



SWOT Analysis of Bt Cotton cultivation in Andhra Pradesh

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ABSTRACT

SWOT as an acronym which represents strengths, weaknesses, opportunities and threats of an organization, programme and project. SWOT analysis was applied to unearth the strengths, weaknesses, opportunities and threats of Bt cotton cultivation as perceived by the 180 respondents selected from Guntur, Adilabad and Kurnool districts of Andhra Pradesh. Higher yields, higher net income and reduction in total number of pesticide sprays were the major strengths of Bt cotton. Weaknesses include higher incidence of sucking pests, Bt cotton potential is low under rain fed condition and escalating labour cost. Opportunities in Bt cotton cultivation were Bt cotton cultivation facilitates for strengthening public and private partnership in agriculture, scope for the Bt cotton farmers to repay long pending debts and facilitates to improve the efficiency of insecticides due to dual protection of Bt and insecticides. Frequent droughts, International policies and market fluctuations and environmentalists protects against Bt cotton were the threats as perceived by the respondents.

Key words : Bt cotton, SWOT, RBQ.

Cotton is a major fiber-yielding crop of global importance and enjoys special place in cash crops of India. In Andhra Pradesh entire cotton cultivated is under Bt cotton hybrids. In view of the magnitude of the area under Bt cotton cultivation, the large number of farmers who are cultivating Bt cotton under rain fed situation and impending problems, it is most appropriate to undertake a SWOT Analysis for sustainability of Bt cotton cultivation by analyzing what are the strengths, weaknesses, opportunities and threats in Bt cotton cultivation. This analysis is expected to highlight the points for an in depth understanding of the situation in its totality, which in turn helps the top administrators, planners of state government, scientists to take strategic decision to overcome the weakness and threats in Bt cotton cultivation. To acquire proper insights in to the identification of strengths, weakness, opportunities and threats of Bt cotton cultivation an attempt has been made in this investigation.

MATERIAL AND METHODS

Exploratory design was followed. Three districts namely Guntur, Adilabad and Kurnool of Andhra Pradesh, two mandals from each district and 3 villages from each mandal were selected for the study. From each village ten farmers were selected thus a total number of 180 respondents

were selected from 18 villages. A schedule was prepared to unearth the SWOT of Bt cotton cultivation. The perceived responses of the farmers under each parameter were listed. Ten important strengths, 8 weaknesses, 8 opportunities and 6 threats were identified by applying Rank Based quotient (RBQ) developed by Sabaratnam (1988). The data obtained from the farmers regarding strengths, weakness, opportunities and threat parameters in Bt cotton cultivation was quantified i.e. The number of farmers who gave the particular rank were used for calculation of RBQ

The formula for RBQ Calculation is as follows

$$RBQ = \frac{(f_i)(n+1-i) \times 100}{Nn}$$

Where

F 1 = frequency of farmers for 1th rank of SWOT Parameters

N= number of farmers

n= number of ranks

RESULTS AND DISCUSSION

In order to understand the nature of the Strengths, Weaknesses, Opportunities and Threats (SWOT) of Bt cotton cultivation as perceived by the Bt cotton farmers rank based quotients were computed and the values had been presented in table 1 to 4

1. Strengths of Bt cotton cultivation based on RBQ estimation

From the table 1, it could be observed that the important ten strengths in the Bt cotton cultivation, which were ranked by the Bt cotton farmers identified based on Rank based quotients and placed in order which include: Higher yields (72.16%), higher net income (71.05%), reduction in the total number of pesticide sprays (71.00%), better boll worms control (66.16%), serve the large as well as small farmers equally well (64.11%), early cotton pickings (57.11%), Good quality of cotton lint (48.05%), Reduced exposure of the farmers, farm workers and the environment to insecticides (35.44%), high prices in the market (33.44%) substantial contribution to sustainable IPM in cotton (31.44%).

2. Weaknesses of Bt cotton cultivation based on RBQ estimation as perceived by the respondents

From the table 2 it was clear that the important eight weaknesses in the Bt cotton cultivation, which were ranked by the Bt cotton farmers were identified based on Rank based quotients and placed in order which include: higher incidence of sucking pests, diseases and micronutrient deficiencies (78.19%), Bt cotton potential is low under rainfed condition (73.40%), high escalating labour cost (66.88%), Bt cotton protects the crop against boll worms up to 90 days only (57.08%) higher cost of Bt cotton seed (52.63%), very difficult to maintain refuge crop around the cotton fields (52.22%), present Bt cotton technology is available in hybrids only not in varieties (34.51%) and more dependence on multinationals for Bt cotton seed (35.13%).

3. Opportunities of Bt cotton cultivation based on RBQ estimation as perceived by the respondents

From the table 3 it could be observed that that the important eight opportunities in the Bt cotton cultivation, which were ranked by the Bt cotton farmers identified based on Rank based quotients and placed in order which includes facilitates for strengthening public and private partnership in agriculture (75.06%), scope for the Bt cotton farmers to repay long pending debts (72.91%),

facilitates to improve the efficiency of insecticides due to dual protection of Bt and insecticides (65.90%). Facilitates leisure time for cotton farmers and his family members (53.54%), improvement of socio economic condition of the farmers (52.77%) brighter outlook for the cotton industry (50.13%), scope to introduce Bt gens into local varieties (47.22%) and opportunity for improving cotton breeding programme (32.43%).

4. Threats of Bt cotton cultivation based on RBQ estimation as perceived by the respondents

Table 4 focused on the seven important threats which were ranked by the Bt cotton farmers. They were frequent droughts and floods (60.31%), international policies and market fluctuations (55.23%), environmentalists protects against Bt cotton (51.74%), Non maintenance of refuge crop that poses the danger of development of resistance in bollworm against Bt (46.98%), ill effects of Bt cotton on human flora and fauna (46.03%) and marketing of spurious Bt cotton seeds (39.68%).

Strengths of Bt cotton as perceived by the Bt cotton growers

The results of the table 1 reveal that earlier due to boll worms farmers used to get lesser yields. After introduction of Bt cotton they are taking up Bt cotton cultivation on large scale. Generally farmers adopt new varieties if they are relatively advantageous in yields over existing varieties. That's why respondents had given first rank for the statement "higher yields"

Success of any farm business mainly depends upon net income. In addition to higher yields, Bt cotton was also giving higher net income to farming community. It could be due to reduction in total number of pesticide sprayings against boll worms. This might be the reason behind preferring "higher net income" as the top second rank by the respondents

Reduction in the total number of pesticide sprays against boll worms and better boll worm control were the third and fourth important strengths respectively as perceived by the respondents. During interaction, respondents opined more than fifty percent reduction in number of pesticide sprays

Table 1. Strengths of Bt cotton cultivation as perceived by the Bt cotton growers.

N= 180

Strengths	Rank											Rank
	1	11	111	1V	V	V1	V11	V111	1X	X	RBQ	
1. Higher yields	27	26	17	42	49	11	1	1	3	3	72.16	1
2. Higher net income	30	35	33	19	19	15	10	8	3	8	71.05	2
3. Reduction in total number of pesticide sprays	68	26	15	11	9	6	1	17	1	26	71.00	3
4. Better boll worms control	15	38	14	24	16	50	12	3	8	0	66.16	4
5. Serve the large as well as small farmers equally well	1	10	28	55	45	25	8	4	2	2	64.11	5
6. Early cotton pickings	28	11	29	15	20	11	12	8	19	27	57.11	6
7. Good quality of cotton lint	4	7	7	7	18	34	80	14	8	1	48.05	7
8. Reduced exposure of the farmers, farm workers and environment to Insecticides.	1	4	5	1	4	19	43	61	29	13	35.44	8
9. High prices in the market	4	14	23	2	0	1	2	25	41	68	33.44	9
10. Substantial contribution to sustainable IPM in cotton	2	9	9	4	0	8	11	39	66	32	31.44	10

Table 2. Weakness of Bt cotton cultivation as perceived by the Bt cotton growers.

N= 180

Weaknesses	Rank										Rank
	1	11	111	1V	V	V1	V11	V111	RBQ		
1. Higher Incidence of sucking pests, diseases and micronutrient deficiencies in Bt cotton compare to Non Bt cotton	66	42	34	23	8	1	7	8		78.19	1
2. Bt cotton potential is low under rain fed condition	43	66	21	12	3	4	3	27		73.40	2
3. High escalating labour cost		17	24	53	12	42	12	3	3	66.88	3
4. Bt technology protects the crop against boll worms up to 90 days only		34	6	16	23	19	25	29	19	57.08	4
5. Higher cost of Bt cotton seed		16	24	10	30	33	14	21	31	52.63	5
6. Very difficult to maintain refuge crop around the cotton fields		2	13	15	31	44	50	5	9	52.22	6
7. Present Bt cotton technology is available in hybrids only not in varieties		0	3	6	15	18	43	63	31	34.51	7
8. More dependence on multinationals for Bt cotton seed		1	1	22	11	13	31	47	52	35.13	8

against boll worms. In addition to that there was no need to apply any insecticides against bollworms up to 90 to 110 days of crop growth period. This might be the reason to give third rank and fourth ranks for the above strengths.

“Serve the large as well as small farmers equally well” was ranked as fifth strength by the respondents. The Government of Andhra Pradesh

has given subsidy on the cost of Bt cotton seed for Bt cotton growers irrespective of the area they have under Bt cotton cultivation. So Bt cotton served the large as well as small farmers equally well. So the above rank was perceived as fifth strength of Bt cotton cultivation.

Due to non occurrence of bollworms, farmers could be able to get early picking compared

to non-Bt cotton. So “Early cotton pickings compared to non Bt cotton” was considered as an important strength of Bt cotton.

Getting good quality cotton lint from Bt cotton was given seventh rank. It might be due to the reason that Bt cotton looks better as the bollworms damage was minimized. Farmers were also reported that cotton lint picking from bolls without any foreign material was another advantage with Bt cotton hybrids.

The strength i.e., reduced exposure of the farmers, farm workers and the environment to pesticides was due to the reduction of pesticide sprays in Bt cotton compared to non Bt cotton. Respondents opined that frequent health concerns such as giddiness, nervousness, was experienced by farmers and farm workers due to higher number of pesticides applications in non-Bt cotton, were reduced to a larger extent due to cultivation of Bt cotton.

High price in the market was another important strength of Bt cotton cultivation as perceived by the farmers. No doubt that better quality fetches better price in market. It is true with Bt cotton cultivation. In addition to that Government of India has given better minimum support price for cotton. Due to these reasons respondents perceived it as one of the important strengths of Bt cotton.

Substantial contribution to sustainable Integrated Pest Management (IPM) of cotton was perceived by the respondents as the last but most important strength for integrated pest management. Eco friendly method of controlling bollworms not only gives the farmer better yields, but also was an important component in the integrated pest management.

Weaknesses of Bt cotton as perceived by the Bt cotton growers

Respondents were asked about weaknesses of Bt cotton cultivation. An observation of the results in the table 2 focussed that higher incidence of sucking pests; diseases and micro nutrient deficiency were cited as the top most weaknesses of Bt cotton. Sucking pests like Jassid, thrips, whiteflies, mealy bugs made the farmers to go for more insecticides sprayings to Bt cotton. Earlier farmers thought that Bt cotton was the

panacea for all ills of cotton. But year after year sucking pests incidence was increasing. That could be the reason for giving first rank for the above weakness. So there is an urgent need to evolve Bt cotton hybrids resistant to sucking pests.

The second rank has gone to “Bt cotton potential is low under rain fed conditions. Presently available Bt cotton hybrids were performing better under irrigated condition. But the major cotton growing areas are under rain fed situation.

High escalating labour cost was ranked third most important weakness of Bt cotton. High escalating labour cost is an important threat particularly for Bt cotton cultivation and generally for agriculture. Cotton picking was the major labour intensive activity in Bt cotton cultivation. Farmers were paying Rs 4.00 to 15.00 for picking of one kilogram of cotton. Development and evaluation of mechanical cotton harvesters were the need of the hour. In addition to that Government should give more subsidy on mechanical cotton harvesters which will help the farmers to reduce their cost of cultivation.

Bt technology protects the crop against boll worms up to 90 days only was the weakness ranked fourth by the respondents. Farmers opined that the incidence of boll worms was observed in 90-100 days crop. Farmers expressed that it was another important weakness this has to be tackled by developing Bt cotton hybrids which protects cotton against bollworms during entire crop growth period.

Higher cost of Bt cotton seed was the another important weakness of Bt cotton cultivation. This weakness has given fifth rank by the respondents. The cost of non-Bt cotton seeds was lower compared to the cost of Bt cotton seeds. There is a need to incorporate Bt genes in improved recommended cotton varieties to reduce the cost of Bt cotton seed. This finding is in agreement with the findings of Loga Nathan *et al.*, (2009).

The sixth weakness in Bt cotton cultivation as mentioned by the respondents was the difficulty in maintaining refuge crop around the Bt cotton fields. Farmers remarked that the land would be wasted as refuge crop gives very less yields. More over it was very difficult to do inter cultivation. But scientists advise raising non-Bt cotton as refuge. Extension functionaries should motivate the farmers to adopt this practice so that the development of

Table 3. Opportunities of Bt cotton cultivation as perceived by the Bt cotton growers.

N= 180

Opportunities	Rank									RBQ	Rank
	1	11	111	1V	V	V1	V11	V111			
1. Facilitates for strengthening public and private partnership in agriculture	75	11	38	15	6	21	0	14	75.06	1	
2. Scope for the Bt cotton farmers to repay long pending debts	55	18	50	18	8	15	1	15	72.91	2	
3. Facilities to improve the efficiency of insecticides due to dual protection of Bt and insecticides	18	74	4	4	41	3	34	2	65.90	3	
4. Facilitates leisure time for cotton farmers and his family members	9	4	31	50	24	35	7	20	53.54	4	
5.Improvement of socio economic conditions of the farmers	6	13	26	38	26	49	2	20	52.77	5	
6. Brighter outlook for the cotton industry	6	40	8	17	29	14	37	29	50.13	6	
7.Scope to introduce Bt genes in to local varieties	9	9	21	33	21	39	5	43	47.22	7	
8.Scope for improving cotton breeding programme	2	11	2	5	25	4	94	37	32.43	8	

Table 4. Threats of Bt cotton cultivation as perceived by the Bt cotton growers.

N= 180

Threats	Rank							RBQ	Rank
	1	11	111	1V	V	V1			
1. Frequent droughts and floods	13	12	1	10	9	0	60.31	1	
2. International policies and market fluctuations	15	6	3	9	3	9	55.23	2	
3. Environmentalists protects against Bt cotton	6	8	14	2	10	5	51.74	3	
4. Non maintenance of refuge crop that poses the danger of development of resistance in boll worms	6	5	13	5	4	12	46.98	4	
5. Ill effects of Bt cotton on human flora and fauna	4	7	6	10	14	4	46.03	5	
6. Marketing of spurious Bt cotton seeds	1	7	8	9	5	15	39.68	6	

resistance in boll worms could be delayed. Scientists have different opinion regarding growing of refuge crop. So concrete research should be conducted on these aspects and provide clarity regarding whether to grow or not to grow refuge crop.

Present Bt cotton technology is available in hybrids only, not in varieties was the seventh weakness mentioned by the respondents. This may be due to high cost of Bt cotton hybrid seeds and lack of suitable Bt cotton hybrids to different farming situations.

More dependence on multinationals for Bt cotton seed was the another important weakness perceived by the respondents.. At this juncture, farmers have no way except to depend on private seed agencies for Bt cotton seed. Farmers felt that in long run this type of monopoly could create negative effect on seed industry.

More dependence on multinationals for Bt cotton seed was last but important weakness in Bt cotton cultivation as perceived by the farmers. Before introduction of Bt cotton, SAUs and ICAR

are the leaders in release of suitable cotton hybrids for the benefit of farming community. But the situation has changed after the introduction of Bt cotton seed by the Monsanto and Mahyco. The efforts to release public Bt cotton hybrids are in right direction. The efforts should be further accelerated by the ICAR and SAUs to release public Bt cotton hybrids

Opportunities of Bt cotton as perceived by the Bt cotton growers

An observation of the results of the table 30 shows the opportunities of Bt cotton cultivation as perceived by the respondents. It facilitates for strengthening of public and private partnership in agriculture and was given first rank under opportunities. This could be due to the fact that cent percent of Bt hybrids were released by the private seed companies and package of practices were recommended by State Agricultural Universities. In addition to that number of research projects on genetically modified crops are being undertaken by the ICAR and SAUs with collaboration of private seed companies. If we consider reducing the budget burden of the Government, it is in right direction. Similarly public-private partnership in research and extension facilitates to sharing of knowledge, there by enhances overall efficiency of agricultural production system.

Because of higher yield of Bt cotton and remunerative price given by the government for cotton, farmers were faring well on the socio-economic situation. Farmers told during interaction that with Bt cotton cultivation they were able to repay the long pending debts. Due to this they have given second rank to this opportunity.

As per as the technological point of view farmers gave 3rd rank for the statement "It facilitates to improve the efficiency of insecticides due to dual protection of Bt and insecticides". Farmers opined that the Bt cotton (Bt toxin) provides opportunity to save the crop against boll worms up to half of its growth period (90-100 days) and second half growth period was taken care by the insecticides. With the introduction of Bt cotton the efficiency of insecticides were improved due to dual protection of Bt toxin and insecticides.

Facilitates leisure time for cotton farmers and his households was given 4th rank by the

respondents under opportunities of Bt cotton cultivation. Generally spraying of insecticides requires 2 to 3 members. Due to reduction of number of sprays against bollworms in Bt cotton, Bt cotton farmers and their family members got free time to attend for other economic activities. So indirectly Bt cotton cultivation has helped the farming community especially for women and children to attend for other economic and educational activities.

Improvement of socio economic conditions was the visible opportunity of Bt cotton cultivation. During group discussion, respondents told that Bt cotton cultivation impacted their farming income positively. In addition to that after introduction of Bt cotton, the number of sprayings were reduced drastically. So family members got leisure time for spending on other economic activities.

Facilitates brighter outlook for the cotton industry was perceived as another important opportunity with Bt cotton. It was very gratifying to note that India has registered a highest growth regarding cotton production with a share of 21 per cent in the global production of cotton. This is more than double its share of 9.6 per cent in 1980-81.

Scope to introduce Bt genes into local varieties and improving cotton breeding programme are the other opportunities pointed out by the respondents. If it is materialized, farmers could able to get Bt cotton seeds for lesser price.

Threats of Bt cotton as perceived by the Bt cotton growers

An observation of the results of the table 4 shows the threats of Bt cotton cultivation as perceived by the respondents.

The first rank among threats was gone to frequent droughts and floods .Farmers felt that Bt cotton performance was not good under drought situation. Hence farmers felt that frequent droughts and floods was an important threat to Bt cotton cultivation.

International policies and market fluctuations were perceived as second important threat of Bt cotton cultivation as perceived by the farmers. Majority of the cotton area at international level is under Bt cotton hybrids. So there is every chance for less demand for cotton in long run at international market .That's why extension functionaries might perceive this as an important threat of Bt cotton cultivation. So the government

of India should safe guard the Bt cotton growers by providing high remunerative price.

Environmentalists protects against Bt cotton was also an important threat as perceived by the farmers. In European countries, some of the organizations are campaigning against genetically modified crops. It was also observed from this study that majority of the respondents had negative feeling towards genetically modified food crops i.e., Bt brinjal. So the above causes might be forced the farmers to perceive this as an important threat.

The fourth threat as opined by the respondents was non maintenance of refuge crop that poses the danger of development of resistance in boll worms. Majority of the farmers opined that maintenance of refuge crop was the wasteful exercise and difficult to undertake inter cultivation practices. Respondents also opined that will be the responsibility of the research wing to develop other Bt hybrids, if bollworms develop resistance to existing Bt cotton hybrids. So there is an imperative need to raise the level of adoption of refuge crop by the Bt cotton growers in order to delay the development of resistance in bollworms against Bt cotton. Hence the extension functionaries need to educate the farmers about the beneficial effects of the maintenance of refuge crops by conducting training programmes and result demonstrations.

Ill effects of Bt cotton on human, flora and fauna was perceived as fourth important threat of Bt cotton cultivation. During interaction with the Extension functionaries, they informed that, some of the farmers reported some ill effects of Bt cotton on cattle, earthworms and also on soil fertility. Anyhow this needs further investigation for getting real picture of pros and cons of genetically modified crops.

The last rank among threats was the marketing of spurious Bt cotton seeds for Bt cotton cultivation. This might be due to lack of awareness and knowledge about the pure Bt cotton seeds. More over the seed agents were marketing the spurious Bt cotton seeds in the villages itself for lower cost. But after sowing of these spurious seeds farmers were facing lot of problems. These were the main reasons for prioritizing the above statement as a threat of Bt cotton cultivation.

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(Received on 15.03.2014 and revised on 19.10.2014)