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Sanjay Kumar Ram
Krishi Vigyan Kendra, Palamau
Birsa Agricultural University,
Ranchi, Jharkhand, India

Dilip Kumar Pandey
Krishi Vigyan Kendra, Palamau
Birsa Agricultural University,
Ranchi, Jharkhand, India

Correspondence
Sanjay Kumar Ram
Krishi Vigyan Kendra, Palamau
Birsa Agricultural University,
Ranchi, Jharkhand, India

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Effect of different dose of nitrogenous fertilizers on the incidence of major insect pests of rice and their management

Sanjay Kumar Ram and Dilip Kumar Pandey

Abstract
To investigate the effect of different dose of nitrogenous fertilizers on the incidence of major insect pests of rice and their management, the experiment had conducted at the research farm of Birsa Agricultural University, Ranchi. The incidence of major insect pests of rice viz., gall midge, *Orseolia oryzae* Wood Mason; rice leaf folder, *C. medinalis*; green leaf hopper, *Nephotettix nigropictus* (Stal.); stem borer, *Scirpophaga incertulas* (Wlk.); and rice hispa, *Dicladispa armigera* (Oliv.) were increased with the application of higher levels of nitrogen. The highest incidence of gall midge (13.2% silver shoots), leaf folder (19.7% damaged leaves), green leaf hopper (15 nymphs/10 hills) stem borer (8.7% dead hearts) at 60 days after transplanting (DAT) and hispa at 40 DAT (12.3% infested leaves) were recorded with the application of 120 kg N/ha which were significantly higher than 100 kg and 80 kg N/ha. The highest incidence of gall midge (12.0% silver shoots), stem borer (7.4% dead hearts), leaf folder (25.8% damaged leaves), green leaf hopper (45.87 nymphs/10 hills), gundhi bug (15.02 bugs/5 hills) at 60 days after treatment and rice hispa (30.7% infested leaves) at 40 DAT were recorded which were significantly reduced by nursery treatment with cartap hydrochloride 4G (caldan 4G)@ 1.0 kg a.i./ha, 5 days before uprooting the seedlings or seedling root dip in chlorpyriphos 20 EC (0.02%) followed by foliar application of monocrotophos 36 SL at 35 and 55 DAT. Higher grain yields of 24.75 and 24.24 q/ha were obtained with the application of 120 kg and 100 kg N/ha, respectively.

Keywords: insect pests, rice, nitrogenous fertilizer, gall midge, stem borer, hispa, leaf folder, green leaf hopper

Introduction
In recent years, the insect pest problems has considerably increased with the spread of high yielding varieties and intensive cultivation like close spacing of plants, water logging in the crop, growing year round the paddy crop, use of high doses of nitrogenous fertilizers and manipulation in the time of transplanting (Kushwaha and Chand, 1988) [3]. More than 100 insect species attack rice crop of which brown plant hopper, green leaf hopper, stem borer, gall midge, rice hispa, leaf folder, white backed plant hopper are the major ones (Pathak and Dhaliwal, 1981) [5]. Some of the sporadic pests like rice hispa, root weevil, ear cutting caterpillar and gundhi bug have been reported causing serious damage to rice crop during favourable environmental conditions (Singh and Dhaliwal, 1994) [6].
About 10 to 30 per cent yield loss is attributed to insect pest's damage. The crop between 30-60 days after transplanting was found to be the most vulnerable where maximum yield losses (20 to 68%) occurred in majority of areas. However, less yield losses were recorded during first 30 days after transplanting and beyond 60 days after transplanting. High levels of nitrogenous fertilizers significantly increase the incidence of most of the insect pests including yellow stem borer, leaf folder, gall midge, green leaf hopper, brown plant hopper, earhead bug, rice hispa etc on the crop (Dhaliwal and Arora, 2001). Cramer (1976) estimated a yield loss Due to insects in tropical rice to the tune of 34.0 per cent. The losses due to insect pests are

estimated To be 94,680 million rupees (Dhaliwal and Arora, 1993) [1]. Annual yield loss due to gall midge has been calculated vary from 28 per cent (Kalode, 1987) [2] to 35 per cent (Way, 1976) [11]. Recently Puri (2000) [6] advocated that yellow stem borer, gall midge and brown plant hopper were the key pests in rice causing 10 to 70 per cent, 15-60 per cent and 25-30 per cent loss, respectively. Severe infestation of leaf folder led to as high as 60 to 70 per cent leaf damage (Kushwaha and Singh, 1984) [4] and inflicted significant yield losses to the extent of 80 per cent (Prabal *et al*., 1999). Shukla *et al*. (1986) [10] recorded 17.28 per cent leaf damage due to hispa. In Bihar, loss in yield was as high as 50 per cent during the year of epidemic.

However, repeated applications of granular insecticides at recommended doses is very costly and not within the means of marginal and small farmers. Several workers evaluated the efficacy of various chemical insecticides against insect pests as nursery treatment, seedling root dip and post transplanting application had been carried out in other states, but in this states, no other reports are available in this regard.

1. Keeping all the above view in mind, the following objectives have been undertaken:
2. To determine the incidence of major insect pests under the influence of nitrogenous fertilizers To determine the impact of nursery treatment with cartap hydrochloride 4G seedling root dip in chlorpyriphos 20 EC (0.02%) followed by foliar application by monocrotophos 36 SL against insect

Materials and Methods

The experiment was carried out in the research farm of Birsa Agricultural University Ranchi during Kharif season when 80-90% of average annual rainfall of 1400 mm rain is received between June to September and average maximum temperature varies from 22.50 to 29.5^0 C and minimum temperature from 11.50 to 24.2^0 C. The maximum relative humidity varies from 89 to 96 % and minimum relative humidity at 2 pm ranged from 40- 86 percent.

Layout plan

1. Design: Randomized Block Design (RBD)
2. Replication: 3 (Three)
3. Treatment: 12 (Twelve)
4. Plot size: 3m X 3m

Nitrogen levels

1. N_1 (control)- 80 kg N /ha + 60 kg P_2O_5 /ha + 40 kg K_2O /ha
2. N_2: 100 kg N/ha+60 kg P_2O_5 /ha + 40 kg K_2O /ha
3. N_3: 120 kg N/ha+60 kg P_2O_5 /ha + 40 kg K_2O /ha

Insecticide treatments

1. T_1: Nursery treatment with Caldan 4G at five days before uprooting the seedling followed by foliar application of monocrotophos 36SL at 35 & 55 days after transplanting (DAT).
2. T_2: Seedling root dip in chlorpyriphos 20 EC (0.02%) followed by foliar application of monocrotophos 36SL at 35 and 55 DAT
3. T_3: Only foliar application of monocrotophos 36 SL at 35 and 55 DAT.
4. T_4: Untreated control

Paddy variety Jaya was used for raising the seedlings. Four numbers of nursery beds of size 2 X 2 m were raised separately. The seeds were sown. Ten gram of Caldan 4G (cartap hydrochloride) was spread in one nursery beds, five days before uprooting the seedling. This seed bed was bunded around nursery bed for maintaining 4cm standing water.The land was thoroughly puddled by desi plough and leveled by pata. Twenty five days old seedlings treated with caldan 4G were transplanted in nine plots. Whereas nine plots were transplanted by the seedlings treated with chlorpyriphos 20EC (0.02%). Untreated seedling were transplanted in eighteen plots. Control plots of rice (total nine plots) was maintained without any insecticide throughout the investigation. All the plots except control (9 plots) were sprayed with monocrotophos 36 SL at 35 and 55 DAT.

Observations to be recorded

1. Rice gall midge: Total number of tillers as well as damaged tillers bearing silver shoots (Plate 1) were counted in 10 randomly selected plants at 20, 30, 40 50 and 60 DAT to calculate the incidence of gall midge.
2. Stem borer: Total number of tillers as well as number of dead hearts were recorded on 10 randomly selected hills at 30 & 50 DAT to calculate the percentage of dead hearts caused by stem borer. Similarly total number of panicle bearing tillers as well as white earheads (Plate 2) were calculated on 10 randomly selected hills prior to harvest to determine the percent earhead damage.
3. Leaf folder: Total number of leaves and number of folded leaves (Plate 3) due to leaf folder were counted on 10 randomly selected hills at 30, 50 & 60 DAT to calculate the per cent folded leaves.
4. Rice hispa: Like leaf folder, total number of leaves as well as infested leaves due to rice hispa (Plate 4) were counted on 10 randomly selected hills at 30 & 40 DAT.
5. Green leaf hopper: Number of nymphs were counted on 10 randomly selected hills at 30, 40 & 60 DAT in each plot.
6. Rice gundhi bug: During milking stage of the grain, number of gundhi bug (Plate 5) were counted on five randomly selected hills in each plots. However, total number of grains as well as chaffy grain (empty) were counted during maturity to determine the per cent grain damage.

Statistical analysis were subjected to statistical test of significance. The per cent data were transformed into arcsin percentage while insect population data were transformed into x + 0.5, to draw the conclusion.

Avoidable loss

Avoidable loss will be calculated by the following formula

$$\text{Avoidable loss (\%)} = \frac{T - C}{T} \times 100$$

Where T = Yield of treated plot and
C = Yield of untreated plot

Result and Discussion

Five prominent insect pests were observed at different stages of crop growth of rice under the kharif agroclimatic conditions and influence of rice gall midge rice leaf folder, and rice green leaf hopper has been recorded at 20, 40 and 60 days after transplanting (DAS) indicated that highest incidence of rice gall midge (13.2% silver shoots), rice leaf folder (19.7% damaged leaf) and rice leaf hopper (15.0

nymph / 10 hills were observed) with application of 120 kg N / ha. Lowest infestation were recorded under ude of 80 kg N / ha. the record of damage by stem borer was recorded at 30 & 60 (DAT) and found maximum damage under 120 kg / ha at 60 (DAT) and damage by rice hispa were recorded at 30 and 40 (DAT) and shows 12.3% infested leaves at 40 (DAT).

Table 1: Influence of different levels of nitrogen on the incidence of major insect pest of rice

Nitrogen level (kg/ha)	Mean silver shoots (%) of rice gall midge				% of folded leaves/10 hills of rice leaf folder				Mean No./10 hill of rice green leaf hopper			
	20 DAT	40 DAT	60 DAT	Pooled	30 DAT	40 DAT	60 DAT	Pooled	30 DAT	40 DAT	60 DAT	Pooled
80	0.84 (5.26)a	6.1 (14.33a	8.8 (17.22a	5.24 (12.27)a	9.0 (17.44)a	12.2 (20.49)a	14.2 (22.15)a	11.8 (20.03)a	8.02 (2.92)a	8.68 (3.03)a	10.06 (3.25)a	8.92 (3.06)a
100	1.2 (6.12)b	7.9 (16.35)b	9.9 (18.34)a	6.33 (13.60)b	13.0 (21.11)b	15.2 (22.93)b	16.4 (24.85)b	14.86 (22.96)b	9.93 (3.23)b	11.09 (3.39)b	12.67 (3.63)b	11.23 (3.42)b
120	1.7 (7.53)c	9.9 (18.35)c	13.2 (21.27)b	8.26 (15.71)c	15.9 (23.51)c	18.1 (25.14)c	19.7 (26.39)c	19.7 (25.01)c	12.89 (3.66)c	13.56 (3.75)c	15.00 (3.93)c	13.81 (3.78)c
SEm ±	0.16	0.15	0.40	0.23	0.14	0.19	0.17	0.16	0.054	0.066	.057	0.59
CD at 5%	0.46	0.43	1.16	0.68	0.40	0.56	0.51	0.49	0.16	0.19	0.17	0.17
CV %	8.75	8.16	7.35	8.08	8.27	7.93	7.47	7.89	5.76	6.74	5.51	6.00

Table 2

Nitrogen level (kg/ha)	Dead heart (%) of stem borer				Mean damage leaves (%) of rice hispa		
	30 DAT	60 DAT	Pooled	White ear heads (%)	30 DAT	40 DAT	Pooled
80	3.4 (10.68)a	5.5 (13.51)a	4.45 (12.10)a	6.2 (12.09)a	6.3 (14.49)a	6.9 (15.23)	6.6 (14.86)
100	5.2 (13.18)b	6.8 (15.10)b	6.0 (14.14)b	6.00 (14.41)a	8.4 (16.87)b	9.1 (17.51)	8.75 (17.19)
120	7.5 (15.85)c	8.7 (17.14)c	8.1 (16.49)c	8.5 (16.91)b	11.4 (19.71)c	12.3 (20.57)	11.85 (20.14)
SEm ±	0.18	0.16	0.157	(16.91)b	0.16	0.21	0.185
CD at 5%	0.51	0.47	0.49	11.3	0.46	0.61	0.53
CV%	7.62	8.70	8.16	9.43	7.27	6.13	6.70

Table 3: Effect of insecticides on the incidence of major insect pest of rice

Treatment	Mean silver shoots (%) of rice gall midge				% of folded leaves/10 hills of rice leaf folder				Mean No./10 hill of rice green leaf hopper			
	30 DAT	40 DAT	60 DAT	Pooled	30 DAT	40 DAT	60 DAT	Pooled	30 DAT	40 DAT	60 DAT	Pooled
T_1 Caldan 4G at 5 DBU + Monocrotophos at 35 & 55 DAT	0.63 (4.54)b	5.2 (13.10)b	6.8 (15.06)b	4.21 (10.90)b	7.1 (15.44)a	9.5 (18.00)a	11.1 (19.41)a	9.2 (17.61)a	5.85 (2.52)a	2.77 (1.81)a	3.5 (2.00)a	4.04 (2.11)a
T_2 Seedling root dip in Chlorpyriphos (0.02%) + Monocrotophos at 35 & 55 DAT	0.41 (3.65)a	4.6 (12.35)a	5.8 (13.98)a	3.60 (9.99)a	10.3 (18.76)b	13.1 (21.19)b	14.6 (22.50)b	12.6 (20.81)b	8.68 (3.03)b	4.92 (2.33)b	5.75 (2.50)b	6.45 (2.62)b
T_3 Monocrotophos at 35 & 55 DAT	2.1 (8.46)c	9.0 (17.48)c	12.0 (20.24)c	7.7 (15.39)c	16.9 (24.28)c	16.6 (24.07)c	18.4 (25.40)c	17.3 (24.58)c	13.48 (3.74)c	9.54 (3.17)c	9.23 (3.12)c	10.75 (3.35)c
T_4 Control	2.2 (8.56)c	14.9 (22.72)d	19.9 (26.47)d	12.53 (19.25)d	16.9 (24.26)c	22.3 (28.16)d	25.8 (30.53)d	21.66 (27.65)d	13.78 (3.78)c	38.56 (6.25)d	45.87 (6.81)d	32.73 (5.61)d
SEm ±	0.18	0.17	0.46	0.27	0.15	0.22	0.20	0.19	0.06	0.07	0.06	0.06
CD at 5%	0.53	0.50	1.34	0.79	0.45	0.65	0.58	0.56	0.18	0.22	0.19	0.19
CV%	8.75	8.16	7.35	8.08	8.27	7.93	7.47	7.89	5.75	6.74	5.50	5.999

Table 4

Treatment	Dead heart (%) of stem borer				Mean damage leaves (%) of rice hispa		
	40 DAT	60 DAT	Pooled	White ear heads (%)	40 DAT	60 DAT	Pooled
T_1 Caldan 4G at 5 DBU + Monocrotophos at 35 & 55 DAT	2.4 (8.90)a	4.2 (11.81)a	3.36 (10.35)a	5.1 (13.01)a	4.3 (11.98)a	2.6 (9.22)a	3.45 (10.60)a
T_2 Seedling root dip in Chlorpyriphos (0.02%) + Monocrotophos at 35 & 55 DAT	3.8 (11.21)b	5.0 (12.93)b	4.4 (12.07)b	6.2 (14.48)a	7.5 (15.88)b	4.1 (11.72)b	5.80 (13.80)b
T_3 Monocrotophos at 35 & 55 DAT	7.8 (16.27)c	7.4 (15.83)c	7.6 (16.05)c	8.7 (17.18)c	11.7 (20.04)c	8.0 (16.46)c	9.85 (18.25)c
T_4 Control	8.1 (16.56)c	12.2 (20.44)d	10.15 (18.50)d	15.7 (23.31)d	11.9 (20.19)c	30.7(33.66)d	21.30 (26.93)d
SEm ±	0.20	0.19	0.19	0.53	0.18	0.24	0.21
CD at 5%	0.59	0.54	0.56	1.54	0.53	0.70	0.61
CV%	7.62	8.70	8.16	9.43	7.27	6.13	6.70

Table 5: Grain yield of rice procured under different levels of nitrogen

Nitrogen level (kg/ha)	Grain yield (q/ha)
120	24.75
100	24.24
80	23.13
SEm ±	0.18
CD at 5%	0.54
CV%	8.71

Table 6: Effect of insecticides on grain yield of rice

Treatment	Grain yield (q/ha)
T_1 Caldan 4G at 5 DBU + Monocrotophos at 35 & 55 DAT	31.66 a
T_2 Seedling root dip in Chlorpyriphos (0.02%) + Monocrotophos at 35 & 55 DAT	29.20 b
T_3 Monocrotophos at 35 & 55 DAT	21.64 c
T_4 Control	13.65 d
SEm ±	0.21
CD at 5%	0.63
CV%	8.71

The perusal data of table: 3 revealed that all the insecticide were found to be effective against gall midge Orseolia oryzae (Wood Meson) over untreated control. The best performance was obtained by T_1(Nursery treatment with Caldan 4G at five days before uprooting the seedling followed by foliar application of monocrotophos 36SL at 35 & 55 days after transplanting (DAT)) followed. The highest incidence of rice leaf folder, *Cnaphalocrosis. Medinalis* (Guenee) L,were recorded by untreated control plots (T_4) at 30,40 and 60 days after transplanting which were significantly reduced by the application of insecticides as in case of T_1,T_2 and T_3. The best results were abtained by T1(Nursery treatment with Caldan 4G at five days before uprooting the seedling followed by foliar application of monocrotophos 36SL at 35 & 55 days after transplanting (DAT) by followed by T2.The highest population density of rice green leaf hopper, *Nephotettix virescens* were recorded in untreated plot at 30,40 and 60 DAT and best result found under T_1 ((Nursery treatment with Caldan 4G at five days before uprooting the seedling followed by foliar application of monocrotophos 36SL at 35 & 55 days after transplanting (DAT)). Treatment of stem borer and rice hispa done 40 and 60 DAT and found best result under T_1 ((Nursery treatment with Caldan 4G at five days before uprooting the seedling followed by foliar application of monocrotophos 36SL at 35 & 55 days after transplanting (DAT) followed by T_2 (Seedling root dip in chlorpyriphos 20 EC (0.02%) followed by foliar application of monocrotophos 36SL at 35 and 55 DAT). Higher grain yields of 24.75 and 24.24 q/ha were obtained with the application of 120 kg and 100 kg N/ha, respectively (Table-5) while 31.66 and 29.20 q/ha (Table -6) were received by nursery treatment and seedling root dip, respectively

Conclusion

It can be concluded that rice crop could be grown with 80-100 kg N/ha under the protection of nursery treatment with cartap hydrochloride 4G (caldan 4G)/ seedling root dip with chlorpyriphos 20 EC (0.02%) followed by foliar application with monocrotophos 36 SL at 35 and 55 days after transplanting.

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