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Effect of different Nitrogen application Techniques on the Yield and Yield Components of Fine Rice

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ABSTRACT

Effect of different nitrogen application strategies on the yield and yield components of fine rice was studied. Results revealed that ½ of the nitrogen at transplanting and remaining ½ at the tillering stage caused a significant increase in number of per hill tillers, straw yield, plant height. Nitrogen application at transplanting and tillering stage resulted in highest grain yield. However, the number of spikelets per panicle and 1000-kernel weight were not affected significantly by different nitrogen application strategies.

Key Words: Nitrogen; Application techniques; Yield; Rice

INTRODUCTION

Rice occupies an important place in cereal crops. It is the staple food of the millions of South East Asians whose number is increasing rapidly. It is also a main stay of the economy of Pakistan. Pakistan Basmati (Fine Rice) is very famous in the international market (especially in Gulf) for the aroma and softness of the kernel and hence is a very important source of foreign exchange earnings. There is a wide difference between Pakistan (2.82 t ha^{-1}) and other countries (China 6.05; Japan 6.21 and Korea Rep. 6.99 t ha^{-1}) average yield (Anonymous, 1999). An inadequate fertilizer applied through improper application technique is one of the factor responsible for low yield of rice (Chaudhary & Ali, 1982).

Availability of plant nutrients, particularly nitrogen at various plant growth stages according to the type of variety grown, is of crucial importance in rice production. Increasing the fertilizer use efficiency is very important, particularly in developing countries like Pakistan where the cost of fertilizer is rather very high and is increasing. The judicious use of fertilizers contributes a lot towards improving the yield and quality of grain (Place *et al*., 1990). The present study was conducted to find out the most appropriate N application strategy to enhance the yield of rice cv. KSK-385 under Faisalabad conditions.

MATERIALS AND METHODS

The present investigations were carried out at the experimental area of the Department of Agronomy, University of Agriculture, Faisalabad. The experiment was quadruplicated in RCBD. The net plot size was 3 m x 2 m.

Almost one month old seedlings were transplanted in the Ist week of July with row to row and hill to hill spacing of 20 cm. Nitrogen rate was 115 kg ha^{-1}. All the agronomic operations except those under study were kept normal and uniform. Nitrogen application strategies were (T_1) no nitrogen, (T_2) 1/3rd nitrogen applied each at transplanting tillering and panicle emergence, (T_3) 2/3rd at transplanting + 1/3 rd at tillering, (T_4) 2/3 at transplanting + 1/3 rd at panicle emergence, (T_5) all nitrogen at transplanting, (T_6) ½ at transplanting + ½ tillering, (T_7) ½ at transplanting + ½ at panicle emergence, (T_8) ½ at tillering + ½ at panicle emergence, (T_9) 3/4th at transplanting + ¼th at tillering and (T_{10}) 3/4th at transplanting + ¼th at panicle emergence stage.

P_2O_5 and K_2O each @ 60 kg ha^{-1} were applied at transplanting time. Data on 10 competitive plants from each plot were averaged to get plant height at maturity (cm), number of tillers per hill, number of panicle bearing tillers, number of spikelets per panicle, 1000-kernel weight (g). Grain yield per plot (kg) and straw yield per plot (kg) were recorded at harvesting.

The data so collected were analysed statistically by using Fisher's analysis of variance technique and treatments means were compared by LSD test at 5% probability level (Steel & Torrie, 1984).

RESULTS AND DISCUSSION

Plant height at maturity (cm). Plant height was significantly increased by nitrogen application (Table I). However nitrogen application strategies showed non-significant effect on plant height. Reddy *et al*. (1985) and Oh *et al*. (1990) have also reported similar type of effect of nitrogen application on plant height in rice. **Number of tillers $hill^{-1}$.** Nitrogen application resulted in significantly on number of tillers per hill as compared

Table I. Yield and yield components of fine rice as affected by different N application techniques

Treatments	N. application. strategies			Plant height at maturity (cm)	Tillers per hill	Panicle bearing tillers	Spikelets per panicle	1000-kernel weight (kg)	Grain yield per plot (kg)	Straw yield plot (kg)	Harvest index (%)
	Trans.	Tiller	P. Em.								
T_1	0	0	0	131.30 c	8.58 d	7.66 e	198.42 NS	15.32 NS	3.17 f	8.62 f	27.11 a
T_2	1/3	1/3	1/3	142.73 ab	13.31 c	12.23 abcd	221.47	15.64	5.04 abc	15.25 cd	25.10 bc
T_3	2/3	1/3	0	147.28 ab	17.05 ab	14.01 ab	214.70	16.20	4.98 abcd	15.87 bc	24.07 bcd
T_4	2/3	0	1/3	140.69 ab	13.76 c	11.68 bcd	227.09	15.20	4.70 cde	13.75 de	25.49 b
T_5	1	0	0	146.88 ab	13.13 c	10.40 d	218.90	15.84	4.58 de	14.00 de	25.01 bc
T_6	1/2	1/2	0	146.88 a	17.42 a	14.08 a	234.36	15.07	5.17 ab	17.87 a	22.55 e
T_7	1/2	0	1/2	143.88 ab	13.39 c	11.56 cd	223.10	15.00	4.36 e	13.25 e	24.86 bcd
T_8	0	1/2	1/2	145.30 ab	13.13 c	13.06 abc	206.87	15.42	4.75 bcde	15.75 bc	23.36 de
T_9	3/4	1/4	0	148.83 a	17.02 ab	13.66 abc	225.70	16.24	5.21 a	17.00 ab	23.60 cde
T_{10}	3/4	0	1/4	140.84 ab	14.00 c	11.18 c	200.00	15.50	4.81 abcd	14.50 cde	24.91 bc

Trans.=Transplanting; Till.=Tillering; P.E =Panicle emergence; NS=Non-significant

with control (Table I). Statistically highest and equal number of tillers per hill were produced where 2/3rd, ½ or 3/4th of nitrogen was applied at transplanting and the rest of it at tillering stage. Application of all nitrogen at transplanting or delaying some of it till panicle emergence resulted in statistically minimum number of tillers per hill. These findings are in agreement with those Khan and Vargara (1981) and Oh *et al*. (1990).

Number of panicle bearing tillers. The number of panicle bearing tillers were markedly affected by different nitrogen application strategies (Table I). Maximum number of panicle bearing tillers (14.08) were obtained where nitrogen was applied in two equal splits at transplanting and tillering stage. However, T_2, T_3, T_8, T_9 produced statistically similar number of panicle bearing tillers hill^{-1}. This may be partly due to nitrogen supply and partly due to more number of tillers per hill in these treatments. These results are in agreement with those of Datta (1978).

Number of spikelets per panicle. Nitrogen application over control did not influence the number of spikelets per panicle (Table I). Similarly different nitrogen application strategies also produced similar number of spikelets per panicle statistically. Although an increasing trend (24.36) was recorded in T_6. The number of spikelets per panicle may be due to the genetic make up of the specimen. These results are supported by other scientists like Keisers (1987).

1000-kernel weight (g). 1000-kernel weight was not affected by nitrogen application over control (Table I). Different nitrogen application strategies also did not effect on this character. These findings partially agree with Keisers (1987).

Grain yield (kg). Nitrogen application significantly increased grain yield over control (Table I). The data suggested that for getting maximum yield at least some nitrogen must be applied at tillering stage along with that applied at transplanting. The only exception to this behaviour was noticed in treatment where major share of total nitrogen (3/4th) was applied at transplanting and rest was applied at panicle emergence with no nitrogen application at tillering. Nitrogen applied in equal splits at transplanting, tillering and panicle emergence, 2/3rd at transplanting and 1/3rd at tillering, ½ N each at transplanting and tillering, 3/4th at transplanting and ¼th at tillering or panicle emergence gave statistically similar and highest yields of 5.04, 4.98, 5.17, 5.21 and 4.81 kg per plot, respectively. Application of nitrogen at transplanting and tillering in rice is also reported by Reddy *et al*. (1985) and Sahoo *et al*. (1990) for getting its maximum grain yield.

Straw yield (kg). Nitrogen application increased straw yield over control (Table I). As regards nitrogen application strategies, ½ nitrogen each at transplanting and tillering or 3/4th at transplanting + ¼th at tillering resulted in maximum and statistically similar straw yield. All other nitrogen application strategies resulted in less straw yield as compared with these two. Almost similar findings has been reported by Reddy *et al*. (1985).

Harvest index (%). Harvest index was significantly affected by nitrogen application over control as well as nitrogen application strategies (Table I). The maximum harvest index value (27.11) was recorded in control. Data showed an increased straw yield when nitrogen was applied but the relative increase in grain yield by nitrogen application was low. This reduced the harvest index at all plots fertilized with nitrogen. The response of N application strategies was variable.

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