

INFLUENCE OF VARIETY, FERTILIZER DOSE AND WATER MANAGEMENT ON STEM BORER INCIDENCE AND YIELD OF RICE

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The influence of variety, fertilizer levels and water management on the stem borer incidence in summer rice revealed that neither fertility levels nor continuous standing water or alternate irrigation at 10 days interval had a profound influence on the dead heart (DH) incidence mainly due to low borer population in the early vegetative growth stage. The third dose of fertilizer applied at pre-booting stage of the crop had a distinct effect on the white earhead (WE). The N:P:K dose of 120:60:60 resulted significantly higher (16.9%) WE as compared to the lower doses and/or no fertilizers. Both from the point of low infestation and higher yield N:P:K level of 90:45:45 was the best. Between the rice varieties, Jaya and Daya the latter one was more susceptible to the borers.

The assured water supply in the Hirakud Command area not only influenced the cropping pattern but also brought about a marked change in the pest status. Growing of high yielding rice varieties in both the seasons coupled with improved cultivation practices aggravated the severity of gall midge, stem borers, leaf folder, case worm etc. in this tract. Of late, the scientists working for the control of rice pests around the globe unanimously agreed that cultural control is a vital component of the integrated pest management.

The influence of chemical fertilizers on the incidence of stem borer have been reported by Koyama, 1955; Ishii and Hirano, 1959; Israel and Vedamoorthy, 1963; Saha and Saharia, 1970; Hirano, 1971; Prakasa Rao 1972; Raj and Morachan, 1973; Kisimoto, 1977; Nath and Sen, 1978; Palchamy and Nagarajan, 1978; Pillai *et al.*; 1979 and Saroja and Raju, 1981. But most of the workers have indi-

cated the influence of nitrogen only instead of balanced fertilizers on the stem borer incidence.

Therefore in the present investigation, the influence of graded levels of balanced fertilizers and water management on the stem borer incidence and yield in two different rice varieties such as Jaya and Daya were tested.

MATERIALS AND METHODS

To find out the influence of irrigation, variety and fertilizer doses on the incidence of rice stem borers, a replicated field trial in a split plot design was conducted at the Regional Research Institute, Chipilma (Sambalpur) during the summer, 1985-86. Thirty three days old seedlings of Jaya and Daya varieties were transplanted on February 5 1985 at 15 x 20 cm spacings. The varieties and the levels of fertilizer to the plots, levels of irrigation which were imposed from 30 days

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Table 1. Effect of variety and irrigation on the stem borer incidence and yield of rice.

Variety	Dead heart at 75 DAT (%) [*]			White ear head (%) [°]			Yield ^c (kg/ha)		
	Jaya	Daya	Mean	Jaya	Daya	Mean	Jaya	Daya	Mean
Irrigation									
Submerged	21.6 (4.6)	17.9 (4.1)	19.8 (4.4)	7.3 (2.7)	15.3 (3.8)	11.3 (3.3)	2137.4	1757.7	1947.6
Alternate	20.4 (4.5)	19.7 (4.4)	20.0 (4.4)	3.6 (1.9)	13.3 (3.5)	8.4 (2.7)	1985.5	1931.3	1958.4
Mean	21.0 (4.5)	18.9 (4.3)		5.5 (2.3)	14.3 (3.7)		2061.5	1844.5	
SE (m) for variety & irrigation			0.13			0.16			30.11
C.D. (0.05) for variety & irrigation			N.S.			0.57			104.18

* Mean of three replications.

Figures inside the parenthesis represents the square root transformation.

after transplanting (DAT) till panicle maturity were i) continuous standing water of 5 cm and ii) alternate drying and wetting at 10 days interval. The N:P:K levels were 60:30:30, 90:45:45 120:60:60 kg/ha which were compared with an untreated check. Full dose of P₂O₅ and K₂O were given as basal which N₁ was given in three splits as per the local recommendations. No insecticidal protection was given throughout the crop period.

Observations on the incidence of stem borer were recorded at 10 days interval starting from 25 DAT. From each sub-plot 20 clumps were diagonally selected and the percentage of DH were calculated from total tillers to infested tillers. Pre-harvest observation on WE was recorded in the similar manner from total productive tillers to damaged ones. The plotwise grain yield was recorded leaving the border two rows from all sides and it was converted to kg/ha.

RESULTS AND DISCUSSION

Effect of variety and irrigation on borer incidence and yield :

Under Sambalpur agroclimatic conditions due to low night temperature the stem borer activity usually remains low upto mid March. Therefore, the DH incidence in the observed plots did not exceed 5% upto 65 DAT. With the emergence of the first brood the activity of stem borer increased steadily and as high as 21.0 and 18.9% (average) DH were recorded in Jaya and Daya respectively at 75 DAT.

The borer damage was more pronounced at the reproductive phase particularly in Daya. The emergence of the second brood coincided with the heading stage of Daya resulting significantly higher percentage (14.3) of WE as compared to Jaya (Table 1)

Table 2. Influence of variety and graded levels of fertilizer on the stem borer incidence and yield of rice.

Variety	Dead heart at 75 DAT (%) [*]			White ear head (%) [*]			Yield [*] (kg/ha)		
	Jaya	Daya	Mean	Jaya	Daya	Mean	Jaya	Daya	Mean
Fertilizer (N:P:K in kg/ha)									
60 : 30 : 30	23.9 (4.9)	18.9 (4.3)	21.4 (4.6)	5.1 (2.1)	13.7 (3.6)	9.4 (2.9)	2018.1	1714.3	1866.2
90 : 45 : 45	21.2 (4.6)	18.9 (4.3)	20.0 (4.4)	5.6 (2.4)	11.2 (3.4)	8.4 (2.9)	2365.3	2256.8	2311.0
120 : 60 : 60	20.8 (4.5)	18.8 (4.3)	19.8 (4.4)	7.6 (2.8)	26.1 (5.1)	16.9 (3.9)	2538.9	2039.8	2289.3
No fertilizer	17.9 (4.2)	18.7 (4.2)	18.3 (4.2)	3.5 (1.9)	6.2 (2.6)	4.8 (2.2)	1323.7	1367.1	1345.4
		SE _(m)	C.D. (0.05)		SE _(m)	C.D. (0.05)		SE _(m)	C.D. (0.05)
Fertilizer		0.12	N.S.		0.13	0.39		52.22	152.41
Fertilizer at one variety		0.17	N.S.		0.19	0.55		73.85	215.54
Variety at one fertilizer level		0.24	N.S.		0.30	0.96		63.9	192.82

* Mean of three replications.

Figures inside parenthesis are the square root transformed values.

Table 3. Influence of levels of fertilizer and irrigation on the stem borer incidence and yield of rice.

Irrigation	Dead heart at 75 DAT (%) [*]			White ear head (%) [*]			Yield [*] (kg/ha)		
	Submerged	Alternate	Mean	Submerged	Alternate	Mean	Submerged	Alternate	Mean
Fertilizer: (N:P:K in kg/ha)									
60 : 30 : 30	21.4 (4.6)	21.4 (4.6)	21.4 (4.6)	14.4 (3.7)	4.4 (2.0)	9.4 (2.9)	1779.4	1953.0	1866.2
90 : 45 : 45	21.1 (4.5)	18.9 (4.3)	20.0 (4.4)	8.4 (2.9)	8.4 (2.9)	8.4 (2.9)	2213.4	2408.7	2311.0
120 : 60 : 60	19.9 (4.4)	19.8 (4.4)	19.8 (4.4)	17.3 (4.1)	16.4 (3.8)	16.9 (3.9)	2343.6	2235.1	2289.3
No fertilizer	16.6 (4.0)	19.9 (4.4)	18.2 (4.2)	5.1 (2.3)	4.5 (2.2)	4.8 (2.2)	1453.9	1236.9	1345.4
		SE _(m)	C.D. (0.05)		SE _(m)	C.D. (0.05)		SE _(m)	C.D. (0.05)
Fertilizer at one irrigation level		0.17	N.S.		0.19	0.55		73.85	215.54
Irrigation at one fertilizer level		0.24	N.S.		0.30	0.30		63.90	192.84

* Mean of three replications

Figures inside the parenthesis represents the square root transformation.

Table 4 : Combined effect of variety, irrigation and graded levels of fertilizer on the stem borer incidence and yield of rice.

Fertilizer	Dead heart at 75 DAT (%)*				White ear head (%)*				Yield (kg/ha)*				
	F ₁	F ₂	F ₃	Mean	F ₁	F ₂	F ₃	Mean	F ₁	F ₂	F ₃	Mean	
Variety x Irrigation													
Jaya (Submerged)	24.4 (4.9)	23.2 (4.8)	21.7 (4.6)	17.0 (4.1)	21.6 (4.6)	8.7 (2.9)	6.2 (2.5)	10.1 (3.2)	7.3 (2.7)	1909.6	2343.6	2951.2	1345.4
Daya (Submerged)	18.5 (4.2)	19.1 (4.3)	18.0 (4.2)	16.3 (3.9)	17.9 (4.1)	20.2 (4.5)	10.7 (3.3)	24.5 (4.9)	15.3 (3.8)	1649.2	2083.2	1736.0	1562.4
Jaya (Alternate)	23.5 (4.8)	19.2 (4.4)	19.9 (4.4)	18.9 (4.3)	20.4 (4.5)	1.5 (1.3)	5.1 (2.2)	5.1 (2.2)	2.6 (1.7)	2126.6	2387.0	2126.6	1302.0
Daya (Alternate)	19.3 (4.3)	18.7 (4.3)	19.7 (4.4)	21.0 (4.6)	19.7 (4.4)	7.3 (2.8)	11.8 (3.5)	27.7 (5.3)	13.3 (3.5)	1779.4	2430.4	2343.6	1171.8
				SE _(m)	C.D. (0.05)			SE _(m)	C.D. (0.05)			SE _(m)	C.D. (0.05)
Variety x Irrigation (VI)	—	—	—	0.18	N.S.			0.23	0.81			42.58	147.33
VI at same fertility level	—	—	—	0.34	N.S.			0.42	1.36			90.37	121.81
Fertilizer at same VI level	↔	↔	↔	0.24	N.S.			0.26	0.78			104.44	304.82

* Mean of three replications.

Figures inside the parenthesis represents the square root transformation.

Fertilizer doses:— F₁—60 : 30 : 30, F₂—90 : 45 : 45, F₃—120 : 60 : 60, F₄—No fertilizer, (N : P : K in kg/ha)

The mean yield obtained from Jaya was 2061.5 kg/ha while it was 1844.5 kg/ha in Daya. The reason for low yield in Daya may be due to high percentage of WE.

Neither continuous submergence nor alternate drying and wetting had any influence on the stem borer damage.

Interaction effect of variety and irrigation :

The combined effect of variety and irrigation on the stem borer attack revealed that Jaya under continuous submerged condition recorded the highest percentage of DH (21.6%) in the tillering phase while Daya under similar conditions showed maximum WE damage (15.3%) in the reproductive phase. Jaya grown under continuous submerged conditions, even with higher percentage of DH gave significantly higher yield (2061.5 kg/ha) as compared to other treatments. Besides other factors, alternate drying and wetting permitted more weed growth which might have influenced the yield.

Effect of fertility levels on the stem borer incidence and yield :

Higher doses of fertilizer application apart from other things was responsible for bringing about more vegetative growth and more tiller production. Hence, even if there were more numbers of DH in such plots, the percentage infestation were not higher than in the plots with low fer-

tilizer level or no fertilizer. However, varying doses of fertilizers showed a marked difference in the WE expression. Plots receiving 60:30:30 and 90:45:45 kg N:P:K/ha did not show any variation in WE incidence but, compared to unfertilized plots they produced 85% more WE. Further increasing the doses to 120:60:60 level resulted significantly higher WE particularly in Daya (Table 2). Similar observations were also made by Samalo (1981).

Enhancing the fertilizer dose resulted in a significant increase in the yield upto 90:45:45 level. The yield was increased by 521 kg/ha at N:P:K dose of 60:30:30 and 996 kg/ha at 90:45:45 level as compared to the fields receiving no fertilizers. Further increase in the N:P:K dose brought about a significant increase in the WE which in turn decreased the yield.

Interaction effect of variety and irrigation :

The combined effect of fertility levels and variety indicated that Daya at 120:60:60 dose exhibited 26.1% WE which was distinctly higher as compared to all other levels. On the other hand, Jaya with the same fertility status had less than 8% WE and recorded highest yield of 2538.9 kg/ha as against 1323.7 kg/ha from the same variety receiving no fertilizers (Table 2).

Highest fertilizer dose resulted significantly higher WE in both the water management levels (Table 3).

Treatments receiving 90:45:45 levels of fertilizer with alternate irrigation produced significantly higher yield of 2408.7 kg/ha than all other treatments.

A critical observation of the results indicate that as compared to water management, fertilizer application has a marked effect on the borer incidence and the yield of rice. It appears that both from the point of low borer incidence and economy 90:45:45 level of N:P:K will be more remunerative.

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