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Effect of Nitrogen Application Techniques on Different Parameters of Yield in Rice (*Oryza sativa*)

Muhammad Rasheed, M. Anjum Ali, Nasir Saleem, M. Asif and M. Aslam
Department of Agronomy, University of Agriculture, Faisalabad-38040, Pakistan

Abstract

A factorial experiment comprised of two varieties viz. B-385 (V2) and KS-282 (V1) along with four fertilizer treatments, was conducted at University of Agriculture, Faisalabad. The treatments for nitrogen application techniques used were T1 (control), T2 (½ N + total P + total K applied at transplanting). T3 (1/3 N at transplanting, 1/3 N at tillering and 1/3 N at flowering stage) and T4 (total NPK applied at transplanting). V1 produced more panicles bearing tillers (7.76), 1000-grain weight (22.97 gm), paddy yield (2.92 kg), No. of tillers (8.16), No. of spikelets (122.4), 1000-grain weight (23.64), yield (2.85 kg) and harvest index (30.275). The treatment T2 followed the T3 in the above mentioned parameters which were statistically at par. PK-NK% were non-significant whereas to NK% are also behave similarly under different treatments. Tillering, panicle formation and seed setting are the critical stages contributing maximum to yield. The application of fertilizer in three split dose with a little more stress at panicle initiation stage is best technique to increase paddy yield.

Introduction

Recently the cost of fertilizers i.e. of nitrogen is increasing vertically and eventually it will become less attractive for the farmers unless its efficiency use is increased through appropriate application techniques. Abdullah *et al.* (1976) found that split application of N resulted in increased yields and efficient use of applied nitrogen. Patel (1992) found that N split dressing gave the higher yield when applied in four equal split dressing at transplanting, tillering and panicle initiation. Ramasamy *et al.* (1985) found higher grain yield with 25, 50 and 75 percent of N applied 5, 10 and 15 days after transplanted, respectively. Dubey (1993) found an increased nitrogen use efficiency when applied in split doses. Liao *et al.* (1993) and Singh *et al.* (1993) indicated that split application of N increased grain yield compared to full application at transplanting. Jhonkully *et al.* (1993) found that split application of urea in 4 splits gave higher yield compared to single and other splittings. Sato *et al.* (1993) gave their findings that split applications was better than other indigenous techniques. Das and Singh (1994) reported enhanced nitrogen use efficiency when split application of N was practiced. Singh and Singh (1994) observed an increase of 12 and 7 per cent increase in yield in KS-282 (V1) and B-385 (½) respectively by split application of nitrogen fertilizer. Son (1994) stated that application of nitrogen fertilizer was economical when used with farm yard manure. Zhi *et al.* (1994) indicated split application of N increased grain yield compared to full application at transplanting. Kim *et al.* (1995) reported enhanced nitrogen use efficiency when split application of N was practiced. Shiang *et al.* (1995) reported that application of 45 kg N/ha in 2 or 3 split dressings was superior to single dressing application for increasing yields of long duration rice cultivars. Yeo *et al.* (1995) found that split application of N in direct seedling rice resulted in increased yield and quality of rice kernal.

The present study was, therefore, undertaken to evaluate the effect of N application techniques on the yield of kernal of rice varieties commonly grown in the country.

Materials and Methods

A two year mean data experiment comprised of two varieties namely B-385 and KS-282 along with four treatments of nitrogen was laid in split plot design with four replications. Varieties and fertilizer were kept in the main and sub-plots respectively. The net plot size was 2 x 3 m with 8 plots in each replication. The plant to plant and row to row distance was maintained as 20 cm. The nursery was sown during the first week of June and transplanting by maintaining a single seedling per hill, was accomplished in the first week of July. Nitrogen at the rate of 60 kg/ha for B-385, 120 kg/ha for KS-282 in the form of urea was applied through different application techniques as T_1 (control), T_2 (½ N applied at transplanting + ½ N applied at flowering) T_3 (1/3 N at transplanting + 1/3 at tillering and 1/3 at flowering) and T_4 (total N applied at transplanting) phosphorus (P_2O_5) at the rate of 30 and 60 kg/ha for B-385 and KS-282 respectively and potash (K_2O) at the rate of 30 kg/ha and 60 kg/ha was applied respectively to B-385 and KS-282 as basal dose at transplanting.

The individual observations on the yield attributes were based on 10 hills taken at random from each plot. The paddy yield was recorded on per plot basis in kg. Plant height and panicle bearing tillers were recorded at harvesting. To observe sterility, abortiveness and opaqueness a common electric lamp and a seed working board were used. The data was pooled and analyzed statistically using the analysis of variance technique and treatment means were compared by Duncan's Multiple Range Test at 5 per cent probability level to test the difference of varieties, treatment and their interaction (Duncan, 1955).

Table 1: Effect of nitrogen application on rice *(Oryza sativa* L.)

	Plant height (cm)	No. of tillers m^2	No. of spikelet /spike	1000-grain weight	Paddy yield t ha ^{1}	Harvest index (%)
Varieties						
V1	77.53 a	7.76 b	102.83 b	22.97	2.92	37.08 a
V2	109.36 b	6.09	128.81 a	22.05	2.08	21.49 b
LSD	20.74	N.S.	22.16	N.S.	N.S.	10.92
Fertilizer level						
T1	87.30 c	5.17	105.3 c	19.75 c	1.93 c	26.71
T2	96.83 a	7.21	121.07 a	22.17 b	2.74 a	29.91
T3	96.96 a	8.10	122.10 a	23.64 b	2.85 ab	30.21
T4	91.66 b	7.07	115.92 b	23.93 a	2.41 b	29.62
LSD	3.05	N.S.	5.13	1.40	0.24	N.S.

Results and Discussion

Interaction shows non-significant results, however, the individual factors like varieties and fertilizer gave the significant impact statistically (P 0.05). The mean of varieties showed statistically highly significant results for height and harvest index. Whereas, the mean differences among panicle bearing tillers, 1000-grain weight and paddy yield were only significant. Similarly different treatments of nitrogen showed highly significant mean difference in yield, 1000-grain weight, tillers and plant height. While number of spikelets were affected significantly.

Table show that V1 produced more paddy yield than the V2 in all the treatments which may be due to inherent yield potential of the variety. Comparison of mean showed V1 possessed more number of tillers (7.76) and more harvest index (37.08) than the V2 having number of tillers and harvest index as 6.09 and 21.49 respectively. But V2 also gave more spikelets per panicle (128.81) than KS-282 (102.83). But the major cause of low yield in B-385 may be due to high percentage of sterility (1.9%) with respect of KS-282 (9.6%).

The mean square values due to treatments, were also highly significant for all the biological characters except number of spikelets per panicle (42.41). The treatments T2 and T3 produced larger paddy yield than T1 to the tune of 2.74 and 2.85 kg/plot. The application of nitrogen in three split doses resulted in more gain of paddy yield (2.85 kg/plot), number of tillers (8.10). Number of spikelets/panicle (122.10) 1000-grain weight (23.64 g), plant height (96.96 cm) and harvest index (30.21), respectively. The Table showed that the T2 was at par with T3 in respect of yield but the T2 was the best treatment to reduce the sterility percentage. Similarly the yield of T4 was at par with T2 but significant differences were observed in the cases of plant height and no. of spikelets/spike whereas 1000-grain weight was statistical high in T4 treatment. The low average yields in T1 and T4 were mainly due to high sterility percentage, less number of tillers and spikelets. So we may conclude that the application of nitrogen in split doses with a little more stress at panicle initiation stage not only will help control sterility percentage but also significantly enhance the other yield parameters also.

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