

Response of summer rice (*Oryza sativa* L.) to different organic and inorganic sources of nutrients

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ABSTRACT

A field experiment was conducted for two years during summer seasons (February-May) of 1997 and 1998 at Mondouri Teaching Farm (23° N, 89° E, 9.75 m AMSL) of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur to study the effect of FYM and mustard cake alongwith inorganic fertilizers on the yield and yield components of transplanted rice (cv. IET 4094). The number of panicles/m² and number of filled grains/panicle was highest (422.7 and 98.3, respectively) with 75% of the recommended dose of NPK (60 kg N+30 kg P₂O₅+30 kg K₂O) alongwith FYM 4 t/ha. The maximum rice grain yield (6 t/ha) and the highest benefit : cost ratio (1.82) were also recorded at 75% of the recommended dose of NPK+FYM 4 t/ha. In all the treatments involving mustard cake, the yield was not satisfactory and due to higher cost of mustard cake, the benefit : cost ratio was also very low (0.20-1.16).

Key words : Benefit : cost ratio, FYM, mustard cake, rice, yield, yield components

INTRODUCTION

The yield level of rice has to be increased by 25-30% from the present level of 1.9 t/ha to make India self-sufficient in food grain by the year 2010. To sustain the rice producing capacity of Indian soils, factor productivity relating to plant nutrients is to be considered seriously. Because uptake of nutrients in excess of what is actually applied or soil nutrient reserve becoming increasingly unavailable to the crop (rice) in the absence of corrective measures leads to factor productivity decline. Rice productivity decline appears to be much more sharp in West Bengal (among other states). Depletion of organic matter content to a level lower than the minimum required in the soil system and slow mineralisation of accumulated organic matter are the causes of reduced level of N availability leading to

declining productivity of different degrees. Organic matter content either by external application of organic matter or any other suitable method appears to reverse the declining trend in productivity (Siddiq, 2000). Therefore, to study the effect of organic matter on rice productivity, an experiment was carried out by application of FYM or mustard cake alongwith different levels of inorganic fertilizers to transplanted summer rice grown in the southern plains of West Bengal.

MATERIALS AND METHODS

A field experiment was conducted for two years during summer seasons (February-May) of 1997 and 1998 at the Teaching Farm, Mondouri (23°N, 89°E, 9.75 m AMSL). Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, on clay-loam soil with pH 7.1. The

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soil was medium in organic carbon (0.60%), total nitrogen (0.059%), available phosphate (20 kg/ha) and available potash (164 kg/ha). The experiment was carried out in randomized block design with 10 treatments replicated thrice. The treatments were: T_1 —No fertilizer, T_2 —100% of the recommended doses of N, P and K (80 : 40 : 40 kg N, P_2O_5 and K_2O /ha) through inorganic sources, T_3 —Farm yard manure (FYM) 16 t/ha, T_4 —75% of the recommended doses of N, P and K+FYM 8 t/ha, T_5 —50% NPK+FYM 8 t/ha, T_6 —25% of the recommended doses of N, P and K+FYM 12 t/ha, T_7 —75% of the recommended doses of N, P and K+mustard cake (MC) 4 q/ha, T_8 —50% of the recommended doses of N, P and K+MC 8 q/ha, T_9 —25% of the recommended doses of N, P and K+MC 12 q/ha and T_{10} —MC 16 q/ha. The inorganic sources of N, P and K were urea, single super phosphate and muriate of potash, respectively. The treatment amount of FYM and mustard cake was applied seven days before transplanting.

In case of inorganic fertilizer application, 1/4 N, whole of P and K were applied as basal dose. Remaining 1/2 and 1/4 N was applied in two splits at tillering and panicle initiation stages, respectively. The rice variety used was IET 4094 (Khitish). One month old rice seedlings were transplanted with 20 cm x 10 cm spacing and harvesting was done at 105 days after transplanting.

RESULTS AND DISCUSSION

Dry Matter Accumulation

Dry matter accumulations (DMA) at panicle initiation (PI) and heading stages of crop growth differed significantly with different treatments. The maximum DMA (672.3 g/m²) at PI was recorded with 75% NPK+FYM 4 t/ha which was statistically at par with 50% NPK+FYM 8 t/ha and 100%

NPK (Table 1). Similarly, at heading stage also 75% NPK+FYM 4 t/ha produced maximum dry matter (904.6 g/m²).

Yield Components

Yield components, namely, number of panicles/m² and number of filled grains/panicle differed significantly with different treatments. The highest number of panicles (422.7/m²) was recorded with 75% NPK+FYM 4 t/ha which was at par with 50% NPK+FYM 8 t/ha and 100% NPK resulting in 420 and 412.7 number of panicles/m², respectively. Keeping similar trend as in the number of panicles/m², the number of filled grains/panicle was the maximum (98.3) with 75% NPK+FYM 4 t/ha which was at par with 50% NPK+FYM 8 t/ha and 100% NPK producing 97.7 and 97.0 number of filled grains/panicle, respectively. The 1000-grain weight (test weight) did not differ significantly with the treatments.

Grain Yield

The grain yield of rice differed significantly due to different nutritional management treatments. The highest grain yield (6 t/ha) was recorded with 75% NPK+FYM 4 t/ha which was at par with 50% NPK+FYM 8 t/ha and 100% NPK producing 5.8 and 5.7 t of grains/ha. Similar results were reported earlier by Mondal *et al.* (1988), Mondal *et al.* (1996) and Thakur and Patel (1998) and all of the researchers laid emphasis on the judicious use of FYM alongwith the inorganic fertilizers to sustain higher rice productivity. Baruah *et al.* (1999) reported from Assam that a significant increase in the yield of rice was noticed in the treatments receiving both organic and inorganic sources of nutrients. The lowest grain yield (3.1 t/ha) was recorded in the no fertilizer treated plots.

The harvest index (HI) did not differ

Table 1. Effect of organic and inorganic sources of nutrients on the growth, yield, yield components and benefit-cost ratio in summer rice (Mean data of two years)

Treatment	Dry matter accumulation (g/m ²)		Yield components			Gain yield (t/ha)	Harvest index (%)	Benefit-cost ratio
	Panicle initiation	Heading	No. of panicles/m ²	No. of filled grains/panicle	Test weight (g)			
No fertilizer	282.0	472.0	200.0	70.3	19.1	3.1	47.1	0.76
100% NPK	646.7	868.3	412.7	97.0	19.5	5.7	48.4	1.61
FYM 16 t/ha	505.3	754.6	404.7	93.0	19.2	4.8	47.5	1.25
75% NPK + FYM 4 t/ha	672.3	904.6	422.7	98.3	19.6	6.0	48.6	1.82
50% NPK + FYM 8 t/ha	668.7	894.6	420.0	97.7	19.5	5.8	48.1	1.71
25% NPK + FYM 12 t/ha	497.7	729.8	387.7	92.3	19.2	4.4	47.1	1.08
75% NPK + Mustard cake 4 q/ha	621.7	841.0	412.3	96.0	19.4	5.4	48.6	1.16
50% NPK + Mustard cake 8 q/ha	586.4	806.0	407.7	94.3	19.3	5.1	48.2	0.80
25% NPK + Mustard cake 12 q/ha	486.2	719.5	380.0	91.7	19.2	4.4	47.6	0.37
Mustard cake 16 q/ha	478.4	708.4	378.3	91.3	19.2	4.2	47.3	0.20
C. D. (P=0.05)	23.8	18.3	13.1	6.0	NS	0.3	NS	-

100% NPK=80 kg N, 40 kg P₂O₅ and 40 kg K₂O.

NS: Not Significant.

significantly among the various treatments. Considering all the treatments, the HI varied between 48.6 and 47.1%.

Benefit : Cost Ratio

The maximum benefit : cost ratio (1.82) was obtained with 75% NPK+FYM 4 t/ha which was closely followed by 50% NPK+FYM 8 t/ha. The lowest benefit : cost ratio (0.20) was observed in case of sole mustard cake treatments and it was due to low rice grain yield and higher cost of mustard cake.

It may be concluded from this experiment that application of 60 kg N, 30 kg P_2O_5 and 30 kg K_2O (75% of the recommended doses) alongwith 4 t FYM/ha may give higher grain yield of transplanted rice (IET 4094) during the summer season in the lower gangetic plains of West Bengal.

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