Madras Agric. J. 89 (7-9) : 506-508 July-September 2002
https://doi.org/10.29321/MAJ.10.A00259

Effect of nitrogen levels on growth and yield of rice [SSRC 91216 (TRY 2)] under sodic soil conditions

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Abstract : Field experiments were conducted during Thaladi season (October-January) of 1998-99 and 1999-2000 on sodic tolerant short duration rice variety TRY 2 (SSRC 91216) with five levels of nitrogen (0, 75, 100, 125 and 150 kg ha^{-1}) to study the optimum level of N required to produce the maximum yield under sodic soil conditions. The results revealed that there was significant increase in plant height, leaf area index, drymatter production, panicle number, filled grains/panicle, straw and grain yields with an increase in the level of N from 0 to 125 kg ha^{-1}. Further increase upto 150 kg N ha^{-1} did not show any significant increase in the growth and yield parameters observed. Application of 125 kg N ha^{-1} produced the highest grain yield of 5.15 and 5.51 t ha^{-1} during 1998-99 and 1999-2000, respectively. Agronomic N use efficiency, nitrogen uptake at various growth stages were found to be maximum at 125 kg N ha^{-1}.

Keywords : Nitrogen levels, Grain yield, Nitrogen use efficiency.

Introduction

Among the agronomic management practices, nutrient management particularly nitrogen plays an important role, since it is the key element that decides the yield of rice. Plant physiological processes are influenced by N application in rice. The direct bearing of N on source influences the sink size there by increasing grain yield of rice. SSRC 91216, recently released as TRY 2 is tested for its nitrogen requirement under sodic soil conditions.

Materials and Methods

Field experiments were conducted during Thaladi 1998-99 and 1999-2000 at Anbil Dharmalingam Agicultural College and Research Institute farm, Trichirapalli, Tamil Nadu. The experiments were laid out in randomized block design with four replications. Five nitrogen levels *viz.* 0, 75, 100, 125 and 150 kg ha^{-1} were used in the study. The soil of the experimental field was a sandy clay loam (pH 9.2, EC 0.46 dSm^{-1}, SAR 19 and ESP 22) and had low available N (198 kg ha^{-1}) and P_2O_5 (7.2 kg ha^{-1}) and medium

Table 1. Effect of varying levels of N on TRY 2 (SSRC 91216) performance under sodic soil conditions

N levels kg ha^{-1}	Plant height (cm) at harvest		Leaf area index at 50% flowering		Productive tillers $hill^{-1}$ (No.)		1000 grain weight (g)		Grain yield (kg ha^{-1})		Straw yield (t ha^{-1})	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
0	86.8	81.2	3.56	1.8	9.4	9.2	16.2	15.8	4711	3825	7.61	4.46
75	93.1	91.9	4.06	"3.98	12.7	12.5	17.1	16.9	4906	4646	9.21	5.17
100	95.2	94.8	4.25	4.01	13.1	13.0	17.3	17.2	5139	4946	9.61	5.8)'
125	99.8	99.7	4.75	4.51	13.8	13.7	17.6	17.7	5587	5507	9.59	6.71
150	97.8	99.2	4.70	4.50	13.3	13.5	17.3	17.6	5339	5198	9.82	6.26
SEd	1.98	2.02	0.285	0.224	0.23	0.19	0.13	0.12	179	178	0.13	0.235
CD (P = 0.05)	4.30	4.40	0.620	0.487	0.50	0.41	0.28	0.26	390	387	0.27	0.512

Table 2. Effect of varying levels of nitrogen on drymatter production, N uptake and N use efficiency of TRY 2 (SSRC 91216) grown under sodic soil conditions.

N levels kg ha^{-1}	Dry matter production (g m^{-2})								Nitrogen uptake (kg ha^{-1})								ANUE (kg grain per kg N)	
	AT		PPI		F		H		AT		PPI		F		H			
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
0	21.0	18.6	112.2	102.4	285.4	268.1	495.8	454.2	14.0	14.2	23.8	22.2	31.4	30.7	21.4	20.9	-	-
75	35.9	33.8	215.6	216.2	525.0	510.0	612.3	604.2	20.9	21.7	8.4	36.3	61.0	60.2	44.1	41.3	12.55	10.95
100	52.8	50.7	260.4	254.2	645.2	651.6	868.7	842.4	22.8	23.1	51.9	50.7	72.4	68.4	53.2	51.4	14.3	11.21
125	67.9	66.8	328.2	302.6	782.8	802.2	962.4	928.3	243.9	24.6	66.8	65.4	84.2	82.1	70.1	69.7	19.61	13.46
150	68.2	65.4	110.6	294.3	746.2	794.2	910.9	896.8	23.6	24.2	66.5	65.2	83.6	82.3	69.4	69.6	13.51	9.15
SEd	3.25	3.14	14.15	13.21	18.72	17.64	24.63	23.70	0.20	0.21	0.18	0.20	0.56	0.60	0.12	0.38	-	-
CD (P=0.05)	7.08	6.84	0.83	28.82	40.79	38.4	53.66	51.64	0.43	0.45	0.39	0.48	1.21	1.30	0.69	0.82	-	-

(AT - Active tillering; PPI - Panicle Primordia Initiation stage; F - Flowering; H - Harvest)

available K_2O (180 kg ha^{-1}). Nitrogen was applied in 5 equal splits *viz.* basal, 7 days after transplanting (DAT), tillering (15 DAT), inflorescence initiation (30 DAT) and heading (50 DAT) stages. The observations on growth and yield parameters and yield were recorded at harvest.

Results and Discussion

Significant increase in plant height, leaf area index and drymatter accumulation was observed with each successive increase in N level from 0 to 150 kg ha^{-1}. Addition of N from 100 to 150 kg ha^{-1} did not significantly improve the above parameters. However, maximum values for growth parameters were recorded at 125 kg N ha^{-1} level (Table 1).

Yield contributing factors like number of panicles hill^{-1}, number of filled grains panicle^{-1} and grain yield of rice increased significantly with increase in N level upto 125 kg ha^{-1} (Table 1). Further increase in N from 125 to 150 kg ha^{-1} could not show significant increase in these parameters. Similar observation on yield parameters to successive increase in N levels were noticed by Rajendran and Veeraputhiran (1999) on rice. Panicles number per hill and grain yield was significantly lesser under 150 kg N ha^{-1} compared to 125 kg N ha^{-1} during 1998-99 but was comparable during 1999-2000.

During 1998-99, 125 kg N ha^{-1} produced significantly greater mean grain yield of 5.15 t ha^{-1} than 150 kg N ha^{-1}. However, the highest straw yield was observed with 150 kg N ha^{-1} and was comparable with 125 kg N ha^{-1}. In 1999-2000, 125 kg N ha^{-1} produced the highest grain (5.51 t ha^{-1}) and straw (6.71 t ha^{-1}) yields. Grain yield increased by 28, 34, 46 and 39 and 21, 29, 44 and 36 percentages over the control under 75, 100, 125 and 150 kg N during 1998 and 1999 respectively. Such a yield response of rice to applied N had also been reported by Budhar (1996).

The dry matter production increased with increase in N levels upto 125 kg ha^{-1} and further increase to 150 kg N ha^{-1} decreased the dry matter production. This indicates that the dry matter production obeys the law of diminishing returns to the successive additions of N. Increase in rates of N application upto 125 kg ha^{-1} increased the uptake of nitrogen at all crop growth stages. Significant N uptake was noticed at 125 kg

N ha^{-1} than other levels of nitrogen, however it was comparable with 150 kg N ha^{-1}. The higher uptake of N could be due to higher drymatter production at 125 kg N ha^{-1}.

The agronomic nitrogen use efficiency (ANUE) ranged from 9.15 to 19.61 and the maximum value was noticed at 125 kg N ha^{-1} (Table 2). It is normally possible to achieve an ANUE of 24 to 33 kg grain per kg of applied N (Cassman *et al.* 1995). However, the ANUE was sub-optimal in the study region and similar results were observed by Nagarajan *et al.* (1996) earlier.

Thus, the requirement of N for higher grain yield for the recently released TRY 2 (SSRC 91216) rice variety grown under sodic soil conditions was found to be 125 kg ha^{-1}. This level is found to be superior over the existing recommendation of 150 kg N ha^{-1} by elevating the excess 25 % N recommended under sodic soil conditions.

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(Received : July 2001; Revised : December 2001)