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Effects of rare earth on the growth characteristics and productivity of rice

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Key words : Rare earth forage rice , root activity , nitrate-N , glutathion reductase

Introduction There is a strong desire for the rice crop to be used as forage in Korea . Rare earth(RE) , which has been widely used in environmentally friendly agriculture in Korea , makes most crops strong , healthy , and nutritive . This study was to investigate the effects of RE on the growth and yield of forage rice .

Materials and method Plot size was 0 .1 ha with four replications . Rice hull was applied at the rate of 3t/ha to the experimental field at Sunchang , Chonbuk , Korea , on 9 April 2005 . Rice seedlings (var . Ilmee) were transplanted on 5 June . Urea(200kg/ha) and potassium chloride(200kg/ha) were top dressed on 5 August , respectively . Rare earth(RE , 1 ,000ppm) was sprayed to the rice leaves at seedling stage (15 June) , tillering stage (20 July) , and dough stage (20 September) . The growth characteristics of rice were investigated on 10 October 2005 . Protein for the determination of glutathion reductase(GR) was extracted by 50mM potassium phosphate(pH 7 .0) , 0 .1 mM EDTA ascorbate , and 10 mg/ml PVPP . The extracted solution was centrifuged for 20 minutes at 4°C , 16 ,000g centrifuge . GR activity was determined by the method of O`kane et al .(1996) .

Results Leaf size and plant height of rice treated with RE were reduced , while the diameter of stem and panicle was increased by RE application compared with the control . Rice plants treated with RE were more lodging resistant . Number of leaf per plant , productive tillers , and glumes were significantly increased by RE . Number of leaf per plant was increased by 28 .5% by RE spray . Chlorophyll content of leaf was slightly increased by RE . Nitrate-N content of leaf was decreased to 21 .6% , and root activity was increased by 61 .2% by RE sprinkling . Stem and panicle were become thicker 25 .5 and 21 .3% by RE . Number of glume per spikelet and glume number per plant were significantly increased by RE application , but there was not significant difference in fresh matter yield of rice among treatments . Protein content of leaf , GR activity , and total enzyme activity of rice leaf were highly increased by RE sprinkling . Total enzyme activity was increased 4 .7 times more by RE application compared with the control .

Table 1 Effects of rare earth on the growth characteristics and productivity of forage rice .

Treatment	Leaf number /plant	Chlorophyll ($\mu\text{g/ml}$)	Nitrate-N (ppm)	Root activity (mg/g/h)	Lodging resistance(g)	Fresh weight yield(g/plant)
Control	57 .7 ^b	12 .83	821 ^a	0 .134 ^b	355 .4	117 .2
Rare earth	74 .7 ^a	13 .4	644 ^b	0 .216 ^a	436 .9	127 .1

P<0 .01

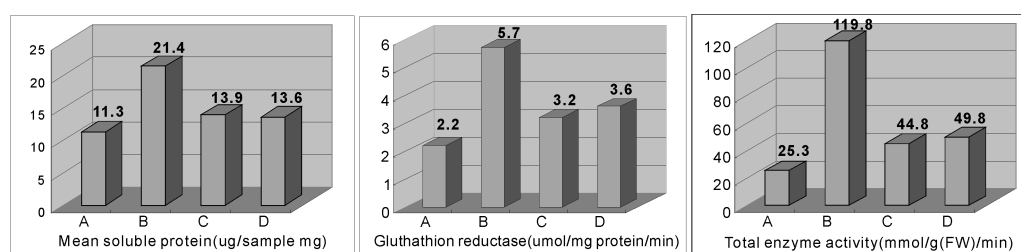


Figure 1 Effect of rare earth application on the activity of glutathion reductase of rice leaf and glume . (A : control leaf , B : RE treated leaf , C : control glume , D : RE treated glume) .

Conclusions The growth of forage rice was vigorous by RE application with increasing chlorophyll content , leaf thickness , leaf number , and number of productive tillers . Lodging resistance was improved by RE sprinkling with shortening plant height , and increasing stem and panicle thickness . RE could increase the quality of forage rice by reducing nitrate-N content and increasing protein content of leaves .

Reference

Wang J , Yang J , Liu X(2004) Status of rare earths for agriculture in China . *Journal of Rare Earth* , 22 , 313-316 .