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Insecticide Use Pattern on Tomato Crop in Punjab

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ABSTRACT

Tomato is one of the important, popular and remunerative vegetable crops grown around the world for fresh market and processing. Fruit borer, *Helicoverpa armigera* (Hubner) is rated as one of the most noxious pests infesting tomato crop. Overuse of insecticide to knock down this destructive pest has led to many problems like build up of insecticide resistance, resurgence, replacement of natural enemies and insecticide residue in tomato fruits. The vegetable growers, therefore, are using a wide range of insecticides, either single or in mixtures for its control. Out of the six insecticides viz. flubendiamide, profenophos, carbaryl, cypermethrin, deltamethrin, and fenvalerate recommended by Punjab Agricultural University, Ludhiana for its control, carbaryl was not being used by the farmers. Fourteen insecticides singly and two mixtures were being used extensively by the vegetable growers of the state. On an average, 3.87 sprays (range 3-8 sprays) were done by each tomato grower. Out of these, 29.97 per cent sprays were done with recommended insecticides, 56.31 per cent with unrecommended insecticides and 13.69 with unrecommended mixtures. Chlorantraniliprole 18.5 SL, being unrecommended was used to a tune of 17.31 per cent, while flubendiamide 480 SC (10.59%) lead in recommended insecticides. Cypermethrin and chlorpyriphos were the most frequently used mixtures.

Key words: Fruit borer, helicoverpa armigera, insecticide, spray pattern, tomato.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the important and remunerative vegetable crops grown around the world for fresh market and processing. It is a popular vegetable globally ranking second in importance after potato in many countries. It occupies the daily menu of people all over the world, especially in the Indian subcontinent, where the diet is predominantly vegetarian in nature (Mandaokar *et al.,* 2000). It is not only traded in the fresh market but is also used in the processing industry in soups, as paste, concentrate, juice and ketchup. The production and productivity of the crop is greatly hampered by the fruit borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) which causes damage to the developing fruits and results in yield loss ranging from 20 to 60 per cent (Selvanarayanan, 2000, Lal and Lal, 1996, Tewari and Krishnamoorthy, 1984). *H. armigera* is a polyphagous pest whose outbreaks in various crops are common and highly devastating. Early instars feed on flower buds, flowers and foliage while the matured instars bore into the fruits resulting in drastic yield reduction (Rath and Nath, 1997). The larvae bore characteristic circular holes mostly near the calyx of green fruits. This pest causes scarring, tissue damage and aberration in fruit shape or colour, making tomatoes undesirable for fresh market (Reddy and Miller, 2014).

Among the various strategies adopted to combat this pest of tomato, insecticides form the first line of defense. The farmers have a tendency to overuse insecticide in an over ambitious approach to knock down this destructive pest. Most of the insecticides used in tomato crop are based on quite limited number of chemically different classes. Of them, the most important insecticides that are used in tomato belong to organophosphates, carbamates and synthetic pyrethroids (Pawar and Jadhav, 1993). Recently, it has been noticed that some of these insecticides recommended for the control of fruit borer, not only had a shift in the status of their toxicity, but also caused resurgence. The indiscriminate use of synthetic chemical pesticides to control this pest has resulted in development of resistance (Armes *et al*., 1992). Most of the insecticides do not provide satisfactory level of control, probably due to the development of insecticide resistance. Apart from these, monitoring data on the above conventional insecticides showed that certain amount of insecticide residues were present at detectable levels, occasionally persisted at concentrations above the standards established by EPA (Kumar, 1998). Primarily, this is attributed to the application of insecticides at higher doses for want of effective control. Ultimately, this has resulted in the presence of these insecticides at higher concentration in edible parts of the plant as well as in the environment (Thilagam, 2006). Due to the problem of resistance and low level of control of fruit borer, the growers intensively spray tomato crop with insecticides either singly or in mixtures throughout the growing season of the crop. Six insecticides have been recommended by Punjab Agricultural University,

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Ludhiana for the control of *H. armigera* in tomato crop (Anonymous, 2013). However, there is an apprehension that farmers are not following the recommended practices regarding the use of insecticides. This practice may lead to worsening the problems of insecticide resistance by increased selection pressure on the pest. In addition, it may also leave excessive residues on edible portion and increased insecticidal load in the environment that may in the long run prove to be hazardous from public health/consumer safety point of view. Therefore, a survey was conducted to determine the insecticide spray pattern adopted by vegetable growers of Punjab for the management of tomato fruit borer and the results of the same are discussed in this paper.

METHODOLOGY

A survey to observe insecticide spraying pattern, adopted by the vegetable growers for tomato fruit borer management was conducted during the season November, 2009 to August, 2010 in the districts of Amritsar, Fatehgarh Sahib, Kapurthala, Ludhiana and Sangrur. The information was collected from 100 tomato growers of these districts. The data were collected on kind of insecticide(s) used, spray interval followed, purchase of insecticide and dosage used for sprays. The response of the farmers was recorded in a proforma devised for the purpose.

RESULTS AND DISCUSSION

Insecticide used

A wide range of insecticides belonging to all major groups were being used by the farmers (Table 1) for control of fruit borer in tomato. Out of six insecticides recommended (Anonymous, 2013) by Punjab Agricultural University, Ludhiana flubendiamide 480 SC, profenophos 50 EC, cypermethrin 10 EC, deltamethrin 2.8 EC and fenvalerate 20 EC were used by the farmers while carbaryl 50 WP was never used by the vegetable growers. Other 14 insecticides were being used singly and two as tank mixtures.

Dosage of Insecticides

The dosage for most of the insecticides (75-2500 ml/ha) was about the same as recommended for different insect pests on various crops except that of cypermethrin, deltamethrin and fenvalerate each @ 500-750 ml/ha, which was more than double to the recommended dosage of pyrethroids against various insect pests (Table 1). In an earlier survey, Chandi *et al.,* (2012) reported the use of higher dosage of pyrethroids by farmers for the control of diamondback moth in cole crops. Joia *et al.,* (2000) also reported the use of synthetic pyrethroids at higher dosages by the vegetable growers. Dhawan and Simwat (1996) reported the use of higher dosage of pyrethroids by farmers for control of bollworm in cotton.

Number and frequency of sprays

On an average, 3.87 sprays (range 3-8 sprays) were done by each tomato grower during the season (Table 1). Out of these, 29.97 per cent sprays were done with recommended insecticides, 56.31 per cent with unrecommended insecticides, while 13.69 with unrecommended mixtures. Chlorantraniliprole 18.5 SL alone was used by 17.31 per cent, while flubendiamide 480 SC with 10.59 per cent share lead in recommended insecticides. Cypermethrin and chlorpyriphos (505) was the most frequently used mixture followed by cypermethrin and endosulfan.

Table 1: Pattern of insecticides use on tomato in punjab

Insecticide	Dosage (ml/g per ha)	Number of sprays	Per cent of total sprays
Chlorantraniliprole 18.5 SL	125-200	67	17.31
Flubendiamide 480 SC	75-125	41	10.59
Spinosad 48 SC	150-225	36	9.30
Indoxacarb 15 SC	375-500	18	4.65
Pyridalyl 10 EC	625-750	11	2.84
Emamectin benjoate 5 SG	125-250	7	1.81
Novaluron 10 EC	250-500	15	3.87
Cypermethrin 10 EC	500-750	37	9.56
Deltamethrin 2.8 EC	500-750	14	3.62
Endosulfan 35 EC	1250-2500	22	5.68
Metasystox 25 EC	625-1250	6	1.55
Fenvalerate 20 EC	500-750	8	2.07
Profenophos 50 EC	1250-1500	16	4.13
Quinalphos 25 EC	625-1250	12	3.10
Chlorpyriphos 20 EC	1250-2500	6	1.55
Monocrotophos 36 SL	1250-1500	7	1.81
Acephate 75 SP	625-750	5	1.29
Triazophos 40 EC	1000-1250	4	1.03
Malathion 50 EC	1250	2	0.52
Cypermethrin + Endosulfan	1250-1500	22	5.68
Cypermethrin + Chlorpyriphos (505)	1000-1250	31	8.01

Spraying interval

As against the recommended interval of 10 days, the vegetable growers practiced the spraying of various insecticides or mixtures at intervals ranging from 4 to 12 days (Table 2). Some farmers even sprayed the crop with mixtures containing cypermethrin at four days interval during severe infestation of the pest. Spraying interval of 5-7 days was the most common. The practice of non-adherence to recommended spray schedule has also been observed earlier in potato (Kaur, 1994) and cole crops (Chandi *et al.,* 2012, Joia *et al.,*2000 and Nahar, 1993).

The present study indicated that the majority of tomato growers use the unrecommended insecticides, viz. chlorantraniliprole 18.5 SL, spinosad 48 SC, indoxacarb 15 SC, cypermethrin 10 EC, endosulfan 35 EC and mixture of cypermethrin with endosulfan and chlorpyriphos in contrast to the recommended ones. This improper use of insecticides may jeopardize the control of tomato fruit borer in the long run. The use of monocrotophos is restricted in vegetables, but the study revealed that still some of the farmers are using it (1.81% of total sprays). Many of the vegetable growers used mixtures for the control of fruit borer. There seemed no scientific basis in selecting components of mixtures.

Table 2: Spraying interval between two sprays with different insecticides on tomato in Punjab

Insecticide	Spray interval (days)
Chlorantraniliprole 18.5 SL, flubendiamide 480 SC, spinosad 48 SC, indoxacarb 15 SC, pyridalyl 10 EC, emamectin benjoate 5 SG, novaluron 10 EC	10-12
Profenophos 50 EC, endosulfan 35EC, chlorpyriphos 20 EC, triazophos 40 EC, monocrotophos 36 SL, acephate 75 SP, quinalphos 25 EC	7-10
Cypermethrin 10 EC, deltamethrin 2.8 EC, fenvalerate 20 EC, metasystox 25 EC, malathion 50 EC	5-7
Tank mixtures : c ypermethrin + endosulfan, cypermethrin + chlorpyriphos (505)	4-6

CONCLUSION

The present study indicates that the majority of tomato growers are not using the insecticides as per the recommendations regarding choice of insecticides, interval, number of sprays, mixtures *etc.* The vegetable growers are using a wide range of insecticides, either singly or in mixtures for the control of fruit borer in tomato. Out of the six insecticides recommended by Punjab Agricultural University, Ludhiana for its control, five insecticides *viz.* flubendiamide, profenophos, cypermethrin, deltamethrin, and fenvalerate were being used by the farmers. Fourteen unrecommended insecticides and two mixtures were being used extensively by the vegetable growers of the state. On an average, 3.87 sprays were done by each tomato grower. It is strongly felt that vegetable growers of the state need to be educated more effectively on the proper use of insecticides on vegetables. Surveys on the insecticide use pattern on major crops should be carried out as a routine practice to monitor the actual field use of insecticides and if needed, re-evaluation of recommended insecticides should be carried out so as to rationalize their use.

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