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Effect of Trinexapac-ethyl on Increased Resistance to Drought Stress in Wheatgrass (*Agropyron desertorum* L.)

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Introduction: Drought is one of the most detrimental abiotic stresses for turfgrass growth across a wide range of geographic locations. Most cool-season grass species are not well adapted to extended periods of drought, particularly during summer months. Decline in turf quality caused by drought stress is a major concern in turfgrass culture. Therefore, developing management practices for improving drought resistance of turfgrasses has become essential in arid and semi-arid regions, especially during water use restriction. One strategy to improve plant drought resistance is to promote drought avoidance by reducing water loss during drought, which may be achieved by slowing growth rate of shoots and lowering leaf area canopy to reduce demand for water. Application of growth regulators is one of the methods for increasing resistance of plants to biotic and abiotic stresses. Trinexapac-ethyl (TE) is one of the most widely used PGRs in the management of cool-season and warm-season turfgrass species. TE absorbed quickly by foliage and slow cell elongation through inhibiting of converting one form of gibberellic acid (GA20) to another (GA1). Most studies conducted under non-stressed conditions found that TE application increased chlorophyll content, turf quality, turf density and reduced shoot extension rate. We hypothesized that TE may influence plant tolerance to drought stress. Limited available data─ as reported in the above referred studies─ suggest that TE application may be beneficial for plant tolerance to stresses, but the effectiveness varies with turfgrass species, dose and duration of TE treatment, and type of stress. The main aim of this research is to evaluate the effect of Trinexapac-ethyl on increased resistance to drought stress in wheatgrass.

Materials and Methods: Wheatgrass (*Agropyron desertorum* L.) was used in this study. This study was conducted in field conditions at Isfahan University of Technology, Isfahan, Iran.. Wheatgrass native seeds (*Agropyron desertorum* L.), collected from the turfgrass research farm at Fereydan, Isfahan, which were cultivated hand broadcast in plots (3m × 2m) with seeding rates of 30 gm^{-2}. A factorial experiment based on randomized complete block design (RCBD) with three replications was conducted for TE (Primo Maxx; Syngenta Crop Protection, Inc., Greensboro, NC) and drought stress. Treatments involved three levels of Trinexapac-ethyl growth regulator (0, 0.25 and 0.5 kg/h) and two levels of drought stress (with irrigation and without irrigation). After planting, the plots were irrigated to maintain soil moisture at 80% field capacity or higher. Irrigation was applied as required to prevent any drought stress during grass establishment. Turfgrass species were maintained at cutting height of 4 cm and were mowed once a week using a reel-type mower. All data were subjected to analysis of variance using SAS 9.1 (SAS Institute Inc., Cary, NC) and Fisher's protected LSD test was employed at the 5% probability level.

Results and Discussion: Results indicated that Trinexapac-ethyl and drought reduced growth, fresh weight and dried above ground organs significantly. Wheatgrass growth in concentrations 0.25 and 0.5 kg/h were 19.20 and 26.90%, respectively. Previous studies reported plants that have slow-growing shoots may survive more extended periods than faster-growing plants in drought conditions. Slow growth may reduce the adverse impact of drought by conserving water and carbon energy, and plants can use limited water to survive drought for an extended period of time. Unlike drought stress, Trinexapac-ethyl improved the quality of plant tissues and their color. Increase in turf quality under TE treatment might occur as a result of improved canopy photosynthesis capacity and single-leaf photochemical efficiency. Drought stress reduced relative water and chlorophyll content, increased proline level and finally led to electrolyte leakage. Trinexapac-ethyl improved wheatgrass in drought stress conditions by increasing relative water content, prolin, chlorophyll and decreasing electrolyte leakage and increased wheatgrass to drought stress resistance. Proline acts as an osmotic regulator in cytoplasm and vacuoles, protects proteins against dehydration, adjusts osmosis; detoxify radical active oxygen species, keeping more stable antioxidant enzymes. Proline immediate increase under drought stress is associated with decreasing leaf water content, in turn, induced drought tolerance. Under drought stress conditions, penetration of root depth and effective root depth has been increased, while Trinexapac-ethyl did not affect root traits significantly. The results of the present study indicated that TE decreased damages on drought stress probably via improving turf quality,

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chlorophyll concentration, leaf water content, proline content and less electrolyte leakage in Wheatgrass.

Keywords: Height, Growth regulators, Without irrigation, Turf quality