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## Cost benefit analysis of different bio-pesticides use in for control of brinjal shoot and fruit borer (*Leucinodes orbonalis*. Guenee) at Bundelkhand region (Uttar Pradesh)

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### Abstract

An experimental trial was conducted to evaluate the Cost benefit analysis of different biopesticides use in for control of brinjal root and shoot borer (*Leucinodes orbonalis* Guenee) during *Rabi* season 2019-2020 at Bundelkhand University campus, Jhansi( U.P.), India. During the study, brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee was the major pest found infesting this crop in Jhansi area of Bundelkhand region. Results revealed that the treatments were found significant superior over control. The economics pattern of bio-pesticides viz., *Bacillus thuringiensis* (*Bt*) 2.0 kg/ha, Neem oil @ 0.5%, NSKE @ 0.5%, has found effective compared to other bio-pesticides for the control of brinjal shoot and fruit borer. The treatment *Bacillus thuringiensis* (*Bt*) with its recommended dose recorded the highest net income was 1,81,120 Rs/ha<sup>1</sup> with benefit cost ratio of 13:733.5 with yield 4.528 q/ha. It can be concluded that maximum control of brinjal shoot and fruit borer, provided through the bio-pesticides followed by two sprays at recommended interval and doses of *Bacillus thuringiensis* (*Bt*) 2.0 kg/ha, Neem oil @ 0.5%, NSKE @ 0.5%, has found effective and economic for the control of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee.

**Keywords:** Brinjal, bio-pesticides, pest, yield, *Leucinodes orbonalis*

### Introduction

Brinjal (*Solanum melongena* L.) is an important subtropics and tropics and indigenous vegetable crop of India. It contributes 9% of the total vegetable production of the country. In India, brinjal is grown in an area of 730.4 thousand ha with the production of 12801 thousand metric tons and productivity with 17.5 metric tons/ha. Whereas, in Uttar Pradesh, it occupies an area 7.83 thousand ha with a production of 268.82 metric tons and productivity of 18.5 metric tons/ha Anonymous [1]. Brinjal contains potassium, an important mineral, which plays a key role in maintaining electrolyte balance in the body. Thus help in neutralizing the effects of sodium in the entire human body and thus aiding in blood pressure control. Brinjal shoot and fruit borer is regarded as one of the most destructive pest attacking brinjal at every stage of its development [11]. As a vegetable crops it is consumed by different people in many countries viz., Central, South and South East Asia, some parts of Africa and Central America [6]. It is native of India [4, 10]. This pest due to its destructive nature causes severe loss in its higher productive potential, and its cultivation in the Bundelkhand region both in summer and winter period of the year produces harsh result in its productivity and production. Despite the several constraints the lower yields of brinjal, is in many regards to insect pests attack and takes a major share of the accountable loss. The yield loss caused by this pest has been estimated upto 70-92 per cent [3]. It is a versatile crop adapted to different agro-climatic conditions and thus grown throughout the year. It is perennial but grown as an annual crop. It has been best recognized that analysis of economics results systematic valuation of desired inputs and outcomes. Lately, the development of populace is more than 1000 millions, just as rising interest for vegetable farming from the agro-based enterprises with the beginning of new financial strategy in the nation. Presently a-days vegetable based enterprises are developing as incredible for monetary development.

Today, the pattern is changed. Around the guaranteed markets, numerous ranchers are raising 3 to 4 harvests in year just by remembering brinjal harvests. Brinjal cultivation can be taken consistently and thusly as they give constant progression of salary to the ranchers. As the work prerequisite of vegetable harvests is more and nonstop when contrasted with different harvests, they give work to the works consistently [16]. The purpose of this experiment was to identify the best course of action of selected bio-pesticides application on the evident of recommended doses. Hence the study of evaluation of cost benefit analysis was planned, on brinjal (*Leucinodes orbonalis* Guenee). during Rabi season which will derive out a conclusion and certainly be helpful for progressive brinjal cultivation in Bundelkhand region.

### Materials and Methods

An investigation on Cost benefit analysis of different biopesticides use in for control of brinjal root and shoot borer (*Leucinodes orbonalis* Guenee) was carried out during Rabi season 2019-20 at B. U campus, Jhansi, UP, India. Experiment was laid out in RBD design. The total plot size was kept 3.6 m x 3.0 m (Gross) and 1.8 m x 1.8 m (Net) with spacing 90 cm x 60 (plant x row) with brinjal (*Kashi Uttam*) variety. Seven treatments including control were taken T<sub>1</sub> = *Verticillium lecanii* (2.5kg/ha), T<sub>2</sub> = *Metarrhizium anisoplae* (2.5kg/ha), T<sub>3</sub> = *Beauveria bassiana* (2.0kg/ha), T<sub>4</sub> = *Bacillus thuringiensis*, T<sub>5</sub> = Panchagavya (0.01%), T<sub>6</sub> = Neem seed kernal extract (NSKE) (0.5%) T<sub>7</sub> = Neem oil (0.005%), T<sub>0</sub> = control without spray. Observation were made on five tagged plants and were randomly selected from net plot area of each plot. The harvested fruits of each plot were carefully observed after each picking to ascertain fruit infestation by brinjal (*Leucinodes orbonalis* Guenee). The data based on yield parameters were worked out statistically and analyzed after suitable transformation. The observations will be recorded at weekly interval of the crop. Healthy and damaged fruits due to shoot and fruit borer were recorded and weighed separately

during each picking. The yield was recorded in Kg/net plot and then it was converted on hectare basis [15].

### Results and Discussion

The data presented in table -01 on per cent fruit infestation (on weight basis) due to brinjal shoot and fruit borer, (*Leucinodes orbonalis* Guenee) revealed that all the treatments were significantly superior over control when sprayed with bio-pesticides. Among all the treatments significantly, maximum result revealed on fruit infestation due to brinjal shoot and fruit borer, *L. orbonalis* on weight on the basis of weight before spraying of biopesticides were recorded maximum (0.357%) followed by the *Beauveria bassiana* with (0.236%) and *Metarrhizium anisoplae* (0.225%). However significantly the lowest fruit infestation on weight basis (0.069%) followed by NSKE (0.142%) the lowest fruit infestation on weight basis Neem oil with foliar application of (0.005 followed by NSKE (0.142%) with the rest% fruit infestation of 0.089 to 0.236 percent.

The data on yield amongst the treatment were significant as depicted in table - 02. The highest yield was recorded in *Bt* (452.830), NSKE (270.090) with Neem oil (262.510). Significantly the minimum yield was recorded in 142.130 kg/plot was recorded. These result are with conformity as reported by [9, 2, 12, 5, 7]. Hence, the present findings are in confirmation with the earlier reports. When the cost benefit was worked out an interesting result was achieved as presented in table-03. Among the treatment studied, the best and most economical treatment was *Bacillus thuringiensis* 2.0 kg/ha (13:733.5) followed by NSKE 0.5% (7:785.4) Panchagavya 0.01% (7:632.5), Neem oil 0.005% (7:541.4) *Metarrhizium anisoplae* (5:684.9), as compared to control untreated plot(3:623.7). Recommended doses of biopesticides may be useful in devising proper integrated pest management against brinjal shoot and root borer, *Leucinodes orbonalis*. The present investigation are also partial agreement with the finding of [8, 14].

**Table 1:** Effect of biopesticides on fruit infestation (on weight basis) due to brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee

Treatment Number	Treatment Names	% fruit infestation weight basis	
		(before) spray	(After spray
T <sub>0</sub>	Control (Water spray)	9.054 (0.244)	6.418 (0.357))
T <sub>1</sub>	<i>Verticillium lecanii</i> (2.5kg/ha)	8.612 (0.244)	4.496 (0.173)
T <sub>2</sub>	<i>Metarrhizium anisoplae</i> (2.5kg/ha)	8.995 (0.245)	5.460 (0.225)
T <sub>3</sub>	<i>Beauveria bassiana</i> (2.0kg/ha)	8.668 (0.215)	5.212 (0.236)
T <sub>4</sub>	<i>Bacillus thuringiensis</i> var. Kurstaki (2.0kg/ha)	8.520 (0.301)	4.303 (0.144)
T <sub>5</sub>	Panchagavya (0.01%)	8.776 (0.796)	4.602 (0.089)
T <sub>6</sub>	(NSKE) (0.5%)	8.920 (0.524)	5.114 (0.142)
T <sub>7</sub>	Neem oil (0.005% )	8.778 (0.294)	4.976 (0.069)
	C.D.	N/S	0.613
	SE(m)	0.423	0.200
	SE(d)	0.598	0.283
	C.V.	8.335	6.834

Figures in the parentheses are transformed values  $\sqrt{x + 0.5}$  values.

**Table 2:** Effect of biopesticides on marketable yield due to brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee

Treatment Number	Treatment Names	Marketable yield (Kg/plot)
T <sub>0</sub>	Control (Water spray)	142.130
T <sub>1</sub>	<i>Verticillium lecanii</i> (2.5kg/ha)	231.560
T <sub>2</sub>	<i>Metarrhizium anisoplae</i> (2.5kg/ha)	188.560
T <sub>3</sub>	<i>Beauveria bassiana</i> (2.0kg/ha)	198.190
T <sub>4</sub>	<i>Bacillus thuringiensis</i> var. Kurstaki (2.0kg/ha)	452.830
T <sub>5</sub>	Panchagavya (0.01%)	265.320
T <sub>6</sub>	Neem seed kernal extract (NSKE) (0.5%)	270.090

T <sub>7</sub>	Neem oil (0.005%)	262.510
	C.D.	60.482
	SE(m)	19.749
	SE(d)	27.929
	C.V.	13.606

**Table 3:** Economics of different biopesticides evaluated against shoot and fruit borer *L. orbonalis* infesting brinjal

Sr. no.	Treatment	Quantity of biopesticides used for 6 spray (l or kg/ha)	Cost of biopesticides for 6 spray	Total cost of control measures (Rs/ha)*	Fruit yield (q/ha)	Gross realization (Rs/ha)**	C: B ratio
1	Control				1.421	56840	3:623.7
2	<i>Verticillium lecanii</i>	2.5 kg/ha	2880	3480	2.310	92400	6:514.4
3	<i>Metarrhizium anisoplae</i>	2.5 kg/ha	3300	3900	1.865	74600	5:684.9
4	<i>Beauveria bassiana</i>	2.0 kg/ha	3300	3900	1.981	79240	5:445.9
5	<i>Bacillus thuringiensis</i>	2.0 kg/ha	3720	4320	4.528	181120	13:733.5
6	Panchagavya (Cow urine)	5gm / 10 litre	900	1500	2.653	1061120	7:632.5
7	Neem. seed kernel. extrac (NSKE)	5gm / litre	2100	2700	2.700	108000	7:785.4
8	Neem-oil	5gm / litre	1680	2280	2.625	105000	7:541.4

### Conclusion

Since all the bio-pesticides and botanicals were significantly superior over control in reducing brinjal shoot and fruit borer after application of bio-pesticides. Cost economics for all the treatments was worked out on the basis of the incurred input cost and market price of the produce at the time of experimentation. More emphasis should be given on best IPM approaches to combat brinjal shoot and fruit borer with best research techniques. As brinjal shoot and fruit borer defeat is a major concern as it causes yearly economic loss in India and across the world.

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