

# Development of Management Strategies Against Red Ant (*Dorylus Orientalis* Westwood) of Potato

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**Abstract** Several management approaches against red ant of potato *Dorylus orientalis* (Westwood) were studied at farmer's field near Hill Agricultural Research Station, Khagrachari during 2008-09 and 2009-10 cropping seasons to find out the most effective management technique. Dursban 20 EC and Sevin 85 WP reduced red ant damage significantly. From both the season (2008-09 and 2009-10), three times application of Dursban 20 EC @ 5ml/lit of water around the root zone starting from 45 days after sowing of potato tuber at 10 days interval gave the lowest tuber infestation (17.28% and 10.68%) with (62.77% and 56.60%) infestation reduction over control closely followed by 3 times application of Sevin 85 WP @ 3 gm/lit of water (20.14% and 13.73%) with (85.77 % and 81.71%) infestation reduction over control. Both the season the highest infestation (46.41% and 75.06%) was recorded from the control treatment.

**Keywords** Potato, Red Ant, *Dorylus Orientalis*, Chloropyrifos, Carbaryl

## 1. Introduction

Potato (*Solanum tuberosum* L.) belongs to the family Solanaceae is used as the most important food for a large number of people in the world. It is the most important non-cereal food crop and ranks fourth in terms of total global food production after maize, wheat and rice [1]. It is one of the important vegetables as well as cash crop in Bangladesh which achieved 11<sup>th</sup> position in the world in terms of potato production in 2008 [2]. Owing to promotional effort of government it is being placed as a third crop next to rice and wheat [3] [4]. It is a staple food in the developed countries and which accounts for 37% of the total potato production in the world [5]. Considering the trend of population growth and consequently the increased demand for food in the country and dwindling cultivable land area, the potato is likely to play a very important role in the future. Potato is a

popular and important vegetable in Bangladesh. For the whole year, it is used as main vegetable and also represents about 53% of the total edible vegetables.

Potato crop is attacked and damaged by a number of insect pests which directly cause damage to the tubers. Among these, Red ants (*Dorylus orientalis*), is one of the most important soil pests of potato reducing the yield up to 35-40% in West Bengal [6]. The pest made hole on the surface of tuber which reduced tuber yield as well as market quality [7]. The insect is reported causing 70-90% damage at harvest to potatoes in farmer's fields in Bihar [8]. *Dorylus orientalis* has long been known as an important pest of potato in middle and higher hills of Nepal [9] and it causes serious damage to potato, radish, carrot, cauliflower, cabbage and many solanaceous and cruciferous vegetables in Nepal [10]. [11] reported that red ant severely damaged the marketable potato tuber yield in Nepal. Red ants are reported as a pest of potato, cauliflower, cabbage, groundnut, sugarcane, and coconut seedlings in the North-Eastern states, Bihar, and Uttar Pradesh [12]. The pest appears during December and remains active until April, causing more than 10% of the damage in irrigated potato crops. High temperatures and dry weather favor population build-up [13]. The pest damages mainly the potato stems and tubers by chewing holes and in case of severe attack plants become wilt in direct sunlight and will eventually dry up [14].

In Bangladesh red ant is reported as a serious problem in the hilly areas of Khagrachari district. During winter season it attacks potato crop just after tuber formation and infestation in continued upto harvesting of potato unless any management approach is taken. From assessment report the highest 90.3 % infestation was found by numbers, while by wt. the highest 54.91 % infestation was recorded from red ant damage [15].

This pest is generally controlled by the application of pesticides in the soil. Spraying of infested potato fields with chlorpyrifos (Dursban) 20 EC @ 2.5 L/ha checked the further spread of infestation in Bihar [16]. However, in Bangladesh there is no comprehensive information available in the literature regarding the management of red ant. There

is a need to develop a strategy to control the pest. Therefore, the present investigation was carried out to find out the suitable management approach for controlling potato red ant.

## 2. Materials and Methods

The experiment was carried out at farmer’s field near Hill Agricultural Research Station, Khagrachari during 2008-09 and 2009-10 cropping seasons. Diamant variety of potato was used in the experiment. Plot size was 3m×3m and spacing was maintained as 60cm×40cm. Recommend dose of fertilizer was applied under recommendation of fertilizer recommendation guide and other intercultural operation were done with irrigation uniformly. The experiment was laid out in randomized complete block design (RCBD) with 4 replications. There were seven treatments: T<sub>1</sub>: Application of Neem oil cake @ 300 kg/ha during final land preparation, T<sub>2</sub>: Application of Poultry manure @ 3 ton/ha during final land preparation, T<sub>3</sub>: Application of Dursban 20 EC @ 5 ml/lit of water for 3 times, T<sub>4</sub>: Application of Sevin 85 WP @ 3 gm/lit of water for 3 times, T<sub>5</sub>: Application of Kerosine @ 5 ml/lit of water for 3 times, T<sub>6</sub>: Application of Furadan 5G @ 40 kg/ha for 3 times and T<sub>7</sub>: Untreated control.

Neem oil cake was applied at final land preparation; insecticides and kerosine were applied 3 times at 10 days interval starting from 45 days after sowing. During final harvest data were taken on weight of healthy and infested tuber and percent infestation was calculated using the following formula:

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

Yield data of different treatments were recorded. Marketable yield was determined calculating the weight of healthy tuber only. The experimental data were analyzed by MSTAT-C software. Mean comparisons for treatment parameters were compared using Dun-can’s Multiple Range Test [17] at 1% level of significance. The marginal benefit cost ratio (MBCR) was calculated on the basis of prevailing market price of potato, insecticides, Neem oil cake, poultry manure and spraying cost. Marginal benefit cost ratio was

calculated as follows:

$$\text{Marginal BCR} = \frac{\text{Benefit on control}}{\text{Cost of treatment}}$$

## 3. Results and Discussion

### 3.1. Effect of Different Management Approaches Against Red Ant Damage and Yield

From two consecutive sessions (2008-09 and 2009-10) results indicated that three times application of Dursban 20 EC @ 5ml/lit of water around the root zone starting from 45 days after sowing of potato tuber at 10 days interval gave the lowest tuber infestation (17.28% and 10.68%) closely followed by 3 times application of Sevin 85 WP @ 3 gm/lit of water (20.14% and 13.73%). Both the season the highest infestation (46.41% and 75.06%) was recorded from the control treatment (Table 1 and 2).

During both the cropping season the highest red ant infestation reduction over control (62.77% and 85.77%) was recorded from Dursban 20 EC followed by Sevin 85WP (56.60% and 81.71%). Highest marketable yield was also obtained from application of Dursban 20 EC (21.37 ton/ha and 17.47 ton/ha) closely followed by Sevin 85 WP (19.82 ton/ha and 16.03 ton/ha). The lowest marketable yield was recorded from control treatment (6.55 ton/ha and 7.10 ton/ha). The similar result was also observed by [13], that chlorpyrifos (Dursban) 20 EC @ 2.5 L/ha could control the pest very effectively. [8] also concluded that spraying of infested potato fields with chlorpyrifos (Dursban) 20 EC checked the further spread of infestation in Bihar. [16] recommended that mixture of carbaryl and lindane were superior to the other treatments and equally effective in reducing infestation and damage to tubers by the ant. Application of chlorpyrifos emulsifiable concentrate mixed with sand granules and applied to the soil before planting at the rate of (2000 g a.i./ha to 2500 g a.i./ha) was effective to control red ants [15].

**Table 1.** Efficacy of different management practices on the infestation of red ant on potato during 2008-09

Treatment	% Tuber infestation (by wt)	% Tuber infestation reduction over control	Yield (ton/ha)
Neem oil cake	41.59 a	10.39	13.37 b
Poultry manure	39.90 ab	14.03	11.96 b
Dursban 20 EC (Chlorpyrifos)	17.28 c	62.77	21.37 a
Sevin 85 WP (Carbaryl)	20.14 c	56.60	19.82 a
Kerosene	31.79 b	31.50	12.33 b
Furadan 5G (Carbofuran)	31.06 b	33.07	12.67 b
Untreated control	46.41 a	-	6.55 c
Level of significance	**		**
CV (%)	10.88		8.30

In a column means followed by the same letters do not defer significantly at 1% level of probability

**Table 2.** Efficacy of different management practices on the infestation of red ant on potato during 2009-10

Treatment	% Tuber infestation (by wt)	% Tuber infestation reduction over control	Yield (ton/ha)
Neem oil cake	53.32 bc	28.96	9.10 c
Poultry manure	56.75 b	24.39	9.57 bc
Dursban 20 EC (Chlorpyrifos)	10.68 e	85.77	17.47 a
Sevin 85 WP (Carbaryl)	13.73 e	81.71	16.03 a
Kerosene	42.31 cd	43.63	10.97 bc
Furadan 5G (Carbofuran)	38.74 d	48.39	11.43 b
Untreated control	75.06 a	-	7.10 d
Level of significance	**		**
CV (%)	13.27		7.75

In a column means followed by the same letters do not defer significantly at 1% level of probability

**Plate 1.** Damaged tuber by potato red ant**Plate 2.** Adult potato red ants

### 3.2. Economic Analysis

The net income and marginal benefit cost ratio was varied depending on cost of pesticidal application (table 3). The highest net income (Tk. 55900/ha) was recorded from Dursban 20 EC treated plots followed by Sevin 85 WP treated plots (Tk. 47310/ha). The marginal benefit cost analysis of insecticidal application revealed the highest monetary benefit from Dursban 20 EC treated plots. For each taka spent, Dursban 20 EC gave on an average the profit of Tk. 9.73 followed by Tk. 5.78 in Sevin 85 WP treated plots.

**Table 3.** Economic analysis of different management options against red ant on potato during 2008-09 and 2009-10

Treatments	Yield (t/ha)	Addl. yield over control (t/ha)	Addl. income over control (Tk/ha)	Cost of insecticide appl.(Tk/ha)	Net income (Tk/ha)	MBCR
Neem oil cake	11.24	4.41	22050	9600	12450	1.30
Poultry manure	10.77	3.94	19700	6600	13100	1.98
Dursban 20 EC (Chlorpyrifos)	19.42	12.59	62950	7050	55900	7.93
Sevin 85 WP (Carbaryl)	17.93	11.10	55500	8190	47310	5.78
Kerosene	11.65	4.82	24100	2288	21812	9.53
Furadan 5G (Carbofuran)	12.05	5.22	26100	17040	9060	0.53
Untreated control	6.83	-	-	-	-	-

For calculating income and benefit the following market prices were used:

Farm gate Price of Potato = Tk. 5 /Kg, Neem oil cake = Tk. 30/kg, Poultry manure = Tk. 2/kg, Dursban 20 EC = Tk. 70/100ml, Sevin 85 WP = Tk. 142/100gm, Kerosene= Tk. 65/L, Furadan 5G = Tk. 137/kg, Labour wage for spraying pesticides = Tk. 200/day/labourer (8 hours day), Spray volume required: 500L/ha.

Other variable costs were same in different treatments.

### 4. Conclusion

From two year experiment it can be concluded that application of Dursban 20 EC @ 5ml/lit of water for 3 times or Sevin 85 WP @ 3gm/lit of water for 3 times at 10 days interval starting from 45 days after sowing of potato can minimize red ant infestation in potato significantly. However,

Dursban 20 EC to the best tool in managing red ant infestation in potato considering efficacy, profitability.

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## REFERENCES

- [1] Chakraborty, S. N. Chakraborty and A. Datta. 2000. Increased nutritive value of transgenic potato by expressing a non-allergenic seed albumin gene from *Amaranthus hypochondriacus*. Proc. Natl. Acad. Sci. USA, 97(7).
- [2] Hossain, M.A. and M.A.M. Miah. 2010. Post-harvest losses and technical efficiency of potato storage systems in Bangladesh. Technical Report submitted to FAO Bangladesh. Available at: <http://www.fao.org/inpho/content/condpend/text>.
- [3] Haq, A. S. M.A. Matin, M.A. 2006. A study of potato export from Bangladesh. Bangladesh J. Agril. Res. 31(2): 259-266.
- [4] Rashid, M.M. 1999. Shabji Bijnan (in Bengali). Vegetable Production. 2nd edition. Rashid Publishing House, 94, Old DOHS, Dhaka- 1206. Pp: 141-142.
- [5] FAO and CIP. 1995. Potatoes in the 1990s: Situation and prospects of the world potato economy. FAO, Rome (Italy), 39pp.
- [6] Konar, A. Paul. S. Basu. A. Chattri, M. 2005. Integrated management of mole cricket attacking potato in Eastern Gangglic plains of West Bengal. Potato J. 32 (250).
- [7] Butani, D.K. and Verma, S. (1976). Pest of vegetables and their control: sweet potato. Pestic, 10(2) 36-38.
- [8] Ram, K. Misra, S.S. and Singh, L. 1993. Incidence of red ant, *Dorylus orientalis* on different genotypes. J. Indian Potato Assoc. 20:62
- [9] GC, Y. D. Pandey, R. R & Dhital, B. K. 1997. Management of red ant on potato and cauliflower during 1994/95 and 1995/96. Lumle Agricultural Research Centre, Kaski, Nepal LARC Working Paper No. 97/26.
- [10] Joshi, S. L. 1998. Ecology and Management of Red Ants in Nepal. PhD Thesis Submitted to Imperial College Of Science, Technology and Medicine, Ascot, Berkshire, UK.
- [11] Bhandari, M. R. 2011. Assessment of red ant organic management options in potato field of Dhading, Nepal. Nepalese Journal of Agricultural Sciences 9: 90-94.
- [12] Roonwal, M. L. 1976. Plant pest status of root eating ants. *Dorylus orientalis* with notes on taxonomy, distribution and habits (Insects: Hymenoptera). J. Bombay Nat. Hist. Soc.. 72:305 - 313.
- [13] Kishore, R. Ram G. and Misra S. S. 1990. Red ant, *Dorylus orientalis* Westwood-an insect pest of potatoes in Bihar. Journal of Entomological Research 14(1)87-88
- [14] Trivedi, T. P. and Rajagopal, D. 1999. Integrated Pest Management in Potato. In: IPM System in Agriculture, Cash Crops 6:299-313.
- [15] Alam, S. N. 2012. Entomological Research Abstracts. Etnomology Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, 282 pp.
- [16] Yein, B. R. 1984. Relative efficacy of some insecticides against red ants on potato. Journal of Research, Assam Agricultural University. 5(1), pp. 68-71.
- [17] Steel, Robert G D & Torrie, James H. Principles and procedures of statistics. New York: McGraw, 1960.