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Integrated pest management in potato with special reference to ITK

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ABSTRACT

An experiment was conducted in the Horticultural orchard of Assam Agricultural University, Jorhat from 2014-15 and 2015-16 to develop IPM module against pest and diseases of potato. Ten different IPM modules were followed against the target pest and diseases. Out of these, the IPM module consisting of soil application of MOC followed by high ridge planting and use of yellow sticky trap followed by application of malathion 5 per cent dust and Ridomil MZ-72 @ 0.01% recorded lowest infestation of mole cricket and red ant with 3.42 and 7.71 per cent, respectively with a highest yield of 248.61 q/ha. Likewise, the per cent increase in yield and benefit cost ratio was observed highest (8.54) in the module with low incidence of late blight and leaf roll disease.

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INTRODUCTION

Potato (*Solanum tuberosum* L.) is the most important non-cereal crop in human nutrition and ranks fourth in terms of total global food production after maize, wheat and rice (Chakraborty *et al*., 2000). The crop requires cool nights and well drained soil with adequate moisture for its growth. India rank 2nd in terms of production after China in the list of top potato producing countries in the world (FAO STAT, 2015). In Assam, potato is cultivated in 99.7 thousand hectare of land with production of 75.27 thousand tones and productivity of 9775 kg per hectare (Anonymous, 2012). The crop is attacked by more than 80 numbers of different insect pests from field to storage. Among the insects that attacks potato in the field, red ants (*Dorylus orientalis*), is considered as the most important soil pests of potato which can reduce the yield and market value of the crop several folds. The pest makes holes on the surface of tuber which reduced the market value as well the yield (Butani *et al*.,1976). Red ant along with mole cricket causes severe loss to the farmers and reduce the yield upto 35- 40 per cent in West Bengal (Konar *et al*., 2005).

The insect is reported of causing 70-90 per cent damage at harvest to potatoes in farmer's fields in Bihar (Ram *et al*., 1993). In severe cases of pest infestation the tuber infestation may be as high as 51.77- 61.50 per cent and recently the pest is also reported as a sporadic pest of French been in some parts of India. Similarly, the mole cricket also damages the potato stems and tubers by chewing and making holes. In case of severe attack of mole cricket on potato plants, the plant shows wilting symptoms under direct sunlight and eventually the plant dries up (Trivedi and Rajagopal,1999). Mole crickets form vertical tunnels as well as horizontal galleries just below the soil surface and it is usually present in the top 20-25 cm of soil and have been recorded to tunnel as deep as 75 cm (Hudson, 1985). Management of these soil insects with only chemical pesticide is not viable and both ecologically and economically not effective. Pest problems vary from field to field and season to season because of differences in soil type, cropping history, cultural practices, cultivar and the nature of surrounding land. Different control methods may be needed even for closely related species. So, alternative management strategies or integrated strategies have to be developed which is the Integrated pest management (IPM).

Integrated pest management (IPM) may supply effective control of the potato pests including aphids (vector of some viruses). The IPM of potato involves different eco friendly methods like removal and destruction of shoots and fruits with larvae, use of resistant varieties. application of plant extracts such as neem extracts, use of microbials like *Bacillus thuringiensis* var. *krustaki*, release of egg parasitoids *Trichogramma japonicum*, judicious application of chemical pesticides etc. 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 and Patnaik and Singh, 1997). The incorporation of biopesticides and IPM technology is also gaining importance in recent years (Prabhat and Johnsen, 2000; Sohi, 1966 and Bajpai *et al*., 2005). In order to overcome this problem as well as other associated problems, it is necessary to adopt IPM strategies for the management of these insects.

In the present study, an attempt has been made for to evaluate various components of integrated pest management (IPM) by formation of different IPM modules for the management of important field pests of potato.

MATERIAL AND METHODS

The experiment was conducted in the Horticultural Orchard of Assam Agricultural University, Jorhat from 2014-15 and 2015-16 to develop IPM module against pest and diseases of potato. The potato variety used in the study was "Kufri Megha". Plot size was 4 m x 4 m with spacing of 50 x cm 20 cm. The difference between the replication and treatments were maintained as 75 cm 50 cm, respectively applying all the agronomic package of practice. The experiment was done in three replications in specific blocks with Randomized Block Design.There were eleven treatments (modules).

Treatments:

T_1: High ridging (HR)

T_2: HR: Yellow sticky trap (YST)

T_3: HR+ YST+ Malathion 5% dust

T_4: HR+ YST+ malathion 5% dust + Ridomil MZ-72 (0.01%)

T_5: HR+YST++ malathion 5% dust + Ridomil MZ-72 (0.01%)+ wood ash @ 200kg/ha

T_6: Mustard oil cake @ 250kg/ha

T_7: MOC+HR

T_8: MOC+HR+ Yellow sticky trap

T_9: MOC+HR+ Yellow sticky trap+ Malathion 5% dust

T_{10}: MOC+HR+ Yellow sticky trap+ Malathion 5% dust+ Ridomil MZ-72 (0.01%)

T_{11}: Control where only chemical fertilizers were applied at recommended dose.

Target pests:

Mole cricket and red ant.

Target disease:

Late blight and leaf roll virus of potato.

Design: RBD

During final harvest, data were taken on weight of healthy and infested tuber and per cent infestation was calculated using (Dash *et al*., 2013) the following formula:

$$\%\text{infestation} = \frac{\text{Weight of infested potatoes}}{\text{Total weight of potatoes}} \times 100$$

Yield data of different treatments were recorded to find out Benefit Cost Ratio using following formula:

$$BCR = \frac{\text{Gross return}}{\text{Gross cost}}$$

The pooled data on per cent infestation of mole cricket and red ant along with yield data were analysed for both the year 2014-15 and 2015-16.

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 mole cricket and red ant infestation was observed in one time application of combination of mustard oil cake + High ridging + Yellow sticky trap + Malathion 5% dust +

Table 1 : Per cent infestation of potato by mole cricket and red ant for the year 2014-15 and 2015-16

Treatments	Mean mle cricket infestation		Mean red ant infestation		Yield (q/ha)	
T_1	21.56 (27.65)		20.58 (26.60)		79.37	
T_2	18.84 (25.72)		18.38 (25.06)		82.41	
T_3	11.11 (19.78)		13.25 (20.71)		102.84	
T_4	10.08 (17.84)		12.31 (19.86)		107.51	
T_5	8.93 (17.31)		11.27 (18.91)		119.96	
T_6	14.85 (22.65)		12.98 (22.53)		93.24	
T_7	12.77 (20.93)		14.13 (21.57)		102.60	
T_8	14.26 (22.15)		16.80 (23.79)		88.87	
T_9	7.40 (15.71)		9.04 (16.54)		129.61	
T_{10}	3.42 (10.36)		7.71 (14.98)		148.61	
T_{11}	23.45 (28.95)		23.47 (28.80)		73.37	
	Treat	YxT	Treat	YxT	Treat	YxT
C.D. (P=0.05)	1.35	0.94	1.28	0.91	2.43	1.72

*Values in parenthesis represent the angular transformed value

Table 2: Yield, per cent infestation and BC ratio for different treatments

Treatments	Mean mole cricket infestation	Mean red ant infestation	Yield (q/ha)	% increase in yield over control	BC ratio
T_1	21.56	20.58	79.37	8.17	3.23
T_2	18.84	18.38	82.41	12.32	5.32
T_3	11.11	13.25	102.84	40.16	6.50
T_4	10.08	12.31	107.51	46.53	6.56
T_5	8.93	11.27	119.96	63.50	6.89
T_6	14.85	12.98	93.24	27.08	5.89
T_7	12.77	14.13	102.60	39.83	6.42
T_8	14.26	16.80	88.87	21.12	3.87
T_9	7.40	9.04	129.61	76.65	7.23
T_{10}	3.42	7.71	148.61	102.54	8.54
T_{11}	23.45	23.47	73.37	-	

Table 3 : On farm trial of the best treatment during 2015-16

Location	Crop	Yield (q/ha)	% infestation	
			Mole cricket	Red ant
Allengmara	Potato	135	11.34	17.45
Namdeori	Potato	149	17.54	13.32
Gorumora	Potato	142	9.78	14.77

Ridomil MZ-72 (0.01%) with 3.42 per cent and 7.71 per cent, respectively (Table 1). This was closely followed by application of combination of mustard oil cake+ High ridging+ Yellow sticky trap+ Malathion 5 per cent dust and highest in control in both the cropping season 2014-15 and 2015-16. Similarly, the highest yield of 148.61 q/ha was recorded in T_{10} followed by 129.61q/ha in the treatment combination of T_9 and lowest in control (73.37 q/ha). Likewise, per cent increase in yield was observed highest in the treatment T_{10}. Similarly, the highest benefit cost ratio (8.54) was observed in the plots treated with Mustard oil cake+ High ridging+ Yellow sticky trap+ Malathion 5% dust + Ridomil MZ-72 (0.01%) which was followed by 7.23 in the plots treated with Mustard Oil Cake+ High Ridging+ Yellow sticky trap+ Malathion 5% (Table 2).

The best treatment has been demonstrated as on farm trials in three different villages, where it has been given promising results with highest yield and low per cent infestation of mole cricket and red ant (Table 3). However, during the experiment period low incidence of late blight and leaf roll disease was recorded which is another promising results of the experiment and need further research.

ITK Observed:

A number of ITK s are generally followed by potato growers amongst which application of wood ash and mustard oil cake to control the infestation of mole cricket and red ant is common. Generally, application of wood ash however, helps in reduction of attack by soft bodied insects. Ash act as the physical poison and contributes towards enriching the soil with potash. Potash on the other hand, build up the resistance in the plant. Likewise, mustard oil cake helps to reduce soil arthropods and other soil insects. Summer deep ploughing of the field is expected to reduce the pest population by killing the residual population of the pest residing inside the stubbles. Time of planting is also crucial, early planting helps the crop to escape the attack of late blight. Therefore, early planting is advocated in Assam.

Conclusion:

From the experiment, it can be concluded that application of combination of mustard oil cake+ High ridging+ Yellow sticky trap+ Malathion 5% dust+ Ridomil MZ-72 (0.01%) can manage the mole cricket and red ant infestation very efficiently. However, treatment with of mustard oil cake+ High ridging+ Yellow sticky trap+ Malathion 5% dust also proved to be good which closely followed the high ridging, YST, Malathion 5 per cent dust and MOC combination.

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