

**ECONOMICS OF PRODUCTION OF COTTON IN
PARBHANI DISTRICT OF MAHARASHTRA**

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B.Sc. (Agri.)

MASTER OF SCIENCE
(Agriculture)
IN
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**“ECONOMICS OF PRODUCTION OF COTTON IN
PARBHANI DISTRICT OF MAHARASHTRA”**

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DISSERTATION

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CANDIDATE'S DECLARATION

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

Place : Latur

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CERTIFICATE – I

This is to certify that the dissertation entitled “**ECONOMICS OF PRODUCTION OF COTTON IN PARBHANI DISTRICT OF MAHARASHTRA**” Submitted by **Mr. MR. SAYYAD AJAJ ABUBAKAR (Reg.No.2017A/49ML)** to the Vasantnao 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 him 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 him for a degree of any university.

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CERTIFICATE - II

This is to certify that the dissertation entitled “**ECONOMICS OF PRODUCTION OF COTTON IN PARBHANI DISTRICT OF MAHARASHTRA**” Submitted by **MR. SAYYAD AJAJ ABUBAKAR (Reg.No.2017A/49ML)** to the Vasantnao 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** has been approved by the student’s advisory committee after *viva-voce* examination in collaboration with the external examiner.

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Introduction



CHAPTER-I

INTRODUCTION

Cotton (*Gossipium species*) a plant of the mallow family produces fibers that can be woven into cloth.it has been valued since antiquity and its cultivation was an important factor stimulating European colonialism in regions of Asia, Africa, and the Americas ; it is still a major trade commodity . Numerous species of cotton exist, but four are of commercial importance : *Gossypiumarboreum* (native to Asia), *G.herbaceum* (native to Africa) *G.hirsutum* and *G.barbadense*(both native to the Americas). cotton plants originated in tropical regions, but are now grown worldwide in a variety of climate zones where adequate heat and water are available. The cotton plant produces capsules, called bolls, in which seeds are surrounded by a fluffy fiber, or lint .

Cotton is the crop of tropical and subtropical areas and required uniformly high temperature varing between 21⁰cand 30⁰c. The growth of cotton is retarded when the temperature falls below 20⁰c. Frost is enemy number one of the cotton plant and it is grown in areas have in at least 210 frost free days in year. The modest requirement of water can be made by an average annual rainfall of 50-100 cm however, it is successfully grown in areas of lesser rainfall with the help of irrigation about 80 percent of the total irrigated area under cotton is in Punjab, Haryana, Gujarat and Rajasthan most weather and heavy rainfall at the time of ball opening and picking are detrimental to cotton as the plant becomes vulnerable to pest and disease. High amount of rainfall in beginning and sunny and dry weather at ripening time are very useful for good crop.

Cotton was known and used in ancient Egypt, India, China, and the Americas. Europeans probably learned about the value of cotton garments as results of British and French commercial activities in India in the seventeenth century. cotton fibers brought back from India led to the establishment of a cotton textile industry in Brittan especially in the city of Manchester .cotton textile producers originally faced restrictions placed on them by the government at the behest of wool growers, who realized that cotton cloth would compete with woolens these restrictions were largely unsuccessful, however, as the public increasing demanded cotton cloth. The invention of the cotton gin by the American Eli Whitney in 1793 allowed cotton seeds to be easily removed mechanically, eliminating

the slow and laborious process of removing the seeds by hand and lowering the cost of cotton production.

Cotton (*Gossypium Spp.*) ‘king of fiber’ which closely linked to the human civilization itself is a large, rich and economically important germ comprising about 40 species of which four are commercially cultivated for cotton lint and seed. Cotton fiber was discovered more than 4000 years ago in Coastal Peru and Mohenjo-Daro in the Indus valley. Cotton the ‘White Gold’ is played a vital role in updating Indian Economy and evolution of human ethical, moral and cultural values. Although the cotton is primarily a fiber crop, it is used as feed. Cotton plays a key role in national economy in terms of both employment generations and foreign exchange earnings. In addition to cotton fiber, the cottonseed also has various uses. The oil that it contains is used in cosmetic products and in certain food products. Cotton is the second most important field crop in Indian for the production of table oil: 13.7 per cent of the 7.88 million tons of table oil produced in India is obtained from Cotton seed. Cottonseed has also become the main ingredient (33 per cent) in processed Animal fodder, with soya, rapeseed and groundnuts lagging far behind. The “pressed cake” that remains after the oil extracted sometimes processed in animal feed. Bt proteins can be found in the seed and the pressed cake of Bt cotton, but not in the oil. Cotton is a basic raw material for Textile Industry. The Indian Textile Industry has an overwhelming presence in the economic life of the Country. Apart from providing one of the basic necessities of life, the Textile Industry also plays a pivotal role through its contribution to industrial output, employment generation, and the export earnings of the Country. Today in India there are 1500 mills, 4 million hand looms, 7 million power looms. Cotton Textile is one of the largest industries in India, providing employment to over 15 million people. The livelihood of 60 million people depends on cotton cultivation, processing, trade and textile industry. Textile industry contributes 20.24 per cent of total Indian Export.

Production in world

Cotton is cultivated across the world in about 80 countries in an average area of 329.50 lakh hectare with 1482.90 lakh bales (170 kg each) of production with productivity of 765 kg lint per hectare in the year 2017-18. (Source- Directorate of Cotton Development Government of India)

Production in India

India is at the first place in acreage as well as in production of cotton in the World & contribute 38.13%, (118.81 lakh Ha) and 260.75% (345.82 lakh Bales) respectively as per triennium ending 2016-17. India is self -sufficient in cotton production, however, the average productivity is 522 kg per ha against the Worlds average of 765kg per hectare in the year 2017-18. (Source- Directorate of Cotton Development Government of India)

Production in Maharashtra

Maharashtra is the largest producer and produces 29.78 per cent of the total cotton production of India. Maharashtra is a traditional producer of cotton. The lava soil of Deccan plateau is world renowned for cotton production and is popularly known as the black cotton soil. Over 80 per cent of the production comes from Khandesh, Vidarbha and Marathwada regions comprising the districts of Yavatmal, Nanded, Amravati, Parbhani, Wardha, Jalgaon, Akola, Buldhana, Nagpur, Dhule, etc. In Maharashtra the cotton crop is cultivated mostly in Marathwada region, area under cotton crop is 40.72 lakh ha with production of 372.82 kg per hectare in the year 2017-18. (Source - Central Institute of Cotton Research).

Production in Parbhani district

Cotton is major crop in Parbhani district of Maharashtra .Cotton is the major crop growing in Parbhani district of Maharashtra cotton crop is cultivated area 6.55 lakh ha with production of 340.82 kg per hectare 2018-19. (India stat)

By considering above aspects the present study has been undertaken with the following objectives.

1. To study socio economic characteristics of cotton growers
2. To estimate cost and returns in cotton production
3. To estimate resource productivity and resource use efficiency of cotton production
4. To study the constraints of cotton growers in production

HYPOTHESIS

Cotton cultivation is profitable in study area.

SCOPE OF THE STUDY

The present study will be useful to the cotton growers by providing information regarding production and marketing of cotton. This need cotton. The findings of the study will be helpful to the cotton producers in Parbhani district. The various agencies involved in cotton marketing will also be beneficial, so as to maximize their income.

LIMITATIONS OF THE STUDY

Due to the limitation of the time and other resources the present investigation has been restricted to the selection of tehsils, sample size and the variables. Hence, the findings have to be viewed in the specific context of the conditions prevailing in the study area and can't be generalized for wider geographical area. However, careful and rigorous procedures have been adopted in carrying out the research as objectively as possible in spite of the individual base made by respondent farmers in electing the necessary responses; it is believed that the findings and conclusions drawn in the present study would form the basis for future research study.



*Review of
Literature*



CHAPTER-II

REVIEW OF LITERATURE

The review of research work compiled by statements of various past research workers relating to the problem under study which is not only necessary for proper understanding of concept but also to understand the methodological and analytical issues related to the study. Scanning of relevant literature is helpful in formulating the frame work of research problem undertaken. To encompass the past research work, it becomes dispensable to take the review of literature that will build a sound footing to the problem. The review of literature is useful in approaching problem in right way and in analyzing and interpreting the data in a systematic manner. The review of literature has been divided into following heads.

- 2.1 To study the socio economic characteristics of cotton growers.
- 2.2 To work out the cost and returns of cotton.
- 2.3 To study the resource use efficiency of cotton.
- 2.4 To study the constraint of cotton growers in production.

1. To study the socio economic characteristics of Bt-cotton growers

Maske *et al.* (2015) examined that Parbhani and Beed districts were purposely selected because of these districts were taking contract farming in cotton crop. Selu Tehsil was selected from Parbhani district and Georai from Beed district on the basis of highest area under cotton. Ten farmers were selected randomly from each village for contract farming and same procedure was adopted for non-contract farming in case of cotton crop. Thus, a sample of 100 for contract farmers and 100 for non-contract farmers was selected. The total effective sample size of respondents was 200. Data pertained to the year 2007-08. Majority of cotton growers under contract and non-contract farming belonged to young age group. It implied that in contract farming. It means in both situation main occupation was agriculture and after that allied services farmers was giving more importance to education as compared to non-contract farming. In an average capital investment was more in contract farming compared to non-contract farming. The result of analysis revealed that significant differences in these factor except land holding.

Kumar Sanjay (2015) studied that Cotton is a major commercial crop in India, but has substantial problems particularly from extensive pest damage and poor yields. Bt cotton offers a promising solution to these serious problem. It may prove beneficial to know socio-economic characteristics of the bt cotton cultivators as well as their knowledge about bt cotton. Generally, it is found that all the farmers residing in the same community do not adopt improved agricultural technology to the same extent. This may be because of several reasons such as personal, socio-economic characters which are related to the adoption of improved agricultural practices. Factors which affect these phenomena are age, education, size of family, social participation, mass media exposure, extension participation, occupation, size of landholding, annual family income and irrigation potential. Most of the Bt cotton growers were of middle age group, higher secondary educated having small family, members of any organization and three forth of them had medium mass media exposure, extension participation. Majority of the Bt cotton grower had farming as main business and landholding above three hectare.

Veeraih *et al.* (2005) studied socio-economic characteristics with the relationship between land holding (0.199), area under cotton (0.176), annual income (0.211), education (0.221), and social participation (0.182) has found to be positively significant indicating that socio-economic character makes the farmer to charge and accept innovative ideas more quickly. It was further indicate that under socio-economic characteristics most of the cotton farmers were having land holding between 2 to 4 ha with an average holding 3.15 ha. The annual income of the farmer varies Rs.50000 to Rs.100000.

Rao and Dev (2009) studied the Socio-Economic impact of transgenic cotton. This study reported the impact of Bt cotton cultivation on cost of pesticides, cost of production and profitability across social categories, size groups of farmers and different agro-climatic zones in Andhra Pradesh state. Study shown that Bt cotton technology is superior to the conventional cotton hybrids in terms of both yield and net returns. The Bt farmers from all size categories, agro-climate zones and social groups are benefited from its cultivation compared to non-Bt cotton farmers from the same categories. Bt technology is scale neutral and small holder cultivators are benefited from it. More of cultivator farmers are of small land holdings with the insufficient irrigation sources on farm.

Sabo *et al.* (2009) studied the socio-economic characteristics of cotton out growers in southern Adamawa state. The principle socio-economic variables measured were age (years), sex, occupation, and experience in years of cotton production, educational attainment, farm size, family and marital status. The socio-economic characteristics of the respondents indicate that to a large extent most of the cotton farmers are male. The mean age of the respondents was 45 years. Therefore the sizable proportion of the cotton growers are still in their active age, and will continue to cultivate cotton for years to come. The survey showed that the respondents are well educated, having at least one form of education. Cotton production is the major occupation of the respondents in the surveyed areas. The majority of the respondents have experience in cotton production ranging between 6 and 11 years. Most of the farmers rented their farmlands, as opposed to lease ownership and family inheritance.

Subramanian & Qaim (2010) studied in this article, analyzed the direct and spillover effects of Bt-cotton on poor households in different parts of rural India. The results demonstrate that technology adoption entails important positive socioeconomic effects in the small farm sector. More specifically, we have shown that Bt cotton adoption raises the returns to rural labour with interesting gender implications. Compared to conventional cotton, Bt-cotton cultivation increases aggregate labour returns by 42 per cent, while the returns for hired female agricultural workers even increase by 55 per cent. Likewise, total household incomes rise considerably, including for poor and vulnerable farm families that constitute the largest proportion of rural dwellers. Strikingly, the main beneficiaries are vulnerable farmers, whose household income gains are 134 per cent higher under Bt than under conventional cotton. This disproves the often heard argument that only wealthy farmers could benefit from GM crops.

Kiresur and Ichangi (2011) studied the performance of Bt technology and its impact on farming community have been assessed in northern Karnataka. On an average, the average land holding size of Bt cotton farmers was 3.33 ha, while that of non-Bt cotton farmers was 2.93 ha, most of which was rainfed (to the tune of 70 per cent and 73 per cent, respectively). The holding-size varied from 1.48 ha (small farmers) to 4.65 ha (large farmers) in the case of Bt-cotton, while for the Non-Bt cotton counterparts, it correspondingly ranged from 1.18 ha to 4.10 ha. The area under Bt cotton ranged from 1.03 ha (small farmers) to

2.90 ha (large farmers) with an average of 2.21 ha, accounting for 66 per cent of the total land holdings. The area under Non Bt-cotton was lower, varying from 0.96 ha to 2.20 ha with an average of 1.97 ha (67 % of the total landholdings). The impact of Bt-cotton, as perceived by the farmers, has been in terms of enhanced yield; reduced pest and disease incidence; increased income, employment, education and standard of living; and reduced health risk.

Kauthekar (2012) studied in 2010-2011 in this study cotton based farming system. The age of farmer was 37.18 years, with standard deviation of 6.09 years. Education level of farmer was 1.93 scores; Family size was 6.40 in numbers. Occupation level of farmer was 1.61 scores. It was observed that land holding was 3.40 hectares. The milch animal was 1.12 in numbers. In regard to investment, the commonly used asset was Rs. 9353.12. Similarly investment on irrigation structure was Rs. 113031.25. Thus, coefficient of age of farmer was the lowest as 16.75 per cent followed by that of family size (25.15 per cent), investment on irrigation structure (25.63 per cent) and bullock pair (27.41 per cent). It implied that there was lower fluctuation in the above characteristics. On the contrary coefficient of education level was highest as 38.86 per cent followed by that of commonly used asset (38.71 per cent), occupational level (37.26 per cent), milch animal (33.03 per cent) and land holding (30.29 per cent). It inferred that there was higher fluctuation in these characteristics.

Khuda Baksh (2013) studied the economic and environmental impacts of Bt cotton in Pakistan. In socio economic characteristics of sample farmers included the age of respondents, Total area under cotton in hectares, Farming experience in years, Education in schooling years, Number of plots, and farmers getting credits. The age of respondents was 44 years. The total area under cotton production in hectares was 20 hectares with the farming experience of 19 years. At overall, cotton growing experience 12 years. In the educational level on an average Bt cotton growers had 4 years schooling years. Number of plots was 2. Regarding to the credit, farmers getting credit was 20 per cent.

2. To work out the cost and returns of Bt-cotton.

Shelke *et al.* (2016) Investigation was carried out during the year 2013-14. About 96 Bt-cotton growers were randomly selected from twelve villages of two tehsils of Beed district of Maharashtra. Cross sectional data were collected from Bt-cotton grower with the help of pretested schedule by personal interview method. The techniques like mean, percentage, ratio and cost concept of Cost-A, Cost-B and Cost-C were used to analyze the data. The results revealed that per hectare cost of cultivation of Bt-cotton was Rs. 67137.76. Among individual items of expenditure, the share of rental value of land was 31.85 per cent followed by hired human labour (13.79 %), bullock labour (9.21), irrigation (8.17%), seed (7.51%), fertilizers (6.19%), family human labour (5.64%), manure (5.45%), plant protection (3.75%) and machine labour (2.15 %), respectively. Per hectare gross returns and net profit was Rs. 129111.85 and Rs. 61974.09, respectively. Output-input ratio was 1.92.

Sankar *et al.* (2011) examined that the farmer uses various inputs in varying quantity depending on a type of crop grown, type of soil and type of input, etc. Therefore, it is very much pertinent that an optimum inputs mix is achieved by a farmer so as to obtain the best possible production in agriculture. The cost of cultivation or the cost of production of any crop helps the farmers in judging the profitability of the crop and accordingly changing the cropping pattern. The cost and returns of cotton cultivation have, therefore, been estimated in the present study. The cost of cultivation of cotton incurred by the sample farmers during the reference year 2013-14 included home produced and purchased impulses. The impulses implemented in the cotton varieties are seed, FYM, oil cakes, chemical/organic fertilizers, irrigation, pesticides, tractor and bullock labour, human labour, land revenue, interest on working capital and fixed capital, rental value of owned land etc. The output-input ratio over Cost C2 was 1.42 for large farmers, followed by 1.33 for medium farmers and 1.26 for small farmers with the overall average of 1.34. This indicates that on an average one rupee invested in the cultivation of cotton earned Rs. 1.34. The output-input ratio over Cost C2 had increased with increase in farm size groups. It is clearly shows that the relationship between output-input ratio over Cost C2 and farm size groups were positively related with the size of landholding groups. The co-efficient of determination (R^2) turned out to be significant at 1 per cent level, indicating that the included variables explained between 74 to

89 per cent of variation in the production of cotton for all the categories of farmers. The inputs, area under cotton, seed, human labour, manures and fertilizers, pesticides and irrigation are having significant influence on the output of cotton for all the categories of sample farmers except the input variable education.

Verma *et al.* (2002) studied the economics of production and marketing cotton in Khargone district of Madhya Pradesh. The per hectare total cost of cultivation of hybrid cotton was Rs. 21392.34 among various component of operational cost, plant protection chemicals accounted for 19.98 per cent of total cost followed by expenditure on human labour 14.52 per cent, family labour 12.02 per cent, manures and fertilizers 11.86 per cent, bullock labour 10.24 per cent etc. The average yield of main product and by-product for hybrid cotton 20.36 quintal and 85.40 quintal, respectively. The average gross returns was work out to Rs. 43282 per hectare. It was highest on large size group of farmers.

Richard Bennett *et al.* (2003) studied the results of a detailed farm-level survey of 32 small-scale cotton farmers in the Makhathini Flats region of South Africa. The aim was to assess and measure some of the impacts (especially in terms of savings in pesticide and labour as well as benefits to human health) attributable to the use of insect-tolerant Bt-cotton. The study reveals a direct cost benefit for Bt growers of SAR416 (\$51) per hectare per season due to a reduction in the number of insecticide applications. Cost savings emerged in the form of lower requirements for pesticide, but also important were reduced requirements for water and labour. The reduction in the number of sprays was particularly beneficial to women who do some spraying and children who collect water and assist in spraying. The individual economic benefits resulting from less spraying can amount to around SAR66 per spray per season, which translates to around SAR467 per ha per season. Savings come in the form of lower pesticide and water use, as well as lower labour costs for spraying. There are social implications that could arise from these savings. The reduction in the number of sprays would certainly free up women's time to care for children, or for income generation, and children could spend more time studying or in other beneficial activity.

Chetana and Singh (2005) studied the cost of cultivation of cotton crop in Hisar and Sirsa district. The study revealed that the average cost of cultivation per hectare cotton was Rs 17156.20 in which cost-A was Rs 9629.20 (56.12 per cent). Share of rental of land

was highest to the cost- C (32.25 per cent). Among all various items of expenditure, hired human labour, 23.39 per cent followed plant protection (11.23 per cent), machine labour (3.44 per cent), fertilizers (3.63 per cent), bullock labour (1.86 per cent) and irrigation (2.17 per cent).

Qaim and Janvry (2005) studied in this article; we have empirically analyzed the effects of Bt cotton on pesticide use and productivity in Argentina. The farm survey reveals that the technology leads to a considerable decline in pesticide application rates. On an average, adopting farmers use 50 per cent less insecticides on their Bt plots than on plots grown with conventional cotton. Almost all of these reductions occur in highly toxic chemicals, with concomitant positive effects for the environment. Moreover, Bt adopters benefit from significantly higher yields, which is due to insufficient pest control in conventional cotton. Net yield gain is predicted at 17 per cent for average large-scale growers, for small producers the gain could be around 42 per cent. Also, total gross benefit per hectare of Bt cotton is predicted to be higher for smaller than for larger farms.

Richard Bennett *et al.* (2006) studied the costs and returns of growing Bt-cotton and non-Bt cotton varieties for the two seasons in Maharashtra. In both seasons, the non-Bt plots were larger than the Bt plots but yields (quintal/acre) of Bt cotton were significantly higher (by an average of 45% in the first season and 63% in the second season). This is despite both soil type and irrigation being much the same for the different types (at least in the 2002 season for which data on these are available). Expenditure on seed for Bt plots was over three times non-Bt plots, reflecting the relatively high cost of Bt cotton seed. There is a slight difference in the price per unit of cotton sold by producers for Bt (lower) compared to non-Bt in the first but not in the second season. It may be that in the first season there was some perceived uncertainty as to the acceptance of the Bt variety in some areas, which was reflected in a slightly lower price. The revenue from Bt-cotton is significantly higher in both seasons due to the greater yields generally obtained on Bt plots. The final row of table 1 shows differences in gross margin (revenue less costs of seed and costs of sprays per acre) 2 across the two seasons. Gross margins are 50% or more high for the Bt cotton varieties due to the higher yields of the Bt plots since any savings in bollworm pesticide costs are negated by the more costly Bt seed. Gross margins are 50 per cent or more high for the Bt-cotton

varieties due to the higher yields of the Bt plots since any savings in bollworm pesticide costs are negated by the more costly Bt seed.

Visawadia and Fadadu (2006) studied the cost structure of Bt-cotton and Hybrid cotton in Gujarat state. The average total cost per hectare amounted to Rs. 44553/- for Bt-cotton and Rs. 39816/- for hybrid cotton. The average total cost per quintal was estimated to be Rs. 2381 in Bt-cotton and Rs. 2746 in hybrid cotton. This implied that reduction in the unit cost of cotton production was an added advantage for Bt-cotton farmers. The bulk line cost per quintal of cotton ranged from Rs. 2300 to Rs. 2651 in Bt-cotton and Rs. 2550 to Rs. 3201 in hybrid cotton. Returns from the Bt-cotton and hybrid cotton include main produce 18.71 quintal and 14.46 quintal with the by-produce of 27.71 and 17.80 of Bt-cotton and hybrid cotton respectively. Gross returns from the Bt-cotton and hybrid cotton was Rs.44686 and Rs.34500 respectively. Farm business income was Rs.16602 and Rs.8853 for Bt-cotton and hybrid cotton respectively. The Input Output ratio of Bt-cotton (1.00) was higher than hybrid cotton (0.87).

Gandhi and Namboodiri (2006) studied the Economics and adoption of Bt-cotton in India. Study indicates that Bt-cotton offers good resistance to bollworms as well as several other pests. The incidence of these pests is reported to be considerably lower in Bt-cotton versus Non-Bt cotton. The yields of Bt-cotton are found to be higher and the yield increase statistically significant in all the states under both irrigated and rain-fed conditions. As a result, given the good market acceptance of the product, the value of output per hectare is higher in all the states and conditions. The question of higher cost of cultivation exists because of high seed cost and not commensurate reduction in pesticide cost. However, the profit is found to be higher in all the states to the estimated extent of about 80-90 per cent on an average when the effects of the associated inputs are included. Subjective assessment indicates that farmers find advantage in pest incidence, pesticide cost, cotton quality, yield and profit.

Stephen (2007) studied Socio-economic impacts of Bt cotton in the Makhathini Flats, South Africa in terms of gross margin (revenue – costs) the clear benefits of a greater yield for Bt-cotton with costs that are more or less the same as growing non-Bt results in Bt cotton plots having a higher gross margin than non-Bt cotton. This gross margin differential

of between 387 SAR/ha (1999/2000) and 1,090 SAR per ha (2000/01) was statistically significant for each of the two studies and season, but in both studies should be seen as an overestimate as not all labour was included. In the third study no comparison between Bt cotton and non-Bt cotton plots was possible, and it should also be noted that the farmers included here could arguably be the more better off considering that none of them required credit. However, it is clear that the gross margin of Bt-cotton has held at around SAR 1,200 per hectare; much higher than that recorded for any of the non-Bt plots in studies 1 and 2.

Loganathan (2009) studied the cost and return of Bt-cotton in which human labour as the major component of cost on input supplied for cotton production. Its share in total cost was about 44.5 per cent in Bt-cotton. It was followed by fertilizers accounting for 18 per cent of the total cost of cotton cultivation cost of machinery used for field operation accounted for about 10 per cent in all categories of farms. Share of pesticides in total cost was less than 5 per cent in Bt-cotton. The share of seed cost was about 14 per cent in Bt-cotton. However, the saving in pesticides cost for Bt-cotton have been found to be more to offset the higher seed cost of Bt-cotton hence the total cost of all inputs was about 10 per cent lower in Bt cotton than non Bt-cotton. The average kapas yield was much higher for Bt (33 qtl/ ha) than non Bt (20 qtl/ha) consequently. Net Return from Bt cultivation was almost twice than that of non Bt cotton and gross margin from Bt cultivation (about Rs 45,000) was more than 6 times higher than the gross margin from non-Bt.

Gandhi and Namboodiri (2009a) they studied the input use pattern under Bt cotton vis-à-vis traditional cotton varieties that is Non-Bt cotton varieties in the Maharashtra state of India. This has been examined by farm size under irrigated and un-irrigated conditions. The total cost of cultivation/ ha, including the marketing cost, was respectively Rs. 32368 for Bt-cotton in irrigated conditions and Rs. 30783 under un-irrigated condition. Higher cost of growing mainly attributed to higher dose of fertilizer use, greater cost of irrigation and high levels of human labour use, particularly for cotton harvesting. Even though pesticide sprayings not eliminated, there is a substantial reduction in the pesticide use and cost under Bt cotton. The total cost per hectare reduces by 21 per cent. Net profit per hectare under the Bt cotton was Rs. 24894 irrigated and Rs. 19702 under un-irrigated conditions. The input use in total cost of the Bt cotton production, cost of seed accounted for

on around 11-13 per cent of the cost of cultivation for Bt-cotton, whereas this was around 5-6 per cent for Non-Bt cotton. Relative share of various inputs in cost of cultivation of Bt. cotton in descending order of their shares are human labour with 37.10 per cent, fertilizer with 22.46 per cent seed at 12.18 per cent, pest with 10.23 per cent and Bullock labour with 6.04 per cent. Average farm size of Bt growers is marginally higher. Percentage of area irrigated in total operated area is subsequently higher on an average among the Bt grower 46 per cent.

Swaminathan and Rawal (2010) studied costs and returns from the cultivation of different types of cotton in a rain fed village in the Vidarbha region of Maharashtra, India. Further, expenditure on chemical pesticides was higher for Bt-cotton than for other varieties of cotton. Variability in production was also higher for Bt-cotton than for other types of cotton. The net income or farm business income from stand-alone Bt-cotton fields was Rs 7,059 per acre or Rs 17,435 per hectare (equivalent to 425 USD per hectare at the June 2007 exchange rate). The income advantage of Bt cotton fell with inter-cropping. On intercropped plots, the gross value of output per acre from intercropped Bt cotton was only slightly higher than from intercropped premium non-Bt cotton, but as costs were also higher, net incomes became slightly lower (Rs 6,355 an acre from intercropped Bt cotton and Rs 6,729 per acre from intercropped premium non-Bt cotton)

Ali *et al.* (2010) studied in cotton production inputs involved are cost intensive and overtime the cost of production has increased. The highest share on the total cost was that of land rent (28.536 per cent) and the lowest of seed (21.3336 per cent). Over the time, the maximum increased in input cost growth rate have been noticed in pesticide (8.98per cent). However the minimum input cost growth rate was observed in seed (4.26 per cent).

Quaim (2010) studied potential impacts of genetically modified (GM) crops on income; poverty and nutrition in developing countries continue to be the subject of public controversy. Bt-cotton has already been adopted by millions of small-scale farmers, in India, China, and South Africa among others. On average, farmers benefit from insecticide savings, higher effective yields and sizeable income gains. Insights from India suggest that Bt cotton is employment generating and poverty reducing. This clearly demonstrates that GM crops

can contribute to poverty reduction and food security in developing countries. To realize such social benefits on a larger scale requires more public support for research targeted to the poor, as well as more efficient regulatory and technology delivery systems. The estimates from the three village studies are remarkably close and provide credibility to our data. In absolute terms, the difference in net incomes between Bt and local varieties of cotton was around Rs 3,400 per acre. Per acre net revenues were on average Rs. 2,000–3,000 higher on Bt than on conventional cotton plots.

Kiresur and Ichangi (2011a) studied the performance of Bt technology and its impact on farming community have been assessed in northern Karnataka. Studied the average expenditure on seeds was higher (Rs. 3718/ ha) in Bt-cotton than in non-Bt cotton (Rs. 2550/ha), largely due to higher cost of Bt- cotton seeds. The quantity of organic manure (tonnes) used in Bt (6.5/ha) and non Bt cotton (6.7/ha) farms was almost same, But, the cost incurred on chemical fertilizers and organic manure was higher in non Bt (Rs. 2605) than Bt (Rs. 2502/ ha) per farms. The total costs of production (cost- D per ha) including interest on working capital, land Revenue, Depreciation charges, imputed value of family labour and marketing cost was worked out to be higher for non-Bt cotton (Rs.39304) than Bt-cotton (Rs.36675). Bt farmers realized higher gross returns (Rs. 67284/ ha) as compared to non-Bt cotton farmers (Rs.51493/ha), and in both cases farm-size increased, the Gross returns also increased. The net returns over cost-D were much higher from Bt-cotton production (Rs. 30618/ha) than from non-Bt cotton (Rs.12189/ha), accounting for an increasing 151 per cent. Across the farm size categories, the net returns per ha varied between Rs. 30014 and Rs.31035 for Bt-cotton and Rs. 11797 to Rs.12912 for non-Bt cotton. The higher profitability of Bt-cotton was also reflected in terms of Benefit cost ratio (1.83 in Bt-cotton versus 1.31 in non-Bt cotton).

Shah (2011) studied higher generation of income and employment for rural workers in India, especially for hired female labour, through plantation of insect resistant Bt toxin cotton, which also indicates a rise in total wage income by US\$40 per hectare as compared to conventional cotton. There are also several other studies on the impact of Bt-cotton conducted by public sector institutions during the period between 1998 and 2010. The studies conducted during both pre-and post-commercialization of Bt-cotton with their major

impact related findings. All these studies have consistently confirmed 50 to 110 per cent increase in profits from Bt-cotton as compared to conventional cotton. The profit emanating from Bt-cotton cultivation ranges from US\$76 to US\$250 per hectare. The accrual of profit is seen for the small and resource poor farmers belonging to various cotton growing states of India. The rise in productivity is seen in the range of 30 to 60 per cent, whereas the reduction in number of insecticides sprays averaged at around 50 per cent.

Reddy *et al.* (2011) studied this paper explores the economic performance of Bt-cotton in Andhra Pradesh and consequent perceived social benefits accrued for the technology adopters. Introduction of Bt-cotton reduced number of sprays on cotton from 8.9 to 4.6 and the share of plant protection from 32.16 to 11.84 percent in total costs. Productivity increase is significant that 51.16 percent more yield with the introduction of Bt-cotton. The percentage increase in net returns is 291 resulted in relief from debts, more spending on education, health and social functions. The amount of time spent in the field reduced. This makes them perceive better life after Bt introduction.

Kauthekar (2012a) studied cotton based farming system in Nanded district of Maharashtra in 2011. Area under all crops was 4.19 hectare in which share of cotton crop was 44.75 per cent. In individual items of costs, rental value of land was predominant item with 35.03 %. In next order, hired human show the highest share of 15.85 % followed by bullock labour (8.09), fertilizer (7.93), seed (6.31), manure (5.16) and irrigation (4.95). Net profit from all crops was Rs. 86598.08 in which share of cotton was 61.08 per cent. Regarding per hectare efficiency, cotton crop showed the highest net profit and output input ratio compared to other crop in cotton based farming system. Cost- C was Rs.46571.46 in which share of cost-A was 58.77 per cent and Cost-B was 51.80 per cent. Gross return was found to be Rs.99471.50. Thus, net profit from cotton crop was found to be Rs.52900.04. The out-input ratio was 2.13.

Kranthi (2012) Studied Prior to the introduction of Bt-cotton, the average seed-cotton yield was only 4 q/ha which increased to 7.48 q/ha in 2007-08 and 10 q/ha after 2007. The productivity was low at an average of 150 kg lint per hectare during 1999 to 2005. The productivity increased to an average of 290 Kg lint per hectare over the five year period 2006 to 2011 Bt. cotton was introduced in 2002 primarily for bollworm control. Subsequently,

there has been a significant leap in the cotton production. During 2001 India produced about 158 lakh bales, which increased to 243 lakh bales in 2004 and 345 lakh bales by 2011. However, it is interesting to note that the yield increase by 2004 was mainly due to the IPM/IRM strategies, new insecticides, new hybrids, and new area in Gujarat, apart from the 5.4 per cent area under Bt cotton. The area under non-Bt straight varieties was about 55.0 per cent in 2004 and non-Bt hybrids at 38.0 per cent. Cotton Advisory Board data show that cotton yields increased by about 60 per cent in three years between 2002 and 2004 when the area under Bt cotton was a meager 5.6 per cent and the area under non-Bt cotton was 94.4 per cent. The yields did not increase significantly more than the pre-Bt era even until 2011 when the Bt-cotton area touched 96 per cent.

Bury (2013) studied although the total production cost price of cotton is 15 per cent higher than that of non-Bt cotton, the income of Bt-cotton farmers is 53 per cent to 71 per cent higher. An IFPRI overview study demonstrates that Indian Bt-cotton farmers spend 31 per cent to 52 per cent less on insecticides and achieve a 34 per cent to 42 per cent higher cotton yield per ha than farmers who cultivate traditional cotton. In 2001, the use of insecticides in the cotton industry accounted for 33 per cent of all pesticide use in India. This figure decreased dramatically following the introduction of Bt-cotton. First to 17 per cent in 2006 and then to 11 per cent in 2010 that Bt-cotton resulted in an average increase in income for individual farmers of between 53 per cent and 71 per cent compared to non-Bt cotton. Although the production costs of Bt-cotton are 15 per cent higher than traditional cotton due to the higher seed price, this increase is compensated by the decreased expenditure on pesticides (31 per cent - 52 per cent) and a higher yield per ha (34 per cent - 42 per cent).

Khuda Baksh (2013) studied Yields from Bt-cotton plots in Pakistan, on an average higher by 17 per cent. Also the pesticide use declines by 22 per cent/ha. Labour costs increase at a decreasing rate as Bt cotton acreage increases. The estimated coefficient for Bt cotton share is positive and significant for the labour regression along with significant and negative square term (for both the RE and FE models). We include the square of Bt-cotton area-share in the labour regression to allow for non-linear linkages between Bt cotton and labour. Our results suggest that labour cost in cotton production increases at decreasing rate with more allocation of area to Bt cotton type. Although the labour cost increases, it may

create more employment opportunities for the rural poor, particularly for rural female workers at the harvesting stage because of higher yields.

Balakrishna (2013a) studied with base of a sample survey of selected farmer households in cotton cultivating villages in Andhra Pradesh of India. he study used Multi-stage stratified random sampling method to select the respondents from among the farm households. A detailed structured questionnaire was used to conduct face-to-face interviews with the farmer households. The sample households among the cotton cultivating households who have cultivated non-Bt cotton during last year or last two years have been taken up to study the impact of the presence of technology. In order to ensure the accuracy of the data related to the previous year, care is taken in selection of farm households, those households who have maintained records. The data on input and output variables like cost of seed, cost of labor, cost of irrigation, cost of fertilizers, cost of pesticides and capital used for the both years were collected for the study

Resource productivity and resource use efficiency in cotton production

Pawar and Pawar (2007) Cotton (*Gossypium hirsutum* L.) has the important characters of high lint production and long staple length. JKCH-666 cotton is one of the intra-hirsutum hybrids. It is suitable to grow under rainfed condition. Investigation was carried out for the year 2003-04 in order to study the marginal productivity, economic efficiency and optimum resource use in JKCH-666 cotton production in Parbhani district of Maharashtra. Results revealed that regression coefficients of manure (0.141) and hired human labour (0.172) were highly significant at 1 per cent level while regression coefficients of phosphorus (0.062), area of JKCH-666 cotton (0.184) and bullock labour (0.142) were positive and statistically significant at 5 per cent level. Thus, it was inferred that these resources were under-utilized and there was scope to increase them in the cotton production. The ratios of MVP to price with respect to above resources were higher than unity. Optimum use of resource, where value of the additional product would be equal to the cost of additional resource. So long as the specific return is more than the added cost, one should go on pushing up production till marginal cost become equal to marginal return.

Mohammad and Mohammad (2012). This Study attempts to examine the resource use efficiency and return to scale of the medium sized Bt cotton farmers in the Punjab province of Pakistan. A sample of 150 farmers was selected through multistage sampling technique from Rahim Yar Khan, Multan and Mianwali districts for cotton season 2009. Bt cotton farmers were categorized on the basis of land holding into small, medium and large farmers. Cobb Douglas production function approach was used to measure the resource use efficiencies by calculating and comparing Marginal Value Products (MVPs) and Marginal Factor Costs (MFCs). Results depicted that ratio of MVP to MFC for fertilizer and numbers of spray were greater than 1 i.e. 1.06 and 3.19 showing under-utilization of these resources. While the ratios for irrigation water and labour i.e. 0.05 and 0.67 were less than 1 indicating over utilization of these resources. While the elasticity of production (E_p) for medium sized Bt cotton farmers was found to be 0.77 showing decreasing returns to scale. Adjustments are required in the use of resources for Bt cotton production by medium sized farmers to increase the profitability of their cotton crop. A clear cut government agricultural policy is needed to improve the profitability of the crops by providing access to information regarding best management practices.

Tayade and Borkar (2015) studied the Inefficiency in the use and allocation of resources constitutes a major problem to increased agricultural production in Parbhani. This study analyzed the efficiency of resource use in smallholder's cotton production in Parbhani district, Maharashtra. Data were collected from a random sample of 83 cotton farmers using questionnaire. The study reveals that there is under utilization of farm size and plant protection measures under consideration. In addition seed and hired labour was a significant factor influencing output level of cotton in the area. The result indicates that cotton production has an increasing return to scale. Also, there are different farming systems operated by cotton small holders in the study area. Incorporating policy measures of efficient use of production inputs are also to guard against all bids that may stands as obstacles towards efficient use of these production inputs were suggested.

Belsare (1991) studied the performance of different cotton variety grown by cultivator in Amravati district of Vidarbha region. Cobb-Douglas production function was fitted. It was observed that coefficient of variation of multiple determination (R^2) ANH-468 cotton variety from 82.13 per cent in small size group, 95.62 per cent in LSG.

Where as in LRA-5166 cotton variety from 97.75 per cent increase of medium sized group. It inferred that in small sized group independent variable are mostly consider in independent variable in present study.

Gadre *et al.* (1992) studied the resource use efficiency in hybrid cotton production. The data were collected by cost accounting method from 140 hybrid cotton growers of Vidarbha. In order to measure relative shares of various factors in cotton production they fitted the Cobb-Douglas production function. The results of the production function indicated higher efficiency in the use of human labour, bullock labour, fertilizer and plant protection chemicals on small farms than on medium and large farms.

Vishweshwar (1997) studied the efficiency of various inputs in the production of cotton under IPM and CPM practices adopted farmers in Malaprabha command area of MVP to MFC for land was greater than one, while it was less than one for labour. It was negative for seed, fertilizers and pesticides in conventional farmers. In the case of IPM adopted farmers the MVP to MFC ratio for land, labour, seeds and plant protection chemicals were greater than one and were negative for fertilizers.

Jawanjal (2001) studied resource productivity and use efficiency in cotton cultivation in Buldhana district. Cobb- Douglas production function was used. He revealed that per hectare use of bullock labour and seed were maximum on medium farms. Per hectare costs and returns of cotton was high on small farms followed by medium and large farms. Area under cotton was significant and positive. Human labour, manure and fertilizer exert significant influenced on yield of cotton at overall level. The sum of elasticity of production was showed decreasing returns to scale on medium farms. Comparison on marginal value productivities indicated that there is scope to bring more area under cotton crop with addition use of human labour, manure and fertilizer to maximize the returns.

Pawar and Pawar (2007) studied that resource productivity, resource use efficiency and optimum resource use in rainfed JKCH- 666 cotton production. It is suitable to grow under rainfed condition. Investigation was carried out for the year 2003-2004 in order to study the marginal productivity, economic efficiency and optimum resource used in JKCH-666 cotton production in Parbhani district of Maharashtra. Result

revealed that regression coefficient of manure was 0.141 and hired human labour was 0.172 while regression coefficient of phosphorus was 0.062.

Loganathan., *et al.* (2009) studied the resource use efficiency and productivity of Bt-cotton. Human labour, Machine labour, and Plant protection, these variables are significant at 10 per cent level in that Plant protection is negatively significant and remaining both Human labour and Machine labour are positive with the value of co-relation coefficient is -0.0422, 0.367 and 0.095 respectively. Potash fertilizer was positive and significant at 5 per cent with the value of correlation coefficient is 0.037. Irrigation is non-significant. Coefficient of multiple determination (R²) is 0.094 with the F-value was 2.56.

Asmatoddin *et al.* (2009) studied that resource productivity, resource use efficiency and optimum resource use in cash crops cotton and sugarcane on medium farm in Marathwada region of Maharashtra. The results revealed that regression coefficient cotton area was positive and significant at 1 per cent level. Coefficient of multiple determination was (R²) 0.58 which indicate 58 per cent variation in independent variable. The sum of elasticity was 1.21 which was indicated that increasing return to scale. Sugarcane area was also positive and significant at 1 per cent level, the sum of elasticity was 0.61 per cent which indicates decreasing return to scale coefficient of multiple determination was 0.61 which indicated that 61 per cent variation in all explanatory variables.

Kunte *et al.* (2009) studied resource use efficiency in the cultivation of cotton, banana, soybean and sugarcane crops in the command area of upper Penganga irrigated project in Maharashtra. The three districts like, Nanded, Yavatmal and Hingoli could get irrigation water from the projects. From these 3 districts, 24 villages were selected for the present study. The total sample was 310 comprising with 78 marginal 82 small 78 medium and 72 large farms. The information pertained for the year 2000-05. Cobb-Douglas production function in double log form was used to estimate resource use efficiency and return to scale. It was found that almost all resources were efficiently used in soybean production. Coefficient of multiple determinations (R²) was 0.9220 which indicated 92.20 per cent of variation in the production of soybean due to variation in the explanatory variables. Production elasticities of land (0.431), pesticides (0.012) and seeds

(0.379) were positive and significant. Human labour, bullock labour manure, fertilizers and working capitals were positive but non-significant. The sum of production elasticity was 0.921 with indicated.

Sakaranarayanan *et al.* (2011) studied in addition to labour savings following automation, greater efficiency is achieved through other cultural operations like spraying, weeding, thinning, and harvesting of row crops etc. while the crop is still irrigated. Moreover, labour and operational costs can be reduced by the simultaneous application of water, fertilizer, herbicide, insecticide, or other additives through the drip system. Drip irrigation offers considerable flexibility in fertilization. Frequent or nearly continuous application of plant nutrients along with the irrigation water is feasible and appears to be beneficial for crop production. The contributing factors for increased efficiency of fertilization include decreased quantities of applied fertilizer, improved timing of fertilization and improved distribution of fertilizer with minimum leaching or runoff. Significant reduction in weed biomass was observed in drip irrigation plot as compared to surface irrigated plots. Drip irrigation increases the yield of cotton on an average of 27 per cent.

Abid *et al.* (2011) studied the resource use efficiency of small Bt cotton farmers of Punjab province of Pakistan using the production function approach. Average farm size of small farmer was found to be 5 acres. Regression results indicated that Fertilizer, Spray Number, Irrigation acre inch and labour cost were significantly affecting Bt-cotton production while farm size was found non-significant. The resource use efficiency analysis showed that efficiency ratios i.e. MVP/MFC for inputs fertilizer (Kg), spray number, irrigation (acre inch) and labour cost (Rs) were found to be 1.5, 3.94, 3.01 and 1.27, respectively. All the efficiency ratios, more than unity indicated the underutilization of all the production inputs under consideration in case of small Bt-cotton farmers. Bt-cotton production for small Bt farmers had an increasing return to scale with elasticity of production 1.27. Opportunities still exists to increase Bt-cotton output in the study area by increasing the level of Bt above mentioned productive resources.

Kiresur and Ichangi (2011b) studied the performance of Bt technology and its impact on farming community have been assessed in northern Karnataka. The ratio of

marginal value product (MVP) to marginal factor cost (MFC) was computed for each of the factors of production. For PPC and Bullock labour, the MVP to MFC ratio was negative implying that these resources were being used excessively. The MVP to MFC ratio was negative in both Bt (-0.0306) and non-Bt cotton (-0.2641), which clearly indicated the excessive use of PPC. This was mainly due to use of more sprays to control sucking pests in Bt-cotton, and in non-Bt cotton for control of mainly bollworm. While in the case of farm yard manure and chemical fertilizers, it was positive in Bt and negative in non-Bt cotton production.

Manjunath (2011) had studied the resource use efficiency of Bt cotton and non-Bt cotton in Haveli district of Karnataka. The results showed that the regression coefficients of seeds, human labour and fertilizers in Bt- cotton cultivation seeds and human labour in non-Bt cotton cultivation were significant indicating that increase of these resources over and above the present level lead to a significant increase in gross returns. The regression coefficients of plant protection chemicals in Bt and non-Bt cotton cultivation was negative indicating that increase in use of plant protection chemicals result in reduction of gross returns. The Allocative efficiency (MVP to MFC ratio greater than one) was greater than one for seeds, organic manure, and human labour, machine/bullock labour for both Bt cotton and non-Bt cotton. It suggested that quantity of these resources was used less than optimum and there exists further scope for increased use of these resources. The allocative efficiency was negative for plant protection chemicals for Bt cotton and non-Bt cotton indicating that any further increase in use of plant protection chemicals would reduce the yield.

Pawar *et al.* (2012) Studied through the Investigation which was carried out during the year 2010-11. About 32 cotton growers were randomly selected from eight villages of one tehsil of Nanded district of Maharashtra. Cross sectional data were collected from cotton growers with the help of pretested schedule by personal interview method. Data were related to cotton output and inputs like hired human labour, seed, manure, fertilizer and family labour as resources. Cobb Douglas production function was fitted to data. The results revealed that, regression coefficient of area under cotton was 0.412 followed by, human labour 0.218, bullock labour 0.085, manure 0.064 and nitrogen 0.015 which were positive at five percent level. Regression coefficient seed phosphorus

and irrigation were positive but not significant. Marginal product of area under cotton was 6.400 quintals followed by that of seed (0.359q) bullock labour (0.298q), and manure (0.127q) and so on. MVP to price with respect to irrigation was 26.56 followed by manure (5.27), seed (3.74), phosphorus (3.67) and human labour (2.11). Hence preference might be given to increase irrigation on priority basis in cotton production.

Balakrishna (2013b) studied the resource use efficiency with estimated production function appears to be best fit as the variation explained in yield by different farm inputs varies between 0.78 and 1.82% in Bt and non-Bt cotton crop situations. It is further observed that most of the elasticity coefficients of inputs have registered the expected signs with a prior economic logic and found to be significant at probability levels ranging from 5 to 10%. The results of the estimated production functions reveal that fertilizer is the most important input to which output is highly responsive in both Bt and non-Bt cotton crop situations. The elasticity of output with respect to fertilizer is found to be positive and significant at 5% probability level in both Bt and non-Bt crop situations. From the analysis of the results, it is found that expenditure on seeds is another important input to which output is highly responsive in both cotton crop situations. The coefficient associated with expenditure on seed is found to be positive and significant at 5% probability level of significance in both categories of farms. On the other hand, it is observed that elasticity coefficient of output with respect to pesticides is higher in non Bt cotton cultivation as compared to Bt cotton cultivation. That is, output elasticity of pesticide is higher in non Bt cotton cultivation than that of in Bt cotton cultivation which reveals that an increase in expenditure on pesticides resulted in increased output in non-Bt cotton cultivation when compared to Bt cotton cultivation. The elasticity coefficient of pesticides though found to be positive in Bt cotton cultivation, it is not significant. The elasticity coefficient of pesticides is found to be positive and significant in non Bt cotton crop situation. It could be observed that the elasticity coefficient with respect to human labour is positive and significant in both Bt cotton and non-Bt cotton crop situations. Farther, it is observed that output elasticity of human labour is found to be higher in Bt cotton cultivation when compared to non-Bt cotton crop situation. The elasticity coefficient with respect to human labour is positive and significant in both Bt cotton and non-Bt cotton crop situations. The output elasticity of human labour is higher in Bt-cotton

cultivation when compared to non- Bt cotton crop situation. It is summarized most of the reviews showed Cobb-Douglas production function in resource productivity analysis. In production function land, human labour, bullock labour and fertilizer were considered as important resource in which in human labour was mostly positive and significant resource. Mostly review showed MVP to price ratio to know resource use efficiency.

Marketing channel and Price spread in different marketing channels of cotton

Rani and Gupta (2017) studied 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. The present research paper provides some guidelines to the policy makers about the need of efficient marketing system.

Ramesh (2013) studied the cotton cultivation and marketing in Tripur District. It identified the position of land holdings of respondents from above A that 48.7 per cent of the respondents are having own land, 24.0 per cent of the respondents are having leased land and 27.3 per cent of the respondents are having both own and leased land. It concluded from the above analysis that majority of the respondents are having own land. Distance of Market Yard from the Place of respondents, It observed from the above A that 40.6 per cent of the respondents are having below 5 kms of distance from their field, 36.0 per cent of the respondents are having 5-10 kms of distance from their field and 23.4 per cent of the respondents are having above 10 kms of distance from their field. It is concluded from the above analysis that majority of the respondents are having below 5 kms of distance from their field. Problems in Storing the Cotton in the Godown, It is noted from the above A that 32.7 per cent of the respondents are facing the problem of 'loss of weight' while in storing their cotton, 8.0 per cent of the respondents are facing

the problem of 'wastage during handling' while in storing their Cotton, 16.7 per cent of the respondents are facing the problem of 'improper fumigation service' while in storing their Cotton, 17.3 per cent of the respondents are facing the problem of 'damage by rats' while in storing their Cotton, 15.3 per cent of the respondents are facing the problem of 'wet due to rain' while in storing their Cotton, and remaining 10.0 per cent of the respondents are facing the problem of 'poor maintenance' while in storing their Cotton,. It is concluded from the above analysis that majority of the respondents are facing the problem of 'loss of weight' while in storing their Cotton.

Manan *et al.* (2013) studied that village beoparies (traders) earned gross marketing margin of Rs. 72 per maund (40 Kg), net margin of Rs. 26 per maund and 3.73 per cent margin in marketing chain of seed cotton in district Khanewal. Commission agents earned Rs.35 per maund as gross marketing margin, Rs.23 per maund as net margin and 1.85 per cent margin in marketing chain. The gross marketing margin of ginner was estimated as Rs.136 per maund, net margin as Rs. 45 per maund and 6.56 per cent margin in marketing chain. The study suggests rationalising the role of middleman to economize and justified margins in the marketing chain of seed cotton in district Khanewal. Ginners were purchasing seed cotton on an average Rs. 1935 per maund and selling further on an average Rs. 2071 per maund. The gross marketing margin of ginner was Rs. 136 per maund out of this marketing cost was Rs. 91 per maund. Total costs include market fee, diesel charges, income tax fee and labor cost etc. So the net margin was Rs. 45 per maund. In the marketing chain of cotton in district Khanewal, ginner was getting 6.56 percent of the total margin of the marketing chain. The net profit as percentage of sale price was 2.17 percent. In gross margin of ginner, marketing cost contributed 66.92 percent whereas rest of the 33.08 percent was the profit of ginner.

Birla *et al.* (2014) studied the price spread and marketing efficiency in the marketing of cotton in different channels by using different tools such as price spread, marketing costs, marketing margins and marketing efficiency. The study showed that Producer received maximum net profit in channel IV (3213Rs/q) minimum in channel I (3163 Rs/q). Thus it could be concluded that as the length of marketing channels increases, the cost of marketing ought to be more i.e. Rs 376. The ultimate consumer also ends up paying much higher than that in other channels i.e. 3825 Rs/q. Under channel V

Traders margin was 106 Rs/q and commission agent margin was Rs 130. Thus it could be concluded that as the length of marketing channels increases, the cost of marketing ought to be more i.e. Rs 356. The ultimate consumer also ends up paying higher than that in other three channels (channel I, channel II and Channel III) i.e. 3795 Rs/q. The maximum quantity of cotton was sold by the channel I (60 per cent) and minimum by channel V (7.5 per cent). The highest marketing efficiency of channels was in channel III (136.57 per cent) and minimum in channel IV (123.67 per cent). The price spread of marketing channels was maximum in channel IV (465 Rs/Q) and minimum in channel III i.e. 295 Rs/Q. As the length of marketing channels become lengthy, the cost of marketing ought to be more.

Gandhi and Namboodiri (2009b) studied the Findings on the access to the markets for cotton for the sample farmers indicated that for about 1/3 of farmers the nearest cotton market was within a radius of 5 kms for about 24% of Bt growers and 15% of the non-Bt growers the nearest cotton market was beyond 10 kms. On the whole there is no substantial difference in the access to the cotton market across the Bt and non-Bt farmers.

Mann and Gill (1988) studied price spread in American cotton under three marketing channel as farmer-ginner-spinner- textile mill. Second is farmer- trader-spinner-textile mill and third is farmer-intinerant merchant spinner- textile mill. Total share of farmer in consumer rupee is 66.32 per cent in channel third and 66.67 per cent in channel first and second. The intinerant merchant net margin was 0.70 per cent of the consumer rupee. About 33 per cent of consumer's rupee was aborted in the form of cost of margin of intermediaries. The marketing cost paid by various agencies includes farmers cost 41.92 Rs/bales, intinerant merchants cost 315.75 Rs/bales, traders cost 272.30 Rs/bales, ginner cost 275.33 Rs. /bales and spinner costs 655.74 Rs./bales. The farmers share was reduced with the advancements in processing.



Methodology



CHAPTER-III

METHODOLOGY

Methodology is of vital importance in the economic study. Methodology is devoted to explain the plan of investigation and sources of data. Any type of investigation to be conducted with specific objectives invariably requires the adoption of scientific method and procedure for conduct of investigation and drawing useful conclusions. The methodological issues such as selection of sample, methods of data collection and analytical techniques used, which are important to judge the quality of findings so arrived at by researchers.

The present chapter is divided into following parts.

- 3.1 Salient feature of Parbhani district
- 3.2 Location of the study
- 3.3 Method of sampling
- 3.4 Analysis of data
- 3.5 Cost and concept

3.1 Salient feature of Parbhani district

Salient feature consist with location, soil, climate, population and cropping pattern of district where study has been undertaken.

3.2 Location

Parbhani district is located between 18.450 and 20.010 North Latitude and 76.13to 77-29 East longitude. It is bounded at North by Buldhana and Hingoli districts, while at West by Jalna district. To the South it is bounded by Beed and Latur districts and to the East by Nanded district. The Ajanta hill ranges run through Jintur Taluka of Parbhani district. The Balaghat hill ranges run through Gangakhed Taluka of the district. The district comes under Godavari and Dudhna river valley. It is bounded a North by Buldhana and Hingoli districts, while at west by Jalna district. To the South it is bounded by Beed and Latur districts and to the East by Nanded district. It is located between 18.45 and 20.01 North latitude and 76.13 to 77.29 East longitudes.

3.2.1 Soils

Parbhani district has black soil rich in nutrients. The depth and fertility of soils differs from Taluka to Taluka taking into account the fertility of soils, the district can be



Fig.3.1. Map of Parbhani district

divided into 3 parts. Soils in the Godavari Valley are very fertile, deep and rich in nutrients. The central part of the district comprising of Selu, Pathri, Parbhani and Purna talukas and a part of Jintur taluka the soils are medium block. Hilly areas north of the district and Gangakhed and Palam talukas in the South, have medium and low quality soils.

3.2.2 Climate

Parbhani climate is classified as tropical. The average annual temperature is 26.9°C in Parbhani. During the rainy season which starts from June and ends in October September, the other seasons are mostly dry. The raining season again starts in and ends in November. Between December & February end the district experiences winter seasons. During the months of March up to May, the district passes through the Summer Season. During the year 2017, the maximum and minimum temperatures of the district recorded 42.2°C and 13.4°C, respectively

3.3 Sampling Design

Multi stage sampling design was adopted for selection of district, tehsils, villages, as well as producer farmer of Bt-cotton. In the first stage, Parbhani District was purposively selected on the basis of area under the Bt-cotton production. In the second stage, Jintur and Parbhani tehsils were selected on the of basis higher area under Cotton. In third stage, ten villages were selected from the selected tehsils on the basis of highest area under cotton production. In the fourth stage, from each village, the separate list of cotton grower was prepared. From each of the lists ten farmers of cotton were randomly selected. Thus, from one village, ten farmers were selected with equal distribution. Thus total 100 farmers of cotton were selected for present study.

3.4 Analytical Techniques

The techniques like tabular analysis, functional analysis were used to analyze data in the present study. In analytical techniques, the first objective that is to study socioeconomic characteristics of cotton growers was achieved by tabular analysis. The second objective that is to estimate cost and returns of cotton was achieved by tabular analysis in which arithmetic mean of cost-A, Cost-B and Cost-C, percentage and output – input ratio was emphasized. The third objective that is to study the resource use efficiency of cotton was achieved by applying Cobb-Douglas production function analysis. The fourth objective that is to fix out the marketing cost, market margin and

price spread of cotton through different marketing channels was achieved by tabular analysis. Analytical techniques were used for achieving the pre-determined objective.

3.4.1 Tabular analysis

This method was used in case of cropping pattern and socioeconomic characteristics of the grower of cotton crop.

3.4.2 Concepts of cost

The second objective, cost and returns of Bt-cotton was achieved by application of cost concepts viz. cost-A, cost-B, cost-C in tabular analysis. Tabular analysis comprised of arithmetic mean, percentage and ratio.

3.4.3 Marketing cost and market margin

Market cost and market margin was worked out from actual data collected from market intermediaries; marketing cost incurred by producer was estimated from the data collected from selected cultivars for the present. Price spread of the producer showed the difference between net price received by the producer in the assembling market and price paid by ultimate consumer to produce in the retail market. It includes all the market charges incurred by the producer, village merchant, ginner as well as profit margin at village merchant and ginner. Producer's share in consumer's rupee is very helpful in deciding the appropriate strategies for reducing the marketing cost in the present study. If price is the retail price the producer share in consumer's rupee (Ps) is expressed as follows.

$$Ps = \frac{\text{Net price received by the producer}}{\text{Price paid by the consumer}} \times 100$$

3.4.5 Functional analysis

3.4.5.1 Production function analysis

The empirical evidence from previous studies suggested that amongst the many mathematical Cobb-Douglas type of function is appropriate one for the studies of resource productivities because it gives specific diminishing, increasing or constant returns. The data were therefore, subjected to functional analysis by using the following form of Cobb-Douglas type of production function. The third objective, resource productivity and resource use efficiency was achieved by application of functional analysis. In functional analysis linear and Cobb-Douglas production functions were used

for data. On the basis of goodness of fit (R²) Cobb-Douglas production function (non-linear) was used to determine the resource productivity in cotton production. The data were, therefore, subjected to functional analysis by using the following form of equation.

$$Y = aX_1^{b_1} \times X_2^{b_2} \times X_3^{b_3} \dots \times X_n^{b_n} \cdot e^u$$

In this functional form ‘Y’ is dependent variable, ‘Xi’ are independent resource variables, ‘a’ is the constant representing intercept of the production function and ‘bi’ are the regression coefficients of the respective resource variables. The regression coefficients obtained from this function directly represent the elasticities of production, which remain constant throughout the relevant ranges of inputs. The sum of coefficients that is ‘bi’ indicates the nature of returns to scale. This function can easily be transformed into a linear form by logarithmic transformation. After logarithmic transformation, this function is,

$$\text{Log } Y = \log_a + b_1 \log X_1 + b_2 \log X_2 + \dots + b_n \log X_n + u \log e$$

3.4.5.2 Selection of input variables

The main consequences of Multicolliniarity are (a) the sampling variances of the estimate coefficients increases as the degree of collinearity increases between the explanatory variables (b) estimated coefficients may become very sensitive to small charges in data that is addition or deletion of a few observations produce a drastic changes in some of the estimates of the coefficients. These results in regression coefficients are significant but the value of R² is very high. The equation fitted was of the following formula.

$$\hat{Y} = aX_1^{b_1} \cdot X_2^{b_2} \cdot X_3^{b_3} \cdot X_4^{b_4} \cdot X_5^{b_5} \cdot X_6^{b_6} \cdot X_7^{b_7} \cdot X_8^{b_8} \cdot X_9^{b_9}$$

Where,

- Y = Estimated yield of the crop in quintals per farm,
- A = Intercept of production function
- bi = Partial regression coefficients of the respective resource Variable (i = 1, 2, 3,...9)
- X₁ = Area of the crop in hectares per farm
- X₂ = Human labour in man days per farm
- X₃ = Bullock pair in pair days per farm
- X₄ = Seed in kg per farm
- X₅ = Manure in quintals per farm

X_6 = Nitrogen in kg per farm

X_7 = Phosphorus in kg per farm

X_8 = Potash in kg per farm

X_9 = Irrigation in m^3 per farm

The marginal value of productivity of resource indicates the addition of gross value of farm production for a unit increase in the 'i'th resources with all resources fixed at their geometric mean levels. The MVP of various inputs is worked out by the following formula.

3.4.5.6 Resource use efficiency

The resource use efficiency is judged on the basis of the ratio of marginal value product of the resource to its factor cost and should be greater than or equal to one. Marginal value product (MVP) of factor taken at their prevailing market prices or opportunity cost indicate the efficiency of resources use i.e. $MVPX_1/PX_1$

3.5 Terms and Concepts used

3.5.1 Cost concepts

Following cost concept were used for calculating per field costs and returns of all crops on the farm.

Cost A

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

1. Hired human labour
2. Owned and hired bullock labour
3. Machinery charges
4. Seeds
5. Manures
6. Fertilizers
7. Plant protection measures
8. Irrigation charges
9. Land revenue and other cesses
10. Depreciation on implements and machinery
11. Repairs of machinery

12. Interest on working capital

Cost B

It includes cost 'A' plus imputed rental value of owned land and interest on fixed capital.

Cost C

It includes cost 'B' plus imputed value of family human labour. The cost C represents the total cost of production.

The standard cost concepts mentioned above provide different measures of income to the cultivator.

a) Farm business income: The difference between gross returns and cost- A.

b) Family labour income: The difference between gross returns and cost B.

c) Net profit or loss to the cultivator: The difference between gross returns and cost C.

3.5.2 Measurement and evolution of cost items

1. Hired human labour

This category includes the hired labour employed in the crop production. The payment paid in cash or kind has been considered on the basis of working day i.e. 8 hours a day. Labour cost evaluated at the rate of Rs.300 per a day for male and Rs.150 per day for female. The female labour was converted into man day to multiplying to number of female with 0.2.

2. Bullock labour

Owned bullock labour has been calculated by maintenance of bullock pair in year divided by number of working days. Accounted as per the rates of hired bullock labour prevailed in the locality and in case of hired bullock labour, actual payment made in cash or kind per day i. e. 8 hours a day has been considered. For the present study, hired bullock charges were at the rate of Rs.400 per day on farm for one pair of bullocks.

3. Machine labour

Hired machined has been accounted as per the actual amount paid. In which thresher hour and power tiller hour converted into tractor hour. In which one hour

thresher is considered as half tractor hour and one hour power tiller is considered as one fourth tractor hour. Machine charges were charged as the rate of Rs.312.50 per hour.

4. Seed

Home produced seed has been valued at the prevailing market rates of the region and purchased seed has been valued at the actual cost paid and expenditure incurred on procurement was taken in to account.

5. Manure

Manure produced on owe farm was evaluated at the rate prevailed in village. The cost of purchased manure was according to the price paid by cultivators. One cartload of manure was considered as four quintals and prevailing price was Rs. 250/q.

6. Fertilizers

Fertilizes in the form of urea, single super phosphate, murate of potash, DAP or 18:46:0 were used and quantity of nitrogen, phosphorus and potash was calculated in order to determine the actual expenditure on nitrogen, phosphorus and potash. The rate prevailing in the market for nitrogen, phosphorus, potash was Rs.13.47/kg, Rs. 41.47/kg and Rs. 27.33/kg, respectively.

7. Plant protection

This includes the actual cost incurred on purchase of insecticides, pesticides, fungicides and their procurement

8. Irrigation structure

It includes capital investment on well, pipeline. Annual expenditure on irrigation structure means, electric charge, repairing charge, depreciation on well (@ 2 per cent), interest on well at 10 per cent, depreciation on electric motor at 10 per cent, interest on electric motor at 10 per cent depreciation on pipeline (@ 10 per cent) and interest on fixed capital of well and pipeline (@ 11 per cent).

9. Land revenue

The land revenue was considered actually paid by the cultivators for specific crop area.

10. Incidental Charges

Include minor repairs, repairing charges and other expenditure for cultivation of the crops.

11. Interest on working capital

It was calculated at the rate 13 per cent on items of expenditure as hired human labour, bullock labour, machine labour, seed, fertilizers, manure, plant protection, land revenue and incidental charges for crop cultivation. This 13 per cent calculated on the basis of 60 percent farmers were getting loan @ 7 per cent rate of interest, 20 per cent farmer were getting loan @ 60 per cent rate of interest, 20 per cent farmer were getting loan @ 30 per cent rate of interest from friends and relatives. Therefore average rate of interest was found more than 13 per cent. Hence rate of interest on working capital was considered @ 13 per cent per annum as per the period of crop. Cotton period was 6 months

12. Depreciation of asset

The depreciation charge was calculated by straight line method. Depreciation means the decrease in value of asset through wear and tear. The uniform rate of 10 per cent on the present value of the beginning of the year of farm implements and machinery was taken and only the proportionate charge was taken for the cropped area.

13. Rental value of land

Rental value of land was 1/6th of the value of total produce excluding the land revenue.

14. Interest on fixed capital

Value of total asset was calculated and then 11 per cent of fixed asset was considered as the total interest on fixed asset like wooden implements, iron implements, equipments and which distributed on the cropped area.

15. Commonly used asset

It includes plough, harrow, seed drill, hoe, bullock cart, hand sprayer, machine sprayer and power sprayer, sickle, weeding hook.

16. Asset

An item of value is called an asset. It is a physical property or intangible right owned by a business or an individual that have a value.

17. Current asset

The assets that could be quickly converted into cash within a short time, usually a year like seeds, fertilizers, cash on land and agriculture produce ready for disposal. They are the most liquid assets and consumable in a year.

18. Liability

It refers to all things which are owned to others by the farmer.

19. Grade

Grade is an important aspect of cotton crop. Grading is done according to staple length of cotton. There are 3 grades in cotton, grade I, grade II and grade III in which grade I is superior. The variables measuring the characteristics of the cotton varieties as fiber length, amount of extraneous material, fineness and maturity of cotton.



*Results
&
Discussion*



CHAPTER-IV

RESULTS AND DISCUSSION

The data collected for the present investigation were analysed as per the methodology, keeping in view the objectives of the study. The result of the analysis are presented and discussed in this chapter. In this chapter, the results of the study are presented in following sections.

1. Socio-economic characteristics of cotton growers
2. Cost and returns of cotton
3. Resource productivity and resource use efficiency of cotton
4. Marketing cost, Marketing margin and Price spread of cotton
5. Constraints of cotton growers in production

4.1 Socio-Economic Characteristics of Cotton Growers

Socio-economic characteristics and cropping pattern of cotton grower has been explained as follows.

4.1.1 Socio-economic characteristics of cotton grower

Socio-economic characteristics of cotton growers are presented in Table 4.1. The results revealed that age of cotton farmer was 45.67 years, with standard deviation of 7.44. Education level of cotton farmer was 1.87 scores; Family size was 5.94 in numbers. Occupation level of cotton farmer was 1.52 scores. It was observed that land holding was 2.83 hectares. The milch animal was 1.44 in numbers. In regard to investment, the commonly used asset was Rs.26580. Similarly investment on irrigation structure was Rs.169161.96. Thus, coefficient of variation for investment on irrigation structure (25.64 per cent) was the lower as followed by that of, family size (25.13 per cent) and age of farmer 15.95 per cent. It implied that there was lower fluctuation in the above Socio-economic characteristics. On the contrary coefficient of variation for commonly used asset was highest as 38.62 per cent followed by that of educational level (38.58 per cent), occupational level (37.50 per cent), milch animal (32.64 per cent), land holding (30.39) and bullock pair (27.14 per cent). It inferred that there was higher fluctuation in these Socio- economic characteristics.



Fig.4.1. Sowing of cotton crop

Table 4.1 Socio-economic characteristics of cotton grower

Sr. No.	Particular	Mean	SD	CV %
1	Age of farmer(Years)	45.67	± 7.44	15.95
2	Educational level in three quantum score (Illiterate/ primary school/High school)	1.87	± 0.76	38.58
3	Family size(number)	5.94	± 1.49	25.13
4	Occupational level in three quantum score(Agriculture/Industry/Service)	1.52	± 0.57	37.50
5	Land holding(ha)	2.83	± 0.86	30.39
6	Bullock pair(no)	0.70	± 0.19	27.14
7	Milch animal(no)	1.44	± 0.47	32.64
8	Investment on commonly used assets and farm buildings (Rs.)	26580.00	±10264.70	38.62
9	Investment on irrigation structure (Rs.)	169161.96	±43366.52	25.64

4.1.2 Cropping pattern and livestock pattern of cotton grower

In cropping pattern, crops were grouped into three seasons like *kharif*, *rabi* and summer with their areas along with animals on the farm and are presented in Table 4.2. Results revealed that gross cropped area was 3.91 hectares. It was observed that in *kharif*, area under cotton was highest as 34.53 percent. While in *rabi* season, the highest area under *rabi* Jowar which was 9.72 per cent. In summer season highest area under groundnut was 11.25 per cent. The net sown area on farm was 2.51hectares and double crop area was1.40 hectares. Cropping intensity was found to be 155.77 per cent. Crossbreed cow and buffalo herds were also estimated and presented in table.4.2. It was observed that herd size of cow enterprise was found to be 0.62 number followed by herd size of buffalo enterprise was 0.82 number. Thus total livestock was 1.44 in which the share of crossbred cow was 43.06 per cent followed by buffalo (56.94 per cent).

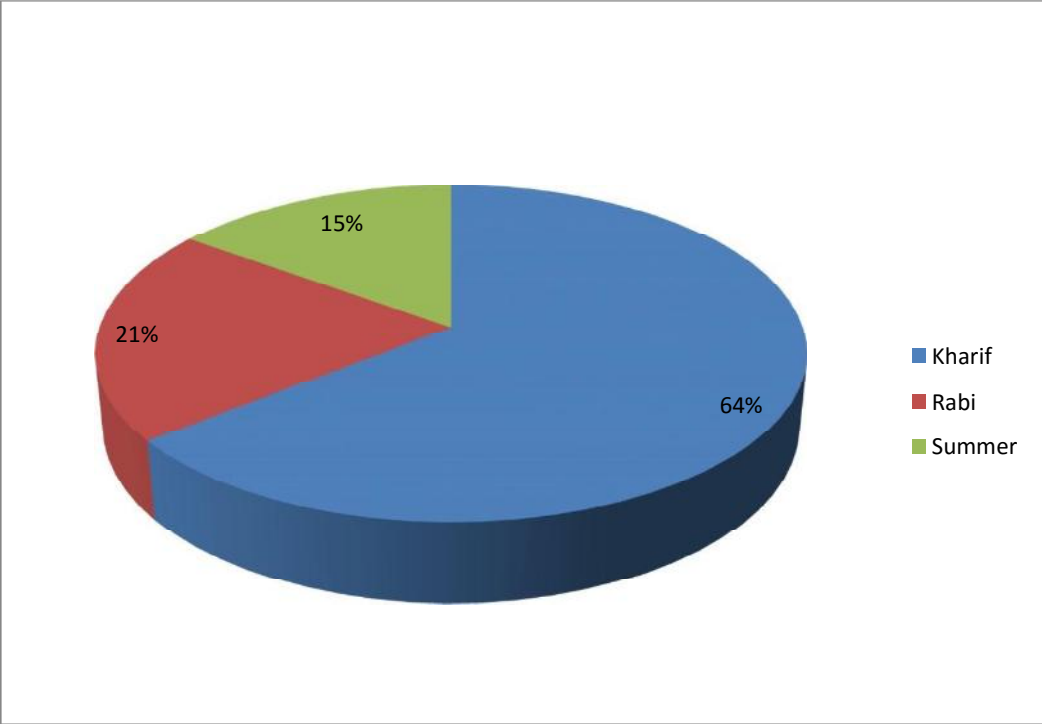


Fig. 4.2 Share of cropping pattern on sample cotton farms

Table 4.2 Cropping pattern and livestock pattern on cotton grower

Sr. No.	Particulars	Area(ha)	Percent
Crops			
<i>Kharif</i>			
1	Bt Cotton	1.35	34.53
2	Bajra	0.43	11.00
3	Soybean	0.39	9.97
4	Pigeon pea	0.12	3.07
5	Black gram	0.12	3.07
6	Green gram	0.10	2.56
<i>Rabi</i>			
7	<i>Rabi</i> Jowar	0.38	9.72
8	Wheat	0.31	7.93
9	Gram	0.12	3.07
Summer			
10	Groundnut	0.44	11.25
11	Maize	0.15	3.84
Gross cropped area		3.91	100.00
Net sown area		2.51	64.19
Double cropped area		1.40	35.81
Cropping intensity		-	155.77
Livestock			
1	Buffalo	0.82	56.94
2	Crossbred cow	0.62	43.06
Total		1.44	100.00

4.2 Costs and Returns of Cotton crop

The physical inputs and outputs were converted into monetary terms to calculate costs and returns and profit. As per the area under the cotton cost, return and profits were calculated. In order to know efficiency of cotton crop, these economic aspects converted into per hectare basis.

4.2.1 Per hectare physical inputs used in cotton production

Per hectare physical inputs used in cotton production were estimated and presented in Table 4.3. It was observed that, Use of hired human labor in Bt-cotton crop was 48.50 man days, respectively. Similar trend also observed in case of use of family human labour in cotton crop were 21.20 man days per hectare. Bullock labour was utilized in Bt-cotton up to 14.10 pair day and also the machine labour was utilized in case of field preparation for 4.63 hours. The quantity of seed used in Bt-cotton was 2.45 kg. It was observed that use of manures was higher i.e. 9.5 qt. In regards to fertilizer application i.e. Nitrogen, Phosphorus and Potash use 82.90, 47.65 and 38.96 kg, respectively. Use of plant protection in Bt-cotton crop was 3.16 liters, the resistance capacity for the sucking pests and insects due to which it lowers down the requirement of higher quantity of spraying. The application of irrigation was higher in Bt-cotton crop 2364.71 m³ due to timely irrigations. In regard yield Bt-cotton yield was greater i.e. 26.70 quintals.

Table: 4.3 Per hectare physical production inputs used and outputs of Bt-cotton (Unit/ ha)

Sr. No.	Particular	Unit	Bt-cotton
Input			
1	Hired human labour	man days	48.50
2	Bullock labour	pair days	14.10
3	Machine labour	Hour	4.63
4	Seeds	kg	2.45
5	Manure	qt.	9.5
6	Fertilizers	kg	
	N		82.90
	P		47.65
	K		38.95
7	Plant protection	lit	3.16
8	Irrigation	m ³	2364.71
9	Family human labour	man days	21.2
Output			
10	Main produce	qt.	26.70
11	By-produce	qt.	6.67

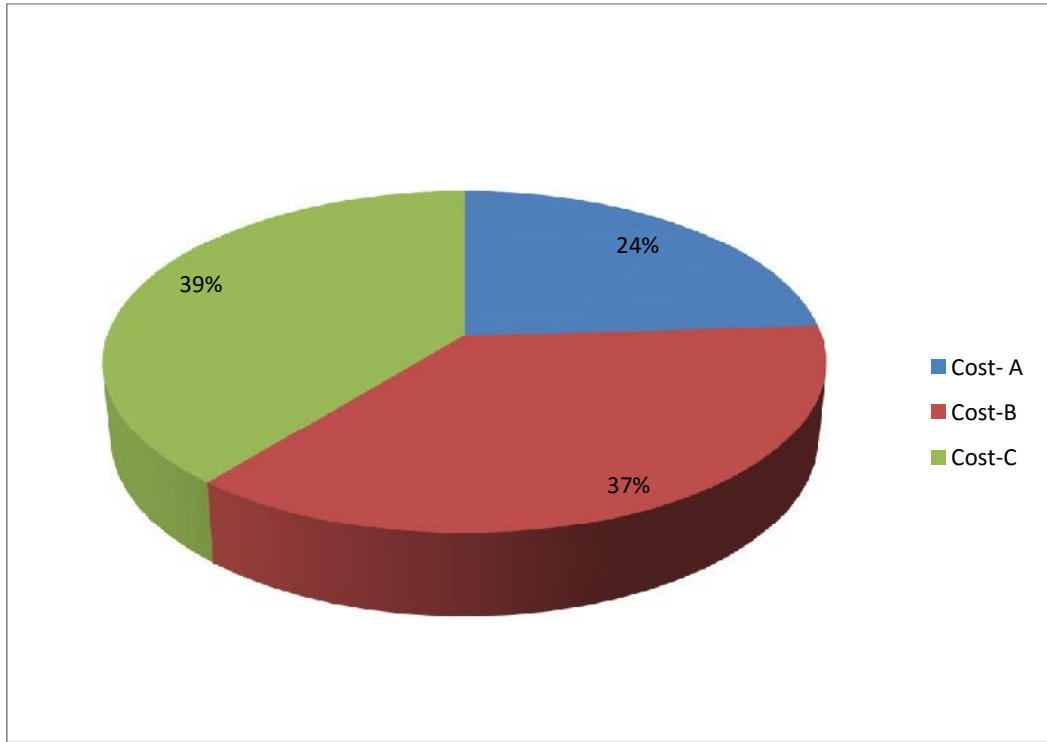


Fig. 4.3 Per hectare item wise expenditure in cotton production

4.2.2 Cost of production and Returns of cotton crop

The important Bt-cotton varieties were grown like Kanak, Malika, Ajit-155, Jaganath, and Rashi. Most of the Bt-cotton grown under rainfed condition, sowing was done by dibbing method. Per hectare costs and returns of Bt-cotton with respect to physical inputs and outputs were estimated and are presented in Table 4.4. The results revealed that cost-C was Rs. 67137.76 in which share of cost-A was 61.39 per cent.

Table: 4.4 Per hectare cost and returns of cotton Crop (Rs. /ha)

Sr. No.	Particular	Amount (Rs.)	Per cent
1	Hired human labour	9258.20	13.79
2	Bullock labour	6175.00	9.21
3	Machine labour	1447.87	2.15
4	Seed	5030.00	7.51
5	Manure	3600.00	5.45
6	Fertilizer(N:P:K)	4151.72	6.19
7	Plant Protection	2501.09	3.75
8	Irrigation	5382.37	8.17
9	Land Revenue	135.45	0.20
10	Incidental Charges	175.37	0.25
11	Interest on working capital	2410.15	3.68
12	Depreciation on capital Assets	665.79	1.01
	Cost –A(∑1-12)	40929.80	61.39
13	Rental Value of Land	21382.19	31.85
14	Interest on Fixed Capital	747.77	1.11
	Cost-B(∑13-15)	63347.76	94.36
15	Family human labour	3789.00	5.64
	Cost-C(∑16-17)	67137.76	100.00
	Returns		
	Main Produce	127109.63	98.45
	By-produce	2002.22	1.55
	Gross Returns	129111.85	100.00
	Net profit	61974.09	-
	Output –input Ratio	1.92	-

Among individual items of costs, rental value of land was predominant item with 31.85 per cent. In next order, hired human labour showed the highest share of 13.79 per cent followed by bullock labour (9.21 per cent), irrigation (8.17 per cent), seed (7.51 per cent) and fertilizer (6.19 per cent).

It was observed that other items of expenditure i.e. Family labour (5.64 per cent), Manure (5.45 per cent), Plant protection (3.75 per cent), Machine labour (2.15 per cent), land revenue (0.20 per cent) showed minor proportions. Thus an average expenditure on Cost-A was 61.39 per cent in Bt-cotton grower. The proportionate expenditure on Cost-B was found 94.36 per cent. Per field main produce, by produce and gross returns were also calculated and are presented in table 4.4. It was clear from the table that main produce of Bt-cotton was Rs. 127109.63 while the by produce was Rs. 2002.22. Gross return was found to be Rs. 129111.85. Thus, net profit from Bt-cotton crop was found to be Rs.61974.09. The out-input ratio was 1.92. Results are conformity to the results obtained by Kanhore (2008), with respect to cost-C, gross return, net profit, output-input ratio and so on.

4.2.3 Profitability of cotton production

Per hectare profitability of cotton production was calculated and presented in Table 4.5. The results revealed that, gross return from cotton was Rs.129111.85.

Table: 4.5 Per hectare profitability of cotton production (Rs/ha)

Sr. No.	Particulars	Amount
1	Gross returns (Rs)	129111.85
2	Cost-A	41217.80
3	Cost-B	63347.76
4	Cost-C	67137.76
5	Farm Business income (Gross returns minus Cost-A)	87894.05
6	Family labour income (Gross returns minus Cost-B)	65764.09
7	Net profit (Gross returns minus Cost-C)	61974.09
8	Output-Input ratio(Gross returns divided by Cost-C)	1.92
9	Per quintal cost of production (Cost-C minus by produce value divided by main produce)	2439.53

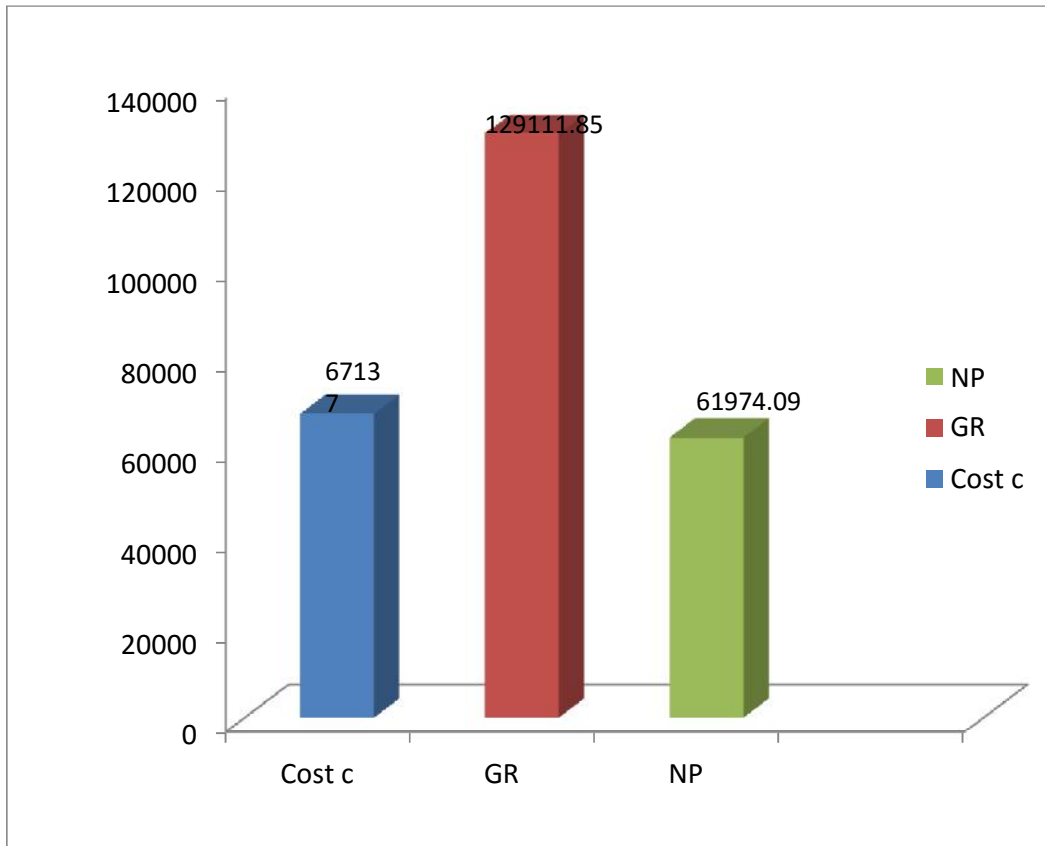


Fig. 4.4 Per hectare Profitability of cotton Production

It was observed that farm business income was Rs.87894.05 and family labour income was Rs.65764.09 in cotton production. It was observed that net profit that was Rs. 61974.09 and output- input ratio was 1.92 higher in cotton.

It was observed that profitability of cotton was more, it means gross returns, farm business income, family labour income, net profit as well as output-input ratio were higher in Bt. cotton because gross yield of cotton were more and Hypothesis is accepted. The results were conformity with the results obtained by Kauthekar (2012).

4.3 Resource Productivity and Resource use efficiency

Linear and Cobb-Douglas production function were used and on the basis of goodness of fit (R^2), proper function was selected for further analysis of data. The independent variables used in the production function, correlation matrix for each crop was developed. Correlation coefficients of independent variables with respect to production were observed and on the basis of non- significant correlation coefficients, some of the variables were dropped. Similarly in order to solve problem of Multicolliniarity, the correlation coefficient among independent variables which had less than the value of multiple determination was taken in to consideration and one of the variable was dropped thus remaining independent variables, lastly used in specific production function. Mostly, Cobb-Douglas production function was used whereas, the regression coefficient are the elasticity's of production and easy to determine the returns to scale in production function.

4.3.1 Estimates of Cobb- Douglas Production function in Cotton Production

Regression coefficients with respect to various explanatory variables were calculated and are presented in Table 4.6. It was observed from the table that regression coefficient of area under cotton was 0.247 which was positive and highly significant at 1 per cent level. It inferred that when one per cent increases in use of area under cotton over its geometric mean, it would lead to increase production of cotton by 0.247 per cent. Regression coefficients of human labour were 0.234 which was positive and significant at 5 per cent level. When use of human labour increased by one percent, it would lead to increase cotton production by 0.234 per cent. Similarly, regression coefficient of manure was 0.142 which was positive and significant at 1 per cent level. On the contrary, regression coefficients of bullock

labour and nitrogen were 0.129 and 0.093, respectively which were negative and significant at 5 per cent level. Regression coefficients of seed, phosphorus, and potash and plant protection were positive but non-significant. Coefficient of multiple determinations was (R^2) 0.847, it meant that there was 84.70 percent effect of all independent variables together on cotton production. Return to scale was found to be 0.633 which indicated that in production of cotton increasing in return to scale were observed.

With respect to resource productivity, marginal produce of area under Bt-cotton was 6.803 quintal; it meant that when increase in cotton area by one hectare over its geometric mean, there would be possibility to increase in cotton production by 6.803 quintals. Marginal produce of human labour was 0.098 quintal. It implied that addition of one human labour would cause to give additional production of cotton as 0.098 quintal followed by manure (0.209 quintal). In addition to these, marginal produce of bullock labour and nitrogen was -0.129 and -0.093 quintal, respectively, which implied that with addition of one kg of nitrogen and one bullock labour would cause to give reduction in production of Bt-cotton by 0.230 and 0.030 quintal. Thus, there was scope to increase the use of area under cotton, human labour and manure in Bt-cotton production.

In regards to resource efficiency, MVP to price ratio with respect to phosphorus was highest as 5.27 followed by manure (3.97), potash (3.13), seed (2.51) and human labour (2.33). It inferred that in cotton production system use of phosphorus was highly underutilized. Hence, preference was given to increase phosphorus on the priority basis in cotton production. Similarly, use of manure, potash could be increased in order to realize better resource use efficiency in money term in cotton production along with use of seed as well as human labour in cotton production.

In regards to optimum resource use, it was observed that optimum area under cotton was 1.76 hectares. Use of human labour and manure could be increased up to 197.70 man days and 86.38 quintals, respectively. Use of bullock labour and nitrogen could be extended, while the optimum resource use of phosphorus, potash, seed and plant protection in cotton production could be 289.71 kg and 139.11 kg, 6.99 kg and 6.75 liters, respectively.

Table 4.6 Estimates of Cobb-Douglas production function in cotton production

Sr. No.	Independent Variable	Regression Coefficient (bi)	Standard error (SE)	't' value	Geometric Mean (Xi)	Marginal Product (q)	Marginal Value Produce (Rs.)	Price of Input (Rs.)	MVP to price ratio	Optimum Resource Use
1	Area under Bt-cotton (ha/farm)	0.247	0.092	2.684**	1.16	6.803	32382.28	21382.96	1.51	1.76
2.	Human Labour (man day/farm)	0.234	0.102	2.294*	75.60	0.098	466.48	180	2.33	197.70
3	Bullock Labour (pair day/farm)	-0.129	0.062	-2.080*	17.87	-0.230	-1094.80	400	-2.73	-
4	Seed (kg/farm)	0.092	0.098	0.938	2.78	1.057	5031.32	2000	2.51	6.99
5	manure (q/farm)	0.142	0.048	2.958**	21.69	0.209	994.84	250	3.97	86.38
6	Nitrogen (kg/farm)	-0.093	0.034	-2.375**	96.40	-0.030	-142.80	13.47	-10.60	-
7	Phosphorus (kg/farm)	0.079	0.089	0.887	54.45	0.046	218.65	41.47	5.27	289.71
8	Potash (kg/farm)	0.025	0.051	0.490	43.80	0.018	85.68	27.33	3.13	139.11
9	Plant protection (lit./farm)	0.036	0.029	1.241	3.464	0.332	1580.32	810.32	1.95	6.75

Intercept (log a)-----0.513 Note: Geometric mean of (Y) cotton production was 31.95 q per farm and price asRs.4760/q

Fvalue-----2.54**

R²-----0.847

Return to scale($\sum bi$)-----0.633

* Significant at 5 per cent level

** Significant at 1 per cent level

4.4.1 Production, Retention, Marketed Surplus and Marketing of Cotton through different channels

Production, retention, marketed surplus and marketing of Bt-cotton through different channels was calculated and presented in Table 4.7. In general, production of cotton was 31.95 quintal/farm. Out of total production, proportion of retention for consumption of cotton was 0.78 per cent. The result revealed that in case of cotton, 12.20 quintals (38.15 per cent) of cotton was marketed through channel-I (Producer-Village Merchant-Ginner-Consumer), 19.51 quintals (61.07 per cent) cotton through channel-II (Producer-Ginner-Consumer). In respect of total production 8.69, 19.79 and 3.46 qt. with the proportionate share of 27.20, 61.97 and 10.83 per cent produce was distributed in three grades i.e. grade-I, II and III, respectively. It was implied that, grade II has higher quantity followed by grade I and grade III in cotton marketing. In channel- II cotton sold at long distant market and by Channel I in near market.

Table 4.7 Production, retention and marketed surplus of cotton through different channels qtl /farm

Sr. No.	Particular	Total	Grade I	Grade II	Grade III
1	Bt-Cotton production	31.95 (100.00)	8.69 (27.20)	19.79 (61.97)	3.46 (10.83)
2	Retention for home consumption	0.25 (0.78)	0.14 (0.42)	0.07 (0.22)	0.04 (0.14)
3	Marketed surplus in channel I (Producer- Village merchant- Ginner-Consumer)	12.20 (38.15)	3.95 (12.38)	5.25 (16.45)	2.98 (9.32)
4	Marketed surplus in channel II (Producer- Ginner-Consumer)	19.51 (61.07)	4.60 (14.40)	14.47 (45.30)	0.43 (1.37)

Figure in the parenthesis indicate percentages to total production

4.4.2 Marketing cost with respect to various items incurred by producer

Per quintal expenditure on cost of marketing of cotton incurred by producer in different channels were calculated and presented in Table 4.8. The results revealed that marketing cost of cotton incurred by producer was highest as Rs 82.00 per quintals (Grade II) in channel-II, while marketing cost of cotton, incurred by producer for Grade I, II and III was Rs.21.06, Rs.22.30 and Rs.19.50 and Rs. 82.00, Rs.84.00 and Rs. 80.00 per quintal in channel-I and channel-II, respectively. It was observed that the proportionate expenditure on labour charge was highest in Channel-

II i.e. Rs.25. In channel- II, highest expenditure on transportation i.e. Rs. 52.50 per cent (grade III) followed by Rs. 31.25 per cent on labour and 12.50 per cent on weighing charge for per quintal.

Table 4.8 Marketing Cost of Cotton incurred by Producer (Rs. /qt.)

Sr. No.	Particular	Channel I			Channel II		
		Grade I	Grade II	Grade III	Grade I	Grade II	Grade III
1	Labour charge	15 (71.22)	15 (67.26)	15 (76.92)	25 (30.49)	25 (29.76)	25 (31.25)
2	Electric charge	-	-	-	1.02 (1.24)	1.71 (2.03)	0.90 (1.12)
3	Storage charge	1.05 (4.98)	1.12 (5.02)	0.80 (4.10)	1.38 (1.68)	2.05 (2.44)	1.51 (1.89)
4	Transportation charge	4.00 (18.99)	5.00 (22.42)	3.20 (16.41)	42.00 (51.22)	42.00 (50.00)	42.00 (52.50)
5	Weighing charge	-	-	-	10 (12.19)	10 (11.90)	10 (12.50)
6	Losses	1.01 (4.79)	1.18 (5.29)	1.50 (2.56)	2.60 (3.17)	3.24 (3.86)	1.47 (1.84)
	Total	21.06 (100)	22.30 (100)	19.50 (100)	82.00 (100)	84.00 (100)	80.00 (100)

Figures in the parenthesis indicate percentages to total

4.4.3 Marketing cost with respect to various items incurred by village merchant

Per quintal cost of marketing of cotton with respect to various items of cost incurred by village merchant in channel-I was calculated and presented in Table 4.9. Result revealed that in regard to village merchant in channel-I of cotton, the cost of marketing was found to be Rs. 116, Rs. 120 and Rs. 114 for grade I, II and III per quintal in which proportionate share of transportation charge was highest as Rs. 52 per quintal with its share 44.82, 43.33, 45.61 per cent due to distant market followed by labour charge Rs. 40 per quintal with its share 34.48, 33.33 and 35.89 per cent, respectively. In regards to commission charge Rs.3 per quintal was given to the APMC by village merchant. The proportionate losses and interest on fixed assets for grade I, II and III in channel I were 1.73, 2.90, 1.54 per cent and 1.00, 1.28 and 1.07 per cent, respectively, weighing charge Rs. 10 per quintal was taken by APMC. The storage charge for grade I, II and III were Rs. 1.20, 1.26 and 1.05 that was 1.03, 1.05 and 0.95 per cent, respectively.

Table 4.9 Marketing Cost of Cotton incurred by village merchant (Rs. /qt.)

Sr. No.	Particulars	Channel II		
		Grade I	Grade II	Grade III
1	Labour cost	40 (34.48)	40 (33.33)	40 (35.89)
2	License charge	1.09 (0.94)	1.20 (1.00)	0.98 (0.86)
3	Weighing charge	10 (8.62)	10 (8.33)	10 (8.77)
4	Commission charge	3.00 (2.29)	3.00 (2.50)	3.00 (2.63)
5	Shop tax	1.02 (0.88)	1.42 (1.18)	0.89 (0.78)
6	Electricity charge	1.38 (1.19)	1.05 (0.87)	0.90 (0.80)
7	Storage charge	1.20 (1.03)	1.26 (1.05)	1.05 (0.92)
8	Transportation charge	52 (44.82)	52 (43.33)	52 (45.61)
9	Communication charge	2.16 (1.86)	3.04 (2.53)	1.08 (0.95)
10	Depreciation and Repair	1.22 (1.05)	2.01 (1.67)	1.12 (0.98)
11	Interests on fixed Assets	1.16 (1.16)	1.54 (1.28)	1.22 (1.07)
12	Losses	2.01 (1.73)	3.48 (2.90)	1.76 (1.54)
	Total	116.00 (100.00)	120.00 (100.00)	114.00 (100.00)

4.4.4 Marketing Cost of Cotton incurred by Ginner

Marketing cost with respect to various items incurred by Ginner in channel-I of Bt-cotton are showed in table 4.10, highest cost of marketing was found to be Rs. 911.50 per quintal for grade I and in grade II and III Rs. 908.40 and Rs. 887.02, respectively for in which proportionate share of commission charges and tax per quintal was highest as Rs. 517.50, Rs. 512.60, Rs. 496.00 for grade I, II and III, respectively with its proportionate share 56.77, 56.36 and 52.87 per cent followed by labour charges Rs. 250 in each channel with the proportionate share of 27.42, 27.52 and 28.18, respectively. Electricity charges incurred was Rs.70.48, Rs.77.30 and

Rs.76.00 with its proportionate share of 7.73, 8.51, and 8.57 per cent. The transport charges incurred Rs. 46 per quintal in each channel with proportion of 5.05, 5.06, and 5.18 per cent. In next order, license charges, shop tax, storage charge, communication charge and losses determine lower values in total marketing cost. License fee 0.10, 0.11 and 0.11 per cent, storage charge incurred 0.26, 0.29 and 0.26 per cent, with the shop tax 0.28, 0.30 and 0.27 per cent and the depreciation, repair on fixed assets 0.71, 0.59 and 0.45 per cent for grade I, II and III respectively. Interests on fixed assets were 0.55, 0.48, and 0.44 for grade I, II and III. Losses were higher in channel I compared to channel II i.e. 0.58, 0.62 and 0.45 per cent in that for grade II highest.

Table 4.10 Marketing Cost incurred by Cotton Ginner (Rs. /q)

Sr. No.	Particulars	Channel I			Channel II		
		Grade I	Grade II	Grade III	Grade I	Grade II	Grade III
1	Labour cost	250 (27.42)	250 (27.52)	250 (28.18)	250 (27.31)	250 (27.55)	250 (28.18)
2	License charge	0.96 (0.10)	0.98 (0.11)	1.02 (0.11)	0.80 (0.09)	0.88 (0.10)	1.02 (0.11)
3	Shop tax	2.60 (0.28)	2.70 (0.30)	2.40 (0.27)	2.10 (0.23)	2.35 (0.26)	2.40 (0.27)
4	Electricity charge	70.73 (7.73)	77.30 (8.51)	76.00 (8.57)	70.78 (7.70)	77.30 (8.52)	76.00 (8.57)
5	Storage charge	2.40 (0.26)	2.60 (0.29)	2.30 (0.26)	2.00 (0.22)	2.20 (0.24)	2.30 (0.26)
6	Commission charge and Tax	517.50 (56.77)	512.60 (56.36)	496.00 (52.87)	528.40 (56.73)	512.40 (56.48)	496.00 (52.87)
7	Transportation charge	46.00 (5.05)	46.00 (5.06)	46.00 (5.18)	46.00 (5.02)	46.00 (5.07)	46.00 (5.18)
8	Communication charge	6.50 (0.71)	5.40 (0.59)	4.02 (0.45)	5.60 (0.61)	5.75 (0.63)	4.02 (0.45)
9	Depreciation and Repair	1.26 (0.14)	1.75 (0.19)	1.40 (0.16)	1.20 (0.13)	1.35 (0.15)	1.40 (0.16)
10	Interests on fixed Assets	5.00 (0.55)	4.35 (0.48)	3.88 (0.44)	4.50 (0.49)	4.60 (0.51)	3.88 (0.44)
11	Losses	5.30 (0.58)	5.32 (0.58)	4.00 (0.45)	4.20 (0.46)	4.45 (0.49)	4.00 (0.44)
	Total	911.50 (100.00)	908.40 (100.00)	887.02 (100.00)	915.50 (100.00)	907.23 (100.00)	876.02 (100.00)

In regard to ginner in channel-II of cotton marketing costs are showed in

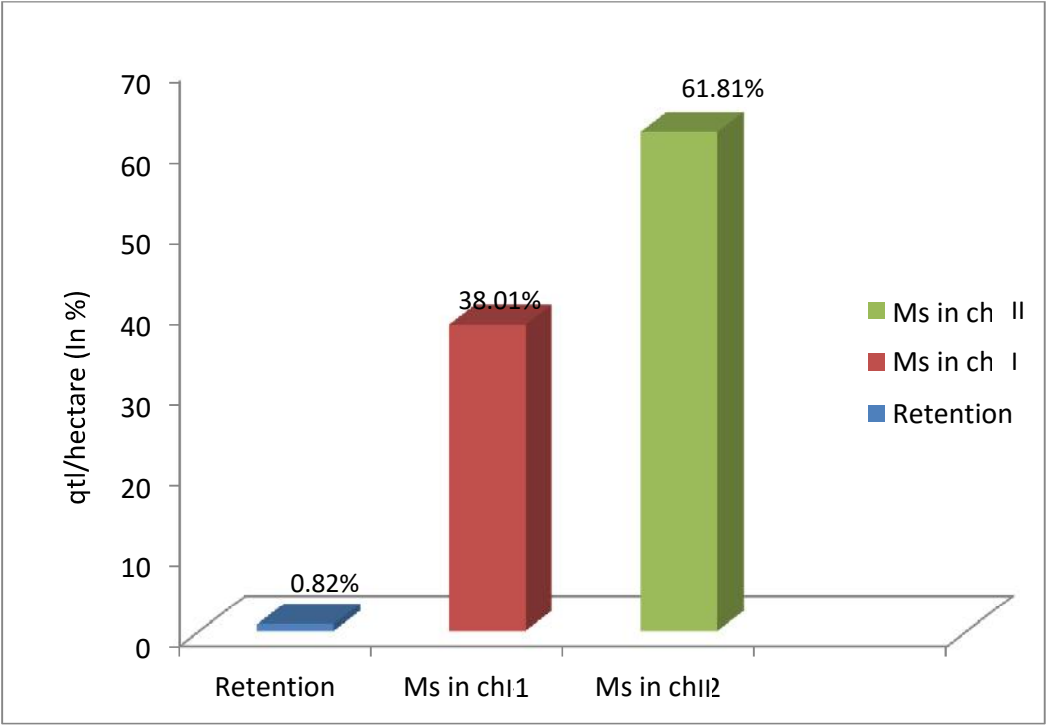


Fig. 4.5 Retention and Marketed Surplus in channel I and II

Table 4.10, highest cost of marketing was found to be Rs 915.28 per quintal for grade I and Rs.907.23 and 876.02 for grade II and III in which proportionate share of tax and commission charges was highest as Rs. 528.40, 512.40 and 486.00 for grade I, II and III per quintal, respectively with its proportionate share 56.73, 56.48 and 52.87 per cent followed by labour charges Rs. 250 with the proportionate share of 27.31, 27.55 and 28.18, respectively. Electricity charges incurred was Rs.70.48, Rs.77.30 and Rs.76.00 with its proportionate share of 7.70, 8.52 and 8.57 per cent. The transport charges incurred Rs. 46 per quintal with proportion of 5.02, 5.07 and 5.18 per cent. In next order, license charge, shop tax, storage charge, communication charge and losses determines lower values in total marketing cost. Interests on fixed assets were 0.49, 0.51, and 0.44 per cent for grade I, II and III, respectively. Losses are higher in channel I compared to channel II i.e. 0.46, 0.49 and 0.44 per cent in that for grade II was highest.

4.4.5 Price spread in cotton marketing

Per quintal marketing cost, marketing margin and price spread in cotton marketing with respect to different marketing channels at overall level were calculated and presented in Table 4.11. Regarding the cotton result revealed that price paid by consumer was the highest as Rs. 6100 per quintal for grade I in channel-I and Rs. 6200 per quintal in channel-II, followed by in both channels Rs. 6000 and Rs. 5800 in grade II and III, respectively. In regard to channel-I of Bt cotton, highest price paid by the village merchant to producer was Rs.4510 (79.93 per cent) for grade I and Rs.4415, Rs.4330 i.e.73.58 and 74.65 per cent for grade II and III respectively. While cost incurred by producer was only Rs. 21.06, Rs. 22.30 and Rs. 19.50 due to lower distance to selling place for grade I, II and III, respectively. Thus, net price received by the producer in channel-I was Rs. 4488.94 (73.58 per cent), Rs. 4392.70 (73.21 per cent), and Rs. 4310.50 (74.32 per cent) in the same order.

The expenses incurred by village merchant are Rs. 116, Rs. 120 and Rs. 114 with proportion of 1.90, 2.00 and 1.96 per cent for grade I, II and III, respectively. Price paid by ginner for grade I, II and III is 4700, 4600 and 4500 i.e. 77.05, 76.67 and 77.59 per cent, respectively. Thus, margin of village merchant per quintal was Rs. 74.00 (1.21 per cent), Rs. 65.00 (1.08 per cent) and Rs.56.00 (0.93



Fig. 4.6 Marketing of cotton by village merchant

Table 4.11 Per quintal marketing cost, margin and price spread of cotton

(Rs. /q)

Sr. No.	Particulars	Channel I			Channel II		
		Grade I	Grade II	Grade III	Grade I	Grade II	Grade III
1	Net price received by producer (producers share in consumer rupee)	4488.94 (73.58)	4392.70 (73.21)	4310.50 (74.32)	4638 (74.81)	4536 (75.60)	4440 (76.55)
2	Expenses incurred by producer	21.06 (0.34)	22.30 (0.37)	19.50 (0.34)	82.00 (1.22)	84.00 (1.40)	80.00 (1.38)
3	Price received by producer	4510 (79.93)	4415 (73.58)	4330 (74.65)	4720 (76.12)	4620 (77.00)	4520 (77.93)
4	Expenses incurred by village merchant in channel I	116.00 (1.90)	120.00 (2.00)	114.00 (1.96)	-	-	-
5	Margin of village merchant	74.00 (1.21)	65.00 (1.08)	56.00 (0.93)	-	-	-
6	Price paid by ginner (channel I and II)	4700 (77.05)	4600 (76.67)	4500 (77.59)	4720 (77.38)	4620 (77.00)	4520 (77.93)
7	Expenses incurred by ginner (channel I and II)	911.50 (14.94)	908.40 (15.14)	887.02 (14.78)	915.28 (14.76)	907.23 (15.12)	876.20 (15.11)
8	Margin of ginner (channel I and II)	488.50 (8.01)	491.60 (8.19)	412.98 (6.88)	564.72 (9.11)	472.77 (7.88)	403.80 (6.96)
9	Price paid by consumer	6100 (100.00)	6000 (100.00)	5800 (100.00)	6200 (100.00)	6000 (100.00)	5800 (100.00)
10	Marketing cost	1048.56 (17.19)	1050.70 (17.51)	1020.52 (17.01)	997.28 (16.08)	991.23 (16.52)	956.20 (16.49)
11	Marketing margin	562.50 (9.22)	616.60 (10.19)	468.98 (7.82)	564.72 (9.10)	472.77 (7.88)	403.80 (6.96)
12	Price spread	1611.06 (26.41)	1667.30 (27.79)	1489.50 (24.82)	1562.00 (25.19)	1464.00 (24.40)	1360.00 (23.79)

Figures in the parenthesis indicate percentages to total

per cent) for grade I, II, III respectively. Cost incurred by ginner in channel I with the commission charges and VAT for grade I, II, III was Rs.911.50 (14.94 per cent), Rs.908.40 (15.14 per cent) and Rs. 887.02 (14.78 per cent) thus the price spread in channel-I was Rs.1611.06, Rs.1667.79 and Rs.1489.50 which was 26.41, 27.79 and 24.82 per cent, respectively.

In regard to channel-II of cotton price paid by consumer was the highest as Rs. 6200 per quintal for grade I in channel-I, followed by Rs 6000, Rs. 5800 in grade II and III, respectively. In regard to channel-II, highest price paid by the ginner to Producer was Rs. 4720 (77.38 per cent) for grade I, Rs. 4620, Rs. 4520 i.e. 77.00 and 77.93 per cent for grade II and III respectively. While cost incurred by producer was only Rs. 82.00 (1.22 per cent), Rs. 84.00 (1.40 per cent), Rs. 80.00 (1.38 per cent) for grade I, II and III, respectively due to long distance to market. The expenses incurred by ginner in channel II were lower than channel I with the commission charges and VAT for grade I, II and III was Rs. 915.28(14.76 per cent), Rs. 907.23(15.12 per cent) and Rs. 876.20 (15.11 per cent) thus the price spread in channel-II was Rs.1562, Rs.1464 and Rs.1360 which was 25.19, 24.40 and 23.79 per cent, respectively. Thus, margin of ginner per quintal was Rs. 564.72(9.10 per cent) Rs. 472.77 (7.88 per cent) and Rs. 403.80 (6.96 per cent) for grade I, II and III, respectively.

The total marketing cost involved was higher in channel I compared to channel II was Rs. 1048.56 (17.19 per cent), Rs. 1050.70 (17.51 per cent), Rs.1020.52 (17.01per cent) thus the total marketing margin involved in marketing of cotton in channel I was Rs. 562.50, Rs. 616.60 and Rs. 468.98 i.e. 9.22, 10.19 and 7.82 per cent, respectively. The total marketing cost involved in channel II was Rs. 997.28 (16.08 per cent), Rs. 991.23 (16.52 per cent) and Rs. 956.20 (16.49 per cent). Thus the total marketing margin involved in marketing of cotton was higher in channel I, Rs. 564.72, Rs. 472.77 and Rs. 403.80 i.e. 9.10, 7.88 and 6.96 per cent respectively. Also the price spread in channel-I was higher than the channel-II i.e. Rs.1611.06, Rs.1562.00 in grade I.

Producer's share in consumer's rupee was highest in channel II as 76.55 per cent for grade-III followed by 75.60 per cent for grade-II and 74.81 per cent in grade-I. As we moved from channel-II to channel-I producer's share in consumer's rupee was decreased from grade-I, then grade-III and grade-II. On the contrary, the proportionate share of marketing cost was continuously increased and was highest for

grade-II followed by grade-I and grade-III in channel-I. Marketing margin and price spread was continuously decreased in both the channels.

4.5 Constraints and suggestions of cotton growers

Cotton growers are facing the problems in production and marketing of cotton. In order to solve problems, the opinion of the sample farmers of both the categories in the form of their suggestions must be considered for the solution of the problems. The problems and suggestions were arranged in the form of frequency and percentage and major problems and suggestion were discussed as follows.

4.5.1 Constraints of cotton growers

Constraints faced by cotton growers were calculated in frequency and percentage form and presented in Table 4.12. The result revealed that, major problem face by cotton growers Non availability of quality cotton seed is about 85 per cent, stands in rank first, followed by Attack of pest

Table 4.12 Constraints of cotton growers

Sr. No.	Problems	Frequency (n=100)	Per cent	Rank
1.	Unpredictable Price Fluctuations	65	65	IV
2.	Specialized market are not unavailable at village level	60	60	V
3.	Non availability of quality cotton seed	85	85	I
4.	Loss due to uneven climate	55	55	VII
5.	Non-availability of labour and higher wages	68	68	III
6.	Poor storage structures	45	45	X
7.	Picking of cotton	54	54	VIII
8.	Attack of pest and diseases	72	72	II
9.	Lack of Market information	59	59	VI
10.	Low transport facilities	51	51	IX

and diseases was next major problem which was expressed by 72 per cent by cotton growers, stands in rank second.

Loss due to Non-availability of labour and higher wages was next major

problem which was expressed by 68 per cent, stands in rank third. Unpredictable Price Fluctuations and poor storage structures were calculated at 65 and 45 per cent, stands in rank fourth and ten, respectively. Problem face by the cotton grower during picking of cotton was seen to be at 54 per cent stands in rank eight.

4.5.2. Suggestions of cotton growers

Suggestions of cotton growers were recorded and presented in frequency and percentage form in Table 4.13.

Table 4.13. Suggestions of cotton growers

Sr. No.	Suggestions	Frequency (n=100)	Percent	Rank
1.	Price support facility	70	70	IV
2.	Contract farming should be done	60	60	VII
3.	Increase availability of quality seed	82	82	I
4.	Proper and timely weather forecast done through mass media	62	62	VI
5.	Availability of improved storage facility	65	65	V
6.	Rate of fertilizer should be minimized by giving government subsidies	55	55	VII
7.	Release resistant varieties for controlling pests and diseases	72	72	III
8.	Market information through mass media	45	45	IX
9.	Improved machinery from sowing to picking should be available at market with affordable price to farmer	80	80	II

It was observed that, 82 per cent of the cotton growers suggested increase availability of quality seed stands in rank first. Followed by farmer also opined that improved machinery from sowing to picking should be available in market with affordable price, was observed 80 per cent, stands in rank second.

Similarly, Release resistant varieties for controlling pests and diseases by 72 per cent of cotton growers. Suggestions of 62 per cent farmers were given that; there is need for proper and timely weather forecast so that farmers can take proper measures against natural calamities to save their crop. And 65 per cent of cotton

farmers also suggested that government should provide improved storage facilities to store cotton until they get proper price for their produce.

Whereas, 55 per cent, farmers opined that Rate of fertilizer should be minimized by giving government subsidies. Cotton farmers who suggested for provision of market information through mass media were 45 per cent.



*Summary and
Conclusions*



CHAPTER-V

SUMMARY AND CONCLUSION

Cotton (*Gossypium species*) a plant of the malvaceous family produces fibers that can be woven into cloth .it has been valued since antiquity and its cultivation was an important factor stimulating European colonialism in regions of Asia , Africa, and the Americas ; it is still a major trade commodity. Numerous species of cotton exist, but four are of commercial importance: *Gossypium arboreum* (native to Asia), *G.herbaceum* (native to Africa)*G.hirsutum* and *G.barbadense* (both native to the Americas) . Cotton plants originated in tropical regions, but are now grown worldwide in a variety of climate zones where adequate heat and water are available. The cotton plant produces capsules, called bolls, in which seeds are surrounded by a fluffy fiber, or lint.

Cotton is cultivated across the world in about 80 countries in an average area of 329.50 lakh hectare with 1482.90 lakh bales (170 kg each) of production with productivity of 765 kg lint per hectare in the year 2017-18.India is at the first place in acreage as well as in production of cotton in the World & contribute 38.13%,(118.81 lakh Ha) and 260.75% (345.82 lakh Bales) respectively as per triennium ending 2016-17. India is self -sufficient in cotton production ,however, the average productivity is 522 kg per ha against the Worlds average of 765kg per hectare in the year 2017-18.In Maharashtra the cotton crop is cultivated mostly in Marathwada region , area under cotton crop is 40.72 lakh ha with production of 372.82 kg per hectare in the year 2017-18.Cotton is the major crop growing in Parbhani district of Maharashtra cotton crop is cultivated area 6.55 lakh ha with production of 340.82 kg per hectare 2018-19.

Multistage sampling design was adopted for selection of district, tehsils, villages, as well as producer farmer of Bt-cotton. In the first stage, Parbhani District was purposively selected on the basis of area under the Bt-cotton production. In the second stage, Jintur and Parbhani tehsils was selected on the of basis higher area under Cotton. In third stage, ten villages were selected from the selected tehsils on the basis of highest area under cotton production. In the fourth stage, from each village, the separate list of cotton grower was prepared

In the light of above, the present study viz., “Production and marketing of

cotton in Parbhani district of Maharashtra” has been outlined with following specific objectives;

1. To study socio economic characteristics of cotton growers
2. To estimate cost and returns in cotton production
3. To estimate resource productivity and resource use efficiency of cotton production
4. To study the constraints of cotton growers in production

Socio-economic characteristics of cotton growers

Age of cotton farmer was 45.67 years, with standard deviation of 7.44. Education level of cotton farmer was 1.87 scores; Family size was 5.94 in numbers. Occupation level of cotton farmer was 1.52 scores. It was observed that land holding was 2.83 hectares. The milch animal was 1.44 in numbers. In regard to investment, the commonly used asset was Rs.26580. Thus, coefficient of variation for investment on irrigation structure (25.64 per cent) was the lower as followed by that of, family size (25.13 per cent) and age of farmer 15.95 per cent. It implied that there was lower fluctuation in the above Socio-economic characteristics. On the contrary coefficient of variation for commonly used asset was highest as 38.62 per cent followed by that of educational level (38.58 per cent), occupational level (37.50 per cent), milch animal (32.64 per cent), land holding (30.39) and bullock pair (27.14 per cent). It inferred that there was higher fluctuation in these Socio- economic characteristics.

Cropping pattern and livestock pattern of cotton growers

Results revealed that gross cropped area was 3.91 hectares. It was observed that in *kharif*, area under cotton was highest as 34.53 percent. While in *rabi* season, the highest area under *rabi* Jowar which was 9.72 per cent. In summer season highest area under groundnut was 11.25 per cent. The net sown area on farm was 2.51 hectares and double crop area was 1.40 hectares. Cropping intensity was found to be 155.77 per cent

Costs and Returns of Cotton crop

The physical inputs and outputs were converted into monetary terms to calculate costs and returns and profit. As per the area under the cotton cost, return and profits were calculated. In order to know efficiency of cotton crop, these economic aspects converted into per hectare basis.

Per hectare physical inputs used in cotton production

It was observed that, Use of hired human labour in Bt-cotton crop was 48.50 man days, respectively. Similar trend also observed in case of use of family human labour in cotton crop were 21.20 man days per hectare. Bullock labour was utilized in Bt-cotton up to 14.10 pair day and also the machine labour was utilized in case of field preparation for 4.63 hours. The quantity of seed used in Bt-cotton was 2.45kg .It was observed that use of manures was higher i.e. 9.5 qt. In regards to fertilizer application i.e. Nitrogen, Phosphorus and Potash use 82.90, 47.65 and 38.96 kg, respectively. Use of plant protection in Bt-cotton crop was 3.16 liters, the resistance capacity for the sucking pests and insects due to which it lowers down the requirement of higher quantity of spraying.

Cost of production and Returns of cotton crop

Most of the Bt-cotton grown under rainfed condition, sowing was done by dibbing method. Per hectare costs and returns of Bt-cotton with respect to physical inputs and outputs were estimated and are presented in Table 4.4. The results revealed that cost-C was Rs. 67137.76 in which share of cost-A was 61.39 per cent. It was observed that other items of expenditure i.e. Family labour (5.64 per cent), Manure (5.45 per cent) and Plant protection (3.75 per cent), showed minor proportions. Thus an average expenditure on Cost-A was 61.39 per cent in Bt-cotton grower.

Profitability of cotton production

The results revealed that, gross return from cotton was Rs.129111.85. It was observed that farm business income was Rs.87894.05 and family labour income was Rs.65764.09 in cotton production. It was observed that net profit that was Rs.61974.09 and output- input ratio was 1.92 higher in cotton. It was observed that profitability of cotton was more, it means gross returns, farm business income, family labour income, net profit as well as output- input ratio were higher in Bt. cotton because gross yield of cotton were more.

Resource Productivity and Resource use efficiency

Linear and Cobb-Douglas production function were used and on the basis of goodness of fit (R^2), proper function was selected for further analysis of data. The independent variables used in the production function, correlation matrix for each crop was developed. Mostly, Cobb-Douglas production function was used whereas, the regression coefficient are the elasticity's of production and easy to determine the

returns to scale in production function.

Estimates of Cobb- Douglas Production function in Cotton Production

It was observed that regression coefficient of area under cotton was 0.247 which was positive and highly significant at 1 per cent level. It inferred that when one per cent increases in use of area under cotton over its geometric mean, it would lead to increase production of cotton by 0.247 per cent. Regression coefficients of human labour were 0.234 which was positive and significant at 5 per cent level. When use of human labour increased by one percent, it would lead to increase cotton production by 0.234 per cent. Similarly, regression coefficient of manure was 0.142 which was positive and significant at 1 per cent level. On the contrary, regression coefficients of bullock labour and nitrogen were 0.129 and 0.093, respectively which were negative and significant at 5 per cent level. Regression coefficients of seed, phosphorus, and potash and plant protection were positive but non-significant. Coefficient of multiple determinations was (R^2) 0.847, it meant that there was 84.70 percent effect of all independent variables together on cotton production. Return to scale was found to be 0.633 which indicated that in production of cotton increasing in return to scale were observed. With respect to resource productivity, marginal produce of area under Bt-cotton was 6.803 quintal; it meant that when increase in cotton area by one hectare over its geometric mean, there would be possibility to increase in cotton production by 6.803 quintals. Marginal produce of human labour was 0.098 quintal.

Production, Retention, Marketed Surplus and Marketing of Cotton through different channels

In general, production of cotton was 31.95 quintal/farm. Out of total production, proportion of retention for consumption of cotton was 0.78 per cent. The result revealed that in case of cotton, 12.20 quintals (38.15 per cent) of cotton was marketed through channel-I (Producer-Village Merchant-Ginner-Consumer), 19.51 quintals (61.07 per cent) cotton through channel-II (Producer-Ginner-Consumer). In respect of total production 8.69, 19.79 and 3.46 qt. with the proportionate share of 27.20, 61.97 and 10.83 per cent produce was distributed in three grades i.e. grade-I, II and III, respectively..

Marketing cost with respect to various items incurred by producer

The results revealed that marketing cost of cotton incurred by producer

was highest as Rs 82.00 per quintals (Grade II) in channel-II, while marketing cost of cotton, incurred by producer for Grade I, II and III was Rs.21.06, Rs.22.30 and Rs.19.50 and Rs. 82.00, Rs.84.00 and Rs. 80.00 per quintal in channel-I and channel-II, respectively. It was observed that the proportionate expenditure on labour charge was highest in Channel-II i.e. Rs.25.

Marketing cost with respect to various items incurred by village merchant

Result revealed that in regard to village merchant in channel-I of cotton, the cost of marketing was found to be Rs. 116, Rs. 120 and Rs. 114 for grade I, II and III per quintal in which proportionate share of transportation charge was highest as Rs. 52 per quintal with its share 44.82, 43.33, 45.61 per cent due to distant market followed by labour charge Rs. 40 per quintal with its share 34.48, 33.33 and 35.89 per cent, respectively. In regards to commission charge Rs.3 per quintal was given to the APMC by village merchant. The proportionate losses and interest on fixed assets for grade I, II and III in channel I were 1.73, 2.90, 1.54 per cent and 1.00, 1.28 and 1.07 per cent, respectively, weighing charge Rs. 10 per quintal was taken by APMC.

Marketing Cost of Cotton incurred by Ginner

The highest cost of marketing was found to be Rs. 911.50 per quintal for grade I and in grade II and III Rs. 908.40 and Rs. 887.02, respectively for in which proportionate share of commission charges and tax per quintal was highest as Rs.517.50, Rs. 512.60 and Rs. 496.00 for grade I, II and III, respectively with its proportionate share 56.77, 56.36 and 52.87 per cent followed by labour charges Rs.250 in each channel with the proportionate share of 27.42, 27.52 and 28.18, respectively.

In regard to ginner in channel-II of cotton marketing costs are highest cost of marketing was found to be Rs 915.28 per quintal for grade I and Rs.907.23 and 876.02 for grade II and III in which proportionate share of tax and commission charges was highest as Rs. 528.40, 512.40 and 486.00 for grade I, II and III per quintal, respectively.

Price spread in cottonmarketing

Regarding the cotton result revealed that price paid by consumer was the highest as Rs. 6100 per quintal for grade I in channel-I and Rs. 6200 per quintal in channel-II, followed by in both channels Rs. 6000 and Rs. 5800 in grade II and III,

respectively. In regard to channel-I of Bt cotton, highest price paid by the village merchant to producer was Rs.4510 (79.93 per cent) for grade I and Rs.4415, Rs.4330 i.e.73.58 and 74.65 per cent for grade II and III respectively. While cost incurred byproducer was only Rs. 21.06, Rs. 22.30 and Rs. 19.50 due to lower distance to selling place for grade I, II and III, respectively. Thus, net price received by the producer in channel-I was Rs. 4488.94 (73.58 per cent), Rs. 4392.70 (73.21 per cent), and Rs. 4310.50 (74.32 per cent) in the same order.

In regard to channel-II of cotton price paid by consumer was the highest as Rs. 6200 per quintal for grade I in channel-I, followed by Rs 6000, Rs. 5800 in grade II and III, respectively. In regard to channel-II, highest price paid by the ginner to Producer was Rs. 4720 (77.38 per cent) for grade I, Rs. 4620 and Rs. 4520 i.e. 77.00 and 77.93 per cent for grade II and III, respectively.

The total marketing cost involved was higher in channel I compared to channel II was Rs. 1048.56 (17.19 per cent), Rs. 1050.70 (17.51 per cent) and Rs.1020.52 (17.01per cent) thus the total marketing margin involved in marketing of cotton in channel I was Rs. 562.50, Rs. 616.60 and Rs. 468.98 i.e. 9.22, 10.19 and 7.82 per cent, respectively. The total marketing cost involved in channel II was Rs. 997.28 (16.08 per cent), Rs. 991.23 (16.52 per cent) and Rs. 956.20 (16.49 per cent).

Producer's share in consumer's rupee was highest in channel II as 76.55 per cent for grade-III followed by 75.60 per cent for grade-II and 74.81 per cent in grade-I. As we moved from channel-II to channel-I producer's share in consumer's rupee was decreased from grade-I, then grade-III and grade-II.

Constraints and suggestions of cotton growers

Cotton growers are facing the problems in production and marketing of cotton. In order to solve problems, the opinion of the sample farmers of both the categories in the form of their suggestions must be considered for the solution of the problems. The problems and suggestions were arranged in the form of frequency and percentage and major problems and suggestion were discussed as follows.

Constraints of cotton growers

The result revealed that, major problem face by cotton growers is Non availability of quality cotton seed is about 85 per cent, stands in rank first , followed

by Attack of pest and diseases was next major problem which was expressed by 72 per cent by cotton growers. Loss due to uneven climate and Non-availability of labour and higher wages was next major problem which was expressed by 55 and 68 per cent, respectively. Non-availability of special storage structures was calculated at 45 per cent, problem face by the cotton grower during picking of cotton picking of cotton was seen to be at 54 per cent.

Suggestions of cotton growers

It was observed that, 82 per cent of the cotton growers suggested to provide quality seed. Followed by farmer also opinion that Improved machinery from sowing to picking should be available at market with a affordable price to were 80 per cent. Similarly, Release resistant varieties for controlling pests and diseases by 72 per cent of cotton growers.. Suggestions of 62 per cent farmers were given that, there is need for proper and timely weather forecast so that farmers can take proper measures against natural calamities to save their crop And 65 per cent of cotton farmers also suggested that government should provide improved storage facilities to store cotton until they get proper price for their produce. Whereas, 55 per cent, farmers opinioned that Rate of fertilizer should be minimized by giving government subsidies. Cotton farmers who suggested for provision of market information through mass media were 45 per cent.

CONCLUSIONS

The following conclusions are drawn from the present study:

1. The average age of farmers were seen to be of cotton farmers was 45.67 years.
2. The average family size cotton growers were seen to be 5.94.
3. Per hectare cost of cultivation of cotton was ₹ 140824.
4. The share of Cost-A and Cost-B in Cost-C of cotton production was 61.39 per cent and 94.36 per cent.
5. Output-input ratio was 1.92 in case of cotton production.
7. Per quintal cost of production of cotton was ₹ 2439.53.
8. Net profit of cotton grower is 61974.09.
9. Price paid by consumer was the highest as Rs. 6200 per quintal for grade I in channel-I

POLICY IMPLICATIONS

In order to achieve a more production with proper marketing channels as to get more profit by cotton grower, some of the following policy implications based on present study are made.

1. Agricultural universities should arrange training at village level for cotton growers to understand the balanced and judicious use of their scare input like manures and costly input like fertilizers.
2. Cooperative society should provide seed, fertilizer and pesticides at cheaper cost and at time.
3. Government should provide improved storage facilities to store cotton until they get proper price for their produce.
4. Area of cotton can increase because of higher profitability.

*Thesis
Abstract*



ABSTRACT

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Degree	: M.Sc. (Agri.)
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Title of Dissertation	: “Production of Cotton in Parbhani district of Maharashtra”

INTRODUCTION

Cotton, a plant of the Malvaceous family produces fibers that can be woven into cloth. It has been valued since antiquity and its cultivation was an important factor stimulating European colonialism in regions of Asia, Africa, and the Americas; it is still a major trade commodity. Cotton is cultivated across the world in about 80 countries in an average area of 329.50 lakh hectare with 1482.90 lakh bales (170 kg each) of production with productivity of 765 kg lint per hectare in the year 2017-18. India is self -sufficient in cotton production, however, the average productivity is 522 kg per ha against the Worlds average of 765kg per hectare in the year 2017-18. Multi stage sampling design was adopted for selection of district, tehsils, villages, as well as producer farmer of cotton. Parbhani district was purposively selected on the basis of area under the Bt-cotton

production. Thus, from one village, nine farmers were selected with equal distribution. Thus total 90 farmers of cotton were selected for present study.

The results revealed that the age of cotton farmer was 45.67 years, with standard deviation of 7.44. Education level of cotton farmer was 1.87 scores; Family size was 5.94 in numbers. Occupation level of cotton farmer was 1.52 scores. It was observed that land holding was 2.83 hectares. The milch animal was 1.44 in numbers. In regard to investment, the commonly used asset was Rs.26580. Similarly investment on irrigation structure was Rs.169161.96. A gross cropped area was 3.91 hectares was observed that in *kharif*. While in *rabi* season, the highest area under *rabi* Jowar which was 9.72 per cent. The net sown area on farm was 2.51 hectares and double cropped area was 1.40 hectares. Cropping intensity was found to be 155.77 per cent. Gross return from cotton was Rs.129111.85. It was observed that farm business income was Rs.87894.05 and family labour income was Rs.65764.09 in cotton production. It was observed that net profit was Rs.61974.09 and output- input ratio was 1.92 higher in cotton.

The major problem faced by cotton growers Non availability of quality cotton seed is about 85 per cent, followed by Attack of pest and diseases was next major problem which was expressed by 72 per cent by cotton growers. Loss due to uneven climate and Non-availability of labour and higher wages was next major problem which was expressed by 55 and 68 per cent, respectively.



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Appendix



APPENDIX I

TITLE: ECONOMICS OF PRODUCTION OF COTTON IN PARABHANI DISTRICT

SCHEDULE-I

1) Socio economic status of Bt-Cotton grower:

1.	Name of farmer :	
2.	Village :	
3.	Taluka :	
4.	Age in year :	
5.	Educational level : Illiterate/Primary/High School/Higher Secondary/College level	
6.	Family size (No.):	
7.	Occupation level: Agriculture/Buissiness/Service	
8.	Land holding (ha):	
	Uncultivated land (ha)	
	Irrigated land (ha)	
	Rain fed land (ha)	
9.	Land revenue	
10.	Soil type: Light /Medium/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	Number	age	Present value (Rs)
i.	Bullock pair			
ii.	Cow			
iii.	Buffalo			
iv.	Goat			
v.	Sheep			
vi.	Other			
	Total			

4) Machinery:

Sr. No	Assets	Financial Liability			Number/Qty	Age	Present value (Rs)
		Own	Private	Govt.			
i.	Tractor						
ii.	Thresher						
iii.	Other						
	Total						

5) Irrigation Structure:

Sr.no	Assets	Number/Qty.	Age	Present value (Rs)
i.	Well /tube well/left irrigation			
ii.	Electric motor			
iii.	Shed for electric motor			
iv.	Pipeline(length)			
v.				
vi.				
vii.				
	Total			

6) Commonly used assets:

Sr.N o.	Assets	No./Qty.	Age	Present Value(Rs.)
A.	Implements			
i.	Plough a)Wooden Plough b)Iron plough			
ii.	Harrow			
iii.	Seed drill			
iv.	Hoe			
v.	Bullock cart			
vi.	Sprayer : a)Hand sprayer b)Power sprayer			
vii.	Hand tools			
viii.	Weeding hooks			
ix.	Kudali			
x.	Pickaxe			
	Total			

7) Building:

Sr. No.	Type	Number	Construction year	Present value (Rs.)
1.	Residential			
2.	Farm house			
3.	Cattle byre			

8) Operation wise Labour Requirement in Cotton crop:

Variety:

Area.....ha

period of crop

Sr. No.	Operation	Number	Human Labour				Bullock Pair (days)	Machine power hrs.
			HM Hired male	HF Hired female	FM Family male	FF Family female		
1	Ploughing							
2	Clod crushing							
3	Harrowing							
4	Stubble collection							
5	Application of Manure							
6	Sowing							
7	Basal dose of Fertilizer							
8	Irrigation							
9	Application of fertilizers							
1.	1)							
2.	2)							
10	Intercultural Operation							
	a) Hoeing							
	b) Weeding							
11	Spraying of :							
	Pesticide							
	Fungicide							
	Insecticide							
12	Harvesting							
	Total							

Rate of Labour:

Hired Male/day:

Bullock Pair/day:

Hired Female /day:

Machinery/hour:

9) Use of physical inputs in Cotton Crop:

Sr. No.	Particulars	Units	Qty.	Rate/Unit	Value (RS.)
1.	Seed	Kg			

2.	Manures	Qtl.			
3.	Type of Fertilizers	Bag			
i)	10:26:26				
ii)	15:15:15				
iii)	Urea				
iv)	DAP				
v)	SSP				
vi)	MOP				
vii)	24:24				
viii)	20:20:0				
ix)					
4.	Plant protection	Kg/lit.			
	Insecticides				
a)					
b)					
c)					
d)					
	Pesticides	Kg/lit			
a)					
b)					
c)					
d)					

10) Yield of Cotton crop:

Sr. no.	Particulars	Qty.	Rate/Qtl.	Value (Rs)
i.	Main produce			
ii.	By produce			
	Total			

11) Intercrop taken in Cotton Crop:

Sr. No.	Particular	Qty.	Rate	Value (Rs)
i)				
ii)				
iii)				
iv)				
v)				
vii)				

Schedule-II

a) Cost of Marketing Incurred By Producer:

b) Farm to Market:

Sr. no	Items of cost	Channel I	Channel II	Channel III
1.	Loading charge			
2.	Transport charge			
3.	Unloading charge			
4.	Weighing charge			
5.	Commission charge			
6.	Market fees			
	Total			

c) Cost of Marketing Incurred By Producer cum Village Merchant :

Sr no.	Item of Cost	Amount (Rs/qtl)
1.	Labour Charge	
2.	License Charge	
3.	Weighing Charge	
4.	Commission Charge	
5.	Shop Tax	
6.	Electric Charge	
7.	Storage Charge	
8.	Transport Charge	
9.	Communication Charge	
10.	Depreciation , Repair of fixed Assets	
11.	Interest on fixed Assets	
12.	Losses	
	Total	

d) Cost of Marketing incurred by Ginner :

Sr no.	Item of Cost	Amount (Rs/qtl)
1.	Labour Charge	
2.	License Charge	
3.	Weighing Charge	
4.	Commission Charge	

5.	Shop Tax	
6.	Electric Charge	
7.	Storage Charge	
8.	Transport Charge	
9.	Communication Charge	
10.	Depreciation , Repair of fixed Assets	
11.	Interest on fixed Assets	
12.	Losses	
	Total	

e) Constraints of cotton grower

Sr. No.	Problems	Frequency	Per cent	Rank
1.	Unpredictable Price Fluctuations			
2.	Specialized market are not unavailable at village level			
3.	Non availability of quality cotton seed			
4.	Loss due to uneven climate			
5.	Non-availability of labour and higher wages			
6.	Poor storage structures			
7.	Picking of cotton			
8.	Attack of pest and diseases			
9.	Lack of Market information			
10.	Low transport facilities			

f) Suggestions of cotton growers

Sr. No.	Suggestions	Frequency	Percent	Rank
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1.	Price support facility			
2.	Contract farming should be done			
3.	Increase availability of quality seed			
4.	Proper and timely weather forecast done through mass media			
5.	Availability of improved storage facility			
6.	Rate of fertilizer should be minimized by giving government subsidies			
7.	Release resistant varieties for controlling pests and diseases			
8.	Market information through mass media			
9.	Improved machinery from sowing to picking should be available at market with affordable price to farmer			

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