

IMPACT OF TECHNOLOGIES ON PRODUCTION OF KHARIF JOWAR IN BULDHANA DISTRICT

THESIS

**Submitted to
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
in partial fulfilment of the requirements
for the Degree of**

**MASTER OF SCIENCE
IN
AGRICULTURE
(AGRICULTURAL ECONOMICS)**

**By
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**DEPARTMENT OF AGRICULTURAL ECONOMICS
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DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled **"IMPACT OF TECHNOLOGIES ON PRODUCTION OF KHARIF JOWAR IN BULDHANA DISTRICT"** or part thereof has neither been submitted for any other degree or diploma at any university, nor the data have been derived from any thesis / publication of any university or scientific organization. The source of materials used and all assistance received during the course of investigation have been duly acknowledged.

Place: Akola

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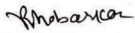
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This is to certify that the thesis entitled **"IMPACT OF TECHNOLOGIES ON PRODUCTION OF KHARIF JOWAR IN BULDHANA DISTRICT"** submitted in partial fulfillment of the requirements for the degree of **"Master of Science in Agriculture (AGRICULTURAL ECONOMICS)"** of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafied research work carried out by Ganesh B Giri under my guidance and supervision.

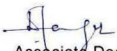
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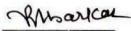
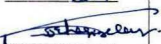
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TABLE OF CONTENTS

Sr. No.	Particulars	Page
A	List of Tables	i -ii
B	List of Figures	iii
D	Abbreviations	iv
F	Thesis Abstract	v-vi
I	Introduction	1-5
II	Review of Literature	6-22
III	Methodology	23-27
IV	Socio-Economic Status of Buldhana District	28-34
V	Results And Discussion	35-58
VI	Summary And Conclusions	59-61
VII	Implications	62
VIII	Literature Cited	63-66
	Vita	
	Appendix	

(A)**List of Tables**

Table	Title	Page
4.2.1	Socioeconomic features of Buldhana district	29
4.2.2	Land utilization pattern of buldhana district	30
4.2.3	Cropping pattern of study area	31
4.2.4	Crop season and crop rotation	32
4.2.5	Size of land holding in Buldhana district	32
4.2.6	Sources of irrigation of buldhana district	33
5.1	Distribution of selected farmers according to size of holding	35
5.2.1	Average size of family of selected <i>Kharif</i> jowar cultivators	36
5.2.2	Educational pattern of selected farmers	36
5.2.3	Average per farm land utilization pattern of <i>Kharif</i> jowar cultivators	37
5.2.4	cropping pattern of selected farmers	39
5.2.5	Per holding investment in various fixed farm assets	41
5.3	Recommended technology developed by Dr.P.D.K.V. Akola for <i>Kharif</i> jowar cultivation.	42
5.4.1	Extent of adoption in of recommended soil type	42
5.4.2	Extent of adoption of recommended technology: preparatory tillage	43
5.4.3	Extent of adoption of recommended technology: Spacing	43
5.4.4	Extent of adoption of recommended technology: Varieties	44
5.4.5	Extent of adoption of recommended technology: Time of sowing	45
5.4.6	Extent of adoption of recommended technology: seed rate	45
5.4.7	Extent of adoption of recommended technology: Nitrogen	46
5.4.8	Extent of adoption of recommended technology: Phosphorus	46
5.4.9	Extent of adoption of recommended technology: Potassium	47

5.4.10	Extent of adoption of recommended technology: Intercultural operation	48
5.4.11	Extent of adoption of recommended technology: Plant protection	48
5.5	Weight of different factors in yield	49
5.6	Regression analysis of composite adoption index on yield.	50
5.7	Distribution of the farmers on the basis of composite adoption of index	50
5.8	Average input use by the farmers at different adoption level	52
5.9	Average per hectare cost of cultivation of <i>Kharif jowar</i> crop	53
5.10	Economics of production of <i>Kharif jowar</i>	56
5.11	Constraints faced by the farmers in adoption of modern technologies in <i>Kharif jowar</i> production.	57

(B)

List of Figure

Figure	Title	After Page
1.	Map of Buldhana district showing study area	34

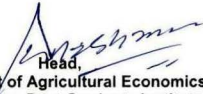
(D)**Abbreviations**

%	- Per cent
/	- Per
@	- At the rate
Agril.	- Agricultural
Avg.	- Average
B:C	- Benefit Cost
Dist.	- District
Dr. PDKV	- Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
e.g.	- Exempli gratia (For example)
et al.	- Et alia (and others)
etc.	- Et cetra
Fig.	- Figure
Ha	- Hectare
i.e.	- That is
Kg.	- Kilogram
Kh.	- Kharif
Mha	- Million hectare
No.	- Number (s)
q/ha	- Quintals per hectare
qtl.	- Quintal
Qty.	- Quantity
resp.	- Respectively
Rs./	- Rupees
Sr. No.	- Serial number
vis-à-vis	- In relation to
Viz.,	- Videlicet (namely)
w.r.t.	- With respect to
TAI	- Technology adoption index
CAI	- Composite adoption index
CV	- Coefficient of variation
SD	- Standard Deviation

(F)

THESIS ABSTRACT

- a) Title of the thesis : "IMPACT OF TECHNOLOGIES ON PRODUCTION OF KHARIF JOWAR IN BULDHANA DISTRICT"
- b) Full name of student : GIRI GANESH BHAGWAT
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ABSTRACT

The study was conducted in Buldhana district with an objective of identifying level of adoption of recommended technologies, economics of production and constraints face by farmer while adopting technologies. The relevant primary data were collected by prescribed questionnaire for the year 2010-11.

Buldhana district in Maharashtra was selected purposively to carry out the present study. Two tahsils viz. shegaon and khamgaon were selected. Three villages from each tahsil were selected. Thus, Two tahsils and six villages were ultimately selected. Fifteen farmer from each village were selected randomly, thereby, making a total sample size of 90 respondents.

In study area 11.11 per cent *Kharif* jowar growers used low level of technologies, 54.44 per cent medium level of technologies and 34.35 per cent high level of technologies.

Net returns from *Kharif* jowar can be increased if the technology is adopted as per the recommendation i.e. low adopter group Rs. 2362.28 medium adopter group Rs.3795.77 and high adopter group Rs.5608.51.

Level of fertilizer, seed rate, Intercultural operation, Varieties, and time of sowing are the most important factors which influence the yield of *Kharif* jowar. Hence, it is recommended that the farmers should be convinced for adopting recommended level of these inputs.

Increase in the level of adoption of recommended technology in *Kharif* jowar was associated with the increase in cost of cultivation and leads to high margin of profit.

In adoption of recommended technology majority of *Kharif* jowar cultivators found the problem of high cost of fertilizers and manures. Next to it non availability of labour in time, inadequate technical knowledge of the respondents and untimely credit availability were the other problems.

CHAPTER I

INTRODUCTION

1.1 Background information

Agriculture is the main source of occupation in India. The most difficult task with which we are confronted today is of obtaining yield of food grains from limited land. The earliest gains from the green revolution have already been reaped and future growth in production to meet in herring demand for food to up warding population can only be input based.

Now a day importance is being given to the development of modern agricultural technology. This modern technology consists of package of practices which contains research contribution by a group of agricultural scientists coming from different disciplines targeted towards a crop or crop combinations. These research outcomes can be of yield increasing / stabilizing / cost effective approach. It can have further dimensions in terms of sustainability, equity, employment and ecological considerations. The modern technology involves the use of seeds of high yielding varieties, chemical fertilizers, irrigation water, pesticides, etc.

If we compare our agricultural production with the average production of developed countries it would be seen that the same is comparatively low and this situation can be changed with the adoption of modern technology. Modern technology play a key role in increasing agricultural production through use of high yielding varieties, fertilizers, plant protection measures, post-harvest technology farm mechanization can be help to double the production.

Jowar is an important food crop of India. The botanical name of the jowar crop is *jowar bicolor* (L) *Monech* considered to be of Ethiopian Italic origin (Vavilov 1935). Jowar is the one of the major dual purpose crops of India. Earlier it was considered as poor man's food but it is very easy to digest and nutritious, it is becoming popular even among rich classes. *Jowar bicolor* locally called as jowar is the King of millets and occupies an important place among cereals grown in India,

especially in the arid and semiarid regions of the country. The word jowar is derived from the Latin word "Sargo" which means rising above i.e. growing taller than other crops in the field. It also known as camel of desert.

Jowar is the fifth most important cereal crop in the world. It is an important cereal crop because of the increasing importance as a source of food (Porridge, breads baked goods, couscous), feed (silage, hay making), industrial raw material (for ethanol, production, production of adhesives, papers, dyes) and others like fibers are used in wallboard, fences biodegradable packaging materials and solvents. The nutritional value of jowar grains contains about 74.1 percent starch, 11.2 percent proteins, 37 per cent fats, 2.6 percent crude fiber, 1.5 percent ash and 0.1 percent tannins. It is also used for preparation of syrups and penicillin medicine etc.

The popularity of the crop is clear from the fact that it is cultivated in 99 countries in the world major production share being contributed by the African countries. The total world production of the cereal grain in 2010-11 was 2259.4 million tons. India occupies the third position with the production of 3.00 million tonnes (NCRS-2010-11) among the major producers countries. More than 55 percent of the total production is consumed as a food for human beings and around 33 percent used as fodder. India also maintains a place in the top ten consumers of jowar in the world with 7.7 million metric tons of consumption.

In 2010-11 jowar ranks third in area and production after rice and wheat with 7.06 million ha area under its cultivation in India. The yield per hectare of jowar in India was 1117 kg/ha. The production of jowar crop in India was 3.00 million tonnes. Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, Gujarat, Rajasthan, Uttar Pradesh (Bundelkhand region) and Tamil Nadu are the major jowar producing states. Other states grow jowar in small areas primarily for fodder (Source-<http://dacnet.nic.in>) purpose.

In Maharashtra state the area under *Kharif* jowar during 2012-13 was 888700 ha and total production was 1197400 tonnes (www.mahaagri.gov.in)

In Vidharbha region, the area under *Kharif* jowar during 2012-13 was 209300 ha and total production was 290800 tones (www.mahaagri.gov.in) In Buldhana district area under *Kharif* jowar crop in the year 2012-13 was 41600 ha. with production was 70700 tonnes. Shegaon, Khamgaon, Mehkar, Chikhli, Sindakhed Raja and Dewulgaon Raja talukas of Buldhana district. Was major jowar cultivation areas. (Annual crop cutting report, DSAO Buldhana 2012-13)

1.2 Importance and need of the study

The average per hectare yield of *Kharif* jowar is lower than its potential yield. There is very little wide in production in crop between the yield of improved varieties on research farm and those obtained on farmer field, It is doubted that new production technologies developed in the University have not reached up to the farmers for large scale adoption. The reasons for low yield may be attributed to inadequate knowledge about the cultivation practices and non-adoption of package of recommended practices. To meet the increasing demands of food for growing population, *Kharif* jowar offer great potential and could be increased.

Technologies are recommended by Dr. P.D.K.V. Akola for *Kharif* jowar cultivation is very important to know at what extent these technologies have been adopted by farmers. Effect of the differential adoption of these technologies on economics of production also needs to be investigated. Further it is necessary to study the yield contributing factors in *Kharif* jowar. Thus, this study will help to form base for improvement in *Kharif* jowar cultivation.

The present investigation therefore is modest attempt in this direction which would provide the empirical evidence for planning vertical improvement and cultivation to promote development programme of *Kharif* jowar crops in the Buldhana district. It will be

helpful to seek suggestions from *Kharif* jowar cultivators on various constraints in its production.

Keeping this in view the present study was planned and carried out with the following specific objectives.

1.3 Objectives of the study

1. To study the extent of adoption of *Kharif* jowar production technologies on farmers field.
2. To study the economics of production under different level of adoption of technologies.
3. To study constraints faced by farmers in adoption of technologies.

1.4 Hypothesis

Majority of the farmers do not adopt recommended practices for jowar

1.5 Scope and limitations

The area under high yielding varieties of *Kharif* jowar crop in Vidarbha has been increasing, while the yields obtained are not showing any appreciable increase. The general nature is that the farmers are not fully exploiting the advantage of available technologies in the crop production and that is why there is a large gap between the potential productivity and the actual productivity.

Technology breakthrough in the field of agriculture has resulted in increased crop productivity. Even through large scale verification trials and demonstrations are conducted to test the feasibility and suitability of the new technologies before releasing for the adoption on farmers' fields. The yields obtained by farmers in several are considerably lower in its demonstrations thus imply clear for those recorded on the existence of considerable untapped yield potential in various crops and attribute this gap largely to differences in inputs level between farmers fields and demonstration plots. Proper application of input at the recommended levels and better cultural practices are the solutions for improvement in crop productivity on farmer's fields.

The investigator of the research project being the student, the study had to be carried out with some limitations. The major limitation

is that the study was conducted in six villages from two tahsils of Buldhana district. Hence the results of this study can be made applicable to similar agro-climatic region elsewhere. The findings of present study were based on the responses expressed by the selected farmers. Hence the objectivity of the data would be limited to the correctness of responses given by respondent farmers.

CHAPTER II

REVIEW OF LITERATURE

Review of work done by different research workers in the field helps the research not only to formulate plan of his research programme and line of action but also avoids pitfalls in collection of data, its processing and interpretation and to conduct the work on proper lines a research Therefore, the review of literature is a precondition for planning a research project. Similarly it provides a base on the conduct of research on similar obligation lesions level from such studies with past.

2.1 Extent of adoption of technology

Hugar *et al.* (1992) studied the extent of adoption of new technology in different crops. The study has been undertaken in North-Eastern transitional and North-Eastern dry zones of Karnataka state. Data was collected from 181 farms. The degree of adoption of various recommended practices was worked out using a six point scoring pattern. The study revealed that the recommended sowing time was the only practice followed by all the farmers. The extent of adoption of practices like sowing method, seed treatment was moderate in case of groundnut and sunflower. The extent of adoption was relatively higher with respect to time of sowing, manual weeding, and improved variety, method of sowing and plant protection measures.

Venkatkrishnan and Vijayraghavan (1993) conducted a study with an objective of analyzing the knowledge and adoption levels of beneficiaries on the special food grains production programme. The results revealed that 92.50 per cent of beneficiaries reported low yield paddy production of the 21 variables, 16 showed significant and positive relationship towards extent of adoption. These variables significantly contributed to 68.11 per cent variation in their knowledge level and 50.05 per cent variation in their extent of adoption of rice technologies.

Gangwar *et al* (2000) examined the level of technology studies adoption and its impact on socio-economic status of sugarcane

growers. A linear regression model was used to identify the determinants in the adoption of technology in sugarcane based cropping system. The study indicated that a majority of sugarcane farmers were either low or medium adopter of the recommended package of practices. The results of regression analysis revealed that among the various determinants, technology adoption was positively associated with income, attitude, risk orientation and availability of land. Family size and age of farmer have negative impact on technology adoption.

Jaulkar *et al.* (2000) studied the adoption of improved technology for mustard crop in Gwalior district of Madhya Pradesh. The study examined that the association between socio-economic and personal characteristics of wheat and mustard cultivators with their knowledge and adoption level and degree of constraints responsible for wider gap in technology adoption. A linear regression model was used to identify the determinants in the adoption of improved production technology. The regression equation was estimated taking adoption gap as the dependent variable, age, education, size of holding, annual income, social participation, extension contact, occupation and knowledge as independent variable.

Barman *et al.* (2002) studied adoption and constraints of blackgram and lentil production technology in Assam- A case study. The study attempts to analyse the factors influencing the adoption of improved pulse production technology and identify the constraints in pulses production in Barpeta district of Assam. The district records the highest acreage and production of pulses in the state. Two important and extensively grown pulse crops black gram and lentil were brought under the purview of the study. The necessary data for the study were collected by survey method from the selected farmers identified through a probability proportional to size sampling technique pertaining to the year 2000-01. A Tobit model was used to study the adoption behavior and other characteristic features of the farmers growing improved black gram and lentil varieties. A regression model of cobb-Douglas type was also fitted to the pooled data to examine the

resource use efficiency for both improved and local black gram and lentil varieties. The size of land holding was found to be negatively related with the adoption of improved black gram and lentil varieties. Estimation of regression equation indicates that the value of fertilizer, plant protection chemicals, seed treatment and seed inoculated with rhizobium culture had significant influence on the production of the selected pulse crops.

Barman *et al.* (2005) studied on Real adoption impact measures of potato technologies on production at farmers level in Comilla district Bangladesh. To study the nature of FAI on potato crop yield at farmer's level the necessary data were collected from 45 potato farmers who cultivated diamond variety in Comilla district. This variety tolerant of late blight and other mosaics disease and give higher yield as compared to other varieties. However, potato growers were selected with a simple random sampling procedure from a sample frame of 850 potato farmers. Data were collected through direct interviews from the growers during potato growing season in year 1998. For this study technology recommended by tuber crops research centre. The yield of diamond potato was 27.50 tonnes/ha during study period and it was found that there was positive and significant relationship between yield and value of FAI. It implied that the higher the value of FAI resulted from proper adoption of technologies in cultivation would give higher potato yield.

Pouchepparadjou *et al.* (2005) has studied on an econometric analysis of green technology adoption in integrated rice in Pondicherry Union Territory. For this study farmer field schools have been conducted in two regions. So these two regions were selected to undertake the present study. The FFss, a programme by the Department of Agriculture organizes training programme to the farmer on various aspects on IPM. To select the respondents, 3 FFs villages were selected randomly in each of the two regions. From these village 30 farmers who were trained through FFs and 30 who did not undergo were selected randomly. Selected sample size in each of the two regions was 225. Thus total sample size was 450. Data were analyzed

using frontier production, factor analysis, logistic regression and result is obtain that trained farmer get more yield than untrained farmer.

Jadhav (2008) studied an technological adoption gap in different crops. The cost of cultivation was estimated to Rs. 13891.55, Rs. 17287.78 and Rs. 20772.91 for low adopter, medium adopter and high technology adopter for cotton cultivation respectively. The cost of cultivation for soybean crop was estimated to Rs. 10359.13, Rs. 14448.74 and Rs. 17063.59 for low adopter, medium adopter and high technology adopter respectively. The cost of cultivation for *Kharif jowar* crop was estimated to Rs. 10922.84, Rs. 13140.50 and Rs. 15661.88 for low adopter, medium adopter and high technology adopter respectively. In case of cotton production yield obtained was highest i.e. 12.88 qtls/ha in high technology adoption group, 10.63 qtls/ha in medium technology adoption group and lowest i.e. 7.88 qtls/ha in technology adoption group. In case of soybean production yield obtained was highest i.e. 17.98 qtls/ha in high technology adoption group, 14.45 qtls/ha in medium technology adoption group and lowest i.e. 11.51 qtls/ha in technology adoption group. In case of *Kharif jowar* production yield obtained was highest i.e. 24.85 qtls/ha in high technology adoption group, 21.82 qtls/ha in medium technology adoption group and lowest i.e. 17.32 qtls/ha in technology adoption group respectively.

2.2 Economics of production at different levels of adoption of technology

Sapate (1990) examined the departure from recommended package of practices by the cultivators on their fields in cotton cultivation. The study was based on the data of 13 cultivators collected for the year 1987-88, by cost account method and stretches over Amravati and Yavatmal districts. The study revealed that under cotton cultivation more than half of the cultivators observed to be adopting the recommended seed rate. It was observed that 25 per cent of the cultivators did not use any chemical fertilizers, while, more than 50 per cent of the cultivators did not use farm yard manure. Similarly, about 50 per cent of the farmers did not take crop protection measures and the

expenditure incurred by others in crop protection measures was very low.

Alshi *et al* (1992) studied productivity hybrid jowar in relation to farm size studies in Akola district. Attempted to ascertain the impact of farm size on input use efficiency in agricultural production by selecting 75 hybrid jowar growers Stratified into small, medium and large size groups. At overall level per hectare use of human labour and bullock labour was 75.56 days and 15.17 days respectively. Use of NPK at overall level was 41.30 kg, 18.15 kg and 3.98 kg per hectare, respectively. The expenditure on plant protection was negligible in all size groups. Per hectare output of hybrid jowar at overall level was 26.43 quintals. The output was highest on large farmers 29.62 quintals per hectare

Satpute *et. al.* (1993) studied cost structure of *Kharif jowar* in Marathwada region. In this region, *Kharif jowar* plays a very important role in cropping pattern. This crop contributed 35.38 per cent and 31.26 per cent in area and production of the state, respectively. Therefore, an attempt was made to examine its cost structure. The require data for the study were obtained from the cost of cultivation. The study indicated that the proportion of variable cost increased with increasing size of holding while, inverse trend was noticed in respect of fixed cost. On an average in total cost the contribution of variable and fixed cost was 61.98 per cent and 38.02 per cent, respectively amongst variable costs, human and bullock labour, manure and fertilizer accounted for about 80 per cent share in total variable cost. Amongst fixed cost rental value of land and family labour constituted 53.65 per cent and 26.04 per cent share, respectively. The study suggested adoption of labour saving technologies in the cultivation of *Kharif jowar*.

Verma (1993) in a study on actual utilization of inputs as against the recommended level for hybrid Jowar in Akola district observed that the use of nitrogen, phosphorous and potash for hybrid jowar in the study area was below the recommendation. The gap being 46.66 per cent and 93 per cent respectively. On an average per hectare utilization of male, female and bullock labour were 49 days, 39.30 days

and 14.28 days, respectively. The per hectare productivity of Jowar was 26.65 quintal as against the potential production of 48 quintals per hectare.

Patanaik (1994) attempted to investigate the adoption of high yielding varieties and productivity disparities among the tenant, small and large farmers in the green revolution in belt and dry land belt in Orissa. The study was based on the data collected from 150 farmers. The analysis of data revealed that the large, small and tenant farmers in the green revolution belt have adoption index of 87.71, 86.12 and 81.33 per cent, respectively, while, their counterparts in the dryland belt have adoption index of 31.17, 29.67 and 21.54 per cent respectively. The correlation coefficient between adoption and productivity in the green revolution belt was 0.94, which shows that higher level of adoption of high yielding varieties, seeds and package of practices has lead to higher production.

Ingle *et al.* (1995) examined the level of adoption of recommended technologies for groundnut. The study was conducted in command area of Nirguna irrigation project during the year 1991-92. The study revealed that the adoption of preparatory tillage practices, sowing time and method of sowing, spacing, interculture and harvesting were followed by all as per recommendations. It was further observed that SB-11 was the only variety adopted fully by almost all respondents. Adoption of other improved varieties was nil. Use of manures was more than the recommended dose in case of 48.93 per cent respondents. The seed rate was less than recommended in case of 63.82 per cent respondents, seed treatment was not adopted by 55.31 per cent respondents, whereas, 34.04 per cent respondents adopted it partially. It was noticed that majority of the respondents (72.34%) used excess fertilizer doses in terms of N, P, K. The number of irrigations recommended was fully adopted by 61.70 per cent respondents. Insecticides were either not used or partially used in 42.55 per cent cases.

Devid and Pandey (1998) in an attempt to get the overall technology adoption index for the four crops under study, viz. paddy,

jowar, wheat and gram. The indices ranged from 40.50 in Type I to 61.97 in Type V in case of paddy, 15.10 in Type I to 85.60 in Type III in case of jowar, from 46.74 in Type I to 81.36 in Type V in case of wheat, from 3.54 in Type IV to 20.48 in Type III in case of gram. This index was found to be 44.35 in case paddy, 50.99 in case of jowar, 72.53 in case of wheat and 10.43 in case of gram. This showed that technology adoption in case of gram was very low at 10.43, that in case of paddy and jowar was mediocre and in case of wheat it was better. The technology index in case of 3 crops was more than 44, the overall index (composite index) was only 25.21, revealed that adoption of new technology was only a quarter of the perfect technology adoption level.

Dudhabade (2001) studied impact of technology adoption on pigeon pea production. The adoption per cent age of technology by small, medium and large groups was observed. The time of sowing shows the highest adoption among technologies i.e. 97.57 per cent followed by seed treatment 82.26 per cent, variety 84.51 per cent, weeding 81.30 per cent, hoeing 80.40 per cent, tillage operation 77.14 per cent and soil type 71.84 per cent. The adoption of all the technologies at overall level was 64.35 per cent. The factor share of each technologies in the yield was worked out by linear regression analysis and the highest contribution was observed in weeding (41.73 per cent) followed by hoeing (31.11 per cent). It was seen that none of the farmer indicate composite Adoption Index below 33 per cent. 10 per cent farmers were in between 33-50 per cent level of adoption of recommended technologies. 30 per cent were in between 51.57 per cent and 60 per cent farmers in above 75 per cent category. The per quintal cost of production were found to be highest (1,344.09) in low adoption group and lowest (Rs. 1,038.24) in high technology adoption group. The input output ratio was increased with the technology adoption. As in the low adoption group it was 1:1.28, medium adopter group it was 1:1.48 and high adoption group 1:1.67.

Rekha Thakare (2001) studied on impact of recommended technologies of wheat cultivation. The study was based on the primary. In all 120 farmers were selected for the study. The farmers were

classified into three groups as small, medium and large based on land holding. From each size group 40 farmers were selected randomly. The total cost of cultivation was found to be highest i.e. Rs. 12959.86 as compared to low and medium adopter group. The study revealed that, as the level of adoption of technology increases the cost of cultivation decreases.

Sarap (2001) studied impact assessment of adoption of recommended technologies of *Kharif jowar* production. The observed that the gross income per hectare obtained by low, medium and high level of adopter groups were Rs. 10,044.30, Rs. 10,703.59 and Rs. 12,724.54 respectively. At overall level, per hectare gross return was worked out to Rs. 6,365.18, Rs. 6,390.51 and 8,666.84 for low, medium and high level adopter group respectively. As regard net return at cost A at overall level it was Rs. 7,135.13. The input ratios at cost A for low, medium and high level of adopter were 1.57, 1.67 and 1.46 respectively and 1.5 at overall level. At cost B, this ratio worked out to 1.33, 1.12 and 1.1 respectively while overall it was 1.60. The ratio at cost C was 1.4 in case of low adopter followed by 1.30 in medium and 1.0 in high adopter group. This indicated that role of turnover high in low level of adopter followed by medium adopters.

Munde (2001) studied impact of adoption of recommended technologies of green gram production. The results of study indicated that overall adoption index for the sample as a whole was 64.15 per cent. 40 per cent of the total selected farmers had composite adoption index above 80 per cent. The composite adoption index of the middle group was 67.25 per cent followed by 32.12 per cent of small size group farmers. The per hectare cost of cultivation for the sample as a whole was Rs.5, 742. The per hectare gross return from mung cultivation was Rs. 8,761.46. At overall level. The overall net return at cost A was Rs. 5,667.37. the per hectare returns at cost C observed as Rs.3,019.21.

Gavit (2001) studied impacted of recommended technologies of Deshi cotton production. Economics of production of Deshi cotton have been worked out to know the productive capacities have been

measured for all crops grown on the farm in terms of net income i.e. surplus over cost C and farm business income i.e. surplus over cost A. At overall level per hectare gross returns were estimated to Rs. 9,240.03, the farm business income i.e. profit over cost A worked out to Rs. 4,649.27 while net return profit over cost C worked out to Rs. 1,518.14. The out-put ratio worked out to 2.01 and 1.19 respectively for cost A and cost C. Adoption index technology by size group of farmer is 75.16 per cent, this shows that in general, the Deshi cotton growers were adopted different technologies at 75.16 per cent of the recommended levels.

Kajale (2001) studied impact of assessment of adoption of recommended technologies of soybean production. The results indicate that if the farmers adopt all the technologies at their recommended levels, they can get 24.34 quintals yields of soybean. Factor share analysis indicated that manures constitute, highest share in production i.e. 27.16 per cent, followed by phosphorus 21.63 per cent, intercultural operations 9.50 per cent and soil type 6.87 per cent.

Kumar (2002) studied impact of technology mission on oilseeds production and its regional spread in India. The study attempts to assess the impact of Technology Mission on Oilseeds (TMO) production performance and examine the regional pattern of oilseed growth in India. The analysis covers a period of 31 years from 1966-67 to 1997-98 sub-divided into pre-and post-TMO periods respectively. The review of the past trends in agricultural production revealed that oilseeds and pulses were labeled as 'slow growth crops' during green revolution period. However, under the import substitution strategy adopted since the early eighties and followed by the constitution of the TMO in May 1986, India's oilseed sector witnessed a dramatic turnaround in its fortune. The production of oilseeds increased from 10.8 million ton in 1985-86 to 22.1 million ton in 1997-98.

Kunnal *et al* (2002) studied Impact of New Technology in Bengal gram Production Karnataka-An Economic Analysis. The study aims at assessing the impact of new technology on output, factor shares and employment in Bengal gram production in Karnataka. Growing of high

yielding varieties (HYVs) of Bengal gram (technical change) resulted in about 25 per cent of additional output. To this increased output, the technology (HYV) component accounted for 10.76 per cent, while the increased use of inputs accounted for 14 per cent. All the inputs stood to gain with the introduction of new technology in Bengal gram production. However, the percentage gain was more in favor of nitrogen, followed by land and phosphorus. This was a windfall gain to the landowner. These results brought the interdependence of the agricultural sector and the industrial sector which manufactures and distributes fertilizers. Replacing the area under local variety of Bengal gram with HYVs would not only add to the total production of the pulse crop but also create additional employment opportunities to the sample farmers by 15 per cent. Thus there is scope to increase the area under HYVs of Bengal gram to get higher yield levels and create additional employment opportunities to the farmers and increase its production in the state.

Rachana Wasule (2004) studied impact of assessment of recommended technologies of groundnut production. The study indicates that as the level of adoption of technology increase the cost of cultivation increases. Among the groups highest per hectare groundnut production of 18.28 quintals was obtained by high level of adoption group. It was followed by 18.00 quintals in medium level of adoption group and then 17.98 quintals in low level adoption group. Profit over cost A, cost B and cost C, and input-output ratio were employed for estimation of economics of production of groundnut. Average profit cost A was Rs.16706.01. at cost B and cost C it was Rs.7269.87 and Rs.9950.56 respectively. The average input ratio at overall level was estimated as 1:2.00, 1:1.45 and 1:42 as cost A, cost B and cost C respectively. The major problem faced by groundnut growers were high cost of fertilizers and chemicals, lack of labour, inadequate technical knowledge and financial problem were the other problems next to it.

Basavaraja *et al.* (2005) studied an *Kharif* jowar in Karnataka: An economic analysis. Jowar, which once occupied more than 18 M ha

of area in the country, has been on a continuous decline during the past two decades and has fallen down to 10.39 M ha. Most of the decline in area has occurred in *Kharif* jowar. This warrants critical examination of the changing scenario of *Kharif* jowar and identification of the reason thereof. For the macro analysis, secondary data on various aspects of *Kharif* jowar have been used, whereas the farm survey data have been used to draw the inferences at the micro level with respect to changing scenario of *Kharif* jowar. The growth rate in area, in production and productivity of *Kharif* jowar has been computed. The Herfindahl index has been computed to find out crop diversification in the sample of Dharwad and Belgaon. The declaration in the *Kharif* jowar area in the overall period 1970-1971 to 1997-98 and different sub periods has been found due to the diversion of *Kharif* jowar area to more remunerative crops like oilseed and pulses. Belgaon district displayed a moderate degree of crop diversification compared to that of Dharwad district. Unfavorable prices, declining yields, inadequate credit and adverse climatic conditions have been identified as the major reasons for the replacement of *Kharif* jowar crop in the two samples districts. The net returns and benefit cost ratio have been found low in the cultivation of *Kharif* jowar compared to those of its competing crops, viz. cotton, green gram and ground nut.

Sharma *et al.* (2006) studied of determinants of adoption of soybean production technology by the cultivators at different regions of India. For this study data were collected by interview schedule from different regions of India. The adoption gap was estimated on the basis of recommended package of practices of soybean developed by the research scientists for the soybean grower and demonstrated in different location of the study. The average yield obtained from these demonstrations was treated as potential yield of the area. The yield gap between the potential and maximum farm yield in the area (yield gap-I) was worked out, which refers gap due to non-transferable soybean production technology in the area. The field gap between maximum farm yield and average farm yield (yield gap-II) denotes gap due to socio-economic constraints gap between potential and average

farm yield (yield gap -III) also consider for examine total yield gap and the factors which are responsible for degree of adoption of soybean production technology were examined and there affect was analyzed by using multiple regression analysis.

Deorukhakar *et al* (2011) studied an economics of rice production in Ratnagiri district of Maharashtra. The per hectare total cost of cultivation of rice of high adopter group was Rs.57100 as against in low and moderate adopter group were Rs 47767 and Rs 52793 respectively. This indicates that more investment was done by high adopters as compared to low and moderate adopters adopting improved technologies. per hectare gross returns highest in high adopters (Rs. 59865) followed by moderate adopters (Rs 53437) and low adopters (Rs.46310).the production of rice in high adopter group showed in net profit of Rs.2764.87 per hectare and moderate adopter group , it was Rs.643.65 per hectare while in low adopter group , the production of rice showed a net loss of Rs.1457.84 per hectare .the benefit cost ratio was observed to be 1: 0.97 in low adopters , 1:1.01 in moderate adopters and 1:1.05 in high adopter groups.

2.3 Constraints in adoption of technology

Alshiet *et al* (1991) studied the constraints in adoption of recommended technologies in summer groundnut cultivation. The study was under taken in Akola district and based on a sample of 47 cultivators drawn from Alegaon and Charangaon village of Patur tahsil. Data for the study pertained to the year 1990-91. They observed that the yield of summer groundnut per hectare was 13.68 quintals and yield of byproduct was 10.50 quintals. The gross returns of Rs. 13972.52 were obtained per hectare whereas; the total variable cost was worked out to be Rs. 6541.81 per hectare. Returns over variable cost were Rs. 7430.71 and output-input ratio was found to be 1:2.13 indicating the summer groundnut cultivation is economically profitable

Suryawanshi *et al* (1992) studied the constraints in adoption of agricultural technology in production of jowar and cotton crops. This study was carried out to understand configuration of different constrains responsible for non-adoption of new technology on large

scale in Marathwada region. The study revealed that physical constraints were up to 21.60 per cent and about 30 cultivators reported labour problems. Technology constraints were found to be maximum in case of cotton crop. Socioeconomic conditions of farmer and marketing crops were also studied.

Patel and Nandapurkar (1992) studied constraints faced by farmers in adoption of recommended technology of jowar crop. This study was conducted in Parbhani district of Marathwada region in Maharashtra, using data collected from a sample of 220 farmers, it reports on the constraints faced by progressive and non-progressive farmers in the adoption of recommended technology for jowar production, and on the farmers' suggestions for overcoming these constraints.

Patil and Kalyankar (1992) examined the impact of research on the productivity of major crops grown in Marathwada region of Maharashtra state. Wheat was grown over an area of about 2.3 lakh hectares in Marathwada. It accounted for about 8.1 and 5.0 per cent of area under total cereals and food grain crops, respectively. Wheat production has increased from 1.12 lakh tonnes in 1960-61 to 2.44 lakh tonnes in 1989-90. The productivity levels have been doubled from 429 to 1045 kg/ ha during the above period in this region. The value addition to Marathwada economy was also increased to Rs. 7708 lakh during the period due to increased production and per hectare productivity. It was possible due to availability of modern technology. Adoption of high yielding varieties has crossed 97 per cent of area under wheat crop in the region. The high yielding variety PBN-142 (Kailash) for irrigated condition and Ajantha for rainfed condition has been released.

Girase *et al* (1994) studied the constraints in adoption of recommended technology for *Kharif* jowar in Maharashtra. The major constraint in adoption of new technology in cultivation of jowar as perceived by the farmers were high cost involved in adoption of practices, lack of knowledge about practices and the risk involved in adopting these practices. The recommended practices of *Kharif* jowar cultivation were adopted by over 90 per cent respondents. The

recommended practices were selection of proper soil, preparatory tillage, use of improved varieties and intercultural operations.

Shinde *et al* (2002) studied constraints in adoption of recommended technologies of groundnut cultivation. A study was carried out in Satara district from Maharashtra state to know the constraints faced by groundnut growers in adoption of recommended technologies of groundnut cultivation and to obtain their suggestions for overcoming the constraints. The study revealed that lack of knowledge about various recommended cultivation practices, non-availability of inputs in time and at reasonable prices, non-availability of improved implements, inadequacy of laborers and high rates of wages were the major constraints in adoption of recommended technologies of groundnut cultivation. There is a need to give more emphasis by extension agencies through mass media, training and organization method and result demonstration for educating the farmers about non adopted practices.

Sharma *et al* (2002) studied constraints in adoption of chickpea constraints associated with its adoption and yield gap. In order to know the share and impact of various constraints, farmers' opinion was collected through personal interviews with 100 chickpea growers in six villages of blocks as a typical representative chickpea growing block of the state. The secondary data of front line demonstrations collected from All India Co-ordinate Project on Chickpea which were used for analyzing the yield gap. The information gathered reveals the wide gap in the adoption of improved production technology in chickpea by farmers, which was the highest increase of use of micronutrient (99 per cent) and the lowest in proper field preparation (10 per cent). Wide yield gap was also observed between the potential yield and the yield obtained by chickpea growers, which may be attributed to various constraints, viz., crop management, labour management labour management and the constraints related to institutional organizations. Low availability of high-yielding varieties seed, lack of knowledge about soil testing facilities, high cost of fertilizers, irregular power supply, lack of capital for purchase of weedicides and insecticides are the main

constraints related to crop management. As regards the constraints related to labour management the leading constraint is the shortage of power supply at peak operation time. Among the institutional constraints the lack of knowledge about warehouses and the non-availability of quality input through co-operative society are some of the main constraints in the study area. These constraints are creating hindrances in the adoption of improved technology of chickpea in the state which needs to be overcome by proper planning and execution for enhancing the productivity and production in the state.

Ramamurthy *et al* (2005) studied an on-farm evaluation of seed priming technology in jowar (*jowar bicolor L.*) Participatory Rural Appraisal techniques were used to identify reasons for low yield in jowar crop. Poor crop establishment was identified as a major cause of low yield and seed priming was agreed upon as an intervention to circumvent this problem. The effect of on-farm seed priming on jowar yield was studied in the farmer's fields during *Kharif* 2001 to 2003. Seed priming improved germination and vigour of the crop which helped to establish a good plant stand, which in turn led to significantly higher grain yield (9.5 %) of jowar over non-primed. The effect of seed priming was maximum in medium deep as compared to shallow as well as deep soils. Cultivars didn't differ significantly in their performance. However, cultivar BJH-117 responded significantly to seed priming in terms of grain yield than CSH-9. Farmer's opinioned that seed priming helped in hastening germination, maturity and harvest and some extent reduced the effect of dry spell as well as pest and disease incidence in jowar.

Badodia *et al* (2006) studied constraint in adoption of chick pea production technology. the most important constraint faced by the chick pea growers in adoption of recommended chick pea production technology were lack of knowledge, high cost of inputs, non-availability of inputs in proper time, lack of capital, poor marketing facilities and high cost of fertilizers etc. an attempt was also made to ascertain in suggestion from the chick pea growers to overcome the constraints faced by them.

Singh *et al.* (2008) studied an Rice production constraints in Durg district of Chhattisgarh plains. Data on rice production constraints were collected by scientists-farmers interaction through participatory rural appraisal survey method. The most important constraints faced by the rice farmers were adoption of long duration cultivars, low plant population, non-availability of good quality seeds in time, attack of insect pests and diseases, unscientific use of plant nutrients and dominance of wild rice in fields. The major suggestions offered by the village farmers to overcome the constraints associated with rice production were (i) cultivation of suitable medium duration (120-130 days) cultivars, (ii) demonstrations on improved 'biasi' (broadcasting) method for optimum plant stand, (iii) ensure timely availability of improved high-yielding cultivars, (iv) guidance should be available regarding plant protection measures and balanced use of fertilizers at village level, and (v) knowledge in respect of timely identification as well as removal of wild rice should be made available at field itself. A total of 57 demonstrations were conducted in rainfed as well as irrigated farming situations under transplanting and broadcasting methods of rice cultivation from 1996-2000 *Kharif* seasons as per the farmers suggestion. Irrigated transplanting method recorded higher yields than rainfed transplanting and broadcasting method under demonstration as well as farmers practice/conditions. The average yield of demonstrations (34.9 q/ha) was 39.6% higher than the farmers yield (25.4 q/ha). The extension gap ranging from 4.30 to 20.40, with an average of 9.51%, indicated an urgency to transfer the recommended technology among rice farmers through effective extension services.

Deorukhakar *et al* (2011) studied an constraints in adoption of modern technologies in rice production in Ratnagiri district of Maharashtra. The majority of farmers faced natural constraints like excess rainfall, abnormal distribution of rainfall and inadequate rainfall, reported by 26.55, 58.82 and 49.39 per cent farmers respectively at overall level. constrain regarding HYV seed material were high cost of seed inadequate supply and non-availability in time which was reported

by 100 , 27.21and 39.69 per cent farmers respectively . Non-availability of labour and other inputs at peak period, high cost of key inputs, low price to produce and lack of technical knowledge were the major constraint faced by cultivators in adoption of rice technologies.

CHAPTER III

METHODOLOGY

It is important to have methodology for any research work. It gives as the knowledge of different steps through which research is conducted. For a research knowledge on methodology is most important without it the person cannot do the research. Provide frame of research carried out.

This chapter is devoted to discuss in brief the methodology adopted for this study. It deals with method and type of data collection, source of data, crop concerned and analytical tools used to get the result as per the objective of the study.

3.1 Selection of area

The present study was based on primary data of Buldhana district for the year 2010-11. Shegaon and Khamgaon tahsils of Buldhana district were purposively selected where maximum area is occupied under *Kharif* jowar cultivation. Three villages from each tahsil and 15 *kharif* jowar cultivator from each village were selected. So total six villages and 90 cultivator were selected for present investigation.

3.2 Selection of *Kharif* jowar growers

A list of farmers from the selected village who have raised the *Kharif* jowar crop during the year of investigation was obtained from Patwari. The 90 cultivator further classified in to small (upto 2 ha), medium (2.01 to 4 ha) and large (4.01 and above) on the basis of size of holding.

3.3 Collection of data

The data for the present study was obtained by survey method in a specially designed pre tested schedule regarding land utilization, area under different crops, capital investment, technology adoption, cost of cultivation, production, marketing etc.

Data were collected from the selected growers through personal interview method. The data pertained to the cropping year 2010-11 was collected from the selected farmers.

3.4 Recommended technology

The term recommended technology refers to the cultivation practices recommended by Dr. P. D. K. V. Akola for *Kharif* jowar crop. The University has made recommendations about soil type, varieties, preparatory tillage practices, spacing, seed rate, time of sowing, level of fertilizer, intercultural operations, and plant protection of *Kharif* jowar crop.

3.5 Adoption of technology

Adoption of technology means actual practices adopted by the farmers for cultivation of *Kharif* jowar crop. It is most likely that in these practices most of resource management technologies are either partially adopted or modified by farmers depending upon their convenience. The practices adopted by selected farmers were studied.

3.6 Analytical technique

The components of recommend technology recommended by the Dr. P. D. K. V. Akola for *Kharif* jowar were identified and thereafter the level of adoption of each component of recommended technology adopted by the farmers was accessed. The adoption score was developed for those components whose value could not be measured in terms of unit per hectare. Level of adoption of technology was worked out, adoption index for each technology was developed by using given formula.

3.6.1 Method used for estimating adoption index:

$$\text{Adoption index} = T A_{ij} = \left(\frac{A_{ij}}{RT_i} \right)$$

Where,

$T A_{ij}$ = Technology adoption index of i^{th} component for j^{th} farmer.

A_{ij} = i^{th} component technology level adopted by j^{th} farmer.

RT_i = Recommended level of i^{th} component.

3.6.2 Factor share analysis

For estimating the contribution of each factor to the crop yield, different production function was carried out i.e. Linear production function, Quadratic production function and Cobb-Douglas production function, Among three, the Linear production function was found to be

best fit as the multiple regression coefficients, R^2 was maximum and minimum error sum of square was least. the multiple linear regression analysis was carried out by using the following equation.

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8 + b_9x_9 + b_{10}x_{10} + b_{11}x_{11} + u$$

Where,

Y= Dependent variable

x_1 to x_{11} = Independent variables

b_1 to b_{11} = Regression coefficient

a = constant

u = A random term

The specification of the selected variables is as follows.

Y = Yield quintals

x_1 = Type of soil (Light/ medium/ heavy)

x_2 = Preparatory tillage

x_3 = Spacing

x_4 = Verities

x_5 = Time of sowing

x_6 = Seed rate

x_7 = Nitrogen (Kg/ha)

x_8 = Phosphorus (Kg/ha)

x_9 = Potassium (Kg/ha)

x_{10} = Intercultural operations

x_{11} = Plant protection

3.6.3 Composite Adoption Index

Composite index was developed to study the extent of adoption of technology by the farmers. The index developed is as follows

$$PTA_j = \frac{\sum W_i \times T A_{ij}}{100}$$

Where,

PTA_j = The composite adoption index technology package by j^{th} farmer

W_i = The weight assigned to j^{th} technology component

$T A_{ij}$ = Adoption index of j^{th} component of technology adopted by j^{th} farmer

3.7 Economics of production

Economics of production of *Kharif* jowar was worked out on the basis of different level of technology. Standard cost concept was used for economics of production.

Cost concept

The standard applied cost concepts namely cost-A, cost-B and cost-C which commonly used in farm management research are used in present study to estimate per hectare cost of cultivation of jowar. These cost concepts are described below in brief.

Cost 'A'

It is an actual paid out cost of cultivation. This cost approximates the expenditure incurred by the farmers in cash and kind for cultivation of crop and includes the following items.

- i) Hired human labour
- ii) Owned and hired bullock labour
- iii) Seed
- iv) Manures
- v) Fertilizers
- vi) Depreciation and machinery charges
- vii) Plant protection
- viii) Land revenue
- ix) Interest on working capital

Cost 'B' = Cost 'A' + Interest on fixed capital + Rental value of land

Cost 'C' = Cost 'B' + Imputed value of family human labour

Hired Human Labour :

Casual labour was charged at the rate of actual wages paid in cash and kind from time to time.

Seed:

For the seed purchase from the market actual cost paid was taken into account for its evaluation. The home produced seed was evaluated at prevailing market rate.

Manures and Fertilizers

Manures and fertilizers purchased from outside were evaluated on the basis of actual price paid by the farmer. The home produced manure was evaluated at the price prevailed in the locality.

Plant Protection

In case of plant protection the actual expenses incurred by the farmer on their purchase were taken into account.

Bullock Labour

The prevailing hiring rate in the locality for various operations was considered for evaluating bullock labour.

Implements and Machinery Charges

It included depreciation charges and repairing charges of implements and machinery. The depreciation charges on implements and machinery were worked out by straight line method. In case of repairs of implements the actual cost incurred was taken into account for hired implements the actual charges paid for their use were taken as the cost

Rental Value of Land

The actual rental value of land is generally calculated on the basis of prevailing market price of land. However, there is no realistic approach to estimate prevailing market price of land. Therefore, rental value of land in the present study was taken as $1/6^{\text{th}}$ of the gross value of produce.

Value of Family Labour

Wages for the work done by the family labour should be imputed on the basis of average wages rate of permanent labour. However, in view of difficulties in calculating average wages rate of permanent farm servant labour, the prevailing rate in the locality for various operations was considered.

Interest on Working Capital

Interest on working capital was calculated at the rate of 14 per cent and was charged for 4 months. In case of fixed capital, the interest was calculated at the rate of 10 per cent and it was apportioned among various crops on the basis of area under each crop.

CHAPTER - IV

SOCIO-ECONOMIC STATUS OF BULDHANA DISTRICT

The findings of any field research study in agriculture at the micro level cannot be generalized at the national level. However, findings of each study can be taken for granted as relevant for those areas having similar condition with regards to other factors. The findings therefore, must follow a clean mention about the socioeconomic features of study area to facilitate better understanding of the observation and also to apply same in other areas with similar features.

The present chapter is therefore devoted to discuss in brief some of the socioeconomic features of Buldhana district, just to facilitate comparison and to get better idea of the economy.

4.1 Physical features of Buldhana district

4.1.1 Location and boundaries

The district is part of Vidarbha region and lies between 19° 51' and 21° 17' north latitudes and 76° 38' and 76° 40' east longitudes and is to north corner of Maharashtra. It is surrounded by Khandwa district of M.P in north, Parbhani district of Marathwada region in south, Akola and Amravati in east and Jalgaon and Jalna in west.

4.1.2 Topography

The north portion of district consists of Satpuda mountain ranges. Similarly the west portion of district particularly Chikhali and Mehkartahsils consist of Ajanta mountain ranges. It is at 360 meter high from mean sea level.

4.1.3 Soils

The soils are varied in structure and texture. It varies from black soils particularly in Chikhali and Mehkar, deep black cotton soils in Malkapur, Jalgaonjamod and khamgaontahsils. Other region generally consists of murmad types of soils which are considered as less fertile.

4.1.4 Climate and Rainfall

The climate of the district is hot and dry although, Buldhana city is cold and have healthy atmosphere. There were local variations in climate of the district. Some of the tahsils like Malkapur, Nandura,

Jalgaonjamod, Sangrampur, shegaon, Khamgaon are very hot in summer.

Buldhana district falls in western zone of Vidarbha region having an average annual rainfall ranges between 750-800 mm. There were wide variations in average rainfall and number of rainy days within different tahsils of district.

4.1.5 River

In all eight rivers namely Painganga, Khadakpurna, Purna, Nalganga, Vishwaganga, Dnynganga, Kordi and Mas flow through district. Out of these, Purna is PerennialRiver. Painganga is the main river of the district.

4.2.1 Socioeconomic features of study area

The information regarding to socioeconomic features of study area is depicted in Table 4.2.1.

Table 4.2.1 Socioeconomic features of Buldhana district

Sr. No	Particulars	Buldhana District	Percentage
1	Total area (sq. km)	9671	-
2	No. of villages	1433	-
3	No. of families	445634	-
	i) Rural	358411	-
	ii) Urban	87223	-
4	Population	2232480	100
	i) Rural	1759097	78.79564
	ii) Urban	473383	21.20436
	A) Male Population	1147403	51.39589
	i) Rural	902445	40.42343
	ii) Urban	244958	10.97246
	A) Female Population	1085077	48.60411
	i) Rural	856652	38.37221
	ii) Urban	228425	10.23189
5	A) Total workers	1016015	100
	i) Rural	873326	85.95601
	ii) Urban	142689	14.04399
	B) Farmers	353661	34.80864
	i) Rural	343368	33.79556
	ii) Urban	10243	1.008154
	C) Farm labours	465163	45.78308
	i) Rural	436585	42.97033
	ii) Urban	28578	2.812754
	D) Workers engaged in other than Agril. Work	197191	19.40828
	i) Rural	93373	9.19012
	ii) Urban	103818	10.21816
	E) Non Workers	1216465	119.729
	i) Rural	885771	87.1809
	ii) Urban	330694	32.54814

(Source: district socio-economic Review, 2012-13)

The population of the district according to 2001 census is 2232480 persons composed of 1147403 males (51.40 per cent) and females 1085077 (48.60 per cent). Out of total workers (1016015) 34.81 per cent is the farmers and 45.78 per cent are the farm labours. The workers engaged in other than agricultural work constituted 19.40 per cent of total work.

4.2.2 Land utilization pattern

The information in respect of land utilization pattern in Buldhana district is presented in Table 4.2. It can be seen from the Table 4.2 that, out of the total geographical area (967100 ha) and 58.94 per cent area is under cultivation. There is need to improve cultivable waste land for bringing it under cultivation.

Table 4.2.2 Land utilization pattern of buldhana district

Sr. No.	Particular	Area (00 ha)	Percentage to total
1	Total geographical area	9671	100
2	Area under forest	770	7.91
3	Barren land	410	4.23
4	Non-agricultural land	420	4.34
5	Cultivable waste land	800	8.27
6	Permanent pasture and other grazing land	390	4.03
7	Land under miscellaneous tree crop and not included in net area sown	10	0.10
8	Current fallow	910	9.41
9	Other fallow	650	6.72
10	Net sown area	5020	58.94
11	Area sown more than once	1800	18.61
12	Gross cropped area	7820	77.55
13	Cropping intensity (%)		125.36

(Source: district socio-economic Review, 2012-13)

4.2.3 Cropping pattern of study area

The study of cropping pattern focuses on the economic condition of the farmers. The nature of cropping pattern shows predominance of food or commercial crops which in turn indicates economic level and economic condition of cultivators in tract. The information regarding area under different crops is given Table 4.2.3

Table 4.2.3 Cropping pattern of study area

Sr.No.	Crop	Area (ha)	Percentage to total
1	Rice	368	0.047
2	Wheat	21423	2.73
3	Jowar(kharif+Rabi)	56300	7.19
4	Bajara	3500	0.44
5	Maize	61100	7.81
6	Other millet	200	0.02
	Total cereals	142891	18.27
7	Gram	13126	1.67
8	Tur	65000	8.31
9	Mung	49500	6.32
10	Udid	48400	6.18
11	Other pulses	600	0.07
	Total pulses	176626	22.58
	Total food grain	319518	40.79
12	Sugarcane	374	0.04
13	Vegetable	3735	0.47
14	Cotton	244400	31.25
15	Other fiber crop	309	0.03
	Total cash crop	248818	31.81
16	Groundnut	400	0.05
17	Sesamum	3436	0.43
18	Sunflower	2100	0.26
19	Soybean	208300	26.63
	Total oilseed crop	214236	27.39
	Total non-food crops	463054	59.21
	Gross crop area	782000	100

(Source: district socio-economic survey report, Buldhana 2012-13)

It can be seen from Table 4.2.3 that, cash crop and oilseed are important crops in district having occupied 31.81 per cent and 27.39 per cent of the gross cropped area respectively. Cotton and soybean are the two important crops contributing 31.25 per cent and 26.63 per cent of total gross cropped area respectively. The total area under food grains and nonfood grains are 40.79 and 59.21 per cent respectively.

4.2.4 Crop season and crop rotation

There were two important crop growing season i.e. kharif and Rabi season. In summer season, land generally remains fallow. Cotton, Jowar, Maize were important crops grown in kharif season. Green gram, Tur, Black gram, Soybean and Groundnut were also grown in kharif season on large scale. In Rabi season wheat and Gram are the main crops but onion, Safflower, sunflower, vegetables was also taken. Following crop rotation were commonly followed in Buldhana district.

Table 4.2.4 Crop season and crop rotation

Sr. No.	Kharif season	Rabi season
1.	Cotton	-
2.	Cotton + Tur + Jowar	-
3.	Jowar	Gram
4.	Cotton +Green gram+Black gram	Wheat
5.	Cotton + Tur + Green gram	Gram
6.	Jowar	Safflower/wheat
7.	Cotton + Tur	Safflower
8.	Cotton +Tur +Jowar+Green gram	Sunflower
9.	Mung	Safflower
10.	Cotton + Mung.	-

(Source: district socio-economic Review, 2012-13)

4.2.5 Size of land holding

Table 4.2.5 indicates that, maximum farmers of district are small (111170) and marginal (82409) covering 160647 ha and 52197 ha area respectively. Farmers having medium land holding are less (34913) but contributing maximum area of 202566 ha. The average size of holding is 2.2 ha.

Table 4.2.5.Size of land holding in Buldhana district

Land holding	No. of farmers	Area (ha)
Marginal(below 1 ha)	82409	52192
Small(1to 1.99)	111170	160647
Semi-medium(2 to 3.99)	73536	199620
Medium(4 to 9.99)	34913	202566
Large(10 and above)	4110	59883
Total holding	366138	674908

(Source: district socio-economic survey report, Buldhana 2012-13)

4.2.6 Irrigation

For the agriculture development, in general economic development, it is necessary to increase irrigation facilities. Wells, minor projects and rivers are the main sources of irrigation in district. The Table 4.6 shows source wise irrigation in district.

Table 4.2.6 Sources of irrigation of buldhana district

Sr.No.	Source	Area(ha)	Percentage
1.	Surface irrigated area	2653	3.89
2.	Wells	14726	21.58
3.	Net area under irrigation	17379	25.46
4.	Total area under irrigation	68261	100

(Source: district socio-economic survey report, Buldhana 2012-13)

4.3 Input supply

Agricultural inputs like seed, manures, insecticides, pesticides etc. required by farmers are made available to them through number of agricultural service centers established at district and block level.

Maharashtra state seed corporation and other private seed companies supply quality seed to farmers. Farm inputs are made available to the farmers by co-operative societies also.

4.4 Credit supply

The credit supply was done by primary agricultural co- operative credit society, panansansta, production society, social service society and commercial banks.

4.5 Marketing and transportation

Agricultural marketing comities were functioning for the marketing of agricultural produce. Alltahsils having facility of regulated market. The main markets were Khamgaon, Jalgaonjamod, Chikhali, Mehkar, Malkapur etc.

Markets were linked with roads. The produce therefore easily transported from the district. Bullock carts, tractors and trucks were means of transportation.

4.6 Development of infrastructural facilities in district

Previously district was considered to be agricultural backward as agriculture in district was mainly dependent on rainfall and there was absence of commercial outlook among farming communities. Agriculture was moreover of subsistent nature. But after development of irrigation, the agriculture in the district has a tremendous change. Cotton was main commercial crop and responsible for economic development in the district. Cereals and pulses are taken on commercial basis than subsistence. The district was well connected with adjoining districts by roads. Railway facilities were also available for transport.

The factors like well developed transport facilities, regulated market, establishment of co- operatives are distinct features of the district. These together have helped in changing the face of district. All these development, in turn have increased the income of agriculturist. The increased income in the agriculture sector has brought about many changes in socioeconomic aspect of the people in general and agriculturist in particular.



Fig.1. Map showing the location of selected tahsil of Buldana District

CHAPTER V

RESULTS AND DISCUSSION

The present study would provide the information on technologies recommended, extent of their adoption, input utilization level, cost incurred, factors affecting the adoption and profitability of *Kharif* jowar crop.

In this chapter the position of farm organization i.e. the existing land utilization, cropping pattern and investment in various fixed farm assets is discussed among groups of selected farmers having different size of holding. The level of adoption of different technologies resource utilization and economics of production i.e. cost incurred, gross return, net return etc. from *Kharif* jowar crop is discussed among the groups of selected farmers according to level of adoption of recommended technologies.

5.1 Distribution of selected farmers according to size of holding

The information regarding the distribution of selected holdings in size groups in Table 5.1. For the present study 90 *Kharif* jowar growers have selected purposively and classified into three groups i.e. small, medium and large size.

Table 5.1. Distribution of selected farmers according to size of holding

Sr. No.	Land holding group	Area in hectare	Number of cultivators
1	Small	Upto 2 ha	10 (11.12)
2	Medium	2.01 to 4 ha	49 (54.44)
3	Large	4.01 and above	31 (34.44)
4	Total		90(100)

(Figures in parenthesis indicate the percentage to the total)

The land holding for small, medium, and large groups were upto 2 hectare, 2.01 to 4 hectare and 4.01 hectare and above, respectively.

5.2 Economic characteristics of selected farmers

5.2.1 Size of family

The details of family size of selected farmers are presented in the Tables 5.2.1

Table 5.2.1.Average size of family of selected Kharif jowar cultivators

Sr. No.	Particulars	Group			
		Small	Medium	Large	Overall
1	Male	2 (33.33)	1 (20.00)	2 (40.00)	2 (33.33)
2	Female	2 (33.33)	2 (40.00)	1 (20.00)	2 (33.33)
3	Children	2 (33.34)	2 (40.00)	2 (40.00)	2 (33.34)
4	Total	6 (100)	5 (100)	5 (100)	6 (100)

(Figures in parenthesis indicate the percentage to the total)

Family size and its components are basically the functions of economic and social characteristics, customs and religious belief of society. Table 5.2.1.indicated that the average size of family was 6 for small group, 5 for medium group and 5 for large size group. At overall level, average family size worked out 6.At the overall level, the average number of male, female and children per family were 2 (33.33 per cent), 2 (33.33 per cent) and 2 (33.33 per cent) respectively.

Table : 5.2.2 Educational pattern of selected farmers (Nos)

Sr. No.	Particulars	Size group			
		Small	Medium	Large	Over all
1	Illiterate	3 (30.00)	17 (34.69)	13 (41.93)	33 (36.66)
2	Primary school	2 (20.00)	11 (22.44)	7 (22.58)	20 (22.22)
3	Middle school	2 (20.00)	9 (18.36)	4 (12.90)	15 (16.66)
4	High school	1 (10.00)	6 (12.24)	3 (9.67)	10 (11.11)
5	Higher secondary	1 (10.00)	4 (8.16)	2 (6.45)	7 (7.77)
6	Graduate & above	1 (10.00)	2 (4.08)	2 (6.45)	5 (5.55)
	Total	10 (100.00)	49 (100.00)	31 (100.00)	90 (100.00)

(Figure in parenthesis indicate the percent to total)

It can be seen from Table 5.2.2 that, at overall level 36.66 per cent of farmers are illiterate and rest of them have educated, among them 25.55 per cent, 17.77 per cent, 11.11 per cent, 7.77 per cent and 4.44 per cent people have completed their primary school, middle school, high school, higher secondary, graduate and above level of education respectively. Highest illiterate people were observed in small size of holding.

5.2.3. Land utilization

Land utilization indicated the area of land actually utilized for different purposes, like crop production, pasture, fallow land etc.

Table 5.2.3 Average per farm land utilization pattern of Kharif jowar cultivators
(Area in ha)

Sr.No	Particulars	Group			
		Small	Medium	Large	Overall
1	Total land	1.20 (100)	4.073 (100)	11.12 (100)	6.18 (100)
2	Fallow land	0.00 (0.00)	0.16 (4.01)	1.25 (11.24)	0.52 (8.41)
3	Net sown area	1.20 (100)	3.91 (95.99)	9.87 (88.75)	5.66 (91.59)
4	Irrigated area	0.40 (33.33)	2.54 (62.36)	7.29 (65.55)	3.94 (63.75)
5	Unirrigated area	0.80 (66.66)	1.36 (33.39)	2.58 (23.20)	1.72 (27.83)
6	Area sown more than once	0.28 (23.33)	0.92 (22.58)	1.63 (14.65)	1.09 (17.64)
7	Gross cropped area	1.48	4.83	11.50	6.76
8	Cropping intensity (%)	123.33	123.52	116.51	119.43

(Figures in parenthesis indicate the percentage to the total)

Land is said to be the scarce resource and is one of the income generating resources for the farm families dependent on agriculture as a main source of livelihood. Land utilization indicated the area of holding actually put to use of different purposes like crop production,

pasture, multiple cropping etc. as well as area under irrigation. Table 5.2.3 present the land utilization pattern per farm for selected holdings.

It was observed that from Table 5.2.3 that the proportions of net cropped area to average farm area in respect of small, medium and large farmer were 100, 95.99 and 88.75 per cent, respectively.

The overall permanent fallow land, net cropped area, irrigated and non-irrigated area was 8.41, 91.59, 63.75 and 27.83 per cent respectively. Average gross cropped area was 1.48, 4.83 and 11.50 ha respectively in small, medium and large size groups. The farmers followed 123.33, 123.52 and 116.51 per cent cropping intensity in respect of small, medium and large size groups of farm.

5.2.4 Cropping pattern

Cropping pattern adopted in selected area was to be the resultant of farmers past experience, the type of soil, available irrigation resources and pattern of distribution of rainfall. The cropping pattern followed by selected farmers during the year 2010-11 is presented in Table 5.2.4.

It reveals that, the selected farmers adopted diversified cropping pattern and had grown crops in two seasons viz., *Kharif* and *rabi*. The cropping pattern adopted was dominated by *Kharif* crops, because of limited irrigation facilities available. *Kharif* jowar was the major crop grown in the *Kharif* season.

In small size group *Kharif* jowar occupied 7.63 per cent of gross cropped area, followed by cotton 30.15 per cent and soybean 17.94 per cent. In medium size group, *Kharif* jowar occupied 7.68 per cent of gross cropped area, followed by cotton 29.43 per cent and soybean 17.92 per cent. In case of large size group the area under *Kharif* jowar was found to be 8.07 per cent and under cotton was 30.55 per cent, followed by soybean 18.54 per cent of gross cropped area.

The area under mung in small, medium and large groups was 2.67, 2.74 and 3.17 per cent, respectively.

Table 5.2.4 cropping pattern of selected farmers(area in ha)

Sr. No.	Particulars	Size of Land holding			
		Small	Medium	Large	Overall
A	Kharif				
1	Cotton	0.79 (30.15)	1.61 (29.43)	3.18 (30.55)	1.77 (30.11)
2	Soybean	0.47 (17.94)	0.98 (17.92)	1.93 (18.54)	1.07 (18.23)
3	Tur	0.07 (2.67)	0.17 (3.11)	0.35 (3.36)	0.19 (3.17)
4	Kharif Jowar	0.2 (7.63)	0.42 (7.68)	0.84 (8.07)	0.46 (7.87)
5	Green gram	0.07 (2.67)	0.15 (2.74)	0.33 (3.17)	0.17 (2.95)
6	Black gram	0.08 (3.05)	0.17 (3.11)	0.35 (3.36)	0.19 (3.23)
7	Maize	0.06 (2.29)	0.13 (2.38)	0.28 (2.69)	0.15 (2.52)
	Sub total	1.74 (66.41)	3.63 (66.36)	7.26 (69.74)	4.00 (68.07)
B	Rabi				
1	Gram	0.45 (17.18)	0.96 (17.55)	1.69 (16.23)	0.99 (16.83)
2	Wheat	0.25 (9.54)	0.54 (9.87)	1.08 (10.37)	0.59 (10.07)
3	Maize	0.14 (5.34)	0.29 (5.30)	0.31 (2.98)	0.24 (4.14)
4	Rabi Jowar	0.01 (0.38)	0.01 (0.18)	0.02 (0.19)	0.01 (0.22)
5	Other	0.03 (1.15)	0.04 (0.73)	0.05 (0.48)	0.04 (0.67)
	Sub total	0.88 (33.59)	1.84 (33.64)	3.15 (30.26)	1.87 (31.93)
	Gross cropped area.	2.62 (100.00)	5.47 (100.00)	10.41 (100.00)	5.87 (100.00)

(Figures in parentheses indicate percentage of total cropped area.)

As size revealed from table 5.2.4, cotton crop dominated the cropping pattern in all groups of beneficiary farmers. Cotton occupied 30.11 per cent of the gross cropped area. Soybean is the next important crop grown by the beneficiary farmer and it occupied 18.23 per cent. For beneficiary farmers the next important crop was gram which occupied 16.83 percent of gross cropped area. Wheat and Jowar is also important crop for beneficiary farmers, the area under these crops was 10.07 per cent and 7.87 per cent respectively.

5.2.5 Investment in fixed farm assets

The capital assets owned by farmers in the present study are land, livestock, implements and machineries. The average investment pattern in various fixed farm assets on different groups of farms is presented in Table 5.2.5.

From Table 5.2.5.it is observed that he major share in total value in fixed farm assets was land in all the groups. It ranged from 72.42 per cent in respect of small group, 88.66 per cent in respect of medium size group and 93.84 per cent in respect of large size group and overall average value in land worked out to 91.96 per cent.

The major item of investment was housing. Average per household investment on housing in case of small, medium and large group was Rs. 79000 (21.19 per cent), Rs.106122.4 (6.27 per cent) and Rs.137741.9(2.32 per cent), respectively. At overall level average investment on housing worked out to Rs.113999.96 (3.80per cent).

The next major item of investment was livestock and its per household investment in small, medium and large groups was Rs.14500 (3.89 per cent), Rs.46061.22 (2.72 per cent), Rs.82258.06 (1.39 per cent), respectively.

After that next important item wascattleshed and its per household investment in small, medium and large groups was Rs. 4500(1.21 per cent), Rs. 15510.2(0.92 per cent), Rs.22419.35 (0.38 per cent) respectively.

The next major items of investment were implements and machinery in case of per household investment in small, medium and large groups were Rs.4800 (1.29 per cent), Rs.24065.31 (1.42 per cent), and Rs.122732.3 (2.07 per cent), respectively.

At overall level land, housing, implements and machineries, cattleshed, livestock constituted 91.96, 3.80, 1.86, 0.56 and 1.83 per cent to the total investment, respectively.

Table 5.2.5 Per holding investment in various fixed farm assets (inRs)

Sr. No	Particulars	Groups			
		Small	Medium	Large	Overall
1	Land	270000 (72.42)	1500000 (88.66)	5560000 (93.84)	2761777.78 (91.96)
2	Cattle shed	4500 (1.21)	15510.2 (0.92)	22419.35 (0.38)	16666.66 (0.56)
3	Housing	79000 (21.19)	106122.4 (6.27)	137741.9 (2.32)	113999.96 (3.80)
4	Implements and machinery	4800 (1.29)	24065.31 (1.42)	122732.3 (2.07)	55910.02 (1.86)
5	livestock	14500 (3.89)	46061.22 (2.72)	82258.06 (1.39)	55022.22 (1.83)
	Total	372896.1 (100)	1691856 (100)	5925250 (100)	3003376.64 (100)

Figure in parentheses indicate percentage to the total

The total value of capital assets per farm was use in small size group (Rs.372896.1), followed by medium group (Rs. 1691856) and large size group (Rs. 5925250). At overall level the total value of assets owned worked out at Rs. 3003376.64.

5.2 Adoption of different technologies

Recommended technologies developed by Dr. P.D.K.V. Akola for Kharif jowar cultivation.

The main objective of present study is to be identify the level of adoption of various technologies for *Kharif* jowar against the recommended technologies in Dr. P.D.K.V. Akola and evaluate such impact. It would not be out of way to present the levels of various technologies recommended for *Kharif* jowar. The data on the recommended technologies by Dr. P.D.K.V. Akola is presented in Table 5.3



Table 5.3: Recommended technology developed by Dr.P.D.K.V. Akola for Kharif jowar cultivation.

Sr. No.	Particulars	Recommended
1.	Type of soil	Heavy to medium having good drainage
2.	Preparatory tillage	1 ploughing and 3-4 harrowing
3.	Seed rate	10 kg /ha
4.	Varieties	CSH-14, CSH-17, SPV-669
5.	Time of sowing	Last week of june to first week of july
6.	Spacing	45x10 cm
7.	Level of fertilizer	80 kg N : 40 kg P ₂ O ₅ : 40 kg K ₂ O
8.	Intercultural operation	3 hoeing and 3 weeding
9.	Plant protection	Thiurcarbenziumetc spraying Atrazine @ 1 to 1.5 kg/ha. in 600-700 liters water per ha. End.35 Ec@ 14ml/ 10 liters water at 7-10 days after sowing if necessary repeate after 14 days
10.	Potential yield (qtls/ha)	40 tls/ha

5.4 Extent of adoption of technology

Actual level of adoption of each item of technology on farmer's field was identified comparing with the recommended technologies developed by and accordingly Dr. PDKV, Akola and other Agriculture Universities in Maharashtra extent of each technology was calculated.

5.4.1 Extent of adoption of recommended technology : type of soil (X₁)

Extent of adoption of recommended technology for type of soil adopted by different group of cultivator was calculated and presented in Table 5.4.1.

Table 5.4.1 Extent of adoption in of recommended soil type

Per cent	Group			
	Small	Medium	Large	Total
Up to 50	10 (100)	8 (16.33)	1 (3.23)	19 (21.11)
51-80	-	4 (8.16)	-	4 (4.44)
81 and above	-	37 (15.51)	30 (96.77)	67 (74.44)
Total	10 (100)	49 (100)	31 (100)	90 (100)

From Table 5.4.1, it was revealed that 19 (21.11 per cent) farmers adopted type of soil technology in the range of upto 50, 4 (4.44 per cent) farmers adopted this technology in the per cent of 51-80, whereas 67 (74.44 per cent) farmers adopted this technology in the per cent of 81 and above.

5.4.2 Extent adoption of recommended technology :preparatory tillage (X_2)

Extent of adoption of recommended technology for preparatory tillage by different groups of cultivators was calculated and presented in Table 5.4.2.

Table 5.4.2 Extent of adoption of recommended technology: preparatory tillage (X_2)

Per cent	Group			
	Small	Medium	Large	Total
Upto 50	10 (100)	49 (100)	31 (100)	90 (100)
51-80	-	-	-	-
81 and above	-	-	-	-
Total	10 (100)	49 (100)	31 (100)	90 (100)

From Table 5.4.2, it was revealed that 90 (100 per cent) farmers adopted preparatory tillage technology in the per cent of up to 50.

5.4.3 Extent of adoption of recommended technology : Spacing (X_3)

Extent of adoption of recommended technology for spacing adopted by different groups of cultivators was calculated and presented in Table 5.4.3.

Table 5.4.3 Extent of adoption of recommended technology: Spacing(X_3)

Per cent	Group			
	Small	Medium	Large	Total
Upto 50	-	-	-	-
51-80	3 (30)	-	-	3 (3.33)
81 and above	7 (70)	49 (100)	31 (100)	87 (96.67)
Total	10 (100)	49 (100)	31 (100)	90 (100)

According to recommendation of Dr. PDKV, Akola and other Universities, 45*10cm spacing is sufficient for optimum plant population . From Table 5.4.3, it was revealed that 3 (3.33 per cent) farmers adopted spacing technology in the per cent of 51-80, whereas 87 (96.67 per cent) farmers adopted this technology in the per cent of 81 and above.

5.4.4 Extent of adoption of recommended technology: Varieties (X₄)

Extent of adoption recommended technology in respect of varieties adopted by different groups of cultivators was calculated and presented in Table 5.4.4.

According to recommendation of Dr. DPKV, Akola and other universities, CSH-14,CSH-17,SPV-669 recommended for cultivation of *Kharif jowar*. From Table 5.4.4, it was revealed that 15 (16.67 per cent) farmers applied varieties in the range of 0.51-0.80, whereas 75 (83.33 per cent) farmers adopted this technology in the range of 0.81 and above.

Table 5.4.4 Extent of adoption of recommended technology: Varieties (X₄)

Per cent	Group			
	Small	Medium	Large	Total
Upto 50	-	-	-	-
51-80	10 (100)	5 (10.21)	-	15 (16.67)
81 and above	-	44 (89.79)	31 (100)	75 (83.33)
Total	10 (100)	49 (100)	31 (100)	90 (100)

5.4.5 Extent of adoption of recommended technology : Time of sowing(X₅)

Extent of adoption recommended technology for time of sowing operation adopted by different groups of cultivators was calculated and presented in Table 5.4.5.

Table 5.4.5 Extent of adoption of recommended technology: Time of sowing (X_5)

Per cent	Group			
	Small	Medium	Large	Total
Upto 50	10 (100)	35 (71.43)	-	45 (50)
51-80		-	-	-
81 and above	-	14 (28.57)	31 (100)	45 (50)
Total	10 (100)	49 (100)	31 (100)	90 (100)

According to recommendation on of Dr. DPKV, Akola and other Universities on time of sowing for *Kharif* jowar. From Table 5.4.5, it was revealed that 45 (50 per cent) farmers adopted time of sowing technology in the per cent of upto 50, whereas 45 (50 per cent) farmers adopted this technology in the per cent of 81 and above.

5.4.6 Extent of adoption of recommended technology : Seed rate(X_6)

Extent of adoption recommended technology seed rate adopted by different groups of cultivators was calculated and presented in Table 5.4.6.

Table 5.4.6. Extent of adoption of recommended technology: seed rate (X_6)

Per cent	Group			
	Small	Medium	Large	Total
Up to 50	1 (10)	-	-	1 (1.11)
51-80	-		-	-
81 and above	9 (90)	49 (100)	31 (100)	89 (98.89)
Total	10 (100)	49 (100)	31 (100)	90 (100)

According to recommendation of Dr. DPKV, Akola and other Universities on seed rate technology in *Kharif* jowar. From Table 5.4.6, it was revealed that only 1 (1.11 per cent) farmers adopted recommend seed rate technology in the per cent of upto 50, whereas 89 (98.89 per cent) farmers adopted this technology in the per cent of 81 and above.

5.4.7 Extent of adoption of recommended technology : Nitrogen (X_7)

Extent of adoption of recommended technology for nitrogen application by different groups of cultivators was calculated and presented in Table 5.4.7.

Table 5.4.7. Extent of adoption of recommended technology: Nitrogen (X_7)

Per cent	Group			
	Small	Medium	Large	Total
Up to 50	- ()	3 (6.13)	2 (6.45)	5 (5.56)
51-80	4 (40)	- ()	- ()	4 (4.44)
81 and above	6 (60)	46 (93.87)	29 (93.55)	81 (90)
Total	10 (100)	49 (100)	31 (100)	90 (100)

According to recommendation of Dr. PDKV, Akola and other agricultural Universities, 80 kg nitrogen recommended for cultivation of *Kharif* jowar. From Table 5.4.7, it was revealed that only 5 (5.56 per cent) farmers adopted nitrogen technology as per recommendation in the per cent of upto 50, 4 (4.44 per cent) farmers adopted this technology in the per cent of 51-80, whereas majority 81 (90 per cent) farmers adopted this technology in the per cent of 81 and above.

5.4.8 Extent of adoption of recommended technology: Phosphorus (X_8)

Extent of adoption of recommended technology with respective phosphorus application by different groups of cultivators was calculated and presented in Table 5.4.8.

Table 5.4.8. Extent of adoption of recommended technology: Phosphorus (X_8)

Per cent	Group			
	Small	Medium	Large	Total
Up to 50	5 (50)	8 (16.33)	2 (6.45)	16 (17.78)
51-80	4 (40)	32 (65.31)	24 (77.42)	59 (65.56)
81 and above	1 (10)	9 (18.37)	5 (16.13)	15 (16.67)
Total	10 (100)	49 (100)	31 (100)	90 (100)

According to recommendation of Dr. PDKV, Akola and other agricultural Universities, 40 kg phosphorus recommended for cultivation of *Kharif* jowar. From Table 5.4.8, it was revealed that 16 (17.78 per cent), 59 (65.56 per cent) and 15 (16.67) farmers adopted phosphorus technology in the per cent of upto 50, 51-80, 81 and above, respectively.

5.4.9 Extent of adoption of recommended technology :Potassium (X₉)

Extent of adoption of recommended technology for potassium application by different groups of cultivators was calculated and presented in Table 5.4.9

According to recommendation of Dr. PDKV, Akola and other agricultural Universities, 40 kg potassium recommended for cultivation of *Kharif* jowar. From Table 5.4.9, it was revealed that 56 (62.22 per cent), 30 (33.33 per cent) and 4 (4.44 per cent) farmers adopted potassium technology in the per cent of upto 50, 51-80, 81 and above, respectively.

Table 5.4.9.Extent of adoption of recommended technology: Potassium (X₉)

Per cent	Group			
	Small	Medium	Large	Total
Up to 50	10 (100)	39 (79.59)	7 (22.58)	56 (62.22)
51-80	-	10 (20.41)	20 (64.52)	30 (33.33)
81 and above		-	4 (12.90)	4 (4.44)
Total	10 (100)	49 (100)	31 (100)	90 (100)

5.4.10 Extent of adoption of recommended technology:Inter cultural operation (X₁₀)

Extent of adoption of recommended technology for intercultural operation as adopted by different groups of cultivators was calculated and presented in Table 5.4.10.

Table 5.4.10. Extent of adoption of recommended technology: Intercultural operation (X₁₀)

Per cent	Group			
	Small	Medium	Large	Overall
Up to 50	8 (80)	37 (75.51)	18 (58.06)	63 (70)
51-80	-	-	-	-
81 and above	2 (20)	12 (24.49)	13 (41.94)	27 (30)
Total	10 (100)	49 (100)	31 (100)	90 (100)

According to recommendation of Dr. PDKV, Akola and other agriculture Universities, three weeding and three hoeing recommended for cultivation of *Kharif* jowar. From Table 5.4.10, it was revealed that 63 (70 per cent) farmers adopted intercultural operation technology in the per cent of 0-0.50; whereas, 27 (30 per cent) farmers adopted this technology in the per cent of 81 and above.

5.4.11 Extent of adoption of recommended technology: Plant protection (X₁₁)

Extent of adoption of recommended technology for plant protections adopted by different group of cultivators was calculated and presented in Table 5.4.11.

Table 5.4.11 Extent of adoption of recommended technology: Plant protection (X₁₁)

Per cent	Group			
	Small	Medium	Large	Overall
Up to 50	10 (100)	5 (10.20)	1 (2.56)	16 (17.78)
51-80	-	-	-	-
81 and above	-	44 (89.79)	30 (96.78)	74 (82.22)
Total	10 (100)	49 (100)	31 (100)	90 (100)

According to recommendation of Dr. PDKV, Akola and other agriculture universities, plant protection recommended for cultivation of

Kharif jowar. From Table 5.4.11, it was revealed that 16 (17.78 per cent) farmers adopted plant protection technology in the per cent of upto 50; whereas, 74 (82.22 per cent) farmers adopted this technology in the per cent of 81 and above.

5.5. Factor weight analysis

For estimating the contribution of each factor in yield, the multiple linear regression analysis was carried out. The contribution of different technologies in yield assigned as a weight is presented in Table 5.5.

Table 5.5. Weight of different factors in yield

Sr. No	Technology	Variables (Xn)	Weight (%)
1	Type of soil	X1	3.2
2	Preparatory tillage	X2	4.3
3	Spacing	X3	3.5
4	Varieties	X4	14.9
5	Time of sowing	X5	12.9
6	Seed rate	X6	5.41
7	Nitrogen	X7	22.4
8	Phosphorus	X8	3.2
9	Potassium	X9	8.7
10	Intercultural operation	X10	16.4
11	Plant protection	X11	5.1
		Total	100

Nitrogen showed highest contribution (i.e. 22.4 per cent in yield, followed by intercultural operation (16.4 per cent) and varieties (14.9 per cent), time of sowing and phosphorus contributed 12.9 per cent and 8.7 per cent share in total yield, respectively. Number of preparatory tillage, spacing, type of soil, seed rate, potassium and plant protection was the other technologies which contributed less than 8 per cent share in yield. Thus, Table 5.5 revealed the nitrogen, Interculture operations, varieties, time of sowing, are the more important technologies in production of *Kharif Jowar* crop.

After estimating the contribution of each factor the same was used as a weight for estimating composite index of adoption of technologies.

5.6 Regression analysis of composite adoption index on yield

The regression analysis was done by LSQ technique to find out the contribution of different technologies. Independent variable (x) is the composite adoption index. Dependent variable is (y) yield per hectare. Results of this analysis are presented in the Table 5.6. Analysis revealed that yield varied according to the level of adoption of recommended technologies.

Table 5.6: Regression analysis of composite adoption index on yield.

Sr.No.	Production functions	Constant	Regression Co-efficient	R ²
1.	Linear	1.96	37.24	0.97

5.7 Estimation of composite index of adoption

Composite index of adoption of the technologies was estimated for each farmer separately based on the adoption index of technology and factor share of respective technology as per the procedure given in methodology chapter. The farmers were arranged in the ascending order of composite index of adoption. Distribution of farmers according to the composite index (i.e. the level of adoption of different technologies) is presented in Table 5.7.

Table 5.7 Distribution of the farmers on the basis of composite adoption of index

Size of holding	Adoption range			Overall
	Low (0-50.03)	Medium (50.03- 81.57)	High (81.57 and above)	
Small	2 (12.50)	5 (9.62)	3 (13.64)	10 (11.11)
Medium	9 (56.25)	31 (59.62)	9 (40.91)	49 (54.44)
Large	5 (31.25)	16 (30.76)	10 (45.45)	31 (34.35)
Overall	16 (100)	52 (100)	22 (100)	90 (100)
Overall level of adoption	16 (17.77)	52 (57.77)	22 (24.44)	90 (100)

It is observed from Table 5.7 that out of 90 farmers 16 farmers adopted technology in the range of 0 to 50.03 per cent which is categorized as low adopter. 52 farmers adopted technology in the range of 50.03 to 81.57 per cent which is categorized as medium adopter while 22 farmers adopter technology above 81.57 per cent which is categorized as high adopter.

5.8 Resource utilization

The pattern of utilization of resources by farmers indicated the degree of management of resource, their choice and decision making. Besides this, it indicated the level of technology adopted by the farmers. Human labour, bullock labour, seed, manures and fertilizers for *Kharif jowar* were the basic type of resources being considered in the present study. Levels of key inputs utilization per hectare in the different adoption groups for *Kharif jowar* crop are given in Table 5.8

Average per hectare input used by the selected *Kharif jowar* cultivators for different group

As seen from Table 5.8 male labour employed for *Kharif jowar* crop was 24.66 man days, 28.65 man days and 30.63 man days for low, medium and high technology adoption groups, respectively. The total female labour requirement was 28.81 man days, 33.6 man days and 43.1 man days for low, medium and high technology adoption groups, respectively. Bullock labour utilization per hectare worked out to 7.63 pair days, 11.29 pair days and 10.66 pair days in low, medium and high technology adoption groups, respectively. The level of utilization of machinery for various operations was 6.91 hrs, 7.54 hrs and 9.23 hrs in low, medium and high technology adoption groups respectively and overall average worked out 7.84 hrs. The utilization of seed by *Kharif jowar* cultivators near about equal to the recommended level in all groups. The use of seed was 9.83 kg, 9.68 kg and 9.40 kg in case of low, medium and high technology adoption groups respectively.

Utilization of FYM and fertilizer is an important component of modern technology. The utilization of FYM was very low being 3.94 cart loads in low adoption group and 8.85 cart loads in high technology

adoption group. While, overall average utilization worked out to 6.64 cart loads. The application of nitrogen per hectare was 72.57 kg, 74.24 kg and 75.55 kg in case of low, medium and high technology adoption groups respectively while the overall average worked out to 74.12 kg. In case of phosphorus actual utilization level was 33.13 kg, 34.47 kg and 35.51 kg in case of low, medium and high technology adoption groups, respectively. This implied that with increase farm size the was an interdiction is the use of different input except in case of farm labour.

Table 5.8 Average input use by the farmers at different adoption level (ha)

Sr. No	Particulars	Unit	Group			Overall
			Low	Medium	High	
1	Total labour					
	a. Male	Days	24.66	28.65	30.63	28.42
	b. female	Days	28.81	33.6	43.1	33.15
2	Hired human labour					
	a. Male	Days	10.32	15.59	22.19	15.58
	b. female	Days	21.45	29.35	39.38	30.40
3	Machine labour	Hrs.	6.91	7.54	9.23	7.84
4	Bullock labour	Days	7.63	11.29	10.66	10.48
5	Seed	Kg	9.83	9.68	9.40	9.63
6	Manure	C.L/ha	3.94	6.53	8.85	6.64
7	Fertilizer					
	N	Kg	72.57	74.24	75.55	74.12
	P	Kg	33.13	34.47	35.51	34.37
	K	Kg	31.76	32.86	34.95	33.19
8	Family labour					
	a. Male	Days	14.34	13.06	8.44	12.16
	b. female	Days	7.36	4.25	1.72	4.44

5.9 Cost of cultivation

One of the objectives of the present investigation was to study the economics of *Kharif* jowar cultivation. This involved the estimation of different costs. The data regarding the cost of cultivation of *Kharif* jowar is presented in Table 5.9.

Table 5.9: Average per hectare cost of cultivation of Kharif jowar crop

Sr.No.	Particulars	Group			
		Low	Medium	High	Overall
1	Hired human labour				
	a. Male	1290.00 (5.96)	1948.75 (7.80)	2373.75 (8.72)	2033.31 (7.74)
	b. Female	1501.50 (6.94)	2054.50 (8.22)	2456.60 (9.02)	2127.81 (8.09)
2	Bullock labour	1526.00 (7.05)	1458.00 (5.84)	1332.00 (4.89)	2097.06 (7.98)
3	Machine labour	2764.00 (12.77)	3016.00 (12.07)	3292.00 (12.09)	3136.44 (11.93)
4	Seed	673.60 (3.11)	702.40 (2.81)	752.00 (2.76)	709.40 (2.70)
5	Manure	1288.00 (5.95)	1306.00 (5.23)	1570.00 (5.77)	1327.33 (5.05)
6	Fertilizer				
	N	907.12 (4.19)	928.00 (3.71)	944.37 (3.47)	926.50 (3.52)
	P	679.16 (3.14)	706.63 (2.83)	727.95 (2.67)	704.58 (2.68)
	K	333.48 (1.54)	345.03 (1.38)	366.97 (1.35)	348.49 (1.33)
7	Insecticides	43.31 (0.20)	49.16 (0.20)	52.57 (0.19)	48.34 (0.18)
8	Land revenue	22.33 (0.10)	24.34 (0.10)	24.70 (0.09)	24.07 (0.09)
9	Depreciation	299.55 (1.38)	306.26 (1.23)	311.21 (1.14)	305.67 (1.16)
10	Interest on working capital	673.78 (3.11)	765.59 (3.06)	845.32 (3.10)	821.68 (3.13)
11	Repairing charges	223.50 (1.03)	245.50 (0.98)	220.40 (0.81)	235.45 (0.90)
	<u>Cost 'A'</u>	12225.33 (56.50)	13856.16 (55.46)	15269.84 (56.07)	14846.13 (56.48)
12	Rental value of land	3977.67 (18.38)	4772.33 (19.10)	5448.63 (20.01)	5343.71 (20.33)
13	Interest on fixed capital	3127.02 (14.45)	4425.74 (17.71)	5197.62 (19.09)	4250.12 (16.17)
	<u>Cost 'B'</u>	19330.02 (89.33)	23054.23 (92.28)	25916.09 (95.17)	24439.96 (92.97)
14	Family human labour				
	a. Male	1792.50 (8.28)	1632.50 (6.53)	1055.00 (3.87)	1519.78 (5.78)
	b. Female	515.20 (2.38)	297.50 (1.19)	260.40 (0.96)	327.13 (1.24)
	<u>Cost 'C'</u>	21637.72 (100.00)	24984.23 (100.00)	27231.49 (100.00)	26286.87 (100.00)

(Figure in parentheses indicate the percentage to the cost C)

In case of low adopter group, the total cost of cultivation was estimated to be Rs 21637.72. The cost A which accounted for 56.50 per cent of the total cost included variable cost items. The important cost items were hired human labour, bullock labour cost, machine cost and seed cost having 11.90 per cent, 7.05 per cent, 12.77 per cent and 3.11 per cent share respectively in the total cost. The other important items in cost A were fertilizers and manures which together accounts for 14.82 per cent of the total cost.

Cost B which accounted for 89.33 per cent of the total cost. The rental value of land and inters was the major item of cost B having highest share of 18.38 per cent in the total cost. The share of family labour to the total cost was estimated to 10.66 per cent in low adopter group.

In case of medium adopter group, the total cost of cultivation was estimated to be Rs 24984.23. The cost A which contributed for 55.49 per cent of the total cost which was the major cost component. In cost A the major cost items were hired human labour cost, machinery cost, bullock labour seed cost which contributed to the extent of 16.02 per cent, 12.07 per cent, 5.84 per cent, 2.81 per cent of the total cost respectively. Cost B which accounted for 92.28 per cent of the total cost, the interest on fixed capital and rental value of land were the major components which accounted for 17.71 per cent and 19.10 per cent respectively of the total cost. The share of family human labour to the total cost was estimated to 7.72 per cent in case of medium adopter group.

In high adopter group the total cost of cultivation was found to be highest and it was estimated to at Rs 27231.49. Cost A which contributed to the extent of 56.07 per cent of the total cost. The major cost items were hired human labour cost, machinery cost, bullock labour seed cost which accounts for 17.73 per cent, 12.09 per cent, 4.89 per cent 2.76 per cent of the total cost, respectively. In cost B the major component was rental value of land which accounted for 20.01 per cent of the total cost. The share of family labour was found to

be lowest in high group and it was estimated to 4.83 per cent of the total cost.

In overall the total cost of cultivation was found to be Rs 26286.87 Cost A which contributed to the extent of 56.48 per cent of the total cost. The major cost items were hired human labour cost, machinery cost, manure and fertilizer cost and seed cost which accounted for 15.83 per cent, 11.93per cent, 12.58per cent and 2.70per cent of the total cost respectively. In cost B the major components were interest on fixed capital and rental value of land, which accounted for 16.17 per cent and 20.33 per cent of the total cost, respectively. The share of family labour was found to be lowest and it was estimated at 7.02 per cent of the total cost.

The study revealed that the major cost components were rental value of land, hired human labour and interest on fixed capital in all groups of farmers. The share of family labour was found to be highest in case of low group followed by medium and high group. The study indicated that as the level adoption of technology increased the cost of cultivation also increased.

5.10 Economics of production of *Kharif* jowar

Net return over cost A, cost B and cost C, input-output ratio were tools employed for estimation of economics of production of crops.

Data on per hectare production and returns from *Kharif* jowar cultivation was presented in Table 5.10. It would be seen from this table that on an average the *Kharif* jowar cultivators in the study area obtained the yield of 24.80 quintals in high group followed by 21.50 quintals and 17.50 quintals in medium and low groups, respectively. The quantity of by-product was highest i.e. 40.20 quintals in high group followed by medium group i.e. 36.40 quintals and low group i.e. 32.50 quintals. The per hectare gross income received by the farmers was highest i.e. Rs 32840 in high group followed by Rs 28780 in medium group and Rs 24000 in low group.

The net returns per hectare at cost A was highest i.e. Rs 17570.16 in high group followed by Rs 14923.84 in medium group and

Rs 11774.67 in low group. The net returns per hectare at cost B in low, medium and high group were Rs4669.98, Rs 5725.77 and 6923.91, respectively. The figures of net returns at cost C in low, medium and high group were Rs 2362.28, Rs 3795.77 and Rs 5608.51 respectively.

Thus, the study indicates that per hectare output of *Kharif* jowar and consequently the gross and net returns increased with the level of adoption of technology.

Table 5.10: Economics of production of *Kharif* jowar according to composite index of adoption

Sr No.	Items	Groups			
		Low	Medium	High	Overall
1	Per hectare yield				
	a) Main(Qtl)	17.50	21.50	24.80	21.59
	b) By product(Qtl)	32.50	36.40	40.20	36.63
2	Gross income(Rs)	24000.00	28780.00	32840.00	32206.67
3	Per hectare cost(Rs)				
	Cost A	12225.33	13856.16	15269.84	14846.13
	Cost B	19330.02	23054.23	25916.09	24439.96
	Cost C	21637.72	24984.23	27231.49	26286.87
4	Net returns at				
	Cost A	11774.67	14923.84	17570.16	17360.54
	Cost B	4669.98	5725.77	6923.91	7766.71
	Cost C	2362.28	3795.77	5608.51	5919.80
5	Input-output ratio at				
	Cost A	1.96	2.08	2.15	2.17
	Cost B	1.24	1.25	1.27	1.32
	Cost C	1.11	1.15	1.21	1.23

The input output ratio worked out at cost A 2.17. At cost B 1.32 and cost C 1.23 at overall level .

The foregoing discussion thus revealed that the production and returns from *Kharif* jowar cultivation in general increased with the increase in the adoption of recommended technologies. Thus, the farmers should adopt *Kharif* jowar production technology to the fullest extent to exploit all the production potential of this crop.

5.11 Constraints in adoption of *Kharif jowar* production technology

Table 5.11 Constraints faced by the farmers in adoption of modern technologies in *Kharif jowar* production

Sr. No.	Particular	Group			
		Low N=10	Medium N=49	High N=31	Overall N=90
A)	Improved seed				
1.	High cost of hybrid seed	50	45	40	45
2.	Non availability of seed at proper time	31.25	32.69	68.18	41.11
B)	Seed treatment				
1	Inadequate knowledge about use of thiram	60	58	54	57
C)	Sowing time				
1.	Unavailability of labour in time	54.6	65.8	72.4	65.42
D)	Recommended doses of fertilizers				
1.	Unavailability of fertilizer	77.5	65.07	56.81	65.26
2.	Inadequate knowledge about recommended doses	75	65	54	64.66
3.	High price of fertilizer	97	92	87	92
E)	Plant protection measures				
1.	Inadequate knowledge about control measures of pest and diseases	75	46.15	54.54	53.33
2.	Unavailability of fungicide and pesticides at right time	55	50	45	50
3.	Unavailability of capital at time	83	51	45	59.66

It could be seen from Table 5.11; at overall level the major problem faced by *Kharif jowar* was 92 per cent farmer problem with high cost of fertilizers, 65.42 per cent farmer problem with unavailability of labour in time.

The 65.26 per cent face problem with Unavailability of fertilizer , 64.66 per cent farmer inadequate knowledge about recommended doses of fertilizer application while 57 per cent farmers faced the problem of inadequate knowledge about use of thirum. Another constraint faced by 59.66 per cent *Kharif jowar* grower was problem with unavailability of capital at proper time.

Another constraint was non-availability of seed at proper time and inadequate knowledge about plant protection were other problems faced by 41.11 per cent and 53.33 per cent farmers respectively.

It can be concluded that the high cost of fertilizer, and seed, lack of labour, inadequate technical knowledge and financial problems were some of the major constraint of the selected farmers for non-adoption of recommended level of technology at fullest extent.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The study was undertaken to examine the effect of technical change on output of *Kharif* jowar. The contribution of different technologies to *Kharif* jowar output was studied in each group of farmers at different levels of adoption. Thus, the present study examined the impact of various production technologies on yield and economics of *Kharif* jowar cultivation and constraints faced by *Kharif* jowar. The study was undertaken with the following objective.

1. To study the extent of adoption of *Kharif* jowar production technologies on farmers field.
2. To study the economics of production under different level of adoption of technologies.
3. To study constraints faced by farmers in adoption of technologies.

Present study was based on the primary data collected from farmers for the year 2010-2011. In all total 90 farmers were classified into three group small, medium and large.

The average size of family was 6 for small group, 5 for medium group and 5 for large.

The average sizes of land for small, medium and large groups were 1.2 hectares, 4.07 hectares and 11.12 hectares, respectively.

The net sown area of selected holding for small size group was 1.2 hectares, for medium group size 3.91 hectares and 9.87 hectares for large size group.

The selected farmers adopted diversified cropping pattern and grown crop in three seasons namely *Kharif*, *rabi* and summer. The area covered under *Kharif* jowar crop in small, medium and large size groups was 28.38, 17.60 and 9.48 per cent to the gross cropped area respectively.

The per farm capital investment was highest at Rs. 5925250 in large size group followed by Rs. 1691856 in medium size and it was lowest at. 372896.1 in small sized group.

The extent of adoption of technology was observed as 21.11 per cent farmers had adopted 0 to 50 per cent technology. 4.44 per cent of cultivator's farmers had 51 to 80 per cent and 74.44 per cent farmers adopted above 81 per cent of technology related to soil type.

After estimating composite index of each farmer, they were classified into three groups i.e. low adopters (0-50.03), medium adopters (50.03-81.57) and high adopters (81.57 and above) on the basis of composite adoption index.

The contribution of different technologies in the yield was worked out by using multiple linear regression analysis. The result indicates that if the farmers adopt all the technology at their recommended level they can get 21.26 quintals of yield per hectare. The maximum share in yield was of level of fertilizer i.e. 22.4 per cent and intercultural operation showed 16.4 per cent.

Total hired human labour utilization was highest in high level of technology adopter (73.73 days) followed by medium adopter (62.25 days) and then low adopter (53.47 days). The average hired human labour was 61.57 days.

Per hectare use of seed was observed to be highest at 9.8 kg in high technology adopter followed by medium technology adopter at 9.6 kg per hectare and 9.4 kg per hectare in low adopter. The average per hectare seed used was found to be 9.63 kg. As regards to requirement of machinery hours in case of low group was estimated 6.91 hours, 7.54 hours in medium and 9.23 hours large group respectively.

The total cost of cultivation was found to be highest in high level adoption group at Rs. 27231.49 as compared to low and medium groups. The share of family labour to the total cost was estimated to 10.66 per cent in low adopter group. The share of family labour was found to be highest in case of low group followed by medium and high adopter groups.

Profit at cost 'A' over gross return was highest in high level adoption groups at Rs. 17570.16 per hectare and lowest was observed under low level of adoption group.

Profit at cost 'B' was highest in high level adoption groups at Rs. 6923.91 per hectare and lowest in low level adoption group.

At high level adoption group profit at cost 'C' was Rs. 5608.51 per hectare followed by medium adoption group and low adoption group.

At overall major problem faced by *Kharif jowar* growers was high cost of fertilizers and manures. This was expressed by 92 and 87.33 per cent farmers. Second major problem was unavailability of sufficient irrigation water and unavailability of labour.

Conclusions

The following conclusions were drawn from the present study.

1. In Buldhana district 17.77 per cent *Kharif jowar* growers used low level of technologies, 57.77 per cent medium level of technologies and 24.44 per cent high level of technologies.
2. The net returns from *Kharif jowar* for low, medium and high technology adopter at cost C was Rs 2362.28, Rs 3195.77 and Rs.5608.51 respectively.
3. In adoption of recommended technology majority of *Kharif jowar* cultivators found the problem of high cost of fertilizers and unavailability of fertilizer. Next to it non availability of labour in time, inadequate technical knowledge of the respondents and timely credit unavailability were the major constraints faced by the growers.

CHAPTER VII

IMPLICATIONS

1. The professional extension workers can also be advised to take more and more participatory approach for promotion greater adoption of technologies by the farmers.
2. Farmers need to be educated for optimum use of various inputs that minimizes cost A so that it can help in making crop production profitable.

CHAPTER VIII

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(Ganesh B Giri)

APPENDIX

TITLE: IMPACT OF TECHNOLOGY ON KHARIF JOWAR PRODUCTION IN BULDANA DISTRICT

A) Information of farmers

1. Name of farmer :
2. Name of Village:
3. Main occupation:
4. Subsidiary occupation:
5. Age:
6. Education:

B) Information of Family

Sr. No	Male	Female	Child	Total
1				
2				
3				

C) Information of land

- 1) Total land (ha):
- 2) Area under cultivation:
- 3) Area under irrigation:
- 4) Fallow land:
- 5) Cropping pattern for 2010 – 11

Sr. No.	Name of Crop	Variety	Area (ha)
	A) Kharif		
1.			

2.			
3.			
4.			
	B) Rabi		
1.			
2.			
3.			
4.			
	C) Summer		
1.			
2.			
3.			

6) Machinery and Equipment

Sr. No.	Particulars	Numbers	Year of purchase	Present Value
1.	Tractor			
2.	Electric pump			
3.	Plough			
a)	Wooden			
b)	Iron			
4.	Harrow			
5.	Seed drill			
6.	Cart			
7.	Sprayer			
8.	Oil engine			
9.	Well			
10.	Other farm implements			
11.	Housing			
12.	Cattle shed			

D) Livestock Particulars

Sr. No.	Description	Numbers		Present Value
		Milch	Dry	
1.				
2.				
3.				
4.				
5.				
6.				
7.				

Information of Jowar crop

A) Name of variety

- 1) Type of land: light / medium / heavy

Whether recommended for Jowar cultivation

- 2) Status of fertility: good / medium / bad

Preparatory tillage 1. _____
2. _____
3. _____

- 3) Date of sowing:

- 4) Method of sowing:

- 5) Seed rate:

- 6) Spacing:

- 7) Whether seed treatment done Yes / No

- 8) If yes which chemical used

- 9) Gap filling: Yes / No

If Yes, How many days after sowing

- 10) Thinning: Yes / No

If Yes, How many days after sowing

B) Method of fertilizer application

1) Type of fertilizer: _____ Quantity of fertilizer _____

2) At the time of sowing: N _____ kg. P _____ kg. K _____ kg.

3) After sowing dose of N, P, K,

1st dose _____ days _____ kg _____ method

2nd dose _____ days _____ kg _____ method

3rd dose _____ days _____ kg _____ method

C) Intercultural operation

1) Weeding:

1st weeding after sowing _____ days

2nd weeding after sowing _____ days

3rd weeding after sowing _____ days

2) Hoeing:

1st hoeing after sowing _____ days

2nd hoeing after sowing _____ days

3rd hoeing after sowing _____ days

D) Irrigation: Full irrigation / Protective irrigation

Time of irrigation:

No. of irrigation:

E) Weedicide used: Yes / No

If yes which weedicide used

Before sowing after sowing _____ dose _____

Total Quantity used (lit) _____ cost (Rs) _____

F) Plant protection after sowing

Spraying	Days	Chemical	Quantity	Price
1 st				
2 nd				
3 rd				

G) Cost of cultivation

Name of Crop _____ Variety _____

Total land (ha) _____

[illegible]

2.														
I)	supervision													
J)	Harvesting													
K)	Other													

H) Output obtained

Product	Total Quantity	Rate	Total value
Main Product			
By Product			
Total			

VI. Constraints in Adoption Kharif Jowar Production Technology

1. Preparatory tillage

- Whether cost of land preparation is more Yes/No
- All the primary tillage operation carried Yes/No
- Implement are available Yes /No

2. Improved seed

- Knowledge about recommended seed Yes / No
- Cost of hybrid seed High/ Low
- Availability of Improved seed at proper time Yes/No

3. Seed treatment

- Knowledge about use of thiram Yes/No

4. Sowing time

- Weather bullocks are available for sowing. Yes / No
- Availability of laborers in time.
Yes / No
- Availability of seed in time. Yes / No

5. Organic manures

- | | |
|-----------------------------|------------|
| a. Availability of manures. | Yes /No |
| b. Price of manures. | High / low |

6. Recommended doses of fertilizers

- | | |
|------------------------------------|----------|
| a. Knowledge of recommended doses. | Yes / No |
| b. Price of fertilizer. | High/Low |

7. Recommended irrigation stages

- | | |
|--|--------|
| a) Knowledge about application of irrigation at critical | Yes/No |
| b) Availability of sufficient irrigation water | Yes/No |

8. Plant protection measures

- | | |
|---|--------|
| a) Knowledge about control measures of pest and diseases | Yes/No |
| b) Availability of fungicide and pesticides at right time | Yes/No |
| c) Availability of capital at time | Yes/No |

9. Other

