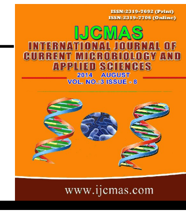

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 8 (2014) pp. 1063-1068**
http://www.ijcmas.com

Original Research Article

Productivity of rice as influenced by planting method and nitrogen source

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Keywords

Rice, Productivity, Nitrogen source, Varieties, Planting methods, Nutrient uptake

A B S T R A C T

A field experiment was conducted during *kharif* 2011 and 2012 on sandy clay loam soil at Regional Agricultural Research Station, Chintapalli, Andhra Pradesh to find out the influence of nitrogen source and planting methods on productivity of rice varieties. The experiment consists of twenty treatment combinations involving two methods of planting *i.e*., direct seeding and transplanting and two rice varieties viz., BPT 8024 and MTU 2077 as main treatments and the sub plot treatments consisted of five nitrogen management practices *i.e*.,no nitrogen, 100% recommended nitrogen through fertilizer, 100% recommended nitrogen through organic source(FYM), 50% recommended nitrogen through fertilizer + 50% recommended nitrogen through FYM and 100% recommended nitrogen through fertilizer + 25% recommended nitrogen through FYM. The results indicated that neither neither the two planting methods nor the two varieties had any significant effect on the growth and yield of rice. Among the different nitrogen management practices, combination of 100% recommended nitrogen through fertilizer and 25% recommended fertilizer through FYM increased numbe r of tillers, drymatter accumulation, panicle length, number of panicles m^{-2} and number of filled spikelets per panicle, test weight, grain and straw yield as well as harvest index and nutrient uptake of rice crop which was superior to other nitrogen management practices except 100% recommended nitrogen through fertilizer and 50% recommended nitrogen each through fertilizer and farm yard manure.

Introduction

As water is likely to become a scarce and costly commodity for rice production in future, agronomic strategies should therefore be worked out to decrease water use. Rice consu,es about 90% of the fresh water resources in Asia used for agriculture (Gorantla *et al*. 2005). Different methods of planting of lowland rice on puddle soil are being widely adopted with varying levels of success.

However, the best method of planting in terms of productivity and profitability differs with the agro-ecological situations. Transplanting practice, conventionally accepted by the farmers, has become costlier and at times constrained by labour availability. Further, the practice also witnessed planting of over age seedlings late in the season owing to delayed monsoon and undependable release of water into the irrigation canals. Direct sowing of sprouted seeds on puddle soil either by broadcasting or drilling is the nearest to surmount the difficulties of transplanting method, provided land levelling, weed menace and adequate as well as timely availability of water do not constrain.

Nutrient dynamics, especially of nitrogen, differ largely among the methods of planting as well as water availability to rice. Integrated nutrient supply concept, involving both organic and inorganic sources based on their availability and cost effectiveness, is well adopted and judicious combination of these two sources has been found to mutually reinforce the efficiency of both the sources resulting in higher productivity and soil fertility. Application of FYM at 10 t ha^{-1} in combination with inorganic fertilizers increased the grain yield of rice (Dixit and Gupta, 2000). The quantitative performance of rice under varied methods of reduced water supply has to be thoroughly understood in order to develop a sound nutrient management strategy for a given method of planting. In the light of the above context, this study has been planned to study the performance of rice varieties under direct seeding and transplanting and to know the effect of nitrogen source on rice productivity.

Materials and Methods

A field experiment on "productivity of rice as influenced by nitrogen source and planting methods" was conducted during kharif 2012 and 2013 at Regional Agricultural Research Station, Chintapalli, Visakhapatnam district of Acharya N.G. Ranga Agricultural University. The experimental site was sandy clay loam in texture, low in organic carbon (0.41), available nitrogen (219 kg ha^{-1}), medium in available phosphorus (16.5 kg ha^{-1}) and high in available potassium (383 kg ha^{-1}). The experiment consists of twenty treatment combinations with two varieties *viz*., BPT 8024 (V_1) and MTU 2077 (V_2) and two planting methods *viz*., direct seeding (M_1) and transplanting (M_2) as main plot treatments and nitrogen management practices as sub plot treatments. Nitrogen management practices (5) include N_1 – No nitrogen(N_0), N_2 - 100% recommended nitrogen through fertilizer (RDN_{100}), N_3- 100% recommended nitrogen through farm yard manure (M_{100}), N_4- 50% recommended nitrogen through fertilizers + 50% recommended nitrogen through farm yard manure (RDN_{50} + M_{50}) and N_5- 100% recommended nitrogen through fertilizers + 25% recommended nitrogen through farm yard manure (RDN_{100} + M_{25}) in split plot design with three replications.

The recommended dose of 100 kg nitrogen, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} was applied through urea, single super phosphate and muriate of potash, respectively. Entire P_2O_5 and K_2O was applied basally to all the treatments duly taking into consideration of the phosphorus and potassium content of the organic manure. Nitrogen was applied as per the treatments in 3 split doses of 50% basal and 25% each at active tillering and panicle initiation stages, respectively.

Results and Discussion

Growth parameters

The results indicated that the plant height at maturity, total number of tillers at maturity and dry matter production of rice were not significantly influenced by both the planting methods and varieties (Table 1). Nitrogen sources, however, manifested significant differences in plant height, number of tillers at maturity and dry matter production of rice. The taller plants, highest tiller number

m^{-2} and dry matter production of rice were produced with the combined supply of 100%nitrogen (N) through fertilizer and 25% N through organic source (FYM) which was, however, on a par with those received 50% N through fertilizer and 50% N through FYM as well as 100% N through fertilizer alone. But, all these were significantly superior to that of 100% N supplied through FYM alone. Obviously, the shorter plants, less number of tillers and low dry matter production were recorded with non-supply of N through any source. None of the interactions was found to be significant in respect of plant height, tiller production and dry matter production of rice crop. Plant height of rice crop in response to N sources exhibited a clear trend in the descending order of 125% N through fertilizer and organic source, 100% N through fertilizer and organic source (50% each), 100% N through fertilizer alone, 100% N through organic source alone and control. Influence of N sources on total number of tillers and dry matter production of rice crop exhibited in the descending order of 100% N through fertilizer and 25% N through organic source, 100% N through fertilizer and organic source (50% each), 100% N through fertilizer alone, 100% N through organic source alone and control. The percent increase in dry matter production at maturity was 7.9, 7.2, 5.9 and 3.7 due to N_4, N_3, N_1 and N_2, respectively, over control.

Table.1 Growth parameters and yield attributes as affected by planting method, variety and source of nitrogen

Treatments	**Plant height at maturity (cm)**	**Total no.of tillers m^{-2} at maturity**	**Dry matter production (kg ha^{-1}) at maturity**	**Panicle length (cm)**	**Total no.of panicles m^{-2}**	**Filled spikelets $panicle^{-1}$**
Planting method (M)						
M_1-Direct seeding	101.2	369	9155	22.2	258	100
M_2-Transplanting	102.4	374	9184	22.6	246	107
SEm±	1.47	9.23	47.5	0.15	3.32	2.50
CD (0.05)	NS	NS	NS	NS	NS	NS
Varieties(V)						
V_1-BPT 8024	99.9	370	9156	22.3	248	102
V_2-MTU 2077	100.4	369	9162	22.4	256	105
SEm±	1.82	3.42	58	0.29	5.63	2.47
CD (0.05)	NS	NS	NS	NS	NS	NS
Nitrogen sources (N)						
N_1-N_0	92.3	287	8743	19.1	200	81
N_2- RDN_{100}	102.0	384	9260	22.3	269	109
N_3-M_{100}	98.3	363	9068	21.1	237	94
N_4- RDN_{50}+ M_{50}	102.8	403	9369	22.6	274	108
N_5-RDN_{100}+ M_{25}	105.4	412	9436	23.3	284	118
SEm±	2.19	8.42	92.6	0.52	8.88	5.97
CD (0.05)	4.3	16.5	181.5	1.0	17.4	11.7
Interaction	NS	NS	NS	NS	NS	NS
CV (%)	7.5	5.8	5.5	5.8	8.6	14.0

Table.2 Sterility %, test weight and yield and N uptake of rice as affected by planting method, variety and source of nitrogen

Treatments	Sterility percent	1000-grain weight(g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)	Nitrogen uptake (kg ha^{-1})
Planting method (M)						
M_1-Direct seeding	13.3	21.4	4165	4779	46.5	82.7
M_2-Transplanting	11.3	21.6	4212	4674	47.4	82.9
SEm±	0.27	0.19	121.2	133.2	0.48	0.74
CD (0.05)	1.18	NS	NS	NS	NS	NS
Varieties(V)						
V_1-BPT 8024	12.1	21.6	3924	4762	46.9	82.7
V_2-MTU 2077	12.4	21.4	4363	4690	46.2	82.9
SEm±	0.12	0.39	169.6	63.9	0.66	0.48
CD (0.05)	NS	NS	NS	NS	NS	NS
Nitrogen sources (N)						
N_1-N_0	17.2	20.1	2462	3226	43.5	57.0
N_2- RDN_{100}	11.7	21.4	4695	5321	47.3	87.0
N_3-M_{100}	14.2	20.6	3758	4450	45.9	75.1
N_4- RDN_{50} + M_{50}	10.6	22.3	4835	5276	47.8	95.3
N_5-RDN_{100}+ M_{25}	7.7	22.4	4967	5359	48.1	99.6
SEm±	0.38	0.37	162.1	173.2	0.99	1.04
CD (0.05)	0.7	0.7	317.8	339.6	1.95	2.0
Interaction	NS	NS	NS	NS	NS	NS
CV (%)	7.6	4.2	9.6	9.0	5.3	3.1

Yield attributes and yield

In the present study, neither the methods of planting nor the varieties as well as their interaction had significant effect on panicle length, number of panicles m^{-2}, total number of spikelets per panicle, number of filled spikelets panicle^{-1} and 1000-grain weight (Table 1). Combined supply of 100% N through fertilizer and 25% N through organic source recorded the longest panicles (23.3 cm), number of panicles m^{-2}, number of spikelets panicle^{-1}, number of filled spikelets panicle^{-1} and the highest test weight (22.4) which was however, on a par with that received 50% N each through fertilizer and organic source (FYM) and 100% N through fertilizer alone, but conspicuously superior to 100% N through organic source. Nitrogen being the constituent of protoplasm, adequate supply ensure cell division and cell enlargement exerting a positive cognizant on the growth as well as yield attributing characters. Spikelet sterility was significantly influenced by planting methods and nitrogen sources. But, the varieties and their interaction did not influence significantly on sterility percentage. Minimum spikelet sterility (11.3%) was recorded with transplanted rice which was significantly decreased the sterility percentage upto 15% over direct sown rice.

Lower spikelet sterility in transplanted rice might be due to availability of better light intensity, optimum spacing and efficient translocation of photosynthates to the spikelets. Application of 100% N through fertilizer and 100% N through FYM recorded significantly lower means of spikelet sterility than those received 50% N each through fertilizer and organic source, 100% N through fertilizer alone and 100% N supply through organic source alone which were 27.3, 34.1 and 45.7 percent higher over the best treatment. Similar results of improved growth characters under integrated nitrogen supply to rice were reported by Natarajan *et al*. (2008).

Planting methods and rice varieties did not exhibit significant variations on the grain and straw yields and harvest index of rice (Table 2). However, transplanted rice recorded higher grain yield over direct seeded rice. Similarly, the variety MTU 2077 recorded increased grain yield over the variety BPT 8024.

Grain and straw yields of rice in response to nitrogen sources manifested significant differences though their interaction effect was found non-significant. The highest grain yield (4967 kg ha^{-1}), straw yield (5359 kg ha^{-1}) and harvest index (48.1) of rice were produced with the combined supply of 100% N through fertilizer and 25% N through organic source (FYM), which was on a par with 50% N through fertilizer and 50% N through organic source as well as 100% N supply through fertilizer, but significantly superior to those with 100% N through organic source alone. The percent increase in grain yield was 101.7, 96.3, 90.6 and 52.6 due to N_4, N_3, N_1 and N_2, respectively, over control. Comfortable level of plant N nutrition manifested increased growth stature and augmented the yield structure, thus resulting in higher yield of rice. Similar increased yield due to conjuctive use of organic and inorganic nitrogen was reported by Surendra singh *et al*. (2006) and Majunder *et al*. (2007) and Sampath Kumar and Sankara Reddy (2010).

Nitrogen uptake

Data pertaining to the uptake of nitrogen of rice crop was not significantly influenced by both the planting methods and varieties. Combined supply of 100% N through fertilizer and 25% N through organic source (FYM) was distinctive in recording the highest nitrogen uptake (99.6 kg ha^{-1}) which exhibited conspicuous superiority over 50% N each through fertilizer and organic source, 100% N through fertilizer alone and 100% N through organic source alone. Nitrogen uptake by rice crop in response to N sources exhibited in the descending order of 50% N each through fertilizer and organic source, 100% N through fertilizer and 25% N through organic source, 100% N through fertilizer alone, 100% N through organic source alone and non-supply of N through any source (Table 2).

A proper blend of both organic and inorganic sources of N at required combination results in a conducive environment of N nutrition in the *rhizosphere* for lowland rice. Inorganic nitrogen released immediately after the application, fulfils the initial N requirement of the crop while the organic N mineralizes gradually at a steady rate catering the later requirement, thus assuming continuous N supply throughout the growth period. Such situation promotes adequate N absorption by rice at different stages. Similar results of improved nutrient status of soil after the harvest of rice with combined sources of inorganic and organics was reported by Mithun Saha *et al.* (2007).

References

Dixit, K. G. and Gupta, B. R. (2000). Effect of farm yard manure, chemical and biofertilizers on yield and quality of rice (*Oryza sativa* L) and soil properties. *Journal of the Indian Society of Soil Science* 48 (4) : 773-780.

Gorantla, M, Babu, P.R, Reddy Lachagiri, V.B, Alex Feltus, E, Paterson, A. H. and Arjula Reddy. (2005). Functional genomics of drought stress responses in rice: Transcript mapping of annotated unigenes of an Indica rice (*Oryza sativa* L.) cv. Naginazz). *Current Science* 89: 496-514.

Majunder, B, Venkatesh, M. S. and Saha, R. (2007). Effect of nitrogen, farm yard manure and non-symbiotic nitrogen fixing bacteria on yield, nutrient uptake and soil fertility in upland rice (*Oryza sativa* L.). *Indian Journal of agricultural Sciences* 77:335-339.

Mithun Saha, Mondal, S.S, Acharya, D. and Sanjoy Saha. (2007). Effect of integrated Nutrient management on productivity and quality of rice (*Oryza sativa* L.). *Oryza*44(2): 125-129.

Natarajan, S, Premsekhar, M, Velayuthem, K, Paulraj, C. and Nagarajan, P. (2008). Influence of organic and inorganic N fertilization on growth, yield and economics of transplanted rice. *Indian Journal of Agricultural Research* 42(4): 266-271.

Sampath Kumar, D. and Sankara Reddy, K. (2010). Effect of organic and inorganic sources of nitrogen on productivity, profitability and soil fertility of low land rice (*Oryza sativa L.*). *Journal of Research ANGRAU* 38 (39&40): 1-8.

Surendra Singh, Singh, R.J, Janardhan Prasad and Singh, B.P. (2006). Effect of integrated Nutrient management on yield and uptake of nutrients by rice and soil fertility in Rainfed uplands. *Journal of Indian Society of Soil Science* 54: 327-330.