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# Efficacy of some insecticides against cutworm and molecricket of potato in West Bengal

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**A B S T R A C T**

A field investigation was conducted to evaluate the efficacy of some insecticides against soil pests *i.e.* cutworm (*Agrotis ipsilon Hufner;* Noctuidae: Lepidoptera) and molecricket (*Gryllotalpa africana* P. de Beau; Gryllotalpidae: Orthoptera) infesting potato at Adisaptagram Block Seed Farm, Mogra, Hooghly, West Bengal (India) during 2007-08 and 2008-09. The field trial was conducted in Randomized Blocked Design with six treatments and five replications. Among the various treatments for managing soil pests of potato (cv. Kufri Bahar) *i.e.* cutworm and molecricket soil treatment of phorate 10 G @ 15kg $ha^{-1}$ at planting plus drenching the ridges with chlorpyriphos 20 EC @ 2.5ml/L of water on appearance of pest ($T_5$) was found most effective in decreasing the incidence of cutworm and molecricket followed by soil treatment at planting with phorate 10 G @ 15kg $ha^{-1}$ with addition drenching the ridges with imidacloprid 17.8 SL @ 0.004% (2ml/10 L of water) on the occurrence of the pest ($T_6$) than other treatments as well as control. Both the treatments ($T_5$ and $T_6$) were more or less equally effective to decrease the incidence of cutworm and molecricket. Yield of healthy tubers was recorded maximum (31.66 t $ha^{-1}$) in $T_5$ treatment succeeds by $T_6$ than other treatments as well as control.

***Keywords****:* Chlorpyriphos, imidacloprid, phorate, cutworm, molecricket, kufri bahar

## Introduction

Potato, the most important food crop in the world after wheat, rice, maize and is one of the important cash crop grown in the plains of West Bengal, which is the second largest producer in the country. The productivity of the crop is highest in this state due to favorable weather and soil texture. But the yield of potato tuber is greatly reduced due infestation of different soil pests, which directly cause damage to the tubers along with the foliage of the crop. Among these cutworm, *Agrotis ipsilon* (Hufner) is the most important soil pest of potato reducing the yield to 35 – 40% in West Bengal (Konar & Chettri 2003). The pests also cuts the plants at their bases near the ground level as well as feeds on shoots and leaves resulting stunted growth of the plant and reduced the tuber yield of the crop (Bhutani & Verma 1976). Molecricket, (*Gryllotalpa africana,* P. de Beau) is also one of the important pests of potato in West Bengal. Paul & Konar (2003) recorded ten percent tuber damage by this pest along with four percent foliage damage on potato in West Bengal. To avoid the yield loss by soil pests, the frequent use of toxic chemicals has been a common practice to the farmers. However, use of such toxic chemicals is responsible for the environmental pollution, health hazards and adverse effect on beneficial organisms. Therefore, the present field experiment was conducted to evaluate the efficacy of various treatments against soil pests, *i.e.* cutworm and mole cricket of potato.

## Materials and Methods

The field investigation was conducted during *rabi* season of 2007-08 and 2008-09 in randomized block design (RBD) with five replications and six treatments including control at Adisaptagram Block Seed Farm, Mogra, Hooghly, West Bengal. For this potato tubers (*cv*. Kufri Bahar) were planted in 3m X 2m plots with 60cm X 20cm spacing during end of November. All the standard agronomic practices

were strictly followed except the application of insecticides. The six different treatments consist, $T_1$, (control), $T_2$, (soil treatment at planting with phorate 10 G @ 1.5kg a.i. $ha^{-1}$), $T_3$, (drenching of ridges with chlorpyriphos 20EC @ 2.5ml/L of water on the appearance of pest), $T_4$, (drenching of ridges with imidacloprid 17.8 SL @ 0.004% (2ml/ 10 L of water on the appearance of pest), $T_5$, (soil treatment at planting with phorate 10 G @ 1.5kg a.i. $ha^{-1}$ followed by drenching of ridges with chlorpyriphos 20 EC @ 2.5ml/ L of water on the appearance of pest) and $T_6$, (soil treatment at planting with phorate 10 G @ 1.5 kg a.i. $ha^{-1}$ followed by drenching of ridges with imidacloprid 17.8 SL @ 0.004% (2ml/ 10 L of water on the appearance of pest).

Data on the incidence of the pests were recorded at 45 days after planting (DAP), 60 DAP, 75 DAP and at harvesting from randomly selected 15 plants in each plot and the weight of healthy and damaged tubers were also recorded from each plot during harvesting. The mean data of five replications was taken for statistical analysis and the means were compared by Randomized Complete Blocked Design (RCBD) factor test.

## Result and Discussion

The data collected in two consecutive years of 2007-08 and 2008-09 regarding the incidence of cutworm and mole cricket and percentage of tuber damage caused by soil pests has presented in Table 1 (2007-08) and Table 2 (2008-09). From both tables, it is revealed that all the treatments were significantly superior over untreated control. But soil application of phorate 10 G @ 1.5kg a.i.$ha^{-1}$ applied at planting + drenching of ridges with chlorpyriphos 20 EC @ 2.5ml/L of water on the appearance of pest ($T_5$) was recorded most effective in decreasing the incidence of cutworm (0.00-0.60) and mole cricket (0.00-0.20) followed by soil applications of phorate 10 G @ 1.5kg a.i. $ha^{-1}$ + drenching of ridges with imidacloprid 17.8 SL @ 0.004% (2ml/10L of water) on the appearance of pest ($T_6$). It was due to the systemic action with longer persistency of phorate and contact action of chlorpyriphos. The present results of the experiment are more or less corroborated with the findings of Konar & Paul (2005). They also worked with contact insecticides like chlorpyriphos 20EC and endosulfan 35EC and systemic insecticides phorate 10G and carbaryl 5G against soil pest of potato. Similarly, $T_5$ also found most effective in reducing the tuber damage caused by cutworm (0.36 - 0.40%) and molecricket (0.15 - 0.16%), followed by $T_6$ (0.38 - 0.68% for cutworm and 0.16 - 0.39% for molecricket), $T_2$ (0.87 - 1.10% for cutworm and 0.22 - 0.25% for molecricket), $T_3$ (1.01 - 1.25% for cutworm and 0.35 - 0.39% for molecricket), $T_4$ (1.15 - 1.35% for cutworm and 0.59 - 0.64% for molecricket), respectively than ($T_1$) control (22.08 - 23.50% for cutworm and 2.50 - 2.75% for molecricket).

The efficacy of chlorpyriphos (contact insecticides) and phorate (systemic insecticides) is due to its high toxicity with systemic action for a longer period. The application of this insecticide is selective in plants and soil and also safe from the toxic residual effect in potato tubers. Maximum yield (t $ha^{-1}$) of healthy tubers was recorded in $T_5$ (31.66-33.51) succeeded by $T_6$ (30.42-32.90), $T_2$ (29.98-30.41), $T_3$ (29.14-29.46) and $T_4$ (28.54-28.66) respectively than control (21.65-21.19). Das & Ram (1998); Kishore & Mishra (2001); Tripathy *et al.* (2003) observed that only chlorpyriphos or phorate plus chlorpyriphos gave better results to reduce the tuber damage caused by soil pests, *i.e.* cutworm and mole cricket. Islam *et al.* (1991) also

recorded more than 80% decrease in infestation level of cutworm in pyrethroids and chlorpyriphos treated plots.

The economics of treatments were worked out in comparison to untreated control in terms of additional yield gain (t/ha$^{-1}$) as well as added benefit (Rs/ha$^{-1}$) over untreated check (Table 3 and 4). The increase in yield over control varied between 7.47 and 12.32t/ha$^{-1}$ during 2007-08 and 6.89 and 10.01 t/ha$^{-1}$ during 2008-09. Consequently the maximum return (net profit) was obtained from Rs. 23,324 to Rs. 38,922 ha$^{-1}$ during 2007-08 and from Rs. 22,315 to Rs. 32,535 ha$^{-1}$ during 2008-09 in different treatments. But the most favorable cost benefit ratio (CBR) was found in $T_2$ during both the year *i.e.* 2007-08 (1:17.71) and 2008-09 (1:16.15) among different treatments. Because $T_2$ was least costly (Rs. 1700 per ha$^{-1}$) while $T_5$ and $T_6$ was most costly (Rs. 2400 ha$^{-1}$ and Rs. 2450 ha$^{-1}$) thus $T_2$ produced maximum monetary return over control ($T_1$), followed by $T_5$, $T_3$, $T_6$ and $T_4$, respectively.

Therefore, from the result it may be concluded that $T_5$ and $T_6$ yielded greater quantity of marketable potato tubers but the CBR was always found maximum in $T_2$ because this treatment was less costly as single application was given against the infestation of the pests during planting. Though $T_5$ and $T_6$ yielded maximum quantity of marketable potato tubers, but the treatments were not so economical due to two applications of two different insecticides were given against the pests during planting and on the emergence of the pests. Chlorpyriphos 20 EC 2.0 kg ha$^{-1}$ was most effective treatment to protect the crop from the attack of cutworm and also recorded highest potato tuber yield followed by quinalphos 25 EC @ 2.0 kg ha$^{-1}$ (Tripathi *et al.* 2003) low percentage of plant damage caused by soil pest (cutworm and molecricket) was found with applications of phorate 10G @ 1.0 kg a. i. ha$^{-1}$ at planting plus spraying of chlorpyriphos @ 0.5 kg ha$^{-1}$ at 45 days after planting plus spraying of cartap hydrochloride 50 SP @ 1.0 kg ha$^{-1}$ at 60 days after planting and spraying with imidacloprid 17.8 SL @ 0.04 kg ha$^{-1}$ at 75 days after planting (Konar *et al.* 2006). Phorate 10 G @ 1.0 kg a. i. ha$^{-1}$ at planting plus spraying of chlorpyriphos @ 0.5 kg ha$^{-1}$ at 45 days after planting plus spraying with *Bacillus thuringiensis* var. *kurstaki* $10^9$ spore count ml$^{-1}$ @ 750g ha$^{-1}$ at 60 days after planting with nemazal 5000 ppm @ 0.4 % concentration at 75 days after planting was found most effective in decreasing the incidence of cutworm and molecricket on potato plants and potato tubers (Anonymous 2009).

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**Table 1.**
Incidence of cutworm and mole cricket per 5 plants per plot during 2007-08

| Treatments | Cutworm | | | | Molecricket | | | | % tuber damage | | Yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 45 DAP | 60 DAP | 75 DAP | At harvest | 45 DAP | 60 DAP | 75 DAP | At harvest | Cutworm | Molecricket | |
| $T_1$ | 1.80 | 2.40 | 3.80 | 4.20 | 0.80 | 1.00 | 1.60 | 1.40 | 22.08 | 2.50 | 21.19 |
| $T_2$ | 0.40 | 0.40 | 1.00 | 1.20 | 0.0 | 0.0 | 0.20 | 0.40 | 0.87 | 0.22 | 30.41 |
| $T_3$ | 0.50 | 0.60 | 1.20 | 1.40 | 0.20 | 0.20 | 0.40 | 0.40 | 1.01 | 0.39 | 29.46 |
| $T_4$ | 0.30 | 0.80 | 1.40 | 1.60 | 0.20 | 0.40 | 0.60 | 0.30 | 1.15 | 0.59 | 28.66 |
| $T_5$ | 0.0 | 0.0 | 0.60 | 0.40 | 0.0 | 0.0 | 0.0 | 0.00 | 0.40 | 0.16 | 33.51 |
| $T_6$ | 0.20 | 0.20 | 0.40 | 0.60 | 0.0 | 0.0 | 0.0 | 0.20 | 0.68 | 0.17 | 32.90 |
| CV% | 106.07 | 76.74 | 64.55 | 36.48 | 212.13 | 148.43 | 90.91 | 104.98 | 19.07 | 96.61 | 4.98 |
| SEM± | 0.36 | 0.36 | 0.57 | 0.36 | 0.27 | 0.25 | 0.27 | 0.31 | 0.51 | 0.34 | 0.92 |
| LSD value | 0.75 | 0.73 | 1.19 | 0.76 | 0.56 | 0.52 | 0.57 | 0.65 | 1.06 | 0.71 | 1.92 |

DAP= days after planting

**Table 2.**
Incidence of cutworm and mole cricket per 5 plants per plot during 2008-09

| Treatments | Cutworm | | | | Molecricket | | | | % tuber damage | | Yield (t/ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 45 DAP | 60 DAP | 75 DAP | At harvest | 45 DAP | 60 DAP | 75 DAP | At harvest | cutworm | Molecricket | |
| $T_1$ | 1.70 | 2.80 | 4.20 | 5.80 | 1.00 | 1.40 | 2.00 | 1.60 | 23.50 | 2.75 | 21.65 |
| $T_2$ | 0.60 | 0.80 | 1.00 | 1.40 | 0.20 | 0.30 | 0.40 | 0.40 | 1.10 | 0.25 | 29.98 |
| $T_3$ | 0.50 | 0.70 | 1.40 | 1.00 | 0.30 | 0.40 | 0.60 | 0.50 | 1.25 | 0.35 | 29.14 |
| $T_4$ | 0.40 | 0.60 | 1.00 | 1.80 | 0.20 | 0.50 | 0.80 | 0.60 | 1.35 | 0.64 | 28.54 |
| $T_5$ | 0.0 | 0.00 | 0.40 | 0.60 | 0.00 | 0.00 | 0.00 | 0.20 | 0.36 | 0.15 | 31.66 |
| $T_6$ | 0.10 | 0.20 | 0.60 | 0.80 | 0.00 | 0.00 | 0.00 | 0.40 | 0.60 | 0.18 | 30.42 |
| CV% | 93.28 | 81.24 | 68.36 | 61.33 | 217.26 | 162.35 | 86.96 | 107.15 | 13.30 | 46.52 | 5.47 |
| SEM± | 0.26 | 0.42 | 0.62 | 0.67 | 0.32 | 0.27 | 0.35 | 0.41 | 0.38 | 0.16 | 0.99 |
| LSD value | 0.67 | 0.79 | 1.29 | 1.41 | 0.64 | 0.57 | 0.73 | 0.85 | 0.79 | 0.35 | 2.61 |

DAP= days after planting

**Table 3.**
Cost effectiveness of different treatments against soil pests of potato during 2007-08

| Treatments | Marketable yield (t $ha^{-1}$) | Increased yield over control (t $ha^{-1}$) | Added benefit over control (Rs $ha^{-1}$) | Cost of treatment (Rs $ha^{-1}$) | Net profit (Rs $ha^{-1}$) | ICBR |
|---|---|---|---|---|---|---|
| $T_1$ | 21.19 | - | - | - | - | - |
| $T_2$ | 30.41 | 9.22 | 30887 | 1650 | 29237 | 1:17.71 |
| $T_3$ | 29.46 | 8.27 | 27704 | 1600 | 26104 | 1:16.32 |
| $T_4$ | 28.66 | 7.47 | 25024 | 1700 | 23324 | 1:13.72 |
| $T_5$ | 33.51 | 12.32 | 41272 | 2350 | 38922 | 1:16.56 |
| $T_6$ | 32.90 | 11.71 | 39228 | 2400 | 36828 | 1:15.34 |

Selling price of potato Rs. 3350 per ton, ICBR: Incremental Cost Benefit Ratio

**Table 4.**
Cost effectiveness of different treatments against soil pests of potato during 2008-09

| Treatments | Marketable yield (t/ha) | Increased yield over control (t/ha) | Added benefit over control (Rs/ha) | Cost of treatment (Rs/ha) | Net profit (Rs/ha) | ICBR |
|---|---|---|---|---|---|---|
| $T_1$ | 21.65 | - | - | - | - | - |
| $T_2$ | 29.98 | 8.33 | 29155 | 1700 | 27455 | 1:16.15 |
| $T_3$ | 29.14 | 7.49 | 26215 | 1600 | 24615 | 1:15.38 |
| $T_4$ | 28.54 | 6.89 | 24115 | 1800 | 22315 | 1:12.39 |
| $T_5$ | 31.66 | 10.01 | 35035 | 2400 | 32535 | 1:13.56 |
| $T_6$ | 30.42 | 8.77 | 30695 | 2450 | 28095 | 1:11.46 |

Selling price of potato Rs. 3500 per ton, ICBR: Incremental Cost Benefit Ratio