ECONOMIC ANALYSIS OF CHICKPEA PRODUCTION UNDER DIFFERENT TECHNOLOGICAL STATUS OF FARMS IN KHARGONE DISTRICT OF MADHYA PRADESH

THESIS

Submitted to the

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya

In partial fulfilment of the requirements for the Degree of

MASTER OF SCIENCE

In

AGRICULTURE

(AGRICULTURAL ECONOMICS AND FARM MANAGEMENT)

by

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Sehore (M.P.)

2015

CERTIFICATE-I

This is to certify that the thesis entitled **"Economic analysis of chickpea production under different technological status of farms in Khargone district of Madhya Pradesh"** submitted in partial fulfilment of the requirements for the Degree of **MASTER OF SCIENCE** in **Agricultural Economics & Farm Management** of Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior is a record of the bona-side research work carried out by Mr**. Savan Patel** under my guidance and supervision. The subject of the thesis has been approved by the student's Advisory Committee and the Director of Instruction.

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

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CERTIFICATE-II

This is to certify that thesis entitled **"Economic analysis of chickpea production under different technological status of farms in Khargone district of Madhya Pradesh"** submitted by **Mr. Savan Patel** to the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior in partial fulfilment of the requirements for the degree of Master of Science in **Agriculture** in the Department of **Agricultural Economics & Farm Management** has been accepted after evaluation by the External Examiner and approved by the Student's Advisory Committee after an Oral examination on the same.

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ACKNOWLEDGEMENT

Thanks to Almighty God for giving me this opportunity to express my heartfelt gratitude to all the dedicated people whose support and kind co-operation encouraged me during the course of investigation. I avail this opportunity to express my deep sense of gratitude to my guide and Chairman of the Advisory Committee, Dr.P.S.Raghuwanshi, Professor, Department of Agricultural Economics for his inspiring guidance, untiring interest, immense labour, thought provoking comments, constructive criticism, constant encouragement and generous help throughout the course of investigation and the course of writing this manuscript.

I am deeply obliged to all the members of my Advisory Committee, namely, Dr.S.N.Soni, Head of Department, Department of Agricultural Economics and Farm Management and Dr.S.N.Sharma, Professor, Department Extension Education, R.A.K. College of Agriculture, Sehore. I also express my deep sense of gratitude to, Dr.P.K.Malviya, Professor, Department of Agricultural Economics and Farm Management, Sehore for their valuable guidance.

I am also thankful to Dr.A.K.Singh Hon'ble Vice Chancellor, RVSKVV, Gwalior, Dr. R.L. Rajput, Director of Instruction, RVSKVV, Gwalior and Dr.(Smt.)S.B.Tambi, Dean R.A.K. College of Agriculture, Sehore for providing me the necessary facilities during the studies.

I feel short of words to express my gratitude to my parents Shri. Salakram Patel, Mother Smt.Shakuntala Patel, Brother Sohan Patel for their utmost co-operation, love and encouragement during the course of this work.I am also thankful to Friend Mithun, Ravindra, Mahendra, Ritesh, Loken, Lalit, Ankit, Hariom, Rajesh, Nitesh, Amar, Harshali, Pratibha, ramesh, Rajeev.

Last, but not least, my grateful thanks are due to all the respondents for the study and staff of R.A.K. College of Agriculture, Sehore of their co-operation during thesis work.

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CHAPTER - I
INTRODUCTION

After our success on “household food security” we should strive for “household nutritional security”. Pulses are the major source of protein for the vegetarians. Pulses constitute an important component in Indian agriculture since centuries. The role of pulses in Indian Agriculture needs hardly any emphasis. India is the premier pulse growing country. India is the world's largest pulse producer, consumer and importer, accounting for 27 per cent of the global pulse production. Madhya Pradesh is one of the important pulses growing State in India. The common pulses growing in Madhya Pradesh are pigeonpea, moong bean, urad bean during kharif season and chickpea, lentil, pea and rajma during rabi season. The split data on these pulse crops’ statistics shows that 60 per cent of pulses are grown in rabi and 40 per cent in kharif season respectively. Chickpea is commonly known as gram which is one of the important pulse crop of the State. However, chickpea production in the State is slow in post green revolution years due to strong competition from other rabi cereal crops as expansion in irrigation and rapid technological change has favoured the cereal crops at the cost of chickpea. The recent liberalization has expanded the demand for chickpea from international markets in addition to the growing domestic demand.

Madhya Pradesh ranks first in India with respect to chickpea’s area and production. Chickpea is an important pulse crop and stands third amongst the food grains after rice and wheat. The share of Madhya Pradesh in area of chickpea as compared to the country is 43.2 per cent. Chickpea accounts for 61.99 per cent area and 40.52 per cent production of the total pulses in Madhya Pradesh. In Madhya Pradesh the area under chickpea has remarkably increased from 1495 thousand hectare in 1968-69 to more than 2900 thousand hectares in 2011-12. Similarly production has also increased from 726 thousand tones to more than 2800 thousand tones during the same period. The average yield of chickpea in the state found to more than 970 kg/hectare. These figures show the importance of chickpea cultivation and production in the State.

Research data revealed that in Madhya Pradesh, there are prospects for enhancing general farm chickpea yield as potential yield of chickpea obtained on

progressive farm with the use of improved chickpea production technology. It showed improvement in chickpea production is needed through conservation, diversification of agriculture and to enhance adoption level of improved chickpea production technology. So to increase the productivity, particularly under rainfed chickpea growing regions is one of the major challenges and concern which need to be addressed on priority basis.

Growth model adopted by Indian agriculture is popularly called ‘Green Revolution Model’. This has transformed the primitive modes of production into modern, high-tech agriculture sector. The change invaded through a set of measures suitably supported by various existing institutions, be it research or extension. Farmers have a lot of knowledge about agricultural technologies but they choose only those, which are profitable from their viewpoint. The progressive farmers of the Madhya Pradesh State increased their production through adoption of latest agricultural technologies. Moreover, certain backward area of the State and general farmers do not adopting latest agriculture technology at judicious level. The state has diverse agro climatic conditions and the crops grown and cropping practices followed in these areas found to as per their suitability in different agro climatic condition.

Keeping the view of importance of technology in agricultural development most extension services are actively engaged in promoting new technologies with farmers. Resources are invested in various extension activities, such as field days or demonstrations, and the extension service may undergo considerable reorganization, such as with the training and visit (T&V) system. But only infrequently are resources reserved for monitoring the outcome of these extension efforts and using the analysis to understand why some recommendations or extension techniques are more successful than others. For those farmers who have not adopted, do they find disadvantages with the new practice and improved technology is the practice too far removed from farmers' knowledge base, or has the extension methodology not been effective in acquainting these farmers with the new technique? There are several reasons to invest in studying the adoption of agricultural technology. These include improving the efficiency of technology generation, assessing the effectiveness of technology transfer, understanding the role of policy in the adoption of new technology, and demonstrating the impact of investing in technology generation.

Several studies revealed that if the benefits of the new technology are largely expressed as increased yield, the first step is to estimate yield changes due to adoption of different level of technology, its called yield gap. Yield gap refers to the difference between the potential yield (yield on progressive farms) and actual farm yield (realized on the general farmers' filed). These facts nevertheless, signify the broad scope for increasing the crop yields through proper application of inputs at the recommended levels and better management practices.

Once the yield difference has been estimated, it is possible to calculate a value of increased yield and calculate the total value of increased production resulting from adoption of improved technology in crop production in the study area. It may also be important to obtain an estimate of the increased income for farmers who have adopted the new technology. Such an estimate will require good data on the variable costs of the technology. Estimates of the benefits of a new technology should be balanced against possible costs implied by changes in other parts of the farming system. The long-term sustainability of a new practice may also need to be examined when considering costs and benefits.

Another important use of the information from level of adoption of crop production technology and its economic studies is to assess the impact of technology on agricultural development and to measure the returns to investments. Adoption studies are an important tool for measuring and assessing impact of adoption of technology at various farm situations. Such an analysis may be used to justify further investment in these sectors or to help identify the most productive opportunities for investment within crop production system.

An important question on the minds of policymakers is who benefits from new technology. Adoption studies may be designed to document what kinds of farmers and what areas of the country have profited most from the development of a particular technology. The evaluation of impact and returns to investment is also a common feature of agricultural development projects, but these evaluations are often done without access to solid data on adoption. Adoption studies are also useful for illustrating the degree to which acceptance of new technologies is limited by insufficient inputs, credit, or marketing infrastructure. If it appears that farmers are unable to take advantage of a new technology because they lack inputs, this information can be presented to policymakers who have responsibility for the

agricultural inputs that are available and the way they are distributed. The present study would be determine the answer of that, if adoption study shows that access to credit significantly influences the type of technology that farmers use, then this information may be presented to those responsible for designing and funding credit programmes. Similarly, adoption studies may be used to highlight marketing bottlenecks that limit the acceptability of new technologies.

At the last it is highlighted that any program that attempts to develop and promote improved farming practices should be able to assess progress and use that information to make future actions more effective. The aim of this study is to help strengthen institutional capacity to carry out such adoption studies. This capacity is important for agricultural research organizations that develop innovations for farmers, extension institutions that promote new technology, various types of rural development projects that introduce changes in agricultural technology, and a range of non-governmental organizations (NGOs) and community level efforts that are working to improve farming practices. Taking above views the present study was therefore, under taken “Economic analysis of chickpea production under different technological status of farms” with the following objectives:

Objectives:

- To identify socio economic characteristics of chickpea growers in study area.
- To estimate the different adoption levels of chickpea production technology at existing farm situation.
- To assess the extent of yield gap at different adoption levels of chickpea production technology.
- To estimate the profitability of chickpea production at different adoption levels of production technology.
- To identify the constraints responsible for the existing yield gap in chickpea production.
- To suggest ways and means for reducing yield gap in chickpea production.

Limitation of the study:

A. In this study, no reference is made for factors like risk and uncertainty, only those factors are considered which are under the control of farmers and contributes significantly towards the returns and use of resources.

B. The coverage of study area was limited. This is due to the fact that coverage of large area is beyond the capacity of investigator.

C. The primary data collected for the study were entirely based on memory of the cultivators because cultivators do not keep any records regarding their farm practices.

D. The data are pertaining to the agriculture year 2013-14 only. Hence, the generalization of research result can be only made for study area.

Significance of the study

The study is expected to throw some light on extent of technological gap in adoption of improved cultivation practices of the chickpea crop. Any attempt to understand the basic problems in the adoption of recommended technology package assumes special significance. This step needs a scientific evaluation of the extent of yield gap. The farmers also spend the scare capital in production technology according to level of profitability, needs a critical analysis of cost involved in production and level of return realized. The present study is of paramount importance on the above point of view. The findings of this study will provide valuable information to all the private, voluntary and government agencies for the development of appropriate extension strategies for boosting the chickpea production as well as productivity. The study also aims to analyse the constraints faced by the farmers in adoption of recommended cultivation practices of the crop. This will help the concerned authorities to take the problems of the chickpea cultivation to their best satisfaction.

CHAPTER – II

REVIEW OF LITERATURE

Scanning of relevant literature is helpful in formulating the framework of research problem undertaken. The researcher would be able to make an improvement over the existing studies and also expend the horizon of investigation on the subject matter. The review could also help in refracting the concept and statement, which were made in the earlier studies as well as for supporting of the present study. The attempt of new research worker is to study the literature related to the problem undertaken. Therefore, it forms an integral part of any systematic research work. Hence, efforts have been made in this chapter to review the selected references available for study as per the stated objectives in following subheads:

1. Adoption levels of chickpea production technology.
2. Yield gap at different adoption levels of chickpea production technology.
3. Profitability of chickpea production.
4. Constraints responsible for the existing yield gap.

2.1 Adoption levels of chickpea production technology:

Adoption behaviour of farmers tends to be specific to particular technology, individuals, and environment of the farming situation. Farmer's incentives and disincentives to adopt particular technology are determined by his personal belief about its value and permissiveness of his environment. So adoption of a technology varies not only from area to area but also from farmer to farmer. The findings of different investigators regarding this aspect are presented as under.

Joshi *et al*. (1998) studied the pattern and spread of adoption of improved chickpea varieties and their economics in India and measures returns to investment on chickpea research at ICRISAT. Survey data relating to the period 1992-95 were collected from 1150 chickpea growers drawn from four states (Andhra Pradesh, Gujarat, Madhya Pradesh and Maharashtra). The on-farm benefits of improved chickpea varieties over traditional varieties are shown in terms of yield, income, unit cost, employment and price premium. The internal rate of return and net present value of benefits from research were calculated as 21% and $1.44 million for ICCV 2 and 25% and $2.87 million for ICCC 37.

Reddy and Rao (1998) revealed that 52.33% of the respondents showing average adoption level about cultivation practices of crops followed by 85% low

adoption. However, the farmers falling in the category of high adoption were 19.6%.

Islam *et al.* (2002) examined the adoption of high yielding variety (HYV) chickpea, the chickpea cultivation practices, and the costs and returns of chickpea production in the High Barind Tract of Bangladesh. Data were obtained from a survey of 120 farmers conducted during the 1999-2000 rabi season. 58% of the farmers adopted HYV chickpea, and the area planted to HYV chickpea covered 60 per cent of chickpea cultivated land. On average, chickpea farmers used 53 man days, 50 kg of seeds, and 152 kg of manures per hectare. The average chickpea yield was 1131 kg/ha. The overall benefit cost ratio (on a full cost basis) of chickpea cultivation was 3.13. It is concluded that there is a scope for increasing HYV chickpea production in the Barind area.

Patel *et al.* (2003) this study reveals that majority (91%) of chickpea growers (n=200) in Bhopal district, Madhya Pradesh, India, has completely adopted recommended field preparation practices, improved varieties, sowing time, seed rate, sowing methods and time of harvesting, whereas 53-63.6% have partially adopted seed treatment, balanced dose of fertilizers, insect control and irrigation management. 85% of the respondents have not adopted soil testing and weed management practices. Irrigation intensity, extension participation, socioeconomic status, information seeking behaviour and risk preference were found to be significantly related to adoption behaviour.

Rathore (2008) reported that on an average yield per hectare of gram produced by 14.28 Qt. The highest yield level was achieved by large size group i.e. 14.72 Qt./hect. and lowest was 13.72 Qt./hect. by marginal farmers respectively. Cost of production per quintal was the lowest in case of large farmer was found Rs.699 followed by Rs.720 per quintal in case of medium farmer respectively. The average cost of production per quintal of gram crop was found to Rs.672.

Chouhan (2009) reported that in case of gram production, the average adoption index of improved technology was 71.72 per cent on adopter farm followed by 57.42 per cent on non-adopter farm respectively. This result shows about 14 per cent differences in adoption of gram production technology between farmers of adopter and non-adopter farm situation. With regards to category wise adoption index of improved technology in case of adopter farm, the percentage of adoption were found to varies as 61.66 per cent on small category followed by 72.75 and 80.75 per cent on medium and large farm category respectively. On the other hand,

non-adopter farm situations, the adoption of gram production technology found to variations on small, medium and large farm which were found to 48.04 per cent 58.21 per cent and 66.00 per cent respectively.

The over all adoption index of gram production technology by adopter and non adopter farm situation and different size of farm category revealed that there exist wide gap in adoption of improve crop production technology on the farm of adopters and non-adopter as well as different size of holding also. The adoption level found to increase with increase in the size of holding under gram crop production.

Solanki (2011) reported that majority 39.17 per cent had partial adoption of overall average technology followed by 35.83 per cent full adoption and 25.00 per cent no adoption categories respectively.

Kangali (2012) reported that in the case of adopter farmers, majority of the respondent were in partial level of adoption followed by full and low category respectively regarding adoption of chickpea production technology/ practices. On the other hand, in case of non adopter farmers, majority of the respondent were in low level of adoption followed by partial and full category (equal) respectively regarding adoption of chickpea production technology/ practices.

2.2 Yield gap at different adoption levels of chickpea production technology:

Bajpai (1998) reported that despite increase in land productivity, still there is a considerable gap between the potential yields and the current yield of major crops. In general the programme proved to be beneficial to the farmers specially the small and marginal farmers in the dryland area. Therefore, the involvement of more and more small and marginal farmers under this programme will be helpful in achieving the national objective of uplifting rural poor as well as increasing agricultural production.

Tomar (1994) reported a large gap between on-farm and research station yields of chickpeas, mustard, summer moong beans and soybeans. First line demonstrations were carried out in cultivators' fields in Tikamgarh district during 1991/92-1992/93 to test the research findings in farmers' fields and to disseminate the improved varieties, better agronomic practices and improved plant protection measures. Compared with local practices, there was an increase of 95%, 137%, 40% and 207% in the yields of chickpeas, summer moong beans, soybeans and mustard, respectively, grown in the demonstration plots.

Yadav and Dwivedi (1999) reported that a field experiment was conducted during rabi [winter] 1996/97 and 1997/98 at Zonal Agricultural Research Station,

Morena, to determine the effects of different agronomic inputs on the productivity of chickpeas in the Gird zone of Madhya Pradesh, A combination of fertilizers, irrigation and plant protection gave the highest chickpea seed yield (30.70 q/ha) which was 54.9, 43.7, 22.2, 16.3, 15.5, 12.3 and 4.4 percent higher than control, plant protection, irrigation, fertilizer, plant protection + irrigation, plant protection + fertilizer and fertilizer + irrigation respectively. The cost benefit ratio was highest from irrigation + fertilizer (1:4.30).

Soni (2002) reported that the perceptions of improved technologies users need to be under-stood and ensure viable potential of modern technology use on their own end. In other side it is very essential both for the farmers and execution of programme designed both raising agricultural production that they would know whether investment in modern inputs like high yielding variety, fertilizer, plant protection, chemicals and irrigation etc. the present study is examine the comparative economics of gram production of the existing and improved technology adopted by the farmers and adoption gap influence the productivity. The result indicated that with the adoption of modern technology the yield of gram increased on an average 3.35 quintal per hectare. This we can say that there exist a vast yield potential in the area. In economics point of view the improved technology was found to be highly remunerative also. It resulting in encouraging additional net returns Rs. 910.50/hectare.

Tripathi and Das (2002) studied front line demonstration of chickpea (*C. Arietinum*) conducted in 4 locations in Kaymore Plateau and Satpura hills in Madhya Pradesh, India during the winter of 1996-1997, 1997-1998, 1998-1999 and 2000-2001. Data collected from 323 farmers indicated that additional yield and income was 4.7 q/ha and Rs. 6471/ha, respectively, were obtained following improved technology package. The timely supply of adequate quality seeds was the major constraint in chickpea production in the hilly region of Madhya Pradesh.

Patole *et al.* (2008) reported that the use of the most important inputs per hectare was lower in sampled farms than in demonstration plots. A benefit: cost ratio of 1.19 for chickpea indicated the profitability of its cultivation. Production function analysis indicated the intensive use of human labour, bullock labour, nitrogen and phosphorous, and reduction in the use of manures for chickpea cultivation. The decomposition analysis of yield gaps showed that 52.99% of the potential farm yield in chickpea was left untapped by the sampled farmers. Therefore, chickpea

production may be increased by at least 53%.

Rathore (2008) reported that on an average it required Rs.11014 per hectare as a production cost C3. Out of which (58.2%) shared by that cost A1 followed by (6.55%) cost B1, (79.26%) cost B2, (73.69%) cost C1 and (92.46%) cost C2 respectively. The gross return was estimated to on an average Rs.24360 per hectare which returns to Rs.13386 per hectare as net profit. The average benefit cost ratio was 2.22. This crop return higher benefit cost ratio as per the increases size of holding. The highest 2.32 was the benefit cost ratio from gram production in case of large farmer, which reduced and lowest was 2.15 incase of marginal farmers.

Chouhan (2009) reported that the level of output (yield of gram) on adopter farm situation was maximum i.e. 11.93 quintal per hectare with large farm to 10.25 quintal per hectare with small farm size and average yield was obtained 11.06 quintal per hectare. This was found quite satisfactory and reasonable with the adoption level of improved technology used in gram production. The average productivity of gram on non-adopter farm was quite below than the obtained from adopter farm i.e.8.92 quintal per hectare. The yield was found to decrease with the decrease in the size of holding. This was mainly due to lower use of yield attributing inputs by small and medium farmers in the area.

Patidar (2012) portrays that the average yield of gram on irrigated farm found to be 12.15 q/ha. and in various size of farm it was 12.24 q/ha., 12.50 q/ha. and 11.72 q./ha. on small, medium and large farm size which found to be higher per hectare in compare to unirrigated farm. The study showed that the average yield of gram on unirrigated farm found to be 9.58 q/ha. which was 10.66 q/ha. on small farmers, 9.09 q/ha. n medium framers and 8.99 q/ha. on large farmer's field.

Rao *et al.* (2012) reported that the recommended package to grow chickpea in Chhattisgarh (CG) and Madhya Pradesh (MP) was highly profitable and cost-effective. On the basis of information gathered from 1241 farmers in CG, gain in average net return was 42.00 %. The reason behind the per cent gain in net return due to improved practice over the local practice in CG was the selection of Rainfed Rice Fallow Lands (RRFLs) in the tribal backward areas, where farmers are cultivating traditional chickpea and use minimum inputs in terms of fertilizers/ insecticides/ fungicides/ improved varieties. Though the cost of the Improved Pulse Production and Protection Technologies (IPPPT) package for chickpea production was 13.33% higher than the local farmer practices in MP, net returns using IPPPT

was 49.14 % in MP more than local farmer practices. The benefit- cost ratio of chickpea production using IPPPT was estimated to be 3.25 in MP and 2.60 in CG.

2.3 Profitability of chickpea production:

Mruthyanjaya and Kumar (1989) found that the cost of cultivation of crops has increased in all the crops over the years owing to inflationary pressure. The increases in the cost mainly come from the rise in cost of machine power. Fertilizer, human and bullock labour etc. the cost of production has shown on upward trend, the yield levels in general have shown little improvement. Declining profitability and terms of trade were observed in all the crops except sugarcane and cotton on account of little improvement in yield coupled with rising cost of production. The cost of production at constant input prices indicated generally declining trend in all the crops except maize, gram and jute. The share of operational cost and purchased input was increased in the total cost.

Tomar (1994) reported the demonstration plots provided returns of Rs.9995, Rs.4180, Rs.9448 and Rs.9621/ha for chickpeas, summer moong beans, soybeans and mustard, respectively, as compared with Rs.3940, Rs.1376, Rs.4471 and Rs.4180/ha, respectively, for the local practice plots. The percentage increase in cost-benefit ratio was 75% for chickpeas and mustard, 90% for summer moong beans and 56% for soybean demonstration plots.

Raghuwanshi (1999) costs and returns from gram [*Cicer arietinum*] crop grown in small, medium and large sized holdings in Tikamgarh district of Madhya Pradesh during 1994/95 were analyzed. The results indicated that per hectare cost of gram cultivation was Rs. 6064 with the little variation between the holding sizes. The net income, family labour income and farm business income were highest on small farms and lowest on large farms. The return of investment per Rs. 1 invested was Rs. 1.84, indicating that it is a profitable crop.

Dubey (2000) study on economic viability and sustainability of different rabi crops under rainfed conditions was conducted. Field experiments were conducted during the winter (rabi) season for two consecutive year, 1993-94 and 1994-95, at JNKV, Regional Agricultural Research Station, Sagar, Madhya Pradesh, India, on clay soils to evaluate the economic viability and sustainability of seven rabi crops under rainfed conditions. Results reveal that in the first year of the experiment, five crops linseed (*Linum usitatissimum*), safflower (*Carthamus tinctorius*), India mustard Brassica junces, chickpea (*Cicer arietimnum*) and pea (*Pisum sativum*) produced

higher yields than in the second year, although the reverse was true for lentil (*Lens culinaris*) and wheat (*Triticum aestivum*). Lentil produced the highest yield (14.57 q/ha.) followed by wheat (12.89 q/ha). similarly, lentil produced the highest wheat equivalent yield (25.75 q/ha) and earned the highest gross as well as net monetary return (Rs.14253.00 and Rs.10716.00,respectively) and proved to be the most profitable crop (benefit: cost ratio,4.01:1) of this region under rainfed conditions. Wheat and chickpea occupied the second and third place, respectively, in terms of profitability, while mustard produced the lowest return (benefit: cost ratio, 1.18:1).

Singh *et al.* (2005) studied the costs and returns of pulses production in Hanumangarh district, Rajasthan. Results revealed that the highest expenses incurred in the cultivation of pulse crops were on harvesting, threshing and seed. Among the pulse crops, moong and moth beans were found to give higher returns per hectare as compared to gram. This was because of higher prices for moong and moth beans. Though the average yield of gram was observed to be higher, the net returns per hectare of all pulse crops were low on small farms due to inefficient use of modern inputs and low yield. The pulses were not much profitable because of low productivity, absence of improved production technology, less use of modern inputs, lack of irrigation water and adverse climatic conditions.

Patole *et al.* (2008) reported that Chickpea production in Ahmednagar district, Maharashtra, India, was studied during 2002-03. Sixty farmers were sampled. Data on input use and chickpea production in demonstration plots and farmers' fields were analyzed using Cobb-Douglas production function and decomposition analysis. The results revealed that the use of the most important inputs per hectare was lower in sampled farms than in demonstration plots. A benefit: cost ratio of 1.19 for chickpea indicated the profitability of its cultivation. Production function analysis indicated the intensive use of human labour, bullock labour, nitrogen and phosphorous, and reduction in the use of manures for chickpea cultivation. The decomposition analysis of yield gaps showed that 52.99% of the potential farm yield in chickpea was left untapped by the sampled farmers. Therefore, chickpea production may be increased by at least 53%.

Chouhan (2009) reported that on an average the adopter farmers could produce this crop with the use of improved technology at the cost of Rs.11271 per hectare as cost C3, out of which Rs.6582 was cost A1, Rs.6681 cost B1, Rs.8181 cost B2, Rs.8883 cost C1 and Rs.10383 was cost C2 respectively. The average

gross return from cultivation of gram on adopter farm was found to Rs.23226 per hectare which gave the net return to the average Rs.11955 per hectare.

Mayda (2011) reported that the overall gross income of chickpea (main product + by product) per hectare of this crop was found to be Rs.22688.00 and it decreased with the increase of size of holding. The other measurement of farm profit like net income was found to be on an average Rs.5864.62 per hectare. The net income per hectare was found to be the highest with small farmers i.e. Rs.8582.26 and lowest with medium farmers i.e. Rs.4467.37 followed by large farmers i.e. Rs.4544.24 per hectare.

Verma (2011) reported that cost C_1, C_2 and C_3, the average cost of cultivation of pulses per hectare was higher in recommended practices i.e. on an average found to Rs.19704, Rs.21704 and Rs.23874 per hectare respectively. The cost C_1, C_2 and C_3 were found lower than recommended practices when considered on farmer's practices. In farmers technological status it was found to Rs.12473, Rs.14473 and Rs.15920 respectively.

Patidar (2012) portrays that on an average cost of cultivation per hectare of irrigated gram was found to Rs.10132.8 (Cost A_1) followed by Rs.10173.2 (Cost B_1), Rs.12753.2 (Cost B_2), Rs.14847.8 (Cost C_1), Rs.17427.8 (Cost C_2) and Rs.19170.6 (Cost C_3) respectively. Whereas, on an average cost of cultivation per hectare of unirrigated gram was found to Rs.9424.5 (Cost A_1) followed by Rs.9464.8 (Cost B_1), Rs.11830.1 (Cost B_2), Rs.13496.8 (Cost C_1), Rs.15862.1 (Cost C_2) and Rs.17448.3 (Cost C_3) respectively.

Narayanamoorthy (2013) reported that this study examines trends in profitability of different crops in India using data from a cost of cultivation survey on six important crops (rice, wheat, Bengal gram, groundnut, sugarcane, and cotton) covering the period 1975/76-2006/07. Results show that crop farmers have suffered substantial losses most of the time considered for the analysis. When profits were earned by the farmers, it was found in majority of cases to be less than 30% over the cost of cultivation. Except in wheat and gram, the returns over the cost of cultivation had also worsened in all other crops especially during the post-1990s. Importantly, the quantum of loss incurred by the farmers in crops like cotton, groundnut and sugarcane was also large in recent years as compared to the pre-1990s situation.

Yadav (2013) depicted that on an average farmers could produces gram at the cost A_1 of Rs.11833 per hectare followed by Rs.11920 cost B_1, Rs.15420 cost

B_2, Rs.16192 cost C_1, Rs.19692 cost C_2 and Rs.21661 cost C_3. The average yield of gram in study area was found to 12.15 quintal per hectare, which gave the average farm business income Rs.31533 per hectare, farm investment income Rs.25292 per hectare, family labour income Rs.27946 per hectare and net return of Rs.21705 per hectare.

2.4 Constraints responsible for the existing yield gap:

Marothia (1986) stated the study reports on the second phase of the constraint analysis project which was sponsored by Madhya Pradesh Council of Science and Technology. It assessed the constraints to high wheat and gram yields in three villages (Barbanda, Nowardi and Tor) of Dharsiwa Block where these two crops are grown under a tank irrigation system. Basic data were obtained from a survey of 82 randomly selected farmers. The results show a positive association between adoption rates of improved inputs and profitability of the new wheat and gram technology. The yield and income gaps between the survey farms and experimental farms for the wheat crop were greater than those for gram. The results indicate the positive correlation between irrigation facilities and use of growth promoting inputs and quality seeds.

Agarwal and Gautam (1999) conducted a survey of constraints analysis of Kharif and Rabi crop production in Kundam Tribal block of Kaymore and Satpura hills Region was conducted in the year of yield of paddy, wheat, sesamum, mustard, pigeon pea and gram in farmers field was lower than state average, viz; 41.47%, 57.48%, 12.4% 62.3%, 58.7% and 57.74% respectively. This indicates lower per hectare crop production in tribal farms due to various, social, economical and technical constraints which are effectively create lower level of adjustment to boost up productivity of Kharif and Rabi crops. The study reveals that constraints in Kharif and Rabi, crops production were lack of knowledge about improved seed tribal development programme, agriculture extension programme etc. Lake of irrigation facilities, capital for purchase of inputs improve methods of sowing and improve implement of sowing in existing resources were more predominant constraints with tribal community. Beside these, suggestions for improvement in existing tribal condition to increase crop productivity has also prescribed to state administration and extension authority of Madhya Pradesh.

Patel (1999) reported the constraints identified in the cultivation of pulses are that most of farmers lacked modern farm inputs with marginal variations in land

owned and operated, led to low cropping intensity, and a change in cropping pattern in favour of food crops. The productivity of pulses was low and its cost of cultivation was high as compared to other crops. The study provides several suggestions to increase pulse production in the state.

Rajput *et al.* (2000) a study was conducted during 1993-94 to investigate crop productivity and constraints on tribal farms in Dhar block, Dhar district, Madhya Pradesh, India (n=75). Average yield of soybean (11.5 q/ha), wheat (19.5 q/ha) and chickpeas (9.75 q/ha) was highest on large farms (above 6 ha) followed by small (up to 2 ha) and medium farms (2.1 to 6 ha). Cost benefit ratio for soybean (1:1.61), wheat (1:1.68) and chickpeas (1:1.41) was also highest on large farms. Cost benefit ratio of wheat was 1:1.56, 1:1.55 and 1:1.68 on small, medium and large farms, respectively. The major constraints were low price of farm produce, labour shortage and high transportation charges. These three constraints were experienced by more than 70 per cent of the sample farmers.

Ramaswamy (2002) reported that the productivity of pulses in India is quite low. He also reported that pulse crops being mainly grown under rainfed condition (90 per cent) in the country and adoption of HYV is minimal.

Tripathi and Das (2002) studied front line demonstration of chickpea (*C. Arietinum*) conducted in 4 locations in Kaymore Plateau and Satpura hills in Madhya Pradesh, India during the winter of 1996-1997, 1997-1998, 1998-1999 and 2000-2001. Data collected from 323 farmers indicated that additional yield and income was 4.7 q/ha and Rs. 6471/ha, respectively, were obtained following improved technology package. The timely supply of adequate quality seeds was the major constraint in chickpea production in the hilly region of Madhya Pradesh.

Sharma *et al.* (2003) reported that data were collected from 100 chickpea growers from six villages of the Sehore Development Block, Madhya Pradesh, India, to explore the constraints in the adoption of improved chickpea production technology in the state. Results revealed a wide adoption gap, which was highest in use of micronutrients (99%) and lowest in proper field preparation (10%). A wide gap was also observed between the potential and actual yield, which may be attributed to various constraints, viz., crop management, labour management, and infrastructural constraints.

Sikandar Kumar and Sandeep Kumar (2004) reported that the main aim of the production unit is to coordinate and utilized resources or factors of production in such

a manner that together they yield the highest net returns. It is suggested that farmers should use more of high yielding variety seeds, insecticide and pesticide, bullock labour and tractorization, improved implements to turn out negative return in to positive. Again consolidation of land holding and a redistribution of land in favor marginal and small farmers will undoubtedly help in increasing the agricultural production, productivity and rural employment.

Kiran (2008) found many reasons for low yields for pulses like (1) Unavailability of adequate soil moisture. (2) Fluctuations in temperature during crop season. (3) Marginal and sub marginal resources. (4) Soil conditions like acidic, alkaline and saline due to excess soil moisture. (5) No availability of high yielding varieties. (6) Lack of proper agronomic practices. (7) Improper / Defective sowing. (8) Inadequate plant population. (9) Susceptibility to different pest and diseases.

Patidar (2012) reported that the constraints confronted by farmers are divided into five parts and each part having their own importance. The most important constraints was economic cause (rank Ist) followed by natural causes got (rank IInd), technological cause got (rank IIIrd), social cause (rank IVth) and institutional infrastructure cause (rank Vth) respectively.

CHAPTER - III

MATERIAL AND METHODS

In this chapter, the material and methods used in the study along with the research procedure are presented in detail. Material and methods are mainly determined the research procedure and research design which are use on the scientific and statistical procedure. This chapter is split into following sections.

1. The study area
2. Sampling procedure
3. Nature and collection of data
4. Method of enquiry and study period
5. Analytical procedure and concepts used

3.1 The study area:

Khargone district of Madhya Pradesh has been selected for the purpose of this study because of that chickpea is the main and important rabi crop in the region. The total geographical area of the district covers 8153 square kilometers and consists of 9 development blocks. Sandy loam and black loam soil is generally found in the area. This soil is quite suitable for growing cotton, jowar, maize, soybean, arhar, moong, groundnut, wheat, chickpea and lentil etc.

3.2 Sampling Procedure:

For the study, multi stage sampling technique was used for drawing the sample. At the first stage, Block in the district was selected. The district comprises of 9 blocks. At the second stage, villages in selected block were selected randomly. At the third stage, for the selection of respondents (chickpea growers), was selected from each village randomly for the study.

Selection of block:

Khargone block in Khargone district has been selected purposively due to most suitable area for chickpea crop and well known for researcher.

Selection of villages:

At the second stage, a list of major chickpea growing villages was prepared and among these 5 villages was selected randomly.

Selection of respondents:

At the third stage for the selection of respondents, a list of chickpea growing cultivators of each village was prepared and among them 60 chickpea grower was selected randomly for the study. Thus, the sample was confined to 60 chickpea grower form 5 villages in Khargone block of the district.

3.3 Nature and collection of data:

For the present study, primary data was collected as per the analysis of present study to draw the conclusions.

Primary data:

Primary data was collected from sample chickpea growers. The primary data were recorded regarding input use pattern and improved practices in chickpea cultivation. On the basis of input use pattern the farms of sampled chickpea growers had been divided into three categories i.e.

Ist chickpea cultivation with use of improved chickpea production technology (progressive farmers).

IInd chickpea cultivation as majority of farmers practices as per their own decision in adoption of chickpea production (general farmers).

IIIrd chickpea growers are least adopter of improved chickpea production technology (poor technological farmers).

The first of all the data was collected regarding level of input utilization pattern was adopted by them. The specific and details information on cost incurred and returns realized in the cultivation of chickpea were also collected from the sample respondents. The information also collected regarding yields obtained per unit of area and their market price obtained. The constraints confronted by the farmers in respect of yield gap of chickpea production also recorded.

The primary data regarding recommended chickpea production technology in respect of input use pattern, yield, cost, return and profitability, the data was

collected from the office of Scientist in Zonal Research Station Khargone.

Collection of data:

The data on different aspects were collected through pre-tested interview schedule. Each of the selected sample chickpea growers was approached personally for recording relevant data (Appendix-1).

3.4 Method of enquiry and study period:

The data were collected using survey method. All the collected primary data was related to the agriculture year 2013-14 rabi seasons.

3.5 Analytical procedure and concepts used:

Collected data were edited and checked for their adequacy and accuracy. Keeping in view the objectives of the study, the data were classified and tabulated. The classified and tabulated data were further processed in terms of average and percentage to arrive at conclusive figures for interpretation of data. In present study following statistical and econometrics tools were used.

Adoption pattern of improved production technology:

Productivity of chickpea depends upon the adoption of recommended production technologies. Adoption is a decision to make full use of new ideas in the best course of action. Consulting literature and scientists, working under Agricultural Research Station Khargone (M.P.), 9 recommended components of chickpea production technologies were identified and presented in table 3.1.

Table: 3.1 Weights for different components of chickpea **production technology.**

S.No.	Component of technology	Assign weight
1.	**High yielding variety seed for specific area based Gourav, JG-16, JAKI-9218**	18
2.	**Sowing method (Spacing 30 to 10 cm)**	13
3.	**Seed treatment (Benomil + Thirum (1:1) @ 3 g/kg**	07
4.	**Inoculation with Rhizobium and PSB cultures @ 5g/kg seed each).**	06
5.	**Fertilizer application (NPK) 30:50:40**	11
6.	**Interculture operations as per specific needs**	09
7.	**Insect-pest control as recommended (Imidacloprid 17.8%SL)**	08

8.	**Disease control (Dythen M 45, 0.3% solution**	**07**
9.	**Irrigation (2 time)**	**10**

On the basis of adoption score obtained by individual chickpea grower, the selected chickpea growers were classified into three categories with respect to level of adoption [poor resource farmers (least adoption), general farmers (moderate) and progressive farmers (high)]. Having identified the number of farmers under each category the indices of adoption was calculated as under

$$\text{Adoption index (\%)} = \frac{\text{Adoption score obtained by respondent}}{\text{Possible maximum score}} \times 100$$

Yield gap:

The potential farm yield is that which obtainable on farmer's field with the adoption of recommended chickpea production technology. The difference between the potential farm yield and actual farm yield is termed as a yield gap. In present study to assess yield gaps on chickpea farms when compared to those of demonstration's farms with high (progressive), moderate (general) and least (poor resource) adoption level of at farmer's field level.

The present study is under taken to assess the yield gaps on chickpea farms and the concepts of yield gap used are as follows:

Gap I: Between demonstration farms and progressive farms.

Gap II: Between progressive farms and average farmers practices.

Gap III: Between progressive farmers' practices and least adopted farmers' practices.

Economics of cultivation:

Cost A_1 = All actual expenses in cash and kind incurred in production of chickpea by producer

Cost A_2 = Cost A_1 + rent paid for leased in land

Cost B_1 = Cost A_2 + interest on fixed capital (excluding land)

Cost B_2 = Cost B_1 + imputed rental value of owned land

Cost C_1 = Cost B_1 + imputed value of family labour

Cost C_2 = Cost B_2 + imputed value of family labour

Cost C_3 = Cost C_2 + 10% of Cost C_2 (As managerial cost)

Profitability aspects:

For the estimation of profitability, the following income measures were used.

a) Net farm income (NFI) = Gross income – Cost C_3 (total cost)

b) Family labour income (FLI) = Gross income – Cost B_2

c) Farm business income (FBI) = Gross income –Cost A_1

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

Production constraints:

The different aspects i.e. technological, production and financial constraints was considered to know the overall production constraints faced by the respondents in chickpea growing in study area.

Concepts used in study:

Estimation of profitability:

The estimates of profitability were based on different cost and return incurred in chickpea cultivation.

Cost concepts:

The cost of cultivation classified as recommended, “Special expert committee on cost estimates, GOI, New Delhi”, was used in this study. The cost concepts are given below:

Cost A_1: It includes: -

i. Value of hired human labour,

ii. Value of hired and owned bullock labour,

iii. Value of hired and owned machinery labour,

iv. Value of owned and purchased seed,

v. Value of fertilizers, manures and chemical,

vi. Value of insecticide and pesticides,

vii. Expenditure on irrigation,

viii. Land revenue and taxes,

ix. Interest paid on crop loan if taken,

x. Depreciation on farm assets excluding land,

xi. Interest on working capital,

xii. Miscellaneous expenses.

Cost A_2: It includes-

Cost A_1 + rent paid for leased in land

Cost B_1: It includes-

Cost A_2 + interest on value of owned fixed capital assets. (excluding land)

Cost B_2: It includes-

Cost B_1 + rental value of owned land

Cost C_1: It includes-

Cost B_1+ imputed value of family labour

Cost C_2: It includes-

Cost B_2 +imputed value of family labour

Cost C_3: Cost C_2 + 10 percent of cost C_2 to account for as managerial cost.

Evaluation of farm inputs:

Methods followed in evaluating different farm input for the present study are described in the following paragraphs.

i. Hired human labour:

The farmers normally engage permanent farm labour on the basis yearly wages and casual labour on daily wages basis, for performing farm operations. The casual labour was evaluated on the basis of actual wages prevailed in the locality. The wages of male and female labour included payment given both in cash and /or kind. The value of kind components given to the labour was calculated at their prevailing market prices.

ii. Family labour:

The family labour cost was evaluated at the rate of prevailing wages in the locality for casual hired labour at various stages of operations.

iii. Bullock and machinery labour:

Estimation of bullock and machine labour charges on actual wage prevailed in the locality were considered.

For estimation of depreciation, interest on working capital, interest on fixed capital and rental value of owned land, following standard norms were used.

iv. Depreciation on farm assets:

The straight-line method is used for calculating rate of depreciation. The depreciation rates for different farm assets are taken @ of 10 per cent.

v. Interest on working capital:

It is worked out @ 12.50 percent for half of the duration of the crop.

vi. Interest on fixed capital:

Interest is charged @ 10 percent per annum on the value of implements, machineries, farm building, irrigation structure and drought animals. It excludes interest on land input, because rental value of owned land is calculated separately.

vii. Rental value of owned land:

It is calculated on the basis of $1/6^{th}$ of the gross income or prevalent rate in the area for the same.

Value of farm produce:

This includes the value of main product and the by – product of the crop. The harvest price of the crop was considered for calculating the value of main produce. The value of by – produce was calculated at the prevailing price in the locality.

CHAPTER - IV

RESULTS

Result is a most important chapter which determines the relationship between facts and findings. In this chapter assembled data after processing and analysis are presented in an appropriate, and logically consistent tabular form. This chapter is necessary because the collected data are discussed in a logical order that is consistent with the major objectives or focus of the research problem. This chapter also deals with interpretation of the true meaning of the facts presented, in terms of the purpose of the study in the form of data. The purpose of interpretation and generalization is to search for the broader meaning of these answers by linking them to the other available knowledge. For the convenience of the study the chapter consists of six sections as below:

- **Socio economic characteristics of chickpea growers.**
- **Different adoption levels of chickpea production technology.**
- **Extent of yield gap.**
- **Profitability of chickpea production at different adoption levels.**
- **Constraints responsible for the existing yield gap.**
- **Suggestions for reducing yield gap.**

4.1 Socio economic characteristics of chickpea growers:

Socio economic characteristics are mostly affect the level of adoption of improved technology and decision making pattern of the farm. It can be say that in socio economic family structure is one of the production factors because most of the farmers are using family labour in production process. The family structure is determined as socio economic characteristics of farm family. Keeping the importance of farm family this part of study is primarily concerned with micro level analyses of general socio economic information of sampled chickpea growers. Since, socio economic characteristics of farmers and their family reflect the efficiency of farm, level of resource use and decision making process. Hence, it is very important to study these characteristics of the sample chickpea growers. These characteristics mainly concerned with age, education level of chickpea growers, size of family and work force availability in individual family. The data on distribution of sample chickpea growers according to age and education level is presented in table 4.1.

a) Age and education level:

Table: 4.1 Distribution of chickpea growers according to their age and education.

S.No.	Description	Level of adoption		
		Least	Moderate	High
A.	Average age (year)	43.50	44.29	40.85
B.	Education level			
1.	Illiterate and functionally educated	6	7	8
2.	Primary and middle education	4	9	13
3.	High school and above	2	5	6
4.	Percentage literate to total	50.00	67.00	70.00

The data shows that the average “least adopter” sample chickpea growers found to 43.50 years of age, ranged from minimum 20 years and maximum 64 years old. The “moderate adopter” sample chickpea growers found to on an average 44.29 years, ranged from minimum 22 years and maximum 65 years old. On the other hand, the “high adopter” sample chickpea growers found to on an average 40.85 years, ranged from minimum 21 years and maximum 70 years old. It is concluded that the age of sample chickpea growers varied from range of minimum 20 year to maximum 70 years. This shows that in chickpea growing the higher percentage of chickpea growers found to medium age group.

Regarding literacy position, study shows that the higher number of chickpea growers found to literate. The literacy position among the “least adopter” chickpea growers revealed the equal 50.00 per cent was literate. In case of “moderate adoption” chickpea growers the maximum chickpea growers (67.00 per cent) were found to be literate. On the other hand, in case of “high adoption” chickpea growers the maximum chickpea growers (70.00 per cent) were found to be literate.

This showed that the maximum chickpea growers were literate and among them they were educated upto medium level.

b) Size of family and work force:

Size of family and work force determines and provides family labour for earning of family income through their activities. Table 4.2 presents the detail of size of family and work force available in the family of chickpea growers.

Fig:1: Distribution of the respondents according to their age:

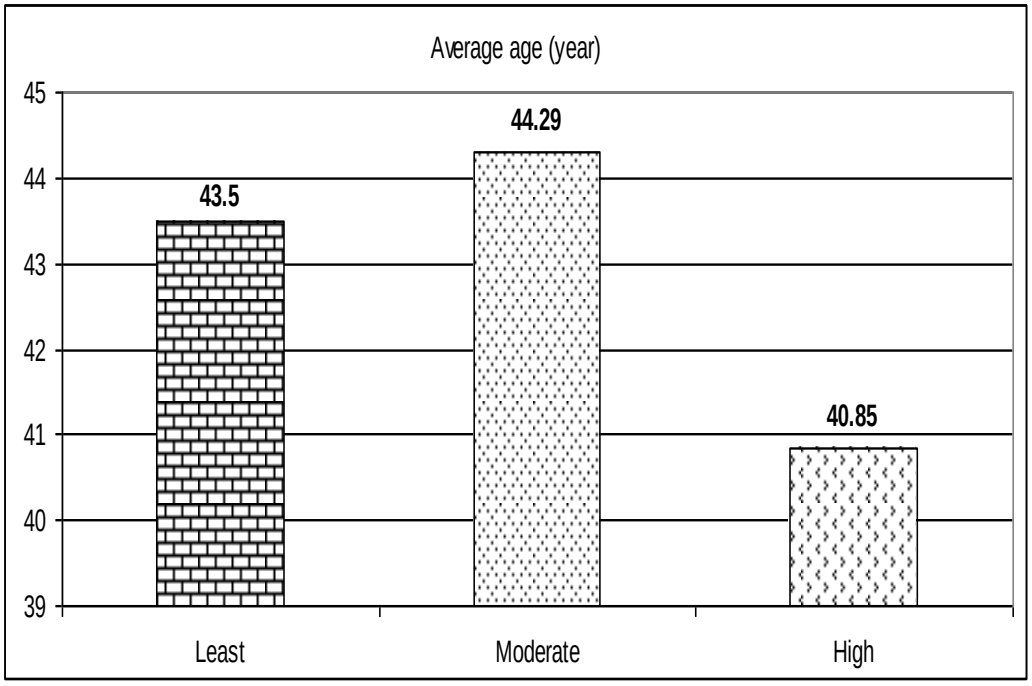


Fig:2: Distribution of the respondents according to their Education:

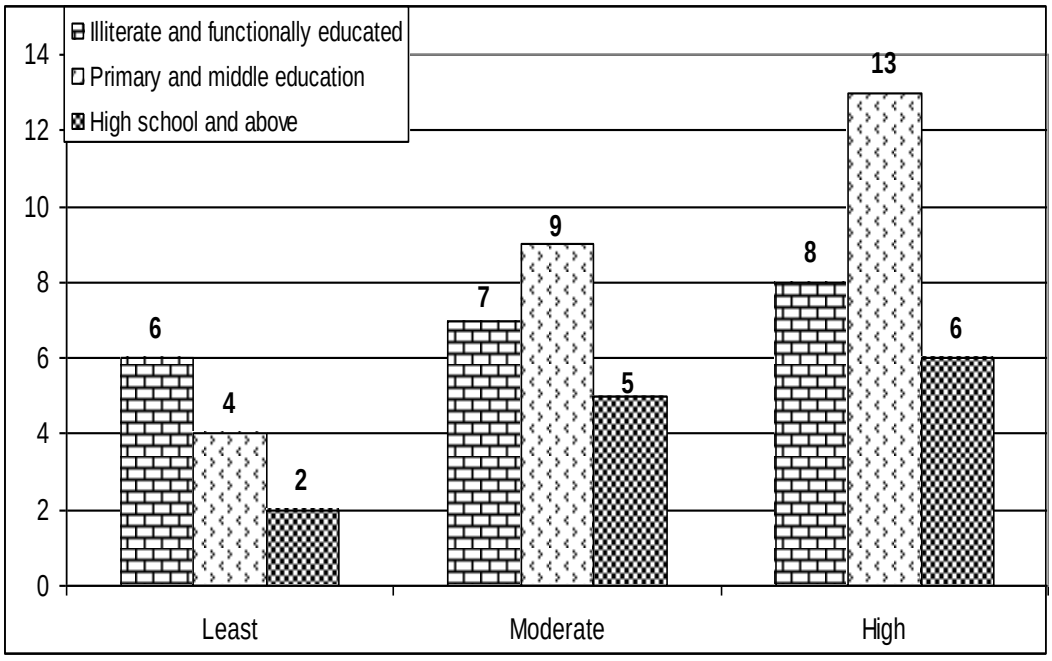


Table: 4.2 Distribution of chickpea growers according to size of family and work force. **(Average number of person per farm)**

S.No.	Description	Level of adoption		
		Least	Moderate	High
A	Strength			
1.	Male	2.25	1.95	2.15
2.	Female	1.67	1.62	1.85
3.	Children	3.33	3.05	3.48
4.	Total	7.25	6.62	7.48
5.	Per cent male to total	31.03	29.46	28.74
6.	Per cent female to total	23.03	24.47	24.73
B	Work force			
1.	Male worker	1.67	1.71	1.59
2.	Female worker	1.42	1.38	1.63
3.	Total	3.08	3.10	3.22
4.	Per cent male worker to total	54.22	55.16	49.38
5.	Per cent female worker to total	46.10	44.52	50.62

Table 4.2 shows the distribution of farm family as strength and work force available in their family. The data revealed that on an average the “least adopter” chickpea growers found to have 7.25 persons in a family. Among them, the male persons were found to be on an average 2.25 person (31.03% to total) followed by 1.67 female (23.03% to total) and 3.33 children, respectively. This indicated that male persons are higher than female in a family.

The data revealed that on an average the “moderate adopter” chickpea growers have 6.62 persons in a family. Among them, the male persons were found to be on an average 1.95 person (29.46% to total) followed by 1.62 female (24.47% to total) and 3.05 children, respectively. This indicated that male persons are higher than female in a family.

On the other hand, on an average the “high adopter” chickpea growers have 7.48 persons in a family. Among them, the male persons were found to be on an average 2.15 person (28.74% to total) followed by 1.85 female (24.73% to total) and 3.48 children, respectively. This indicated that male persons are higher than female in a family.

The availability of work force in a family is important parameter for family income because mostly farmers used their family labour in crop production. The data revealed that on an average in “least adopter” chickpea growers 3.08 people in a family found to active members. Among the total workforce in this category 1.67

persons (54.22% to total) were male workers and 1.42 persons (46.10% to total) were female workers in a family. These family workers are performing so many activities including farming for earning of family income.

Fig:3: Distribution of chickpea growers according to size of family
(Average number of person per farm)

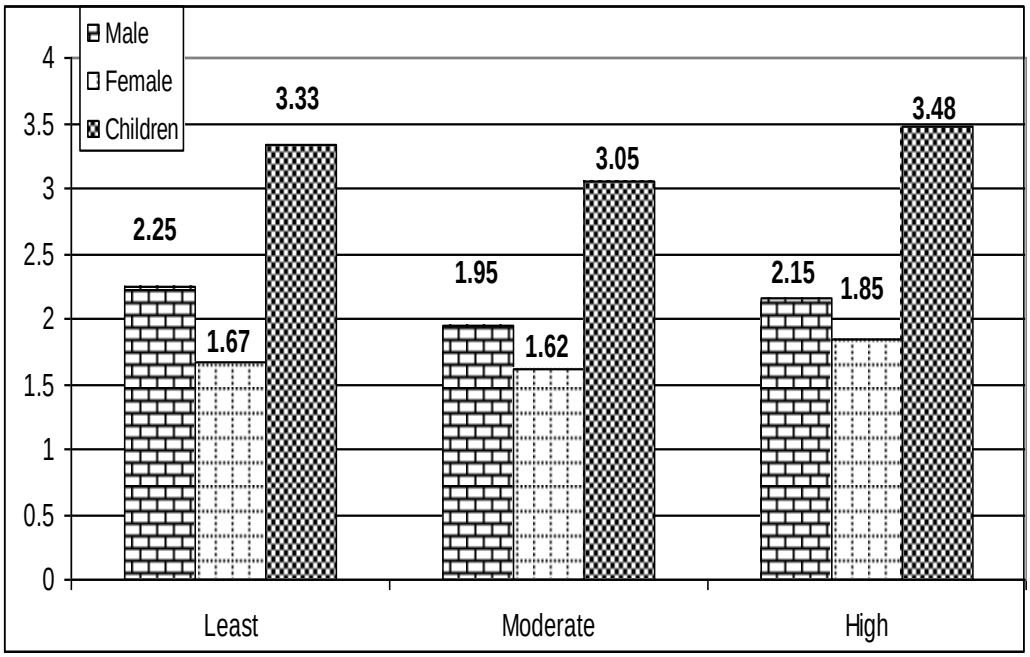
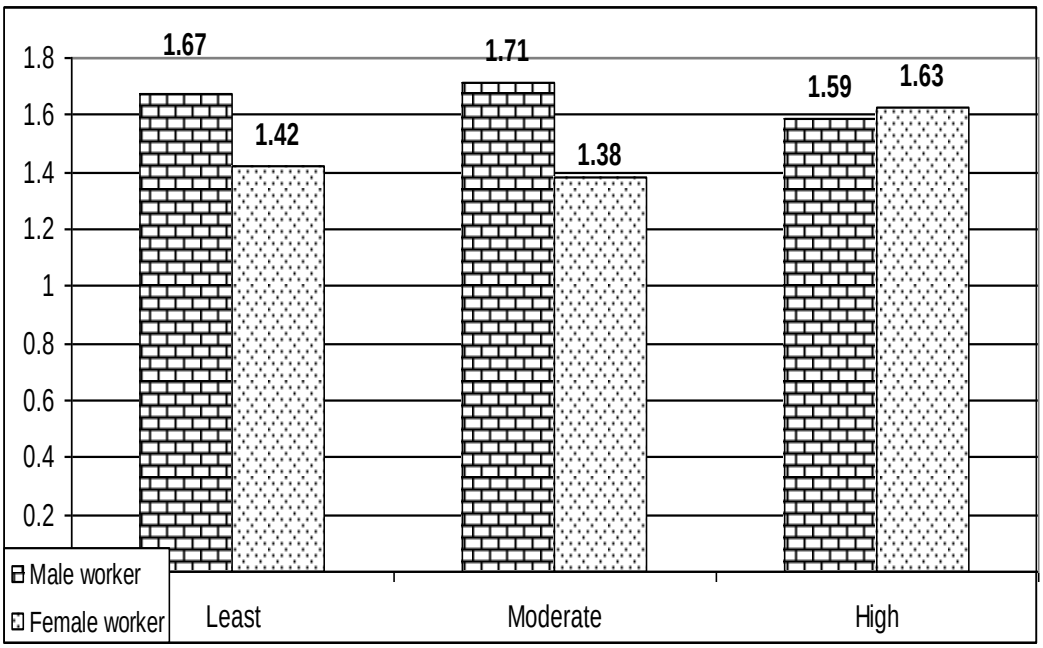


Fig:4: Distribution of chickpea growers according to work force
(Average number of person per farm)



The data revealed that on an average in “moderate adopter” chickpea growers 3.10 people in a family found to active members. Among the total workforce in this category 1.71 persons (55.16% to total) were male workers and 1.38 persons (44.52% to total) were female workers in a family. These family workers are performing so many activities including farming for earning of family income.

On the other hand, on an average in “high adopter” chickpea growers 3.22 people in a family found to active members. Among the total workforce in this category 1.59 persons (49.38% to total) were male workers and 1.63 persons (50.62% to total) were female workers in a family. These family workers are performing so many activities including farming for earning of family income.

c. Farm structure of sample chickpea growers:

The farm structure determines the operational, organizational and managerial constraints of the farm business activity. It also reflects the level of income of family and other business activities. Operational holdings of the chickpea growers are the basic unit of study. The physical and financial resources available to the farmers determine farm business activities and adoption of suitable cropping systems on their farms amongst the prevailing cropping system in the area. Opportunities for utilization of these resources and other factors that affect the crops production should be known prior to decision making process. Chickpea growers own resource comprise chiefly of land, family labour, machinery and the other available assets and inputs. The distribution of these resources and their utilization in conjunction with the hired resources has been studied as follows:

i) Land utilization and irrigation pattern:

Land is probably the most important measure in classifying the farms, because it is a primary and fixed input constituting the major portion of the fixed cost. It is also free from the substantial annual fluctuations. The land use pattern of sample chickpea growers is presented in table 4.3.

Table: 4.3 Land utilization and irrigation pattern of sample chickpea growers.
(Hectare Per farm)

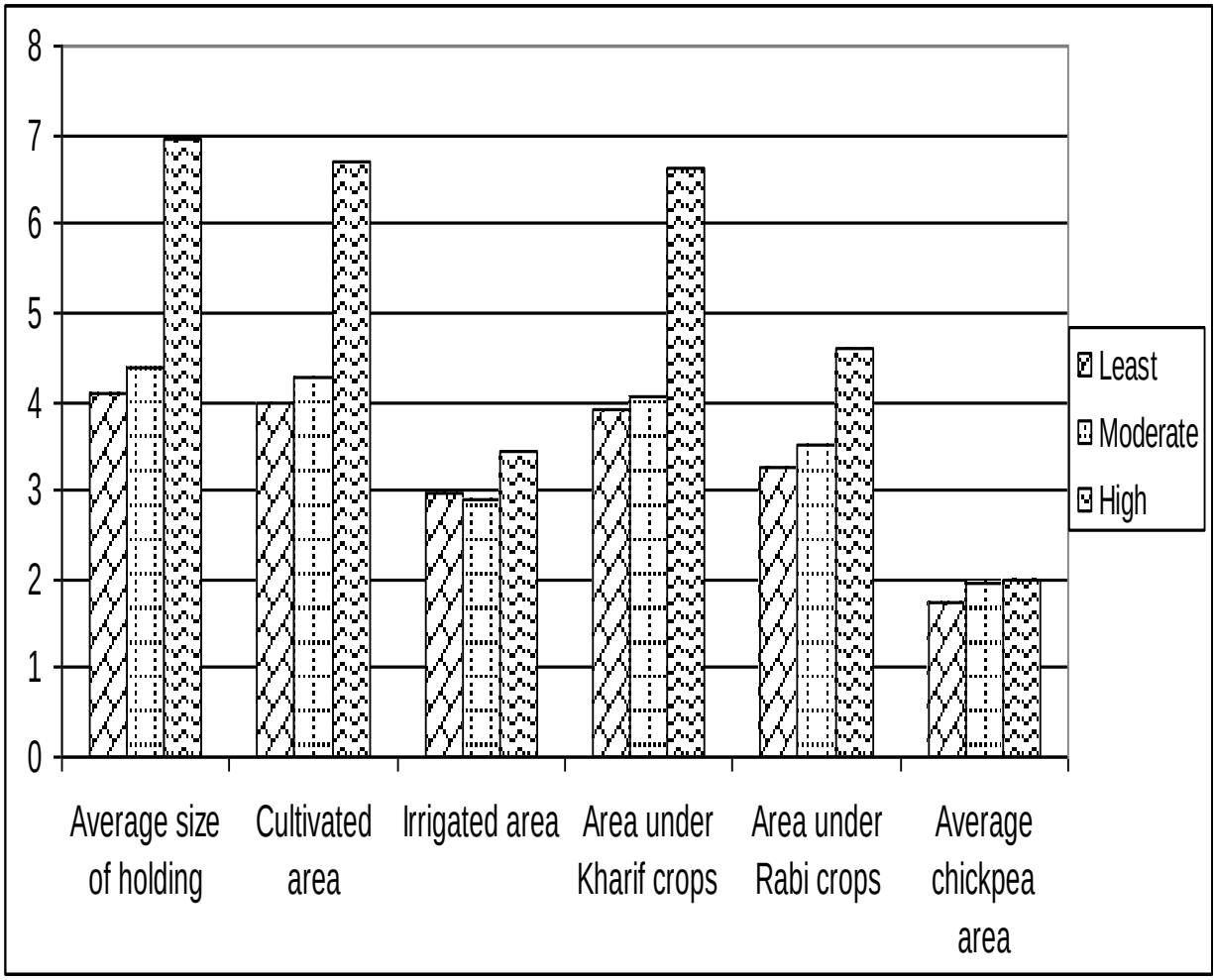
S.No.	Land use pattern	Level of adoption		
		Least	Moderate	High
1.	Average size of holding	4.09	4.38	6.95
2.	Area under other use	0.12	0.11	0.26
3.	Cultivated area	3.97	4.27	6.69
4.	Irrigated area	2.96	2.91	3.45
5.	Percentage irrigated area to cultivated area	74.56	68.15	51.57
6.	Area under Kharif crops	3.91	4.06	6.63
7.	Area under Rabi crops	3.26	3.52	4.60
8.	Gross cropped area	7.17	7.58	11.23
9.	Average chickpea area	1.72	1.97	2.00
10.	Percentage chickpea area to rabi area	52.76	55.97	43.48

As observed from the data, the average size of farm holding was found to 4.09 hectares with “least adopter” chickpea growers per farm, among them 0.12 hectare was under other use and remaining 3.97 hectares per farm was under cultivation. The average size of farm holding was found to 4.38 hectares with “moderate adopter” chickpea growers per farm, among them 0.11 hectare was under other use and remaining 4.27 hectares per farm was under cultivation. On the other hand, the average size of farm holding was found to 6.95 hectares with “high adopter” chickpea growers per farm, among them 0.26 hectare was under other use and remaining 6.69 hectares per farm was under cultivation.

Irrigation is compulsory for higher production of crops, particularly, in chickpea cultivation due to rabi season. The irrigated area as a percentage of cultivated area was found to on an average 75.56 per cent in “least adopter” chickpea grower’s farms followed by 68.15 per cent at “moderate adopters” farm and 51.57 per cent at “high adopter” farms, which shows unsatisfactory as per the irrigation availability in the area.

Chickpea is one of the important rabi pulse crop in the region. The higher percentage area under chickpea to rabi area found due to selection of predominant chickpea growing farmers in study. The average area under chickpea with “least adopter” farmers was found to 1.72 hectare per farm followed by 1.97 hectare with “moderate adopter” farmers and 2.00 hectare with “high adopter” farmers.

Fig:5: Land utilization and irrigation pattern of sample chickpea growers



ii) Fixed assets on the sample farm:

Fixed assets comprises the value of the fixed capital like land, farm building, implements, machinery and the value of miscellaneous assets which are presented in the table 4.4.

Table: 4.4 Fixed assets of sample chickpea growers.

(Rs. thousand per farm)

S.No.	Particulars of assets	Level of adoption		
		Least	Moderate	High
1.	Value of land	2044	2192	3615
2.	Farm building	40.74	54.43	122.86
3.	Irrigation structure	27.83	53.70	79.81
4.	Implements and machinery	16.66	45.08	55.25
5.	Minor implements and miscellaneous	5.85	8.70	8.28
6.	Bullock	14.55	15.19	17.96
7.	Total value excluding land	105.63	177.10	284.15

In general, the values of fixed farm assets determine the absolute farm production unit, which is invested during the past years. Among the total value of fixed capital, land is the costly assets out of all the farm assets. On an average total value of land in study area was found to be Rs.2044 thousand per farm in “least adopter” chickpea growers which is followed by Rs.2192 thousand per farm in “moderate adopter” chickpea growers and Rs.3615 thousand per farm in “high adopter” chickpea growers.

The total value of fixed assets excluding land is important for farmers to know the level of improved farm practices adopted by them. The total value of fixed assets excluding land was found to lowest in least adopter chickpea growers i.e. Rs.105.63 thousand per farm followed by Rs.177.10 thousand per farm with moderate adopter chickpea growers and Rs.284.15 thousand per farm with high adopter chickpea growers respectively.

4.2 Different adoption levels of chickpea production technology:

In general, the aim of agricultural economist is, to reduce the marginal cost of input for getting the maximum profit with the use of improved production technology. This can occur either by employing (adoption) the existing inputs but in different composition (a change in package of practices as per the recommendation) or by introducing new factors of production either for replacing old ones or simply as additional inputs (technological innovation). Chickpea being an important commercial crop and capital intensive production process requires a judicious decision in the investment. Because, maximization of profit with changing improved technology and yield effect are the main aim of the farmers to achieve the goal. In the present study, to find out the impact of technology on yield and production profitability, the different level of improved chickpea production technology was assessed at field level.

Table 4.5 represents the main components of technological process or technological status at farm level of chickpea production in study area.

Table: 4.5 Technological status at farm level of chickpea production.

(Adoption index)

S.No.	Component of technology	Level of adoption (%)			
		Least	Moderate	High	Average
1.	**High yielding variety seed for specific area based Gourav, JG-16, JAKI-9218**	**62.96**	**75.93**	**92.18**	**77.02**
2.	**Sowing method (Spacing 30 to 10 cm)**	**82.69**	**82.78**	**94.30**	**86.59**
3.	**Seed treatment (Benomil + Thirum (1:1) @ 3 g/kg)**	**25.00**	**68.03**	**91.01**	**61.35**
4.	**Inoculation with Rhizobium and PSB cultures (@ 5g/kg seed each).**	**65.28**	**81.75**	**88.89**	**78.64**
5.	**Fertilizer application (NPK) 30:50:40**	51.52	87.01	92.93	**77.15**
6.	**Interculture operations as per specific needs**	32.41	64.55	90.53	**62.50**
7.	**Insect-pest control as recommended (Imidacloprid 17.8%SL)**	55.21	62.50	90.28	**69.33**
8.	**Disease control (Dythen M 45, 0.3% solution**	**64.29**	**67.35**	86.24	**72.63**
9.	**Irrigation (2 time)**	**56.67**	**51.90**	**87.41**	**65.33**
10.	Overall technology	57.21	72.34	90.93	**73.49**

For effective planning of transfer of recommended technology to the chickpea growers, it is not only required to assess the adoption pattern of the production technology, but also necessary to assess the level of adoption of each components of technology on the farm level. The data depicted that on average chickpea growers adopted only 73.49 per cent of recommended chickpea production technology at farm level. In the study, all the selected chickpea growers were divided into three groups as per their levels of adoption of chickpea production technology. According to this adoption scale, the “least adoption” level of technology (least adoption level i.e. upto 60.00%) chickpea growers adopted overall 57.21 per cent of recommended technology followed by “moderate adoption” level chickpea growers (more than 60.00%-75.00%) adopted overall 72.34 per cent of recommended technology and “high adoption” level chickpea growers (more than 75.00%) adopted overall 90.93 per cent of recommended technology. The detail of components wise technological status is identified as below:

High yielding variety seed:

As per the chickpea scientists, for best results the farmers should use new pure seed every few years, particularly in case of chickpea production to get higher yield and net income. In the area the Gourav, JG-16, JAKI-9218 are common chickpea variety are recommended by the agricultural scientist. Many researches' results indicated that about 2.00 per cent yield of chickpea reduced after 2nd year and it simultaneously reduced by 3.00 to 5.00 per cent and 5.00 to 7.00 per cent after 3rd and 4th years. Agricultural scientists suggested that for higher production it is essential that seeds used should be of proven quality and recommended as high yielding. It was observed during study that some of the farmers were reluctant to buy expensive quality seeds and they used seed or managed from other sources which were not reliable. The data depicted that on an average chickpea growers adopted only 77.02 per cent of "high yielding variety seed for specific area based" in cultivation of chickpea. According to adoption scale, the high level of adopters adopted maximum level of "high yielding variety" (92.18 per cent) followed by moderate adoption level chickpea growers adopted 75.93 per cent and least adoption level chickpea growers adopted 62.96 per cent of "high yielding variety" seed on their farm as per specific area based recommendation .

Sowing method:

For proper germination and total plant population existence in per unit of area, adoption of recommended sowing method is essential to get higher yield. The data depicted that on average chickpea growers adopted only 86.59 per cent of "sowing method" in cultivation of chickpea. According to adoption scale, the high level of adopters chickpea growers adopted maximum level of "sowing method" 94.30 per cent followed by moderate adoption level chickpea growers adopted 82.78 per cent and least adoption level chickpea growers adopted 82.69 per cent of "sowing method" on their farm as per recommendation.

Seed treatment:

Another problem that has also attracted attention is the fungicide seed treatment. Fungicides and other recommendation for chickpea seed treatment in Madhya Pradesh is "Seed treatment (Benomil + Thirum (1:1) @ 3 g/kg)". The data depicted that on average chickpea growers adopted only 61.35 per cent of "fungicide seed treatment" in cultivation of chickpea. According to adoption scale, the high level

of adopters chickpea growers adopted maximum level of “fungicide seed treatment” 91.01 per cent followed by moderate adoption level chickpea growers adopted 68.03 per cent and least adoption level chickpea growers adopted 25.00 per cent of “fungicide seed treatment” on their farm as per recommendation.

Inoculation with Rhizobium and PSB cultures:

Culture is a best low cost technology source for fertility improvement at farm level. The culture recommendation for chickpea seed inoculation in Madhya Pradesh is “Inoculation with Rhizobium and PSB cultures @ 5g/kg seed each”. The data depicted that on average chickpea growers adopted only 78.64 per cent of “culture inoculation” in cultivation of chickpea. According to adoption scale, the high level of adopters chickpea growers adopted maximum level of “culture inoculation” 88.89 per cent followed by moderate adoption level chickpea growers adopted 81.75 per cent and least adoption level chickpea growers adopted 65.28 per cent of “culture inoculation” on their farm as per recommendation.

Fertilizer application:

With the introduction of high yielding variety the use of chemical fertilizers has increased considerably. The use of chemical fertilizer was found to be a common practice amongst the chickpea growers in the area, but the lacunae lies in using inadequate doses of N.P.K. per unit of area. The data depicted that on average chickpea growers adopted only 77.15 per cent of “fertilizer application” in cultivation of chickpea. According to adoption scale, the high level of adopters chickpea growers adopted maximum level of “fertilizer application” to the extent of 92.93 per cent followed by moderate adoption level chickpea growers adopted 87.01 per cent and least adoption level chickpea growers adopted 51.52 per cent of “fertilizer application” on their farm as per recommendation.

Interculture operations:

Improved agronomical practices are must to reap the highest production at farm level. Weed is the common problem in chickpea production. On the other hand, increase soil aeration is one of the important agronomical practices. For this process interculture operations are conducting by farmers. The data depicted that on average chickpea growers adopted only 62.50 per cent of “interculture operations as per specific needs” in cultivation of chickpea. According to adoption scale, the high level of adopters chickpea growers adopted maximum level of “interculture operations as per specific needs” to the extent of 90.53 per cent followed by moderate adoption

level chickpea growers adopted 64.55 per cent and least adoption level chickpea growers adopted 32.41 per cent of “interculture operations as per specific needs” on their farm as per recommendation.

Insect pest control:

Recommended plant protection measures should be used and haphazard use of insecticides and pesticides should be avoided to get the optimum yield. But the study revealed that there was low adoption of plant protection measures by the chickpea producers, while insect is a common problem in chickpea. The data depicted that on average chickpea growers adopted only 69.33 per cent of “insect pest control” in cultivation of chickpea. According to adoption scale, the high level of adopters chickpea growers adopted maximum level of “insect pest control” i.e. 90.28 per cent followed by moderate adoption level chickpea growers adopted 62.50 per cent and least adoption level chickpea growers adopted 55.21 per cent of “insect pest control” on their farm as per recommendation.

Disease control:

Recommended disease control measures should be used for optimum yield level. The data depicted that on average chickpea growers adopted only 72.63 per cent of “disease control measures” in cultivation of chickpea. According to adoption scale, the high level of adopters chickpea growers adopted maximum level of “disease control measures” i.e. 86.24 per cent followed by moderate adoption level chickpea growers adopted 67.35 per cent and least adoption level chickpea growers adopted 64.29 per cent of “disease control measures” on their farm as per recommendation.

Irrigation practices:

Chickpea is a rabi crop and irrigation facilities are must during crop period due to unavailability of soil moisture during crop stage. The data depicted that on average chickpea growers adopted only 65.33 per cent of “irrigation practices” in cultivation of chickpea. According to adoption scale, the high level of adopters chickpea growers adopted maximum level of “irrigation practices” i.e. 87.41 per cent followed by moderate adoption level chickpea growers adopted 51.90 per cent and least adoption level chickpea growers adopted 56.67 per cent of “irrigation practices” on their farm as per recommendation.

4.2 Extent of yield gap:

The actual farm yield needs to be compared under different situations to be of more use for decision making. The most widely used term ‘potential’ yield is defined as the yield of chickpea which is obtainable on demonstration fields under farmers environments with the use of modern and recommended production inputs and practices giving maximum yield. In the present study potential yield is treated as the yield realized by farmers through demonstrations laid by agricultural scientists by Zonal Research Station Khargone. The result of demonstration depicted that average yield on demonstration field with use of improved and recommended production practices was on an average 16.00 q/ha (ranging from minimum 14.62 to 17.00 q/ha). The difference between the potential farm yield and the average farm yield in different situation of technological status may be called as the yield gaps which are considered in the present study. The table 4.5 revealed quantification of yield gap between potential (demonstration farm) and actual farm situation (average farm) yield with different technological status.

In the study following yield gaps were considered:

Gap I: Between demonstration farms and progressive farms.

Gap II: Between progressive farms and average farmers practices.

Gap III: Between progressive farmers’ practices and least adopted farmers’ practices.

Table: 4.6 Average yield of chickpea under different situation.

S.No.	Situation	Yield (Q./Ha.)	Termed as	Remarks
1.	Assured input supply (demonstration farm)	16.00	Attainable	Supply of recommended yield attributing inputs assured, improved practices and farmers management.
2.	High adoption package of practices, (progressive farm)	13.74	Technological practices	Farmers own resources with recommended use of yield attributing inputs and management with normal practices followed by progressive farmers in the area.
3.	Farm used own practices (moderate average in the area)	12.15	General farm practices	Farmers own resources with own practices and moderate use of improved inputs.
4.	Poor farm practices (traditional/least practices)	11.00	Poor farm practices	Farmers own resources with least practices and meager use of improved inputs.
5.	Average yield	12.30		

It is observed that the yield obtained in demonstration field was the highest 16.00 q/ha, while the average yield of chickpea was found to be 12.30 q/ha. The higher yield can be achieved by general farm condition also as demonstration was laid on farmers' field situation but in the supply of recommended yield attributing inputs assured and high management practices. From a compression among the yields between general farm conditions found to vary. The progressive or high adoption package of practices farms realized yield on an average 13.74 q/ha. followed by moderate adoption farmers realized yield on an average 12.15 q/ha. and least adoption farmers realized yield on an average 11.00 q/ha. This yield variation was due to adoption of different level of improved production technology. Hence, study has given clear cut idea that with the fill-up of the gap in adoption of improved

production technology one can reduce the yield gap also. In nut shell, it is concluded that the yield of chickpea positively increase with the increase of level of technology.

The quantification of yield gap between potential farm and general farm in the area can be revealed in table 4.7.

Table: 4.7 Magnitude of yield gap in chickpea production with different level of technological status.

S.No.	Situation	Extant of gap		Contributing factors
		Q/Ha.	%	
1.	Attainable yield (Potential yield)	--	--	Best Management and resource used
2.	Demonstration farms and progressive farms (Feasible yield)	2.26	16.45	Resource knowledge and high adoption of improved production technology
3.	Progressive farms and moderate average farmers practices	1.59	13.10	Moderate adoption by general farmer In area
4.	Progressive farmer and least adopter farmers practices	2.74	24.91	Traditional practices Poor yield
5.	Overall average	2.20	18.15	Average yield gap

It is indicated by the data that there exists a reservoir of untapped yield potential of chickpea in the area. The contributing factors as derived in the study show that nearly 16.45 per cent yield of the progressive farmers can be increased merely by improved management practices and with use of judicious chickpea improved yield attributing inputs like demonstrations' fields. The study also revealed that with the use of improved production inputs; the general "moderate adopter" farmers in the area can get additional average yield by 13.10 per cent as the progressive farms which are feasible in the area as actual yield gap. Traditional farmers (least adopter) also can increase their yield upto 24.91 per cent with the use of improved management practices as progressive farmers are practicing in the area.

From comparison of the chickpea yield realized by different situation of technical status in the area, it may be concluded small and poor farmers with use of

traditional production practices recorded the lowest yield (11.00q/ha.). On the other hand, the demonstration yield which can be attainable by general farmers recorded the highest yield (16.00q/ha.). The study also revealed that the yield of chickpea found to increase with the higher use of technological level. The yield gap was of the range from 1.59 q/ha to 2.74 q/ha in chickpea cultivation which can be realized by farmers through the use of proper management of resources and adoption of improved practices on their farms.

4.4 Profitability of chickpea production at different adoption levels:

The main aim of agricultural economists and planners is to make the agriculture as a profitable enterprise. Estimation of profitability from chickpea production different monetary aspects are determine as input utilization pattern, cost of cultivation and return realized by producers in chickpea production.

i) Input utilization pattern:

The resource use pattern of chickpea growers indicates the degree of resource management, their choice and decision-making in selection among different alternative resources to get maximum profit. Besides the above, it also indicates the adoption level of technology by the farmers in chickpea cultivation. Labour utilization (Human, bullock, and machine), seed, manures and fertilizers, plant protection measures, irrigation and other cost were the basic resources used in chickpea production process. Hence, in present study, these factors were considered in adoption of improved chickpea technology. The details regarding utilization pattern of resources in chickpea production with different level of technological utilization pattern are presented in table 4.8.

Table: 4.8 Input utilization patterns in chickpea production by different technological status.

Input utilization	Level of Adoption (per farm)			Level of Adoption (per hectare)		
	Least	Moderate	High	Least	Moderate	High
Area under chickpea	**1.72**	**1.97**	**2.00**	**1.00**	**1.00**	**1.00**
Human labour (days)	**-**	**-**	**-**	**-**	**-**	**-**
Hired	**5**	**36**	**34**	**3**	**18**	**17**
Family	**105**	**87**	**100**	**61**	**44**	**50**
Total	**110**	**123**	**134**	**64**	**63**	**67**
Bullock pair (days)	**11**	**12**	**14**	**6**	**6**	**7**
Machinery (hours)	**6**	**8**	**12**	**4**	**4**	**6**
Seed + treatment (Rs.)	**4869**	**6380**	**6599**	**2847**	**3238**	**3300**
Manure+ Fertilizer (Rs.)	**2936**	**4570**	**4887**	**1707**	**2320**	**2443**
Plant protection (Rs.)	**748**	**2124**	**2400**	**435**	**1078**	**1200**
Irrigation charges (Rs.)	**973**	**1280**	**1551**	**566**	**650**	**775**
Other (Rs.)	**2291**	**2865**	**3487**	**1332**	**1455**	**1744**

To measure the utilization level of package of practices for chickpea cultivation, many studies recommended a best way of analysis i.e. expenditure on particular components of technology utilized on a unit area. The expenditure incurred on particular component of technology shows its quality as well as quantity. Therefore, this expenditure method of analysis of input utilization was adopted to analyse the cost of production per unit of area of chickpea at different levels of input utilization.

The table 4.8 depicted that among the total human labour required for cultivation of a hectare of chickpea on different technological status, the higher number was accounted by family labour followed by hired labour. The study also showed that the hired labour was found to maximum with high level of technological adoption.

The per hectare basis total labour requirement found to be maximum (67 days/hectare) in case of "high adoption level" followed by minimum (63 days/hectare) in case of "moderate adoption" level and (64 days/hectare) in case of "least adoption" level . All the farmers used higher bullock labour and lower of machine hours for cultivation of chickpea per hectare.

The expenditure on seed and seed treatment, manure + fertilizer, plant protection measure and irrigation charges required for a hectare of chickpea cultivation with different technological status found to increase with increase in adoption level of technology.

ii) Cost of cultivation:

The most important objective of present study is to analyse the comparative economics of improved chickpea production technology with different technological status. The economics of production may be analyzed with the help of cost and return concepts. In the study, these two concepts are used to find out the economic level of chickpea production through different technological status. The cost of cultivation incurred in chickpea production with different technological status is presented in table 4.9.

Table: 4.9 Cost of cultivation of chickpea in different level of technology.

(Rs/ha)

S.No.	Cost particulars	Level of Adoption		
		Least	**Moderate**	**High**
1.	Hired human labour	480	2880	2720
2.	Bullock labour	2100	2100	2450
3.	Machine power	2400	2400	3600
4.	Seed + treatment	2847	3238	3300
5.	Manure + Fertilizer	1707	2320	2443
6.	Plant protection	435	1078	1200
7.	Irrigation charges	566	650	775
8.	Other costs	1332	1455	1744
9.	Interest on working capital	198	269	304
10.	Depreciation	430	674	681
11.	Land revenue	106	110	110
	Cost-A_1	**12601**	**17174**	**19327**
12.	Interest on fixed capital	43	67	68
	Cost-B_1	**12644**	**17241**	**19395**
13.	Rental value of land	4000	4000	4000
	Cost-B_2	**16644**	**21241**	**23395**
14.	Imputed value of family labour	9760	7040	8000
	Cost-C_1	**22404**	**24281**	**27395**
	Cost-C_2	**26404**	**28281**	**31395**
	Cost-C_3	**29044**	**31109**	**34535**

On the basis of different cost concepts, the cost of cultivation of chickpea for different level of technology was analyzed. The data on cost of cultivation per hectare on sample holding determine that on an average the cost was found to highest in case of “high adoption” level of technology due to higher use of yield attributing inputs and its practices. On the other hand, the cost of cultivation per hectare decreases with “lower technological adoption level”.

The cost A_1 which is the actual farm investment made by chickpea growers is more important in analysis of cost of cultivation. The study revealed that the average cost A_1 on “high adoption” technological level of farms accounted to Rs.19327 per hectare followed by Rs.17174 and Rs.12601 on “moderate and least adoption” technological level farms respectively. The study indicated that the cost A_1 found to increases with increasing level of technological adoption. This increasing trend was due to higher use of yield attributing inputs and practices by progressive farms. Cost A_2 was not considered in the study because chickpea growers cultivated their own land.

In case of cost B_1 and cost B_2, these cost of cultivation found to higher in high adoption level farms and decreasing with low level of technological use.

The total cost estimates i.e. cost C_1, C_2 and C_3 based on the imputed values of family labour would give an unrealistic and even misleading picture of costs. It is attributable to the fact that chickpea growers try to minimize only out of pocket expenses of cultivation and that by and large, they make maximum use of resources they own, but it is also not justifiable to take into account only paid out costs. To determine the cost structure cost C_1, C_2 and C_3 were also analyzed in the present study.

It is revealed that the average Cost C_3 of chickpea cultivation was found to highest on the farm adopted “high level of production technology” accounted Rs.34535 per hectare followed by “moderate adoption” level farms Rs.31109 and “least adoption” level farms Rs.29044 per hectare respectively. This shows that cost C_3 was found increase with increasing adoption level of technology and it was due to higher use of yield attributing inputs and its practices with increasing level of technology.

iii) Returns:

The returns from chickpea production with using different level of technology were analyzed. The returns were mainly concerned rupees per hectare realized by

chickpea growers in the form of gross returns, net profit, family labour income, farm business income and B.C.ratio. For this purpose, the profitability of chickpea per hectare at different adoption level of improved production technology was analyzed and is presented in table 4.10.

Table: 4.10 Returns and profitability of chickpea production through different technological status. **(Rs/ha)**

S.No.	Cost particulars	Level of Adoption		
		Least	Moderate	High
1.	Cost-C_3	29044	31109	34535
2.	Gross income (Rs.)	33989	36928	41730
3.	Net income	4945	5819	7195
4.	Family labour income	17345	15687	18335
5.	Farm business income	21388	19754	22403
6.	B.C. Ratio	1.17	1.19	1.21

The market price of chickpea per quintal received by different farmers found to vary. It was due to size of marketing cost, time of selling and quality of produce which made differences on total gross return, accordingly. The gross income on “high adoption” level of farms was found to be highest accounting Rs.41730 per hectare due to higher farm yield. The gross income was accounted Rs.36928 per hectare on “moderate adoption” level farm and Rs.33989 on “least adoption” level farms respectively.

The net income is real profit for which farmers are interested to realize as highest as possible. The study reveals that the highest net income Rs.7195 per hectare was realized by chickpea growers when they adopted “high level of chickpea production technology”. On the other hand, the “moderate and least adoption of technological status” chickpea growers realized Rs.5819 and Rs.4945 per hectare as net profit from chickpea cultivation.

The other measurement of farm profit like family labour income was found to be highest in case of “high adoption” technological farm, accounted Rs.18335 followed by Rs.17345 and Rs.15687 by farmers of “least and moderate adoption technological status”.

Farm business income is also important profitability measurement and it is depicted that the farm business income was found to be highest in case of “high adoption technological” farms which was accounted Rs.22403 followed by Rs.21388

and Rs.19754 by the farmers of “least and moderate adoption of technological status”.

The benefit over per rupee investment also found to highest i.e. 1.21 on “high level of adoption” farms followed by 1.19 and 1.17 in case of “moderate and least adoption of technological status” farms respectively.

It is concluded that the highest profit from chickpea production per unit of area was realized with use of high level of recommended production technology on judicious level and management. The study also revealed that the high technological adoption level of progressive farmers realized highest net income, family labour income, farm business income and return over per rupee investment. On the other hand, the moderate adoption level farmers realized medium of net income but lowest of family labour income and farm business income due to injudicious use of yield attributing inputs and lower farm management efficiency. Although the least technological adopters’ farmers are incapable to realize economic return from their production process but they get better family labour income over moderate farmers due to higher use of family labour.

4.5 Constraints responsible for the existing yield gap.

As observed in study that in general the productivity of chickpea is low as compared to high potential yield existed in the area. This yield gap could be due to various reasons which have to be identified to make strategy for improvement in chickpea production and to reap the optimum profit. The various constraints confronted by chickpea growers in the study area regarding existing yield gap and non adoption of improved chickpea production technology the same are presented in table 4.11.

Table: 4.11 Production constraints identified by chickpea growers for existing yield gap.

S.No.	Constraints	Frequency N=60	%	Rank
A.	**Biological constraints**			
1.	Non adoption of high yielding varieties.	**32**	**53.33**	**ivth**
2.	Weed infestation	**20**	**33.33**	**viith**
3.	Incidence of insect pests	**45**	**75.00***	**ist**
4.	Incidence of diseases	**25**	**41.67**	**vith**
5.	Water management	**29**	**48.33**	**vth**
6.	Amount of rainfall received	**38**	**63.33***	**iind**
7.	Soil fertility variation	**35**	**58.33***	**iiird**
	Average	**32**	**53.33**	
B.	**Socio economic and technological constraints**			
1.	Lack of own funds	**38**	**63.33***	**ivth**
2.	Lack of credit facilities	**15**	**25.00**	**xth**
3.	Traditional belief	**20**	**33.33**	**ixth**
4.	High cost of inputs	**43**	**71.67***	**ist**
5.	Lack of technical knowledge	**40**	**66.67***	**iind**
6.	Non availability of inputs in time	**37**	**61.67***	**vth**
7.	Non interested to high investment	**30**	**50.00**	**viith**
8.	Lack of trained skilled labour	**33**	**55.00***	**vith**
9.	Lack of training and guidance	**25**	**41.67**	**viiith**
10.	Continued crop failure	**39**	**65.00***	**iiird**
	Average	**32**	**53.33**	

***higher than average value**

The constraints confronted by chickpea growers in yield gap was due to mainly biological constraint and non adoption of improved chickpea production technology due to socio economic and technological constraint on their farm as partial level or non judicious level of input utilization were considered into two groups i.e. “biological constraints” and “socio economic and technological constraint”.

A. Biological constraints:

Agricultural production is related with biological science since plants being living organisms. Hence, Agricultural production is not a smooth and continuous process; it bristles with a number of biological hurdles. Agricultural production depends on so many biological factors among them few are discussed as follows:

Incidence of insect pest and diseases:

Higher damage due to insect, pest and diseases is one of the important constraints caused lower yield. It has been observed that mostly farmers do not control diseases and pest and seldom practice seed treatment. “Incidence of insect pests” and “incidence of disease” were problems in existing yield gap in chickpea which was confronted by 75.00 per cent and 41.67 per cent of the total chickpea growers. Data indicated that chickpea production suffers maximum from insect pest and lowest due to diseases.

Amount of rainfall received:

Chickpea is a rabi season crop hence, need more irrigation. The irrigation requirement also depends on the amount of rainfall received during the rainy season. The availability of adequate moisture at crucial stage depends upon “amount of rainfall received”. In past few years the rainfall was a problem as it exhibited erratic behaviour and this problem are confronted by 63.33 per cent of the total chickpea growers confronted this problem.

Soil fertility variation:

To reduce the yield gap, it is imperative that the suitability of the soil for a particular crop has to be carefully determined. Depending on the size of the cultivation unit, it is necessary to draw a soil map of the area which include the soil characteristics of surface soil and sub soil with specific production package programme. On the basis of the soil fertility there may be possibility of changing the cropping pattern to the one which is more adoptable from the stand points of soil fertility. “Soil fertility variation” is also one of the constraints for existing yield gap as confronted by 58.33 per cent of the total chickpea growers.

Non adoption of high yielding varieties:

The most outstanding achievement of modern agriculture including chickpea production is the production of improved varieties of seeds. With successful evolution of high yielding varieties of chickpea, new vistas were opened for the attainment of high chickpea production. “Non adoption of high yielding varieties” recommended for area is also one of the constraints for existing yield gap as confronted by 53.33 per cent of the total chickpea growers.

Water management:

Soil moisture is a precondition for higher yield. The water management

process solves a considerable proportion of moisture losses from soil. “Water management” is also one of the constraints for existing yield gap as confronted by 48.33 per cent of the total chickpea growers.

Weed infestation:

Weeds are one of the problems because they are competing with plants for their existence which caused yield gap. “Weed infestation” problem for existing yield gap as confronted by 33.33 per cent of the total chickpea growers.

B. Socio economic and technological constraints:

These constraints are also having their own importance in non adoption of or injudicious use of improved production technology caused low yield or higher yield gap.

High cost of inputs:

“High cost of inputs” is the next important constraint confronted by 71.67 per cent of chickpea growers in the study area. Due to change in input market behaviour, the input cost per hectare becomes heavy for the farmers particularly when yield per hectare is low. Consequently farmers are either using low inputs against recommendation or they are reluctant to buy expensive quality inputs.

Lack of technical knowledge:

“Lack of technical knowledge” is one of the important constraints confronted by 66.67 per cent of chickpea growers in the study area. Knowledge is the part of a person’s information, which is in accordance with established fact. Low knowledge is due to extension gap in the area. This extension gap is contributing to the existing yield gap. Adequate extension staff at field level to make farmers more aware of latest technology is suggested by farmers.

Continued crop failure:

“Continued crop failure” is one of the important constraint confronted by 65.00 per cent of chickpea growers in the study area. Chickpea production totally depends upon nature in the form of climatic condition, rainfall condition, insect pest infestation and other natural hazards. It has been observed that from many years’ chickpea crop was being damaged due to these uncertainties. It is also observed that to a great extent, production of chickpea dependent on weather cycle, there are periods of low production or lean periods, followed by good crops.

Lack of own funds:

“Lack of own fund” is one of the important constraints confronted by 63.33 per

cent of chickpea growers in the study area. In general farmers are with poor socio economic condition. Hence, availability of credit is next source of fund. Short term credit should be provided easily with low interest rate which is of paramount importance for adoption of capital intensive technology.

Non availability of inputs in time:

"Non availability of inputs in time" is one of the important constraints confronted by 61.67 per cent of chickpea growers in the study area. Timely supply of inputs is one of the important responsibilities of development agencies in the area, but it is commonly noticed now a days that the farmers are suffering due to lack of availability of improved seeds, fertilizers and proper insecticides and pesticides. The delay in availability of inputs causes delay in agricultural operations which in turn reduces the yield.

Lack of trained skilled labour:

"Lack of trained skilled labour" is important constraints confronted by 55.00 per cent of chickpea growers in the study area. Generally farmers have great experience in proper utilization practices of yield attributing inputs on the farms. Some times they required hired labour for application of these inputs. In the case some times skilled labour is not available in agricultural area because the literate labour is engaged in near by cities for other works.

Non interested to high investment:

"Non interested to high investment" is one of the important constraints confronted by 50.00 per cent of chickpea growers in the study area. Chickpea is capital intensive cash pulse crop and it requires higher investment to fulfill the needed technology. Some of the farmers are not interested to invest additional money due to risk point of view.

Lack of training and guidance:

"Lack of training and guidance" is one of the important constraints confronted by 41.67 per cent of chickpea growers in the study area. Agricultural extension is an important source of transferring technology. Again, in extension activities training and guidance are a way by which the confidence of farmers can be increased regarding proper utilization of improved technology. Though, it is good in some part of the state, adequate in others while very poor in remaining including the study area. Some times production suffers due to inadequate and/or poor quality of seed,

pesticides, fertilizers, rhyzobium etc.

Traditional belief:

"Traditional belief" is one of the important constraints confronted by 33.33 per cent of chickpea growers in the study area. The traditional belief can be overcome by execution of extension method "seeing and believing". More demonstrations are suggested on scientific lines so that more farmers will be convinced to adopt the latest technology which is a prerequisite for higher productivity.

Lack of credit facilities:

"Lack of credit facilities" is least important constraints confronted by only 25.00 per cent of chickpea growers in the study area. Short term credit is very essential especially to poor resource endowed farmers to adopt the improved production technology.

4.6 Suggestions for reducing yield gap.

The suggestions are reported on the basis on opinion survey conducted by chickpea growers. The details of suggestions are presented in table 4.12.

Table: 4.12 Suggestion confronted by chickpea growers for increasing production.

S.No.	Suggestions	Frequency N=60	%	Rank
1.	More demonstrations	40	66.67	iind
2.	Subsidized supply of inputs	42	70.00	ist
3.	Timely supply of inputs	30	50.00	vth
4.	Availability of crop production and marketing credit at low rate	20	33.33	viith
5.	Availability of technical help in greater degree	18	30.00	viiith
6.	Organization of the marketing of produce	38	63.33	iiird
7.	There should be facilities for soil testing	35	58.33	ivth
8.	Recommended seed variety should be available at local level	28	46.67	vith
9.	Overall average	31	52.29	

*** higher than average value**

In present study the suggestions made by chickpea growers are divided into two groups as per the seriousness of the problems i.e. the suggestions contains higher

frequency than average value and remaining had lower frequency value than average.

The suggestions contain higher frequency than average value:

"Subsidized supply of inputs" was suggested by 70.00 per cent of chickpea growers. Majority of farmers want subsidized supply of inputs. This impression is more in case of small and poor farmers. The inputs like seeds, fertilizers and pesticides are essential in production process, which are not adequately available with poor farmers.

"More demonstrations" was suggested by 66.67 per cent of chickpea growers. Extension activities are the important factors for enhancing the knowledge regarding use of improved technology. Demonstration is best extension method (seeing and believing), hence, more demonstration are suggested by farmers.

A good majority of the farmers (63.33%) want "organization of the marketing of produce". Proper marketing is one of the ways to assure remunerative price to farmers.

"There should be facilities for soil testing" was suggested by 58.33 per cent of the chickpea growers. Now day's agricultural scientists convince the farmers the need for soil testing. In order to have comprehensive information regarding quantity and type of fertilizer that is needed in various soil type for optimum production, soil testing is must.

The suggestions contain lower than average frequency value

"Timely supply of inputs" was suggested by 50.00 per cent of the chickpea growers. This feeling is more with farmers who are incapable to purchase the inputs from market. The delay in availability of inputs causes delay in agricultural operations which in turn reduces the yield.

"Recommended seed variety should be available at local level" was suggested by 46.67 per cent of the chickpea growers. There are very few good varieties of chickpea available suitable for the area in respect of higher yields. Use of specific varieties must be followed scrupulously in order to increase yield, reduced cost on disease/pest control, slow down the spread of disease/pest. Hence, these suitable varieties should be available at local level as suggested by chickpea growers.

"Availability of crop production and marketing credit at low rate" was suggested by 33.33 per cent of the chickpea growers. This is due to the fact that

farmers are in general poor and need money for their family purpose. Hence, they can not afford to do additional expenditure on production and marketing.

“Availability of technical help in greater degree” was suggested by 30.00 per cent of the chickpea growers. Nature and utilization pattern of inputs best suitable for production is complex in nature, needs technical help. On general farmers are with rural background and are technically poor. In this respect to enhance the benefits of technology, the farmers should be motivated with knowledge based extension activities.

CHAPTER - V

DISCUSSION

In the chapter of results, the data were analyzed, processed, prescribed and presented in the form as per the stated objectives. In this chapter the inference were make the research results purposeful and to draw broad conclusions of the study. It is also called the presentation of the findings of the result chapter. Therefore, it is important that the results of the study are presented clearly and meaningfully as per the objectives of the study.

It is well known fact that after our success on “household food security” we should strive for “household nutritional security”. Pulses are the major source of protein for the vegetarians. Pulses constitute an important component in Indian agriculture since centuries. The role of pulses in Indian Agriculture needs hardly any emphasis. The common pulse crops growing in Madhya Pradesh are chickpea, lentil, pea and rajma during rabi season. Chickpea is commonly known as gram which is one of the important pulse crops of the India. Chickpea is an important pulse crop in India. About 65% of global area with 68% of global production of chickpea is contributed by India. However, chickpea production in India is slow in post green revolution years due to strong competition from wheat, rice and mustard, as expansion in irrigation and rapid technological change has favoured the latter crops at the cost of chickpea. The recent liberalization has expanded the demand for chickpea from international markets in addition to the growing domestic demand. The share of Madhya Pradesh in area of chickpea as compared to the country is 43.2 per cent. Chickpea accounts for 61.99 per cent area and 40.52 per cent production of the total pulses. In Madhya Pradesh the area under chickpea has remarkably increased from 1495 thousand hectare in 1968-69 to more than 2900 thousand hectares in 2011-12. Similarly production has also increased from 726 thousand tones to more than 2800 thousand tones during the same period. The average yield of chickpea in the state found to more than 970 kg/hectare. These figures show the importance of chickpea cultivation and production in the state. Lacuna in chickpea production is that the yield level found to remain static from few years and the yield decreases with low adoption of improved production technology.

Along with low productivity and production of chickpea the problem is also

arising that the pattern of chickpea production has been changing over time in different regions and the changing situation is more where the farmers are not using judicious level of yield attributing inputs. Hence, it is necessary that we must aim to proper resource management and realized optimum yield.

The production pattern of chickpea also affected due to use of resource pattern, level of production technology and price factor of input and output respectively. It has been found in various studies that the yield of chickpea is directly influencing with level of technology used in production, or we can say that the influence of technology development in chickpea production and its adoption is augmenting regarding total production and productivity of chickpea is being recognized. However, wide gap prevails between the performance of technology at the progressive farmer's level and of the fields of general farmers. The question arising that "are investment on modern technology was proportionately enhanced the output and net return? needs investigation and verification in respective of chickpea growing area.

For effective planning of transfer of recommended technology to the chickpea growers, it is not only required to assess the adoption pattern of the production technology, but also necessary to assess the level of adoption of each components of technology on the farm level. The data depicted that on an average chickpea growers adopted only 73.49 per cent of recommended chickpea production technology at farm level. In the study, all the selected chickpea growers were divided into three groups as per their levels of adoption of chickpea production technology. According to this adoption scale, the "least adoption" level of technology (least adoption level i.e. upto 60.00%) chickpea growers adopted overall 57.21 per cent of recommended technology followed by "moderate adoption" level chickpea growers (more than 60.00%-75.00%) adopted overall 72.34 per cent of recommended technology and "high adoption" level chickpea growers (more than 75.00%) adopted overall 90.93 per cent of recommended technology.

Farmers are generally confronted with the problems of determining the profitability and productivity with increasing levels of variable inputs as recommended in improved production technology in the production process. Farmers are facing the problems of changing input –output prices. Stable equilibrium of cost and return is liable to change due to change in price parity between input and

output. The present study would be giving the information to the farmers on cost and returns from chickpea production to answer two questions. The first set of question is how profitable of chickpea production and the second one is how does the profitability of chickpea production vary with the use of different level of chickpea production of technology. The extension workers may use this study for advising the farmers to plan their resource use within the range of input–output prices, considered in the study for enhancing the profitability and adoption of recommended technology as best as possible. Similarly, policy makers can plan their policies regarding popularization of improved chickpea production technology in the study area and a broad for increasing average production of chickpea crop. Hence, this study lies in the fact that on the basis of economics of changing chickpea production technology the farmers will get maximum profit from there resource utilization and higher productivity, shows the relevance and importance of this study.

It is well known fact that the cost and returns analysis is the relevant tool where the prime motive of the activity is profit measured in terms of the measuring rod of money. Economist has for obvious reasons not developed suitable measures to evaluate costs, returns and profits in terms other than money. But for most chickpea growers the cost is the quantum and quality of the present consumption sacrificed and the return is the level of future consumption obtained. It is difficult to measure the limit of scarifies of chickpea growers with different technological status due to uncertain of immediate and long run goals of the farmers. Hence, in study only attempts was made measuring rod of money as profit from cultivation of chickpea with use of different technological status. In this way the researcher has under taken the usual economic exercises and present the cost – return and income analysis in terms of rupee of the sample farmers.

On the basis of different cost concepts, the cost of cultivation of chickpea for different level of technology was analyzed. The data on cost of cultivation per hectare on sample holding determine that on an average the cost was found to highest in case of “high adoption level of technology” due to higher use of yield attributing inputs and its practices. On the other hand, the cost of cultivation per hectare decreases with “lower technological adoption level”.

The returns from chickpea production with using different level of technology were analyzed. The returns were mainly concerned rupees per hectare realized by

chickpea growers in the form of gross returns, net profit, family labour income, farm business income and B.C.ratio. For this purpose, the profitability of chickpea per hectare at different adoption level of improved production technology was analyzed. The result inferred that the highest profit from chickpea production per unit of area was realized with use of high level of recommended production technology on judicious level and management. The study also revealed that the high technological adoption level of progressive farmers realized highest net income, family labour income, farm business income and return over per rupee investment. On the other hand, the moderate adoption level farmers realized medium of net income but lowest of family labour income and farm business income due to injudicious use of yield attributing inputs and lower farm management efficiency. Although the least technological adopters' farmers are incapable to realize economic return from their production process but they get better family labour income over moderate farmers due to higher use of family labour.

The actual farm yield needs to be compared under different situations to be of more use for decision making. The most widely used term 'potential' yield is defined as the yield of chickpea which is obtainable on demonstration fields under farmers environments with the use of modern and recommended production inputs and practices giving maximum yield. In the present study potential yield is treated as the yield realized by farmers through demonstrations laid by agricultural scientists. The result of demonstration depicted that average yield on demonstration field with use of improved and recommended production practices was on an average 16.00 q/ha (ranging from minimum 14.62 to 17.00 q/ha). The difference between the potential farm yield and the average farm yield in different situation of technological status may be called as the yield gaps which are considered in the present study. The table 4.5 revealed quantification of yield gap between potential (demonstration farm) and actual farm situation (average farm) yield with different technological status.

In the study following yield gaps were considered:

Gap I: Between demonstration farms and progressive farms.

Gap II: Between progressive farms and average farmers practices.

Gap III: Between progressive farmers' practices and least adopted farmers' practices.

It is observed that the yield obtained in demonstration field was the highest 16.00 q/ha, while the average yield of chickpea was found to be 12.30 q/ha. The higher yield can be achieved by general farm condition also as demonstration was laid on farmers' field situation but in the supply of recommended yield attributing inputs assured and high management practices. From a compression among the yields between general farm conditions found to vary. The progressive or high adoption package of practices farms realized yield on an average 13.74 q/ha. followed by moderate adoption farmers realized yield on an average 12.15 q/ha. and least adoption farmers realized yield on an average 11.00 q/ha. This yield variation was due to adoption of different level of improved production technology. Hence, study has given clear cut idea that with the fill-up of the gap in adoption of improved production technology one can reduce the yield gap also. In nut shell, it is concluded that the yield of chickpea positively increase with the increase of level of technology.

On the basis of discussion as above it can be concluded that the adoption of improved production technology has lagged far behind. The chickpea productivity could be increased in the area through the judicious use of improved inputs and practices for that purpose. On the other hand, the proper use of improved technology and improved practices of chickpea production need to be demonstrated. Hence, the extension worker and planner should be taken care on this point. It was revealed on the study that chickpea production required much higher initial investment. Hence, to reduce the risk aversion influence on productivity, an attractive crop insurance scheme needs to be implemented effectively in the area.

CHAPTER - VI

SUMMARY, CONCLUSIONS AND SUGGESTIONS

Summary:

After our success on “household food security” we should strive for “household nutritional security”. Pulses are the major source of protein for the vegetarians. Chickpea is commonly known as gram which is one of the major pulse crops of the India. The important Chickpea growing states in India are M.P., U.P., Maharashtra, Rajasthan, A.P, Bihar, and Orissa. Madhya Pradesh ranks first in India with respect to chickpea’s area and production. The share of Madhya Pradesh in area of chickpea as compared to the country is 43.2 per cent. Chickpea accounts for 61.99 per cent area and 40.52 per cent production of the total pulses in Madhya Pradesh. In Madhya Pradesh the area under chickpea has remarkably increased from 1495 thousand hectare in 1968-69 to more than 2900 thousand hectares in 2011-12. Similarly production has also increased from 726 thousand tones to more than 2800 thousand tones during the same period. The average yield of chickpea in the state found to more than 970 kg/hectare.

Many studies shows there are existed potential for increasing the productivity of chickpea with the proper and judicial use of improved production technology. There is question that whether improved production technology will give better returns to the cultivators in proportion to investment made on their farm. On the other hand, the use of differential technological status resulting yield gap in production process. This step needs a scientific evaluation of the extent of yield gap, the causes and constraints thereof. To get the optimum return in the benefit of farmers, it is also necessary to estimate the cost benefit ratio of chickpea production in different level of technological use. The specific objectives of study have been considered as below:

Objectives:

- To identify socio economic characteristics of chickpea growers in study area.
- To estimate the different adoption levels of chickpea production technology at existing farm situation.

- To assess the extent of yield gap at different adoption levels of chickpea production technology.
- To estimate the profitability of chickpea production at different adoption levels of production technology.
- To identify the constraints responsible for the existing yield gap in chickpea production.
- To suggest ways and means for reducing yield gap in chickpea production.

Khargone district of Madhya Pradesh has been selected for the purpose of this study because chickpea is one of the main rabi pulse crops in the region. For the study, three stage sampling technique was used for drawing the sample. Khargone district comprises of 9 blocks. At the first stage, Khargone block in Khargone district was selected purposively due to most suitable area for chickpea crop and well known for researcher. At the second stage, a list of important chickpea growing villages was prepared and among them 5 villages was selected randomly. At the third stage for the selection of respondents, a list of chickpea growing cultivators of each village was prepared and among them 60 farmers was selected randomly for the study. Thus, the sample was confined by 60 farmers form 5 villages in Khargone block of the district.

Depending upon the objectives of the study primary data was used. The primary data was collected from selected respondents using pre-tested questionnaire, through survey method. Each selected respondents was approached personally for recording relevant data. The data was collected for the Agricultural year 2013-2014.

The primary data regarding recommended chickpea production technology in respect of input use pattern, yield, cost, return and profitability, the data was collected from the office of Scientist in Zonal Research Station Khargone.

In respect of technological status at farm level, the selected chickpea growers were classified into three categories with respect to level of adoption (low, moderate and high). Having identified the number of farmers under each category the indices of adoption was calculated as under

$$\text{Adoption index (\%)} = \frac{\text{Adoption score obtained by respondent}}{\text{Possible maximum score}} \times 100$$

For yield gap analysis the potential farm yield was considered which is obtainable on a farmer's field with the adoption of recommended chickpea production technology. The difference between the potential farm yield and actual farm yield is termed as a yield gap. In present study to assess yield gaps on chickpea farms when compared to those of research station with high, medium and low adoption level of at farmer's field level.

Cost A_1 = All actual expenses in cash and kind incurred in production of chickpea by owner operator

Cost A_2 = Cost A_1 + rent paid for leased in land

Cost B_1 = Cost A_2 + interest on fixed capital (excluding land)

Cost B_2 = Cost B_1 + imputed rental value of owned land

Cost C_1 = Cost B_1 + imputed value of family labour

Cost C_2 = Cost B_2 + imputed value of family labour

Cost C_3 = Cost C_2 + 10% of Cost C_2 (As managerial cost)

For the estimation of profitability, the following income measures was used.

e) Net farm income (NFI) = Gross income – Cost C_3 (total cost)

f) Family labour income (FLI) = Gross income – Cost B_2

g) Farm business income (FBI) = Gross income –Cost A_1

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

The different aspects i.e. technological, production and financial constraints was considered to know the overall production constraints faced by the respondents in chickpea growing in study area.

Conclusion:

From the foregoing results it could be concluded as under:

1. The higher number of chickpea growers found to literate. The literacy position among the “least adopter” chickpea growers revealed the equal 50.00 per cent was literate. In case of “moderate adoption” chickpea growers the maximum chickpea growers (67.00 per cent) were found to be literate. On the other hand, in case of “high adoption” chickpea growers the maximum chickpea growers (70.00 per cent) were found to be literate.
2. The data revealed that on an average in “least adopter” chickpea growers 3.08 people in a family found to active members. Among the total workforce in this category 1.67 persons (54.22% to total) were male workers and 1.42 persons (46.10% to total) were female workers in a family. In case of “moderate adopter” chickpea growers 3.10 people in a family found to active members. Among the total workforce in this category 1.71 persons (55.16% to total) were male workers and 1.38 persons (44.52% to total) were female workers in a family. On the other hand, on an average in “high adopter” chickpea growers 3.22 people in a family found to active members. Among the total workforce in this category 1.59 persons (49.38% to total) were male workers and 1.63 persons (50.62% to total) were female workers in a family.
3. The average size of farm holding was found to 4.09 hectares with “least adopter” chickpea growers per farm, among them 0.12 hectare was under other use and remaining 3.97 hectares per farm was under cultivation. The average size of farm holding was found to 4.38 hectares with “moderate adopter” chickpea growers per farm, among them 0.11 hectare was under other use and remaining 4.27 hectares per farm was under cultivation. On the other hand, the average size of farm holding was found to 6.95 hectares with “high adopter” chickpea growers per farm, among them 0.26 hectare was under other use and remaining 6.69 hectares per farm was under cultivation.
4. The irrigated area as a percentage of cultivated area was found to on an average 75.56 per cent in “least adopter” chickpea grower’s farms followed by 68.15 per cent at “moderate adopters” farm and 51.57 per cent at “high adopter” farms, which shows unsatisfactory as per the irrigation availability in the area.
5. Chickpea is one of the important rabi pulse crop in the region. The higher percentage area under chickpea to rabi area found due to selection of

predominant chickpea growing farmers in study. The average area under chickpea with “least adopter” farmers was found to 1.72 hectare per farm followed by 1.97 hectare with “moderate adopter” farmers and 2.00 hectare with “high adopter” farmers.

6. The data depicted that on average chickpea growers adopted only 73.49 per cent of recommended chickpea production technology at farm level. In the study, all the selected chickpea growers were divided into three groups as per their levels of adoption of chickpea production technology. According to this adoption scale, the “least adoption” level of technology (least adoption level i.e. upto 60.00%) chickpea growers adopted overall 57.21 per cent of recommended technology followed by “moderate adoption” level chickpea growers (more than 60.00%-75.00%) adopted overall 72.34 per cent of recommended technology and “high adoption” level chickpea growers (more than 75.00%) adopted overall 90.93 per cent of recommended technology.

7. It is observed that the yield obtained in demonstration field was the highest 16.00 q/ha, while the average yield of chickpea was found to be 12.30 q/ha. On the other hand, The progressive or high adoption package of practices farms realized yield on an average 13.74 q/ha followed by moderate adoption farmers realized yield on an average 12.15 q/ha and least adoption farmers realized yield on an average 11.00 q/ha.

8. The contributing factors as derived in the study show that nearly 16.45 per cent yield of the progressive farmers can be increased merely by improved management practices and with use of judicious chickpea improved yield attributing inputs like demonstrations’ fields. The study also revealed that with the use of improved production inputs; the general “moderate adopter” farmers in the area can get additional average yield by 13.10 per cent as the progressive farms which are feasible in the area as actual yield gap. Traditional farmers (least adopter) also can increase their yield upto 24.91 per cent with the use of improved management practices as progressive farmers are practicing in the area.

9. The study revealed that the average cost A_1 on “high adoption” technological level of farms accounted to Rs.19327 per hectare followed by Rs.17174 and

Rs.12601 on “moderate and least adoption” technological level farms respectively. The study indicated that the cost A_1 found to increases with increasing level of technological adoption. This increasing trend was due to higher use of yield attributing inputs and practices by progressive farms. Cost A_2 was not considered in the study because chickpea growers cultivated their own land.

10. It is revealed that the average Cost C_3 of chickpea cultivation was found to highest on the farm adopted “high level of production technology” accounted Rs.34535 per hectare followed by “moderate adoption” level farms Rs.31109 and “least adoption” level farms Rs.29044 per hectare respectively. This shows that cost C_3 was found increase with increasing adoption level of technology and it was due to higher use of yield attributing inputs and its practices with increasing level of technology.

11. The study reveals that the highest net income Rs.7195 per hectare was realized by chickpea growers when they adopted “high level of chickpea production technology”. On the other hand, the “moderate and least adoption of technological status” chickpea growers realized Rs.5819 and Rs.4945 per hectare as net profit from chickpea cultivation.

12. The other measurement of farm profit like family labour income was found to be highest in case of “high adoption” technological farm, accounted Rs.18335 followed by Rs.17345 and Rs.15687 by farmers of “least and moderate adoption technological status”. Farm business income is also important profitability measurement and it is depicted that the farm business income was found to be highest in case of “high adoption technological” farms which was accounted Rs.22403 followed by Rs.21388 and Rs.19754 by the farmers of “least and moderate adoption of technological status”.

13. The benefit over per rupee investment also found to highest i.e. 1.21 on “high level of adoption” farms followed by 1.19 and 1.17 in case of “moderate and least adoption of technological status” farms respectively.

14. The constraints was categorized into two groups and under biological constraints, “incidence of insect pests” and “incidence of disease” were problems in existing yield gap in chickpea which was confronted by 75.00 per cent and

41.67 per cent of the total chickpea growers followed “amount of rainfall received” confronted by 63.33 per cent and “Soil fertility variation” confronted by 58.33 per cent.

15. In “socio economic and technological constraints” the important constraints were “high cost of inputs” confronted by 71.67 per cent of chickpea growers followed “lack of technical knowledge” confronted by 66.67 per cent, “continued crop failure” confronted by 65.00 per cent, “lack of own fund” confronted by 65.00 per cent, “non availability of inputs in time” confronted by 61.67 per cent and “lack of trained skilled labour” confronted by 55.00 per cent of chickpea growers.

16. The suggestions contain higher frequency than average value were there should be “subsidized supply of inputs” suggested by 70.00 per cent of chickpea growers followed by “More demonstrations” was suggested by 66.67 per cent and a good majority of the farmers (63.33%) want “organization of the marketing of produce”. Proper marketing is one of the ways to assure remunerative price to farmers.

Suggestion:

For further development of cotton production, to reduce the existing yield gap and to obtain higher remunerative profit, following suggestions may be considered.

1. The technological development involves a fair balance between welfare and productive services. This feature departs a great deal from the present methods of cultivation and allocation of resources on redrawn priorities. Hence, farmers should given priority to use their resources on the basis of economic viability with proper management of their farm.

2. Improved chickpea production technology is capital intensive and in general the chickpea growers are found to have poor economic status. In this condition the prices of improved inputs required for chickpea cultivation has many fold over a decade and hence, the cost of production in general has increased over many fold. On the contrary the price of output has not only fluctuated over years, but also did not rise in tune with increase in the factor price. The national policy is to encourage condiments production; the purpose cannot be achieved without fair and remunerative price and adequate incentive to the chickpea growers in the area. The price has to be remunerative enough to earn a legitimate profit. Alternatively, the small farmers could also be encouraged to augment to get

maximum profit, by supporting reduction of cost of cultivation by subsidizing the inputs like fertilizer, quality seed and plant protection materials etc. From above discussion it is clear that emphasis should be given on resources availability and their economic use.

3. A considerable higher number of farmers are generally adopting injudicious level of yield attributing inputs and practices may be called low adoption technological status. The lacunas confronted by them are so many constraints and their impact on income generation and return as low availability. They are also unable to take risk due to imperfect knowledge about agronomical practices. Hence, it is suggested that chickpea production technology and its related skill orientated regular training should be arranged for the cultivators, so that available capital and resources can optimally be used in chickpea production.

4. Social services in respect of agricultural development such as education, training and other extensive activities have a strong case both on economic and welfare grounds. But if they do not lead to productive efficiency then they are sterile and consume an over increasing recurrent allocation causing depletion of resource for productive purposes. Hence, even in the sphere of education and extension works emphasis needs to be laid on enhancing productive capacity of the population and the agricultural field.

5. Adaptive research must be conducted for chickpea production with the use of recommended improved production technology for better convincing the farmers regarding impact of technology on enhancing yield and income. Agricultural research institutions should be taken varietals improvement and development of suitable agronomic practices for varying soils and geographic situations. Economic study to be conducted suggests optimal cropping pattern and practices including recommendations for varying quantities of fertilizer applications under varying price and output situations. Extensive research on promising varieties and cropping practices by joint teams of research and extension workers to be done.

CHAPTER – VII

BIBLOGRAPHY

Agarwal,G.P. and Gautam,D.S. (1999). Constraint study of Kharif and Rabi crop production in Kundam Tribal block of Madhya Pradesh- Kaymore & Satpura hills Region. *Bhartiya Krishi Anusandhan Patrika.* **14**(1&2):23-32.

Bajpai,M.K. (1998). Adoption of dry land crop production technology. *Maharastra J.Extn.Edun.* **17**(0):103-106.

Chouhan,K. (2009). Impact of improved agriculture technology on production, employment and income in Rewa district of Madhya Pradesh. M.*Sc. (Ag.) Thesis, Submitted to College of Agriculture, Rewa, J.N.K.V.V. Jabalpur (M.P.).*

Dubey,M.P. (2000).Study on economic viability and sustainability of different rabi crops under rainfed conditions. *Research on Crops.* **1**(1):9-11.

Islam,Q.M.S.; Karim,M.R.; Ali,M.O. and Rahman,M.M. (2002). Adoption of HYV chickpea and the profitability of chickpea cultivation in the High Barind Tract of Bangladesh. *Economic Affairs (Calcutta).* **47**(2):100-107.

Joshi,P.K.; Bantilan,M.C.S.; Shiyani,R.L.; Asokan,M. and Sethi,S.C. (1998). Chickpea in the hot and dry climate of India - adoption and impact of improved varieties. *Assessing joint research impacts Proceedings of an International Workshop on Joint Impact Assessment of NARS/ICRISAT Technologies for the Semi Arid Tropics*, Patancheru, India. pp:94-102.

Kangali,Sarita (2012). A study on impact of frontline demonstration of chickpea in Sehore district of Madhya Pradesh. M.*Sc. (Agri) Thesis submitted to the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior.*

Kiran,B. Bankar (2008). Constraints and strategies in pulse production. *Agrobios News Letter.* **7**(7):25.

Marothia,D.K. (1986). Farm level constraints to high yields of wheat and gram in Dharsiwa Block of Raipur District, Madhya Pradesh (mimeo). ISAE. Raipur, Madhya Pradesh, India*; Jawaharlal Nehru Krishi Vishwa Vidyalaya.* pp:41.

Mayda,Susila (2011). An Economic Analysis and Marketing of Chickpea Production

in Alirajpur District of Madhya Pradesh. *M.Sc. (Ag) Thesis submitted to R.V.S.K.V.V. Gwalior.*

Mrathyunjaya and Kumar,P. (1989). Trend and structural changes in the cost of production and profitability of crops in India. *Agril. Situ. In India.* **44**(6): 451-457.

Narayanamoorthy,A. (2013). Profitability in crops cultivation in India: some evidence from cost of cultivation survey data. *Indian Journal of Agricultural Economics*. **68**(1):104-121.

Patel,V.G. (1999). Economics of pulses production and identification of constraints in raising their production in Gujarat. *Research Study Agro Economics Research Centre, Sardar Patel University*. (110):58.

Patel,M.M.; Amit Chatterjee and Bhargav,A.K. (2003). Adoption of chickpea production technology. *Indian Journal of Pulses Research*. **16**(1):36-38.

Patidar,Vijay (2012). An economic analysis of production constraints of major rabi crops in tribal area in Badnawar block of Dhar district in Madhya Pradesh. *M.Sc. (Ag.) Thesis submitted to the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior.*

Patole,S.D.; Shinde,H.R. and Yadav,D.B. (2008). Chickpea production in Ahmednagar district of Maharashtra: a technological gap analysis. *Journal of Food Legumes*. **21**(4):270-273.

Sharma,H.O.; Singh,R.P. and Mahesh Patidar (2003). Production constraints in adoption of improved chickpea technology in Madhya Pradesh. *Indian Journal of Pulses Research.* **16**(2): 125-127.

Sikandar Kumar and Sandeep Kumar (2004). Resource use efficiency and returns from selected food grain crops of Himachal Pradesh. *Agricultural Situation in India*. pp:475-785.

Singh,R.; Dalip Kumar; Suhag,K.S. and Hasija,R.C. (2005). Comparative economics of pulse crops in Rajasthan State. *Environment and Ecology*. **23**(1):20-24.

Solanki,Gopal Singh (2011). Technological gap in adoption of recommended chickpea production practices in Ashta block of Sehore district of Madhya Pradesh. M.Sc. (Agri) Thesis s*ubmitted to the Rajmata Vijayaraje Scindia*

Krishi Vishwa Vidyalaya, Gwalior.

Soni,S.N. (2002). “Perception analysis of adoption of improved gram production technologies”. *Madhya Journal of extension education.* **1**(4&5):62.

Raghuwanshi,R.S. (1999). Economic analysis of gram cultivation in Tikamgarh district of Madhya Pradesh. *Legume Research*. **22**(2):130-132.

Rajput,A.M.; Porwal, Rajesh; Deshpande,S.L. (2000). Crop productivity and its constraints on tribal farms of Dhar district of Madhya Pradesh. *Crop Research Hisar*. **19**(2):350-352.

Ramaswamy,C. (2002). Pulses, oil seeds and coarse cereals why they are slow growth crops. *Indian Journal of Agricultural Economics* **57**(3): 290-315.

Rao,S.K.; Lakhani,J.P.; Babbar Anita; Gupta Om; Agrawal,S.B.; Kathal Dhananjay, Singh Saurabh; Patel Ashish and Usmani Mohamad Guffran (2012). Enhancing chickpea production in Rainfed Rice Fallow Lands (RRFL) of Chhattisgarh (CG) and Madhya Pradesh (MP) states of India following Improved Pulse Production and Protection Technologies (IPPPT). *Annual Report*.

Rathore, Vijay Kumar (2008). Study on optimum and profitable crop-livestock enterprise in Ujjain district of Madhya Pradesh. *M.Sc (Ag) Thesis submmited to Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur.*

Reddy,P.Rameshkumar. and Rao,V.Shivshankara.(1998). Assessing knowledge, attitude, and adoption of farmers about improved practices in agriculture. *Maharastra J.Extn.Edun.* **17**(0): 285-287.

Tomar,R.K.S. (1994). Impact of first line demonstrations on the productivity and profitability of pulse and oilseed crops in Bundelkhand zone of M.P. *Advances in agricultural research in India*. **1**:125-133.

Tripathi,A.K. and Das,S.K. (2002). Economics of improved chickpea (Cicer arietinum L) technology in Kaymore and Satpura hills of Madhya Pradesh. *Indian Journal of Hill Farming*. **15**(1):35-38.

Verma, Nageen (2011). An economic analysis of adoption of improved pulses production technology in Sehore district of Madhya Pradesh. *M.Sc.(Ag.) Thesis submitted in R.V.S.K.V.V. Gwalior.*

Yadav,M. (2013). An evaluation of optimum and profitable combination of crop-livestock enterprise in Khargone Block of Khargone District Madhya Pradesh. *M.Sc. (Ag.) Thesis submitted to R.V.S.K.V.V. Gwalior (M.P.).*

Yadav,R.P. and Dwivedi,S.C. (1999). Study on the effect of agronomic inputs on productivity of chickpea. *Bhartiya Krishi Anusandhan Patrika*; 1999. **14**(3&4):28-32.

DEPARTMENT OF AGRICULTURAL ECONOMICS AND F.M.

R.A.K., COLLEGE OF AGRICULTURE, SEHORE (M.P.)

INTERVIEW SCHEDULE

1. Title of the Research Problem:

"Economic analysis of chickpea production under different technological status of farms in Khargone district of Madhya Pradesh".

Investigator : Savan Patel

Advisor : Dr. P.S. Raghuwanshi

A) GENERAL DESCRIPTION

1. Name of farmer : …….

2. Father's name/caste: ……

3. Village: ……, **Tehsil:** …….., **District:** ……

4. Occupation : ……

5. Details of family member:

S.No.	Name of family member	Age	Sex	Relation with head	Education	Occupation
1.						
2.						
3.						
4.						
5.						

6. Details of land holding and irrigation (Ha.):

i. Land owned ……ha. Total revenue paid Rs……..

ii. Land leased in ……ha. Rent paid for leased in Rs…….

iii. Land leased out……..ha Rent received for leased out Rs…….

iv Total land operated……..ha. Revenue paid Rs…….

v. Total irrigated area……ha.

7. Land utilization pattern (ha.)

i. Total land: ……. ii. Operated area: ……

iii. Cultivated area (Kharif): …… iv. Cultivated area (Rabi): ……

8. Farm Assets:

S.No	Particulars	Area/no.	Present value	Expected Annual Rent	Expected life at the line of construction
a	Land				
b	Farm building				
c	Irrigation structure				
d	Implement: Major Minor				
e.	Other (Specify)				
f.	Total				

9. Cropping pattern:

S.No	Season/Crop	Area	Variety	Irrigated	Unirrigated
1.	Kharif: a. b. c.				
2.	Rabi: a. b. c.				

B) TECHNOLOGICAL STATUS AT FARM LEVEL OF CHICKPEA PRODUCTION.

(Level of adoption)

S.No.	Component of technology	Assign weight	Weight obtained
1.	High yielding variety seed for specific area based **Gourav, JG-16, JAKI-9218**	**18**	
2.	**Sowing method (Spacing 30 to 10 cm)**	**13**	
3.	**Seed treatment (Benomil + Thirum (1:1) @ 3 g/kg**	**07**	
4.	**Inoculation with Rhizobium and PSB cultures @ 5g/kg seed each).**	**06**	

5.	**Fertilizer application (NPK) 30:50:40**	**11**	
6.	**Interculture operations as per specific needs**	**09**	
7.	**Insect-pest control as recommended (Imidacloprid 17.8%SL)**	**08**	
8.	**Disease control (Dythen M 45, 0.3% solution**	**07**	
9.	**Irrigation (2 time)**	**10**	
10.	**Total**	**89**	

Potential yield (Adoption of recommended practices) …….. (q./ha.)

C) COST OF CULTIVATION

1. Production Practices (Chickpea) Low/Moderate/High:

Area: …….. Variety : …….

2. Labour use information:

S.No.	Operation	Family labour		Hired labour		Bullock labour		Machine labour	
		Days	Value	Days	Value	Days	Value	Days	Value
1.	Ploughing								
2.	Harrowing								
3.	Leveling								
4.	Fertilizer application								
5.	Sowing								
6.	Plant Protection								
7.	Weeding								
8.	Irrigation								
9.	Harvesting								
10.	Threshing and Winnowing								
11.	Transportation and Other								
12.	Total								

3. Material used and cost:

S.No.	Input used	Quantity	Value	Remark
1.	Seed			
2.	Seed treatment and culture			

3	**Manures/compost**			
4.	**Fertilizers (NPK)**			
5.	**Irrigation Charges**			
6.	**Plant protection**			
7.	**Threshing charges**			
8.	**Other**			
9.	**Total**			

4. Output:

S.No.	Production	Quantity	Sale value
1. **2.**	**Main Product** **By product**		
3.	**Total**		

D) CONSTRAINTS

Reasons identified by the selected farmers for the yield gap:

A. Biological constraints

1) Non adoption of high yielding varieties.
   Yes/No
2) Weed infestation
   Yes/No
3) Incidence of insect pests
   Yes/No
4) Incidence of diseases
   Yes/No
5) Water management
   Yes/No
6) Amount of rainfall received
   Yes/No
7) Soil fertility variation
   Yes/No

B. Socio economic and technological constraint

1) Lack of own funds
   Yes/No

2) Lack of credit facilities

Yes/No

3) Traditional belief

Yes/No

4) High cost of inputs

Yes/No

5) Lack of technical knowledge

Yes/No

6) Non availability of inputs in time

Yes/No

7) Non interested to high investment

Yes/No

8) Lack of trained skilled labour

Yes/No

9) Lack of training and guidance

Yes/No

10) Continued crop failure

Yes/No

F) SUGGESTION FOR REDUCING THE GAP

1. More demonstrations

2. Subsidized supply of inputs

3. Timely supply of inputs

4. Availability of crop production and marketing credit at low rate

5. Availability of technical help in greater degree

6. Organization of the marketing of produce

7. There should be facilities for soil testing.

8. Recommended seed variety showed be available at local level

9. Other suggestion

VITA

Savan Patel, the author of thesis was born on 10th June 1991 in Khargone district of Madhya Pradesh. He completed his primary school education, High School and Higher Secondary Certificate Examination Board Bhopal (M.P.). from M.D.Jain H.S. School District Sanawad.

He was selected through entrance examination (P.A.T.) and joined the College of Agriculture, Indore (M.P.) in 2009 and obtained B.Sc. (Ag.) degree in 2013 with 6.90 OGPA out of 10.00point scale.

The author continued his post graduation from R.A.K.College of Agriculture, Sehore (M.P.), to specialize in "**Department of Agriculture Economics and Farm Management**" and partial fulfillment of the requirements for the award of the same, he allotted with interesting problem as "**ECONOMIC ANALYSIS OF CHICKPEA PRODUCTION UNDER DIFFERENT TECHNOLOGICAL STATUS OF FARMS IN KHARGONE DISTRICT OF MADHYA PRADESH"** for thesis work which has been duly completed by him and presented in this thesis.

His achievement in the sports is praiseworthy. He actively participated in all the cultural activities of the college. Now, he is going to complete his master's degree programme by submission of this thesis.