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Resource Use Efficiency of Bt Cotton and Non-Bt Cotton in Haveri District of Karnataka

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Abstract

The study was conducted to ascertain the resource use efficiency of Bt cotton and non-Bt cotton in Haveri district of Karnataka. Cobb-Douglas production function analysis was used to calibrate the resource use efficiency. 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 was greater than one for seeds, organic manure, 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.

Keywords: Resource use efficiency, Bt cotton, non-Bt cotton.

1. Introduction

Cotton (*Gossypium* spp.) the Queen of fibers is multipurpose crop grown under various agro-climatic conditions. It is cultivated mainly for its lint which is the most sought textile fiber due to its inherent eco-friendly and comfort characters. Cotton is major supplier of raw material to textile industry. Cotton provides livelihood to over 60 million people through its cultivation, trade and industry. Cotton and textiles contribute nearly one third of India's annual export, thus bring valuable foreign exchange to the country.

Cotton plays an important role in generation of employment and foreign exchange. It provides raw material for 1500 mills, 4 million handlooms and 7 million power looms. In India, total area under cotton cultivation was 103.10 lakh ha in 2009-10. The production of cotton lint in India has been increasing at a steady pace from 80.62 lakh bales in 2002-03 to 305 lakh bales in 2009-10. In Karnataka Haveri district has the highest area under cotton (1,11,548 ha) followed by Dharwad (83,461 ha) and Mysore district (41,255 ha). Haveri with 1.43 lakh bales of production is a leading producer of cotton followed by Dharwad (1.03 lakh bales) and Gadag (0.82 lakh bales). The highest cotton lint yield is observed in Gulbarga (422 kg/ha) followed by Raichur (432 kg/ha) and Chitradurga (422 kg/ha). The varieties grown include DCH 32, Bunny, Kanaka, BG1, BG2 and Suvin. In the recent past, Bt cotton has emerged as a leading variety of the region. Cultivation of cotton requires several resources such as FYM, fertilizers, plant protection chemicals, seeds, labours etc. it is essential to know the contribution of each one of these to total output. Hence the present study has been undertaken with overall objective of empirical analysis of resource use efficiency in Bt and non Bt cotton cultivation.

2. Materials and Methods

The study was carried out in Haveri district of Karnataka as it has larger area under cotton cultivation. A multistage random sampling procedure was adopted for the selection of respondents. In first stage, Hirekerur taluk was selected for the study as the cultivation of Bt cotton and non-Bt cotton, respectively, was mostly concentrated in these taluk and in second stage 5 villages were selected randomly such as rattihalli, kod, battikoppa, bogavi and suttagtti. From each village, 10 respondents growing Bt cotton and 10 respondents growing Non-Bt cotton were selected thus making a total sample of 50 Bt cotton and Non-Bt cotton farmers each. For evaluating the specific objectives of the study, requisite primary data pertaining to the agricultural year 2011-12 were collected from the sampled farmers by personal interview method with the help of pre-tested and well-structured schedule. The data thus collected were processed using tabular analysis, multiple egression/ production function.

Cobb-Douglas production function was employed to study the resource use efficiency of Bt cotton-vis- non-Bt cotton. The estimated regression coefficients indicate the production elasticities. The general form of Cobb-Douglas production function used in the present study as follows,

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}\,X_4^{b4}\,X_5^{b5}X_6^{b6}\,e^u$$

Where, Y = Gross returns in rupees per acre, a = Intercept (efficiency) term, X_1 = Expenditure on seeds (Rs/acre), X_2 = Expenditure on FYM (Rs/ acre), X_3 = Human labour expenditure (Rs/ acre), X_4 = Bullock/machine labour expenditure (Rs/ acre), X_5 = Expenditure on Fertilizer (Rs/ acre), X_6 = Expenditure on PPC (Rs/ acre), e^u = Error term, bi's = Output elasticities of respective factor inputs (i=0,1,2,…,n) (n=6)

2.1 Allocative efficiency

Given the technology, allocative efficiency exists when resources are allocated within the farm according to market prices. To decide whether a particular input is used rationally or irrationally, its marginal value products were computed. If the marginal value product of an input just covers its acquisition cost it is said to be used efficiently.

Allocative efficiency= MVP/MFC

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 (MP) with the price of the product and was compared with its marginal cost. The criterion for determining optimality of resource use was,

MVP/MFC > 1 under utilization of resource

MVP/MFC = 1 optimal use of resource

MVP/MFC < 1 excess use of resources.

3. Results and Discussion

The estimates of the production functions were presented in Table 1. The variables included in the function explained 86 per cent and 67 per cent of the variation in the production of Bt and non-Bt cotton cultivation, respectively. The regression coefficients of seeds, human labour and fertilizers in Bt cotton cultivation; seeds and human labour in non-Bt cotton cultivation are significant indicating that increase on the use 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 results in reduction in gross returns. Hence, it is advisable to reduce application of plant protection chemicals.

Table 1: Production function estimates of Bt and non-Bt cotton cultivation.

Variables	**Regression co-efficients (elasticities)**			
	Bt cotton	**t-value**	**non-Bt cotton**	**t-value**
Intercept	0.32	0.88	1.50	1.01
seeds (Rs.)	0.58**	4.69	0.54**	4.96
FYM (Rs.)	0.09	1.89	0.12	1.58
Human labour (Rs.)	0.42**	4.28	0.39*	3.09

Machine/bullock labour (Rs.)	0.05	0.22	0.09	1.24
Fertilizer (Rs.)	0.17*	2.70	0.06	1.22
PPC (Rs.)	-0.02	-0.72	-0.08	-0.57
Adjusted R2	**0.86**		**0.67**	

Source: Primary data.

Note: ** and * indicate significance at 1 and 5 per cent levels, respectively.

Table 2 provides the details of allocative efficiency in Bt and Non Bt cotton cultivation. The ratio of marginal value product (MVP) to marginal factor cost (MFC) was computed for each of the factors of production to draw some inferences about the allocative efficiency (Table 2). The MVP to MFC ratio for Seeds, Organic manure, Human labour and machine labour was greater than one for both the Bt and non Bt cotton. It suggests that quantity of these resources was used less than optimum and there is further scope for increased use of these resources. Interestingly, the MVP to MFC ratio was negative for both Bt (-0.56) and non-Bt cotton (-0.73), which clearly indicated any further increase in use would reduce the yield. While in the case of chemical fertilizers, it was more than unity in Bt and less than unity in non-Bt cotton production. Allocative efficiency for fertilizers was less than one but greater than zero indicating that these resources are over used but are still in the rational region of the production.

4. Conclusion

The results of the estimated production functions reveal that seeds and human labour were the most important input to which gross return is highly responsive in both Bt and non-Bt cotton crop situations. On the other hand regression coefficient of plant protection chemical was negative indicating excessive use. All the factors were under (advantageously) utilized in both Bt and non Bt cotton excluding ppc and fertilizer. Allocative efficiency for plant protection chemicals was negative in both Bt cotton (-0.56) and non-Bt cotton (-0.73) cultivation implies the excessive utilization. Bt cotton seeds must be made available to farmers at reasonable prices to farmers to increase the area under Bt cotton. Farmers needs to be educated to reduce the use of plant protection chemicals in cotton since any further increase in the use of the above resource would lead to financial loss and environmental damage.

Table 2: Allocative efficiency in Bt and non-Bt cotton cultivation.

Sl. No.	**Input**	**Bt farmers**			**non-Bt farmers**		
		MVP	**MFC**	**MVP/MFC**	**MVP**	**MFC**	**MVP/MFC**
1	Seeds (Rs)	9.96	1	9.96	9.37	1	9.37

2	Organic manure (Rs)	4.50	1	4.50	5.69	1	5.69
3	Human labour (Rs)	3.36	1	3.36	2.27	1	2.27
4	Machine/bullock labour (Rs)	1.19	1	1.19	1.10	1	1.10
5	Fertilizers (Rs)	3.41	1	3.41	0.86	1	0.86
6	PP Chemicals (Rs)	-0.56	1	-0.56	-0.73	1	-0.73

Source: Primary data.

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