A Study on Farmers' Willingness to Pay for Bt Cotton Seed Brands in Andhra Pradesh

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ABSTRACT

Andhra Pradesh is the third largest cotton cultivating state in India. After introduction of genetically modified cotton (Bt cotton) in India, the state too adopted it in a big way. There were more than 30 popular Bt cotton brands in the state. Cotton farmers are getting economic benefit out of the genetically modified cotton in the state over the years. In this context, current study was aimed to measure farmers' willingness to pay for Bt cotton seed brands in the state. The study was conducted in Adilabad district of Andhra Pradesh during the year 2012-13. The results showed that net income from irrigated and rainfed cultivation were Rs.28,771 and Rs.16,823 per hectare respectively. Brahma, Mallika and Sudarshan were the major brands cultivated by the sample farmers in the study area. Majority of the farmers were highly satisfied by the fiber quality of Bt cotton brands and resistance to bollworms. Further, most of the farmers were loyal to the current brands (54 per cent) and 46 per cent were ready to switch from their brands. Nearly 70 per cent of the sample farmers were willing to pay more price for Bt cotton seed brands. Annual income of the farmers, irrigation availability, age of the farmers and area under cotton had a positive and also significant influence on willingness to pay more price to the Bt cotton seed by sample farmers.

Introduction

Andhra Pradesh is the third largest cotton cultivating state in India. After introduction of Bt cotton in the state, the area under cotton has largely been increased over the years from 2002. The area under cotton had more than doubled from 1.10 million hectares in 2001-02 to 2.40 million hectares in 2012-13 in the state. The production had also increased from 1.87 million bales to 7.35 million bales during the same period (Government of Andhra Pradesh, 2013). Demand for Bt cotton seeds has increased over the years among farmers due to nearly double the profit over non Bt cotton. This attracts more companies to get license from Mahyco-Monsanto Biotech Limited (MMBL) and produced their own Bt cotton brands. The price of Bt cotton seeds was Rs.1600 per 450 grams of seeds at the time of introduction. However, the South India Cotton Association and farmers groups had expressed concern

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over the price of Bt cotton. This concern gained popularity among various farmer organizations, which encouraged the state government of Andhra Pradesh to approach the Monopolies and Restrictive Trade Practices Commission (MRTPC), claiming that the price charged by MMBL was "exorbitant" and "unscientific" (Business Line, January 3, 2006). In their ruling, the MRTPC directed MMB to bring the trait fee in line with those in other countries. The government of Andhra Pradesh fixed a price ceiling of Rs.750 per packet of cotton seed and ordered other seed companies to abide the pricing structure. The other cotton growing states of India followed suit. The attitude of the rural consumers in India favors quality products and brands but brand pricing has to take into account both the income level and income flow of the consumers. There are consumers who can afford high priced brands, a group of rural consumers can not only afford, but also are also willing to buy, high priced brands (Agarwal, 2009). Independent studies claimed that the economic benefit was higher from Bt cotton seeds and farmers were willing to pay more than market price. Further, the difference of willingness to pay was also found between irrigated and rainfed farmers due to the difference in economic benefits. The willingness pay for per packet of Bt cotton varied from Rs.1362 in 2002-03, Rs.2594 in 2004-05 and Rs.1808 in 2006-07 (Sadashivappa & Qaim, 2009). The willingness to pay for any technology may be high before and initial period of introduction, but it may diminish after years. The varying trend on willingness to pay was reported in most of the studies. Hence, it is necessary to study the willingness to pay to the Bt cotton seeds by the farmers during recent years. In this context, it is necessary to study willingness to pay and factors influencing willingness to pay Bt cotton seeds in Andhara pradesh.

Hypothesis

H1: Farmers are not willing to pay more for Bt cotton seeds in Andhra Pradesh

H2: Farm size and irrigation are the major factors influencing willingness to pay for Bt cotton seeds

Objectives

1. To measure the willingness to pay for Bt cotton seeds in Andhra Pradesh
2. To study the factors influencing willingness to pay for Bt cotton seeds in Andhra Pradesh

Methodology

Data

Andhra Pradesh state was purposively selected for this study, as it occupied third position in both area and production of cotton among the states in India. Among the 23 districts of Andhra Pradesh, Adilabad district was selected for the study based on the largest area under Bt cotton. In the selected district, mandals were arranged in descending order based on area under cotton. From the list of mandals, two mandals were selected randomly viz., Tamsi and Jainath. Villages under the selected mandals were collected from the Assistant Director of Agriculture, Adilabad district. Villages were arranged in descending order based on the area under cotton cultivation. From the list of villages, five villages were randomly selected from each mandal, from each village, five irrigated and five rainfed farmers were selected through pre- stratified random sampling method. Thus, the total number of sample constituted to 100 with 50 irrigated and 50 rainfed farmers.

In order to fulfil the objectives of the study, primary data were collected from the sample respondents through personal interview method using a pre-tested structured interview schedule. Primary data on size of holding, source of irrigation, cropping pattern, credit availability, brand preference, brand switchover behaviour and willingness to pay for Bt cotton seed brands were collected from the farmers. The study was conducted during the agricultural year 2012-2013 and the primary data were collected from the sample respondents from January to April of 2013.

Willingness to pay

Farmers' willingness to pay (WTP) for Bt cotton seed was measured by using contingent valuation method of dichotomous choice approach. In this method, the farmers were asked whether they would use Bt cotton in the next season at a higher bid level from the current market price. If the respondent was willing to purchase at that level, same question would be asked at the next higher bid level, if he was not willing to purchase at that level, then his willingness to purchase at lower level was asked and finalise the willingness to pay for the Bt cotton seeds.(Breidert et.al., (2006) Verbic and Erker (2007))

Probit regression was applied to study the influence of independent variable on farmers' willingness to pay for Bt hybrids. The willingness to pay (WTP) was the dependent variable and the explanatory variables include those variables which directly or indirectly affect the willingness to pay of the farmers. The dependent variable in this model would have a value 1 if the farmers gave a positive willingness to pay the price for Bt cotton brands; otherwise 0. The probit model was built on a latent variable with the following formulation (Qaim & de Janvry, 2003):

Where

$WTP^* = X_i ß + e_i$ ..... (1)

ß = Coefficient parameter

X_i = Vector of Independent Variables

If WTP* >O, WTP= 1 and if WTP* < 0, WTP= 0.

Probit regression was used to estimate the equation (1) and it is defined as follows:

$WTP= b_0 + b_1 X1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + \ldots + e.$

WTP=Willingness to pay for Bt cotton brands by farmers (if yes, WTP=1; otherwise, WTP=0)

X_1=Age of the sample farmers (in years)

X_2=Education of the sample farmers (in years)

X_3=Farming experience of the sample farmers (in years)

X_4=Total area cultivated under cotton by the sample farmers (in hectare)

X_5=Irrigational status of the sample farmers (Irrigated =1, Rain fed=0)

X_6=Credit facility availability (Yes=1, No=0).

X_7=Income level of the sample farmers (in Rupees)

X_8=Yield (in kilogrames).

Results and Discussion

Size of land holding

In general, the size of land holding of the sample farmers would influence their cropping pattern, brand preference, quantity of seeds used, etc. Hence, the details of size of holding of the farmers were collected and the results are presented in Table 1.

It could be observed from the Table that, among the sample farmers, 41 per cent belonged to medium size group followed by 39 per cent, 13 per cent, and 7 per cent were with large, small and marginal farmers' group respectively. However, more numbers of rain-fed farmers (48 per cent) belonged to the large farm size category when compared to irrigated farmers. In contrast, medium farm size category was found high among irrigated farmers (52 per cent). Thus, the majority of the sample farmers were under the categories of medium and large farm size.

Table 1 : Size of land holding of the sample farmers

(Numbers)

S.No	Size of land holding	IrrigatedFarmers	Rain-fedFarmers	Overall
1.	Marginal (<1 ha)	2 (4.00)	5 (10.00)	7 (7.00)
2.	Small (1-2 ha)	7 (14.00)	6 (12.00)	13 (13.00)
3.	Medium (2-4 ha)	26 (52.00)	15 (30.00)	41 (41.00)
4.	Large (>4 ha)	15 (30.00)	24 (48.00)	39 (39.00)
	Total	**50(100.00)**	**50(100.00)**	**100(100.00)**

(Figures in parentheses indicate percentage to total)

Occupational status

The farmers were classified into two groups based on their occupation. They were agriculture and agriculture with other occupation. The results (Table 2) showed that most of the respondents (60 per cent) had agriculture as their main occupation. Farmers who had agriculture with other occupation were 40 per cent. Comparatively more number of farmers (64 per cent) depended on agriculture in rain-fed farming than irrigated farming (56 per cent). The results indicated that the majority of the farmers depended on agriculture as the primary occupation.

Table 2 : Occupational status of the sample farmers

(Numbers)

S.No	Occupation	IrrigatedFarmers	Rain-fedFarmers	Overall
1.	Agriculture only	28 (56.00)	32 (64.00)	60 (60.00)
2.	Agriculture + others	22 (44.00)	18 (36.00)	40 (40.00)
	Total	**50(100.00)**	**50(100.00)**	**100(100.00)**

(Figures in parentheses indicate percentage to total)

Source of irrigation

Source of irrigation plays a critical role in the selection of the crop and also the number of crops cultivated per year. Irrigation is also a major determinant of the choice of selecting various brands and crop management practices. Source of irrigation among the irrigated sample farms was analysed and the results are presented in Table 3.

Table 3 : Source of irrigation for sample farmers

(Numbers)

S.No	Source of Irrigation	Irrigated Farmers	Percentage to Total
1.	Bore well	12	24.00
2.	Open well	24	48.00
3.	Canal	14	28.00
	Total	**50**	**100.00**

(Figures in parentheses indicate percentage to total)

From the above Table, it could be observed that 48 per cent of the sample farmers used open well as their main source of irrigation followed by 28 per cent and 24 per cent of the sample farmers used canal and bore well respectively. Hence, it could be inferred that wells were the major source of irrigation in the study area, since bore wells and open wells contributed more than fifty per cent of the area.

Cropping Pattern

Knowledge of cropping pattern followed in the sample farms would help the firm to formulate promotional strategies. Crops raised by the sample farmers are presented in Table 4.

It showed that, cotton occupied 25.35 per cent of the gross cropped area of the sample farmers followed by sorghum (4.66 per cent), pulses (5.26 per cent) and soyabean (2.31 per cent). Other crops like tomato, brinjal and other crops occupied comparatively less area among sample farmers. Irrigated farmers cultivated vegetables and rain-fed farmers cultivated bengal gram exclusively when compared to their counterparts during the off-season.

Table 4. Cropping pattern of the sample farmers

(hectares)

S.No	Crops	IrrigatedFarmers	Rain-fedFarmers	Total area
1.	Cotton	201.61 (25.23)	221.05 (25.47)	422.66 (25.35)
2.	Sorghum	23.88 (2.99)	53.84 (6.20)	77.72 (4.66)
3.	Red gram	10.93 (1.37)	21.05 (2.42)	31.98 (1.92)
4.	Black gram	11.74 (1.47)	14.17 (1.63)	25.91 (1.55)
5.	Green gram	14.57 (1.82)	6.47 (0.75)	21.04 (1.26)
6.	Soya bean	29.95 (3.75)	8.50 (0.98)	38.45 (2.31)
7.	Sesamum	4.85 (0.61)	17.40 (2.00)	22.25 (1.33)
8.	Bengal Gram	-	8.90 (1.03)	8.90 (0.53)
9.	Brinjal	14.57 (1.82)	-	14.57 (0.87)
10.	Tomato	11.33 (1.42)	-	11.33 (0.68)
11.	Others	475.57 (59.52)	516.62 (59.52)	992.19 (59.54)
Gross Cropped Area		**799 (100.00)**	**868 (100.00)**	**1667 (100.00)**

(Figures in parentheses indicate percentage to total)

Cost of cultivation of Bt cotton

Investment in crop cultivation varied based on size of land holding, occupational status, family income, etc. Large farmers ready to invest more money on mechanization, fertilizers, plant protection chemicals etc. However, marginal and small farmers are struggling to invest money to protect their crop. The cost of cultivation for irrigated and rain-fed cotton is presented Table 5.

Among the two categories of the farmers, the higher amount of Rs. 65,980 was incurred as 'Cost A' by the irrigated farmers while it was observed to be Rs. 42,012 for rain-fed farmers. The difference was found to be Rs.23,968 which was due to higher usage of various inputs by irrigated farmers including inorganic fertilizers and human labour. Cost B was higher in the case of irrigated farmers with Rs. 8713 whereas it was Rs. 7280 in case of rain-fed farmers. In Cost C, it could be observed that rain-fed farmers had incurred Rs.529 more on family labour than irrigated farmers. Out of the total costs both irrigated and rain-fed farmers had incurred 83.41 per cent and 77.47 per cent respectively on Cost A than the other costs. The cost of cultivation under the rain-fed farmers category was (Rs.54,232 per ha) lower than the cost incurred by irrigated farmers (Rs.79,105 per ha). However, Bt cotton varieties have had a significant positive impact on average yields and on the economic performance of adopters than the non adopters (Bennett et.al,(2004)).

Table 5 : Cost of cultivation of Bt cotton

(Rs/ha)

S.No	Particulars	Irrigated farmers	% to the total	Rain-fed farmers	% to the total
I	**Costs**				
i.	**Cost 'A'**				
	Hired human labour	27686.6	34.99	15835.44	29.19
	Machine power	2037.75	2.57	2140.65	3.94
	Seed	2099.5	2.65	2949.5	5.43
	Organic Manures	2805.20	3.54	2708.15	4.99
	Inorganic fertilizers	11883.86	15.02	7383.52	13.61
	Plant protection charges	9719.45	12.28	5292.85	9.75
	Interest on working capital	3348.60	4.23	2222.00	4.09
	Depreciation	4129.35	5.22	3450.00	6.36
	Land revenue and other cesses	30.00	0.03	30.00	0.05
	Irrigation	2240.00	2.83	-	-
	Total cost A	**65980.31**	**83.41**	**42012.11**	**77.47**

ii.	**Cost 'B'**				
	Rental value of land	8258.71	10.44	6900.0	12.72
	Interest on fixed capital	454.22	0.57	379.5	0.69
	Total cost B	**8712.93**	**11.01**	**7279.5**	**13.43**
iii.	**Cost 'C'**				
	Family labour	4411.42	5.57	4940.0	9.10
	Total cost C	**4411.42**	**5.58**	**4940.0**	**9.10**
	Total Cost (A+B+C)	**79104.66**	**100.00**	**54231.61**	**100.0**
II	**Returns**				
	Average yield (Q / ha)	28.33		18.87	
	Average price (Rs / Q)	3807.85		3765.52	
	Gross returns (Rs / ha)	107876.39		71055.36	
	Net Returns (Rs / ha)	28771.73		16823.75	

The gross returns for irrigated farmers were observed to be higher (Rs.1,07,876) as compared to rain-fed farmers (Rs.71,055) as a result of increase in productivity. Similarly, the net returns realized by irrigated farmers were also higher (Rs. 28,771), than that of rain-fed farmers (Rs. 16,823). The net returns received by the farmers were closer to the results (Rs.24894 and Rs.19702 per ha in irrigated and rainfed farmers respectively) of the study conducted by Gandhi and Namboodiri (2009) in Maharashtra State.

Brand preference of sample farmers

Brand preference of Bt cotton of the sample farmers is presented in Table 6. The results showed that the majority of the farmers used Brahma (Monsanto Holding Private Ltd.) Bt cotton brand for the past three years, followed by Mallika (Nuziveedu seeds) and RCH2 (Rasi seeds). Further, Sudarshan (Monsanto Holding Private Ltd.) and Jadoo (Kaveri Seeds) brands were also used by farmers during the past years. The results indicated that there could be definite brand loyalty among sample farmers.

Table 6 : Bt cotton brands cultivated by the sample farmers

(Numbers)

S.No	Year	Brand	Total sample farmers	Percentage to the total
1.	2012-13	Brahma	22	22.00
		Mallika	21	21.00
		Sudarshan	13	13.00
		Jadoo	11	11.00
		MCH2	8	8.00
		RCH2	9	9.00
		Hanuman	6	6.00
		Bunny	3	3.00
		Jackpot	7	7.00
	Total		**100**	**100.00**

2	2011-12	Brahma	23	23.00
		Mallika	20	20.00
		Bunny	5	5.00
		RCH	8	8.00
		Maycho	6	6.00
		JK2	5	5.00
		Sita	10	10.00
		Geetha	11	11.00
		Haritha	12	12.00
	Total		**100**	**100.00**
3.	2010-11	Brahma	24	24.00
		Mallika	18	18.00
		Bunny	12	12.00
		Maycho	10	10.00
		RCH	9	9.00
		JK2	16	16.00
		Chirutha	7	7.00
		Pravardhan	4	4.00
	Total		**100**	**100.00**

Satisfaction level of the farmers

The satisfaction level of Bt cotton hybrid is an important factor which plays a major role in future purchase decisions of farmers. Hence, the satisfaction level of farmers regarding Bt cotton brands was assessed based on six parameters, using five-point Likert's scale namely, highly satisfied (5), satisfied (4), neutral (3), dissatisfied (2) and highly dissatisfied (1). The details of the satisfaction level of the sample farmers were analyzed and the results are presented in the Table 7.

It could be inferred from the Table that majority of the farmers were highly satisfied by the fiber quality (4.58) of Bt cotton brands and resistance to bollworms (4.12). Similar to the results of this study, Gandhi et.al.,(2015) had found that farmers were satisfied with fibre colour, boll size and quality of seeds of Bt cotton. The Bt cotton brands with high quality and performance in the field were adopted quickly by the farmers (Mayee and Choudhary (2013)). Further, farmers were also satisfied with the price (3.60). However, the farmers were highly dissatisfied with germination (1.94) and availability (2.26). Kiresur and Ichangi (2011) had alos identified that non availability of quality seeds and in required quantity were the important factor constraining Bt cotton adoption. In some cases, the farmers had to compromise planting of non-preferred Bt cotton hybrids in the absence of pre-booked Bt hybrids with local retailers (Mayee and Choudhary (2013)). It could be concluded that the majority of the farmers were not satisfied with product characteristics like seed germination and firms' distribution channels.

Table 7 : Satisfaction Level of the Farmers towards Bt cotton brands

S.No	Particulars	Mean score
1.	Fiber Quality	4.58
2.	Resistance to bollworms	4.12
3.	Price	3.60
4.	Yield	3.14
5.	Availability	2.26
6.	Germination	1.94

Brand switch behaviour

Brand switching behaviour of the sample farmers was analyzed and results are presented in Table 8. It showed that majorities of the farmers were not ready to switch from their existing brands (54 per cent) and 46 per cent were ready to switch from their current brands. However, the majority of the irrigated farmers (70 per cent) were not ready for the brand switch over. It could be observed from the results that the irrigated farmers were more loyal to their brands than the rain-fed farmers.

Table 8 : Brand switching behaviour of sample farmers

(Numbers)

S.No	Brand switch over	IrrigatedFarmers	Rain-fedFarmers	Overall
1.	Yes	15(30.00)	31(62.00)	46(46.00)
2.	No	35(70.00)	19(38.00)	54(54.00)
	Total	**50(100.00)**	**50(100.00)**	**100(100.00)**

(Figures in parentheses indicate percentage to total)

Willingness to pay (WTP)

Farmer's willingness to pay for Bt cotton brands were collected and the results are presented in Table 9.

Table 9 : Willingness to pay for Bt cotton brands among sample farmers

(Numbers)

S.No	Willingness to pay (WTP)	Irrigated	Rainfed	Total
1	**Yes**	41(82.00)	32(64.00)	73(73.00)
2	**No**	9(18.00)	18(36.00)	27(27.00)
	Overall	**50(100.00)**	**50(100.00)**	**100(100.00)**

Chi Square 1.110, 3.000; P Values 0.293, 0.083

(Figures in parentheses indicate percentage to total)

Results presented in the Table showed that 73 per cent of the sample farmers were willing to pay more price for Bt cotton brands and 27 per cent of the sample farmers were not willing to pay more price for Bt cotton brands. The observed values of Chi square values test were less than the expected values. Hence, the null hypothesis (*H1*) was rejected. It indicated that the willingness to pay decision of the farmers was independent. The average willingness to pay for Bt Cotton seeds by irrigated farmers was higher (Rs.1159/packet of 450gms) than the rainfed farmers (Rs.1048/packet of 450gms). It could be observed from the results that the willingness to pay for Bt cotton brands was more among the irrigated farmers than the rainfed farmers. Though the majority of farmers were willing to pay marginally more than the market price, the decline in seed price would lead to increase in diffusion of Bt cotton seeds (Arora and Bansal (2011)).

Variables Influencing the WTP for Bt Cotton Seed Brands

Probit model was used evaluate the influence of variables on farmers willingness to pay for Bt cotton seed brands. The independent variables used in the analysis were age of the farmers, annual income, farming experience, irrigation availability, area under cotton, yield, and credit facility and education level of the farmers. The results of the probit analysis are presented in the Table 10.

Table 10 : Result of Probit analysis for WTP for Bt Cotton Seed Brands

(WTP=1, and otherwise=0)

S. No	Variables	Co-efficient	Standard error	t-value	Marginal effect of the variables
1.	Annual Income	0.002***	0.001	3.405	0.001473
2.	Age	0.227**	0.107	2.121	0.1672
3.	Farming experience	-0.121	0.107	-1.129	-0.089
4.	Irrigation availability	9.692***	3.092	3.134	7.1387
5.	Area under cotton	0.691***	0.235	2.943	0.5089
6.	Yield	0.426	0.519	0.820	0.3137
7.	Credit facility	-1.130	1.190	-0.950	-0.83232
8.	Education	0.747	0.507	1.474	0.550212

(***1% significance level; **5% significance level)

It could be observed from the Table that annual income of the farmers, irrigation availability, age of the farmers and area under cotton had a positive and also significant influence on willingness to pay more price to the Bt cotton seed by farmers. Hence, the alternate hypothesis (*H2*) was accepted. The estimate indicated that one per cent increase in income above the mean value, the probability of WTP for Bt cotton seed brands would increase by 0.002 per cent. Similarly, every one percent increase in the availability of irrigation above the mean value of the sample farmers increases the

probability of WTP for Bt cotton seed brands by 7.14 per cent. As age of the farmers increases by one per cent above the mean value, the probability of WTP for Bt cotton seed brands will increase by 0.17 per cent. Further, as area under cotton increases by one per cent over the mean value, the probability of WTP for Bt cotton seed brands would increase by 0.51 per cent. It could be concluded from the analysis that income, age, availability of irrigation and area under cotton were significantly and positively influencing the WTP of the farmers for Bt cotton seed brands in the study area.

Conclusion

The net return from irrigated Bt cotton cultivation was Rs. 28771 per hectare where as it was only Rs. 16823 per hectare in rainfed condition. However, the total cost of cultivation of irrigated Bt cotton was higher (Rs.79104 per hectare) than rainfed cost of cultivation (Rs.54231 per hectare). Brahma, Mallika and Sudarshan were the major brands cultivated by the sample farmers in the study area. Majority of the farmers were highly satisfied by the fiber quality of Bt cotton brands and resistance to bollworms. Further, most of the farmers were loyal to the current brands (54 per cent) and 46 per cent were ready to switch from their brands. Nearly 70 per cent of the sample farmers were willing to pay more price for Bt cotton seed brands. The average willingness to pay for Bt Cotton seeds by irrigated farmers was higher (Rs.1159/packet) than the rainfed farmers (Rs.1048/packet). Annual income of the farmers, irrigation availability, age of the farmers and area under cotton had a positive and also significant influence on willingness to pay more price to the Bt cotton seed by sample farmers.

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