ECONOMICS OF PRODUCTION AND VALUE ADDITION TO SOYBEAN IN MADHYA PRADESH

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1. INTRODUCTION

Soybean is known as the “golden bean”, “miracle crop” etc, because of its several uses. It is an excellent source of protein and oil. It contains about 43 per cent of good quality protein (43%), carbohydrates (21%), minerals (5%), moisture (8%), fat (20%), fiber (4%) and reasonable amounts of vitamins. Besides utilization of soybean as vegetable, it is also used in oil industry where it occupies first place in the world oil production. Soybean containing 43 per cent protein and 20 per cent oil has tremendous potential to meet the protein-calorie malnutrition of the ever increasing Indian population. Soy based food products are also suitable to diabetic patients as they contain less carbohydrates and low cholesterol. Soy protein is also good to people who are allergic to animal protein. Therefore, it is one of the most economical protein source in the world. It is a versatile crop with innumerable possibilities of improving agriculture and supporting industry (Ali, 2003).

Soybean (*Glycine max* (L) Merrill) is a major oilseed crop in the world covering 91.29 million hectares under oilseed crops and contributing around 57 per cent (220.81 million metric tons) of the total 390.39 million metric tons during 2007-08 which makes it as the leading oilseed crop in the world, ahead of cotton, rapeseed, groundnut, sunflower etc. The phenomenal increase in its area and production together with the expansion in processing units has earned a prominent position for India on the world map of soybean industry. In fact, it proved to be a fortune crop in terms of edible oil production, export earnings and rural prosperity.

Today USA, Brazil, Argentina and India are the five major soybean producing countries. They produce 91 per cent of the world’s total soybean production. India ranked fifth both in area (8.85 million hectare) and production (9.473 million metric tons) in the world during 2007-08. To the edible oil pool, soybean has attained a prominent position in India’s agro-economy with 12 per cent contribution. Earnings through soybean meal export during 2007-08 were Rs 43,857 million. Soybean is making a head way in oilseed front both in area and production immediately after groundnut, rapeseed and mustard.

Though soybean crop was introduced in Madhya Pradesh during the later part of 1960’s, its spread in the state has been remarkable. The area under the crop in the state during 2007-08 was 5.024 million hectare and the production was 5.480 million metric tons. During 2007-08, productivity in Andhra Pradesh was (1278 kg/ha) highest and Madhya Pradesh with 1021 kg per hectare yield was at third position. Average productivity of India was 1070 kilogram per hectare. Madhya Pradesh has emerged as the soy state of the country with over 55 percent share in area as well as in production. In Madhya Pradesh, soybean has emerged as an important crop in the cropping pattern of Ujjain, Dewas and Shajapur districts occupying about 4.3 lakh hectare and 5.27 lakh tons, 2.81 lakh hectare and 3.29 lakh tons and 3.32 lakh hectare and 3.02 lakh tons area and production, respectively, during 2007-08. In the recent past, soybean cultivation has increased manifold as compared to any other oilseed crop in India and stands next only to groundnut. Though commercial production of soybean began only in 1971-72, soybean production is mainly confined to Madhya Pradesh (also known as soybean bowl of India), Maharashtra, Rajasthan, Andhra Pradesh, Karnataka, Uttar Pradesh and Chhattisgarh.

It was observed that the ratio of price received of soybean to each of its competing crops particularly groundnut and cotton seen to be more profitable for farmers particularly in Maharashtra and Madhya Pradesh. Studies revealed that good seeds and better practices could deliver yield of the order of three tonnes per hectare which could place India’s total production around 15 million tonnes. Thus, there is ample scope of increasing the production (Kajale, 2002). However, non-availability of short duration high yielding varieties and good quality seed on adequate scale are the major constraint in achieving higher productivity. Only limited seed varieties are available and production of quality seed is also limited. Further, low and unbalanced use of chemical fertilizers is another major factor for poor yield of soybean crop. As the country is in short supply of edible oil and about 50 per cent of our edible oil consumption is fulfilled by imports of different vegetable oils, there is a dire need to promote the production of oilseeds like soybean when compared to other countries. There has been a slow but steady growth in the production of soybean in India, which is attributed to erratic monsoon, poor management, incidence of pests and disease, shattering of pods, soybean rust and above all low input technology (Singh *et al.,* 2003).

There are more than 400 units in the country till 2003 for processing utilization and allied activities. Indian soybean industry has capabilities to process soybean for food, feed, pharmaceutical and industrial applications. Present utilization pattern of soybean in India is that 85% for oil extraction 10% for seed and only 5% for food and feed. Soybeans are considered by many agencies, including the US Food and Drug Administration, to be a source of complete protein. For this reason, for many vegetarians and vegans or for people who cannot afford meat it can act as a good substitute (Kulkarni, 2003).

The beans can be processed in a variety of ways. Common forms of soy (or soya) include soy meal, soy flour, soy milk, tofu, tempeh, soy lecithin, soybean oil and textured vegetable protein (TVP). TVP is made into a wide variety of vegetarian foods, some of them intended to imitate meat. Soybeans are the primary ingredient in many processed foods, including dairy product substitutes (e.g., margarine, soy ice cream, soy yogurt, soy cheese and soy cream cheese) as well as soy nut butter, soy crisps, are among others. Soybeans are processed to produce a texture and appearance similar to other foods (e.g., butter, ice cream, milk, yogurt, cheese, lard, olive oil, ground beef, peanut butter, potato chips, etc.) and are readily available in most supermarkets (Iiyas, 2003).

In view of dominance of soybean crop in the cropping pattern, besides the low yield and infrastructural problems that the industrial units face such as in adequacy of power, lack of efficient and quick transport, non–availability of proper market for these soy products and consumer acceptability are amongst major problems faced by these processing units in Madhya Pradesh including value addition of soybean, since processing or value addition has a crucial effect on the economics of the crop (Rangasamy, 2007).

It has been estimated that nearly 85 per cent of soybean produced in the country is processed and nearly 40 percent in Madhya Pradesh alone. Therefore processing is an important function of soybean. Further more, the processing sector is still far from achieving satisfactory success (only 2 per cent of fruits and vegetables are processed in organized sector). There are more than 200 soybean processing units in Madhya Pradesh but most of them are engaged in oil, deoiled cake (DOC) and lecithin making only. Only a few are engaged in making value added products (Kulkarni, 2003) indicating apprehensions on viability of investments in soybean value added products. People are aware of milk and its products but not soya and its products. Hence there is need to create awareness and demand for these value added products.

In this regard, there is need to understand the profitability of soybean as whole pulse as well as processed soy products. Therefore, in the present study, attempt is made to find out the economics of soybean production and its value addition in Madhya Pradesh state with the following specific objectives:

Specific Objectives

1. To find out the profitability of soybean cultivation vis-à-vis competing crops.
2. To identify different value added products of soybean and to assess their costs and returns.
3. To find out the financial feasibility of investment in value addition to soybean.
4. To identify constraints in value addition and suggest remedial measures.

Hypothesis

1. Soybean cultivation is profitable over its competing crops.
2. Value addition in soybean is profitable over raw soybean.
3. Investment in value addition to soybean is financially feasible.
4. Constraints are limiting the value addition in soybean.

Presentation of the study

The study has been presented in seven chapters. In chapter-I, the nature and importance of research problem, specific objectives of the study have been depicted. Chapter-II deals with review of the relevant past studies related to the study.

Chapter–III gives an overview of the study area, the nature and source of the data, the analytical tools employed for evaluating the objectives and interpreting the results and various concepts used in the study. The results of the study have been presented through a variety of tables in the Chapter-IV. A critical discussion of the result has been presented / depicted in the Chapter-V.

A brief summary of the overall results and the main findings of the study have been presented in the Chapter-VI along with the policy implications that emerged from the findings of the study.

Chapter-VII includes the list of the referred books and journals for the study.

2. REVIEW OF LITERATURE

In this chapter, past studies in the field of soybean and value addition are reviewed and compiled to enable better understanding of these issues concerned to the study. The review of literature is presented under the following headings.

2.1 Profitability of soybean vis-à-vis competing crops

White (2001) reported that U.S. farmers announced intentions to grow 76.7 million acres of soybeans in 2001, matching the level of corn planting intentionsfor the first time since 1983 when soybean plantings exceeded corn due to drought and the payment-in-kind program. Though harvested acreage was down slightly from intentions, 74.1 million acres for soybeans and 69.2 million acres for corn, the trend remains in place for soybeans to emerge as the most important of the field crops. This analysis illustrated how soybean planting intentions changed from last year as a result of changes this year in price-related factors, including benefits from marketing loans, prices of competing crops, and higher fertilizer and fuel costs in corn production.

Kajale (2002) examined the ratio of price (received) of soybean to each of its competing crops and found that net returns per hectare in chilli was higher than that of soybean. Competing crops particularly groundnut and cotton were seen to be more profitable for all the houses.

Lin (2002) estimated the trend in yields along with planting intentions and observed a larger U.S. corn crop as against slightly smaller soybean crop than last year's. Even with slightly lower expected wheat acreage, production prospects point to a larger crop than last year due to lower projected abandonment (unharvested acres). A smaller cotton crop is anticipated as cotton acreage is being bid away to more profitable competing crops.

Shrivastav and Mishra (2002) studied the opinion of farmers, which revealed that soybean crop rotted due to heavy rains in all the years resulting in low yields of 6 quintals per hectare, whereas in paddy it was 18 quintals per hectare. They found that paddy was less risky and economically more competing crop than soybean in Bilaspur district of Chhattisgarh.

Rao *et al.* (2004) reported that soybean was the competing crop, especially in central and western India replacing sorghum. Cotton, sunflower, maize, groundnut, pulses and soybean are replacing pearl millet. Some factors responsible for replacement of sorghum and pearl millet by these competing crops are low productivity and profitability of sorghum and pearl millet vis-à-vis competing crops, increased irrigation availability and price support to other cash crops. Thus, yield improvements and value-addition through industrial utilization may enhance the profitability and alleviate rural poverty.

Lamm *et al.* (2007) studied the crop production and economics of corn, grain sorghum, soybean, and sunflower under irrigated and dry land conditions by simulating 34 years (1972-2005) of weather data in Northwest Kansas. Assuming a 95% application efficiency (Ea), the average long-term crop yield was approximately 12.9, 8.2, 4.4, and 3.2 Mg/ha for corn, grain sorghum, soybean, and sunflower, respectively. Although corn was currently the predominant irrigated crop in western Kansas, projections for the year 2006 indicated soybean as a more profitable alternative.

Welch *et al.* (2008) observed that increasing returns from competing crops had greater impact on net returns from cotton production. While current U.S. farm policy moderates the effects of rising prices for cotton lint, returns from the seed portion of cotton production increased significantly. These findings highlight the contribution that cottonseed makes to the overall profitability of U.S. cotton production.

2.2 Costs and returns of value added products

Rude and Goddard (1995) indicated the measures of market power and returns to scale worked out for the Canadian dairy industry with the estimation of a cost system. A two-stage production process resulted in a cost function which was additively separable between raw milk costs and processing costs for other inputs. The processing cost component was multiplicatively separable between an input price index and an aggregate input which was a transformation of output.

Verma *et al.* (1999) studied the productivity of the dairy industry across states in India during 1976-95. The output from the dairy industry recorded an annual growth rate of 17.14%. Value addition as a proportion of output ranged from -4.79% (West Bengal) to 17.16% (Indian Punjab) against the national average of 7.22%. The performance of the dairy industry in terms of net returns over cost has been satisfactory in few states.

Deorukhakar *et al.* (2007) in their study in Sindhudurg district of Maharashtra, India, worked out costs and returns structure and employment potential in kokum (*Garcinia indica*) processing units. The study revealed that processing of kokum into kokum syrup was more profitable than kokum agal and kokum rind. The processing of kokum into kokum syrup resulted in gross returns of Rs 3780 per quintal at a cost of Rs 2440/-, thereby yielding net returns of Rs 1339.63 per quintal. On the other hand, kokum rind and kokum agal yielded net returns of Rs 604.91 and Rs 476.33 per quintal.

Sharma and Pandey (2008) studied the costs and net profits from Guava processing in Uttar Pradesh. The cost of processing guava into jam and jellies was estimated at Rs 3,96,482 per year, the gross returns obtained from selling it was worked out to Rs. 5,28,750 per year and the net returns obtained were Rs 1,32,268 per annum. It was observed that the processing of guava was more profitable than selling it raw.

2.3 Financial feasibility of investment in agricultural production

Rao (1993) conducted a study on economics of investment in mango plantation in Ratnagiri district (M.S.) and estimated that the plantation of Alphonso mango was profitable with per hectare net return of Rs.30,000 at Rs.24,926 cost of cultivation in addition to Rs.17,469 cost of marketing. The investment in mango cultivation was found to be economically viable as the estimated project analysis parameters favorable with 19.33 percent of internal rate of return which was higher than prevailing interest rate, benefit cost ratio higher than one and 11 years payback period.

Mitrannavar and Kulkarni (1998) studied the economic viability of investment in grape cultivation in Bijapur district of Karnataka using data collected from 80 sample grape growers for the year 1995-96. Financial feasibility measures like net present value, benefit cost ratio and the internal rate of return were found to be favorable with minimum pay-back period for all surveyed vineyards justified the investment in grape cultivation in the area.

Sekar and Ramasamy (1998) conducted a study to assess the financial feasibility of various soil conservation structures (contour bund, staggered trench, stone wall, and waterway) to conserve soil in Nilgiris district, TamilNadu, India. Three major issues were considered: (i) analysis of investment on soil conservation measures; (ii) determinants of land value; and (iii) adoption analysis of soil conservation technologies. Four major crops were covered: potato, carrot, cabbage and tea. Net present value (Rs 12,25,365), benefit-cost ratio (1.42) and internal rate of return (38.65%) were calculated for the four soil conservation technologies.

Talathi *et al.* (2001) in their study on economic feasibility of *kokum* plantation established on the research farm coming under Konkan region of Maharashtra reported that investment in kokum plantation is economically viable since net present value (NPV) was positive, benefit cost ratio was greater than one and internal rate of return (IRR) was also greater than the opportunity cost of capital with nine years pay back period. Further, study indicated that, crop was equally remunerative when compared to other crops, and the cost incurred on the establishment of *kokum* orchard per hectare worked to Rs.56,699/-.

Naik (2002) studied economic feasibility of mango plantation in south Konkan of Maharashtra for near sea shore orchards (Group A) and away from sea shore orchards (Group B) and worked out project feasibility parameters at 8, 10 and 12 percents discount rates. The NPV of group A orchards was found to be Rs. 2,52,770/-, Rs. 1,50,270/- and Rs. 86,400/- at the discount rates respectively. The respective figures for Group–B were Rs. 156020, Rs. 85580 and Rs. 41740. All the NPV's were positive indicating viability of mango plantation in the study area. Further, the pay back period (PBP) was 14, 15 and 16 years in Group – A and 15, 17 and 19 years in Group–B for the respective discounting rates. However, without discounting the pay back period for both groups was observed to be 12 years. This indicated that mango plantation project required 12 years period for recumbent of investment. The value of IRR was 17.97 per cent in Group-A while 15.38 per cent in Group-B. In both the

groups, these values were greater than prevailing rate of interest (13%) on borrowings. The study indicate that Group A orchards had better comparative advantage when compared with Group B orchards.

Gobbi and Casasola (2003) examined the financial feasibility of investing in silvopastoral systems on 20% of the area of a conventional livestock farm in Esparza, Costa Rica. The findings from an ex-ante benefit-cost analysis indicated that the investment was financially viable with an incremental net present value of US$1613 and an internal rate of return of 20%, if only livestock production was considered. Investment feasibility was directly related to improvements in the productive and reproductive parameters of the livestock herd caused by the incorporation of silvopastoral systems.

Liao et *al.* (2003) examined the economic feasibility which included methods such as pay back period, rate of profitability, net present value, internal rate of return, benefit- cost ratio, and break-even analysis to evaluate the financial feasibility of an aquaculture venture.

Gangwar *et al.* (2005) undertook the study on economic evaluation of Peach cultivation in North Indian plains with the help of different investment appraisal methods. The Net Present Value (NPV) worked out to be Rs.44807/-, the Benefit Cost Ratio (BCR) as 1.41 and Internal Rate of Return (IRR) as 22.20 under the present value summation method. Under the amortization method also the Net Present Value (NPV) and Benefit Cost (BC) ratio were favorable with Rs. 42877/- and 1.28, respectively, indicating that peach cultivation in Punjab and Uttarakhand (North Indian Plains) were a profitable venture.

Hegde and Patil (2005) examined the costs and return as well as the feasibility of establishing mango scion blocks for mango production. The net present value, cost benefit ratio, internal rate of return and payback period was worked out to know the financial viability of the enterprise. Results showed that the returns per acre were marginally higher in Dharwad scion blocks (Rs. 5404.29) than that of Bangalore scion blocks (Rs. 5202.90). Returns increased from first year to third year in both districts. The net present value of Dharwad scion blocks (Rs. 82 777/-) was higher than that of Bangalore scion blocks (Rs 69 958.05/-). Similarly, the benefit cost ratio for Dharwad scion blocks was higher (2.13) than that of Bangalore (2.01). The payback period for Bangalore scion block was 7 years and 6.11 years for Dharwad scion blocks. Thus, it was concluded that investing on mango scion blocks is economically feasible and financially viable, irrespective of region of production.

Meena *et al.* (2006) conducted a study to examine the economic viability of different sizes of chilli processing units in Jodhpur District, Rajasthan, India. The data were gathered from 12 processing units in the district during 2000-01. Results showed that the cost of processing per quintal of chilli was Rs. 180.06, Rs. 167.30, Rs. 234.42 for small, medium and large processing units, respectively. Margin of processors increased with an increase in the size of processing unit. Value addition by investment rupee as processing cost and returns to per rupee investment, also increased with an increase in size of processing unit. All the processing units were operating above the break-even quantity, but failed to utilize their installed capacity.

Azad and Sikka (2007) in their study on production and marketing of temperate fruits have adopted project evaluation measures to study the economic viability of fruits such as apples, peaches, plums and apricots. The net present value was Rs. 26257/- for apples, Rs. 89222/- for peaches, Rs. 117837/- for plums and Rs. 160541/-for apricots. The internal rate of return was 22, 33 and 47 per cent respectively. The benefit cost ratios were 1.36, 3.87, 4.62 and 5.10 respectively.

Sundarevarodarayan and Ramanathan (2008) reported that B C ratio and IRR for new plantations were 1.42 and 34.36 per cent, while for old plantations it was 1.06 and 17.17 per cent respectively. Further, they suggested that need to create an awareness to adopt improved varieties (HYV) which not only reduce the cost of cultivation but also to increase the net income among the different size group of farmers.

2.4 Constraints faced by processing units

Gupta *et al.* (1971) studied on modernization of rice processing industry in Punjab and found that lack of financial resources to meet the procurement requirement was the major problem faced by the millers. Non-availability of gunny bags and the high moisture content of

paddy were the other problems encountered in paddy procurement. One third of the millers had experienced problems in paddy storage.

Hemchand (1989) studied the economics of processing units in Narasinghpur district (MP) and found that the main problems of arhar processors were inadequate availability of raw materials, short supply of power leading to under utilization of the plant, declining output inefficient utilization of machinery and labour and problems of transportation of processed material to different destinations.

Ansari (1990) studied the organization and management in Co-operative Sugar Mills in Uttar Pradesh and concluded that the sugar co-operatives of Uttar Pradesh area were in the grip of a number of management problems at various levels. The nature of the co-operatives multiplies their complexity. Lack of professionalisation of management was mainly responsible for this state of affairs besides other things such as vested interests of office bearers.

Nagesh (1990) found that the major problems faced by the cashew Processors in Karnataka were the existence of large number of processing units, inadequate availability of raw cashewnut, poor quality of raw cashewnuts, rise in prices of raw cashewnut, non availability of skilled labour, increase in wage rate and high taxes. All these problems ultimately resulted in underutilization of the installed capacity.

Veerkar *et al.* (2001) studied constraint in *kokum* processing industry. They found that the common problem faced by the industry was higher transport charges incurred in marketing which was 60 per cent of the processing units, similarly high price of raw material and its non-availability were reported by the same (60%) processing units. On the other hand 70 and 80 per cent of the processing units faced the problem of non-availability of labour and capital respectively. Similar problems were also found in the Amrit *kokum* and *kokum* butter processing units. To overcome their problem, more than 70 per cent *kokum* processors proposed to provide long term financial assistance with lower rate of interest by the financial institutions.

Chakravorty *et al.* (2004) found that soymilk chhana and potato paste combination at 60:40, 50:50 and 40:60 ratios were used to prepare the potato analogue. A product with 40:60 combination yielded a most suitable and acceptable sample with smooth soft and spongy and was similar to the market sample. The product was without typical beany odour which is the major constraint in consumer acceptability of soymilk and its products.

Kohler *et al.* (2007) examined the project which was launched in mid-2006, looking into value-addition to various camel products, especially camel milk. Ice cream made from camel milk, which was launched during an inception workshop, had generated significant interest among local hoteliers. Furthermore, it was suggested to analyze the hurdles that need to be overcome before value added products can truly contribute to improve local incomes and livelihoods.

Rangasamy and Dhaka (2007) found that the economic efficiency of dairy plants is severely influenced by a variety of constraints at 3 important value addition stages of milk procurement, processing and manufacturing and distribution of dairy products. This study was conducted to compare the constraints faced by cooperative and private dairy plants at these vital value addition stages. Some of the members of the cooperative society selling the milk to private milk vendors and some of the collection centres taking the inadequate quantity of milk were the very serious problems faced by cooperative and private dairy plants, respectively. Underutilization of transport vehicles at milk transport, underutilization of chilling centres and underutilization of plant at milk processing and manufacturing levels were the most serious constraints faced by both the cooperative and private dairy plants. Encouraging value addition, effective sales promotion and advertisement strategy and also focusing on consumer-oriented market research and development were some of the suggested strategies.

Verma and Jain (2007) examined value addition of nutri-cereals (nutritious cereals) coarse cereals and millets. The important coarse cereals generally referred are sorghum (Sorghum bicolor), barley, pearl millet (Pennisetum glaucum) and maize. Finger (Eleusine coracana), kodo (Paspalum scrobiculatum), foxtail (Setaria italica), proso (Panicum miliaceum), barnyard (Echinochloa frumentacea) and little millets (Panicum sumatrense) are a few other common types of millets. Their production, agro-economic constraints, uses,

nutritional quality, traditional processing techniques, and storage were described in the study area.

Yadav *et al.* (2007) studied the prevailing practices of post harvest handling and management (focusing on processing, pre-cooling, grading, packaging, transport, storage and marketing) of horticultural produce (including fruits and vegetables) in the northeastern region of India: Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Postharvest handling, processing and marketing constraints were enumerated. Some thrust areas, identified in post harvest technology for value addition and employment generation, were given.

Singh (2008) found that the major problems faced by processing sector were, low productivity of raw materials leading to high unit price of final products, lack of storage infrastructure leading to wastage and increasing unit price of finally available quantity, lack of trained human resource, inadequate knowledge of material and lack of market intelligence and inadequate cold storage and refrigerated transport facility of the fresh as well as processed commodities which needs to be solved immediately for the growth of processing sector.

3. METHODOLOGY

A general description of the study area, the data base, the sampling techniques, tools and techniques used for analysis is presented in this chapter. For better understanding, this chapter is arranged in an appropriate sequence with the following sub-heading.

3.1 Description of the study area

3.2 Sampling design

3.3 Nature and source of data

3.4 Analytical Techniques

3.5 Terms and concepts used in the study

3.1 Description of the study area

The study was purposively confined to Madhya Pradesh state since area (55.13%) and production (52.58%) in soybean is more than 50 per cent of the total area and production in the country (Table 3.1).

Madhya Pradesh is located at North latitude 15°40' and 22°00' and East longitudes 72°30' and 80°30' with geographical area of 3,07,713 sq. kms. The state is bounded in north by Uttar Pradesh, east by Chhattisgarh, south by Maharashtra and west by Gujarat and Rajasthan. At present, administratively it is divided into 48 districts. The state has a total area of 3,08,000 sq km and population more than 6 crores. Out of the total area of the state, 64 per cent (196936.32 sq.kms.) is cultivable. Like most of the other part of India, the climate of Madhya Pradesh state is sub tropical monsoon type. Generally, there are three distinct seasons within a year viz. summer from March to May, rainy season from June to September with post monsoon rainfall in October and winter from December to February.

The distribution of area and production of soybean in Madhya Pradesh state clearly indicated that the Ujjain region comprising Ujjain, Dewas and Shajapur region districts together occupied major area (20.78%) and production (21.16%) in the state (Table 3.2).

Ujjain District is situated on the Malawa plateau in the West-central part of Madhya Pradesh and lies between 18º15' and 22º25' North latitude and 73º44' and 75º06' East longitude. It has four seasons with clear bright weather (December to February), hot season (March to May), south-west monsoon season (June to September) and north-east monsoon season (October and November). The major portion of the rains being received from the south-west monsoon rain. The average rainfall in Ujjain district in 2008 was 411.4 mm .The crops grown in Ujjain district are soybean, maize, jowar, wheat, potato etc. The district has an area 6091 Sq. Km, and a population of 17.11 lakhs (2001 census), an increase of 23.71percent since 1991.The district is now divided into six tehsils viz., Ujjain, Badnagar, Mahidpur, Tarana, Khachrod, Ghatia. Soybean is the major crop grown in Ujjain district which occupies the first position in area and production under soybean cultivation in Madhya Pradesh.

Dewas District in Ujjain Revenue Division, is situated on the Malawa plateau in the West-central part of Madhya Pradesh and lies between 20º17' and 23º20' North latitude and 75º54' and 77º08' East longitude. It has similar climatic conditions as like Ujjian district and receives from the south-west monsoon. The average rainfall in Dewas district in 2008 was 261.3mm.The crops grown in Dewas district are soybean, maize, jowar, wheat, gram etc

The district has an area 7,020 km², and a population of 1,306,617 (2001 census), an increase of 26 percent since 1991.The district is now divided in to six tehsils *viz.,* Sonkatch, Dewas, Bagli, Kannod, Tonk-Khurd and Khategaon. Dewas tahsil is situated on the north-western part of the district, Sonkatch on the north-eastern part, Bagli on the south, Kannod on the south-central part and Khategaon on the South-east. Soybean is the major crops grown in Dewas district which occupy the second highest area and production under soybean cultivation in Madhya Pradesh.

Shajapur District is part of the Malwa Plateau. The district is situated in the northwestern part of the state and lies between latitudes 32"06' and 24" 19' North and longitude 75" 41' and 77" 02' East. It has similar climate as that of Dewas. The major portion

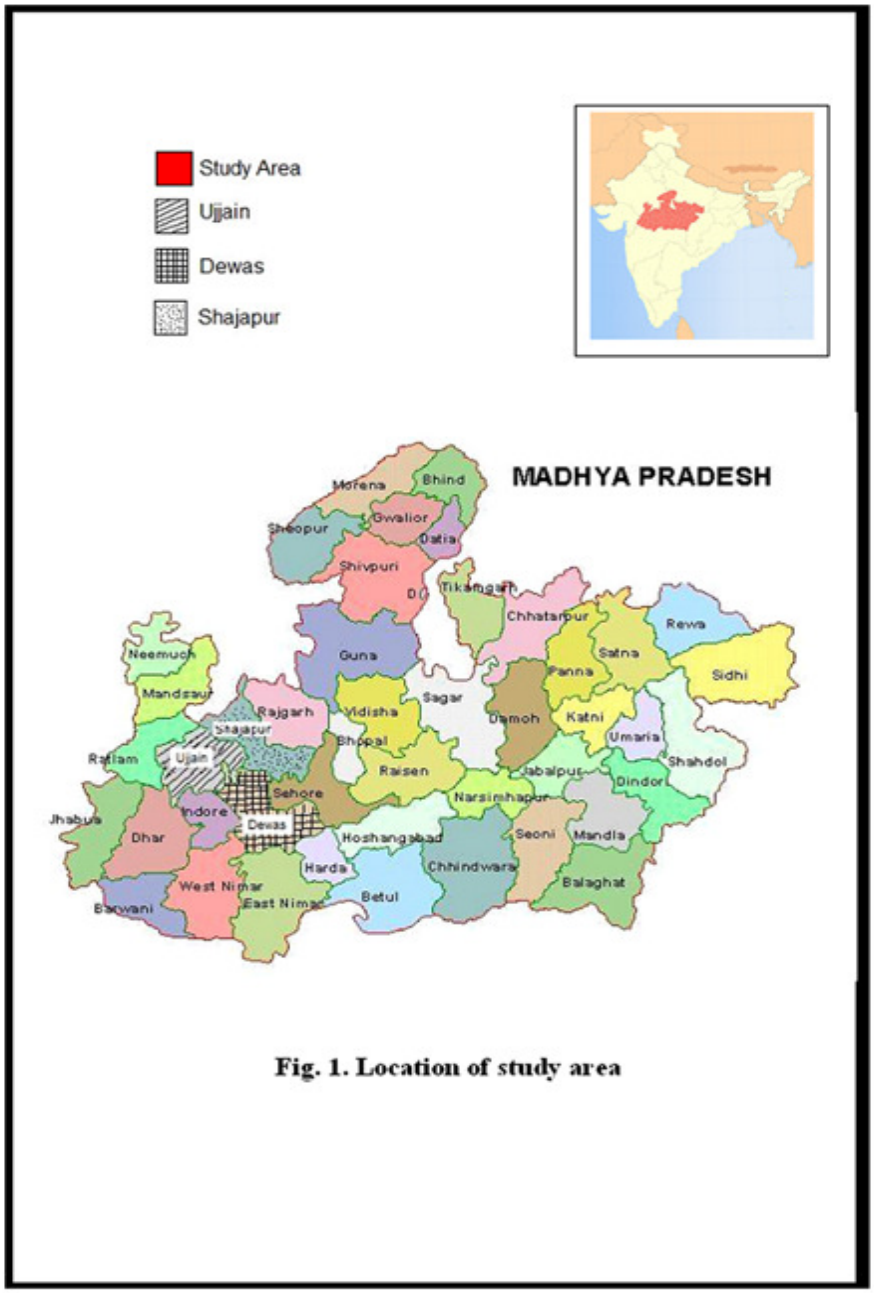

Fig. 1. Location of study area

Fig.1. Location of study area

Table 3.1. Area and production of soybean in major producing states in India

State	Area (Million Hectare)	Production (Million Metric Ton)
Madhya Pradesh	4.879 (55.13)	4.981 (52.58)
Maharashtra	2.652 (29.97)	3.237 (34.17)
Rajasthan	0.764 (8.63)	0.735 (7.76)
Andhra Pradesh	0.107 (1.21)	0.137 (1.45)
Karnataka	0.162 (1.83)	0.154 (1.63)
Chattisgarh	0.11 (1.24)	0.088 (0.93)
Other States	0.176 (1.99)	0.141 (1.49)
Total	8.85 (100)	9.473 (100)

Note: Figures in parentheses indicate percentage to their totals

Table 3.2. District wise area, production and productivity of soybean in Madhya Pradesh during 2007-08

Sl. No.	Districts	Area (000 hectares)	Production (000 tonnes)	Productivity (kg/ha)
1.	Ujjain	430.5 (8.57)	527.4 (9.62)	1225
2.	Dewas	281.4 (5.60)	329.8 (6.02)	1172
3.	Shajapur	332.3 (6.61)	302.3 (5.52)	910
4.	Madhya Pradesh	5024.4 (100)	5480.5 (100)	1092

Note: Figures in parentheses indicate percentage to their totals

of the rains being received from the south-west monsoon rain. The average rainfall in Shajapur district in 2008 was 449.7 mm. The crops grown in Shajapur district are soybean, maize, jowar, wheat, gram and lentil.

The district is now divided into eight tehsils viz.,Susner, Nalkheda, Badod, Agar, Shajapur, Mohanbadodia, Shujalpur and Kalapipal. Soybean is the major crop grown in Shajapur district which occupy the second highest area and third highest in production under soybean cultivation in Madhya Pradesh.

3.2 Sampling design

For selection of sample farmers, a multistage sampling procedure was adopted for the selection of districts, blocks, villages and farmers in the study area. In the first stage, three districts namely Ujjain, Dewas and Shajapur were chosen since they occupy the highest area of soybean in Madhya Pradesh. Ujjain district occupied highest area followed by Dewas and Shajapur. Similarly, one block was chosen in each of the selected districts based on the highest area in the second stage. Therefore, Kachrod block from Ujjain district, Dewas block from Dewas district and Shajapur block from Shajapur district were selected. In the third stage, three villages from each of the selected blocks were chosen based on highest area under soybean crop. Accordingly, Mokdi, Gungava and Ghinoda from Kachrod block; Brotha, Devas and Doublechauki from Dewas block and Panvari, Abhaypur and Sonara from shajapur block were selected. In the fourth stage 10 farmers were selected randomly from each of the sample villages who were growing soybean. Thus, the total sample size of soybean farmers constituted 90 (Table 3.3). Correspondingly, 30 farmers were chosen randomly who were growing competing crops of soybean such as jowar and maize from the selected districts.

In addition to farmers, the existing two soybean processing units involved in production of soya products such as soymilk, tofu and soyflour were selected from the study area. The soybean processing into soy oil was not considered in the study, because the soybean oil processing units are large scale as compared to small scale nature of soymilk tofu and flour. The processing unit on soymilk and tofu is having a capacity of 4 ton soybean per annum, while the other unit which processes soyflour had capacity of processing 20 ton of soybean annually (Table 3.4).

3.3 Nature and source of data

The primary data required for the study pertaining to agriculture year 2008 was collected through personal interview method with the help of a pre-tested comprehensive questionnaire for soybean and its competing crops from sample farmers. The data on general characteristics, cropping pattern, area under cultivation, inventory record, farm asset position, livestock/animal husbandry, details of cost of cultivation of soybean, jowar and maize, inputs used and returns were elicited from the sample farmers. The required data was collected by personal interview method by canvassing the structured questionnaires.

Similarly, data pertaining to the processing aspect was collected by personal interview method by interviewing the processors/owner of processing units regarding investment pattern, cost of processing, returns from processing and constraints in working of processing units.

The primary data from sample farmers and processors of soybean pertained the agricultural year 2008-09.

3.4 Analytical techniques

The collected data was subjected to various statistical and econometric analyses to draw meaningful inferences. The following analytical tools were adopted in the study. Descriptive statistics such as mean and t-test were computed to compare the groups.

3.4.1 Tabular analysis

3.4.2 Functional analysis

3.4.3 Project analysis techniques

Table 3.3. List of selected districts, blocks and villages in Madhya Pradesh

Sl. No.	Districts	Blocks	Villages	No of Respondents
1.	UJJAIN	KHACHROD	MOKDI	10
			GUNGAVA	10
			GHINODA	10
2.	DEWAS	DEWAS	BAROTHA	10
			DOUBLECHAUKI	10
			DEWAS	10
3.	SHAJAPUR	SHAJAPUR	PANVARI	10
			ABHAYPUR	10
			SONARA	10

Table 3.4. Soya processing units studied

Sl. No.	Name	Owners Name	Location	Products Manufacture
1.	Anurag Metal Firms Pvt Limited (Prosehat)	Mr.Manohar Lal Baheti	Indore	Soymilk & Tofu
2.	Shakti soy flour mill	Mr. Ashok Sharma	Bhopal	Soyflour

3.4.1 Tabular analysis

The tabular presentation technique was followed to study the economic characteristics of different size groups of sample farmers such as size of land holding, cropping pattern, costs and returns expressed by the farmers in case of soybean, maize and jowar. Cost of processing, returns and profits in case of processing units were also computed by tabular method. Descriptive statistics such as averages, percentages, t- test, were computed to compare the groups.

3.4.2 Functional analysis

To study resource productivity and allocative efficiency among soybean producing farmers, a modified Cobb-Douglas type of production function was fitted. This was done with a view to determine the extent to which the important resources that have been quantified, explain the variability in the gross returns of the soybean cultivating farmers and to determine whether the resources were optimally used by these farmers.

Cob-Douglas production function

In the present study, resource productivity in soybean farming was studied by fitting the Cobb-Douglas production function due the following merits of the function.

a. The coefficients of the factor inputs in the function are themselves the elasticities of production.

b. It assumes a constant elasticity of production over the entire range of input use.

The form of the production function fitted for soybean crop was as follows.

$$Y = a X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} X_8^{b8} e^0 \quad \text{.....(1)}$$

Where,

Y = Yield (Kg)

X_1 = Seeds (Kg)

X_2 = Manure (FYM) (Ton)

X_3 = Chemical fertilizers (Kg)

X_4 = Plant protection chemicals (Rs.)

X_5 = Human labour (Man days)

X_6 = Bullock labour (Bullock pair days)

X_7 = Machine work (Hours)

X_8 =Land (Hectare)

a = Constant term

e = Error/disturbance term

b_1 to b_8 = Elasticity coefficients of respective inputs or regression coefficients of factor input

The Cobb-Douglas type of production function was converted into log-linear form and the coefficients were estimated by using ordinary least squares (OLS) method. In logarithmic form, it assumed a log-linear equation as under,

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_{8+} \text{ b log e} \quad \text{……(2)}$$

The regression coefficients (bi) were tested for the significance using ‘t’ test.

$$t = \frac{b_i}{\text{Standard error of } b_i} \quad \ldots\ldots\ldots\ldots\ldots \quad (3)$$

3.4.3 Project analysis techniques

To find out the financial feasibility of investment in soybean processing units, financial feasibility parameters such as net present value (NPV), benefit cost ratio (BCR), pay back period (PBP) and internal rate of return (IRR) were estimated using discounting technique.

i) Net Present Value (NPV)

It is believed to be a more meaningful measure of the long-term investment proposal and useful in comparing the other investment proposal. Net present value is the discounted value of all cash inflows, net of all cash outflows of the project during its life period. Generally, higher the net present value better would be the preference. In calculating the net present value, the present value of benefits was considered at a discount rate of 14 per cent. The discount rate or 14 percent chosen since the prevailing rate of interest for long term commercial banks is around 14 percent. Net present value was computed using the following formula.

$$NPV = \sum_{i=0}^{n} \frac{Ai - Ci}{(i+r)^n}$$

Where,

A_i = Cash inflow in the i^{th} year

Ci = Cash out flow in the i^{th} year

r = Discount rate (14 %)

n = No. of years

ii) Benefit Cost Ratio

The benefit cost ratio of an investment is the ratio of the discounted value of all cash inflows to the discounted value of all cash outflows during the life of soybean processing units. It is calculated by using following formula.

$$BCR = \sum_{t=0}^{T} \frac{Bt/(1+r)^t}{Ct(1+r)^t}$$

Where,

B = Benefits in period t

r = Discount rate (14 %)

t = Time period

C = Costs in period t

iii) Pay Back Period (PBP)

It indicates the time period required to recover the initial investment made in a project. Symbolically, the pay back period equal t* where, t* is the lowest value of‘t’ for which the following inequality holds.

$$\sum_{t=0}^{t^*} Ct = \sum_{t=0}^{t^*} Bt$$

Where,

Bt = Return in period‘t’

Ct = Cost in period‘t’

iv) Internal Rate of Return (IRR)

The internal rate of return is that discounted rate at which the NPV is equal to zero. The internal rate of return is arrived at, through interpolation technique by using different discount rates so as to see that net present value is equated to zero. The IRR was estimated as follows,

$$IRR = \text{Lower discount rate} + \text{Difference between the two discount rates} \left(\frac{\text{Present worth of cash flows at lower discount rate}}{\text{Sum of the absolute values of the two NPV's}} \right)$$

3.5 Terms and concepts used in the study

Small farmer: Farmer with an area of less than 2 hectares of rainfed land.

Medium farmer: Farmer having an area of between 2-4 hectares of rainfed land.

Large farmer : Farmer having an area of more than 4.01 hectares of rainfed land.

Cost of cultivation : It is the sum of variable costs and fixed costs including marketing cost expressed on per hectare basis.

Gross returns : Gross returns were obtained by multiplying the total product with its unit value.

Net returns : Net returns were obtained by deducting the total costs incurred from the gross returns obtained.

Hired human labour

Hired human labour was estimated in terms of eight hours of work per day. The woman labour days converted into man days on the criteria that one woman day equal to 0.65 man days on the basis of wage rate equivalent.

Bullock labour

It was measured in pair days. Hence one pair means eight hours of work by a pair of bullock and a man required operating this bullock pair.

Seeds

Actual quantity of seeds used by the farmers was considered.

Manure

Manure was according to prevailing market rates during period of study. Manures were charged at Rs. 150 per ton in the study area.

Fertilizers

Fertilizers were charged according to prevailing market rates during period of study. Fertilizers were charged at Rs.5/kg, Rs.10/kg and Rs.5 for Urea, DAP and SSP. Biofertilizer (Rhizobium culture) was charged at Rs. 20/200gm packet.

Family labour

Family labour cost was calculated on the basis of charges paid to hired labour.

Hiring charges of machines works

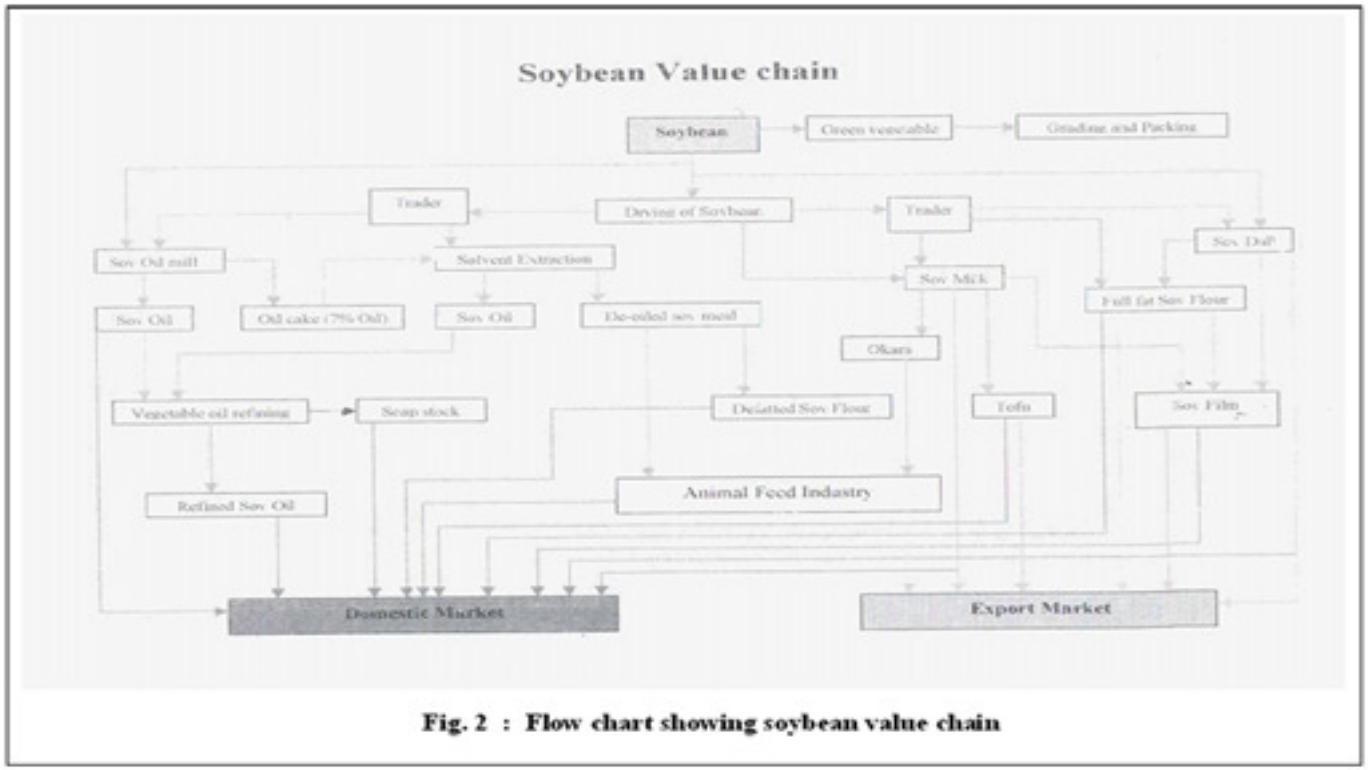

Fig. 2 : Flow chart showing soybean value chain

Fig.2. Flow chart showing value chain

Hiring charges of machines works was calculated based on actual cost incurred in hiring a machine like tractor.

Interest on working capital: This was calculated on the entire working cost of the enterprise at the prevailing bank interest of 8 per cent per annum and was computed for half of the cropping period.

Fixed cost The fixed cost is the cost associated with the owning of fixed resources which incurred on the fixed assets. The fixed cost includes rental value of land, land revenue, depreciation.

Rental value of land: The prevailing land rents for agricultural enterprises were imputed for the sample, since all land holdings were observed to be owner operated.

Land revenue and other taxes

These were charged according to the actual payment incurred by the cultivators i.e. Rs 4 per hectare

Depreciation cost: The depreciation was calculated by straight-line method. It was worked out by dividing the purchase value of implement machinery by its life period.

Interest on fixed capital: Interest on fixed capital is the interest on the fixed cost and is calculated at 15 per cent per annum.

Soymilk

Soymilk is made by soaking soybeans and later on grinding them with water. The fluid which results after straining is called soymilk.

Tofu

Tofu is the most popular among all soy products which is also called as soy paneer in India. Soybean tofu is a tasty and very nutritious product made by coagulating hot soymilk with some food grade chemicals such as calcium chloride, magnesium chloride, calcium sulphate, acetic acid and citric acid etc.

Soy flour

It is that flour which is fat is not removed, made by grinding of soybean (*dal*) without removing fat which is also known as full fat soyflour.

Farm management cost concepts

The following recent farm management cost concepts (Raju and Rao, 1990) were used for calculating the cost per hectare of soybean crop.

Cost 'A_1': It included wages of hired human labour, cost of bullock labour, cost of seed, value of organic manure and chemical fertilizers, value of plant protection components, interest on working capital, depreciation on farm machinery, implements, equipments, farm buildings etc.

Cost 'A_2': Cost A_1 + Rent paid for leased-in land.

Cost 'B': Cost A_2 + Imputed rental value of owned land + Interest on owned fixed capital.

Cost 'C': Cost B + Imputed value of family labour. Cost-C is the total cost of cultivation or gross cost.

4. RESULTS

The results obtained from the analysis of the data pertaining to the study are presented in the chapter under the following headings.

4.1 Socio- economic profile and cropping pattern of sample farmers

4.2 Profitability of soybean vis-à-vis competing crops of jowar and maize

4.3 Costs and returns of soybean value added products

4.4 Financial feasibility of soybean processing units

4.5 Constraints in soybean cultivation and processing and remedial measures

4.1 Socio-economic profile and cropping pattern of sample farmers

The socio-economic profile including family characteristics, occupational level, land holding, cropping pattern, etc of sample farmers were assessed and presented under different heads.

4.1.1 Socio-economic characteristics of sample farmers

The socio-economic characteristics of sample farmers (Table 4.1) clearly indicated that joint type of family (63.33%) was generally observed as compared to nuclear type of family (36.67%). Majority of the sample farmers were of middle aged (39 years). The family size revealed that males (43.70%) were dominated in the family as compared to females (30%) and children (26%). It is interesting to note that nearly 85 percent of the sample farmers were literates. However, the middle school educated farmers (43.33%) were highest followed by high school (20%), degree level (12.22%) and primary educated (8.89%) farmers. Out of 4.42 hectares of average size of holding, 57 percent of land holdings were under rainfed situations while 43 percent under irrigated situation. The average size of the land holdings/ farms (Table 4.2) revealed that medium farms (52 %) formed majority followed by small (30%) and (18%) large farms. The average productivity of sample farmers showed the marginal differences in yield of soybean among small (11.39 q/ha), medium (11.82 q/ha) and large (12.74 q/ha) farmers in the study area.

4.1.2 Cropping pattern of the sample farmers in the study area

It is worth noting that majority of the sample farmers (46.80%) have cultivated soybean in *kharif* season (Table 4.3) followed by bengal gram (26.26%) and wheat (19.42%) in *rabi* season. A similar pattern of cropping was observed across the different size of farmers. In *kharif*, maize and jowar were grown by small and medium farmers as compared to garlic in case of large farmers. Similarly, large farmers cultivated potato in *rabi* season.

4.2 Profitability of soybean vis-à-vis competing crops of jowar and maize

The jowar and maize were identified as competing crops to soybean. The profitability of soybean was examined vis-à-vis jowar and maize to facilitate in appropriate decision making by farmers on allocating land and their resources. In this regard, the pattern of material inputs use, labour use, costs and returns were estimated and evaluated among soybean, jowar and maize.

4.2.1 Inputs use pattern

4.2.1.1 Inputs use pattern in soybean cultivation

A perusal of Table 4.4 shows that the quantity of material inputs like seeds, manures, chemical fertilizers and biofertilizers used by the farmers were less than the recommended level. Similar pattern was observed in all the categories of farmers. In case of seed, on an average, 66 kg per hectare was used as against recommendation of 70-80 kg per hectare. The extent of manure used was less than half of the recommended level. The application of 'N' with 9.13 kg per hectare was lower by half of the recommended level (20 kg/ha). In case of phosphorus, application was less than one-third of the recommendation. It was worth noting

Table 4.1. Socio economic characteristics of sample farmers

Sl. No.	Particulars	Numbers	Percent
1.	Age (years)	39.14 Range (22-59)	-
2.	Family type		
	(a) Joint	57	63.33
	(b) Nuclear	33	36.67
	Total	90	100
3.	Family size		
	(a) Male	4	43.70
	(b) Female	3	29.81
	(c) Children	3	26.49
	Total	10	100
4.	Education level		
	(a) Illiterate	14	15.56
	(b) Primary	8	8.89
	(c) Middle	39	43.33
	(d) High school	18	20.00
	(e) Degree	11	12.22
	Total	90	100.00
5.	Average size of land holding (Hectares)		
	(a) Rainfed	2.52	57.01
	(b) Irrigated	1.90	42.99
	Total	4.42	100

Table 4.2. General characteristics of the sample farmers in the study area

N=90

Sl.No.	Particulars	Small farmers	Medium farmers	Large farmers	Average
1.	Sample size (No.)	27 (30)	47 (52)	16 (18)	-
2.	Average size of farm (ha.)	1.95	2.98	12.88	4.42
3.	Average size of dry farm (ha.)	1.36	1.91	6.25	2.52
4.	Average size of irrigated farm (ha.)	0.57	1.1	6.63	1.90
5.	Average area under soybean (ha.)	1.84	2.74	12.27	4.17
6.	Average yield of soybean (qtls./ha.)	11.39	11.82	12.74	11.86

Note: Figures in parentheses indicate percentage to their totals

Table 4.3. Cropping pattern of sample farmers

Sl. No.	Crops	Area (Hectares)			
		Small farmers	Medium farmers	Large farmers	Average
I	Kharif				
1	Soybean	1.84 (47.43)	2.74 (46.05)	12.27 (47.65)	4.17 (46.80)
2	Maize	0.07 (1.80)	0.11 (1.85)	0.35 (1.36)	0.14 (1.57)
3	Jowar	0.03 (0.77)	0.06 (1.01)	0.00 (0.00)	0.09 (1.01
4	Garlic	0.00 (0.00)	0.06 (1.01)	0.25 (0.97)	0.08 (0.90)
	Sub total	1.94 (50.00)	2.97 (49.92)	12.87 (49.98)	4.48 (50.28)
II	Rabi				
1.	Wheat	0.57 (14.69)	1.03 (17.31)	5.74 (22.29)	1.73 (19.42)
2.	Bengal gram	1.24 (31.96)	1.66 (27.90)	6.20 (24.08)	2.34 (26.26)
3.	Lentil	0.13 (3.35)	0.29 (4.87)	0.23 (0.89)	0.23 (2.58)
4.	Potato	0.00 (0.00)	0.00 (0.00)	0.61 (2.37)	0.11 (1.23)
5.	Garlic	0.00 (0.00)	0.00 (0.00)	0.10 (0.39)	0.02 (0.22)
	Sub total	1.94 (50.00)	2.98 (50.08)	12.88 (50.02)	4.43 (49.72)
	Gross Cropped Area (GCA)	3.88 (100)	5.95 (100)	25.75 (100)	8.91 (100)

Note: Figures in parentheses indicate percentage to gross cropped area.

Table 4.4. Inputs use pattern in soybean cultivation

Sl. No.	Inputs	Units	Per hectare				
			Small farmers	Medium farmers	Large farmers	Overall	Recommended level*
1.	Seed	Kg	63.03	66.37	68.54	65.76	70-80
2.	Manure (FYM)	Ton	5.35	6.46	6.95	6.22	15-20
3.	Chemical fertilizer						
	(a) N	Kg	9.06	9.03	9.59	9.13	20
	(b) P	Kg	23.29	23.31	24.99	23.61	60
	(c) K	Kg	-	-	-	-	20
4.	Bio fertilizer	g	109.78	224.55	247.00	194.11	500
5.	Herbicide	Kg	0.65	0.63	0.78	0.66	-
6.	Plant protection chemicals	Kg	1.00	1.06	1.12	1.05	-
7.	Human labour	MD	47.22	49.60	51.00	49.13	-
8.	Bullock labour	BPD	5.08	4.91	5.25	4.99	-
9.	Machine hours	Hours	9.97	10.48	10.50	10.29	-

Note : * As per Modern Techniques of Raising Field Crops by Chidda Singh (2003)
MD - Man days
BPD - Bullock pair days

that none of the farmers have applied potash. Similarly, even though the cost of biofertilizers was lower, its use (194 g/ha) was less than half of the recommended level (500 g/ha). This is more so in case of small farmers (110 g/ha) as compared to medium (224 g/ha) and large (247 g/ha) farmers.

4.2.1.2 Labour utilization pattern in soybean cultivation

There was no significant difference in the labour utilization amongst all the group of farmers in soybean cultivation (Table 4.5). The total human labour utilized by large farmers (51 man days/ha) was found to be marginally higher than that of small (47.22 man days/ha) and medium farmers (49.70 man days/ha). Similar trend of labour utilization among different categories of farmers was observed in performing all the operations. However, the intensity of labour use was found to be highest for harvesting of soybean (22.63%) followed by hand weeding (14.17%), application of manure (10.77%) and so on. Bullock labour was mainly utilized for transportation of manure (52.91%) and transportation and marketing of soybean (47.29%). In case of use of machineries in soybean cultivation, about 45 percent of machineries were used for clod crushing and harrowing followed by ploughing (25.56%) and threshing (6.32%). However, there was no significant difference in machinery use among different size of farmers.

4.2.1.3 Input use pattern in jowar and maize

In general, it was found the material inputs like manures and chemical fertilizers used by the farmers in case of jowar and maize crop were less than the recommended level (Table 4.6). However, the extent of seeds used by farmers in maize (26.27 kg/ha) and jowar (14.51 kg/ha) were on par with the recommended level. In case of manures, the extent of use in maize was less than one-third while it was less than one-fifth in jowar than those of recommended level. Similar pattern was observed in case of nitrogenous fertilizers. It is interesting to note that none of the farmers have applied potash in both maize and jowar as in case of soybean indicated earlier. Again no farmer applied herbicide in maize and jowar. Farmers applied plant protection chemicals only in case of maize crop. Human labour requirement was similar in both crops with 34.33 man days in maize and 36.13 man days in jowar per hectare. Bullock labour requirement was found to be marginally higher in case of jowar (8.65 bullock pair days/hectare) as compared to maize (5.84 bullock pair days/ hectare) whereas machine labour use was higher in case of maize (5.51 hours), compared to jowar (1.24 hours).

4.2.1.4 Input use pattern in soybean vis-à-vis jowar and maize

The input use pattern in soybean (Table 4.7) in general indicated that the level of input used such as fertilizer and manure was less than the recommended level. Similar pattern was observed in jowar and maize. Biofertilizer and herbicide were used in soybean only. The potash was not used in all the crops.

4.2.2 Costs and returns of soybean vis-à-vis jowar and maize

4.2.2.1 Costs and returns structure in soybean

A perusal of Table 4.8 shows that the costs of cultivation of soybean worked out to Rs 15946 per hectare, of which variable cost and fixed cost formed about 76.79 and 23.21 percent respectively. Similarly, the cost on human labour (24.39%) formed highest total cost component followed by machine works (20.59), imputed cost on rental value of land (20.22%) and seed (11.49%). Similar pattern of components of total cost of cultivation was observed in all categories of farmers namely small, medium and large farmers. However, the extent of total cost and its component in large farmers was relatively higher than those in medium and small farmers.

In case of returns (Table 4.9), soybean farmers have obtained per hectare gross returns of Rs 20499 at an average yield of 11.86 quintal. However, the gross returns of large farmers (Rs 22209 /ha) was comparatively higher than medium (Rs 20444 /ha) and small (Rs19595 /ha) farmers. On an average, soybean farmers obtained per hectare net returns of Rs 10259 over Cost A_1 out of the total gross returns indicating about 49.12 percent of reward to the paid out cost. Cost A_1 and cost A_2 was same in all the categories of farmer as no farmer was using leased in land. Further, the pattern of net returns over Cost A_1, A_2, B and C also found to be similar in all categories of farmers. It is interesting to note that the return to

Table 4.5. Labour utilization pattern in soybean cultivation

Sl. No.	Operations	Units	Per hectare			
			Small farmers	Medium farmers	Large farmers	Overall
1	Human Labour					
	a) Transportation of manure (FYM)	MD	4.39 (9.30)	4.89 (9.86)	4.92 (9.65)	4.75 (9.67)
	b) Spreading of manure (FYM)	MD	5.03 (10.65)	5.26 (10.60)	5.80 (11.37)	5.29 (10.77)
	c) Sowing	MD	3.77 (7.98)	3.63 (7.32)	4.40 (8.63)	3.81 (7.75)
	d) Hand weeding	MD	6.61 (14.00)	7.06 (14.23)	7.26 (14.24)	6.96 (14.17)
	e) Application of herbicide	MD	2.38 (5.04)	2.25 (4.54)	2.14 (4.20)	2.25 (4.58)
	f) Plant protection chemicals	MD	2.56 (5.42)	2.79 (5.63)	3.47 (6.80)	2.68 (5.45)
	g) Harvesting	MD	10.49 (22.22)	11.10 (22.38)	11.62 (22.78)	11.12 (22.63)
	h) Threshing	MD	3.62 (7.67)	3.76 (7.58)	4.05 (7.94)	3.69 (7.51)
	i) Drying, Packing	MD	3.88 (8.22)	4.02 (8.10)	3.03 (5.94)	3.93 (8.00)
	j) Transportation and marketing	MD	4.48 (9.49)	4.83 (9.74)	4.31 (8.45)	4.66 (9.49)
	Total Human Labour	MD	47.22 (100)	49.60 (100)	51.00 (100)	49.13 (100)
2	Bullock Labour					
	a) Transportation of manure (FYM)	BPD	2.61 (51.38)	2.60 (52.95)	2.80 (53.33)	2.64 (52.91)
	b) Transportation and marketing	BPD	2.47 (48.62)	2.31 (47.05)	2.45 (46.67)	2.36 (47.29)
	Total Bullock Labour	BPD	5.08 (100)	4.91 (100)	5.25 (100)	5.00 (100)
3.	Machine works					
	a) Ploughing	Hours	2.56 (25.68)	2.64 (25.19)	2.74 (26.10)	2.63 (25.56)
	b) Clod crushing and harrowing	Hours	4.44 (44.53)	4.70 (44.85)	4.52 (43.05)	4.59 (44.61)
	c) Threshing	Hours	0.55 (5.52)	0.67 (6.39)	0.77 (7.33)	0.65 (6.32)
	d) Sowing	Hours	2.42 (24.27)	2.47 (23.57)	2.47 (23.52)	2.46 (23.91)
	Total Machine Labour	Hours	9.97 (100)	10.48 (100)	10.50 (100)	10.33 (100)

Note: Figures in parentheses indicate percentage to their totals.

Table 4.6. Input use pattern in jowar and maize

Sl. No.	Inputs	Units	Per hectare			
			Jowar	Recommended level *	Maize	Recommended level *
1.	Seed	Kg	14.51	12-15	26.27	20-25
2.	Manure (FYM)	Ton	1.85	10-15	2.81	10-15
3.	Chemical fertilizer (kg)					
	(a) N	Kg	20.59	100	58.17	120
	(b) P	Kg	-	50	26.62	60
	(c) K	Kg	-	40	-	40
4.	Herbicide	Kg	-	-	-	-
5.	Plant protection chemicals	Kg	-	-	8.49	-
6.	Human labour	MD	34.33	-	36.13	-
7.	Bullock labour	BPD	8.65	-	5.84	-
8.	Machine hours	Hours	1.24	-	5.51	-

Note : * As per Modern Techniques of Raising Field Crops by Chidda Singh (2003)
MD = Man days
BPD = Bullock pair days

every rupee of investment in soybean cultivation with 1.29 was similar in small and medium farmers but slightly higher in case of large farmers (1.34).

4.2.2.2 Cost and return structure in cultivation of jowar and maize

A perusal of Table 4.10 shows that the total cost of cultivation of jowar worked out to Rs 8923 per hectare which was about three fourth of total cost of cultivation of maize (Rs 12516/ha). It is interesting to note that variable cost incurred in maize was higher than jowar but fixed cost incurred in jowar was slightly higher than maize. Further, the costs incurred on all the components of total cost like seed, manure, chemical fertilizer etc were higher in case of maize than jowar. However, expenditure on plant protection chemicals was made only in case of maize. The cost incurred on human labour in case of maize (Rs.2957 /ha) was higher than that incurred in jowar (Rs2876/ha). The expenditure on bullock labour was higher in jowar (Rs 1146 /ha), compared to maize (Rs 759 /ha). Out of the total cost in jowar, the share of the imputed rental value of land (Rs 3225 /ha) formed highest (36.14%) followed by human labour (32.23%). In case of maize, rental value of land (25.77%) and human labour (23.62%) were major components followed by cost on machinery use (13.80%) seed (8.61%), chemical fertilizer (8.59%), bullock labour (6.06%) and plant protection chemicals (5.09%).

In case of returns (Table 4.11) maize farmers have obtained higher per hectare gross returns of Rs 14570 mainly due to higher productivity per unit area (18.02 q/ha) whereas jowar farmers could only manage gross returns of Rs 9393 per hectare due to their low productivity (9.42 q/ha). Cost A_1, A_2, B and C all were higher in case of maize when compared with jowar. Net returns per hectare were significantly higher over Cost A_1, A_2, B, and C, in case of case of maize when compared to jowar. It was worth noting that although the net returns in maize were higher than those in jowar, it was significantly higher over Cost C.

4.2.2.3 Costs and return structure of soybean vis-à-vis jowar and maize

An examination of profitability of soybean vis-à-vis its competing crops (Table 4.12), clearly shows that cultivation of soybean was highly profitable over jowar and maize. Even though the cost of cultivation of soybean was higher than that of jowar and maize, its gross returns as well as net returns were also correspondingly higher than jowar and maize. The net returns in soybean over jowar (868.72%) was significantly higher than maize (121.67%). Similarly benefit cost ratio was higher in case of soybean (1.29) than that of maize (1.16) and jowar (1.05). The percentage change in benefit cost ratio of soybean over maize and jowar was 11.21 and 22.86 percent, respectively.

4.2.3 Resource use efficiency in soybean cultivation

An attempt has been made to explain the productivity of important inputs used in soybean cultivation by way of assessing the resource use efficiency of inputs used in soybean cultivation. It acts as a guideline to judge whether resources are used optimally or not.

4.2.3.1 Regression coefficients of production function in soybean

A perusal of Table 4.13 revealed that manure (0.20*), machine works (-0.01**) and land (0.03*) have significantly influenced the production of soybean in the study area as indicated by their significant regression coefficients. Manure and land have positively influenced the production of soybean whereas machinery use had negative influence. Other inputs like seeds, fertilizer, plant protection chemicals and bullock power were positively associated with the production of soybean even though their influence was not significant. In case of small and large farmers, all the inputs used were non–significant, however, positively related. Similar trend was observed in case of medium farmers except manure (0.210*) and machine work (-0.015*) which was significant. The 'F' value was significant in all the group of farmers. The input variables included in the production function contributed substantially in the production of soybean as indicated by their higher values of coefficients of multiple determination (R^2). The estimated R^2 for the study area as a whole was 0.81 as against 0.84, 0.79 and 0.81 in case of small, medium and large farmers respectively, clearly indicating about more than 80 percent of the production of soybean is influenced by the inputs include in the study.

Table 4.7. Input use pattern in soybean, jowar and maize

Sl. No.	Inputs	Units	Soybean	Jowar	Maize
1.	Seeds	Kg	65.76	14.51	26.27
2.	Manure	Ton	6.22	1.85	2.81
3.	Chemical Fertilizer				
4.	a)N	Kg	9.13	20.59	58.17
5.	b) P	Kg	23.61	-	26.62
6.	c) K	Kg	-	-	-
7.	Herbicide	Kg	0.66	-	-
8.	Plant protection chemicals	Kg	1.05	-	8.49
9.	Bio-fertilizer	g	194.11	-	-
10.	Human labour	MD	49.13	34.33	36.13
11.	Bullock labour	BPD	4.99	8.65	5.84
12.	Machine labour	Hours	10.29	1.24	5.51

Table 4.8. Costs of cultivation of soybean in different size groups of sample farmers in the study area

Rs. per ha

Particulars	Small farmers		Medium farmers		Large farmers		Overall	
	Value	Per cent	Value	Per cent	Value	Per cent	Value	Per cent
Variable cost								
Seed	1765	11.39	1846	11.55	1906	11.49	1832	11.49
Manure (FYM)	803	5.18	970	6.07	1042	6.28	933	5.85
Chemical fertilizer	511	3.30	509	3.18	548	3.30	517	3.24
Bio fertilizer	11	0.07	22	0.14	25	0.15	19	0.12
Plant protection chemicals	612	3.95	620	3.88	745	4.49	640	4.01
Human labour	3916	25.26	3920	24.53	3756	22.65	3890	24.39
Bullock labour	666	4.30	646	4.04	690	4.16	660	4.14
Machine works	3158	20.37	3341	20.90	3324	20.05	3283	20.59
Interest on working capital @ 8%	458	2.95	475	2.97	481	2.90	471	2.95
Total variable cost	11900	76.76	12349	77.26	12517	75.49	12245	76.79
Fixed cost								
Land revenue	4	0.03	4	0.03	4	0.02	4	0.03
Depreciation	122	0.79	152	0.95	552	3.33	214	1.34
Rental value of land	3225	20.80	3225	20.18	3225	19.45	3225	20.22
Interest on fixed capital @ 15%	251	1.62	254	1.59	284	1.71	258	1.62
Total fixed cost	3602	23.24	3635	22.74	4065	24.51	3701	23.21
Total cost (variable + fixed)	15502	100.00	15984	100.00	16582	100.00	15946	100.00

Table 4.9. Costs and returns structure in soybean cultivation

Rs. per ha

Sl. No.	Costs/ Returns	Small	Medium	Large	Overall
A	Costs (Rs)				
	(a) Cost A_1	9777	10252	10984	10240
	(b) Cost A_2	9777	10252	10984	10240
	(c) Cost B	13253	13731	14493	13723
	(d) Cost C	15502	15984	16582	15946
B.	Returns (Rs.)				
	1) Yield (qtls)				
	(a) Main product	11.39	11.82	12.74	11.86
	(b) By product	7.27	7.38	8.18	7.49
	2) Price (Rs/qtls)				
	(a) Main product	1677	1689	1706	1688
	(b) By product	68	65	58	64
	3) Gross returns	19595	20444	22209	20499
	4) Net returns over (Rs)				
	(a) Cost A_1	9818	10192	11225	10259
	(b) Cost A_2	9818	10192	11225	10259
	(c) Cost B	6342	6713	7716	6776
	(d) Cost C	4093	4460	5627	4553
	5) BC ratio	1.26	1.28	1.34	1.29

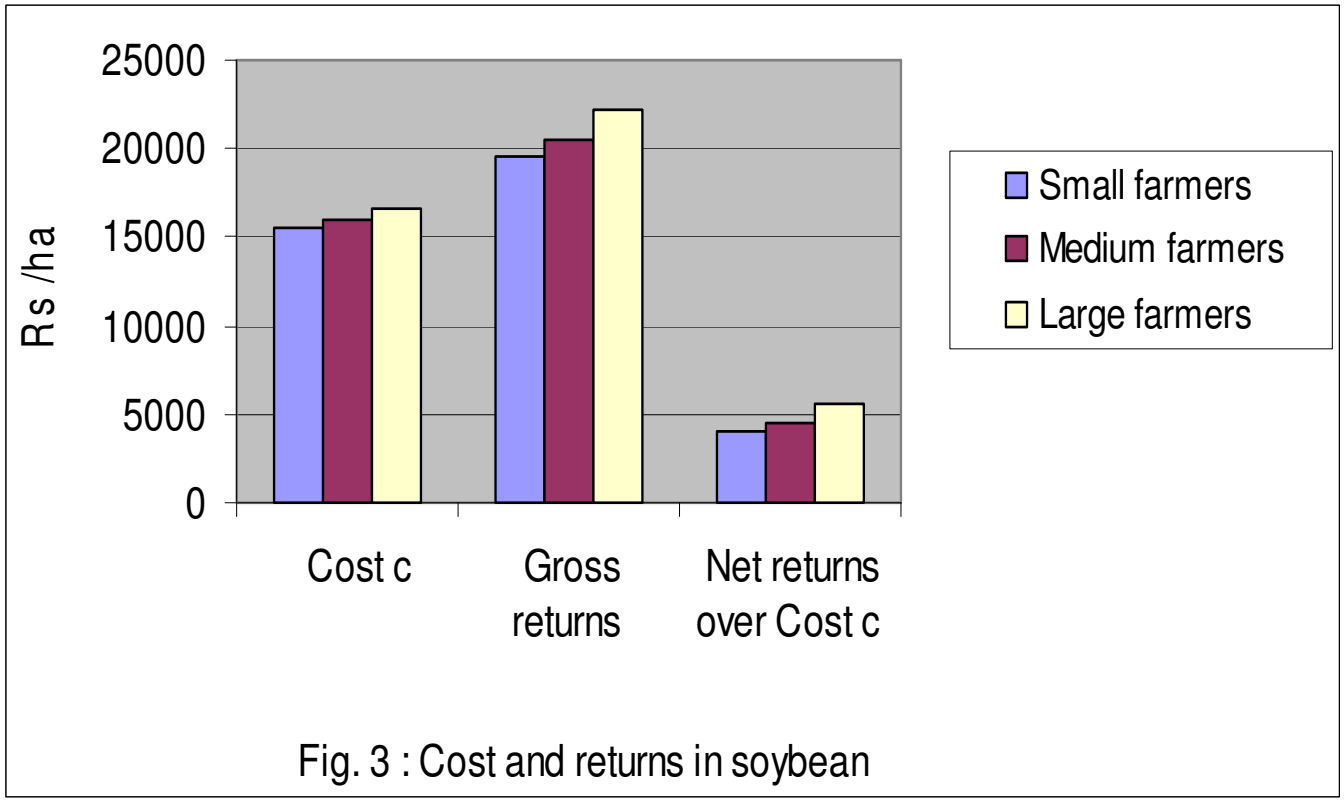

Fig.3. Cost and returns in soyabean

Table 4.10. Cost of cultivation of jowar and maize

Rs. per ha

Sl. No.	Particulars	Jowar		Maize	
		Value	Percent	Value	Percent
A	Variable cost				
1.	Seed	180	2.02	1078	8.61
2.	Manure (FYM)	278	3.12	421	3.36
3.	Chemical fertilizer	298	3.34	1075	8.59
4.	Plant protection chemicals	0	0.00	637	5.09
5.	Human labour	2876	32.23	2957	23.62
6.	Bullock labour	1146	12.84	759	6.06
7.	Machine works	394	4.42	1727	13.80
8.	Interest on working capital @ 8%	207	2.32	346	2.77
	Total variable cost	5379	60.28	9000	71.91
B	Fixed cost				
1.	Depreciation	68	0.76	42	0.34
2.	Land revenue	4	0.04	4	0.03
3.	Rental value of land	3225	36.14	3225	25.77
4.	Interest on fixed capital @ 15%	247	2.77	245	1.96
	Total fixed cost	3544	39.72	3516	28.09
	Total cost (variable + fixed)	8923	100.00	12516	100.00

Table 4.11. Costs and returns structure of jowar and maize

Rs. per ha

Sl. No.	Costs/ Returns	Jowar	Maize
A	Costs		
	1. Cost A_1	2601	6813
	2. Cost A_2	2601	6813
	3. Cost B	6073	10283
	4. Cost C	8923	12516
B	Returns		
	1. Yield (qtls)		
	(a) Main product	9.42	18.02
	(b) By product	28.41	26.05
	2. Price (Rs/qtls)		
	(a) Main product	831.25	745.45
	(b) By product	55	43.64
	3. Gross returns	9393	14570
	4. Net returns over		
	(a) Cost A_1	6792	7757
	(b) Cost A_2	6792	7757
	(c)Cost B	3320	4287
	(d)Cost C	470	2054
	5. BC ratio	1.05	1.16

Table 4.12. Costs and returns of soybean vis-a-vis jowar and maize

Rs. per ha

Sl. No.	Costs/ Returns	Jowar	Maize	Soybean	Percent change in soybean over jowar (%)	Percent change in soybean over maize (%)
A.	Costs					
	1. Cost A_1	2601	6813	10240	293.69	50.30
	2. Cost A_2	2601	6813	10240	293.69	50.30
	3. Cost B	6073	10283	13723	125.97	33.45
	4. Cost C	8923	12516	15946	78.71	27.40
B.	Returns					
	1. Gross returns	9393	14570	20499	118.24	40.69
	2. Net returns over					
	(a) Cost A_1	6792	7757	10259	51.05	32.25
	(b) Cost A_2	6792	7757	10259	51.05	32.25
	(c) Cost B	3320	4287	6776	104.10	58.06
	(d) Cost C	470	2054	4553	868.72	121.67
	3. BC ratio	1.05	1.16	1.29	22.86	11.21

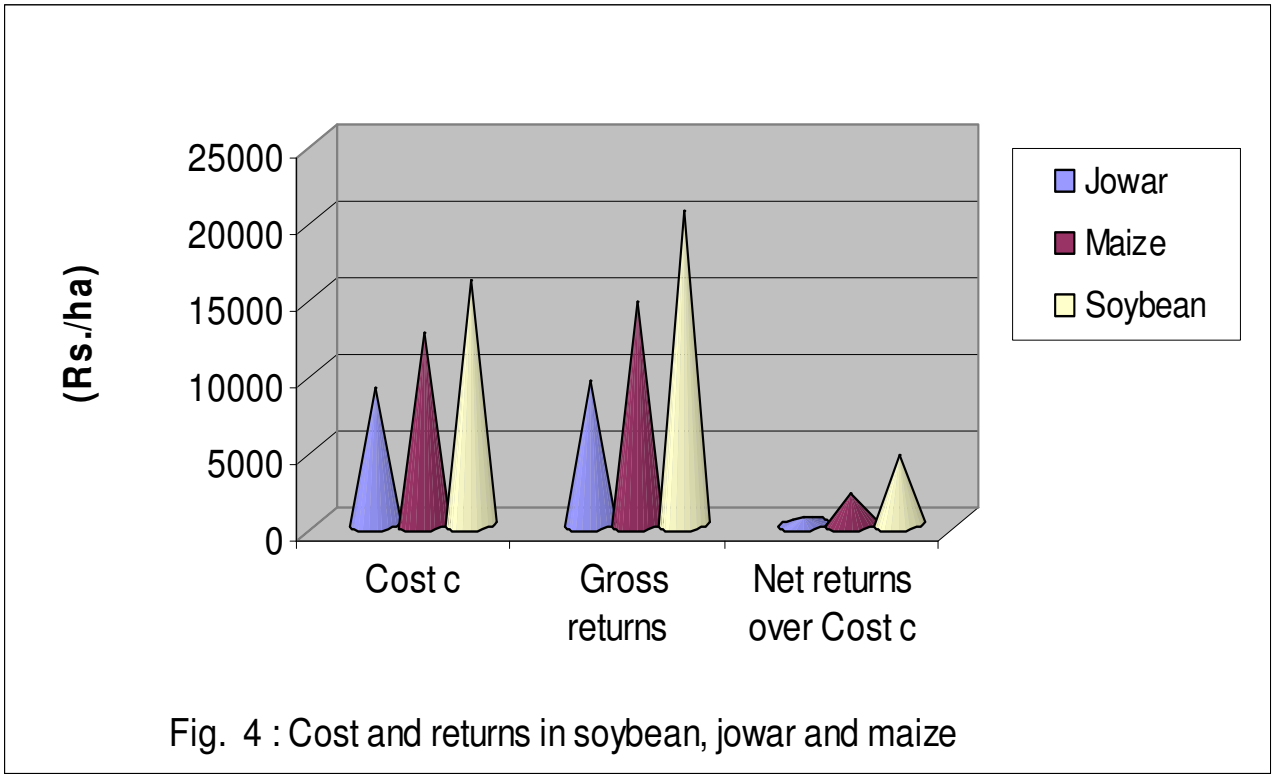

Fig. 4 : Cost and returns in soybean, jowar and maize

Fig.4. Cost and returns in soyabean, jowar and maize

4.2.3.2 Ratio of MVP to MFC of soybean production function factors

In general for the study area as a whole, the ratio of MVP to MFC was positive and more than one for seeds (3.817), manures (1.568), fertilizers (8.903), plant protection chemicals (3.80), bullock labour (2.535) and land (1.864) indicating that resources were used advantageously. Whereas, it was less than one in case of human labour (-3.127) and machine work (-0.007) indicating over utilization of inputs in soybean cultivation. Similar trend was observed in all categories of farmers except human labour in medium farmers and machinery use in small farmers and large farmers (Table 4.14).

4.3 Costs and returns of soybean value added products

The soymilk, tofu and soyflour were the major soya value added products in the study area. Therefore, an attempt is made to examine the profitability of these products to facilitate in appropriate decision making by farmers on whether to go for value addition of soybean or not.

4.3.1 Structure of processing cost and returns of soybean into soymilk and tofu

The structure of costs incurred by processors in converting raw soybean into soymilk and tofu is presented in Table 4.15. The total cost of processing of 4 tons of soybean into soymilk and tofu worked out to Rs 1,90,806 per ton, out of which Rs 1,62,792 (85.32%) was towards variable inputs, while Rs 28,014 (14.68%) towards fixed inputs. The cost on packing material (Rs 42000 /ton) formed major (22.01%) component of total processing cost of soymilk and tofu followed by gas (13.21%), salaries to permanent employees (11.01%), raw material (9.43%), transportation (8.39%) and wages to casual labour (7.86%).

As indicated in Table 4.16, from 4 tons of raw soybean processed, 20,000 litres of soymilk and 1800 kg of tofu were produced in the processing unit. The gross returns worked out to Rs 9,00,000/- per year from soymilk and Rs 1,80,000/- per year from tofu, considering average market price of Rs 45 per liter of soymilk and Rs 100 per kg of tofu. Thus, the net returns per year amounted to Rs 3,16,776/-. In other words, Rs 79,194 was obtained as net returns for every ton of soybean processed into soymilk and tofu. Further, for every rupee of investment in soymilk and tofu processing, about Rs 1.42 was obtained as returns, indicating its profitability.

4.3.2 Structure of processing cost and returns of soybean into soyflour

The total cost incurred by processors in converting raw soybean into soyflour is presented (Table 4.17) was found to be Rs 6,15,543/- in each year. In other words, Rs 30,777/- was incurred per ton of soybean processing into soyflour, out of which Rs 26,406 (85.80%) formed variable cost, while Rs 4,371 (14.20%) formed fixed cost per ton of soybean processed. It was worth noting that, in variable cost, cost of raw material (Rs17000/ton) was more than half (55.24%) the total cost of processing. The other major component formed, salaries to permanent employees (11.70%) followed by transportation (7.80%), interest on working capital (6.36), power and wages for casual labour (4.05 percent each).

Table 4.18 shows, whole of raw soybean (20 ton) was used for preparation of soyflour (18 tons /year). The gross returns (Rs 36000 /ton) were nearly seven times of net returns (Rs5223/ton). The benefit cost ratio was high (1.18) showing the profitability of converting soybean into soyflour.

4.4 Financial feasibility of soybean processing units

To assess financial feasibility of investment in soybean processing units, parameters such as net present value, benefit cost ratio and internal rate of return were estimated (Table 4.20).

A perusal of Table 4.20 shows the comparison between two soya processing units. Wherein one unit was processing soybean into soymilk and tofu and other was processing raw soybean into soyflour. The net present value (NPV) at 14 percent discount rate, in case of soymilk and tofu unit (Rs 22,30,823) was more than soyflour (Rs 7,24,137). Similarly benefit cost ratio (BCR) at same discount rate was more in case of

Table 4.13. Regression coefficients of production function in soybean

Sl. No.	Particulars	Parameter	Small farmers	Medium farmers	Large farmers	Overall
1.	Intercept	A	-0.73 (3.42)	5.626 (1.40)	5.61 (5.31)	3.26 (1.31)
2.	Seed (Kg)	X1	0.59 (0.32)	0.480 (0.11)	-0.11 (0.89)	0.53 (0.11)
3.	Manure (FYM) (Ton)	X2	0.18 (0.10)	0.210* (0.06)	0.21 (0.20)	0.20* (0.04)
4.	Fertilizer (Kg)	X3	0.24 (0.14)	-0.081 (0.06)	-0.15 (0.26)	0.02 (0.06)
5.	Plant protection chemicals (Rs)	X4	0.05 (0.12)	0.040 (0.14)	0.28 (0.15)	0.04 (0.44)
6.	Human labour (Man days)	X5	-0.05 (0.16)	0.009 (0.06)	-0.12 (0.18)	-0.04 (0.06)
7.	Bullock labour (Bullock pair days)	X6	0.45 (0.32)	0.012 (0.13)	0.49 (0.76)	0.27 (0.12)
8.	Machine work (Hours)	X7	0.23 (0.43)	-0.015** (0.01)	0.04 (0.16)	-0.01** (0.01)
9.	Land (Hectares)	X8	0.06 (0.11)	0.013 (0.23)	0.15 (0.39)	0.03* (0.02)
10.	R^2		0.84	0.79	0.77	0.81
11.	'F' value		0.05*	0.009**	0.02*	0.007**

Note: Figures in parentheses indicate standard error
* Significance at 5% probability level
* * Significance at 1% probability level

Table 4.14. Ratio of MVP to MFC of soybean production

Sl. No.	Particulars	Parameter	Small farmers	Medium farmers	Large farmers	Overall
1.	Seed (Kg)	X1	4.186	3.534	2.8361	3.817
2.	Manure (FYM) (Ton)	X2	1.841	1.267	1.098	1.568
3.	Fertilizer (Kg)	X3	10.621	8.715	5.912	8.903
4.	Plant protection chemicals (Rs)	X4	4.337	4.026	2.876	3.80
5.	Human labour (Man days)	X5	-4.285	0.692	-9.259	-3.127
6.	Bullock labour (Bullock pair days)	X6	4.011	3.118	4.817	2.535
7.	Machine work (Hours)	X7	0.173	-0.012	0.030	-0.007
8.	Land (Hectares)	X8	5.888	1.226	2.688	1.864

Table 4.15. Structure of processing cost of soybean into soymilk and tofu

Sl. No.	Particulars	Amount (Rs/year)	Amount (Rs/ton)	Percentage (%)
A	Fixed cost			
1.	Salaries to permanent employees	84,000	21,000	11.01
2.	Depreciation	12,840	3,210	1.68
3.	Others	600	150	0.08
4.	Interest on fixed capital	14,616	3,654	1.92
	Total fixed cost	112,056	28,014	14.68
B.	Variable cost			
1.	Cost of raw material (4 tons) purchased	72,000	18,000	9.43
2.	Cost of packing material	1,68,000	42,000	22.01
3.	Power charges	24,000	6,000	3.14
4.	Gas	1,00,800	25,200	13.21
5.	Transportation cost	64,000	16,000	8.39
6.	Wages for casual labour	60,000	15,000	7.86
7.	Office maintenance	600	150	0.08
8.	Telephone charges	4,800	1,200	0.63
9.	Sugar	36,000	9,000	4.72
10.	Salt	1,000	250	0.13
11.	Flavour	12,000	3,000	1.57
12.	Coagulant	2,400	600	0.31
13.	Sales tax	34,000	8,500	4.45
14.	Amortized value on investment	23333	5,833	3.06
15.	Interest on working capital	48,235	12,059	6.32
	Total variable cost	6,51,168	1,62,792	85.32
	Total cost	7,63,224	1,90,806	100.00

Table 4.16. Returns structure of soybean processing into soymilk and tofu

Sl. No.	Particulars	Unit	Soymilk	Unit	Tofu	Total
1.	Quantity of soybean processed	Ton	2.5	Ton	1.5	4
2.	Quantity produced	litres	20,000	Kg	1800	-
3.	Price	Rs/litre	45	Rs/Kg	100	-
4.	Total cost	Rs/year	-	Rs/year	-	7,63,224
5.	Total cost	Rs/ton	-	Rs/ton	-	1,90,806
6.	Gross return	Rs/year	9,00,000	Rs/year	1,80,000	10,80,000
7.	Gross return per ton of soybean processed	Rs	3,60,000	Rs	1,20,000	2,70,000
8.	Net return	Rs/year	-	Rs/year	-	3,16,776
9.	Net return per ton of soybean processed	Rs	-	Rs	-	79,194
10.	BC ratio	-	-	-	-	1.42

Table 4.17. Structure of processing cost of soybean into soyflour

Sl. No.	Particulars	Amount (Rs/year)	Amount (Rs/ton)	Percentage (%)
A	Fixed cost			
1.	Salaries to permanent employees	72,000	3,600	11.70
2.	Depreciation	3,420	171	0.56
3.	Others	600	30	0.10
4.	Interest on fixed capital	11,403	570	1.85
	Total fixed cost	87,423	4,371	14.20
B.	Variable cost			
1.	Cost of raw material (20 tons) purchased	3,40,000	17,000	55.24
2.	Cost of packing material	18,000	900	2.92
3.	Power charges	24,000	1200	3.90
4.	Transportation cost	48,000	2400	7.80
5.	Wages for labour	24,000	1200	3.90
6.	Office maintenance	600	30	0.10
7.	Telephone charges	2,400	120	0.39
8.	Sales tax	20,000	1000	3.25
9.	Amortized value on investment	12000	600	1.95
10.	Interest on working capital	39,120	1956	6.36
	Total variable cost	5,28,120	26,406	85.80
	Total cost	6,15,543	30,777	100.00

Table 4.18. Returns structure of soybean processing into soyflour

Sl. No.	Particulars	Soyflour
1	Quantity of soybean processed (tons)	20
2	Quantity of soyflour produced (tons)	18
3	Price of soyflour (Rs/kg)	40
4	Total cost (Rs/year)	6,15,543
5	Total cost (Rs/ton)	30777
6	Gross return (Rs/year)	7,20,000
7	Gross return per ton of soybean processed (Rs)	36,000
8	Net return (Rs/year)	1,04,457
9	Net return per ton of soybean processed (Rs)	5223
10	BC ratio	1.18

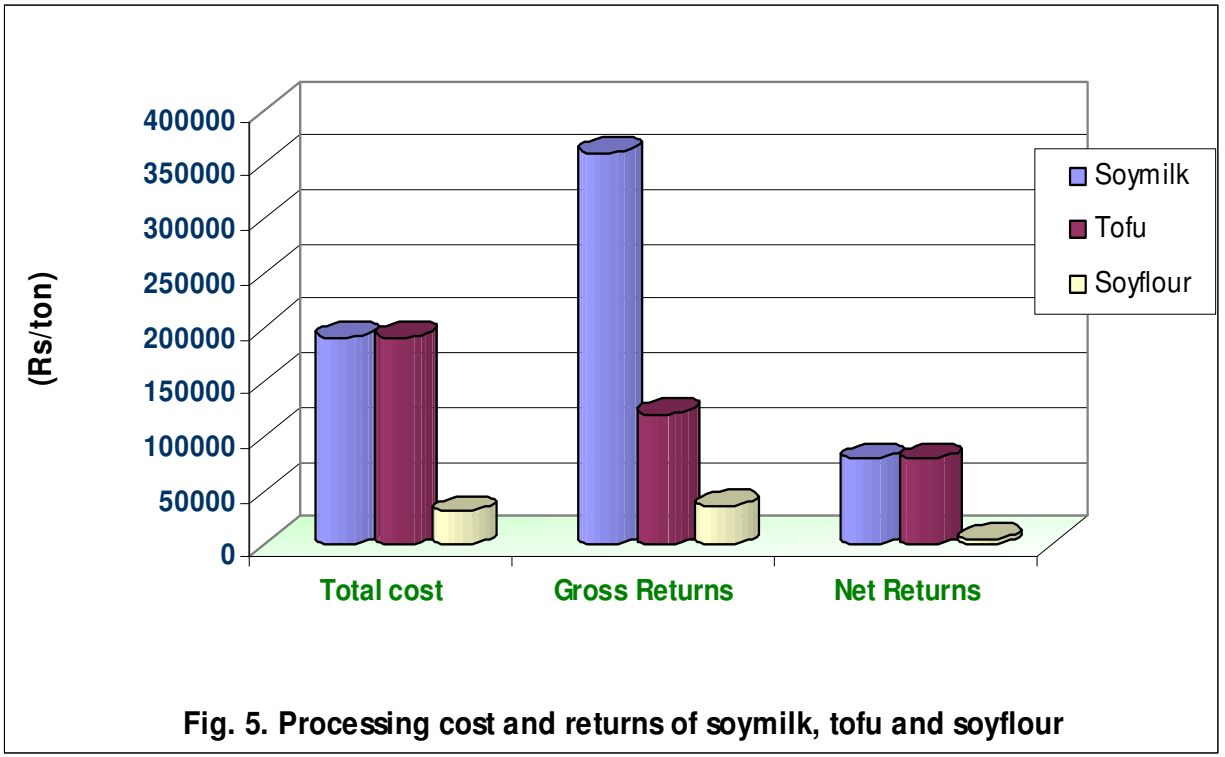

Fig. 5. Processing cost and returns of soymilk, tofu and soyflour

Fig.5. Processing cost and returns of soymilk, tofu and soyflour

Table 4.19. Investment pattern in processing units involved in value addition to soybean

(Rs/ unit)

Sl.No.	Particulars	Soymilk and Tofu	Soyflour
1.	Land value	50000	50000
2.	Building	100000	50000
3.	Machinery	200000	80000
	Total	3,50000	1,80000

Table 4.20. Estimates of project analysis parameters

Sl. No.	Particulars	Units	Soymilk and Tofu	Soyflour
1.	Net Present Value (NPV) at 14% Discount Rate	Rs	22,30,823	7,24,137
2.	Benefit Cost Ratio (BCR) at 14% Discount Rate	-	1.42	1.17
3.	Pay Back Period (PBP)	Years	3	6
4.	Internal Rate of Return (IRR)	Per cent	72.25	37.25

soymilk and tofu unit (1.42) than soyflour unit (1.17) indicating profitability of converting soybean into soymilk and tofu was more than soyflour. It is worth noting that pay back period (PBP) in both soy processing units was less, only 3 years in case of soymilk and tofu unit and 6 years in soyflour unit. The internal rate of return (IRR) was more in case of soymilk and tofu unit 75.25 percent to 37.25 percent in soyflour unit.

4.5 Constraints in soybean cultivation and processing and remedial measures

4.5.1 Problems faced by farmers cultivating soybean in the study area

The constraints faced by soybean farmers in the study area are presented in Table 4.21. The major problem were high labour wage rate (90.04%) followed by high incidence of yellow rust disease (73.81%) and inadequate and timely availability of labourers (67.19%) which were faced by all the group of farmers cultivating soybean in the study area. For control of rust disease, farmers should go for seed treatment with proper fungicide before seed sowing and use good quality seed for sowing purpose and also follow crop rotation to avoid reoccurrence of the disease.

4.5.2 Problems faced by processing units while processing of soybean into different products and remedial measures

The constraints faced by soybean processors while processing of soybean into different products are presented in Table 4.22. The major problem faced by both the units producing soymilk, tofu and soyflour was non availability of quality raw material, non availability of expected market for soy products and inadequate trained labour were some of the major problem discussed by both the soy processors. In soymilk and tofu high products spoilage and lack of proper storage structure were other major problem faced by the soy processor producing soymilk and tofu. In soyflour high cost of transportation was the other major problem which was conferred by soyflour processor. To get good quality raw material soy processors should go to farmers and make them available seed of required quality. For creating market demand, they should do employ some sales agent, give sample of these products free of cost along with instructions of benefits of consuming these soy products to probable customers. For avoiding losses due to spoilage they should create hygienic and keep surface clean where these processing takes place and use hand gloves while touching processed material, so that it does not get contaminated, which is the main cause of spoilage.

Table 4.21. Problems faced by farmers in soybean cultivation

Sl. No.	Particulars	Small farmers	Medium farmers	Large farmers	Overall
1.	Higher incidence of yellow rust disease	26 (86.67)	21 (70.00)	19 (63.33)	22 (73.81)
2.	Higher labour wages	30 (100.00)	27 (90.00)	22 (73.33)	27 (90.04)
3.	Inadequate and untimely availability of labourers	24 (80.00)	18 (60.00)	20 (66.67)	20 (67.19)
4.	Low seed germination of soybean	18 (60.00)	12 (40.00)	7 (23.33)	13 (43.04)
5.	Fluctuating prices of soybean	17 (56.67)	8 (26.67)	5 (16.67)	10 (33.89)

Note: Figures in parentheses indicate percentage to sample size

Table 4.22. Problems of processing units in processing of soybean

Sl. No.	Particulars	Soymilk	Tofu	Soyflour
1.	Non availability of quality raw material	Yes	Yes	Yes
2.	High products spoilage	Yes	Yes	No
3.	High cost of transportation	No	No	Yes
4.	Non availability of expected market for soy products	Yes	Yes	Yes
5.	Lack of proper storage structure	Yes	Yes	No
6.	Lack of adequate trained labour	Yes	Yes	Yes
7.	Necessity of adopting of improved processing practices were at high cost	No	Yes	Yes

5. DISCUSSION

In this chapter, the findings of the present study are discussed to throw light on outcome of results under the following headings.

5.1 Socio- economic profile and cropping pattern of sample farmers

5.2 Profitability of soybean vis-à-vis competing crops of jowar and maize

5.3 Costs and returns of soybean value added products

5.4 Financial feasibility of soybean processing units

5.1 Socio- economic profile and cropping pattern of sample farmer

The knowledge of the socio-economic characteristics of sample farmers would facilitate in better understanding of the ground realities of the study area. Hence, the data were collected and analyzed in this regard. The data were collected from three districts namely Ujjain, Dewas and Shajapur. The farmers belonging to these districts were homogeneous with respect to the socio-economic characteristics and farming indicating credibility of the study. Majority of the farmers were middle aged with an average age of 39.14 years of the sample farmers in the study area. From this it can be inferred that because of non availability of alternative job facilities in the study area for the yearlong, farmers were continued to be engaged in agriculture. Majority of the sample farmers belonged to joint family type mainly dominated by male member in the family. It is interesting to note that nearly 85 percent of the sample farmers were literates, however, majority of farmers were educated up to middle school only (Table 4.1). The reason was non availability of educational institutions for higher studies locally and their inability to pursue higher education due to economic inability. The landholdings under rainfed (57.01) situations were higher than those under irrigated conditions (42.99). The farmers belonging to Ujjain and Dewas districts were blessed with majority of irrigated area because of presence of some local rivers, whereas, those land holdings in Shajapur district were having mostly rainfed land because of non availability of any irrigation sources. Area under soybean was highest in *kharif* season among all categories of farmers followed by maize and jowar. This was due to the fact that large number of soybean oil processing industries situated in the study area have created better market opportunities. Further, soybean is preferred due to its highly commercial value, higher yield and good remunerative price. However, the alternative to soybean were jowar and maize which were grown to meet the family consumption requirements by small and medium farmers.

In *rabi* season, gram occupied major area (26.26%) mainly in rainfed land while wheat (19.42%) in irrigated situation (Table 4.3). In many cases, farmers who were cautious about the fertility of their land, preferred to grow soybean as it retains the soil fertility by fixing atmospheric nitrogen in to the soil. The higher profitability, commercial value and improvement of the soil fertility as perceived by the farmers in their opinion survey might have enabled the respondents to allocate the manageable size of the area under soybean over other crops.

5.2 Profitability of soybean vis-à-vis competing crops of jowar and maize

The farmers of Madhya Pradesh grow different crops in *kharif* season such as paddy, jowar, maize, vegetables, fruits etc, in addition to soybean. It is essential to find out which is the most profitable crop in that particular area. Is soybean is most profitable in terms of per unit area as well as per rupee of investment as compared to its competing crops is the prime question. Therefore, an attempt has been made to assess the profitability of soybean, maize and jowar crops in the study area based on resource use efficiency and returns.

The input use pattern in soybean cultivation clearly indicated that most of the material inputs such as seed, manure (FYM), chemical fertilizer and biofertilizer were used less than the recommended level (Table 4.4). This has been reflected in the under utilization of these inputs in terms of more than unity ratio of marginal value product (MVP) to marginal factor

cost (MFC) (Table 4.14). Similar pattern of input use was observed in case of jowar and maize. This is mainly due to the lack of knowledge among farmers about usage of recommended package of inputs. Especially, the farmers have not applied potash fertilizers in soybean because they were under the apprehension that the black cotton soil is rich in potash and does not require additional application. However labour utilization in soybean was found to be higher as compared to use of machines and bullock labour (Table 4.5). In general the input use in soybean was found to be relatively higher than those in jowar and maize (Table 4.4 and Table 4.5). The resource use efficiency in terms of ratio of MVP to MFC clearly indicated that the human labour and machines work were over used in soybean cultivation since MVP and MFC ratio were less than unity (Table 4.14). The higher use of human labour in soybean was mainly due to the excess use of labour for harvesting, hand weeding, application of manure etc. similarly machines were used largely on land preparation followed by sowing and threshing. In view of the limitations of labour availability as opined by the farmers, it is suggested to develop the machines for harvesting, threshing combinedly in soybean. In analysis of cost and return structure revealed that soybean was considerably profitable than its competing crops of jowar and maize. Even though the cost of cultivation in soybean is higher than jowar and maize, the gross returns were substantially higher in soybean over jowar and maize resulting in higher levels of net returns in soybean. This is reflected in higher benefit cost ratio over Cost C in soybean as compared to jowar and maize (Table 4.12). However, returns to paid out cost, fixed cost, family labour and management including marketing were lower in soybean as compared to jowar and maize. This substantiates the early statement that input use and thereby cost incurred in soybean was higher. Therefore it is essential to educate the soybean farmers for the use of recommended level of inputs so that the cost of cultivation reduced. This would facilitate in further enhancing profitability of soybean cultivation.

5.3 Costs and returns of soybean value added products

Soybean processing units does not require huge initial investment when compared to other processing units. More over the gestation period is also less. It requires 2-3 months time to set up the plant and the processing can be initiated immediately once the required quantity of raw material (soybean) is procured.

In the present study, the existing two soybean processing units involved in production of soya products such as soymilk, tofu and soyflour were selected for the detailed study. The processing unit on soymilk and tofu had a capacity utilization of 4 ton soybean per annum while another which unit processes soyflour had capacity of processing 20 ton of soybean annually. They were working for 8 hours in a day and 300 days in a year.

The main cost component of fixed costs in processing of soybean into soymilk and tofu (Table 4.15) was salaries to permanent employees (Rs 84000 /year), forming nearly half of the total fixed costs. In the salaries to permanent employees, three employees were involved, one technical person who operates the machine and two helpers. The machinery used in case of soymilk and tofu was named as ‘soyacow’, which is nothing but a table-top, batch processing machine that yields high quality soymilk at the cottage industry level. This machine produces 15 litres of soymilk every half an hour (using 2 kg. of soybean in one batch) i.e. 8 batches could be done per day but soy processor were producing only 6 batches per day due to lack of demand for these soy products. These 15 litres of milk could then be converted into approximately 2.5 kg of tofu. This is the only machine which can produce both soymilk and tofu simultaneously, hence, it was the major cost component in the case of machinery. The depreciation value on the machine formed major cost since the value of the machine was Rs 2.0 lakhs with 15 years of expected life. The cost of investment on other machineries for bottling, packing and storing of these products was found to be marginal. When soymilk is converted into tofu, coagulant such as citric acid, 30 gm for 15 litres of soymilk is required along with some additional machinery namely filter press, tofu box and tofu press for separating water from paneer (tofu).

The permanent employees of the processing unit are trained to take up the present job and hence need to be paid suitably. The other major cost component of variable cost incurred was the sales tax which they use to pay in the form of value added tax (VAT) at the rate of 4 percent. However, the sales tax on soymilk and tofu seems too high as revealed by the processor. Since there is no much demand for these value added products of soybean, it

is necessary to reduce the sales tax. This would encourage the consumers also to use more of these products. The major component of variable cost was on cost of packing material. Soymilk of 200 ml bottles with label were preferred for witch the cost of packing was around Rs 1.5/- per bottle. Similarly in case of tofu packing, 200 gm packets were preferred which cost about Rs 1.0/- per packet. Thus the cost for 2000 litres of soymilk and 1800 kg of tofu packing worked out to Rs 1,68,000/- per year which appears to be very high considering the turnover of the processing unit.

As indicated above, from 4 tons of raw soybean processed, 20,000 litres of soymilk and 1800 kg of tofu were produced. The gross returns worked out to Rs 9.00 lakhs per year from soymilk and Rs 1.80 lakhs per year from tofu, considering average market price of Rs 45 per liter of soymilk and Rs 100 per kg of tofu. Out of 4 tons of soybean processed, 2.5 tons was converted into soymilk and only 1.5 tons was used to make tofu mainly because the conversion ratio of soybean to soymilk (1:7.5) was higher than the tofu (1:1.2). Although the market price of tofu was higher, its demand in the market was less than soymilk. Therefore, processors were processing higher quantity of soybean into soymilk. The higher shelf life of soymilk (45 days) than of tofu further attracted the processors to go for soymilk production. The total net returns per year from soymilk and tofu together amounted to Rs 3,16,776/-, while per ton it worked out to Rs 79,194/-. Thus, for every rupee of investment in soymilk and tofu processing, about Rs 1.42 was obtained as returns, indicating its profitability. The results of the study are in conformity with Deorukhakar *et al.* (2007) who observed that processing of kokum into kokum syrup was more profitable than kokum agal and kokum rind in their study on costs and returns structure and employment potential in kokum (*Garcinia indica*) processing units in Sindhudurg district of Maharashtra.

In case of processing of soybean into soyflour, salaries paid to employees was the major component in the fixed cost though there were only two employees, one was working as technical assistant and the other person as helper. The investment cost on machinery including huller and grinder was found to be moderate with Rs80,000/-. However, sales tax appears to be higher considering the value added product having nutritional importance. As suggested earlier, it is suggested to rationalize the sales tax on soybean value added products to encourage this industry.

During the survey, it was noticed that the capacity of processing unit was 30 tons of soybean per year. However, due to lack of demand for soyflour in the market, the processing was restricted to 20 tons of soybean per year for making 18 tons of soyflour. The conversion ratio in converting soybean to soyflour (1:0.9) indicates that from 1 kg soybean, one can make 900 grams of soyflour. The gross returns obtained were Rs 7.2 lakhs per annum considering the average market price of soyflour at Rs 40 per kg. The shelf life of soyflour is more than 3 months, if it is stored in a vacuum pack. The net returns per ton of soyflour worked out to Rs 5223 with benefit cost ratio (1.18) of more than one indicated processing of soybean into soyflour is a profitable venture.

An assessment of profitability of processing of soybean into different value added products clearly indicated that the processing units involved in processing soymilk and tofu together were more profitable than those involved in processing of soybean into soyflour only. Since there is no much demand for all the types of soya value added products, the awareness on nutritional importance of soybean needs and to be carried out to consumers.

5.4 Financial feasibility of soybean processing units

Soybean processing unit, once established continues to generate returns up to 15 years. To establish soybean processing unit, the requirement of initial investment is relatively lower but, once the resources are committed, retrieval is impossible. Therefore, costs and returns have to be analyzed carefully to test the worthiness of investment in soybean processing enterprise. This would help soybean processors in making appropriate decision making. The techniques of project evaluation such as net present value, benefit-cost ratio, pay back period and internal rate of return were employed to assess the financial feasibility of investment on soy processing units. In analyzing the investment feasibility, the establishment costs, maintenance costs and gross returns from the soybean processing units were discounted at 14 percent discount rate to since it represented the opportunity cost of capital. Two soybean processing units involved in production of soya products viz., soymilk and tofu together and soyflour were selected from the study area. The processing unit which produces

soymilk and tofu together was having a processing capacity of 4 ton soybean per annum while, another unit which processes soyflour had capacity of processing 20 ton of soybean annually.

The net present value (NPV) criterion helps to evaluate the benefits accrued and costs incurred during the project life. One advantage of NPV is that it gives an idea about surplus and varies with level of investment and discount rates. In this study, NPV was calculated to indicate the money that would be generated by a project at a given discount rate. It is an absolute measure by discounting the net cash inflows. The NPV of soybean to soymilk and tofu processing unit at 14 per cent discount rate was Rs. 22,30,823/- and that in soyflour was Rs 7,24,137/- (Table 4.20). The formal selection criterion of NPV is to accept all the projects with positive values. Applying this principle, the net present value of soy processing units clearly indicated financial feasibility of investment.

Benefit-Cost (BC) ratio is another tool for appraising the worthiness of investment and it helps to ascertain the profitability of an enterprise. In production of soymilk and tofu together and soyflour, initial investment were made to establish the soy processing units and maintenance costs be incurred during subsequent years of establishment. The decision in BC ratio frame work is to select the projects where the ratio is more than one. The BC ratio of the processing units confined to soymilk and tofu (1.42) and soyflour unit (1.17) at 14 percent discount rate were more than unity indicating the worthiness of investment on these units.

Internal rate of return (IRR) is suggested to be very suitable measure for evaluating the profitability of investment on different projects. The IRR is the rate of discount at which the net present worth of project is zero or the discounted costs are equal to the discount returns. It is superior over the other measures since it takes into consideration the reinvestment opportunities of enterprises during the life span. The formal selection criterion of IRR is to accept the projects with IRR more than the opportunity cost of capital. The internal rate of return being 72.25 per cent for soymilk and tofu and 37.25 per cent for soyflour units were higher than the interest rate at which the soy processors can borrow from lending agencies and invest on these units. In other words, it is the average earning power of money invested on soybean processing units during its life span. Since IRR was more than the opportunity cost of capital, it clearly indicated that investment on soymilk, tofu and soyflour processing units is financially feasible.

The pay back period refers to the time required for the net benefits to equal the cost of the project. In the present study, it worked out to be 3 years for soymilk and tofu unit, while, 6 years for soyflour enterprise.

Thus, it is calculated that the investment in soybean processing units is financially feasible and economically viable. Therefore, so as to encourage the entrepreneurs, it is suggested to offer same sops by the government.

6. SUMMARY AND POLICY IMPLICATIONS

Soybean (*Glycine max* (L) Merrill) is a major oilseed crop in the world covering 91.29 million hectares under oilseed crops and contributing around 57 per cent (220.81 million metric tons) of the total 390.39 million metric tons during 2007-08 which makes it as the leading oilseed crop in the world, ahead of cotton, rapeseed, groundnut, sunflower, etc. The phenomenal increase in its area and production together with the expansion in processing units has earned a prominent position for India on the world map of soybean industry. In fact, it proved to be a fortune crop in terms of edible oil production, export earnings and rural prosperity. India is one of the leading producers of soybean, ranked fifth both in area (8.85 million hectare) and production (9.473 million metric tons) in the world. Soybean has attained a prominent position in India's agro-economy with 12 per cent contribution in India's agro-economy. The earnings through soybean meal export during 2007-08 were Rs 43857 million.

Cultivation of soybean in India was first started in Punjab and Uttar Pradesh in 1969. But farmers did not take interest in its cultivation since productivity was low due to high moisture content in these states. On the other hand, it became a popular crop in Madhya Pradesh as most of its cultivated area is in rain-fed and availability of irrigation water is comparatively very less. Its production had been increasing year after year in the country as it continues to fetch lucrative prices to the farming community. Madhya Pradesh has emerged as the soy state of the country with over 55 percent share in area as well as in production. It was observed that the ratio of price received of soybean to each of its competing crops particularly groundnut and cotton seen to be more profitable for farmers particularly in Maharashtra and Madhya Pradesh. Studies revealed that good seeds and better practices could deliver yield of the order of three tons per hectare which could place India's total production around 15 million tons. Thus, there is ample scope of increasing the production, however, non-availability of short duration high yielding varieties and good quality seed on adequate scale, low and unbalanced use of chemical fertilizers were the major factor for poor yield of soybean crop.

The present utilization pattern of soybean in India is that 85 percent used for oil extraction, 10 percent for seed and only 5 percent for food and feed. It has been estimated that nearly 85 per cent of soybean produced in the country is processed and nearly 40 percent in Madhya Pradesh alone. Therefore, processing is an important function of soybean. The processing sector is still far from achieving satisfactory success (only 2 per cent of fruits and vegetables are processed in organized sector). There are more than 200 soybean processing units in Madhya Pradesh but most of them are engaged in oil, deoiled cake (DOC) and lecithin making only. Only a few are engaged in making value added products such as soy meal, soy flour, soy milk, tofu, tempeh etc, indicating apprehensions on viability of investments in soybean value added products. In view of dominance of soybean crop in the cropping pattern coupled with low yield and problems faced by soybean processing units in Madhya Pradesh such as inadequacy of power, lack of efficient and quick transport, non–availability of proper market for these soy products and consumer acceptability have a crucial effect on the economics of the crop.

In this regard, there is need to understand the profitability of soybean as whole pulse as well as processed soy products. Therefore, in the present study, an attempt is made to find out the economics of soybean production and its value addition in Madhya Pradesh state with the following specific objectives:

Specific Objectives

1. To find out the profitability of soybean cultivation vis-à-vis competing crops.
2. To identify different value added products of soybean and to assess their costs and returns.
3. To find out the financial feasibility of investment in value addition to soybean.
4. To identify constraints in value addition and suggest remedial measures.

For selection of sample farmers, a multistage sampling procedure was adopted for the selection of districts, blocks, villages and farmers in the study area.. In the first stage, three districts namely Ujjain, Dewas and Shajapur were chosen since they occupy the highest

area of soybean in Madhya Pradesh. Similarly, one block was chosen in each of the selected districts based on the highest area in the second stage. Therefore, Kachrod block from Ujjain district, Dewas block from Dewas district and Shajapur block from Shajapur district were selected. In the third stage, three villages from each of the selected blocks were chosen based on highest area under soybean crop. In the fourth stage, 10 farmers were selected randomly from each of the sample villages who were growing soybean. Thus, the total sample size of soybean farmers constituted 90. Correspondingly, 30 farmers were chosen randomly who were growing competing crops of soybean such as jowar and maize from the selected districts.

In addition to farmers, the existing two soybean processing units involved in production of soya products such as soymilk, tofu and soyflour were selected from the study area.

The data were analyzed using tabular analysis, functional analysis and project analysis techniques.

Major findings of the study

1. The average productivity of sample farmers showed the marginal differences in yield of soybean among small (11.39 q/ha), medium (11.82 q/ha) and large (12.74 q/ha) farmers in the study area.
2. Soybean crop is dominated (46.80 %) the cropping pattern of sample farmers in *kharif* season followed by bengal gram (26.26%) and wheat (19.42%) in *rabi* season.
3. In soybean, quantity of material inputs like seeds, manures, chemical fertilizers and biofertilizers used by the farmers were less than the recommended level.
4. There was no significant difference in the labour utilization amongst all the group of farmers in soybean cultivation.
5. The material inputs like manures and chemical fertilizers used by the farmers in case of jowar and maize crop were less than the recommended level.
6. It is interesting to note that none of the farmers have applied potash in soybean, maize and jowar crop.
7. The cost on machinery use (20.59%) formed highest total cost component in soybean cultivation.
8. On an average, soybean farmers obtained per hectare net returns of Rs 10259 over Cost A_1 which is actually the paid out costs to the farmers.
9. It is interesting to note that the return to every rupee of investment in soybean cultivation with 1.29 was similar in small and medium farmers but slightly higher in case of large farmers (1.34).
10. That the total cost of cultivation of jowar worked out to Rs 8923 per hectare which was about three fourth of total cost of cultivation of maize (Rs 12516 /ha).
11. Net returns per hectare were significantly higher over Cost A, B and C and in case of case of maize when compared to jowar.
12. The net returns in soybean over jowar (868.72%) and maize (121.67%) were significantly higher. Similarly, benefit cost ratio over Cost C was higher in case of soybean (1.29) than that of maize (1.16) and jowar (1.05).
13. Manure (0.20*), machine works (-0.01**) and land (0.03*) have significantly influenced the production of soybean in the study area as indicated by their significant regression coefficients. Manure and land have positively influenced the production of soybean whereas machinery use had negative influence.
14. The cost on packing material (Rs 42000 /ton) formed major (22.01%) component of total processing cost of soymilk and tofu unit.
15. For every rupee of investment in soymilk and tofu processing, about Rs 1.42 was obtained as returns, indicating its profitability.

16. Cost of raw material (Rs17000/ton) was more than half (55.24%) and hence formed the major component of the total cost of processing soybean into soyflour.

17. The benefit cost ratio was high (1.18) showing the profitability of converting soybean into soyflour.

18. The estimates of net present value, benefit cost ratio and internal rate of return were higher in case of soymilk and tofu unit as compared with soyflour unit.

19. Pay back period (PBP) in soymilk and tofu units was only 3 years whereas it was 6 years in case of soyflour unit.

20. The major problems in cultivation of soybean were high labour wage rate (90.04%) followed by high incidence of yellow rust disease (73.81%) by all the group of farmers.

21. The major constraints faced by soy processing units producing soymilk, tofu and soyflour was non availability of quality raw material and non availability of expected market for soy products.

POLICY IMPLICATIONS

1. In view of use of inputs lower than the recommended level, there is need to educate farmers to apply the recommended dose for enhancing the productivity.

2. Due to under use of seeds, manures and chemical fertilizers, there is a need to reallocate the resources for optimum use so as to increase profitability. Similarly, labour and machines needs to be reallocated for optimization of returns.

3. In view of the mentioned advantages of soymilk, its usage may be encouraged among the consumers.

4. In view of nutritional advantage of soyflour, it may be mixed with wheat flour for better health of consumers.

5. Since the value addition is profitable over raw soybean, farmers may be motivated to take up value addition to soybean.

6. In view of feasibility of investment in soybean units, small scale entrepreneurs may be encouraged to establish them for widening the soybean industry.

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APPENDIX I

Cash flow statement of soy processing unit producing soymilk and tofu

Years	Out flow	Inflow	Net cash flow	pay back period	Dis. Outflow 14%	Dic. Inflow 14%	Disc.Net flow
1	763,224	0	-763224	-763224	763224	0	-763224
2	651,168	1080000	428832	-334392	586638	972973	386335
3	651,168	1080000	428832	94440	528503	876552	348050
4	651,168	1080000	428832	523272	476128	789687	313558
5	651,168	1080000	428832	952104	428945	711429	282485
6	651,168	1080000	428832	1380936	386437	640927	254491
7	651,168	1080000	428832	1809768	348141	577412	229271
8	651,168	1080000	428832	2238600	313641	520191	206551
9	651,168	1080000	428832	2667432	282559	468641	186082
10	651,168	1080000	428832	3096264	254558	422199	167641
11	651,168	1080000	428832	3525096	229331	380359	151028
12	651,168	1080000	428832	3953928	206605	342666	136061
13	651,168	1080000	428832	4382760	186130	308708	122578
14	651,168	1080000	428832	4811592	167685	278115	110430
15	651,168	1080000	428832	5240424	151068	250554	99487
					5309591	7540414	2230823

APPENDIX II

Cash flow statement of soy processing unit producing soyflour

Years	Out flow	Inflow	Net cash flow	pay back period	Dis. outflow 14%	Dic. Inflow 14%	Disc.Net flow
1	615543	0	-615543	-615543	615543	0	-615543
2	528120	720000	191880	-423663	475784	648649	172865
3	528120	720000	191880	-231783	428634	584368	155734
4	528120	720000	191880	-39903	386157	526458	140301
5	528120	720000	191880	151977	347889	474286	126397
6	528120	720000	191880	343857	313414	427285	113871
7	528120	720000	191880	535737	282355	384941	102587
8	528120	720000	191880	727617	254373	346794	92421
9	528120	720000	191880	919497	229165	312427	83262
10	528120	720000	191880	1111377	206455	281466	75011
11	528120	720000	191880	1303257	185996	253573	67577
12	528120	720000	191880	1495137	167564	228444	60880
13	528120	720000	191880	1687017	150958	205805	54847
14	528120	720000	191880	1878897	135998	185410	49412
15	528120	720000	191880	2070777	122521	167036	44515
					4302806	5026943	724137

ECONOMICS OF PRODUCTION AND VALUE ADDITION TO SOYBEAN IN MADHYA PRADESH

ANKIT JAISWAL 2009 Dr. L. B. HUGAR

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ABSTRACT

Soybean is known as the “golden bean”, “miracle crop” etc., because of its several uses. The present utilization pattern of soybean in India indicated that 85 per cent used for oil extraction, 10 per cent for seed and only 5 per cent for food and feed. Therefore, processing is an important function of soybean. In recent years jowar and maize in rainfed areas have been competing with soybean in Madhya Pradesh. In the present study effort is made to study profitability of soybean vis-à-vis its competing crops in addition to value addition. The study indicated that net returns in soybean over jowar (868.72%) and maize (121.67%) were significantly higher. Similarly, benefit cost ratio over Cost C was higher in case of soybean (1.29) than that of maize (1.16) and jowar (1.05) which clearly indicated that soybean cultivation was more profitable than any of competing crops. For every rupee investment in soymilk and tofu processing, Rs. 1.42 was obtained as returns, indicating its profitability. Benefit cost ratio was more than unity (1.18) showing profitability of converting soybean into soyflour. In this regard, there is need to understand the profitability of soybean as whole pulse as well as processed soy products. Therefore, in the present study, an attempt is made to find out the economics of soybean production and its value addition in Madhya Pradesh state. An assessment of profitability of processing of soybean into different value added products clearly indicated that the processing units involved in processing soymilk and tofu together were more profitable than those involved in processing of soybean into soyflour only. Since the value addition is profitable over raw soybean, farmers may be motivated to take up value addition to soybean. Further, small scale entrepreneurs may be encouraged to establish the above enterprises for widening the soybean industry.