



ISSN: 0974 - 0376

The Ecoscan : Special issue, Vol. VII: 91-94: 2015
AN INTERNATIONAL QUARTERLY JOURNAL OF ENVIRONMENTAL SCIENCES
www.theecoscan.in

IMPACT OF NUTRITION MANAGEMENT ON INCIDENCE OF RICE INSECT PESTS

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KEYWORDS

Inorganic and organic fertilizers
YSB
Leaf folder
BPH

**Proceedings of National Conference on
Harmony with Nature in Context of
Bioresources and Environmental Health
(HARMONY - 2015)**
November 23 - 25, 2015, Aurangabad,
organized by
Department of Zoology,
Dr. Babasaheb Ambedkar Marathwada University
Aurangabad (Maharashtra) 431 004
in association with
NATIONAL ENVIRONMENTALISTS ASSOCIATION, INDIA
www.neaindia.org



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ABSTRACT

The field study was conducted to determine the effects of inorganic and organic fertilizers on insect prevalence viz., YSB, leaf folder, BPH and yield of rice. The results revealed that highest insect population and yield was recorded in treatment received N:P₂O₅:K₂O @ 150: 60: 90 kg/ha with 9.10% dead hearts, 14.87% white ears, 13.79% leaf folder damage, 34BPH/hill and 64.50 q/ha. Application of N: P₂O₅: K₂O: ZnSO₄ @100: 60: 40: 10 kg /ha reduced the infestation with 6.09% dead hearts, 9.75% white ears, 7.75% leaf folder damage, 20 BPH/hill and 57.60 q/ha. Combined application of inorganic and organic sources like FYM (7.08% dead hearts, 10.96% white ears, 8.85% leaf folder damage, 23 BPH/hill and 64.45 q/ha), BGA (4.10% dead hearts, 8.38% white ears, 5.05% leaf folder damage, 18 BPH/hill and 50.30 q/ha) and green manuring (3.98% dead hearts, 8.15% white ears, 4.95% leaf folder damage 17 BPH/hill and 57.40 q/ha) did not affect the pest infestation compared to treatments received higher doses of organic fertilizers compared to control plot. The prevalence of insect pests gradually increased with increase in inorganic fertilizers. Therefore study suggests that combined application of organic and inorganic fertilizers on need based may produce good yields while minimizing insect prevalence in the rice fields.

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INTRODUCTION

Rice (*Oryza sativa* L.) is one of the important cereal crops of the world and forms the staple food for more than 50 per cent of population (Bhupesh Joshi *et al.*, 2015). About 90 % rice in the world is grown and consumed by the population of the Asian countries which constitute 58 % population of the World (Chowdhury *et al.*, 2014). Incidence of yellow stem borer on rice was reported throughout the country with a varied level of severity and the reported yield losses ranged from 3 to 30 per cent (Chormuleet *et al.*, 2014). The yield loss caused by leaf folder reported to the extent of 30 per cent (Baby Rani *et al.*, 2007). The yield loss caused by brown plant hopper reported to the extent of 18 to 20 per cent (Chandramaniet *et al.*, 2009). Among various constraints of rice production, damage due to insect pests is substantial and needs regular attention. Large-scale cultivation of high yielding varieties, monocropping, close planting, water regime, excessive use of nitrogenous fertilizers further aggravated the pest incidence. Cultural practices formed one of the accepted and well conceived approach in reducing the pest incidence in many crops and more so in rice. But, the incidence of yellow stem borer, leaf folder and brown plant hopper was significantly lower in fields that received high rates of potash and significantly greater in fields that received high rates of nitrogen (Loung Minh Chau *et al.*, 2003). The economic doses of given nutrient, however, is to be determined critically considering its rate as plant nutrient and insect suppressant or promoter. Therefore, the present study aimed to study the influence of organic and inorganic fertilizer on the incidence of insect pests in paddy.

MATERIALS AND METHODS

Field study conducted at the long term fertilizer site of soil science department, situated at research farm of IGKV Raipur (C.G.) during *khari* 2014. The experimental field is properly demarcated with a spacing of 1 m from treatment plot and 2 m from replication. Seedlings were transplanted 30 days after sowing with inter and intra row spacing of 20 x 10 cm. The detail of treatments as follows: T1 – Untreated check (control); T2 – NPK @ 50:30:20 kg/ha; T3 – NPK @ 100:60:40 kg/ha standard check; T4 – NPK @ 150:90:60 kg/ha; T5 – NPK + Zn @ 100:60:40:10 kg/ha; T6 – NP @ 100:60 kg/ha; T7 – N @ 100 kg/ha; T8 – NPK + FYM @ 50:30:20 kg/ha + 5 t/ha; T9 – NPK + BGA @ 50:30:20 + 10 kg/ha; T10 – NPK + GM @ 50:30:20 kg/ha. Each treatment is replicated four times.

After crop establishment the experimental field will be observed for different foliage feeder, internal feeder and sap sucker insects up to maturity stage of crop on random plants for each treatment. Total number of leaf and leaves damaged by the insect pests will be counted for calculating percent leaf damage, total number of tiller/panicle and insect affected tiller/panicle will be counted for calculating percent tiller/panicle damage and sap suckers will be counted per hill basis as suggested by Anon., 2007.

The per cent damaged leaves for leaf folder will be computed by following formula:

$$\text{Per cent damaged leaves} = \frac{\text{Number of damaged leaves}}{\text{Total number of leaves}} \times 100$$

The per cent incidence (dead heart/ white ears) of yellow stem borer will be calculated as follows.

$$\text{Per cent incidence} = \frac{\text{Number of dead heart / white ears}}{\text{Total number of tillers/ panicles}} \times 100$$

RESULTS AND DISCUSSION

The investigations on the influence of organic and inorganic fertilizers on insect pest population and yield conducted during *kharif* 2014 revealed there was a significant difference among treatments with respect to insect prevalence and yield. Stem borers, leaf folders and brown plant hopper were observed major pests damaging the crop. Detail of their incidence on crop is given in Table 1.

Stem borer

The results indicate that the lowest percent incidence of stem borers was in the treatment where fertilizers was not applied at all recorded 3.15% dead hearts, 5.33% white ears. The results further show that the pest incidence increases with the dose increase of fertilizer application. The highest incidence of stem borers was recorded in treatments received NPK @ 150:90:60 kg/ha with 9.10% dead hearts, 14.87% white ears. Application of phosphorous (8.32% dead hearts, 13.31% white ears) did not affect the stem borer infestation and showed on par effect with treatments received nitrogen (9.54% dead hearts, 13.41% white ears) alone. Moderate reduction of infestation observed with application of potassium. Treatment received NPK + Zn @ 100:60:40:10 kg/ha recorded the 6.09% dead hearts, 9.75% white ears. Application of BGA and green manuring did not showed any affect on stem borer infestation. These findings are in accordance with Kaushik chakraborty (2011) who recorded highest YSB infestation in plots received N @ 160 kg/ha compared to organic plot treated with vermicompost. Prasad and Gupta(2010) reported moderate

YSB infestation (6.6% white heads) when field was fertilized with *S. acculeata* @ 40 kg/ha with supplemental doses of 40kg inorganic N in two splits during top dressing. Singh *et al* (1990) who reported that NPK ratio of 120-60-60 Kg/ha increased the susceptibility of rice crop to rice stem borers. Saha and Saharia (1970) reported the incidence of stem borers from 8.36% in plots without nitrogen fertilizer to 20.12% in those treated with 100 Kg/ha. Dash *et al.*, (2011) reported that lower dead heart (7.01 and 9.74%) recorded at nutrient level 60:30:30 kg/ha with ZnSO₄ when compared with untreated control (9.53 and 13.13%).

Leaf folder

The lowest percent incidence (3.45%) of leaf folder was recorded in the plots without fertilizer application that tends to increase with the increase of nitrogen application. The highest pest incidence (13.79%) was noted in the plots with NPK @ 150:90:60 kg/h. The lowest incidence of leaf folder was observed in the plots with BGA (5.05%) and GM (4.95%) and showed on par effect followed by zinc (7.75%). Phosphorous application has no effect on leaf folder infestation. Findings are in line with Mustahafa and Potty (2001) who reported that leaf folder incidence increased with the increasing N rates up to 70 kg N/ha. Luong Minh Chau and K.L Heong (2005) recorded lower leaf folder incidence in manure compost plot (7.5 and 5.0 tons/ha) with 6.60 and 9.07 larva/square feet, respectively followed by organic fertilizer plots (5.0 tons/ha) with 7.97 larva/square feet when compared to control (NPK) plots with 25.77% incidence.

Brown plant hopper

The investigations on the influence of fertilizers on insect pest population revealed there was significant BPH population difference among the treatments at 80 DAT. The treatment which received N: P₂O₅:K₂O @ 150:60:90 kg/ha supported significantly highest BPH population (34/hill), followed by NPK + FYM @ 50:30:20 kg/ha + 5 t/ha (23/hill), NPK+Zn @ 100:60:40:10 kg/ha (20/hill). Application of BGA and green manuring did not affect the BPH population. Significantly lowest BPH population was obtained in control treatment (13/hill), differed significantly from all the other treatments included in the trial. The results are in accordance with Loung Minh Chau (2003) reported population of BPH was induced when

Table 1: Influence of fertilizers on the incidence of insects pests of paddy.

Treatment	Yellow stem borer		Leaf folder Damaged leaves (%) 80 DAT*	BPH No./Hill 80DAT*	Yield q/ha*
	Dead hearts (%) 50 DAT*	White ears (%) 80 DAT*			
T1 Control	3.15(10.22)	5.33(13.35)	3.45(10.81)	13.00(3.60)	25.00
T2 50% NPK	4.21(11.84)	8.65(17.10)	6.15(14.33)	18.00(4.24)	52.85
T3 100% NPK	7.28(15.65)	11.32(19.66)	9.10(17.46)	24.00(4.90)	58.80
T4 150% NPK	9.10(17.56)	14.87(22.68)	13.79(21.87)	34.00(5.83)	64.50
T5 100% NPK + Zn	6.09(14.33)	9.75(18.19)	7.75(16.11)	20.00(4.47)	57.60
T6 100% NP	8.32(16.86)	13.31(21.40)	10.90(19.12)	28.00(5.29)	57.55
T7 100% N	8.54(16.99)	13.41(21.48)	11.43(19.73)	30.00(5.47)	41.60
T8 100% NPK + FYM	7.08(15.51)	10.96(19.33)	8.85(17.31)	23.00(4.79)	64.45
T9 50% NPK + BGA	4.10(11.68)	8.38(16.82)	5.05(13.01)	18.00(4.24)	50.30
T10 50% NPK + GM	3.98(11.54)	8.15(16.59)	4.95(12.86)	17.00(4.12)	57.40
SEm ±	0.21	0.51	0.21	0.13	4.38
CD@5%	0.44	1.05	0.44	0.27	8.99

Values in the parenthesis are angular transformed values. *Mean of four replications. Days After Transplant (DAT).

applying more nitrogen fertilizer and most abundance in the treatment of 200 kg N/ha (4.97 nymphs/ square foot) and phosphorous does not affect the outbreak of BPH. Luong Minh Chau and K.L Heong (2005) recorded lower BPH incidence in organic fertilizer plots (7.5 tons/ha, 10 tons/ha and 5 tons/ha) with 41.25, 41.25 and 48.95 BPH/square feet respectively followed by manure compost (2.5 tons/ha) with 32.80 BPH/square feet when compared to control (NPK) plots with 66.47 BPH/square feet.

Paddy yield (t/ha)

Maximum yield was recorded in T4 (64.50q/ha). This was followed by T8 (64.45q/ha), T3 (58.80q/ha), T10 (57.40q/ha), T5 (57.60q/ha), T6 (57.55q/ha), T2 (52.85q/ha), T9 (50.30q/ha) and T1 (25.00q/ha) in descending order. Application of N: P₂O₅:K₂O @ 150:60:90 kg/ha (T4) generated the maximum yield though it supported maximum incidence of stem borer, leaf folder and Brown plant hopper. This is due to fact that increase of additional doses of fertilizer imparted positive effect both on incidence of pest and the yield generation. Though the proportional yield loss due to pest incidence is increased but the gross impact on the yield production is positive. But nearly same amount of yield obtained in FYM plots (T8) with reduced inorganic fertilizers compared to T4. Application of BGA (T9) and Green manuring (T10) in combination of reduced inorganic fertilizers given the good yields. The results are in line with Prasad and Gupta(2010) who reported increased doses of fertilizers increased the yield but also have positive impact on increased pest infestation in rice fields. Similar findings are concluded by Kaushik chakraborty (2011) who reported increased yield and pest infestation with increased fertilizers in rice fields.

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