RESPONSE OF RICE CROP (SUPER BASMATI) TO DIFFERENT NITROGEN LEVELS.

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ABSTRACT

Field experiment was conducted during the kharif seasons of three successive years from 2000 to 2002 at Rice Research Institute, Kala Shah Kaku, Lahore, Pakistan to find out the most appropriate level of nitrogen to get maximum paddy yield of rice variety, Super Basmati. Effect of nine different nitrogen levels i.e. 0, 50, 75,100,125,150,175,200 and 225 kg/ha on paddy yield and yield components were studied in this experiment. Plant height, number of productive tillers per hill, panicle length, number of grains per panicle, 1000 grain weight and paddy yield showed increasing trend from 0 kg N/ha up to 175 kg N/ha. The yield parameters including paddy yield, number of grains per panicle and 1000 grain weight started declining at 200 kg N/ha level and above . Maximum paddy yield (4.24 t/ha) was obtained from 175 kg/ha nitrogen application treatment which also produced highest values of number of grains per panicle (130.2) along with a maximum 1000 grain weight (22.92 gm). The plant height (139.8 cm) along with number of productive tillers per hill (23.42) and panicle length (29.75 cm) was maximum at 225 kg N/ha level.

Key words: Rice; nitrogen levels; parameters; paddy yield; plant height

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INTRODUCTION

Rice (*Oryza sativa* L.) is an important food of the world. It is the staple food of the people of South-East-Asia and at present more than half of the world population subsists on this crop. Rice is also one of the most important cereals of Pakistan and occupies second position after wheat .It is a very important source of foreign exchange earning giving about US $ 933 annually through its export, in Pakistan. Rice is grown on an area of 2.5 million hectares, with an annual production of 4.95 million tons giving an average yield of 2806 Kg/ha (Anonymous, 2003-04). Inspite of huge efforts on the part of the research works and the government, its production have not been increased according to the genetic potential. Average yield of fine rice is much below than its production potential. There are a number of factors contributing to this yield gap. There is no alternative, than to use more plant nutrients for high productivity (Ahmad, 1992).

Since fertilizer is an expensive and precious input, determination of an appropriate dosage of application that would be both economical and appropriate to enhance productivity and consequent profit of the grower under given situation needs intensive study. At present the world is facing the problem of shortage of major fertilizer nutrients especially nitrogen. The developing countries like Pakistan are more sensitive to this shortage because the fertilizer production in these countries is expensive and less than its demand. Even when the fertilizer supply is satisfactory, the importance of increasing its use efficiency cannot be underestimated. The application of nitrogen fertilizer either in excess or less than optimum rate affects both yield and quality of rice to remarkable extent, hence proper management of crop nutrition is of immense importance.

Rice grain yield was recorded significantly highest between range of 90-250 Kg per ha nitrogen application (Kanade and Kalra, 1986; Marazi *et al*., 1993; Dixit and Patro, 1994; Daniel and Wahab; 1994; Bali *et al*., 1995; Spanu and Preneddu, 1997; Nawaz, 1999; Meena *et al*., 2003). An increase in nitrogen supply increased the plant height (Awan *et al*., 1984; Singh and Sharma, 1987; Irshad, 1996; Maqsood 1998; Meena *et al*., 2003), dry matter / straw yield and N,P,K and Ca uptake (Barner, 1985; Park, 1987; Munda, 1989; Rafey *et al*., 1989; Hussain *et al*., 1989; Mahabari *et al*., 1996; Nawaz, 1999; Meena *et al*., 2003). A significant increase in tillering (Ramasamy *et al*., 1985; Munda, 1989; Maqsood, 1998) and number of tillers per hill (Hussain *et al*., 1989; Irshad, 1996; Nawaz, 1999; Meena *et al*., 2003) with increase in nitrogen supply was observed. With increasing rate of nitrogen application, spike length (Singh and Sharma, 1987; Rafey *et al*., 1989; Maqsood, 1998; Nawaz, 1999), number of grains per panicle and 1000-grain weight (Awan *et al*., 1984; Rafey *et al*., 1989; Munda, 1989; Maqsood, 1998) were significantly increased. The present study is therefore, conducted to find out the most optimum economic dose of nitrogen at which rice variety Super Basmati gave maximum paddy yield.

MATERIALS AND METHODS

Studies were carried out during the kharif seasons of three successive years from 2000 to 2002 at experimental area of Rice Research Institute, Kala Shah Kaku, Lahore, Pakistan to find out the most appropriate dose of nitrogen fertilizer for rice variety Super Basmati. The physiochemical properties of experimental site are given in table 1. Urea, diammonium phosphate (DAP) and sulphate of potash (SOP) were used as nitrogen, phosphorous and potassium sources, respectively. Nine levels of nitrogen corresponding to 0, 50, 75,100,125,150,175,200 and 225 kg per hectare formed the treatment variables whereas phosphorus and potash were kept constant @ 50 and 50 kg per hectare in each treatment except control where no fertilizer was used. The trial was set up in a randomized complete block design with three replications. The unit plot size was 6m x 9m (54m^2). Phosphorus and potash were applied basely (at transplanting) whereas nitrogen was applied in 3 equal splits viz. 1/3 at transplanting, 1/3 at 50 % tillering (8-12 t1illers / hill) and remaining 1/3 at panicle initiation.

Table: 1 Some physical and chemical properties of the soil used for the study

Parameter	0-6 Inch Depth	6-12 Inch Depth
E.C. mS\Cm	1.1	1.0
Soil pH	7.8	7.9
Organic Matter %	0.90	0.63
Nitrogen %	0.045	0.032
Available Phosphorous	8.3	7.1
Available Potash	113	130
Saturation % age	38	36
Texture	Clay Loam	Clay Loam

Nursery of rice variety Super Basmati was sown in the 2nd week of June and transplanted at 30 days after planting (DAP). $ZnSO_4$ containing 35% zinc was applied @ 12.5 kg per hectare at 12 days after transplanting (DAT) to eliminate zinc deficiency. Other agronomic and plant protection practices were kept optimum. The crop was harvested each year in the second week of November. The plant height, number of tillers per hill and panicle length was noted at maturity whereas yield and yield components were recorded at harvest. Data were subjected to analysis of variance using Fisher's analysis of variance technique and treatment means were compared with standard (control) by Least Significant Difference (LSD) test (Steel and Torrie, 1984). The differences were only considered when significant at $p \leq 0.05$. As the results obtained during three years were similar therefore, these were pooled.

RESULTS AND DISCUSSION

The results of mean data of three years from 2000 to 2002 showed that plant height, number of productive tillers per hill, panicle length, number of grains per panicle, 1000 grain weight and paddy yield were significantly influenced by different nitrogen application treatments (Table 2). Maximum plant height of 139.8 cm was recorded in treatment where 225 kg/ha nitrogen was applied which remained statistically at par with that obtained by nitrogen application levels of 175 and 200 kg/ha. However minimum plant height (128.0 cm) was achieved in control treatment where no fertilizer was applied. Singh and Sharma (1987) reported that application of 180 kg N per hectare resulted in higher plant height of rice. Maqsood (1998) and Meena *et al.*, (2003) also reported similar results. The increase in plant height with increased N application might be primarily due to enhanced vegetative growth with more nitrogen supply to plant.

Rice plants produced more number of productive tillers per hill (23.42) as well as longest panicles (29.75 cm) where 225 kg nitrogen per hectare was applied which remained statistically at par with that obtained by nitrogen application levels between 125 to 200 kg per hectare. The lowest values of number of productive tillers per hill (18.17) and shortest panicles (25.03 cm) were recorded in control treatment receiving no fertilizer. These results are in line with those reported by Singh and Sharma (1987), Rafey *et al.* (1989), Munda (1989), Maqsood (1998), Nawaz (1999) and Meena *et al.*, (2003). Enhanced tillering by increased nitrogen application might be attributed to more nitrogen supply to plant at active tillering stage. The longer panicles obtained in treatments receiving higher nitrogen rates were probably due to better nitrogen status of plant during panicle growth period.

Numbers of grains per panicle were more (130.2) at a nitrogen level of 175 kg/ha which remained statistically at par with that obtained by nitrogen application levels between 125 to 225 kg per hectare. The lowest value of this parameter (121.1) was recorded in control treatment receiving no fertilizer. These results are in line with those reported by Singh and Sharma (1987), Rafey *et al.* (1989), Munda (1989); Maqsood (1998) and Nawaz (1999). The more number of grains per panicle obtained in treatments receiving higher nitrogen rates were probably due to better nitrogen status of plant during panicle growth period.

1000 grain weight was highest (22.92 g) in treatment getting 175 kg/ha nitrogen level which was statistically similar with that produced by each of the nitrogen level of 150, 200 and 225 kg/ha. Zero kg/ha nitrogen (control) obtained minimum (19.13 g) grain weight. Similar results were also noted by Awan *et al.* (1984), and Rafey *et al.* (1989). Increase in grain weight at higher nitrogen rates might be primarily due to increase in chlorophyll content of leaves which led to higher photosynthetic rate and ultimately plenty of photosynthates available during grain development.

The treatment where 175 kg nitrogen per hectare was applied produced a maximum (4.24 t/ha) of paddy yield which is statistically similar with that obtained in 150, 200, and 225 kg/ha nitrogen application treatments. The lowest paddy yield (2.24 t/ha) was recorded in control treatment where no fertilizer was applied. Kanade and Kalra (1986) and Spanu and Pruneddu (1997) also reported a highest paddy yield by nitrogen application of 150 kg/ha and 250 kg/ha, respectively. The higher paddy yield at higher nitrogen rates was also reported by Marazi *et al.* (1993), Dixit and Patro (1994), Daniel and Wahab (1994), Bali *et al.* (1995), Nawaz (1999) and Meena *et al.*, (2003). The highest paddy yield at 175 kg per hectare N application was due to highest number of grains per panicle and 1000 grain weight at this nitrogen rate. A decline in paddy yield at 200 and 225 kg N per hectare level might be due to reduction in number of grains per panicle and 1000 grain weight at this N level.

Table 2: Plant Height, Panicle Length, Yield and Yield Components of Super Basmati as Influenced by Different N Application Rates (Mean of 3 years).

Tr. No.	Fertilizer rates $N\text{-}P_2O_5\text{-}K_2O$ (kg/ha)	Plant height (cm)	No of tillers/hill	Panicle length (cm)	No. of grains/ panicle	1000 grain weight (g)	Paddy yield (t/ha)
T_1	0 – 0 – 0	128.0^{e}	18.17^{d}	25.03^{e}	121.1^{e}	19.13^{e}	2.24^{e}
T_2	50-50-50	133.4^{d}	19.62^{cd}	26.68^{d}	125.5^{d}	20.56^{d}	3.32^{d}
T_3	75-50-50	134.3^{d}	20.58^{bc}	27.81^{c}	126.6^{cd}	20.88^{cd}	3.54^{cd}
T_4	100-50-50	135.2^{cd}	20.87^{bc}	28.39^{bc}	127.4^{bc}	21.09^{cd}	3.67^{c}
T_5	125-50-50	135.7b^{cd}	21.66^{ab}	28.81^{ab}	128.6^{ab}	21.42^{bc}	3.82^{bc}
T_6	150-50-50	136.2b^{cd}	22.37^{ab}	29.05^{ab}	129.7^{a}	22.68^{a}	4.17^{a}
T_7	175-50-50	137.4^{abc}	22.72^{a}	29.42^{a}	130.2^{a}	22.92^{a}	4.24^{a}
T_8	200-50-50	138.3^{ab}	23.18^{a}	29.63^{a}	129.6^{a}	22.62^{a}	4.19^{a}
T_9	225-50-50	139.8^{a}	23.42^{a}	29.75^{a}	129.4^{a}	22.21^{ab}	4.09^{ab}
	LSD	2.930	1.805	0.9417	1.739	0.7970	0.3238

Means having same letter do not differ significantly ($P \leq 0.05$)

Table 3: Analysis of variance table of means square of yield & yield components

Sourse	DF	plant height (cm)	No. of tillers /hill	Panicle length (cm)	No. of grains / panicle	1000 grain wt (gm)	Paddy yield (t/ha)
Repli-cation	2	0.391	3.900	0.156	0.354	0.414	0.016
Treat-ments	8	34.688**	9.208**	7.317**	25.162**	4.585**	1.208**
Error	16	2.865	1.087	0.296	1.009	0.212	0.035

** = significant ($P<0.01$)

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