Platinum TE
PASPALUM

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DROUGHT TOLERANCE RESPONSE IN PLATINUM TE™

Platinum TE has a better drought tolerance response than Sealsle 1, which to this point, has been the most drought tolerant paspalum cultivar. However, any seashore paspalum cultivar does not respond to drought stress the same way as bermudagrass.

Bermudagrass will rapidly adjust to depleted soil moisture and go into ‘drought dormancy’ rapidly; paspalum does not transition quickly into a drought dormancy state even though it is generally listed in the good ‘relative drought tolerance’ category among warm season grasses. Understanding this drought response is critical for developing management strategies to minimize drought damage with any paspalum turfgrass cultivar.

Platinum TE total root volume (generally 2x+ that compared to bermudagrasses) in combination with morphological traits (rhizomes, root hairs, lateral branching roots) and physiological characteristics (cytokinin hormonal stimulation, nutrient absorption and utilization priorities especially potassium) govern water uptake and moisture supply to shoots.

Paspalum shoots are predominately composed of water plus some lignin and cellulose. Bermudagrass has a larger composition of lignin and cellulose and less water in the shoots. Potassium is the critical nutrient for regulating osmotic adjustments and maintaining turgor pressure in paspalum plant cells.

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In paspalum, the internal shoot K concentration is apparently more critical in this turfgrass because of its water turgor pressure adjustment requirements, especially in response to increasing root-absorbed and foliarly applied (from irrigation water) salt ions. Maintain % K in Platinum TE at the 3% + level to minimize any problems with scalping or salt ion concentration adjustments. Realize also that different genes control drought tolerance and salt tolerance in seashore paspalum.

ROOT COMMUNICATION

Paspalum roots communicate to shoots concerning soil moisture status via hormones—predominately, abscisic acid (ABA) as the 'early alert' chemical messenger to mediate paspalum responses to increasing drought stress challenges. ABA is synthesized in roots during soil drydown and this hormone is subsequently translocated via the transportation stream to the shoots, thereby increasing the leaf epidermal ABA concentration. As ABA concentration increases in the leaves, stomatal closure is induced and transpiration of water out of the stomates is reduced. Growth inhibition of both roots and shoots usually result as ABA levels increase in the plant.

In arid regions, evapotranspiration (ET) correlates with overall turfgrass drought resistance (sustaining a deep and extensive root system, reduction of water use) (Carrow 1994). Paspalum in general has a thick waxy cuticle on the leaf surfaces, but generally does not roll or fold leaves in conjunction with reduced water uptake availability.

The grass does not readily transition into leaf senescence compared with other warm season grasses, which lends credence to the ABA inefficiency theory especially in the shoots since the grass is totally genetically programmed for root system sustainability. This turfgrass evolved on ocean-water and rainwater-exposed sandy beaches and the entire genetically-programmed focus of this grass for survival with abiotic stresses is to maintain a foundation, or sufficient root volume to sustain the grass without going into the senescence mode.

PLATINUM TE DROUGHT RESPONSE EXPLANATION

Why then does paspalum transition so slowly to drought dormancy? The extensive root architecture, the high salinity tolerance which mandates an efficient turgor pressure and osmolyte adjustment system to mediate salt increases, and the rapid growth responses of the grass all theoretically imply that it should handle impending drought stress quite well.

When I have collected this grass in native wild ecosystems, I have seldom found the grass on top of sand dunes; instead, the wild ecotypes colonize the areas at the base of the dunes that retain more moisture for a longer period of time than the dune tops that normally experience rapid moisture infiltration/percolation rates as well as surface drydown. The lower topography dune areas traditionally move slowly into dryer soil moisture availability conditions. As a result, paspalum probably did not develop mechanisms for rapid transitioning into complete drought dormancy and are programmed for a slow transitioning into moisture stress conditions. Seashore paspalum also has a high tolerance to salt water inundation and this genetically controlled trait might be involved in the slow drought tolerance transitioning tendency.

An additional explanation would be that the rhizome generation/ sustainability and 'root foundation' regeneration priority of the grass genetically and hormonally over-rides or slows down this early alert ABA signaling system. As a result, the shoots do not rapidly adjust to the escalating moisture stress, and since shoot turgor pressure maintenance is so critical in paspalum leaves, the transition to the drought stress response must be gradual. Any rapid drought stress exposure will then damage the shoots quickly and the paspalum plant automatically reverts back to root regeneration for sustainability and canopy density is reduced during this recovery period.

A third explanation would involve ABA inefficiency in not sufficiently closing stomates, especially during night time respiration. If night time water loss is high because the stomates are even partially open, cell turgor pressure (which is so critical in seashore paspalum) could be lower at the beginning of the day when water stress (soil drought, salinity, and high atmospheric demand) challenges can rapidly increase (Christman et al., 2009).

MANAGEMENT OPTIONS

Therefore, the focus on drought stress management with Platinum TE must involve:

(1) continuous hormonal stimulation for root development and regeneration (frequent seaweed or kelp extract cytokinin applications),

(2) carefully programmed irrigation scheduling (do not overwater and gradually transition to longer duration, less frequent irrigation cycles) to slowly activate the drought tolerance mechanisms as well as reposition the root system deeper in the soil profile, and

(3) maintaining at least 3% K in the leaves to facilitate osmotic adjustments by accumulation of solutes to maintain turgor pressure as drought stress conditions increase. If nitrogen concentration is too high (>3.0% in leaves), the leaves will become more succulent and therefore more prone to drought stress damage.

The strategy should be a slow, deliberate transition to dryer and dryer soil profile conditions. Maintain a moist subsoil profile at all times—do not let this lower zone below the root system to completely dry-down if at all possible. Drought stress recovery will always occur from rhizomes once Platinum TE has been subjected to severe drought stress. Recovery of lost canopy density can take 6-8 weeks.

Bermudagrasses will recover rapidly from drought dormancy, but paspalum recovery will be a slower process. If Platinum TE is exposed to severe drought stress over a long period, the grass will need to be managed for root regeneration recovery and subsequent stolon fill-in during regrowth using carefully applied cytokinin and gibberellin products.

THE EVAPOTRANSPIRATION FACTOR

Early research on Adalayd from Australia and Futurf from Israel indicated a 6.2-8.1 mm/day (1.7-2.5 inches/week or 0.25-0.31 inches/day) summer evapotranspiration (ET) rate at 3.0-3.8 cm cutting height, which places those early cultivars in the Medium to Medium-High to High range among turfgrass ET rates (Beard 1985).

Later research on SeaIsle 1 paspalum indicated an 8.1 mm/day ET rate over 136 days in Arizona at similar mowing heights as above (Kopec et

al. 2006). Although no comparative research has been conducted on Platinum TE, the cultivar in early preliminary testing has exhibited a better drought tolerance response than SeaIsle 1 under exceptional prolonged drought conditions in Texas.

The ET rate at most locations will normally range from 1-2 inches/week (25-50 mm) or 0.14-0.30 in (3.6-7.6 mm) per day depending on soil profile, irrigation water quality, irrigation scheduling, climatic conditions (especially wind velocity), and soil infiltration/percolation rates plus available soil moisture. The key strategy on irrigation scheduling is to maintain a moist subsoil so that Platinum TE will maintain the rhizome layer in the 2-3 inch deep upper soil profile; then apply irrigation water, depending on salt load and need for leaching excess salts in conjunction with aeration events, at 75% of ET for the site.

The crop coefficient (K_c) for warm season turfgrasses generally ranges from 0.50-0.70 (Puhalla, Krans, & Goatley 1999), and 0.60 is normally used for all seashore paspalum cultivars.

Citations:

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