Study on the Low Temperature Tolerance of Zoysiagrass

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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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Key words : zoysiagrass ,low temperature tolerance ,vegetative organ ,cold acclimation ,soluble protein

Zoysiagrasses are widely used warm season turfgrass species and are also environmental-friendly turfgrasses with excellent wear tolerance , drought tolerance , disease resistance , salinity tolerance , low fertility tolerance and low maintenance requirements . Most accessions are adapted to warm climates , and the coastal climate is especially beneficial to the growth of zoysiagrasses . However , the low temperature tolerance of most Chinese germplasm of zoysiagrass and Low temperature tolerance of different organs of zoysiagrass haven't been assessed . Nothing have been conducted on the soluble proteins variation of zoysiagrass under the low temperature acclimation .

A total 97 zoysiagrass accessions of five species and one variety were selected from 160 accessions to assess the low temperature tolerance of *Zoysia* Willd . Most accessions were Chinese native zoysiagrass except 9 cultivars introduced from USA and two accessions from Japan .

Low temperature tolerance of leaf was identified by electrolyte leakage , low temperature tolerance of rhizome and stolon of 15 representative accessions was identified by survival rate . And based on the evaluation of the low temperature of zoysiagrass , soluble proteins in leaves , stolon and rhizome of Z125 (poor cold resistance) and Z141 (strong cold tolerance) in a simulated low temperature acclimation ,which was extreme low temperature tolerance two accessions Zoysia (*Z .japonica*) , were studied by SDS-PAGE .

The leaf LT_{50} of zoysiagrasses tested ranged from-1 .9℃ to-10 .4℃ with a coefficient of variation (CV) of 27 .79% . The LT_{50} of different species ranked as : *Z .japonica* (-6 .68℃) < *Z .sinica* (-5 .90℃) < *Z .matrella* (-5 .35℃) < *Z .tenuifolia* (-3 .5℃) < *Z .sinica* .var *longiflora* (-3 .1℃) < *Z .macrostachya* (-2 .7℃) . The LT_{50} variations of *Z .japonica* ,*Z .sinica* and *Z . matrella* were from-1 .9℃ to-10 .4℃ , from-3 .0℃ to-9 .5℃ and from-2 .8 ～-6 .8℃ with CV as 25 .28% , 28 .86% and 32 . 24% , respectively . The average LT_{50} of leaf (-6 .9℃)>the average LT_{50} of stolon (-7 .8℃)>the average LT_{50} of rhizome (-8 . 4℃) . The LT_{50} CV of leaf (42 .88%) was greater than that of stolon (23 .55%) and rhizome (23 .31%) . The R^2 values of regression analysis between stolons and leaves , between rhizomes and leaves and between stolons and rhizomes was 0 .5826 , 0 .6743 and 0 .5489 , respectively . All R^2 values were significant at $P \leqslant 0.05$ or $P \leqslant 0.01$, which means the positive linear relation were existed among stolons LT_{50} , rhizomes LT_{50} and leaves LT_{50} .

SDS-PAGE electrophoresis revealed that after two weeks of cold acclimation , the soluble protein synthesis in Z125 had a great change , a new 40KD protein components in rhizome and a 66KD in leaves in cold-acclimation appeared comparing to the non-acclimation ; a more 50KD and less 40KD protein components changed in rhizome in cold-acclimation Z141 comparing to non-acclimation Z141 .After 4 weeks of cold-acclimation , two new protein compositions , about 60KD , appeared in cold-acclimated Z141 both stolon and rhizome , about 60KD and 20KD soluble protein compositions were disappeared in cold-acclimated Z141 leaf . And only 2 new soluble protein compositions , about 50KD , appeared in cold-acclimated Z125 rhizome .

This papers suggested that LT_{50} of different organs were correlated and leaf LT_{50} could be used to evaluate low temperature tolerance of zoysiagrasses . COR proteins synthesis of *Zoysia japonica* changed during the cold acclimation , the change in Z125 was larger than Z141 during the beginning of cold acclimation , and the change in Z141 was larger than Z125 with the cold acclimation time extension . So COR proteins may be useful as molecular markers of low temperature tolerance .