SHADE STRESS AND TURFGRASS CULTURE

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The maintenance of quality turf in shaded areas presents problems for even the most competent turfgrass manager. It has been estimated that 20% of the turf grown in the U. S. is subjected to some degree of shade. Although the maintenance of turf in shaded environments presents difficulties, a suitable turf can be achieved through (a) the use or shade adapted species, (b) alteration of the shade environment, and (c) modification of turfgrass cultural practices.

The most obvious, and certainly the most important aspect of the shaded environment, is a reduction in light intensity. In an unshaded situation, photosynthesis greatly exceeds respiration. This results in a favorable carbohydrate balance necessary for adequate turfgrass growth. When the light intensity is reduced, a reduction in the photosynthetic rate occurs. If the light intensity is low enough, the use of carbohydrates in respiration may exceed the resupply of carbohydrates by photosynthesis. If these conditions persist, the carbohydrate reserves can be exhausted, resulting in a deterioration of turfgrass quality. Other physiological responses to reduced light intensities include:

Higher chlorophyll content
Lower respiration rate
Reduced transpiration
Higher tissue moisture

A low light intensity is required for chlorophyll synthesis while high light intensity results in increased chlorophyll destruction. Reduced transpiration results from the lack of direct radiation, and decreased wind movements over the turf within the shade environment.

The morphology of turfgrass plants is also altered at reduced light intensities.

Morphological responses include:

Thinner leaves
Reduced shoot density
Reduced root growth
Reduced tillering
Reduced rate of new leaf appearance
Increased leaf length
Longer internodes
Upright growth habit

Turfgrass quality obviously would be reduced under continuous shading.

Leaf structure is also altered at low light intensities. Common anatomical responses include thinner cell walls, poorly developed supporting tissues and vascular system, and a thinner cuticle layer.

In addition to the reduction in light intensity, there are a number of other factors within the shade environment which contribute to the deterioration of turfgrass quality. Some of the more critical factors include:

Restricted wind movement
Increased relative humidity
Tree root competition
Alteration of light quality
Moderation of temperature extremes

Restricted wind movement and increased relative humidity are particularly severe in areas surrounded by underbrush or shrubs. As a result, when rainfall or a dew occurs, the turf will remain wet for a longer period of time. This effect plays an important role in the enhancement of disease development within the shaded environment.

Tree root competition can be an important factor when the trees have shallow feeder roots. In such a case, the tree roots can deprive the turf plants of water and nutrients. Trees which may cause problems include silver and Norway maple, willow, sweet gum, and cotton wood.

The consequences of altered light quality are not fully understood. Trees will absorb those wavelengths of light which they use in photosynthesis. As a result, light reaching the turf is deficient in wavelengths which can be used in photosynthesis. The extent to which turf can use this light is not known.

Temperature extremes are moderated in the shade environment. Temperatures are lower during the day since the turf does not receive direct sunlight. Higher night temperatures generally can be expected because the tree canopy prevents radiational cooling.

As turfgrass managers, you should be concerned with the following factors in the shade environment: (a) reduced light intensity, resulting in a depletion of carbohydrate reserves, and producing undesirable plant characteristics such as thinner leaves, reduced shoot density, reduced root growth, reduced tillering, and reduced rates of new leaf appearance; (b) increased disease development, caused by prolonged dews, decreased wind movement, and increased relative humidity, and a more delicate leaf structure, (e.g. thinner cell walls, thinner cuticle), making the plant less resistant to disease infestation; (c) more succulent tissue, making the turf more susceptible to injury from wear, heat, cold or drought stress.

Despite these adverse conditions within the shade environment, a suitable turf can be maintained. The most important factor is the use of a shade adapted species. Red fescue is far superior to any other cool-season turfgrass in shade. Rough bluegrass is best suited to wet, shaded conditions. Bentgrasses can be maintained in moderate shade if a proper fungicide program is used.

In areas receiving extreme shade, turfgrasses cannot be maintained. In this case, the use of a shade tolerant ground cover is preferred, such as myrtle, pachysandra, or English ivy.

Next, alterations of the shade environment can often be made. (a) Light intensity reaching the turf can be increased by selectively pruning limbs within the tree canopy. This may be particularly effective with trees having a dense canopy, such as maple, oak, and linden. (b) Pruning lower tree limbs will enable direct sunlight to reach the turf during early morning and late afternoon. Single trees which have their limbs pruned below 10 ft. present no shade problem. (c) Underbrush or shrub plantings can be thinned or removed to improve wind movement, enhancing the drying of wet turf. This should be done in relation to prevailing winds. (d) Prune shallow tree roots, to decrease competition for water and nutrients.

Finally, cultural practices within the shaded environment must be modified. (a) Raise the height of cut to 2 - 2 1/2 inches. This will provide a greater leaf surface for the absorption of light. (b) Avoid excessive nitrogen applications. Excessive nitrogen will place a further drain on carbohydrate reserves, and also increase tissue succulence. Red f scue in shade requires only 1-2 lbs. N/1000 ft.^{2}/yr. (c) Deep, infrequent irrigation. Avoid the maintenance of a wet soil surface which will enhance disease activity. (d) Control traffic by directing it around shaded areas. (e) The use of fungicides when necessary.

The preferred time for establishment under deciduous trees is early autumn. This will make use of the long period of direct sunlight from autumn until mid-spring. Immediate removal of fallen leaves is necessary.