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Title

A STUDY ON VIABILITY OF BT COTTON IN ANDHRA PRADESH

Author(s)

Dr. A. Balakrishna

Dept. of Economics,

Acharya Nagarjuna University,

Guntur -522510,

Andhra Pradesh.

Abstract:

As the demand for Bt cotton has been increasing, it has invoked novel interest and exciting emotion among a large section of eminent Indian personalities like biotechnologists, plant breeders, social scientists, environmentalists and on the likely impact of Bt cotton. An in-depth and intensive analytical survey has been carried out through personal interaction and group conversation with the respondent farmers. Although none of the farmers reported cases of any health, food or environmentally negative effects of Bt cotton, some expressed concerns about the possible risks. Several farmers emphasized the need for a cautious approach while exploiting GM technology and asked for a science-based pre and post-release testing and monitoring.

Key words: Bt cotton and Non-Bt cotton, Size of holding, Perceptions.

INTRODUCTION:

Since India is country with diversified geographical and agro-climatic conditions the adoption of Bt cotton in India has not taken place overnight with a sudden occurrence and has not been drastic. After many years of research and examination of this genetically transgenic cotton seed over different types of soils and under different agro-climatic conditions the adoption has been taken up. Consequently and subsequently the extension of area under transgenic cotton cultivation has been got increased year by year. In this regard the detailed data has been displayed in the following table and further analyzed. One of the conditions for environmental release of Bt cotton, which includes commercial cultivation, is that each field of Bt cotton is to be surrounding by a belt of non-Bt cotton of the same variety to serve as a 'refuge' for bollworms. It is a consequent result of long years of many researches and experiments as well as discussions and debates, besides suggestions of the agricultural scientists. Cultivation of Bt cotton has gradually grown and the expansion of the area under Bt cotton cultivation has extended greatly to a remarkable extent and the number of cotton cultivators. Due to false awareness of the farmers, improper guidance and ineffective experiments, a wrong notion has been created among the Indian farmers and so it has taken long years of time for the Indian peasants to adopt Bt seeds in cotton cultivation.

Emergence of Bt cotton:

In the face of progressively acquired resistance of the bollworms, it seemed to have won the war against the most toxic and recently released insecticides, thereby inflicting heavy losses to the cotton growers. In addition, regular substantial damage by a variety of sucking pests had driven the farmers to frequent and more number of chemical sprayings. Epidemics of white fly and bollworms beside frequent and severe droughts, had forced several farmers to comate suicide individual cases of suicide by cotton farmers are still frequently in the news. The desperate situation faced by many cotton farms has led to a search for solutions. So it has become a necessity to control this pest attack by using newer resistant plants having resistant genes against bollworm. This has been made possible with the break through achieved in the field of biotechnology.

The technology has become an effective means in genetic transformation that could be released through traditional breeding. There for from green revolution it is now entering in to the gene revolution. Research in biotechnology has led to the development of genetically modified crops like Bt cotton. Bt cotton is a genetically engineered form of natural cotton. This is known and transgenic cotton, which contains endotoxin protein inducing gene from soil bacterium (Bt) Bacillus thurainginesis. This Bt gene endows a special type of toxin commonly known as delta endotoxin. Delta toxin kills bollworms only with out any deleterious effect on living creatures.

Origin of Bt cotton:

Bt cotton refers to transgenic cotton with contains endotoxin proten inducing gene from soil bacterium Bacillus thuringinesis. The Japanese Bacteriologist 'Ishiwata Shigetane first discovered Bt gene in 1901. Subsequently in 1915 a German scientist, named Ernst Berliner, isolated this toxin from a dead Moth in Thuringen region of Germany. And thus the name formed as Bacillus Thuringiensis. In cotton Monsanto Delta and Pine companies developed the first transgenic plant in 1987 in U.S.A., then after it were spread to all over the global.

Adoption of Bt cotton India:

A new chapter was added to Indian agriculture when the G.E.A.C (Genetic engineering approval committee) permitted the commercial release of Bt cotton hybrids. The decision evoked a mixed response from both the farming community and the civil society. On the one hand, it was hoped that Bt cotton would help in reduce the pesticides use and increase the yield, and on the other makes the cultivation of cotton more economical and environmental friendly. After a thorough assessment of bio-safety of Bt cotton through various scientific studies conducted by National Level Institutes, the Government of India through GEAC, Ministry of Environment and Forests considered the proposal for the commercial release of Bt cotton in its meeting held on 26th March, 2002. And after the careful and in-depth considerations, accorded approval for release into the environment of three transgenic Bt hybrid cotton varieties, developed by Maharashtra Hybrid Seed Company (MAHYCO), namely, Bt MECH-12, Bt MECH-162 and Bt MECH-184, containing cry1Ac gene and nprll and add genes, for the period of 3 years from April 2002 to March 2005. Monsanto (Mahyco-Monsanto Biotech Ltd) developed these cotton hybrids by inserting genes responsible for production of delta-endotoxin from a soil bacterium, Bacillus thuringiensis. This had earlier been released for commercial cultivation in 1996 as 'Bollgard' in the US and 'Ingard' in Australia. Global adoption of Bt cotton has risen dramatically from 800000 hectares in 1996 to 5.7 million hectares in 2003. Significant economic and production advantages have been expected from growing Bt cotton globally. Perhaps no other crop has garnered as much controversy in the history of Indian agriculture as has Bt cotton, both before as well as after its introduction. Not only in India, but also all over the world, these genetically altered crops (GACs) are subjects of controversy. Genetically modified cotton is being cultivated is about 12 percent of the total world area under cotton where as Bt cotton in India estimated to be 5 % to total area.

IMPORTANCE OF THE STUDY:

As the demand for Bt cotton has been increasing, it has invoked novel interest and exciting emotion among a large section of eminent Indian personalities like biotechnologists, plant breeders, social scientists, environmentalists and on the likely impact of Bt cotton. There have been several reports from individuals in the past few years that there has been remarkable

increase in cotton productivity that have come about through adoption of Bt cotton since 2002. There were some reports that cotton production was stagnant before the introduction of Bt cotton. Taking all these factors into consideration it is aimed to obtain the perceptions of Bt cotton growers in regard to their awareness on growing Bt cotton, their experiences regarding their capability to achieve maximum production and productivity and particularly more whether their socio- economic standards have got improved after the adoption Bt cotton cultivation are discussed diligently. In this broad connatural sense the experiences of the cotton cultivators are studied intensively which are presented in following tables and further analyzed. Further their perceptions on various aspects such as consultation, willing to grew Bt cotton in future.

OBJECTIVES:

1. To obtain the perceptions of Bt cotton growers in regard to their awareness on growing Bt cotton.
2. To understand the socio-economic background of Bt growers.

METHODOLOGY:

The study used Multi-stage stratified random sampling method to select the respondents from among the farm households. The study is based on sample survey of selected farm households in six villages of Warangal and Guntur districts of the Andhra Pradesh. By using simple random sampling method from each village 33 respondents were interviewed in 6 villages of each district. A detailed structured questionnaire was used to elicit the information from the farm households. Data regarding gender wise hired labour participation, family labour contribution, farm practices, wage rates, household activities, literacy level and some perceptions of the respondents were collected.

RESULTS AND DISCUSSIONS:

Socio economic conditions of the respondents:

The worker households' backwardness was reflected in low levels of housing facilities. From the analysis it is clearly evident that 43 % of the selected farm households belong to higher socio-economic strata in the study. And 40 % of farm holdings belong to Backward caste communities. Nearly 17 % of the farm holdings belong to schedule caste and scheduled tribe communities. The respondents belonging to Forward Caste category and Backward castes category are more or less in equal number. It is also found that the operational holdings of the respondents reflect caste hierarchy prevalent in the villages. As the data reveals major chunk of households constituting 73 % are of nuclear families, while the remaining 27 % are of joint families. With regard to the civic facilities 95 % of the respondents have electricity, 68 % of the respondents have the drinking water facility and 50 % have the drainage facility. Further, it is evident that 38 % of the farm respondent households are living in pucca houses, 48 % are living in semi-pucca houses and 14 % are living in kucha houses. Nearly 81 % of the farm households are covered under Public Distribution System (PDS). The possession of consumer durable goods represents the socio-economic status of households. About 52 % of farm households possess cows or buffaloes for milk products. Nearly 34.33 % of households own bullocks for cultivation and for hiring out and 10.33 % of households rare goat and sheep. Almost 72 % of the farm households have TV, 84 % have electric fans, 66 % have cell phones, 54 % have bicycles, 21 % have two wheelers, 6 % have VCD/ DVD players, 1 % of farm households have domestic pump sets. Though, LPG gas is one of the basic needs of the households, 57 % of the farmers do not have access to it. They depend on firewood for cooking.

Farmers experience with Bt cotton cultivation

Though cotton growing is common, in India, growing Bt cotton has not occurred over night. It has been a result of long years of many researches, experiments as well as discussion and debates and suggestions of the agricultural scientists Bt cotton has gradually grown and the area under Bt cotton and the number of farmers has got increased. In this broad conceptual sense the experiences of various farmers in growing Bt cotton obtained and their perceptions are analyzed.

Of the total sample respondent Bt cotton growers, 9.6 % percent only have grown for the first time. Of the Bt growers for the first time, marginal farmers occupy first place with 17.4 %, followed by 9.2 % small farmers, 4.9 % of semi-medium and 2.8 % of medium farmers. Cent percent of larger farmers, 97.2 % of medium farmers, 95.1 % of semi-medium farmers, 90.8 % of small farmers and 82.6 % of marginal farmers, altogether accounting for 90.4 % of the total respondents are cultivating Bt cotton who already cultivated in the previous year.

It is to be observed that the (number/ strength) size of the Bt cotton growers increases year by year. It is also observed that the adoption of Bt cotton has been very late among marginal farmers followed by small farmers. Having had no awareness on scientifically developed transgenic seeds coupled with their ignorance due to illiteracy they have fallen in dilemma whether to grow Bt seeds. Hence the ratio of Bt adoption among marginal and small farmers is low but shows the increasing trend of growth rate of Bt cotton adoption.

Consultants to adopt and to cultivate Bt cotton:

As it has been observed in the secondary sources statistics and other literature adoption of Bt seeds in cotton cultivation has not taken place immediately after its introduction. It has taken a long span of time for the farmers to cultivate Bt cotton as they have their own doubts and false notions. Besides, the reliance on the quality of Bt has been doubted even by the agricultural scientists. After so many researches on the quality and performance as well as on reliability, it has been proved to be a better tolerant from pests and insects. And so it has been delayed to adopt Bt cotton by the Indian farmers, most of whom are illiterate and ignorant of scientific and technological advancement in agriculture. However, by the time of study period there has been a remarkable size of farmers growing cotton cultivation. The field survey has emphasized the same notion.

The statistical data displayed in the table no.2 depicts the sizes of Bt farmers distributed as per the source of motivation to adopt Bt cotton seed. Besides division of farmers as per farming size categories. Farmers have been motivated by various sources and persons to adopt Bt seed in their cotton cultivation. Having had continuously motivated by various sources for adopting Bt as well as having had observed other Bt cotton growers, 70.1 percent of the farmers

have taken their own decision to adopt Bt seed in their cotton cultivation. The farmers, constituting 24.8 % have taken and followed the suggestion of other farmers, who have got succeeded in growing Bt cotton in the previous year.

There are also some other sources of motivation for adoption of BT cotton such as expert agencies, commission agencies, relatives and neighbors as well as other sources, every one of them accounting for less than 2 percent'.

Among farmers who have grown Bt cotton with their own decision, first place is occupied by medium farmers constituting 91.7 percent, followed by large farmers with 88.9 percent. Semi medium farmers, small farmers and marginal farmers constitute 81.4 percent, 69.1% and 52.3% respectively. Among the Bt cotton growers who have taken the suggestion of other farmers, majority, constituting 43.1% are marginal farmers, followed by small farmers accounting for 25.0 percent. Semi medium farmers constitute 13.7% and medium farmers account for 5.6 percent.

It is also observed from the above analysis that the illiteracy and ignorance regarding scientific and technological advancement prevent a remarkable number of marginal farmers and small farmers to adopt Bt cotton. Only after keen observation on the success of other farmers and on knowing the volume of risk behind Bt cotton cultivation, these two categories have adopted BT cotton cultivation. And it is evidently clear that the impact and influence of other sources, such as, expert agencies, commission agencies, relatives and neighbors is not upto considerable extent to take decision by the farmers to cultivate Bt cotton.

Perceptions on reliability in growing Bt cotton:

As it is observed from the various reports on Bt cotton cultivation the main purpose of inventing genetic cotton seed and to provide them for the use of cotton growers is to afford them and help them reduce expenditure on insecticides as well as to increase yield so that the farmer gain higher profits. To fulfill this, Bt cotton seed is brought to the reach of cotton growers after so many long years of research.

As the statistics displayed in the above table 3 reveals, 65.0 % of the respondents have stated/ have opined that the adoption of Bt cotton has increased yield when compared to non-Bt cotton. They consist of 51.4% of marginal farmers, 63.2% of small farmers and 69.6% of semi-medium farmers, cent percent of large farmers and 91.7% of medium farmers. It clearly indicates the ability to utilize the modern technology in both medium and large farming categories. Further 57.4 % of the respondents Bt cotton growers have stated that sowing BT cotton seed has helped them to reduce their expenditure on insecticides. Marginal farmers accounting for 69.7 %, 59.9 % of small farmers, 50.0 % of semi-medium farmers, 38.9 % of medium farmers and 22.2 % of large farmers are in support of this perception.

It is observed that majority of the marginal farmers (69.7 %) and small farmers (59.9 %) are helped to get reduced their expenditure on insecticides. But the farmers gained higher yield among these two categories are comparatively less in number. For this they have expressed their personal grievances.

Perception on Growing Bt cotton in future:

Taking various reasons and perceptions into consideration including profitability, the respondent Bt cotton growers have been asked whether they are willing to cultivate Bt cotton in the forth coming years also. The data pertaining to their positive and negative responses is presented in table no. 4. The table depicts that most of the respondents are willing to grow Bt cotton in future, and a very few number are not willing to grow. As the data explains, all the cent percent of semi-medium, medium and large farmers are willing cultivate BT cotton again in the forth coming years. But a few of marginal farmers and small farmers are not willing to cultivate Bt cotton in the coming years. Marginal farmers accounting for 88.1% and 96.1% of small farmers are willing to cultivate Bt cotton whereas 11.9% of the marginal farmers and 3.9% of small farmers are not willing to grow Bt cotton in the coming years.

It is to be seriously think of why there is still considerable number of marginal and small farmers are unwilling to cultivate Bt cotton, as they are not getting satisfying profits due to the impact of socio-economic standards, coupled with lack of awareness over the utilization of technological advancement, while the other farming categories are getting profits.

Problems faced by farmers with Bt cotton cultivation:

As majority of the respondent Bt cotton growers agreed that Bt cotton is better tolerant to pests, diseases and drought as well as risk. It doesn't mean that it prevents and resists problems. There do lies the problem in the cultivation of Bt as there was problems with other crops. It's a common perception that weather condition determines the growth and yield of the crops. It is so with the cultivation of Bt cotton cultivation. Weather is the common problem in the cultivation of Bt cotton, which has been remarked by 70.40 % (Table 5) respondents, as it shows the equal impact physically on the Bt cotton crop of all the farmers. But in economic standards its impact varies from the impact on marginal and small farmers is more than that of its impact on semi-medium, medium and large farmers. Since the financial status of the marginal and small farmers is at low level comparatively with that of the other farming categories, these farmers find it a difficult problem.

Problem of high labour charges is the major problem, which severity has been remarked by 68.40% of the respondent. Of them majority are of semi-medium farmers (77.40 %), medium farmers (77.70 %) and large farmers (77.70 %). This problem is comparatively, in less intensity with marginal and small farmers, who constitute 57.80 % and 67.10 % to their respective totals. The reason behind this, is that the high income group farming categories (semi-medium, medium and large farmers) completely depend on labourers to perform agricultural activities.

Whereas marginal and small farmers, being low income groups, involve their members of families and for themselves in labour activities. Hence, the intensity of the problem of high labour charges will be less on them. But contrary to this problem, the intensity of the problem of high input prices lies vice versa. Since the semi-medium, medium and large farmers are financially well off the intensity of this problem on them will be less, whereas the financial status of the marginal and small farmers is unstable, the intensity of the problem of high prices of inputs will be at higher level. This has been understood from the statement of 65.70% of the respondents who consist of 73.40% of marginal farmers and 65.70% of small farmers.

Lack of remunerative price to the produce of Bt cotton is also the other problem which has to be checked with immediate effect. As the MS price of the cotton produce is fixed by the government, sometimes the farmers will not get remunerative price. Hence, 50.50 % of the total respondent Bt cotton growers have stated this problem. Besides the fluctuations in the price

become problematic to some extent, which is stated by 23.60 % of the respondents. However, the other problems like, lack of labour availability, unpredictable output, pests, lack of proper marketing facilities and such other problems may not be treated as inconsiderable. They do have their impact.

From the above analysis, it is clearly observed that besides lack of remunerative prices coupled with fluctuations in prices are the major grievances of the Bt cotton growers, besides high prices of inputs and high labour changes. Vagaries of weather always be a problem that worries all the farming categories of growing various crops and as such it worries the Bt cotton growers.

Motivation for growing Bt cotton:

As it has been surveyed by many studies, once cotton farmers had suffered a great loss that led to their frustration and depression. At that crucial junction Bt cotton has been introduced which is a boon to the cotton growers. Moreover, farmers have suffered from various problems in growing other crops such as food grains and pulses. Having had obtained awareness after prolonged motivation many a farmer has opted to grow Bt cotton taking various reasons into consideration. Hence to know the reasons for growing Bt cotton, a structured query has been posed at the respondent Bt cotton growers, and their responses on reasons which have been displayed in table no. 6, in the form of statistical data.

It is observed that 62.0 % of the total respondents have grown Bt cotton this year with the hope of getting better yield since they had acquired higher yield in the previous year. It is known fact that cotton crop is easily prone to bollworms. Bt cotton is not resistant to some of pest and insects. But Bt cotton being a genetic seed, is said to be a strong resistant to pest and insects. But it makes one wonder to observe that 87.5 % of the total farmers have been confident and have believed that Bt cotton contains better tolerance capacity to pests and resistance power to diseases and so they have grown Bt cotton. More surprisingly, it has been stated by 85.0 % of the respondents that Bt cotton is the better drought tolerant and so they have grown Bt cotton. Bt cotton production will get better market price is another major reason for growing Bt cotton as stated by 48.5% of the respondents. Significant reduction in seed price has also been a reason for

38.7% the respondents to grow Bt cotton. But it is not rational, since government provides subsidy in seed price.

There are also some other reasons which are not to be left unnoticed eventhough they are stated by inconsiderate number of respondents. These reasons are namely, less capital investment/ less risk bearing which has been stated by 5.9% of the total respondents. These reasons are also include special farmers scheme and change of crop etc which is mentioned by 1.2% of total respondents only. From the above analysis, it is clearly evident that majority of marginal farmers and small farmers are opting to cultivate Bt cotton since it is better tolerant to pests, resistant to diseases and better tolerant to drought. Besides, higher yield and rational and better market price are also the major helpers for these low income groups such as marginal farmers and small farmers to grow Bt cotton and gain considerate profits. Moreover, it is also to be noted that it being risk tolerant and requires less capital investment majority of the farmers are opting for cultivation of Bt cotton.

Extension services provided to the Bt cotton growers:

Government and other private institutions provide service to farmers in growing/ cultivating crops. Since A.P. is state where majority of rural population depend on agriculture and allied activities to eke out their livelihood. Hence, in the table no. 7, the statistical data has been obtained regarding services provided to the Bt cotton growers by different institutions. As it is stated in the table, 24.0 % of the total respondents have been provided service by the government in growing Bt cotton. Private companies extend their services to 23.0 % of the respondents, whereas just 8.3 % of the respondents are provided service from product sellers in growing Bt cotton. However, it is to be noted that services extended by the above mentioned institutions are not reaching to all the Bt cotton growers. Moreover, it is observed that the marginal farmers and small farmers who receive service from either government or private companies or product sellers are considerably very less. Hence, it is suggested being the low income group they have to be provided with extension services extensive so that they would be prosperous.

Health status:

Farmers and children working in cotton cultivation are expected to suffer from health problems as a result of exposure to pesticides. Some studies revealed that complaints of extreme of fatigue, loss of appetite, headaches and acute stomach pain. Some other studies revealed that farmers exposed to Bt-cotton suffered from respiratory problem. The farmers and their family members face health problems, while performing their agricultural operations, particularly while spraying fertilizers and pesticides. Table-8 gives the details of those health problems that the farmers and their family members have faced.

The data reveals that most of the family members of the respondents constituting 85.3 % (348) of the total respondents have not been affected by any disease. Further the data reveals that small and marginal farmers in higher proportions prone to health problems. Nearly 12 % of marginal farmers and 21 % of small farmers are suffering from health problems like skin diseases and other allergies. Cancer has attacked one person who belongs to semi-medium farming category. Out of the total respondents, 7.6 % have suffered with skin diseases and allergies, whereas marginal farmers constitute 16.1 % and there has been only one medium farmer.

CONCLUSION:

An in-depth and intensive analytical survey has been carried out through personal interaction and group conversation with the respondent farmers. While interaction with them interesting perceptions of the Bt cotton cultivation reflecting their personal experiences been extracted, which are depicted through statistical data. Quite surprisingly their experiences are contradictory. Despite increasing productivity, as it is perceived by majority of the small and marginal farmers, they could not enhance their economic standards as they are ignorance towards utilization of technological advancement and lacking of awareness to obtain optimum benefits from Genetic seeds. However, their incomes have increased but not upto their satisfaction besides less profit.

And only few of the respondents, particularly those of farming categories belonging to marginal and are unwilling to grow cotton.Bt growers expressed that the expenditure incurred on

pesticides has decreased. As they are illiterate they are not in a position to acquire awareness and knowledge about dosage and utilization of pesticides and insecticides. Bewildered due to illiteracy Bt cotton growers unable to understand the reliability of Bt seeds at risk resistance. As the respondent farmers are poor and who cannot afford financially far themselves to invest on Bt cotton cultivation, they go for debts from various sources. And after harvesting what ever the amount remains will go directly to the government towards the payment of dues or to the lenders. In spite of the above cited drawbacks, many a Bt cotton farmers desires to grow Bt cotton provided they are afforded with extensive services form the policy makers in the form of finance, training and education as well as subsidy.

Certain problems do swing and string the farmers of Bt cotton, particularly in regard to labour changes remunerative price and ungraceful weather. Refuge crop, which determines the viability of Bt technology, only a negligible number are sowing the refuge crop. This situation is mainly because of their unawareness. However most of them suggest for introduction of Bt technology in other crops.

SUGGESTIONS:

Although none of the farmers reported cases of any health, food or environmentally negative effects of Bt cotton, some expressed concerns about the possible risks. Several farmers emphasized the need for a cautious approach while exploiting GM technology and asked for a science-based pre and post-release testing and monitoring. Bt cotton farmers grew no refugia and did not provide recommended isolation distances needed for preventing cross-pollination between Bt and non-Bt strains so as to reduce the chances for breakdown of resistance to bollworm in Bt cotton varieties. A general misgiving prevails, may be partly due to aggressive advertisement by seed companies, that the Bt cotton needs no pesticide application, forgetting that the Bt provides protection (often not 100%) only against bollworms. For controlling other pests, which at times assume serious proportions, such as aphids and whitefly, pesticides will need to be applied as per recommendations. In the case of seed failure, the company must compensate the losses incurred by the farmer. It also suggested insurance cover to be provided along with the sale of GM seeds.

Table- 1

Farmers experience in Bt cotton cultivation

	Farm Size Groups					
	Marginal	**Small**	**Semi-medium**	**Medium**	**Large**	**Total**
Bt for the first time	17.4%	9.2%	4.9%	2.8%		9.6%
Already grown Bt	82.6%	90.8%	95.1%	97.2%	100.0%	90.4%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Primary data.

Table- 2

Consultants to adopt and to cultivate Bt cotton

	Farm Size Groups					
	Marginal	Small	Semi-medium	Medium	Large	Total
Own decision	52.3%	69.1%	81.4%	91.7%	88.9%	70.1%
Other successful farmers	43.1%	25.0%	13.7%	5.6%		24.8%
Expert agencies	1.8%	2.0%	2.0%			1.7%
Commission agent		2.0%	1.0%	2.8%		1.2%
Any other	1.8%	.7%	1.0%		11.1%	1.2%
Relatives/ Neighbors	.9%	1.3%	1.0%			1.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Primary data.

Table- 3

Reliability in growing Bt cotton

Reasons for Profitability	Marginal farmers	Small farmers	Semi-medium	Medium farmers	Large farmers	Total
Reduced expenditure on Insecticides	69.7%	59.9%	50.0%	38.9%	22.2%	57.4%
Increases yield	51.4%	63.2%	69.6%	91.7%	100.0%	65.0%

Source: Primary data.

Note: Each cell calculated as taking in to cent %.

Table- 4

Farmers interest to Grow Bt in future

	Marginal farmers	Small farmers	Semi-medium	Medium farmers	Large farmers	Total
Willing to grow Bt again	88.1%	96.1%	100.0%	100.0%	100.0%	95.3%
Not willing to grow Bt again	11.9%	3.9%				4.7%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Primary data.

Table- 5

Problems in Bt cotton cultivation

	Farm Size Groups					Total
	Marginal farmers	Small farmers	Semi-medium farmers	Medium farmers	Large farmers	
High input prices: Fertilizers/Seeds/Pesticides	73.40%	66.50%	60.70%	55.60%	44.40%	65.70%
Lack of remunerative prices	49.60%	50.10%	53.00%	44.40%	44.40%	50.50%
Fluctuating prices for cotton	24.70%	26.30%	19.60%	25.00%		23.60%
Lack of labour availability	9.30%	9.30%	10.30%	5.70%	.7%	35.30%
Weather	70.70%	64.40%	73.50%	83.40%	77.70%	70.40%
Unpredictable output	2.80%	8.50%	11.30%	22.60%	11.10%	6.60%
Pests		1.40%	1.00%		11.10%	0.90%
High labour charges	57.80%	67.10%	77.40%	77.70%	77.70%	68.40%
Lack of proper marketing facilities	1.80%	8.60%	4.00%			6.80%
Any other	1.80%	1.30%		2.80%		1.20%

Source: Primary data.

Note: Each cell calculated as taking in to cent %.

Table- 6

Reasons for growing Bt cotton

Reasons for growing Bt	Marginal farmers	Small farmers	Semi-medium	Medium farmers	Large farmers	Total
Better tolerance to pest and diseases	89.0%	86.8%	85.3%	91.7%	88.9%	87.5%
Better drought tolerance	85.3%	86.2%	80.4%	88.9%	100.0%	85.0%
Better yield last year	65.1%	57.9%	67.6%	58.3%	44.4%	62.0%
Better market price last year	56.9%	48.0%	47.1%	38.9%	11.1%	48.5%
Reduced seed price	52.3%	33.6%	39.2%	25.0%	11.1%	38.7%
Special farmer's scheme available	.9%	2.0%	1.0%			1.2%
Any other reason	1.8%	7.9%	8.8%		11.1%	5.9%

Source: Primary data.

Note: Each cell calculated as taking in to cent %.

Table – 7

Source of Service Extended

Extension service	Marginal farmers	Small farmers	Semi-medium	Medium farmers	Large farmers	Total
Government officials	12.8%	28.3%	28.4%	30.6%	11.1%	24.0%
Private Companies	12.8%	20.4%	27.5%	41.7%	66.7%	23.0%
Product Sellers	9.2%	8.6%	7.8%	5.6%	11.1%	8.3%

Source: Primary data.

Note: Each cell calculated as taking in to cent %.

Table-8

Health Problems faced by Bt growers

Health Problem	Farming Category					Total
	Marginal farmers	Small farmers	Semi-medium farmers	Medium farmers	Large farmers	
Not affected	(88.1)	(79.6)	(87.3)	(91.7)	(100.0)	(85.3)
Cancer	(0.0)	(0.0)	(1.0)	(0.0)	(0.0)	(0.2)
T.B	(1.8)	(1.3)	(0.0)	(0.0)	(0.0)	(1.0)
Skin Diseases and allergies	(4.6)	(11.8)	(6.9)	(2.8)	(0.0)	(7.6)
Others	(5.5)	(7.2)	(4.9)	(5.6)	(0.0)	(5.9)
Total	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: Primary data

Note: Figures in parentheses indicate percentage.

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