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Screening Upland rice Genotypes for Zinc Use Efficiency

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INTRODUCTION

Soils of the Cerrado region are mostly Oxisols and Ultisols.

Zinc deficiency is Brazilan Oxisol is widely reported in annual crops like upland and lowland rice, corn and wheat (Fageria and Baligar, 1997; Fageria and Zimmermann, 1998; Fageria, 2001; Fageria, 2009).

The main region of Zn deficiency in these soils is low natural level of zinc and use of lime which increases soil pH and consequently Zn uptake (Fageria et al. 2002).

Genotypic variation in Zn use efficiency in crop plants is widely reported in annual crops (Graham, 2008; Fageria and Stone, 2008; Fageria et al. 2008a). Use of Zn efficient genotypes is an important strategy in correcting this nutrition disorder in crop plants. **The objective of this study** was to evaluate Zn use efficiency of 20 upland rice genotypes.

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METODS

A greenhouse experiment was conducted at the National Rice and Bean Research Center of EMBRAPA, Santo Antônio de Goiás, GO, Brazil.

The Zn treatment used were 0 mg kg^{-1} (natural level of the soil) and 20 mg kg^{-1} of soil using zinc sulfate with 23% of Zn. The genotypes tested were: BRA 01506, BRA 01596, BRA 01600, BRA 02535, BRA 02601, BRA 032033, BRA 032039, BRA 032048, BRA 032051, BRA 042094, BRA 042156, BRA 042160, BRA 052015, BRA 052023, BRA 052033, BRA 052034, BRA 052045, BRA 052053, BRS Primavera and BRS Sertaneja.

RESULTS

Table 1. Plant height and straw dry weight of 20 upland rice genotypes as influenced by Zn fertilization

Genotype	Plant height (cm)	Shoot dry weight (g $plant^{-1}$)	
		Zn_0	Zn_{20}
BRA 01506	115abcde	9.64ab	12.15abcd
BRA01596	108cdefg	7.57b	10.34bcdef
BRA01600	118abcd	8.92ab	13.11abc
BRA02535	124ab	11.03ab	16.11a
BRA02601	99fg	8.66ab	13.31abc
BRA032033	102efg	9.85ab	14.23ab
BRA032039	104efg	9.58ab	12.82abc
BRA032048	107cdefg	8.38ab	10.81bcdef
BRA032051	119abc	8.59ab	10.42bcdef
BRA042094	119abc	10.70ab	11.41bcdef
BRA042156	127a	9.61ab	9.23cdef
BRA042160	126a	11.85a	11.85bcde
BRA052015	112bcdef	8.55ab	9.47cdef
BRA052023	105defg	11.68a	10.34bcdef
BRA052033	98g	10.79ab	7.96ef
BRA052034	103efg	9.71ab	9.12cdef
BRA052045	104efg	11.15ab	12.02abcde
BRA052053	125ab	9.60ab	7.57f
BRS Primavera	123ab	9.83ab	8.31def
BRS Sertaneja	112bcdef	11.55a	10.33bcdef
Average	112	9.86a	11.04a
F-Test			
Zn level (Zn)	NS	NS	
Genotype (G)	**	**	
Zn X G	NS	**	
CVZn (%)	8.10	31.95	
CVG (%)	5.57	10.07	

**, NS Significant at th 1% probability level and not significant, respectively. Means followed by the same letter in the same column are not significantly different at 5% probability level. Means of the average values are compared at low and high Zn levels.

Table 2. Grain yield and panicle number of 20 upland genotypes as influenced by zinc fertilization

Genotype	Grain yield (g $plant^{-1}$		Panicle number ($plant^{-1}$)	
	Zn_0	Zn_{20}	Zn_0	Zn_{20}
BRA01506	7.81def	13.51a	3.66ab	5.33abc
BRA01596	9.47abcd	12.70ab	4.00ab	5.66abc
BRA01600	7.66ef	11.46abc	3.66ab	4.66abc
BRA02535	7.92def	10.61abcdef	4.33ab	6.33ab
BRA02601	7.88def	10.92abcd	4.33ab	6.33ab
BRA032033	7.94def	11.74abc	4.66ab	7.00a
BRA032039	7.76def	12.07abc	4.00ab	6.00abc
BRA032048	8.03cdef	9.83bcdefg	3.66ab	6.00abc
BRA032051	7.89def	10.11bcdef	4.00ab	4.00bc
BRA042094	7.39f	6.98g	3.33b	4.66abc
BRA042156	9.73abc	11.45abc	3.33b	3.66bc
BRA042160	8.71bcdef	10.49abcdef	4.00ab	4.00bc
BRA052015	9.21abcde	9.98abcdefg	3.66ab	3.66bc
BRA052023	8.08cdef	7.95defg	5.00ab	4.00bc
BRA052033	10.32ab	7.69efg	5.66a	4.33abc
BRA052034	7.54ef	7.88defg	4.33ab	5.33abc
BRA052045	7.29f	7.56fg	5.33ab	6.00abc
BRA052053	10.35ab	10.66abcde	3.66ab	3.33c
BRS Primavera	10.83a	10.10bcdef	4.00ab	3.66bc
BRS Sertaneja	9.91ab	9.53cdefg	3.66ab	4.00bc
Average	8.58b	10.16a	4.11b	4.90a
F-Test				
Zn level (Zn)	**		*	
Genotype (G)	**		**	
Zn X G	**		**	
CVZn (%)	13.94		27.68	
CVG (%)	8.21		17.46	

*,** Significant at the 5 and 1% probability level, respectively. Means followed by the same letter in the same column are not significantly different at 5% probability level.
Means of the average values are compared at low and high Zn levels.

Fig. 1. Growth of upland rice genotype BRA01506 without (left) and with (right) zinc fertilization.

Fig. 2. Growth of genotype BRA02601 at low (left) and high (right) zinc levels.

Fig. 3. Panicle number at low(left) and high (right) zinc levels in genotype BRA025535.

Fig. 4. Panicle number in genotype BRA01506 at low (left) and high (right) Zn levels.

Fig. 5. Root growth of genotype BRA02535 at low (left) and high (right) level of Zn.

CONCLUSIONS

Upland rice is an important crop in South American cropping systems. Brazil is largest producer of upland rice. Zinc is one of the most yield limiting micronutrients in annual crop production in highly weathered tropical Oxisols. Use of nutrient efficient plant species or genotypes within specie sis an important strategy in reducing cost of crop production and also adverse effects of chemical fertilization on environment. Results of this study show that there is significant differences among upland rice genotypes in Zn use efficiency. The Zn X genotype interactions were significant for most of the yield and yield attributing characters, suggesting variation in upland rice genotypes responses to Zn fertilization and selection of Zn efficient genotypes is an important decision in Brazilian Oxisol.

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ESTADO DE GOIÁS

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