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Effect of plant nutrients on the incidence of yellow stem borer, *Scirpophaga incertulas* (Wlk.)

D. Dash*, P. R. Mishra and D. Panigrahi

Department of Entomology, College of Agriculture, Orissa University of Agriculture and Technology,Bhubaneswar-751 003, India

ABSTRACT

Field experiments were conducted to study the effect of plant nutrients on the incidence of YSB and grain yield of rice. It was observed that the incidence of borer was enhanced with application of increased doses of NPK fertilizers. But the supplementation of Zn ($ZnSO_4$) with NPK nutrients recorded low incidence of borer both at vegetative (dead heart) and heading stage (white ear head).

Key words: *Plant nutrients, Scirpophaga incertulas, incidence*

Among the major insect pests attacking rice crop the yellow stem borer (YSB) *Scirpophaga incertulas* (Walk.) is the most important and attacks the crop both at vegetative and reproductive stages (Pasalu *et al*., 2002). The pest causes 25-30 % loss to rice crop (Lal, 1996). Plant nutrients both major and micro ones not only influence the growth, development and yield of crop plants but also influence the population build up and activities of insect pests both directly and indirectly with ultimate effect on yield. Increasing crop yields through efficient plant nutrient management can thus, reduce the application of harmful and expensive pesticides and make farming more productive, sustainable and environment friendly. Keeping in mind the above facts a field study was undertaken to study the incidence of YSB in response to plant nutrients.

The field experiments were laid out during wet seasons of 2002 and 2003 in factorial randomized block design (RBD) with four treatments and five replications at Central Research Station, OUAT, Bhubaneswar to assess the incidence of yellow stem borer (YSB) of rice raised under NPK nutrient levels with and without zinc. The soil of the experimental plot was sandy loam having pH 5.8 containing available N 140 kg ha^{-1}, P 15.30 kg ha^{-1}, K 125.35 kg ha^{-1}, zinc 0.5 ppm and sulphur 10.40 ppm. The treatments comprised of four nutrient levels (60:30:30 and 120:60:60 kg NPK ha^{-1} with and without $ZnSO_4$ @ 25 kg ha^{-1} as basal) along with untreated control. The seedlings of rice variety Jaya were planted in plots of size 6m x 3.5 m at spacing of 20 cm x 15 cm with recommended agronomic practices. The micronutrient fertilizer zinc in form of zinc sulphate was broadcasted basally @ 25 kg ha^{-1} to the respective treatments of NPK nutrient levels. The stem borer damage was recorded 4 times at weekly interval in vegetative stage (DH) and once at reproductive stage (WEH) 15 days prior to harvest. In the vegetative stage the total number of tillers and infested tillers (DH) were counted in 10 randomly selected hills in individual treatment of each replication leaving the border lines from sides and the percentage DH was estimated. At pre-harvest stage i.e., 15 days prior to harvest, the stem borer damage was assessed by computing white ear head percentage as suggested by (Gomez, 1972). The data thus obtained on extent of damage by stem borer (DH and WEH %) were pooled for two years and the mean data were subjected to statistical analysis after suitable transformation.

The impact of nutrient levels on borer infestation was discernible and observations indicated that application of NPK @ 60:30:30 kg/ha as such recorded higher DH incidence (8.29 %) but where it was supplemented with $ZnSO_4$ @ 25 kg ha^{-1}, the incidence of DH was reduced significantly (7.08 %). On the contrary when the higher dose of N was applied (120:60:60 kg NPK ha^{-1}) the DH incidence was found

to be higher either with $ZnSO_4$ (9.16%) or without $ZnSO_4$ (8.87 %) (Table 1). Therefore, the effect of $ZnSO_4$ at higher N level was not quite apparent in suppressing the YSB damage during early vegetative stage of the crop (29 DAT). Higher DH incidence under high nitrogen treatment was due to increased succulency of the stem ensuring easy penetration of larvae in stem (Dhandapani *et al*., 1990) In subsequent observations (37-52 DAT), it was observed that the application of $ZnSO_4$ had some impact on the YSB incidence and low DH was recorded when it was supplemented with either 60:30:30 kg NPK ha^{-1} (2.03-5.32 %) or with 120:60:60 kg NPK ha^{-1} (3.47-8.86 %). While, without $ZnSO_4$ the incidence for the corresponding nutrient levels was recorded as 3.04-8.24 % and 4.31-11.38 %, respectively. Similarly at heading stage, although increased nutrient levels had higher WEH incidence, supplementation of $ZnSO_4$ with 120:60:60 kg NPK ha^{-1} could exceptionally record the lowest WEH incidence 6.46 % (Table 1). Higher incidence of WEH in plants treated with higher doses of nitrogen has been reported by earlier workers (Saroja and Raju, 1981).In rice the role of zinc in reducing the stem borer incidence through induced antibiosis have been demonstrated earlier by Panda *et al*. (1975) and Panda (1976).

Significant increase in grain yield was observed with increase in NPK levels from 60:30:30 (2.96 t ha^{-1}) to 120:60:60 kg ha^{-1} (3.48 t ha^{-1}) (Table 1). Higher grain yield with increase NPK doses has been reported by Dixit and Patro (1994). Further more the grain yield was enhanced when zinc sulphate was supplemented with NPK fertilizers and the grain yield was more (4.59 t ha^{-1}) in plots receiving NPK @ 120:60:60 kg ha^{-1} with $ZnSO_4$.This was attributed to low incidence of WEH (6.46 %).

However, recommended nutrient level (60:30:30 kg NPK ha^{-1}) with $ZnSO_4$ also yielded better (4.38 t ha^{-1}). Thus supplementation with $ZnSO_4$ has been considered to have some role in suppressing incidence of YSB and other pests and thereby enhancing the grain yield. Enhancement of grain yield of rice due to supplementation of Zn with NPK fertilizers was also reported by earlier workers (Khanda *et al*., 1997; Rao and Shukla, 1997) who were of the opinion that zinc application increased the number of productive tillers $plant^{-1}$, Panicle length, number of total grains and field grains $panicle^{-1}$ and thousand grain weight. However, Raju and Reddy (2001) reported that significant improvement in grain yield was observed due to sulphur application while zinc application failed to improve the yield conspicuously. Again soil application of ZnSO4 was reported to be superior to foliar spray (Takkar *et al*., 1973). Our findings are in conformity with the observations of the above workers.

Table 1. Effect of plant nutrients on yellow stem borer incidence in variety Jaya at Bhubaneswar (mean data of wet seasons 2002 and 2003)

Nutrient dose(kg ha^{-1})	Percentage of dead heart (DH)* at				White ear head* (%)	Grain yield* (t ha^{-1})
	29 DAT	37 DAT	45 DAT	52 DAT		
F_1 – 60:30:30 NPK	8.29(2.95)	5.61(2.44)	3.04(1.86)	8.24(2.92)	10.30(3.21)	2.96
F_2 – 120:60:60 NPK	8.87(3.05)	8.33(2.94)	4.31(2.16)	11.38(3.39)	13.42(3.69)	3.48
F_3 – 60:30:30 NPK + $ZnSO_4$ @ 25 kg ha^{-1} as basal	7.08(2.74)	3.67(2.00)	2.03(1.57)	5.32(2.36)	9.05(3.05)	4.38
F_4 – 120:60:60 NPK + $ZnSO_4$ @ 25 kg ha^{-1} as basal	9.16(3.14)	5.93(2.49)	3.47(1.96)	8.86(3.00)	6.46(2.60)	4.59
CD (P=0.05)	0.11	0.14	0.11	0.20	0.17	1.23

Figures in the parentheses are the square root transformed values
* Mean of four replications

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