



The entire test area of these fall color retention plots in Riverside, Calif., is Princess-77 bermudagrass fertilized at 1 pound/M during late summer and fall. The dormant plot is Princess-77 mowed at $\frac{5}{8}$ inch with no scalping or verticutting during the growing season. The dark green plot in front of that was initially mowed at $\frac{5}{8}$ inch, and on July 25 was scalped at $\frac{3}{8}$ inch, and maintained at this height for the remainder of the season. This picture was taken on Nov. 15, 2000.

True Colors

Your management practices can promote good fall color retention of bermudagrass.

By Charlie Rodgers and Arden Baltensperger, Seeds West Inc.

Bermudagrass (*Cynodon spp*) is one of the most important and widely adapted warm-season turfgrass species. Advantages of bermudagrass are that it forms a fine dense sod, is more drought tolerant and has relatively few insect and disease problems compared to other grass species. Limitations to bermudagrass and warm-season

grasses in general are that they go dormant and turn a tan straw color in areas that are exposed to below-freezing temperatures. To some, this is an unattractive feature.

Fall color retention is a term that should not be confused with cold tolerance. Cold tolerance refers to

the ability of turfgrass to survive through the winter months and is a concern with warm-season turfgrasses in the transition zone. Cold tolerance is a measure of survival, and is a complex interaction of many factors: freezing temperatures, desiccation, pathogens and abiotic factors. Extended growing season is a different concept, which refers to how early the grass greens up and how late into the fall the grass stays green. This article focuses on bermudagrass variety selection and aspects of turf maintenance in relation to fall color retention.

LOCATION AND WEATHER PATTERNS HAVE AN IMPACT

The climate and weather patterns of your loca-

tion have a huge influence on fall color retention of bermudagrass, and what you are able to do as a turf manager to influence its fall color retention. A good rule of thumb for bermudagrass growth is 55 degrees F. Bermudagrass generally will not begin to green-up in the spring with a soil temperature below 55 degrees F (taken at a 4-inch depth) and, in the fall, bermudagrasses will start to lose their green color when the soil temperature drops below 55 degrees F. When soil temperatures drop to and below 55 degrees F, bermudagrass has difficulty producing chlorophyll more rapidly than it is degrading in the plant, particularly with high light intensity. As a result, the turfgrass will start to lose its dark green color. All bermudagrass will go dormant with air temperatures below 32 degree F. The ice crystals that form within the cells of the leaf tissue with freezing temperatures pierce the cell walls, ultimately killing the leaf tissue. It takes several days after this event for the bermudagrass to turn its characteristic dormant color; this happens gradually over the next several days as the sunlight degrades the chlorophyll in the leaf tissue.

In the Southern bermudagrass belt (USDA Plant Hardiness Zones 8b-11), the first frost generally is not encountered until mid-November or later. In these locations, you can perform management practices that will significantly increase fall color retention with little risk of winter injury to the bermudagrass. In the Northern limit of bermudagrass use (USDA Plant Hardiness Zones 6 and 7), you must use caution with some management practices as they may lead to increased winter injury of the bermudagrass.

Variety	2 Year Average
Seeded	1-9; 9=Complete color retention.
Princess-77	4.5
Guymon	2.1
Sultan	1.8
Jackpot	1.6
NuMex Sahara	1.4
Mirage	1.4
AZ Common	1.2
Vegetative	
Windsor Green	6.6
Santa Ana	6.0
Tifgreen	5.2
LSD (0.05)	0.9

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CULTIVARS MAKE A DIFFERENCE

Santa Ana is a vegetative variety that was released specifically for its fall color retention. It was identified in Southern California where the winters are mild and soil temperatures generally don't fall below 50 degrees F. With proper management during years where these types of conditions prevail, it is possible to keep bermudagrass green year round. Windsor Green is a vegetative cultivar that is only commercially available in Australia that also possesses excellent fall color.

TABLE 2. FALL COLOR (NOVEMBER) RATINGS OF BERMUDAGRASS CULTIVARS – 2000 DATA

Variety	Tucson, AZ	Riverside, CA	Gainesville, FL	Mean
Seeded				
<i>1-9; 9=Complete color retention</i>				
Princess-77	6.7	2.3	6.7	5.2
Savannah	6.0	1.0	6.0	4.3
Sydney	5.0	1.0	5.7	3.9
NuMex-Sahara	5.0	1.0	5.3	3.8
AZ Common	4.0	1.3	5.7	3.7
Mirage	4.7	1.0	5.3	3.7
Jackpot	4.0	1.0	5.3	3.4
Vegetative				
Tifsport	6.7	3.0	7.3	5.7
Tifway	6.0	3.0	7.3	5.4
Midlawn	5.7	2.3	6.0	4.7
Tifgreen	4.0	2.0	6.0	4.0
Cardinal	3.7	2.3	3.0	3.0
LSD (0.05)	2.0	0.9	0.9	0.8

This table contains all NTEP standard entries, top and bottom performing entries, and some select entries. However, only 12 of 28 entries are included – for full report see NTEP Progress Report 2000 – NTEP No. 01-5.

Tifsport and Tifway (419) are two other vegetative varieties that have excellent fall color retention; and Princess-77 is a seeded bermudagrass that has excellent fall color retention (see Table 2, above). Tifsport and Tifway are sterile interspecific hybrids that you must plant vegetatively; Princess-77 is a fertile intraspecific hybrid that you can seed or vegetatively propagate. Some other cultivars provide moderate to good fall color retention. Before deciding which to use, refer to the complete

National Turfgrass Evaluation Program's (NTEP) tables of the National Bermudagrass Test, 1997. You can find these in either printed reports or by visiting the NTEP Web site at www.ntep.org.

MANAGEMENT STRATEGIES INFLUENCE FALL COLOR RETENTION

Fertilization and cultivation have been suggested as a means of extending fall color in bermudagrass; however, few research results have been reported with fall color retention as the objective. Nitrogen and iron have often been shown to increase green color during the growing season if they are not readily available to the plant. In highly calcareous soils of the Southwestern United States and acid soils in the Southeastern United States, available iron is often a limiting factor for optimum bermudagrass growth and color. Bermudagrass is widely known for its excellent response to nitrogen applications, resulting in rapid growth and a dark green color. Therefore, for good fall color retention nitrogen and iron should not be limiting.

Recent research at the University of California-Riverside has investigated management practices to increase

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Mowing, scalping and verticutting all have a positive influence on fall color retention. Photo courtesy of Charlie Rodgers

fall color retention in bermudagrass. In the first two-year study, nitrogen rates, foliar iron and vertical mowing were examined for their influence on fall color retention. Researchers found that 1 pound/1,000 ft² of nitrogen per month during late summer and fall promoted good color retention in late fall and early winter. You should avoid rates higher than 1 pound/1,000 ft² of nitrogen because excess nitrogen can result in a rapid accumulation of thatch, complicating other turf maintenance practices.

You should use nitrate sources of nitrogen in fall and early winter for color retention, as nitrate nitrogen is readily available to the plant. Calcium nitrate and am-

monium nitrate are good sources of readily available nitrogen, but they must be watered-in quickly as they have a high burn potential. Natural organic (sewage-, plant- and animal-based products, etc.) and synthetic organic (urea forms, IBDU and methyleneureas, etc.) sources of nitrogen need to be converted to nitrate nitrogen before becoming readily available to the plant, and must undergo biological or chemical conversions, which often are temperature dependant. In cool soils, these biological and chemical conversions take longer to occur, so the nitrogen is not as readily available to the plant.

In the second set of studies conducted at U.C. Riverside, researchers studied mechanical cultural practices more intensely. They examined management practices including mowing height, scalping and vertical mowing (see Figure 1, page 36). They found that all of these practices could have a positive influence on fall color retention, but also can have complex interactions with each other. Generally, lower mowed turf that has been verticut or scalped can promote good fall color retention. By scalping or verticutting, the amount of thatch present is reduced, which allows for better light penetration through the canopy resulting in soil heating, as well as promotes juvenile growth to come back from the crowns, stolons and rhizomes of the thinned turf, promoting good fall color retention. This juvenile growth that results from the scalping and verticutting seems to hold its color better going into the fall.

If you perform scalping or verticutting, you must do so before late summer to allow the turf plenty of time to heal before growth slows with the cooler fall temperatures. If you verticut or scalp in the fall, the turf will not have enough time to heal itself. Also, it has been observed in the transition zone that verticutting in the late summer can help reduce the injurious effects of spring dead spot the following spring as well.

FOR WHAT IT'S WORTH

Both selection of a cultivar, and the management of that cultivar can have an influence on fall color retention in bermudagrass. Management practices that you can use to extend fall color of a bermudagrass variety should be exercised with caution. For example, high nitrogen rates may extend fall color of bermudagrass in all locations, but in the transition zone this may result in severe winter kill and lead to an increase in spring dead spot; whereas in the southern bermudagrass belt no adverse reactions would be observed with late nitrogen applications.

In most locations, selection of a cultivar and

“Increased fall color retention is just one of the many characteristics that plant breeders and turfgrass managers are trying to improve through conventional means.”

management practices can increase fall color retention to an acceptable level for two to six weeks, depending on weather patterns. Where winter soil temperatures don't drop much below 55 degrees F and freezing temperatures are not incurred, it is possible to keep bermudagrass green year round.

Some turf managers and homeowners perceive dormant warm-season grasses as unsightly. In many regions of the country, overseeding with annual or perennial ryegrass is performed to maintain year round green color. I too overseeded dormant bermudagrass my first years of living in the desert southwest. However, I soon realized that year-round green was a lot of work and not very energy efficient. The tan color of the dormant bermudagrass is attractive, and no irrigation or mowing is required of the dormant turf. By variety selection and management practices I can extend the growing season of my turf, as well as have a few months of rest and relaxation from yard work.

Increased fall color retention is just one of the many characteristics that plant breeders and turfgrass managers are trying to improve through conventional means. Perhaps with new tools such as biotechnology fall color retention in warm-season grasses may be improved dramatically. Stay tuned, there are many exciting improvements being made in bermudagrass. **GM**

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8-2003/11375