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The XXI International Grassland Congress / VIII International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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Presenter Information

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Development of transgenic tall fescue plants with enhanced tolerance to multiple abiotic stresses

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Key words: abiotic stress, *Agrobacterium*, tall fescue, transgenic plants

Introduction Abiotic stress causes a significant decrease in growth and yield of forage crops. Molecular breeding such as genetic transformation has become a popular biotechnological tool for improving forage quality as well as improving tolerance to various abiotic stresses. In the plant cell, SOD and APX are the major antioxidant enzymes for ROS scavenging pathways, and nucleoside-diphosphate kinase 2 (NDPK2) and peroxylredoxin (Prx) are considered as multiple stress tolerant genes with a broad-range of functions. In this study, we generated transgenic tall fescue plants expressing NDPK2, Prx or both the SOD and APX genes (Lee et al. 2007), and investigated their performance to several abiotic stresses.

Materials and methods *Agrobacterium* strains EHA105 harboring expression vectors containing NDPK2, Prx or both SOD and APX were used for infection of mature seed-derived embryogenic calli of tall fescue. These genes are controlled separately by CaMV35S or oxidative stress inducible SWPA2 promoter. Integration of the T-DNA into the putative transgenic plant genomes was confirmed by PCR and Southern blot analyses (Lee et al., 2006). To examine abiotic stress tolerance, leaf segments of transgenic plants were subjected to stress treatments such as methyl viologen, H₂O₂, NaCl or heavy metals, and we measured several physiological parameters such as ion leakage, in vivo H₂O₂ content and lipid peroxidation.

Results Integration and expression of the transgenes in transgenic plants were confirmed by Southern and Northern blot analyses (Figure 1), respectively. All transgenic lines showed normal growth phenotypes. Leaf segments of transgenic plants were subjected to different abiotic stresses as described in Materials and Methods. Transgenic plants showed lower accumulation of TBARS and H₂O₂ in their cells, and lower electrolyte leakage and chlorophyll degradation compared to control plants. In addition, transgenic plants overexpressing NDPK2 showed enhanced tolerance against salt and drought stresses at the whole plant level (Figure 2).

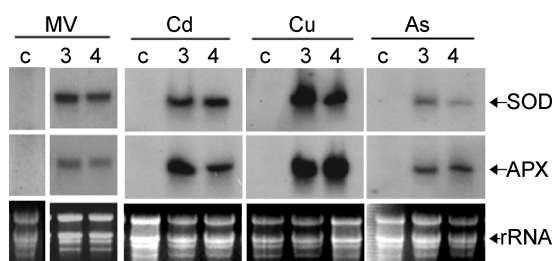


Figure 1 Overexpression of CuZnSOD and APX in transgenic plants.

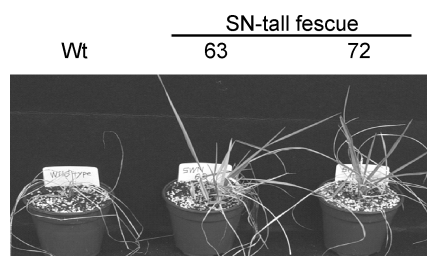


Figure 2 Enhanced drought tolerance of transgenic plants expressing NDPK2 gene.

Conclusions We generated transgenic lines of tall fescue with enhanced abiotic stress tolerance using *Agrobacterium*-mediated genetic transformation, and evaluated its tolerance to a wide range of oxidative stress-generating abiotic stresses. Transgenic plants showed enhanced tolerance to multiple abiotic stresses. These results suggest that transgenic plants would be a useful forage grasses for commercial cultivation under unfavorable growth conditions.

References

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