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# Economic Assessment of Sustainable Cotton Production in Maharashtra, India

**A. D. Dhunde [a*], V. G. Naik [a], D. B. Malave [a], J. R. Kadam [b], J. S. Dhekale [a], S. R. Torane [a] and C. Sundaramoorthy [c]**

*[a] Department of Agricultural Economics, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.*
*[b] Department of Extension Education, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.*
*[c] ICAR- Central Institute for Research on Cotton Technology, Mumbai, Maharashtra, India.*

***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

Cotton, the king of fibers is often quoted as 'White Gold' because of its higher commercial values. It is a primary raw material in the textile industries. Cotton, cotton yarn, cotton fabrics and garments have substantial demand in the global market. Cotton is the most important fibre crop of India playing a dominant role in its agrarian and industrial economy. In the present study efforts have been made to study the cost, returns, profitability of organic and conventional cotton. The primary data required for the study were collected during year 2021-22 from 320 cotton growers of Maharashtra. Simple statistical tools like averages and percentages were used in analysing the collected data and standard cost concepts was used for analysis. The result of the study examined that, the total cost of production (cost 'C') of cotton was worked out to Rs. 87633 and Rs. 72683 in conventional irrigated and conventional rainfed cotton cultivation, respectively, the per hectare

**Corresponding author;*

conventional rainfed cotton production was worked out to be 13.18 qtls. The per hectare conventional irrigated cotton production was worked out to be 20.95 qtls. The benefit-cost ratio was estimated to 2.09 and 1.77 for irrigated and rainfed respectively, This indicated that, organic irrigated cotton production was more profitable than organic rainfed cotton. Organic cotton farming promises to be a more sustainable form of agriculture that is aimed at producing food in a more environmentally friendly, economically viable and socially just way. Organic methods also have wider social and environmental benefits that come from the use of sustainable methods.

*Keywords: Organic cotton; profitability; sustainability; Maharashtra.*

## 1. INTRODUCTION

Cotton, the king of fibers is often quoted as 'White Gold' because of its higher commercial values. It is a primary raw material in the textile industries. Cotton, cotton yarn, cotton fabrics and garments have substantial demand in the global market. The cotton seed which remains after the cotton ginning is used to produce cotton seed oil, which, after refining, can be consumed by humans like any other vegetable oil [1,2]. The cotton seed meal that is left generally is fed to ruminant livestock. Cotton seed hulls can be added to dairy cattle rations for roughage.

Cotton is an important commercial crop of India with an area of about 120 lakh ha. Cotton was found to be one of the most stable crops of the country which competes with food and other crops for area (Aravind Kumar & Basvaraja 2012, Madhuri and Nagpure 2017). Among the states, Maharashtra is the most important state following a traditional cropping pattern dominated by cotton. It ranks first in cotton area and second in production [3-5].

According to Agricultural Census of India (2011), 61.5 per cent of total population depends upon agriculture. As mentioned above during pre-independence era and ancient time, agriculture was a system of harnessing nature for the sustenance of human beings. In post–independent era, green revolution changed the system of farming by introducing new hybrid seeds, establishment of fertilizer industry and the various schemes for irrigation and farm mechanization as well improved marketing facilities [6,7]. As a result, the food production was increased and country became self-sufficient which was earlier depending heavily on other countries for food grains. But at the same time, indiscriminate and excessive use of chemicals has put forth a question mark on sustainability of agriculture in the long run calling attention for sustainable agricultural production [8,9].

Maharashtra is the major cotton growing state and the main cotton growing districts of Maharashtra are Jalgaon, Dhule, Nandurbar, Akola, Amaravati, Nagpur, Yawtmal, Wardha, Buldana, Aurangabad, Nanded, Parbhani, Jalna and Nasik. In Maharashtra, area under cotton was 41.84 lakh ha with a production of 86 lakh bales of cotton, stands at the second position after Gujarat in the list of cotton production in India in 2021 (AICCIP, 2021). Maharashtra, the largest cotton growing state in the country, covers about 34 per cent of total cotton area and contributes to 17 per cent of the production. However, in comparison with most other states in 5-700 range, Maharashtra produces significantly low yields of 349 kg/ha, due to a variety of reason including pest attacks, poor soil quality, lack of irrigation among others. Major inter cropping system in the Maharashtra followed i) Cotton + Green gram / Black gram (1:1 row proportion) ii. Cotton + Sorghum + pigeon Pea + Sorghum (6:1:2:1 row proportion).

## 2. METHODOLOGY

The present study was based on primary data used to meet the specified objectives of the study. The primary data were collected from the selected organic and conventional farmers of the study area by personal interview during visit of the village. Simple statistical tools like averages and percentages were used in analysing the collected data.

### 2.1 Following Standard cost Concepts Were Used in Study

**i) Cost 'A'**

The items considered in Cost-A are as under

i. Value of hired human labour
ii. Value of manures (owned and purchased)

iii. Value of fertilizers, seed and other inputs
iv. Value of plant protection chemicals and growth regulators
v. Depreciation on implements and machinery
vi. Land revenue including other cesses
vii. Interest on working capital

**ii) Cost 'B'**

$$\text{Cost B} = \text{Cost A} + \text{Rental value of land} + \text{Intrest on fixed capital} + \text{Amortized cost of crop}$$

**iii) Cost 'C'**

$$\text{Cost C} = \text{Cost B} + \text{Imputed value of family labour} + \text{Supervision charges}$$

### 2.1.1 Valuation of the costs

The procedure adopted for valuation of cost of different items is given as under

**i) Hired human labour**

Actual amount paid to hired labour for performing different farm operations is considered as cost of hired human labour.

**ii) Other inputs**

Inputs purchased such as manures, fertilizers, pesticides, *etc.* are valued on the basis of actual market price. However, for inputs produced on farm, opportunity cost is considered.

**iii) Family human labour**

The cost of family human labour used is considered on the basis of wage rates paid to hired human labour.

**iv) Depreciation**

The depreciation on farm assets used in cotton production is worked out by using straight line method.

**v) Revenue and other cess**

Actual amount paid to revenue department on account of land revenue, Zillah Parishad cess plus other local cess is taken into consideration as land revenue and other cesses.

**vi) Interest on working capital**

It is charged at the rate of 13 per cent on all paid out expenses for a period of one year.

**vii) Rental value of owned land**

The rental value of the owned land is estimated by using following formula,

$$\text{Rental value of land} = \left(\frac{\text{Gross value of produce}}{6}\right) - \text{Land revenue}$$

In our study we have calculated on the basis of actual rent paid.

**viii) Supervision charges**

They are considered at the rate of 10 per cent of Cost A.

**ix) Benefit Cost Ratio**

As the cotton is annual crop the benefit cost ratio was calculated by using following formula.

$$\text{Benifit cost ratio} = \frac{\text{Gross return (₹)}}{\text{Total cost (₹)}}$$

**x) Per quintal cost of production**

Per quintal cost of production was worked out by using following formula,

$$\text{Per quintal cost of production} = \frac{\text{Total cost} - \text{Value of by produce}}{\text{Cotton yield in quintal}}$$

## 3. RESULTS AND DISCUSSION

### 3.1 Per Hectare Profitability of Irrigated vs Rainfed Growers of Organic Cotton

The item-wise per hectare cost of production of irrigated and rainfed organic cotton production was workout and presented in Table 3.A. It is observed that, total cost of production (cost 'C') of cotton was worked out to Rs. 71870 and Rs. 63458 in organic irrigated and rainfed cotton cultivation, respectively.

**Table 3. A: Per hectare profitability of Irrigated Vs Rainfed growers of Organic cotton (Rs/Ha)**

| Sr. No. | Particulars | Irrigated (N=35) | Rainfed (N=125) | t Stat | P Value |
|---|---|---|---|---|---|
| 1 | Hired Labour Male | 2503 (3.49) | 886 (1.40) | 2.612 | 0.0049 |
| | Female | 8756 (12.18) | 6952 (10.95) | 2.252 | < 0.0001 |
| | Total | 11259 (15.67) | 7838 (12.35) | 3.901 | < 0.0001 |
| 2 | Machinery charges | 2346 (3.26) | 2459 (3.88) | -0.744 | 0.785 |
| 3 | Bullock Charges | 5539 (7.71) | 5155 (8.12) | 3.351 | 0.9996 |
| 4 | Seed cost | 2251 (3.13) | 2581 (4.07) | -3.541 | 0.9634 |
| 5 | Manures | 7347 (10.22) | 4198 (6.62) | 5.817 | < 0.0001 |
| 6 | Traditional Fertilizers | 2994 (4.17) | 3648 (5.75) | -4.736 | 0.0388 |
| 7 | Herbicides | 0 (0.00) | 0 (0.00) | | 0.9088 |
| 8 | Insecticides | 1526 (2.12) | 1604 (2.53) | -0.495 | 0.6548 |
| 9 | Irrigation charges | 885 (1.23) | 571 (0.89) | 2.082 | < 0.0001 |
| | **Input cost** | **34148** (47.51) | **28054** (44.21) | | |
| 10 | Land revenue and taxes | 147 (0.21) | 105 (0.17) | 3.877 | |
| 11 | Depreciation cost | 1206 (1.68) | 407 (0.64) | 14.681 | < 0.0001 |
| 12 | Interest on working capital (@ 6% for 6 Months) | 1024 (1.42) | 842 (1.33) | | |
| | **Cost "A"** | **36526** (50.82) | **29408** (46.35) | | |
| 13 | Rental value of land | 17756 (24.71) | 10000 (15.76) | 2.665 | 0.0090 |
| | **Cost " B"** | **54282** (75.53) | **39408** (62.11) | | |
| 14 | Family labour Male | 5974 (8.31) | 6501 (10.24) | -1.1935 | 0.0004 |
| | Female | 8200 (11.41) | 14744 (23.23) | -2.874 | 0.0001 |
| | Total | 14174 (19.72) | 21245 (33.48) | -2.515 | < 0.0001 |
| 15 | supervision charges (10% of input cost) | 3415 (4.75) | 2805 (4.42) | | |
| | **Cost- "C"** | **71870** (100.00) | **63458** (100.00) | | |
| 16 | Yield (qtl/ha) | 16.06 | 12.20 | 9.7456 | < 0.0001 |
| 17 | Average price (Rs/qtl) | 9347.86 | 9183.36 | 1.386 | 0.1997 |
| 18 | Gross return | 150165 | 112057 | | |
| 19 | **Net return@ cost C** | **78295** | **48599** | | |
| 20 | Per quintal cost @ cost C | 4473.97 | 5200.54 | | |
| 21 | **BC ratio @ Cost C** | **2.09** | **1.77** | | |

*(Figure in parenthesis indicate percentage to total cost)*

In case of the organic irrigated cotton growers, out of the total cost of production, the cost was found to be maximum for rental value of land (24.71%) which was followed by total family labours (19.72%), total hired human labour days (15.67%), manures (10.22%), bullock charges (7.71%), and supervision charges (4.75%) in organic irrigated cotton production. Similarly, it was also found that, out of the total cost, the input cost, cost 'A' and cost 'B' were comprising 47.51 per cent, 50.82 per cent, 75.53 per cent respectively. It was revealed from the Table 3. A that, the per hectare organic irrigated cotton production was worked out to be 16.06 qtls. The per hectare gross return obtained from organic irrigated cotton production was Rs. 150165. The net profit at total cost for organic irrigated cotton production were worked out to be Rs. 78295

However, the benefit-cost ratio was estimated to 2.09. This indicated that, organic irrigated cotton production was more profitable than organic rainfed cotton in the study area.

In case of the organic rainfed cotton growers, out of the total cost of production, the cost was found to be maximum for total family labours (33.48%) which was followed by rental value of land (15.76%), total hired human labour days (12.35%), bullock charges (8.12%), traditional fertilizers (5.75%) and manures (6.62%).

Similarly, it was also found that, out of the total cost, the input cost, cost 'A' and cost 'B' were comprising 44.21 per cent, 46.35 per cent, 62.11 per cent respectively. It was revealed from the Table 3.A that, the per hectare organic rainfed cotton production was worked out to be 12.20 qtls. The per hectare gross return obtained from organic rainfed cotton production was Rs. 112057. The net profit at total cost for organic rainfed cotton production were worked out to be Rs. 48599.

However, the benefit-cost ratio on was estimated to 1.77. This indicated that, organic rainfed cotton production was profitable in the study area.

There are some inputs whose reduction has substantially reduced the cost of input in case of rainfed cotton by 18 per cent. Out of 18 per cent reduction in total input cost of rainfed cotton farming 56 per cent is contributed by reduction in hired labour cost, followed by price of manure 52 per cent. The reduction in hired labour cost can be attributed to the fact that in rainfed organic growers' whole family of farmers were involved in farm activities.

Thus, it can be concluded that both organic rainfed and irrigated cotton production is profitable in study area but profitability of organic irrigated cotton production is much more higher than that of organic rainfed cotton production.

### 3.2 Per Hectare Profitability of Irrigated Vs Rainfed Growers of Conventional Cotton

The item-wise per hectare cost of production of conventional cotton was worked out and presented in Table 3.B.

It was observed from the Table 3.B that, total cost of production (cost 'C') of cotton was worked out to Rs. 87633 and Rs. 72683 in conventional irrigated and conventional rainfed cotton cultivation, respectively. In case of the conventional irrigated cotton growers, out of the total cost of production, the cost was found to be maximum for total hired human labour days (20.38%) which was followed by, rental value of land (20.26%), total family labours (9.43%), manures (9.40%), cost of fertilizers (7.33%), bullock charges (7.33%), and supervision charges (6.08%) in conventional irrigated cotton production.

Similarly, it was also found that, out of the total cost, the input cost, cost 'A' and cost 'B' were comprising 60.77 per cent, 64.24 per cent, 84.50 per cent respectively. It was revealed from the Table 3. B that, the per hectare conventional irrigated cotton production was worked out to be 20.95 qtls. The per hectare gross return obtained from conventional irrigated cotton production was Rs. 169562. The net profit at total cost for conventional irrigated cotton production were worked out to be Rs. 81969. However, The benefit-cost ratio on was estimated to 1.93. This indicated that, conventional irrigated cotton production was more profitable than conventional rainfed cotton in the study area.

In case of the conventional rainfed cotton growers, out of the total cost of production, the cost was found to be maximum for total hired human labour days (16.93%) which was followed by total family labours (15.91%), rental value of land (13.76%), cost of fertilizers (9.74%), bullock charges (8.83%), manures (7.04%), and insecticide charges (6.66%) in conventional rainfed cotton production. Similarly, it was also

**Table 3. B: Per hectare profitability of Irrigated Vs Rainfed growers of Conventional cotton (Rs/Ha)**

| Sr. No. | Particulars | Irrigated (N=45) | Rainfed (N=115) | t stat | P Value |
|---|---|---|---|---|---|
| 1 | Hired Labour Male | 1658 | 2353 | -2.888 | 0.0049 |
| | | (1.89) | (3.24) | | |
| | Female | 16200 | 9949 | 6.945 | < 0.0001 |
| | | (18.49) | (13.69) | | |
| | Total | 17858 | 12302 | 5.109 | < 0.0001 |
| | | (20.38) | (16.93) | | |
| 2 | Machinery charges | 4155 | 4076 | 0.274 | 0.785 |
| | | (4.74) | (5.61) | | |
| 3 | Bullock Charges | 6421 | 6421 | 0.0004 | 0.9996 |
| | | (7.33) | (8.83) | | |
| 4 | Seed cost | 3200 | 3206 | -0.046 | 0.9634 |
| | | (3.65) | (4.41) | | |
| 5 | Manures | 8241 | 5114 | 8.750 | < 0.0001 |
| | | (9.40) | (7.04) | | |
| 6 | Fertilizers | 6423 | 7080 | -2.095 | 0.0388 |
| | | (7.33) | (9.74) | | |
| 7 | Herbicides | 1074 | 1106 | -0.116 | 0.9088 |
| | | (1.23) | (1.52) | | |
| 8 | Insecticides | 4991 | 4843 | 0.449 | 0.6548 |
| | | (5.70) | (6.66) | | |
| 9 | Irrigation charges | 882 | 147 | 14.106 | < 0.0001 |
| | | (1.02) | (0.20) | | |
| | **Input cost** | **53245** | **44295** | | |
| | | (60.77) | (60.94) | | |
| 10 | Land revenue and taxes | 150 | 70 | 65535 | |
| | | (0.17) | (0.10) | | |
| 11 | Depreciation cost | 1293 | 572 | 8.616 | < 0.0001 |
| | | (1.48) | (0.79) | | |
| 12 | Interest on working capital | 1597 | 1427 | | |
| | (@ 6% for 6 Months) | (1.82) | (1.96) | | |
| | **Cost "A"** | **56285** | **46364** | | |
| | | (64.24) | (63.79) | | |
| 13 | Rental value of land | 17756 | 10000 | 2.686 | 0.0090 |
| | | (20.26) | (13.76) | | |
| | **Cost " B"** | **74041** | **56364** | | |
| | | (84.50) | (77.55) | | |
| 14 | Family labour Male | 5007 | 6726 | -3.605 | 0.0004 |
| | | (5.71) | (9.25) | | |
| | Female | 3261 | 4837 | -3.990 | 0.0001 |
| | | (3.72) | (6.66) | | |
| | Total | 8268 | 11563 | -4.296 | < 0.0001 |
| | | (9.43) | (15.91) | | |
| 15 | supervision charges (10% of | 5324 | 4756 | | |
| | input cost) | (6.08) | (6.54) | | |
| | **Cost- "C"** | **87633** | **72683** | | |
| | | (100.00) | (100.00) | | |
| 16 | Yield (qtl/ha) | 20.95 | 13.18 | 13.050 | < 0.0001 |
| 17 | Average price (Rs/qtl) | 8095.56 | 8176.52 | -1.291 | 0.1997 |
| 18 | Gross return | 169562 | 125245 | | |
| 19 | **Net return@ cost C** | **81969** | **35084** | | |
| 20 | Per quintal cost @ cost C | 4183 | 5515 | | |
| 21 | **BC ratio @ Cost C** | **1.93** | **1.48** | | |

*(Figure in parenthesis indicate percentage to total cost)*

found that, out of the total cost, the input cost, cost 'A' and cost 'B' were comprising 60.94 per cent, 63.79 per cent, 77.55 per cent respectively. It was revealed from the Table 3.B that, the per hectare conventional rainfed cotton production was worked out to be 13.18 qtls. The per hectare gross return obtained from conventional rainfed cotton production was Rs. 125245. The net profit at total cost for conventional rainfed cotton production were worked out to be Rs. 35084. However, the benefit-cost ratio on was estimated to 1.48.

These are the input whose reduction has substantially reduced the cost of input in case of rainfed cotton by 17 per cent. Out of 17 per cent reduction in total input cost of rainfed cotton farming 70 per cent is contributed by reduction in hired labour cost, followed by price of manure 35 per cent and irrigation 8 per cent. This indicated that, conventional rainfed cotton production was profitable in the study area.

## 4. CONCLUSIONS

The total cost of production (cost 'C') of cotton was worked out to Rs. 87633 and Rs. 72683 in conventional irrigated and conventional rainfed cotton cultivation, respectively, the per hectare conventional rainfed cotton production was worked out to be 13.18 qtls.. The per hectare conventional irrigated cotton production was worked out to be 20.95 qtls. The benefit-cost ratio was estimated to 2.09 and 1.77 for irrigated and rainfed respectively, This indicated that, organic irrigated cotton production was more profitable than organic rainfed cotton. There is need to developed non-price and price policy recommendations for cotton growers which ensure remunerative prices and higher farm income.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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