EVALUATION OF RICE GENOTYPES FOR AGRONOMIC AND YIELD RELATED TRAITS

BY

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DECLARATION

This thesis is my original work and has not been presented for an award of a degree in any other university.

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GENERAL ABSTRACT

The demand for rice in Kenya is high while production has remained far below consumption demand for quite a number of years. Growing of poorly adapted varieties with undesirable traits is one of the major factors limiting production. The specific objectives of this study were a) to determine the performance of rice cultivars for both agronomic and yield related traits and b) to determine the combining ability and heritability of agronomic and yield traits among the rice genotypes. Seven rice genotypes namely Basmati 370, Kuchum, Komboka, Mwur 4, Nerica 1, Duorodo and Nerica 4 were crossed in a North Carolina II mating design to generate F_1 hybrids. The 12 F_2 seeds, 7 parents and 1 check variety which made a total of 20 entries were planted at Kenya Agricultural and Livestock Research Organization -Mwea. Each genotype was planted in a plot size of 3 × 3 m, at inter-row spacing of 20 cm and intra spacing of 15 cm in a randomized complete block design replicated three times. Leaf blast severity data was scored based on a SES scale from IRRI. Further phenotypic characterization of these rice germplasm was done by collecting agronomic and yield data namely plant height, productive tillers, SPAD, days to anthesis, days to heading, days to maturity, filled grains,1000 grain weight, panicle length, grain length and grain yield. The data collected was subjected to analysis of variance using the PROC ANOVA procedure of Genstat program 15th Edition. The genotype means were separated using the Fisher's protected least significant differences (LSD) test at 5% significance level. To determine combining ability, data of each trait was analyzed using SAS (Version 9.3) program. Rice genotypes were significantly different for all the agronomic and yield traits except SPAD, filled grains and thousand grain weight. The parents, Nerica 4, Nerica 1, Mwur 4 and hybrids generated from a cross between Nerica 4 and Mwur 4, Nerica 1 and Kuchum and Nerica 1 and

Komboka showed significantly shorter duration to flowering. The maturity period varied greatly with Nerica 4, Nerica 1 and Mwur 4 maturing early while BW 196 and BS 370 were late. Significant higher plant height was recorded in Duorodo. Similarly, BW 196 and a hybrid cross generated between Nerica 1 and Kuchum produced significantly higher number of productive tillers. From this study, Mwur 4 and Nerica 1 recorded significantly higher grain yield. Correlation analysis revealed that genotypes with a high number of filled grains, thousand seed weight, longer panicle length and longer grain length had high yield while those with few panicles per plant had lower yield. The parents, Nerica 4, Duorodo and hybrids generated from a cross between Nerica 4 and mwur 4 and Nerica 1 and mwur 4 combined low leaf blast severity and early flowering. The study revealed that the mean square GCA (m) were significantly different for all traits except SPAD while for GCA (f) significant differences were recorded in all traits except productive tillers, panicles per plant and thousand grain weight. SCA showed significant differences for all traits measured. Further analysis using General Predictability Ratio revealed that agronomic and yield traits were governed by non-additive genes. The parents, Komboka, Mwur 4 and Nerica 4 were good general combiners for grain yield, filled grains and had shorter duration to flowering. The hybrids generated from a cross between Mwur 4 and Nerica 4 and Komboka and Nerica 4 were the best crosses for grain yield, filled grains and had minimum days to 50% days to flowering. No single parent or specific cross contained all desirable traits hence to develop a high yielding genotype, a combination of desirable traits may be introgressed into adapted rice genotypes. The three parents with good general combining ability for grain yield could be used in a hybridization program to introgress yield traits into adapted low yielding lines. The two best specific combiners could be exploited for heterosis breeding. The genotypes should be further screened under different

environments for several seasons to conclusively determine resistance to prevalent races of the blast pathogen.