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Influence of nitrogen management on growth and yield of rice under SRI technique

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ABSTRACT

Field experiment was conducted on rice with different levels of nitrogen management (100% RDF along with biofertilizer, 125% RDF+ biofertilizer, LCC-based nitrogen management CV-3, 4 and 5, 50% N through organic sources and 50% N through inorganic sources, 100% N through organic sources, without N application P and K recommended dose and absolute control). The highest plant height, leaf area index and dry matter production were recorded in the 125 per cent RDF + biofertilizer applied treatment. N (100%) applied through organic sources recorded the highest grain and straw yield over the other treatments. All the growth and yield parameters were recorded at lowest in absolute control. The straw yield was increased with the application of 100 per cent N through organic sources due to the adequate nutrient supply throughout the growing period of the crop. Application of nitrogen (187 kg/ha) through organic sources viz in situ growing and incorporation of dhaincha along with 4.0 tonnes/ha of vermicompost recorded the highest grain yield of 6,710 kg/ha with benefit-cost ratio of 3.06. The results indicated that salt tolerant rice variety, TRY 1 performed better in SRI method of cultivation under alkaline soil environment.

Keywords: Growth; nitrogen; nutrition; system of rice intensification; yield

INTRODUCTION

The world population is projected to increase 40 per cent by the year 2020 and grain cereals such as rice and wheat are expected to assume a larger role in providing the basic daily dietary requirement for human growth and development. Rice is the crop of the Asia-Pacific region. The projected demand by the year 2025 is mind boggling (Hossain 1996) as in major Asian countries rice consumption will increase faster than the population growth. In summary in Asia the rice consumption by the year 2025 over the base year 1995 will increase by more than 51 per cent. Another significant change will be the development of many mega cities of the size of 10-15 million people over and above the general urbanization of the populace. Thus the number of consumers will grow and the number of producers will be reduced dramatically. The current demand of 524 million tonnes is expected to increase to over 700 million tonnes (http://www.fao.org/3/x6905e/x6905e04.htm). Rice will continue to supply 50-80 per cent of the daily calories and thus the average growth rate in production has to keep pace with the growth rate of the population. To sustain the present food sufficiency and to meet out the future food requirements, new methods of rice cultivation must be identified to increase water productivity. The system of rice intensification (SRI) developed at Madagascar has been reported to increase grain yield of rice and to save water based on the synergistic effects of simultaneously adopted various cultivation practices. SRI has its own methodologies that is transplanting very young seedlings usually 8-12 days old and not more than 15 days old.

Nitrogen is pivotal in yield realization of rice. In India about 67 per cent of rice soils are estimated to be in shortage of adequate nitrogen and consequently rice crop has become a major consumer of nitrogen fertilizer. The use efficiency of applied fertilizer nitrogen by rice crop is very low, Nitrogen use efficiency ranges from 30 to 40 per cent (Prasad and De Data 1979). Hence the present study was conducted to evaluate rice for varying sources and levels of nitrogen management under SRI technique.

MATERIAL and METHODS

A field experiment was conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirapalli, Tamil Nadu for consecutive two years. The field experiment was laid out in randomized block design with three replications using TRY 1 as the test variety. There were ten treatments consisting of application of 100 per cent RDF and their combination along with biofertilizers, LCC-based nitrogen application (CV 3, 4 and 5), 50 per cent N through organic sources, 100 per cent N through inorganic sources, 100 per cent N through organic sources, without N application P and K RDF and absolute control. The soil of the experimental field was sandy loam with 8.92 pH, 0.56 per cent OC, 0.53 dS/m EC and 246, 15.6 and 284.12 kg/ha available N, P and K respectively.

Fifteen-days old seedlings were transplanted at a spacing of 25 x 25 cm keeping single seedling per hill. At the time of last puddling 25, 100 and 50 per cent of recommended N, P and K were broadcast uniformly. Remaining N was top dressed in 3 equal splits at 21, 42 and 63 days after transplanting (DAT). Remaining potassium was top dressed at 42 DAT.

The observations on growth attributes were recorded at periodical growth stages like active tillering (AT), panicle initiation (PI), 50 per cent flowering and maturity stages of the crop. The crop duration was increased by 10 days in 100 per cent N through organically-manured treatment.

RESULTS and DISCUSSION

Effect on growth attributes of rice

Different sources and successive increments brought about significant increase in growth in terms of plant height, LAI and dry matter accumulation during the cropping period (Tables 1 and 2). Plant height was found maximum at the time of harvest in 125 per cent RDF + biofertilizers treatment which was on par with 100 per cent RDF along with biofertilizer application. The poor plant growth was recorded in absolute control at all the stages of crop growth. The results are in conformity with the findings of Naik and Paryani (2005). Leaf area index (LAI) increased significantly with application of 100 per cent nitrogen through organic manure. Application of 125 per cent RDF + biofertilizers resulted in significantly higher dry matter production and it was on par with supply of N completely through organic sources. At all the stages of observations, control recorded very low amount of

Table 1. Effect of different sources and levels of nitrogen on plant height (cm) and LAI of rice under SRI technique

Treatment	Plant height (cm) at				LAI at			
	Active tillering	Panicle initiation	50% flowering	Maturity	Active tillering	Panicle initiation	50% flowering	Maturity
T_1	52.00	93.5	130.90	140.4	2.64	3.92	5.27	5.36
T_2	53.53	98.7	136.57	144.4	3.26	4.51	5.84	6.03
T_3	56.27	98.9	139.07	148.6	3.52	4.85	6.13	6.46
T_4	46.73	84.3	121.67	129.0	2.04	3.43	4.72	4.94
T_5	51.73	89.8	127.87	136.0	2.15	3.57	4.94	5.16
T_6	43.93	85.4	124.10	136.4	2.43	3.86	5.19	5.37
T_7	53.00	90.4	126.33	136.6	2.86	4.34	5.78	5.95
T_8	49.07	88.0	127.33	143.4	2.78	4.26	5.96	6.38
T_9	48.47	80.6	120.00	124.7	1.91	3.27	4.14	4.24
T_{10}	49.07	79.2	111.83	121.1	1.80	2.38	3.25	3.32
SEd	3.10	2.50	4.83	3.74	0.02	0.02	0.03	0.03
$CD_{0.05}$	6.53	5.25	10.15	7.87	0.04	0.05	0.06	0.06

T_1: 100% recommended dose of fertilizer (RDF), T_2: 100% RDF + biofertilizer, T_3: 125% RDF + biofertilizer, T_4: LCC-based N application (CV-3), T_5: LCC-based N application (CV-4), T_6: LCC-based N application (CV-5), T_7: 50% N through organic and 50% N through inorganic sources, T_8: 100% N through organic sources, T_9: No nitrogen (P & K RDF), T_{10}: Absolute control

Table 2. Effect of different sources and levels of nitrogen on dry matter production, grain yield and straw yield of rice under SRI technique

Treatment	Dry matter production (tonnes/ha) at				Grain yield (kg/ha)	Straw yield (tonnes/ha)
	Active tillering	Panicle initiation	50% flowering	Maturity		
T_1	3.23	5.62	10.08	13.89	5,648	11.97
T_2	3.81	6.48	11.52	14.26	5,889	12.15
T_3	4.53	8.61	12.36	15.34	6,127	12.5
T_4	2.64	4.04	7.23	9.52	4,218	8.5
T_5	2.92	4.82	7.95	10.52	5,055	10.33
T_6	3.47	6.45	9.82	11.95	5,583	10.61
T_7	3.91	7.27	11.96	14.40	5,938	12.13
T_8	3.18	5.86	10.23	15.17	6,710	13.1
T_9	1.94	3.15	4.94	7.68	3,217	5.27
T_{10}	1.62	2.83	4.26	6.22	2,316	4.52
SEd	0.02	0.05	0.08	0.10	41	0.1
$CD_{0.05}$	0.05	0.12	0.18	0.20	87	0.2

T_1: 100% recommended dose of fertilizer (RDF), T_2: 100% RDF + biofertilizer, T_3: 125% RDF + biofertilizer, T_4: LCC-based N application (CV-3), T_5: LCC-based N application (CV-4), T_6: LCC-based N application (CV-5), T_7: 50% N through organic and 50% N through inorganic sources, T_8: 100% N through organic sources, T_9: No nitrogen (P & K RDF), T_{10}: Absolute control

dry matter. Hema et al (2004) and Kanwar et al (2006) observed increase in dry matter production in response to the dhaincha-incorporated treatment.

Effect on grain and straw yield

Different nutrient management and straw packages exerted positive influence on the grain yield of rice (Table 2). Application of 100 per cent N through organic sources viz dhaincha and vermicompost produced the highest grain yield of 6,710 kg/ha which was 9.1 per cent higher than the next best treatment of 125 per cent RDF + biofertilizers. The same trend was noticed in straw yield sources which positively resulted in higher straw yield of 13.1 tonnes/ha. The lowest amount of both grain and straw yield was registered in control. Similar observations were made by Thilagavathi and Ramanathan (2005).

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