

**“TO ANALYSE THE COSTS AND PROFITABILITY
OF SOYBEAN CULTIVATION IN DEWAS
DISTRICT OF MADHYA PRADESH”**

THESIS



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Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya

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by

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CERTIFICATE- I

This is to certify that the thesis entitled “To analyse the costs and profitability of soybean cultivation in Dewas district of Madhya Pradesh.” submitted in partial fulfillment of the requirement for the degree of “MASTER OF SCIENCE IN AGRICULTURE” in Department of Agricultural Economics of the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya Gwalior is a record of the bona-fide research work carried out by MR. ANAND PATEL under my guidance and supervision. The subject of the thesis has been approved by the Student’s Advisory Committee and the Director of Instructions.

No part of the thesis has been submitted for any other degree or diploma has been published. All the assistance and help received during the course of the investigations has been acknowledged by the scholar.

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*This is to certify that the thesis entitled “**To analyse the costs and profitability of soybean cultivation in Dewas district of Madhya Pradesh.**” submitted by **MR. ANAND PATEL** to **Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior**, in partial fulfillment of the requirements for the degree of “**MASTER OF SCIENCE IN AGRICULTURE**” in the **Department of Agricultural Economics** has been approved by the Student’s Advisory Committee and the External Examiner(s) after an oral examination of the same.*

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ABBREVIATIONS AND ACRONYMS

Abbreviations/ Acronyms	Meaning
Fig.	Figure
&	And
<i>et al.</i>	And co-workers
@	At the rate of
MT	Million tones
Mha	Million hectare
CV	Coefficient of Variation
G	Gram
Ha	Hectare
i.e.	In reference to; that is
Kg	Kilogram
kg ha ⁻¹	Kilogram per hectare
S.E.	Standard error
M	Meter
Min	Minimum
Max.	Maximum
No.	Number
%	Per cent
Rs.	Rupees
Qtl.	Quintal
Gov.	Government
CGR	Compound growth rate
CC	Correlation Coefficient
FAO	Food and agriculture organization
S.E.(m)±	Standard error add mean of difference
Approx.	Approximately
MVP	Marginal value productivity

CHAPTER – I

INTRODUCTION

Soybean is known as miracle crop, because of its many benefits. Soybean is an important oil seed legume crop in the India and world. It is a good source of oil and protein. It contains about 20 per cent oil and 42 per cent high quality protein, which has 2-3 times more protein than other legumes. It is termed as “*GOLDEN BEAN*” of the 20th Century because of its unique qualities. It also contains 21% carbohydrates, 5% minerals, 8% moisture, 4% fiber and vitamins. The soybean protein has good quantity of Lysine (4-6 per cent) and the extracted oil is edible which fulfill the requirement of vegetable oil consumer. In India, mostly people are vegetarian so soybean protein is important source to overcome from the short supply of protein. Soybean is the best source among plant based protein. Soybean contains sufficient amount of vitamins, iron, phosphorus, and calcium, copper etc. which is well-suited for humans. Soybean stands on first place in the world vegetable oil production. In Asia, soybean is normally eaten whole, but at present processed soya products are more common in use. Different types of products are available, including tofu, soya sauce, yoghurt, soya milk, soya protein, soya flour etc. Soya flour's biscuits, snacks, papad and sweets are also available. Soybean fortified wheat flour makes nutritious and delicious Chapati. This is used for making protein food for young age people. Soya products contain less carbohydrates and low cholesterol which is beneficial for diabetic and heart disease patients. Soybean contains phytonutrients and antioxidants, which is beneficial for health. Soybean contains plant compounds that also helps to prevent prostate and breast cancer. It also relieves menopause symptoms. For sustainability of agriculture systems, soybean plays an important role because leguminous nature of soybean helps in improving soil fertility. It has ability of fixing atmospheric nitrogen with symbiosis of *Rhizobium japonicum* micro-organism.

Soybean is basically a legume crop but used as oilseed crop. It can not be used as a pulse because of inherent presence of trypsin inhibitor. The demand for edible oils, oilseeds and oilcake meals has been increased in the country. Soybean plays major role in edible oil economy and it is the fastest growing oilseed crop globally. This crop covered 54 per cent of the area under kharif oilseed crops and 37 per cent of the area of total oilseeds crops in India. In the country during 2010-2012, Soybean covered 40 per cent of the oilseed production, 25 per cent of the total vegetable oils and 2/3 of the oil meals supplies. Now this crop takes very important place in agricultural and oil economy of India.

India secures 5th position in world top soybean producer countries. India is Asia's second largest producer of soybean, and it accounts 3.95 per cent of global production according to Statista. USA is the top soybean producer of the world. The USA accounts for approx. 35 per cent of the world's soybean production. Soybean has shown tremendous growth in area and production in the country and in Madhya Pradesh, particularly during recent past. This crop has emerged as one of the important kharif season crop in central India and 3rd most important oilseed crop after mustard and groundnut in India. In India, the states of Madhya Pradesh and Maharashtra account for 89 per cent of the country's total soybean production. Madhya Pradesh is the leading state in the soybean production in India. Madhya Pradesh produces 50 per cent (42.001 MT) soybean of India's total production (83.504 MT) and its covered 50 per cent (50.100 lakh ha.) area of total soybean crop area(101.61 lakh ha.) of the country, Based on kharif 2017 SOPA data. Thus, Madhya Pradesh is known as '**soya-state**'. Whereas area under soybean in Dewas district is 3.275 lakh hectare, Production is 3.193 lakh MT and productivity is 975 kg per hectare in kharif 2017-18. The growth in its area and production together with development of soybean processing units in India. Madhya Pradesh is divided into 11 agro-climatic regions. Malwa region has the highest area under soybean crop and production also highest. Ujjain district having largest area and highest production under soybean crop followed by Dewas district in Madhya Pradesh. This crop plays an important role in the agricultural development of India, soybean sharing 14 per cent in

the country's gross cropped area and about 3 percent of the gross domestic product and about 6 per cent of the value of all types of agricultural products (ICAR-IIOR, 2015).The present study is an attempt to examine cost and returns per hectare in soybean crop in Dewas block of Dewas district of Madhya Pradesh. Further investigation also identifies the soybean production.

Objectives:-

1. To study the compound growth rates of area, production and productivity of soybean of Madhya Pradesh during last 10years (2005-06 to 2014-15).
2. To analyse the economic efficiency of soybean production.
3. To find out the relationship between cost of production and productivity of soybean.
4. To examine the resource use efficiency of different inputs in soybean production.
5. **Table 1.1: All India state wise area, production and productivity of soybean during kharif 2017, 2018 and 2019. (Area in lakh ha., productivity in kg per ha., production in lakh MT.)**

Name of state	Kharif 2017			Kharif 2018			Kharif 2019		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
Madhya Pradesh	50.10	42.00	838	54.09	58.18	1075	51.95	40.10	772
Maharashtra	34.48	29.00	841	36.39	34.34	944	37.36	39.41	1055
Rajasthan	9.24	7.49	811	9.21	8.94	971	9.627	6.56	681
Karnataka	2.71	1.73	639	3.19	2.90	911	3.302	2.69	816
Andhra Pradesh	1.65	1.05	639	1.79	1.57	877	1.783	1.50	846
Gujarat	1.29	0.88	688	1.34	1.24	925	1.003	0.86	858
Chhattisgarh	1.32	0.86	654	1.28	1.10	865	0.742	0.53	726
Others	0.76	0.46	608	1.09	1.04	955	1.841	1.37	748
Grand total	101.56	83.50	822	108.93	109.33	1009	107.61	93.06	865

Source: The Soybean Processors Association of India (SOPA), Indore

Table 1.2: Area, production and productivity of soybean in Ujjain division during Kharif 2017, 2018 and 2019. (Area in lakh ha., productivity in kg per ha. , production in lakh MT.)

District	Kharif 2017			Kharif 2018			Kharif 2019		
	Area	Production	Productivity	Area	Production	Productivity	Area	Production	Productivity
Ujjain	4.47	4.225	945	4.72	5.645	1195	4.76	3.822	802
Dewas	3.27	3.193	975	3.81	4.783	1254	3.53	2.819	798
Shajapur	2.48	2.244	905	2.55	2.896	1136	2.54	1.941	762
Ratlam	2.20	1.956	889	3.12	3.876	1242	2.35	1.697	722
Mandsaur	2.70	2.714	1005	3.29	3.981	1209	2.79	1.409	505
Agar malwa	1.20	1.092	910	1.69	1.917	1129	1.38	1.039	753
Neemach	1.35	1.336	985	1.77	2.162	1219	1.29	0.690	535
Grand Total	17.68	16.760	948	20.97	25.260	1204	18.65	13.417	719

Source: The Soybean Processors Association of India (SOPA), Indore

1.1 Justification of selecting problem

Soybean is a major kharif crop in Dewas district of Madhya Pradesh. So, this study has selected for estimating economics and for suggesting ideas to increase productivity and profit by cultivation of this crop.

1.2 Scope of the study:-

The present study is addressed to the farmers to inform them with the cost and profitability concept of Soybean. The results of the study could address the possibilities of increasing returns from Soybean crop. The farmers may use this study to plan their farms and resource use within the limit of input and output prices, considered in the study for accelerating the profitability from cultivation of Soybean.

1.3 Limitations of the Study:-

- (i) The study belongs to Dewas district of Madhya Pradesh. Therefore, the results of this study are area situation specific and also results of the study related to only specific season i.e. 2019-20 (Kharif)
- (ii) The farmers do not keep any systematic and exact records of their farming practices and have provided the information based on their recall memory, hence presence of the memory bias should be ignored in this study.
- (iii) The study includes only those factors which are under the control of the farmers and contribute significantly towards the returns and use of resources. There is no reference made to factors like risk and uncertainty.
- (iv) Due to the limitation of time and resources in hand, it would not be possible to cover fairly large area for the purpose of investigation. Therefore only a very limited number of just 120 respondents from five Patwari halka of Dewas block of Dewas District are proposed to be covered for detailed study to arrive at various conclusions.

CHAPTER-II

REVIEW OF LITETRATURE

A comprehensive and up-to-date review of literature is necessary for any field of scientific enquiry so as to understand the various concepts to be used in the proposed study. To analyses any problem, it is necessary to understand the research work done in past related to different parameters. Which are helpful in interpretation of results obtained during the research. This chapter deals with review of research work already done related to problem of study in hand to provide support to the finding of the present study. The review could also help in reflecting the concept and statement of the objectives under study. The review of literature is a guide line which method of study was considered in the earlier as well as for supporting of the present study. In this chapter, the works of several researchers are mentioned in brief which the researcher have been studied, understood and adopted as the guidance to complete his research. Some of the important and relevant studies done so far in India and abroad are reviewed below:

Pawar *et al.* (2000) studies an overall productivity level of soybean from 114 soybean growers from 6 villages in Satara district. The highest productivity was obtained on large sized farms (26.82 q/ha) and the lowest on small farms (22.55 q/ha). The cost of cultivation was Rs.10958 per hectare at the overall level. The gross and net returns were Rs.22200 and Rs.11242, respectively, input-output ratio for soybean cultivation worked out to 1:1.97, which indicates that soybean production is economically profitable proportion.

Babu (2001) studied the economics of tribal farming, resources in tribal farming to obtain better returns, the changes brought in the cropping pattern, intensity of cropping and other different developmental programs. The total cultivation cost of all crops put together on whole farm per hectare was worked out. The total costs accounted for were Rs.5,182, Rs.5,467, Rs.4,982 and Rs.5,215 for small, medium, large and all farms respectively. The net returns were highest on large farms (Rs.2492/ha), followed by small (Rs.1,315.49) and medium (Rs.1,244.78) farms.

Gaddi *et al.* (2002) observed that with the help of capital, input did not exert any significant influence on cotton production, while the plant nutrients (-0.2452) was excessively used in the cause of sample farms also, the Cobb-Douglas. Type of production function turned to be good fit since R^2 and F-values were significant at one per cent probability level. About 90 per cent of the variation in cotton production on the farmers' fields was explained by the variables included in the model. The production elasticity of all inputs on all the farmer's fields were variably in lower than unity implying diminishing marginal productivity with respect to each of these inputs human labour and capital. Coefficient was significant at one per cent on all. The farms Seed coefficient exerted significant influence on cotton production on all sample farms, barring large farms where the coefficient was negative (0.1042), but not significant. The geometric mean value of inputs showed that human labour and bullock labour worked used in higher quantity on demonstration plots, whereas use of all the inputs was more on the farmers filed.

Mandal, *et al.* (2002) examined the energy requirement and energy input-output relationship of soybean-based crop production systems viz., soybean (*Glycine max* (L.) Merr.) Wheat (*Triticumaestivum* L.), soybean-mustard (*Brassica juncea* (L.) Czern & Coss.) and soybean-chickpea (*Cicerarietinum* L.) in central India. Using a pre-tested questionnaire, 135 farmers were selected through a multi-stage stratified random sampling technique. Though the net return from soybean-wheat was marginally higher than other systems, the soybean-chickpea system is more suitable in the central ecological niche of India due to its low requirement for non-renewable resources, higher EUE and benefit-cost ratio.

Verma (2002) analyzed the economics of production, resource use efficiency and constraints: A case study of onion in Shajapur District of Madhya Pradesh. The main aim of the study was to the economics of production of onion in 12 the different farm size-groups, to examine the input output relationship and resource use efficiency in onion enterprise on different sizes of farms, to identify various constraints in onion production and

marketing and to suggest measures for improvement. The study was conducted in Shajapur block of Shajapur district of Madhya Pradesh. A sample of 8 Villages comprising 80 farmers were selected from these Villages for the study. The numbers of selected farmer were in 40 in small, 25 in medium and 15 in large category. An average the cost of cultivation per ha of onion over cost A_1 , cost B_1 , cost C_1 and cost C_2 and cost C_3 were worked out to Rs.21790.24, Rs.22309.05, Rs.24499.28, Rs.24949.28, Rs.27139.28 and Rs.29853.20, respectively. The average net return over cost A_1 , cost B_2 , cost C_1 , C_2 and C_3 were calculated at Rs.50741 .01, Rs.50222.20, Rs.48032.20, Rs.47581.97, Rs.45391.97 and Rs.42678.05 per hectare of onion respectively. The average cost of production per quintal of onion was worked out to be Rs.102.89 on cost C_2 and Rs.113.18 on cost C_3 . The average input-output ratio at cost A_1 , Cost B_1 , Cost B_2 , Cost C_1 , C_2 and C_3 were worked out to be 1:3.32, 1:3.25, 1:2.96, 1:2.90, 1:2.67 and 1:2.42, respectively. The return per rupee of investment of onion was higher in small size group of farms.

Vyas et al. (2003) reported that demonstrations of improved production technologies of soybean performed better than local check, it improved the productivity by 53.13 per cent and net return by 54.84 per cent over local check. The integration of different components of technologies of soybean cultivation reduced the cost of production (Rs. /q) by 1.15 per cent.

Lokesh and Chandrakanth (2004) showed that the gross return of local and improved varieties of turmeric was Rs.55,000 and Rs.73,160 respectively per acre. The higher gross return in improved variety was due to higher yield by 25 percent compared to local variety.

Patidar (2004) reported that the operational cost A_1/A_2 was considerably higher in small size (Rs.45657.81) in comparison to large size farms (Rs.38740.34). The same pattern was observed in cost B_1 and B_2 . Cost C_1 was higher in small size group, but in medium and large size group have a very narrow variation. In case of cost C_2 it was maximum in small size and lowest in large size group. Cost C_3 was higher in small size group followed by medium and large size groups.

Perez *et al.* (2004) reported that in Tucuman, Argentina, during 2003-04, with reference to the maize-soybean rotation. An increase of 14% of the area cultivated with soybeans was observed in comparison with 2002-03. Three cultural techniques were used, with normal or certified seed: fertilizers and fungicides; fungicides only for rust control; and fertilizers only. The costs of planting, maintenance and harvesting were Rs.400-500/ha, depending on the cultural methods used. An economic study is summarized of soybean monoculture or a rotation of 1 year maize, 2 years soybeans. For the rotation, the expenditure was Rs553.77/ha for soybeans and Rs.624/ha for maize, the price of soybeans was Rs.678/t and of maize Rs.237.52/t. The gross margins for soybean in monoculture were Rs.907/ha over 3 years, while those for the rotation were Rs.1192 and Rs.1050.

Sharma and Sharma (2004) reported that magnitude of increase of the net return through relaxed capital is important. Magnitude of increment was one and half to three times of existing net return depending upon area and location of the farms and adoption of new technology. The net return per farm increased with increase in level of technology on all farm sizes. The net return capital ratio increased with in the level of technology at all size of the farms. There are urgent needs for economizing resources and calls for preparation of the optimum farm plan considering regional needs and resource availability with the farmers.

Jain *et al.* (2005) conducted a study on soybean-wheat cropping system for 3 consecutive year during 1999-2000 to 2001-2002 in Jabalpur district of Madhya Pradesh, with the objective to maximize the productivity and profitability of system. Study revealed that recommended dose of fertilizers to both crops significantly increased the grain yields of crop components and it was remuneration also without deterioration of soil properties, application of 10 tones FYM/ha to Soybean along with different fertilizers dose increased the grain yields of both crops. The use of recommended seed rate of wheat also helped to increase the productivity, net monetary return and benefit cost ratio of entire soybean-wheat system.

Castro, *et al* (2006) this study identifies the economic indexes of cost that influence the decisions made by soybean producers in Bahia, India. The research is based on the theory of costs. The study showed that expenses on variable resources represent the greater portion of the final cost of soybean, like cost of fertilizers, services, and chemical products. The items with fixed cost, which affected most of soybean production cost in west of Bahia were machinery, equipment and land. The economic study also indicated that not all of the fixed costs were lost, as would be the case if production were discontinued. It is suggested that soybean producers could earn only for a short time, but under the process of recapitalization, these producers could earn in the long run with best economic and alternative use of their investment.

Mandloi (2006) reported that the average operational cost of chili production i.e. cost A_1 was highest on large size group being Rs.26475.14 per hectare and the lowest on small farms (Rs.23817.26 /ha.). Likewise, in case of cost C, the average values varied from Rs.34153.09 on large farm to Rs.36339.97 on small farm respectively. It is interesting to note that the cost concept cost A, B and C shown no definite trend with different size of holding. But it is clear that the cost per unit area was found to be highest on medium farms and lowest was on large farms respectively. It is also revealed that the overall cost per unit of area on farm medium and small farm were increased with compare to large farms. This was mainly due to increase in labour charges, interest on fixed capital and other charges like value on depreciation of fixed capital etc.

Singh (2006) was reported soybean originated in China and was introduced to India centuries ago through the Himalayan routes, and also brought in via Burma (now Myanmar) by traders from Indonesia. As a result, soybean has been traditionally grown on a small scale in Himachal Pradesh, the Kumaon Hills of Uttar Pradesh (now Uttaranchal), eastern Bengal, the khasi hills, Manipur, the Naga Hills, and parts of central India covering Madhya Pradesh. Because of its high protein and oil content, and another attributes such as its beneficial effects on soil fertility, several attempts were made in the past to popularize soybean cultivation in India. However, these

initiatives were far from successful, mainly because of the inadequate knowledge about its cultivation, lack of high-yielding varieties, lack of marketing, and unfamiliarity with its utilization. To deal with the country's perennial protein malnutrition due to the stagnant pulse production, fresh efforts were initiated in the mid-1960s by the G.B. Pant University of Agriculture and a Technology Pant Nagar (Uttaranchal) and the Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (Madhya Pradesh), in collaboration with the University of Illinois, USA to popularize soybean cultivation in India. The preliminary trials conducted at Pantnagar in 1965-66, using soybean varieties from southern USA, yielded 3 to 4 per hectare within 110-130 days, which prompted the Indian Council of Agricultural Research (ICAR) to initiate, on 1st April 1967, an All-India Project for Coordinated Research on Soybeans. Through the well-coordinated and collaborative efforts of a number of national, international, and private sector organizations over the years, soybean has now become an important crop in India. From about 11,000 ha until 1961, soybean occupied over 6 million ha in 2003 producing over 6 million tones. This has made India the 5th largest producer of soybean in the world today. Among the many partners in this success story, GBPUAT played a major role in the initial phase of soybean variety improvement, soybean market development, and coordination of the national soybean research and development in India.

Ahirwar *et al.* (2007) studies Madhya Pradesh is designated as the 'Soya State' as it has major share in area (67%) and production (57%) of soybean in India. In this study, an effort has been made to examine the profitability and input use efficiency in cultivation of soybean at different size of farms in soybean producing district (Ujjain) of Malwa plateau agro-climatic zone of Madhya Pradesh which is selected purposively having maximum area under cultivation of soybean in the state. The sampling unit comprised of randomly selected 240 farm holdings (110 small, 70 medium and 60 large). The required primary data related to agricultural year 2004-05 were collected through survey method using pre-tested interview schedule. It was observed from the analyzed data that the total cost of cultivation was maximum on large (Rs8574.80/ha) as compared to medium (Rs.8538.19/ha) and small

(Rs.7680.73) size of farms revealing that soybean production involves high expenditure on purchased inputs viz., seed, fertilizers, insecticides and hired mechanical power. The maximum gross income was found on medium (Rs.13400/ha) followed by large (Rs.12969.50/ha) and small (Rs.11813.00/ha) size of farms. As far as the cost benefit ratio is concerned, it was found to be maximum on medium (1: 1.57), followed by small (1: 1.54) and large (1: 1.51) size of farms. The use of human labour showed positive and significant contributions towards yield of soybean on all sizes except large size of farms. The use of fertilizer and plant protection chemicals showed positive and significant impact on yield on all sizes of farms except large. The other factors of production did not show any positive response towards yield revealing that these factors were not used efficiently by the soybean growers or the quality of the inputs was not up to the mark. The sum of the regression coefficients indicated constant return to scale in all the category of farms. This implies that the further increase in soybean production is possible only through up-gradation of existing production technology either through seed (varietals) replacement coupled with superior inputs, balanced use of fertilizers and judicious farm management practices. This will not only enhance the input use efficiency but will also help to reduce the cost per unit of production of soybean.

Chandel (2007) studies the increased oilseed production and productivity in India has not helped out our country. The study of sustainability of production and productivity of oilseeds, its technological improvement, profitability, input growth and their efficient use. The area under six edible oilseed crop namely, rapeseed and mustard (RSM), groundnut (GNUT), sunflower, (SUNF) soybean (SOYA) and safflower (SAFF). Per hectare production of these crops increased from 580 kg to 880 kg which is still 50-60 per cent lower than the world averages varying from crop to crop registered a growth rate 2.2% per annum. The data from two states Madhya Pradesh and Uttar Pradesh were used to calculate IFP. These states are representative sample of soybean cultivation in India as they account for 85 per cent of the crop area in the country.

Khadwe *et al.* (2007) conducted on the farmer's fields of Chindwara district under Satpura Plateau of Madhya Pradesh during to 2004 revealed that varieties PK 1024, JS 335 and JS 80-21 yields and 78.67, 64.29 and 43.82 per cent higher seed yield as compare to local variety with traditional practices. The productivity of soybean ranged from 10.80 to 22.80 q/ha with the highest average yield to 20.55 q/ha under recommended practices. There was an increase of 55.42 to 91.16% in seed yield over local check. The demonstrations gave an additional income of Rs.8100 to 16735/ha and 3.02 to 6.25 incremental benefit cost ratio.

Singh *et al.*, (2007) conducted a study to estimate production cost and return of sugarcane cultivation in Uttar Pradesh, India, during 2003-04. Data were gathered by administering a pre-tested schedule to 150 sugarcane growers. Results showed that the average production cost of sugarcane was Rs.36730.32/ha, which varied from Rs.35303.93/ha on small farms and Rs.39396.11/ha on large farms. The average net return was Rs.36290.95/ha, with lowest return of Rs.13364.01/ha. It is concluded that the State Advisory Price announced by the Uttar Pradesh Government is sufficient to meet the production cost of sugarcane. It is suggested that the Government should take more interest to increase the supply of sugarcane to sugar factories rather than gur and khandsari.

Kakade, *et al.* (2009) the present study was conducted during 2006-07 in Nagpur District of Maharashtra state. Under soybean seed production, average per hectare total cost *i.e.*, cost C was worked to Rs.16172.72. The input-output ratio for soybean seed production at cost 'C' was 1:1.20 which indicated that soybean seed production was profitable preposition.

Rajur (2008) has done work on economics of Chilli production in Karnataka. Economic analysis of data indicated that Cost A₂ accounted for 30.70 per cent in Gulbarga, 28.81 per cent in Raichur and 32.30 per cent in Bijapur district. Cost B₂ accounted for 50.25 per cent in Bijapur, 44.54 per cent in Raichur and 47.09 per cent in Gulbarga district. It is obvious from cost C₃ that Use of family labour was more in case of Bijapur district than Gulbarga and Raichur districts due to non-availability of hired labour during peak period. Returns over cost C₃ was highest in Raichur district (Rs.34955.50) followed by

Gulbarga (Rs.33870.40) and (Rs.28836.26) in Bijapur districts, which was due to the lower total cost of chilli production in Raichur district Compared to Bijapur and Gulbarga districts.

Rekha and Dhurua (2009) a field experiment was conducted during *kharif* seasons of 2002, 2003 and 2004 to study the effect of planting pattern and duration of pigeon pea varieties on productivity of pigeon pea + soybean intercropping system under rainfed conditions. The highest seed yields were recorded by sole crops of pigeon pea (1401 kg/ha) and soybean (1853 kg/ha). Planting of pigeon pea, Durga at 90 cm with 1 row of soybean and pigeon pea MRG-66, 150 cm with five rows of soybean recorded maximum net returns of (Rs.17,226/ha) and (Rs.22,035/ha) respectively. Pigeon pea, MRG-66 at 180 cm with six rows of soybean recorded maximum (1.39) land equivalent ratio.

Bifang (2010) data (1990-2007) of soybean production in China were analyzed using slacks-based measure in data envelopment analysis (SBM-DEA). Results showed that the total-factor productivity (TFP) of soybean production had an average annual increase of 0.06%, the technology growth had an average annual increase of 0.59%, and the technology efficiency had an annual decrease of 0.5%. Analyses on the factors that affected the production of soybean in China showed that the effect of TFP was fairly limited, while the capital input had the main effect.

Nadani Devi (2010) reported soybean is consumed by every household in Manipur in the form of fermented soybean as a tradition from time immemorial. Soybean was grown in an area of about 820 ha with a production of 615 tones during 2008-09. The productivity (750 kg/ha) was quite low as compare to the national average (1000 kg/ha). Thus, there is a need to identify the high yielding genotype suitable under Manipur condition to bridge the demand supply gap. Looking into this view, cultivation of soybean genotypes JS 97-52, Bragg, RAUS-5 and JS 335 were carried out at different location under real farm situations of the stated from kharif 2005 to 2007. The trials were carried out under All India Coordinated Research Project on soybean, central Agricultural University, Imphal. Maximum number of pods per plant (40) was obtained from the variety JS 335 (1284 kg/ha). The optimum plant population for JS 335 was found to be 0.4 million per hectare.

From the economic point of view the maximum net return (Rs.3814/ha) and B:C ration (2.12) were obtained from the variety JS 335 as compare to other varieties tested under Manipur condition.

Shukla (2010) reported that cost of producing one ha chili was Rs. 25155.00 which included material cost, labour cost in nursery and labour cost in main field. On an average the yield from one ha was 22.03 q. The market price of that was Rs.83273.40. The total benefit received by farmers by cultivating chilli was Rs. 58118.4 per ha. The BC ratio of one ha was recorded 3.31. The present study showed that chilli cultivation in the area is quite beneficial for the farmers and they also find good marketing facilities in nearby areas.

Tomar and Sawarkar (2010) seventy two front line demonstrations on farmer's field on soybean crop wise conducted under NATP project by Zonal Agricultural Research Station Chhindwara (M.P.) during 2001-2003. The specific objective of these FLD'S was to demonstrate improved technology (HYV JS – 335, 20:80:20 NPK kg/ha plant protection measure) to moderate farming community for obtaining highest yield. Results revealed that 17.18 q/ha yield and profit of Rs. 11208/ha was obtained through improve technology, which were highest 35.62 per cent in yield and Rs. 3924/ha more in net profit than 13.12 q/ha yield obtained by the use of untreated old seed of variety JS-335 and 7.20 NP Kg/ha (farmers practices)

El-Agroudy, *et al.* (2011) The study showed the decrease of the cultivated area with Soya bean with an annual rate statistically signified reached about 2.3 thousand feddan and the stabilization of the feddanic productivity of the yield around the average that reached about 1.216 ton during the period of study (1990-2008), also the cost of production statistically signified reached about 75.8 Pound in the time, the net feddanic revenue increased by an annual rate statistically signified reached about 76.1 pound per feddan which is not representing a buckle to the farmers to cultivate this crop.

Jing (2011) Soybean production in China is affected by low yield per hectare caused by technical inefficiency in production inputs. This paper measures impact of excessive fertilizer input on soybean production utilizing a stochastic frontier production function model and a data envelopment analysis method to estimate technical efficiency and scale factors in farmer-level soybean production. The paper also examines problems related to excessive fertilizer input. Results indicate the presence of certain technical and scale efficiency losses in soybean production, severe technical efficiency loss in fertilizer input and output per unit, and excessive fertilizer input per hectare. Results also reveal that farmers should decrease their fertilizer input by 33% per hectare to optimize the proportion of inputs. The study provides important information that the technical misunderstanding of the application of fertilizers that "the more fertilizer, the more yield" during the fertilizing process can be avoided and the farmers' soybean production efficiency can be effectively improved if they can obtain training on fertilizer use and technical supports from public extension system. Furthermore, expanding the area of cultivation of soybean farmers can also effectively reduce the scale efficiency loss.

Pawar, *et al.* (2011) investigated for the year 2007-08 in order to study the marginal productivity and economic efficiency in soybean production in Latur district of Marathwada region of Maharashtra. The cross sectional data were collected from 180 soybean growers. Cobb-Douglas production function was fitted to the data in soybean production. Results revealed that, partial regression coefficients of phosphorus (0.081) and plant protection (0.055) were positive and significant at 1 per cent level of significance. Similarly partial regression coefficients of machine labour (0.427) and nitrogen (0.028) were positive and significant at 5 per cent level of significance. It could be inferred that, if one per cent increased in use of phosphorus, plant protection, machine labour and nitrogen, it would lead to increase the soybean production by 0.081, 0.055, 0.427 and 0.028 per cent, respectively. Thus, it implied that, there was scope to increase these resources in soybean production. The value of coefficient of multiple determinations (R^2) was 0.94.

XiuQing (2011) examined stochastic frontier production function (SFPF) is specified to evaluate productivity growth, technical efficiency, and

technical change in China's soybean sector. A panel data set of 12 major soybean-producing provinces across the nation during the period of 1983 to 2007 was used. Results indicate that total factor productivity for China's soybean production increased by 1.5% annually, with productivity growth, mainly, from technological progress. However, both technical efficiency and technical progress showed a decreasing trend through time. Clearly, market liberalization has produced negative impact on China's soybean productivity.

Acharya (2012) had studied the growth in area, production and productivity of major crops in Karnataka. The analysis of growth is usually used in economic studies to find out the trend of a particular variable over a period of time and used for making policy decisions. The growth in the area, production and productivity of different crops in Karnataka was estimated using the compound growth function. The necessary secondary data were collected for a period of 26 years from 1982-83 to 2007-08. Growth rates showed a significant positive growth in area under pulses, vegetables and spices and fruits and nuts while cereals showed significant negative growth. The area under jowar, bajra, ragi and minor millets are experiencing a substantial annual decrement. The area under rice has recorded a mild annual increment. The growth in area under oilseeds and commercial crops was negative and insignificant. Similarly the production of cereals, pulses, vegetables and fruits showed a significant positive growth. The production of oilseeds and commercial crops registered insignificant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and fruits. Productivity of oilseeds recorded moderately positive growth. The productivity of commercial crops registered insignificant positive growth and for vegetables the growth in productivity was insignificant and negative.

Das (2012) this study was attempted to examine the trends and variability in the growth of rapeseed and mustard crop in Nagaon district as well as in the state Assam as a whole. For the analysis purpose, the relevant secondary data from 1980-81 to 2009-2010 have been examined. The compound growth rates have been estimated with the help of exponential function and variability has been calculated by using technique of co-efficient

of variation. For the convenient of comparison the whole period is subdivided into three periods. The study concludes that a moderate to high significant growth has been observed in case of area, production and yield of rapeseed and mustard for Nagaon district and the state of Assam as a whole covering the study period. Concerning the variability, the study concludes that there persist wide fluctuations in the growth of area, production and yield of rapeseed and mustard over the study period.

Jagtap *et al.* (2012) economic analysis of chilli production indicated that cost 'C' was found to Rs.40541.72, Rs.42811.07 and Rs.53421.29 per acre for small, medium and large farmers respectively. Net returns over cost 'C' was Rs.19329.52, Rs.24114.79 and Rs.21400.51 per acre and input-output ratio at cost 'C' was 1:1.48, 1:1.56 and 1:1.40 for small, medium and large farmers respectively.

Patel (2012) determined the cost structure of chilli production and revealed that the cost C_1 , C_2 and C_3 were found to variation. The study revealed that Rs.28068.74 incurred as (Cost C_1) followed by Rs.37176.24 (Cost C_2) and Rs.40893.86 (Cost C_3) respectively. The average yield of green chilli in the study area was 98.36 quintal per farm which shows very satisfactory in respect to average yield of Madhya Pradesh. The other measurement of farm profit like net farm income found to on an average Rs.13751.14 per hectare. The average B.C. ratio was observed 1.33 and it was found to very nominal.

Ashoka (2013) has done research on growth, instability and direction of chilli trade in India Compound growth rate analysis, Instability analysis and Markov chain analytical tools were used for the study. The results indicated that the growth in area under chilli was negative, while production showed increasing growth due to increased productivity. The sources of instability in chilli production were found to be change in area variance and change in yield variance. Malaysia, Sri Lanka, United Arab Emirates and Indonesia were found to be the loyal markets for Indian chillies. The influence of export price and production on the changes in export of chilli was positive, but the influence of domestic price was negative.

Mana Solanki et al. (2013) an attempt was made to examine the district wise compound growth rate in APY of soybean in Madhya Pradesh. Study found that among out of 39 districts only twenty two districts having the positive growth and two districts namely tikamgarh and sheopur found negative growth in area, production and yield. Four districts namely jabalpur, narsinghpur, shahdol and hosangabad observed that negative CGR area and production but positive growth in yield. The negative growth in area and production was observed in Jabalpur district which was -16.29 and -15.04 per cent respectively. The maximum positive growth in area and production was observed in Anuppur district but it was examined for six years only therefore maximum positive was noted in district shivpuri which was 9.00 and 10.14 per cent respectively. The substantial improvement in production has been noticed due to concerted efforts on soybean development in the state of Madhya Pradesh as well as in the country, resulting in a positive growth rate in area and production of Soybean.

Singh (2013) studied growth rate of area, production and productivity of fruit crops in Jharkhand .This study revealed positive growth rate in all selected fruits (litchi, mango guava and banana) except citrus. It has also been observed that among periods, IV period (2005-10) was found to be favorable for litchi, mango and guava particularly, while negative growth rate was found in banana and citrus. The productivity growth rate was also observed to be positive nearly 2.56 percent, 2.56 percent, 1.50 percent, 5.21 percent respectively in litchi, mango, guava and banana. This trend resulted in positive growth in volume of these fruits in the state. The study further revealed that variability in area was highest in litchi (71 percent) due to shifting in area from other fruit crops in the litchi area followed by mango and banana respectively. Similarly variability in productivity was observed to be high in banana and there was no considerable variation in the yield of other fruit crops.

Suneetha and Kumar (2013) the main objective of the study was the cost and returns in the production of paddy in the study area. The findings are the highest profit income is found the small farmers in paddy production as a whole in the study area and hypothesis test proves that there is the

significant difference in the return and among the groups of farmers in the study area.

Patel (2014) study revealed that average cost of cultivation of chilli was estimated as Rs.122935.62 per hectare and observed highest i.e. Rs.130302.58 per hectare at small farms. The yield of green chilli was observed 95.81 quintal per hectare, 107.11 quintal per hectare, 123.50 quintal per hectare and 141.31 quintal per hectare at marginal, small, medium and large farms respectively along with 117.40 quintal per hectare on an average. The gross return from chilli crop was observed as Rs.257072.66 per hectare across the farms. The net return from this crop was calculated as Rs.127451.60 per hectare while farms are spent on an average of Rs.1047.15 for produce the one quintal of chilli. The average ratio of input-output was estimated at 1:2.04 across the different farms of district which shows cultivation is profitable to the farms of the district. The average use of human labour was estimated as about 521 labour days per hectare.

S.C. Srivastava *et al.* (2015) studied that the total cost increased with the increase in the farm size. All costs increased with increase in farm size. The net income, family labour income, farm business income and farm investment income is increases with increase in farm size. Output input ratio indicates that the return to every rupee of investment in soybean cultivation increased with increase in farm size. Manure, chemical fertilizer and machine works have significantly influenced the production of soybean in the study area.

Banjare (2016) reported that an overall the cost of cultivation per hectare of chilli was calculated as Rs.93724.87. The cost of cultivation per hectare showed rising trend with the rise in farm size. On the other hand, an overall input –output ratio of chilli came to 1:2.53 on the sample farms. The overall gross return of chilli is estimate as Rs.289867.56 per hectare.

Sharma (2016) studied Soybean has emerged as a leading oilseed crop in India which accounts for 55.6 per cent of area under kharif oilseeds and 38 per cent of area under total oilseeds during TE 2012-13,42.5 per cent of total oilseeds production, and contributing to 28.6 percent of the total

vegetable oils production in the country. Input use, cost, returns and profitability of soybean cultivation for major soybean growing states was analyzed by using CACP data. The inverse relationship in cost of production and productivity of soybean was observed in major growing states. As the productivity of crop is the major factor in reducing the relative cost of production government should focus on the non-price incentives to increase the productivity and also to reduce the cost of cultivation, apart from price incentives.

Srikala *et al.* (2016) reported that the per hectare cost of cultivation of chillies for the period from 2005 -06 to 2010-11 for Andhra Pradesh indicated that the operational costs ranged from Rs.93,332 in 2005-06 to Rs.1,84,391 in 2010-11. Similarly, the total costs varied from Rs.1,09,597 to Rs.2,21,656 for the corresponding periods. Among the operational costs the percentage of labour component in the total costs increased from 35.13 in 2005-06 to 40.00 in 2010-11. Analogously, among fixed costs, rental value of owned land as a percent of total cost rose from 12.77 in 2005-06 to 15.79 in 2010-11. During the corresponding period, net returns increased from Rs.66,403 to Rs.1,63,430 per hectare.

Reddy and Kingsly (2017) studied on area, production, yield trends and pattern of oilseeds growth in India. India is the fourth largest producer of oilseeds accounting for about 19% of the global area, 2.7% of global production in the world. The oilseeds crops have registered the significant growth in area and production in last 30 years. However, compare to cereals like paddy and wheat, the growth rate of area and production of oilseeds is insignificant and there exists wide variability in their yield in different states of the country. The study has explored the growth performance, and dynamics of major oilseeds in different states of the country. Oilseeds exhibited a dismal picture in their production performance both spatially and temporally.

S.K .Jamanal and Syed Sadaqath (2017) conducted the study was undertaken in Dharwad district of Karnataka State during the year 2013-14. The study covered 15 villages from 3 talukas of Dharwad district to form a sample of 150 respondents. A pre-tested structured interview schedule was used to collect the data from the respondents by personal interview method.

The findings of the study reported that, for the country as a whole, the resulting growth rate of soybean area under cultivation was 0.41 per cent per annum for the period 2003-04 to 2012-13.

Thakur and Rai (2017) compound annual growth rate was calculated on area production and yield of sugarcane for about sixty years in UP. Compound annual growth rate (%) of area increases up to 1990, but there is sharp decrease in the compound annual growth rate (CAGR) to 0.74. This means that there was not much change in the area after 1990. Overall CAGR in area, production and yield were found to be 1.28%, 2.25% and 0.96%. CAGR in production showed increasing trend till 1990 and after that there was decline per annum. Compound annual growth rate for production was highest (2.95%) in between 1970-90. Yield was having positive sign which indicates, farmer can take up this crop in better way.

Gautam *et al.* (2018) reported that Madhya Pradesh is one of the largest soybean producing states in India, where soybean accounts for more than 55 per cent of total oilseeds produced in the state. On the basis of agro-climatic conditions, Madhya Pradesh is divided into eleven regions. Among all regions, Malwa region occupies the highest area under soybean crop. Though Malwa region is a major producer of soybean in the Madhya Pradesh, but its productivity is lower in comparison to other regions in the state. Our country is in short supply of edible oil and about 50 per cent of its edible oil consumption is fulfilled by imports of different vegetable oils, therefore, there is a need to promote the production of oilseeds like soybean.

Jorwar (2018) worked on economics of production and marketing of chilli in Amravati district. The economic analysis of data indicating that cost 'C' was found to Rs.168507.96, Rs.181705.77 and Rs.184739.08 per hectare for small, medium and large growers respectively. Net returns over cost 'C' was Rs.80619.40, Rs.93008.90 and Rs.107722.00 per hectare and input-Output ratio at cost 'C' was 1.48, 1.51 and 1.58 for small, medium and large growers respectively.

Kumar (2018) has worked on an economic analysis of production and marketing of turmeric in Guntur district of Andhra Pradesh was conducted in year 2017-2018 with a sample of 120 respondents. The results indicated that the number of respondents who had large and middle school education were more in large farms followed by small and medium. And it was also observed that the number of illiterates were more in small size farms followed by medium and large size of farms. The average area per hectare holdings in small, medium and large of farms, 5.18/ha, 6.52/ha and 7.14/ha. The cost incurred by small, medium and large size farms (Rs.144525.20/ha), (Rs.139161.80/ha) and (Rs.126011.60/ha) respectively. The gross Returns obtained per hectare by small, medium and large was (Rs.361400/ha and Rs.344500/ha and Rs.307450/ha) respectively. And net returns per hectare small, medium and large farms (Rs.216874.80/ha and Rs.205338.20/ha and Rs.181438.40/ha) respectively. Input- output ratio per hectare was small (1:1.50), medium (1:1.47) and large (1:1.43) respectively.

Goutam and Sisodia (2018) attempted study on trends in growth of area, production and productivity have been found almost linear with little bit fluctuations in certain years. The growth rates of area, production and productivity during the last four decade have been found to be 1.13, 3.17 and 2.28 per cent annually (based on linear growth function). However, the maximum growth rates in area and production, i.e. 2.71 and 4.99 per cent respectively have been observed in the first decade, while the productivity was 2.27 per cent. Almost similar growth rate in area, production and productivity have been obtained on the basis of growth function like compound and semi-log functions. Since trends in area, production and productivity were found to be linear in nature, the linear growth function was found to be best fitted. Thus, the results based on linear growth function were more reliable as compared to compound growth function.

K. Vasudeva Naik *et al.* (2018) studied that seed, FYM, human labour, bullock labour and fertilizer were over utilized and machine labour and plant protection chemicals were underutilized by the farmers. The MVP to MFC ratio for seed (-0.59), FYM (0.27), human labour (0.13), bullock labour (-0.23), fertilizer (-0.05) were less than 1 hence the resources in study area was

over utilized and machine labour (3.60) and PP chemicals (2.21) were showing more than one. Hence these resources are underutilized hence there is scope for increasing these resources.

Kumar et al. (2018) examined in his study that the R² value for average production was observed to be 0.73 which indicate that function was good fit and able to explain the independent variable to an extent of 73 percent. The elasticity coefficient was found to be 0.804, which shows that return to scale, was decreasing state. The value of coefficient of fertilizer (0.664) and plant protection (0.804) was observed positive and highly significant. The value of coefficient of seed (-0.147) labour (0.211) and irrigation (-0.001) was found negative but significant, revealed that the above resources were not used at their optimum level. Marginal value productivity of resources and their ratio to their respective paddy was observed and found that the factor X₁, X₃ and X₄ was over utilized in the study area, whereas factor X₂ and X₅ was found underutilization and leaving scope for their increase use

Kasula (2019) studied that the compound growth rate of the area under Paddy during 1991-92 to 1999-2000 is 0.77 per cent and the t value is significant at 1 per cent level. But the compound growth rate of area under Paddy during 2000-01 to 2009-10 decreased to 0.51 per cent and the t value is significant at 5 per cent level and ever since the compound growth in the area under food grains drastically declined and the t value is not significant.

Swamy et al. (2019) study the global area, production and productivity of maize were registered the positive significant growth rate of 2.37, 3.32 and 1.01 per cents respectively, during 2004-05 to 2013-14. It indicates that the area under maize in Karnataka was increasing at an annual growth rate of 7.08 per cent as compared to national growth rate of 2.67 per cent during 1999-2014, respectively. The production trend in Karnataka was also showing increasing trend as the growth rate was registered at 7.72 per cent as compared to all India level (5.63%) during 1999-2014. However, the productivity of maize was highest (3.5 tones per ha) in Karnataka compared to the national average (2.5 metric tones per ha) finally the results revealed that

the area, production and productivity of maize in NEK region was increased at a growth rate of 8.59, 6.77 and 10.13 per cent respectively during 1998-2014.

Patidar (2020) has studied on Capsicum or Bell pepper or Hot pepper (*Capsicum annum* L.) is a crop of Solanaceae family and its genus is Capsicum. It is also known as green pepper or shimla mirch. Present investigation was conducted in Shajapur District of M.P. A multistage stratified random sampling technique was adopted to selection of sample. The study showed that on an average, cost of cultivation per hectare of capsicum crop on overall basis was found to be cost A1 that is paid out cost Rs.53318 followed by Rs.56624.32 (cost B1), Rs.10015.50 (cost B2), Rs.64383.98 (cost C1), Rs.107775.16 (cost C2) and Rs.118552.68 (cost C3) respectively. The average yield was found to be 110.08 quintal per hectare. The net income is the real income realized by capsicum growers and it was found to be on an average of Rs.141794.40 per hectare, and B.C. ratio on an average of 2.19 as B.C. ratio in capsicum production.

Kumar *et al* (2021) A study has been carried out over a period of 20 years from 1998–99 to 2018–19 in the Gwalior District of Madhya Pradesh. This study is primarily based on secondary data which was collected from Department of farmer welfare and agriculture Development Madhya Pradesh and Deputy Director of Agriculture office Gwalior, and then CAGR is calculated by fitting exponential function. It is observed from the study that area, production and productivity in paddy increased at a compound annual growth rate of 2.38 percent, 6.89 percent, and 4.01 percent respectively and 1.11 percent, 4.07 percent, and 2.40 percent, in wheat respectively. And it has also been seen that the productivity effect has a dominant component in increasing the output in both the crop.

CHAPTER-III

RESEARCH METHODOLOGY

This chapter describes the characteristics of the study area, the sources and nature of data used for the study, the sampling methods adopted for the collection of required data, statistical tools and techniques employed for analyzing the data and concepts used in the study. Present study was constricted to Dewas district of Madhya Pradesh.

3.1 Sampling procedure: -

The multistage sampling was used to select the ultimate unit.

3.1.1 Selection of district: -

In the first stage of sampling Dewas district was selected purposively because Dewas is second largest district of Madhya Pradesh regarding the area and production of soybean.

3.1.2 Selection of block: -

Dewas district has 9 blocks (Bagli, Dewas, Hatpiplya, Kannod, Khategaon, Satwas, Sonkatch, Tonkkhurd, Udaynager). At the second stage of sampling, out of 9 blocks of Dewas, Dewas block was selected purposively because this block has largest area (75215.76ha) under soybean and highest production (80738.85 tonne) of soybean in the Dewas district. (Source- Land revenue department, Dewas).

3.1.3 Selection of Patwari halka: -

Under the Dewas block 103 patwari halka has come. At the third stage of sampling, according to the area and production of the soybean separate list of all patwari halka was prepared and rearrange in increasing order and there after top 5 patwari halka 11, 20, 21, 63 and 77 was identified for the selection of the farmers.

3.1.4 Selection of farmer: -

At the fourth stage of sampling, a list of the farmers of all the selected patwari halka was prepared and classified into 4 categories- marginal (up to 1 ha.), small (1-2 ha.), medium (2-4 ha.), large (above 4 ha.) and in all 120 farmers was selected from all these categories treated as strata with the help of simple random sampling under proportional allocation scheme.

Table 3.1: Number of farmers selected as respondents based on the size of landholding

Category	Land holding (ha.)	Respondent
Marginal	>1	25
Small	1-2	40
Medium	2-4	30
Large	4-10	25

3.2 NATURE OF DATA:-

For this study, both primary and secondary data has been collected.

3.2.1 Primary data:-

The required primary data has collected in selected patwari halka from soybean grower farmers by using interview schedule. The primary data was collected from the randomly selected 120 soybean growers by visiting their farm.

3.2.2 Secondary data:-

The secondary data was collected from various department and websites.

3.2.3 Period of the study:-

All the collected primary data was related for the agricultural year 2019-20kharif seasons.

3.4 ANALYSIS OF DATA:-

The collected data was tabulated in the view of the cited objectives and was interpreted by using suitable statistical and economic measures. Following statistical measures will be used in present study.

3.4.1 Compound growth rate:

By taking time as the independent variable and the area, production and productivity of the Soybean, as the dependent variable, the compound growth rates was estimated by using the formula:

$$Y_t = a(1 + r)^t$$

where,

Y_t = Dependent Variable like area, production and productivity of soybean in the year 't' for which growth rate will be estimated.

a = Constant

r = rate of annual increment

t = time element which takes the value of 1, 2, 3, ..., n

The above exponential equation can be expressed in terms of log forms as follows:

$$\text{Log } Y_t = \text{Log } a + t \text{ Log } (1 + r)$$

$$\log Y_t = \log a + t \log b, \text{ where, } b = 1 + r$$

By putting $\log Y_t = y$, $\log a = A$ and $\log b = B$, the model becomes linear between y and t, as $y = A + Bt$,

Now, CGR per cent can be expressed as:

$$\text{CGR in per cent} = (\text{Antilog } b - 1) \times 100$$

To test the significance of compound growth rate t test was used as follows:

$$t = r / \text{S.E. } (r) \text{ with } (n - 2) \text{ degrees of freedom}$$

$$\text{where, } \text{S.E. } (r) = 100 \times b \times \text{S.E. } (\log b)$$

$$r = \text{CGR per cent; } n = \text{number of years}$$

3.4.2 Cost concepts:

The cost of cultivation was used in this study. The cost concepts are given below:

Cost A₁: It includes: -

- Value of hired human labour,
- Value of hired and owned bullock labour,
- Value of hired and owned machinery labour,
- Value of owned and purchased seed,
- Value of fertilizers, manures and chemicals,
- Value of insecticide and pesticides,
- Expenditure on irrigation,
- Land revenue and taxes,
- Interest paid on crop loan if taken,
- Depreciation on farm assets excluding land,
- Interest on working capital,
- Miscellaneous expenses.

Cost A₂: Cost A₁ + rent paid for leased in land

Cost B₁: Cost A₂ + interest on value of owned fixed capital assets. (Excluding land)

Cost B₂: Cost B₁ + rental value of owned land

Cost C₁: Cost B₁ + imputed value of family labour

Cost C₂: Cost B₂ + imputed value of family labour

Cost C₃: Cost C₂ + 10 per cent of cost C₂ to account for managerial input of the farmer.

Profitability concepts:

These were defined as under: -

Gross income: It is defined as: total value of main product +by product.

Net farm income (NFI) = Gross income – Cost C₃ (total cost)

Family labour income (FLI) = Gross income – Cost B₂

Farm business income (FBI) = Gross income –Cost A₁

B:C ratio (Benefit cost ratio) = Gross income/ Gross expenses

Cost of production per quintal:

$$\text{Cost of production per quintal} = \frac{\text{total cost} - \text{value of by product}}{\text{Output/hactare (quintal)}}$$

3.4.3 Coefficient of correlation (r):-

Coefficient of correlation was used to find out the relationship between cost of production and productivity variables.

$$r_{xy} = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum(x_i - \bar{x})^2 \sum(y_i - \bar{y})^2}}$$

Where,

n = number of respondents

x = cost of production

y = productivity

r = correlation coefficient

t test:

The test of significance of correlation coefficient (r) will be tested at 1 and 5 per cent level significance by using formula.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Where, r = correlation coefficient and n = number of respondents

3.4.4 Resource use efficiency was worked out with the help of Cobb Douglas production function.

$$Y = ax_1^{b_1} x_2^{b_2} x_3^{b_3} x_4^{b_4} x_5^{b_5} x_6^{b_6}$$

(Where y is dependent variable and $x_1 \dots x_6$ are independent variable)

A is constant $b_1 \dots b_6$ coefficient

Y = gross income (Rs/ha)

X_1 = cost of fertilizer (Rs/ha)

X_2 = cost of seed (Rs/ha)

X_3 = cost of plant protection chemicals (Rs/ha)

X_4 = cost of labour (human + bullock) (Rs/ha)

X_5 = cost of machine labour (Rs/ha)

X_6 = cost of weedicide (Rs/ha)

CHAPTER – IV

RESULTS AND DISCUSSION

This chapter deals with the results obtained through the processing and analysis of the data and discussion of various findings related to the objectives stated in chapter first. This chapter deals with analysis, interpretation of primary data collected from various sources for the investigation of facts and findings. The processed data is tabulated in this chapter in the light of the objectives of the study. With the help of tabulated data it is easier to draw the inference. As per objectives the results have been presented under following subheads -

1. To study the compound growth rates of area, production and productivity of soybean of Madhya Pradesh during last 10years (2005-06 to 2014-15).
2. To analyse the economic efficiency of soybean production.
3. To find out the relationship between cost of production and productivity of soybean.
4. To examine the resource use efficiency of different inputs in soybean production.

4.1 COMPOUND GROWTH RATE OF AREA, PRODUCTION AND PRODUCTIVITY OF SOYBEAN OF MADHYA PRADESH –

Compound growth rate of area, production and productivity of soybean of Madhya Pradesh was analyzed and results are presented in table 4.1.1. The table revealed that area increased from 44.75 to 55.46 lakh hectares, production increases 46.31 to 49.67 lakh tone but productivity decreases 1035 to 896 kg/ha due to lack of technology adoption, lack of improved variety, and unaware regarding crop rotation.

During this 10 years average area of soybean was observed 53.32 lakh hectares which varies from 44.75 to 62.60 lakh hectares, average production was observed 53.11 lakh tone which varies 42.67 to 64.86 lakh tone and average productivity was 1001 kg/ha which varies from 684 to 1116 kg/ha.

During 2005-06 to 2014-15, the compound growth rate of the area, production and productivity was observed 3.23 per cent (significant), 1.12 percent and -2.04 percent (significant) respectively in soybean cultivation in Madhya Pradesh. This implied that Compound growth rate of the area and production increased while productivity was decreased. The maximum value of CV was seen in production followed by productivity and area which indicated maximum instability found in production due fluctuation in yield.

Table 4.1.1: Compound growth rate of area, production and productivity of soybean of Madhya Pradesh

YEAR	Area Lakh ha	Production lakh tone	Productivity kg/ha
2005	44.75	46.316	1035
2006	46.56	46.74	1004
2007	48.79	51.009	1045
2008	51.434	51.940	1010
2009	52.985	55.087	1040
2010	55.193	60.989	1105
2011	57.30	61.669	1076
2012	58.128	64.861	1116
2013	62.605	42.849	684
2014	55.462	49.679	896
Average	53.3207	53.1139	1001
CAGR %	3.23*	1.12	-2.04**
T value	6.484	0.652	-1.356
CV	8.60	12.931	12.70

*Indicates, Significant at 1 percent and ** significant at 5 percent level

(Source: The Soybean Processors Association of India (SOPA), Indore)

Fig 4.1.1 Trend in area, production and productivity in soybean

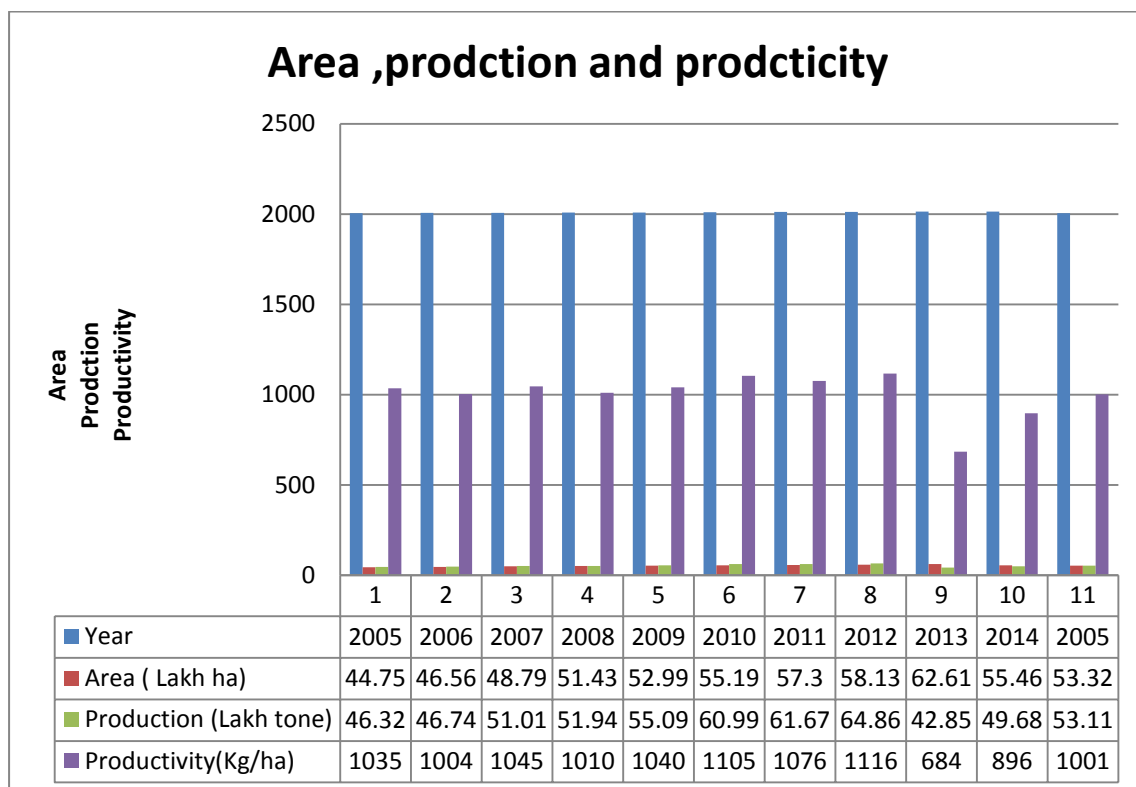
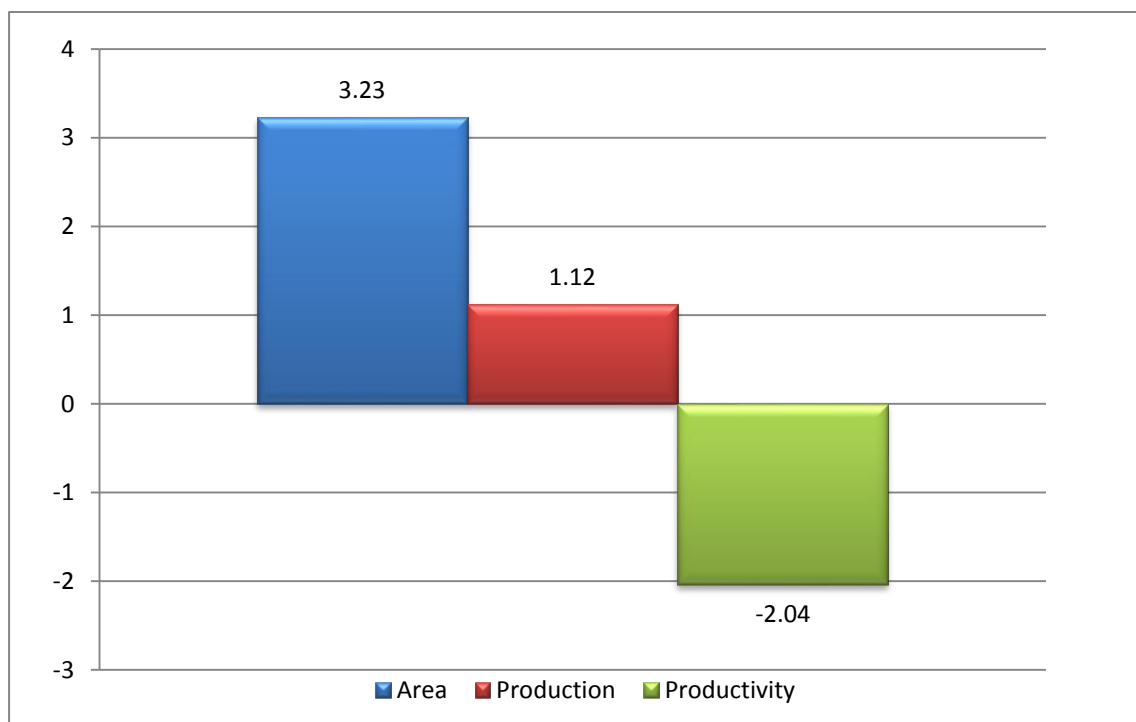


Fig 4.1.2 CGR of area, production and productivity



4.2 COST OF CULTIVATION:-

4.2.1 Cost and returns of soybean cultivation:-

The cost of soybean cultivation was analyzed by primary data collected from the interview schedule in selected patwari halka and the results are presented in table. 4.2.1

The per hectare average cost of cultivation of soybean crop was observed Rs.47648.68. The highest per hectare cost was seen in marginal farm (Rs.50828.14) followed by small farm (Rs.48862.53), medium farm (Rs.46421.79) and minimum cost of cultivation belongs to large farm Rs.44482.24. In the total cost, cost A_1/A_2 share highest cost 65.38 (Rs.31154.25 per cent). In cost A_1/A_2 , highest cost share by seed Rs.7893.23 (16.57%) followed by harvesting and threshing Rs.6791.82 (14.25 %).

In the average total cost highest cost share by rental value of land Rs.9000 per hectare which was 18.89 per cent of total cost (figure 4.2.1). Rental value of land was equal for each category but varies in per cent like for marginal 17.71%, small 18.42%, medium 19.39 % and large 20.23%. Followed by seed Rs. 7893.23 (16.57 %) in total cost. Which was highest on the marginal farm Rs.8145.28 due to use of higher quantity of seed per hectare and they bought major part of their seed requirement from market. In large farm farmers used their own seed that's why total cost on seed per ha reduced (Rs.7608.72), which was observed minimum as compare to other categories of farm.

Out of average total cost of cultivation, Rs.1908.72/ha and Rs.1841.04/ha belongs to land preparation and sowing respectively which is highest on the marginal farm and lowest on the large farm. Land preparation and sowing were covered 4.01 percent and 3.86 percent respectively of total cost of cultivation.

The per ha cost of weeding, human labour and bullock labour were Rs.1564.05, Rs.2321.42 and Rs.540.92 respectively and their percentage share was 3.28 %, 4.87 % and 1.14% respectively in total cost . The per ha cost of weedicide, fertilizer, manure and plant protection were Rs.1137.69,

Rs.1028.24, Rs.1272.95 and Rs.2163.70 respectively and their percentage share were 2.39%, 2.16%, 2.67% and 4.54% respectively.

The cost of interest on working capital was Rs.1707.83/ha (3.58%). The cost of depreciation and land revenue of own land were Rs.960.63/ha (2.02%) and Rs.22/ha (0.05%). The cost of interest on fixed capital was Rs.379.65/ha (0.80 %). The average imputed value of family labour was Rs.2782.89 (5.84%) which was highest on marginal farm Rs.3212.45/ha (6.32 %) due to they employed more family labour and minimum cost on imputed value of family labour on large farm Rs.2243.42/ha (5.04%) because large farmer use more machinery labour in place of family labour.

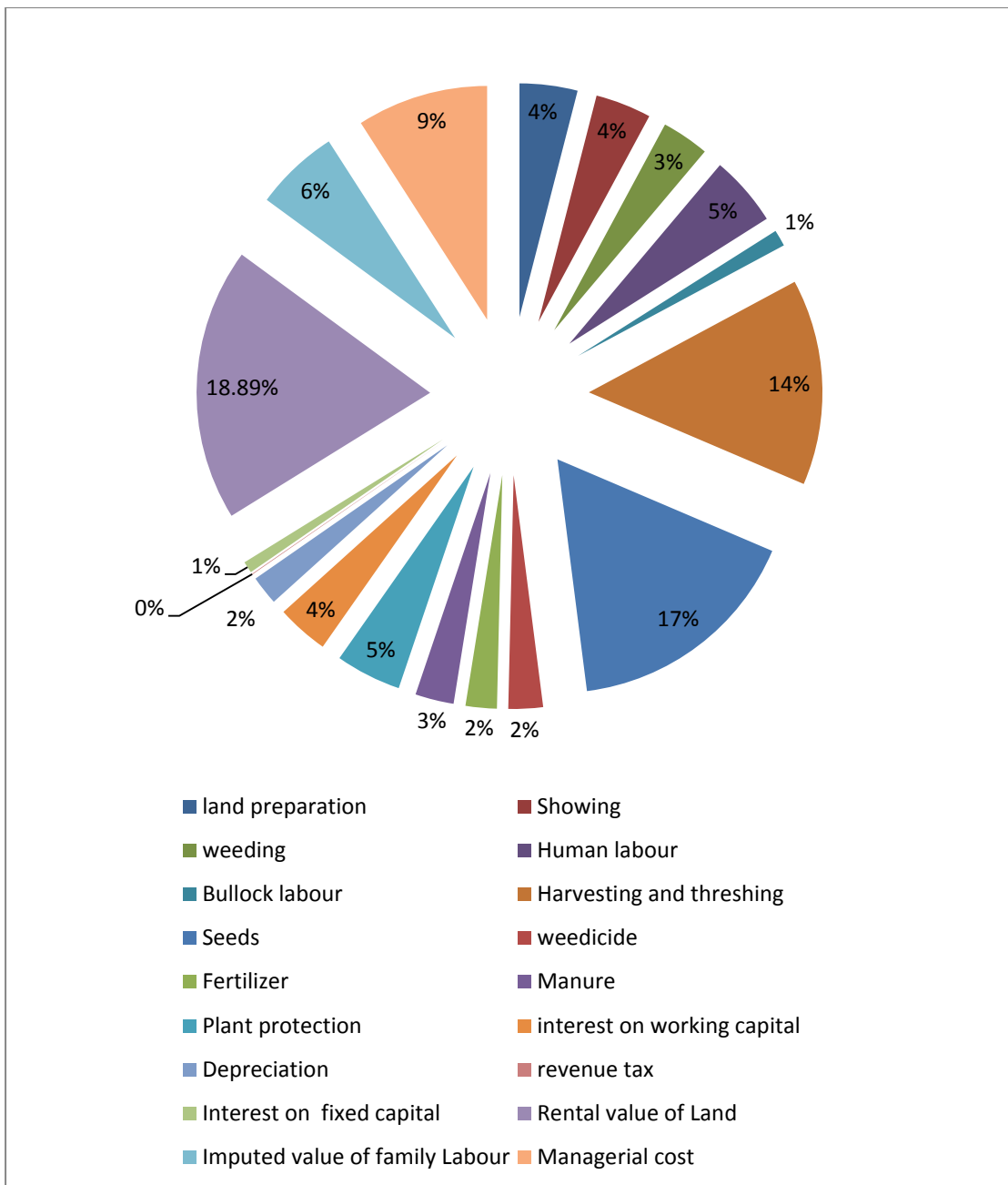
Table: 4.2.1: Cost of cultivation of soybean on different size of farm (Rs. /ha.)

Particulars	Marginal	Small	Medium	Large	Average
Land preparation	2103.77 (4.14)	2016.55 (4.13)	1800 (3.88)	1714.58 (3.85)	1908.72 (4.01)
Showing	2064.15 (4.06)	1900 (3.89)	1800 (3.88)	1600 (3.60)	1841.04 (3.86)
Weeding	1888.75 (3.72)	1918.87 (3.93)	1430.19 (3.08)	1018.38 (2.29)	1564.05 (3.28)
Human labour	2518.86 (4.96)	2707.94 (5.54)	2123.74 (4.57)	1935.15 (4.35)	2321.42 (4.87)
Bullock labour	943.40 (1.86)	602.31 (1.23)	460.44 (0.99)	157.54 (0.35)	540.92 (1.14)
Harvesting and threshing	7288.30 (14.34)	6787.79 (13.89)	6520.3 (14.05)	6570.9 (14.77)	6791.82 (14.25)
Seeds	8145.28 (16.03)	8010.76 (16.39)	7808.16 (16.82)	7608.72 (17.11)	7893.23 (16.57)
Weedicide	1178.21 (2.32)	1104.3 (2.26)	1034.18 (2.23)	1234.06 (2.77)	1137.69 (2.39)
Fertilizer	1173.58 (2.31)	1004.13 (2.06)	1014.24 (2.18)	921 (2.07)	1028.24 (2.16)
Manure	1458.49 (2.87)	1304.47 (2.67)	1207.78 (2.60)	1121.08 (2.52)	1272.95 (2.67)
Plant protection	2412.26 (4.75)	2,109.11 (4.32)	2,124.40 (4.58)	2,009.04 (4.52)	2163.70 (4.54)
Interest on working capital	1870.50 (3.68)	1767.9738 (3.62)	1639.4058 (3.53)	1553.43 (3.49)	1707.83 (3.58)
Depreciation	612 (1.20)	830 (1.70)	1107.32 (2.39)	1293.22 (2.91)	960.63 (2.02)
Revenue tax	22 (0.04)	22 (0.05)	22 (0.05)	22 (0.05)	22 (0.05)
Cost A₁/A₂	33679.55 (66.26)	32086.20 (65.67)	30092.16 (64.82)	28759.08 (64.65)	31154.25 (65.38)
Interest on fixed capital	315.4 (0.62)	338.56 (0.69)	425.19 (0.92)	439.47 (0.99)	379.65 (0.80)
Rental value of Land	9000 (17.71)	9000 (18.42)	9000 (19.39)	9000 (20.23)	9000 (18.89)
Imputed value of family labour	3212.45 (6.32)	2990.13 (6.12)	2685.55 (5.79)	2243.42 (5.04)	2782.89 (5.84)
Managerial cost	4620.74 (9.09)	4447.63 (9.10)	4218.90 (9.09)	4040.25 (9.08)	4331.88 (9.09)
Total cost	50828.14 (100.00)	48862.53 (100.00)	46421.79 (100.00)	44482.24 (100.00)	47648.68 (100.00)

(Source primary data 2019-20)

Note Cost A₁ and A₂ is same due to leasing pattern was not adopted on sample farm

Fig.4.2.1 Cost incurred on different Component in soybean prodction



4.2.2 Cost concepts:-

It is an important tool for measuring farm economics activities. The different seven type cost of cultivation was specified into cost A_1 , cost A_2 , cost B_1 , cost B_2 , cost C_1 , cost C_2 and cost C_3 . These cost concepts have already discussed in research methodology chapter. The results are presented in Table 4.2.2.

The table shows that average cost A_1 was found Rs.31154.25/ha. Cost A_1 was highest on marginal size farm and lowest in large size farm. In marginal size farm cost A_1 was seen Rs.33679.55/ha. and in small size farm it was observed Rs.32086.20/ha. In medium and large size farm cost A_1 were observed Rs.30092.16/ha and Rs.28759.10/ha respectively. Cost A_2 was equal to cost A_1 because soybean cultivation done by respondent farmers on their own land therefore they have not used leased land pattern. The cost B_1 and B_2 were calculated Rs.31533.91/ha. and Rs.40533.91/ha. The cost B_1 and B_2 share 66.18% and 85.06% of total cost of cultivation, respectively. The cost C_1 and C_2 were calculated Rs.34316.80/ha. and Rs.3316.80/ha. respectively. In terms of percentage cost C_1 and C_2 were 72.06% and 90.90% of total cost of cultivation, respectively. The overall cost C_3 was calculated Rs.47648.48/ha. The cost C_3 was highest in marginal farm size and lowest in large size farm. The cost C_3 was observed in marginal, small, medium and large size farm Rs.50828.14/ha.,Rs.48856.38/ha.,Rs.46423.19/ha and Rs.44486.19/ha respectively.

Table 4.2.2: Cost concepts on different size of the farm

Size of farms						
Cost	Marginal	Small	Medium	Large	Average	Percentage
Cost A ₁	33679.55	32086.20	30092.16	28759.10	31154.25	65.383
Cost A ₂	33679.55	32086.20	30092.16	28759.10	31154.25	65.383
Cost B ₁	33994.95	32424.76	30517.35	29198.57	31533.91	66.18
Cost B ₂	42994.95	41424.76	39517.35	38198.57	40533.91	85.068
Cost C ₁	37207.40	35414.89	33202.90	31441.99	34316.80	72.02
Cost C ₂	46207.40	44414.89	42202.90	40441.99	43316.80	90.909
Cost C ₃	50828.14	48856.38	46423.19	44486.19	47648.48	100

Source - Primary data 2019-20

4.2.3 Productivity of soybean:-

Productivity of soybean at overall level and at different size of farm was calculated and results are presented in Table 4.2.3.

It has been observed from data that average yield of main product was found to be 16.34 qtl/ha which was highest on large farm (16.93 qtl/ha.) followed by medium size farm (16.57 qtl/ha), marginal size of farm (16.02 qtl/ha.) and small (15.82 qtl/ha.). In the sense of by product average production of straw was 8.67 qtl/ha. Maximum average production of straw found in marginal size farm with production of 9.01 qtl/ha. followed by small size holdings with production of 8.63 qtl/ha., medium size 8.6 qtl/ha and minimum average production of straw on large farm 8.42 qtl/ha.

Table 4.2.3: Productivity of soybean on different size of farm holdings.

Productivity of soybean on different size of farm holdings					
Particulars	Size of farms				
	Marginal	Small	Medium	Large	Average
Main product (qtl/ha.)	16.02	15.82	16.57	16.93	16.34
By product (qtl/ha.)	9.01	8.63	8.6	8.42	8.67
Price of main product (Rs./qtl)	3696.00	3718.86	3715.29	3691.00	3705.29
Price of by Product (Rs./qtl.)	149.60	145.25	146.28	146.00	146.78
Income from main product (Rs./ha)	59209.92	58832.37	61562.36	62488.63	60523.32
Income from by product (Rs/ha)	1347.90	1253.51	1258.01	1229.32	1272.18
Gross return (Rs/ha)	60557.82	60085.87	62820.36	63717.95	61795.50

Source - Primary data 2019-20

4.2.4 Profitability of soybean cultivation:-

Profitability of soybean cultivation is depend upon quantity of yield per hectare crop area and price received from market based on the quality and quantity of crop and time of selling. The results of profitability are presents in table 4.2.4

The overall per hectare gross income was found to be Rs 61795.50. /ha. The highest gross return of soybean production was found on large size farms which were observed to be Rs 63717.95. /ha. followed by medium size farm Rs 62820.36. /ha., marginal farm Rs 60557.82. /ha and small size farm Rs 60085.87. /ha. The overall cost C_3 was found Rs.47648.48/ha. The cost C_3 was observed highest on marginal farm Rs.48856.38/ha and lowest in large size farm Rs.44486.19/ha. The overall cost of production was found Rs.2844.6 /qtl. The Cost of production was highest in marginal farm size and lowest in large size farm. The Cost of production estimated in marginal, small, medium and large size farm Rs.3088.65/qtl., Rs.3009.42/qtl., Rs.2725.64/qtl. and Rs.2554.81/qtl.

On an average net farm income was observed Rs.14146.82/ha. The maximum net farm income of soybean cultivation was found in large size farm Rs.19235.71/ha followed by medium size farm Rs.16398.56/ha., small size farm Rs.11223.35/ha and marginal size farm 9729.67 Rs./ha. The estimation of net farm income in soybean production indicates that net farm income increases with the increase in the size of the farm holdings. The B:C ratio indicates the return per rupee investment. The results express that the soybean growers were achieved an average of 1.30 B:C ratio in soybean production. The B:C ratio was observed for different size of farm and it was maximum 1.43 for large size farm followed by 1.35 medium size farm then followed by 1.23 small size farm and 1.19 on marginal size of farm. This indicated that B:C ratio increases with the increases in the size of the farm holding.

An overall view of result observed that the average cost of cultivation of soybean production was observed Rs 47648.68/ha which was highest on marginal farm (50828.14/ha) and lowest on large (44482.24/ha).

The average cost of production was found Rs.2844.63/qtl which was highest on marginal farm Rs 3088.65/qtl followed by small Rs 3009.42/qtl, medium Rs 2725.64/qtl and large Rs 2554.81/qtl. The average gross income was seen Rs 61795.50 /ha. The average net farm income was observed Rs.14146.82/ha. The average B:C ratio was seen 1:1.30 which was highest on large farm (1:1.4) and lowest on marginal farm(1:1.19)

Table 4.2.4: Profitability of soybean production at different size of farm

Particulars	Size of farms				
	Marginal	Small	Medium	Large	Average
Gross return(Rs/ha)	60557.82	60085.87	62820.36	63717.95	61795.50
Cost C ₃ (Rs./ha.)	50828.14	48862.53	46421.80	44482.24	47648.68
Net farm income (Rs/ha)	9729.67	11223.35	16398.56	19235.71	14146.82
Cost of production (Rs/ql)	3088.65	3009.42	2725.64	2554.81	2844.63
Farm business income(Rs/ha)	26878.26	27999.67	32728.21	34958.85	30641.25
Family labour income(Rs/ha)	17562.86	18661.11	23303.02	25519.38	21261.59
B:C Ratio	1.19	1.23	1.35	1.43	1.30

Source – Primary Data

Fig. 4.2.3 Gross return and Net income Rs/ha in different size of farms

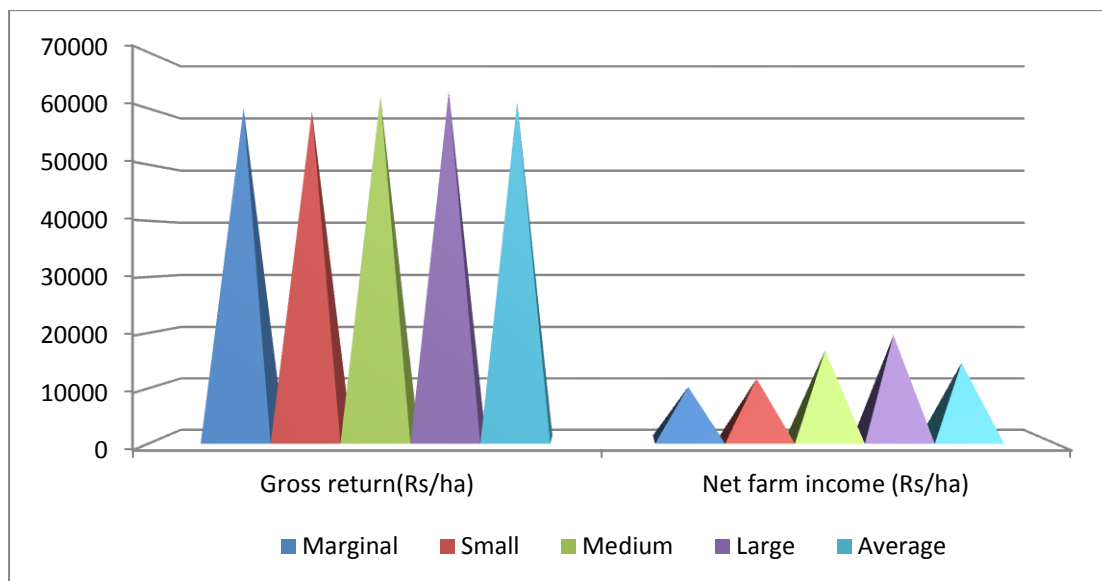
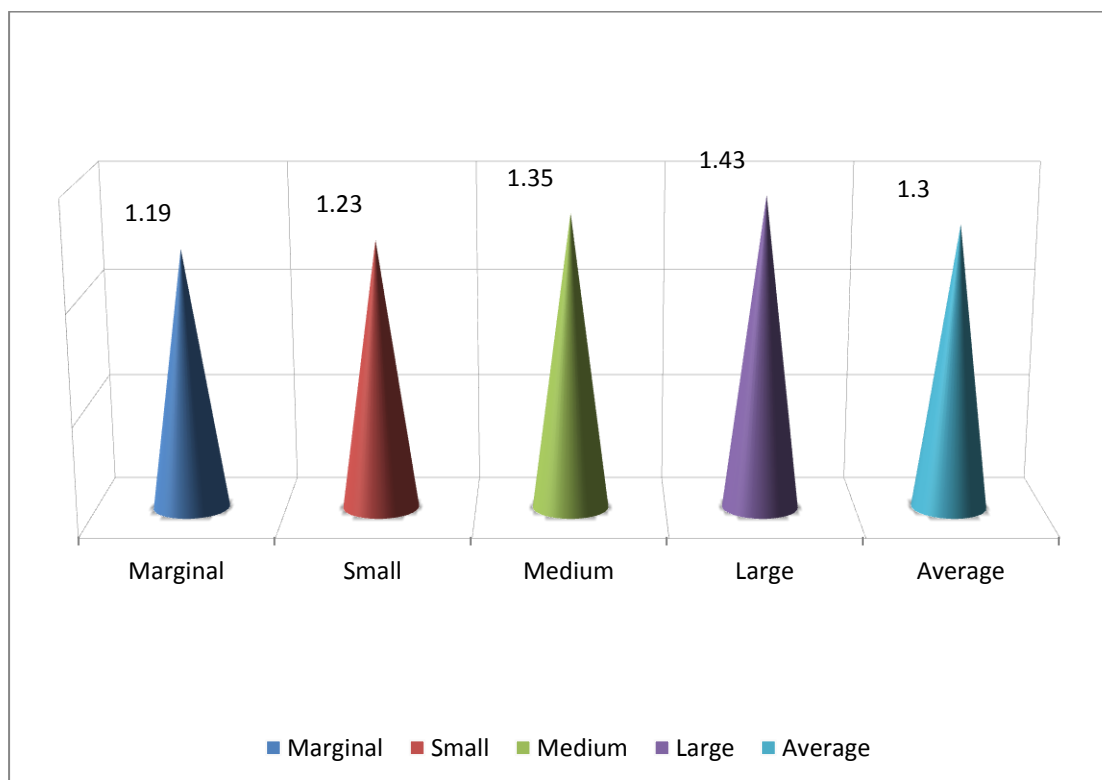


Fig. 4.2.4 B:C Ratio under different size of farms



4.3 RELATIONSHIP BETWEEN COST OF PRODUCTION AND PRODUCTIVITY OF SOYBEAN:-

Table 4.3.1 shows the correlation between cost of production and productivity. To find out the relationship between cost of production and productivity, category wise per quintal cost and per hectare yield was calculated then correlation between them was calculated. It was evident from data that inverse relationship associated between cost of production and productivity because the value of correlation coefficient (r) was observed negative in all size of farm which indicated that if productivity increase cost of production would be decrease. So government should try to enhance productivity of crop by development of technology, HYV, improved cultural practices etc. in the farming.

Table 4.3.1: Correlation between Cost of production and productivity

SN	Farm Size	Cost of production	Productivity
1	Marginal		
	Cost of production	1	-0.654
	Productivity	-0.654	1
2	Small		
	Cost of production	1	-0.027
	Productivity	-0.027	1
3	Medium		
	Post of production	1	-0.751
	Productivity	-0.751	1
4	Large		
	Cost of production	1	-0.377
	Productivity	-0.377	1

4.4 RESOURCE USE EFFICIENCY OF DIFFERENT INPUTS IN SOYBEAN PRODUCTION:-

The Cobb Douglas production function was used to find out resources use efficiency of soybean production in the Dewas. Six independent factors were considered for analysis of the resource use efficiency viz fertilizer (x_1), seed (x_2), PPC (x_3), labour (x_4), Machinery (x_5), and weedicide (x_6). The value of R^2 was seen as 0.99 which shows that the function was a good fit and indicating that 99 percent impact of all these six independent variables together in the output of soybean. The sum of elasticity (b_i) was noted 1.06, which implied that increasing return to scale was operated in the production of soybean. The coefficient of fertilizer (0.1129), seed (0.3802), machinery (0.7155), and weedicide (0.0307) was observed positive and highly significant. The coefficient of PPC (-0.0666), and labour (-0.1132) were noted negative but significant except for plant protection chemical, which revealed that the above resources were not used at their optimum level. Marginal value productivity of factors X_3 and X_4 was seen less than one implied over utilized and MVP of X_1, X_2, X_5, X_6 were seen greater than one indicating that there is a scope to increase these resources in the production of soybean.

Table 4.4.1: Resources use efficiency of Soybean Production

Variable	Coefficient	SE	T value	MVP
Intercept	0.5915***	0.0417	14.20	
X_1 (Fertilizer)	0.1129***	0.0282	4.01	6.645
X_2 (Seed)	0.3802***	0.0712	5.34	2.915
X_3 (Plant protection Chemical)	-0.0666	0.0620	-1.07	-1.863
X_4 (Labour)	-0.1132***	0.0200	-5.67	-2.412
X_5 (Machinery)	0.7155***	0.0934	7.66	6.905
X_6 (Weedicide)	0.0307***	0.0087	3.54	1.63
$\sum B_i$	1.06			
R^2	0.99			

(Note *** indicating significant at 1percent level of significance)

CHAPTER- V

SUMMARY, CONCLUSION AND SUGGESTION

Soybean is an important oil seed legume crop in the India and world. It contains about 20 per cent oil and 42 per cent high quality protein. It is termed as “*GOLDEN BEAN*” of the 20th Century because of its unique qualities. It also contains 21 per cent carbohydrates, 5 per cent minerals, 8 per cent moisture, 4 per cent fiber and vitamins. Soybean is the best source among plant based protein. Soybean stands on first place in the world vegetable oil production. Different types of soy products are available, including soya sauce, yoghurt, soya protein, soya flour, tofu, soya milk etc. Soya products contain less carbohydrates and low cholesterol which is beneficial for diabetic and heart disease patients. Soybean contains plant compounds that may help prevent prostate and breast cancer. For sustainability of agriculture systems, soybean plays an important role because leguminous nature of soybean helps in improving soil fertility. This crop covered 54 per cent of the area under kharif oilseed crops and 37 per cent of the area of total oilseeds crops in India. Soybean sharing 14 per cent in the country’s gross cropped area and about 3 percent of the gross domestic product and about 6 per cent of the value of all types of agricultural products (ICAR-IIOR,2015). India secures 5th position in world top soybean producer countries. In India, Madhya Pradesh produces 50 per cent (42.001 MT) soybean of India’s total production (83.504 MT) and its covered 50 per cent (50.100 lakh ha.) area of total soybean crop area(101.61 lakh ha.) of the country, Based on kharif 2017 SOPA data. Thus Madhya Pradesh is known as ‘**soya-state**’. Ujjain district having largest area and highest production under soybean crop followed by Dewas district in Madhya Pradesh. Whereas area under soybean in Dewas district is 3.275 lakh hectare, Production is 3.193 lakh MT and productivity is 975 kg per hectare in kharif 2019-20.

OBJECTIVES:-

1. To study the compound growth rates of area, production and productivity of soybean of Madhya Pradesh during last 10years (2005-06 to 2014-15).
2. To analyse the economic efficiency of soybean production.
3. To find out the relationship between cost of production and productivity of soybean.
4. To examine the resource use efficiency of different inputs in soybean production.

RESERCH METHODOLOGY:-

The multistage sampling was used to select the ultimate unit. In the first stage of sampling, Dewas district was selected purposively because Dewas is second largest district of Madhya Pradesh regarding the area and production of soybean. At the second stage of sampling, out of 9 blocks of Dewas, Dewas block was selected purposively because this block has largest area (75215.76 ha.) under soybean and highest production (80738.85 tons) of soybean in Dewas district. (Source- Land revenue department, Dewas). At the third stage of sampling, according to the area and production of the soybean, a separate list of all patwari halka was prepared and rearrange in increasing order. After that out of 103 patwari halka, top 5 patwari halka was identified for the selection of the farmers. At the fourth stage of sampling, a list of the farmers of all the selected patwari halka was prepared and classified into 4 categories. In marginal category 25 farmers, small category 40 farmers, medium category 30 farmers and large category 25 farmers selected. All 120 farmers was selected from all these categories treated as strata with the help of simple random sampling under proportional allocation scheme.

The required primary data has collected in selected patwari halka from soybean grower farmers by using interview schedule. The primary data was collected from the randomly selected 120 soybean growers by visiting their farm. The secondary data was collected from various department and websites. All the collected primary data was related for the agricultural year 2019-2020 kharif seasons. The collected data was arranged in tabulated form. The analysis was done by using suitable economic and statistical tools.

5.1 SUMMARY:–

- The compound growth rate of the area, production and productivity was observed 3.23, 1.12 and -2.04 percent respectively. This indicated that positive trends observed in area and production but negative trend observed in productivity.
- Average area of soybean was 53.32 lakh hectares, average production was 53.11 lakh tons and average productivity was 1001 kg/ha.
- The per hectare average cost of cultivation of soybean crop was observed Rs.47648.68. The highest per hectare cost was seen in marginal farm (Rs.50828.14) followed by small farm (Rs.48862.53), medium farm (Rs.46421.79) and lowest on large farm Rs.44482.24.
- In the total cost, cost A_1/A_2 share highest cost 65.38 (Rs.31154.25 per cent). In cost A_1/A_2 , highest cost share by seed Rs.7893.23 (16.57%) followed by harvesting and threshing Rs.6791.82 (14.25 %).
- In the average total cost highest cost share by rental value of land Rs.9000 per hectare which was 18.89 per cent of total cost .
- Out of average total cost, Rs.1908.72/ha and Rs.1841.04/ha belongs to land preparation and sowing respectively which is highest on the marginal farm and lowest on the large farm. Land preparation and sowing were covered 4.01 percent and 3.86 percent respectively of total cost of cultivation.
- The per ha cost of weeding, human labour and bullock labour were Rs.1564.05, Rs.2321.42 and Rs.540.92 respectively and their percentage share was 3.28 %, 4.87 % and 1.14% respectively in total cost . The per ha cost of weedicide, fertilizer, manure and plant protection were Rs.1137.69, Rs.1028.24, Rs.1272.95 and Rs.2163.70 respectively and their percentage share were 2.39%, 2.16%, 2.67% and 4.54% respectively.
- The average imputed value of family labour was Rs.2782.89 (5.84%) which was highest on marginal farm Rs.3212.45/ha (6.32 %) due to they employed more family labour and minimum cost on imputed value of

family labour was seen on large farm Rs.2243.42/ha (5.04%) because large farmer use more machinery labour in place of family labour.

- Average yield of main product was found to be 16.34 (qtl/ha.). which was highest on large farm (16.93 qtl/ha.) followed by medium size farm (16.57 qtl/ha), marginal size of farm (16.02 qtl/ha.) and small (15.82 qtl/ha.).
- In the sense of by product average production of straw was 8.67 qtl/ha. Maximum average production of straw found in marginal size farm with production of 9.01 qtl/ha. followed by small size holdings with production of 8.63 qtl/ha., medium size 8.6 qtl/ha and minimum average production of straw on large farm 8.42 qtl/ha.
- The overall per hectare gross income was found to be Rs 61795.50./ha. The highest gross return of soybean production was found on large size farms which were observed to be Rs 63717.95. /ha. followed by medium size farm Rs 62820.36. /ha., marginal farm Rs 60557.82. /ha and small size farm Rs 60085.87. /ha.
- The overall cost C_3 was found Rs.47648.48/ha. The cost C_3 was observed highest on marginal farm Rs.48856.38/ha and lowest in large size farm Rs.44486.19/ha.
- The overall cost of production was found Rs.2844.6 /qtl. The Cost of production was highest in marginal farm size and lowest in large size farm. The Cost of production estimated in marginal, small, medium and large size farm Rs.3088.65/qtl., Rs.3009.42/qtl., Rs.2725.64/qtl. and Rs.2554.81/qtl.
- On an average net farm income was observed Rs.14146.82/ha. The maximum net farm income of soybean cultivation was found in large size farm Rs.19235.71/ha. followed by medium size farm Rs.16398.56/ha., small size farm Rs.11223.35/ha. and marginal size farm 9729.67 Rs./ha. The estimation of net farm income in soybean production indicates that net farm income increases with the increase in the size of the farm holdings.
- An average B:C ratio was found 1.30 in soybean production and it was maximum 1.43 for large size farm followed by 1.35 medium size farm then 1.23 small size farm and 1.19 on marginal size of farm. This indicated that B:C ratio increases with the increases in the size of the farm holding.

- It was evident from data that inverse relationship associated between cost of production and productivity because the value of correlation coefficient (r) was observed negative in all size of farm which indicated that if productivity increase cost of production would be decrease.
- The sum of elasticity (b_i) was noted 1.06, which implied that increasing return to scale was operated in the production of soybean. The coefficient of fertilizer (0.1129), seed (0.3802), machinery (0.7155), and weedicide (0.0307) was observed positive and highly significant. The coefficient of PPC (-0.0666), and labour (-0.1132) were noted negative but significant except for plant protection chemical, which revealed that the above resources were not used at their optimum level.

5.2 CONCLUSION:-

The following conclusions were made from stated objectives

- The compound growth rate of the area, production and productivity was observed 3.23, 1.12 and -2.04 percent respectively. This indicated that positive trends observed in area and production but negative trend observed in productivity due to lack of technology adoption, lack of improved variety, and unaware regarding crop rotation.
- Production and net income were highest on the large farm as compared to marginal, small and medium farm in soybean production in the study area due to adoption of latest technologies and improved farm practices compared to others farm.
- There is inverse relationship associated between cost of production and productivity because the value of correlation coefficient (r) was observed negative in all size of farm which indicated that if productivity increase, cost of production would be decrease.
- Marginal value productivity of factors namely PPC (x_3) and labour (x_4) was seen less than one implied that over utilized these resources and MVP of fertilizer (x_1), seed (x_2), Machinery (x_5), and weedicide (x_6) were seen greater than one indicating that these resources underutilized hence there is scope to increase these resources in the production of soybean for getting more profit.

5.3.1 SUGGESTION:-

- In general farmers follow traditional method of farming and not adopt new technology. This lead to low productivity. Agriculture officers, scientist and government agencies need to close interaction with farmers and aware them about new technology and practices.
- Cost of seed have major share in the total cost of cultivation. Therefore government agencies and institutions should provide seeds in subsidy scheme or credit basis.
- Farmers should be sowing early variety for avoid sever pest attack and rainfall dissimilarity.
- Use of Balanced dose of fertilizer is very important in soybean cultivation hence government should establish more soil testing lab and aware farmers regarding soil testing.
- Farmers should adopt mechanized farming which will help them in save labour cost and time. So they can invest it in other places.
- Soybean cultivation have been doing in this area from 20-25 years so pest and diseases get favorable environment for spreading. So crop rotation practice is necessary in each farm for avoid pest and disease attack as well as it maintain proper nutrient availability.

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APPENDIX

INTERVIEW SCHEDULE RAJMATA VIJYARAJE SCINDIA KRISHI VISHWA VIDHYALAYA, GWALIOR (M.P.)

TITAL: "To analyse costs and profitability of Soybean Cultivation in Dewas District of Madhya Pradesh."

Advisor

Dr. A.M. Jaulkar
Dept. of Agri. Economics
RVSKVV, GWALIOR

Investigator

Anand Patel
M.Sc. (Ag.) final year

I. General information

Name of farmer : Shri.....

Father's name : Shri.....

Caste :

Village

BlockDistrict - Dewas

II. Family information

S. No.	Name of family member	M/F	Age	Education	Occupation

III. Land Use Pattern (in ha.)

S. No.	Particulars	Area (ha.)
1.	Size of holding	
2.	Net cultivation area	
3.	Permanent fellow land	
4.	Old fellow land	
5.	Current fellow land	
6.	Leased in land	
7.	Leased out land	
8.	Irrigated area	
Source of irrigation		
9.	Well	
10.	Tube well	
11.	Pond	
12.	River	
13.	Canal	

IV. Cropping pattern (in ha.)

Season	Name of crops	Variety	Area (ha.)
Kharif			
Rabi			
Others			

V. Agricultural Assets

S. No.	Assets	Total No.	Present Values (Rs.)
1.	Land (ha.)		
2.	Farm house (No.)		
3.	Well (No.)		
4.	Tube well		
5.	Electric pump and pipe		
6.	Plough		
7.	Duffan/Trifan		
8.	Pata		
9.	Bullock cart		
10.	Tractor		
11.	Cultivator		
12.	Seed drill		
13.	Trolley		
14.	Spade		
15.	Khurpi		
16.	Power implements		
17.	Chaff cutter		
18.	Any other specify		

Cost of cultivation of crop

Name of variety (1) (2)..... (3)

Area under crop

VI. Operational cost

Operations	Human labour Hrs/Days		Bullock pair/Days		Machine Hrs	
	Family	Hired	Family	Hired	Family	Hired
Land preparation						
Sowing						
Weeding time/intercultural						
Manuring						
Fertilize Plant Protection application						
Harvesting						
Threshing						
Others						

VII. Material cost

S. No.	Particulars	Name	Quantity	Rate
1.	Seed			
2.	Fungicides			
3.	Manure			
4.	Fertilizer			
a.	UREA			
b.	SSP			
c.	DAP			
d.	Grow more			
e.	MOP			
f.	Others			
5.	Bio-fertilizers			
6.	Plant Protection Chemicals			
A	Insecticide			
B	Pesticides			
7.	Weedicide			
8.	Others			

VIII Fixed Assets

S.NO.	Particulars	Present value	Residual value	Life of the asset
1.	Implements			
2.	Machinery			
3.	Tractor			
4.	Livestock			
5.	Others			

IX Total production:

Quantity

Price

a. Main Product

b. By Product

Signature of respondent

CURRICULUM VITAE

Name of the Author	:	Anand Patel
Father's name	:	<u>Vrindavan Patel</u>
Date of birth	:	06/09/1997
Address	:	Dewas, Madhya Pradesh

Educational Qualification:-

Name of Degree	Subject(s) Major	Name of Institution	Year of passing	Percentage of marks
High School	All Subjects	M.P. Board, Bhopal	2012	94.33
Higher Secondary	PCMB	M.P. Board, Bhopal	2014	76.8
B.Sc. (Agriculture)	Agriculture	R.V.S.K.V.V, Gwalior (M.P.)	2018	74.9
M.Sc. (Agriculture)	Agricultural Economics	R.V.S.K.V.V, Gwalior (M.P.)	2021	70.02

Anand Patel