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Effect of Nitrogen on the Growth, Yield and Quality of Fine Rice

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Abstract: To evaluate the effect of different N levels on yield and yield components of BAS-385, all the agronomic operations except those under study were kept normal and uniform for all the treatments. Panicle bearing tillers were also affected and treated plots produced more panicle bearing tillers as compared to control. Among the treatments, F_4 (100 kg N ha^{-1}) produced maximum panicle bearing tillers. The spikelets $panicle^{-1}$ were produced more in treated plots than that of control. However, the difference could not reach the level of significance. Similarly the normal kernels were markedly affected by different levels of N. All the treated plots resulted in positive and desirable effects, except the control. But the difference among the treatment in general did not show any difference when compared among themselves whereas the normal kernels were increased. Paddy yield were also enhanced with the application of N and 100 kg N ha^{-1} seems to be the best under the given conditions.

Key words: Nitrogen, growth, yield and Pakistan

Introduction

Pakistan is basically an agricultural country and in agriculture sector the production of rice is taken as an effective weapon for increasing the national income. Rice (*Oryza sativa* L.) is the largest foreign exchange earner and falls next to wheat as a staple food of Pakistan. It has emerged as a major export commodity, contributing, approximately 15% to total foreign exchange earnings. About 2.25 million hectare are put under this crop annually with production potential of 4.31 million tones and the average rice yield per hectare is only 2360 kg ha^{-1} which is too low as compared with many rice growing countries of the world (Anonymous, 1996-97). Per acre yield at farmers level is very low almost the half of that of Egypt, Japan, U.S.A. and Korea. Among the various factors which can help increase the production per unit area, fertilizer being a precious input needs to be thoroughly studied to find out its best combination of nutrients which may be both economical and adequate to enhance the productivity of rice. The balanced and adequate NPK fertilizer may have direct effect on quality of kernel and the ripening, final grain yield. The indiscriminate use of fertilizer may lower the yield and deteriorate the kernel quality. The present study therefore was undertaken to see the effect of different 'N' levels on the yield and quality of fine rice.

Materials and Methods

The investigations were carried out to evaluate the effect of "Nitrogen" on the growth and yield of fine rice Bas-385. The experiment was conducted at Agronomic Research Area, University of Agriculture, Faisalabad. The experiment was laid out in Randomized Complete Block Design with four replications having a net plot size 2m x 3 m. The seed for raising seedlings was sown in last week of May and transplanting was done in the first week of July. There were 10 lines in each plot having a row to row and hill to hill distance of 25cm x 20cm. All the agronomic operations except those under study were kept normal and uniform for all the treatments. The treatments included in the experiment were as follows:

F_0 = 0, F_1 = 40, F_2 = 60, F_3 = 80, F_4 = 100 and F_5 = 120 kg N ha^{-1}. Phosphorous at the rate of 30 kg ha^{-1} was applied as basal dose where as N was applied in two doses i.e. 1/3 at first irrigation and 2/3 at fourth irrigation.

The following observations were recorded i.e. final plant height (cm), number of panicle bearing tillers, number of spikelets per panicle, normal kernel (%), 1000-grain weight (gm) and grain yield $plot^{-1}$ (kg).

Ten plants from each plot were randomly selected to record the observations like final plant height, panicle bearing tillers and normal kernels were differentiated and counted separately for further analysis. The data so collected were analysed statistically by using the analysis of variance technique and Duncan's New Multiple Range test at 5% probability level was applied to see the differences in treatment means. (Steel and Torrie, 1984).

Results and Discussion

Final plant height (cm): It is revealed from the data that the plant height was substantially affected by the different levels of N. All the treated plots resulted in more plant height as compared to control. Among the treatment F_5 (120 kg N ha^{-1}) produced the plant with maximum height. This treatment differed statistically from treatments F_1 (40 kg N ha^{-1}) F_2 (60), F_3 (80) and F_4 (100 kg N ha^{-1}). More plant height recorded in F_5 (120kg N ha^{-1}) may be due to appropriate N levels. Maximum plant height was obtained with the application of 120kg N ha^{-1}. More plant height resulted in case of application of higher level of N fertilizer may be due to adequate availability of N which is essential for maximum growth of plant. These results are quite in line with those of Awan *et al.* (1984) who reported that maximum plant height (98.1 cm) was obtained with 138 kg N ha^{-1}.

Panicle bearing tillers: Panicle bearing tillers show that the effect of application of different N levels did markedly influence the panicle bearing tillers.

All the levels of N fertilizer gave more panicle bearing tillers as compared to control (F_0). Among the treatments, F_4 (100 kg N ha^{-1}) produced maximum panicle bearing tillers (11.57) although this treatment did not differ from treatment F_5 (120) where it was 10.43. Rest of the treatments F_1 (40) and F_2 (60) were next to follow the control. It can be suggested from the data that to get optimum panicle bearing tillers 100 kg N ha^{-1} seem to be the most appropriate level. More panicle bearing tillers in treatment F_4 (100) may again be due to the sufficient Nitrogen availability prior to and at the time of panicle

Table 1: Effect of nitrogen on the growth, yield and quality of fine rice

Treatments/ Level of N kg ha ^{1}	Final plant height (cm)	Panicle bearing tillers	Spikelets panicle^{-1}	Normal kernels	1000-grain weight (gm)	Paddy yield kg plot^{-1}
F_0 (0) Kg Nha^{-1}	57.41 c	6.903 d	100.8 b	62.09 d	18.60 c	1.5 c
F_1 (40) Kg Nha^{-1}	74.33 b	7.980 bcd	143.2 a	82.00 c	19.61 abc	1.9 abc
F_2 (60) Kg Nha^{-1}	75.47 b	9.605 abc	127.2 a	83.70 ab	20.24 ab	1.7 bc
F_3 (80) Kg Nha^{-1}	74.97 b	7.813 cd	127.5 a	83.84 ab	20.91 a	2.0 ab
F_4 (100) Kg Nha^{-1}	77.40 b	11.57 a	126.1 a	84.94 a	20.29 ab	2.5 a
F_5 (120) Kg Nha^{-1}	80.88 a	10.43 ab	123.5 a	83.31 bc	18.99 bc	2.1 ab

Any two means not sharing a letter differ significantly at 0.05 probability level.

emergence. These results are partly in agreement with those of Das-Gutta (1969) who reported that nitrogen increased the number of panicle bearing tillers.

Spikelets panicle ^{1}: The data clearly shows that application of different N levels did effect the number of spikelets panicle^{-1} and all the N levels resulted in more per panicle spikelets as compared to control. Within the treatments all the treatments except control F_0 produced statistically similar number of spikelets panicle^{-1}. Treatment F_0 is statistically different from rest of the treatments which produces less number of spikelets than rest of the treatments. Application of N fertilizer at (40 kg N ha ^{1}) seems to be essential to get an appropriate spikelets panicle ^{1} and Nitrogen fertilizer application showed better performance at spikelets formation stage. These results are supported by Subbiah *et al.* (1975) who reported that nitrogen application increased the spikelets per panicle.

Normal kernels (%): The data indicate that the normal kernels were substantially affected by application of different level of N. Data showed that maximum number of normal kernels (84.94%) are obtained in treatment F_4 (100). But when this treatment is compared with treatments F_2 (40) and F_3 (80) it show no significant differences. This treatment F_4 (100) is significantly differ with F_5 (120), F_1 (40), F_2(60) and F_3(80). Minimum number of normal kernels (62.09) were obtained under controlled conditions where no nitrogen was applied. Treatment F_4 (100) seems to be suitable and appropriate level to get maximum normal kernels. These results are in agreement with those of reported by Chaudhry *et al.* (1985).

1000-grain weight (gm): The maximum 1000-grain weight (20.91) was obtained under treatment F_3 (80 kg N ha^{-1}) which did not differ from treatments F_2 (60) and F_4 (100). Next to follow were treatments F_5 (120) AND F_1 (40) which again however, did not show any difference when compared with each other. Minimum 1000-grain weight (18.60%) was obtained under control conditions. So the treatment F_3 (80) kg N ha^{-1} seems to be the most appropriate level to obtain maximum 1000-grain weight. These results are in contradiction with those of reported by Singh and Modgal (1978) and Awan *et al.* (1984) reported that 1000-grain weight were significantly high in treatments where nitrogen was applied.

Paddy yield kg plot^{-1}: The treated plots resulted in more paddy yield than that of control (F_0). Among the treatments, treatment F_4 (100 kg N ha^{-1}) produced more paddy yield. This treatment however, did not differ significantly with treatments F_5 (120) and F_3 (80) when compared with each other. Next to follow were treatments F_1 (40) and F_2 (60). These treatments differ statistically with treatment F_4 (100) but these treatments did not differ statistically when compared with each other. The treatment F_0 (control) being the last one showed less paddy yield than all the other treatments. It is further indicated that to get increased yield the application of N to the level of 100 kg ha^{-1} is the most appropriate. These results are in conformity with those of Place *et al.* (1970). Chen *et al.* (1984) Dixit and Patro (1994) reported that 120 kg N ha^{-1} gave more paddy yield.

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