Comparative Study on Drought Resistance of Alfalfa Cultivars at Seedling Stage between China and Australia

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Introduction In this study, seedlings of two Australian alfalfa Super10 and Prime and two Chinese alfalfa Zhaodong and Wudi (provided by SARDI) were evaluated during the imposed drought stress under greenhouse conditions to compare the physiological characteristics of drought resistance between cultivars. The objectives are (i) to evaluate physiological traits of four alfalfa cultivars that contribute to tolerance for water deficit at the seedling stage, and (ii) to understand the response of these cultivars to drought stress may further to understand the mechanisms of drought tolerance of different germplasm, that could be incorporated into breeding programs to improve drought tolerance.

Materials and methods Zhaodong and Wudi were Chinese cultivars, Super10 and Prime were Australia bred cultivars. Seeds were scarified and planted in pots filled with UC mix soil. Bulk density simulated field is 1.65-1.80g/cm3. Plants grew in a greenhouse of 25℃ day/18℃ night and photoperiod of 14 hr with natural daylight. 50%/70% RH (day/night), and watered with distilled water twice weekly, and soil water content was maintained 25%. When 30 days old, plants were divided into two groups, one was subjected to drought stress (stop watering) with five degrees and rewatered after 18days drought stress, the other one as control group. Both stressed and controls plants were harvested for measurement with each treatment. Several measurements including biomass, water potential, chlorophyll content and relative water content were determined at various harvest times.

Results and discussion The biomass, relative water content and physiological response were differences between cultivars. Super10 and Prime grew fast than Zhaodong and Wudi in the early seedling stage, but Zhaodong grew quickly later, Wudi appeared lower growth rate than other three. Biomass, relative water content and chlorophyll content declined after drought treatment. The water-holding ability and chlorophyll content of Zhaodong and Wudi were higher than Super10 and Prime. The water potential of Zhaodong was lower than other three cultivars after drought treatment. The ratio of SDW/RDW of Prime were higher than other three cultivars during 4-14 days treatment. There were no differences in SDW/RDW between Zhaodong, Wudi and Super10. These cultivars have their unique genetic background by a long time natural selection, ecological adaptation or genetic variation, so they had their own characteristics for drought resistance. Australian alfalfa grows in subtropical areas and can adapt to the local dry and hot climatic conditions, so adult plants have strong drought resistance, but in Australia, sowing time of alfalfa is in winter because there are plentiful rainfall during this period and it has optimal temperature for alfalfa growing, so alfalfa grows fast, but it has no enough drought resistance and water-holding ability during seedling stage. Chinese alfalfa grows in cold temperate zone, the root grows fast than shoots for adapting to the arid climate during the early establishment period, especially for Zhaodong which was produced in Heilongjiang, north east of China, has strong growth vigor, and higher water holding ability for adapting to the spring drought.

Reference

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