Original Research Article

Evaluation of IPM modules against major pests of okra,(*Abelmoschusesculentus*.L.) in Saran District (Bihar)

Abstract :

Experiments were carried out at ten locations of Saran district, Bihar during *kharif*season 2017 with okra crop cv 'Supper green'. The assessment reveled that module (M_4) proved the most effective treatment against okra pest and diseases *i.e.* shoot and fruit borer,*Eariasvittella*F., yellow vein mosaic virus, *Bemisiatabaci* (Genn.) and red spider mites, *Tetranychusurticae* Koch in which lowest incidence was recorded as compared to other IPM modules, farmer practices and control plot during 2017. Module (M_3) was next effective treatment against the major pest of okra crop. Significantly, maximum fruit yield was observed in module (M_4) 210.10 q/ha. This was significantly superior over all other treatments. The impact of various IPM modules showed that net return was also higher in module (M_4) which was Rs.76430.00/ha. It is conducted that judicious used neonicotinoids pesticides in modules III and IV.

Comment [P1]: Briefly describe the components of the modules , level of damage as compared to control.

Comment [P2]: Draw a meaning ful conclusion

Keywords; IPM modules, Okra, shoot and fruit borer, yellow vein mosaic virus, red spider mites, neonicotinoids

INTRODUCTION:

Okra (*Abelmoschus esculentus*), also known as lady's finger or bhendi, belongs to family Malvaceae and is an important vegetable crop grown throughout the year in India. Besides India, it is grown in many tropical and subtropical parts of the world. India grows okra on about 4.52 lakh hectares with an annual production of 48.03 lakh tons and productivity of 10.61 t/ha. The productivity of our country is low compared to other countries due to yield losses caused by insect pests, diseases and nematodes. The crop is attacked by more than 72 insect pests and infests the crop from seedling to harvest stage (Kedar*et al.*, 2013). Amongst various insect-pests causing damage, shoot and fruit borer, Earias*vittella*F. (Lepidoptera:Noctuidae), yellow vein mosaic virus (YVMV) transmitted by whitefly, *Bemisiatabaci* (Gen) and red spider mites, *Tetranychusurticae* Kochare considered as the most limiting factors (Rawat and Saha, 1973; Alagar andSrivasubramanian, 2006). The excessive and indiscriminate use of pesticides to control these pests has resulted in undesirable ecological changes (Mahapatra and Gupta, 1998). In view of the above, evaluation and adoption of IPM module in holistic manner incorporating judicious use of newly introduced modern pesticides seem to be best alternative. Hence, the present investigation to assessment of the effectiveness of different IPM modules in Saran district of Bihar.

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Materials and Methods:

Field experiments were carried out at ten locations of near KrishiVigyan Kendra, Manjhi Block of Dis~~s~~trict Saran, Bihar, under Dr. Rajendra Prasad Central Agricultural University, Pusa, Biharin 2017. The trials were laid outin randomized block design with ten replications. Okra “Supper green” was sown in firstweek of July with spacing45 x 30 cm. All the agronomical practices recommended to raise the good crops were followed. Observations were made on ten leaves were randomly selected (yellow vein mosaic virus transmitted by whitefly, *Bemisiatabaci* (Gen) and red spider mite) at fortnightly intervals after 50 days of transplanting. Observation were also recorded by counting healthy fruit and damaged of shoot and fruits for shoot and fruit borer insect at each picking and their weight were noted. The weight of healthy and infested fruits was taken separately and per cent infestation was worked out. Per cent infestation and its reduction due to various treatments were transformed to Arcsine before subjected to analysis of variance. The yield data in various IPM modules were also recorded. Finally the crop was harvested in last week of October.

Comment [P4]: Is it 10 farms / 10 farmers in a location or 10 different locations.

Comment [P5]: What was the plot size.

Comment [P6]: Methodology may be more elaborated. Was itschedul ebased or depending on ETL??

Comment [P7]: When and how were the observations taken .

IPM module I : Untreated

IPM module II : Farmers practice

i) Spraying of imidacloprid 0.5 ml/l water once at 30 days after sowing.

ii) Application of quinalphos @ 2 ml/l water 2 to 3 times at 7-10 days interval started 65-70 days after sowing.

iii) Spraying of fenvalerate @ 1 ml/l water twice at 7 days interval commenced 85-90 days after sowing.

Comment [P8]: Is it schedule based ???

Comment [P9]: Is there any recommendation for synthetic pyrethroid??

IPM module III

i) Deep summer ploughing

ii) Seed treatment with imidacloprid 70% WS @ 10g /kg of seeds

iii) Use of neem cake @ 250kg/ha before transplanting

iv) Spraying of spinosad @ 0.4 ml/l water 40 and 50 days after transplanting.

v) Spraying of abamectin @ 1 ml/l water between 60 and 70 days after transplanting ~~.Application of imidacloprid 0.5ml/l water 70 days after transplanting.~~

vi) Application of imidacloprid 0.5ml/l water 70 days after transplanting.~~Spraying of abamectin @ 1 ml/l water between 60 and 70 days after transplanting.~~

IPM module IV

i) Deep summer ploughing

ii) Seed treatment with imidacloprid 70% WS @ 10g /kg of seeds

iii) Use of neem cake @ 250kg/ha before transplanting.

iv) Hand picking and destruction of infested leaves, shoots and fruits of shoot and fruit borer and mite infested leaf at initial stage.

v) Spraying of indoxacarb @ 0.4 ml/l water 45 and 60 days after transplanting.

vi) Application of thiomethoxam 1g/l water 75 days after transplanting.

vii) Spraying of hexythiazox (acaricides) @ 0.5 ml/l water between 65 and 85 days after transplanting.

Results and Discussion:

The result revealed that impact of IPM modules as compared to farmers' practices and untreated plot are presented in Table 1 and 2 during 2017. The incidence of shoot and fruit borer varies from 5.85 per cent to 12.24 per cent during 2017 in vegetative stage. The module (M_4) showed lowest shoot damage *i. e.*5.85 per cent followed by module (M_3) 7.02 per cent shoot damage was recorded with compared to farmer's practices module (M_3) 9.36 per cent and untreated plot module (M_1) 12.24 per cent. Module (M_4) was observed significantly superior to module (M_2) and module (M_1). Similarly, fruit damage was higher in IPM modules (M_1) 18.12 per cent and modules (M_2) 14.86 per cent with compared to modules (M_3) 9.87 per cent and modules (M_4) 7.25 per cent, respectively. The study revealed that module (M_4) was significantly superior to module (M_2) and module (M_1).

Almost same trend was recorded in per cent incidence of yellow vein mosaic virus and red spider mites. The incidence of yellow vein mosaic virus was higher as compared to shoot and fruit borer damage which varies from 14.04 per cent module (M_4) to 24.42 per cent in module (M_1), but red spider mites was lowest in module (M_4) which was only 1.89 per cent and highest in module (M_1) i. e. 9.05 per cent. The data recorded on incidence of shoot and fruit borer, yellow vein mosaic virus and red spider mites during field trials in various IPM modules recorded that module (M_4) significantly reduced all the pest and demonstrated its superiority.

The yield data, gross return cost of cultivation, net return and benefit cost ratio due to adoption of different IPM modules were also worked out. The fruit yield various from 132.50 q/ha to 210.10 q/ha in during 2017. The maximum mean fruit yield was found in module (M_4) *i.e.* 210.10 q/ha, which was significantly superior over all IPM modules. The mean gross return

Comment [P10]: Upto what age. Have you folled this??

Comment [P11]: varied

various from 99375Rs/ha to 157575 Rs/ha in various IPM modules. However mean cost of cultivation was higher in module (M_4) which was 81145 Rs/ha followed by module (M_3) 79825 Rs/ha. Though cost of cultivation was higher in module (M_4) but net return was maximum is 76430 Rs./ha in comparison with module (M_1) i.e. 39090 Rs/ha and mean cost benefit ratio was also found maximum in module (M_4) *i.e*. 0.94 followed by module (M_3) 0.90, module (M_2) 0.85 and module (M_1) 0.65, respectively.

Comment [P12]: ??

In general, the incidence of shoot and fruit borer, yellow vein mosaic virusand red spider mites was minimum and fruit yield was significantly higher in module (M_4). It might be because of the influence of hand picking and destruction of infested leaves, shoots and fruits, seed treatment with imidacloprid, application of indoxacarb, thiomethoxam, hexythiazox, deep summer ploughing and use of neem cake @ 250 kg/ha before sowing. The results showed that application of neonicotioids or chloronicotinyl insecticides in module (M_1) along with other IPM strategies gave effective management from shoot and fruit borer, yellow vein mosaic virus and red spider mites and received higher yield as compared to other insecticides like quinalphos and fenvalerate.

The study conducted by Kodandaram*et al.*, (2010) suggests that because of the relatively low risk to non-target organism and environment, high target specificity and their versatility in application methods, neonicotinoids are more useful Preetha and ~~Nadarajam~~Nadarajan, (2007), Singh *et al.,* (2008) at Jaipur, Rajasthan and Singh *et al*., (2010) revealed that imidacloprid and indoxacarb treated okra crop showed maximum reduction in incidence of shoot and fruit borer and yellow vein mosaic virus and received higher yield as compared to other insecticides like quinalphos and fenvalerate.Satpathy*et al*., (2010) suggest that a good control of okra pest for seed treatment and seedling root dip is 0.02-0.03 per cent solution of Imidacloprid. Campos and Omoto (2002) reported that widely used in controlling many phytophagous mites in vegetable crops.

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Table 1: Incidence of major pests in different IPM modules conducted in okra crop during kharif 2017

Treatments	Shoot & fruit borer (% infestation) on shoot	Shoot & fruit borer (% infestation) on fruits	Yellow vein Mosaic Virus (% infestation)	Red spider mites(% infestation)	Yield (q/ha)
IPM modules I (Untreated)	12.24 (20.48)	18.12 (25.19)	24.42 (29.61)	9.05 (17.51)	132.5
IPM modules II (Farmers' practices)	9.36 (17.81)	14.86 (22.67)	19.23 (26.01)	6.35 (14.60)	172.7
IPM modules III	7.02 (15.36)	9.87 (18.31)	16.25 (23.71)	3.35 (10.55)	202.4
IPM modules IV	5.85 (14.00)	7.25 (15.62)	14.04 (22.01)	1.89 (7.90)	210.1
SEm±	0.26	0.24	0.35	0.15	1.78
CD 5%	0.90	0.84	1.19	0.53	6.23

Figures in ~~parenthesis~~ parentheses are the Arc sine $\sqrt{percentage}$

Table 2: Economic viability of different IPM modules in okra crop during kharif 2017

Treatments	Gross return (₹/ha)	Cost of cultivation(₹/ha)	Net return (₹/ha)	Benefit Cost ratio
IPM modules I (Untreated)	99375	60285	39090	0.65
IPM modules II (Farmers' practices)	129525	70175	59350	0.85
IPM modules III	151800	79825	71975	0.90
IPM modules IV	157575	81145	76430	0.94

Not : The sale price of fruit was considered as Rs. 750 per quintal

Comment [P13]: How did you differentiate both the infestations. Do you have leaves damage by both. What age have you taken the observation.??

Comment [P14]: Please check this representation

Comment [P15]: Selling price