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Influence of Graded Levels of Fertilizers Against Brown Planthoppers (BPH), *Nilaparvata lugens* (Stal) and Green Leaf Hopper *Nephotettix virescens* (Distant) in Paddy

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ABSTRACT

The field experiment was conducted at Central Research Farm of Orissa University of Agriculture and Technology, Bhubaneswar during summer 2014-15 and kharif- 2015 to evaluate the influence of different graded levels of fertilizers and manure against brown plant hopper and green leaf hopper in paddy with twelve treatments and four replications in sub plot size of 15m x 10m taking Lalat and Swarna as test cultivar during summer 2014-15 and kharif -2015 following the recommended package of practices It was observed that the incidence of hopper population increased significantly with increase in application of NPK doses decreased markedly with basal supplementation of zinc (ZnSO4) to the NPK nutrients than application of the corresponding NPK fertilizers alone.

Key words: *BPH, GLH, Zinc, Paddy*

INTRODUCTION

Rice (*Oryza sativa* L.) is an important staple food crop for more than half of the world population and accounts for more than 50% of the daily calorie intake. Insect pests and diseases pose a very serious challenge in improving the productivity and achieving sustainability. Approximately 52% of the global production of rice is lost annually owing to the damage caused by biotic stress factors, of which 21% is attributed to the attack of insect pests[7]. The overall losses due to insect damage in rice were estimated to be 25 per cent. In recent years the problem of brown planthopper, (BPH), *Nilaparvata lugens* (Stal), is becoming serious[3] brown plant hopper alone causes 10-30 per cent loss in rice yield. High intensity of insect pest menace coupled with inadequate and imbalanced plant nutrient use is considered as major factors of low productivity.

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To keep the pest population below economic threshold level (ETL), emphasis is being given on integration of host plant resistance (HPR), judicious use of major plant nutrients NPK and use of induced resistance through application of micronutrients as important component of integrated pest management (IPM). Thus, fertilization not only influences the growth, development and yield of crop plants but also regulate the activities of insect pests both directly and indirectly with ultimate impact on yield. In this context, the economic doses of given nutrient, however, is to be determined critically considering its rate as plant nutrient and insect suppressant or promoter.

MATERIALS AND METHODS

The field experiments were laid out during *kharif* 2015 Randomized block design (RBD) with twelve treatments and four replications at Central Farm, OUAT, Bhubaneswar to assess the incidence of brown plant hopper (BPH) and green leaf hopper (GLH) of rice raised under NPK nutrient levels with FYM and micro nutrients. The soil of the experimental plot was lateritic sandy loam.

The seedlings of rice variety Swarna was taken as the test cultivar in *Kharif*-2015 were planted in plots of size 15m x 10m at spacing of 20cm x 10cm with recommended agronomic practices.

Methods and time of application of manures and fertilizers

Nitrogen was applied in 3 splits i.e. 25% as basal, 50% at 15 days after transplanting at maximum tillering stage and 25% at panicle initiation stage. Total phosphorus and sulphur was applied as basal. Potash was applied as 50% basal and 50% at panicle initiation stage. Boron was applied as two foliar sprays at 0.25% at panicle initiation stage and 15 days after panicle initiation. The required amount of FYM was incorporated one week before transplanting.

Sampling techniques for record of pest population

The number of hoppers like BPH and GLH (both nymphs and adults) were counted from10 randomly selected hills/subplot in each replication from 50 DAT onwards up to 80 DAT and GLH from 40 DAT up to 60 DAT during *Kharif*-2015.

RESULT AND DISCUSSION

Incidence of BPH (no/hill)

The data on mixed population of BPH and WBPH per hill recorded during *kharif* -2015 is presented in Table 1. It can be visualised from Table 1 that, lowest pest population was observed in control plots (2.87/hill) which was devoid of all types of nutrients at 50DAT.

The treatments combination with zinc, sulphur and boron produced less incidence of plant hopper. Whereas, without micronutrients other treatments with only nitrogen produced higher incidence or in combination with boron, zinc etc caused lower incidence. At 60DAT, the plant hopper population showed an increasing trend in all the treatment. The control treatment along with T_4, T_8 and T_7 harboured less than 5 insects per hill. At 70 DAT, treatment T_4 (100% NPK + Zn) supported only 4.25 insects, whereas other treatments excluding control retained higher population of plant hopper per hill (>5). Nearly a similar observation was witnessed at 80DAT, but regardless of treatments plant hopper population executed declining trend. So far mean performance was concerned T_4, T_8, and T_7 (each with 100% NPK and Zn or B or S as supplement) accounted for lower pest incidence, then the rest of the treatments.

This indicated that balance nutrition of NPK along with Zn was responsible for lower number of BPH per hill. Reports as per present finding do exist in literature to corroborate, Dash *et al*[2]. (2009) concluded that hopper population decreased significantly with basal supplementation by zinc ($ZnSO_4$) to the NPK nutrients than application of corresponding NPK fertilizer alone. Effect of zinc in reducing hopper population in rice through induced antibiosis has been earlier reported by Rath and Mishra[6] (1998). Zinc effected the growth and development of BPH causing lower nymphal survival, prolonged nymphal duration, lower female: male ratio, lower growth index and population build up[5]. The present finding is were supported by the findings of above authors.

Incidence of GLH (no/hill)

The data depicted in Table 2 indicates that incidence of GLH during *kharif*- 2015 was observed lower in T_4 (100% NPK + Zn) (2.79/ hill) followed by T_8 (100% NPK+ S + Zn) (2.99/hill) and T_7 (100% NPK + B+ Zn) (3.21/hill). The treatments comprising of 100 % NPK with supplements like Zn, B, S produced less number of GLH population per hill. Application of S increases potential defensive characters of plant against pest earlier reported by Mazid *et al*. Zn with balanced nutrition was responsible for lower GLH population which was earlier observed by Dash *et al*[2]. Antagonistic effect of Zn-EDTA on green leaf hopper population was earlier reported by Padhee and Mishra[4] and Chakravarthy[1]. Therefore, low green leaf hopper population in response to $ZnSO_4$ supplementation was also apparent in present the investigation.

Table 1: Incidence of population of BPH in rice during *kharif* -2015, at Bhubaneswar

Treatments	Incidence of BPH (No/hill) at				Mean (No/hill)
	50DAT	60DAT	70DAT	80DAT	
T_1- 100% PK	7.25 (2.68)	8.15 (2.84)	9.37 (3.05)	7.37 (2.70)	8.03 (2.81)
T_2-100% NPK	7.62 (2.75)	9.00 (2.99)	10.25 (3.19)	8.12 (2.82)	8.74 (2.93)
T_3-150% NPK	10.5 (3.22)	12.25 (3.34)	12.5 (3.53)	9.50 (3.07)	11.18 (3.29)
T_4-100% NPK+ Zn	3.25 (1.79)	3.85 (1.95)	4.25 (2.05)	3.70 (1.87)	3.76 (1.91)
T_5-100% NPK+ FYM	5.62 (2.40)	7.50 (2.73)	9.00 (2.99)	6.75 (2.49)	7.21 (2.65)
T_6-100% NPK+ FYM + Lime	3.87 (1.96)	6.00 (2.44)	7.25 (2.68)	5.82 (2.40)	5.73 (2.36)
T_7-100% NPK +B + Zn	3.37 (1.83)	4.72 (2.17)	6.37 (2.51)	5.00 (2.22)	4.86 (2.18)
T_8-100% NPK + S+ Zn	3.37 (1.83)	4.05 (2.00)	5.12 (2.25)	4.12 (2.02)	4.16 (2.02)
T_9-100% N	12.12 (2.89)	15.37 (3.91)	19.65 (4.42)	14.35 (3.78)	15.37 (3.75)
T_{10}-100% NP	9.12 (3.02)	9.62 (3.10)	12.12 (3.47)	9.12 (3.01)	9.99 (3.15)
T_{11}-100% NPK + Lime	4.37 (2.08)	6.50 (2.54)	8.12 (2.84)	6.12 (3.46)	6.27 (2.73)
T_{12}- Control	2.87 (1.68)	3.75 (1.93)	4.00 (1.99)	3.0 (1.71)	3.40 (1.82)
SE (m) ±	0.19	0.05	0.04	0.07	-
CD (5%)	0.54	0.14	0.13	0.20	-
CV (%)	15.91	3.52	3.02	5.55	-

Figures in parenthesis are$\sqrt{(x+0.5)}$ transformed values

100% NPK = 80:40:60 kg ha^{-1}(N: P_2O_5:K_2O); FYM = 5 t ha^{-1} ; Lime = 1 t ha^{-1} ; Zn = 12.5 kg Zn SO_4 ha^{-1} ; B = 0.25% ; S = 30 kg gypsum ha^{-1}.

Table 2: Incidence of green leaf hoper (GLH) in rice during *kharif*-2015, at Bhubaneswar

Treatments	Incidence of GLH (No/hill) at			Mean (No/hill)
	40 DAT	**50DAT**	**60DAT**	
T_1- 100% PK	3.75 (1.93)	4.20 (2.05)	4.10 (2.01)	4.01 (1.99)
T_2- 100% NPK	4.10 (2.02)	4.30 (2.06)	4.20 (2.04)	4.20 (2.04)
T_3-150% NPK	4.60 (2.14)	5.25 (2.28)	4.40 (2.09)	4.75 (2.17)
T_4-100% NPK+ Zn	2.37 (1.53)	3.12 (1.76)	2.90 (1.70)	2.79 (1.66)
T_5-100% NPK+FYM	3.50 (1.88)	4.12 (2.02)	3.90 (1.97)	3.84 (1.95)
T_6-100% NPK+ FYM +Lime	3.12 (1.76)	3.65 (1.90)	3.60 (1.89)	3.45 (1.85)
T_7-100% NPK +B + Zn	2.75 (1.64)	3.50 (1.86)	3.40 (1.84)	3.21 (1.78)
T_8-100% NPK + S+ Zn	2.50 (1.57)	3.37 (1.83)	3.10 (1.75)	2.99 (1.71)
T_9-100% N	4.90 (2.22)	5.55 (2.36)	4.50 (2.12)	4.98 (2.23)
T_{10}-100% NP	4.20 (2.04)	4.45 (2.10)	4.30 (2.06)	4.31 (2.06)
T_{11}-100% NPK + Lime	3.30 (1.81)	3.75 (1.93)	3.60 (1.89)	3.55 (1.87)
T_{12}- Control	2.00 (1.40)	2.52 (1.58)	2.30 (1.51)	2.27 1.49
SE (m) ±	0.04	0.02	0.01	-
CD (5%)	0.11	0.04	0.04	-
CV (%)	4.23	1.53	1.28	-

Figures in parenthesis are$\sqrt{(x+0.5)}$ transformed

100% NPK = 80:40:60 kg ha^{-1}(N: P_2O_5:K_2O); FYM = 5 t ha^{-1}; Lime = 1 t ha^{-1}; Zn = 12.5 kg Zn SO_4 ha^{-1}; B = 0.25% ; S = 30 kg gypsum ha^{-1}.

CONCLUSION

Concluded that while devising pest management strategy, selection of nutrient level, application of zinc and fertilizers should be taken into consideration which can not only reduce the fertility of soil and expensive of cultivation, but make the farming most productive, sustainable, eco-friendly. The information will be paramount importance for the rice cultivators to devise successful management strategy with judicious use fertilizers and micronutrients in rice ecosystem.

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