Turfgrass Drought Avoidance and Tolerance

by Dr. Jeff Nus, Kansas State University

Recent developments in understanding water use by turfgrasses have led to considerations of how to avoid the effects of drought or at least make grasses more tolerant of water shortages. Dr. Jeff Nus has conducted research to help shed more light on this topic. He suggests the following for your consideration.

- We must recognize difference between the terms drought and water stress. Drought is prolonged water stress. Some water stress is required for solute transport within turfgrasses. There are differences in water stress when it's light compared to when it's dark.
- Drought is affected by morphology of the turfgrasses. For example:
  - decreased growth;
  - decreased tillering;
  - thicker cuticle;
  - deeper rooting;
  - increased root to shoot ratio.
- In solution culture, polyethyleneglycol will produce stress that can affect the turf.
- Turf roots grow deeper and increase in quantity as soil dries from the top down.
- Turf roots are restricted in growth from:
  - too much nitrogen;
  - compacted soil.
  - overwatering;
  - acid soil;
- Drought resistance is noted as follows:
  - fine fescues
  - tall fescues
  - Kentucky bluegrasses
  - perennial ryegrasses
  - bentgrasses
- Under drought conditions, turfgrasses may escape or avoid or tolerate detrimental effects.
- Drought resistance may be defined in two ways. In an ecological sense, it means survival. In a production sense, it means growth.
- Water potential is a measure of the energy level of water. It determines the direction of water flow. Water potential exists in both plants and in soils.
- Water in soils may be classified within 3 ranges:
  - saturated soil;
  - field capacity soil;
  - permanent wilting soil.
- Water potential values vary from atmosphere to leaves to roots to soils.
- Ability of plants to maintain a high water potential is important. Special structures take up water and hang onto it. Xerophytic features include thick cuticles, extensive roots, efficient rooting, night time carbon fixing. Leaf structure varies in terms of numbers and location of stomates and guard cells. Osmotic adjustments keep these cells expanded.
- Drought avoidance involves the promotion of rooting. This is done by:
  - increase in height of cut;
  - aerification;
  - extra potassium.

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- Compensatory growth may involve more leaves or more roots or less leaves or less roots.
- Moderation of canopy temperatures is realized when there is more shading where the crown is located. There is a difference in temperature from canopy surface to soil surface.
- The canopy will help to reduce evaporation of moisture. This is referred to as canopy resistance. This may be realized as a short term effect or as a long term effect.
- Aerification of the soil has an effect on these processes as oxygen diffusion is enhanced so that oxygen gets down deeper in the soil. This promotes root growth that influences canopy development.
- Drought tolerance involves the ability of turfgrasses to withstand the availability of less water. This may range from dehydration to osmotic adjustment under low water potential. Osmotic adjustment results from the ability of turfgrasses to concentrate certain substances:
  - sugars;
  - amino acids;
  - inorganic ions — potassium.
- Full turgor and insipient plasmolysis measurements are useful in the evaluation of osmotic adjustments. A moisture release curve can be calculated.
- Cell wall characteristics are also important in determining drought tolerance. Kentucky bluegrass can osmotically adjust to drought. In this way it retains water. Turgor mediates the process —
  - growth;
  - stomatal conductance;
  - activity of enzyme systems.
- All this is necessary to maintain growth:
  - keep stomates open;
  - maintain growth;
  - maintain cooling.
- With stomates open, leaf temperature may be 85 degrees Fahrenheit. With stomates closed, leaf temperature may be over 100 degreees Fahrenheit. Stomates close rapidly when turfgrasses dry to a certain point.
- What effect will growth retardants have in these instances? Plant growth regulators may make root growth greater. Energy for leaf and seed production should go to the roots. However, when leaf growth is slowed down, will there be adequate translocation to roots? Timing is likely to be important, if roots are to be benefitted. Plant growth regulators are known to be dependent on time of application for favorable results.
- Limit, Cutless and Embark applied in June produced a reduction in turf quality and no reduction in over-all water use. Turf was actually less dense when treated than when not treated.

Learning

According to a recent study by Stanford University, people learn:

- 10% of what they hear,
- 30% of what they hear and see,
- and 70% of what they hear, see and write down.

According to that same study, regardles of source, we must use and put into practice that new insight 28 times before it becomes second nature to us.