

## **UPDATE ON MANAGEMENT OF SUMMER DECLINE OF BENTGRASS**

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Turf quality on bentgrass golf greens often declines in hot weather during the summer, especially in areas with high relative humidity. Many factors such as diseases, environmental stresses, soil properties and heavy traffic have been associated with this problem. High air and soil temperatures appear to be major factors in the southeastern United States. Soil temperatures above 90 degrees F two inches deep in the soil are often recorded in the afternoon on bentgrass golf greens on clear and sunny days when the air temperature is above 90 degrees. The high temperatures cause the roots of cool season grasses to decline and the growth of new roots is inhibited. Published data indicates that bentgrass roots do not grow when the soil temperature is above 77 degrees F. The declining roots are more susceptible to root rotting fungi and other stresses and new roots do not grow in hot weather to replace the old roots.

The roots on individual bentgrass plants that are separated from a turf with decline are few in number and short. A typical bentgrass plant in the summer in North Carolina will have one or two small live roots from 1/4 to 1 inch long attached to a short live stolon. Most of the older and longer roots are dead and are attached to rotted and dead portions of stolons. Rotting of stolons may be as important as the root decline in the summer decline syndrome since the new roots develop on the youngest part of the stolons and as the stolons die the roots die. The "small plants" are very susceptible to any type of disease or environmental stress and as some plants die the turf becomes thin and the turf quality declines.

Other factors that have been observed to contribute to the decline are lack of oxygen in wet soils or in thatch layers, restricted air movement that prevents cooling and drying, localized dry spots, high soluble salts, wilt and diseases. Wet and poorly drained soils have low levels of oxygen which cause roots to drown and provide favorable conditions for disease causing fungi. Too much water around the plants can occur on high-sand-content greens where thatch layers develop on the surface and cause perched water tables around the stolons and roots. Roots can die quickly when soil temperatures are in the 90's and adequate oxygen is not present. Decline usually appears first on greens in low areas surrounded by trees or mounds. Canopy temperatures and humidity are usually higher on these greens than on nearby healthy greens in open spaces with good air movement. Wind blowing on the grass removes boundary layers and provides conditions for maximum evapotranspiration to keep the grass cooler and drier. Decline in patches that has been diagnosed as take all patch in some cases has been associated with localized dry spots in North Carolina. Canopy temperatures of 110 to 115 degrees F have been recorded on bentgrass in localized dry spots when the air temperatures were 90 to 95 degrees F. These temperatures can kill bentgrass plants or cause severe damage that appears as a decline in the spots for several weeks later. High soluble salts in the top 1/2 inch of soil and thatch have been detected on some greens that are developing summer decline. The high soluble salts may be from fertilizers, especially ones with high amounts of potassium, or from irrigation water with high salt content. The high salts usually occur during dry weather when adequate irrigation water has not been applied to replace water removed by the plants and by evapotranspiration. Excessive levels of salt can damage the roots and stolons and make these tissues more susceptible to fungi discussed below.

Root and stolon rot diseases have been identified as major factors in the summer decline of bentgrass. Many different fungi have been isolated from roots with the summer decline syndrome. Pythium species have been isolated most frequently in samples processed in our laboratory. A total of 33 different species of Pythium have been isolated and identified by Dr. Gloria Abad from roots and stolons of bentgrass with decline from golf greens. Typical brown patch is often observed on these greens early in the summer and some of the declining patches in late summer appear to be similar in size and in the same places as brown patch was earlier. Three different species of Rhizoctonia that causes brown patch have been isolated from bentgrass golf greens. The Rhizoctonia species may be causing much of the stolon rot that is observed on declining

bentgrass. The most effective fungicide treatments discussed later have activity against both *Pythium* and *Rhizoctonia* species and would indicate the involvement of both of these fungi in the disease. Wilt which occurs during high temperatures on the bentgrass plants with poor root and stolon systems is probably the final factor that kills most of the plants.

Management practices that encourage new root growth during stress conditions appear to help manage the summer decline problem. Aeration in the spring and early summer to allow better drainage through thatch layers and more oxygen in the soil is probably the best practice to use to help prevent the problem. Removal of trees or undergrowth from around greens to improve air movement has helped in some cases. Fans installed around greens have been very useful to help improve growing conditions in areas without good air movement. Fans should be directed downward to move air across the surface of the green and toward open areas for best efficiency. Irrigation programs should be modified throughout the summer to apply small amounts of water frequently when root systems are short to prevent drought stress. Wilt symptoms should not be allowed to develop during the summer because the bentgrass cannot recover from wilt when the plants are weak. The application of small amounts of fertilizer (1/10 lb. of N/1000 sq. ft.) with a sprayer every 10 to 14 days during the summer has helped to avoid soluble salts problems and to insure adequate nutrients near the soil surface where the new short roots are growing. Fertilizers applied earlier in the year may be deeper in the soil and not available to the new short live roots. Some new bentgrass growth must continue during the hot weather to provide good turf quality.

Some fungicide applications have given good results on the summer decline syndrome in test plots at North Carolina State University. The combination of Aliette plus Fore or Aliette plus Daconil 2787 applied every 14 days beginning in early summer, about June 15, have been the best treatments for improved turf quality in test plots at Raleigh. These fungicide combinations have been shown to be active against both *Rhizoctonia* and *Pythium* species that have been associated with the summer decline of bentgrass in North Carolina. Results with low levels of Aliette plus Fore have indicated a synergistic interaction between these fungicides for the control of brown patch. Tests on bentgrass in 1994 indicated that the Fore formulation gave better brown patch control and better turf quality than other types of mancozeb fungicide formulations. The use of fungicides for brown patch such as Daconil 2787, Banner or Chipco 26019 during the week between applications of Aliette plus Fore resulted in better turf quality than where fungicides for *Pythium* were used. These results indicate that *Rhizoctonia* species, or fungi other than *Pythium* species, probably are involved in the development of summer decline without typical brown patch symptoms being present. Results in 1994 and 1995 indicated that mancozeb products can reduce the germination of bentgrass seeds. These results suggest that other fungicides should be used before and shortly after planting new seeds on greens. Daconil 2787 has given good control of algae which is often a problem when extra water is being applied to encourage seed germination.

More research is planned to identify more factors and diseases that may be involved in the development of the summer decline syndrome and to develop better management methods. Knowing that the roots and stolons of bentgrass decline during the summer will help golf course superintendents adjust management practices to avoid serious damage to golf greens. Management practices that encourage new root growth and proper fungicide applications at the correct time are the most effective ways that we now know to help manage this serious problem on bentgrass in hot and humid climates.