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National Academy of Agricultural Science (NAAS) Rating : 3. 03

To Study the Input-Output Relationship and Resource use Efficiency as Well as Profitability of Bt-Cotton vis-à-vis NHH-44

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ABSTRACT: *The improved situation regarding Bt Cotton made this investigation to undertake the present study "To study the input-output relationship and resource use efficiency as well as profitability of Bt-cotton of Vis-a Vis NHH-44 cotton", with major objectives as to study the socio-economic condition of cotton growers, to work out the cost and returns of cotton, to analyze the input use efficiency and to find out the constraints faced by cotton growers. For this study four stage sampling technique was adopted. Parbhani and Nanded districts of Marathawada region were selected because of maximum area under cotton. From these districts two tahsils viz, pathri from Parbhani district and Naygaon from Nanded district were selected. Eight villages were selected and from these 180 farmers that is 90 each for cotton NHH-44 and Bt-cotton were randomly selected for the study .These farmers were grouped into three categories on the basis of their land holding analysis was carried out by adapting suitable analytical tools. The per hectare total cost of cultivation was worked out to be Rs. 18196.86 and Rs. 19327.03 in respect of cotton NHH-44 and Bt-cotton respectively. The per hectare yield obtained fromNHH-44 was more i.e.11.99 qtls with input with input output ratio of 1; 1.40 and 1:1.13 respectively. Among the different constraints posed by the cotton growers were high seed cost of Bt-cotton problem of price and lack of knowledge about integrated pest management. Study suggested that the seed price of Bt-cotton which was Rs. 1600 was more and hence if should be reduced even though the yield as well as gross returns from NHh-44 were to be more as comp aired to Bt-cotton, but the technology (i.e. genetic engineering) used is very promising and could be useful for reducing the pesticide use and minimizing the bollworm attack. The gene used should be spliced into a stable high yielding variety and proper knowledge regarding recommended packaging practice should be disseminated to the farmers.*

Keywords: *Yield, returns economics profitability production function analysis, constraints etc.*

INTRODUCTION

The use of cotton as a source of textile extends far into the past, thousands of years before the birth of Christ. Documentation establishes that the cotton fibre was being produced in the Indus valley around 3000 Bc India later became the first important exporter of the finished products. Grithasamad, a Vedic rishi, survived some 20,000 years ago in a village called Kalambhi in the present Yavatmal district in Maharashtra State. This village has witnessed world's first successful researched cultivation of cotton by Grithasamad. Cotton crop with history and prosperity, have a profound influence on men and matter as The use of cotton as a source of textile extends far into the past, thousands an industrial commodity of worldwide importance. Cotton continues to remain the backbone of rural economy, particularly in dry land areas. Besides, being a money spinner, it is also an employment generator.

All this is because of Green Revolution, which had saved the world from food and fibre crisis, during the late 1960s and early 1970s. During that period the global population was about 3.7 billion. At present world population is around 7 billion and it is anticipated that it may reach 10 billion by the year 2050. The majority of this population will be in developing, resource poor countries. The increased demand for food and fibre will therefore come from these countries. While the demand for food and fibre increases, the potential for meeting that demand decreases. The adverse factors are ecological and socioeconomic. The per capita availability of land and

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water steadily going down. Whereas, demand for food and fiber goes on increasing, which serves as an index to measure the standard of living of a country.

So to overcome such grim scenario of cotton, use of advanced technologies, such as biotechnology is applied to minimize the pesticide use and provide adequate crop protection for sustainable fibre production in the future.

With the development of transgenic plants one can tackle the problem at its source. Genetically engineered BT crops are spliced with the BT gene (cry 1 AC gene and npt II and and marker gene) BT (*i.e. Bacillus thuringienisis*) is a natural occurring soil bacterium, used as a spray in organic farming as a natural pesticide which does not affect the beneficial insects. Mosanto has engineered BT into crops, making them pest resistant and minimize pesticide use.

This improved situation regarding BT cotton made this investigation to undertake the present study, which will provide information about the comparative economics between BT cotton and existing stable NHH–44 variety of cotton.

METHODOLOGY

The study has been undertaken with the specific object to study the comparative economics of BT-Cotton *vis*-A-*vis* NHH-44 Cultivation in selected area of Parbhani and Nanded district.

Four stage sampling technique was adopted for selection of samples. At first stage the Nanded and Parbhani district was purposively selected because of higher area under cotton. At second stage one tahsil from each district was selected on basis of highest Area under cotton as compared to other talukas. At third stage from each tahsil a cluster of four villages were randomly selected:

Parbhani District

1. Pathri taluka

   Villages

   (i) Babultar (ii) Renapur

   (iii) Babhulgaon (iv) Gunj

Nanded District

2. Nayagaon taluka

   Villages

   (i) Narsi (ii) Ramtirat

   (iii) Kahala (iv) Khusnar

Selection of Cultivators

At fourth stage, a list of cultivators for each village was collected on the basis of the BT cotton and conventional cotton growers. Thus, twenty to twenty five cultivators were randomly selected from each village by random sampling method. The farmers were classified in three size groups (small, medium and large) on the basis of their land holding. For selection of farmers in groups, a list of cotton growers in all the selected villages was arranged in descending area of their total land holding, and from this list, 30 farmers each for small, medium and large groups were selected randomly (*i.e.* total of 180 farmers for both the varieties). Farmers up to 2 hectare were categories as small group, while from 2.01 to 4.00 ha. were medium group farmers and farmers above 4.00 ha. were grouped as large farmers. Thus the total effective sample size of cultivators was ninety for each of the variety (NHH-44 and BT-Cotton).

Collection of Data

The sample farmers were contacted personally and the objectives of the study were explained to them to ensure the co-operation. The information was collected from them in a specially designed schedule by survey method. The schedule covering details of size of holding, input utilization in physical terms, cost incurred on various items of expenditure and returns obtained from the crop was prepared. Data collected was pertained to the year 2002-2003. The data was analyzed by employing simple statistical techniques, *viz*., means, frequency, ratio percentage, etc. and according to nature of the data functional analysis was done to arrive at meaningful conclusions.

Cost Concepts

The total input costs of BT cotton and NHH-44, production have been distributed under three heads using the accepted cost concepts 'A', 'B' and 'C'.

Cost 'A'

Cost 'A' includes actual expenditure incurred in cash and kind i.e. the cost on account of hired human labour, hired plus owned bullock labour, seed value manure and fertilizers, interest on working capital, depreciation and repair of implement and land revenue, etc.

Cost 'B'

Cost 'B comprised of Cost 'A' + imputed rental value of land and interest on fixed capital.

Cost 'C'

Comprised of Cost 'B' + imputed value of family human labour. Thus the Cost 'C' presents the total cost of cultivation.

Evaluation of Inputs

Inputs are the factors of production, they refer to those expenses of cultivation that are incurred in the form of cash and kind. The items considered are as :

Physical inputs; Human labour, Bullock labour, Machine, Seed, Manures, Fertilizers, Plant protection, Depreciation on implement and machinery.

Monetary inputs ;Land revenue, Interest on working capital, Interest on fixed capital, Rental value of the land.

RESULTS

The present investigation entitled "To study the input-output relationship and resource use efficiency as well as profitability of Bt-cotton vis-à-vis NHH-44"was undertaken with a view to identify the comparative economics of Bt-cotton with the stable cotton variety NHH-44 and to study cost and returns ,input use efficiency as well as profitability in selected two districts. The study also attempted to analyze constraints faced by cotton growers .The data collected were analyzed and the results have been presented;

Table 1
Per hectare yield, returns and profitability

Sr. No.	*Particulars*	*Unit*	*Cotton (NHH-44)*	*BT-Cotton*
1.	*Yield*			
	(a) Main Produce	Qtl.	11.99	10.25
		Rs.	24039.95	20243.75
	(b) By Produce	Rs.	1610.00	1580.00
	Total Gross Returns	Rs.	25649.95	21823.75
2.	*Cost*			
	Cost 'A'	Rs.	12916.70	14,181.10
	Cost 'B'	Rs.	15826.03	17,076.43
	Cost 'C'	Rs.	18196.86	19,327.03
3.	*Returns*			
	(a) Returns on cost'A'	Rs.	12733.25	7692.65
	(b) Returns on cost'B'	Rs.	9823.92	4747.32
	(c) Returns on cost'C'	Rs.	7453.09	2496.72
4.	Cost Per Quintal	Rs.	1517.66	1,885.56
5.	Net profit per hectare	Rs.	7453.09	2496.72
6.	Input Output Ratio at			
	Cost – 'A'		1:1.98	1:1.53
	Cost – 'B'		1:1.62	1:1.28
	Cost – 'C'		1:1.40	1:1.13

It is observed from Table 1 that the total gross returns worked out for cotton (NHH-44) and BT-Cotton were Rs. 25649.95 and Rs.21823.75, respectively.

Among the costs, Cost-'A' for NHH-44 was Rs. 12916.7 and for BT-Cotton it was Rs. 14181.10, Cost-'B' worked out for NHH-44 was Rs. 15826.03 and for BT-Cotton it was Rs. 17076.43. It was interesting to note that Cost-'A' of BT-Cotton was higher than NHH-44; it was because of higher cost of seeds which as more than thrice in respect of cost of NHH-44 cotton seed. Reduction in cost was noted the insecticide use in BT-Cotton but still the reduced insecticide use doesn't minimize the Cost-'A' of BT-Cotton. Returns on Cost-'A' for NHH-44 were Rs. 12733.25 and for BT-Cotton they were 7692.65. Returns on Cost-'B' for NHH-44 were Rs. 9823.92 and for BT-Cotton they were 4747.32. Similarly, Cost-'C' for NHH-44 was Rs. 18196.86 and for BT-Cotton it was Rs. 19327.03 and return on Cost-C' were Rs. 7453.09 and 2496.72, respectively for NHH-44 and BT-Cotton. The per quintal cost of production of NHH-44 was Rs. 1517.66 and for BT-Cotton it was Rs. 1885.56.

It was very much surprising to know that the profit per hectare for NHH-44 was higher Rs. 7453.09 than the new BT-Cotton variety i.e. Rs. 2496.72. It was because of the higher seed cost which reduced the profit of BT-Cotton. Here one thing was clearly noted that BT-Cotton was being engineered to reduce the bollworm attack and thus maximize the profit, but it was attacked by sucking pest, which caused considerable damage to crop and also the variety of Mahyco, which was used for inducing the BT-gene was not the stable variety as that like NHH-44 or high yielding and hence resulted into less yield as compared to stable high yielding variety *i.e.* NHH-44. The input out ratio was also estimated. This implied that a rupee spent on cotton (NHH-44) production by the cotton grower generated output worth Rs. 1.40 and a rupee spent on BT-Cotton production by BT-Cotton grower generated output worth Rs. 1.13 at Cost-'C'. Similarly at Cost-'B' of cotton (NHH-44 and BT-Cotton it was Rs. 1.62 and Rs. 1.28, respectively) and for Cost-'A' it was 1.98 and 1.53 respectively. The input-output ratio was found higher in case of NHH-44 productions *i.e.* 1:1.40 than in BT-Cotton production which was 1.1:13.

Table 2
Production function analysis of cotton NHH-44.

Indepen-dent varia-ble	*Means*	*Unit*	*bi*	*SEbi*	*'t' value*	*MP*	*MVP*	*MC*	*Effi.= MVP/MC*
Area	1.7316	ha.	0.1957	0.0822	2.381*	78.11	54.87	1000	0.05
Hired male labour	2.3985	Man days	-0.0267	0.0170	-1.564	11.01	-53.09	50	-1.06
Hired female labour	4.3569	Man days	0.3391	0.1370	2.475*	78.02	95.18	30	3.17
Seed	3.4890	Kg	0.0569	0.0235	2.422*	1.39	896.87	400	2.24
Nitrogen	3.8602	Kg	0.1172	0.0963	1.2167	55.35	46.37	12	3.86
Phospho-rous	3.2395	Kg	0.0004	0.0165	0.0279	29.76	0.49	13	0.038

* indicates significant values at 5%.

Resource Use Efficiency of NHH-44

Results of resource use efficiency are presented in Table 2.

Cotton NHH-44

In the production function analysis of NHH-44, production was estimated by taking the significant variable such as area, hired male and female labour, seeds, nitrogen and phosphorous.

The coefficient of multiple determination $R^2 = 0.998$ was significant and contributed 99.8 per cent variation in the production of the NHH-44 crop, due to the selected variable. The variable such as area, hired female labour and seed were significantly contributed in cotton production of NHH-44.

The production of cotton increased by 0.19 per cent, 0.34 per cent and 0.05 per cent with one per cent increase at its geometric mean level in area, hired female labour and seed, keeping other variable at constant level. The MVP of area was 54.87 as against cost of Rs. 1000, MVP of hired female labour 95.18 as against cost of Rs. 30 and MVP of seeds. 896.87 as against cost of Rs. 400. thus the area, hired female labour and seed was efficiently used in the production of crop.

Resource Use Efficiency of BT-Cotton

BT-Cotton

In the production function analysis of BT-Cotton, production was estimated by taking the significant variable, such as area, hired male and female labour, seed, nitrogen and phosphorous.

The coefficient of multiple determination $R^2 = 0.995$ was significant and contributed 99.5 per cent variation in the production of the BT-Cotton crop, due to the selected variable. Out of the total selected independent variables the affect of use of seed and use of nitrogen was significant on production.

The production of BT-Cotton can be increased by 0.82 per cent and 0.08 per cent with one per cent increase at its geometric mean level in seeds and nitrogen, keeping other variable at constant level. The MVP of seed was 7740.56 as against cost of Rs. 1600 and MVP of nitrogen was 41.32 as against cost of Rs. 12. Thus, the efficiency of these items was more efficiently used in the production of the crop thereby implying scope to increase the use of these inputs for further increase in production of the crop. The other variables could not achieve the significance up to the level of 5 per cent. The efficiency of item of hired female labour was also very high, but it could not achieve the significant level.

Constraints Faced by the Cotton Growers

Data on constraints faced by the cotton growers are presented in Table 4.

Constraints faced by the NHH-44 and BT-cotton farmers are presented in table. 4.11. Indicates that 81.11 per cent of cotton farmers were of the opinion that, the cost of Bt-cotton seeds was very high, while 77 per cent farmers expressed the problem of price given. The other major problems posed were lack of knowledge about Integrated Pest Management (71.11

Table 3
Production function analysis of BT-Cotton

Independ-ent varia-ble	*Means*	*Unit*	*bi*	*SEbi*	*'t' value*	*MP*	*MVP*	*MC*	*Effi.= MVP/MC*
Area	7.7939	Ha.	-0.0757	0.0442	-1.712	4.59	-197.24	1000	-0.20
Hired male labour	1.4672	Man days	-0.0534	0.0368	-1.448	03.82	-167.03	50	-3.34
Hired female labour	3.9732	Man days	0.0559	0.0519	1.077	37.82	17.68	30	0.60
Seed	2.8337	Kg	0.8282	0.1865	4.439*	1.33	7440.56	1600	4.65
Nitrogen	3.5109	Kg	0.08513	0.0320	2.656*	24.62	41.32	12	3.44
Machin-ery	4.1123	Hours	0.2810	0.1447	1.9422	61.09	54.96	100	0.55

* indicates significant values at 5%.

Table 4
Constraints face by the cotton growers

Sr. No.	Particulars	Frequency (N = 90)
1.	Lack of finance	38 (42.22)
2.	Lack of technical knowledge	42 (46.66)
3.	Non-availability of women labour in time	58 (64.44)
4.	Improper grading practice	55 (61.11)
5.	Problem of price given to the farmers by federation and traders.	70 (77.77)
6.	Government delay in taking decision and payment of money	50 (50.55)
7.	Problem of selling cotton either to federation or traders	62 (68.88)
8.	Cost of BT- cotton seed	73 (81.11)
9.	Lack of knowledge for Integrated Pest Management	64 (71.11)
10.	Inadequate transport facilities	30 (33.33)

* Figures in parenthesis indicate percentage to the total respondents.

per cent) and problem due to delayed opening of cotton federation, which forced the farmers to sell their produce to the traders at low price. Non availability of women labour in time, improper grading practices and Governments delay in taking decisions and payment of money were also important problems posed by the selected farmers in the study area.

CONCLUSIONS

The following conclusions have been drawn from the findings,

1. Majority of cotton growers were educated only up to primary level and had agriculture as their main occupation.
2. The irrigated area was more with large size farmer than the small and medium size farmers. Exactly opposite situation was observed in case of follow land, *i.e.* it was less with the small farmers compared to medium and large farmers.
3. Cropping pattern study of small, medium, large farmers as well on overall basis clearly indicated the dominance of cotton cultivation over all other crops.
4. The cost per hectare calculated was more in BT-Cotton as compared to NHH-44 production.
5. Fertilizer use for BT-cotton and NHH-44 was less by 37.7, 19.02 and 35.80 NPK Kgs/ha then its recommended dose (100:50:50 NPK kg/ha.).
6. The manure use was comparatively low by 3.52 tones per hectare than recommended one (12 tones per hectare).
7. Seed cost per hectare was more in case of BT-Cotton, while plant protection cost was comparatively lower than NHH-44.

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