

# INTEGRATED PEST MANAGEMENT OF POTATO CUTWORM, *AGROTIS IPSILON* (HUFNAGEL)

M A Mannan <sup>b\*</sup>, M A Hossain <sup>b</sup>, M R Ali <sup>a</sup> and R Tasmin <sup>a</sup>

<sup>a</sup>Department of Zoology, A.M.College, Mymensingh, Bangladesh

<sup>b</sup>Regional Agricultural Research Station, Jamalpur, Bangladesh

(Received September 28, 2001; accepted January 2, 2004)

An experiment was conducted at Regional Agricultural Research Station (RARS), Jamalpur, Bangladesh, during the period from November 2000 to March 2001 to find out the effective management strategy in controlling potato cutworm, *Agrotis ipsilon* in the field. The integration of different cultural, biological and chemical management practices showed significant effect on cutworm infestation than the control plots. The lowest percentage of infested tuber by number and weight was observed from the plots treated with hand picking + two irrigation + one spray of Dursban + perching and its yield was also highest. It might be considered as an integrated pest management (IPM) package for combating the cutworm on potato.

**Key words:** IPM, Potato cutworm, *Agrotis ipsilon*

## Introduction

Potato (*Solanum tuberosum* L.) is one of the important crops in Bangladesh and plays a significant role in the human diet. About 134 thousands hectares of area are cultivated for potato in Bangladesh (Anonymous 1997). One of the major constraints of potato production in Bangladesh is the attack of insect pests resulting in severe damage to the crop (Das 1995). The cutworm, *Agrotis ipsilon* (Hufnagel) is the most common and major insect pest of potato. In the early stage of the crop, the larvae of the cutworm cut the plants at the ground level and feed on the leaves of the standing plants affecting their growth, vigour and yield. The amount of damage by cutting the plants exceeds the amount by actual eating (Cabello and Hernandez 1988). At tuberization, the larvae bore into the tubers and consume the inner contents of tubers reducing the yield and market value of potato to a great extent (Patel *et al* 1990). Cutworm damage to the tubers varied from 5 to 75% in India (Lal 1990). In Bangladesh, practical experience reveals that the tuber damage due to the cutworm ranges from 5 to 73% without any control measure depending upon the location and year.

In Bangladesh, main reliance for the control of this pest is on insecticides which is not only expensive but also its residues left over the crops or in the soil have become a matter of great concern for human health and environmental pollution. Over the years the problems associated with the use of insecticides led the entomologists to find ecologically sound, environ-

mentally safe methods of the pest control. Cultural control as a vital component of IPM can be used in combination with other control measures. The present research work was undertaken to study the performance of integration of cultural, biological and insecticide management practices against cutworm infestation in the potato field.

## Materials and Methods

The experiment was conducted at Regional Agricultural Research Station (RARS), Jamalpur, Bangladesh, during 2000 - 2001 potato season with eight treatments following Randomized Complete Block (RCB) design having three replications. The eight treatments were as follows:

- T<sub>1</sub> = Hand picking + one irrigation (45 DAP) + perching
- T<sub>2</sub> = Hand picking + two irrigation (30 and 45 DAP) + perching
- T<sub>3</sub> = Hand picking + no irrigation + two spray of Dursban
- T<sub>4</sub> = Hand picking + one irrigation (45 DAP) + one spray of Dursban
- T<sub>5</sub> = Hand picking + two irrigation (30 and 45 DAP) + one spray of Dursban + perching
- T<sub>6</sub> = Hand picking
- T<sub>7</sub> = Spray of Dursban at 15 days interval
- T<sub>8</sub> = Control

The unit plot size was 3m × 3m and spacing was 60cm × 25cm. Fertilizers were used as per recommendation (Urea: 350 Kg / ha, TSP: 220 Kg / ha and MP: 260 Kg / ha). Weeding and other cultural managements were done as and when necessary. Hand picking was done in the morning everyday from the first inci-

\*Author for correspondence; e-mail: wrcjaml@bdonline.com

dence of cutworm infestation. Perching was done by putting bamboo branches in the irrigated plots. One irrigation was given at 45 days after planting (DAP) and two irrigations at 30 and 45 DAP. The insecticide Dursban (Chlorpyrifos) 20EC was sprayed @ 5 ml / L of water. Data on the tuber infestation by the cutworm and yield data were recorded at harvest. All data were analyzed statistically after arcsin transformation and separated by DMRT.

## Results and Discussion

The effect of different management practices for the control of cutworm in the potato field showed that the percentage number and weight of infested tubers varied significantly with different treatment combinations ( $P < 0.01$ ) Table 1 - 2. The percentage of infested tubers ranged from 20.05 to 31.90 in the treated plots as compared to 36.02 in untreated plots. The treatment with the combination of hand picking, two irrigation (30 and 45 DAP), one spray of Dursban (Chlorpyrifos) and perching gave better control of the cutworm resulting in 44.34 % reduction of number of tuber infestation. Statistically, the second better treatment combination was hand picking + two irrigation (30 and 45 DAP) + perching ( $T_2$ ) followed by hand picking + one irrigation (45 DAP) + one spray of Dursban ( $T_4$ ) and spray of Dursban at 15 days interval ( $T_7$ ). Only, the treatment hand picking was least effective and reduced the number of tuber infestation by 11.44 %.

Analysis of data on the percentage of weight of the infested tubers also showed that the combination of hand picking + two irrigation (30 and 45 DAP) + one spray of Dursban and perching were most effective and reduced the percentage of infested tubers by 42.59% over control. Statistically, similar effect on the infestation of tuber by weight was observed in the treatment  $T_2$  (hand picking + two irrigation - 30 and 45 DAP + perching),  $T_3$  (hand picking + no irrigation + two spray of Dursban),  $T_4$  (hand picking + one irrigation (45 DAP) + one spray of Dursban) and  $T_7$  (spray of Dursban at 15 days interval).

Results on the yield of potato tubers from different plots with the combination of different management practices showed significant increase ( $P < 0.01$ ) in the yield of healthy tubers (Table 3). The weight of damaged tubers in different treated plots did not show significant difference ( $P < 0.05$ ). However, there was a statistically significant difference in the total yield of potato when treated with the combination of different IPM components.

The highest healthy tuber yield (22.56 ton / ha) was recorded from the plots treated with the combination of hand picking + two irrigation (30 and 45 DAP) + one spray of Dursban +

**Table 1**

Effect of different management practices in reducing the number of infestation of potato tubers by *A.ipsilon*

Treatment	Percentage of infested tubers (No.)	Percentage reduction of infestation over control*
$T_1$	30.65 <sup>b</sup>	14.91
$T_2$	24.10 <sup>c</sup>	33.09
$T_3$	30.33 <sup>b</sup>	15.80
$T_4$	25.67 <sup>c</sup>	28.73
$T_5$	20.05 <sup>d</sup>	44.34
$T_6$	31.90 <sup>b</sup>	11.44
$T_7$	25.77 <sup>c</sup>	28.86
$T_8$	36.02 <sup>a</sup>	-
CV (%)	5.56	-

\*Percentage of reduction of infestation was calculated from the number of tubers of untreated plot, Data were analyzed after arcsin transformation, Data in a column followed by same letter(s) do not differ significantly.

**Table 2**

Effect of different management practices in reducing weight (%) in potato tubers by *A. ipsilon*

Treatment	Percentage of infested tubers (Wt.)	Weight (%) reduction in infested tubers over control*
$T_1$	27.19 <sup>b</sup>	22.80
$T_2$	24.32 <sup>bc</sup>	30.95
$T_3$	24.77 <sup>bc</sup>	29.67
$T_4$	21.87 <sup>c</sup>	37.90
$T_5$	20.22 <sup>c</sup>	42.59
$T_6$	30.35 <sup>ab</sup>	13.83
$T_7$	22.54 <sup>c</sup>	36.00
$T_8$	35.22 <sup>a</sup>	-
CV (%)	11.14	-

\*Percentage of reduction of infestation was calculated from the weight of tubers of untreated plot, Data were analyzed after arcsin transformation, Data in a column followed by same letter(s) do not differ significantly.

perching ( $T_5$ ) as against 7.01 ton / ha in the untreated plots followed by 20.83 ton / ha recorded from the plots treated with hand picking + two irrigation (30 and 45 DAP) + perching and hand picking + one irrigation (45 DAP) + one spray of Dursban (18.70 t / ha), hand picking + one irrigation (45 DAP) + perching (14.07 ton / ha), spray of Dursban at 15 days interval (13.26 ton/ ha), hand picking + no irrigation + two

**Table 3**  
Effect of different management practices on the yield of potato tubers

Treatment	Weight of healthy tubers (ton / ha)	Weight of damaged tubers (ton / ha)	Yield (ton / ha)
T <sub>1</sub>	14.07 <sup>b</sup> (74.52)	4.81 (25.47)	18.88 <sup>ab</sup>
T <sub>2</sub>	20.83 <sup>a</sup> (83.81)	4.02 (16.19)	24.85 <sup>a</sup>
T <sub>3</sub>	10.33 <sup>c</sup> (66.60)	5.18 (33.40)	15.51 <sup>b</sup>
T <sub>4</sub>	18.70 <sup>ab</sup> (79.78)	4.74 (20.22)	23.44 <sup>a</sup>
T <sub>5</sub>	22.56 <sup>a</sup> (86.27)	3.59 (13.73)	26.15 <sup>a</sup>
T <sub>6</sub>	9.07 <sup>c</sup> (62.00)	5.56 (38.00)	14.63 <sup>bc</sup>
T <sub>7</sub>	13.26 <sup>b</sup> (78.18)	3.70 (21.82)	16.96 <sup>b</sup>
T <sub>8</sub>	7.01 <sup>c</sup> (53.47)	6.10 (45.84)	13.11 <sup>c</sup>
CV (%)	16.02	23.75	12.63

Data in a column followed by same letter(s) do not differ significantly, Data within the parenthesis represent percentage of healthy and damaged tubers in respective column, Percentage of weight of healthy and damaged tubers were calculated from total yield data, Data were analyzed after arcsin transformation.

spray of Dursban (10.33 ton / ha) and hand picking only (9.07 ton / ha). The treatments T<sub>2</sub> (hand picking + two irrigation - 30 and 45 DAP + perching) and T<sub>5</sub> (hand picking + two irrigation - 30 and 45 DAP + one spray of Dursban + perching) increased 83.81% and 86.27% healthy tuber yield, respectively over total yield.

The cutworm caused a tuber damage of 3.59 ton / ha when treated with hand picking + two irrigation (30 and 45 DAP) + one spray of Dursban + perching and 3.70 ton / ha in the plots treated with spray of Dursban at 15 days interval. Only hand picking was found to be ineffective as the level of damage was similar with that of untreated plots. The total yield was higher (26.15 ton / ha) in the plots treated with hand picking + two irrigation (30 and 45 DAP) + one spray of Dursban + perching. Statistically, similar yield was obtained from the plots treated with hand picking + one irrigation (45 DAP) + perching (18.88 ton / ha), hand picking + two irrigation (30 and 45 DAP) + perching (24.85 ton / ha) and hand picking + one irrigation (45 DAP) + one spray of Dursban (23.44 ton / ha).

The results indicated that among the seven treatments, the management practice with the combination of hand picking + two irrigation (30 and 45 DAP) + one spray of Dursban + perching was found most effective in reducing the infestation of cutworm in potato field.

Ram *et al* (2001) reported that Dursban 20 EC (Chlorpyrifos) @ 0.5 kg a.i. / ha / spray application once at earthing and once after 21 to 30 days of first spraying was the best treatment for suppressing the damage of cutworm. Dursban or Chloropyrifos proved as an effective insecticide for the control of plant and tuber damage in potato crops by the cutworm (Mannan *et al* 1998). Nikkhoo and Moïini (1991) reported that *Agrotis ipsilon* was the most dominant pest of vegetables. The most effective control measures were collecting and burning of crop residues, deep ploughing and flood irrigation of infested fields in winter. Prasad *et al* (1987) reported that irrigation resulted in a significant increase in plant height and in yield. Some important pests were reduced in numbers (*Agrotis* sp) or even eliminated. Esbjerg *et al* (1986) showed that mortality of young larvae (*A. segetum*) increased with increasing soil moisture. The young larvae hide in the top layer of the soil, this behaviour being disturbed by wet soil. The infestation of *A. ipsilon* was lower in the irrigated plots than drought stress (Davis and Pedigo 1991). The findings of the above authors are in partial agreement with the findings of the present study. From the present study, it can be concluded that integration of cultural, mechanical, chemical and biological control could show better performance than the one component of integrated pest management. However, further researches on the effectiveness of different combinations of these treatments are warranted.

## References

- Anonymous 1997 Potato In: *Statistical Year Book of Bangladesh*. Bangladesh Bureau of Statistics, Bangladesh pp 136.
- Esbjerg P, Nielsen J K, Philipsen H, Zethner O, Ogard L 1986 Soil moisture as mortality factor for cutworms, *Agrotis* spp (Lepidoptera: Noctuidae). *J Appl Entomol* **102** (3) 277 - 285.
- Cabello T, Hernandez M D 1988 Feeding behaviour of larvae of *Agrotis segetum* (Denis and Schiffermuller) and *A. ipsilon* (Hufnagel) (Lepidoptera: Noctuidae) and levels of damage to maize. *Bol Sanidad Veg Plagas* **14** (2) 295 - 305.
- Das G P 1995 In: *A Bibliography of Cutworm, Agrotis spp. Complex*. Tuber Crops Research Centre, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur - 1701, Bangladesh, pp 1 - 2.

- Lal L 1990 Insect pests of potato and their status in North-eastern India. *Asian Potato J* **1** 49 - 51.
- Mannan M A, Islam K S, Jahan M, Saha K C, Hossain M A 1998 Comparative efficacy of some insecticides against cutworm, *Agrotis ipsilon* (Hufnagel) in potato field. *Progress Agric* **9** (1&2) 43 - 46.
- Nikkhoo F, Moiiini M 1991 Study of cutworm biology in the vegetable growing areas around Tehran and determination of its control measures. *Appl Entomol and Phytopath* **58** (1 & 2) 1 - 3.
- Patel M M, Godhani B G, Patel R L, Patel P K, Vyas H N 1990 Relative bioefficacy of certain insecticides against potato cutworm (*Agrotis ipsilon* Rott.). *Agric Sci Dig* **10** (4) 213 - 216.
- Prasad S, Singh K M, Katiyar R N, Singh R N 1987 Influence of irrigation on the crop growth, pest incidence and crop yield of cowpea, *Pisium sativum* Linn. *Indian J Entomol* **49** (3) 330 - 344.
- Ram K, Misra S S, Kishore R 2001 Field evaluation of synthetic insecticides and neem cake for the management of cutworm, *Agrotis ipsilon* (Hufnagel) damaging potatoes in different agroclimatic zones of India. *J Entomol Res* **25** (1) 31 - 35.
- Davis P M, Pedigo L P 1991 Economic injury levels for management of stalk borer (Lepidoptera: Noctuidae) in corn. *J Econ Entomol* **84** (1) 290 - 293.