

Productivity and Economics of rice – wheat cropping system as influenced by organic manures and fertilizer management under irrigated conditions

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ABSTRACT

A field experiment was conducted during *kharif* and *rabi* seasons of 2003-04 and 2004-05 at J.V. College, Baraut, Baghpat (U.P.), to study the influence of organic manures and fertilizer management on productivity and economics of rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.) cropping system under irrigated conditions of Western Uttar Pradesh. Incorporation of organic manures i.e., FYM, PM and FYM + PM had similar favourable effects on yield and yield attributes of rice over control during both the seasons. Organic manures increased the mean grain yield of rice by 16.1 to 18.8%. Fertilizer N application increased grain and straw yields of rice up to 120 kg/ha. However, the difference between 80 and 120 kg N/ha were not marked. The residual fertility left after rice due to organic manures had significant influence on grain and straw yields of wheat. Application of P along with N to preceding rice produced more grain yield of wheat than control. The mean increase in grain yield of wheat due to NP application was 15.8% over control. Combined use of FYM + PM fetched higher mean net returns of Rs. 14,795 in rice cultivation. Application of 120 kg N/ha fetched the maximum mean net returns of Rs. 17,380/ha.

Key words : Rice, Wheat, Nitrogen, Phosphorus, Zink, Poultry manure, farmyard manure, yield

INTRODUCTION

Rice (*Oryza sativa* L.) and wheat (*Triticum aestivum* L.) are the principal food crops of the world. Rice-wheat sequential cropping being an important cropping system plays a significant role in food security of India. This system has gained popularity in Uttar Pradesh, Bihar, Punjab and Haryana which at present occupies nearly 10 million ha area. Growing of two cereal crops in a year involves heavy removal of plant nutrients which leads to poor soil fertility. Continuous use of only chemical fertilizers in rice-wheat system resulted in the decline in the yield potential of the crops of this cropping system and also deteriorated physico-chemical properties of soil (Das *et al.*, 2003). Therefore, it is desirable to increase the productivity and reduce the cost of cultivation in rice-wheat cropping through integration of organic and inorganic sources of nutrients. Keeping this in view, the present investigation was undertaken to evaluate the integrated nutrient supply on the productivity of rice and wheat in rice-wheat system.

MATERIALS AND METHODS

The field experiment was conducted during the *kharif* and *rabi* seasons of 2003-04 and 2004-05 at the research farm of J. V. College, Baraut, Baghpat (U.P.). The soil was sandy clay loam, having pH 7.3 (soil : Solution ratio 1:2.5), organic carbon 0.54% total kjeldahl N 0.058% and 22.8 and 270.4 kg/ha available P and K respectively. The treatments comprised 4 organic manures (No organic manure, farm yard manure, poultry manure and farmyard manure + poultry manure) and 6 fertilizer treatments (0, 40, 80, 120 kg N, N 20 P60 and N120 P60 Zn 25 kg/ha). The experiment was laid out in split-plot design keeping the organic manures in the main plot and fertilizer treatments in subplots, using 3 replications. FYM, PM and FYM + PM were applied @ the rate of 10.0, 3.0 and 5.0 + 1.5 tonnes/ha, respectively. Seedlings of 27 days of 'Pusa Basmati-1' rice were transplanted, keeping 2 seedlings/hill on 13 and 11 July in 2003 and 2004 under puddled conditions. All organics were applied on dry weight basis 3 weeks before transplanting. The N content in 2 organic manures was analysed 0.50 and 1.81% in FYM and PM respectively. The nitrogen treatments were imposed in 2 equal splits, half at the time of transplanting and the remaining half at 35 DAT. Total amount of P and Zn were applied at the time of transplanting. The sources of N, P and Zn were prilled urea, single super phosphate and Zinc sulphate, respectively. All other operations were performed as per recommendations of the crop. The data on various yield attributes, grain and straw yields were recorded under various treatments. Rice crop was harvested in the second week of November in both the years and grain yield was reported at 14% moisture. The gross and net plot size was 5m x 3m and 4m x 2.5m, respectively. Wheat crop

was sown during the succeeding *rabi* (winter) season. A uniform dose of N (50 kg/ha) was applied to wheat crop. Statistical analysis of data was carried out using standard analysis of variance (Cochran and Cox, 1957). The significance was tested by 't' test and critical difference (CD, P = 0.05) was calculated to compare the differences of treatment means.

RESULTS AND DISCUSSION

Effect of organic manures

Rice responded well to organic manures incorporation during both the seasons. Maximum plant height was recorded with FYM + PM followed by PM and FYM. All organic manures recorded more plant height than the control (Table 1). Significant higher values of yield attributes, viz., effective tillers/hill, panicle length, grains/panicle and 1000-grain weight, were recorded with organic manures over control. However, the differences among organic manures were not significant in either years of study. It showed that under the organic manures, the crop enjoyed a better nutritional environment and was reflected in the yield attributes as well. Similar increase in growth and yield attributes of rice and other crops due to incorporation of organic manure reported by (Singh *et al.*, 1998).

Significantly higher mean grain yield of rice was obtained with FYM, PM and FYM + PM, with a yield increase of 16.1, 17.7 and 18.8% over control, respectively (Table 3). Least mean grain yield of 36.1 q/ha was recorded under no organic manures during the study. The corresponding increase in mean straw yield under FYM, PM and FYM + PM was 10.9, 11.8 and 14.8% respectively, over control. However, among the organic manures, none was found superior than other during both the seasons. Such favourable response of organic manure on yield was the result of increased availability of nutrients which in turn must have improved synthesis and translocation of metabolites to various reproductive structures of the plant. Similar increases in yield of rice and other crops due to FYM (Thakur and Kanwar, 1994) and PM (Singh *et al.*, 1998) incorporation have been reported.

Effect of fertilizer nitrogen

Fertilizer nitrogen showed a favourable influence on growth and yield attributes (plant height, effective tillers/hill, Panicle length and 1000-grain weight) up to 80 kg N/ha (Table 1). Fertilizer treatments applied to rice indicated a significant increase in plant height of rice due to each successive dose of 40 kg N/ha up to 120 kg N/ha in 2003, while in 2004 each successive dose of 40 kg N/ha up to 80 kg/ha resulted in a significant increase in plant height of rice. Fertilizer treatments, applied to rice observed a significant improvement in 1000-

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