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Research Article

ENHANCING PRODUCTIVITY AND INCOME THROUGH MANAGEMENT OF INSECT PESTS IN MAKHANA (*Euryale ferox* Salisb) CROP WITH FARMERS PARTICIPATION

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Abstract: On the basis of experimental findings, the Front Line Demonstration (FLD) were conducted by selecting 2.0 ha land of 4 farmers from one villages in each of seven Krishi Vigyan Kendra of Bihar Agricultural University, Sabour, Bihar during summer season, 2017. The field trials were carried out with three treatments in randomised block design (RBD) in (0.5 ha land of each farmer). The result of Front Line Demonstration showed that the lowest infestation of insect pests *viz*, aphid, *Rhopalosiphum nymphaeae* L. (0.13/ 20 leaves), case worms, *Elophila crisonalis* W. (0.47/ leaves) & *E. depunctalis* W. (0.38/leaves) and Rib borer, C*hironomous spp*. (0.67/ leaves) and highest yield (26.09 q/ha), avoidable loss (20.16%), B.C. ratio (5.26:1) were found in plot having Seed treatment with imidacloprid 70 WS (@5 g/kg seed), Root dip treatment with imidacloprid 70 WS@ 5 g/ lt. water and three foliar spray of NSKE @ 5% and followed by slightly higher infestation of aphid, *Rhopalosiphum nymphaeae* L. (0.17/ 20 leaves), case worms, *Elophila crisonalis* W. (0.50/ leaves) & E. *depunctalis* W. (0.42/leaves) and Rib borer, *Chironomous spp*. (0.76/ leaves) and yield (25.67 q/ha) in FLD plot having treatment with thiomethoxam 25 WG (@5g/kg seed, Root dip treatment with thiomethoxam 25 WG @ 5 g/ lt. water and three foliar spray of NSKE @ 5%., both were non- significant to each other and significantly superior over farmers practice (no insecticidal treatment) in effectively controlling the insect pests and gave highest yield. Both the management practices were found equally better than farmers' practices. It may be concluded that seed treatment with imidacloprid70WS or thiomethoxam 25 WG @5 gm/kg seed and root dip treatment @ 5 gm/Lt of water for half an hour along with three foliar spray of NSKE @5 % effectively managed the insect pests in Makhana crop.

Keywords: Makhana, Insect pest, Management, Productivity

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Introduction

Makhana (*Euryale ferox* Salisb.), also known as Gorgon or Fox nut is an important minor aquatic fruit crop. Makhana is a good source of carbohydrate, protein and minerals. The popped kernels (g/100g) are having 12.8 moisture, 76.9 carbohydrate, 9.7 proteins, 0.1 fat, 0.5 total minerals, 0.02 calcium, 0.9 phosphorus, 0.0014 iron has chemical constituents [1]. Biochemical analysis of Euryale ferox seeds revealed 61% carbohydrate, 15.6% protein, 12.1% moisture, 7.6% fibre, 1.8% ash, and 1.35% fat. The seeds were found to contain 12 amino acids, which are histidine, leucine, isoleucine, glutamic acid, lysine, tyrosine, valine, aspartic, threonine, alanine. methionine and arginine [2]. Traditionally, it is grown in stagnant perennial water bodies like ponds, land depressions, oxbow lakes, swamps and ditches but now a days, the area under this crop is increasing in low land rice field condition. Makhana (*Euryale ferox* Salisb) is cultivated over an area of 20,000 ha in Bihar which constitutes about 80% of the Makhana crop in the country with their production and productivity of 3.18 lakh/q and 21.25 q/ha, respectively [3]. The production and productivity of Makhana crop is low due to many constraints, of which insect pests are of paramount importance. Out of four dozen insect species found associated with Makhana crop [4], the emerging insect pests *viz*., Aphid (*Rhopalosiphum nymphaeae* L.), Caseworms (*Elophila depunctalis* W.& *E. crisonalis* W.) and Ribborer (*Chironomous spp*.) causes17.04 to 23.67 per cent loss in seed yield [5]. Till date, no any recommended management practices are available with the Makhana growers to cope-up with the menace of insect pests. Considering the facts, experiments were conducted and the best management practices were demonstrated at farmer's field for testing their efficacy to disseminate the findings among the Makhana growers in Makhana growing districts of North Bihar for their large scale adoption.

Materials and Methods

The experiments were conducted to evaluate the management strategies for effective management of important insect pest in Makhana crop during crop season 2015 and 2016 at B.P.S. Agricultural College, Purnea, 854302, Bihar Agricultural University, Sabour, Bhagalpur, 813210, Bihar, India. The experimental finding showed that the two of the treatments [Table-1] were found better in reducing insect pests and gave highest yield, avoidable loss and B:C ratio. So, on the basis of experimental findings, Front Line Demonstration (FLD) were conducted by selecting 2.0 ha land of 4 farmers from one village each of seven Krishi Vigyan Kendra of Zone-II of Bihar Agricultural University, Sabour, during summer season, 2017. The field trials were carried out with three treatments [Table-1] in randomised block design(RBD) with seven replications (0.5 ha land of each farmer). All the recommended agronomical practices were adopted except for insecticidal treatment. Insecticidal seed treatments were done at the time of sowing and root dip treatment at the time of transplanting along with three foliar spray of NSKE @ 5% in first two treatments and compared with farmers practice (No insecticidal treatment). Observations on insect pests were recorded by randomly selected three leaves per plant (one each of newly emerged leaves, fully opened and older leaves) of five randomly selected plants per plot at every week. Seed yield was recorded at harvest and converted in to quintal per ha as well as pooled mean was calculated over the location (seven KVKs) and farmers.

Table-1 *Validation of management practices against insect pests in Makhana var. Swarn Vaidehi with farmers participation during crop season 2017*

Treatments	Aphid	Case worms		Rib Borer	Av.
	(*R.* nymphaeae) / 20 Leaves	*E.crisonalis* / Leaf	*E.depunctalis* / Leaf	(*Chironomus spp*) / Leaf	yield (q/ha)
T_1	0.13	0.47	0.38	0.67	26.04
T_2	0.17	0.50	0.42	0.76	25.67
T_3	17.13	4.31	2.33	5.83	21.89
CD (P≤0.05)	1.38	0.18	0.04	0.05	2.69
SE(m)	0.42	0.05	0.01	0.02	0.86

T_1: Seed treatment with thiomethoxam 25 WG (@5 g/kg seed+ Root dip treatment with thiomethoxam 25 WG @ 5 g/ lt. water + three foliar spray of NSKE @ 5%
T_2: Seed treatment with imidacloprid 70 WS (@5 g/kg seed) + Root dip treatment with imidacloprid 70 WS @ 5 g/ lt. water + three foliar spray of NSKE @ 5%
T_3: Farmers practice (No treatment)

Table-2 *Avoidable loss, B:C ratio of management practices against Insect pests in Makhana during crop season 2017*

Treatments	Yield(q/ha)	Avoidable loss(%)	Cost of Intervention(Rs/ha)	Return over Control(Rs/ha)	Net Return(Rs/ha)	B:C ratio
T1	26.04	20.83	6300.00	39450.00	33150.00	5.26:1
T2	25.67	18.85	5370.00	36300.00	30930.00	5.76:1
T3	21.89	-	-	-	-	-
CD (P≤0.05)	2.69	-	-	-	-	-
SE(m)	0.86	-	-	-	-	-

Makhana Seed@ Rs7500/quintal, Imidacloprid 70 WS@ Rs 8000/kg X 300 gm= Rs 2400.00
Thiamethoxam 25 WG@ Rs 4900/kg X 300 gm= Rs 1470.00, NSKE 1500 PPM@ Rs 600/ltX 3 lt= Rs 1800.00
Cost of application@ Rs 300/man daysX 7=Rs 2100.00

Avoidable loss due to insect pests was worked out on the basis of seed yield in different treatment as compared to farmers practice (no insecticidal spray). Finally, the avoidable loss was calculated with the following formula:

Avoidable loss (%)=(Yield in treated plot – Yield in control)/(Yield in treated plot)

Similarly, Benefit: Cost ratio was also calculated for each rupee incurred on insecticidal treatment and cost of their application as well as return over control.
BCR=(Return over control (Rs.)-Cost of insecticides and their application)/(Cost of insecticides and their application)

Results and Discussion

Mean of the pooled data [Table-1] [Fig-1] of Front Line Demonstration (FLD) showed that the lowest infestation of aphid, *Rhopalosiphum nymphaeae* L. (0.13/20 leaves), case worms, *Elophila crisonalis* W. (0.47/leaves) & *E. depunctalis* W. (0.38/leaves) and Rib borer, *Chironomous spp.* (0.67/ leaves) and highest yield (26.09 q/ha) were found in T1 and followed by infestation of aphid, *Rhopalosiphum nymphaeae* L. (0.17/ 20 leaves), case worms, *Elophila crisonalis* W. (0.50/ leaves) & *E. depunctalis* W. (0.42/leaves) and Rib borer, *Chironomous spp.* (0.76/ leaves) and yield (25.67 q/ha) in T2, both were non- significant to each other. However, both the treatments were significantly superior over farmers practice(T3) in effectively controlling the insect pests and gave highest yield. The infestation of aphid, *Rhopalosiphum nymphaeae* L. (17.13/20 leaves), case worms, *Elophila crisonalis* W. (4.31/ leaves) & *E. depunctalis* W. (2.33/leaves) and Rib borer, *Chironomous spp.* (5.83/ leaves) and lowest yield (21.89 q/ha) Further, the result of FLD [Table-2][Fig-2] showed that the average yield (26.09 q/ha.), avoidable loss (20.16%) , B.C. ratio (5.26:1) was recorded in T1 having Seed treatment with imidacloprid 70 WS (@5 g/kg seed), Root dip treatment with imidacloprid 70 WS@ 5 g/ lt. water and three foliar spray of NSKE @ 5% followed bythe average yield (25.67 q/ha.), avoidable loss (18.85%) , B:C. ratio (5.76:1) recoded in T2 having Seed treatment with thiomethoxam 25 WG (@5 g/kg seed), Root dip treatment with thiomethoxam 25 WG @ 5 g/ lt. water and three foliar spray of NSKE @ 5%.. Both the management practices were found equally better than farmers' practices (T3). The impact of technological intervention on insecticidal treatment against insect pests in Makhana in seven villages of each of seven KVK of zone II Bihar changed the mind set of makhana growers. The result encouraged the farmers to save their crops from the menace of insect pests.

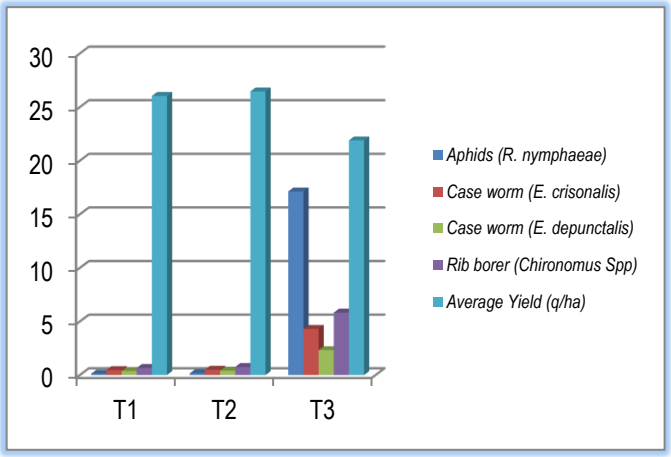

Fig-1 Validation of management practices against insect pests in Makhana var Swarn Vaidehi with farmers participation during crop season 2017

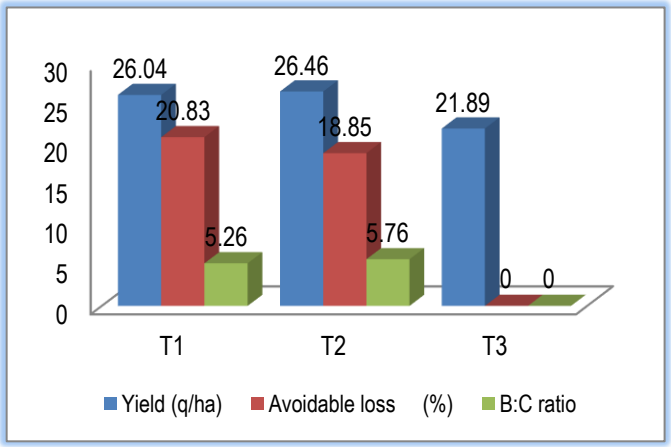

Fig-2 Avoidable loss, B:C ratio of management practices against Insect pests in Makhana during crop season 2017

Conclusion

It may be concluded that seed treatment with imidacloprid70WS or thiomethoxam 25 WG @5 gm/kg seed and root dip treatment @ 5 gm/Lt of water for half an hour

along with three foliar spray of NSKE @5 % effectively managed the insect pests and gave highest yield of Makhana. The present findings neither support nor contradict the earlier findings because of paucity of information. However, the present finding find support from earlier finding of Kalra and Sharma, (1996) [6] who reported that the seed treatment with imidacloprid 70WS or thiomethoxam 25 WG @4-5 gm/kg seed in okra gave effective control of leafhopper for more than 45days.

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Application of research: Recommended and Technology released by 14th Research Council of BAU, Sabour for general adoption against Makhana pests.

Research Category: Pest management

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Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

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