SCALD-HEAT STRESS AND THEIR PREVENTION

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Biological activity occurs over a fairly wide temperature range from approximately 32 F to 125 F. The growth and development of turfgrasses however, is restricted to a much narrower range. This range is usually limited to 40-105 F. Temperature fluctuations within this range are one of the principal factors dictating turfgrass species adaptation. The distribution of cool-season and warm-season grasses in the United States is determined primarily by their temperature adaptation.

Optimum growth temperatures vary with the turfgrass species and are different for root and shoot growth. The optimum root growth temperature of the cool-season grasses ranges from 50 to 65 F, while the optimum temperature for shoot growth ranges from 60 to 75 F. For warm-season grasses the optimum temperature ranges for growth of roots and shoots is approximately 75 to 85 F and 80 to 95 F, respectively. Maximum root and shoot production for short periods of time may occur at temperatures slightly higher than the optimum temperatures. Night temperatures and environmental conditions may also influence or alter the optimum growth temperatures.

In addition to the effects of temperature on root and shoot production, there are numerous other factors effected. Most physiological processes and reaction rates are temperature dependent. The photosynthetic and respiratory rate usually increases or decreases with a change in temperature. Floral initiation and floral induction of most turfgrasses require specific temperature regimes. The influence of temperature on turfgrass disease incidence is also an important consideration to the professional turfman.

High temperature stress occurs during mid-summer periods on the cool-season turfgrasses in the northern latitudes of the United States. High temperature stress frequently occurs in association with one or more other stresses such as wear, desiccation, disease, and drought.

Heat stress can be divided into two areas for consideration: (1) indirect growth stoppage and (2) direct kill.

Indirect growth stoppage of a turfgrass plant occurs in several steps preceding lethal temperatures. An increasing rate of root saturation occurs above the optimum range for root growth. Root extension stops and the roots become brown, spindly, and weak. Death of a significant portion of the root system may occur. New root initiation also ceases. The leaves become dark green or bluish-green as shoot growth declines due to heat stress. There is a decrease in density and a reduction in leaf length, leaf width, leaf area, and leaf initiation.

Direct high temperature kill may occur when turfgrasses are subjected to very high temperatures for longer periods of time and usually involves protein denaturation. Although it is not thought to be a frequent occurrence on cool-season turfgrasses in Michigan, it may occur at mid-day on very hot summer days. High soil temperatures are probably more important than air temperatures for this type of injury to occur. The possibility of kill is, therefore, reduced by cool nights which tend to moderate the general increase in soil temperatures.

Several factors affect the heat hardiness of turfgrasses. Heat hardiness is greater in grasses grown in sunlight than in the shade, probably due to the increased succulence in the shade. Turfgrasses grown under minimum moisture conditions also have improved heat hardiness. Young tissues are more heat hardy than older tissues, and semidormant organs are more hardy than actively growing tissues.

Several things can be done to minimize the heat stress injury to turfgrasses.

1. Plant heat tolerant species. The relative heat hardiness of the cool season turfgrasses is listed in Table 1.

Table I. Relative heat hardiness (after J. B. Beard)

Heat hardiness ranking	Species
Good	Tall fescue
	Meadow fescue
Medium	Colonial bentgrass
	Creeping bentgrass
	Kentucky bluegrass
Fair	Canada bluegrass
	Chewings fescue
	Red fescue
	Annual bluegrass
	Perennial ryegrass
	Redtop
Poor	Italian ryegrass
	Rough bluegrass

2. Insure proper air movement. This can sometimes be done in critical areas where heat stress is a problem by removing wind barriers such as dense plantings or low hanging tree limbs. The turf mat temperature can be reduced significantly by a slight wind.

3. Practice syringing during critical periods. A light syringing not only reduces the mat temperature immediately, but also delays the mid-day heat accumulation which results in a lower maximum temperature.

Scald is a term applied to the condition that exists when grass collapses and turns brown under water logged conditions and high temperature. One of the symptoms commonly observed is a burned or scorched appearance on the turfgrass leaves. Several conditions will cause scald. The prerequisites are standing water and high temperature.

Conditions which will increase scald injury are a high relative humidity, (2) succulent rapidly growing tissue, and (3) a high light intensity.

Several preventative measures can be followed to reduce the chances of scald injury. The first measure is to insure rapid surface drainage to prevent excess water from ponding. Dry wells or tile drains will assist in rapid removal of surface water from depressional areas that may be susceptible to scald injury. The second factor is to improve the internal soil drainage. Irrigation rate and frequency should be adjusted to avoid surface ponding when other factors are favorable for a scald problem. And finally, reduce the high temperatures where possible by improving the air movement.

Reference

J. B. Beard. 1973. TURFGRASS SCIENCE AND CULTURE. Prentice-Hall, Inc. Englewood Cliffs, New Jersey. 658 pp.