

## COMPENSATORY BEHAVIOR OF PADDY CROP IN RESPONSE TO ADDITIONAL NITROGEN AND PHOSPHORUS APPLICATION WITH INCIDENCE OF YELLOW RICE STEM BORER

A. A. BHUTTO, AND M. FARHANULLAH KHAN\*, TAHIRA JABEEN URSANI AND JAVED IQBAL CHANDIO

*Department of Zoology, University of Sindh, Jamshoro, Sindh-Pakistan*

*\*Department of Zoology, University of Karachi, Karachi, Pakistan*

### Abstract

As a parameter of the rice stem bores damage more Dead Heart percentage, White Head percentage, a high tillers percentage and a higher yield was recorded when fertilizer application was made at the rate of P-80 + N-120 kg/ha. P-80 + N-120 kg/ha followed by P-70 + N-110, P-60 + N-100, P-50 + N-90 and P-40 + N-80 Kg/ha respectively. No significantly difference was recorded among each treatment. All the applications were found to provoke higher Dead Heart percentage, White Head percentage and tillers than the control. Overall the P-80 + N-120 kg/ha dose was found producing a significant higher yield than control.

### Introduction

The fertilizer applications are necessary almost in all the rice fields for positive upshot on crop such as increased number of tillers, better growth of plant, ultimately the enhanced yield etc. Aziz et al. (2005) recorded enhancement in paddy growth due to additional supply of  $PO_4$ . In the most parts of the world rice soils needs nitrogen, As an indispensable measure of practice, Nitrogen with Phosphorus and in certain conditions with other elements are recommended to obtain more yields. The correct ratio of Nitrogen and Phosphorus should apply at proper stage of the rice crop. The ratio of Nitrogen and Phosphorus must be applied at 2:1. Single dose of Phosphorus should be applied two or three days before the transplanting. Due to deficiency of Nitrogen ill effects like: small size plant, small number of tillers, orange colored old leaves, and yellowish medium upper leaves, small, straight and stiff upper leaves are developed. While excessive Nitrogen application shows increased plant size, excessive vegetative growth, weak plants, a higher pest attack and brittle grains etc. Whereas, the phosphorus is responsible for the root development, better tiller formation, improvement in the resistant lodging, high feeding value to the rice, due to high phosphate content. Moreover, in the field higher phosphorus helps in algal development, which perform important role in fixing up the atmospheric nitrogen. On the other hand, deficiency of phosphorus caused small-sized plants with lesser number of the tiller formation, low yield, At the plant, the first stage leaves become green bluish and the lower part of the stem become purple, consequently, at the latter stage, medium leaves turn green bluish and the upper ones become dark green and nearly blue (Bhutto, 1973; Salim 2002 and Bhutto et al. 2009).

Along with other factors, pests damage contribute low rice yields in Pakistan, hence the pests attack that is the major constraint in this country. Amongst them rice stem borers cause big loss with rice crop. It is under regular observance to cause dominating damage consequences (Wakil et al. 2001). Jiang and Cheng (2003) reported that more dead heart was recorded and the borer larval developmental rate was found increased with the increasing fertilization level. Bandong and Litsinger (2005) reported that nutrients deficiency caused a delayed maturity of IR-72 rice crop. Salim. (2002) reported that the number of tillers per hill was increased significantly with corresponding increase in the application of the nitrogen. Excessive nitrogen application significantly reduced the root length and biomass than the plants grown in standard culture solution. The cost and benefit ratio was calculated at 1:5 in case of recommended dose of fertilizer applied which means that for every rupee spent on fertilizers gave a return of 5 rupees (Bhutto 1973). Presently, a study was conducted to understand the effect of phosphorus in combination with the nitrogen on the rice yield and the rice stem bores attack.

### Materials and Methods

Experiment was conducted on randomized complete block with three replications and six treatments. Basmati-370 rice variety was transplanted at experimental area of RRI, Dokri. Line transplanting was done with space plant to plant and row to row 20 cm. The sub-plot size was maintained  $7 \times 9 = 63m^2$ . Experiment conducted during 2006 and repeated during 2007. Nursery was sowing 15<sup>th</sup> and 10<sup>th</sup> June 2006 and 2007 and line transplanting was done on 12<sup>th</sup> and 7<sup>th</sup> July 2006 and 2007 at 8 AM. The experiment was conducted with 5 levels of Phosphorus + Nitrogen (P-40 + N-80, P-50 + N-90, P-60 + N-100, P-70 + N-110 and P-80 + N-120 kg / ha). Two applications of fertilizers were applied. First application (Full P and half N) was applied 3 days before transplanting and second application (Remaining half of N) was applied at 40-45 days after treatments.

Thereafter, Dead Heart percentage and White Head percentage was recorded at the vegetative and reproductive stages of crop. Productive and un-productive tillers were recorded. Yield was also recorded from the each treatment and the each replication.

### Results and Discussion

Significantly the higher Dead Heart percentage during 2006 was recorded (10.47) at the rate of P-80 + N-120 kg/ha, this followed by 10.18, 9.46, 9.10 and 8.75 from the P-70 + N-110, P-60 + N-100, P-50 + N-90 and P-40 + N-80 kg/ha; while during 2007 it was recorded 10.34, 9.97, 9.36, 9.21 and 8.36 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90 and P-40 + N-80 Kg/ha respectively. The average Dead Heart percentage of 2006-2007 was noted 10.41, 10.08, 9.41, 9.16, 8.56 and 8.21 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 Kg/ha and Control respectively. No significantly difference was recorded between all the tested treatments. P-80 + N-120 kg/ha was highly significant to control (Table-1).

Significantly the higher White Head percentage during 2006 was recorded (9.77) at the fertilizer rate of P-80 + N-120 kg/ha, this followed by 9.21, 8.87, 8.43 and 8.31 from the P-70 + N-110, P-60 + N-100, P-50 + N-90 and P-40 + N-80 kg/ha; while during 2007 it was recorded 9.61, 9.18, 8.76, 8.35 and 8.27 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90 and P-40 + N-80 Kg/ha respectively. The average White Head percentage of 2006-2007 was noted 9.69, 8.70, 8.82, 8.39, 8.29 and 8.15 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 Kg/ha and Control respectively. No significantly difference was recorded between all the tested treatments. P-80 + N-120 kg/ha was highly significant as compared to the control. (Table-1).

**Table 1. Effect of P and N on Dead Heart and White Head - Percentage during 2006- 2007.**

Treatments kg / ha	DH% 2006	DH% 2007	Total	Mean	WH% 2006	WH% 2007	Total	Mean
40 (P) + 80 (N)	8.75	8.36	17.11	8.56	8.31	8.27	16.58	8.29
50 (P) + 90 (N)	9.10	9.21	18.31	9.16	8.43	8.35	16.78	8.39
60 (P) + 100 (N)	9.46	9.36	18.82	9.41	8.87	8.76	17.63	8.82
70 (P) + 110 (N)	10.18	9.97	20.15	10.08	9.21	9.18	17.39	8.70
80 (P) + 120 (N)	10.47	10.34	20.81	10.41	9.77	9.61	19.38	9.69
Control	8.15	8.27	16.42	8.21	8.12	8.18	16.30	8.15

DH, Dead heart and WH, White Head.

**Table 2. Effect of Phosphorous and Nitrogen on rice production during 2006-2007.**

#	N & P level Kg/ha	Yield 2006	Yield 2007	Total	Mean (Kg / Plot)
1.	40 (P) + 80 (N)	25.13	25.87	51.00	25.50
2.	50 (P) + 90 (N)	25.97	26.29	52.26	26.13
3.	60 (P) + 100 (N)	26.31	26.57	52.88	26.44
4.	70 (P) + 110 (N)	26.95	27.18	54.13	27.07
5.	80 (P) + 120 (N)	27.46	27.76	55.22	27.61
6.	Control	17.62	17.36	34.98	17.49

**Table 3. Correlation Between Various Characteristics under the Effects of N and P Supply.**

Variables			r
Yield	vs.	White Head	0.60
Yield	vs.	Dead Heart	0.77
N <sub>2</sub> + P	Dose	vs. Yield	0.99
N <sub>2</sub> + P	Dose	vs. White Head	0.69
N <sub>2</sub> + P	Dose	vs. Dead Heart	0.85

More yield during 2006 was recorded at the rate of P-80 + N-120 Kg/ha (27.46 Kg/plot), this followed by 26.95, 26.31, 25.97 and 25.13 from the P-70 + N-110, P-60 + N-100, P-50 + N-90 and P-40 + N-80 Kg/ha respectively; while during 2007 it was recorded 27.76, 27.18, 26.57, 26.29 and 25.87 from the P-80 + N-120, P-

70 + N-110, P-60 + N-100, P-50 + N-90 and P-40 + N-80 kg/ha respectively. The average yield of 2006 and 2007 was recorded 27.61, 27.07, 26.44, 26.13, 25.50 and 17.49 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 kg/ha and Control respectively. No significant difference was recorded between all the tested treatments. P-80 + N-120 kg/ha was highly significant to control. All the applications of phosphorus were significantly the higher yield than the control (Table-2). The average Dead Heart percentage of 2006 and 2007 was recorded 10.41, 10.08, 9.41, 9.16, 8.56 and 8.21 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 kg/ha and Control respectively. More Dead Heart percentage (10.41) was recorded when fertilizer application applied at the rate of P-80 + N-120 kg/ha. The average White Head percentage of 2006 and 2007 was recorded 9.69, 8.70, 8.82, 8.39, 8.29 and 8.15 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 kg/ha and Control respectively. The average productive tillers of both years were recorded 20.32, 19.87, 18.29, 18.06, 17.38 and 12.89 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 kg/ha and Control respectively. The average of unproductive tillers during 2006-2007 were recorded 0.83, 1.16, 1.34, 1.58, 1.79 and 3.81 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 kg/ha and Control respectively. Average yield of both years was recorded 27.61, 27.07, 26.44, 26.13, 25.50 and 17.49 from the P-80 + N-120, P-70 + N-110, P-60 + N-100, P-50 + N-90, P-40 + N-80 kg/ha and Control respectively. No significant difference was recorded between 90 and 100 Kg/ha and 110 & 120 Kg/ha. P-80 + N-120 kg/ha was highly significant as compared to the Control. All the applications gave significantly the higher yield than the control. As indicated in the Table (3) the yield was observed in a correlation with the white head i.e.  $r = 0.6$  whereas a better correlation was found in respect of dead heart ( $r = 0.77$ ). On the other hand the fertilizer exerted promontory effect on the yield with  $r = 0.99$ , simultaneously, the insect attack was found to increase with the increase in the fertilizer dosage with  $r = 0.69$  and  $0.85$  for the white head and dead heart, respectively. Conversely, with an increase in yield the loss due to the pest attack was found in a compensatory manner.

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