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EFFECT OF NITROGEN AND SPACING ON GRAIN YIELD AND NUTRIENT UPTAKE OF RICE UNDER SRI

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Abstract

India is one of the leading rice producer and consumer in the world. Rice is life for 50 per cent world population and 60 per cent for Indian population. The increasing food demands from an increasing population necessitate global efforts to increase rice productivity and ensure food security. In this context, this study was designed to determine the effect of nitrogen and spacing on grain yield and nutrient uptake of rice. Field investigation was conducted at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu, India. The treatments were arranged in a factorial randomized block design with three replications and plot size of 20 m^2. The 100 %, 125 % and 150 % recommended dose of nitrogen tried with 20 x 20 cm, 25 x 25 cm, 30 x 30 cm and 35 x 35 cm spacing. The results revealed that application of 150 % nitrogen with 25 x 25 cm spacing recorded the maximum grain yield and nutrient uptake.

Key words : Rice, nitrogen, spacing and SRI.

Introduction

India is one of the leading rice producer and consumer in the world. Rice is life for 50 per cent world population and 60 per cent for Indian population. Rice production needs to be increased for feeding the increasing global population. However, cultivable land resources are limited and it is critical to ensure future food security through continuous improvements in grain yields per unit area (Peng *et al.,* 2008). System of rice intensification (SRI) is an alternate to the conventional practice where fields are kept wet, not flooded with water. SRI seems to be promising to overcome the water shortage. Successful results of SRI were reported from many countries (Norman Uphoff, 2004). System of rice intensification increased the grain yield, straw yield and saved the inputs like seeds and water (Himanshu Thakkar, 2005). SRI method increased the growth characters, yield attributes, grain and straw yield than conventional method of planting (Balamurugan, 2011 and Tejendra Chapagian *et al*., 2011).

Nitrogen is the important yield limiting nutrient in rice. Application of N fertilizer is necessary to obtain a desirable grain yield. Many studies have been conducted to determine the response of rice to nitrogen application (Sakakibara *et al.,* 2006; Liu *et al.,* 2011). Spatial arrangement is an important agronomic practice which influences the performance of rice. Proper spatial arrangement have more advantages *viz.,* maximize solar utilization efficiency, improved aeration within crop canopy and provide better weed control thereby resulting in higher crop yields. The SRI method with spacing of 25 x 25 cm registered higher grain yield and nutrient uptake (Kokila *et al*., 2014 and Islam *et al*., 2014). In this context, this study was designed to determine the effect of nutrient management and spacing on grain yield and nutrient uptake of rice.

Materials and Methods

Field experiment was conducted in the Experimental Farm (11^{o}24' N, 79^o 44' E, +5.79 m MSL), Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar. The climate of study area is sub-tropical, with a mean annual temperature between 23.75 °C and 32.99 °C and an average annual rainfall of 1500 mm. The soil of the experimental field was clay loam in texture with the following properties in the upper 20 cm layer: pH 7.5, low in available nitrogen, medium in available phosphorus and high in available potassium. The treatments were arranged in a factorial randomized block design with three replications and plot size of 20 m^2. The nitrogen levels of 100%, 125% and 150% recommended dose of nitrogen tried with 20 x 20 cm, 25 x 25 cm, 30 x 30 cm and 35 x 35 cm spacing. The 15 days old seedlings were pulled out and taken to the main field and transplanted. Transplanting was done @ 1 seedling $hill^{-1}$. The spacing was adopted according to treatment. Care was taken to fill the gaps on seventh day with the same aged seedlings to maintain uniform population. The fertilizers were applied to the experimental field as per the recommended fertilizer schedule of 120:38:38 kg N, P_2O_5 and K_2O ha^{-1}. Urea (46 % N), Single super phosphate (16% P_2O_5) and

Muriate of potash (60 % K_2O) fertilizers were used to supply N, P and K nutrients, respectively. Nitrogen dose was increased as per the treatment schedule. Half dose of nitrogen and full dose of phosphorus and potassium were applied basally just before transplanting. The remaining nitrogen was top dressed in two equal splits during active tillering stage and panicle primordial initiation.

Results and Discussion

The grain yield and nutrient uptake was strongly influenced by the application of different levels of nitrogen and spacing (Table 1). Higher grain yield with higher nitrogen level might have been obtained owing to better growth which might have resulted in better utilization of solar energy and inturn led to enhanced values of yield-attributing characters, which ultimately resulted in realizing higher grain yield of rice. The optimum plant population of 16 hill m^{-2} might have utilized the available resources to the maximum extent and resulted with increased growth characters and yield attributes which contributed to higher grain yield. These results are in line with reports of Meena *et al*. (2003) and Anandan (2003).

The nutrient uptake was significantly influenced by the application of 150% nitrogen with 25 x 25 cm spacing. This may be due to increase in total dry matter production, yield and yield components *viz*., number of panicles m^{-2} and number of filled grains $panicle^{-1}$. Optimum planting configuration enhanced the superiority of the growth characters such as LAI, root proliferation and finally DMP of the crop which facilitated higher accumulation of N, P and K in the foliage, reflecting better uptake of the nutrients. Similar findings were also reported by Baloch *et al*. (2002); Ranjitha *et al*. (2011) and Sanjai Gandhi (2012).

Conclusion

The present study confirmed that the grain yield and nutrient uptake of rice were improved with increased nitrogen levels and optimum spacing. Therefore, application of 150 % nitrogen with 25 x 25 cm spacing would likely be an effective approach for utilization of nutrients and to enhance rice yields.

Table 1 : Effect of nutrient management and spacing on grain yield and nutrient uptake of rice under SRI technique

Treatments	Grain yield (t ha^{-1})	Nitrogen uptake (kg ha^{-1})	Phosphorus uptake (kg ha^{-1})	Potassium uptake (kg ha^{-1})
N_1S_1	5.15	86.73	19.28	94.40
N_1S_2	5.82	97.00	20.19	109.30
N_1S_3	5.62	95.24	19.65	100.57
N_1S_4	5.11	84.25	18.77	88.48
N_2S_1	5.24	99.11	21.70	100.61
N_2S_2	6.23	120.11	24.79	128.55
N_2S_3	5.82	105.08	22.10	105.33
N_2S_4	5.26	94.19	21.28	98.19
N_3S_1	5.31	105.02	22.20	104.46
N_3S_2	6.25	125.75	24.97	132.45
N_3S_3	5.86	107.62	22.45	110.51
N_3S_4	5.27	98.33	20.86	99.15
S.Ed	0.15	5.93	0.31	3.96
CD (P = 0.05)	0.32	12.40	0.63	8.29

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