ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF *KHARIF* MAIZE IN SOLAPUR DISTRICT OF MAHARASHTRA

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DISSERTATION

Submitted to the
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani
in partial fulfilment of the
requirement for the degree of

MASTER OF SCIENCE
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IN
AGRICULTURAL ECONOMICS

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MAY, 2019

CANDIDATE'S DECLARATION

I hereby declare that this dissertation
or part thereof has not been
previously submitted by me
for a degree of any
University or
Institute

Place: LATUR
Date: / /2019

(JAIN A.B)
Reg. No. 2017A/56ML

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CERTIFICATE – I

This is to certify that the dissertation entitled "**ECONOMIC ANALYSIS OF PRODUCTION AND MARKETING OF *KHARIF* MAIZE IN SOLAPUR DISTRICT OF MAHARASHTRA"** submitted by **Miss. JAIN ARTI BAHUBALI , Reg. No. 2017A/56ML** to the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (Agriculture)** in the subject of **AGRICULTURAL ECONOMICS** is record of original and bonafide research work carried out by her under my guidance and supervision. It is of sufficiently high standard to warrant its presentation for the award of the said degree.

I also certify that the dissertation or part thereof has not been previously submitted by her for a degree of any university.

Place: LATUR
Date: / /2019

(R.D.Shelke)
Research Guide

CERTIFICATE – II

This is to certify that the dissertation entitled "**ECONOMIC ANALYSIS OF PRODUTION AND MARKETING OF *KHARIF* MAIZE IN SOLAPUR DISTRICT OF MAHARASHTRA** submitted by **Miss. JAIN ARTI BAHUBALI, Reg. No. 2017A/ 56ML** to the Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani in partial fulfilment of the requirements for the degree of **MASTER OF SCEINCE (Agriculture)** in the subject of **AGRICULTURAL ECONOMICS** has been approved by the student's advisory committee after viva-voce examination in collaboration with external examiner.

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Place : Latur ***(Jain A.B.)***

Date: / /2019 *Reg.no. 2017A/56ML*

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INTRODUCTION

CHAPTER – I

INTRODUCTION

Agriculture is the backbone of Indian economy, as the economic growth largely depends on agriculture and allied sectors. Sixty seven per cent of total population, mostly from rural areas is dependent on agriculture as a primary source of income whereas, seventy per cent population is indirectly dependent on agriculture.

As a part of first green revolution, India has reached self sufficiency in food by producing above 200 million metric tones of foodgrains. Over the period of time, there has been cons. It can be seen that at the overall level, the average size of family was 6.82 comprising 2.64 males, 2.51 females and 1.68 children. At the overall level, total earners were 3.21, of which male and female earners were 2.04 and 1.17, respectively. Iderable increase in the input costs which are not been compensated by increase in output prices. This ultimately resulted reduction in agriculture income. In addition, the scope for bringing more land under cultivation has reduced due to industrialization and increasing civilization. Policies are being formulated have a mission to achieve a minimum production of 360 million metric tonnes of foodgrains in the next two decades. This will satisfy the domestic consumption and surplus. Among the foodgrains, paddy, wheat, jowar, bajara and maize are the important general cereal crops grown in our country. It is grown in many parts of the country throughout the year.

Maize *(Zea maize)* belong to family (Gramineae). It is the third most important cereal foodgrain crop in the world followed by rice and wheat. The origin of maize is Mexico in Central America. It contributes about 20 per cent world's total cereal production.

The term maize has been derived from Arawak-cexi word, 'Mahiz', is also known as Indian corn. Maize among the cereals ranks third, both in terms of area and production in the world. The major maize producing countries are the USA, China, India, South Africa, Brazil, and Mexico **(Source: Foreign Agricultural services/USDA).** It occupies a prominent place in the humid tropics; maize in fact is the most extensively

distributed cereal crop**.** In India important maize growing states are Rajasthan, Punjab, Maharashtra, West Bengal, Uttar Pradesh, Karnataka and Andhra Pradesh Telangana.

In our country, maize is mainly grown for grain purpose, which is consumed either as food or feed. Utilization of maize for specialized purpose, good feed for poultry, piggery and other animals. This crop is being considered as a "Queen of cereals''(Reddy and Reddy-Principle of Agronomy) because of its special characteristics that include its carbon pathway (C_4), wider adoptability, higher multiplication ratio, desirable architecture, superior transpiration efficiency, high versatile use etc. The maturity period of maize is relatively shorter than other cereal crops.

Maize has many assets for its wide distribution, its husk give protection from birds and rain can be harvested over a long period since it can be left dried in the field until harvesting is convenient, can be stored long, provide numerous useful food products and frequently preferred to sorghum and other millets. In fact it is a major source of starch. Cornstarch (maize flour) is a major ingredient in home cooking and in many industrialized food products. Maize is also a major source of cooking oil (corn oil) and of maize gluten. Maize starch can be hydrolyzed and enzymatically treated to produce syrups, particularly high fructose corn syrup, a sweetener; and also fermented and distilled to produce grain alcohol. Grain alcohol from maize is traditionally the source of bourbon whiskey. Maize is sometimes used as the starch source for beer. It is also nutritive for adults of different ages.

The green straw is suitable for making silage. Maize is also used as the fodder for livestock. The 100 grams of maize grains contains carbohydrate 71-72 kcal, sugars 2-3 grams, dietary fibers 9-10 grams, fats 4-45 grams and proteins 9-10 grams minerals 1-4 grams.(**Source:Agmarknet**). The nutrients are very important for the smooth functioning of the body. It is a rich source of carbohydrates, besides this, it provides essential body building substances such as minerals and proteins. It is also a rich source of water (75.96 grams). Maize is consumed by the people in India in many forms, it can be consumed as a rotis or breads, in the forms of pop corns or a pop grains. Besides this, maize is used in

preparation of starch, syrup, glucose, paper adhesive, acetic acid and lactic acids, etc., the demand for which is increasing day-by-day.

1.1. Worlds's present scenario of maize cultivation

Maize is widely cultivated throughout the world, and a greater weight of maize is produced each year than any other grain. The world production of maize in 2016-17 was 10,65,114 (000 MT) annually and cultivated over area 1,83,055 (000 Ha) and productivity was 5.82MT/Ha. Maize is one of the most important cereals of the world. In terms of world area. India stands next to USA, Brazil, China and Mexico, where as in production it ranks eleventh. (**Source:USDA).** The worlds production of maize in 2017-18 was 10,33,664 (000 MT) annually and cultivated area 1,80,639 (000 Ha) and productivity was 5.72 (MT/Ha) respectively. (**Source:USDA).**

1.2. India's present scenario of maize cultivation

Maize being important cereal grown in India. The area under maize was about 96.33 lakh hectares in, with production of 258.8 lakh tonnes. The average yield of maize in India was 26.89 quintals per hectare in 2016-17 **(Source:Agricultural Statistics at a glance, 2016-17).** The area under maize was about 9500 (000 Ha) with production 25000 (000 MT) and productivity was 2.63 (Mt/Ha) in 2017-18 (**Source:USDA**). The area under maize in the country and its annual production showed the increasing trend right from 1990-91 to 2016-17. The area under maize was 59.04 lakh hectares in 1990-91 which increased to 73.43 lakh hectares in 2003-04 and it reached to 96.33 lakh hectares in 2016-17. The same trend was observed in case of annual production of maize. It was 89.62 lakh tonnes in 1990-91 which increased to 149.84 lakh tonnes in 2003-04 and 258.84 lakh tonnes in 2016-17. The average yield also increased from 15.2 quintals/ha. in 1990-91 to 20.89 quintals /ha. in 2016- 17. The average yield observed during the year 2016-17 was 26.89 quintals/ha.

In India 55 per cent of the grain produce concurrently is used for food purposes, about 14 per cent for livestock feed, 18 per cent for poultry feed, 12 per cent for starch

and 1 per cent for seed. By the end of this century the expected demand will be around 46 per cent for food, 14 per cent for livestock feed, 19 per cent for poultry feed, 19 per cent for starch industry and 15 per cent for seed.

Considering the area under cultivation of maize, Karnataka, Madhya Pradesh, Maharashtra, Telangana and Uttar Pradesh are the leading states in the country, during the year 2016-17. The production of maize is highest in Maharashtra 3452.96 (000 tonnes), followed by Madhya Pradesh 3340.86 (000 tonnes) and Karnataka 3314.00 (000 tonnes), Telangana 2663.19 (000 tonnes). The average yield of maize is observed highest in Andhra Pradesh i.e. (6612 Kg /ha) followed by Telangana (3321 kg/ha),Tamil Nadu (3026 kg/ha) and Maharashtra (3009 kg/ha) during the year 2016-17. **(Source: Agricultural Statistics at a glance, 2016-17**).

The Maharashtra is leading state as far as area under the maize cultivation is considered followed by Rajasthan and Karnataka. But in the case of production and productivity, it lags behind in the list. The average yield of maize in Maharashtra is higher than the all India average. In 2017-18, the area under maize crop is 1097 (000 ha) with production 3450.4 (000 tonnes) and productivity was 3143 (Kg/ha). (**Source: Krishi.maharashtra.gov.in**).The area under *kharif* maize in 2017-18 is 913.8 (000 ha) with production 2977.2 (000 tonnes) and productivity was 3248 (Kg/ha) (**Source: Krishi.maharashtra.gov.in**)

1.2. Importance of the study

Maize is the important source of foodgrain among the cereal crops grown in the state, so it competes with other crops in area allocation. Therefore, calls for its economic evaluation. There was a debate few years ago, regarding the profitability of this crop in the state. This crop has importance in the cropping pattern of the farmers. Therefore, in order to study the costs and returns structure, it was decided to take up this particular study with the following specific objectives.

1.3. Objectives:

The specific objectives of the present study are.

- To know socio-economic characteristic of maize growers.
- To identify the cost and returns in maize production.
- To study resource productivity and resource use efficiency in maize production.
- To study marketing channels and price spread in marketing of maize.
- To know the constraints of maize growers in production and marketing.

1.4. Hypothesis:

Maize is a profitable enterprise.

1.5. Scope And Utility

The present study will be useful to the *kharif* maize growers by providing information regarding economic aspects of production and marketing of *kharif* maize. The findings of the study will be helpful to the *kharif* maize farmers in Solapur district of Maharashtra state and also to the student research who will work on same line in future.

1.6. Limitations:

- The result of the study will be based on data collected for only one agricultural year i.e 2017-18.
- Data will be collected by survey method.
- Data pertains to selected villages of district.

REVIEW OF LITERATURE

CHAPTER-II

REVIEW OF LITERATURE

Review of literature forms an integral part of research work. Review of literature published elsewhere related to the subject under study is always useful to the investigator to outline the problem of research, formulate objectives, choose suitable methodology and avoid unnecessary duplication of efforts. It also provides general orientation about the topic of investigation by creating a insight and sense of integration about the subject as a whole. An attempt is made to review the literature on the problem in this chapter. The review of literature is grouped under the following heads.

- Socio-economic characteristics of maize growers.
- Cost and returns in maize production.
- Resource productivity and resource use efficiency in maize production.
- Marketing channels and price spread in maize marketing.
- Constraints of maize growers.

1. Socio-Economic Characteristics of Maize Growers

Ibitoye, S.J *et. al* (2012) conducted a study on economic and adoption levels of improved dryland technologies among the farmers in Andhra Pradesh. The comparison between targeted (beneficiaries) and non-targeted (non-beneficiaries) farmers were made for number of production factors, family composition, cropped area, cropping intensity, cultivated area per pair of drought animals, asset liability level, productivity, costs and returns. No clear trend between the two groups of farmers was found for any of the variables. The proportion of farmers adopting dry land technologies was low, as was the percentage of area placed under improved practices by adopting farmers.

Ebojei C.O. *et.al* (2012) This paper presents the results of an empirical application of maximum likelihood estimate of Logit Model to determine the factors influencing farmers' adoption of hybrid maize. The results indicates that the mean predicted probability of technology adoption was Age (X1) ($P<0.013$), income (X5) ($p<0.034$),

education (X6) ($p<0.001$) and extension visits (X7) ($P<0.017$). On the contrary, farming experience, family size, farm size had no significant influence on participation in hybrid maize. This study suggests the need to bring more area under hybrid maize cultivation.

Ibitoye S.J *et.al* (2012) The study examined the socio-economic background of maize farmers as well as the cost and returns associated with maize production in Kogi State of Nigeria. A multistage random sampling technique was used in the selection of the four local government areas, eight communities and 240 farmers used in this analysis. A structured questionnaire was used to obtain information from the farmers on their sex, age, farm size, educational status, farming experience, input used, their costs, output and the revenue. Gross margin analysis was used to analyze the data. The result showed that the gross margin for maize production was 57,300 per hectare and benefit-cost ratio was 1.91.This implies that maize production in Kogi State is profitable. It was therefore recommended that farmers should be encouraged to go into maize production.

Ajah J. and Nmadu N. (2012) Based on this, research on the socio-economic factors influencing small-scale maize farmers output was conducted in Abuja. A multi-stage sampling technique and semi-structured questionnaire were used for data collection. A total of 160 maize farmers were interviewed in four agricultural zones (40 from each zone). Data were analyzed using multiple regression analysis and descriptive statistics. The results showed that the land area cultivated, land rent, quantity of fertilizer applied, years of farming experience and household size were the

major socioeconomic factors that significantly ($p < .05$) influenced maize output. The R2 value of 0.31 (adjusted R2 = 0.26) indicated that the variables accounted for 31 percent of the variation in maize output. The mean outputs of maize per hectare and per farmer were 316.73 kg and 614.56 kg, respectively. Socio-economic results showed that the mean age of the farmers was 39 years with a substantial percentage (68.12%) of them having, at most, primary school education.

Osundare F.O. (2013) This study compared the socio-economic characteristics of maize farmers under different production technologies. The socio-economic variables of

study were age, level of education, farming experience and cropping system, farm size, levels of outputs and income, growing seasons observed and the available sources of production technologies. Data were collected from 311 maize farmers in South West Nigeria using multi stage random sampling techniques through the use of validated and pre- tested structured questionnaire. Descriptive statistics and ANOVA were used for data analysis. showed that the mean ages were 45.4,49.7 and 51.1 years for farmers using traditional technology (TT) improved technololgy (IT) and Semi improved technology (ST) respectively. The mean farm size were 0.7ha (TT), 2.63(IT) and 3.62 ha (ST) while the mean values for maize output were 0.77 tonnes/ha; 1.70 tons/ha and 1.02 tons/ha for TT. IT and ST users respectively. The proportion of illiterates was highest (46.51%) among TT users.

Onojah *et.al* (2013) The study examined socio-economic characteristics as it affect maize production in Kogi State, Nigeria. Like other studies, it found that some social demographic characteristics such as gender, primary occupation, credit source, family size, storage facilities and annual income negatively affect maize production in the study area. The study revealed that women in the study area have limited access to land as factor of production. Maize growers in the study area also engaged in other non farming activities thereby do not invest properly in the farming enterprise. Evidence from the study suggests that household members live on approximately US$0.45 dollars per day. Although the study populations are members of one cooperative societies or the other, there were insufficient credit sources available to boost maize production. The study also link large family size with low overall output from maize production of a household farmer. Storage facilities which offer protection against fungal infestation and moth destruction of the grains were identified as lacking by 89% of maize growers. 87.8% of the maize growers operated on fragmented of land ranging between 2.5 heaters and below and there were no guaranteed markets for maize products.

Nathane N. N. (2015) This paper examined the socio-economic factors affecting early maturing maize varieties adoption in Safana Local Government Area of Katsina

State, Nigeria. Using random sampling techniques, 300 maize farmers were selected across 10 communities in the Local Government area. Out of the 300 respondents sampled 163 were non-adopters and 137 were adopters. Data obtained were analyzed using descriptive statistics, adoption index and Probit regression models. The major findings showed that 88% of respondents were male headed, average age of household head was 44 years, average household size was 11 persons, dependency ratio was 1.49, level of education was Islamic education, average years of schooling was 5 years and average years of farming was 25 years. About 65% of farmers had access to extension agent, only about 10% had access to credit and labor force was mostly family labor. Results of probit model showed that farmers' size of land for maize cultivation (1%), farmers' participation in an association (1%), number of extension contacts (10%), age of farmer (5%) and income from sales of maize (1%) influenced the adoption of early maturing maize varieties.

Manu I. N. (2015) This study was carried out during April -September 2013 in the North West Region of Cameroon on the socio-economic analysis and adoption of improved maize varieties (IMVs). One hundred and forty farmers were administered semi-structured questionnaires and the data were analysed using SPSS. Socio-economic analysis showed that majority of the sample size were female (50.70%), aged below 50 with an average of nine members per household. Majority of the respondents were Christians (82.60%) and had formal education with access to extension services (72.70%). Most of the farmers depended on household generated income mainly from farm activities. Most of the farm sizes were below 2 ha indicating low scale production and low capacity to obtain loans. In the study area, maize was allocated over 60.00% of the farm lands. The level of adoption was found to be 74.30%, with 25.70% of the farmers cultivating both IMVs and local ones

Palapala Valerie *et.al* (2016) A survey was conducted to determine the effect of the socio-economic and institutional factors on farmers' adoption of Bambara nut as food security crop. Purposive survey research design was used to generate both qualitative and

quantitative data. 384 respondents were interviewed in the study. Proportionate sampling technique was used to select 131, respondents from Kakamega North Sub- county, 127 from Butere and 94 from Matungu and 32 respondents from Mumiassub counties based on population. Primary data was collected through structured questionnaire, interview schedules alongside focused group discussion. Findings indicated that that seven variables were statistically significant and contributed to adoption. These factors include: sub county of farmer's residence, gender, farm size, on-farm income, labor, member of social group, marketing problems, access to extension services and respondents' access to credit.

Devkota D. (2017) Altogether, 100 samples were taken by simple random sampling from the major maize growing areas and relevant publications were reviewed. Descriptive statistics, unpaired t-test, probit regression and indexing were used for data analysis using statistical tools- SPSS, STATA and MS-Excel. Probit econometric model revealed that ethnicity (1% level), gender (5% level), area under open pollinated improved maize (1% level), seed source dummy (1 % level) and number of visits by farmers to agrovet (5% level) significantly determined the adoption of open pollinated improved maize varieties. In addition, unpaired t-test revealed that the productivity of open pollinated improved maize varieties was significantly higher (at 1% level) than local; also, the multinational companies' hybrids showed significantly higher productivity (at 1% level) when compared to open pollinated improved varieties. Further more, indexing identified- lack of availability of quality seeds and fertilizers (I= 0.86) as the major problem associated with the maize production.

2. Cost and Returns of Maize Production

Paudel P. and Matsuoka A. (2009) This study was carried out to analyze the cost efficiency of maize production in the chitwan district, nepal with a view to predict economic efficiencies using stochastic frontier cost function. The primary data were collected from 180 maize farmers representing 12 village development committees

(VDcs) including one municipality of the district during May–June 2005 for the cropping year 2004–2005. Among various factors, use of manure accounted the highest share in the production cost followed by labour and tractor costs. The maximum-likelihood (ML) estimates of the parameters revealed that estimated coefficients of cost of tractor, animal power, labour, fertilizer, manure, seed and maize output gave positive coefficients and were significant at 5% level. Further, quantitative estimates obtained from the cost function shows the mean cost efficiency of 1.634 indicating that an average maize farms from the study incurred about 63% costs above the frontier cost-an indication of inefficiency.

Karim M. R. (2010) The present study is an attempt to assess the existing agronomic practices of hybrid maize cultivation, its profitability, constraints, and factors affecting hybrid maize production. The majority of the total farmers sowed seeds during the first week of December. The average seed rate was found to be 20.94 kg per hectare. About 16 varieties were found to cultivate by farmers, of which majority farmers used NK-40 followed by Pacific-II. All kinds of fertilizer used by the farmers were below the optimum level of recommendation. About 33 and 28 percent of the total variable cost was for human labour and chemical fertilizer, respectively. The average gross margin was observed to be Tk. 28456 on total variable cost basis. The cost per kilogram of maize cultivation was Tk. 4.12 and return from one kilogram of maize production was Tk. 7.80. It is found that the coefficient of human labour, land preparation, irrigation, urea and borax have significantly impact on gross return. Timely non-availability of seeds, high price of fertilizer, and low price of yield were the major problems for hybrid maize production.

Leung L. and Jenkins G. P. (2012) Maize is important in Uganda because of its dual function both as an income-generating cash crop and as a staple crop that improves food security. Increasing the utilization of commercial inputs- the focus of the intervention is to overcome the low maize yield situation in Uganda. The purpose of this study is to determine if financial and economic conditions allow the maize farmers to

acquire and properly apply the commercial inputs. Maize storage- Absence of adequate storage facilities forces majority of farmers to store maize at home resulting on 22 percent post-harvest loss of the commodity. This study explores the merits of sponsoring the expansion of the network of community warehouses for maize storage. The levelized cost of the investments required per kg of maize stored over the life of the facility is computed to approximate the charge required to amortize the initial investment costs of the facility over the project's lifetime. The objective of P4P intervention is to improve the market linkages of farmers so that they can obtain higher prices for their production.

Nongnooch Poramacom (2013) The objectives of this study were to compare farmer's perception regarding different schemes, calculate break even price of maize production, analyze supply respond, and analyze cointegration on maize prices. The paper found that farmers preferred income guarantee scheme to pledging scheme. Since 2003, farm prices had increased above break even price. Supply response of maize mainly depended on price received in the previous year, area in the previous year and cost. This price related to government policy in two different schemes: income guarantee scheme and pledging scheme. This study applied co-integration analysis for farm price with wholesale price and F.O.B. price for maize. Farm price was affected positively by wholesale price and F.O.B. price. The estimated coefficients associated with explanatory variable agreed with a priori expectations, and were statistically significant. Signs of all estimated coefficients agreed with expectations and were statistically significant.

Zalkuwi J. (2014) The study analyzed the socio-economic characteristics of maize farmers and cost and returns per hectare. Multistage sampling technique was employed to select Ninety seven (97) maize producing farmers for the study. Data for the study were collected using structured questionnaires. The result of the analysis showed that the mean age for respondents was 46 years while more than half of them were literates. The major source of finance for the farmers was personal savings while the average land area cultivated was 2.6 hectares. The average gross margin analysis was estimated to be 7,228.71 per hectare indicating that maize production is profitable in the study area.

Other economic indices were gross farm ratio obtained as 0.813, which indicates that the farmers got higher return, also the operating ratio was 0.815 all pointing towards how profitable the venture in the study area.

Murthy C. *et.al* (2015) Maize is an important cereal of India and is grown over 4 per cent of the net area sown of the country. Unlike other crops maize can be cultivated with small capital. Uses of machines have reduced the labour requirements. Most of the maize grown is utilised within the country, although its limited international trade is also there. Present study throws a light on cost and return structure in maize production among different farm sizes i.e., marginal, small and medium farmers. Keeping in view the objectives of the study a multistage random sampling procedure has been adopted for the selection of the districts and sample respondents. The total sample size was 240. Among the different category of farms the total variable cost incurred per acre by medium farmers was highest followed by small farmers and marginal farmers. The cost of human labour, fertilizer, FYM, seeds and bullock labour were the items of cost with major share in the variable costs. The average per acre cost of cultivation was Rs.12532.78 in Dharwad district and Rs. 12529.38 in Haveri district and the average net returns were Rs. 7582.86 in Dharwad district and Rs. 7831.96 in Haveri district. Maize production in the study area found to be profitable as also supported by B: C Ratio of 1.42 to 1.50 among different categories of farmers.

A. Girei and Onuk E. Galadima (2016) The parameters of production function were estimated using double log production function analysis. The values of the parameters were used to estimate the productivity and profitability of the factors of production. The result shows that the coefficient of multiple determinations (R^2) was 0.87 implying that about 87% of the variation in the output of maize could be explained by the inputs indicated by the significant F- ratio. The study revealed that the total variable cost of maize production was 51, 901.2/ha, the total farm revenue was 61, 764.0439/ha, the gross margin obtained was 9, 862.8439/ha and the average rate of returns was 0.19 indicating that the maize farmers in the study area earn 19 kobo on every naira invested

in maize production. Various constraints encountered by the groups of farmers were identified.

Dhomne U.K and Raghuwnashi R.S (2016) Thus, present study was canvassed to know the existing knowledge and adoption gap among the farming community of maize growers of the Chhindwara district. The study was conducted on 60 hybrid maize growers (20 from each category according to their size of holding) Chhindwara block of Chhindwara district because of having maximum area and production under hybrid maize crop. The findings indicate that total cost per hectare incurred in hybrid maize production on sample farm was Rs. 34700.76 which decreased as the farm size increased. The proportion of operational cost and fixed cost to total cost on sample farm was 63 and 38 of the total cost was alone contributed by owned and family labours which varied between 38 to 40 per cent on different farm. The cost of cultivation according to various cost concepts (Cost A1 to Cost C3) in different size of farms decreased as the farm size increased.

Hamsa, K. R (2017) A study was carried out for comparison of cost and returns of major food crops under rainfed condition and bore well situation in Central Dry Zone of Karnataka. In CDZ, paddy, ragi, maize and groundnut are the major crops. To analyse cost and returns, the techniques such as tabular method with percentage, numbers and market approach were used. Random sampling technique was employed in the selection of 90 farmers for the study, which comprises of 45 irrigated farmers and 45 rainfed farmers. The study showed that cost and net returns for borewell irrigated paddy were Rs. 56225 ha-1 and Rs. 34091 ha-1, respectively. Among these crops, cost of cultivation was higher in rainfed and borewell irrigated groundnut (Rs. 47274 ha-1 and Rs. 51619 ha-1), respectively. The net returns realised under rainfed and borewell irrigated maize was found to be more i.e., Rs.11570 ha-1 and Rs.31405 ha-1, respectively. Whereas, in case of ragi, net returns under rainfed condition was Rs. -2440 ha-1 and in irrigated condition it was Rs.13552 ha-1. Comparison reveals that, the cost and net returns of all crops in CDZ were more than the Cost of Cultivation Scheme (CCS) estimates for Karnataka due

to higher productivity of crops in Tumakuru district (CDZ) except in rainfed ragi (Rs.-2440 ha-1).

Abdulaleem M. A. *et.al* (2017) This study analyzed the costs and returns on maize production among small scale farmers in Osun State Nigeria. A multistage sampling technique was employed to select one hundred and eighty (180) maize producing farmers for the study. Data were collected using structured questionnaires. Descriptive statistics and gross margin analysis were employed to describe the socio-economic characteristics and estimate the profitability of maize enterprise respectively. The result of the analysis showed that majority (80.0%) of the respondents were male with mean age of 42.3 years. 84.5 percent were married and most could read and write. The mean household size was about 7 persons. The gross margin was estimated to be N 638,465.22 with a benefit-cost ratio (BCR) of N1.74. This implies that maize production in the study area is profitable. The major problem smilitating against maize production in the study area were lack of control measures against pests and diseases, poor social infrastructures coupled with high transportation cost and low market price of maize.

Choudhri H. P. *et.al* (2018) Study was conducted in Tejwapur block of Bahraich district of U. P. A sample of 100 respondents was chosen through purposive cum proportionate random sampling and were categorised as marginal, small and medium size group of farms. A survey was conducted by personal interview method with use of pre-structured schedule. Simple tabular analysis was done to find out the result. It was found that maize cultivation was profitable at all categories of farm. The total costs of cultivation and gross income per hectare were positively related with size of farms, where as negative trend of net income with farm size should that resources are not efficiently used in maize cultivation at larger size group of farm, technical, managerial and financial problem were noticed as major constraints. The result of the presents study as well as relevant discussion has been presented in cost and returns of Maize crop in the study area: The cost and return have been summarized in this part on the sample farms. Beside

the estimate of total costs, on the basis of six cost concept i.e. Cost A_1/A_2, cost B_1, cost B_2, cost C_1, C_2 and cost C_3, have been worked out for estimation of cost.

Rana J. B. (2018) In the light of economics evaluation of maize production, primary data for the year 2013-14 were collected from randomly selected 100 farmers of maize growers in Azamgarh district of Uttar Pradesh. In order to coping the objectives of the study, revealed overall average size of farms i.e. 1.05 ha, cropping intensity ranged 197.84 – 236.94 per cent among sample forms. The cost of cultivation of maize per hectare came to Rs. 37387.13. On an average the major components on which maximum cost was incurred being 19.28 per cent whereas minimum in plant protection 1.25 per cent, the cost of production was observed i.e. 1457.97 Rs/ha whereas productivity witnessed i.e. 31.97 qt/ha. Gross returns was calculated as Rs. 43062.50, cost C_1, C_2 and C_3 was found maximums in large farms Rs. 37003.98, Rs. 24143.98 and Rs. 20281.83, however minimums was observed in marginal farm being Rs. 18152.91, Rs. 6152.91 and Rs. 2848.67, respectively. Input-output ratio was found highest in large farms 1:1.48 and lowest marginal farms 1:1.08.

3. Resource productivity and resource use efficiency in maize production.

B. S. Gani and B.T. Omonona. (2009) Inefficiency in the use of available scarce resources has been the bane on increased food production hence low income among the cream of farmers across the nation. The study examined resource use efficiency (with water as the key variable) in irrigated maize production in the Northern part of Taraba State techniques. of irrigated maize growers, estimate cost and returns and identify constraints to irrigated maize production among respondents. The study revealed the cost and returns per hectare as 55,152.61 and 105,937.50 respectively. About 73.1% variability in the dependent variable was accounted for by the independent variables. The estimate of elasticity of production summed up to 0.961 meaning decreasing return to scale. Irrigational facilities such as water pumps, sprinklers, pipes and relevant accessories should be made available to farmers to encourage them expand the scale of production thereby boosting increased food production.

Gani B. S. and Omonona B.T. (2009) The study revealed that water was over-utilized in irrigated maize production in the area of study since it had an MVP of less than unity. Multistage stratified random and purposive random sampling techniques involving six wards and eighteen villages were used to select respondents. One hundred and twenty (120) questionnaires were administered on one hundred (120) irrigated maize growers. Only one hundred and seventeen (117) of the questionnaires were retrieved for analysis. Data were analyzed using descriptive statistics, gross margin and net farm income analyses and production functions. Data were fitted to four functional forms based on the OLS techniques. The Cobb-Douglas (power function) production function gave the best fit. The study revealed the cost and returns per hectare as 55, 152.61 and 105,937.50 respectively. About 73.1% variability in the dependent variable was accounted for by the independent variables. The result revealed that all the scarce resources were not used efficiently hence not to optimum economic advantage. This was attested to by the high ratios (greater than unity) of MVP/MFC for fertilizer, seeds, labour and land and low ratio (less than unity) for the key variable, water. For optimum resource allocation to water about 233% decrease in MVP was required while seeds, labour, fertilizer and land required 92.8%, 87.1%, 71.8% and 98.7% increase in MVP respectively.

Ayinde T.B (2011) The aim of this study was to conduct a comparative study on the productivity of hybrid and open-pollinated maize, with the participation of farmers in Giwa Local Government Area of Kaduna state. Precisely, it evaluated the current hybrid and open-pollinated maize production technologies by describing their major socio-economic factors, and most importantly identifying the economic difference between hybrid and open-pollinated maize, using the farm survey data collected from 160 maize farming communities in October- December for the cropping year 2009-'10. The result of analysis of resource use efficiency of hybrid and open pollinated maize showed that all resources were inefficiently utilized because the ratios were not equal to one. The resource use efficiency of hybrid and open pollinated maize production in the study area

was computed from Efficiency ratio i.e., the ratio of MVP (Marginal Value Product) and MFC (Marginal Factor Cost). The ratio indicates that sampled farmers underutilized fertilizer and insecticides.

Dhakal S.C. (2015) The study used 53 maize-pumpkin mix crop adopting farmers from among 300 farmers adopting different pollinator friendly practices. Descriptive and statistical tools including Cobb-Douglas production function were used to analyze data, collected from structured interview schedule. The benefit cost ratio (1.58) indicates that maize pumpkin mix cropping was profitable with productivity of 2.83 ton per ha on maize main product equivalent basis. The magnitude of regression coefficients of maize pumpkin mix cropping implied that expenditure on seed and fertilizer and irrigation had significant positive effect on gross return with estimated decreasing return to scale (0.85). According to estimated allocative efficiency indices, it is suggested to increase expenditure on seed and fertilizer cum irrigation by about 90% and 55% respectively.

Zalkuwi J. (2014) This paper attempts to analyze the efficiency of maize (Zea mays L.) production in Numan Local Government of Adamawa State, Nigeria. Multistage sampling technique was employed to select Ninety seven (97) maize producing farmers for the study. Data for the study were collected using structured questionnaires. Multiple regression analysis was used to study the relationship between inputs and output. The result shows that there is a positive and significant relationship between farm sizes, quality of seed used, fertilizer, plough-cost, labour with maize output in the study area.

Saravanadurai A.and. Kuma J.S. (2014) The farmers of the study area in Madathukulam block of Tiruppur District displayed a high degree of entrepreneurship in the organisational and operational efficiency of farming as judged by the level of income on their farms. They had devoted a larger area to Sugarcane in their farms to ensure larger profits from their farm business. Besides this the farmers (specially small and marginal farmers) also had a good number of milch cattle for additional farm income.

The stages of agricultural development i.e., traditional intermediate or modern in the study area would be worthwhile to consider the distinction among them. A traditional stage implied a way of living rather than a business proposition where production was subsistence oriented. The produce being mainly intended for family consumption. The input used in such situation i.e., crop varieties, seed, labour, fertilizer etc., was chosen mainly on the basis of what the farmer and his family likes and owns. In these circumstances, there was very little of market orientation or consequences of prices cost and returns. At the other extreme, a modern agriculture would imply careful selection of enterprises, crop varieties, fertilizers and pesticides by procuring them largely from the market. The bulk of the produce in such a case has to be sold in the market at a profit in order to obtain cash needed for purchasing inputs from the market. In modern agriculture, necessarily there was evidence of selectivity and careful decision making. Thus, the standard of farming was considered as of the intermediate stage in development i.e., in between traditional and modern agriculture. The farming was commercial oriented as factor and product of market was relatively well developed.

B.A. Zongoma*, et.al.* (2015). Analytical tools used include descriptive statistics, budgetary techniques using Gross Margin analysis and Regression Analysis. Results of the socioeconomic characteristics from the data collected showed that majority of the respondents (67%) were males and only 36% were females. Majority of the respondents (75%), were youth aged between 21-40 years, while only 3% were above 50 years of age. Maize production is profitable in the study area with Gross Margin of N28, 1741.00 per ha and a Total variable Cost of N12, 001.20 per ha. Semi-log function was the lead equation chosen with R^2 0.81ie 81 % of the changes in output is attributed to changes in the independent variables. Fertilizer and quantity of seed has coefficient of 0.426 and 1.336 and significant at 5% and 1% respectively. The result also indicates that size of the farm, labour, fertilizer and seed were excessively utilized with resource efficiency level of 0.01, 0.07, 0.23 and 0.10 respectively. Major problems of the farmers in the study area

include, lack of finance, high cost of inputs, transportation problem and the problems of pest and diseases.

Laxmi N. T. and Mundinamani S.M. (2015) The present study was under taken in Dharwad district to analyse the resource use efficiency of major crops. Major crops grown in the district such as chickpea, cotton, paddy, soybean, maize and chilli were selected for the study. Multistage random sampling was adopted for selection of sample respondents. Results of the study revealed that seed, fertilizers, PPC and machine labour were over utilized and human labour and bullock labour were underutilized by the chickpea farmers. Cobb-Douglas production function for cotton under rainfed condition revealed that seed, PPC, human labour and bullock labour were over utilized and FYM, fertilizer and machine labour were underutilized. During production of paddy seed, fertilizers, FYM, bullock labour and machine labour were over utilized and human labour and PPC were underutilized by the farmers. FYM and PPC were underutilized and seed, fertilizers, human labour, bullock labour and machine labour were underutilized by farmers in cultivation of soybean. Resource use efficiency under rainfed chilli production revealed that seed, PPC, bullock labour and machine labour were over utilized and FYM, fertilizer and human labour were under- utilized by the farmers.

Zongoma B.A. *et.a*l (2015) This study was conducted to determine efficiency of resource use in Maize Production among Small-scale Farmers in Biu Local Government Area of Borno State, Nigeria. Primary data were collected through multi-stage random sampling, where 60 respondents were sampled. Analytical tools used include descriptive statistics, budgetary techniques using Gross Margin analysis and Regression Analysis. Results of the socio-economic characteristics from the data collected showed that majority of the respondents (67%) were males and only 36% were females. Majority of the respondents (75%), were youth aged between 21-40 years, while only 3% were above 50 years of age. Maize production is profitable in the study area with Gross Margin of 28, 1741.00 per ha and a Total variable Cost of 12, 001.20 per ha. Semi-log function was the lead equation chosen with R^2 0.81 ie 81 % of the changes in output is attributed to

changes in the independent variables. Fertilizer and quantity of seed has coefficient of 0.426 and 1.336 and significant at 5% and 1% respectively. The result also indicates that size of the farm, labour, fertilizer and seed were excessively utilized with resource efficiency level of 0.01, 0.07, 0.23 and 0.10 respectively. Major problems of the farmers in the study area include, lack of finance, high cost of inputs, transportation problem and the problems of pest and diseases.

Girei A.A. and Galadima O. E. (2016) This study examined the resource-use efficiency and profitability of maize production in Lafia Local Government Area of Nasarawa State, Nigeria. Primary data were collected with the aid of structured questionnaire administered on 70 respondents who were purposively selected through random sampling technique. The parameters of production function were estimated using double log production function analysis. The values of the parameters were used to estimate the productivity and profitability of the factors of production. The result shows that the coefficient of multiple determinations (R2) was 0.87 implying that about 87% of the variation in the output of maize could be explained by the inputs indicated by the significant F- ratio. The study revealed that the total variable cost of maize production was 51,901.2/ha, the total farm revenue was 61,764.0439/ha, the gross margin obtained was 9,862.8439/ha and the average rate of returns was 0.19 indicating that the maize farmers in the study area earn 19 kobo on every naira invested in maize production.

Shehu U. A *et.al* (2016) This paper analyzed the resource-use efficiency of small-scale Maize production in Tafawa-Balewa local government area of Bauchi State. Data were collected from a sample of 120 Maize farmers selected through multi-stage sampling procedure using questionnaire and analyzed using simple descriptive statistics, double-log function and marginal value productivity analysis. The result showed that 90.17% had formal education; 51.67% were males; 90.17% were between the ages of 21-50. Majority 72.50% were married. In terms of farming experience, majority (86.67%) of the respondent had farming experience between 5-20 years. 75.00% had no contact with extension. The double-log function gave the best fit with Adjusted R2 of 81.16%.

Production inputs such as seed, fertilizer, labour affected output significantly. Maize production in the study area has an increasing return to scale from the sum of elasticity of production (1.747). Seed and fertilizer were underutilized in Maize production, whereas labour was over used. The major problem confronting the farmers include high cost of inputs (77.50%); Untimely disbursement of credit/inputs (62.50; inadequate extension services (59.17); unstable price (41.67%); draught (33.33%), inadequate credit facilities (31.67%) etc. Profit could be enhanced by increasing the quantity used of seed and fertilizer inputs, its timely supply. Labour should be reduced to optimum level for increase output and total revenue respectively. It is also recommended that extension education and financial support to farmers be improved to allow them increase output and total revenue. There is need for adjustment in resource use in order to improve farm profit at this level of technology used by Maize farmers in the study area.

Owoeye R. S. (2017) The study used multistage sampling techniques. Data were collected from 120 maize farmers through well-structured questionnaires from three Local Government Areas of Ekiti State. The collected data were analyzed by using descriptive statistics, and stochastic frontier regression model. Results from descriptive analysis showed that 30 percent of the maize farmers had secondary school education and above. Majority of the respondents (66.70%) had between 5 and 8 members that made up the household in the study area. It was revealed through the study that the majority of the respondents produced on a fairly large scale with average maize farm size of 3.39 hectares. Also, 80.0% of the maize farmers in the study area had more than 15 years farming experience. With profit of 116,590 per hectare and percentage profit of 58.63%, the venture is considered to be highly profitable. Farmers who invested 1 realized revenue of 1.59. The level of technical efficiency in maize production in Ekiti State ranged from 29.8% to 96.5% with a mean of 64.3%. This means that there are substantial opportunities to increase productivity and income through more efficient utilization of productive resources The RTS parameter (0.931) was obtained from the summation of

the coefficients of the estimated inputs (elasticities) which indicates that maize production in the study area was in the Stage II of the production surface.

Sapkota M. *et.al* (2018) The study aimed to analyze profitability and resource use efficiency of maize seed production in Palpa district of Nepal. Raosoft Inc. software was used to determine the sample size of 182 maize seed producers from the total 260 maize seed producers in the district. Data was collected using a pre-tested semi-structured questionnaire survey administered to the randomly selected samples. Results showed that the uses as well as cost of major inputs such as seed, labor, farmyard manure (FYM), and management/other cost including tillage were higher among small scale farmers compared to the large scale farmers. The average cost of production among small scale farmers was Rs. 94,195 per hectare compared to Rs. 64,145among large scale farmers. Resource use efficiency analysis showed FYM, tillage and labor were overused. This suggests that the use of FYM, tillage and labor should be decreased by 665,456 and 68 percent respectively. Similarly, cost on seed, chemical fertilizer and management/other were underused, hence, need to increase by 92, 69 and 97 percent respectively for the optimum allocation of resources. Overall, maize seed production is profitable but resources should be optimally utilized and should be carried on larger scale.

Adhikari S. (2018) This study was carried out to identify the profitability and productivity of maize production in Arghakhanchi district of Nepal. A total of 120 farmers, 60 each from two villages namely Wangla and Bhagwati, were randomly selected and interviewed using pre-tested, semi-structured interview schedule. Collected data was analyzed using descriptive statistics and Cobb-Douglas production function. The production function revealed that manual labor cost had significant effect on gross returns with magnitude of regression coefficient 0.823 whereas seed cost, nutrient cost and animal labor were found to be statistically non-significant. Sum of regression coefficient also revealed that production function exhibited decreasing returns to scale by 0.89. So, providing market information, training and extension services would increase

resource productivity of maize production. Farmers can be motivated to shift from grain production to seed production for increasing profitability.

4. Marketing Channels And Price Spread In Marketing of Maize

Chauhan S.K and Chhabra A. (2005) A study has been conducted on the production, marketed surplus, disposal channels, margins and price-spread for maize cultivation in the Hamirpur district of Himachal Pradesh. A multi-stage stratified sampling technique has been used to select the sample of blocks (2), villages (10) and maize growers (120) for the year 2001-02. The study on factors affecting marketed surplus, and cost & margins in the marketing of maize has revealed that farm-level marketable surplus is comprised of 53.21 per cent of the total production. The practices of storing maize for sometime and selling at a later date for higher price have led to storage losses to the extent of 0.16 quintal (2.80% of marketable surplus). Much of the marketable surplus of maize (66.92%) was disposed of by a majority of farmers (74.56%) during the first quarter (October- December). Producer → Local trader → WS/ CA → Processor/ Consumer has been found as the main channel in the marketing of maize followed by about 71.93 per cent farmers, accounting for about 70 per cent of the produce. The producer's share in consumer's rupee has been estimated at 78.01 per cent in this channel.

Yamano T. and Ayumi A. (2010) The farm-market price spread is calculated by subtracting the farm-gate price from the market price at the nearest maize market. We find that the farm-market price spread of maize is about 15 and 33 percent of the market price in Kenya and Uganda, respectively. In both countries, the price spread increases by 2 percentage points for each additional driving hour away from the nearest maize market. While the former finding suggests that the overall marketing costs are lower in Kenya than in Uganda, the latter finding indicates that reductions in transportation costs will increase the farmer prices of maize in both countries.

Raj Kumar and S.S. Chahal (2011) An economic analysis of maize marketing in Punjab revealed that producers' share in consumers'rupee and marketing efficiency was highest of 99.44 per cent and 177.57 through Channel I. However, this channel
Can not be considered as an important channel because farmers could dispose of just 2.50 per cent of maize produce through this channel. The other important and efficient channel in which the producers' share in consumers' rupee was higher to the tune of 87.02 per cent was found to be Channel VII followed by Channel III (81.22 per cent) and Channel VI (81.22 per cent). It testifies that the reduction in the number of intermediaries in the process of marketing is in the interest of both the producers and the end consumers.

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Changule R.B. and Gaikwad G.P (2013) Marketed surplus and price spread in case of maize were studied in the year 2010-2011 in Aurangabad district of Maharashtra. For the study, 60 maize growers were selected from Kannad and Sillod tehsils. Wholesaler and retailer, from Aurangabad market were selected to investigate the cost, margin and price spread in maize marketing. The results revealed that, the size of maize farm was 0.84 hectare. Maize production on farm was 46.15 quintals. Price paid by consumer was Rs. 1010.00 per quintal in channel-I in which producer's share in consumer's rupee was 94.20 per cent. In case of Channel-II, price paid by consumer was Rs.1035.00 per quintal in which the producer's share in consumer's rupee was 87.69 per cent. In regard to Channel-III, price paid by consumer was Rs.1155.00 per quintal in which the producer's share in consumer's rupee was 76.02 per cent. The producer's share in consumer's rupee

was highest in Channel-I than that of Channel-II and Channel-III. Net price received by producer was highest in Channel-I and price spread was higher in Channel-III which was Rs.269.29 followed by Rs.127.42 in Channel-II and Rs.58.58 in Channel-I. It was found that, the Channel-I was benefited to producers.

Devi *et.al* (2014) Present paper attempts to identify existing marketing channels, price spread and margins in Ranga reddy and Mahaboobnagar districts of Andhra Pradesh. A probe is made to document the marketing problems along value chain. Simple random sampling technique has been used for the study. Maize has different channels as it gives rise to variety end products and reaches different consumer groups. Study confirmed that majority of farmers see their produce in the regulated markets Price spread and marketing costs calculated for five dominant channels of value chain like green cobs, sweet corn, poultry feed manufacturers, popcorn and kurkure making revealed that the price spread calculated reveals that in poultry feed manufacturing channel (3b) has highest producer's share in the consumer's rupee is 54.1, followed by channel of green cobs (1a), which is 51.25 and then the pop corn channel (4a) with 16.01, and for sweet corn (2b) and kurkure channel (5a) it is 10.62 and 4.5. The study found that even though diversified value addition is done for maize and margins are high for finished products, due share in the consumer's rupee is not received by the farmers, this can be achieved by initiating direct contracts between farmers and processors removing the present hurdles in the markets.

Rajesh Kumar *et.al* (2017) The present study was conducted in Hanumangarh district of Rajasthan state which has highest production under rice cultivation. This study is based on the data collected from 60 rice-producers in Rajasthan in 2012- 13. The rice producers were using two marketing channels for the disposal of rice. Channel-I Producer- village trader wholesaler - miller- retailer- consumer while Channel-II was having Producer- wholesaler- -miller-retailer- consumer. The total marketing cost in Channel-I and II was estimated to be 816.08 and 749.25 per quintal, respectively. The marketing cost has been found to be higher in Channel-I due to involvement of more number of middlemen as compared to Channel-II. The producer’s share in the

consumer's price was estimated to be 62.50 and 66.41 per cent in Channel-I and II, respectively. Price spread was maximum in channel-I (24.76 per cent) followed by channel-II (21.87 per cent).

Srikanth B. *et.al* (2017) The study area selected was Chinthakani mandal of Khammam (dist.). A multi-stage sampling method involving a combination of purposive and random sampling procedures was employed in drawing up the sample block, villages and farmers for collecting primary data. Sixty farmers (23 marginal, 20 small and 17 large) were selected at random by proportional probability sampling technique. In the study Maximum likelihood Estimation (MLE) technique was used in stochastic frontier production for finding out the technical efficiency. The coefficients of stochastic regression model were used to calculate the Marginal Value Product of Variable Inputs (MVP) and its ratio R with Marginal Factor Cost (MFC) used to determine resource use efficiency (RUE. The benefit cost ratio is Maximum in case of medium farmers with at 2.7:1, followed by small farm (2.5:1) and marginal farmers (1.5:1). The gross returns from a hectare land are highest in case of medium farm with Rs 89364.63, followed by small (75396.54) and marginal (64845.89). The study suggested that a well-built strong infrastructure provision with efficient use of inputs and without marketing malpractices would show the way to an economically well-built maize economy.

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Parveen R. and Gupta S. (2017) The present study is carried out with the objective of studying the marketing channels because farmers producing agricultural produce are scattered in remote villages while consumers are in semi urban and urban areas. This produce has to reach consumers for its final use and consumption. There are different agencies and functionaries through which produce passes and reach the consumer. Therefore, it is important to study the various functionaries involved in the marketing of cotton crop. Besides, it is important to analyze the costs associated with the services rendered by the market functionaries, marketing margins and price spreads in the marketing of cotton. Such studies are useful for both the producers/sellers and the buyers/consumers because the former are interested in getting the highest price for their produce while the latter are interested in paying as low a price as possible.

Ozor M. U. and N wankwo T. N. (2018) This study examined the market channels and structure of dry maize (zea mays) marketing in Southeast, Nigeria. Specifically, it described the roles and linkages of dry maize intermediaries and examined the dry maize market structure in the study area. Multi-stage sampling method was used to select three States (Anambra, Enugu and Imo), 15 Local Government Area (LGAs), 15 largest and busiest daily markets and 225 intermediaries (75 wholesalers and 150 retailers for the study) who were served with structured questionnaire to obtain primary data. Descriptive statistics, such as frequency distribution, flow chart and percentage were used to describe the market channels. The Gini coefficient was used to determine the market concentration or nature of competition in the market i.e. market structure. Four channels of dry maize were identified. Gini coefficient indices of 0.321 and 0.356 for producers/suppliers of white and yellow maize, 0.285 and 0.273 for wholesalers and retailers of white maize, and 0.224 and 0.198 for retailers of white and yellow maize reflected evidence of a competitive market. Government should provide necessary transportation facilities such as good network of roads and mass transit vehicles to ameliorate the transportation problems of the marketers, improve the distribution system and reduce unhealthy competition amongst the marketers

5. Constraints Of Maize Growers In Production And Marketing

Kudadjie C.Y. *et.al* (2004) This paper reports on the results of a diagnostic study conducted to assess the problems and needs of sorghum farmers in north-east Ghana with the aim of determining the type of research that would be useful for them in their own context. The importance of the crop and its position within the cropping system are identified. Sorghum is still an integral part of the livelihoods of farmers. The crop is very versatile and not only contributes to food security but also plays a part in the socio-cultural, socio-economic, and religious aspects of the lives of farmers. Farmers have different uses for the varieties they grow, which depends on the morphological, agronomic and gastronomic traits of the crop. Sorghum varieties introduced from the research institutions have several problems including lodging, poor grain quality, bird damage and precocious germination. Farmers have developed management strategies for dealing with some of these problems. Nevertheless, further work is required by breeders to make the varieties more acceptable to users. Sorghum production constraints identified include poor soils, erratic rainfall and pest infestation of the grain during storage. The diagnostic study suggests that because farmers produce their own seed, enhancing their ability to improve the quality of their seed would be of benefit to them.

Hasan M. F. (2008) The study was conducted at the Sadar upazila of Dinajpur and Panchagarh to estimate the costs, returns and economic efficiency of maize production compared to Boro rice. The growth rate of maize in the country and constraints to maize production at farm level was also emphasized. The sample size of the study was 100 equally from each district. All the farmers used hybrid seeds for maize cultivation with an average yield of 6.27 ton/ha, which is higher in Dinajpur (6.35 ton/ha) compared to Panchagarh district (6.18 ton/ha). The returns of scale of the selected inputs were 0.72 and 0.68 for Dinajpur and Panchagarh respectively. The technical efficiency was found on an average 0.84 at Dinajpur and 0.80 at Panchagarh. It was also found that, farmers in the study area had scope to increase maize productivity by attaining full efficiency through reallocating the resources. High seed price, low grain price, and unavailability of fertilizers at time when required are the top most three constraints as indicated by the

maize farmers. It was suggested that, supply of inputs at fair price at time when required and an organized marketing system is essential for expanding the maize production in the country.

Faruq Hasan M. (2008*).*The growth rate of maize in the country and constraints to maize production at farm level was also emphasized. The technical efficiency was found on an average 0.84 at Dinajpur and 0.80 at Panchagarh. It was also found that, farmers in the study area had scope to increase maize productivity by attaining full efficiency through reallocating the resources. Economic analysis of maize and maize-based cropping pattern in comparison to Boro rice and Boro-based cropping pattern indicates the high profitability of maize production system than that of Boro rice. Comparatively high growth rate was found in area, production as well as in yield of maize. It was suggested that, supply of inputs at fair price at time when required and an organized marketing system is essential for expanding the maize production in the country.

S.S. Chahal and Poonam Kataria (2010). The findings of the study revaeled that the selected maize growers faced constraints as the maize crop specific technology adoption was concerned. The institutional, marketing and socio-economic constraints were found to be impediments in the production of maize. More specifically the sample farmers suffered on account of non-availability of credit, poor marketing facilities, lack of storage facilities, non-availability of seed suitable to the local needs, late sowing of crop etc. The detailed analysis of the constraints impediment to production and marketing of maize reflect the urgent need for overhauling of the entire marketing system. This in turn helps in the allocations of resources to maize crop in the state like Punjab where groundwater is depleting very fast, needs to be diversified in favour of less water requiring crops like maize.

Abu G. A. *et.al* (2011) A study of Evaluating the constraints and opportunities of Maize production in the West Region of Cameroon was carried out using primary and secondary data collected. One hundred and twenty (120) maize farmers randomly selected from eight (8) villages were interviewed using structured questionnaire. Data from the study were analyzed using descriptive statistics such as frequency distribution,

percentages, and inferential statistics such as multiple linear regressions. The study found that most maize farmers in the study area were small scale farmers and are full time farmers, the major maize production constraints was poor access to credit facilities. it was also found any unit increase in the quantity of any of the resources used for maize production will increase maize output by the value of their estimated coefficients respectively, however to raise maize production, the study recommend that financial institutions such as agricultural and community banks should be established in the study area with the simple procedure of securing loans.

W. Abera (2013) This study was conducted to assess the present importance, and productivity constraints of maize in the mid-altitude, sub-humid agro-ecology of Western Ethiopia. Data was collected through a semi structured questionnaire and focus group discussions, using 240 randomly selected respondent farmers, in 12 sub-districts, within three administrative zones. Maize was ranked number one as both food and cash crop by 82.9% of respondents. Most farmers (59%) use hybrids, while 24% grow landrace varieties. Unavailability of improved seed and lack of production inputs were the two major constraints reducing maize productivity, as reported by 62 and 60% of respondents, respectively. A high proportion of respondents (80%) indicated that, unpredictable grain prices are the major market constraint as 97% of the respondents sell their maize crop in the local market. Northern corn leaf blight (NCLB) was reported to be important by 46% of respondents. Breeding for improved disease resistance and grain yield, enhancing the availability of crop input and stabilizing market price during harvest time are the most important strategies to increase maize production by small-scale farmers in Western Ethiopia.

Devi S. and Suhasini K. (2015) This paper has been drawn from part of work done by the authors to assist Varsha NGO, Hyderabad in project on the value chain analysis of maize with an objective to study the economics of maize farmers cultivating under tank irrigation and constraints faced by them in Mahbubnagar district. The study showed that out of total cost of cultivation of Rs. 32041.23 per hectare, the operational costs contributed 84.41 per cent and the remaining 15.59 per cent by fixed costs. Farmers

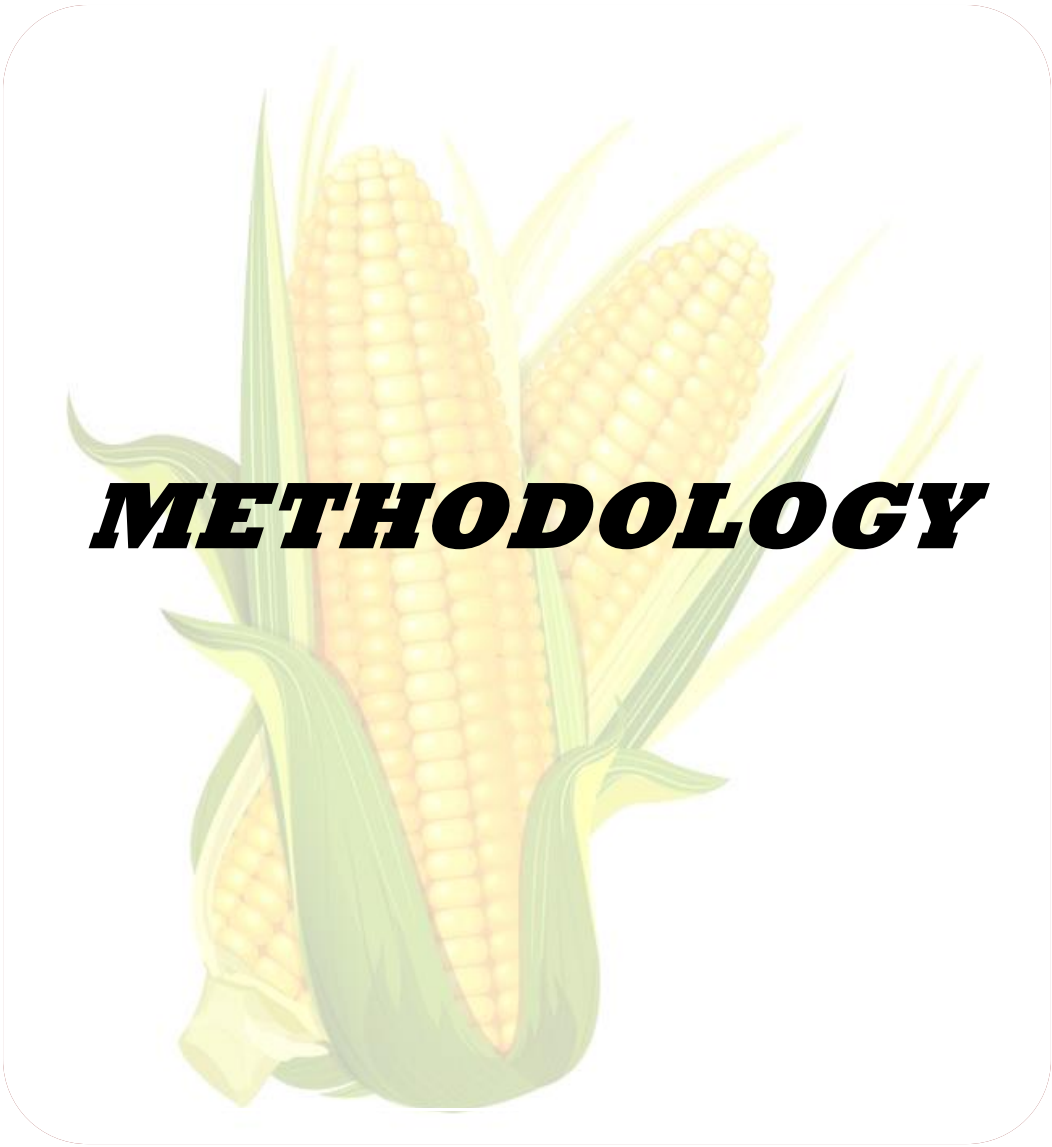
secured a net benefit cost ratio of Rs. 0.56, i.e., receiving Rs. 0.56 for every rupee invested in maize cultivation. Small farm holdings and limited resource availability and vagaries of monsoon like drought associated with highest cost on labour increased pressure of diseases/pests are the major constraints faced by the farmers in the study area.

Chahal S.S. and Kataria P. (2017) The present study was undertaken to examine constraints in the production and marketing of maize in Punjab. A representative sample of 300 maize growers was drawn from the three districts of Punjab by using multi-stage random sampling technique on the basis of concentration of area under maize. The findings of the study reveled that the selected maize growers faced constraints as the maize crop specific technology adoption was concerned. The institutional, marketing and socio-economic constraints were found to be impediments in the production of maize. More specifically the sample farmers suffered on account of non-availability of credit, poor marketing facilities, lack of storage facilities, non-availability of seed suitable to the local needs, late sowing of crop etc. The detailed analysis of the constraints impediment to production and marketing of maize reflect the urgent need for overhauling of the entire marketing system. This in turn helps in the allocation of resources to maize crop in the state like Punjab where groundwater is depleting very fast, needs to be diversified in favour of less water requiring crops like maize.

Jones, P. J. (2017) After 10 years of GM maize cultivation in Portugal, the area produced remains modest, at 6.3% of total maize production in 2015. This fact suggests that significant constraints to further expansion continue to exist. Through a survey of the structural and attitudinal characteristics of GM and conventional maize producers, this article explores constraints to adoption of GM crops in Portugal. The survey revealed a complex mix of barriers based around structural and attitudinal factors. For example, GM adopters managed larger farms than conventional, with double the area of maize grown. GM maize growers felt more constrained (in terms of factors depressing yields) by pests, especially corn borers and weeds than their non-GM counterparts. A number of non-structural barriers to GM uptake were also identified, such as perceived public opposition

to GM cultivation and increased management burden associated with coexistence measures, through the requirement to make decisions in conjunction with neighbors.

Ngonkeu E. L. M *et.al* (2017) Ten farmers were randomly selected in the humid forest zone of Cameroon to form the main focus group of 50 people. A total of 178 farmers were individually interviewed. The objectives of the study were to elucidate farmer's perceptions on maize cultivars and to identify farmer's constraints on their maize production system. Quantitative data analyses were performed using least square means of the Statistical Package for Social Scientists (SPSS) version 17. Results showed that poor soil fertility was among the major six problems listed by farmers in the BHFZ. Maize was the main cereal produced as food and cash crop in the study area. The practice of appropriate agricultural system associated with the utilization of improved and adapted varieties could significantly increase their maize yield.



METHODOLOGY

CHAPTER-III
METHODOLOGY

This chapter is devoted to discuss in brief the methodology adopted for this study. It deals with the procedure used for the selection of area, sample, method of data collection, source of data and analytical procedure used to get the results as per the objectives under study.

3.1. Location of study

The present study viz; Economics of production and marketing of maize has been taken up in Pandharpur, Malshiras and Sangola tahsil of Solapur district in Western Maharashtra region of Maharashtra state. The study was undertaken because the area under maize cultivation in the district is increasing day by day.

3.2. Sample design

The Solapur district has been purposively selected for the study because Pandharpur, Sangola and Malshiras tahsils have maxiumum area under maize as compared to other tahsils in the district. From the each tahsil, two villages were selected on the basis of maximum area under maize cultivation. The villages viz., Jainwadi and Bhalwani from Pandharpur tahsil, villages viz., Dombalwadi and Hanumanwadi from Malshiras tahsil and villages viz. Gheradi and Parre from Sangola tashil was selected. Fifteen cultivators from each village were selected. 15 *kharif* Maize growers was randomly selected from each selected villages. Thus from 6 villages, 90 growers was selected.

3.3. Method of data collection

Survey method of data collection was used for collection of data from the selected respondents for the year 2017-18. The data on family and farm organization, physical resources, prices of inputs and output, productivity and output and various marketing aspects were obtained by the author personally from respondents with the help of a schedule specially prepared for the purpose for the selected crop.

3.4. Method of data analysis

The data so collected were subjected to analysis keeping in view the objectives under study. The method of analysis adopted has been briefly explained objective wise, in this section.

3.4.1. Input utilization

The information obtained on physical input use was analyzed by a simple tabular method for studying per hectare physical input used such as human labour, bullock labour, seed, manure, fertilizers etc.

3.4.2. Estimation of costs and returns

The data were analyzed with the help of standard cost concepts normally used in Farm Management studies. The simple tabular analysis was done to work out various costs, gross returns and output-input ratio for the crop. The cost concepts used are as follows.

3.4.2.1. Cost 'A'

It is also called as paid out cost. This cost approximates the expenditure incurred by the cultivator in cash and kind in the cultivation of the crop and includes the following items.

1. Hired human labour (male and female)
2. Owned and hired bullock labour
3. Seed
4. Manure
5. Fertilizers
6. Machinery charges
7. Plant protection charges
8. Irrigation charges
9. Interest on working capital
10. Land revenue and other cesses
11. Depreciation on implements, machinery and buildings

3.4.2.2. Cost 'B'

Cost 'B' was worked out by adding rental value of land and interest on fixed capital in cost 'A' value i.e.

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

3.4.2.3. Cost 'C'

Cost 'C' was calculated by adding imputed value of family human labour in cost 'B'. i.e.

Cost 'B' + Imputed value of family human labour.

3.4.3. Evaluation of inputs

1. Human labour

i) Causal labours were charged at the rate of actual wages paid in the villages in cash and kind.

ii) Family male and female labours were charged at the prevailing wage rates in the locality for causal labour.

2. Bullock labour

i) Owned bullock labour was evaluated on the basis of hiring out rates prevailing in the village for the bullock pair.

ii) In case of hired bullock, the actual rates paid from time to time were considered.

3. Seed

i) For purchased seed, the actual cost paid and expenditure incurred on procurement was taken into account.

ii) For the farm produced seed, the price prevailing in the locality at the time of sowing of crop was considered.

4. Manure

The cost of farm yard manure produced on the own farm was estimated at the prevailing rates in the locality. In case of purchased farm yard manure, the actual price paid and transportation cost was taken into account.

5. Fertilizers

The actual prices paid for fertilizers and their procurement costs were considered.

6. Plant protection

This include the actual cost incurred on purchase of insecticides, pesticides, fungicides and hiring charges of spraying and dusting appliances.

7. Land revenue

It included land revenue and other cesses paid along with land revenue.

8. Implements and machinery

Owned implements and machinery used were charged at the hiring rates prevailing in the locality and for hired implements and machinery the actual cost incurred was taken into account.

9. Interest on working capital

The interest on working capital was calculated for the crop period @ 6 per cent per annum.

10. Irrigation charges

The actual charges incurred for irrigation by cultivators for maize were considered. To estimate the irrigation charges, following formula was used.

$$\text{Irrigation cost} = \frac{\left\{\begin{array}{c}\text{Depreciation on irrigation structure}\end{array} + \begin{array}{c}\text{Interest on fixed capital for irrigation structure}\end{array}\right\} \times \text{Plot area}}{\begin{array}{c}\text{Irrigated gross cropped area} \\ + \\ [\text{Irrigation hrs. x per hr. machine maintenance cost}]\end{array}}$$

11. Depreciation on implements, machinery and farm building

To estimate depreciation on implements, machinery and farm buildings, following formula was used.

$$\text{Depreciation} = \frac{\text{Present value of Commodity} - \text{10\% of value of commodity}}{\text{Remaining life of commodity}}$$

12. Interest on fixed capital

The items of fixed capital assets (excluding land) required for the cultivation of *kharif* maize were considered. The interest was calculated at the rate of l0 per cent per annum on the total fixed capital investment.

13. Rental value of owned land

Rental value of owned land was estimated as l/6th of the value of gross produce i.e. value of main produce and value of by produce.

3.3.4. Evaluation of output

The main and the by-produce of maize were evaluated at the actual prices received by the growers in the market.

3.3.5. Estimation of resource use efficiency in selected crops

In order to estimate the resource use efficiency in cultivation of selected crop, the Cobb- Douglas type of production function was used which gives directly the elasticities of the independent variables introduced in the function.

The general form of Cobb-Douglas production function used was

$$Y = a.\ X_1 b_1\ X_2 b_2\ X_3 b_3\ X_4 b_4 \ldots\ldots\ldots X_n b_n\ e_u$$

Where,

Y is dependent variable,

$b_1, b_2, b_3, b_4, \ldots\ldots, b_n$ are regression coefficients to be estimated

'a' is a constant which is also to be estimated,

eu is the error term with usual assumption of OLS.

This function is linear in logarithm and its logarithmic transformation can be written as,

$$\text{Log } Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 +$$

$$b_4 \log X_4 + \ldots + b_n \log X_n + u$$

Where,

Y= Gross value of the produce in Rs. including by produce.

X_1 = Human labour in man days.

X_2 = Bullock labour in pair days.

X_3 = Manure (qtl.)

X_4 = Nitrogen (kg.)

X_5 = Phosphorus (kg.)

X_6 = Potash (kg.)

X_7 = Irrigation charges (`.)

X_8 = Other working capital (Seed, plant protection etc.).

a = Constant term.

bi's = Are regression coefficients/ elasticities of Production.

u = Error term

3.4.5.1. Marginal value product (MVP)

This represents a change in total value product (TVP) due to an additional unit of inputs (X). Thus,

$$MVP = \frac{\Delta TVP}{\Delta X}$$

The linear multiple regression

$$MVP = bi \times Py$$

Where,

bi is regression coefficient of Xi and also elasticity of output with respect to input Xi.

Py = Price of out put

In the Cobb- Douglas production function,

$$MVP = \frac{bi \times Y}{X} \times Py$$

Where,

bi = Regression coefficient.

Y = Geometric mean of yield.

X = Geometric mean of independent variable.

Py = Price of output.

Specification of variables

I) Dependent variable

a) Gross value of the produce in rupee(Y)

The output of selected crop i.e. main produce and by produce has been expressed in terms of rupees.

II) Independent variables

- **Human labour in man days**

Human labour including hired and other family labour required for different operations has been considered in terms of man days.

- **Bullock labour in pair days**

Bullock labour has been considered as a separate independent variable and it is measured in pair days.

- **Manure and fertilizers**

Manure have been considered as a separate independent variable and it is measured in qtls. The nutritive value of fertilizers was worked out in physical terms i.e. in kg.

- **Irrigation charges**

Irrigation charges were considered as a separate independent variable and it was worked out in monetary terms i.e. Rs.

3.4.6. Economics of marketing

It included the marketing practices followed by farmers. The aspects such as market function, intermediaries market cost and market margins were studied. The costs actually paid by the selected growers for marketing of these foodgrains in the market were considered and analyzed to derive the market costs and margins of the intermediaries involved in the market channel.

3.4.6.1. Marketing efficiency

The marketing efficiency of various markets was worked out by Acharya's Index of marketing efficiency.

Acharya and Agarwal (1999) suggested the formula as

$$ME = \frac{FP}{[MC+MM]}$$

Where,

ME = Marketing Efficiency

FP = Prices received by the farmer

MC = Total marketing cost

MM = Net marketing margin

GENERAL PROFILE OF STUDY AREA

CHAPTER - IV

GENERAL PROFILE OF THE STUDY AREA

General information of the area under study

The agricultural production is primarily influenced by the natural resources. The control over natural resources is beyond the limits of human beings. The crops grown and farming techniques adopted have to be adjusted to the climatic and geographic factors. For better understanding of the physical features and the pattern of agriculture in the area under study, it was felt necessary to explain briefly the salient features of the area under study.

4.1. Geographical features

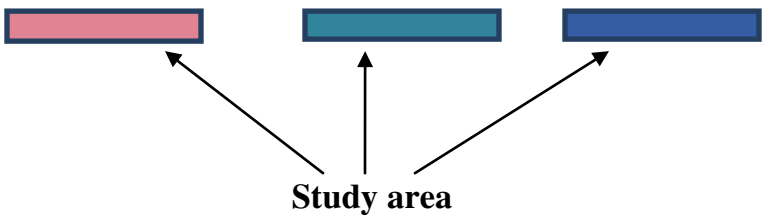
4.1.1. Location

Solapur district is situated on the south-east fringes the state of Maharashtra. It lies between latitude 17.10° to 18.32° north and longitude 75° to 77° on the border of Maharashtra. It has been total area covered by 14844.6 sq.km, which is a total area of Maharashtra state only 4.82 per cent. On the northern side of the Solapur district are bounded by Ahmednager and Osmanadad district, on the east by Osmanabad and Gulbarga (Karnataka State) districts, on the south by Sangli and Bijapur (Karnataka) and west by the Satara and Pune district. The district is situated on the south east fringe of Maharashtra and its lies entirely in the Bhima and Sina basins.

4.1.2. Soils

Soils of Solapur district are volcanic in origin. The soils of Pandharpur tahsil are light in texture and are suitable for grain crops. However, soils of Malshiras and Sangola tahsil differ in depth and texture.

Fig.4.1. Map of Solapur district



4.1.3. Climate and rainfall

Solapur district is located basically in drought prone area, occupies the southern part of Maharashtra state. The climate of the district is characterized by dryness during major part of the year. The temperature is maximum 46°c and minimum 9°c in the district. The monsoon comes early, so rainfall in the district is low as compared with western part of Maharashtra state. The south-west monsoon is during the end of August and September. The rainy season is in the month of June to September in Solapur district. The average rainfall is 545.4 mms. In last 10 years,the district is stands last in rainfall in Maharashtra state.

4.1.4. Population and literacy

In 2011, Solapur had population of 4,317,756 of which male and female were 2,227,852 and 2,089,904 respectively. In 2001 census, Solapur had a population of 3,849,543 of which males were 1,989,623 and remaining 1,859,920 were females.

Average literacy rate of Solapur in 2011 were 77.02 compared to 71.25 of 2001. If things are looked out at gender wise, male and female literacy were 85.03 and 68.55 respectively. Total literate in Solapur District were 2,910,676 of which male and female were 1,651,266 and 1,259,410 respectively.

4.1.5. Transport and communication

The main transport is Railway and Road. The total lengths is 14087.12 Km. in Solapur district and rail way has 375.40 kms. The national highway No. 9 joint to Solapur district (Pune-Solapur highway). The roadway has about 14087.12 km. length. The district has Solapur-Pune, Solapur-Bijapur route, Solapur-Osamanabad and Solapur-Kolhapur route. The total leant of road is 14914 kms.in 2011-12. Solapur district has 6.35 lakh vehicles for transportation, which account their 79.14 per cent two-wheelers (vehicles) in the district.

4.2. The pattern of agriculture in study area

4.2.1. Land utilization pattern

Table 4.2.1 depicts the land utilization pattern of Solapur district.

Table 4.2.1. Land utilization pattern of Solapur district

Sr.No	Area	Ha	Per cent
1	Total geographical area	1487843	100
2	Forest area	35300	2.37
3	i) Non- agricultural use	5700	0.38
	ii) Un-cultivable land	63700	4.28
4	Not cultivated land (excluding fallow land).	111500	7.49
5	Fallow land (i +ii)		
	i) Current fallow	111200	7.47
	ii) Otherfallow	121000	8.13
6	Net cultivated area	919700	61.81
7	Gross cropped area	1022500	68.72
8	Intensity of cropping		111%

(**Source**: Economic survey of Maharashtra (As per latest record), GOM.P.T 20)

It can be seen from the table 4.2.1 that, the total geographical area of Solapur district is 1487843 ha (100 per cent), gross cropped area is 1022500 ha (68.72 per cent) , net cultivated area is 919700 ha (61.81 per cent) area under forest is 35300 ha i.e. (2.37 per cent), non cultivable use area is 5700 ha (0.38 per cent) , Un- cultivable area is 63700 ha (4.28), not cultivated land is 111500 ha (7.49). Under fallow land, current fallow is 111200 ha (7.47 per cent) and other fallow is 121000 ha (8.13 per cent) and the cropping intensity is 111 per cent respectively.

4.2.2. Cropping pattern

The cropping pattern of Solapur is presented in Table 4.2.2.

Table 4.2.2. Cropping pattern of Solapur district.

Sr.No	Crops	Area in (00 ha)	Per cent
1	*Kharif* jowar	2.00	0.02
2	Rice	3.00	0.02
3	Bajra	168.00	1.31
4	Maize	157.00	1.22
5	Tur	252.00	1.96
6	Mung	23.00	0.18
7	Udid	78.00	0.61
	Other pulses	0.00	0.00
8	Groundnut	32.00	0.25
9	Sunflower	92.00	0.72
10	Soybean	30.00	0.23
11	Sesamum	2.00	0.02
	Other *kharif* oilseed crops	0.00	0.00
12	Sugarcane	1252	9.75
13	Cotton	11	0.09
14	*Kharif* vegetables	0	0.00
	Total *kharif* season	2102	16.37
15	*Rabi* jowar	6631	51.64
16	Wheat	751	5.85
17	*Rabi* maize	207	1.61
	Other cereals	0	0.00
18	Gram	460	3.58
19	Safflower	86	0.67
20	*Rabi* sunflower	63	0.49
	Other *rab*i oilseed crops	0	0.00
21	Summer jowar	0	0.00
22	Summer groundnut	2541	19.79
	Other summer crop	0	0.00
	Total *rabi* crops	**8198**	**63.84**
	Total *summer* crops	**2541**	**19.79**
	Gross cropped area	**12841**	**100**
	Total cereals	**7919**	**61.78**
	Total pulses	**813**	**6.33**
	Total oilseeds	**2846**	**22.19**

(**Source**: krishi.maharashtra.gov.in)

The cropping pattern shows that the crop wise (cereals, pulses and oilseed etc.) Distribution of cropped area gives an indication of land use. Sugarcane, maize, *rabi* jowar, and *summer* groundnut are the major crops grown in Solapur. Maize is one of the important cereal crop in Solapur district.

Total area under cereal crops was 7919 ha (61.78 per cent). The highest area under cereal crop was *rabi* jowar 6631 ha (51.64) followed by wheat 751 ha (5.85 per cent), gram 440 ha (3.58 per cent), maize 366 ha (2.85 per cent), bajra 168 ha (1.31 per cent) respectively

Further, the total area under pulse crop was 813 ha (6.33 per cent), total area under oilseed was 2846 ha (22.19 per cent). Total area under *kharif* crop was 2102 ha (16.37 per cent). Total area under *rabi* and *summer* crop was 8198 ha (63.84 per cent) and 2541 ha (19.79 per cent). Total gross cropped area was 12841 ha i.e. (100 per cent) respectively.

4.2.3. Irrigation resources

Irrigation is the most important input in agriculture. A significant change can be brought in the cropping pattern with the help of adequate irrigation facilities. But Solapur district comes under scarcity zone and therefore, there are no adequate irrigation facilities in tahsils. The details regarding the sources of irrigation and area irrigated in the district are presented in Table 4.2.3

Table 4.2.3. Sources of irrigation and irrigated area of solapur district (2000-01)

(ha.)

Sr.No	Source of water for irrigation	Area irrigated (ha)	Percentage (%)
1	Tanks	550	0.16
2	Open wells	207350	59.12
3	Tube/ bore wells	5500	1.57
4	Lift irrigation	28600	8.15
5	Canal	74191	21.15
6	Other sources	34540	9.85
	Total	**350731**	**100.00**

(**Source:**Directorate of Economics and Statistics Solapur 2012-2013)

The total irrigated area of Solapur district was about 3,50,731 hectares. Under total irrigated area 207350 ha (59.12 per cent) i.e. highest area under open wells irrigation followed by canal, other sources, lift irrigation, tube/ bore wells and tanks were 74191 ha (21.15 per cent), 34540 ha (9.85 per cent), 28600 ha (8.15 per cent), 5500 ha (1.57 per cent) and 550 ha (0.16 per cent) respectively.

4.2.4. Size Pattern of holding in the District

The term agriculture holding implies the total area of land which is held for cultivation as a single unit by an Individual joint family or more than one farmer on a joint basis. In the year 2011-12. The total number of rural operational holding at about 6.68 lakh covering an estimated are about 12.60 lakh hectare. The distribution of land holding in the district is given in the following table.

Table: 4.2.4. Distribution of Land Holding

Sr.No	Land holding types	No. of holdings	Area operated hect.
1	Marginal holding 0 to 1 hect.	236819 (35.46%)	129615.55 (10.28%)
2	Small holding	222830 (31.87%)	305519.57 (27.23%)
3	Semi medium 2 to 5 hect.	181034 (27.10%)	528289 (41.91%)
4	Medium 5 to 10 hect.	31130 (4.66%)	207059 (16.43%)
5	Large above 10 hect.	6097 (0.97)	901035 (7.15%)
6	Total	667910 (100)	1260458.58(100)

(**Source**:Directorate of Economics and Statistic Solapur 2012-2013)

The above table 4.2.4 shows that 66 per cent of the holding in the size group less than 1 hectare accounting 35.46 per cent of the total cultivated area. 27.10 per cent of the land holding in the size group 2 to 5 hectare which is known as semi medium holding accounting 41 per cent of the total cultivated land 4.66 per cent are medium cultivator who got 16.43 per cent cultivated land and below 0.97 per cent holders got more than 10 hectare land which is 7.15 per cent of the total area.

RESULT AND DISCUSSION

CHAPTER V

RESULTS AND DISCUSSION

Present investigation is intended to study the Economics Analysis of Production and Marketing of *Kharif* Maize in Solapur District of Maharashtra. Data regarding cost of production and marketing of maize have been collected by personal interview method. The data collected have processed, tabulated, analyzed and discussed to draw valid conclusion, it gives implications for future policy and research. In accordance with the specified objective the chapter is arranged in five sections.

5.1 To know socio-economic characteristic of maize growers.

5.2 To identify the cost and returns in maize production.

5.3 To study resource productivity and resource use efficiency in maize production.

5.4 To study marketing channels and price spread in marketing of maize.

5.5 To know the constraints of maize growers in production and marketing.

5.1 SOCIO ECONOMIC CHARACTERISTICS OF MAIZE GROWERS

Socio-economic characteristics viz. age; family size, education, occupation and land holding etc. were studied and there mean values are presented in Table 5.1

5.1.1. Age:

Age of maize grower family members was calculated and presented in Table 5.1. Farm family members were grouped into three categories according to their ages.

In case of the maize farmers it can be seen in the table 5.1 that, 11.11 per cent farmers belonged to the age group of up to 30 years, 60.00 per cent between 30 – 50 years and 27.77 per cent of the farmers were above 50 years of age.

It is observed from Table 5.1 that, the average age of the maize grower was 30 years. This indicated that, maize growers were in adult.

5.1.2. Education:

The educational status was evaluated which shows 4.44 per cent maize growers were illiterate. It is revealed from Table 5.1 that, 4.44 per cent respondent were post graduate level, 6.66 per cent were primary school level, 6.66 per cent were high school, 10 per cent were at college level, 27.77 per cent at SSC level,40 per cent at HSC level. This indicated that the maize growers in the study area were educated, upto post graduate level.

5.1.3. Occupation:

Although Agriculture was seen to be the main source of employment for the people in study area, the selected farmers were also engaged in other occupations. Besides Agriculture, some farmers were engaged in dairy business, some were engaged in government and non-government activities, school activities and other non-agricultural services. The occupational status of the farmers has been categorized into three groups as shown in Table 5.1. namely; Agriculture, Agriculture-cum-Business and Agriculture-cum-Service.

It is evident from the table that in case of maize growers, 66.80 per cent of the farmers sole occupation was Agriculture. While 18.88 per cent farmers were involved in both Agriculture and Business, and 14.44 per cent were involved in Agriculture and Service.

5.1.4. Family size:

This study measured family size in terms of actual members in a farmer's family during the period of study. The sample farmers were categorized into three groups according to their family size. The family size of *kharif* maize growers is given in Table 5.1. Number of family members varies among the selected farm families.

In case of *kharif* maize growers, it was seen that, 22.22 per cent families had 1 to 3 members, 50 per cent families had 4 to 6 members, and 27.77 per cent of families had more than 6 family members.

And the average family size in *kharif* maize growers was seen 30 given in Table 5.1.

5.1.5. Size of land holding:

It appears from Table 5.1 that, in case of maize growers, 45.00 per cent of the sample farmers had less than 2 hectares of land holding and 43.33 per cent of the farmers had 2 to 4 hectares of land while 11.11 per cent of the sample farmers had more than 4 hectare of land holding.

The total land holding under maize growers were calculated to be 224.4 hectares.

5.1.6. Livestock availability with maize growers:

In Table 5.1 it was seen that all the maize growers had livestock within their farm. About 8.88 per cent had one bullock pair, 33.33 per cent of buffalo, 33.33 per cent of cow, 16.66 per cent of goat and 7.75 per cent of poultry respectively.

5.1.7. Investment on Commonly used farm assets:

The maize growers the average investment was calculated to be Rs. 33790.94 per maize farm. (Table 5.1).

Table 5.1. Socio-economic characteristics of maize grower

Sr.No.	Particulars	Frequency (N=90)	Per cent
1	**Age(year)**		
	a) Up to 30 yrs	10	11.11
	b) 30 to 50yrs	55	60.00
	c) Above 50 yrs	25	27.77
	d) Average of Age (year)	30	32.96
2.	**Education(In 7 quantum number)**		
	a) Non-literate	4	4.44
	b) Primary School	6	6.66
	c) High School	6	6.66
	d) SSC	25	27.77
	e) HSC	36	40.00
	f) College	9	10.00
	g) Post Graduate	4	4.44
3.	**Family Size(Person)**		
	a) Upto 3	20	22.22
	b) 4 to 6	45	50
	c) More than 6	25	27.77
	d) Average of family size	30	33.32
4.	**Land holding**		
	a) Up to 2 ha	41	45.00
	b) 2 ha to 4 ha	39	43.33
	c) 4 ha and above	10	11.11
5.	**Livestock position(Nos)**		
	a) Bullock pair	8	8.88
	b) Buffalo	30	33.33
	c) Cow	30	33.33
	d) Goat	15	16.66
	e) Poultry	7	7.75
6.	**Occupational level**		
	a) Agriculture	60	66.60
	b) Agriculture-cum-Busines	17	18.88
	c) Agriculture-cum-Service	13	14.44
7.	**Investment on commonly Assets (Rs)**	33790.94	

5.1.8. Land use pattern

Details regarding size of holding, net cultivated area in which irrigated, gross cropped area and cropping intensity in relation to selected maize grower farms were calculated and presented in table 5.2. Average size of holding was 4.98 hectares. The proportionate irrigated area was 35.06 per cent. Net sown area was 50.38 per cent. While Gross cropped area was 100 per cent and cropping intensity was 348.59.

5.1.9 Cropping pattern followed by maize growers

Cropping pattern of maize growers was studied and it was presented in Table 5.3. The result revealed that, gross cropped area was 4.30 hectares. It was observed that, proportionate area under maize crop was highest i.e. 15.21 per cent. Followed by jowar, bajra, sunflower and red gram was 8.45, 7.27, 2.99, 0.92 per cent in *kharif* season. The proportionate area of wheat was 11.44 per cent, Followed by *rabi* jowar crop was 9.95 per cent, chickpea was 7.27 per cent and maize was 6.39 per cent in *rabi* season. The area under jowar was 3.45 per cent, followed by maize and summer groundnut was 3.04 and 0.87 per cent respectively in summer season. The area under annual crop i.e. sugarcane was 15.52 Per cent and the area under perennial crop i.e. Pomogranate was 7.16 per cent. In regards to cropping intensity, it was observed that, the double cropped area was 41.51 per cent and cropping intensity was 348.59 per cent in the study area

Table 5.2. Per farm land use pattern of maize growers.

Sr.No	Particulars	Area (ha)	Per cent
1.	Irrigated area	1.51	35.06
2.	Rainfed area	-	-
3.	Net sown area	4.98	50.38
4.	Total area	4.98	50.38
5.	Gross cropped area	4.30	100
6.	Cropping intensity	-	348.59

Table 5.3. Cropping pattern of maize grower

Sr.No	Crops	Area (ha)	Per cent
	Kharif		
1	*Kharif* maize	0.65	15.21
2	Jowar	0.36	8.45
3	Bajra	0.31	7.27
4	Red gram	0.04	0.92
5	Sunflower	0.12	2.99
	Sub total	**1.48**	**34.84**
	Rabi		
1	*Rabi* jowar	0.42	9.95
2	Wheat	0.49	11.44
3	Chickpea	0.31	7.27
4	Maize	0.27	6.39
	Sub total	**1.49**	**35.05**
	Summer		
1	*Summer* groundnut	0.03	0.87
2	Maize	0.13	3.04
3	Jowar	0.14	3.45
	Sub total	**0.30**	**7.36**
	Annual		
1	Sugarcane	0.66	15.52
	Sub total	**0.66**	**15.52**
	Perennial		
1	Pomogranate	0.30	7.16
	Sub total	**0.30**	**7.16**
	Gross cropped area	**4.30**	**100**
	Net sown area	**4.98**	**50.38**
	Double cropped area	**3.53**	**41.51**
	Cropping intensity		**348.59**

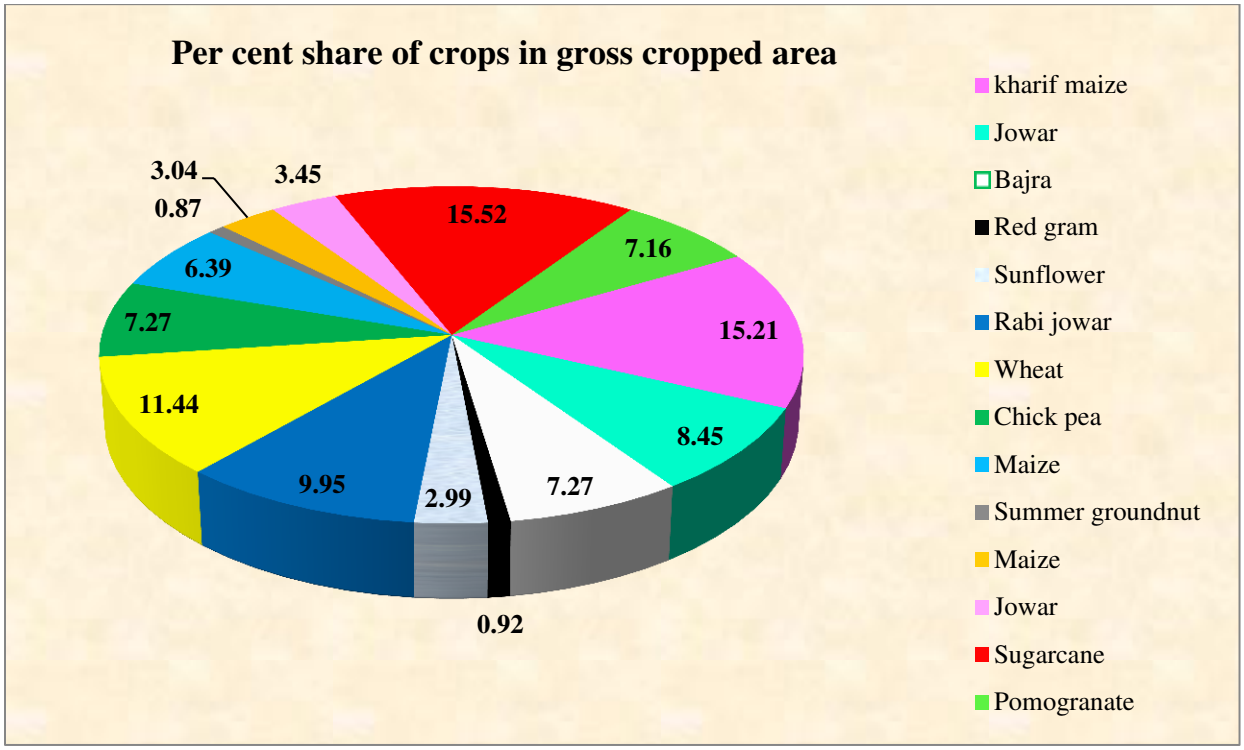


Fig.5.3.1. Per cent share of crops in gross cropped area 4.30 ha.

5.2. COSTS AND RETURNS OF MAIZE PRODUCTION

Physical inputs can be transformed in production of maize. The inputs can be converted into monetary form, to determine the per hectare cost of cultivation. Similarly, main produce and by-produce can be converted into monetary form to know gross return. With the help of costs and returns, profitability of maize production was determined as follows.

5.2.1. Operation wise labour requirement in maize crop

Per hectare operation wise labour requirement for cultivation of maize was estimated and presented in table 5.4. The results revealed that, In the operation of Ploughing, machine labour used was 4.49 i.e. (22.63) per cent followed by hired male labour, bullock labour and family male labour were 0.52 (6.49%), 0.76 (4.50%) and 0.36 (4.35%) per cent respectively. In the operation of harrowing, machine labour used was 2.43 i.e. (12.25%) per cent followed by hired male labour, family male labour and bullock labour were 1.23 (7.58), 0.91 (6.02), 0.23 (1.40) per cent respectively. In operation of cleaning, family female labour used was 2.30 (16.66%) and hired female labour used was 3.96 (13.79%) per cent. For application of manure, machine labour was 4.45 i.e. 22.61 per cent, followed by family female labour, hired male labour, family male labour, bullock labour and hired female labour were 2.32 (16.78), 2.62 (15.97), 2.05 (13.50), 0.54 (3.20) and 0.64 (2.24) per cent respectively. In the operation of sowing, bullock labour used was 14.94 i.e. 88.30 per cent followed by family male labour and hired male labour were 1.52 (10.04) and 1.52 (8.11) per cent respectively. In irrigation operation family male labour used was 1.52 (10.04) per cent.

For weeding operation use of hired female labour was 12.71 i.e. 44.25 per cent followed by family female labour was 2.28 i.e. 16.58 per cent for maize production. In the operation of hoeing bullock labour used was 0.44 (2.60) followed by hired male labour and bullock labour were 0.44 (2.34) and 0.44 (2.05) respectively. While in operation of plant protection use of machine labour 3.70 (18.65) per cent, family male labour and hired male labour was 2.05 (13.50) and 0.16 (0.90) per cent. In operation of

harvesting, hired female labour, hired male labour, family female labour and family male labour were, 8.81 (30.76), 3.72 (17.83), 2.30 (16.66), and 2.05 (13.50) per cent respectively. In threshing operation machine labour, family female labour, family male labour, hired male labour and hired female labour were, 4.73 (23.86), 2.30 (16.66), 2.05 (13.50), 2.42 (12.93), 2.57 (8.96) per cent respectively.

Table 5.4. Operation wise labour requirement in maize crop

Sr.No	Particulars	Hired male labour	Hired female labour	Family male labour	Family female labour	Bullock labour	Machine labour
1	Ploughing	0.52 (6.49)	0 0	0.36 (4.35)	0 0	0.76 (4.50)	4.49 (22.63)
2	Harrowing	1.23 (7.58)	0	0.91 (6.02)	0 (0.00)	0.23 (1.40)	2.43 (12.25)
3	Cleaning	0 (0.00)	3.96 (13.79)	0 (0.00)	2.30 (16.66)	0 (0.00)	0 (0.00)
4	Application of manure	2.62 (15.97)	0.64 (2.24)	2.05 (13.50)	2.32 (16.78)	0.54 (3.20)	4.45 (22.61)
5	Sowing	1.52 (8.11)	0 (0.00)	1.52 (10.04)	0 (0.00)	14.94 (88.30)	0 (0.00)
6	Irrigation	0 (0.00)	0 (0.00)	1.52 (10.04)	0 (0.00)	0 (0.00)	0 (0.00)
7	Application of fertilizer	5.42 (27.85)	0 (0.00)	2.05 (13.50)	2.30 (16.66)	0 (0.00)	0 (0.00)
8	Weeding	0 (0.00)	12.71 (44.25)	0 (0.00)	2.28 (16.58)	0 (0.00)	0 (0.00)
9	Hoeing	0.44 (2.34)	0 (0.00)	0.44 (2.05)	0 (0.00)	0.44 (2.60)	0 (0.00)
10	Spraying of insecticide/ pesticide	0.16 (0.90)	0 (0.00)	2.05 (13.50)	0 (0.00)	0 (0.00)	3.70 (18.65)
11	Harvesting	3.72 (17.83)	8.81 (30.76)	2.05 (13.50)	2.30 (16.66)	0 (0.00)	0 (0.00)
12	Threshing	2.42 (12.93)	2.57 (8.96)	2.05 (13.50)	2.30 (16.66)	0 (0.00)	4.73 (23.86)
13	**Total**	**18.05 (100)**	**28.69 (100)**	**15.16 (100)**	**13.80 (100)**	**16.91 (100)**	**19.77 (100)**

Fig. 5.4.1. Maize field at the time of tasseling stage

Fig. 5.4.2. Maize field at the time of harvesting stage

5.2.2. Physical inputs and outputs in maize production

Per hectare physical inputs and outputs of maize production were calculated and presented in Table 5.5. It was observed that, the use of hired human labour was 31.14, family human labour was 18.99 man days and use of bullock labour was 11.1 pair days in maize farm. On the contrary, use of machine labour was 13.01 hours/ha. The use of seed was 17.44 kg/ha in maize farm. In regard to manure, the quantity of 2.97 quintals/ha was used in maize farm. Use of nitrogen, phosphorous and potash was 72.77, 41.10 and 26.90 kg/ha, respectively in maize farm. Use of plant protection was 9.57 litre. Use of irrigation was 3466.67 cubic meters/ha in maize farm. It was also observed from the Table 5.5 that, main produce of maize was 37.47 quintals/ha and by produce was 2.63 quintals/ha.

Table .5.5. Per hectare use of physical input and outputs in maize production

(Unit/ha)

Sr. No	Particulars	Unit	Maize farm
INPUT			
1.	Hired human labour	man day	31.14
2.	Family human labour	man day	18.99
3.	Bullock labour	pair day	11.1
4.	Machine labour	hour	13.01
5.	Seed	Kg	17.44
6.	Manure	qtl	2.97
7.	Fertilizer		
	N	Kg	72.77
	P	Kg	41.10
	K	Kg	26.90
8.	Plant protection	liter	9.57
9.	Irrigation	m^3	3466.67
OUTPUT			
10.	Main produce	qtl.	37.47
11.	By-produce	qtl.	2.63

5.2.3. Per hectare cost of cultivation of maize production

Per hectare cost of cultivation of maize were calculated and presented in Table 5.6. The result revealed that, the per hectare cost of cultivation was Rs. 49631.66 in which Cost-A consist 69.58 per cent, Cost-B, 91.81 per cent and cost-C is 100 per cent i.e. Rs. 65483.72, and Rs. 71276.94 respectively. Expenditure on machine labour was Rs. 19847.46 i.e. 27.84 per cent. Next item of expenditure is rental value of land i.e. Rs.14770.98 (20.72 per cent), hired human labour accounted, Rs.11877.12 (16.66 per cent), seed Rs. 6652.54 (9.33 per cent), family human labour Rs.5793.22 (8.12 per cent), interest on working capital Rs. 2488.48 (3.49 per cent), phosphorus Rs. 1579.47 (2.21 per cent), manure accounted, Rs.1472.03 (2.06 per cent), bullock labour Rs.1185.54 (1.66 per cent), interest on fixed capital Rs.1081.08 (1.51 per cent), irrigation accounted, Rs. 1000 (1.40 per cent), depreciation on farm assets Rs. 956.23 (1.34 per cent), nitrogen Rs. 948.92 (1.33 per cent), potash Rs.309.78 (0.94 per cent), incidental charges Rs. 491.59 (0.68 per cent), plant protection Rs. 309.78 (0.43 per cent) and land revenue Rs. 150 (0.21 per cent) respectively.

Table 5.6. per hectare cost of cultivation of maize production

Sr. No	Particulars	Unit	Quantity	Amount	Percent
1.	Hired human labour	man day	31.14	11877.12	16.66
2.	Bullock labour	pair day	11.1	1185.54	1.66
3.	Machine labour	Hour	13.01	19847.46	27.84
4.	Seed	Kg	17.44	6652.54	9.33
5.	Manure	qtl.	2.97	1472.03	2.06
6.	Fertilizer	Kg			
7.	N		72.77	948.92	1.33
8.	P		41.10	1579.47	2.21
9.	K		26.90	672.5	0.94
10.	Plant protection	Ltr	9.57	309.78	0.43
11.	Irrigation	m^3	3466.67	1000	1.40
12.	Land revenue	-	-	150	0.21
13.	Incidental charges	-	-	491.59	0.68
14.	Interest on working capital @ 13%	-	-	2488.48	3.49
15.	Depreciation on capital assets@10%	-	-	956.23	1.34
16.	**Cost A (1-15)**	**-**	**-**	**49631.66**	**69.58**
17.	Rental value of land	-	-	14770.98	20.72
18.	Interest on fixed capital @ 11%	-	-	1081.08	1.51
19.	**Cost B (16-18)**	**-**	**-**	**65483.72**	**91.81**
20.	Family human labour	man day	18.99	5793.22	8.12
21.	**Cost C (19-20)**	**-**	**-**	**71276.94**	**100**

5.2.4. Profitability of maize production

Per hectare profitability in maize production was calculated and presented in table 5.7. The results revealed that, per hectare gross return was found to be Rs. 92475.42 in maize farm. It was clear that, farm business income, family labour income and net profit/ha were Rs. 42843.76 Rs. 26991.7 and Rs. 21198.48 respectively. It was clear that, output-input ratio was 1.29. It implied that, when 1 rupee spent on maize production, it would lead to give the returns of Rs 1.29. Per quintal cost of production of maize was Rs.730.45.

Table 5.7. Per hectare profitability of maize production

(Rs/ha)

Sr.No.	Particulars	Amount
1.	Returns from main produce (Seed	91471.19
2.	Returns from by produce	1004.23
3.	Gross returns (item 1+2)	92475.42
4.	Cost-A	49631.66
5.	Cost-B	65483.72
6.	Cost-C	71276.94
7.	Farm business income (Gross return minus cost-A)	42843.76
8.	Family labour income (Gross return minus cost-B)	26991.7
9.	Net profit (Gross return minus cost-C)	21198.48
10.	Output Input ratio (Gross return divided by cost-C)	1.29
11.	Per quintal cost of production (Cost-C minus by produce value divided by main produce quantity)	730.45

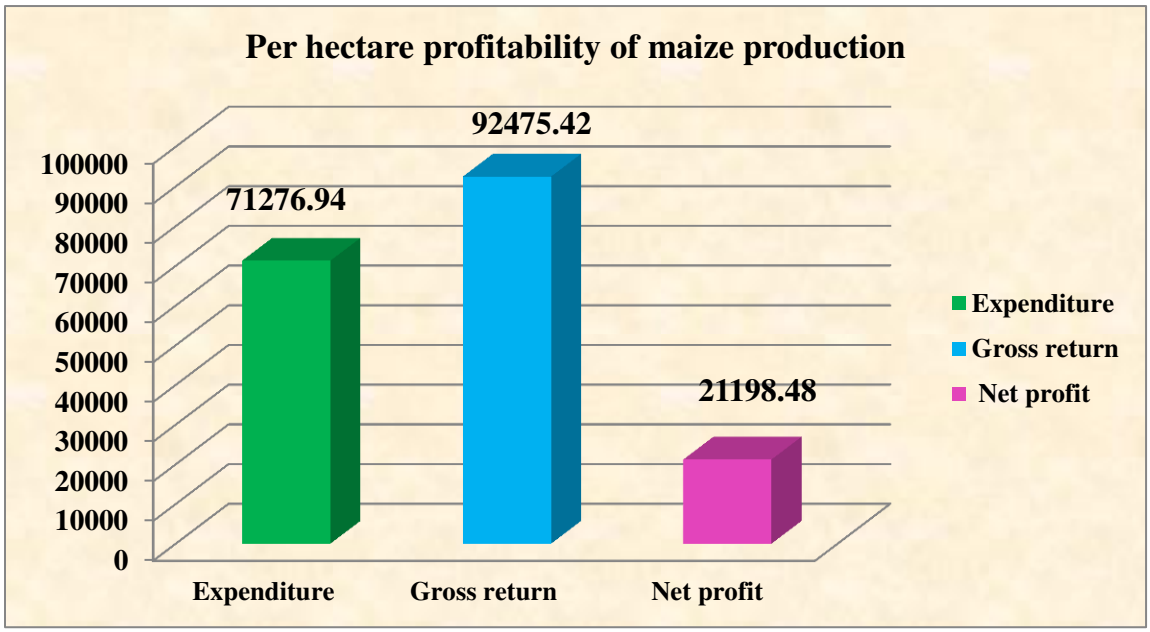


Fig.5.7.1. Per hectare profitability of maize production

5.3. RESOURCE PRODUCTIVITY AND RESOURCE USE EFFICIENCY OF MAIZE CROP

Linear and Cobb-Douglas production function was fitted on the basis of goodness of fit (R^2) hence Cobb-Douglas production function was selected. The selected independent variables used in the production function, correlation matrix for maize crop was developed. On the basis of non significant correlation coefficients, some of the variables were dropped. Similarly in order to solve problem of multicollinearity, the correlation coefficient among independent variables were which had less than the value of multiple determinations was taken into consideration and one of the variables was dropped. Thus, remaining independent variables were used in specific production. The regression coefficient of the Cobb-Douglas function are the elasticities of production and easy to determine the returns to scale in production function.

5.3.1. Estimates of Cobb-Douglas production function in maize production

Estimates of Cobb-Douglas production function in maize production were obtained and are presented in table 5.8. The findings with respect to elasticity of production, marginal productivity, resource use efficiency and optimum resource use are presented as follows.

5.3.1.1. Elasticity of production

The result revealed that, coefficient of multiple determinations (R^2) was 0.94 which indicated 94.00 per cent effect of all independent variables together in maize production. F-value was 0.106 which were highly significant. Return to scale was 0.30 which indicated increasing return to scale. Among the individual independent variables, partial regression coefficient of area under maize was 0.175 which was positive.

5.3.1.2. Marginal productivity

It was observed that marginal product with respect to Phosphorous was 0.92 which means that in addition of one kg of Phosphorous to geometric mean which gives production of maize by 0.92 quintals. Marginal product of Plant Protection was 3.73 it

indicated that when there was additional use of one liter of plant protection which caused to gives additional product of maize by 3.73 quintals. Marginal product of area under maize was 17.28 which means that when there was addition of one ha. of land it give additional product by 17.28 quintals. Marginal product of seed was -0.14 which means that when there was addition of one kg of seed it give additional product by -0.14 quintals.

5.3.1.3. Resource use efficiency

Results revealed that, marginal value product (MVP) of area under maize was found to be Rs. 28652.14 and marginal input cost of land under maize was Rs. 14770.98 hence MVP to marginal input cost ratio was 1.93. MVP to marginal input cost ratio of Plant Protection was found to be 21.26 which was highest, Manure (-2.43), seed (-0.92), machine (0.38), Phosphorus (39.69), bullock (1.40), hired labour (8.68), Nitrogen (-33.05), potash (13.26) irrigation (4.02) and family labour (69.41).

It was cleared that, higher the MVP marginal input cost ratio there was greater chance to increase these resources. So the results inferred that there was greater chance to increase nitrogen, manure, seed, machine and bullock labour utilization. It was clear that, MVP to marginal input ratios of these variables were large and away from unity. Thus, it was obvious that, the expenditure on area under maize, machine and plant protection can be increased. These resources were found to be under utilization in maize production. On the contrary, the expenditure on hired labour, and phosphorus can be reduce because over utilization of these resources in Maize production on overall farm.

Table 5.8. Cobb-Douglas production function in maize production

Sr. No.	Independent variable	Regression Coefficient (bi)	Standard error bi (SE)	t Value	Geometric Mean of input (xi)	Marginal Product (q)	Marginal Value Product (Rs.)	Price of input (Rs.)	MVP to price ratio
1.	Area of maize	0.175	0.469	3.745	0.29	17.28	28652.14	14770.98	1.93
2.	Hired human labour	0.045	0.017	2.588	3.59	1.31	2172.12	250	8.68
3.	Family human labour	0.032	0.017	1.806	0.87	6.28	10412.93	150	69.41
4.	Bullock labour	-0.032	0.002	-0.111	0.11	1.19	1973.15	1400	1.40
5.	Machine labour	0.012	0.007	-3.511	3.98	0.23	381.36	1000	0.38
6.	Seed	0.001	0.002	0.782	7.20	-0.14	-232.13	250	-0.92
7.	Manure	-0.023	0.001	2.134	1.97	-0.44	-729.56	300	-2.43
8.	Nitrogen	-0.015	0.007	0.364	2.82	-0.26	-431.10	13.04	-33.05
9.	Phosphorus	0.001	0.002	-1.920	4.85	0.92	1525.46	38.43	39.69
10.	Potash	0.10	0.004	0.239	7.39	0.20	331.62	25.00	13.26
11.	Plant protection	0.002	0.005	0.439	142.32	3.73	6168.16	290	21.26
12.	Irrigation	0.011	0.054	2.129	9.90	0.97	1608.36	400	4.02

Intercept (log a) ------- 3.83
F value ---------- 0.106
R^2----------0.94
Return to scale (∑bi)---0.30

Note: Geometric mean of (Y) maize production was 37.44 qtl per farm and price was Rs.1658.11/q

5.4. MARKETING COST, MARGIN AND PRICE SPREAD IN MAIZE MARKETING

5.4.1. Major marketing channel in the study area.

Marketing channels reveal that how produce passes through different agencies from producer to final consumer. In the study area following prominent channels were observed in the marketing,

i) Producer-- Consumer
ii) Producer--Retailer--Consumer
iii) Producer--Wholesaler--Retailer--Consumer

5.4.2. Production, retention and marketed surplus of maize

Per farm production, retention, marketed surplus and marketing of maize through different marketing channels were calculated and presented in Table 5.9. The result revealed that, the average maize farm was 0.65 hectares. It was clear from the result that, maize production on farm was 57.16 quintals. It was also observed that, the quantity of maize retained for home consumption was 2.03 quintals. Quantity of maize sold through channels-I, Channel-II and channel-Ill were quintals per farm 11.93, 18.90 and 24.30 quintals, respectively. Total marketed surplus was 55.13. It was observed from the result that, the highest quantities of maize were marketed through channel-III.

Table 5.9. Per farm Production, retention and marketed surplus of maize (q/farm)

Sr. No.	Particulars	Maize farm
1	Maize farm size (ha)	0.65
2	Production of maize(q)	57.16
3	Retention of maize for consumption(q)	2.03
4	Marketed surplus in channel-I(q) (Producer-Consumer)	11.93 (21.63)
5	Marketed surplus in channel-II(q) (Producer-Retailer-Consumer)	18.90 (34.28)
6	Marketed surplus in channel-III(q) (Producer-Wholesaler-Retailer-Consumer)	24.30 (44.07)
7	Total marketed surplus(q)	55.13 (100)

(Figure in parenthesis is the percentage to the marketed surplus in different channel)

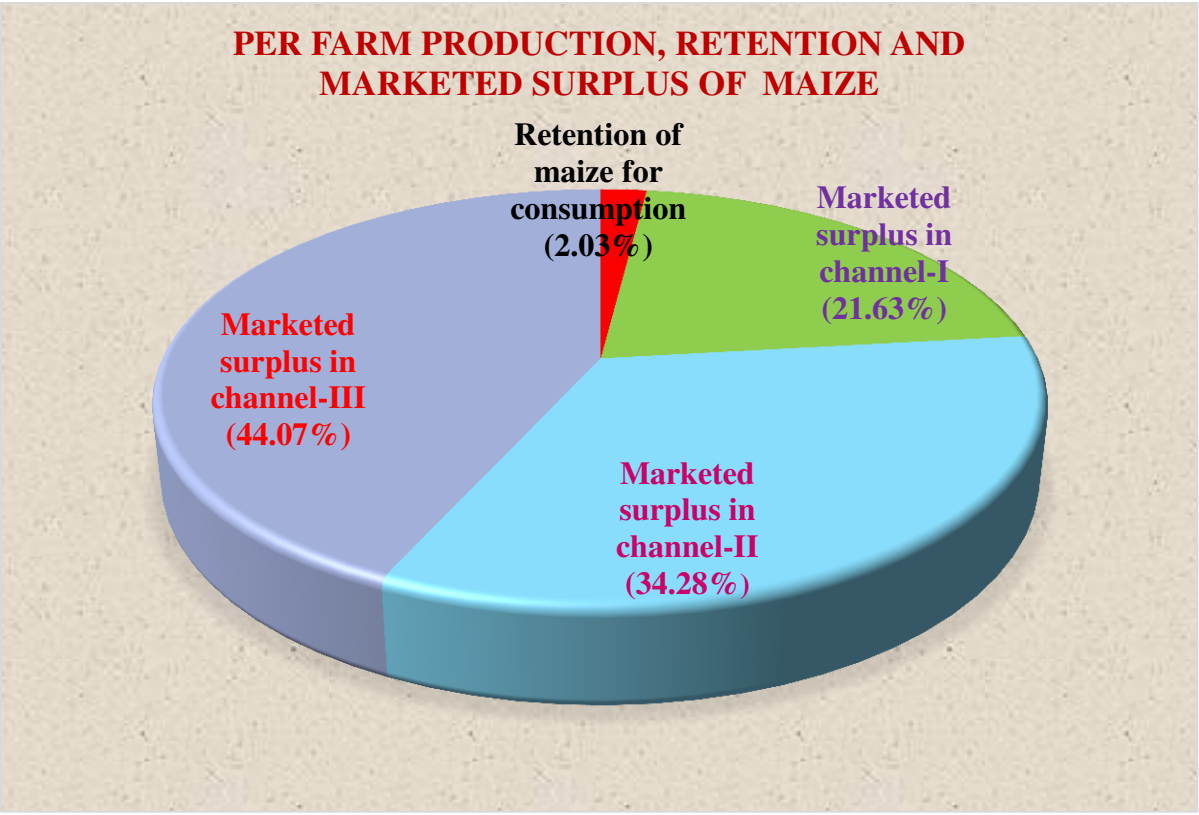


Fig.5.9.1. Per farm Production, retention and marketed surplus of maize

5.4.3. Marketing cost of maize incurred by different intermediaries.

5.4.3.1. Marketing cost incurred by producer

Per quintal marketing cost of maize with respect to various items incurred by producer in different marketing channels were calculated and presented in Table 5.10. The result revealed that, in channel-III, cost incurred by producer was higher as Rs.86.66 followed by Rs.80.67 in channel II and Rs.59.09 in channel I. Proportionate expenditure on individual items showed that, packaging charges was the highest as (76.39 per cent) followed by transportation charges (15.07 per cent), unloading charges (4.33 per cent), loading charges (4.19 per cent) in channel-I. Similarly, proportionate expenditure on packaging charges was the highest as (57.17 per cent) followed by commission charges (23.42 per cent), transportation charges (12.08 per cent), loading charges (3.09 per cent), unloading charges (2.47 per cent) and weighing charges (1.73 per cent) in channel-II. Similarly, proportionate expenditure on packaging charges was (53.80 per cent) followed by commission charges (20.94 per cent), transportation charges (17.58 per cent), unloading charges (2.65 per cent), loading charges (2.45 per cent) and weighing charges (1.51per cent) in channel-III.

Table 5.10. Marketing cost incurred by Maize producer in different channels

Sr. No	Particulars	Channel-I (Producer-Consumer)	Channel-II (Producer-Retailer-Consumer)	Channel-III (Producer-Wholesaler Retailer-(Consumer)
1.	Packaging charge	45.14 (76.39)	46.12 (57.17)	46.57 (53.80)
2.	Loading charges	2.48 (4.19)	2.50 (3.09)	2.13 (2.45)
3.	Transport charges	8.91 (15.07)	9.75 (12.08)	15.24 (17.58)
4.	unloading charges	2.56 (4.33)	2.00 (2.47)	2.26 (2.65)
5.	Weighing charges	-	1.40 (1.73)	1.31 (1.51)
6.	Commission charges	-	18.90 (23.42)	18.15 (20.94)
	TOTAL	**59.09 (100)**	**80.67 (100)**	**86.66 (100)**

(Figure in parenthesis is the percentage to the cost incurred by producer)

Fig.5.10.1 packaging of maize

Fig. 5.10.2 Weighing of maize bag

5.4.3.2. Marketing cost incurred by wholesaler

Per quintal marketing cost of maize incurred by wholesaler with respect to various items in different marketing channels were calculated and presented in Table 5.11. In regard to marketing cost incurred by wholesaler in channel-III, it was Rs 94.33 per quintals. Proportionate expenditure on packaging charges was the highest as (52.15 per cent) followed by commission charges (19.79 per cent), transportation charges (17.91 per cent), loading charges (2.65 per cent), unloading charges (2.50 per cent), losses (2.49 per cent), weighing charges (1.53 per cent), license charges (0.63 per cent) and market fee (0.31 per cent) in channel-III.

Table 5.11. Marketing cost incurred by wholesaler in channel-III

(Rs/qtl)

Sr. No	Particulars	Channel-III
1.	Packaging charge	49.20 (52.15)
2.	Loading charges	2.50 (2.65)
3.	Transport charges	16.90 (17.91)
4.	unloading charges	2.36 (2.50)
5.	License charges	0.60 (0.63)
6.	Weighing charges	1.45 (1.53)
7.	Commission charges	18.67 (19.79)
8.	Market fee	0.30 (0.31)
9.	Losses	2.35 (2.49)
	TOTAL	**94.33** **(100)**

(Figure in parenthesis is the percentage to the cost incurred by wholesaler)

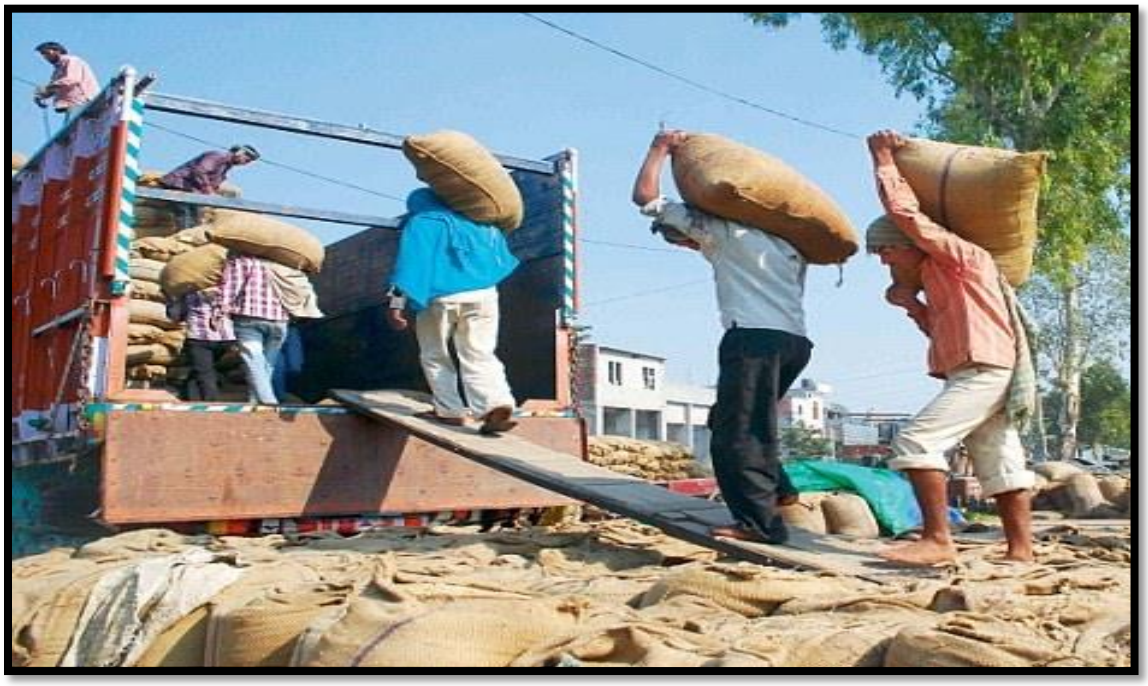


Fig: 5.11.1. Loading of maize bag

Fig:5.11.2. Unloading of maize bag

5.4.3.3. Marketing cost incurred by retailer

Per quintal marketing cost of maize incurred by retailer was calculated and presented in Table 5.12. Cost incurred by retailer in channel-III was higher as Rs. 26.33 followed Rs. 24.20 in channel-II. Proportionate expenditure on transportation charges was highest as (74.58 per cent) followed by losses in marketing (11.15 per cent), license charges (5.16 per cent), storage charges (4.95 per cent), market fee (2.47 per cent) and shop tax (1.65 per cent) in channel-II. Proportionate expenditure on transportation charges was the highest as 74.21 per cent followed by losses 11.77 per cent, license charges 4.93 per cent, storage charges 4.74 per cent, market fee charges 2.46 per cent and shop tax 1.86 per cent in channel-III.

Table 5.12. Marketing cost incurred by retailer

(Rs/q)

Sr.No.	Particulars	Channel-II	Channel-III
1.	Transport charges	18.05 (74.58)	19.54 (74.21)
2.	License charge	1.25 (5.16)	1.30 (4.93)
3.	Shop tax	0.40 (1.65)	0.49 (1.86)
4.	Storage charges	1.20 (4.95)	1.25 (4.74)
5.	Market fees	0.60 (2.47)	0.65 (2.46)
6.	Losses	2.70 (11.15)	3.10 (11.77)
	TOTAL COST	**24.20 (100)**	**26.33 (100)**

(Figure in parenthesis is the percentage to the cost incurred by retailer)

5.4.4. Price spread in maize marketing

Per quintal marketing cost, marketing margin and price spread in marketing of maize with respect to different channels were calculated and presented in Table 5.13. The result revealed that, in regard to channel-I net price received by producer from consumer was Rs.1700.40 while cost incurred by producer was Rs.59.09. The price paid by consumer was Rs.1759.49, thus price spread was found to be Rs.59.09. In channel-I producers share in consumer's rupee was found to be 96.66 per cent.

In regard to channel-II price received by producer from retailer was Rs.1650.35 while cost incurred by producer was Rs. 80.67. The cost incurred by retailer and margin of retailer was Rs.24.20 and Rs.185.54, respectively. The price paid by consumer was Rs. 1940.76. Thus, price spread was found to be Rs.287.10. In channel-II producer's share in consumer's rupee was found to be 85.03 per cent. It was clear that, producer's share in consumer's rupee was maximum in channel-I. It was observed that, marketing cost in channel-I was 59.09. Thus price spread was found to be Rs.59.09. In Channel-II marketing cost was 101.56 and margin was Rs.185.54. Thus price spread was found to be Rs.287.10

In channel-III, that the price paid by consumer in this channel was Rs. 2090.60. It was clear that, the price received by the producer from wholesaler was Rs. 1570.30 while cost incurred by producer was Rs. 86.66. In next order, cost incurred by the wholesaler was Rs. 94.33 while marketing margin of wholesaler was Rs. 90.50. The wholesaler had sold the produce to retailer at Rs. 1760.79. Next order, cost incurred by retailer was Rs. 26.33 while marketing margin was 303.48 and thus it inferred that, in this channel the marketing cost was Rs. 112.99 while marketing margin was Rs. 303.48 and the price spread was found to be Rs. 416.47. It inferred that, price spread was found higher in channel-III as compared to channel-I and channel-II.

Table 5.13 Per quintal marketing cost, margin and price spread in maize

(Rs/q)

Sr. No	Particulars	Channel-I	Channel-II	Channel-III
1	Net price received by producer(producer share in consumer rupee)	1700.40 (96.66)	1650.35 (85.03)	1570.30 (75.00)
2	Cost incurred by producer	59.09 (3.35)	80.67 (4.15)	86.66 (4.00)
3	Price paid by wholesaler	-	-	1656.96 (79.00)
4	Cost incurred by wholesaler	-	-	94.33 (3.65)
5	Margin of wholesaler	-	-	90.50 (3.10)
6	Price paid by retailer	-	1731.02 (89.18)	1760.79 (85.75)
7	Cost incurred by retailer	-	24.20 (1.24)	26.33 (1.25)
8	Margin of retailer	-	185.54 (9.56)	303.48 (13.00
9	Price paid by consumer	1759.49 (100)	1940.76 (100)	2090.60 (100)
10	Marketing cost	59.09 (3.35)	101.56 (5.23)	112.99 (5.40)
11	Marketing margin	-	185.54 (9.56)	303.48 (13.00)
12	**Price Spread**	**59.09 (3.35)**	**287.10 (14.79)**	**416.47 (18.40)**

(Figure in parenthesis is the percentage to the marketing cost, margin and price spread)

5.5. CONSTRAINTS AND SUGGESTION OF MAIZE GROWERS INPRODUCTION AND MARKETING

5.5.1. Constraints faced by maize growers in production and marketing of maize.

The sample farmers surveyed for the constraints faced by them during both production and marketing of maize. The constraints faced by maize growers in the production of maize are identified and are listed and ranked based on the frequency in the Table 5.14. About 88% of the sample farmers expressed the inadequate and untimely rainfall and high input cost 84% was their major problem in the production of maize, Apart from these unavailability of labour 77%, then 75 % sample farmers expressed lack of irrigation facility problem, pest and disease problem 72% and lack, high cost of fertilizer 61% and 55% lack of credit facility were identified as the other constraints faced by the farmers during the production of maize.

Table 5.14. Constraints faced by the maize growers in Production of maize.

Sr.No.	Particulars	Frequency (N=90)	Percentage	Rank
1.	Inadequate and untimely rainfall	80	88	I
2.	High input cost	76	84	II
3.	Unavailability of labour	70	77	III
4.	Lack of irrigation facility	68	75	IV
5.	Pest and disease	65	72	V
6.	Lack and high cost of fertilizer	55	61	VI
7.	Lack of credit facility	50	55	VII

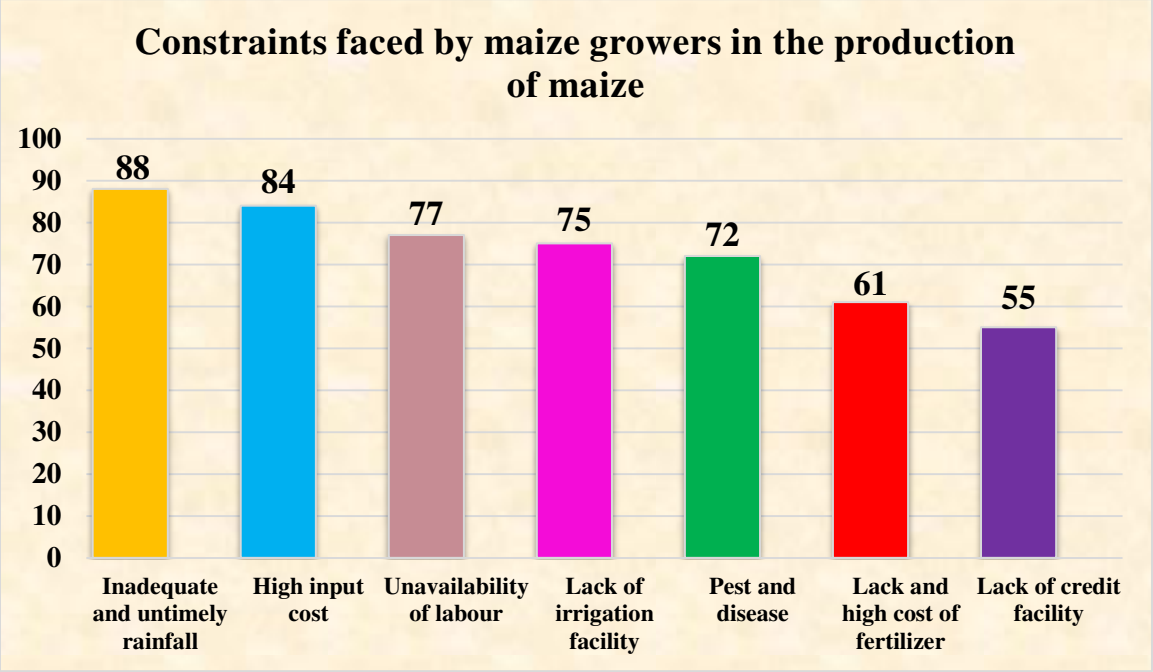


Fig. 5.14. Constraints faced by maize growers in the production of maize

Table 5.15. Constraints faced by the maize growers in marketing of maize

Sr.No	Particulars	Frequency (N=90)	Percentage	Rank
1.	Poor marketing facilities	85	94	I
2.	Lack of technical knowledge	80	88	II
3.	Lack of storage facility	78	86	III
4.	High transportation cost	72	80	IV
5.	Late payment	65	72	V
6.	Price fluctuation	60	66	VI

The constraints faced by maize growers in the marketing of maize were identified and are listed and ranked based on the frequency in the Table 5.15. About 94% of the sample farmers expressed poor marketing facilities was their major problems in marketing of maize, then 88 per cent sample farmers expressed the lack of technical knowledge as their problem. Lack of storage facility was expressed as a problem by 86% of the sample farmers. Apart from these high transportation cost (80%), late payment (72%) and price fluctuation (66%) were identified.

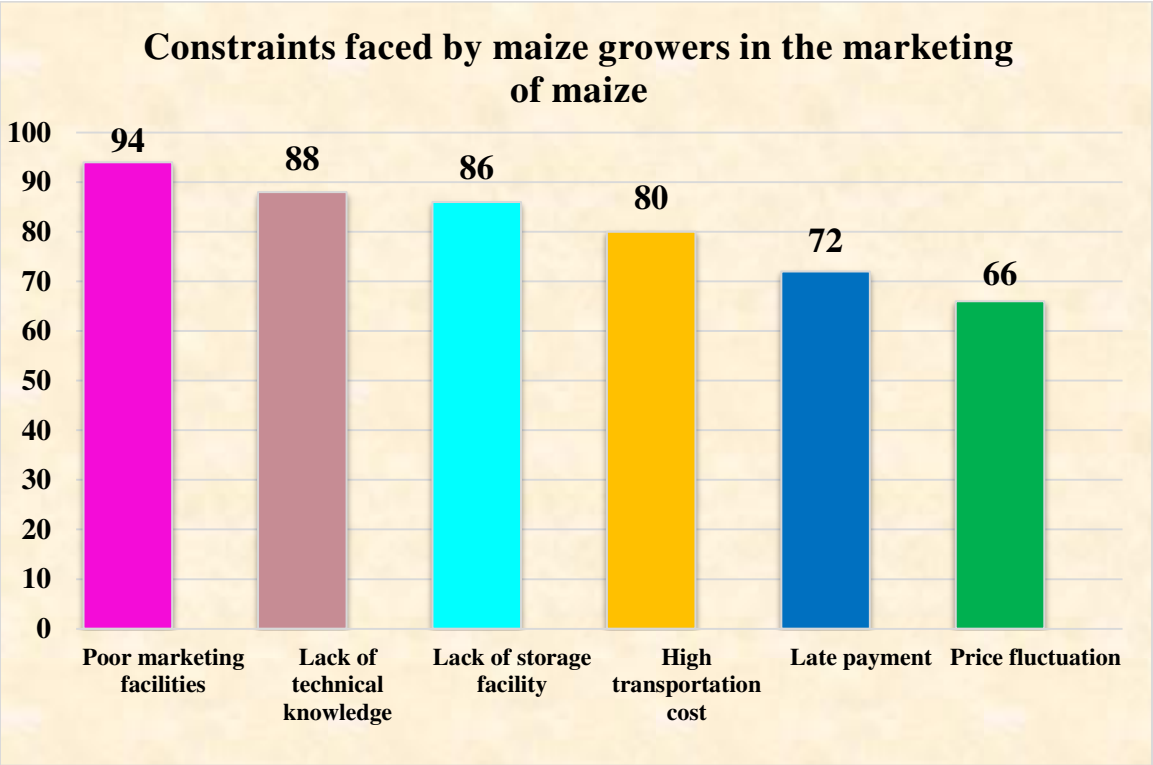


Fig.5.15. Constraints faced by maize growers in the marketing of maize

5.5.2. Suggestions made by maize growers in production and marketing of maize

Suggestions made by maize growers to overcome the problems were calculated and presented in table 5.16 indicated that great majority of the farmers suggested that Release resistant varieties (86) per cent, Availability of input at reasonable prices (80) per cent, provision for low rate of fertilizer should be given to the farmers as and when they needs (72) per cent, timely supply of water for irrigation (66) per cent, providing loan (61) per cent, Use of plant protection chemicals (55) per cent and providing improved seed (50) per cent.

Table 5.16. Suggestion made by maize growers in production of maize

Sr.No	Particulars	Frequency (N=90)	Percentage	Rank
1.	Release resistant varieties	78	86	I
2.	Availability of input at reasonable prices	72	80	II
3.	Provision for low rate of fertilizer	65	72	III
4.	Timely supply of water for irrigation	60	66	IV
5.	Providing loan in time	55	61	V
6.	Use of plant protection chemicals	50	55	VI
7.	Providing improved seed	45	50	VII

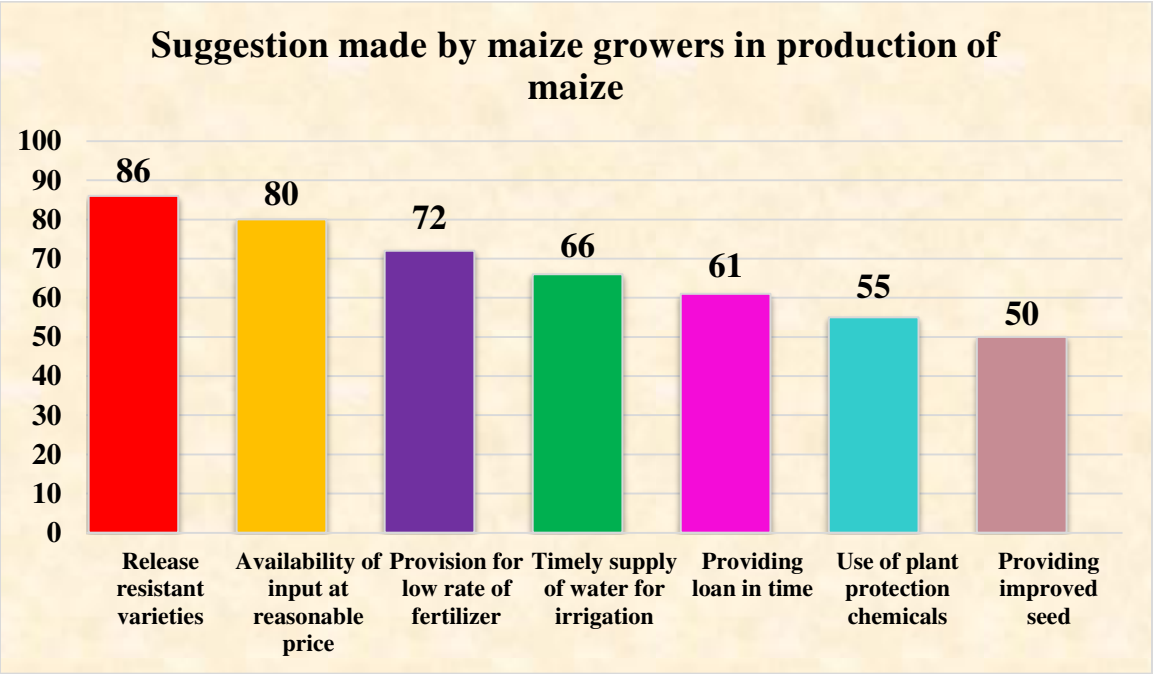


Fig.5.16. Suggestion made by maize growers in production of maize

Table 5.17. Suggestion made by maize growers in marketing of maize

Sr.No	Particulars	Frequency (N=90)	Percentage	Rank
1.	Availability of transport facility	82	91	I
2.	Better price policies	78	86	II
3.	Provision for crop insurance	74	82	III
4.	Provision for storage of maize at low price	67	74	IV
5.	Improve the grading facility	64	71	V
6.	Mechanization in maize	55	61	VI

Suggestions made by maize growers to overcome the problems were calculated and presented in table 5.17. To minimize the expenditure in maize production, 91.00 per cent maize growers suggested availability of transport facility. To minimize the expenditure in maize production 86.00 per cent maize growers suggested better price policies, 82 per cent maize growers suggested that provision for crop insurance. As we see that low price of maize at the time of harvesting, hence 74 per cent maize growers suggested that provision for storage of maize at low price, 71 per cent maize growers suggested that improve the grading facility and 61 per cent suggested that mechanization in maize.

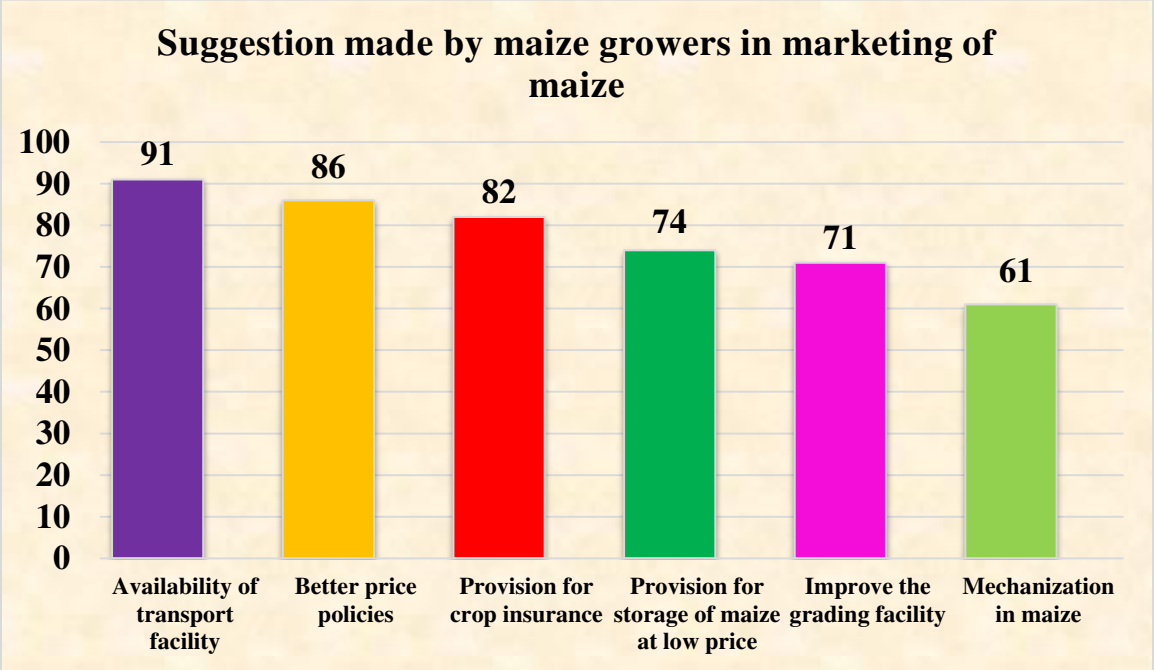


Fig 5.17. Suggestion made by maize growers in marketing of maize

SUMMARY AND CONCLUSIONS

CHAPTER -VI
SUMMERY AND CONCLUSION

6.1. Introduction

Agriculture is the backbone of Indian economy, as the economic growth largely depends on agriculture and allied sectors. Sixty seven per cent of total population, mostly from rural areas is dependent on agriculture as a primary source of income whereas, seventy per cent population is indirectly dependent on agriculture.

As a part of first green revolution, India has reached self sufficiency in food by producing above 200 million metric tonnes of foodgrains. Over the period of time, there has been cons. It can be seen that at the overall level, the average size of family was 6.82 comprising 2.64 males, 2.51 females and 1.68 children. At the overall level, total earners were 3.21, of which male and female earners were 2.04 and 1.17, respectively. Iderable increase in the input costs which are not been compensated by increase in output prices. This ultimately resulted reduction in agriculture income. In addition, the scope for bringing more land under cultivation has reduced due to industrialization and increasing civilization. Policies are being formulated have a mission to achieve a minimum production of 360 million metric tones of foodgrains in the next two decades. This will satisfy the domestic consumption and surplus. Among the foodgrains, paddy, wheat, jowar, bajara and maize are the important general cereal crops grown in our country. It is grown in many parts of the country throughout the year.

Maize *(Zea maize)* belong to family (Gramineae). It is the third most important cereal foodgrain crop in the world followed by rice and wheat. The origin of maize is Mexico in Central America. It contributes about 20 per cent world's total cereal production.

The term maize has been derived from Arawak-cexi word, 'Mahiz', is also known as Indian corn. Maize among the cereals ranks third, both in terms of area and production in the world. The major maize producing countries are the USA, China, India, South Africa, Brazil, and Mexico. (**Source:Foreign Agricultural services /USDA).**

It occupies a prominent place in the humid tropics; maize in fact is the most extensively distributed cereal crop**.** In India important maize growing states are Rajasthan, Punjab, Maharashtra, West Bengal, Uttar Pradesh, Karnataka and Andhra Pradesh Telangana.

In our country, maize is mainly grown for grain purpose, which is consumed either as food or feed. Utilization of maize for specialized purpose, good feed for poultry, piggery and other animals. This crop is being considered as a "Queen of cereals''(Reddy and Reddy-Principle of Agronomy) because of its special characteristics that include its carbon pathway (C_4), wider adoptability, higher multiplication ratio, desirable architecture, superior transpiration efficiency, high versatile use etc. The maturity period of maize is relatively shorter than other cereal crops.

Maize has many assets for its wide distribution, its husk give protection from birds and rain can be harvested over a long period since it can be left dried in the field until harvesting is convenient, can be stored long, provide numerous useful food products and frequently preferred to sorghum and other millets. In fact it is a major source of starch. Corn starch (maize flour) is a major ingredient in home cooking and in many industrialized food products. Maize is also a major source of cooking oil (corn oil) and of maize gluten. Maize starch can be hydrolyzed and enzymatically treated to produce syrups, particularly high fructose corn syrup, a sweetener; and also fermented and distilled to produce grain alcohol. Grain alcohol from maize is traditionally the source of bourbon whiskey. Maize is sometimes used as the starch source for beer. It is also nutritive for adults of different ages.

The green straw is suitable for making silage. Maize is also used as the fodder for livestock. The 100 grams of maize grains contains starch 71-72 kcal, sugars 2-3 grams, dietary fibers 9-10 grams, fats 4-45 grams and proteins 9-10 grams minerals 1-4 grams. **(Source:Agmarknet**). The nutrients are very important for the smooth functioning of the body. It is a rich source of carbohydrates, besides this, it provides essential body building substances such as minerals and proteins. It is also a rich source of water (75.96 grams). Maize is consumed by the people in India in many forms, it can be consumed as a rotis or breads, in the forms of pop corns or a pop grains. Besides this, maize is used in preparation of starch, syrup, glucose, paper adhesive, acetic acid and lactic acids, etc., the demand for which is increasing day-by-day.

6.2. Objectives:

The specific objectives of the present study are.

- To know socio-economic characteristic of maize growers.
- To identify the cost and returns in maize production.
- To study resource productivity and resource use efficiency in maize production.
- To study marketing channels and price spread in marketing of maize.
- To know the constraints of maize growers in production and marketing.

6.3. Methodology

The Solapur district has been purposively selected for the study because Pandharpur, Sangola and Malshiras tahsils have maxiumum area under maize as compared to other tahsils in the district. From the each tahsil, two villages were selected on the basis of maximum area under maize cultivation. The villages viz., Jainwadi and Bhalwani from Pandharpur tahsil, villages viz., Dombalwadi and Hanumanwadi from Malshiras tahsil and villages viz. Gheradi and Parre from Sangola tashil was selected. Fifteen cultivators from each village were selected.15 *kharif* Maize growers was randomly selected from each selected villages. Thus from 6 villages, 90 growers was selected.

6.4. Results and discussions

The average age of the maize grower was 30 years. This indicated that, maize growers were in adult age group. The educational status was evaluated which shows 4.44 per cent maize growers were illiterate. It is revealed that, 4.44 per cent respondent were post graduate level 6.66 per cent were primary school level, 6.66 per cent were high school, 10 per cent were at college level, 27.77 per cent at SSC level , 40 per cent at HSC level. This indicated that the maize growers in the study area were educated, upto post graduate level.

In case of maize growers, that in case of maize growers, 66.80 per cent of the farmers sole occupation was Agriculture. While 18.88 per cent farmers were involved in both Agriculture and Business, and 14.44 per cent were involved in Agriculture and Service. In case of *kharif* maize growers, it was seen that, 22.22 per cent families had 1 to 3 members, 50 per cent families had 4 to 6 members, and 27.77 per cent of families had more than 6 family members.

The maize growers had livestock within their farm. About 8.88 per cent had one bullock pair, 33.33 per cent of buffalo, 33.33 per cent of cow, 16.66 per cent of goat and 7.75 per cent of poultry respectively.

In case of maize growers, 45.00 per cent of the sample farmers had less than 2 hectares of land holding and 43.33 per cent of the farmers had 2 to 4 hectares of land while 11.11 per cent of the sample farmers had more than 4 hectare of land holding. The total land holding under maize growers were calculated to be 224.4 hectares.

Average size of holding was 4.98 hectares. The proportionate irrigated area was 35.06 per cent. Net sown area was 50.38 per cent. While Gross cropped area was 100 per cent and cropping intensity was 348.59. The proportionate area under maize crop was highest i.e. 15.21 per cent. Followed by jowar, bajra, sunflower and red gram was 8.45, 7.27, 2.99, 0.92 per cent. This indicated that, the cropping pattern of the maize growers was dominated by maize alone. The cropping intensity 348.59.

In case of maize 31.14 man days of hired human labour and 18.99 man days of family human labour were utilized on maize farm i.e. in total 50.13 man days human labour were utilized for maize crop. The use of hired labour is maximum on farm. On the farms 11.1 pair days of bullock labour were utilized per hectare. About 13.01 hours of machine labour were utilized per hectare on maize farm. The use of seed was 17.44 Kg/ha .Use of manure per hectare for maize crop was 2.97qtl. Use of irrigation was 3466.67 cubic meters/ha. In regards to fertilizer, it is observed that Nitrogen, Phosphorous and Potash was the common fertilizers utilized in study area. Use of N,P& K was maximum i.e. 72.77, 41.10 and 26.90 kg per hectare on maize farm. The use of plant protection chemicals were 9.57 lit per hectare for maize crop. The combined effect of above inputs was reflected in output and it is observed that per hectare 37.47 qtl main produce and 2.63 qtl by produce of maize was harvested by the growers.

The item wise per hectare cost of cultivation was Rs.49631.66 in which Cost-A consist 69.58 per cent, Cost-B, 91.81 per cent i.e. Rs. 65483.72 and cost-C is 100 per cent i.e. Rs.71276.94 respectively. Expenditure on machine labour was Rs. 19847.46 i.e. 27.84 per cent. Next item of expenditure is rental value of land i.e. Rs.14770.98 (20.72 per cent), hired human labour accounted, Rs.11877.12 (16.66 per cent), seed Rs. 6652.54 (9.33 per cent), family human labour Rs.5793.22 (8.12 per cent), interest on working capital Rs.2488.48 (3.49 per cent), phosphorus Rs.1579.47 (2.21 per cent), manure accounted, Rs.1472.03 (2.06 per cent), bullock labour Rs. 1185.54 (1.66 per cent), interest on fixed capital Rs.1081.08 (1.51 per cent), irrigation accounted, Rs.1000 (1.40 per cent), depreciation on farm assets Rs. 956.23 (1.34 per cent), nitrogen Rs.948.92 (1.33 per cent), potash Rs.309.78 (0.94 per cent), incidental charges Rs. 491.59 (0.68 per cent), plant protection Rs.309.78 (0.43 per cent) and land revenue Rs.150 (0.21 per cent) respectively.

The results revealed that, per hectare gross return was found to be Rs. 92475.42 in maize farm. It was clear that, farm business income, family labour income and net profit/ha were Rs 42843.76, Rs 26991.7 and Rs 21198.48 respectively. It was clear that, output-input ratio was 1.29. It implied that, when 1 rupee spent

onmaize production, it would lead to give the returns of Rs 1.29. Per quintal cost of production of maize was Rs.730.45.

The result revealed that, coefficient of multiple determinations (R^2) was 0.94 which indicated 94.00 per cent effect of all independent variables together in maize production. F-value was 0.106 which were highly significant. Return to scale was 0.30 which indicated increasing return to scale. Among the individual independent variables, partial regression coefficient of area under maize was 0.175 which was positive

It was observed that marginal product with respect to Phosphorous was 0.92 which means that in addition of one kg of Phosphorous to geometric mean which gives production of maize by 0.92 quintals. Marginal product of Plant Protection was 3.73 it indicated that when there was additional use of one liter of plant protection which caused to gives additional product of maize by 3.73 quintals. Marginal product of area under maize was 17.28 which means that when there was addition of one ha.of land it give additional product by 17.28 quintals. Marginal product of seed was -0.14 which means that when there was addition of one kg of seed it give additional product by -0.14 quintals.

Results revealed that, marginal value product (MVP) of area under maize was found to be Rs. 28652.14 and marginal input cost of land under maize was Rs. 14770.98 hence MVP to marginal input cost ratio was 1.93. MVP to marginal input cost ratio of Plant Protection was found to be 21.26 which was highest, Manure (-2.43), seed (-0.92), machine (0.38), Phosphorus (39.69), bullock (1.40), hired labour (8.68), Nitrogen (-33.05), potash (13.26) irrigation (4.02) and family labour (69.41).
It was cleared that, higher the MVP marginal input cost ratio there was greater chance to increase these resources. So the results inferred that there was greater chance to increase nitrogen, manure, seed, machine and bullock labour utilization. It was clear that, MVP to marginal input ratios of these variables were large and away from unity. Thus, it was obvious that, the expenditure on area under maize, machine and plant protection can be increased. These resources were found to be under utilization in maize production. On the contrary, the expenditure on hired labour, and phosphorus

can be reduce because over utilization of these resources in Maize production on overall farm.

With regard to marketing study, three types of marketing channels were observed viz. (Channel-I) Producer-Consumer, (Channel-II) Producer-Retailer-Consumer) and (Channel-III) Producer-Wholesaler-Retailer-Consumer).

Per farm production, retention, marketed surplus and marketing of maize through different marketing channels were calculated. The result revealed that, the average maize farm was 0.65 hectares. It was clear from the result that, maize production on farm was 57.16 quintals. It was also observed that, the quantity of maize retained for home consumption was 2.03 quintals. Quantity of maize sold through channels-I, Channel-II and channel-Ill were quintals per farm 11.93, 18.90 and 24.30 quintals, respectively. Total marketed surplus was 55.13. It was observed from the result that, the highest quantities of maize were marketed through channel-III.

Item wise Per quintal marketing cost of maize with respect to various items incurred by producer in different marketing channels were calculated. The result revealed that, in channel-III, cost incurred by producer was higher as Rs. 86.66 followed by Rs 80.67 in channel II and Rs. 59.09 in channel I. Proportionate expenditure on individual items showed that, packaging charges was the highest as (76.39 per cent) followed by transportation charges (15.07 per cent), unloading charges (4.33 per cent), loading charges (4.19 per cent) in channel-I. Similarly, proportionate expenditure on packaging charges was the highest as (57.17 per cent) followed by commission charges (23.42 per cent), transportation charges (12.08 per cent), loading charges (3.09 per cent), unloading charges (2.47 per cent) and weighing charges (1.73 per cent) in channel-II. Similarly, proportionate expenditure on packaging charges was (53.80 per cent) followed by commission charges (20.94 per cent), transportation charges (17.58 per cent), unloading charges (2.65 per cent), loading charges (2.45 per cent) and weighing charges (1.51 per cent) in channel-III

Per quintal marketing cost of maize incurred by wholesaler with respect to various items in different marketing channels were calculated. In regard to marketing cost incurred by wholesaler in channel-III, it was Rs 94.33 per quintals. Proportionate expenditure on packaging charges was the highest as (52.15 per cent) followed by commission charges (19.79 per cent), transportation charges (17.91 per cent), loading charges (2.65 per cent), unloading charges (2.50 per cent), losses (2.49 per cent) weighing charges (1.53 per cent), license charges (0.63 per cent) and market fee (0.31 per cent) in channel-III

Per quintal marketing cost of maize incurred by retailer was calculated. Cost incurred by retailer in channel-III was higher as Rs. 26.33 followed Rs. 24.20 in channel-II. Proportionate expenditure on transportation charges was highest as (74.58 per cent) followed by losses in marketing (11.15 per cent), license charges (5.16 per cent), storage charges (4.95 per cent),market fee (2.47 per cent)and shop tax (1.65 per cent) in channel-II. Proportionate expenditure on transportation charges was the highest as 74.21 per cent followed by losses 11.77 per cent, license charges 4.93 per cent, storage charges 4.74 per cent, market fee charges 2.46 per cent and shop tax 1.86 per cent in channel-III.

Per quintal marketing cost, marketing margin and price spread in marketing of maize with respect to different channels were calculated and presented in Table 5.13. The result revealed that, in regard to channel-I net price received by producer from consumer was Rs. 1700.40 while cost incurred by producer was Rs. 59.09. The price paid by consumer was Rs. 1759.49, thus price spread was found to be Rs. 59.09. In channel-I producers share in consumer's rupee was found to be 96.66 per cent.

In regard to channel-II price received by producer from retailer was Rs. 1650.35 while cost incurred by producer was Rs. 80.67. The cost incurred by retailer and margin of retailer was Rs. 24.20 and Rs. 185.54, respectively. The price paid by consumer was Rs. 1940.76. Thus, price spread was found to be Rs. 287.10. In channel-II producer's share in consumer's rupee was found to be 85.03 per cent. It was clear that, producer's share in consumer's rupee was maximum in channel-I. It was observed that, marketing cost in channel-I was 59.09. Thus price spread was found to

be Rs 59.09. In Channel-II marketing cost was 101.56 and margin was Rs 185.54. Thus price spread was found to be Rs.287.10

In channel-III, that the price paid by consumer in this channel was Rs. 2090.60. It was clear that, the price received by the producer from wholesaler was Rs. 1570.30 while cost incurred by producer was Rs. 86.66. In next order, cost incurred by the wholesaler was Rs.94.33 while marketing margin of wholesaler was Rs 90.50. The wholesaler had sold the produce to retailer at Rs. 1760.79. Next order, cost incurred by retailer was Rs. 26.33 while marketing margin was 303.48 and thus it inferred that, in this channel the marketing cost was Rs. 112.99 while marketing margin was Rs. 303.48 and the price spread was found to be Rs. 416.47. It inferred that, price spread was found higher in channel-III as compared to channel-I and channel-II.

6.5. Conclusions

It concluded that gross cropped area on an overall level was 4.30 hectare in the study area. In case of cropping pattern, a proportionate area under *kharif* maize crop was 15.21 per cent. Cropping intensity on maize farm was 348.59 per cent. Use of hired human labour was 31.14 man day. It inferred that, as farm size increased it shows the positive relationship. On the contrary, use of family human labour was 18.99 man day. Use of machine labour was increased with an increase in farm size. Net profit of maize crop was Rs.21198.48. it was clear that maize crop was profitable. It observed that, there is scope to increase in use of machine labour area and family human labour for maize crop. It was observed that price spread was more in channel – III.

6.6. Policy implications

1. Transport cost charges were major part of marketing cost to the producers. Step may be taken at government level to regularize the transport charges.

2. The farmer should use the recommended level of inputs minimize the labour, Nitrogen and Organic manures to increase the output.

3. The Maize growers need to be encouraged to form co-operative society for collecting marketing of their product for better price realization or any other form like group sale.

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ABSTRACT

ABSTRACT

Name of the student : **Miss. Jain Arti Bahubali**

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Title of dissertation : **"ECONOMIC ANALYASIS OF PRODUCTION AND MARKETING OF *KHARIF* MAIZE IN SOLAPUR DISTRICT OF MAHARASHTRA''**

Maize *(Zea maize)* belong to family (Gramineae). It is the third most important cereal foodgrain crop in the world followed by rice and wheat. It contributes about 20 per cent world's total cereal production. It occupies a prominent place in the humid tropics; maize in fact is the most extensively distributed cereal crop**.** In India important maize growing states are Rajasthan, Punjab, Maharashtra, West Bengal, Uttar Pradesh, Karnataka and Andhra Pradesh Telangana.

Survey method of data collection was used for collection of data from the selected respondents. The Solapur district has been purposively selected for the study because Pandharpur, Sangola and Malshiras tahsils have maximum area under maize as compared to other tahsils in the district. From the each tahsil, two villages were selected on the basis of maximum area under maize cultivation. The villages viz., Jainwadi and Bhalwani from Pandharpur tahsil,villages viz., Dombalwadi and Hanumanwadi from Malshiras tahsil and villages viz. Gheradi and Parre from Sangola tashil was selected. Fifteen cultivators from each village were selected. 15 *kharif*

Maize growers was randomly selected from each selected villages.Thus from 6 villages, 90 growers was selected. The majority of respondents were in 30 to 50 years age group 60.00 per cent.In respect of educational status 40 per cent respondents were attended 10^{th} standard.

The cropping intensity was 348.59 per cent. The average area under *kharif* maize was 0.65 ha. The gross cropped area was 4.30 hectares. During *kharif* season the crops grown were *kharif* maize, jowar, bajra, red gram, sunflower etc. During *rabi* season the crops grown were *rabi* jowar chickpea, wheat, maize etc. was major crop grown by cultivators.

Per hectare labour utilization of maize revealed that. In case of maize 31.14man days of hired human labour and 18.99 man days of family human labour were utilized on maize farm i.e. in total 50.13 man days human labour were utilized for maize crop. The use of hired labour is maximum on farm. On the farms 11.1 pair days of bullock labour were utilized per hectare. About 13.01 hours of machine labour were utilized per hectare on maize farm. The use of seed was 17.44 Kg/ha.Use of manure per hectare for maize crop was 2.97 qtl. Use of irrigation was 3466.67 cubic meters/ha. In regards to fertilizer, it is observed that Nitrogen, Phosphorous and Potash was the common fertilizers utilized in study area. Use of N,P & K was maximum i.e. 72.77, 41.10 and 26.90 kg per hectare on maize farm. The use of plant protection chemicals were 9.57 lit per hectare for maize crop. Net profit from maize was 21198.48 and yield of maize main produce 37.47 qtl/ha.

The coefficient of multiple determinations (R^2) was 0.94 which indicated 94.00 per cent effect of all independent variables together in maize production. F-value was 0.106 which were highly significant. Return to scale was 0.30 which indicated increasing return to scale. Among the individual independent variables, partial regression coefficient of area under maize was 0.175 which was positive.

With regard to marketing study, three types of marketing channels were observed viz, (Channel-I) Producer-Consumer, (Channel-II) Producer-Retailer-Consumer) and (Channel-III) Producer-Wholesaler-Retailer-Consumer).

The result revealed that, the average maize farm was 0.65 hectares. It was clear from the result that, maize production on farm was 57.16 quintals. It was also observed that, the quantity of maize retained for home consumption was 2.03 quintals. Quantity of maize sold through channels-I, Channel-II and channel-Ill were quintals per farm 11.93, 18.90 and 24.30 quintals, respectively. Total marketed surplus was 55.13. It was observed from the result that, the highest quantities of maize were marketed through channel-III.

APPENDIX

APPENDIX-I

SCHEDULE-I

TITLE: - ECONOMICS ANALYSIS OF PRODUCTION AND MARKETING OF *KHARIF* MAIZE IN SOLAPUR DISTRICT Of MAHARASHTRA.

1. Socio- economic Characteristics of Maize growers

1. Name :

2. Village : Taluka: District:

3. Age :

4. Contact No. :

5. Education : Illiterate/Primary School/High school/SSC/HSC/college level /Post graduate

6. Family Size : Male Female Children

7. Family Workers :

8. Occupation : 1] Primary
2] Secondary
3] Tertiary

9. Land holding : Total land _____ha.
Rainfed _____ha.
Irrigated land _____ha
Uncultivated land _____ha.

10. Land revenue :

11.Distance of farm from village(km) :

12.Value of land (Rs/ha):

Sr.No.	Soil type	Area	Rate	Value of land
i	Light			
ii	Medium			
iii	Heavy			

2. Cropping Pattern:

Kharif			***Rabi***			***Summer***			**Annual**		
Crop (Variety)	**I (ha)**	**R (ha)**	**Crop (Variety)**	**I (ha)**	**R (ha)**	**Crop (Variety)**	**I (ha)**	**R (ha)**	**Crop (Variety)**	**I (ha)**	**R (ha)**

3. Livestock:

Sr. No.	**Name of livestock**	**No.**	**Age**	**Present value(Rs)**
1	Bullock Pair			
2	Cow			
3	Buffalo			
4	Sheep			
5	Goat			
6	Poultry			
	Total			

4)Machinery:

Sr. No.	Assets	No./Qty.	Year of purchase	Purchase price	Present Value (Rs.)
1	Tractor				
2	Thresher				
3	Other				
	Total				

5) Irrigation structure:

Sr.No.	Assets	No./Qty.	Age	Present value (Rs.)
1.	Well/Tube well/Lift Irrigation			
2.	Electric Motor			
3..	Shed for Electric Motor			
4.	Pipeline(length)			
	Total			

6) Commonly used assets:

Sr. No.	Assests	No./Qty.	Year of purchase	Purchase price	Present value (Rs.)
A)	**Implement**				
i)	Plough				
ii)	Harrow				
iii)	Seed drill				
iv)	Hoe				
v)	Bullock cart				
vi)	Sprayer				
	a) Hand sprayer				
	b) Power sprayer				
B)	**Hand Tools**				
1)	Weeding Hook				
2)	Kudali				
3)	Pickaxe				
4)	Sickle				
	Total				

7) Building:

Sr.No.	Type	No	Construction Year	Present Value(Rs.)
1.	Residential			
2.	Farm House			
3.	Cattle byre			
4.	Poultry house			

8) Operation wise labour requirement for Maize crop

[Area: ……ha] Period of crop:

Operation	No	Human labour				Bullock Pair day	Machine power (hours)
		Hired		Family			
		male (Man day)	female (Man day)	male (Man day)	female (Man day)		
Ploughing							
Clod crushing							
Harrowing							
Application of Manure							
Preparation of Ridges and Furrows							
Sowing							
Basal dose of Fertilizer							
Irrigation							
Application of fertilizer							
Interculture							
a)Thinning							
b)weeding							
c)Hoing							
Spraying of pesticide /Fungicide /insecticide							
Cutting of earheads							
Harvesting							
Threshing							
total							

Rate of labours (Rs):

1) Male/day Rs: 3) Bullock Pair/ day Rs:
2) Female /day Rs: 4) Machinery charge /hr Rs

9) Use of physical inputs in Maize production

Sr.No.	Particulars	Unit	Qty	Rate/Unit	Value (Rs.)
1.	Seed	Kg			
2.	Type of fertilizers	Bag			
	Urea				
	DAP				
	SSP				
	MOP				
	10:26:26				
3.	Manure	qt			
4.	Plant Protection	Kg/lit			
i)	Insecticide				
	a)				
	b)				
ii)	Pesticide				
	a)				
5.	Gunny bags				
6.	Irrigation	No.			

10) Yield of Maize:

Particular	Qty.(q)	Rate/q	Value (Rs.)
1.Main produce (Grain)			
2. By produce			
Total			

11) Information about disposal of maize:

Sr.No.	Detail	Quantity (q.)	Rate/q	Value(Rs./q)
I.	Total yield of Maize			
II.	Maize sold			
III.	Maize kept for seed purpose			
IV.	Maize kept for home purpose			

9. Constraints and suggestions in Maize production

1. Constraints

i) _____

ii) _____

iii) _____

iv)_____

2. Suggestions

i) _____

ii) _____

iii) _____

iv) _____

SCHEDULE –II
MARKETING OF MAIZE

1. General information

Name of Market:

Distance (km):

Marketing channel	Name of Market	Distance(km.)
Channel-1 (Producer - Consumer)		
Channel-2(Producer – Retailer – consumer)		
Channel-3 (Producer –Wholeseller- Retailer-Consumer)		

2. Marketed surplus of Maize

Sr. No.	Particular	Quantity	Market place	Distance
1.	Production of main produce of farm			
2.	Marketed surplus			
	a) Channel-I			
	b) Channel-II			
	c) Channel- III			

3. Cost of marketing incurred by producer

Sr.No.	Item of cost	Channel-I	Channel-II	Channel-III
1.	Packaging			
2.	Loading charges			
3.	Transport charges			
4.	Unloading charges			
5.	Commission charges			
	Total			

4. MarketingCost incurred by wholesaler

Sr. No.	Items of cost	Total value (Rs)
1.	Packing charges	
2.	License charges	
3.	Loading	
4.	Unloading	
5.	Weighing charges	
6.	Transportation charges	
7.	Market fee	
8.	Losses	
9.	Commission	

5. Marketing cost incurred by retailer

Sr.No.	Item of Cost	Amount(Rs./q)
1.	Transport charge,	
2.	Packing charge	
3.	License charge	
4.	Losses	
5.	Market fee	
6.	Shop tax	
7.	Storage charges	

1. Constraints

i) _____

ii)_____

iii)_____

2. Suggestions

i) _____

ii) _____

iii) _____

APPENDIX-II

Score and rate per unit used

Sr.No.	Particulars	Score/Rate
1	**Education**	
	Illiterate	1
	Primary School	2
	High School	3
	SSC	4
	HSC	5
	College	6
	Post graduate	7
2.	**Occupation level**	
	Agriculture	1
	Business	2
	Service	3
3.	**Fertilizer**	
	Nitrogen (Kg)	Rs.13.04/Kg
	Phosphorus (Kg)	Rs.38.43/Kg
	Potash (Kg)	Rs.25/Kg
4.	**Labour**	
	Hired male labour	Rs.250/ man days
	Hired female labour	Rs.150/ man days
	Hired bullock labour	Rs.700/ pair days
	Hired machine labour	Rs.1000/hour
5.	**Seed**	Rs.300/Kg
6.	**Price of commodities**	
	Main produce of maize	Rs.1700/qtl
	By produce of maize	Rs.500/qtl

APPENDIX-III

List of selected maize growers in Solapur district

Sr.No	Name of maize growers	Tehsil	Village	Phone No.
1	Shivaji Gore	Gherdi	Sangola	9767477352
2	Machindra Devdate	Gherdi	Sangola	7350549165
3	Shrimant Sargar	Gherdi	Sangola	9503778499
4	Annaso Sargar	Gherdi	Sangola	9284200655
5	Dhanaji Khule	Gherdi	Sangola	9503886107
6	Mubarak Addegavkar	Gherdi	Sangola	9049185895
7	Mahadev Yamgar	Gherdi	Sangola	9623076925
8	Sambhanji Ghadage	Gherdi	Sangola	7028829209
9	Balasaheb Pole	Gherdi	Sangola	7709993337
10	Vijay Sawant	Gherdi	Sangola	9527072139
11	Dagadu Ghutukade	Gherdi	Sangola	7875244860
12	Jagannath Lalge	Gherdi	Sangola	8600737877
13	Sampatrao Kolekar	Gherdi	Sangola	8408806290
14	Jaywant Pole	Gherdi	Sangola	9730513493
15	Narayan Kokare	Gherdi	Sangola	9420092445
16	Madhukar Gorad	Parre	Sangola	9822886288
17	Balaso Pukale	Parre	Sangola	9421028210
18	Uttam Gaikwad	Parre	Sangola	9763036446
19	Suresh Salunkhe	Parre	Sangola	9765744332
20	Bapuso Ghutukale	Parre	Sangola	9689791067
21	Sampatti Kharat	Parre	Sangola	7709387904
22	Krishndev Tikole	Parre	Sangola	9730268280
23	Gorakh Pukale	Parre	Sangola	9767185615
24	Mahadev pukale	Parre	Sangola	9037740952
25	Dnyaneshwar Mali	Parre	Sangola	9881176517
26	Bayaji Mate	Parre	Sangola	9763037901
27	Babaso Jadhav	Parre	Sangola	7758871718
28	Shrimant Pukale	Parre	Sangola	9767474604
29	Annasaheb Gaikwad	Parre	Sangola	9881873119
30	Raju Gejage	Parre	Sangola	9763036521
31	Dadaso Maharnavar	Dombalwadi	Malshiras	9921476540
32	Balu Ghadage	Dombalwadi	Malshiras	9763441779
33	Dattatrya More	Dombalwadi	Malshiras	9527225871
34	Ramchandra More	Dombalwadi	Malshiras	9689237109
35	Navnath Vayse	Dombalwadi	Malshiras	9623459467
36	Sahdev karande	Dombalwadi	Malshiras	9604283114
37	Vasant Khandekar	Dombalwadi	Malshiras	9561247257
38	Ganesh Maharnavar	Dombalwadi	Malshiras	9960736522
39	Narayan Mane	Dombalwadi	Malshiras	9822108420
40	Jagannath Maharnavar	Dombalwadi	Malshiras	9130305003
41	Mahadev Dhaygude	Dombalwadi	Malshiras	9112973354
42	Ishwar Gosavi	Dombalwadi	Malshiras	9975616972
43	Shankar Dhaygude	Dombalwadi	Malshiras	9975435655
44	Dnyandev Hake	Dombalwadi	Malshiras	7875394669

45	Ganesh More	Dombalwadi	Malshiras	9657202121
46	Chagan Rupnavar	Hanumanwadi	Malshiras	9922274983
47	Arvind Rupnavar	Hanumanwadi	Malshiras	9527462007
48	Bhagwan Rupnavar	Hanumanwadi	Malshiras	9730639808
49	Ratan Suryawanshi	Hanumanwadi	Malshiras	9767036670
50	Chandrakant Suryawanshi	Hanumanwadi	Malshiras	9970867520
51	Sanjay Rupnavar	Hanumanwadi	Malshiras	9850265695
52	Sukhdev Rupnavar	Hanumanwadi	Malshiras	9881143812
53	Sandip Suryawanshi	Hanumanwadi	Malshiras	8805694372
54	Haridas Rupnavar	Hanumanwadi	Malshiras	9921067107
55	Pramod Rupnavar	Hanumanwadi	Malshiras	9730488506
56	Nitiin Yadav	Hanumanwadi	Malshiras	9850266605
57	Ankush Yadav	Hanumanwadi	Malshiras	9503739066
58	kantilal Dombale	Hanumanwadi	Malshiras	9552231646
59	Mahadev Rupnavar	Hanumanwadi	Malshiras	9730275897
60	Rajendra Dombale	Hanumanwadi	Malshiras	9730384048
61	Dinesh Mirje	Jainwadi	Pandharpur	8550903231
62	Rajendra Umdale	Jainwadi	Pandharpur	9922723080
63	Balu Umdale	Jainwadi	Pandharpur	9922723276
64	Dattatray Jamdade	Jainwadi	Pandharpur	9890740779
65	Indrajeet Danole	Jainwadi	Pandharpur	9763660313
66	Manik Jamdade	Jainwadi	Pandharpur	9158451377
67	Balasaheb Jamdade	Jainwadi	Pandharpur	9767833159
68	Bahubali Bhosekar	Jainwadi	Pandharpur	8975251005
69	Rajendra Hasure	Jainwadi	Pandharpur	8459901671
70	Pandurang Patil	Jainwadi	Pandharpur	9923095417
71	Kantilal Danole	Jainwadi	Pandharpur	9604404349
72	Popat Sadalage	Jainwadi	Pandharpur	7507667553
73	vardhaman Danole	Jainwadi	Pandharpur	9145846330
74	Ashok Sadalage	Jainwadi	Pandharpur	-
75	Babaso Shinkte	Jainwadi	Pandharpur	9689426180
76	Vijaysinh Gawali	Bhalawani	pandharpur	9860114115
77	Somnath Shinde	Bhalawani	pandharpur	9960321377
78	Gawali Madansinh	Bhalawani	pandharpur	9665748369
79	Adinath Shinde	Bhalawani	pandharpur	9960629825
80	Annaso Shinde	Bhalawani	pandharpur	9975420852
81	Sahdev Navade	Bhalawani	pandharpur	9822344039
82	Mahadev Navade	Bhalawani	pandharpur	7972154652
83	Bandu Linge	Bhalawani	pandharpur	8605776195
84	Ajay Chawgule	Bhalawani	pandharpur	7757834666
85	Dinesh Chawgule	Bhalawani	pandharpur	9921500498
86	Mauli Linge	Bhalawani	pandharpur	9881376505
87	Dilip kuchekar	Bhalawani	pandharpur	9730813639
88	Anand Gawali	Bhalawani	pandharpur	-
89	Dagadu Gawali	Bhalawani	pandharpur	8668919009
90	Shivajirao Gawali	Bhalawani	pandharpur	9850239977