EVALUATION OF A SOUTH DAKOTA BUFFALOGRASS FOR REDUCED-INPUT TURF

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ABSTRACT

Development of improved turf-type buffalograsses [*Buchloë dactyloides* (Nutt.) Englem.] has increased demand for this native warm-season grass species in recent years as a reduced-input turfgrass. Buffalograss requires less water, mowing, fertilizer, and pesticides than more commonly used cool-season turfgrasses and is well-adapted to the northern Great Plains. Highly diverse populations of buffalograss native to South Dakota's grasslands offer unique genetic potential for development of improved turf-type cultivars. 'Legacy' and '118' are commercially available buffalograsses that consistently rank high in national and regional tests. The objective of this study was to compare a native buffalograss selection from South Dakota vs. 'Legacy' and '118' at different mowing heights under non-irrigated, reduced-input conditions. Results indicated that the South Dakota selection was as good or better in all criteria tested except genetic color. The results also suggest that collection and evaluation of South Dakota buffalograss germplasm would be a worthwhile strategy to develop improved reduced-input turfgrasses.

INTRODUCTION

Turf-type buffalograsses are well-suited to the Great Plains as a reduced-input turf. Previous research has demonstrated the excellent drought and heat tolerance as well as cold hardiness of buffalograss (Johnson et al., 1997). Compared to traditional cool-season turfgrass species, buffalograss requires less mowing, fertilizer, pesticides, and perhaps of greatest importance, water (Riordan et al., 1993).

Several turf-type buffalograsses developed since the 1980's are well-adapted to the Northern Plains. 'Legacy' (LG) and '118' are registered, commercially available buffalograss cultivars developed at the University of Nebraska from selections obtained from stands in the Great Plains (Johnson et al., 2000; Riordan et al., 2000). Both buffalograsses are female clones with improved turf-type characteristics compared to forage-type buffalograsses and possess a darker color, finer leaf texture, shorter canopy height, and greater vigor than earlier buffalograss releases (Johnson et al., 2000; Riordan et al., 2000). In the 1996 National Turfgrass Evaluation Program (NTEP) buffalograss test, '118' and LG ranked first and second, respectively, in mean turfgrass quality among vegetative cultivars and had the shortest canopy heights among all cultivars (Morris, 2001). In the same test, both LG and '118' were among the top rated entries in turfgrass density and LG ranked first in genetic color. The most recent (2002) NTEP buffalograss test does not include '118', but ranks LG among the highest-rated entries in turfgrass quality, genetic color, and turfgrass density (Morris, 2005). A 1998 to 2000 evaluation of 16 commercial or experimental buffalograss entries at Brookings, S.D. ranked LG and '118' among the top buffalograsses in turfgrass quality, genetic color, and turfgrass density (Schleicher and Ness, 2001).

Highly diverse buffalograss populations are traditional constituents of shortgrass and mixed grass prairies in South Dakota and other Great Plains states (Beetle, 1950). In 1997, a buffalograss stand approximately 0.5-m diam. was discovered growing in a wildflower demonstration at McCrory Gardens in Brookings, S.D.. The demonstration was established in the 1980's from native wildflower seeds collected near Pierre, S.D. (N.P. Evers, personal communication, 1997). Evidently, the buffalograss stand originated from a single seed unintentionally included with the wildflower mix. Buffalograss individuals in the stand were connected by stolons and all were female. Plugs were vegetatively propagated in the greenhouse from a single original plant (hereafter referred to as SD) and planted on 15-cm centers at the N.E. Hansen Research Center near Brookings, S.D. The accession was managed as a non-irrigated, reduced-input turf and observed from 1998 to 2001.

The objective of this study was to compare a native South Dakota buffalograss selection against two of the highest-rated commercial buffalograsses that are well-adapted to the northern Great Plains region under non-irrigated conditions. Results of this study will aid decision-making regarding the value of collecting additional germplasm from South Dakota grasslands to develop improved turf-type buffalograsses.

MATERIALS AND METHODS

Pre-rooted buffalograss plugs of LG, '118', or SD were planted on 30.5-cm centers in one of three 1.5 m x 18 m field strips at the N.E. Hansen Research Center near Brookings, S.D. in 2001. Each buffalograss strip was randomly divided into three replications of 1.5 m x 1.5 m plots consisting of four mowing treatments: 2.5, 5.1, or 7.6-cm mowing height, or unmowed. Mowed plots received twice-weekly mowing during the period of active seasonal growth. All plots were fertilized annually in June and again in July at 49 kg ha^{-1} with a complete fertilizer. No supplemental irrigation was provided throughout the study except during the first month of establishment in 2001. Turfgrass quality, genetic color, and spring greenup were rated visually on a 1 to 9 scale, where 9=ideal and 5=acceptable. Turfgrass density was calculated as the number of individual live plants in a 7.3-cm core taken randomly from each plot. Broadleaf weeds were controlled postemergence in 2001-2002, but not 2003. Individual dandelion plants were counted 26 May 2003 to provide a comparison of weed infestation vs. mowing height.

Data were analyzed as a split-block (strip plot) experimental design arranged in three randomized complete blocks with buffalograss types as the horizontal factor and mowing treatment as the vertical factor (Gomez and Gomez, 1984). Analyses of variance were performed using the general linear model procedure (GLM) (SAS Institute, 1991). Mean separations were calculated using Fishers Least Significance Difference test (LSD) at the 0.05 probability level. Pre-planned comparisons of means between SD vs. mean of LG &'118' for each mowing treatment were performed using the SAS® System for Linear Models Contrast statement (SAS Institute, 1991).

RESULTS AND DISCUSSION

Precipitation

Figure 1 illustrates daily precipitation during the growing season at Brookings, S.D. from 2001 to 2004. During this period, Brookings remained on the eastern edge of moderate to severe drought conditions that affected South Dakota and other western states. During the buffalograss growing seasons (Apr. to Sept.) from 2001 to 2004, 17 of the 24 months (71%) received less than normal precipitation (S.D. Office of Climatology, 2005). These conditions provided an excellent opportunity to evaluate non-irrigated buffalograss under moisture deficit conditions.

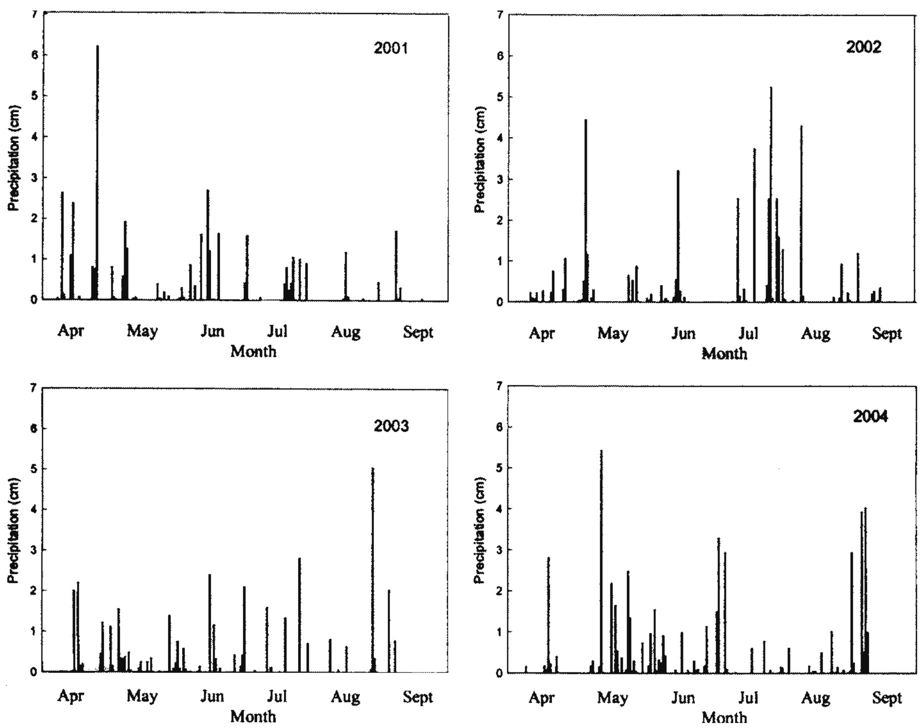

Figure 1. Daily precipitation during four growing seasons at Brookings, SD, 2001-2004.

Cultivar comparison

SD turfgrass density was greater than the other two buffalograsses when averaged across mowing heights in 2003, but there was no difference in density among the three buffalograsses in 2004 (Table 1). Pre-planned comparisons of SD vs. LG & '118' at each mowing height showed a greater SD density in the unmowed plots, but not the mowed plots in 2003 (Table 2). Genetic color of both SD and LG was better than '118' in 2003 and 2004. Although there was no color difference between SD and LG in 2003, LG color was better than SD in 2004 (Table 1). A highly desirable characteristic of turf-type buffalograss is a darker color compared to earlier forage types. LG consistently ranks high in genetic color in NTEP tests (Morris, 2001; 2005). Although LG was darker in genetic color than SD in 2004 (Table 1), it should be noted that SD visually appeared 'greener' than the darker blue/gray color of LG.

Contrasts of SD vs. LG & '118" clearly indicated superior SD turfgrass quality in unmowed plots for all years as well as 7.6 cm plots in 2002 (Table 3). Turf-type buffalograsses that green up earlier in spring and enter dormancy later in fall are desirable aesthetically because they lengthen the season of green turf in the landscape. SD greened up earlier in spring than LG in 2002 and 2003 and earlier than '118' for all years when averaged across mowing heights (Table 1). Pre-planned comparisons of SD vs. LG & '118' for each mowing treatment showed that SD greened up earlier at all mowing heights and years except for the unmowed plots in 2003 and 2004 (Table 3).

Effect of mowing height

Data in Table 2 support previous research results demonstrating the relationship between mowing height and turfgrass density; i.e., density generally

Table 1. Comparison among three buffalograss cultivars for turfgrass density, genetic color, turfgrass quality, and spring greenup.†

	DENSITY		GENETIC COLOR‡		TURFGRASS QUALITY§			SPRING GREENUP¶		
Cultivar	**2003**	**2004**	**2003**	**2004**	**2002**	**2003**	**2004**	**2002**	**2003**	**2004**
	plants cm^{-2}		*1 to 9 scale*							
SD	0.62	0.83	5.42	5.58	6.75	6.75	6.92	5.92	4.17	5.67
LG	0.44	0.75	6.17	6.08	6.42	7.00	7.00	5.17	3.58	4.92
'118'	0.47	0.80	4.50	4.67	4.17	5.75	6.17	3.00	2.00	3.92
Mean	0.51	0.79	5.36	5.44	5.78	6.50	6.69	4.69	3.25	4.83
LSD ($P \leq 0.05$)	0.12	NS	0.95	0.44	0.38	0.33	0.30	0.38	0.33	0.81

†Values are means averaged across 4 mowing heights.

‡ Genetic color, 1 to 9, where 1=brown, 9=dark green

§ Visual quality, 1 to 9, where 1 = dead, 5 = acceptable, 9=excellent

¶ Spring greenup, 1 to 9, where 1 = fully dormant, 9=no dormancy

Table 2. Turfgrass density and color rating comparisons between a South Dakota buffalograss selection vs. two commercially-available buffalograsses under four mowing height regimes.

		TURFGRASS DENSITY		COLOR†	
		2003	2004	2003	2004
Mowing height	Cultivar	*plants cm^{-2}*		*1 to 9 scale*	
2.5 cm	SD	0.76	1.06	6.00	5.00
	LG	0.42	0.83	6.67	5.33
	'118'	0.57	0.92	5.00	4.00
	SD vs. LG, '118'‡	NS	NS	NS	NS
5.1 cm	SD	0.61	0.84	6.00	5.33
	LG	0.45	0.84	7.00	6.00
	'118'	0.58	0.98	4.00	4.67
	SD vs. LG, '118'	NS	NS	NS	NS
7.6 cm	SD	0.61	0.79	5.67	6.00
	LG	0.55	0.79	5.67	6.00
	'118'	0.42	0.69	5.00	5.00
	SD vs. LG, '118'	NS	NS	NS	NS
Unmowed	SD	0.49	0.62	4.00	6.00
	LG	0.33	0.55	5.33	7.00
	'118'	0.33	0.62	4.00	5.00
	SD vs. LG, '118'	*	NS	NS	NS

*, **, *** Significant at the 0.05, 0.01, and 0.001 probability levels, respectively. NS, not significant.

† Color, 1 to 9, where 1=brown, 9=dark green

‡ SD vs. average of means for LG and '118'.

increases as mowing height is reduced (Beard, 1973). When averaged across all buffalograsses, turfgrass density ranged from 0.59 to 0.38 plants cm^{-2} in 2003 and 0.94 to 0.60 plants cm^{-2} in 2004 from the lowest (2.5-cm mowing height) to the tallest (unmowed), respectively.

There were no differences in turfgrass quality among plots mowed at 2.5, 5.1, or 7.6 cm in any year; however, unmowed plots did not rate as high in quality as mowed plots (Table 2). Shorter mowing heights were also related to earlier spring greenup (Table 2). Mean spring greenup ratings from 2002 to 2004 were 6.5, 5.0, and 3.6 for 2.5, 5.1, and 7.6 cm mowed plots, respectively, and 2.0 for unmowed plots.

Dandelion infestation

The number of dandelions increased as buffalograss canopy height decreased (Fig. 2). Mean number of dandelions in plots mowed at 2.5, 5.4, and 7.6 cm

Table 3. Turfgrass quality and spring greenup rating comparisons between a South Dakota buffalograss selection vs. two commercially-available buffalograsses under four mowing height regimes.

		TURFGRASS QUALITY†			SPRING GREENUP‡		
		2002	2003	2004	2002	2003	2004
Mowing height	**Cultivar**	*1 to 9 scale*					
2.5 cm	SD	6.67	7.00	6.33	7.67	6.67	8.33
	LG	7.00	7.33	7.33	6.67	7.00	7.33
	'118'	4.33	7.00	7.67	5.00	3.67	6.33
	SD vs. LG, '118'§	*	NS	NS	***	***	***
5.1 cm	SD	7.00	7.33	7.67	6.67	4.67	7.00
	LG	7.33	7.33	7.67	6.00	4.00	6.33
	'118'	5.00	6.33	6.67	3.33	2.33	4.33
	SD vs. LG, '118'	*	NS	NS	***	***	***
7.6 cm	SD	7.33	6.67	7.00	5.33	4.00	5.33
	LG	6.67	7.00	7.00	4.67	2.33	4.00
	'118'	4.33	5.67	6.33	2.67	1.00	3.00
	SD vs. LG, '118'	***	NS	NS	***	***	***
Unmowed	SD	6.00	6.00	6.67	4.00	1.33	2.00
	LG	4.67	6.33	6.00	3.33	1.00	2.00
	'118'	3.00	4.00	4.00	1.00	1.00	2.00
	SD vs. LG, '118'	***	*	***	***	NS	NS

*, **, *** Significant at the 0.05, 0.01, and 0.001 probability levels, respectively. NS, not significant.
† Visual quality, 1 to 9, where 1 = dead, 5 = acceptable, 9=excellent
‡ Spring greenup, 1 to 9, where 1 = fully dormant, 9=no dormancy
§ SD vs. average of means for LG and '118'.

were 99.4, 48.8, and 24.9, respectively, while unmowed plots averaged 5.6 dandelions. These data show that unmowed buffalograss, which ranged in height from 11 to 19 cm (data not shown) is very effective at controlling dandelion infestation. The relatively few dandelions in unmowed buffalograss turf could easily be controlled with spot treatment of a non-selective herbicide during early spring or late fall when the buffalograss is dormant.

Summary

Results of this study indicate that the South Dakota accession is comparable to two commercially-available buffalograsses under non-irrigated conditions. Although the genetic color of LG was better than the South Dakota entry, it should be noted that LG is among the highest-rated commercially available buffalograsses in terms of genetic color. SD spring greenup was better than LG and '118', which is an important consideration in the shorter growing seasons

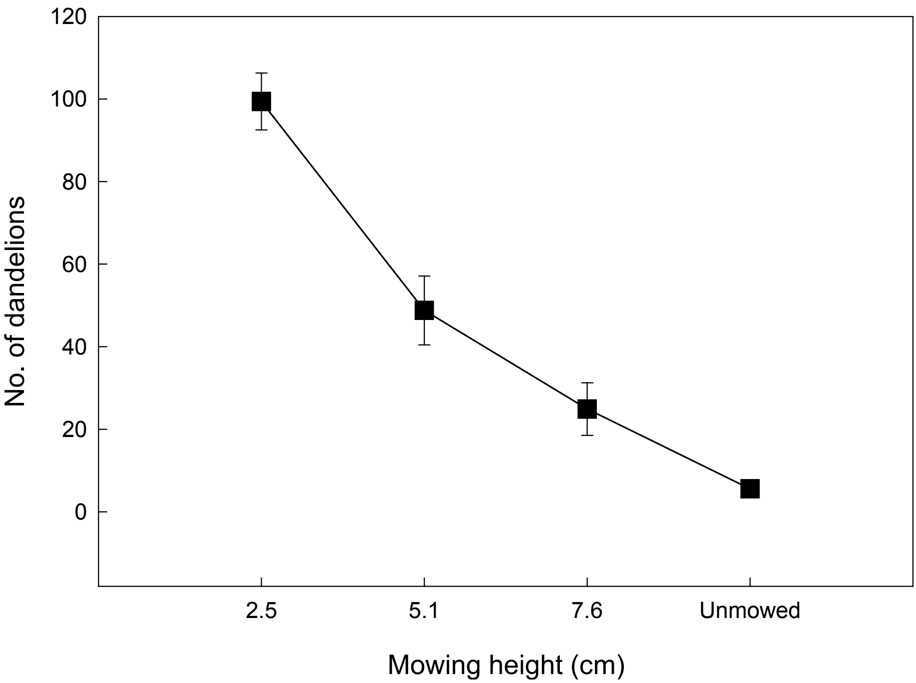

Figure 2. Effect of mowing height on dandelion infestation in 2003. Values are the mean ± SE of the mean of the three replications of three buffalograsses.

Table 4. Effect of mowing height on buffalograss density, color, turfgrass quality, and spring greenup.†

	Density		Color‡		Turfgrass quality§			Spring greenup¶		
Mowing height	**2003**	**2004**	**2003**	**2004**	**2002**	**2003**	**2004**	**2002**	**2003**	**2004**
	plants cm^{-2}		*1 to 9 scale*							
2.5 cm	0.59	0.94	5.89	4.78	6.00	7.11	7.11	6.44	5.78	7.33
5.1 cm	0.55	0.89	5.67	5.33	6.44	7.00	7.33	5.33	3.67	5.89
7.6 cm	0.53	0.76	5.44	5.67	6.11	6.44	6.78	4.22	2.44	4.11
Unmowed	0.38	0.60	4.44	6.00	4.56	5.44	5.56	2.78	1.11	2.00
Mean	0.51	0.79	5.36	5.44	5.78	6.50	6.69	4.69	3.25	4.83
LSD ($P \leq 0.05$)	0.16	0.16	1.15	0.51	0.85	0.96	1.65	0.46	1.66	1.28

† Values are means averaged across cultivars.

‡ Color, 1 to 9, where 1=brown, 9=dark green

§ Visual quality, 1 to 9, where 1 = dead, 5 = acceptable, 9=excellent

¶ Spring greenup, 1 to 9, where 1 = fully dormant, 9=no dormancy of the northern Great Plains. SD density and quality were comparable to LG in plots mowed at 7.6 cm or left unmowed. Results suggest that 1) the South Dakota accession in this study may have commercial potential as a reduced-input turfgrass, particularly in non-irrigated, unmowed turf and 2) collection and evaluation of South Dakota buffalograss germplasm is a worthwhile strategy to develop reduced-input turfgrasses.

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