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Integrated pest management as a tool in influencing growth, yield and economics of tomato

RK Nath, KH Begum, S Brahma and R Sarma

Abstract
A field experiment was conducted in the farm of SCS College of Agriculture, Assam Agricultural University, Dhubri during 2018-2019 to manage major insect pests of tomato through IPM. Six different IPM treatments (including control) were followed against the target pest *i.e.*, tomato fruit borer. The experiment was conducted under randomized block design with three replications. From the experiment, it was observed that integration of different control measures proved to be the best in reducing the pest attack. The lowest per cent fruit borer infestation (16.8) was observed in the IPM trial as compared to chemical control. Likewise the highest yield (429 q/ha) with highest B:C ratio (1:5.92) along with other growth parameters studied was observed higher in IPM treated plots in comparison to chemical treated plot. The absolute control without any pest control measures recorded the highest fruit borer infestation (1.7%) and lowest B:C ratio (3.97).

Keywords: IPM, tomato, fruit borer, YST

Introduction
Tomato (*Lycopersicum esculentum*) belongs to family Solanaceae and is native to Tropical America (Thompson and Kelly, 1957) [12]. Among various vegetables, tomato is one of the most common and extensively grown vegetables all over the country and occupy an important place in the food basket of Indian consumers. Tomato is important source of vitamins and minerals (Bose and Som, 1990) [4]. Tomato production in world is 170.8 million ton, china contributing 31% followed by India, US and Turkey. (Anon., 2014) [2].
Like other crops, tomato is also influenced by a number of biotic and abiotic factors, including insect pests and diseases. Tomato fruit borer (*Helicoverpa armigera*), is a polyphagous pest which feeds on more than 15 crops (Vinutha J.S. *et al*., 2013) [13] and found integrated pest management as an alternative to chemical management (De Bach and Rosen, 1991) [5]. Tomato fruit borer feed on tomato (Sharma *et al*., 2011) [10], cotton (Malik *et al*., 2000) [7], pigeonpea (Sreekanth and Seshamalakshmi, 2005) [11] and chickpea (Ahmad *et al*., 1989) [1]. Several practices including chemical, biological and biopesticides were used for the management of this pest.
In order to overcome the problem of pest and disease infestation, it is necessary to adopt IPM strategies. Several IPM trials have been conducted all over the World and found that integration of all these control measures along with the application of pesticides reduces the pest problem to a great extent (Islam *et al*., 1999; Patnaik and Singh, 1997) [6, 8]. The incorporation of biopesticides and IPM technology is also gaining importance in recent years (Prabhat and Johnsen, 2000; Bajpai *et al*., 2005) [9, 3].
Farmers of Dhubri district of Assam produces a huge quantity of different kinds of vegetables like okra, brinjal, tomato, cabbage, cauliflower, knolkhol, cucurbits etc. During a field visit, it was observed that tomato crop is severely infested by several insect-pests of which fruit borer is a common pest. Tomato fruit borer is a serious problem in commercial tomato production in various parts of the district, which reduces the yield considerably. Hence, farmers are reluctant to grow tomato crop and the area under tomato cultivation is reducing in the district. Thus an attempt has been made to evaluate various components of Integrated Pest Management (IPM) for the control of fruit borer of tomato.

Materials and Methods
The present study on Integrated Pest Management as a tool in influencing growth, yield and economics of Tomato was conducted in farm of SCS College of Agriculture, AAU, Dhubri, Assam during 2019- 2020.

There were 3 treatments – IPM trial, Chemical control and absolute control. The experiment was conducted under randomized block design with three replications. The details of the experiment were as follows-

Target pests: Tomato fruit borer, *Helocoverpa armigera*

Treatments

T_1: IPM Module

- Release of *Trichogramma chilonis* 1,00,000/ ha (6 times at weekly intervals)
- Sowing a row of marigold after every 10 rows of tomato
- Collection and destruction of damaged fruits
- Yellow Sticky Trap
- Need based insecticide treatments

T_2: Chemical Control

T_3: Absolute Control

Crop: Tomato
Variety: Avinash-2 (Hybrid)
Sowing time: Sept-Oct.
Seed rate: 400 gm/ha
Plot size: 4X3 m
Design: RBD

The seed was sown during October, 2019 in well prepared nursery bed. The land was ploughed and harrowed 2-3 times to a fine tilth. Recommended dose of manures and fertilizers like FYM @ 10t/ha, N: P_2O_5: K_2O @ 75:60:60kg/ha were applied. Half of N and full doses of FYM, P_20_5 and K_20 were applied as basal and the remaining half of N were top dressed in two splits. 25-30days old healthy tomato seedlings were transplanted at spacing of 75cm x 60cm. All the intercultural practices like earthing up, top dressing, staking, weeding were done when necessary following the recommended package of practices of Assam Agricultural University, Jorhat. Pest control chemical spray was initiated at the time of appearance of the pest at 30-35 days after sowing and subsequently at 15 days interval. Maximum 2 sprays were given before fruiting stage of the crop.

Results and Discussion

From the experiment, it was observed that integration of different control measures proved to be the best in reducing the pest attack. The lowest per cent fruit borer infestation was observed in the IPM trial as compared to chemical control plots where only chemical treatment was given. The absolute control plots showed highest incidence of fruit borer infestation. The average plant height (cm), no. of branches, days to 50% flowering, days to first harvesting, fruit no. per plant, average fruit weight (g), yield/plant (g) was observed more in IPM treated plot as compare to chemical treated plot. Absolute control recorded the lowest growth and yield attributing parameters.

The highest yield was observed in IPM trial in compare to chemical treated plot. IPM package recorded the minimum fruit damage (16.8%) as against chemical control. The maximum yield (429 q/ha) was recorded in IPM package with a higher B: C ratio (5.92) as against 356 q /ha in chemical control with B: C ratio of 4.88.

Table 1: Growth parameters of tomato as influenced by IPM and Chemical control measures

Treatments	Average plant height (cm)	Average no. of branches	Average Days to 50% flowering	Average Days to 1st harvesting	Average Fruit no./plant	Average yield/plant (g)	Average fruit weight (g)
IPM	75.45	7.33	25.30	50.57	35.36	1935	54.72
Chemical control	68.34	6.78	22.34	45.65	32.43	1786	50.66
Absolute Control	67.25	6.55	23.25	47.33	28.60	1124	46.30

Table 2: Effect of different treatments against *H. armigera* on yield and B:C ratio of tomato

Treatments	% fruit infestation	Yield (q/ha)	Yield gain over control (%)	Total Cost (Rs.)	Gross profit (Rs/ha)	Net profit (Rs/ha)	B:C ratio
IPM	16.8	429	59.47	62,000	4,29000	3,67,000	5.92
Chemical control	21.5	356	35.68	62,000	3,56,000	3,03,000	4.88
Absolute Control	31.7	269	-	54,000	2,69,000	2,15,000	3.98

Market price= Rs 10/kg

Conclusion:

A farmer's choice of selecting crops with the inherent ability of disease and pest resistance ones has always been a corner stone of IPM. IPM could be a boon to farmers in controlling the insect pest of crops especially vegetable crops by way of maintaining soil as well as human health and maintaining ecological balance. The adoption of IPM application is still low owing to a number of socio-economic, institutional and policy constraints. A holistic approach is needed for encouraging the farming community for adoption of IPM module. It needs strengthening from various stakeholders like KVK.s, State Agriculture Departments, State Agriculture Universities, NGOs etc. Crop varieties with disease and pest resistant characteristics which include GM crops have gained quite a controversy. At the same time there is an emerging consensus that modern petrochemical- based farming is unsustainable and there is a need to develop and promote ecological approaches to food production.

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