 1996-97

Rice was the most important crop occupying 47.20 per cent of the cropped area in 1995-96. Teora was the second important crop and occupied one fourth (25.13 per cent) of the cropped area. The third important crop was gram and occupied 14.21 per cent of the cropped area. The percentage of area under rice was highest on medium size farms and lowest on semi medium farms. However, the proportion had no relationship with the size. The percentage of area under gram was higher on larger farms, whereas, the percentage under teora was lower on larger farms.

In 1996-97 the proportions of area under different crops were similar to that in 1995-96. Moreover, the relationship between the proportionsof area under three main crops of rice, teora and gram and the size of holdings was similar as was in 1995-96. It was noted that the proportionsof area under rice and gram declined marginally and that under soybean and wheat increased marginally (Table 4.4).

Table 4.4 Cropping Pattern- Durg District, M.P.

(Figures-Percentage of gross cropped area)

Crops	1995-96						1996-97					
	Marginal	Small	Semi Medium	Medium	Large	Total	Marginal	Small	Semi Medium	Medium	Large	Total
Kharif												
Rice	47.65	48.76	36.63	54.73	41.12	47.20	47.98	50.13	37.63	51.44	38.56	45.80
Kodo	--	--	1.22	--	--	0.25	--	--	0.94	--	--	0.21
Urad	--	--	--	0.63	1.39	0.51	--	--	--	1.07	2.42	0.83
Soybean	--	--	4.88	2.84	5.83	3.22	--	--	5.70	4.27	8.43	4.37
Vegetable	1.18	1.86	0.49	2.02	--	1.27	1.15	1.81	0.47	2.14	--	1.30
Kodo+Arhar	5.38	--	--	--	0.83	0.41	5.77	--	--	--	1.19	0.46
Soybean+Arhar	--	--	5.49	--	--	1.14	--	--	5.75	--	--	1.26
Rabi												
Wheat	--	1.24	2.44	1.01	8.75	2.71	--	1.19	2.36	1.05	9.65	2.80
Gram	4.12	2.32	23.21	16.08	12.92	14.21	4.62	2.38	22.50	16.37	10.65	13.82
Teora	41.17	43.34	20.76	17.34	27.08	25.13	40.48	42.06	19.91	18.08	26.50	25.10
Lentil	--	0.62	--	0.50	2.08	0.68	--	0.62	--	0.53	2.41	0.73
Linseed	--	--	4.88	2.33	--	1.95	--	--	4.74	2.40	--	1.98
Urad+Teora	--	1.86	-	2.52	--	1.32	--	1.81	--	2.65	--	1.34
Gross Cropped Area (Hect.)	8.50	32.30	40.95	79.30	36.00	197.05	8.67	33.65	42.63	75.86	33.58	194.39
Percentage(%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

4.2.5 Pulse Crops Grown

Of the total area under pulses as high as 93.39 per cent area was under single crop and only 6.61 per cent area was under mixed crops. The percentage did not change much in 1996-97 and was 92.95 and 7.05 respectively. It was noted that larger area (65.38 per cent) was sown broadcaste and 34.62 per cent area was line sown. The proportion remained almost same (66.06 and 33.94 per cent respectively) in 1996-97. One of the reasons for low yields of pulses is advanced as "pulses are grown on unirrigated lands". This proved to be true on sample farms. In 1995-96 nearly entire area under pulses (99.06 per cent) was unirrigated. The situation remained same in 1996-97 with 98.94 per cent area unirrigated (Table 4.5).

4.2.6 Inputs Used

The input cost per hectare (cost A2) for different pulses was calculated for selected farms. Input cost was calculated separately for irrigated and unirrigated areas. Since the cost of production of pulses varied due to adoption/non adoption of a particular operation the cost has been described by operations and not by inputs such as human labour, bullock labour, etc.

In Durg district only gram was partly irrigated. Other pulses (arhar, teora, urad and lentil) were grown unirrigated. The cost per hectare of irrigated gram was Rs.6,915.97 and that of unirrigated gram, Rs.6,458.60. The most important item of cost was seed and seed treatment and accounted for 35.74 per cent. The second important item was fertilisers and formed 15.54 per cent of the total cost. The third item of importance was plant protection and occupied 15.05 per cent. Harvesting, threshing, etc. (9.80 per cent) and preparatory tillage (8.52 per cent) were other important items. While seed and seed treatment, fertilisers, harvesting, threshing and preparatory tillage formed higher percentage on unirrigated farms, plant protection and depreciation formed higher percentage on irrigated farms. In the caseof arhar the sequence of importance of inputs was seed and seed treatment, fertilisers, sowing and weeding, preparatory tillage and harvesting. In the cases of teora, urad and lentil the item seed and seed treatment remained

Table 4.5 Pulse crops grown on the sample farms, Durg district, Madhya Pradesh

(Area in Hectares)

Pulse crops/ varieties	1995-96									1995-97								
	Area Sown as			Area Sown		Land Type			Total area under pulses	Area Sown as			Area Sown		Land Type			Total area under pulses
	Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irrigated	Rich Land Unirrigated		Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irrigated	Rich Land Unirrigated	
Kharif																		
Urad	1.00	--	--	1.00	--	--	--	1.00	1.00	1.62	--	--	1.62	--	--	--	1.62	1.62
Kodo+Arhar	--	0.80	--	0.80	--	0.80	--	--	0.80	--	0.90	-	0.90	--	0.90	--	--	0.90
Soybean+Arhar	--	2.25	--	--	2.25	--	--	2.25	2.25	--	2.45	--	--	2.45	--	--	2.45	2.45
Rabi																		
Lentil	1.35	--	--	--	1.35	--	--	1.35	1.35	1.42	--	--	--	1.42	--	--	1.42	1.42
Teora	49.50	-	--	49.50	--	--	--	49.50	49.50	48.77	--	--	48.77	--	--	--	48.77	48.77
Teora+Urad	--	2.60	--	2.60	--	--	--	2.60	2.60	--	2.62	--	2.62	--	--	--	2.62	2.62
Gram Desi	1.50	--	--	--	1.50	--	--	1.50	1.50	1.90	--	--	--	1.90	--	--	1.90	1.90
Gram Gulabi	1.00	--	--	--	1.00	--	--	1.00	1.00	1.21	--	--	--	1.21	--	--	1.21	1.21
Gram Ujjain 21	7.50	--	--	--	7.50	--	--	7.50	7.50	8.70	--	--	--	8.70	--	--	8.70	8.70
Gram JG 74	18.00	--	--	2.00	16.00	--	--	18.00	18.00	15.04	--	--	2.00	13.04	--	--	15.04	15.04
Summer	-	--	--	--	--	--	--	--	--	--	--	--	--	--	-	--	--	--
Total	79.85	5.65	--	55.90	29.60	0.80	--	84.70	85.50	78.66	5.97	--	55.91	28.72	0.90	--	83.73	84.63
Percentage(%)	(93.39)	(6.61)	—	(65.38)	(34.62)	(0.94)	--	(99.06)	(100.00)	(92.95)	(7.05)	--	(66.06)	(33.94)	(1.06)	--	(98.94)	(100.00)

most important with still higher percentage of total cost. The second important item was harvesting etc. in the case of teora, preparatory tillage in the case of urad and fertilisers in the case of lentil. While the third important item in the case of teora was depreciation it was harvesting etc. in the cases of urad, and lentil. (Table 4.6).

4.2.7 Input-Output Analysis

Of the crops studied input and output values per hectare were highest Rs.15,662.00 and Rs.42,292.00 respectively for vegetables. The value of net profit per hectare came to Rs.26,630.00, highest among all the crops. The input-output ratio was highest (2.70) for vegetables.

The input value per hectare was lowest (Rs.3,179) for teora.. The lowest output value per hectare was also for teora (Rs.2,554.00). The net profit per hectare was lowest (Rs.137.00) for kodo. The input-output ratio was lowest (0.77) for linseed.

Thus it was observed that value of input, output and profit per hectare and input-output ratio was highest for vegetables. The input and output values per hectare were lowest for teora. However the lowest profit per hectare was for kodo and the input-output ratio was lowest for linseed.

From the farmers' point of view profit per hectare and input-output ratio are the most important criteria of profitability. Vegetables, rice (irrigated) and soybean (irrigated) were the three crops with highest profitability per hectare. Among pulses lentil earned highest profit per hectare of Rs.6,571. Gram (irrigated) and arhar were next important pulses on the ladder of profit per hectare. Incidentally irrigated wheat earned lower profit per hectare than unirrigated gram. Urad came next and earned a profit of Rs.573 per hectare. Teora incurred a loss of Rs. 625 per hectare.

Table 4.6 Details of Inputs usedper Hectare, Durg District, Madhya Pradesh.

(Figures- percentages)

Operations	Gram			Arhar			Teora			Urad			Lentil		
	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total
-Preparatory Tillage	6.00	9.18	8.52	--	9.75	9.75	--	2.87	2.87	--	13.88	13.88	--	8.83	8.83
-Seed+Seed Treatment	34.69	36.04	35.74	--	31.45	31.45	--	54.00	54.00	--	39.52	39.52	--	47.53	47.53
-Sowing + Weeding	2.12	2.69	2.59	--	13.10	13.10	--	1.01	1.01	--	10.34	10.34	-	-	-
-Manure	-	-	-	--	4.72	4.72	--	-	-	--	3.87	3.87	-	-	-
-Fertilisers	13.47	16.81	15.54	--	15.68	15.68	--	0.32	0.32	--	8.09	8.09	-	15.62	15.62
-Labour used for Fertiliser application	0.43	0.88	0.79	--	-	-	--	1.38	1.38	--	-	-	-	-	-
-Plant Protection	23.14	12.20	15.05	--	4.72	4.72	--	2.46	2.46	--	-	-	-	3.31	3.31
-Irrigation Expenses	0.79	-	0.85	--	-	-	--	-	-	--	-	-	-	-	-
-Labour used in irrigation	-	-	-	--	-	--	--	-	-	--	-	-	-	-	-
-Harvesting, Threshing, Winnowing & Transportation	6.29	10.76	9.80	--	7.86	7.86	--	25.03	25.03	--	11.00	11.00	-	13.88	13.88
-Land revenue & Other taxes	-	-	-	-	-	-	--	-	-	--	-	-	-	--	-
-Interest on working capital	5.10	5.26	5.29	--	5.22	5.22	--	5.31	5.31	--	5.13	5.13	-	5.35	5.35
-Depreciation on implements, machinery, farm building	7.97	6.16	5.83	--	7.50	7.50	--	7.62	7.62	--	8.17	8.17	-	5.48	5.48
-Rent paid for leased in land	-	-	-	--	-	--	--	-	-	--	-	-	--	-	--
-Percentage	100.00	100.00	100.00	--	100.00	100.00	--	100.00	100.00	--	100.00	100.00	--	100.00	100.00
*Cost per hectare(Rs.)	6915.97	6458.60	6558.95	--	3500.00	3500.00	--	3178.75	3178.75	--	3540.92	3540.92	--	4734.75	4734.75

It will thus be seen that except lentil and irrigated gram none of the pulses could compete with the other non-pulses crops (specially irrigated ones) on the criterion of profit per hectare. (Table 4.7)

Table 4.7 Value of Output, Input, Net Profit and input output ratio, Durg District, (M.P.)

(Figures- Rupees per hectare)

Crop	Input	Output	Net Profit	Input output ratio
Rice				
Irrigated	7,297.00	16,540.00	9,243.00	2.27
Unirrigated	6,458.00	9.877.00	3,418.00	1.53
Kodo (Unirrigated)	3,474.00	3,611.00	137.00	1.04
Urad (Unirrigated)	3,541.00	4,114.00	573.00	1.16
Arhar(Unirrigated)	3,500.00	5,425.00	1,925.00	1.55
Vegetables				
Irrigated	15,662.00	42,292.00	26,630.00	2.70
Wheat				
Irrigated	6,683.00	7,704.00	1,021.00	1.15
Unirrigated	4,295.00	3,393.00	(-) 902.00	0.79
Gram				
Irrigated	6,916.00	10,077.00	3,161.00	1.46
Unirrigated	6,458.00	7,603.00	1,145.00	1.18
Teora(Unirrigated)	3,179.00	2,554.00	(-) 625.00	0.80
Lentil(Unirrigated)	4,735.00	11,306.00	6,571.00	2.39
Soybean				
Irrigated	6,741.00	13,909.00	7,168.00	2.06
Unirrigated	9,140.00	11,159.00	2,019.00	1.22
Linseed (Unirrigated)	4,682.00	3,602.00	(-) 1,080.00	0.77

4.2.8 Disposal of Produce

The pattern of disposal varied with the crop and size of holdings.

In the case of rice 63.35 per cent of the produce was sold and 31.12 per cent was consumed. The remaining 5.53 per cent was

stored for seed. Since the total production increased with the size and since consumption per capita did not vary with the size of farms the proportion of produce used for consumption decreased with the increase in the size of farms from 71.30 per cent in marginal size group to 10.56 per cent in large size group. On the other hand the proportion of produce sold increased from 20.99 per cent in the marginal size group to 83.36 per cent in the large size group with the increase in the size of farms. The percentage of produce retained for seed did not vary with the size of farms.

In the case of kodo the percentage of quantity consumed was 81.36. Another 10.03 per cent of the quantity was sold and the remaining 8.61 per cent quantity was kept for seed. The percentage of quantity consumed was highest (95.00) on marginal farm size and decreased to 55.00 on semi medium size group. However the percentage increased to 87.50 on the large size group. The percentage of quantity retained for seed increased from 5.00 in the marginal size group to 10.00 in the semi medium size group and further to 12.50 in the large size group.

In the case of wheat, another staple food crop, trends were noticed similar to kodo. The largest percentage of produce (57.50) was used for consumption. Another 29.08 per cent was sold and the remaining 12.52 per cent was stored for seed. On smaller farms larger percentage of produce was used for consumption, whereas, larger percentage was sold on larger farms.

As pulses were produced mainly for market largest proportion viz. urad (79.52), arhar (54.12), gram (73.63), lentil (66.45) was marketed. The second important item of disposal was consumption in the cases of urad (10.24) and arhar (34.22). It was seed in the cases of gram (17.22) and lentil (20.39).

In the cases of urad and gram the percentage of quantity marketed increased with the size of holdings. In the case of arhar and lentil there was no such relationship.

Teora is a staple pulse in Durg district. Therefore, the percentage of total production on consumption was largest (49.83). This was followed by proportion of quantity sold (33.33) and quantity

retained for seed (16.84). The percentage of quantity consumed was higher on smaller farms, whereas, the percentage of quantity sold was higher on larger farms.

Vegetables were produced for sale and therefore 98.62 per cent of the total production was sold and the remaining 1.38 per cent was consumed.

Soybean and linseed were produced mainly for sale. While in the case of soybean the percentage of produce marketed was 87.61 and that kept for seed was 12.39, in the case of linseed the percentage of produce sold was 75.77 and that kept for seed was 13.08. Being a staple oilseed 11.15 per cent of the produce of linseed was used for consumption which was nil in the case of soybean (Table 4.8).

4.2.9 Farmers' Knowledge and Opinion

When asked to enumerate the factors which affect the growth of pulse area the farmers enumerated following factors.

1. Pulses werecash crops and fetched good prices
2. There was a lot of propaganda for growing pulses.
3. The pulses require lower inputs and the produce fetched higher price.
4. Arhar could be grown on bunds.
5. Pulses increasedthe productivity of soil.
6. Pulses could be grown without irrigation or with limited irrigation.

The reasons enumerated for increase in production were-

1. New techniques were developed
2. New varieties were being grown
3. Farmers had started using, fertilisers, culture, pesticides etc. for pulses.

About 60 per cent of the selected farmers grew new varieties of pulses. The reasons given for not using new varieties included; small holding size, land of poor quality, there were no high yielding varieties of teora. Majority of farmers were not adopting recommended practices of pulse cultivation. The main reason for this was lack of funds. To the question whether good quality land was used for growing

Table 4.8 Disposal of produce, sample farms, Durg district, M.P.

(Qt/hectare)

Crops	Disposal	Farm Size					
		Marginal	Small	Semi-medium	Medium	Large	All
Rice	Seed	1.66 (7.71)	1.51 (5.77)	1.76 (7.50)	1.18 (4.39)	1.78 (6.08)	1.45 (5.53)
	Consumption	15.35 (71.30)	13.07 (49.94)	9.10 (38.77)	6.56 (24.43)	3.09 (10.56)	8.16 (31.12)
	Sold	4.52 (20.99)	11.59 (44.29)	12.61 (53.73)	19.12 (71.18)	24.40 (83.36)	16.61 (63.35)
	Total production	21.53 (100)	26.17 (100)	23.47 (100)	26.86 (100)	29.27 (100)	26.22 (100)
Kodo	Seed	0.60 (5.00)	-	0.50 (10.00)	-	1.00 (12.50)	0.67 (8.61)
	Consumption	11.40 (95.00)	-	2.75 (55.00)	-	7.00 (87.50)	6.33 (81.36)
	Sold	-	-	1.75 (35.00)	-	-	0.78 (10.03)
	Total production	12.00 (100)	-	5.00 (100)	-	8.00 (100)	7.78 (100)
Urad	Seed	-	-	-	0.55 (10.35)	0.37 (10.00)	0.50 (10.24)
	Consumption	-	-	-	0.58 (10.92)	0.31 (8.38)	0.50 (10.24)
	Sold	-	-	-	4.18 (78.73)	3.02 (81.62)	3.88 (79.52)
	Total production	-	-	-	5.31 (100)	3.70 (100)	4.88 (100)
Arhar	Seed	2.00 (33.33)	-	0.54 (6.90)	-	2.80 (14.00)	1.09 (11.66)
	Consumption	1.80 (30.00)	-	2.50 (31.93)	-	8.00 (40.00)	3.20 (34.22)
	Sold	2.20 (36.67)	-	4.79 (61.17)	-	9.20 (46.00)	5.06 (54.12)
	Total production	6.00 (100)	-	7.83 (100)	-	20.00 (100)	9.35 (100)
Vegetable	Seed	-	-	-	-	-	-
	Consumption	5.00 (5.00)	1.64 (2.50)	5.00 (5.00)	1.23 (0.87)	-	1.58 (1.38)
	Sold	95.00 (95.00)	63.93 (97.50)	95.00 (95.00)	140.74 (99.13)	-	113.04 (98.62)
	Total production	100.00 (100)	65.57 (100)	100.00 (100)	141.97 (100)	-	114.62 (100)
Wheat	Seed	-	1.00 (10.00)	1.63 (11.76)	1.25 (16.67)	1.54 (12.48)	1.47 (12.52)
	Consumption	-	9.00 (90.00)	11.09 (80.02)	2.50 (33.33)	6.17 (50.00)	6.75 (57.50)
	Sold	-	-	1.14 (8.22)	3.75 (50.00)	4.63 (37.52)	3.52 (29.98)
	Total production	-	10.00 (100)	13.86 (100)	7.50 (100)	12.34 (100)	11.74 (100)

Continued....

Continued....

Table 4.8 Disposal of produce, sample farms, Durg district, M.P.

(Qt/hectare)

Crops	Disposal	Farm Size					
		Marginal	Small	Semi-medium	Medium	Large	All
Gram	Seed	1.25 (25.00)	1.26 (16.80)	1.41 (19.61)	0.98 (14.62)	0.82 (18.68)	1.13 (17.22)
	Consumption	1.25 (25.00)	0.62 (8.27)	0.62 (8.62)	0.58 (8.66)	0.55 (12.53)	0.60 (9.15)
	Sold	2.50 (50.00)	5.62 (74.93)	5.16 (71.77)	5.14 (76.72)	3.02 (68.79)	4.83 (73.63)
	Total production	5.00 (100)	7.50 (100)	7.19 (100)	6.70 (100)	4.39 (100)	6.56 (100)
Teora	Seed	0.51 (21.61)	0.44 (20.28)	0.38 22.22	0.51 (12.91)	0.67 (16.10)	0.50 (16.84)
	Consumption	1.37 (58.05)	1.14 (52.53)	1.21 (70.76)	1.83 (46.33)	1.80 (43.27)	1.48 (49.83)
	Sold	0.48 (20.34)	0.59 (27.19)	0.12 (7.02)	1.61 (40.76)	1.69 (40.63)	0.99 (33.33)
	Total production	2.36 (100)	2.17 (100)	1.71 (100)	3.95 (100)	4.16 (100)	2.97 (100)
Lentil	Seed	-	2.38 (16.67)	-	0.62 (12.40)	1.85 (24.97)	1.58 (20.39)
	Consumption	-	0.95 (6.65)	-	1.88 (37.60)	0.62 (8.37)	1.02 (13.16)
	Sold	-	10.95 (76.68)	-	2.50 (50.00)	4.94 (66.66)	5.15 (66.45)
	Total production	-	14.28 (100)	-	5.00 (100)	7.41 (100)	7.75 (100)
Soybean	Seed	-	-	2.03 (12.88)	1.23 (10.77)	1.77 (13.18	1.69 (12.39)
	Consumption	-	-	-	-	-	-
	Sold	-	-	13.73 (87.12)	10.19 (82.23)	11.66 (86.82)	11.95 (87.61)
	Total production	-	-	15.76 (100)	11.42 (100)	13.43 (100)	13.64 (100)
Linseed	Seed	-	-	0.25 (12.63)	0.44 (13.33)	-	0.34 (13.08)
	Consumption	-	-	0.25 (12.63)	0.33 (10.00)	-	0.29 (11.15)
	Sold	-	-	1.48 (74.74)	2.53 (76.67)	-	1.97 (75.77)
	Total production	-	-	1.98 (100)	3.30 (100)	-	2.60 (100)

Note : Figures in bracket represent percentage to total production

pulses the answer was in the negative in large majority of cases. It was told that in some cases good land was used for gram and arhar and light soils were used for moong and urad. The best soil was used for rice. About the replacement of crops due to pulses some of the farmers said that the land earlier used for kodo was now utilised for pulses and soybean. About the steps that should be taken to increase the area under pulses the suggestions offered were :

1. New and high yielding varieties should be evolved.
2. Seed should be available on subsidised rates.
3. Suitable variety of gram should be evolved to be taken after rice.
4. Early maturing rice varieties should be evolved so that some pulses can be grown after rice.
5. Effective insect and pest control measures should be taught.
6. The productivity of pulses could be increased by using H.Y.V. seed, higher and correct dosage of fertilisers, pesticides and culture.

4.2.10 Opinions of District Agricultural Officers & AERC Officers

1. Of late there had been an increase in the area under pulses in some areas. The reasons were :
   a) There were schemes popularising pulses and propoganda made thereof.
   b) Pulses had ready market.
   c) The cost of production per hectare was lower than that of rice.
   d) Pulses increased the productivity of soil by fixing nitrogen.
   e) In some areas new varieties seed were used and new techniques were used.
2. The reasons for not growing pulses were also many. some of these were
   a) In gram, variety JG 74-315 was grown. However farmers needed still new varieties.

b) Of late the gram variety was found to be susceptible to fusarium wilt.

c) There was still demand for late sown variety of gram.

d) In urad T-9 variety was grown. However, it was found to be susceptible to mosaic.

e) There was strong demand for H.Y.Variety of lentil.

f) In arhar wilt was affecting the crop since last some years.

g) In teora, the most important pulse crop of Chhattisgarh local varieties were used. There was need for new varieties.

h) Since last 5-6 years rains were abnormal affecting the rainfed pulses.

i) Some of the recommended varieties of arhar were found to be susceptible to heavy rains and waterlogging conditions.

4.3 Jhabua District

The description for Jhabua district follows-

4.3.1 Workers

The number of workers per farm was 3.82. The number per farm decreased with the size of farms. It was 4.00 on marginal size group and decreased to 3.50 on semi medium and medium size groups.(Table 4.9)

Table 4.9 Details of family members, Jhabua district, M.P.

Size group	Total No.of members	No. of farms/ families	No. per farm/ family	No. of workers	Workers per farm/ family
Marginal	50	7	7.14	28	4.00
Small	189	27	7.00	107	3.96
Semi-medium	99	14	7.07	49	3.50
Medium	14	2	7.00	7	3.50
Large	-	-	-	-	-
Total	352	50	7.04	191	3.82

4.3.2 Operated area

The operated area of an average holding was 1.80 hectares. None of the selected farms either leased in or leased out any area. The distribution of land among different size groups was quite skewed. While 68.00 per cent of the holdingsbelonging to marginal and small size groups operated only 48.68 per cent of the area, 4.00 per cent of the total number of holdings belonging to medium size group operated 11.26 per cent of the operated area (Table 4.10)

Table 4.10 Operated area, selected farms, Jhabua district, M.P.

(Area- Hectares)

Size group	Owned cultivated land	Leased out land	Leased in land	Operated land	No. of holdings	Percentage to total
Marginal	4.12	-	-	4.12 (4.58)	7	14.00
Small	39.63	-	-	39.63 (44.10)	27	54.00
Semi-medium	35.99	-	-	35.99 (40.06)	14	28.00
Medium	10.12	-	-	10.12 (11.26)	2	4.00
Large	-	-	-	-	-	-
Total	89.86	-	-	89.86 (100.00)	50	100.00
Average per holding	1.80	-	--	1.80	-	-

Note : Figures in brackets- percentage to total

4.3.3 Irrigated Area and Sources of Irrigation

Of the total operated area 29.79 per cent was irrigated. There was no relationship between size of farms and percentage of irrigated area. The percentage was 19.42 on marginal size group. It increased to 37.55 per cent on the small size group. However, it decreased to 26.31 per cent on semi medium size group and further to 16.01 per cent on the large size group. Wells were the major sources of irrigation commanding 72.13 per cent of the irrigated area. Other sources such as nallahs, rivers and lift irrigation done from these sources accounted for the remaining 27.87 per cent. On the selected farms there was no area irrigated by tanks and canals.

There was no relationship between size of farms and percentage commanded by any of the sources of irrigation (Table 4.11).

Table 4.11 Irrigation by sources, Jhabua district, M.P.

(Area- Hectares)

Size group	Un-irrigated land	Irrigated					Operated land
		Wells	Tanks	Canals	Other (Nallah) river, Lift Irrigation	Total	
Marginal	3.32 (80.58)	0.80 (100.00)	-	-	-	0.80 (100.00)	4.12
Small	24.75 (62.45)	9.64 (64.79)	-	-	5.24 (35.21)	14.88 (100.00)	39.63
Semi-medium	26.52 (73.69)	7.25 (76.56)	-	-	2.22 (23.44)	9.47 (100.00)	35.99
Medium	8.50 (83.99)	1.62 (100.00)	-	-	-	1.62 (100.00)	10.12
Large	-	-	-	-	-	-	-
Total	63.09 (70.21)	19.31 (72.13)	-	-	7.46 (27.87)	26.77 (100.00)	89.86 (100.00)

Note : Figures in brackets denote percentages to operated area

4.3.4 Cropping Pattern 1995-96 and 1996-97

In 1995-96 maize occupied the largest percentage (17.32) of area among cereals. Wheat occupied second largest (13.49) per cent. Urad was the most important crop and important pulse crop occupying 24.08 per cent. Gram (10.90 per cent) and kulthi (5.00 per cent) were other important pulses. Rice occupied 5.30 per cent. Soybean (7.36 per cent) and cotton (5.92 per cent) were other important crops.

The cropping pattern remained almost same in 1996-97 with only minor changes in the percentages of area occupied by different crops. The relative importance of crops did not vary much.

The percentages of area under different crops had no relationship with the size of farms (Table 4.12).

Table 4.13 Pulse crops grown on the sample farms, Jhabua district, Madhya Pradesh

(Area in Hectares)

Pulse crops/ varieties	1995-96									1996-97								
	Area Sown as			Area Sown		Land Type			Total area under pulses	Area Sown as			Area Sown		Land Type			Total area under pulses
	Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irri-gated	Rich Land Unirri-gated		Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irri-gated	Rich Land Unirri-gated	
Kharif																		
Urad	29.39	--	--	6.44	22.95	5.48	0.40	23.51	29.39	31.75	--	--	12.18	19.57	12.38	--	19.37	31.75
Kulthi	6.10	--	--	--	6.10	0.40	0.65	5.05	6.10	4.09	--	--	--	4.09	1.72	--	2.37	4.09
Arhar	1.55	--	--	1.55	--	--	--	1.55	1.55	1.60	--	--	0.50	1.10	--	--	1.60	1.60
Moong	--	--	--	--	--	--	--	--	--	0.40	--	--	--	0.40	--	--	0.40	0.40
Jowar+Arhar	--	0.15	--	--	0.15	0.15	--	--	0.15	--	0.20	--	--	0.20	0.20	--	--	0.20
Groundnut+Arhar	--	0.50	--	--	0.50	--	--	0.50	0.50	--	0.50	--	--	0.50	--	--	0.50	0.50
Maize+Urad+Moong	--	--	--	--	--	--	--	--	--	--	0.37	--	--	0.37	--	--	0.37	0.37
Rabi																		
Gram-JG-74	0.80	-	--	--	0.80	--	--	0.80	0.80	0.40	--	--	--	0.40	--	--	0.40	0.40
Ujjain-21	1.61	-	--	--	1.61	--	1.61	--	1.61	1.21	--	--	--	1.21	--	1.21	--	1.21
Local Gram	10.90	-	--	--	10.90	--	6.26	4.64	10.90	9.49	--	--	--	9.49	--	5.65	3.84	9.49
Castor+Gram	--	0.20	--	--	0.20	--	--	0.20	0.20	--	0.20	--	--	0.20	--	--	0.20	0.20
Total	50.35	0.85	--	7.99	43.21	6.03	8.92	36.25	51.20	48.94	1.27	--	12.68	37.53	14.30	6.86	29.05	50.21
(Percentage)	98.34	1.66	--	15.61	84.39	11.78	17.42	70.80	(100)	97.47	2.53	--	25.25	74.75	28.48	13.66	57.86	(100)

4.3.5 Pulse Crops Grown

As mentioned earlier urad, gram and kulthi were important pulses on the selected farms. In 1995-96 in the case of urad, kulthi, arhar and moong only local varieties were grown. In the case of gram, varieties JG-74 and Ujjain-21 were sown, besides local varieties. Most of the area under pulses (98.34 per cent) was sown as single crop. However, unlike Durg district major area (84.39 per cent) was line sown and the remaining 15.61 per cent was sown by broadcast method. As is commonly seen elsewhere quite a high percentage (70.86 per cent) of the area under pulses was unirrigated. Besides, 11.78 per cent of the land under pulses could be termed as marginal.

In 1996-97, slightly higher percentage of area was sown mixed. However, higher percentage of area was sown broadcast in latter year. The percentage of area sown under marginal lands increased from 11.78 in 1995-96 to 28.48 in 1996-97.

The percentage of area sown irrigated decreased by about 4 per cent to 13.66 per cent and the percentage of area unirrigated decreased from 70.80 to 57.86.

In 1995-96 kulthi was sown as pure crop, whereas, arhar and gram were sown as mixed crops. Kulthi and gram were line sown, whereas, other pulses were partly sown broadcast and partly line sown. It was also noted that crop mixtures were not irrigated. Gram was generally irrigated, whereas, urad and kulthi were generally unirrigated.

The status of crops as regards sowing practices remained more or less same in the year 1996-97. In that year arhar, urad and moong were sown as mixed crops. (Table 4.13)

4.3.6 Inputs Used

In Jhabua district too, only gram was partly irrigated. All other pulses viz. urad, arhar, kulthi and moong were grown entirely unirrigated. The cost per hectare of irrigated gram was Rs.3,988.56 and that of unirrigated gram Rs.3368.08. Like that in Durg district the most important item of cost in Jhabua district was seed and seed treatment forming 31.66 per cent. The second important item of cost

Table 4.13 Pulse crops grown on the sample farms, Jhabua district, Madhya Pradesh

(Area in Hectares)

Pulse crops/ varieties	1995-96									1996-97								
	Area Sown as			Area Sown		Land Type			Total area under pulses	Area Sown as			Area Sown		Land Type			Total area under pulses
	Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irri-gated	Rich Land Unirri-gated		Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irri.	Rich Land Unirri-gated	
Kharif																		
Urad	29.39	--	--	6.44	22.95	5.48	0.40	23.51	29.39	31.75	--	--	12.18	19.57	12.38	--	19.37	31.75
Kulthi	6.10	--	--	--	6.10	0.40	0.65	5.05	6.10	4.09	--	--	--	4.09	1.72	--	2.37	4.09
Arhar	1.55	--	--	1.55	--	--	--	1.55	1.55	1.60	--	--	0.50	1.10	--	--	1.60	1.60
Moong	--	--	--	--	--	--	--	--	--	0.40	--	--	--	0.40	--	--	0.40	0.40
Jowar+Arhar	--	0.15	--	--	0.15	0.15	--	--	0.15	--	0.20	--	--	0.20	0.20	--	--	0.20
Groundnut+Arhar	--	0.50	--	--	0.50	--	--	0.50	0.50	--	0.50	--	--	0.50	--	--	0.50	0.50
Maize+Urad+Moong	--	--	--	--	--	--	--	--	--	--	0.37	--	--	0.37	--	--	0.37	0.37
Rabi																		
Gram-JG-74	0.80	-	--	--	0.80	--	--	0.80	0.80	0.40	--	--	--	0.40	--	--	0.40	0.40
Ujjain-21	1.61	-	--	--	1.61	--	1.61	--	1.61	1.21	--	--	--	1.21	--	1.21	--	1.21
Local Gram	10.90	-	--	--	10.90	--	6.26	4.64	10.90	9.49	--	--	--	9.49	--	5.65	3.84	9.49
Castor+Gram	--	0.20	--	--	0.20	--	--	0.20	0.20	--	0.20	--	--	0.20	--	--	0.20	0.20
Total	50.35	0.85	--	7.99	43.21	6.03	8.92	36.25	51.20	48.94	1.27	--	12.68	37.53	14.30	6.86	29.05	50.21
(Percentage)	98.34	1.66	--	15.61	84.39	11.78	17.42	70.80	(100)	97.47	2.53	--	25.25	74.75	28.48	13.66	57.86	(100)

was preparatory tillage (27.25 per cent). The third important item was fertilisers and occupied 16.82 per cent. Depreciation (7.71 per cent), irrigation expenses (5.82 per cent) and interest on working capital (5.24 per cent) were other items. While the proportions of items of irrigation expenses, harvesting and depreciation were higher on irrigated areas the proportions of items of preparatory tillage, seed and seed treatment, fertilisers and interest on working capital were higher on unirrigated areas. For urad the most important item of cost was preparatory tillage (30.37 per cent) followed by seed and seed treatment (19.85 per cent) and fertilisers (15.94 per cent). Other items were depreciation (7.70 per cent, harvesting, etc. (7.59 per cent) and sowing and weeding (7.24 per cent) in that order. For arhar the most important item was seed and seed treatment (26.04 per cent) closely followed by preparatory tillage (25.63 per cent). Among other important items were harvesting, etc. (12.41 per cent), sowing and weeding (11.98 per cent) and depreciation (7.81 per cent). In the case of kulthi, seed and seed treatment formed as high as 40.12 per cent of the total cost. Preparatory tillage was second important item and accounted for 26.90 per cent. Depreciation formed 9.62 per cent. In the case of moong the four most important items of cost were preparatory tillage (26.74 per cent), sowing and weeding (17.84 per cent), fertilisers (12.67 per cent) and seed and seed treatment (12.04 per cent) (Table 4.14).

4.3.7 Input Output Analysis

Input value per hectare was highest for cotton (Rs.4,717.00) followed by rice (Rs.3,692.00) and gram (Rs.3,657.00). The value of output per hectare was highest for cotton (Rs.11,792.00) followed by gram (Rs.7,675.00) and groundnut (Rs.7,364.00). The profit per hectare was highest for cotton (Rs.7,075.00) followed by groundnut (Rs.4,225.00) and gram (Rs.4,018.00). Thus from profitability point of view cotton ranked first followed by groundnut and gram. Other's

Table 4.14 Details of Inputs used per Hectare, Jhabua District, Madhya Pradesh.

(Figures- percentages)

Operations	Gram			Urad			Arhar			Kulthi			Moong		
	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total
-Preparatory Tillage	27.14	27.41	27.25	--	30.37	30.37	--	25.63	25.63	--	26.90	26.90	--	26.74	26.74
-Seed+Seed Treatment	28.91	34.61	31.66	--	19.85	19.85	--	26.04	26.04	--	40.42	40.42	--	12.04	12.04
-Sowing + Weeding	-	-	-	--	7.24	7.24	--	11.98	11.98	--	5.03	5.03	--	17.84	17.84
- Manure	-	-	-	--	5.14	5.14	--	4.59	4.59	--	2.66	2.66	--	8.93	8.93
-Fertilisers	12.29	21.67	16.82	--	15.94	15.94	--	3.40	3.40	--	3.93	3.93	--	12.67	12.67
- Labour used for Fertiliser application	-	-	-	--	-	-	--	-	-	--	-	-	--	-	-
- Plant Protection	1.32	0.79	1.07	--	0.80	0.80	--	2.93	2.93	--	-	-	--	-	-
- Irrigation Expenses	11.22	-	5.82	--	-	-	--	-	-	--	-	-	--	-	-
- Labour used in irrigation	3.31	-	1.71	--	-	-	--	-	-	--	-	-	--	-	-
-Harvesting, Threshing, Winnowing & Transportation	2.81	2.61	2.72	--	7.59	7.59	--	12.41	12.41	--	6.33	6.33	--	8.93	8.93
- Land revenue & Other taxes	-	-	-	--	0.15	0.15	--	-	-	--	-	-	--	-	-
-Interest on working capital	5.21	5.28	5.24	--	5.22	5.22	--	5.22	5.22	--	5.11	5.11	--	5.22	5.22
-Depreciation on implements, machinery, farm building	7.79	7.63	7.71	--	7.70	7.70	--	7.81	7.81	--	9.62	9.62	--	7.63	7.63
-Rent paid for leased in land	-	-	-	--	-	-	--	-	-	--	-	-	--	-	-
- Percentage	100.00	100.00	100.00	--	100.00	100.00	--	100.00	100.00	--	100.00	100.00	--	100.00	100.00
-Cost per Hectare(Rs)	3988.56	3368.08	3656.71	--	2330.66	2330.66	--	2511.22	2511.22	--	2308.07	2308.07	--	2956.50	2956.50

on the ladder were maize, wheat, arhar and soybean. On the criterion of input-output ratio cotton ranked first (2.50) followed by maize (2.37) and groundnut (2.35). Arhar (2.28), gram (2.09) and urad (2.09) were other crops in order and had input output ratio of more than 2.0. It may be noted that on the criterion of profit per hectare only gram and arhar could compete with other crops. On the criterion of input output ratio only arhar, gram and urad could compete. (Table 4.15)

Table 4.15 Value of Output, Input, Net Profit and Input Output ratio, Jhabua district (M.P.)

(Figures - Rupees per hectare)

Crop	Input	Output	Net Profit	Input output ratio
Rice	3692.00	4733.00	1041.00	1.28
Jowar	2342.00	2349.00	7.00	1.00
Maize	2864.00	6792.00	3928.00	2.37
Soybean	3543.00	6303.00	2760.00	1.78
Urad	2327.00	4859.00	2532.00	2.09
Arhar	2273.00	5177.00	2904.00	2.28
Moong	3087.00	1893.00	(-)1194.00	0.61
Kulthi	2308.00	1906.00	(-) 402.00	0.83
Groundnut	3139.00	7364.00	4225.00	2.35
Cotton	4717.00	11792.00	7075.00	2.50
Wheat	3316.00	6385.00	3069.00	1.90
Gram	3657.00	7675.00	4018.00	2.09
Castor	1488.00	2805.00	1317.00	1.89

Cotton, maize and groundnut were more preferred crops on the criterion of profitability than any of the pulse crops.

4.3.8 Disposal of Produce

In the case of rice, 48.11 per cent of the total produce was consumed. The percentage of produce sold was 37.54 and the percentage kept for seed was 14.35. The percentage of produce kept for seed increased with the size of farms.

Jowar was staple food crop of the district. As high as 87.68 per cent of the total produce was used for consumption and

7.47 per cent was sold. The remaining 4.85 per cent was kept for seed. There was no relationship between the percentage of produce used for different purposes and size of farms.

Maize was another staple food crop. The percentage of produce used for consumption was 88.52. The percentage decreased with the size of farms from 95.58 in the marginal size group to 76.92 in the large size group. The percentage of produce kept for seed was 6.65. The percentage had no relationship with size of farms. The percentage of produce sold was 4.83. The percentage was higher on larger size of holdings, as was the case elsewhere in other crops.

Soybean was grown for market. Eighty five percent of the total produce was marketed and the remaining 15 per cent was kept for seed. There was no relationship between the percentage of produce marketed or kept for seed and the size of farms.

Of the pulse crops grown urad had the highest percentage of produce sold (77.85) followed by gram (68.96). The lowest percentage of produce sold was in the case of moong (39.89) and kulthi (55.55). In both these crops very large percentages of produce were consumed. There was no relationship between the percentage of produce used for different purposes and the size of farms (Table 4.16).

4.3.9 Farmers' Knowledge and Opinion

It was noted that urad was the most popular pulse and was grown without irrigation. It is grown on light soil. Gram is affected by heleothis. The good quality soils are used for either maize, paddy or gram. Gram also required some irrigation. Urad could withstand drought. Seed of high yielding varieties of gram were costly. Insecticides available were not of good quality and sometimes provedineffective. T-9 variety of urad gave less straw. Urad and kulthi were susceptible to waterlogging. There was need for early maturing maize varieties. The soils were shallow and undulating. Low investment capacity and poor economic conditions forced the population out of villages in search of labour in and outside state. Kulthi was grown to feed the cattle. Urad was susceptiple to insectsand pests.

Table 4.16 Disposal of produce, sample farms, Jhabua district, M.P.

(Qt/hectare)

Crops	Disposal	Farm Size					
		Marginal	Small	Semi-medium	Medium	Large	All
Rice	Seed	0.60 (7.50)	1.48 (13.56)	1.03 (14.21)	1.50 (100.00)	-	1.33 (14.35)
	Consumption	7.40 (92.50)	4.02 (36.85)	6.22 (85.79)	-	-	4.46 48.11
	Sold	-	5.41 (49.59)	-	-	-	3.48 (37.54)
	Total production	8.00 (100)	10.91 (100)	7.25 (100)	1.50 (100)	-	9.27 (100)
Jowar	Seed	0.25 (3.33)	0.56 (4.84)	0.13 (3.71)	0.21 (8.47)	-	0.24 (4.85)
	Consumption	7.25 (96.67)	11.00 (95.16)	2.66 (75.78)	2.27 (91.53)	-	4.34 (87.68)
	Sold	-	-	0.72 (20.51)	-	-	0.37 (7.47)
	Total production	7.50 (100)	11.56 (100)	3.51 (100)	2.48 (100)	-	4.95 (100)
Maize	Seed	0.50 (4.42)	0.80 (8.21)	0.50 (5.35)	0.38 (7.69)	-	0.62 (6.65)
	Consumption	10.81 (95.58)	8.95 (91.79)	7.92 (84.70)	3.80 (76.92)	-	8.25 (88.52)
	Sold	-	-	0.93 (9.95)	0.76 (15.39)	-	0.45 (4.83)
	Total production	11.31 (100)	9.75 (100)	9.35 (100)	4.94 (100)	-	9.32 (100)
Soybean	Seed	0.50 (100.00)	1.34 (15.18)	-	0.49 (16.50)	-	1.05 (14.42)
	Consumption	-	-	-	-	-	-
	Sold	-	7.49 (84.82)	4.38 (100.00)	2.48 (83.50)	-	6.23 (85.58)
	Total production	0.50 (100)	8.83 (100)	4.38 (100)	2.97 (100)	-	7.28 (100)
Urad	Seed	0.80 (12.88)	0.38 (7.77)	0.33 (7.78)	0.49 (18.85)	-	0.44 (9.65)
	Consumption	0.50 (8.05)	0.78 (15.95)	0.42 (9.91)	0.49 (18.85)	-	0.57 (12.50)
	Sold	4.91 (79.07)	3.73 (76.28)	3.49 (82.31)	1.62 (62.30)	-	3.55 (77.85)
	Total production	6.21 (100)	4.89 (100)	4.24 (100)	2.60 (100)	-	4.56 (100)

Continued.....

Continued.....

Table 4.16 Disposal of produce, sample farms, Jhabua district, M.P.

(Qt/hectare)

Crops	Disposal	Farm Size					
		Marginal	Small	Semi-medium	Medium	Large	All
Arhar	Seed	0.25 (4.17)	0.33 (7.95)	0.50 (16.67)	-	-	0.38 (9.64)
	Consumption	1.50 (25.00)	0.97 (23.37)	1.50 (50.00)	-	-	1.20 (30.46)
	Sold	4.25 (70.83)	2.85 (68.68)	1.00 (33.33)	-	-	2.36 (59.90)
	Total production	6.00 (100)	4.15 (100)	3.00 (100)	-	-	3.94 (100)
Moong	Seed	-	0.42 (33.60)	0.38 (25.33)	-	-	0.48 (26.96)
	Consumption	-	0.83 (66.40)	0.37 (24.67)	-	-	0.59 (33.15)
	Sold	-	-	0.75 (50.00)	-	-	0.71 (39.89)
	Total production	-	1.25 (100)	1.50 (100)	-	-	1.78 (100)
Kulthi	Seed	-	0.36 (12.95)	0.17 (6.74)	0.12 (16.22)	-	0.22 (9.78)
	Consumption	-	1.83 (65.83)	0.20 (7.94)	0.62 (83.78)	-	0.78 (34.67)
	Sold	-	0.59 (21.22)	2.15 (85.32)	-	-	1.25 (55.55)
	Total production	-	2.78 (100)	2.52 (100)	0.74 (100)	-	2.25 (100)
Groundnut	Seed	-	-	0.75 (7.50)	-	-	0.27 (4.57)
	Consumption	-	1.00 (28.01)	4.25 (42.50)	-	-	2.18 (36.89)
	Sold	-	2.57 (71.99)	5.00 (50.00)	-	-	3.46 (58.54)
	Total production	-	3.50 (100)	10.00 (100)	-	-	5.91 (100)
Cotton	Seed	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
	Sold	-	8.98 (100.00)	10.56 (100.00)	1.61 (100.00)	-	7.41 (100.00)
	Total production	-	8.98 (100)	10.56 (100)	1.61 (100)	-	7.41 (100)

Continued....

4.3.10 Opinionsof District Agricultural Officers & AER Centre Officers

1. The entire Jhabua district had undulating topography and slopy land. The district was prone to soil erosion and run off water losses. The soil was shallow, infertile and had low water retention capacity.

2. The soil was practically devoid of irrigation facilities.

3. The population was poor, illiterate and tribal not responding easily to new agricultural development techniques. The farmers had low risk bearing capacity.

4. The rainfall was erratic and not dependable.

5. Due to limited area under irrigation, rabi crops were not grown.

6. Due to poor agricultural base, population preferred to work as labourers on non-agricultural enterprises within and out of M.P. State.

7. Among the reasons for lowering of area under pulses following were important.

(a) There were no high yielding varieties seed in pulses.

(b) Due to imbalanced use of fertilisers there was more vegetative growth and lower production of crops including pulses.

(c) Kulthi, the main pulse crop of the district was a neglected crop. It was sown on marginal land as late as in August. It was sometimes sown after the main crop had failed.

(d) Fertilisers were applied mainly in maize and rice, not in pulses.

(e) Gram was grown mainly unirrigated.

It was very essential to convince the tribals about balanced use of fertilisers.

4.4 Narsinghpur District

The description of Narsinghpur district follows -

4.4.1 Workers

Average number of workers per family was 3.66. It was 3.28 on the marginal size group and increased to 3.33 on the small size group and to 4.00 on the semi medium size group. On the medium size group, however, the number decreased to 3.33. On the large size group it again increased and was highest (6.00). Thus it was observed that the number of workers per farm was higher on larger size groups (Table 4.17).

Table 4.17 Details of family members, Narsinghpur district, M.P.

Size group	Total No.of members	No.of families	No.per family	No. of workers	Workers per family
Marginal	35	07	5.0	23	3.28
Small	66	12	5.5	40	3.33
Semi-medium	150	21	7.14	84	4.00
Medium	56	09	6.22	30	3.33
Large	14	01	14.00	06	6.00
Total	321	50	6.42	183	3.66

4.4.2 Operated Area

The operated area of the selected farms was 143.00 hectares or 2.86 hectares per farm. The average owned area was 2.90 hectares. Of this 0.18 hectare was leased out and 0.14 hectare was leased in to make it to 2.86 hectares. The leasing in and leasing out of land was localised in semi-medium and medium size farm groups. While marginal and small size farms representing 38 per cent of the total number occupied 15.37 per cent of the area, the medium and large size group farms representing 20 per cent of the total number occupied 47.82 per cent of the operated area. (Table 4.18)

4.4.3 Irrigated Area and Sources of Irrigation

Of the total operated area 78.22 per cent was irrigated. The percentage of irrigated area on the marginal farm size was 59.23 per cent. It decreased to 41.39 per cent on the small size

Table 4.18 Operated area, selected farms, Narsinghpur district, M.P.

(Area-Hectares)

Size group	Owned cultivated land	Leased out land	Leased in land	Operated land	No.of holding	Percentage to total
Marginal	3.58	-	-	3.58 (2.50)	07	14.00
Small	18.41	-	-	18.41 (12.87)	12	24.00
Semi medium	53.84	3.24	2.03	52.63 (36.81)	21	42.00
Medium	49.77	5.67	4.86	48.96 (34.24)	09	18.00
Large	19.42	-	-	19.42 (13.58)	01	2.00
Total	145.02	8.91	6.89	143.00 (100.00)	50	100.00
Average per holding	2.90	0.18	0.14	2.86	-	-

Note : Figures in brackets denotes percentage to total.

group. However, it increased to 75.62 per cent on semi medium size group and further to 87.60 per cent on medium size group. On the large size group the entire operated area was irrigated. Thus it is observed that the percentage of irrigated area increased with the size of farms. Wells and tubewells were the only sources of irrigation. No area was irrigated by tanks and canals. An insignificant area (0.36 per cent) was irrigated by other sources (Table 4.19).

Table 4.19 Irrigation by sources, Narsinghpur district, M.P.

(Area - Hectare)

Size group	Un-irrigated land	Irrigated					Operated land
		Wells	Tanks	Canals	Other (Nallah)	Total	
Marginal	1.46 (40.77)	2.12 (100.00)	-	-	-	2.12 (100.00)	3.58
Small	10.79 (58.61)	7.22 (94.75)	-	-	0.40 (05.25)	7.62 (100.00)	18.41
Semi medium	12.83 (24.38)	39.80 (100.00)	-	-	-	39.80 (100.00)	52.63
Medium	6.07 (12.40)	42.89 (100.00)	-	-	-	42.89 (100.00)	48.96
Large	-	19.42 (100.00)	-	-	-	19.42 (100.00)	19.42
Total	31.15 (21.78)	111.45 (99.64)	-	-	0.40 (0.36)	111.85 (100.00)	143.00

Note : Figures in brackets denote percentages to operated area

4.4.4 Cropping Pattern 1995-96 and 1996-97

In 1995-96 the crop with largest coverage was soybean (41.17 per cent of the gross cropped area). Gram (18.28 per cent) was the second important crop and wheat (16.60 per cent) was third important crop. Other pulse crops of importance were lentil (11.40 per cent) and batari (5.25 per cent). Pea (1.14 per cent) and arhar (1.07 per cent) were of minor importance.

Soybean occupied about equal percentage of cropped area (around 40 per cent) on all size groups in both the years. The percentage of area occupied by wheat did not show relationship with the size of farms. On the other hand the percentage of area under gram decreased with the increase in the size of farms. Lentil occupied larger percentage of gross cropped area of larger farms.

The cropping pattern did not show much change in 1996-97 over 1995-96 (Table 4.20)

4.4.5 Pulse Crops Grown

As mentioned earlier Narsinghpur district is traditionally famous for growing pulse crops specially arhar and gram. New varieties were used and new technology of cultivation was used. All the pulse crops of kharif, rabi and summer seasons were grown as single crops and these were neither mixed or inter cropped. Further, except kharif urad and arhar all other pulses were line sown. Only a small percentage of gram was sown broadcast. Since the technology used for growing pulses was well developed the pulse crops were grown on good soils only a small percentage of area under arhar, gram and lentil was grown on marginal lands. Actually larger percentagesunder these pulses were grown irrigated.

The situation was similar in the subsequent year 1996-97 (Table 4.21).

4.4.6 Inputs Used

As mentioned earlier Narsinghpur district had highest percentage of irrigated area and highest percentage of irrigated area under pulses. This reflected clearly on the results of the selected farms. All the six pulse crops were either fully irrigated (pea) or partly irrigated (gram, arhar, lentil, urad and batari). The cost per hectare of irrigated gram was Rs.6,467.98 and that of unirrigated gram, Rs.6,474.27. Of the different items of cost seed and seed treatment

Table 4.20 Cropping Pattern- Narsinghpur District

(Figures-percentage of gross cropped area)

Crops	1995-96						1996-97					
	Marginal	Small	Semi medium	Medium	Large	Total	Marginal	Small	Semi medium	Medium	Large	Total
A. Kharif												
Paddy	--	1.71	--	--	--	0.18	--	1.44	--	--	--	0.16
Soybean	40.07	34.50	43.87	40.15	42.29	41.17	39.84	33.38	43.77	39.55	45.46	41.20
Urad	8.24	1.16	--	--	--	0.35	7.52	--	--	--	--	0.20
Arhar	--	--	2.12	0.93	--	1.07	--	--	2.01	0.65	--	0.95
Sugarcane	--	--	--	3.61	--	1.29	--	--	--	3.45	--	1.27
Vegetables	--	--	1.60	--	--	0.56	--	--	1.12	--	--	0.40
B. Rabi												
Wheat	13.49	11.99	19.49	16.51	14.10	16.60	13.45	12.32	18.22	16.43	11.38	15.83
Gram	28.05	26.65	22.30	17.04	--	18.28	28.88	28.39	23.10	17.07	--	18.37
Lentil	10.02	10.93	7.55	12.09	18.91	11.40	10.31	12.37	8.64	12.10	17.05	11.55
Batari	0.13	10.59	1.59	2.16	17.65	5.25	--	10.62	1.34	2.17	20.44	5.30
Pea	--	0.73	0.42	1.51	2.35	1.14	--	--	0.44	1.51	--	0.72
Mustard	--	--	--	--	--	--	--	--	0.46	--	5.67	0.96
Vegetables	--	--	1.06	0.63	--	0.60	--	--	0.90	0.65	--	0.56
C. Summer												
Urad	--	1.74	--	1.24	--	0.63	--	1.48	--	1.29	--	0.64
Sunflower	--	--	--	4.13	--	1.48	--	--	--	5.13	--	1.89
D. Gross Cropped area (Hect.)	7.487	29.279	94.398	96.896	42.565	270.625	6.819	27.683	90.02	93.612	35.610	253.744
(%)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Table 4.21 Pulse crops grown on the sample farms - Narsinghpur District

(Area in Hectares)

Pulse crops/ varieties	1995-96									1996-97								
	Area Sown as			Area Sown		Land Type			Total area under pulses	Area Sown as			Area Sown		Land Type			Total
	Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irrigated	Rich Land Unirrigated		Single crop	Mixed crop	Inter crop	Broad caste	Line	Marginal	Rich Land Irrigated	Rich Land Unirrigated	
Kharif																		
Urad	0.958	--	--	0.958	--	--	0.958	--	0.958	0.513	--	--	0.513	--	--	0 513	--	0.513
Arhar (Tur)	2.903	--	--	2.000	0.903	1.000	0.903	1.000	2.903	2.416	--	--	1.606	0.810	0.500	1.500	0.416	2.416
Rabi																		
Gram(Ujjain-21)	2.000	--	--	--	2.000	--	2.000	--	2.000	2.000	--	--	--	2.000	--	2.000	--	2.000
Gram JG-315)	47.463	--	--	2.463	45.000	2.000	38.000	7.463	47.463	44.601	--	--	2.020	42.581	1.160	34.497	8.944	44.601
Masoor	30.839	--	--	--	30.839	1.200	24.000	5.639	30.839	29.297	--	--	--	29.297	0.303	22.336	6.658	29.297
Batari	14.217	--	--	--	14.217	--	9.500	4.717	14.217	13.458	--	--	--	13.458	--	7.680	5.778	13.458
Pea	3.075	--	--	--	3.075	--	3.075	--	3.075	1.816	--	--	--	1.816	--	1.816	--	1.816
Summer																		
Urad	1.710	--	-	--	1.710	--	--	1.710	1.710	1.620	--	--	--	1.620	--	--	1.620	1.620
Total	103.165	--	-	5.421	97.744	4.200	78.436	20.529	103.165	95.721	--	--	4.139	91.582	1.963	70.342	23.416	95.721
	(100)	(-)	(-)	(5.225)	(94.75)	(4.07)	(76.03)	(19.90)	(100)	(100.00)	(-)	(-)	(4.32)	(95.68)	(2.05)	(73.49)	(24.46)	(100.00)

was most important and claimed one fourth (25.78 per cent) of the total cost. The second important item of cost was harvesting, threshing, etc. and occupied 20.01 per cent of the total cost. Plant protection was third in importance and accounted for 12.49 per cent of the total cost. Other important items were fertilisers (10.74 per cent), preparatory tillage (9.85 per cent) and depreciation (8.46 per cent). While proportions of items such as fertilisers and depreciation were higher on irrigated areas those of all other inputs were higher on unirrigated areas.

In the case of arhar the input with highest contribution was harvesting, etc. (22.97 per cent) closely followed by seed and seed treatment (22.32 per cent). Sowing and weeding operations claimed 15.52 per cent and the fourth being preparatory tillage (12.68 per cent). Plant protection operations claimed 9.93 per cent of the total cost. On irrigated areas the proportions of inputs such as sowing and weeding, plant protection and harvesting were higher, whereas, on unirrigated lands proportions of inputs such as preparatory tillage, seed and seed treatment, depreciation and rent paid for leased in land were higher. In the case of lentil the highest proportion of input was that on seed and seed treatment (24.10 per cent). The second highest proportion of input was on harvesting (20.71 per cent). The third and fourth important inputs were preparatory tillage (11.52 per cent) and fertilisers (11.44 per cent).

In the cases of pea and batari the most important input was seed and seed treatment. The second important input was harvesting. The third important input was preparatory tillage. The fourth input was fertilisers. In the case of urad, however, the most important input was harvesting, threshing etc. The second was preparatory tillage. The third important input was sowing and weeding. The fourth was seed and seed treatment (Table 4.22).

4.4.7 Input Output Analysis

Growing of particular crop is decided by farmer mainly on the profitability criterion. Input-output analysis showed that net profit per hectare was highest (Rs.7,629) for sunflower. The second highest profit per hectare (Rs.6,799) was earned by mustard. This

Table 4,22 Details of Inputs use per hectare, Narsinghpur District, Madhya Pradesh

(Figures- Percentages)

Operations	Gram			Arhar			Lentil		
	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri-gated	Total
- Preparatory Tillage	9.21	12.56	9.85	10.40	14.25	12.68	9.41	17.24	11.52
- Seed+Seed Treatment	25.57	26.68	25.78	20.08	33.60	22.32	24.07	24.04	24.10
- Sowing + Weeding	1.57	1.83	1.62	16.94	11.73	15.52	4.38	2.70	3.92
- Manure	1.73	1.78	1.74	-	-	-	1.13	1.62	1.26
- Fertilisers	11.79	6.25	10.74	-	-	-	14.36	3.49	11.44
- Labour used for Fertiliser application	0.28	--	0.22	-	-	-	0.40	-	0.30
- Plant Protection	11.87	15.12	12.49	13.56	-	9.93	8.51	9.48	8.78
- Irrigation Expenses	1.18	-	0.96	-	-	-	1.78	-	1.31
- Labour used in irrigation	0.45	-	0.37	-	-	-	0.50	-	0.37
- Harvesting, Threshing, Winnowing & Transportation	19.86	20.62	20.01	25.40	16.41	22.97	18.60	26.34	20.71
- Land revenue & Other taxes	0.20	0.23	0.20	0.18	2.71	0.84	0.24	0.35	0.27
- Interest on working capital	4.67	5.07	4.75	5.40	4.14	5.06	4.46	5.01	4.61
- Depreciation on implements, machinery, farm building	8.50	8.42	8.46	7.00	8.00	7.50	8.00	7.50	7.75
- Rent paid for leased in land	3.12	1.44	2.81	1.04	9.16	3.18	4.16	2.23	2.46
- Percentage	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
- Cost per Hectare (Rs.)	6,467.98	6,474.27	6,469.16	6,459.00	2,798.37	4,313.53	5,101.67	5,642.58	5,230.19

Continued...

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Table 4.22 Details of Inputs use per hectare, Narsinghpur District, Madhya Pradesh

(Figures- Percentages)

Operations	Pea			Urad			Batari		
	Irri-gated	Unirri-gated	Total	Irri-gated	Unirri.-gated	Total	Irri-gated	Unirri-gated	Total
- Preparatory Tillage	15.52	--	15.52	37.12	16.51	21.82	9.72	12.00	10.93
- Seed+Seed Treatment	27.20	--	27.20	12.37	17.60	16.16	20.76	24.36	22.70
- Sowing + Weeding	0.89	--	0.89	18.55	18.50	18.43	5.23	2.69	3.86
- Manure	2.22	--	2.22	-	2.19	1.61	4.22	1.08	2.54
- Fertilisers	15.37	--	15.37	-	-	-	19.81	2.72	10.62
- Labour used for Fertiliser application	0.37	--	0.37	-	-	-	0.64	-	0.30
- Plant Protection	-	--	-	-	-	-	1.68	16.94	9.89
- Irrigation Expenses	-	--	-	-	-	-	4.22	-	1.95
- Labour used in irrigation	-	--	-	-	-	-	1.43	-	0.67
- Harvesting, Threshing, Winnowing & Transportation	18.18	--	18.18	18.55	27.52	25.06	18.14	25.23	21.93
- Land revenue & Other taxes	1.62	--	1.62	0.32	0.84	0.69	0.34	0.27	0.30
- Interest on working capital	3.96	--	3.96	5.44	3.97	4.34	5.40	4.56	4.93
- Depreciation on implements, machinery, farm building	8.65	--	8.65	7.66	6.06	6.86	8.41	7.78	8.10
- Rent paid for leased in land	6.02	--	6.02	-	6.81	5.02	-	2.37	1.28
- Percentage	100.00	--	100.00	100.00	100.00	100.00	100.00	100.00	100.00
- Cost per hectare (Rs)	5546.81	--	5546.81	4023.39	4883.95	4676.98	4588.15	6528.73	5421.31

was followed by gram which earned third highest net profit per hectare of Rs.6,397. Batari earned a profit per hectare of Rs.6,380. Wheat (Rs.5,870) and Sugarcane (Rs.5,241) were other crops earning net profit per hectare of more than Rs.5,000. Lentil (Rs.4,867), soybean (Rs.3,386), vegetables (Rs.2,739) and urad (Rs.2,477) were other crops earning profit per hectare in that order. Paddy, pea and arhar were on the lower side of the ladder.

On the criterion of input-output ratio mustard (2.50) and sunflower (2.30) proved to be most profitable. Batari (2.18) and gram (1.99) came next. Lentil, wheat and urad had input-output ratio of 1.93, 1.92 and 1.53 respectively. Soybean (1.46), arhar (1.42) and paddy (1.39) came next. Sugarcane (1.34), pea (1.33) and vegetables (1.18) earned lowest input-output ratio.

It was thus observed that sunflower and mustard were most profitable crops. Gram and batari came next. Wheat, soybean and sugarcane were also competitive crops to pulses. Thus pulses would not be in a position to substitute oilseeds like soybean and mustard even on profitability criterion. It was also noted that among pulses gram and batari were two most profitable (Table 4.23).

Table 4.23 Values of Output, Input, Net Profit and Input Output ratio, Narsinghpur district, (M.P.)

(Rs./Hectare)

Crops	Input	Output	Net Profit	Input output ratio
Paddy	5,500	7,625	2,125	1.39
Wheat	6,382	12,252	5,870	1.92
Batari	5,421	11,801	6,380	2.18
Urad	4,677	7,154	2,477	1.53
Gram	6,469	12,866	6,397	1.99
Masoor (lentil)	5,230	10,097	4,867	1.93
Arhar (Tur)	4,313	6,119	1,806	1.42
Pea	5,546	7,373	1,827	1.33
Mustard	4,521	11,320	6,799	2.50
Sunflower	5,871	13,500	7,629	2.30
Soybean	7,414	10,800	3,386	1.46
Vegetables	15,088	17,827	2,739	1.18
Sugarcane	15,476	20,717	5,241	1.34

4.4.8 Disposal of Produce

Among the crops grown on the selected farms rice and wheat were staple food crops. The percentage of produce utilised for consumption was 21.43 and 22.71 respectively for these crops. Pulses were produced more for sale than home consumption and therefore the percentage used for home consumption was lower ; batari (2.76), urad (6.72), gram (7.67) lentil (4.15), arhar (11.23) and pea (8.95). Oilseeds like mustard, sunflower and soybean are solely produced for market. Therefore, the percentage of produce marketed for these crops came to 94.42, 98.60 and 92.16 respectively. A very meagre quantity was retained for next year's seed.

In the case of wheat the percentage of quantity sold was higher on larger farms, whereas, the percentage of quantity consumed was lower on larger farms. In the case of other crops no relationship was noted between the proportions of quantities disposed of for various purposes and size of farms (Table 4.24).

4.4.9 Farmers' Knowledge and Opinion

Farmers opined that the first and foremost reason for low production of pulses was non availability of improved and high yielding varieties seed. Among other reasons were : risk involved due to susceptibility to insects and pests, low profitability and lower input-output ratio. It was opined that due to low profitability pulse crops were grown on average or marginal lands and not on best lands. It was also pointed out that pulses fetch high prices due to shortages in lean season, the farmers do not get the benefit of price fluctuations. The farmers brought the produce immediately after harvest causing glut and eventual fall in price. The real beneficiary was mill owner who purchased pulse crops when the prices were lowest, processed these and deferred the sale to a lean season when prices of dal reached the peak. Due to lower profitability farmers did not follow recommended practices and doses fully. Gram and pea being most profitable among pulses get best lands alloted and best treatment against pests and diseases. Other pulses with moderate or low profitability were alloted marginal lands. To the question whether the area under pulses was getting diverted to other crops, the answer was "partly yes". The reason advanced was

Table 4.24 Disposal of produce, sample farms, Narsinghpur District, M.P.

(Qt/hectare)

Crops	Disposal	Farm Size					
		Marginal	Small	Semi-medium	Medium	Large	All
Rice	Seed	-	1.25 (7.14)	-	-	-	1.25 (7.14)
	Consumption	-	3.75 (21.43)	-	-	-	3.75 (21.43)
	Sold	-	12.50 (71.43)	-	-	-	12.50 (71.43)
	Total production	-	17.50 (100)	-	-	-	17.50 (100)
Wheat	Seed	1.09 (5.00)	1.61 (10.98)	1.43 (6.09)	1.40 (5.76)	0.99 (4.01)	1.38 (5.97)
	Consumption	9.82 (45.02)	9.24 (63.03)	6.74 (28.72)	3.25 (13.37)	2.47 (10.00)	5.25 (22.71)
	Sold	10.90 (49.98)	3.81 (25.99)	15.30 (65.19)	19.66 (80.87)	21.23 (85.99)	16.49 (71.32)
	Total production	21.81 (100)	14.66 (100)	23.47 (100)	24.31 (100)	24.69 (100)	23.12 (100)
Batari	Seed	-	1.02 (13.34)	1.65 (15.35)	0.98 (5.68)	0.69 (5.02)	0.89 (7.03)
	Consumption	-	0.34 (4.44)	1.86 (17.30)	0.25 (1.45)	0.14 (1.02)	0.35 (2.76)
	Sold	-	6.29 (82.22)	7.24 (67.35)	16.01 (92.87)	12.91 (93.96)	11.42 (90.21)
	Total production		7.65 (100)	10.75 (100)	17.24 (100)	13.74 (100)	12.66 (100)
Urad	Seed	-	-	-	1.24 (15.03)	-	0.70 (9.04)
	Consumption	0.19 (3.25)	1.22 (14.29)	-	0.41 (4.97)	-	0.52 (6.72)
	Sold	5.65 (96.75)	7.32 (85.71)	-	6.60 (80.00)	-	6.52 (84.24)
	Total production	5.85 (100)	8.54 (100)	-	8.25 (100)	-	7.74 (100)
Gram	Seed	0.76 (7.48)	1.28 (10.70)	1.30 (10.28)	1.16 (10.53)	-	1.22 (10.29)
	Consumption	0.94 (9.25)	0.95 (7.94)	1.24 (9.80)	0.47 (4.26)	-	0.91 (7.67)
	Sold	8.46 (83.27)	9.73 (81.35)	10.11 (79.92)	9.39 (85.21)	-	9.73 (82.04)
	Total production	10.16 (100)	11.96 (100)	12.65 (100)	11.02 (100)	-	11.86 (100)

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Table 4.24 Disposal of produce, sample farms, Narsinghpur district, M.P.

(Qt/hectare)

Crops	Disposal	Farm Size					
		Marginal	Small	Semi-medium	Medium	Large	All
Lentil	Seed	0.64 (9.47)	1.31 (11.66)	1.34 (17.38)	0.90 (12.89)	0.32 (4.98)	1.05 (10.91)
	Consumption	0.71 (10.50)	0.95 (8.45)	0.80 (10.38)	0.08 (1.15)	0.16 (0.97)	0.40 (4.15)
	Sold	5.41 (80.03)	8.98 (79.89)	5.57 (72.24)	6.00 (85.96)	15.49 (94.05)	8.18 (84.94)
	Total production	6.76 (100)	11.24 (100)	7.71 (100)	6.98 (100)	16.47 (100)	9.63 (100)
Arhar (Tur)	Seed	-	-	0.25 (3.31)	0.41 (12.42)	-	0.29 (4.46)
	Consumption	-	-	0.69 (9.11)	0.83 (25.15)	-	0.73 (11.23)
	Sold	-	-	6.63 (87.58)	2.06 (62.42)	-	5.48 (84.31)
	Total production	-	-	7.57 (100)	3.30 (100)	-	6.50 (100)
Pea	Seed	-	-	5.00 (33.33)	0.71 (12.54)	-	1.65 (21.40)
	Consumption	-	-	2.50 (16.67)	0.18 (3.18)	-	0.69 (8.95)
	Sold	-	-	7.50 (50.00)	4.77 (84.28)	-	5.37 (69.65)
	Total production	-	-	15.00 (100)	5.66 (100)	-	7.71 (100)
Mustard	Seed	-	-	-	-	0.74 (7.87)	0.62 (5.58)
	Consumption	-	-	-	-	-	-
	Sold	-	-	19.51 (100.00)	-	8.66 (92.13)	10.49 (94.42)
	Total production	-	-	19.51 (100)	-	9.40 (100)	11.11 (100)
Sunflower	Seed	-	-	-	0.21 (1.40)	-	0.21 (1.40)
	Consumption	-	-	-	-	-	-
	Sold	-	-	-	14.79 (98.60)	-	14.79 (98.60)
	Total production	-	-	-	15.00 (100)	-	15.00 (100)

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Table 4.24 Disposal of produce, sample farms, Narsinghpur district, M.P.

(Qt/hectare)

Crops	Disposal	Farm Size					
		Marginal	Small	Semi-medium	Medium	Large	All
Soybean	Seed	0.66 (5.28)	0.54 (5.39)	0.94 (7.88)	1.11 (8.47)	0.99 (8.02)	0.96 (7.84)
	Consumption	-	-	-	-	-	-
	Sold	11.85 (94.72)	9.47 (94.61)	10.99 (92.12)	11.99 (91.53)	11.36 (91.98)	11.29 (92.16)
	Total production	12.51 (100)	10.01 (100)	11.93 (100)	13.10 (100)	12.35 (100)	12.25 (100)
Vegetables	Seed	-	-	-	-	-	-
	Consumption	-	-	1.65 (1.77)	0.83 (5.59)	-	1.44 (1.95)
	Sold	-	-	91.76 (98.23)	14.02 (94.41)	-	72.34 (98.05)
	Total production	-	-	93.41 (100)	14.85 (100)	-	73.78 (100)
Sugarcane	Seed	-	-	-	-	-	-
	Consumption	-	-	-	-	-	-
	Sold	-	-	-	340.14 (100.00)	-	340.14 (100.00)
	Total production	-	-	-	340.14 (100.00)	-	340.14 (100.00)

that with the adoption of improved irrigation technology like sprinkler and drip system farmers were going in for soybean and wheat crops which were **more profitable and less risky.**

The farmers opined that to get higher yields and production of pulses use of H.Y.V. seed, adoption of recommended practices including fertiliser doses and timely application of insecticides and pesticides and irrigation were essential. A section of the farmers asked for higher subsidy on inputs and more remunerative prices and formation of cooperative marketing and processing societies.

4.4.10 Opinion of District Agricultural Officers and AER Centre Officials

1) The reasons for lowering of area under pulses were following -

a) Few years back the area under arhar was quite high. But due to frost and caterpillar infestation farmers did not want to take the risk. They preferred soybean.

b) The working of Rural Agricultural Extension Officers was not satisfactory and no advice could be obtained from them.

c) In the absence of mobile soil testing unitsfarmers did not get information about the fertility status of the soils.

d) Good quality seed was not distributed equally among farmers. It was either given to chosen few of the officials or to tribal farmers.

e) For a good pulse crop quality seed, fertilizers, pesticides were must. However since some years spurious products were sold in the market which proved ineffective.

f) Problems of supply of electricity is very acute. The supply was neither continuous nor adequate.

g) The certified seed had an admixture and the quality was not as desired.

h) Small farmers could not take the risk of growing gram due to frost and caterpillar attack. Those with some irrigation facilities were shifting to wheat cultivation.

i) In lentil and some other pulses, due to high doses of nitrogen, vegetative growth was more and the flower and bean production was less.

2. To increase the area under pulses following measures were suggested.

a) Quality control of seed, fertilizers, insecticide and pesticides should checked from time to time.

b) The Rural Agricultural Extension Officers (RAEOs) should be made more responsible and knowledgeable.

c) More facilities for soil testing be provided.

d) The quality of certified seed should be checked before supplying these to farmers.

4.5 Marketing, Prices and Processing of Pulses

4.5.1 Marketing of Pulses

The pulses are marketed as grains by farmers. The ultimate product sold, is dal. In the case of gram, however, part of the product marketed is in the form of grains. Pulses in the form of grains could not be stored for a long time without taking measures against stored grains pests. Therefore, farmers sold the marketable surplus during the harvest season and a minimum quantity was retained till the pre harvest season which fetched highest price.

It was observed that the maximum price could be obtained by selling the product in mandi. The price received from traders outside the village was lower and the price received within the village was lowest.

4.5.2 Prices of Pulses

In Durg mandi the arrivals of gram were highest (8,141 quintals) in the month of March 1996. The price quoted during that month was lowest (Rs.750) during the year. The arrivals were lowest (2,973 quintals) in the month of August 1996. The prices were highest (Rs.1,150) in that month and subsequent three months. In the case of arhar, the arrivals were highest (2,227 quintals) in

the month of January, 1996. The price quoted in that month was lowest (Rs.1,300). From February onwards the arrivals decreased from month to month but the prices showed an upward trend.

In Jhabua district the arrivals of gram were highest (886 quintals) in the month of March. The price quoted in that month was lowest (Rs.650). From April onwards the arrivals decreased but the prices increased although no definite (inverse) relationship could be noted. In the case of arhar the arrivals were highest (330 quintals) in the month of February and second highest (315 quintals) in the month of March. During these two months the prices quoted were lower than those in subsequent months. Urad was an important crop of Jhabua district. Arrivals of urad were higher in January, February and March (8,065, 6,475 and 5,180 quintals respectively). The prices prevailing in those months were lower as compared to subsequent months. When the arrivals declined, the prices increased. However, no definite relationship (inverse) was observed between arrivals and prices.

In Narsinghpur district arrivals of gram were higher in the three months of March, April and May (6,484, 8,352 and 7,386 quintals respectively). Incidentally these were the months when the prices were lowest in the year. After May the arrivals decreased and were lowest (1,209 quintals) in December. In that month the price quoted was highest. However no definite relationship between arrivals and prices could be noted.

In the case of arhar the arrivals were quite higher in the months of January, February and March (610,700 and 690 quintals respectively). The prices were lower in those months. From April onwards the arrivals generally declined till December. In these months the prices increased from month to month till November. In December the price decreased slightly (Table 4.25).

It would thus be noticed that the general rule of higher arrivals and lower prices and decreasing arrivals coupled by higher prices was proved to be good in the cases of gram and arhar in all the selected districts. However, no inverse relationship was noticed in the trends of arrivals and prices.

Table 4.25 Monthwise arrivals and prices of pulses during the year 1996

Arrivals in Quintals
Prices in Rs.per quintal

Month	Durg district				Jhabua district						Narsinghpur district			
	Gram		Arhar		Gram		Arhar		Urad		Gram		Arhar(Tur)	
	Arri-vals	Price	Arri-vals	Price	Arri-vals	Price	Arri-vals	Price	Arri-vals	Price	Arri-vals	Price	Arri-vals	Price
January 96	3,610	950	2,227	1,300	504	660	293	1,540	8,065	1,410	896	800	610	1,250
February 96	6,026	900	1,733	1,400	513	760	330	1,490	6,475	1,440	2,070	750	700	1,200
March 96	8,141	750	660	1,650	886	650	315	1,450	5,180	1,405	6,484	700	690	1,210
April 96	7,397	900	275	1,680	277	800	115	1,650	4,877	1,800	8,352	725	470	1,400
May 96	4,213	1,100	29	1,750	517	850	10	1,600	5,724	1,800	7,386	750	100	1,520
June 96	5,502	1,100	177	1,750	312	810	30	1,550	2,814	1,650	4,200	820	115	1,500
July 96	3,461	1,125	82	1,800	229	965	60	1,690	3,157	1,950	3,014	900	104	1,570
August 96	2,973	1,150	2	1,800	203	865	271	1,695	4,962	1,490	1,903	960	75	1,609
September 96	3,840	1,150	17	1,780	314	830	75	1,450	4,374	1,340	3,316	950	80	1,600
October 96	3,995	1,150	30	1,775	290	1,050	9	1,525	1,358	1,225	3,690	950	50	1,650
November 96	3,784	1,150	--	--	--	--	--	--	908	1,020	2,688	995	45	1,600
December 96	4,517	1,200	2	1,355	153	1,035	79	1,520	2,073	1,075	1,209	1,050	60	1,575

The arrivals, depended on the 4 seasons of harvest, post harvest, sowing and pre harvest seasons. During the harvest season the arrivals were high and the prices were low. On the other hand during sowing and pre harvest seasons the arrivals were weak and the prices soared.

4.5.3 Processing of Pulses

It may be mentioned that processing of pulses was not done at the household or village level except for the needs of own consumption. The produce was sold in mandis, to agents of dal mills and traders. These in turn, sold the produce to dal mills. At the dal mills processing of all kinds of pulses was undertaken. The investigations of the sample dal mills indicated that the quantity processed varied from 25 quintals a day to 120 quintals per day. It varied with the capacity of the mill, season and the demand for dal. It was estimated that in 1 quintals of pulse grains processed, 70-75 kg. of fine dal was obtained. The damaged dal weighed 2 kg. Among the by products bran weighed 12 kg., shell 8 kg. and small pieces 3 kg. (Table 4.26)

Table 4.26 Products obtained from a quintal of pulses

Product/By product	Percentage by weight
1. Fine product	75
2. Damaged product	02
3. By products	
a) Small pieces	03
b) Bran	12
c) Shell	08
Total	100

According to mill owners the percentage of profit in the processing of pulses (conversion of pulses into dal and other products) ranged between 25 to 30 per cent over the price of pulse.

The farmers producing pulses suffered from three ills.

1) The pulse grains being less hardy had to be sold in the harvest and post harvest seasons when there was glut in the market and the prices were low.

2) As the farmer was not able to process and defer the sale he was deprived of the much higher price the dal fetched in the later period, both within the district and outside the district and the state.

3) Not only the farmers faced distress sale but also had to wait for the returns of the product for months.

It may be said that the real beneficiary of marketing and processing of pulses was the dal mill owner who purchased pulses at the lowest price of the season, processed the pulses and got the value of every small product and by product. He deferred the sale of products and by products to the lean season and got the highest price. The farmers, on the other hand, got no benefit of marketing and processing. The only way to benefit the small and big farmers was to set up dal mills in the cooperative sector by the farmers cooperatives.

4.6 Other Aspects

In relation to the objectives set forth observations were made and noted as below.

1. Socio-economic characteristics and pulses cultivation
The pulses cultivation was not restricted to a particular socio-economic group of farmers. The pulses were grown by all socio-economic groups and size groups.

2. The factors which affect the growth of pulses area and productivity were

1) Tradition of growing pulses and technology acquired in cultivation including correct input use.

2) Knowledge of enrichment of soil nitrogen due to growing of pulses.

3) Cultivation as mixed crop to thwart the possibility of total failure of main/cereal crop.

4) Household needs of pulses.

5) Traditional relations with market agencies and receipt of remunerative prices for the product.

6) Absence of substitute crop in the given limitations of soil quality (marginal land) and irrigation.

7) Lower capacity to invest in high capital intensive crops.

8) Inthe absence of irrigation facilities and early withdrawal of monsoon no other crop can be grown.

3. Factors responsible for diversion of area under pulses

Since there was no diversion of area from pulses to other crops on the selected farms the extent of diversion could not be assessed. It was, however, noted from the discussions with govt. officials and knowledgeable farmers that pulses were grown on marginal and unirrigated lands and were risky crops due to insect and pest infestation. With the spread of area under irrigation due to new technology developed in irrigation such as sprinkler and drip system of irrigation larger area can be brought under irrigation. This resulted in diversion of area under pulses to more remunerative and less risky crops like soybean and wheat.

4. Reasons for non/partial adoption of improved production technology are following

a) Adoption of full/partial adoption of production technology required higher investment. Farmer is best judge of where to invest. Since pulses were not highly remunerative crops and on the other hand risky crops farmer would like to invest on additional inputs on crops which give highest profit per hectare and where input output ratio was higher. On both these counts pulses were relegated to the lower positions and therefore did not receive farmer's attention with regard to use of higher and quality inputs.

b) Improved seed varieties were either not available or if available these were not sufficient for all the farmers. Selective approach by govt. officials excluded many farmers from getting the benefit of seed.

There were complaints regarding quality of seed supplied as certified seed.

The prices of fertilisers have abruptly increased during the last few years restricting the use by marginal, small and even semi-medium size farmers.

c) There were lot of complaints about the quality of fertilisers and pesticides available in the market. These prevented farmers from using these inputs.

5. The factors responsible for restricting the increase in production and productivity of pulses were financial and have been described in the preceding paragraphs. The factors were related to adoption of improved production technology.

6. Factors responsible for large gap between purchase price of pulse from farmers (very low) and sale price (of dal) to consumers (very high) of pulses.

Factors have been indirectly narrated in the preceding section on "marketing, prices and processing of pulses". However some of the points may be reiterated and some of the additional factors are enumerated below.

a) The pulses were marketed as grains by farmers. The ultimate product sold was dal. Pulses could not be stored for a long time in the form of grains without taking measures against stored grain pests. Therefore, most of the farmers sold largest share of marketable surplus during the harvest season. This resulted in a glut in the market. Consequently the prices crashed. A study on arrivals of pulses and prices during different months of the year in mandis of the selected three districts has clearly indicated that-

i) Arrivals of gram were highest in the months of March, April and May. In these months the prices were lowest. The arrivals decreased after May and the prices started increasing.

ii) In the case of arhar the arrivals were highest in the months of January, February and March. The prices of arhar were lowest in these months. The arrivals started decreasing after March, whereas, prices started increasing.

iii) It is thus clear that most of the farmers brought the produce during the harvest season and got the lowest price of the year.

The millowners procured the pulses at the lowest price of the year. They processed the pulses and got dal and other products. It was noted that the mill owners made a profit of nearly 30 per cent of the value of pulses purchased excluding the cost of milling. This profit is immediately after the purchase of pulses made in the harvest season. If they preferred to sell the pulses to a deferred date the profit margin increased as the supplies of dal shrank after the harvest season till the next crop of pulses reached the market. In such a situation profit percentage may increase to any thing above 50 per cent.

7. Contract Cultivation

As regards contract cultivation the variation in area, production and productivity of pulses in the selected districts has been noted in chapter III.

With such a variation in area, production and yield farmers would not come forward for contract cultivation. During interview with the selected farmers none did appreciate the idea of contract cultivation. Of the three districts the chances of contract cultivation were none in Durg and Jhabua districts. In Narsinghpur district, with the variability in area, production and yield being least the chances of contract cultivation could be explored in few pockets of the district for arhar and gram.

4.7 Constraints in Raising the Pulses Production

On the basis of data collected in farmers' schedules and the discussions with the farmers and state government officials following constraints have been identified which hinder the raising the production of pulses.

1. Unlike in rice and wheat there were no high yielding varieties of pulses. In majority of cases old and traditional varieties were grown.

2. The supply of new varieties of seed was limited. The seed was cornered by either influential farmers or was supplied to tribals. Seed was not available at subsidised rates.

3. For Chhattisgarh region (rice bowl) early maturing variety of gram was necessary to be sown after the harvest of rice.

4. There were no improved/high yielding varieties of teora and lentil. Some of the recommended varieties of arhar were susceptible to heavy rain and water-logging conditions.

5. Although practices had been recommended in the case of some pulses farmers did not adopt these due to lack of funds.

6. Pulses had lower profitability per hectare and lower input output ratio. Therefore, pulses could not compete with other cereals, oilseeds and cotton.

7. Due to lower profitability pulses were grown on lower fertility soils or marginal lands. Since pulses had lower profitability farmers did not want to invest more on costly inputs resulting in lower yields and it initiated a vicious circle of lower investment, lower output, lower profitability and therefore, lower investment. Good quality land was used at the most for gram that too where irrigation was available. The high fertility soils were used for the cultivation of rice, wheat, maize, cotton, soybean, etc.

8. Pulse crops were susceptible to insects and pests and therefore farmers had to be trained in pest management.

9. Pulses were disposed of in the harvest season itself as the pulses were susceptible to stored grain pests.

10. There was a belief that inspite of sky rocketing prices of pulses the farmers were not taking up the cultivation of pulses in a big way. However, it may be mentioned

that the real beneficiary of increasing pulse prices was not farmer but dal mill owner. As mentioned earlier pulses were susceptible to stored grain pests and therefore the farmers disposed of the produce in the harvest season itself. Due to this there was glut in the market and the dal mill owner could procure pulses at the lowest prices. The dal mill owner purchased pulses grain at low prices, processed these and sold the product dal and other by products. The profit margin in the process ranged between 30 to 35 per cent even in harvest season. If the dal mill owner could store dal and defer the sale to later date the profit margin increased to more than 50 per cent excluding the cost of processing. The only way to benefit farmers from processing and deferring the sales was to encourage cooperative marketing and processing societies.

11. Some of the pulses were susceptible to fusarium wilt and mosaic.

12. Pulses were grown on unirrigated land as the farmers could not afford costly input like irrigation for low profitable crops of pulses. Actually gram was the only pulse crop partially irrigated. No sooner the irrigated area on a farm increased or the irrigation intensity increased the pulse crop such as gram was replaced by more profitable and less risky crops like wheat, soybean, cotton and sugarcane.

13. With low profitability of pulses farmers used very little of fertilisers and pesticides. The farmers were further discouraged when they found that the fertilisers and pesticides were spurious or of inferior quality.

14. Due to imbalanced use of fertilisers (nitrogen dominated) there was excessive vegetative growth resulting in lower production.

15. In Jhabua district kulthi, although largely grown was a neglected crop. It was sown on marginal lands as late as in August, sometimes after the main crop failed.

Narsinghpur

16. In Narsinghpur district area under arhar was replaced by soybean as few years back arhar was affected due to frost and insect attack.

17. At the grass root level the working of Rural Agricultural Extension Officers was not satisfactory as farmers could not obtain any advice from them. There was absence of mobile soil testing units. The farmers could not get information on the fertility status of soil to apply right type of fertilisers.

18. Whatever little of irrigation was available, it was adversely affected due to electricity shortage. The electricity supply was neither continuous nor adequate.

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CHAPTER V

SUMMARY AND CONCLUSIONS

5.1.1 The New Agricultural Technology (NAT) introduced during the mid-sixties has increased the production of foodgrains significantly. However, it did not make uniform impact on all the crops. Production of rice & wheat increased substantially, while it was almost stagnant in pulses. Although productivity of rice and wheat recorded substantial increase the productivity of pulses was almost stagnant over the last four decades. Despite many promotional schemes for increasing pulses production during the different plan periods, the production of the 1990's was almost the same as it was in the early 1960s. Non-availability of good high yielding varieties, as in the case of paddy and wheat, was one of the main reasons for slow growth in pulses production.

India is the largest producer of pulses in the world, both in quantity and quality. The area under pulses in India in 1995 was 24 million hectares or 35.45 per cent of the world area.

The production of pulses in India in 1995 was 14.8 million tonnes. It formed 26.46 per cent of the world production. However, India's yield (595 kg/ha) lagged far behind that of world average (796 kg/ha). Once a net exporter, India is presently one of the largest importers of pulses because our domestic production is chronically short of domestic demand. The crisis of pulses is gradually firing up its grip due to growth in population and introduction of protein based food industries. To bridge the gap between demand and supply of pulses, India needs manifold increase in pulses production.

5.1.2 Pulses are the primary and cheapest sources of vegetable protein for the poor and the vegetarians who constitute majority of Indian population. Protein content of different pulses varies from 20 to 40 per cent which is two to three times more than the cereal grains (wheat and rice). From the agronomic point of view, pulse crops increase the soil fertility through the nitrogen fixing bacteria present in the root nodules. Pulse crops are also helpful to increase the source of income of the farmers by way of intercropping, frequency and crop intensity.

The increasing shortages of pulses, resulted in more and more imports. The per capita net availability of foodgrains increased from 468.7 gm./day in 1961 to 510.1 gm./day in 1991. However, the availability of pulses declined from 69 gm/day in 1961 to 41.6 gm/day in 1991 and further to 34.8 gm/day in 1996. To meet the growing needs of the country, the pulse production programmes were initiated with different developmental strategies during different plan periods.

5.1.3 Several studies have been conducted in the past on pulses. These have offered many reasons for the stagnant area and production of pulse crops. Pulse crops are predominantly grown in rainfed areas where moisture/stress is enormous. Some studies showed that since these are grown mainly in the rainfed areas, farmers are reluctant to use quality inputs such as fertilisers, pesticides etc. Farmers mainly use owned seeds, untreated and of worn out varieties. Though the absolute price of pulses is relatively higher than many competing crops, the total profit is less owing to low productivity. Farmers generally allot poor lands in terms of soil quality and irrigation facilities for growing pulse crops. Adoption of plant protection measures such as weeding, application of rhizobium culture, application of pesticides, etc. are not taken seriously for pulses cultivation. Generally pulses are susceptible to pests, diseases and weather fluctuations and involve a lot of risk.

Unlike in rice and wheat, importance is not given to study the problems and constraints relating to pulses production by using field level data. Lower productivity and lower use of inputs are field level problems and these can be studied only by field level information. In this connection, the Ministry of Agriculture, Government of India asked the Agro-Economic Research Centres to study the constraints and opportunities for pulse production in the respective states. The Agro-Economic Research Centre for M.P. Jabalpur has taken up this study in Madhya Pradesh.

5.1.4 The objectives of the study are :

(1) To find out the socio-economic characteristics of the farmers who cultivate pulse crops.

(2) To analyse the input use pattern of pulse crops

(3) To analyse the relationship between the use of inputs and output.

(4) To find out the factors which affect the growth of pulses area and productivity

(5) To find out the economics of production of different pulse crops grown under irrigated and rainfed conditions as compared to other predominant crops of the area in different seasons.

(6) To identify factors responsible for diversion of area from pulses to other crops and the extent of diversion and its result.

(7) Possibilities and extent of diversification and expansion of area under pulses by way of multiple cropping, inter-cropping, etc. both under rainfed and irrigated systems.

(8) Identify reasons for non/partial adoption of improved production technology and sub optimal use of inputs like improved seed, phosphatic and sulphur rich fertilisers and other micro-nutrients, plant protection chemicals and other inputs.

(9) To suggest various measures (financial and non financial) for increasing production and productivity of pulses.

(10) Factors responsible for large gap between purchase price from farmers (very low) and sale price to consumers (very high) of pulses.

(11) To explore the possibility of contract cultivation of pulses within the country and suggest most suitable areas to undertake this for different pulse crops.

Due to non availability of data on some of the above objectives no observations could be made/conclusions drawn.

5.1.5 Out of the three agro-climatic zones forming Madhya Pradesh, the district of Durg from the agro-climatic zone VII, i.e.,'Eastern Plateau & Hills Region', district Narsinghpur from the agro-climatic zone VIII, i.e. Central Plateau & Hills Region' and district Jhabua from agro-climatic zone IX, i.e. 'Western Plateau & Hills Region' were selected for field work as the area under pulse crops was

highest in these districts among the districts of the respective three zones. From each selected district 5 blocks were selected and from each block one village was selected. Finally, from each of the selected villages, lists of category wise pulse growers, viz., marginal, small, semi-medium, medium and large farmers were prepared with the help of respective Senior Agricultural Development Officer of the block. A sample of 10 pulse growers from each village was randomly selected. In this way, a total of 150 pulse growers, comprising 50 from each of the districts, were selected for the study. The farmers have been divided into five size groups according to the size of land holdings viz., Marginal (upto 1.00 ha), small (1.01 to 2.00 ha), Semi-medium (2.01 to 4.00 ha), medium (4.01 to 10.00 ha) and large (above 10.00 ha.), The reference year of the study was agricultural year 1996-97, viz. crop season rabi 1996, summer 1997 and kharif 1997. Both primary as well as secondary data were collected. Primary data was collected from sample farmers and secondary (time series)data was collected from various agricultural statistics of Directorate of Agriculture, Govt. of Madhya Pradesh, Bhopal. Besides these, the data from dal mill owners of selected districts for the year 1996 (January to December) were collected to understand the factors responsible for large gap between purchase price from farmers and sale price to consumers of pulses. For calculating the trend and growth rates of area, production and productivity of various pulse crops at National level and state level, the exponential trend model was fitted from the regression analysis method (least square technique). The extent of variability in area, production and yield of pulses was measured by the coefficient of variation (C.V.). For computing the contribution of area and yield towards change in production (increase/decrease) between two trienniums, the formula given by Sharma 1977 was used. Cost means Cost A2. Costs were calculated with the help of standard cost concept method. The items included in cost A2 are cost A1 + rent paid for leased in land.

5.2.1 India is the largest grower and producer of pulses in the world as it ranks first in both production (26 per cent) and area (35 per cent) under pulses. Despite being the largest producer, the pulse productivity is one of the lowest in the world. The area

under pulses increased from 18,780 thousand hectares in 1951-52 to 23920 thousand hectares in 1995-96 in the country. In relative terms, area under pulses has been hovering around 19 per cent of the total area under foodgrains. So far as the pulses production scenario in the different states of the country is concerned, Madhya Pradesh is the largest producer of pulses. Madhya Pradesh accounted for 21.45 per cent of the total area under pulses in the country and its share in total production was 23.50 per cent of the country's production. The average productivity level was also much higher in Madhya Pradesh as compared to the national average. The other major pulse growing states in the country were Rajasthan, Maharashtra, Uttar Pradesh, Orissa, Karnataka and Andhra Pradesh. Other States with considerable area were Tamil Nadu, Bihar, Gujarat, Haryana and West Bengal. Madhya Pradesh, Uttar Pradesh, Maharashtra, Rajasthan and Orissa are the major pulse producing states accounting for about 72 per cent of pulses area in the country and 73 per cent of the total production.

5.2.2 The requirement for pulses for 1994-95 as per physiological norms set by ICMR (Normatic Demand Model) works out to 14.32 million tonnes for which production requirement is estimated at 17.66 million tonnes, but the projected supply comes to only 14.50 million tonnes. indicating a huge gap (3.16 million tonnes) between demand & supply. By the turn of the century (2000-2001) production of 19.77 million tonnes would be required to meet the consumption requirement of about 16.04 million tonnes, but the projected supply of pulses comes to only 16.30 million tonnes indicating a gap of 3.47 million tonnes between demand and supply.

5.2.3 Madhya Pradesh has earned an important place in the country's map as it ranked first both in terms of area and production of pulses. The area under pulses in 1982-83 was 5,139 thousand hectares. Thereafter it varied between 4,534 thousand hectares (1991-92) and 5,195 thousand hectares (1994-95). However, it decreased to 5,176 thousand hectares in 1995-96 and to 5,024 thousand hectares in 1996-97. The production of pulses in Madhya Pradesh fluctuated between 2,343 thousand tonnes (1984-85) and 3,654 thousand tonnes (1994-95). The yield of pulses per hectare was 507 kg. in 1982-83 and 705 kg. (highest) in 1996-97. Gram is the major pulse crop of the country as well as the state of Madhya Pradesh. In Madhya Pradesh the area

of pulses increased from 4,988 thousand hectares to 5,132 thousand hectares during the two trienniums. This increase was due to increase in the area under gram, lentil and pea. Other pulse crops showed a declining tendency. The production of pulses increased from 2,551 thousand tonnes to 3,432 thousand tonnes during the two trienniums. This increase was mainly due to the increase in production of gram, teora, lentil & pea. Other pulse crops showed decrease in production. Gram registered highest production increase. In Madhya Pradesh, the highest percentage increase in yield was noticed in teora and lowest in arhar. There was no decline in yield of any crop. In Madhya Pradesh, all the pulse crops had declined area except lentil, pea and gram. In the case of production, lentil registered highest increase. Teora registered highest increase in yield. The growth rate of area was highest in the case of lentil followed by pea, gram, and teora. Moong-moth, urad, kulthi and arhar registered negative growth rates in area. In the case of production, very high growth rate was observed in teora, lentil, pea and gram. In the case of yield, all the pulse crops registered positive growth rates. The variation in area was observed highest in the case of moong-moth followed by pea, lentil, urad, teora and kulthi. Variation in production and yield was highest in the case of teora. Comparing the growth rates of pulses in Madhya Pradesh with the country's, one can see that growth rates of production and yield are highly significant in M.P. for the period 1982-83 to 1996-97, whereas the growth rates are simply significant for India. The coefficient of variation is higher for Madhya Pradesh indicating the more fluctuations than the aggregates figures for the country. The compound growth rate for the country's area is negative for the period 1982-83 to 1994-95 which clearly reflects the short fall of pulses and forcing the country to import pulses. In Madhya Pradesh gram, teora, lentil and pea registered an increase in the production between two trienniums. In the case of gram and teora, yield was the main factor and in case of lentil and pea area was the main factor responsible for increase in production. In the case of total pulses at both the levels (National and State), the change in production was observed positive. In both the cases yield was the main factor responsible for increase in the production.

5.3.1 For the purpose of field level study Durg, Jhabua and Narsinghpur districtsof Madhya Pradesh were selected. Durg district is located in the north-eastern part of the state and is a part of Chhattisgarh region and occupied an area of 8,702 sq.km. and had a forest area of 11.45 per cent of the total geographical area. The density of population per sq.km. was 281. It had 65 per cent rural population and 35 per cent urban population. The district had 12.80 per cent scheduled castes population and 12.43 per cent scheduled tribes population. The literacy percentage of the district was 47.89. Agriculture in the district is mainly dependent on rainfall which although high in magnitude is erratic and uneven in distribution leading to higher intensity of rainfall alternating with periods of moisture stress. Fertiliser consumption in the district was 32.25 kg/ha. The cropping intensity was 144.43 per cent, and the irrigation intensity was 109.86 per cent. Only 28.7 per cent of the gross cropped area of the district was irrigated. The important crops of the district were paddy, teora, gram, linseed and wheat. Cereals dominated the cropping pattern occupying 57.23 per cent followed by pulses, oilseeds and fruits & vegetables.

Jhabua district lies in the extreme western part of the state and is in entirety sub region of Madhya Pradesh. Jhabua is a tribal district of Madhya Pradesh. The fields are undulating, slopy, light and stoney in most parts. The soils are poor and not well suited for cultivation. The water retention capacity of the soils is very poor. Early withdrawal of monsoon rains and soil and water run-off are the important constraints in crop production. The main source of income is agriculture. In kharif season farmers grow maize, jowar, cotton, groundnut, urad, moong and lesser millets like kodo, whereas, in rabi season, wheat, gram and castor are grown. Ninety per cent of the area is sown during kharif and 10 per cent in rabi. Crop raising is very difficult in the hilly areas of Jhabua district. Still, more than 50 per cent of the total geographical area is under cultivation. The area under forest is 19.13 per cent. Of the total population 85.67 per cent belonged to scheduled tribes, 3.06 per cent to scheduled castes and the remaining 11.27 per cent to other castes. The district was rural in character as 91.32 per cent of the population resided in villages.

The literacy percentage of the district was 14.54. The climate is arid to sub-arid with an annual average rainfall of 800 mm. The rainfall is erratic and annual variation in rainfall is a regular feature. The consumption of fertilisers is very low (about 19 kg/ hectare). The cropping intensity was 127.50 per cent and irrigation intensity was 102.07 per cent. Of the net cropped area only 19.17 per cent was irrigated. Cereals dominated the cropping pattern followed by pulses and oilseeds.

Narsinghpur district lies almost in the central part of the state and had an area of 5,136 sq.km. and forest area of 26.53 per cent of the total geographical area. The density of population per sq.km. was 153. Of the total population, rural population was 85.13 per cent and urban population was 14.87 per cent. The population belonging to scheduled castes and scheduled tribes was 16.59 and 12.90 per cent respectively. The proportion of main workers was 36.08. The workers were mainly engaged in agricultural activities. The literacy percentage was 45.33. The average rainfall in the district was 1,300.8 m.m. The consumption of fertilisers was 33.73 kg/ha. Nearly 58 per cent of the district area was under cultivation. The cropping intensity was 135.44 per cent and the intensity of irrigation was 102.15 per cent. Of the gross cropped area 36.09 per cent was irrigated. Among three districts, percentage of forest area was highest in Narsinghpur district followed by Jhabua and Durg. Rural population was highest in Jhabua district followed by Narsinghpur and Durg districts. Percentage of population of scheduled tribes was maximum in Jhabua district followed by Narsinghpur and Durg. The percentage of main workers was highest in Durg district. The proportion of cultivators was highest in Jhabua district and the proportion of agricultural labourers was highest in Narsinghpur district. Literacy percentage was highest in Durg district. Consumption of fertilisers (in kg/ha) was highest in Narsinghpur. Both cropping intensity and irrigation intensity were highest in Durg district. The proportion of irrigated area to net cropped area was highest in Narsinghpur district followed by Durg and Jhabua districts. Cereals dominated the cropping pattern of Durg district, whereas, in Narsinghpur district, pulses (gram) dominated. In Jhabua district, maize and urad dominated the cropping pattern.

5.3.2 In Durg district the rates of growth of area, production and yield of arhar were negative. Teora, lentil and gram showed positive rates of growth in area, production and yield. Teora registered highest growth rates in area and production and urad showed highest rate of growth per annum in yield. In the case of total pulses, the area, production and yield registered positive growth rates. Urad and gram were major pulse crops of Jhabua district. The highest growth rate was observed in area and production of gram and yield of urad. Arhar registered negative growth rates in area, production and yield. In the case of kulthi, the growth rate of area was negative but the growth rate was positive in the case of production and yield. In Narsinghpur district, three crops, namely, arhar, moong and pea registered negative growth rates in area, production and yield. Only gram showed positive growth rates in area, production and yield. Lentil also showed positive and significant growth rates in area and production but negative growth rate in yield. Overall picture shows that gram and total pulses registered positive growth rates in area, production and yield in all the three selected districts, whereas, arhar registered negative growth rates in area, production and yield in all the three districts. Coefficient of variation is an important tool for the stability analysis. Coefficient of variation of area, production and yield of total pulses in Narsinghpur district is lower as compared to Durg and Jhabua districts. It shows that Narsinghpur district is more stable than other two districts. The growth rates of area and production of gram in all the three districts are positive. The growth rates of yield were positive and significant in Jhabua but non significant in Durg and Narsinghpur. The C.V.of area (4.83 per cent) and production (13.52 per cent) of gram in Durg district is lowest followed by Narsinghpur and Jhabuadistrict.

5.3.3 In the case of urad (Durg & Jhabua districts) and teora (only Durg district) very high fluctuations were observed in area, production & yield during the ten years period. In the case of lentil in Durg and Narsinghpur districts, the yield was more stable than area and production. The growth rates of area, production & yield of arhar in all the three districts are negative. On the other hand, the amplitude of fluctuations in area, production and yield of arhar in Narsinghpur district is lower than the other two districts.

It means area, production and yield of arhar in Narsinghpur district is more stable. In the case of kulthi, area was more stable than production & yield in Jhabua district. In the case of moong-moth, yield was more stable than area and production, whereas, in pea the area was more stable than yield and production in Narsinghpur district. Another important aspect is that compound growth rate of total pulses for area is highly significant for all the three districts showing that farmer's preference for the pulses. But the growth rates for production and yield in Durg and Narsinghpur districts are non-significant which show the ample scope to increase the yield of pulses in these two districts. In the case of Durg and Jhabua districts, change in production of pulse crops was mainly due to area effect, (except gram in Durg district and kulthi in Jhabua district) whereas, in the case of Narsinghpur district contribution of yield was more.

The component wise total physical targets and achievements of National Pulses Development Project in five years (1992-93 to 1996-97) show that in Durg district the percentage of achievements to target was highest in the case of PSB culture (9,159.66 per cent) followed by farm implements, storage bins, rhizobium culture, plant protection implements and distribution of certified seeds. In the case of other components, the achievement was less than the target. In Jhabua district, the percentage of achievement was highest (418.66 per cent) to target in the case of PSB culture followed by micro-nutrients (365.00 per cent), farm implements (231.05 per cent), distribution of certified seeds (150.11 per cent), sprinkler sets (118.57 per cent) & rhizobium culture (105.99 per cent). In the case of training, achievement was equal to the target (100 per cent). In Narsinghpur district the percentage of achievement to the target was maximum (497.83 per cent) in the case of farm implements followed by PSB culture (318.84 per cent), distribution of certified seeds (212.31 per cent), rhizobium culture (139.09 per cent) and distribution of seed minikits (101.56 per cent). It was lowest in the case of foundation seeds (11.16 per cent). The financial achievement of NPDP during five years in Durg, Jhabua and Narsinghpur districts shows that the percentage of allocation to the allotment received was 85.52, 91.23 and 83.83 per cent respectively.

5.4.1 In Durg district the number of workers per family was 3.80. The number generally decreased with the size of farms. It ranged between 2.50 on large size group and 4.21 on small size group. The operated area per holding was 2.64 hectares. The system of leasing out area was uncommon on the selected farms as only 1.12 per cent of the area owned was leased out. No farm had leased in land. Marginal and small farms were higher in number (52.00 per cent). The area under control of these farms was quite low (18.34 per cent). On the other hand 24 per cent of farms belonging to medium and large categories commanded as high as 58.17 per cent of the area. The percentage of irrigated area was only 3.53 on the marginal size group. It increased with the size of holdings and was 32.07 on the large size group. Wells commanded largest percentage (66.64) followed by canals (27.98). Rice was the most important crop occupying 47.20 per cent of the cropped area in 1995-96. Teora was the second important crop & occupied 25.13 per cent of the cropped area. The third important crop was gram and occupied 14.21 per cent of the cropped area. The percentage of area under gram was higher on larger farms, whereas, the percentage under teora was lower on larger farms.

In 1996-97 the proportions of area under different crops were similar to that in 1995-96. It was noted that the proportions of area under rice and gram declined marginally and that under soybean and wheat increased marginally. Of the total area under pulses as high as 93.39 per cent area was under single crop and only 6.61 per cent area was under mixed crops. The percentage did not change much in 1996-97 and was 92.95 and 7.05 respectively. It was noted that larger area (65.38 per cent) was sown broadcast and 34.62 per cent area was line sown. In 1995-96 nearly entire area under pulses (99.06 per cent) was unirrigated. The situation remained same in 1996-97 with 98.94 per cent area unirrigated. Input cost was calculated separately for irrigated and unirrigated areas. In Durg district only gram was partly irrigated. Other pulses (arhar, teora, urad and lentil) were grown unirrigated. The cost per hectare of irrigated gram was Rs.6,915.97 and that of unirrigated gram, Rs.6,458.60. The most important item of cost was seed and seed treatment and accounted for 35.74 per cent. The

second important item was fertilisers and the third item of importance was plant protection. In the case of arhar the sequence of importance of inputs was seed and seed treatment, fertilisers, sowing and weeding, preparatory tillage and harvesting. In the cases of teora, urad and lentil the item seed and seed treatment remained most important with still higher percentage of total cost. The second important item was harvesting etc. in the case of teora, preparatory tillage in the case of urad and fertilisers in the case of lentil. Of the crops studied input and output values per hectare were highest Rs.15,662.00 and Rs.42,292.00 respectively for vegetables. The input-output ratio was highest (2.70) for vegetables. It was observed that value of input, output and profit per hectare and input-output ratio was highest for vegetables. The input and output values per hectare were lowest for teora. However the lowest profit per hectare was for kodo and the input-output ratio was lowest for linseed. From the farmers' point of view vegetables, rice (irrigated) and soybean (irrigated) were the three crops with highest profitability per hectare. Among pulses lentil earned highest profit per hectare of Rs.6,571. Gram (irrigated) and arhar were next important pulses. Incidentally irrigated wheat earned lower profit per hectare than unirrigated gram. Urad came next and earned a profit of Rs.573 per hectare. Teora incurred a loss of Rs.625 per hectare. It will thus be seen that except lentil and irrigated gram none of the pulses could compete with the other non-pulses crops (specially irrigated ones) on the criterion of profit per hectare. The pattern of disposal varied with the crop and size of holdings. In the case of rice 63.35 per cent of the produce was sold and 31.12 per cent was consumed. The remaining 5.53 per cent was storedfor seed. The percentage of produce retained for seed did not vary with the size of farms. In the case of kodo the percentage of quantity consumed was 81.36. Another 10.03 per cent of the quantity was sold and the remaining 8.61 per cent quantity was kept for seed. In the case of wheat the largest percentage of produce (57.50) was used for consumption. Another 29.08 per cent was sold and the remaining 12.52 per cent was stored for seed. As pulses were produced mainly for market largest proportion viz. urad (79.52), arhar (54.12), gram (73.63), lentil (66.45) was marketed. The second important item

of disposal was consumption in the cases of urad (10.24) and arhar (34.22). It was seed in the cases of gram (17.22) and lentil (20.39). In the cases of urad and gram the percentage of quantity marketed increased with the size of holdings. In the case of arhar and lentil there was no such relationship. Teora is a staple pulse in Durg district. Therefore, the percentage of total production on consumption was largest (49.83). This was followed by proportion of quantity sold (33.33) and quantity retained for seed (16.84).

The percentage of quantity consumed was higher on smaller farms, whereas, the percentage of quantity sold was higher on larger farms. Vegetables were produced for sale and therefore 98.62 per cent of the total production was sold and the remaining 1.38 per cent was consumed. Soybean and linseed were produced mainly for sale. In the case of soybean the percentage of produce marketed was 87.61 and that kept for seed was 12.39 . In the case of linseed the percentage of produce sold was 75.77 and that kept for seed was 13.08. The farmers enumerated following factors which affect the growth of pulses.

1. Pulses were cash crops and fetched good prices
2. The pulses require lower inputs and the produce fetched higher price
3. Pulses increased the productivity of soil
4. Pulses could be grown without irrigation or with limited irrigation

The reasons enumerated for increase in production were-

1. New techniques were developed
2. New varieties were being grown
3. Farmers had started using, culture, pesticides etc. for pulses.

About 60 per cent of the selected farmers grew new varieties of pulses. The reasons given for not using new varieties included; small holding size, land of poor quality, there were no high yielding varieties of teora. Majority of farmers were not adopting recommended practices of pulse cultivation. The main reason for this was lack of funds. The best soil was used for rice and not for pulses. About the replacement of crops due to

pulses some of the farmers said that the land earlier used for kodo was now utilised for pulses and soybean. About the steps that should be taken to increase the area under pulses the suggestions offered were :

1. New and high yielding varieties should be evolved.
2. Seed should be available on subsidised rates.
3. Suitable variety of gram should be evolved to be taken after rice.
4. Early maturing rice varieties should be evolved so that some pulses can be grown after rice.
5. Effective insect and pest control measures should be taught.
6. The productivity of pulses could be increased by using H.Y.V. seed, higher and correct dosage of fertilisers, pesticides and culture.

Opinions of District Agricultural Officers & AERC Officers were :

1. Of late there had been an increase in the area under pulses in some areas. The reasons were :
   a) There were schemes popularising pulses and propoganda made thereof.
   b) Pulses had ready market.
   c) The cost of production per hectare was lower than that of rice.
   d) Pulses increased the productivity of soil by fixing nitrogen.
   e) In some areas new varieties seed were used and new techniques were used.
2. The reasons for not growing pulses were also many.
   a) In gram, variety JG 74-315 was grown. However farmers needed still new varieties.
   b) Of late the gram variety was found to be susceptible to fusarium wilt.
   c) There was still demand for late sown variety of gram.

d) In urad T-9 variety was grown. However, it was found to be susceptible to mosaic.

e) There was strong demand for H.Y.V. of lentil.

f) In arhar wilt was affecting the crop since last some years.

g) In teora, the most important pulse crop of Chhattisgarh local varieties were used. There was need for new varieties.

h) Since last 5-6 years rains were abnormal affecting the rainfed pulses.

i) Some of the recommended varieties of arhar were found to be susceptible to heavy rains and water-logging conditions.

5.4.2 In Jhabua district the number of workers per farm was 3.82. The number per farm decreased with the size of farms. It was 4.00 on marginal size group and decreased to 3.50 on semi medium and medium size groups. The operated area of an average holding was 1.80 hectares. None of the selected farms either leased in or leased out any area. The distribution of land among different size groups was quite skewed. Of the total operated area 29.79 per cent was irrigated. There was no relationship between size of farms and percentage of irrigated area. Wells were the major sources of irrigation commanding 72.13 per cent of the irrigated area. Other sources such as nallahs, rivers and lift irrigation accounted for the remaining 27.87 per cent. In 1995-96 maize occupied the largest percentage (17.32) of area among cereals. Wheat occupied second largest (13.49) per cent. Urad (24.08 per cent), gram, (10.90 per cent) and kulthi (5.00 per cent) were other important pulses. The cropping pattern remained almost same in 1996-97. The percentages of area under different crops had no relationship with the size of farms. Urad, gram and kulthi were important pulses on the selected farms. In 1995-96 in the case urad, kulthi, arhar and moong only local varieties were grown. In the case of gram, varieties JG-74 and Ujjain-21 were sown, besides local varieties. Most of the area under pulses (98.34 per cent) was sown as single crop. Major area (84.39 per cent) was line sown and the remaining 15.61 per cent was sown by broadcast

method. High percentage (70.86 per cent) of the area under pulses was unirrigated. In 1996-97, slightly higher percentage of area was sown mixed. In 1995-96 kulthi was sown as pure crop, whereas, arhar and gram were sown as mixed crops. Gram was generally irrigated, whereas, urad and kulthi were generally unirrigated. The status of crops as regards sowing practices remained more or less same in the year 1996-97.

The cost per hectare of irrigated gram was Rs.3,988.56 and that of unirrigated gram Rs.3368.08. The most important item of cost in Jhabua district was seed and seed treatment forming 31.66 per cent followed by preparatory tillage (27.25 per cent), fertilisers (16.82 per cent), depreciation (7.71 per cent), irrigation expenses (5.82 per cent) and interest on working capital (5.24 per cent) respectively. For urad the most important item of cost was preparatory tillage (30.37 per cent) followed by seed and seed treatment (19.85 per cent) and fertilisers (15.94 per cent). For arhar the most important item was seed and seed treatment (26.04 per cent) closely followed by preparatory tillage (25.63 per cent), harvesting, etc. (12.41 per cent), sowing and weeding (11.98 per cent) and depreciation (7.81 per cent) respectively. In the case of kulthi, seed and seed treatment formed as high as 40.12 per cent of the total cost. In the case of moong the four most important items of cost were preparatory tillage, sowing and weeding, fertilisers, and seed and seed treatment respectively. Input value per hectare was highest for cotton (Rs.4,717.00) followed by rice (Rs.3,692.00) and gram (Rs.3,657.00). The value of output per hectare was highest for cotton (Rs.11,792.00) followed by gram (Rs.7,675.00) and groundnut (Rs.7,364.00). The profit per hectare was highest for cotton (Rs.7,075.00) followed by groundnut (Rs.4,225.00) and gram (Rs.4,018.00). Thus from profitability point of view cotton ranked first followed by groundnut and gram. Others on the ladder were maize, wheat, arhar and soybean. On the criterion of input-output ratio cotton ranked first (2.50) followed by maize (2.37), groundnut (2.35), arhar (2.28), gram (2.09) and urad respectively. On the criterion of profit per hectare only gram and arhar could compete with other crops. On the criterion of input output ratio only arhar, gram and urad could compete.

In the case of rice, 48.11 per cent of the total produce was consumed. The percentage of produce sold was 37.54 and the percentage kept for seed was 14.35. The percentage of produce kept for seed increased with the size of farms.

Jowar was staple food crop of the district. As high as 87.68 per cent of the total produce was used for consumption and 7.47 per cent was sold. The remaining 4.85 per cent was kept for seed. Maize was another staple food crop. The percentage of produce used for consumption was 88.52. The percentage of produce kept for seed was 6.65. The percentage of produce sold was 4.83. Soybean was grown for market. Eighty five percent of the total produce was marketed and the remaining 15 per cent was kept for seed. Of the pulse crops grown urad had the highest percentage of produce sold (77.85) followed by gram (68.96). The lowest percentage of produce sold was in the case of moong (39.89) and kulthi (55.55). In both these crops very large percentages of produce were consumed.

Regarding farmers knowledge and opinion it was noted that urad was the most popular pulse and was grown without irrigation on light soil. Gram is affected by heleothis. The good quality soils are used for either maize, paddy or gram. Seed of high yielding varieties of gram were costly. Insecticides available were not of good quality and sometimes proved ineffective. T-9 variety of urad gave less straw. Urad and kulthi were susceptible to waterlogging. There was need for early maturing maize varieties. The soils were shallow and undulating. Low investment capacity and poor economic conditions forced the population out of villages in search of labour in and outside state. Kulthi was grown to feed the cattle. Urad was susceptiple to insects and pests.

The opinions of District Agricultural Officers & AER Centre Officers are :

1. The entire Jhabua district had undulating topography and slopy land. The soil was shallow, infertile and had low water retention capacity.

2. The population was poor, illiterate and tribal not responding easily to new agricultural development techniques. The farmers had low risk bearing capacity.

3. The rainfall was erratic and not dependable.

4. Due to limited area under irrigation, rabi crops werenot grown.

5. Due to poor agricultural base, population preferred to work as labourers on non-agricultural enterprises within and out of State.

6. The reasons for lowering of area under pulses were :

   a) There were no high yielding varieties seed in pulses.

   b) Due to imbalanced use of fertilisers there was more vegetative growth and lower production.

   c) Kulthi, the main pulse crop of the district was a neglected crop.

   d) Fertilisers were applied mainly in maize and rice, not in pulses.

   e) Gram was grown mainly unirrigated.

It was very essential to convince the tribals about balanced use of fertilisers.

5.4.3 In Narsinghpur district the average number of workers per family was 3.66. It was 3.28 on the marginal size group and increased to 3.33 on the small size group and to 4.00 on the semi medium size group. The number of workers per farm was higher on larger size groups. The operated area of the selected farms was 143.00 hectares or 2.86 hectares per farm. The average owned area was 2.90 hectares. Of this 0.18 hectare was leased out and 0.14 hectare was leased in. The leasing in and leasing out of land was localised in semi-medium and medium size farm groups. Of the total operated area 78.22 per cent was irrigated. On the large size group the entire operated area was irrigated. The percentage of irrigated area increased with the size of farms. Wells and tube-wells were the only sources of irrigation. In 1995-96 the crop with largest coverage was soybean (41.17 per cent of the gross cropped area). Gram was the second and wheat was third important crop. Other pulse crops of importance were lentil and batari. Soybean occupied about equal percentage of cropped area (around 40 per cent) on all size groups in both the years. The percentage of area under gram decreased with the increase in the size of farms. Lentil occupied larger percentage of gross cropped area of

larger farms. The cropping pattern did not show much change in 1996-97 over 1995-96. Narsinghpur district is traditionally famous for growing pulse crops specially arhar and gram. New varieties were used and new technology of cultivation was used. All the pulse crops of kharif, rabi and summer seasons were grown as single crops and these were neither mixed or inter cropped. Except kharif urad and arhar all other pulses were line sown. Only a small percentage of gram was sown broadcast. Larger percentages under pulses were grown irrigated.

Narsinghpur district had highest percentage of irrigated area and highest percentage of irrigated area under pulses. All the six pulse crops were either fully irrigated (pea) or partly irrigated (gram, arhar, lentil, urad and batari). The cost per hectare of irrigated gram was Rs.6,467.98 and that of unirrigated gram, Rs.6,474.27. Of the different items of cost seed and seed treatment was most important and claimed one fourth (25.78 per cent) of the total cost. The other important items of cost were harvesting, threshing, etc. plant protection, fertilisers, preparatory tillage and depreciation. In the case of arhar the input with highest contribution was harvesting, closely followed by seed and seed treatment (22.32 per cent), sowing and weeding operations, preparatory tillage and plant protection operations respectively. In the case of lentil the highest proportion of input was that on seed and seed treatment (24.10 per cent) followed by harvesting, preparatory tillage and fertilisers respectively. In the cases of pea and batari the most important input was seed and seed treatment. In the case of urad, the most important input was harvesting, threshing etc.

Input-output analysis showed that net profit per hectare was highest (Rs.7,629) for sunflower. The second highest profit per hectare (Rs.6,799) was earned by mustard. Gram earned third highest net profit per hectare of Rs.6,397. Batari earned a profit per hectare of Rs.6,380. Wheat (Rs.5,870) and sugarcane (Rs.5,241) were other crops earning net profit per hectare of more than Rs.5,000. Lentil (Rs.4,867), Soybean (Rs.3,386), vegetables (Rs.2,739) and urad (Rs.2,477) were other crops earning profit per hectare in that order. On the criterion of input-output ratio

mustard (2.50) and sunflower (2.30) proved to be most profitable. Batari (2.18) and gram (1.99) came next. Wheat, soybean and sugarcane were also competitive crops to pulses. Thus pulses would not be in a position to substitute oilseeds like soybean and mustard even on profitability criterion. It was also noted that among pulses gram and batari were two most profitable.

Among the crops grown on the selected farms rice and wheat were staple food crops. The percentage of produce utilised for consumption was 21.43 and 22.71 respectively for these crops. Pulses were produced more for sale than home consumption and therefore the percentage used for home consumption was lower; batari (2.76), urad (6.72), gram (7.67) lentil (4.15), arhar (11.23) and pea (8.95). Oilseeds like mustard, sunflower and soybean are solely produced for market. Therefore, the percentage of produce marketed for these crops came to 94.42, 98.60 and 92.16 respectively. A very meagre quantity was retained for next year's seed.

Farmers opined that the first and foremost reason for low production of pulses was non availability of improved and high yielding varieties seed. Among other reasons were : risk involved due to susceptibility to insects and pests, low profitability and lower input-output ratio. Due to low profitability pulse crops were grown on average or marginal lands and not on best lands. It was also pointed out that pulses fetch high prices due to shortages in lean season, the farmers do not get the benefit of price fluctuations. The farmers brought the produce immediately after harvest causing glut and eventual fall in price. The real beneficiary was mill owner who purchased pulse crops when the prices were lowest, processed these and deferred the sale to a lean season when prices of dal reached the peak. Due to lower profitability farmers did not follow recommended practices and doses fully. Gram and pea being most profitable among pulses get best lands alloted and best treatment against pests and diseases. Other pulses were alloted marginal lands. With the adoption of improved irrigation technology like sprinkler and drip system farmers were going for soybean and wheat crops which were more profitable and less risky.

The farmers opined that to get higher yields and production of pulses use of H.Y.V. seed, adoption of recommended practices including fertiliser doses and timely application of insecticides and pesticides and irrigation were essential. A section of the farmers asked for higher subsidy on inputs and more remunerative prices and formation of cooperative marketing and processing societies.

According to District Agricultural Officers and AER Centre officials the reasons for lowering of area under pulses were :

a) Due to frost and caterpillar infestation in arhar farmers did not want to take the risk. They preferred soybean.

b) The working of Rural Agricultural Extension Officers was not satisfactory.

c) Farmers did not get information about the fertility of the soils.

d) Good quality seed was not distributed equally among farmers.

e) Since some years spurious products were sold in the market which proved ineffective.

f) Problems of supply of electricity is very acute.

g) The certified seed had an admixture and the quality was not as desired.

h) In lentil and some other pulses, due to high doses of nitrogen, vegetative growth was more and the flower and bean production was less.

To increase the area under pulses following measures were suggested.

a) Quality control of seed, fertilizers, insecticide and pesticides should be checked from time to time.

b) The Rural Agricultural Extension Officers (RAEOs) should be made more responsible and knowledgeable.

c) More facilities for soil testing be provided.

d) The quality of certified seed should be checked before supplying these to farmers.

5.4.4 The pulses are marketed as grains by farmers. The ultimate product sold, is dal. In the case of gram, however, part of the product marketed is in the form of grains. Pulses in the form of

grains could not be stored for a long time without taking measures against stored grains pests. Therefore, farmers sold the marketable surplus during the harvest season and a minimum quantity was retained till the pre harvest season which fetched highest price. It was observed that the maximum price could be obtained by selling the product in mandi. The price received from traders outside the village was lower and the price received within the village was lowest.

In Durg mandi the arrivals of gram were highest in the month of March 1996. The price quoted during that month was lowest (Rs.750) during the year. The arrivals were lowest (2,973 quintals) in the month of August 1996. The prices were highest (Rs.1,150) in that month and subsequent three months. In the case of arhar, the arrivals were highest (2,227 quintals) in the month of January,1996. The price quoted in that month was lowest. From February onwards the arrivals decreased from month to month but the prices showed an upward trend. In Jhabua district the arrivals of gram were highest (886 quintals) in the month of March. The price quoted in that month was lowest (Rs.650). In the case of arhar the arrivals were highest (330 quintals) in the month of February and second highest (315 quintals) in the month of March. During these two months the prices quoted were lower than those in subsequent months. Arrivals of urad were higher in January, February and March. The prices prevailing in those months were lower as compared to subsequent months. When the arrivals declined the prices increased. In Narsinghpur district arrivals of gram were higher in the three months of March, April, and May. Incidentally these were the months when the prices were lowest in the year. After May the arrivals decreased and were lowest (1,209 quintals) in December. In that month the price quoted was highest.

In the case of arhar the arrivals were quite higher in the months of January, February and March. The prices were lower in those months. It would thus be noticed that the general rule of higher arrivals and lower prices and decreasing arrivals coupled by higher prices was proved to be good in the cases of gram and arhar in all the selected districts. During the harvest season the arrivals were high and the prices were low. On the other hand during sowing and pre harvest seasons the arrivals were weak and the prices soared.

Processing of pulses was not done at the household or village level except for the needs of own consumption. The produce was sold in mandis, to agents of dal mills and traders. These in turn, sold the produce to dal mills. At the dal mills processing of all kinds of pulses was undertaken. The investigations of the sample dal mills indicated that the quantity processed varied from 25 quintals a day to 120 quintals per day. It varied with the capacity of the mill, season and the demand for dal. It was estimated that in 1 quintal of pulse grains processed, 70-75 kg. of fine dal was obtained. The damaged dal weighed 2 kg. Among the by products bran weighed 12 kg., shell 8 kg. and small pieces 3 kg. According to mill owners the percentage of profit in the processing of pulses (conversion of pulses into dal and other products) ranged between 25 to 30 per cent over the price of pulse. It may be said that the real beneficiary of marketing and processing of pulses was the dal mill owner who purchased pulses at the lowest price of the season, processed the pulses and got the value of every small product and by product. He deferred the sale of products and by products to the lean season and got the highest price. The farmers, on the other hand, got no benefit of marketing and processing. The only way to benefit the small and big farmers was to set up dal mills in the cooperative sector by the farmers cooperatives.

5.4.5 On the basis of data collected in farmers' schedules and the discussions with the farmers and state government officials following constraints have been identified which hinder the raising the production of pulses.

1. Unlike in rice and wheat there were no high yielding varieties of pulses. In majority of cases old and traditional varieties were grown.

2. The supply of new varieties of seed was limited. Seed was not available at subsidised rates.

3. For Chhattisgarh region (rice bowl) early maturing variety of gram was necessary to be sown after the harvest of rice.

4. There were no improved/high yielding varieties of teora and lentil. Some of the recommended varieties of arhar were susceptible to heavy rain and waterlogging conditions.

5. Pulses had lower profitability per hectare and lower input output ratio. Therefore, pulses could not compete with other cereals, oilseeds and cotton.

6. Pulses were grown on lower fertility soils or marginal lands. Good quality land was used at the most for gram that too where irrigation was available. The high fertility soils were used for the cultivation of rice, wheat, maize, cotton, soybean, etc.

7. Pulse crops were susceptible to insects and pests.

8. Pulses were disposed of in the harvest season itself as the pulse were susceptible to stored grain pests.

9. There was a belief that inspite of sky rocketing prices of pulses the farmers were not taking up the cultivation of pulses in a big way. The real beneficiary of increasing pulse prices was not farmer but dal mill owner. The dal mill owner purchased pulses grain at low prices, processed these and sold the product dal and other by products. The profit margin in the process ranged between 30 to 35 per cent even in harvest season. If the dal mill owner could store dal and defer the sale to later date the profit margin increased to more than 50 per cent excluding the cost of processing. The only way to benefit farmers from processing and deferring the sales was to encourage cooperative marketing and processing societies.

10. Some of the pulses were susceptible to fusarium wilt and mosaic.

11. Pulses were grown on unirrigated land as the farmers could not afford costly input like irrigation for low profitable crops of pulses.

12. With low profitability of pulses farmers used very little of fertilisers and pesticides. The fertilisers and pesticides are spurious or of inferior quality.

13. Due to imbalanced use of fertilisers (nitrogen dominated) there was excessive vegetative growth resulting in lower production.

14. In Jhabua district kulthi, although largely grown was a neglected crop. It was sown on marginal lands as late as in August, sometimes after the main crop failed.

15. In Narsinghpur district area under arhar was replaced by soybean as few years back arhar was affected due to frost and insect attack.

16. At the grass root level the working of Rural Agricultural Extension Officers was not satisfactory as farmers could not obtain any advice from them. There was absence of mobile soil testing units.

17. Whatever little of irrigation was available, it was adversely affected due to electricity shortage.

5.5 Policy Implications

1. The impact of green revolution was localised to cereals especially rice and wheat. It had very little or negligible impact on the production of pulses. The production of pulses remained stagnant. The foremost reason for this was non-availability of good high yielding varieties. The need is to intensify research efforts to evolve still higher yielding varieties for various agro-climatic regions. This is true with the agro-climatic zones of the country and for the agro-climatic regions of the state of Madhya Pradesh (Attention- Indian Council of Agricultural Research, Technology Mission on Pulses and National Pulses Development Project, New Delhi).

2. The field investigation indicated that because of non availability of high yielding varieties farmers used own seed, untreated and of worn out varieties. Whatever quantity of new varieties seed was available was cornered by influential farmers and was distributed to scheduled tribes farmers. The seed was in short supply. Necessary steps be taken to see that adequate quantity of seed was available (Attention- State Seed & Farm Development Corporation of the Govt.of M.P.)

3. Since pulses can not compete with other cereals and cash crops in any of the crop seasons of kharif, rabi and summer on the criteria of profit per hectare and input output ratio due mainly to non-availability of high yielding varieties the pulses were grown on marginal and lesser fertile land,

that too under un-irrigated conditions. This initiated the vicious circle of low yields, lower profitability and lower inputs use and lower investment resulting in lower yields. The necessity of supplying high yielding varieties has been described in the above paragraphs. Here the point stressed is that of the necessity of evolving such varieties which can be grown under dry farming conditions and under moisture stress. (Attention- Indian Council of Agricultural Research, New Delhi and State Agricultural Universities located at Jabalpur and Raipur).

4. At the time of initiation of this study and during the course of investigation it was observed that there was total lack of field level studies on pulses, as against several such studies on rice and wheat. Although there were large number of studies based on secondary data there was near absence of studies based on primary data. Looking to the importance of pulses and lowering of acreage, production and yield there is intense need for field level studies to further probe into the reasons for lowering of area, production and yield. (Attention- Directorate of Economics & Statistics and Directorate of Agriculture, M.P., Bhopal).

5. It is generally believed that although the prices of pulse dal have been sky rocketing the area, production and yield of pulses have not increased. The field investigation showed that the beneficiary of the increasing prices of dal was dal mill owner and not farmers. The mill owner purchased the pulses at the lowest price during the year in the harvest season when there was glut in the market. He processed the pulses and sold dal during the later period when the prices rise due to dwrindling supplies. Farmer did not benefit from this deferred sale. If the benefit has to be given to the farmer, farmers cooperative marketing and processing societies should be organised. (Attention- State Cooperative Department and Cooperative Marketing Federation and Ministry of Food Processing, Govt. of India).

6. Pulses are susceptible to pests and diseases. However, the farmers are reluctant to adopt plant protection measures.

It is important that farmers be convinced of the plant protection measures and should be asked to adopt appropriate IPM measures. (Attention- Indian Council of Agricultural Research (ICAR), New Delhi).

7. In all the three selected districts the growth rates of area production and yield for arhar were negative. Arhar is an important pulse and reasons need be probed for this decline. (Attention- Indian Council of Agricultural Research, New Delhi)

8. In Chhattisgarh region (rice bowl) the farmers wanted late sown varieties of gram which could be sown after the harvest of rice crop. The recommended gram varieties were found to be susceptible to fusarium wilt. T-9 variety of urad was found susceptible to mosaic. There was strong demand for high yielding varieties of lentil and teora. (Attention- Agricultural Universities at Raipur & Jabalpur).

9. The percentage of irrigated area was 22.02 in Durg district, 29.79 in Jhabua district and 78.22 in Narsinghpur district. It is essential that efforts be made to increase percentage of irrigated area in Durg and Jhabua districts (Attention- Department of Water Resources, Govt. of M.P.).

10. Generally pulse crops were grown without application of fertilisers. Whenever fertilisers were applied these were nitrogen dominated resulting in high vegetative growth and lower production. Farmers need be convinced of the balanced use of fertilisers. (Attention- Field staff of the Directorate of Agriculture, Govt. of M.P.)

11. Pulses being prone to pests and diseases farmers shifted to more remunerative and less risky crops like wheat, soybean and mustard as soon as irrigation status of a farm improved. (Attention- Pest management staff of the Department of Agriculture, Govt. of M.P., Bhopal).

12. Since last few years the certified seed is found to contain admixture and spurious fertilisers and pesticides have found way in the markets affecting the demand for these from farmers and more importantly shaking the confidence of farmers in these essential inputs. (Attention- Staff of Quality Control Laboratories of the Govt. of India and Govt. of M.P., M.P. State Seed and Farm Development Corporation).

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Appendix Table A 2.2

Production of Major Pulses in India (1982-83 to 1994-95)

(Figures-Thousand tonnes)

Years	Gram	Arhar (Tur)	Teora (Lakh)	Urad	Moong-moth	Pea	Kulthi	Masoor (Lentil)	Total pulses
1982-83	5,290	1,989	416	998	1,375	340	640	489	11,857
1983-84	4,751	2,576	549	1,192	1,784	363	758	534	12,893
1984-85	4,562	2,585	504	1,164	1,322	331	629	547	11,963
1985-86	5,788	2,441	584	1,239	1,279	427	610	663	13,361
1986-87	4,532	2,271	486	1,243	1,170	388	663	659	11,707
1987-88	3,626	2,282	486	1,991	1,262	378	691	660	10,962
1988-89	5,129	2,718	441	1,620	1,862	418	555	734	13,849
1989-90	4,217	2,747	480	1,620	1,635	461	647	706	12,858
1990-91	5,356	2,417	562	1,646	1,850	605	590	851	14,265
1991-92	4,121	2,133	571	1,498	1,430	556	601	802	12,014
1992-93	4,417	2,331	510	1,531	1,846	550	494	791	12,815
1993-94	4,981	2,692	621	1,403	1445	640	427	748	13,305
1994-95	6,208	2,185	578	1,332	1,573	632	422	803	14,116

Source : Area & Production of Principal Crops in India, Ministry of Agriculture, Govt. of India, New Delhi

Appendix Table A 2.3

Yield of Major Pulses in India (1982-83 to 1994-95)

(Figures-Kg./hectare)

Years	Gram	Arhar (Tur)	Teora (Lakh)	Urad	Moong-moth	Pea	Kulthi	Masoor (Lentil)	Total pulses
1982-83	715	680	373	360	327	754	324	491	519
1983-84	663	801	445	398	388	819	393	566	548
1984-85	661	819	428	400	308	746	336	557	526
1985-86	742	767	452	389	286	851	389	607	547
1986-87	649	722	460	394	263	810	378	607	506
1987-88	629	685	474	428	329	875	370	635	515
1988-89	753	779	488	488	408	942	360	679	598
1989-90	652	763	514	488	343	909	404	635	549
1990-91	712	673	530	473	382	1090	403	717	578
1991-92	739	588	598	438	298	954	410	674	533
1992-93	684	652	580	506	411	903	399	657	573
1993-94	783	762	641	460	324	927	411	632	598
1994-95	855	651	609	423	349	860	393	702	609

Source : Area & Production of Principal Crops in India, Ministry of Agriculture, Govt. of India, New Delhi.

Appendix Table A 2.4

Area of Major Pulses in Madhya Pradesh (1982-83 to 1996-97)

(Figures-Thousand Hectares)

Years	Gram	Arhar (Tur)	Teora (Lakh)	Urad	Moong-moth	Pea	Kulthi	Masoor (Lentil)	Total pulses
1982-83	2,387	496	647	749	225	115	188	309	5,139
1983-84	2,106	508	717	790	232	128	188	288	4,982
1984-85	2,076	493	672	771	215	122	183	291	4,844
1985-86	2,282	480	745	792	111	128	179	309	5,149
1986-87	2,218	437	556	758	196	116	174	303	5,775
1987-88	2,236	454	542	706	190	110	169	308	4,713
1988-89	2,237	452	497	663	172	111	159	318	4,630
1989-90	2,157	442	524	643	167	114	161	315	4,543
1990-91	2,462	442	675	648	157	123	160	335	5,019
1991-92	2,138	407	626	584	141	115	157	347	4,534
1992-93	2,346	424	602	570	149	120	147	375	4,752
1993-94	2,342	429	683	574	142	142	148	398	4,880
1994-95	2,741	357	708	507	125	170	146	429	5,195
1995-96	2,660	377	681	500	121	186	140	500	5,176
1996-97	2,509	369	638	533	120	186	134	511	5,024

Source : "Agricultural Statistics" - Ministry of Agriculture, Govt. of Madhya Pradesh, Bhopal.

Appendix Table A 2.5

Production of Major Pulses in Madhya Pradesh (1982-83 to 1996-97)

(Figures-Thousand tonnes

Years	Gram	Arhar (Tur)	Tecra (Lakh)	Urad	Moong-moth	Pea	Kulthi	Masoor (Lentil)	Total pulses
1982-83	1,644	335	189	177	58	35	46	121	2,608
1983-84	1,425	510	230	231	75	42	58	126	2,702
1984-85	1,303	401	181	199	58	37	47	114	2,343
1985-86	1,557	410	212	171	58	34	43	121	2,610
1986-87	1,480	413	166	169	47	39	45	130	2,494
1987-88	1,484	417	198	148	52	41	39	149	2,532
1988-89	1,567	598	162	199	57	39	46	151	2,824
1989-90	1,427	417	202	177	44	42	46	145	2,505
1990-91	1,892	437	278	185	52	47	47	167	3,104
1991-92	1,715	315	330	152	37	39	40	160	2,792
1992-93	1,758	362	290	174	50	41	42	177	2,898
1993-94	1,954	415	377	178	48	54	45	191	3,264
1994-95	2,487	302	360	148	37	65	44	206	3,654
1995-96	1,988	298	255	169	39	72	42	229	3,097
1996-97	2,293	320	388	185	41	76	42	246	3,544

Source : Agricultural Statistics- Ministry of Agriculture, Govt. of Madhya Pradesh, Bhopal (M.P.)

Appendix Table A 2.6

Yield of Major Pulses in Madhya Pradesh (1982-83 to 1996-97)

(Figures-Kg./hectare)

Years	Gram	Arhar (Tur)	Teora (Lakh)	Urad	Moong-moth	Pea	Kulthi	Masoor (Lentil)	Total pulses
1982-83	689	678	292	236	258	303	245	391	507
1983-84	677	1,009	321	292	323	332	308	439	542
1984-85	628	817	369	258	270	307	257	392	484
1985-86	683	859	284	216	523	263	240	393	507
1986-87	668	951	299	223	240	335	259	430	522
1987-88	664	924	365	210	274	376	231	484	537
1988-89	701	1,331	326	300	331	355	289	477	610
1989-90	662	949	386	275	263	365	286	462	551
1990-91	769	995	412	285	331	379	294	498	618
1991-92	803	779	527	260	262	385	255	462	616
1992-93	750	858	482	305	336	346	286	471	610
1993-94	835	973	552	310	338	379	304	479	669
1994-95	908	854	508	292	296	334	301	480	703
1995-96	748	797	374	328	322	388	300	459	598
1996-97	914	867	529	347	342	407	313	480	705

Source : 'Agricultural Statistics' - Ministry of Agriculture, Govt. of Madhya Pradesh, Bhopal (M.P.)