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RESPONSE OF KERNEL DtMEN8tt:>NSOF FINE RICE TO DIFFERENT NPK LEVELS AND N-APPUCATION TECHNIQUES

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A field study was conducted in two Kharif seasons 1995 and 1996 on a sandy clay loam soil to see the effect of different NPK levels and N-application techniques on kernel dimensions of fine rice, Basmati-385. Maximum kernel length in primary and secondary branches of panicle was obtained with NPK level of 180-90-90 kg ha', whereas minimum was obtained with 60-0-0 kg ha"'. However, other kernel dimensions such as kernel width, kernel thickness and length/width ratio were not significantly influenced by different NPK levels. Nitrogen application technique N_3(1/3 N at transplanting + 1/3 at tillering + 1/3 at panicle initiation) resulted in maximum kernel length, kernel thickness and length/width ratio in primary branches and kernel length and kernel thickness in secondary branches of panicle during both the study years.

Key words: fine rice, kernel dimensions, response to NPK levels

INTRODUCTION

The increasing importance of quality is apparent from recent shifts in research emphasis. Of course, the importance of q-uality varies across countries. It is less important as a breeding and management objective where rice self-sufficiency is the permanent goal but it is more important where market competition is vital.. In Pakistan, Basmati rice is a major source of foreign exchange. At present Pakistan is earning nearly 364 million US dollars annually from rice export (Anonymous, 1996-97).

Among the various quality parameters, grain size and shape should be considered in quality improvement along with milling because these determine the market acceptability of milled rice (Santha *et a/.,* 1997), Long, selender rice grain fetches a high price in the international market. Although under normal conditions, the kernel dimensions are genetically controlled, but under stress conditions, appropriate cultural and management practices do contribute to increased kernel length, width and thickness (Khan, 1991). The present investigations were carried out to ascertain the response of kernel dimensions to different NPK levels and N-application techniques.

MATERIALS AND METHODS

The present investigations were carried out at the Agronomic Research Area, University of Agriculture, Faisalabad for two Kharif seasons 1995 and 1996 in a split plot design with 4 replications. The treatments consisted of 3 NPK levels i.e. 60-0-0 (F,), 130-67-67 (F_2) and 180-90-90 (F) kg ha 1 as main plot and 3 N application techniques, i.e. all N at transplanting (N,), 1/2 N at transplanting + 1/2 N at tillering (N_2), 1/3 N at transplanting + 1/3 at tillering + 1/3 at panicle initiation (N) as subplot treatments. Phosphorus and potassium were applied and incorporated as a basal dose. The soil of the experimental field was sandy clay loam with pH 7.8, organic matter 0.22 %, total N 0.051 %, available P 5 ppm and K 176 ppm. Twenty-five days old seedlings of rice variety, Basmati-385, were transplanted in 1st week of July in both the years at a spacing of 20 x 20 cm in a net plot size of 2 x 3 m with one seedling/hill..

Kernel dimensions (length, width and thickness) of milled rice in primary and secondary branches were taken on 100 normal kernels from each treatment with the help of a dial caliper. Length/width ratio was calculated from these values. Fisher's analysis of variance technique and LSD test at 5% level of probability was applied to compare the differences among treatment means (Steel and Torrie, 1984).

RESULTS AND DfSCUSSION

Kernel Dimensions in Primary Branches of Panicle: The data on kernel length given in Table 1 indicated that NPK levels significantly affected the kernel length in 1995. The two years mean data showed a similar significant increase in kernel length as observed in 1995. Treatment F_3 (180-90-90 kg ha"') resulted in significantly longer kernels which, however, did not differ from F_2 (130-67-67 kg ha') for 1995 as well as for two years mean data. Kernel width and thickness

Table 1. Effect of NPK levels andN-~£~!!~iOn techniques on kernel length 'mm)In primary and secondary branches panicle"ι .

Treatment	Pfl~~branches			$econdary .branches		
	1995	,	Mean	1995	.1'996	Mean
A. NPK levels (kg ha"¹)						
Fl: 60-0-0	6.852b	6.791"	6.824b	6,482b	6.726	6.604
F2: 130-67-67	6.938a	6.927	")i.932a	6.627a	6.707	6.667
F3: 180-90-90	6.956a	6.898'	";6;927a	6.664a	6.798	6.731
LSD	0.07	NS	<O~~	0.13	NS	NS
B. N-application techniques						
N1: All N at transplanting	6.734b	6.883	6.850b	6.532b	6.716b	6.624b
N2: 1/2 N at transplanting + 1/2 N at tillering	6.933a	6.978	6.955a	6.561b	6.687	.6.624b
N3: 1/3 N at transplanting + 1/3 at tillering + 1/3 at panicle initiation	7.077a	6.862	6.970a	6.681a	6.828	6.755a
LSD	0.18	NS	0.10	O.dj~,,	NS	0.09

NS = Non-~ignificant; means followedbV different letters in a column aresignificafltlyfdif~.r~.nt atO.oS P

Table 2. Effect of N-application techniques on kernel thickness (mm) in primary andsecbflll:~.l;)ranches panicle"

Treatment	Primary branches			Secondary branches		
	1995	1996.	Mean	1995	1996	(Mean
B. N-application techniques						
NI : All N at transplanting	1.60;3b	1.688	1.645b	1.661 a	1.672	1.666a
N2: 1/2 N at transplanting + 1/2 N at tillering	1.706a	1.658	1.682a	1.677a	1.667	1.6728
N3: 1/3 N at transplanting + 1/3 at tillering + 1/3 at panicle initiation	1.714a	1.640	1.677ab	1.60ob	1.649	1.625b
LSD	0.05	NS	0.03	0.04	NS	0.03

NS = Non-significant; means followe'(j by different letters in a column are significantly different at 0.05 P.

Table 3. Effect of different NPK levels and N-application techniques on kernel length/width ratio

Treatment	1995	1996	Mean
A. NPK levels (kg ha"¹)			
Fl: 60-0-0	3.586b	3.786	3.686b
F2: 130-67-67	3.677a	3.818	3.747a
F3: 180-90-90	3.649ab	3.708	·3.679b
LSD	0,07	NS	0.05
B. N-application techniques			
N1: All N at transplanting	3.542b	3.691	3.616b
N2: 1/2 N at transplanting + 1/2 N at tillering	3.649a	3.769	3.709
N3: 1/3 N at transplanting + 1/3 at tillering + 1/3 at panicle initiation	3.720a	3.852	3.786a
LSD	0.07	NS	0.10

NS = Non-significant; means followed by different letters in a column are significantly different at 0.05 P.

(data not given) were not affected by NPK levels in both the years of experimentation. However, kernel length/width ratio (Table 3) was significantly influenced by NPK levels during 1995 and for two years mean data. Treatment F_2 (130-67-62 kg ha^{-1}) resulted in maximum kernel length/width ratio as compared to the minimum in F_1 (0-0-0 kg ha^{-1}) which did not differ from F_3 in 1995. Kernel dimensions inp;:irr}ary branches further showed that N-application, techniquss significantly affected the kernel length (Table 1), kernel thickness (Table 2) and kernel length/width ratio (Table 3) in 1995 and for two y~ars mean data. Treatment N_3 {~sulted in si9niti~antly more kernel lenqth, kernel thickness and' hi,-,. ker<ne!length/width ratio during the correspoR<;i.i..;'period. Kernel width was hot affected. sjgfti~antly (data not shown). Increased kernellef.\i$~'~nd kernel length/width ratio in F_3 and F_2 CQulAt., due to adequate supply of NPK in these trea;tffi.o~~ which might have helped in starch filling a~l!l: .~mpactness in kernels through better 5l~s-ynthetic activity. Similarly, increased length and-! thickness of kernel and length/width ratio in N_3 might be explained on the basis of sustained supply of N which improved synthesrs and translocation of carbohydrates to fil: the" kernels to initiate and enhance translucency of endosperm, consequently *leading* to optimum kernel length and thickness. These results are partially in ag(cerne:1twith those of Khan (1991) who reported that improved physiological activities of plant do help to fill the rice kernels to a desired extent.

Kernel Dimensions in Secondary Branches of Panicle: The data regarding kernel length in secondarv branches (Table '1) indicated that NPK levels significantly affected the kernel length in 19.95. In contrast, in 1996, according to two years mean values, differences among different treatments could not attain.: the level of significance, although F_3 resulted in increased kernel length. The data on kernel width, thickness and kernel length/width ratio were found to be non-significant. These results conform to those of Khan (1991) who reported that when there was no noticeable stress of any kind, kernel dimensions were controlled by the genome of a rice cultivar ,

Data on kernel dimensions in secondary branches further indicated that N-application techniques sigH~cantly affected the kernel length (Table 1) in 'j 9a5,as well as for two yeers pooled data. Treatment N_3 pr-oduced longer kernels.as cQmpared to minimum kemellength obtained in N~ (all N at transplanting). N_1 again was statistically equal to N_2 (1/2 Nat transplanting + 1/2 N at tilleringl in 1995 and for two ¥':;lats mjan oat,a, Simila,' trend was observed in kernel, thickness as was noticed for kernel length. Other kernel dimensions such as width, and length/width ratio in secondary branches were not affected significantly. Longer kernels with N_3 could be due to increased nitrogen assimilation and photosynthetic activity which probably resulted from late nitrogen application as reported by Zhou *et el.* (1992).

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