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Effect of Nitrogen Level on the Extent of Damage of Rice Caseworm, *Nymphula depunctalis* Gn.

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Abstract: The effect of different levels of urea was investigated on the extent of damage of rice caseworm, *Nymphula depunctalis* (Gn.). Data were collected on infested hill, tiller, leaf, number of cases/m^2 and position of case in leaf at different ages of the plant viz. 20, 27, 34, 41 and 48 days after transplanting (DAT). Grain yield (t ha^{-1}) was recorded after harvesting. The infestation of *N. depunctalis* was significantly different in all the parameters measured except in the position of case in leaf when different levels of urea were applied. The highest infestation was observed from the plot treated with 190 kg urea ha^{-1} and the minimum from 130 kg. The infestation was maximum at 27 DAT which declined thereafter. The lowest yield was obtained from the plot treated with high level of urea. The implication of urea on the level of infestation of *N. depunctalis* is discussed.

Key words: Rice caseworm, *Nymphula depunctalis*, nitrogen, infestation, yield

Introduction

Rice caseworm, *Nymphula depunctalis* Gn. (Lepidoptera: Pyralidae) is an important pest of deep water Aman rice but it may attack the irrigated and rainfed wetland rice. It is a leaf cutting insect. The caseworm caterpillar causes damage to the rice plants by cutting off the leaf tips for making the characteristics tubular leaf cases in which they live and by the removal of green tissues from the leaf blade. Removal of green leaf tissues from the leaf blade shows a ladder like appearance leaving the upper epidermis somewhat papery. A new case is constructed after every larval moult. The case that is carried along by the caterpillar whenever it moves helps the larvae to float on the water surface and attack on other plants (Heinrichs, 1994). Rice caseworm prefers the vegetative stage of rice for infestation (Chantaraprapha and Litsinger, 1986) which usually occurs in patches in the field. Caseworm infestation starts at 18-20 days after transplanting and peak infestation occurs 28-35 days after transplanting (Patgiri and Khound, 1998). Attacked plants produce fewer tillers, smaller panicles and show delayed maturity (Pathak and Khan, 1994). Rice caseworm may cause a considerable reduction in the yield of rice (Heinrichs and Viajante, 1987).

Many factors may be responsible for the severe infestation of insect pests in rice field. Of them, climatic condition, uncontrolled application of fertilizer, close planting, time of planting etc. are important. The only method of controlling the pest infestation in Bangladesh is the application of chemical pesticides. But the sole reliance on the application of chemical pesticides has shown many side effects and limitations (Luckmann and Metcalf, 1975). At present, alternative methods of pest control are being emphasized to minimize the side effects of pesticides and environmental hazards. Control or suppression of pests by cultural practices is becoming popular gradually. Controlled application of fertilizer, shifting the planting date, maintaining optimum plant densities etc. could play a vital role in Integrated Pest Management (IPM) program. Although cultural pest control is an important component of IPM, so far in Bangladesh, no research work has been done on the cultural control of rice caseworm. This research was undertaken to find out the effect of doses of urea on the level of infestation of rice caseworm and its impacts on the yield loss.

Materials and Methods

The experiment was conducted at the Bangladesh Agricultural University (BAU) Farm, Mymensingh during the Aman season from September to December 2000. The experiment was laid out in a Randomized Complete Block Design. The unit plot size was 4 m^2 and the space between blocks and between plots were 1m and 50 cm respectively. The land was fertilized with triple super phosphate (TSP), muriate of potash (MP), gypsum and zinc sulphate @ 140, 100, 60, and 10 kg ha^{-1} respectively as basal dose. The plants were spaced at 25x15 cm^2. Nitrogen was applied in the form of urea. Three doses of urea viz.130, 150 and 190 kg ha^{-1} was applied as experimental specification as top dressing in three installments at 7, 25 and 45 days after transplanting (DAT). The rice variety, BR22 (Kiron) was used as the test variety. Twenty five days old seedlings were transplanted in the experimental plots @ 3-4 seedlings per hill.

Normal cultural practices were followed and about 7-8 cm water level was maintained through irrigation. The field was not treated with any chemical insecticides and remains exposed for natural infestation. As some of the rice fields around the experimental plots were found infested with *N. depunctalis*, the infestation to the experimental plots occurred from the neighbouring rice fields. No other control measures were also taken against the pests. The data were recorded on the infestation of hill, tiller, leaf, position of case in leaf and number of cases/m^2 from 10 randomly selected hills in each plot at 20, 27, 34, 41 and 48 days after transplanting (DAT). The yield data were recorded after harvest. All of the data were analyzed statistically and the means were separated using LSD test (Gomez and Gomez, 1984).

Results and Discussion

Effects of urea level on hill infestation: The effect of different doses of urea on the infestation of hill was found significant at 20, 27 and 34 days after transplanting (DAT) but insignificant at 41 and 48 DAT (Table 1). The highest percentage of infested hill was recorded from 190 kg urea ha^{-1} and the lowest one was from 130 kg ha^{-1} at all sampling dates which was statistically similar to 150 kg urea ha^{-1}.

The hill infestation increased with increasing doses of urea at all sampling dates (Table 1). The increase of hill infestation due to application of increased level of urea might be associated with the stimulating effect of nitrogenous fertilizer on various physiological processes including softness of tissues and increasing cell sap. The infestation starts at 20 DAT and the peak infestation was

Table 1: Effect of urea level on the hill infestation by *N. depunctalis* at different ages of rice plant

Doses of urea ha^{-1}	Percentage of infested hill at different days after transplanting				
	20 days	27 days	34 days	41 days	48 days
130 kg	37.71b (37.04)	62.85b (55.48)	56.60b (49.75)	23.66 (27.50)	8.88 (16.38)
150 kg	40.86 b(39.23)	64.39b (55.52)	59.32b (50.59)	25.23 (28.53)	9.45 (17.00)
190 kg	52.52a (47.69)	70.57a (61.95)	69.32a (59.15)	27.32 (29.97)	11.64 (19.29)
Level of significance	P < 0.05	P < 0.01	P < 0.01		
	LSD = 6.14	LSD = 4.81	LSD = 8.07		

Data were analyzed after tranforming into arcsin (Y = $\sin^{-1}\sqrt{x}$). NS = Non significant
Means followed by different letter in a colunm are significantly different. Values in the parenthesis are tranformed data.

Table 2: Effect of urea level on the tiller infestation by *N. depunctalis* at different ages of rice plant

Doses of urea ha^{-1}	Percentage of infested hill at different days after transplanting				
	20 days	27 days	34 days	41 days	48 days
130 kg	14.22b (20.81)	40.45b (29.07)	31.97b (34.03)	11.29b (18.87)	7.30b (14.99)
150 kg	16.36b (21.21)	43.26b (40.15)	33.81b (35.17)	12.17ab (20.09)	8.13b (15.01)
190 kg	24.97a (29.87)	50.02a (47.61)	45.72a (42.39)	17.26a (24.03)	10.88a (18.78)
Level of significance	P < 0.01	P < 0.05	P < 0.01	P < 0.01	P < 0.05
	LSD = 7.10	LSD = 6.15	LSD = 8.34	LSD = 4.34	LSD = 2.75

Data were analyzed after tranforming into arcsin (Y = $\sin^{-1}\sqrt{x}$). NS = Non significant
Means followed by different letter in a colunm are significantly different. Values in the parenthesis are tranformed data.

Table 3: Effect of urea level on the leaf infestation by *N. depunctalis* at different ages of rice plant

Doses of urea ha^{-1}	Percentage of infested hill at different days after transplanting				
	20 days	27 days	34 days	41 days	48 days
130 kg	6.71b (14.72)	17.27b (23.80)	13.97b (21.02)	4.18b (11.62)	2.41b (8.60)
150 kg	8.01b (16.06)	19.19b (24.01)	15.41b (22.17)	4.84b (12.52)	2.87ab (9.49)
190 kg	11.47a (19.44)	26.81a (30.83)	19.04a (26.33)	7.38a (15.50)	4.86a (12.37)
Level of significance	P < 0.01	P < 0.05	P < 0.01	P < 0.01	P < 0.05
	LSD = 3.20	LSD = 6.28	LSD = 3.63	LSD = 2.92	LSD = 3.73

Data were analyzed after tranforming into arcsin (Y = $\sin^{-1}\sqrt{x}$). NS = Non significant
Means followed by different letter in a colunm are significantly different. Values in the parenthesis are tranformed data.

Table 4: Effect of urea level on the number of cases per square meter by *N. depunctalis* at different ages of rice plant

Doses of urea ha^{-1}	Percentage of infested hill at different days after transplanting				
	20 days	27 days	34 days	41 days	48 days
130 kg	1.58b	3.72b	3.55b	0.97b	0.30b
150 kg	1.83ab	4.02b	3.72b	1.00b	0.44b
190 kg	2.58a	6.25a	5.69a	1.59a	1.08a
Level of significance	P < 0.01	P < 0.01	P < 0.01	P < 0.01	P < 0.05
	LSD = 0.76	LSD = 1.37	LSD = 0.56	LSD = 0.54	LSD = 0.58

Mean followed by different letter in a column are significantly different

Table 5: Effect of urea level on the grain yield of BR22 rice infested by *N. depunctalis*

Dose of urea ha^{-1}	Yield (t ha^{-1})
130kg	3.30a
150kg	3.34a
190kg	2.90b
Level of significance	P< 0.05, LSD = 0.37

Mean followed by different letter in a column are significantly different

at 27 DAT at all the doses of urea which declined later on (Table 1).The results of the present studies are in close agreement with the findings of Patgiri and Khound (1998) and Ramasubbaiah *et al.* (1978).

Effects of urea level on tiller infestation: Different doses of urea exerted significant I nfluence on the percentage of tiller infestation (Table 2). Increasing urea level progressively increased the infestation of tiller at all the stages of plant growth. The highest percentage of infested tiller was recorded from 190 kg urea ha^{-1} at all plant ages and differed significantly from the doses of 130 and 150 kg urea ha^{-1}.The lowest percentage of infested tiller was counted from 130 kg urea ha^{1} at all the sampling dates. Among different plant ages the highest tiller infestation was found from 27 DAT at all the doses of urea and this infestation gradually decreased with increasing plant age (Table 2). These results are in conformity with the results of Chantaraprapha and Litsinger (1986).

Effects of urea level on leaf infestation: A significant effect of different doses of urea was found on the percentage of leaf infestation. The highest percentage of infested leaf was recorded from 190 kg urea ha^{-1} at all the plant ages. The effect of doses of 130 and 150 kg ha^{-1} on the infestation of leaf was statistically similar at all the sampling dates. The leaf

infestation increase with the increase of urea level (Table 3). The highest leaf infestation was recorded from the dose of 190 kg urea ha^{-1} might be associated with the stimulating effect of urea on various physiological processes such as softness of tissues, increasing cell sap which make the plant more vulnerable for insect attack. The effect of different doses of urea on leaf infestation, the results are in close agreement with Panda and Sontakke (1993).

Effects of urea level on the number of cases per m^2: Number of cases per square meter was significantly influenced by different doses of urea (Table 4). The number of cases was highest in plot treated with 190 kg urea ha^{-1} and the second highest one was recorded from the plot treated with 150 kg urea ha^{-1} at all the sampling dates which was statistically identical with 130 kg urea ha^{-1}. Among different DAT, the highest number of cases was found at 27 DAT from all the different doses of urea (6.25 cases at 190 kg urea, 4.02 cases at 150 kg urea and 3.72 cases at 130 kg urea). The number of cases gradually decreased with the increase of plant age.

Effect of urea level on grain yield: There was a significant differences in the grain yield when different level of urea were used ($P<0.05$). Grain yield ranged from 2.90 to 3.34 t ha^{-1}. The highest grain yield (3.34 t ha^{-1}) was obtained from 150 kg urea ha^{-1} which was statistically similar with 130 kg urea ha^{-1}(3.30 t ha^{-1}). The lowest yield (2.90 tha^{-1}) was in 190 kg urea ha^{-1}(Table 5). The decrease in grain yield from the plot of 190 kg urea ha^{-1} might be due to the cumulative effect of the highest percentage of infested hill, tiller, leaf and number of cases per square meter. The doses of 130 and 150kg urea ha^{-1} may be attributed to comparatively low insect infestation and thereby producing higher yield. These findings are in close agreement with those obtained by Trujillo (1991). The cultural methods such as application of different levels of urea could contribute to some extent to reduce the infestation of rice caseworm. Lower doses provided better control of *N. depunctalis* which can be economical also and would help the farmers to reduce the cost of rice production. As high cost of pesticides becomes extra burden to the general rice farmers in the country and the problems caused by pesticides to environment, the judicial use of nitrogenous fertilizer is suggested to achieve a rational, safe and effective control of pest. The dose of 150 kg urea ha^{-1} provided better control and maximum yield and which could be practiced to minimize the attack of rice caseworm in the rice field .

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