Ryegrass Overseeding Effects on Bermudagrass Physiology

Cale Bigelow[1*], Gregg Munshaw[2], Mike Richardson[3], Xunzhong Zhang[4] and Mike Goatley[4]
Purdue University[1], University of Kentucky[2], University of Arkansas[3] and Virginia Tech[4]
corresponding author: cbigelow@purdue.edu

Bermudagrass (*Cynodon dactylon* L.) is a warm-season turf species widely planted on golf courses and athletic fields throughout the South and into the transition zones of the United States. While it readily tolerates close mowing, and forms a dense, aesthetically pleasing turf with excellent durability and recuperative capacity during active summer growth, it goes dormant and turns straw-brown during the winter months. Since bermudagrass turf areas are still used in spring and fall and trafficked outside of the active summer growth season, it is not uncommon for turf managers to overseed the surface with cool-season grasses like perennial ryegrass (*Lolium perenne* L.). This is primarily done to maintain a green appearance and may also improve playing conditions.

Comparison of the impact of winter overseeding on two athletic field areas that had been overseeded (left) and non-overseeded (right) during spring green-up.

Overview of an overseeded bermuadagrass field during green-up after the "polar vortex" winter of 2013-2014 green-up (Elizabethtown, KY).

Winter overseeding: Why is it practiced?

- Superior winter aesthetics (green color)
- Improved playability (recovery, traction, drier surfaces?, etc.)
- Possible protection from severe winter temperatures (insulation, absorption of solar radiation?)

What we know and/or think we know:

- Perennial ryegrass is the species of choice for overseeding bermudagrass fairways or athletic fields.
- Suggested planting rates range from 245-1470 kg ha^{-1} (Goatley et al., 2008; McCarty, 2016). It is not uncommon for some athletic fields to receive much more.
- Overseeded areas often have density/coverage issues the following spring compared to non-overseeded areas with possible influence of seeding rates.
- Bermudagrass requires approximately 60-100 days of no competition to fully recover/replenish carbohydrates (Askew, 2010). Selective herbicides are often used to chemically remove the overseeded species and maximize the opportunity for improving health.

Knowledge gap:

What effect "if any" does the practice of winter overseeding have on the physiological health of the bermudagrass plant? Does this practice alter the plant's carbohydrate status (positively or negatively) that will influence spring green-up and/or recovery?

Experimental Approach:

Four widely separated sites where bermudagrass is grown and overseeded for fall/spring use throughout the transition zone were selected for this study. Bermudagrass was overseeded at three rates (0, 735 and 1470 kg ha^{-1}) in Sept. 2014 with a high quality ryegrass blend (Futura 2000: Pickseed USA-Halsey, OR). Data: Ryegrass cover, bermudagrass cover the following spring, surface soil temperatures at the soil/stem interface (e.g. crown) monitored with data logging temperature probes and temporal stem tissue carbohydrate status evaluated using ground tissue in the turf physiology laboratory at Virginia Tech. Treatments were planted in a randomized complete block with a minimum of three replications.

References:

- Askew, S. 2010. Perennial ryegrass competition affects bermudagrass health. Golf Course Mgmt. 37(10): 96-102
- Goatley, M., S. Askew, E. Ervin, B. Studholme, P. Schultz and B. Horvath. 2008. Sports turf management in the transition zone. Pocahontas Press, Blacksburg, VA. (ISBN# 0-926487-34-5).
- McCarty, L.B. 2016. Best golf course management practices. 3rd edition. Pearson Publishing.
- Munshaw, G.C., E.H. Ervin, C. Shang, S.D. Askew, X. Zhang and R.W. Lemus. 2006. Influence of Late-Season Iron, Nitrogen, and Seaweed Extract on Fall Color Retention and Cold Tolerance of Four Bermudagrass Cultivars Crop Sci 46:273-283.

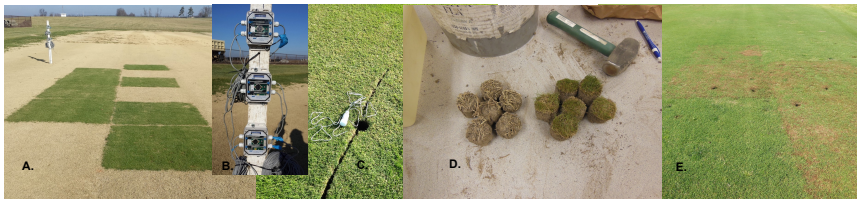
Abstract

Bermudagrass (*Cynodon* dactylon L.) is the warm-season turf species of choice for much of the South and transition zone regions for golf course fairways, tees and athletic fields. It forms a durable, persistent turf that can be closely mowed but also becomes straw-brown during dormancy. Turf managers frequently overseed bermudagrass with cool-season species to provide a green winter color and sometimes for playability reasons. This field study conducted at four locations (Blacksburg, VA; Fayetteville, AR; Lexington, KY; and West Lafayette, IN) evaluated the effects of three perennial ryegrass overseeding rates (0, 735, 1470 kg ha^{-1}) on bermudagrass carbohydrate status and surface soil temperatures. Winter overseeding had positive effects on the general appearance of the overseeded turf but also negative effects on spring density at some locations. Stolon tissue was analyzed for carbohydrate status and at the West Lafayette site total carbohydrate status declined with time and values ranged from 73 to 34 mg g^{-1} tissue. The starch portion of the carbohydrates followed a similar pattern of decline with time and values ranged from 36 to 28 mg g^{-1} tissue. Surface soil temperature effects were somewhat variable with only slight increases (+0.5 °C) in the overseeded plots at the Lexington and Fayetteville sites. This study demonstrates the potential negative effects of overseeding on bermudagrass health and need for further investigations into the cultural management practices that maximize overseeded bermudagrass health and winter survival.

Table 1. Carbohydrate (CHO) status of Patriot bermudagrass stolons on three sampling dates as affected by three perennial ryegrass winter overseeding rates, West Lafayette, IN (2014-2015).

	Bermudagrass stolon carbohydrates ‡					
	Total non-structural carbohydrates			Starch		
Overseeding rate†	Dec 2014	Mar 2015	Apr 2015	Dec 2014	Mar 2015	Apr 2015
kg ha^{-1}	(mg g^{-1} tissue)					
0	79.5 a	48.6 a	36.0 a	37.9 a	37.3 a	30.0 a
735	79.2 a	48.6 a	36.5 a	38.5 a	39.7 a	29.4 a
1470	59.9 a	51.7 a	29.4 a	31.8 b	32.4 a	25.4 a
Overall CHO mean	72.9 A	49.6 B	34.0 C	36.1 A	36.5 A	28.3 B

†Winter overseeding occurred on 15 Sept., 2014 where the seed was applied with 0.5 ft^3 of sand topdressing and immediately brushed into the turf canopy with a stiff bristle broom.
Means in the same column followed by the same lowercase letter and means in the same row within each carbohydrate category followed by the same uppercase letter are not significantly different according to Fisher's protected LSD (p=0.05).



Images: (A.) The winter overseeded study area in Lexington, KY, (B-C.) Soil temperature monitoring equipment used to document the impact of overseeding on soil temperatures, (D.) removed cores from non-overseeded and winter overseeded bermudagrass ready for separation of stem tissue from soil for carbohydrate analysis, (E.) effects of the winter overseeding on bermudagrass spring green-up and density in Lexington, KY-2015.

Table 2. Surface soil temperatures for non-overseeded bermudagrass and turf overseeded at 735 and 1470 kg ha^{-1} at three locations.

	Arkansas			Kentucky			Virginia		
	0	735	1470	0	735	1470	0	735	1470
	Surface soil temperature (degrees Celsius)								
Mean	8.6	8.9	9.1	6.1	6.5	6.5	5.6	5.9	5.9
High	27.5	27.1	26.5	20.3	20.9	20.8	24.5	24.7	24.7
Low	-1.5	-0.5	-0.2	-0.6	-0.7	-0.7	-1.4	-1.2	-1.3

Results and Summary:

- Winter overseeding of bermudagrass improved the visual appearance and potentially playability at each of the four locations.
- Overseeding at either 735 or 1470 kg ha^{-1} resulted in less dense bermudagrass the following spring after a selective transitioning herbicide was applied.
- The effect of winter overseeding on bermudagrass stolon carbohydrate status at the West Lafayette location showed slight temporal differences with progression of the dormancy. There was, however, a decline in December starch concentrations for turf overseeded at 1470 kg ha^{-1} compared to 0 or 735 kg ha^{-1}. This study was repeated in West Lafayette in 2015 and 2016 and analyses are continuing.
- Only a slight temperature increase (+0.5 °C) was measured in the overseeded turf compared to the non-overseeded turf at some locations. This increase may not be practically important.

Acknowledgements: This research was made possible through the generous support of the Midwest Regional Turf Foundation, the United States Golf Association and Seed Research of Oregon.