Managing Turf with Reduced Light

by Dr. R.R. Duncan

Various kinds of shade can affect turfgrass performance. Tree shade is the most widespread problem, affecting both light quality and light quantity (intensity) as well as providing tree root competition for moisture and nutrients. Buildings, beams, mounds and mountains can reduce light quality and quantity, but is normally of shorter duration and this diffuse light is often better quality than tree shade. Low light intensity caused by smog or monsoonal weather patterns, cloudy or foggy events and multiple rainy days provides a third source of light quality and quantity problems, with most of the adverse effects from reduced light intensity.

The primary limiting factors that categorize reduced light intensity, quality or quantity include: A filtering effect (poor light) of the red and blue wavelengths necessary for photosynthesis; and absorption and reflection effects (diffuse or indirect light) which decreases light intensity. Both of these factors limit photosynthesis (poor light duration or quality or both). Many times, all three components are affecting turf performance.

The problem in managing turfgrass with reduced light is that the components of light are constantly changing, both in terms of daily sun movement and climatic changes as well as seasonally with tree leaves dropping in the fall or emerging in the spring. Management decisions are aimed at a moving target and can challenge even the best turf managers.

Light reduction problems in sports fields can occur due to:

* Prolonged cloudy, foggy, rainy or smoggy conditions in open stadiums

* Open-roofed or partially enclosed stadiums with minimal sunlight penetration
* Stadium configuration that prevents direct sunlight penetration in certain areas of the field or with retractable roof opening/closing that provides programmed, scheduled sunlight penetration to portions of the field
* Domed stadiums
* Open fields with partial tree shade or shade from nearby buildings or mountains

Turf response to reduced light

Primary turf and microclimate responses to low light conditions include:

* increased humidity
* prolonged exposure to lower soil and air temperatures
* reduced/restricted air movement
* longer periods of dew/frost
* lower respiration
* lower transpiration
* increased shoot succulence
* greater etiolated growth (hormonal imbalance)
* depleted carbohydrate reserves in crown region
* reallocation of carbohydrates from roots to shoots

Secondary microclimate and turf factors adversely affecting turf include:

* 50-60 percent shorter root systems
* increased disease pressure
* algae buildup
* gradual thinning of turf density
* soil compaction
* drainage problems
* salt buildup from either poor quality water or fertilizers or both
* faster injury response
* slower recovery from injury
* competition with weeds for nutrients
* reduced hardening to winter temperatures or other stresses
* reduced nutrient demands (i.e. less photosynthesis, less growth)

The morning vs. afternoon shade dilemna

Better turf growth normally occurs with morning sun because of:

* faster burn-off of dew; reduced disease pressure
* minimal high temperature stress
* reduced evapotranspiration because of lower temperatures in the morning
* maximum net photosynthesis/ reduced respiration (which minimizes carbohydrate demands during these less stressful environmental conditions)

Increased turf stress problems with morning shade occur because of:

* prolonged moisture on the turf/maximum exposure to disease pressure
* high direct temperature stress in the afternoon, which depletes carbohydrate reserves (high indirect temperature stress)
* high evapotranspiration during the period of maximum photosynthesis
* increased respiration during the period of maximum photosynthesis
* cloudy, reduced light intensity

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with afternoon showers, after morning shade, resulting in poor light duration and reduced photosynthesis

Management strategies

To offset low light conditions, five basic strategies should be used to maximize turf performance:

* choose the right turf species and cultivar/blends
* fertility program adjustment
* aeration, air movement, drainage adjustments
* preventative disease control
* mowing height adjustment, especially on less shade tolerant grasses

Shade/low light intensity tolerant turfgrasses

Turfgrass shade tolerance mechanisms involve:

* leaf orientation, some with upright leaves, which results in light capture problems with reduced intensity/diffuse light (hard fescues) and other grasses with more prostrate, horizontal growth, which tends to maximize light capture (St. Augustine grass)
* photosynthetic efficiency: C3 grasses (cool season) tend to be more shade tolerant than C4 grasses (warm season)

Typical shade related disease problems include powdery mildew with cool season grasses and Helmithosporium and gray leaf spot with warm season grasses. Gray leaf spot on perennial ryegrass has become a major problem in recent years.

Relative shade tolerance of cool season grasses:

Excellent: red fescue, orchardgrass, poa supina

Good: fine fescues (dry shade), poa trivalis (moist shade)

Fair: colonial bentgrass, perennial ryegrass, meadow fescue

Poor: Kentucky bluegrass (exception: A-34/Nugget, because of good disease resistance)

Relative shade tolerance of warm season grasses:

Excellent: Panicum laxum (tree shade, low light intensity), Seashore paspalum (low light intensity, poor tree shade tolerance)

Good: St. Augustinegrass, zoysiagrass (tree shade, low light intensity)

Fair: centipedegrass, bahiagrass, carpetgrass (tree shade, low light intensity)

Poor: buffalograss, bermudagrass (tree shade, low light intensity)

Bullseye bermudagrass has performed quite well in BankOne ballpark

Management adjustments-fertility

Nitrogen

* Excess Nitrogen causes succulence, reduced tolerance to traffic, scalping problems, etiolated growth and salt buildup.
* Use slow release or foliar nitrates in prescription format (small amounts as needed).
* Use organic slow release products (dark in color, will absorb heat units during the day).
* Most important application is during the fall, which promotes recovery from summer stresses and reduces losses from winter kill.
*Spring application increases turf density and vigor.

Phosphorus and potassium

Moderate levels of P and high levels of K are needed to:

* Maintain a functional root system
* Provide adequate K, which is the first line of defense against leaf spot disease
* Fall applications are extremely important

Know the salt index of your fertilizer

Keep track of the amount of salt going into your fields, since salts can build up in shaded areas. High salt index fertilizers include (in decreasing order) potassium chloride, ammonium nitrate, sodium nitrate, calcium chloride, urea, potassium nitrate, ammonium sulfate and calcium nitrate.

Check the root system regularly

A short root system would benefit from a cytokinin application (seaweed extract or Roots 1-2-3) to enhance root development and maintenance. Shallow rooting of less than 2 inches can be associated with three to four hours morning shade in cool season grasses. Grass grown in severely shaded areas may have 50 to 60 percent less root volume compared to the same grass grown in full sun.

Additional management adjustments

These could include the following:

* Enhance air movement (fans)
* Aeration to promote water infiltration/percolation and minimize compaction or water logging
* Good drainage
* Cap with a sand layer or establish a sand profile zone down to drainage tiles
* Grow lights (temporary)
* Raise mowing heights
* Do not mow as often
* Heating coils buried underneath the shaded micropocket problem areas to raise the temperature and hopefully enhance growth of roots and shoots

Conclusions

Proper management does not alleviate the reduced light intensity problem, but can minimize the negative effects that impact turf performance. Micromanage the reduced light problem areas on your field.