The Study on Cross-Breeding of *Zoysia* Willd.

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Introduction Zoysiagrass is a well-known warm season turfgrass used all over the world . There are plentiful zoysia germplasm distributing in China . 158 zoysia germplasm including 9 species and 1 variety have been collected since 1993 by Institute of Botany , Jiangsu Province & Chinese Academy of Sciences . These germplasm have been evaluated for morphological , turf quality , morphological types , seed production , and some resistance characters .

Materials and methods In this study , cross-breeding of zoysiagrass was conducted , and progenies were identified by morphological character , isozymes and SSR , then hybrids were evaluated for turf quality , cold toleramce , growth rate and seed production relative to three established or check cultivars , i .e . , Z014 (Manila grass) , Z129 (*Zoysia japonica* Steud . cv . Qingdao) and Z077(*Zoysia japonica* Steud . cv . Lanyin No . 3) .

Results Fifty-two progenies were obtained from reciprocal cross between four zoysia species by the means of controlled pollinating and involving variations on twelve morphological characters , peroxidase isozymes and esterase isozymes and SSR molecule markers of all progenies and their parents were analyzed and progeny authenticities were determined by these three methods . It was found hybrids can be obtained among the four species of Z . japonica , Z . sinica , Z . matrella , and Z . tenuifolia in all possible combinations . Variation range for the morphological characters of progenies , 60 .11% surpass their parents , Only 39 .89% are within the range of their parents ; There are 20 peroxidase isozymes bands and 19 esterase isozymes bands in the late vegetative period . The peroxidase enzyme band could be divided into 3 zones , i .e . A , B , C and esterase enzyme band could be divided into 4 zone i .e . A , B , C , D according to the distribution of remove rate . Most progenies were not only different in the number of bands and in the activity of the same band from parents , but also had marker enzyme bands" that parents did not . The bands of SSR showed that the hybrids did not always present complementary patterns derived from the two parents , but often some bands of the parents disappeared or new bands appeared . Finally , 52 progenies were identified as true hybrids . In all , 46 progenies were identified by morphlogical characters , 27 progenies by isozymes and 42 by SSR .

The turf quality of the 52 hybrids of 14 zoysia cross combinations were evaluated by density , leaf width , tactility , uniformity , leaf color , green period and rust resistance . Hybrids 18-1 , 22-2 , 31-3 , 37-1 , 22-3 , 40-5 , 40-8 , 40-2 and 18-4 performed very well and their turf auality were better than the check cultivars . Cold tolerance of these 9 hybrids and three check cultivars and growth rate and seed production of all progenies were evaluated . The cold resistance of the 9 hybrids above was ranked as follows : 22-2＞40-2＞40-8＞Z077 (CK) ＞Z129 (CK) ＞Z014 (CK) ＞40-5＞31-3＞18-1＞18-4＞37-1＞22-3 , in which the LT50 of 22-2、40-2 and 40-8 were lower than the checks . Hybrids 40-9 and 31-3 were the fastest growing with the total stolon length measuring 365 .103cm and 326 .475cm and aboveground biomass weighing 25 .418g and 24 .479g , respectively . The seed yield of hybrids 26-4 ,20-1 ,11-1and 20-3 are 1 .32 g/100cm2 , 1 .28 g/100cm2 , 0 .98 g/100cm2 and 0 .96 g/100cm2 , respectively , which is higher than other tested accessions . Hybrid 20-3 was best hybrid for both highest seed yield and higher turf quality .

The DNA fingerprint of eleven new strains of zoysiagrass were established by 2 SSR primers with stable amplification profiles which were selected from 45 pairs of Xgwm SSR primers , by DNA fingerprint of tested materials , conventional plant taxonomy were used for reference , these eleven strains were distinguished from popular cultivars manila , Zoysia japonica cv . Qingdao and Zoysia japonica cv . Lanyin No .3 at molecular level .