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Evaluation of bio-intensive IPM module in okra

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Abstract
Field experiment was conducted to evaluate bio-intensive IPM module in okra during *kharif* season of 2010-11. The experiment was conducted in Randomised Block Design with five insecticidal treatments replicated four times. The variety 'Parbhani Kranti' was used for experimental purpose. The experiment was conducted at Bihar Agricultural College Farm sabour with plot size 4 x3 m^2 with spacing 50 x 50 cm. The different modules under study were chemical module, bio-intensive module, integrated module and Farmer's practice. The modules treatment differed significantly and found to be superior over control. Among the modules under test, chemical module has resulted in significantly lowest population of jassids (2.99 per 3 leaves). But in respect of borer damage, integrated module had lowest shoot and fruit damage of 3.90% and 4.85%, respectively with highest yield of 91.37 q/ha. The yield in chemical module was at par with integrated module recording 89.47 q/ha.

Keywords: Okra, bio-intensive IPM module, chemical module, integrated module

Introduction
Lady's finger (*Abelmoschus esculentus* Linn.) is one of the important vegetable crops grown as commercial and kitchen garden vegetable in India. In North India, it is termed as Bhindi and in South India as okra. Like other crops, bhindi is also subject to the attack of a few insect pests of which spotted bollworm (*Earias fabia* stoll.) is by far, the most destructive and widely spread. It is a cosmopolitan insect and its occurrence on bhindi and cotton has been reported from most parts of the world except North and South America, Deshpande and Nadkarney, 1936. It causes serious damage to bhindi crop from the very early stage of growing shoot resulting in reduced yield and poor quality of fruits. In case of serious infestation, however, the damage may amount to 40-50 per cent of bhindi pods, Lefroy and Mishra, 1908 [2]; Jhaveri, 1921[3] and Srinivasan and Gowder, 1960 [4]; Mote, 1980 [5]; Rai 1985 [6]; and Satpathy et al. 2007 [7]. The pest (*Earis fabia* Stoll.) being an internal borer, passes its larval period inside shoots and fruits of the plants. Increased yield is therefore very difficult to obtain until the extent of damage is minimised to its lowest level by means of discriminate and judicious chemical control measures.
It was the need of the present work to develop strategy to control okra pest complex. The objective of the paper was to evaluate the bio-intensive IPM module in okra in the present investigation.

Materials and Methods
The experiment was laid out in Randomised block design with five treatments replicated four times. The variety, Parbhani Kranti was used for experimental purpose. The field trial was conducted in *kharif* season of 2010-11 under All India Co-ordinated Research Project at Vegetable Farm, college of Agriculture, Bihar Agricultural University, Sabour. The net plot size was 4 x3 m^2. Row to row and plant to plant distance was 50 x 50 cm. Agronomic practices were followed as per recommended schedule. Seedlings grown on raised beds were transplanted in the main field after one month. Transplanting was done in the flat beds with 50 x 50 cm spacing. Healthy and vigorous seedlings were preferred for transplanting. Protective irrigation was given immediately after transplanting and thereafter irrigations were given at an interval of 15 days.

Treatments details

T_1	Chemical module: ➢ Seed treatment with thiamethoxam 70 WS@3gm/kg ➢ Foliar spray of Imidacloprid 200 SL@0.3 ml/lit at 40 DAS ➢ Foliar spray of spinosad 45 SC@0.3 ml/lit as spray at 50 DAS ➢ Foliar spray of Emamectin benzoate 25 WG@0.4gm/lit as spray at 65 DAS ➢ Foliar spray of spinosad 45 SC@0.3 ml/lit as spray at 80 DAS
T_2	Bio-intensive module: ➢ Neem cake @250 kg/ha at the time of sowing ➢ Sowing of maize at the border as barrier crop for conservation of natural enemies ➢ Foliar spray of neem formulation (multineem) @ 3ml/lit at 30 DAS ➢ Foliar spray of *verticillium lecanii* (verticel)@ 4gm +milk@5 ml/lit at 40 DAS ➢ Foliar spray of Bt formulation @1gm/lit at 60, 70 & 80 DAS
T_3	Integrated module: ➢ Seed treatment with thiamethoxam 70 WS@3gm/kg seed ➢ Foliar spray of neem formulation (multineem)@ 3ml/lit at 40 DAS ➢ Foliar spray of Endosulfan @1.0 ml/lit and neem formulation @ 3ml/lit at 50 DAS ➢ Foliar spray of Spinosad 45 SC@0.3 ml/lit at 60 DAS ➢ Foliar spray of Bt formulation @2ml/lit at 75 DAS ➢ Foliar spray of neem formulation@ 3ml/lit at 85 DAS
T_4	Farmer's Practice: ➢ Seed treatment with thiamethoxam 70 WS@3.0gm/kg. ➢ Foliar spray of Endosulfan @2.0 ml/lit at 25 DAS ➢ Foliar spray of Endosulfan @2.0 ml/lit at 35 DAS ➢ Foliar spray of Cypermethrin@0.5 ml/lit at 50 DAS ➢ Foliar spray of Endosulfan @2.0 ml/lit at 65 DAS ➢ Foliar spray of Cypermethrin@0.5 ml/lit at 80 DAS
T_5	Control

Application of insecticidal treatments was initiated one month after transplanting i.e. on 15/08/2010 and continued thereafter at 10 days interval. In all, five sprays were applied during the crop season. Spraying was done in early morning hours to avoid mid-day heat. The spray volume ranged from 250-550 lit per hectare depending upon crop stage. Measured quantity of insecticide was taken in 250 ml capacity beaker and mixed in small quantity of water, then it was added to a bucket containing known quantity of water. Spraying was done using knapsack sprayer, fitted with solid cone nozzle. Due care was taken to cover the lower side of leaves for effective control of pests.

Five plants were selected randomly in each plot. Population of jassids and per cent infestation due to shoot and fruit borer was observed seven days after each insecticidal spray. The data on per cent infestation by shoot and fruit borer were transformed into arcsin values before statistical analysis. For proper and authentic results, proper, authentic and standard method was adopted in the present experiment.

Results and Discussion

The observations on population of jassids and per cent infestation of shoot and fruit borer were recorded and presented in Table 1. The modules treatment differed significantly and found to be superior over control. Among the modules under test, chemical modules have significantly lowest population of jassids (2.99 per 3 leaves). But in respect of borer damage, integrated module had lowest shoot and fruit damage 3.90% and 4.85%, respectively with highest yield of 91.37 q/ha. The yield in chemical module was at par with integrated module recording 89.47 q/ha.

Table 1: Evaluation of bio-intensive IPM module against okra fruit and shoot borer

Treatments	Jassids, nymph population/3 leaves	% damage by borer		Mean pod yield (q/ha)
		Shoots	Fruits	
T_1	2.99	4.89 (12.68)	5.97 (14.10)	89.47
T_2	7.23	5.93 (14.05)	6.58 (14.78)	82.33
T_3	4.82	3.90 (11.33)	4.85 (12.64)	91.37
T_4	6.75	6.40 (14.61)	7.60 (15.93)	80.65
T_5	14.43	10.98 (19.33)	14.45 (22.33)	48.03
C.D. at 5%	1.21	2.20	2.26	13.56
C.V. (%)	10.74	9.92	10.81	11.23

Similar results were also obtained by Sardana *et al.* (2005) [8]. They found that in summer, pest management modules were not effective in managing the pest population, however need based application of pesticides resulted in reduction of the chemical sprays. In *kharif* okra, crop protection module comprising of releases of egg parasite, *Trichogramma chilonis* @1 lakh/ha based on monitoring of pest population using pheromone trap, three sprays of NSKE@5%

intermittently with need based application of chemical pesticides and periodic removal of borer and disease affected plants was found significantly superior over all other crop protection modules in managing the pest complex of okra crop. A large build-up of natural enemies *viz*; spiders and coccinellids were observed in unprotected crop module. Similar results were obtained by C. Satyanarayana and KT Arunakumara (2016) [9]. They found that M-II Module registered significantly lower fruit damage (11.79%) and higher yield (122.4 Qt./ha). Parbhani Kranti okra leaf extract as an effective IPM component enhanced the field parasitisation of *H. armigera* egg by *T. chilonis.* The results obtained in the present investigation were in confirmation with those obtained by Dandapani, N *et.al*. (2003) [10] and Zala M.B *et al*. (2015) [11].

Conclusion

Among the modules under test, chemical module has resulted in significantly lowest population of jassids (2.99 per 3 leaves). But in respect of borer damage, integrated module had lowest shoot and fruit damage of 3.90% and 4.85%, respectively with highest yield of 91.37 q/ha. The yield in chemical module was at par with integrated module recording 89.47 q/ha.

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