Effect of Low Temperature Stress on Malondialdehyde (MDA) Contents in Alfalfa Taproots

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Key words: low temperature stress, malondialdehyde (MDA)

Introduction Cold hardiness is a major factor determining alfalfa (*Medicago sativa* L.) production in northern regions of China with harsh winter conditions. In the presented study we analyzed the content of malondialdehyde (MDA) which is one of the products of membrane lipid peroxidation and widely used as a marker of oxidative lipid injury. The aim of the study was to test if levels of MDA in alfalfa taproots are related to winter hardiness.

Materials and methods 30 cm taproots of 3 alfalfa varieties, Vernal (hardiness), Archer (mid-hardiness), and UC-1465(non-hardiness) (Teuber, et al, 1998), respectively, were treated at 9 temperatures. For each variety, 12 plants were selected randomly from field for each treatment. The temperatures were 8℃, 4℃, 0℃, -2℃, -6℃, -12℃, -18℃, -24℃ and-30℃. For each treatment, the temperature was lowed at a rate of 3℃ · h^{-1} and kept for 36 hours at the aim temperature then increased or decreased at the same rate to 4°C. The level of MDA content in roots was determined by the thiobarbituric (TBA) reaction. Formula 1was used to eliminate the influence of saccharose: $c(\mu mol/L) = 6.45(A_{532}-A_{600})-0.56A_{450}$ (Xu changcheng, et al., 1994), where c is the concentration of MDA in the reaction liquid and A_{532}, A_{600}, A_{450} are absorbance at 532nm, 600nm, 450nm respectively. The concentration of MDA in taproots was calculated by formula 2: $C = c^* A^* V/(1000a^* w)$, where c is the concentration of MDA calculated by formula 1, A is the volume of the reaction liquid, V is the volume of the extracting solution, a is the volume of the extracting solution used in reaction and w is the sample's fresh weight. The MDA content was expressed as $\mu mol \cdot gFW^{-1}$. Data were analyzed using Excel program.

Results MDA content in taproots was low and more or less equal at 8℃ while MDA content increased as the temperature decreased. Both the change rate and range were higher in UC-1465 than the other cultivars, especially when the temperature was lower than-18℃ (Figure 1).

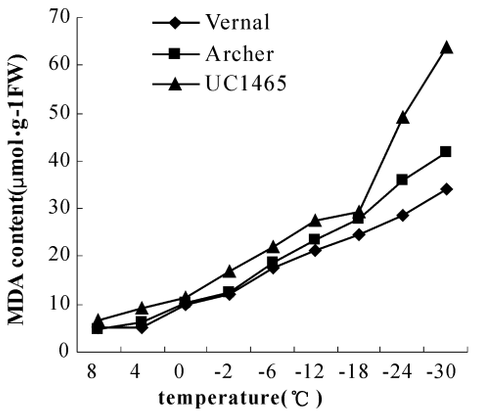

Figure 1 *The malondialdehyde (MDA) content(μmol · g-1FW) in alfalfa taproot at different temperature.*

Conclusions Changes in MDA levels, as seen in this study, demonstrate an increase in membrane lipid peroxidation due to decreases in temperature. The cold sensitive variety UC1465 showed the largest increase in MDA levels, indicating that MDA levels at low temperatures can be used to assess cold hardiness and to select cold tolerant alfalfa varieties.

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