



## Research Article

### PESTICIDE USING BEHAVIOUR OF BT. COTTON GROWERS IN MEHSANA DISTRICT

DODIYA H.D., PATEL J.K., DESHPANDE ANIKET AND PRAJAPATI M.R.

Department of Extension Education, CP College of Agriculture, SD Agricultural University, Sardarkrushinagar, Dantiwada, Banaskantha, Gujarat 385506

\*Corresponding Author: Email- [jk\\_sweta@yahoo.in](mailto:jk_sweta@yahoo.in)

Received: April 10, 2016; Revised: April 21, 2016; Accepted: April 22, 2016; Published: July 21, 2016

**Abstract-** The study was conducted in Mehsana districts of Gujarat state was selected purposively as the most potential for production and productivity of Bt. Cotton. The purpose of study was to know the pesticide using behaviour of Bt Cotton Growers about IPM Practices. Multistage Random Sampling technique was used to select 120 farmers from 12 villages of Vijapur and Visanagar taluka. The result indicated that among the all Bt. cotton growers more than three-fifth (62.50 per cent) of the Bt. cotton growers had medium pesticide using behaviour about IPM Practices followed by 25.00 per cent of them had high pesticide using behaviour about IPM Practices. Whereas, only 12.50 percent of them had low pesticide using behaviour about IPM Practices. While in case of practice-wise pesticide using behaviour in Bt. cotton two-fifth of the respondents were used plant protection measures as per recommendation in seed treatment for sucking pests, seed treatment for diseases. The independent variables viz., education, farming experience, social participation, size of land holding, occupation, annual income, extension participation, sources of information, risk orientation, knowledge level about recommended Integrated Pest Management, and attitude towards use of pesticide were positively and significantly associated with extent pesticide using behaviour of recommended Bt. cotton plant protection measures by the Bt. cotton growers. Whereas, age had negative and non significant association with extent pesticide using behaviour of recommended Bt. cotton plant protection measures by the Bt. cotton growers.

**Keywords-** Behaviour, Knowledge, Integrated Pest Management, Adoption

**Citation:** Dodiya H.D., et al., (2016) Pesticide Using Behaviour of Bt. Cotton Growers in Mehsana District. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 8, Issue 25, pp.-1506-1510.

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**Academic Editor / Reviewer:** B.N. Kalsariya

#### Introduction

Modern agriculture depends on the four main factors viz., water, fertilizers, seed and pesticides. Pesticides are the integral part of modern agriculture. About 35-45 % crop production is lost due to insects, weeds and diseases, while 35% crop produces are lost during storage. The per capita consumption of pesticides in India is 0.6 Kg/ha which is the lowest in the world. The per capita pesticide consumption in China and USA is 13 Kg/ha and 7 Kg/ha, respectively. The main reason for low per capita consumption of pesticides in India is low purchasing power of farmers and small land holdings. The majority of agricultural farm land belongs to Marginal farmers but maximum contribution to the produce is also from marginal farmers. The large scale farming is increasing and therefore, there is good scope for increase of per capita consumption of pesticides in India.

India has registered a significant increase in cotton area from 7.7 million hectares in 2002-03 to 12.25 million hectares in 2013-14 the highest ever cotton area in the history of Indian cotton. Similarly, the number of small holder cotton farmers increased significantly from 5 million small and resource poor cotton farmers in 2002-03 to more than 8 million cotton farmers in 2013-14 with 7.7 million Bt. cotton farmers representing approximately 95% of total cotton farmers in 2013-14. In the thirteen year period, 2002 to 2014, India tripled cotton production from 13 million bales to 39 million bales in 2013, with a projected 40 million bales in 2014. World cotton production was estimated at 151 million bales in 2014, and impressively, India contributed one quarter of this global total. In 2014, India achieved a historic milestone by producing more cotton than China and becomes the number one cotton producing country in the World. For the first time in the

history of agriculture, India dethroned China to earn the crown of the white gold – as cotton is known among smallholder farmers in the rural parts of India and China [5].

The major states growing Bt. cotton in 2014, listed in order of hectare age, were Maharashtra (3.9 million hectares) representing 32% of all Bt. cotton area in India, followed by Gujarat (2.5 million hectares or 21%), Andhra Pradesh and Telangana (2.3 million hectares or 18.6%), Northern Zone (1.4 million hectares or 11.6%), Madhya Pradesh (560 thousand hectares), and the balance of 835 thousand hectares in Karnataka, Tamil Nadu and other cotton growing States including Odisha. The high percentage adoption of Bt. cotton by farmers across the different States reflects the priority of controlling the menace of the American bollworm complex, a group of deadly borer insects that caused heavy damage to cotton crop in the past [2].

In Gujarat (2012-13) total area under cotton cultivation is 26.33 lakh hectares of which 21.33 lakh hectares are under Bt. cotton cultivation and production of 105.00 lakh bales are under Bt. cotton. The major cotton growing districts in Gujarat are Mehsana, Surendranagar, Baroda, Bharuch, Ahmedabad and Sabarkantha. The district wise area, production and productivity of Bt. cotton in Gujarat state are as under.

#### Objectives

- [1] To study the attributes of Bt. cotton growers.
- [2] To find out the extent of pesticide using behaviour of Bt. cotton growers.
- [3] To ascertain the association between selected characteristics of Bt. cotton growers and their extent of pesticides using behaviour.

## Materials and Methods

Ex-post facto research design was used for the study. Mahesana district of Gujarat State was selected purposively as the district is considered as the most potential for production and productivity of Bt. cotton. Two talukas viz., Vijapur and Visnagar having possibility of increasing productivity of Bt. cotton were selected randomly for this study. Six villages were selected randomly from the list of Bt. cotton growing villages from each taluka under Bt. cotton cultivation. Thus, total twelve villages were selected. From each selected villages, ten Bt. cotton growers were selected randomly. Hence, the final sample size was 120 Bt. cotton growers. The attributes of Bt. cotton growers were measured with the help of the scales and indices developed by past researchers as well as structured schedules/tests, which were framed for the purpose. Extent of pesticide use behaviour was considered as dependent variable in the present study. For the measurement of behaviour, a list of the recommended plant protection measures of the Bt. cotton crop was prepared with the help of extension personnel and experts of the subject. The pesticide using behaviour of Bt. cotton growers in each of the identified practices was measured using three point continuum viz., adoption as per recommendation, below recommendation and above recommendation assigned 3, 1 and 1 score, respectively. While, the respondents who have not using practice assigned 0 score. On the basis of score the respondents were classified into four categories viz., below recommendation, as per

recommendation, above recommendation and not using practices. Later on the frequency of each practice was counted and converted into percentage. The pesticide using behaviour index was calculated for each respondent. Later on, respondents were classified into three levels of extent of pesticides using behaviour viz., low, medium and high score by using mean and standard deviation.

The pesticide using behaviour of Bt. cotton growers in each of the identified practices was measured using three point continuum viz., adoption as per recommendation, below recommendation and above recommendation assigned 3, 1 and 1 score, respectively. The 0 score was given when there is no adoption of any practice by respondents. For clear understanding of each of the selected practices, mean score was calculated.

The data were collected by personal contact method with the help of structured interview schedule and collected data were coded, classified, tabulated and analysed in light of objectives and in order to make the findings realistic for drawing meaningful interpretation. The statistical tools such as frequency, percentage, mean, standard deviation and co-efficient of correlation, were used for the study.

## Result and Discussion

### Attributes of Bt. Cotton Growers

**Table-1 Characteristics of the respondents (n=120)**

Characteristics	Category	Freq	Per cent
1. Age	Young (Up to 35 years)	19	15.83
	Middle (36 to 50 years)	83	69.17
	Old (Above 50 years)	18	15.00
2. Education	Illiterate	05	04.17
	Functionally literate	08	06.67
	Primary school	09	07.50
	Middle school	54	45.00
	High school	32	26.66
	College/Post graduation	12	10.00
3. Farming experience	Low (up to 4 years)	19	15.83
	Medium (4 to 8 years)	27	22.50
	High (above 8 years)	74	61.67
4. Social participation	No membership	05	04.17
	Membership in one organization	27	22.50
	Membership in more than one organization	66	55.00
	Office bearer	22	18.33
5. Land holding	Marginal ( Below 1.0 ha)	04	3.33
	Small ( 1.01 to 2.0 ha)	65	54.17
	Medium 2.01 to 4.0 ha)	37	30.83
	Big ( Above 4.0 ha)	14	11.67
6. Major occupation	Farming alone	57	47.50
	Farming + Animal Husbandry	31	25.83
	Farming + Animal Husbandry + Business	17	14.17
	Farming + Animal Husbandry + Business + Service	15	12.50
7. Annual income	Low annual income (up to Rs. 85,333/-)	36	30.00
	Medium annual income (Rs.85,333 to Rs.6,12,366/-)	76	63.33
	High annual income (above Rs. 6,12,366 /-)	08	06.67
8. Sources of information	Low utilization (upto 17.07 score)	25	20.83
	Medium utilization (17.07 to 23.39 score)	77	64.17
	High utilization (above 23.39 score)	18	15.00
9. Extension participation	Low participation (below 3.12 score)	37	30.83
	Medium participation (3.12 to 4.80 score)	56	46.67
	High participation (above 4.80 score)	27	22.50
10. Risk orientation	Low ( below 19.03 score)	35	29.17
	Medium ( 19.03to 23.39 score)	70	58.33
	High ( above 23.39score)	15	12.50
11. Knowledge about IPM	Low (below 56.12 score)	24	20.00
	Medium ( 56.12 to 80.66 score)	79	65.83
	High (above 80.66 score)	17	14.17
12. Attitude towards use of pesticides	Less favourable (below 36.16 score)	20	16.67
	Moderately favourable (36.16 to 44.42 score)	88	73.33
	Highly favourable (above 44.42 score)	12	10.00

A perusal from the data in [Table-1] indicate that majority (69.17 per cent) of the Bt. cotton growers were found in middle age group, having middle to high school level of education (71.66 per cent), found with high farming experience (61.67 per

cent), had membership in one or more than one organization (77.50 per cent), possessed marginal to medium size of land holding (85.00 per cent), having medium annual income(63.33 per cent), engaged in farming occupation (47.50 per

cent), had medium to low level of information sources (85.00 per cent), had medium extension participation (46.67 per cent), found to have medium risk orientation (58.33 per cent), had medium level of knowledge about integrated pest management practices of Bt. cotton (65.83 per cent) and moderately favourable attitude towards the use of pesticides in Bt. cotton (73.33 per cent).

#### Extent of pesticide using behaviour of Bt. cotton growers in integrated pest management of Bt. cotton

Adoption process is the mental process through which an individual passes from first hearing of an innovation to its final adoption. Thus, adoption is a decision to continue full use of an innovation. With a view to find out the level of use of pesticide in integrated pest management of Bt. cotton crop, the respondents were asked to indicate at what extent they had used recommended pesticides in integrated pest management. The data in this regard are presented in [Table-2]

The data presented in [Table-2] indicate that nearly three-fifth (62.50 per cent) of the Bt. cotton growers had medium pesticide using behavior about IPM practices followed by 25.00 per cent of them had high pesticide using behavior about IPM practices. Whereas, only 12.50 per cent of them had low pesticide using behavior about IPM practices.

From the above results, it can be concluded that majority (62.50 per cent) of the

Bt. cotton growers had medium pesticide using behaviour about IPM practices in Bt. cotton.

**Table-2** Distribution of the Bt. cotton growers according to their extent of pesticide using behaviour about IPM practices (n= 120)

Sr. No.	Category	Frequency	Per cent
1.	Low pesticide using behaviour (below 47.53 score)	15	12.50
2.	Medium pesticide using behaviour (47.53 to 60.67 score)	75	62.50
3.	High pesticide using behaviour (above 60.67 score)	30	25.00
<b>Total</b>		<b>120</b>	<b>100.00</b>

Mean = 54.10

S.D. = 6.57

The probable reason might be due to the facts that majority of the Bt. cotton growers were middle to young age group and educated having ability to read, understand and concretize the ideas leads to unique power of decision making which is reflected into using pesticides as per the recommendation.

This finding derives support from the findings of Rathod (2009), [3] Tilara (2009), [4] Chaudhary (2012) [1] and Warawdekar (2014) [6].

**Table-3** Practice wise distribution of Bt. cotton growers according to their pesticide using behaviour about integrated pest management practice (n=120)

Sr. No.	IPM Practices	Below recommendation		As per recommendation		Above recommendation		Not using practices	
		F	P	F	P	F	P	F	P
1.	Seed treatment for sucking pests	17	14.17	57	47.50	21	17.50	25	20.83
2.	Seed treatment for diseases	05	4.10	48	40.00	15	12.50	52	43.40
3.	<b>Sucking pests</b>								
a.	Jassid	17	14.17	19	15.83	84	70.00	00	00.00
b.	Mealy bug	22	18.33	25	20.83	59	49.17	14	11.67
c.	White fly	14	11.67	18	15.00	68	56.66	20	16.67
d.	Aphid	05	4.10	26	21.66	80	66.67	09	7.57
e.	Thrips	12	10.00	24	20.00	43	35.83	41	34.17
f.	Red cotton bug	13	10.83	39	32.50	30	25.00	38	31.67
g.	Mite	10	8.34	26	21.67	25	20.83	59	49.16
4.	<b>Diseases</b>								
a.	Wilt	06	5.00	26	21.67	58	48.33	30	25.00
b.	Root rot	18	15.00	34	28.34	33	27.50	35	29.16
c.	Bacterial leaf blight	08	6.66	27	22.50	35	29.17	50	41.67
d.	Fungal leaf spot	03	2.50	26	21.67	28	23.33	63	52.50
5.	Bio-pesticides	07	5.83	25	20.83	03	2.50	85	70.84
6.	Sticky trap	20	16.66	31	25.84	04	3.34	65	54.16
7.	Predator	12	10.00	19	15.83	07	5.83	82	68.34

(F=Frequency, P=Percentage)

It is clear from the data in [Table-3] that with regards to seed treatment for sucking pests, it was found that 47.50 per cent Bt. cotton growers used pesticides as per recommendation. While, 17.50 per cent and 4.17 per cent Bt. cotton growers were found using pesticide above recommended dose and below recommended dose, respectively. Remaining 20.83 per cent Bt. cotton growers not followed the seed treatment practices for sucking pests.

In the practice of seed treatment for diseases, 40.00 per cent Bt. cotton growers were found using fungicide as per recommendation followed by 12.50 per cent Bt. cotton growers who were using fungicide above the recommended dose. Only, 4.10 per cent Bt. cotton growers were found using fungicide below the recommendation. Whereas, 43.40 per cent Bt. cotton growers could not follow the practices.

Pesticide using behaviour of Bt. cotton growers with regards to sucking pest was assessed against seven pests viz., (1) Jassid (2) Mealy bug (3) White fly (4) Aphid (5) Thrips (6) Red cotton bug (7) Mite.

The percentage of Bt. cotton growers using pesticide as per recommended dose for controlling Jassid, mealy bug, white fly, aphid, thrips, red cotton bug and mite were 15.83, 20.83, 15.00, 21.66, 20.00, 32.50 and 21.67 per cent, respectively. While, 14.17, 18.33, 11.64, 4.10, 10.00, 10.83 and 8.34 per cent Bt. cotton growers were found using pesticide below the recommended dose for controlling

Jassid, mealy bug, white fly, aphid, thrips, red cotton bug and mite, respectively.

Adoption of pesticides above recommended dose for controlling Jassid, mealy bug, white fly, aphid, thrips, red cotton bug and mite was observed among 70.00, 49.17, 56.66, 66.67, 35.83, 25.00 and 20.83 per cent Bt. cotton growers.

Pesticide using behaviour of Bt. cotton growers with regards to disease was assessed against four major diseases viz., (1) Wilt (2) Root rot (3) Bacterial leaf blight (4) Fungal leaf spot.

The percentage of Bt. cotton growers using pesticide as per recommended dose for controlling wilt, root rot, bacterial leaf blight and fungal leaf spot were 21.67, 28.34, 22.50 and 21.67 per cent, respectively.

While, 5.00, 15.00, 6.66 and 2.50 per cent Bt. cotton growers were found using pesticide below the recommended dose for controlling wilt, root rot, bacterial leaf blight and fungal leaf spot, respectively.

Adoption of pesticides above recommended dose for controlling wilt, root rot, bacterial leaf blight and fungal leaf spot was observed among 48.33, 27.50, 29.17 and 23.33 per cent Bt. cotton growers.

With regards to use of pesticides it was found that 20.83 per cent of them used bio-pesticide as per recommendation. While, 5.83 per cent of Bt. cotton growers using bio-pesticides below the recommended dose and 2.50 percent of them using bio-pesticide above recommended dose, respectively. While, remaining

70.84 per cent Bt. cotton growers were found not using any bio-pesticides in Bt. cotton.

Sticky trap were also using by Bt. cotton growers for controlling sucking pests. In this practice, 25.84 per cent of Bt. cotton growers were observed using sticky traps as per recommendation. While, 16.66 and 3.34 per cent Bt. cotton growers were found using sticky traps below recommended rate and above recommended rate per hectare. Whereas, 54.16 per cent Bt. cotton growers were not using sticky traps for controlling sucking pests.

Predators are also important part of IPM in Bt. cotton. Nearly one-third (31.66 per cent) Bt. cotton growers were found using predators for sucking pests. Among them 15.83 per cent Bt. cotton growers were observed using predators as per recommendation while, 10.00 and 5.83 per cent Bt. cotton growers were observed using predators below and above recommendation, respectively. Whereas, 68.34 per cent Bt. cotton growers were not using predators for controlling of pests.

It is observed from [Table-4] with regard to care and management taken while using pesticide in Bt. cotton among the Bt. cotton growers viz., wear protective clothes, mix pesticide thoroughly using stick, use funnel to avoid spillage, spraying in wind direction, no smoking and eating during spraying, wash clothes and take

bath after spraying and destroy and bury the empty container were found 33.33, 77.50, 80.83, 69.16, 62.50, 81.66 and 60.00 per cent, respectively.

**Table-4** Distribution of the Bt. cotton growers according to care and management taken while using pesticides (n=120)

Sr. No.	Care and management practices	Frequency	Per cent
1.	Wear protective clothes	40	33.33
2.	Mix pesticide thoroughly using stick	93	77.50
3.	Use funnel to avoid spillage	97	80.83
4.	Spraying in wind direction	83	69.16
5.	No smoking and eating during spraying	75	62.50
6.	Wash clothes and take bath after spraying	98	81.66
7.	Destroy and bury the empty container	72	60.00

#### Association between Selected Attributes OF the Bt. Cotton Growers and Their Extent of Pesticide Using Behaviour

**Table-5** Zero order correlation coefficients between the personal, socio- economic, communicational and psychological attributes of the Bt. cotton growers and their extent of pesticide using behaviour (n=120)

Sr. No.	Independent variables	Correlation coefficient (r)
I.	<b>Personal</b>	
1.	Age	0.096NS
2.	Education	0.354**
3.	Farming experience	0.235**
II.	<b>Social</b>	
4.	Social participation	0.312**
III	<b>Economic</b>	
5.	Size of land holding	0.154*
6.	Major occupation	0.194*
7.	Annual income	0.270**
IV.	<b>Communicational</b>	
8.	Sources of information	0.158*
9.	Extension participation	0.188*
V.	<b>Psychological</b>	
10.	Risk orientation	0.270**
11.	Knowledge level about IPM of Bt. cotton	0.598**
12.	Attitude towards use of pesticides	0.141*

\*\* Significant at 1 per cent level \* Significant at 5 per cent level NS= Not significant

The results of correlation analysis in [Table-5] indicated that out of the twelve independent variables, eleven variables viz., education, farming experience, social participation, size of land holding, occupation, annual income, extension participation, sources of information, risk orientation, knowledge level about recommended Integrated Pest Management, and attitude towards use of pesticide were positively and significantly associated with extent pesticide using behaviour of recommended Bt. cotton plant protection measures by the Bt. cotton growers. Whereas, age had negative and non-significant association with extent pesticide using behaviour of recommended Bt. cotton plant protection measures by the Bt. cotton growers.

#### Conclusion

It can be concluded that majority of the Bt. cotton growers were found in middle age group, having middle to high school level of education, found with high farming experience, had membership in one or more than one organization, possessed marginal to medium size of land holding, having medium annual income, engaged in farming occupation, had medium to low level of information sources, had medium extension participation, found to have medium risk orientation, had medium level of knowledge about integrated pest management practices of Bt. cotton and moderately favourable attitude towards the use of pesticides in Bt. cotton (73.33 per cent).

Among the all Bt. cotton growers more than three-fifth of the Bt. cotton growers had medium pesticide using behaviour about IPM practices. While in case of

practice-wise pesticide using behaviour in Bt. cotton two-fifth of the respondents were used plant protection measures as per recommendation in seed treatment for sucking pests, seed treatment for diseases. Whereas, control of different sucking pest viz., jassid, mealy bug, white fly, aphid, thrips, red cotton bug and mite one-fifth of the respondents used plant protection measures as per recommendation and similar result was observed in case of diseases control, bio-pesticides, sticky trap and predators. It can be concluded that majority of the Bt. cotton growers were use pesticide above recommendation, below recommendation and not using any pesticides in their field for plant protection.

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**Conflict of Interest: None declared**

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