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Resource Use Efficiency of Bt Cotton in Hanumangarh District of Rajasthan

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ABSTRACT

An attempt has been made to examine the resource use efficiency of Bt cotton in Hanumangarh district of Rajasthan. The purposive random sampling method was used to select 60 farmers. Survey method was adopted to conduct the inquiry by personal interview with the help of interview schedule. The Cobb-Douglas production function was used for estimation of the resources use efficiency. The results revealed that the Marginal Value Product (MVP) to Marginal Factor Cost (MFC) ratio for human labour (1.44), machine labour (5.07), seed (12.76) and irrigation (1.88) were found to be underutilized, which implies the increased usage of these inputs add to the gross income from cultivation of Bt cotton. Hence, there is an ample potential of raising Bt cotton production through adoption of improved and new technologies and optimum utilization of resources like human labour, machine labour, seed, manure and fertilizer, plant protection chemical (PPC) and irrigation with better management practices.

Keywords: Bt cotton, Marginal value product, Marginal factor cost, Resource use efficiency.

INTRODUCTION

Cotton *(Gossypium spp.)* is a natural fibre of vegetable origin, like linen, jute or hemp and composed of cellulose. The cotton is a variety of plants of the genus Gossypium, belonging to the Malvacae family. It is an important fibre crop of global significance, which is, cultivated in tropical and sub-tropical regions of more than seventy countries across the world(Manjunath *et al,*2013). In India cotton the white gold and king of fibres, is an important commercial crop. Cotton plays a key role in the national economy in terms of both employment generation and foreign exchange earnings (Reddy *et al*, 2011). Rajasthan is one of the important states in terms of cotton cultivation. Being a major commercial crop, cotton occupies an important place in agricultural scenario of Rajasthan. It covered an area of about 4.71 lakh ha with the production of 15.60 lakh bales in 2016-17(Anonymous, 2018).

Resource use efficiency can be defined as the ability to derive maximum output per unit of resource. Resource allocation and productivity is an important aspect to increased agricultural production, which is associated with the management of the farmers, who employ these resources in production. Actual yield of Bt cotton differ significantly from potential yield and this has been attributed to low resource productivity. Farmers might use resources rationally but not at the economic optimal level. As the aim of every agribusiness firm is to maximize profit while minimizing cost, it is important to determine the efficiency of resource-use.

MATERIALS AND METHODS

Hanumangarh district of Rajasthan was selected purposively as this district covered highest area (34.15%) of Bt cotton to total area in the state in 2016-17. The district consists of seven blocks: namely, Hanumangarh, Tibbi, Sangaria, Pilibanga,

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Rawatsar, Bhadra and Nohar, out of which Hanumangarh block was considered for study purpose as this block cover highest area (28.15%) under Bt cotton in the district. A list of villages was prepared form the selected block and five village *viz.* Dablirathan, Pakkasaharana, Dholipal, Rodawaliand Nourangdesar were selected on the basis of maximum area of Bt cotton. Purposive random sampling method was used for selection of samples. A list of Bt cotton growers were prepared of these selected villages and further categorized into three size groups small (upto 2.0 ha), medium (2.01 to 4.0 ha) and large (above 4.0 ha). 20 farmers were selected randomly from each category. Thus, the total 60 farmers were considered for detail investigation to fulfill the stated objectives. Primary data collected from the selected respondents. Survey method was adopted to conduct the inquiry by personal interview with the help of interview schedule. The study was conducted during the year 2018-19.The Cobb-Douglas production function was used for estimation of the resources use efficiency of different sizes of Bt cotton growers. The Cobb Douglas production function was as under

$Y = a\ X_1^{b1}\ X_2^{b2}\ X_3^{b3}\ X_4^{b4}\ X_5^{b5}\ X_6^{b6}$

Where, Y=Gross income (in Rs)

a= Constant

X_1 =Expenses on human labour (in Rs)

X_2 =Expenses on machine labour (in Rs)

X_3 =Value of seed (in Rs)

X_4 =Value of manure and fertilizer (in Rs)

X_5 =Value of plant protection chemical(PPC)(in Rs)

X_6 =Irrigation charge (in Rs)

b_1-b_6 =Regression co-efficient of concerned variables

Marginal Value Product (MVP) in relation to Marginal Factor Costs (MFC)

To decide whether a particular input is used rationally or irrationally, its marginal value product (MVP) was computed.

The marginal value product was calculated at the geometric mean levels of variables by using the formula:

$$MVP_i^{th} \text{ resource} = b_i /_i$$

Where, = Geometric mean of the gross income

$_i$ = Geometric mean of i^{th} independent variable

b_i = The regression co-efficient of the i^{th}independent variable

In order to determine the efficiency of allocation of the resources or price efficiency, the value of the marginal product obtained by multiplying the marginal product by the price of the product was compared with its marginal cost. The criterion for determining optimality of resource use was as follows:

MVP/MFC > 1: Underutilization of resources

MVP/MFC = 1: Optimal use of resources

MVP/MFC < 1: Overutilization of resources.

RESULTS AND DISCUSSION

Resource use efficiency

The Cobb- Douglass production function choose gross income realized from Bt cotton output as dependent variable while expenditure made on human labour, machine labour, seed , manure and fertilizer, plant protection chemicals and irrigation as independent variables. The inputs included in function explained 92 per cent (overall) and 86 per cent (small farmers), 77 per cent (medium farmers), 95 per cent (large farmers) variation in gross income from Bt cotton as revealed by the coefficient of multiple determination (R^2), which indicated that the selected form of the production function was best fit (Table 1). The summation of regression coefficients was found to be less than one, which indicated decreasing returns to scale *i.e.* for each incremental use of all inputs. Simultaneously, farmers would get less than one unit of output for overall (0.98) and for small (0.90), medium (0.30) and large farmers (0.37).

Table 1.Factors affecting gross income in different size of farms.

Sr.No.	Particular	Small farmers (upto 2.0 ha)	Medium farmers (2.01 to 4.0 ha)	Large farmers (above 4.0 ha)	Overall
A	Regression coefficient (b_i) of				
1	Human labour (X_1)	-0.318 (0.217)	0.129 (0.248)	0.141* (0.054)	0.269* (0.118)
2	Machine labour(X_2)	0.493* (0.198)	0.127** (0.044)	-0.057 (0.058)	0.399** (0.082)
3	Seed (X_3)	0.517** (0.183)	0.274* (0.121)	0.189** (0.057)	0.379** (0.066)
4	Manure and fertilizer (X_4)	-0.031 (0.251)	-0.174 (0.109)	-0.015 (0.059)	-0.061 (0.048)
5	PPC (X_5)	-0.200 (0.086)	-0.119 (0.095)	-0.010 (0.014)	-0.025 (0.038)
6	Irrigation (X_6)	0.436** (0.134)	0.066 (0.180)	0.126* (0.055)	0.023 (0.137)
B	Constant (a)	2.101	4.141	4.184	1.237
C	Returns to scale (Σb_i)	0.897	0.304	0.374	0.983
D	Coefficient of multiple determination (R^2)	0.862	0.775	0.947	0.922

Figures in the parentheses indicate their respective standard errors.

* and ** shows level of significance at five and one per cent, respectively.

The estimated parameters of seed (0.517) and irrigation (0.436) were found to be significant at one per cent, while machine labour (0.493) co-efficient was significant at five per cent for small farmers. In medium farmers machine labour (0.127) was found to be significant at one per cent, while seed (0.274) co-efficient was significant at five per cent. Where as in the case of large farmers seed (0.189) was found to be significant at one per cent, while human labour (0.141) and irrigation (0.126) co-efficient were significant at five per cent level. In the case of overall level machine labour (0.399) and seed (0.379) were found to be significant at one per cent, while human labour (0.269) co-efficient was significant at five per cent level.

The co-efficient of human labour and machine labour were significant, which implies the increased usage of these inputs adds to the gross income. Since the Bt cotton crop was labour intensive and the operations such as ploughing, inter cultivation, manures application, hand weeding, spraying of plant protection chemicals and harvesting/picking which significantly contributes towards increased yield and thus the income. The other inputs such as seed and irrigation co-efficient were also significant and had positive impact on gross income.

MVP to MFC ratio

In the case of small farmers the MVP to MFC ratio for machine labour (6.60), seed (16.55) and irrigation (29.63) were found to be more than one indicating that these inputs were underutilized, still there is scope for higher utilization of these

Table 2.MVP to MFC ratio of selected variables under Bt cotton.

Sr. No.	Particular	Small farmers (upto 2.0 ha)	Medium farmers (2.01 to 4.0 ha)	Large farmers (above 4.0 ha)	Overall
1	Human labour (X_1)	-1.48	0.67	0.99	1.44
2	Machine labour(X_2)	6.60	1.78	-0.63	5.07
3	Seed (X_3)	16.55	9.27	6.45	12.76
4	Manure and fertilizer (X_4)	-0.39	-2.35	-0.24	-0.89
5	PPC (X_5)	-5.65	-3.44	-0.39	-0.94
6	Irrigation (X_6)	29.63	5.19	14.46	1.88

Note: MVP: - Marginal Value Product, MFC: - Marginal Factor Cost

inputs and which in turn would increase the gross income from Bt cotton (Table 2). This would help to maximize their profit in Bt cotton production. However, lower MVP to MFC ratio for human labour (-1.48), manure and fertilizer (-0.39) and PPC (-5.65), thus it were over utilized than the requirement, there is a need to reduce these inputs to optimize returns.

In the case of medium farmers the MVP to MFC ratio for machine labour (1.78), seed (9.27) and irrigation (5.19) was found to be more than one showed that these inputs were underutilized and there is potential for medium farmers to increase their profit by increasing the use of these inputs in Bt cotton crop. However higher ratio for seed indicated that additional usage of seed would bring more returns. MVP to MFC ratio of human labour (0.67),manure and fertilizer (-2.35) and PPC (-3.44) was found to be less than one showed that over utilization of these inputs, than need to decrease the use of that inputs.

Similar analysis for large farmers the MVP to MFC ratio for seed (6.45) and irrigation (14.46) were found to be more than one indicating that these inputs were underutilized, still there is scope for higher utilization of these inputs to increase gross income from Bt cotton. However, lower MVP to MFC ratio for human labour (0.99), machine labour (-0.63), manure and fertilizer (-0.24) and PPC (-0.39),thus it were over-utilized than the requirement, there is a need to reduce these inputs to optimize returns.

In the case of overall the MVP to MFC ratio for human labour (1.44), machine labour (5.07), seed (12.76) and irrigation (1.88) were found to be more than one indicating that these inputs were underutilized, which implies the increased usage of these inputs adds to the gross income from Bt cotton. The MVP to MFC ratio for manure and fertilizer (-0.89) and PPC (-0.94) was less than one showed that over utilization of these inputs, than need to decrease the use of that inputs to optimize returns.

CONCLUSION

It was concluded that the sum of regression co-efficient was 0.983, indicating decreasing returns to scale in the case of overall category. The ratio of MVP to MFC of human labour (1.44), machine labour (5.07), seed (12.76) and irrigation (1.88) was found to be greater than unity indicating that farmers have an opportunity to increase their profit by using more of these inputs in their fields. Human labour, machine labour, seed and irrigation were the major contributors to the Bt cotton output. This indicates the importance of these inputs in Bt cotton production. Therefore, timely supply of these quality inputs to the farmers must be ensured. There is an ample potentiality of raising Bt cotton production on farms through adoption of improved and new technologies along with optimum utilization of resources like human labour, machine labour, seed, manure and fertilizer, PPC and irrigation with better management practices.

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