



Consequences of Cultivation of Bt Cotton as Perceived by farmers of Andhra Pradesh, India

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Abstract

Bt Cotton recorded improved yields and reduced cultivation costs in some areas, while flaring up of secondary pests, emergence of new diseases viz., grey mildew and health related problems like allergies and nasal bleeding in human and cattle respectively were reported in some other areas. This situation prompted to study consequences perceived due to cultivation of Bt Cotton in the district of Karimnagar, Andhra Pradesh by Bt cotton farmers, Officials of Department of Agriculture, Agricultural scientists, doctors, veterinary doctors and officials of Bt cotton company who formed respondents of this study. Positive consequences of Bt cotton cultivation as perceived by majority of farmers, officials of department of agriculture, agricultural scientists, officials of voluntary agencies and Bt cotton company were increased yields (34%), reduced debts due to high net returns (50%), increase in cropping intensity (90%), reduced pesticide sprays for bollworm (30%) and increased yields (100%) respectively. Negative consequences as perceived by majority of farmers, officials of department of agriculture, agricultural scientists, personnel of voluntary agencies and Bt cotton company, doctors and veterinary doctors were poor performance in rainfed conditions (34%), fall in cotton price due to more production (90%), reduction in area under food crops like Maize, Jowar etc., (80%), incidence of sucking pests, grey mildew and wilt (70%), disappearance of traditional varieties and hybrids (50%), soil infertility as Bt cotton is soil exhaustive (40%) and micronutrient deficiencies (40%), Grey mildew and wilt incidence (90%), increased incidence of sucking pests (40%), skin allergies in humans (100%) and mild cough and sneezing in cattle (100%) respectively.

Keywords: Bt Cotton, Consequences, doctors and veterinary doctors.

Introduction

Cotton, the 'White Gold' and 'King of Fibres' is an important commercial crop of India and is considered to be an industrial commodity of worldwide importance. Cotton occupies a predominant place among cash crops touching the country's economy at several points by generating direct and indirect employment in the agricultural and industrial sectors.

In cotton, bollworms cause significant yield losses and nearly 54 per cent of the total pesticides are used for the control of pests in cotton alone, out of which about 60 per cent are used for the control of bollworms. Indiscriminate use of pesticides has adversely affected pest control and profit to the farmers. Under these circumstances, Bt cotton has emerged as an attractive option before the cotton farmers¹.

Several studies done both in India and China revealed increased yields and reduced insecticide use due to Bt cotton cultivation in both countries. In India, growers recorded increased income upto \$250 or more a hectare, increasing farmer incomes nationally from \$840 million to \$1.7 billion². After introduction of Bt cotton in Andhra Pradesh, the productivity has jumped from a meagre 418 Kg/ha in 2002 to touch 504 Kg/ha during 2011-2012. In addition to yield increase reported in Bt cotton some negative aspects such problems in human and animals, increased

incidence of sucking pests like mirid buds and diseases like *Alternaria*, *Cercospora* and *Helminthosporium* leaf spots, micronutrient deficiencies etc were also found to be reported in various literature^{3,4}. This situation necessitated researchers to conduct a study to unearth consequences of Bt Cotton cultivation as perceived by a wide range of stake holders of Bt cotton viz., farmers, Agricultural scientists, officials from voluntary agencies, Bt cotton company, officials of department of Agriculture, Doctors and veterinary doctors.

Methodology

In the study area, among the respondents, as the variables selected for study were already existing an Exploratory research design was found to be more appropriate and adopted in the study. Karimnagar district of Andhra Pradesh was purposively selected as it has largest area under Bt cotton cultivation. Out of fifty seven mandals of the district, three mandals having highest area under Bt cotton cultivation were selected purposively for the study. From each of the selected mandal, a list of villages having Bt cotton were prepared and out of them four villages from each mandal were selected based on highest area under Bt cotton. Thus 12 villages were finally selected for the study. From the list of Bt cotton cultivating farmers, with the help of Random Sampling technique ten (10) Bt cotton cultivating farmers were selected from each village. Thus from the farmers group, 120 Bt cotton

formed the sample for the study. In addition to the farmer respondents, consequences of Bt cotton cultivation as perceived by ten (10) respondents from each of the categories i.e. Agricultural scientists, officials of Department of Agriculture, Doctors, veterinary doctors and personnel of voluntary agencies and Bt cotton company were also collected.

After extensive review of literature, consultation with scientists, farmers and other experts 45 statements on consequences of Bt cotton cultivation were prepared and pretested by administering them to 30 cotton cultivators of the study area outside the main sample area of study. This helped to eliminate ambiguous questions and a few other questions which did not evoke proper response. Based on the experience gained in pretesting, the interview schedule was modified wherever necessary. The final schedule comprised of a total of 32 statements on consequences of Bt cotton cultivation.

The investigator personally approached all the respondents and developed informal rapport with them by explaining the purpose of the study. The translated version of schedule was administered to the respondents of sample area. Each item was read out to the respondent by the investigator and the responses were recorded.

The collected data were coded, classified and tabulated. The findings were suitably interpreted and necessary inferences were drawn.

After documenting the information on consequences, the consequences were grouped into positive and negative consequences.

Results and Discussion

Consequences perceived by officials of Department of Agriculture: Results given in table-1 and figure-1 inferred that positive consequences of Bt cotton cultivation as perceived by officials of department of agriculture were: reduced debts due to Bt cotton cultivation due to high net returns (50%), protection of ecosystem due to Bt cotton cultivation (due to less pesticide sprays) (50%), reduction in incidence of bollworm (20%). Negative consequences perceived were fall in cotton price due to more production under Bt cotton (90%), incidence of sucking pests, grey mildew and wilt incidence(70%), dependence on local money lenders and other private sources for crop loans (60%), reduction in area under food crops like maize, jowar etc., (40%), micronutrient deficiencies(30%), menace of black market and middlemen (20%) and farmer suicides due to Bt cotton failure (20%)^{5,6,7}.

Consequences perceived by the Agricultural scientists: Results in table-2 and figure-2 indicated positive consequences of Bt cotton cultivation as perceived by the agricultural scientists were Bt cotton cultivation increases the cropping intensity (more number of crops) (90%), increase yields due to high net returns (80%), reduction in incidence of bollworm (70%), changes in cropping pattern(30%). Negative consequences perceived were fall in cotton price due to more production under Bt cotton (80%), reduction in area under food crops like maize, jowar etc., (80%), incidence of sucking pests, grey mildew and wilt(70%), disappearance of traditional varieties and hybrids (50%), soil infertility as Bt cotton is soil exhaustive (40%) and micronutrient deficiencies (40%)^{8,9,10}.

Table-1
Consequences perceived by officials of Department of Agriculture (n=10)

Consequences	Frequency (n)	Percentage (%)
Positive Consequences		
Reduced debts due to Bt cotton cultivation due to high net returns	5	50
Protection of ecosystem due to Bt cotton cultivation (due to less pesticide sprays.)	5	50
Reduction in incidence of bollworm	2	20
Negative Consequences		
Fall in cotton price due to more production under Bt cotton	9	90
Incidence of sucking pests, grey mildew and wilt incidence	7	70
Dependence on local money lenders and other private sources for crop loans.	6	60
Reduction in area under food crops like maize, jowar etc.	4	40
Micronutrient deficiencies.	3	30
Menace of black market and middlemen	2	20
Farmer suicides due to Bt cotton failure	2	20

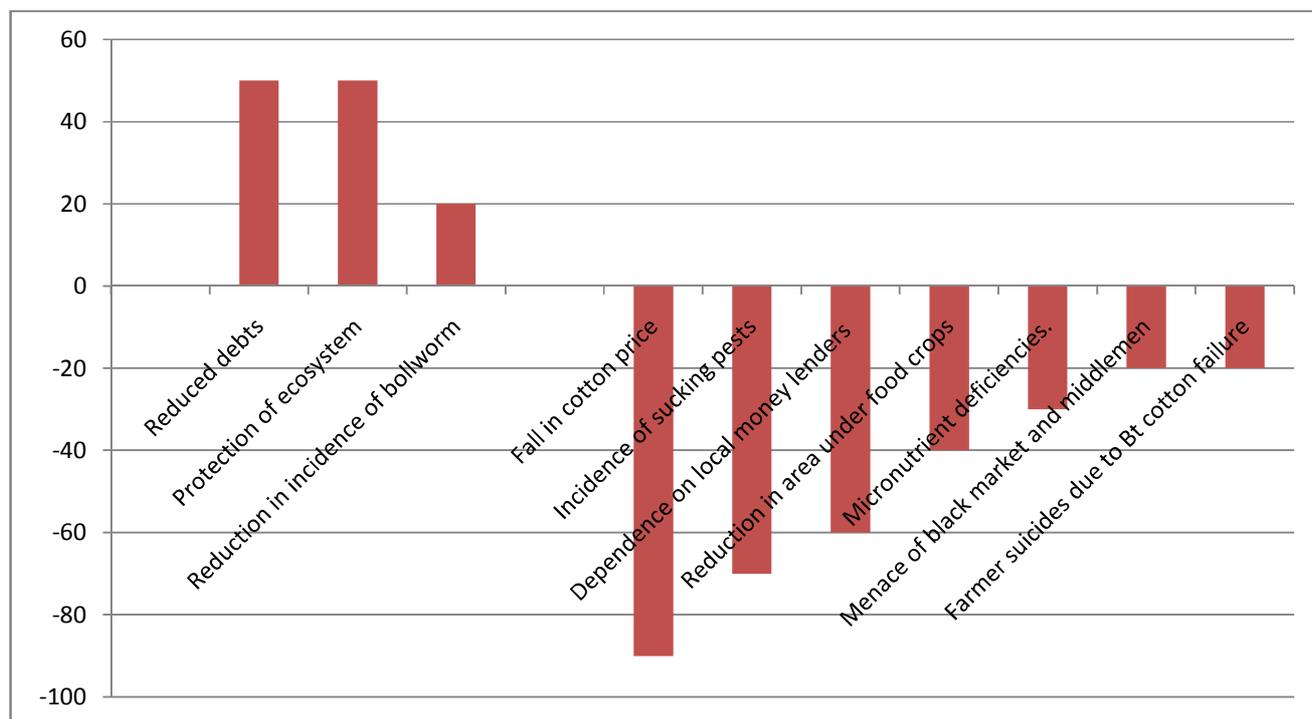


Figure-1
 Consequences perceived by officials of Department of Agriculture

Table-2
 Consequences perceived by the Agricultural scientists (n=10)

Consequences	Frequency (n)	Percentage (%)
Positive Consequences		
Increase in cropping intensity (more number of crops)	9	90
Increase yields due to high net returns	8	80
Reduction in incidence of bollworm	7	70
Changes in cropping pattern.	3	30
Negative Consequences		
Fall in cotton price due to more production under Bt cotton	8	80
Reduction in area under food crops like maize, jowar etc.	8	80
Incidence of sucking pests, grey mildew and wilt.	7	70
Disappearance of traditional varieties and hybrids.	5	50
Soil infertility as Bt cotton is soil exhaustive	4	40
Micronutrient deficiencies.	4	40

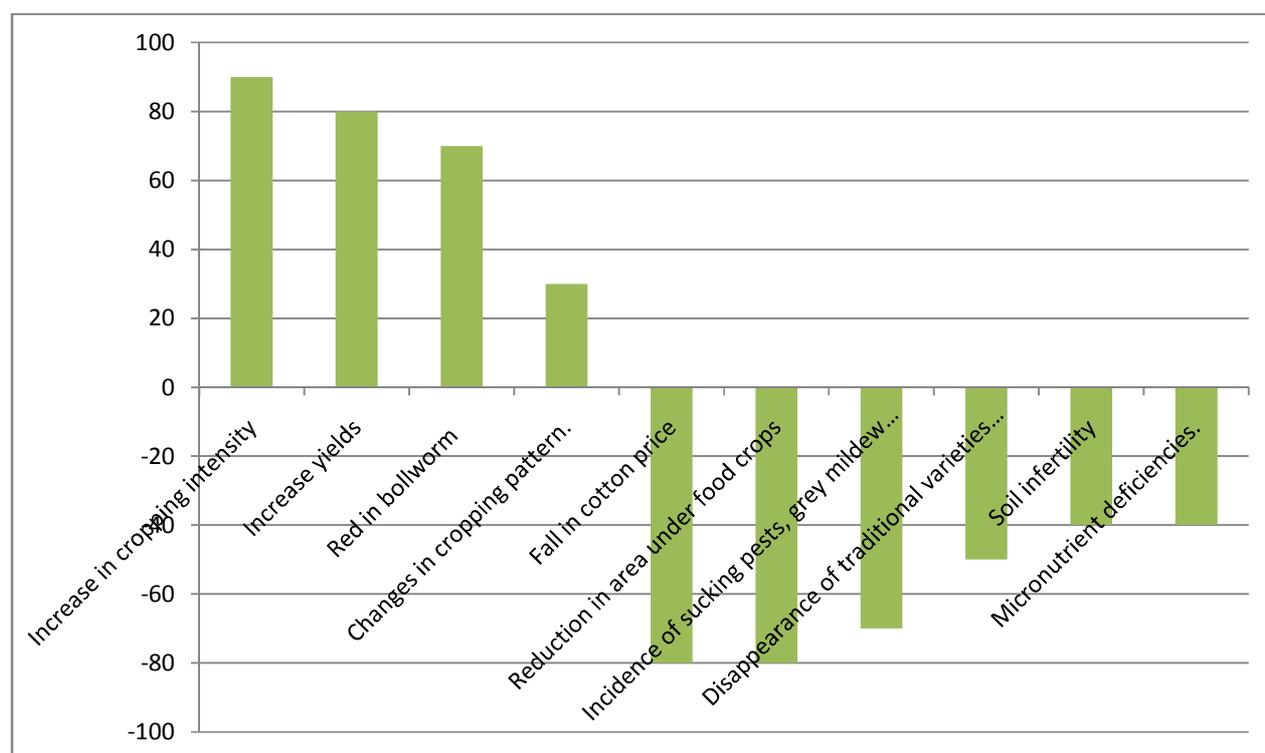


Figure-2
 Consequences perceived by the Agricultural scientists

Consequences of cultivation of Bt cotton in the field as perceived by Doctors: Keen perusal of results in table-3 revealed the consequence of cultivation of Bt cotton as perceived by majority of doctors was the problem of skin allergies (100%)¹⁰. Though other problems like fever, decline in immunity, weakness, unexplained health problem and increased death rate in infants were also noticed in other literature under the consequences of Bt cotton, doctors in the study area who are treating patients with these problems failed to link Bt cotton cultivation with these symptoms. Hence these problems were removed from the table.

Consequences of consumption of Bt cotton stubbles by cattle as perceived by Veterinary Doctors: Results furnished in table-4 and figure-3 on consequences of consumption of Bt cotton stubbles by cattle, sheep and goat as perceived by veterinary doctors indicated mild cough and sneezing in cattle (100%), followed by nasal bleeding in sheep and goat (90%), reduction in rumination (80%) and Salivation (70%), diarrhea (40%), kidney problems (30%), lungs damage (20%) and increase in mortality (20%)¹⁰. Genetic Engineering Approval Committee (GEAC) should thoroughly check for long term and short term results of clinical tests on humans and animals before commercial release as many negative consequences were perceived in the study area on animals.

Table-3
 Consequences of cultivation of Bt cotton in the field as perceived by Doctors (n=10)

Consequences	Frequency (n)	Percentage (%)
Skin allergies	10	100

Table-4
 Consequences of consumption of Bt cotton stubbles by cattle as perceived by veterinary Doctors (n=10)

Consequences	Frequency (n)	Percentage (%)
Mild cough and sneezing	10	100
Nasal bleeding in sheep and goat	9	90
Reduction in rumination	8	80
Reduction in Salivation	7	70
Diarrhoea	4	40
Kidney problems	3	30
Lungs damage	2	20
Increase in mortality	2	20

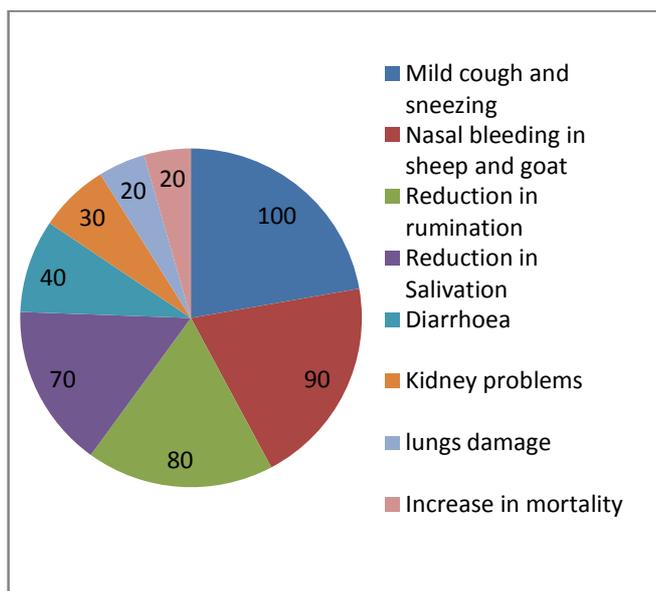


Figure-3

Consequences of consumption of Bt cotton stubbles by cattle as perceived by veterinary Doctors

Consequences perceived by personnel of voluntary agencies: Results given in table-5 and figure-4 inferred the consequences of Bt cotton cultivation as perceived by personnel of voluntary agencies were Bt cotton cultivation reduced pesticide sprays for bollworm (30%) but incidence of grey mildew and wilt (90%), increased mirid bug attack (90%), incidence of sucking pests(80%), increased micronutrient deficiencies (80%) and development of resistance in bollworm(20%) were the negative

consequences perceived where as other positive consequences perceived were increased yields by 30 to 40% (20%) and reduced exposure of the farmers, farm workers and environment to insecticides (20%)¹¹.

Table-5
Consequences perceived by personnel of voluntary agencies (n =10)

Positive Consequences	Frequency (n)	Percentage (%)
Reduced pesticide sprays for bollworm	3	30
Increased Yields (30 to 40%)	2	20
Reduced exposure of the farmers, farm workers and environment to insecticides	2	20
Negative Consequences		
Grey mildew and wilt incidence.	9	90
Increased mirid bug attack	9	90
Incidence of sucking pests.	8	80
Increased micronutrient deficiencies.	8	80
Development of resistance in bollworm	2	20

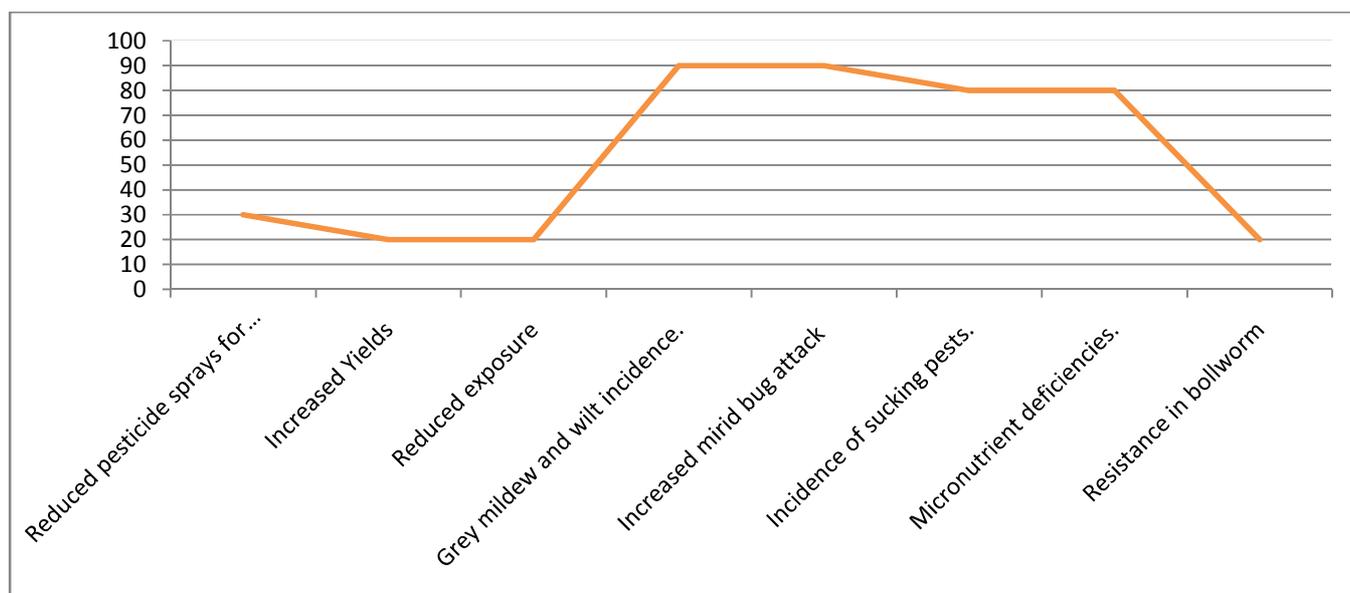


Figure-4

Consequences perceived by personnel of voluntary agencies

Consequences perceived by officials of Bt cotton company: Table-6 and figure-5 on the consequences of Bt cotton cultivation as perceived by officials of Bt cotton company indicated that Bt cotton cultivation increased yields (100%), reduced pesticide sprays for bollworm (90%) and reduced exposure of the farmers, farm workers and environment to insecticides (70%) were the positive consequences perceived where as increased incidence of sucking pests (40%), increased grey mildew and wilt incidence (40%), increased mirid bug attack (30%) and increased micronutrient deficiencies (20%) were the negative consequences perceived by Bt cotton officials.

Consequences of Bt cotton cultivation as perceived by farmers: The data summarized in the table-7 and figure-6 revealed that majority (28.33%) of the respondents perceived positive consequence of Bt cotton cultivation i.e. significant

yield increase followed by reduced pesticide sprays for bollworm (25.83%), higher net income (23.33%), more number of bolls (20%), good quality of cotton lint and kapas (24.17%), better boll worms control (24.17%), reduced cost of cultivation (22.5%), and reduced exposure of the farmers and farm workers to pesticides (25%).

Majority (28.3%) of the respondents had indicated negative consequences such as poor performance in rainfed conditions, emergence of new pests and diseases mealy bugs, Tobacco streak virus, cucumber mosaic virus, grey mildew, wilt (25.8%), Bt crop requires more number of sprays for managing sucking pests than the non-Bt crop (23.3%), micronutrient deficiencies (22.5%), health problems among human beings like irritation while picking, allergies etc. (28.3%), yield reduction (22.5%) and Bt cotton crop is soil exhausting (subsequent crop will not come up healthy (24.2%)¹².

Table-6
Consequences perceived by officials of Bt cotton company (n =10)

Positive Consequences	Frequency (n)	Percentage (%)
Increased Yields (30 to 40%)	10	100
Reduced pesticide sprays for bollworm	9	90
Reduced exposure of the farmers, farm workers and environment to insecticides	7	70
Negative Consequences		
Increased incidence of sucking pests.	4	40
Increased grey mildew and wilt incidence.	4	40
Increased mirid bug attack	3	30
Increased micronutrient deficiencies.	2	20

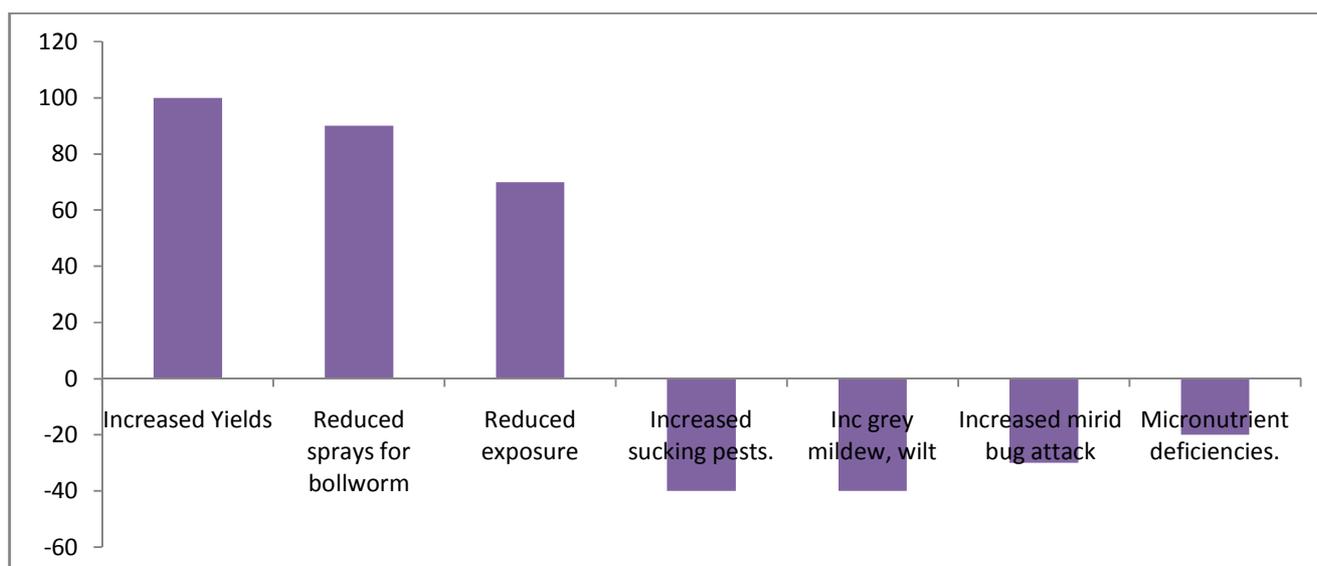


Figure-5
Consequences perceived by officials of Bt cotton company

Table-7
Consequences of Bt cotton cultivation as perceived by farmers (n=120)

Consequence	Frequency (n)	Percentage (%)
Positive consequences		
Significant yield increase	34	28.33
Reduced pesticide sprays for bollworm	31	25.83
Higher net income	28	23.33
More number of bolls	24	20
Good quality of cotton lint and kapas	29	24.17
Better boll worms control	29	24.17
Reduced cost of cultivation	27	22.5
Reduced exposure of the farmers and farm workers to pesticides	30	25
Negative consequences		
Poor performance in rainfed conditions	34	28.3
Emergence of new pests and diseases like mealy bugs, Tobacco streak virus, cucumber mosaic virus, grey mildew, wilt etc.	31	25.8
Bt crop requires more number of sprays for managing sucking pests than the non-Bt crop	28	23.3
Micronutrient deficiencies	27	22.5
Health problems among human beings like irritation while picking, allergies etc.	34	28.3
Yield reduction	27	22.5
Bt cotton crop is soil exhausting, subsequent crop will not come up healthy	29	24.2

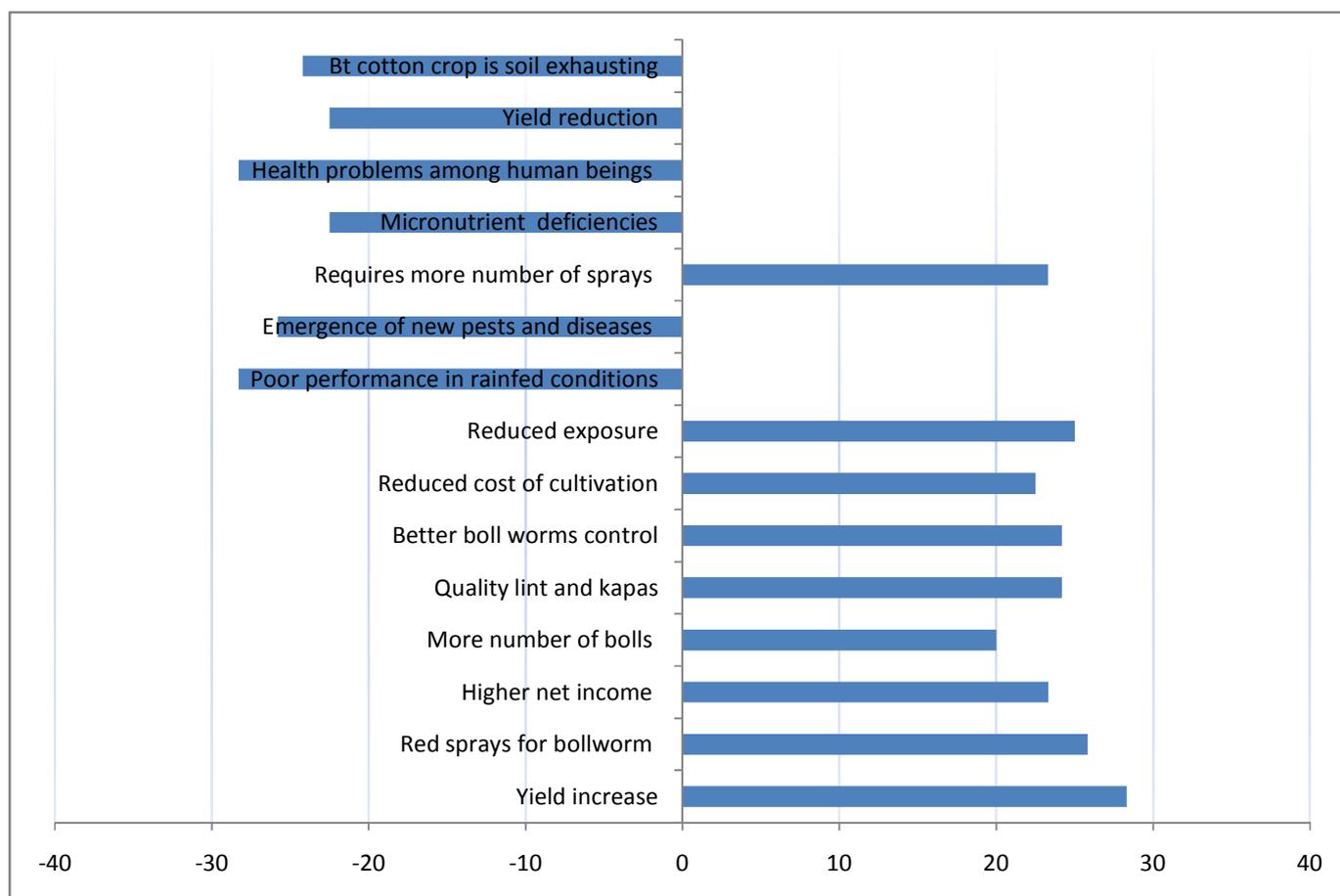


Figure-6
Consequences of Bt cotton cultivation as perceived by farmers

Conclusion

From the exhaustive data generated from the study it can be concluded that yield increase, increased net returns due to reduction in cultivation costs, better bollworm control, reduced pesticide sprays were reported by good majority of stakeholders at the same the negative consequences of emergence of new pests and disease, increased micronutrient deficiencies and above all problems perceived by doctors and veterinary doctors on human, animal and cattle should not be overlooked. The government agencies and NGOs should conduct more number of training programmes on Bt cotton cultivation practices especially on importance of cultivation of refugee rows, management of new pests and diseases, fertilisers and micronutrient application etc by utilizing funds from Agriculture Technology Management Agency (ATMA), which are available at the district level. Genetic Engineering Approval Committee (GEAC) should thoroughly check for long term and short term results of clinical tests on humans and animals before commercial release of GM crops as many negative consequences were perceived in the study area on animals.

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