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Influence of farm yard manure, brown manuring and levels of nitrogen on yield and quality parameters of direct seeded and transplanted rice

B. Kabat
Regional Research and Technology Transfer Sub Station, Motto, Odisha

ABSTRACT

The influence of farm yard manure (FYM), brown manuring and levels of nitrogen on yield and quality parameters of direct seeded and transplanted rice variety Ranidhan was assessed in a field experiment carried out on a sandy loam soil in Odisha. Field experiment comprised of 20 treatment combinations viz., five main plot treatments (Direct seeded rice with and without FYM, Direct seeded with brown manuring, Transplanted rice with and without FYM) and four nitrogen levels as sub-plot treatments (60, 80,100 and 120 kg N ha^{-1}). Rice growth and yield were statistically similar under direct seeded and transplanted conditions. The direct seeded rice gave yield comparable to that of transplanted rice with added advantage of earlier maturity of the crop by 10 days. Both transplanted and direct seeded rice responded to the application of 80 kg N ha^{-1}.

Key words: *brown manuring, direct seeded rice, FYM, nitrogen*

Transplanting of rice is a cumbersome and labor intensive process that requires continuous ponding of water for establishment of the seedlings. This is in turn leads to nutrient losses through leaching besides causing high evapo-transpiration losses. To make paddy cultivation cost effective, direct seeded rice provides an option which saves labor expenses and water. Fertilizers have contributed substantially to the spectacular increase in crop production. The combined use of organic manures and inorganic fertilizers help in maintaining yield stability through correction of marginal deficiencies of micronutrients and providing favorable soil physical conditions. Application of farm yard manure (FYM) to soil improves the physical, chemical and biological properties, thereby improving the nutrient availability in soils. It occupies an important position among bulky organic manures. The fertilizer N-use efficiency varies from 18-40 per cent in transplanted rice, because applied inorganic N is rapidly lost from the soil by leaching, ammonia volatilization and denitrification. Urea is the principal nitrogenous fertilizer in rice-growing Asian countries which is prone to various losses. Application of urea in combination with organic material (FYM) minimizes N losses and increase N-use efficiency. Therefore, a field experiment was conducted in rice to optimize the rate of N application in combination with FYM and its effect on quality parameters.

The field experiment was conducted during wet season 2011-12 at Harekrushnapur village of Dhenkanal district of Odisha. The soil was sandy loam, slightly acidic in reaction having pH 6.05, low in organic carbon (0.41%) and available N (190.4 kg ha^{-1}) and medium in available P (17.4 kg ha^{-1}) and K (134.4 kg ha^{-1}). The field experiment comprised of 20 treatment combinations *viz.,* five main plot treatments (Direct seeded rice with 10 t ha^{-1} FYM, Direct seeded rice without FYM, Direct seeded rice with 'brown manuring', Transplanted rice with 10 t ha^{-1} FYM and Transplanted rice without FYM) and four nitrogen levels as subplot treatments(60, 80, 100 and 120 kg N ha^{-1}). The experiment was laid out in split plot design with four replications. The sowing of direct-seeded rice (Variety Ranidhan) was done by broadcasting of seeds after ploughing (Seed rate of 60 kg ha^{-1}). Transplanting was done with 26 days old seedlings keeping row to row spacing of 20 cm and plant to plant spacing of 15 cm. Uniform application of butachlor (3 l ha^{-1} after mixing in 150 kg sand) was done within three days of sowing/transplanting and later on uniform application

of pretilachlor 30.5 EC(1.25 l ha^{-1}) was made 7 days after sowing/transplanting to control weeds. Nitrogen was applied through urea in three doses i.e. half as basal, one-fourth after three weeks of sowing/ transplanting and rest one-fourth at panicle initiation stage. P_2O_5 and K_2O were applied at the rate of 30 kg ha^{-1}each.The full dose of P_2O_5 and half dose of K_2O were applied at the time of field preparation. The rest half dose of K_2O was applied at panicle initiation stage. To overcome Zn deficiency, basal soil application of $ZnSO_4$ was made @25 kg ha^{-1}. The rainfall received during crop growth period of transplanted rice was more (887 mm) as compared to (871 mm) during crop growth period of direct seeded rice as transplanted rice matured 10 days later and there was 16 mm of rainfall during that period. Protein content in grain was calculated by multiplying the N percentage in grain by the factor 5.95.

There was no effect of FYM and brown manuring on the effective tiller density in direct seeded as well as transplanted rice (Table 1). Among nitrogen levels, 80 kg N ha^{-1} significantly increased the tiller density compared with 60 kg N ha^{-1} and there was no further increase in the tiller density by increasing the N rate to 120 kg ha^{-1} (Table 1). The maximum number of effective tillers was obtained with 80 kg N ha^{-1} which was similar to that with the application of 100 kg ha^{-1} and 120 kg ha^{-1}. The spikelet $panicle^{-1}$ was influenced by planting methods and FYM (Table 1). Transplanted rice with FYM produced 103.7 spikelet $panicle^{-1}$, which was significantly higher than that of direct seeded rice with brown manuring (96.5 spikelet $panicle^{-1}$) and direct seeded rice without FYM (95.2 spikelet $panicle^{-1}$), but it was at par with transplanted rice without FYM (101.9) and direct seeded rice with FYM (99.4 spikelet $panicle^{-1}$).

The grain yield and straw yield of rice were not influenced by the different planting techniques and FYM treatments indicating that direct seeding did not result in any yield reduction (Table 1). Similar observations were also reported by Singh *et al*. (2007) and Singh and Walia (2011). Different nitrogen levels significantly affected the grain yield of rice. Maximum grain yield (5.3 t ha^{-1}) was obtained with 80 kg N ha^{-1} which was superior to 60 kg N ha^{-1}(4.7 t ha^{-1}), but statistically was at par with 100 kg N ha^{-1} was 13.7 per cent higher than 60 kg ha^{-1}. The interaction effect of different methods of planting and levels of nitrogen was non-significant. The present study showed significant effect of methods of crop establishment and nitrogen levels on days to maturity. The transplanted crop took 10 days more to mature as compared to direct seeded rice. The reduction in maturity period of direct seeded rice was due to elimination of the transplanting shock. Dingkuhn *et al*. (1990) also reported reduction in crop

Table 1. Influences of FYM, brown manuring and nitrogen levels on effective tillers, spikelet $panicle^{-1}$ and 1000 grain weight, grain yield, straw yield and maturity of direct seeded and transplanted rice

Treatments	Effective tillers m^{-2}	Spikelet $panicle^{-1}$	1000 grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Maturity (days)
Main plot						
Direct seeded rice with FYM	396.6	99.4	20.2	5.0	7.6	134.5
Direct seeded rice without FYM	383.6	95.2	19.8	4.8	6.9	133.9
Direct seeded rice with brown manuring	388.3	96.5	19.7	4.9	7.0	134.3
Transplanted rice with FYM	417.7	103.7	20.4	5.3	7.1	144.5
Transplanted rice without FYM	402.9	101.9	20.3	5.1	6.5	144.0
CD =0.05%	NS	6.1	NS	NS	NS	0.6
Sub plot(N levels $kgha^{-1}$)						
60	361.0	97.4	19.7	4.7	6.4	138.9
80	416.1	100.4	20.3	5.3	7.1	139.1
100	404.7	100.2	20.1	5.0	7.6	138.9
120	409.4	99.3	20.2	5.1	7.1	139.3
CD =0.05%	30.6	NS	NS	0.4	0.7	NS
Interaction	NS	NS	NS	NS	NS	NS

NS= Non-significant

duration by 8-12 days, regardless of the nitrogen levels, due to the absence of transplanting shock in direct seeded rice. Many workers (Peng *et al*., 1996; Santhi *et al*., 1998 also found similar trends. There was no significant effect of increased level of N application to 120 kg ha^{-1} on days to maturity.

There was non-significant difference in milled rice recovery with respect to seeding techniques and FYM (Table 2). Better performance was observed in

Table 2. Influences of FYM, brown manuring and nitrogen levels on quality parameters of direct seeded and transplanted rice

Treatments	Milled rice recovery (%)	Head rice recovery (%)	Protein (%)
Main plot			
Direct seeded rice with FYM	68.8	55.5	6.94
Direct seeded rice without FYM	67.3	54.2	6.85
Direct seeded rice with brown manuring	67.8	55.2	6.72
Transplanted rice with FYM	69.5	56.2	6.97
Transplanted rice without FYM	67.8	55.3	6.93
CD =0.05%	NS	NS	NS
Sub plot(N levels kgha^{-1})			
60	66.8	53.6	6.67
80	70.1	56.8	6.78
100	67.1	54.5	7.02
120	68.9	56.0	7.08
CD =0.05%	2.1	1.8	0.24
Interaction	NS	NS	NS

80 kg N ha^{-1} and gave significantly higher milled rice recovery (70.1%) as compared to 60 kg N ha^{-1} (66.8%) and 100 kg N ha^{-1} (67.1%), which was, however, at par with 120 kg N ha^{-1} (68.9%). Interaction between treatments was non-significant. Head rice recovery was unaffected by seeding techniques and application of FYM (Table 2). Maximum head rice recovery was obtained in 80 kg N ha^{-1} (56.8 %) which was statistically at par with that of 120 kg N ha^{-1} (56.0%) but significantly more than 60 kg N ha^{-1}(53.6%) and 100 kg N ha^{-1} (54.5%). However, interaction among different planting methods with levels of nitrogen was non-significant. Protein content in grains is one of the important characters to judge the quality of rice. The data indicated that methods of planting and FYM had non-significant effect on protein content. Levels of nitrogen increased the protein content in grains and the highest protein content was recorded with 120 kg N ha^{-1}, which was, however, at par with 100 kg N ha^{-1} but it gave significantly more protein content as compared to 80 kg N ha^{-1} and 60 kg N ha^{-1}.

Based on the results, it may be concluded that rice growth and yield were statistically similar under direct seeded and transplanted conditions. The direct seeded rice irrespective of FYM application gave comparable yield as that of transplanted rice with added advantage of early maturity of the crop by 10 days. Among levels of nitrogen, 80 kg N ha^{-1} recorded all yield attributes, yield and milled and head rice recovery higher than 60 kg N ha^{-1}.

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