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Evaluation of insecticidal schedules for the management of insect pests of potato

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A B S T R A C T

Two year's field study was undertaken to evaluate the efficacy of five treatments against insect pests of potato. The minimum population of aphids, whitefly and epilachna beetle was observed in the treatment T_1 which received soil application of phorate followed by spraying of chlorpyriphos, imadicloprid and cartap hydrochloride, respectively at 40, 55 and 70 DAP than other treatments. Maximum yield of healty potato tuber was recorded in the plot treated with chlorpyriphos before planting and foliar spray of acephate, imadichloprid and chlorpyriphos + cypermethrin at 40, 55 and 70 DAP (T_2). Yield of damaged tuber caused by soil pests was found maximum in control plot and it was recorded lowest in T_4 treatment which received soil application of phorate 10G at 40 DAP and foliar spray with imadichloprid and chlorpyriphos + cypermethrin at 55 and 70 DAP, respectively. But soil application of phorate at planting followed by spraying of chlorpyriphos, azadirachtin and Bt (T_3) was not as effective as T_4.

Introduction

Potato is one of the most important food crops in the world after rice, wheat and maize. Potato crop occupies 90% of the Indo-Gangetic plains of North India during winter. The region occupies a significant position in the national potato production because of favorable climatic condition and soil texture. However, the yield of potato tuber is reduced due to attack of many insect pests (Mishra et al. 2001). Among the insect pests, aphids *Myzus persicae,* (Sulzer) and *Aphis gossypii* Glover (Homoptera: Aphididae), whitefly *Bemisia tabaci,* (Gennadius) (Aleyrodidae: Hemiptera) and epilachna beetle, *Henosepilachna vigintioctopunctata* (Fabr). (Coccinellidae: Coleoptera) are some of the important pests infesting the potato crop throughout the growing season. The soil pests such as Cutworm *Agrotis ipsilon* (Hufn) (Noctuidae: Lepidoptera) and mole cricket *Gryllotalpa africana,* Palisot De Beauyoes (Gryllotalpidae: Orthoptera) are also responsible for reducing the yield of potato tubers to a considerable extent. For the effective management of these pests on potato, various synthetic insecticides and bio-pesticides were evaluated as schedules and the results obtained in the present investigation have been discussed in this paper.

Materials and Methods

A field trial was conducted during *rabi* season of 2006-07 and 2007-08 at Adisaptagram Block Seed Farm, Hooghly, West Bengal to

evaluate four different schedules of insecticides against important insect pests of potato. The experiment was conducted in a randomized block design with five treatments replicated four times. Kufri Jyoti was planted by the end of November in the plots 3.6m×2m area at 60cm×20cm spacing. All the standard agronomic practices were strictly followed except the application of insecticides. The five different treatments consists of T_1= soil application of phorate 10G at 1.5kg a.i./ha at planting followed by foliar spray with chlorpyriphos 20EC at 2.5ml/litre of water at 40 DAP, imidacloprid 17.8SL at 1ml/7.5 litres of water at 55 DAP and cartap hydrochloride 50SP at 1g/litre of water at 70 DAP. T_2= seed treatment with chlorpyriphos 20 EC at 2.5 ml/litre of water at planting followed by foliar spray with acephate 75SP at 0.75 g/litre of water at 40 DAP, imidaclorprid 17.8SL at 1 ml/7.5litres of water at 55 DAP and chlorpyriphos 20EC + cypermethrin 5EC at 1.5 ml/litre of water at 70 DAP, T_3 = soil application of phorate 10G at 1.5 kg a.i./ha at planting followed by foliar spray with chlorpyriphos 20EC at 2.5 ml/litre of water at 40 DAP azadirachtin 1EC at 4 ml/litre of water at 55 DAP and *Bacillus thuringiensis* var. *kurstaki* 5WP at 1.5g/litre of water at 70 DAP. T_4 = soil application of phorate 10G at 1.5 kg a.i./ha at planting followed by foliar spray with chlorpyriphos 20EC at 2.5 ml/litre of water at 40 DAP, imidacloprid 17.8SL at 1 ml/7.5 litres of water at 55 DAP, chlorpyriphos 20EC + cypermethrin 5 EC at 1.5 ml/litre of water at 70 DAP and T_5=control. Data on leaf damage were recorded at fortnightly intervals from 40 days after planting from randomly selected 15 plants in each plot and the number and weight of healthy and damaged tubers were also recorded from each plot during harvesting. The pooled data of two years were statistically analyzed.

Results and Discussion

The results obtained in the experiment revealed that all the treatment schedule were significantly superior over control. The treatments which received phorate at planting, followed by spraying of chloryriphos at 40 days after planting (DAP), imidacloprid at 55 DAP and cartap hydrochloride at 75 DAP, was observed to be the most effective in reducing the population of aphid species and whitefly below their economic threshold level. T_2 and T_3 also maintained lower population of pests throughout the crop growing season. (Mishra *et al.* 2001) also reported that phorate 10G gave long lasting protection followed by monocrotophos. Acephate was quite effective against the pests for short period due to its systemic action with moderate persistency (Patil & Lingappa 2001). However, the population of epilachna beetle was found lowest in T_3. The damage caused by different soil pests like cutworm, molecricket, potato tuber moth (PTM) and rat, under different schedules was recorded at the time of harvesting of potato tubers (Table 2). The number of healthy tubers per plot was found maximum in T_4 (458.33) followed by T_2 (429.66), T_1 (395.00), T_3 (382.66) and T_5 (278.66). Among different treatment schedules, the cutworm damage per plot was recorded minimum in T_2 (11.33) while

molecricket damage was found minimum in T_4 (4.33). The PTM damage was noticed in T_3 and T_5 which was ranged from 1.66-3.33 per plot on number basis and 0.10-0.30 Kg/plot on weight basis. However, the rat damage was recorded in all the treatment schedules. Thus the total number of damaged tubers was recorded minimum in T_4 (28.00) followed by T_2 (33.66), T_1 (37.66), T_3 (47.33) and T_5 (67.33). Among the five different treatment schedules, T_2 and T_4 were found most effective to obtain the highest number of potato tubers. It was due to the fact that in both the schedules phorate and chlorpyriphos were applied along with other chemical insecticides. It was reported by many workers (Das & Ram, 1988; Kishore & Misra, 2001; Tripathy *et al.* 2003; Konar & Paul, 2005) that only chlorpyriphos or phorate plus chlorpyriphos gave better results in reducing the tuber damage caused by cutworm as well as molecricket or any other soil pests. In addition to this, (Isam *et al.* 1991) also recorded more than 80% reduction in infesting level of cutworm in pyrethroids and chlorpyriphos treated plots.

Table 1.
Efficacy of various treatment schedules against major insect pests on potato (pooled data of 2006-07 and 2007-08)

Treatments	Aphids			Whitefly			Epilachna beetle		
	40 DAP	55 DAP	70 DAP	40 DAP	55 DAP	70 DAP	40 DAP	55 DAP	70 DAP
T_1	4.33 (2.19)	5.33 (2.41)	4.66 (2.26)	1.33 (1.27)	1.00 (1.22)	1.33 (1.35)	4.66 (2.77)	3.66 (2.03)	4.66 (2.27)
T_2	15.33 (3.98)	8.66 (3.03)	5.66 (2.48)	3.33 (1.96)	2.66 (1.77)	1.66 (1.46)	5.66 (2.48)	3.33 (1.95)	4.33 (2.20)
T_3	5.33 (2.14)	4.66 (2.27)	8.33 (2.97)	2.33 (1.68)	2.33 (1.68)	2.33 (1.68)	3.66 (2.04)	2.6 6 (1.77)	3.66 (2.03)
T_4	17.66 (4.26)	28.33 (5.37)	7.66 (2.86)	7.33 (2.80)	3.66 (2.03)	1.66 (1.45)	6.33 (2.61)	3.33 (1.95)	4.66 (2.27)
T_5	18.33 (4.34)	33.60 (5.81)	156.33 (12.52)	9.66 (3.19)	14.33 (3.85)	19.66 (4.49)	6.66 (2.61)	9.33 (3.13)	19.66 (4.14)
S.Em.(±)	0.81	0.08	0.11	0.05	0.09	0.11	0.08	0.09	0.08
C.D.(P=0.05)	2.64	0.26	0.36	0.16	0.29	0.36	0.26	0.29	0.26

Figure in parentheses are in $\sqrt{x+0.5}$ values, DAP = Days after planting.

Table 2.
Efficacy of various treatment schedules against soil pests on the yield and damaged tubers of potato (pooled data of 2006-07 and 2007-08)

Treatment schedule	Healthy tubers per plot		Damage tuber per plot									
			Cut worm		Mole cricket		PTM		Rat		Total	
	Number	Wt. (Kg)	Number	Wt. (Kg)	Number	Wt. (Kg)	Number	Wt. (Kg)	Number	Wt. (Kg)	Number	Wt. (Kg)
T_1	395.00 (19.89)	16.50 (4.12)	16.33 (4.10)	1.80 (1.51)	7.00 (2.74)	0.50 (0.99)	0.00 (0.71)	0.00 (0.71)	14.33 (3.85)	0.90 (1.71)	37.66 (6.18)	3.20 (1.92)
T_2	429.66 (20.74)	18.20 (4.32)	11.33 (3.44)	1.50 (1.39)	6.33 (2.61)	0.50 (1.00)	0.00 (0.71)	0.00 (0.71)	15.66 (4.02)	1.00 (1.19)	33.33 (5.82)	3.00 (1.87)
T_3	382.66 (19.57)	15.60 (4.01)	20.66 (4.60)	2.00 (1.58)	8.00 (2.91)	0.85 (1.15)	1.66 (1.47)	0.10 (1.22)	17.00 (4.18)	1.00 (1.85)	47.33 (6.92)	3.95 (2.11)
T_4	458.33 (21.42)	18.90 (4.40)	12.66 (3.63)	1.40 (1.37)	4.33 (2.20)	0.50 (0.99)	0.00 (0.71)	0.00 (0.71)	11.00 (3.39)	0.80 (1.13)	28.00 (5.34)	2.70 (2.04)
T_5	278.66 (16.71)	11.30 (3.44)	34.00 (5.87)	3.40 (1.97)	11.00 (2.68)	1.20 (1.29)	3.33 (1.96)	0.30 (0.84)	19.00 (4.41)	1.10 (1.26)	67.33 (8.24)	6.00 (2.55)
S.Em.(±)	0.26	0.03	0.05	0.08	0.31	0.10	0.03	0.06	0.06	0.26	0.03	0.10
$C.D._{0.05}$	0.84	0.10	0.16	0.26	1.01	0.33	0.10	0.19	0.19	0.85	0.10	0.33

Figure in parentheses are in $\sqrt{x+0.5}$ values

It may be concluded that among the five different treatments schedules T_1 was found most effective in reducing the incidence of aphid and whitefly, whereas the population of epilachna beetle was found lowest in T_3. The tuber damage by cutworm, molecricket and PTM was found lowest in T_2, while the rat damage was observed minimum in T_4.

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