CHAPTER - I
INTRODUCTION

Pulses are an important and relatively inexpensive source of protein for human and animal nutrition in India. Their importance as builder and restorer of soil fertility in arid areas is well recognized. Pulses are known as unique jewels of Indian farming. The per capita net availability of pulses, unfortunately, has been declining continuously and has reached a low level of 26.4 gms/day in 2001 from a much higher level of 61.6 gms/day in 1965. It has declined more during the reforms period indicating a drop from 41.6 gms/day in 1991 to 29.1 gms/day in 2003 as per Economic Survey, 2005. This is due to increase in population and stagnation in production of pulses. Indeed, pulses have been in short supply for nearly two decades. As a result, huge imports of pulses have become a regular feature in the country to bridge the demand and supply gap. A peculiar situation has emerged because rising prices of pulses have not been able to enthuse farmers to increase pulse production.

Problems of Pulse Production

India produces nearly a dozen varieties of pulse crops. At the world level, it is the biggest cultivator of pulses. But, unfortunately, these nutritionally superior legumes never received adequate attention from the policy makers. That is why the government policy of minimum support prices as a safety net and the strategy for pulse crops development has failed to enhance its production in the country. The National Pulses Development Programme has been under implementation in 30 States and Union Territories on a 75:25 cost sharing basis between the Central and the State Governments for a long time but it has not made any headway in production and productivity. The production of pulses in 2002-03 was 11.14 million tonnes, which is much below the target of 16 million tonnes. This was the situation despite scientists claim that around 92
improved varieties of gram, arhar, moong, urad, massar and moth with high potential of yield improvement have already been released. In addition, new plant protection practices such as Integrated Pest Management are available. All these are making varying degrees of impact in different regions. But, the gap between actual and potential yield remains very high even in agriculturally advanced states like Haryana.

Thus, challenges faced in improving the level of production of pulses three decades ago, still exist and the situation has not improved despite the government adopting a mission mode approach under the Technology Mission on Oilseeds and Pulses since 1990-91.

Undoubtedly, the constraints faced by pulse production are daunting. Pulse cultivation faces problems such as use of rain fed marginal land, susceptibility to pest and disease attacks, weather aberrations, lack of genetic breakthrough and diversion of pulse area to more remunerative crops as and when irrigation facilities become available. Policies formulated and implemented during different plans have hardly been helpful. Quite unlike wheat and rice growers, who have a ready market in government procurement and that too at higher than market price, pulse growers are left with no market support. The minimum support price announced and hiked annually are notional and have become irrelevant because pulses are neither procured nor market price reaches that level. Production efficiency of the pulse growers is less due to low and fluctuating yield levels. These constraints have affected the pulse growers’ enthusiasm to raise input use or to adopt improved technology.

In view of the above constraints, pulse production has not been able to keep pace with its demand in India. The successive plan documents have stressed the need to improve the level of pulse production. However, even a modest target of 16 million tonnes has not yet been achieved. Now, policy makers are devoting their attention to pulses and oilseeds due to their tremendous growth potential. In addition, non-
sustainability of wheat/rice based commercial agriculture followed from
1970 onwards is also a major factor. Therefore, pulse cultivation is being
considered one of the important options in cropping pattern diversification.
In addition, favourable changes in trade policy are improving the scenario.
Recently, export of pulses has been made free realizing the export
total of pulses in the international market though they remain a small
percentage of production and lag imports. There is no doubt that this may
help pulse producers to realize better prices. But, for its success,
productivity and quality standards matching internationally competitive
levels are significant challenges. With a view to expanding area, output
and yield levels, a concrete strategy of some support is needed at the
disaggregated level in the regions with high potential of pulse production.
The budgetary allocation for the National Pulses Development Programme
is inadequate and its progress is not monitored even in agriculturally
advanced states like Punjab and Haryana. It seems that higher output
through enhanced level of productivity in core areas can help reverse the
dangerous decline in per capita availability.

Thus, problem of increasing pulse production still remains
unresolved and unsolved. They still remain as one of the lagging sectors
in the crop economy. The area under pulses is stagnating or growing at a
snail’s pace although these crops are vital to the economies of rainfed
agriculture. The situation has become more complicated because of weak
price response of pulses. On the productivity front, India is lagging behind
other pulse producing nations. In fact, India had the largest cultivated
area under pulses (30.32 per cent) in the world but unfortunately
productivity (552 kgs/ha) was one among the lowest and much below the
average productivity (793 kgs/ha) in the world during 2003 (FAO,
Production Year Book, 2003). In addition, yield volatility is a great problem.
This is perhaps due to non-adoption of improved technology despite
extension support provided to the growers under the specially designed
programmes for boosting pulse production.
At the macro level, a number of factors could be responsible for sluggishness in the growth of area, production and yield of pulse crops. The study of agro-climatic factors, technological change in agriculture, relative profitability, yield, price risk, marketing and processing infrastructure, etc. would help identify the causes of near stagnancy in the production of pulses. One needs to find out answers to several related issues. What is the nature of supply response of pulse crops and what are the major explanations for their slow growth? What are the reasons for the relative neglect of these crops in the process of commercialization? Why are these crops largely located in the production base of rainfed regions? What is the nature of competing crop economy vis-à-vis the economy of these crops? What kind of price uncertainty does the cultivators of these crops face? What are the special environmental/policy constraints in the growth of these crops? Are Indian pulses internationally competitive? Whether India should concentrate on pulses or on crops with comparative advantage? Is liberalized policy environment conducive to generating farmers' confidence in growing pulses? A study of above-mentioned issues would enable policy makers to initiate steps to increase pulse production in the country.

A number of factors influence farmer's choice of crops or crop pattern. The irrigation status of land, availability of labour and capital, inputs and technology, etc., are the major deciding factors. Household food and feed security are also important considerations. In addition, history of incidence of insect and pest attacks, diseases, rainfall uncertainty, soil condition etc., also affect farmer's decision. The marketing support also plays a crucial role. The price uncertainty also depresses area allocation. In fact, pulses stand nowhere in terms of relative profitability of wheat and rice, which received technological as well as market support. The price and non-price factors influencing acreage allocation at the farm/state level needs to be carefully analysed.
Regional variations in the production and consumption are important issues too. In particular, inter-regional variations in technology and yield gaps are emerging issues of great concern. On the demand side, income elasticity of pulses is gradually drifting to the lower side due to changes in the consumption basket at large. People with high income in particular, are diversifying their protein basket and shifting to eggs, meat, etc.

The aforesaid problems demand an in-depth investigation at the disaggregated level. In literature, attention has been drawn to area shift in favour of pulse crops in the states of Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra, Karnataka and Tamil Nadu. It has declined in some other states like Bihar, Orissa, Punjab, Haryana and West Bengal and that too in States with assured irrigation facilities, which encourage farmers to adopt wheat/rice rotation in their crop pattern due to higher yield and a good market support. Unless a detailed analysis of growth is carried out and the factors constraining pulse production are identified and analysed at the disaggregated level, policy initiatives cannot be oriented to suit the region specific requirement of the strategy to boost pulse production.

The impact of economic reforms in agriculture adds one more dimension to the problem of pulse crops. India initiated economic reforms process through the Structural Adjustment Programme in 1991 in response to balance of payments crisis. In addition, the member countries under the aegis of World Trade Organization signed many trade related agreements. In 1995, an agreement on agriculture was signed to dismantle the trade barriers. With the gradual liberalization and globalization, Indian economy has steadily been exposed to the international markets. The country has opened up trade in agricultural products and has removed the related trade barriers. The main objective of these policies is to make the agricultural sector globally competitive by improving the efficiency of inputs with the support of complementary policies. For a country like India where agricultural sector contributes
around 58 per cent share in employment and almost 25 per cent in the gross domestic product, it becomes imperative to examine the implications of these policies on the development of various agricultural commodities.

The process of liberalisation has started showing its impact, both at the macro and micro levels, on the growth and development of various crops. At the macro level, trend in prices, imports and exports, demand and supply gap and changes in the level of protection are the major concerns. At the micro level, disaggregated scenario at the state/region/district and crop levels assumes significance. This calls for an assessment of changes in area allocation; yield, cost of cultivation, income and profitability at the crop level. A study of the economic implications of liberalisation on domestic production and the competitiveness of pulses at the world level as well as in India, thus, assumes special importance.

Review of Existing Literature

This study seeks to examine various economic issues related to the problem of improving pulse production in India. Before developing the framework of analysis, it would be pertinent to review the available literature on the related aspects of the present study. A critical review of the research conducted on this subject reveals that two types of studies are available in the literature. First, there are macro level studies and papers based on secondary data at all India and state levels (Chopra and Swamy, 1975, 1982; Rayan and Ashokan, 1977; Nandkarni, 1986; Singh, 1979; Swarna, 1989, 1993; Deshpande and Chandrashekhar, 1982; Baldev at el, 1988; Acharya 1988, 1993; Satyapriya, 1989; Bhatia, 1991; Kelly and Rao, 1994; Dhindsa and Sharma, 1997; Jain and Singh, 1991; Ramesh Chand, 1999; Ali and Mishra, 2000; C. Ramaswamy, 2002; Joshi and Saxena, 2002; Sathe and Aggarwal, 2004).

Second, one comes across micro level studies based on primary data collected through surveys at village and farm household levels (Acharya, 1988; Sharma 1982; Gangwar , Rai and Sriniwas, 1983; Kumar
1993; Tuteja 1986, 1992, 1999, 2000; Dey and Banerjee, 1991; Tripathi, 1998; Pant 1995; Joshi at al., 1999; Shiyani, 2000; Gupta 2001). Such studies are mostly carried out by Agricultural Research Institutes like International Crop Research Institute for Semi Arid Tropics (ICRISAT), Indian Agricultural Research Institute and Agricultural Economics Research Centres. They have focussed their attention primarily on identification of constraints in the growth of pulse production and productivity at the disaggregated level. Some studies were aimed at evaluating the performance of the National Pulses Development Programme in different states. This section presents the main findings of macro as well as micro studies.

(i) Macro Level Studies

Chopra and Swamy1 in their pioneering study on pulses in India for the period 1951 to 1971 have looked into area shifts under individual pulse crops to competing crops. They have also estimated demand and supply functions. In the demand equation, average quantity of pulses consumed was regressed to total expenditure, price of pulses and price of cereal substitutes. The demand of pulses was found price responsive. The supply side was examined through acreage response model in the Nerlovian framework. The relative yield, relative prices, area irrigated under the competing crops and rainfall were used as independent variables. The model was applied to major pulse-producing states. The pattern of the individual states was sufficiently different from each other. The increase in irrigation and relative yield were important factors explaining area shifts out of rabi pulses in the green revolution belt. Here, wheat offered a tough competition to pulses. But, rainfall and prices were found significant in the estimated model for kharif pulses. They have

projected quantity of demand and supply. It was concluded that the supply
will fall short of demand and the gap will widen further.

Ryan and Ashokan\textsuperscript{2} in their paper for the six major wheat growing
states of India namely Punjab, Haryana, Uttar Pradesh, Bihar, Rajasthan
and Madhya Pradesh for the ten years period before and after 1964-65
found that 22 per cent of the expansion in wheat acreage during the later
periods could be accounted for by the reduction in area under pulses.

According to Nandkarni\textsuperscript{3}, pulses are left behind by the green
revolution. The yield of pulses has been growing at the very slow pace
with almost constant area. The major constraint affecting their growth is
 technological in terms of lower yields.

Singh\textsuperscript{4} in his study for the state of Uttar Pradesh examined the role
of price and non-price factors in determining farmer’s decision on shifts in
inter-crop acreage. The study showed that the overall supply-price
relationship was weak and in most cases, results did not support the
generally expected positive supply price response relationship. The
findings indicated that the response of kharif pulses has been more
consistent with economic theory, suggesting a negative relation between
risk and crop acreage. The deterrent impact of risk, weather, yield and
prices pointed out to the need for reducing the occurrence of such risk.
He suggested that appropriate policies need to focus on (a) favourable
pricing and marketing conditions and (b) technological changes in pulses
like variety improvements, disease and pest control measures.

The performance of various pulse crops has been different across
time and space. The estimates of area and production of pulses during
the 60’s, 70’s and 80’s indicate the performance of pulse production has
been poor. Not only production has been stagnant for over four decades,

\textsuperscript{2} Ryan JG and M. Ashokan, “Effect of Green Revolution in Wheat on Production of Pulses and Nutrients in
India”, \textit{Indian Journal of Agricultural Economics}, Vol. 32 (3), 1997
\textsuperscript{3} Nandkarni MV, “Backward Crops in Indian Agriculture: Economy of Coarse Cereals and Pulses”
\textit{Economic and Political Weekly}, Vol XXI, (38-39)
\textsuperscript{4} Singh R.D., “Shifts in Pulses Acreage: An Inter Regional Analysis of Dynamics of Farmers’
but also growth in production has been far less than the growth in population. Moreover, pulses have been recording significant changes at the seasonal, regional and temporal levels. Around 17 per cent of pulse area in irrigated states faced competition from cereals and oilseeds. The remaining 83 per cent of pulse area in rain fed and dry states did not face much competition from other crops. The profit function analysis of gram reveals that non-price factors, such as rainfall influence both the output of gram and the use of inputs in its cultivation. The elasticity of inputs and output with respect to prices was very low. In fact, the impact of weather was found strongest on the yield growth. (Sadasivam5,6).

The study of Deshpande and Chandrasekhar7 for Karnataka state observed that technological change has failed to bring about any positive change in the growth of pulses. The slow growth in production was mainly attributed to stagnancy in yield and decline in area. Their supply response analysis indicated a positive response to real price of the crop and its yield. They opined that the subsistence nature of these crops is primarily responsible for their concentration in smallholdings.

Baldev et.al8 presented a comprehensive account of various aspects related to pulse crops in India. The details of area, production and productivity, reasons for low productivity and genetics of major pulse crops were analysed with a focus on agronomic aspects. The main reasons cited for low productivity included low genetic yield potential of local varieties, application of poor agronomic practices, lack of plant protection measures, lack of stability, adverse effects of cultivation under rain fed conditions and improper method of sowing.

Acharya\textsuperscript{9}; and Acharya and Gupta\textsuperscript{10} observed that the case of Rajasthan was unique and there was no evidence of pulse area being diverted to cereals in the state. But, growth rate of gram area in major wheat-gram producing districts was either zero or negative because incremental production due to irrigation was more for wheat compared to gram and the price difference was not sufficient to offset the yield advantage. The level of use of yield increasing inputs in pulses was very low. Prices of pulses received by farmers though rising at a faster rate compared to cereals and oilseeds but the price at the retail level was not fully transferred at farm level. They suggested that to increase production of pulses, efforts will have to be supplemented by giving price advantage to the pulse growers through either direct deliberate action or removing imperfections in the pulse marketing system.

Acharya\textsuperscript{11} in his presidential address at the Indian Society of Agricultural Economics reviewed overall performance of pulses and its price policy. He opined that area under pulses declined sharply during the green revolution period in India and rabi pulses suffered the maximum loss in area during this period. Kharif pulses also suffered. The area from rabi pulses shifted to wheat and from kharif pulses to paddy under the stimulus of expanding irrigation facilities, high yielding variety seeds, support price policy and public procurement system for wheat and paddy. He suggested an urgent need of creating efficient market infrastructure for pulses.

The study by Satyapriya\textsuperscript{12} focused more on growth aspect. He observed that production of pulses in India remained either stagnant in some states/regions or declined in other states. He opined that production


of pulses could be improved by bringing down the yield gaps across irrigated and un-irrigated pulses.

Bhatia\textsuperscript{13} estimated the growth of area, production and yield of pulses in India for the period 1967-68 to 1989-90. The major constraints for the stagnation in the production of pulses are production under rain fed conditions, low yield and value productivity, higher risk in production and low income from pulse cultivation, low level of adoption of technology, susceptibility to pests and diseases and large price spread. He suggested that evolution of some improved varieties is a must for increasing production of pulses but there is strong need to take up appropriate measures for reducing risk of adopting new technology through expansion of crop insurance scheme to pulse crops. Once productivity of pulse crops is improved, shifting of other resources like irrigation, water, fertilizer and area would follow and its pace of growth of production would go up. Efforts will also have to be made to improve the efficiency of marketing so that producers could get their due share in the price paid by the consumers.

Among the state level studies, Dhindsa and Sharma\textsuperscript{14} analysed the Punjab situation with the help of Nerlovian model. They have shown that non-price factors are relatively more important in the decision-making of the farmers for allocating acreage to pulses. They indicated towards the disappearing nature of pulse cultivation in Punjab farming. Jain and Singh\textsuperscript{15} examined instability in the pulse production in Punjab with the help of decomposition analysis. They observed that decline in area was the primary factor responsible for the decline in production. Yet efforts through proper policy formulation are needed to stabilise yield levels and to reduce disparity in the yield across the districts. Moreover, stability in

\textsuperscript{13} Bhatia M.S, "Economic Constraints in Increasing Pulses Production", \textit{Agricultural Situation in India}, August, 1991.
\textsuperscript{15} Jain K.K. & A.J. Singh, "An Economic Analysis of Growth and Instability of Pulses Production in Punjab", \textit{Agricultural Situation in India}, April, 1991
yield levels would induce more area under these crops and will lead to lessening the burden on foreign exchange through economising on imports.

There are some macro studies, which assess the impact of trade liberalization on pulses. Ramesh Chand\textsuperscript{16} in his study reviewed the case of four commodities and gram was chosen as one of the major crops. The study analysed production, marketing and trade related policy concerns. The impact of trade liberalization was examined with or without situation. The impact of trade liberalization was studied through net protection coefficient. It was observed that price of gram in India was found lower than the border price. The study has shown that implementation of WTO has a mixed impact on net social welfare of India. The author opined that signals of price ratios of domestic to global prices should not be stretched too far. There should be major policy shift. Kelly and Rao\textsuperscript{17} examined chickpea competitiveness in India. They observed that it is not competitive at present. A study by Ali & Mishra\textsuperscript{18} on nutrient management in pulses and pulse based cropping systems highlighted that nutrient imbalance is one of the major constraints limiting productivity of pulses. The built in mechanism of biological nitrogen fixation enables pulse crops to meet 80 per cent of their nitrogen requirements, hence, a small dose of 15-25 Kgs/ha is sufficient to meet out the requirements of most of the pulse crops but even this quantity is not applied and therefore, productivity remains much below the potential.

The growth of pulse production has not kept pace with the population growth resulting in an overall decline in per capita availability and generally higher prices of pulses. To meet the growing demand, the government has to resort to frequent imports and hold down prices of

\textsuperscript{16} Ramesh Chand, "Effects of Trade Liberalization on Agriculture in India", Centre for Gram, Pulses and Tuber Crops Research, 1999.

\textsuperscript{17} Kelley, T.G. and P. Parthasarathy Rao "Chickpea Competitiveness in India", Economic and Political Weekly, Vol. 29 (26), 1994

pulses. Imports are emerging as a cheaper option but a cost effective option for increasing domestic production and infrastructure development should be undertaken at urgent scale Ramaswamy\textsuperscript{19}, Joshi and Saxena\textsuperscript{20} reviewed the recent performance of pulses and tried to identify the constraints. They have also examined growth performance of important pulse crops in the new niches. A small section on trade off presents valuable information. The study has shown that pulses are moving from traditional to non-traditional areas. They emphasised the need for research and extension to bring yellow revolution in pulse sector. A recent paper by Sathe and Aggarwal\textsuperscript{21} (2004) examined the issues related to opening up of the Indian pulse sector as well as relationship between production, prices and imports. The prices of pulses are high despite low duty on imports. They argued for further opening up of the Indian market for pulses, in view of stagnating domestic production and the nutritional significance of these crops.

(ii) Micro level Studies

Pulse crops in India are grown under a wide range of agro-climatic conditions. Historically, they have found a place in diverse cropping systems in different parts of the country. It is important to recognize this wide range of conditions over which cultivation of a particular pulse crop is distributed in different parts of the country for the purpose of planning, research and development programmes. The primary data based case studies, by and large aimed to fulfill these objectives.

\textsuperscript{19} C. Ramaswamy, “Pulses, Oilseeds and Coarse cereals: Why they are Slow Growth Crops”, \textit{Indian Journal of Agricultural Economics}, Vol. 57 (3), 2000


The paper by Sharma and Jodha\textsuperscript{22} has reviewed the performance of pulse production in semi-arid regions of India. They have tried to enumerate the factors, which affect decision making of the farmers in acreage allocation. These are mainly rain fed areas where subsistence nature of farming dominates. They identified agro-climatic, socio-economic and biological constraints in the production of chickpea and pigeon pea. The major constraints in improving pulse production were cited as non-availability of appropriate technology, instability of yield, high risk and lack of adequate capital to invest in expensive inputs.

Gangwar and Rai\textsuperscript{23} have analysed the problems faced by the farmers in production and marketing of gram in Haryana. They have narrated non-availability of improved seeds, low yield, high risk and lack of marketing information as the factors for sluggish response of the farmers.

The two papers (Joshi et.al,\textsuperscript{24} and Shiyani et.al\textsuperscript{25} have shown the extent of adoption of newly introduced chickpea varieties and identified the factors influencing their adoption in the tribal villages of Gujarat and Andhra Pradesh. The sample covered randomly selected adopters and non-adopters of improved varieties. Authors by using the Tobit model revealed that the adoption of newly released chickpea varieties was quite impressive. Their area was gradually increasing in the study area by replacing the prominent local varieties. A substantial increase in the yield rates (from 1096 to 1700 kgs/ha), gross returns (from Rs.11245 to Rs. 18960 per/ha), cost of cultivation (from Rs. 2675 to Rs. 5360 per/ha) was reported. Availability of seeds of new varieties appeared to be a major constraint. A participatory approach of understanding the farmers needs about different variety traits and identifying specific varieties have played a


\textsuperscript{23} Gangwar A.C. and K.N. Rai, Srinivas, "Production and Marketing of Gram in Haryana", Department of Agricultural Economics, HAU, Hisar, 1983


commendable role for wider acceptance and in accelerating the adoption of improved chickpea varieties.

In the array, there are some primary data based studies, which go deeper to farm size classes and cross compare the situation. A study by Kumar\textsuperscript{26} examined problems of pulse production in Uttar Pradesh for different categories of farmers. He concluded that small and marginal farmers are great sufferers, because they have to market their surplus immediately after harvesting at low prices due to weak financial position.

The primary data based studies by Tuteja\textsuperscript{27,28,29} relate to the problems of pulse production in Haryana in dry and irrigated districts of Bhiwani and Ambala. Historically, pulse crops enjoyed a place of pride in the crop pattern of Haryana by indicating 30.16 per cent of the gross cropped area in 1964-65. With the increase in irrigation facilities and introduction of high yielding variety cereals, area under pulses has come down to 7.53 per cent of GCA in 1995-96 But, the state of Haryana has tremendous and immense scope for increasing area under pulses. This, however, would be possible only if the existing available improved technology is extended to the farmers for adoption on a wider scale; both in rain fed and irrigated conditions. The results of farm level data showed that productivity of pulses in Haryana is much above the all India level that was 938 kg./ha. Gram is much ahead of other pulses in terms of yield. But, it is much below the potential yield. The adoption of improved seeds was found poor and covered merely, 25.35 per cent of pulse acreage during 1999. The major constraints in popularizing pulse technology are

\textsuperscript{26} Kumar B.L. “Changing Patterns in the Cultivation of Pulses by Size Groups of Holdings”, \textit{Indian Journal of Agricultural Economics}, Vol 48 (3), 1993.
\textsuperscript{27} Tuteja Usha, “Problems and Prospects of Pulse Crops Cultivation in Haryana”, Agricultural Economics Research Centre, University of Delhi, Delhi, 1986.
\textsuperscript{28} Tuteja Usha, “An Evaluation of Pulses Development Programme in Haryana”, Agricultural Economics Research Centre, University of Delhi, Delhi, 1992.
\textsuperscript{29} Tuteja Usha, “Economics of Pulses Production and Identification of Constraints in Raising Production in Haryana”, Agricultural Economics Research Centre, University of Delhi, Delhi, 1999.
lack of information, non-availability of improved seeds, lack of adequate irrigation facilities, uncertainty of rainfall and unfavourable economics of pulse production. The progress of the National Pulses Development Programme in Haryana is very slow because the coverage of the programme in terms of pulse producers is limited and insignificant. It is being implemented through usual Government channels without involving the farmers at the grass root levels. The efforts of the state are also lacking, as proper attention is not paid to crucial components such as improved seeds, rhizobium culture and Integrated Pest Management (IPM) demonstrations. In a nutshell, the state does not give due priority to this programme and that is why it is neither properly monitored nor evaluated.

The case of Punjab\textsuperscript{30} regarding pulse production is depressing and causes great concern. A status enjoyed by pulses (14.55 per cent of GCA) during 1964-65 has totally vanished by indicating only 1.24 per cent of GCA in 1996-97 allotted to these nutritive, and soil fertility saving legumes. An attempt is now being made to popularize summer moong and inter-cropping of arhar. The adoption of improved technology by farmers in Ludhiana was found impressive but it was not true for Firozpur. The study highlighted unfavourable economics of pulse crops cultivation in comparison to their competing crops. The price spread was significantly high. The impact of the National Pulses Development Programme/Technology Mission was not visible in pulse farming in Punjab.

Dey and Banerjee\textsuperscript{31} in their study on West Bengal revealed that area under pulses is declining and it was being shifted to competing crops such as oilseeds. They also highlighted that producer's share in the consumer's rupee was higher in case of gram than other pulses on sample farms. But, gross returns were found the highest on large farms. For

\textsuperscript{30} Tuteja Usha, "Economics of Pulses Production and Identification of Constraints in Raising Production in Punjab", Agricultural Economics Research Centre, University of Delhi, Delhi, 2000.

massar, small farmers were ahead of others. Khesari gave the lowest returns but again large farmers enjoyed the benefit.

A study conducted at the National Centre for Agricultural Economic and Policy Research by Pant\textsuperscript{32} examined various dimensions of the problem of pulse production in Madhya Pradesh, which is the major pulse growing state in India. The study is based on field survey data covering 10 districts, 20 blocks, 40 villages and 360 farmers from 9 out of 14 agro-climatic zones in the state. A wide variation in the yield was reported. However, this analysis was carried out for total pulses. The failure of improved varieties was cited as the major constraint in the yield improvement. The author opined that the rising support prices reflect the policy intention to promote pulse crops cultivation, but in the absence of yield growth, it could not work because of low returns. Pulses were not found price responsive because traders take the advantage due to weak marketing structure. It was felt that success in increasing pulse production depends upon a favourable price regime and on technological break through that can help in realization of higher yields.

The study by Tripathi\textsuperscript{33} is based on the survey data of 100 farmers in different agro-ecological situations of Uttarakhand region. It deals with the cost structure, gross/net returns and profitability of urad, soyabean, french bean, horse-gram, rajma, and arhar in Uttarakhand. The production function analysis was used to estimate the relationship between dependent and independent variables. The gross returns of pulse crops depended on cost of human labour, bullock labour, cost of seed and manure, size of operational holding and number of family workers. It was observed that the marketing surplus of pulses was very low in this region. The author recommended that popularizing improved variety seeds, water management and plant protection measures can provide immediate results in terms of increased pulse production. The importance of life


\textsuperscript{33} Tripathi R.S. "Production and Marketing of Pulses", Mittal Publications, Delhi, 1998
saving irrigation to pulse crops especially in rabi season was highlighted and the author emphasized the need to tap, conserve and recycle scarce run off water for increasing and stabilizing production of pulses in the area. The marketing infrastructure was inadequate and ineffective. The malpractices, illegal charges, higher taxes and high rate of whole seller’s commission in regulated markets resulted in lower share of the producer. The effective and honest supervision, development of transportation and communication could help in boosting pulse production in Uttarakhand region.

Gupta\textsuperscript{34} carried out a coordinated study on pulses for Agriculture Economics Research Centre by covering 13 states. Two diverse districts with highest acreage under pulses and with low acreage were selected for the field survey in each state. The study was based on both primary as well as secondary sources of data. By using secondary data, it was again proved that India is the largest producer of pulses in the world (around 25 per cent of production) however, the productivity was found one of the lowest (595 kg./ha) in the world during 1997-98. Among the Indian states, Madhya Pradesh accounted for 21.45 per cent of the total area under pulses and 23.50 per cent share in the country’s production. The highest productivity of pulses was observed in Haryana (1002 kg./ha). The area under pulses declined in Punjab, Haryana, Bihar, Orissa and West Bengal. But, a reversal in the trend was observed in Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra and Tamilnadu, however, growth of productivity was found very slow even in these states. The economics of pulses was found unfavourable in comparison to their competing crops. Most of the farmers sold their market surplus during the harvesting season and a minimum quantity was retained for the sale in the lean season to fetch higher prices. The impact of the National Pulses Development Programme was not found visible on cultivation of pulses. The usefulness

\textsuperscript{34} Gupta S.K. "All India Coordinated Study on Pulses", Agricultural Economics Research Centre, Jabalpur, Madhya Pradesh, 2001.
of this study lies in its wide canvass, which can help in policy initiatives for the different locations. Strengthening the analytical part could enhance the utility of the study.

To sum up, the main findings of the above mentioned macro and micro level studies suggest that (i) the adoption of high yielding varieties of wheat in rabi and paddy in kharif is responsible for area shift from pulses to superior cereals in irrigated areas. Oilseeds compete for pulse area in un-irrigated regions. Traditionally, they are grown on low productivity marginal lands. But, now pulses are finding new niches and they are shifting from traditional areas to new destinations on rain fed lands. As a result, area under pulses has increased in Andhra Pradesh, Maharashtra, Karnataka, Gujarat, Madhya Pradesh, and Tamilnadu. (ii) The state level trends of area, production and yield indicated that pulses suffered more on the yield front. (iii) The growth of pulse area in the past was influenced more by non-price factors such as rainfall due to being rain fed in nature, (iv) Input use for pulse cultivation is very low and improved technology has not picked up even in agriculturally advanced states. (v) Increased prices of pulses could not boost area due to low profitability vis-à-vis competing crops and hence, price response of pulses was found weak. (vi) the Indian pulses are internationally not competitive, (vii) Demand and supply gap is wide. (viii) Hardly any attempts are made to develop area specific improved varieties. (ix) small and marginal farmers received very little support.

Most of the secondary data based studies used supply response model of the Nerlovian type to arrive at the results. There are a few studies, which made use of profit function, factor analysis and Tobit model and decomposition analysis to prove their hypotheses. A critical assessment of the research reviewed highlights that acreage has received an adequate attention from scholars. But, productivity, which is the main casualty in boosting production of pulses, has not received the deserved focus in the studies. The same is true for technology aspect. There is lack
of studies on monitoring aspect of the National Pulses Development Programme/Technology Mission. Indeed, problems differ from state to state and crop to crop and the factors affecting pulse production vary from region to region.

**Significance of Study**

The major emerging issues concerning stagnant pulse production relate to sluggishness in the growth of area and yield of various pulse crops grown in India. Regional and district level variations in the production are an important issue. In particular, inter regional variations in technology and yield gaps are emerging issues of great concern. The status of technological change is less explored area in research. The scant attention is paid to the study of the domestic and international competitiveness of pulse crops by scholars.

For improving pulse production in the country, policy makers need comprehensive analysis of the issues along with facts for taking initiatives. So far, this information is not available at one place for the recent period and the current study is an attempt in this direction.

The present study on pulse production in India is expected to make several departures from the existing literature. The broad objective is to parameterize as far as possible the price and non-price determinants of pulse production in India and to analyse important ones in detail. In the process, conscious efforts are made to contribute to the literature in four distinct ways. First, the previous literature used supply response and other regression models for determining the factors influencing pulse production. The present study would take an integrated approach by combining domestic and international concerns together. The efforts are made to capture the issues relating to pulse production at all India, state, district and farm levels. Second, the study also analyses lesser important pulse crops in terms of production and area coverage instead of focusing on gram and arhar only. Third, since international prices are bound to
influence pulse supply scenario in India, efforts are made to include current features of international trade in pulses. Finally, an added weightage is given to status of technological change among the non-price determinants of pulse production. In a nutshell, a modest attempt is made to move towards a total perspective on the subject of pulse production and to put it in a more rigorous format by bring in numerical computations.

**Objectives of Study**

The stagnation in the production of pulses is a serious problem in India. The broad objective of this study is to examine the key determinants of pulse production in some detail during the period 1980-81 to 2001-02. It seeks-

(i) to examine the growth performance of important pulse crops in terms of area, production and yield during the reference period at the all India and state levels;
(ii) to measure the magnitude of instability in area, production and yield of important pulse crops;
(iii) to estimate the contribution of price and non-price factors in determining acreage and yield of selected pulse crops in the core states;
(iv) to analyse district level status of pulse production in major growing states.
(v) to examine the impact of price on production of pulse crops.
(vi) to study the adoption of technology for pulse crops at the state and farm size levels;
(vii) to examine the domestic competitiveness of pulse crops vis-à-vis competing crops;
(viii) to examine the international competitiveness of the Indian pulses;
Hypotheses

Based on the survey of existing literature and the objectives of this study outlined above, it is proposed to test the following hypotheses:

(i) Pulse production performance in India is poor due to low growth of acreage and yield in the study period.

(ii) The non-price factors are more important than relative prices in acreage allocation to pulse crops by farmers.

(iii) Yield of pulse crops is influenced by fertilizer consumption and rainfall.

(iv) Pulse production is responsive to output/input prices.

(v) The adoption of technology for pulse crops at state and farm size levels is slow due to small proportion of cropped area covered by improved seeds, fertilizer and pesticides.

(vi) The domestic competitiveness of pulse crops is poor due to lower profitability of pulse crops in comparison to competing crops.

(vii) International competitiveness of the Indian pulses is low in terms of conventional as well as alternate indices.

Research Methodology

The research methodology used in the analysis of set objectives differs for each part of the study depending upon the availability of information and suitability of statistical technique in facilitating the discussion. The study is confined to five major pulse crops (gram, arhar, moong, urad and, massar), which constitute 85 per cent of country’s pulse
production. The analysis has been carried out at the macro level covering a period of two decades beginning from 1980-81 to 2001-02. The entire period is sub divided into two periods. The first period relates to the eighties (1980-81 to 1990-91) and second to the nineties (1990-91 to 2001-02). These sub-periods represent pre and post reform periods. The cut off point of 1990-91 has strategic significance, as pulse crops were included in the Technology Mission during this year. The study is based on secondary data. The main sources of data have been government publications and field based studies. The data and methodology used for each aspect is narrated below.

Growth Performance and Instability

For estimating the compound growth rates of individual pulse crops in terms of area, production and yield at the state and all India levels, semi-log functions have been used. For measurement of instability indices, Coppock's methodology of log variance was adopted. The state-wise time series data on area, production and yield of gram, arhar, moong, urad, massar and total pulses from 1980-81 to 1997-98 were gathered from 'Area and Production of Principal Crops in India' published by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi. The information for the remaining period was collected from the Directorate of Economics and Statistics. The farm size evidences are drawn from Input Surveys, Cultivation Practices in India and field-based studies.

Acreage Response and Yield Response

The Nerlovian modified model of distributed lags has been used for identifying the factors influencing acreage of considered pulses in the major growing states. The current year acreage was regressed on lagged

year acreage, lagged year relative farm harvest price, lagged year relative yield, pre-sowing rainfall, yield risk and price risk for the referred pulse crops in the leading states. It is essential to mention that technology related variables could not be included in the model due to non-availability of data. Even, increasing value for time (1,2,3,4…n. years) does not seem appropriate as a proxy for technology because there is lack of knowledge about the speed of technological change in pulse cultivation. One-year lag was used in acreage, yield and price assuming that the previous year's acreage; yield and prices influence the decision on acreage allocation for the current year. The required data were once again obtained from above referred sources in addition to Statistical Abstract of India, Government of India, New Delhi.

The separate yield response function was estimated for gram in Madhya Pradesh by using data on value productivity as dependent variable and expenditure on fertilizer, seed and rainfall as independent variables. Normally, yield function should include percentage of cropped area under improved seeds. Unfortunately, data on this aspect are not available for pulse crops. The information on time series data on the above variables was collected from the reports of the Commission on Agricultural Costs and Prices (CACP). This exercise could not be undertaken for arhar, moong, urad and massar due to non-availability of time series data for any of the major growing states.

District Level Status of Pulse Production

After examining the broad perspective of pulse production at the all India and state levels, status of gram, arhar, moong, urad, massar and total pulses at the disaggregated district level is analysed in major growing states. In addition, an attempt has been made to estimate the influence of rainfall and lagged farm harvest price on area allocation and of rainfall on the yield through regression model. Only a limited number of independent variables could be used due to absence of district level data on relevant
indicators like irrigation, fertilizer consumption and percentage of cropped area under improved seeds.

The district-wise data on area, production, yield and coverage of irrigation under gram, arhar, moong, urad, massar and total pulses were obtained from Statistical Abstracts of States, which contributed between 80 to 90 per cent in the production to national kitty. In some cases "District-wise Area and Production of Principal Crops in India" published by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi was used for gathering relevant data.

The information on farm harvest prices of gram and arhar was culled out from Farm Harvest Prices in India published by Ministry of Agriculture, Government of India, New Delhi. The coverage of districts is spread to the extent that all districts, which contributed more than one per cent to state’s total production of a particular crop, were included in the analysis. The latest Statistical Abstracts of major growing states were used for data collection but their years were not found uniform. Still, most of the data used in the analysis relate to the year 1998-99 but in exceptional cases information on earlier years was used due to non-availability of latest documents. The coefficients of variation of included variables were measured in order to estimate degree of variability across the districts. The impact of farm harvest price and rainfall on acreage and of rainfall on yield was estimated through semi-log functions. One-year lag is used in farm harvest price assuming that last year’s price affects current year acreage. It could not be possible to gauge the influence of all possible factors due to non-availability of district level data. Rainfall is used as a main variable because it is known to have a profound effect on yield and hence output of pulses.

Output Response of Price

The main purpose of this exercise is to estimate the influence of pulse price on its production. For better understanding of the price
scenario, trends, variability, growth and inter year changes in the whole sale, farm harvest, retail and minimum support prices of five referred pulse crops were measured for the two sub-periods and the entire study period. The semi-log functions were used for estimation. Since, agricultural prices are known for seasonality component, monthly indices were worked out in wholesale prices in major markets of the core states through deviations from the mean value for 1981, 1991 and 2001. Further, production response of prices of individual pulse crops was estimated through methodology used by Raj Krishna and Raychaudhri (1980). Accordingly, responsiveness of prices to production was measured by estimating separate elasticities of acreage and yield, which were clubbed together to arrive at the output response. The price indices used in the calculation were farm harvest price indices deflated by input price indices. This was purposively done because farmers are also sensitive to input prices. For moong, urad and massar, farm harvest prices are not available and therefore wholesale prices in the harvesting months were used as a proxy. The data on prices were culled out from Agricultural Prices in India and Farm Harvest Prices in India published by Ministry of Agriculture, Government of India, New Delhi. The time series data on input price indices were obtained from the reports of the Commission for Agricultural Costs and Prices (CACP) of the year 2003.

Adoption of Technology

An examination of the adoption of technology, its background and farmers' experiences fulfilled this objective. At the outset, a review of initiatives taken by the Government for promotion and transfer of improved technology in pulse cultivation based on information obtained from plan documents and booklets of Technology Mission on Pulses and Oilseeds (TMOP) was presented. This was followed by yield gap indices of gram,

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arhar, moong, urad and massar computed on the basis of potential yield measured by ICAR on demonstration plots. The analysis of the use of technology enhancing inputs by farmers at the state and farm size levels is based on Input Survey data (1976-77 and 1991-92) and Cultivation Practices in India (1999). It is essential to mention that Input Survey, (1991-92) is the latest available comprehensive data on use of fertilizer, manure and pesticides for gram and arhar cultivation by states and farm sizes. However, yield and adoption of improved varieties are the most important missing links in these data. The second aspect is partially taken care of by the NSSO Survey in 1998-99 but the first remained untouched despite its overwhelming importance. Further, an effort is made to identity the factors influencing adoption of technology for pulse cultivation by regressing state-wise percentage of pulse area under improved variety seeds on percentage of GCA under pulse crops, percentage of irrigated area, percentage of pulse area fertilized, manured and covered by pesticides and tractor use. Before concluding the discussion, farmers' experiences in terms of benefits of improved technology and their suggestions to popularize are analysed on the basis of field studies.

**Domestic Competitiveness**

The domestic competitiveness of considered five pulse crops is judged on the basis of relative profitability of competing crops in three major producing states for which three points of time data were available from the reports of the Commission on Agricultural Costs and Prices (CACP). The competing crops considered for gram were wheat and mustard whereas bajra and jowar were found appropriate for arhar, moong and urad. For massar, gram and mustard were used as alternate crops. The profitability per unit of land and net returns per rupee on investment were computed for the selected pulse crops on operational cost and after inclusion of fixed cost. In the gross returns, value of main as well as by product was added while in operational cost, expenditure on human
labour, bullock labour, machine labour, seed, fertilizer, manures, pesticides, irrigation and interest an working capital were included. In the fixed cost, rental value of owned land, rent paid for leased in land, land revenue and taxes, depreciation and interest on the fixed capital were added. The analysis is carried out for gram (Madhya Pradesh, Uttar Pradesh, Rajasthan), arhar (Madhya Pradesh, Uttar Pradesh), moong (Andhra Pradesh, Maharashtra, Madhya Pradesh), urad (Andhra Pradesh, Madhya Pradesh) and massar (Uttar Pradesh, Madhya Pradesh) at three points of time but massar is excluded from the analysis for first two points of time due to non-availability of data. It is essential to mention that availability of three points of time data has been the major limitation in selection of states. Owing to this difficulty, first ranking state in terms of production of arhar and moong could not be analysed.

International Competitiveness of Indian Pulses

With the gradual liberalization of economy after the initiation of economic reforms in 1991, agricultural markets are slowly getting integrated to global market. In the current scenario, international trade and prices of commodities have become another factor influencing crop choices of the farmers. Therefore, a study of international competitiveness has become essential for understanding the production prospects of various agricultural commodities. This study has attempted to measure international competitiveness of gram, arhar, moong, urad and massar in conventional framework by computing Nominal Protection coefficients (NPCs), Effective Protection Coefficients (EPCs) and Effective Subsidy Coefficients (EECs) as well as alternate indices exhibiting social cost in the form of Domestic Resource Cost Ratios (DRCRs) of individual pulse crops. For understanding the overall perspective of pulse trade, important related aspects are also analysed. The international data on trade and production were obtained from FAO Production and Trade Year Books whereas information on pulse exports and imports was gathered from
Foreign Trade Statistics, Ministry of Commerce, Government of India. The data required for calculating the Domestic Resource Cost Ratios (DRCRs) particularly, information on opportunity cost of inputs going into the production of pulse crops was obtained from the reports of the Commission for Agricultural Costs and Prices, Ministry of Agriculture, Government of India, New Delhi.

Plan of the Study

The study is divided into nine chapters. Chapter-I is introductory in nature. It outlines the problems of stagnation in pulse production in India and emphasises the necessity for finding out an early and appropriate solution to it. The chapter also reviews the existing literature on the subject and identifies the need for undertaking research on pulse production in an integrated manner. In addition, it lists the objectives and hypotheses of the study and touches upon the methodology besides the chapter scheme.

Chapter-II presents an overview of pulse economy of India. It highlights the importance of pulses vis-à-vis other vegetable protein foods and the net availability along with demand–supply gap of pulses in India. This is followed by performance of pulses in comparison to wheat, rice and total food grains. The chapter also gives an idea about the pulses development strategy adopted by the Government during the plan period.

Chapter-III analyses the production performance of major pulse growing states during the study period with a special emphasis on instability problem. It also attempts to identify the determinants of pulse production in terms of acreage by using the Nirlovian model of distributed lags and of yield by using the regression model.

Chapter-IV of the study aims to bring out inter-district variations in area, production and yield of major pulse crops in core producing states during the latest available period. It also examines the impact of rainfall on area and yield.
Chapter-V presents the impact of prices on pulse production in India and core producing states thereof besides analysing the trends and variability in wholesale, retail, farm harvest and minimum support prices during the period of this study. It also looks into yearly changes and seasonality aspects.

Chapter-VI deals with adoption of technology in the context of pulse production. It describes the Government's strategy for the transfer and promotion of technology through Technology Mission on Oilseeds and Pulses. It throws light on the adoption of technology at state and farm size levels and examines the use of improved variety of seeds, consumption of pesticides and fertilisers. The farmer's experiences and suggestions also find a place at the end of this chapter.

Domestic competitiveness of pulse crops is the central theme of Chapter-VII. It examines the profitability of major pulse crops vis-à-vis competitive crops in three important pulse growing states at three different points of time i.e. early eighties, early nineties and the recent period.

Chapter-VIII examines the international competitiveness of the Indian pulses in conventional as well as the alternative framework. It also provides information about trade related issues such as magnitude of imports and exports as well as their composition.

Chapter-IX presents the salient findings of the study in an integrated manner. This is followed by policy implications which include recommendations and suggestions to tackle the problem of stagnant pulse production in India.