

Comparison of Bermudagrass, Bahiagrass, and Kikuyugrass as a Standing Hay Crop

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ABSTRACT

Stockpiling of warm-season perennial grasses for grazing after frost is a management practice that can lower livestock production costs. Six seeded bermudagrass [*Cynodon dactylon* (L.) Pers.] cultivars, two bahiagrass (*Paspalum notatum* Flugge) cultivars, and a kikuyugrass (*Pennisetum clandestinum* Hochst. ex Chiov.) cultivar were compared with 'Coastal' and 'Tifton 85' bermudagrass in a small plot study in northeast Texas. Plots were sampled monthly from October through February in 1999 through 2002 to monitor accumulated dry matter (DM), crude protein (CP), and acid detergent fiber (ADF). Initial standing forage mass was <3000 kg DM ha⁻¹ and remained relatively stable during the sampling period in the first 2 yr. In the third year, initial standing forage mass was >4000 kg DM ha⁻¹ and declined during the sampling period for all entries. Standing forage mass of Tifton 85 bermudagrass was usually greater than the other entries. Crude protein decreased with time, but the rate of decline was related to initial CP concentrations and forage maturity at first frost. Bahiagrass cultivars and kikuyugrass generally had higher CP concentrations than bermudagrass cultivars. Crude protein concentrations were always above the minimum requirements for mature, nonlactating, pregnant beef cows (70–80 g kg⁻¹). Acid detergent fiber increased with time for all entries, with the largest monthly increase usually occurring after December. The ADF concentration in bahiagrass cultivars was always higher than in bermudagrass cultivars and kikuyugrass. Species suitability for stockpiling forage was bermudagrass > kikuyugrass > bahiagrass. Tifton 85 was superior to the other bermudagrasses because of greatest autumn growth.

COW-CALF PRODUCTION systems are popular and widespread across the southeastern USA. Annual production costs per cow in Texas range from \$325 to \$522, with grazing and winter feed costs per cow comprising 35 to 47% of the annual cost (Redmon, 2000). Beef cow-calf producers could potentially reduce input cost by decreasing winter feeding cost. One recommended practice is to accumulate autumn growth of perennial grasses and graze after frost as a standing hay crop (Redmon, 2000). This practice has been a common management option with tall fescue (*Festuca arundinacea* Schreb.), a temperate perennial grass (Fribourg and Bell, 1984). Subtropical perennial grasses typically have lower nutritive value than temperate perennial grasses (Ellis and Lippke, 1976) and are desiccated by the first autumn frost. Therefore, subtropical perennial grasses were not considered suitable candidates for winter stockpiling. The nutritive value of subtropical perennial grasses is the lowest in July and August but it improves with the

cooler autumn temperatures (McCarter and Rouquette, 1976).

The earliest mention of this management strategy for subtropical perennial grasses may be Woodle (1958), who suggested using Coastal bermudagrass for winter stockpiling in South Carolina. Woodle noted that autumn-accumulated forage growth could be grazed after frost through late January instead of feeding hay. Taliaferro et al. (1987) demonstrated that acceptable concentrations of CP could be maintained in four hybrid bermudagrasses from November to February at six locations throughout Oklahoma. However, in vitro dry matter disappearance (IVDMD) tended to decrease more rapidly than CP, and was not considered adequate to supply minimum energy requirements for nonlactating, pregnant, mature beef cows. Recent work in Oklahoma showed that CP and digestible energy in stockpiled 'Midland' bermudagrass were sufficient to meet the nutritional requirements of nonlactating pregnant beef cows from autumn until February (Wheeler et al., 2002). Protein supplementation did slightly improve weight gain and body condition score.

In Arkansas, Scarbrough et al. (2001) followed DM yield, CP, and fiber constituents from October to January of 'Greenfield' bermudagrass managed for hay production or grazing during the previous summer. Forage availability and CP remained relatively stable throughout the sampling period. Neutral detergent fiber (NDF) and ADF increased slightly, and lignin increased significantly. The authors concluded use of stockpiled bermudagrass should only be used during a limited window of time during late autumn. However, the same authors (Scarbrough et al., 2002) looked at the effects of summer management on bermudagrass fields relative to ruminal in situ degradation of CP. These authors concluded that while the ruminal availability of CP in stockpiled bermudagrass decreased as the forage aged, the forage might be adequate to meet the minimum CP requirements for nonlactating pregnant beef cows (Scarbrough et al., 2002). Both these bermudagrass studies agree that CP concentrations are adequate but that energy (IVDMD, NDF, ADF) may be marginal to maintain nonlactating beef cows.

Gates et al. (2001) compared 15 or 30 d regrowth of 'Pensacola', 'Tifton 9', and restricted recurrent phenotypic selection 'Cycle 18' bahiagrass from mid-September through mid-April in central Florida and southern Georgia. In central Florida, where mean minimum daily temperatures were $\geq 8^{\circ}\text{C}$ during the sample period, IVDMD was about 600 g kg⁻¹ and CP concentrations about 150 g kg⁻¹. With freezing temperatures occurring from 18 to 29 d yr⁻¹ in southern Georgia, IVDMD de-

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Published in Crop Sci. 44:1370–1378 (2004).
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Abbreviations: ADF, acid detergent fiber; CP, crude protein; DM, dry matter; IVDMD, in vitro dry matter disappearance; NDF, neutral detergent fiber.

Table 1. Fertilization, number of harvests, first frost, and autumn-winter sampling dates.

	Year		
	1999	2000	2001
Summer fertilization	325N-73P-263K-22Mg-22S	336N-84P-252K	323N-87P-155K
Harvests	4	3	4
Last summer harvest	11 Aug.	26 June	28 Aug.
First frost (°C)	5 Nov. (-1.1)	10 Nov. (-1.3)	21 Nov. (-1.1)
Sample dates	27 Oct. 23 Nov. 20 Dec. 24 Jan. 21 Feb.	9 Nov. 8 Dec. 8 Jan. 13 Feb.	4 Oct. 2 Nov. 3 Dec. 8 Jan. 4 Feb.

creased from 600 to about 300 g kg⁻¹ from September to February, respectively, and CP concentrations decreased from 160 to 100 g kg⁻¹ during the same period.

In recent years there has been interest in seeded bermudagrass as an alternative to hybrid bermudagrass which are vegetatively propagated. Some of the seeded cultivars are as productive as Coastal bermudagrass, but not Tifton 85 (Evers et al., 2001; Evers and Parsons, 2002). Kikuyugrass is another subtropical perennial grass that may have some potential for the southeastern USA (Kretschmer and Pitman, 1995). Limited information is available comparing bahiagrass, kikuyugrass, and seeded bermudagrass cultivars with hybrid bermudagrass for autumn stockpiled forage. Thus, our objective was to evaluate the quantity of forage DM accumulated during the autumn and monitor the CP and ADF concentrations as affected by autumn and winter climate in north-east Texas for 3 yr.

MATERIALS AND METHODS

The study was conducted on a Redsprings fine sandy loam (fine, kaolinitic, thermic Ultic Hapludalfs) at the Texas A&M University Agricultural Research and Extension Center near Overton, TX. Five bermudagrass and two bahiagrass cultivars were established in a prepared seedbed on 2 May 1997. The experimental design was a randomized complete block with four replications. Plot size was 1.8- by 4.6-m. Coastal and Tifton 85 hybrid bermudagrasses were established vegetatively by placing plants started in the greenhouse in two rows 0.9 m apart with plants 0.6 m apart within rows. 'Cheyenne', KF-CD 194, and CD 90160 bermudagrasses and the Pensacola and Tifton 9 bahiagrasses were planted at 1.12 and 2.24 g m⁻², respectively, by hand broadcasting seed on the soil surface. The test site was packed with a roller after seeding and transplanting.

On 13 April 1999, common, 'Giant', and 'Wrangler' bermudagrasses and 'Whittet' kikuyugrass were seeded on a prepared seedbed next to the earlier study in a randomized complete block with four replications. Seeding rate was 1.12 g m². The two planting dates were managed as one study from that point. From 1997 through 2002 the study was harvested to compare DM yield (Evers et al., 2001; Evers and Parsons, 2002). Fertilization and number of harvests are reported in Table 1.

During the autumn and winter of 1999–2000, the seven entries planted in 1997 were compared for DM yield, CP, and ADF. All entries were compared during 2000 to 2002. In preparation for sampling autumn growth, the study site was harvested before 1 September (Table 1). Each 1.8- by 4.6-m plot was subdivided into five 1.8- by 0.9-m subplots. Beginning in Oct. of 1999 and 2001 and Nov. of 2000, one of the subplots was selected at random and harvested monthly through February. A 0.09-m² quadrat was clipped from the center of each

subplot at a 3-cm height and dried at 60°C for 48 h. Dry weights were recorded to calculate DM yield. Date of the last harvest before September, autumn-winter sampling dates, and date of first frost are reported in Table 1.

Crude protein and ADF were determined at the Texas A&M University Soil, Water, and Forage Testing Laboratory in College Station. Samples were analyzed for total N with a Leco FP-428 N Analyzer (LECO Corp., St. Joseph, MI) (Sweeney, 1989), which was multiplied by 6.25 to get CP. Acid detergent fiber was determined using an Ankom A200 Fiber Analyzer (ANKOM Technology, Macedon, NY) (Vogel et al., 1999). Because of very high CP concentrations, the 2000–2001 samples were analyzed for nitrates using a Lachat QuickChem 8000 Flow-Injection Auto-Analyzer (Lachat Instruments, Milwaukee, WI) with a Cd-reduction column according to Dorich and Nelson (1984).

Statistical analysis for the main effect of year was not conducted for all 3 yr because of the different number of entries between the first and last 2 yr. Analysis of variance was performed with the Statistical Analysis System (SAS Institute, 1985) on the last 2 yr that showed significant ($P < 0.05$) differences between years for standing forage mass, CP, and ADF. Therefore, data were analyzed within years as a split plot with four replications. Main plots were cultivars and subplots were month. Analysis of variance was conducted with the Statistical Analysis System with mean separation by Fisher's protected LSD at the 0.05 level.

RESULTS AND DISCUSSION

The first sampling date occurred before the first frost each autumn (Table 1). August through November monthly rainfall was below the long-term average most of the months for all 3 yr (Table 2). In 1999 there was

Table 2. Monthly and long-term average precipitation received at Overton, TX.

Month	33-yr average	1999	2000	2001	2002
Jan.	92	177	58	136	62
Feb.	103	6	37	147	67
Mar.	106	104	91	171	
Apr.	100	151	120	11	
May	117	142	187	222	
June	109	61	61	215	
July	67	92	3	11	
Aug.	52	5	2	84	
Sept.	94	69	21	133	
Oct.	112	47	66	77	
Nov.	111	6	298	79	
Dec.	109	93	128	168	
Total	1169	953	1070	1454	

Table 3. Probability levels by year for main effects of month, cultivar, and their interaction for standing forage mass, crude protein, and acid detergent fiber.

Source of variation	Standing forage mass	Crude protein	Acid detergent fiber
		<i>P > F</i>	
		<u>1999–2000</u>	
Month (M)	0.050	0.001	0.001
Cultivar (C)	0.001	0.001	0.001
M × C	0.019	0.213	0.001
		<u>2000–2001</u>	
Month (M)	0.036	0.001	0.001
Cultivar (C)	0.001	0.001	0.001
M × C	0.137	0.001	0.041
		<u>2001–2002</u>	
Month (M)	0.004	0.001	0.001
Cultivar (C)	0.001	0.001	0.001
M × C	0.012	0.001	0.108

essentially no rainfall in August and November. The drought from June through September of 2000 was particularly severe, with only 87 mm of rainfall compared with a normal of 322 mm. That year, the last summer harvest was 26 June, with essentially no forage growth until precipitation occurred in October. Because of non-existent forage growth from July through October of 2000, plots were not sampled until November.

Year was significant for standing forage mass ($P < 0.001$), CP ($P < 0.001$), and ADF ($P < 0.05$) when the last 2 yr were analyzed. Therefore, data are reported by year.

Standing Forage Mass

There was a month × cultivar interaction ($P \leq 0.05$) for standing forage mass in 1999–2000 (Table 3). Tifton 85 bermudagrass had the greatest amount of forage, peaking in December (Fig. 1). Standing forage mass of other entries was relatively constant across the 5-mo period. Both bahiagrass entries always had the lowest amount of standing forage mass. Coastal bermudagrass and the seeded bermudagrasses did not differ ($P > 0.05$) in standing forage mass and were intermediate between Tifton 85 bermudagrass and the bahiagrasses.

The main effects of month and cultivar were significant ($P < 0.04$) for standing forage mass in 2000–2001, but the interaction was not significant ($P > 0.05$) (Table 3). Because of the summer drought, sampling did not begin until November (Table 4). Tifton 85 bermudagrass and Whittet kikuyugrass had the greatest ($P < 0.001$) amount of standing forage mass at approximately 1200 kg ha⁻¹. Wrangler bermudagrass and the bahiagrasses had the least standing forage mass. Forage mass of Tifton 9 bahiagrass was not different from Coastal, KF-CD194, common, or Giant bermudagrass.

In 2001–2002, both month and cultivar affected ($P < 0.01$) standing forage mass, but there was a significant interaction ($P < 0.01$). The cultivar by month interaction was significant because of the different entry rankings within months. The amount of standing forage mass in 2001–2002 was higher than in the first 2 yr as a result

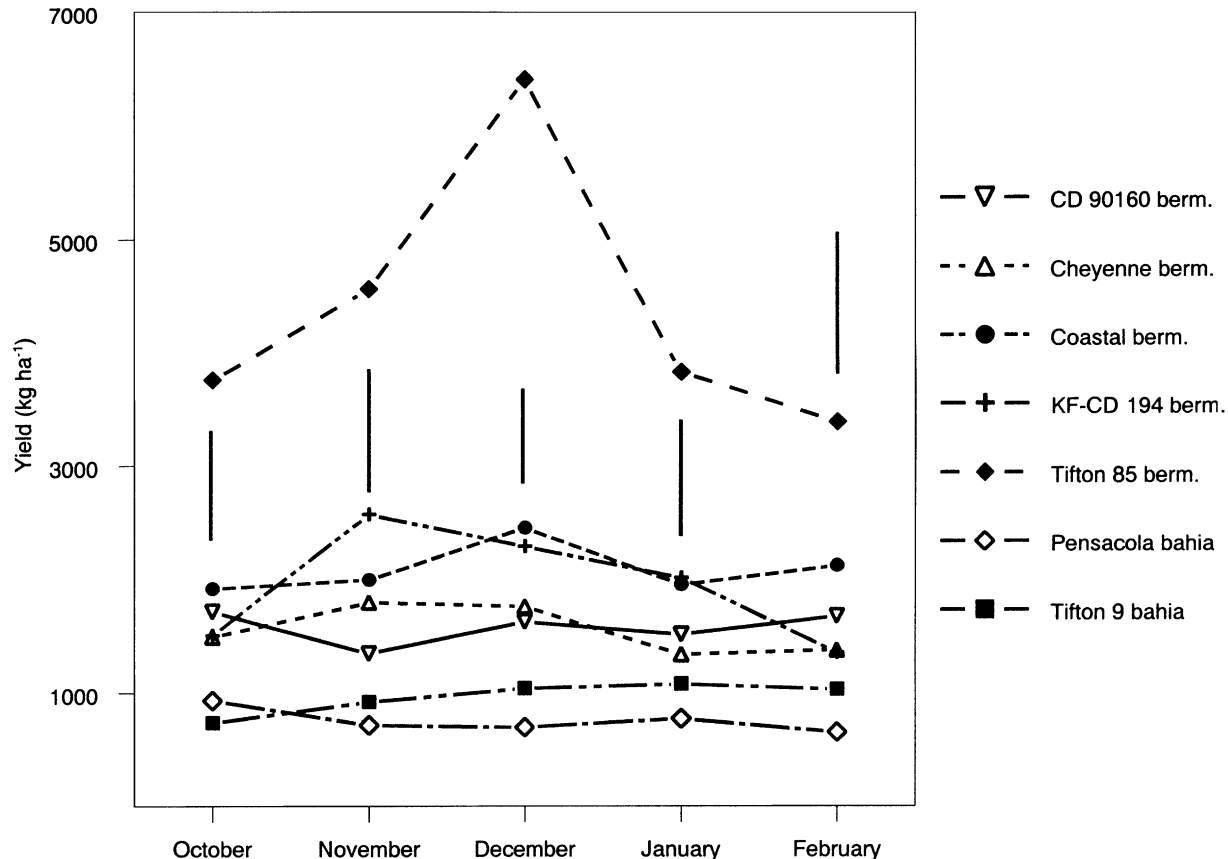


Fig. 1. Interaction of month and cultivar on standing forage mass of warm-season perennial grasses managed as a standing hay crop during the autumn and winter of 1999–2000 at Overton, TX. Vertical bars indicate LSD value ($P = 0.05$) within months.

of greater autumn precipitation and a later frost date (Table 1). Standing forage mass of the entries usually peaked in November or December because the first frost that terminated growth did not occur until 19 d after the November sampling date (Table 1). As in the first 2 yr of this study, Tifton 85 bermudagrass had the greatest amount of standing forage mass (Fig. 2). Wrangler bermudagrass, Whittet kikuyugrass, and both bahiagrasses had the least standing forage mass. The other seeded bermudagrasses had standing forage mass either similar to or less than Coastal bermudagrass and similar or greater than kikuyugrass and the bahiagrasses, depending on month.

Standing forage mass remained relatively stable through the sampling period for all entries in the first and second year when the initial standing forage mass was ≤ 3000 kg ha⁻¹. This is in agreement with Taliaferro et al. (1987) and Scarbrough et al. (2001). In the third year, when initial standing forage mass was ≥ 4000 kg ha⁻¹, standing forage mass declined by January or February for all entries.

Crude Protein

The main effects of month and cultivar were highly significant ($P \leq 0.001$) all 3 yr, but an interaction ($P \leq 0.001$) was detected during the last 2 yr (Table 3). In 1999–2000, CP concentration peaked in November (before the first frost) and then decreased slightly from

Table 4. Influence of month and cultivar on forage dry matter accumulation of warm-season perennial grasses November 2000 to February 2001 at Overton, TX.

	Yield kg ha ⁻¹
Month	
Nov.	792
Dec.	819
Jan.	620
Feb.	1055
LSD 0.05	272
Cultivar	
Tifton 85 bermudagrass	1197
Kikuyugrass	1156
CD 90160 bermudagrass	985
Cheyenne bermudagrass	853
Common bermudagrass	812
Giant bermudagrass	800
Coastal bermudagrass	746
KF-CD 194 bermudagrass	740
Tifton 9 bahiagrass	659
Wrangler bermudagrass	575
Pensacola bahiagrass	513
LSD 0.05	165

November until February (Table 5). Differences noted in CP concentrations were relatively small, but significant ($P < 0.01$) among the seven entries. Of all the entries, the sprigged bermudagrass cultivars, Tifton 85 and Coastal, had the lowest ($P < 0.001$) CP concentrations.

The month \times cultivar interaction for CP in 2000–2001 is presented in Fig. 3. Initial CP concentrations in 2000–

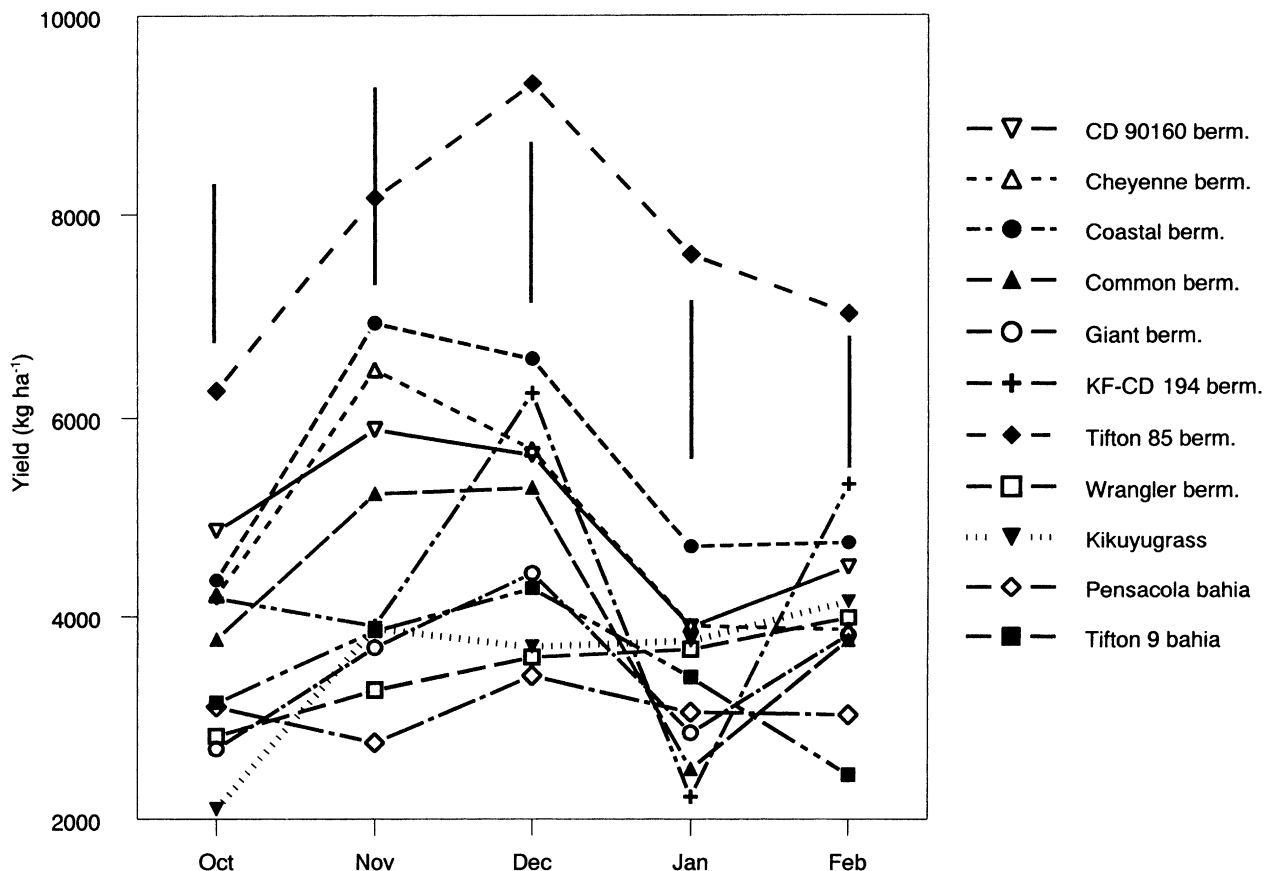


Fig. 2. Interaction of month and cultivar on standing forage mass of warm-season perennial grasses managed as a standing hay crop during the autumn and winter of 2001–2002 at Overton, TX. Vertical bars indicate LSD value ($P = 0.05$) within months.

Table 5. Influence of month and cultivar on crude protein of warm-season perennial grasses from October 1999 to February 2000 at Overton, TX.

Month	Crude protein
	g kg ⁻¹
Oct.	136
Nov.	149
Dec.	131
Jan.	117
Feb.	127
LSD 0.05	6
Cultivar	
Cheyenne bermudagrass	140
Pensacola bahiagrass	139
Tifton 9 bahiagrass	136
KF-CD 194 bermudagrass	135
CD 90160 bermudagrass	133
Tifton 85 bermudagrass	125
Coastal bermudagrass	116
LSD	10

Table 6. The interaction of month and cultivar for nitrate level of warm-season perennial grasses from November 2000 to February 2001 at Overton, TX.

Cultivar	Nitrates			
	10 Nov.	8 Dec.	8 Jan.	13 Feb.
	mg kg ⁻¹			
Kikuyugrass	5419	2440	262	136
Wrangler bermuda	1679	757	348	143
CD90160 bermuda	2362	925	258	156
Common bermuda	3167	911	209	134
Cheyenne bermuda	3051	709	189	130
KF-CD 194 bermuda	4169	588	188	137
Giant bermuda	3857	935	176	121
Tifton 85 bermuda	1474	714	174	159
Coastal bermuda	855	310	172	143
Tifton 9 bahia	623	250	177	137
Pensacola bahia	614	224	179	135
Mean	2479	797	212	139
LSD 0.05	909	417	85	NS

2001 were twice that in 1999–2000. Because of the high CP concentrations and drought conditions, forage samples were analyzed for accumulated nitrates. Nitrate levels in the November samples before the first frost were very high with a cultivar average of 2479 mg kg⁻¹ (Table 6). The samples collected in December after the first frost decreased an average of 68%. The month × cultivar interaction was significant ($P < 0.0001$). Kikuyugrass had higher nitrate levels than the other cultivars in November and December. During these months, the general trend was for the bahiagrass cultivars and the

two vegetatively propagated bermudagrasses to have the lowest nitrate levels and the seeded bermudagrasses were intermediate. There were small differences among cultivars in January and none in February. Caution is advised when nitrate concentrations reach 2500 mg kg⁻¹ (Ball et al., 2002). The steady decrease in CP concentrations during the sampling period is probably the result of a sharp decrease in nitrates after the first frost.

The kikuyugrass had the highest CP concentration every month, followed by common bermudagrass (Fig. 3). Bahiagrasses and Coastal bermudagrass had the lowest CP except in February. The cultivar × month interac-

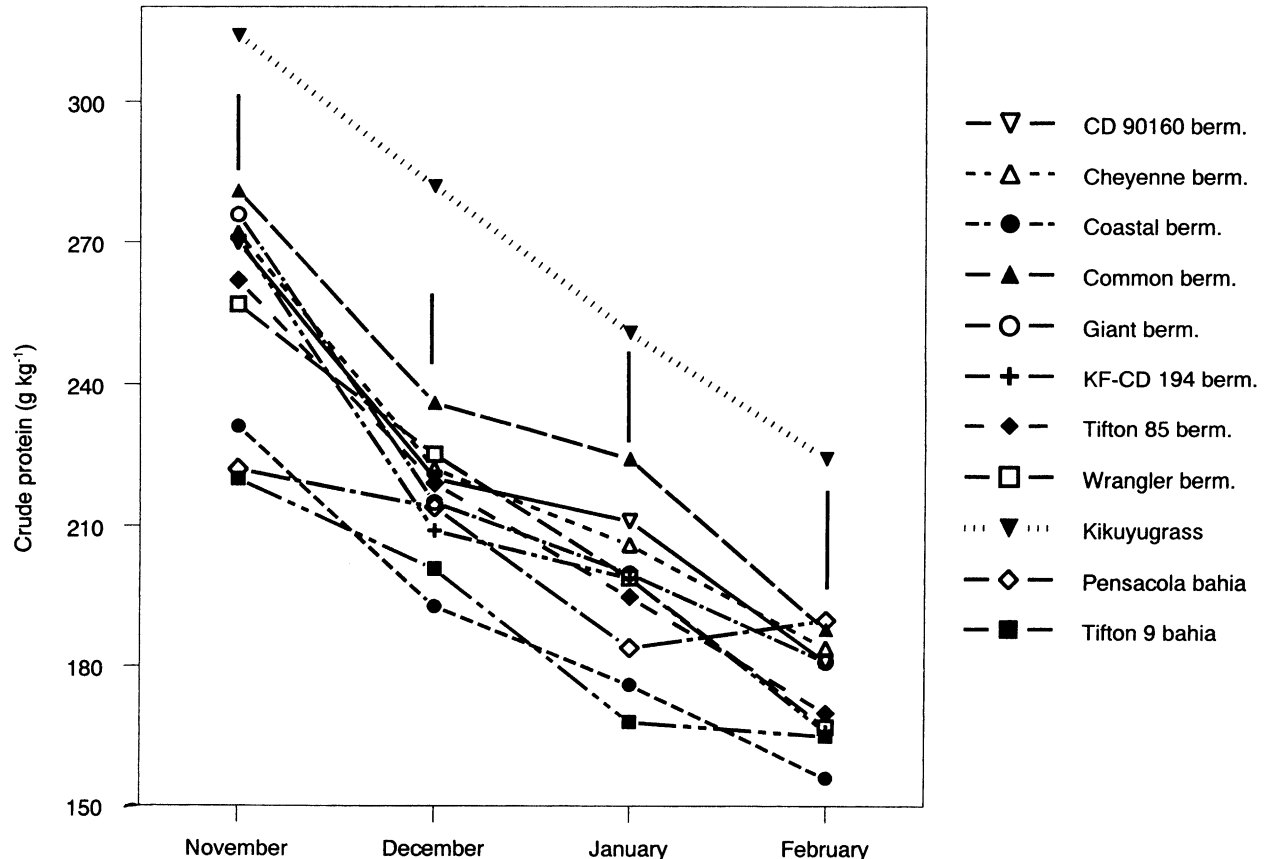


Fig. 3. Interaction of month and cultivar on crude protein of warm-season perennial grasses managed as a standing hay crop during the autumn and winter of 2000–2001 at Overton, TX. Vertical bars indicate LSD value ($P = 0.05$) within months.

tion ($P = 0.0003$) was due to greater CP differences among entries the first three months than in February.

There was a cultivar \times month interaction ($P < 0.001$) for CP in 2001–2002 because of ranking differences among entries in November and February (Fig. 4). In October, common and Giant bermudagrass had lower ($P < 0.05$) CP concentrations than the other entries. The dramatic decrease in CP concentrations for all entries from October to November was probably the result of an increase in plant maturity since the first frost did not occur until 19 d after the November sampling date. Both bahiagrass cultivars had the highest ($P < 0.05$) CP in November and December and Coastal, common, and Giant bermudagrasses had the lowest CP concentrations in November. There were no differences among bermudagrasses in December or January. Bahiagrasses and kikuyugrass usually had substantially higher CP concentrations than the bermudagrasses.

Crude protein concentration of forages is a function of soil N concentrations and plant maturity. In 1999–2000, the slow decrease in CP concentrations with time agrees with Taliaferro et al. (1987) and Scarbrough et al. (2001). The more rapid CP concentration decrease observed in 2000–2001 was probably the result of higher initial CP concentrations resulting from elevated nitrate concentrations following drought. The sharp decreases in CP concentrations during 2001–2002 were most likely the result of increased plant maturity because of a later first frost. Both scenarios present potential problems of

stockpiling autumn growth of warm-season perennial grasses. Nitrate toxicity following drought could cause animal health problems, although we did not observe concentrations high enough to cause problems. Initiating the forage accumulation period too soon before the first frost (3 mo in 2001–2002) along with good climatic conditions for growth may result in mature forage with low CP concentration. All CP concentrations noted in this study were above the minimum CP concentration of 70 to 80 g kg⁻¹ for mature, nonlactating, pregnant cows (Anonymous, 2000).

With moderate to good rainfall in 1999–2000 and 2001–2002, bahiagrasses had the highest CP concentrations. Under dry conditions in 2000–2001, CP concentrations were lower than most of the other entries. Kikuyugrass was only evaluated the last 2 yr but had high CP concentrations both years. This was especially true under the drought conditions in 2000–2001 when high nitrate concentrations contributed to high CP concentrations. Both bahiagrass and kikuyugrass have a prostrate growth habit and short, stout rhizomes that form a dense sod. Essentially all growth above 5 cm is leaf which is probably the reason for having higher CP concentrations than the bermudagrasses. In 2 of 3 yr, Coastal bermudagrass had a tendency to have a lower CP concentration than the other bermudagrasses.

Acid Detergent Fiber

Main effects of month and cultivar were significant ($P \leq 0.001$) for ADF in all 3 yr, but there was an inter-

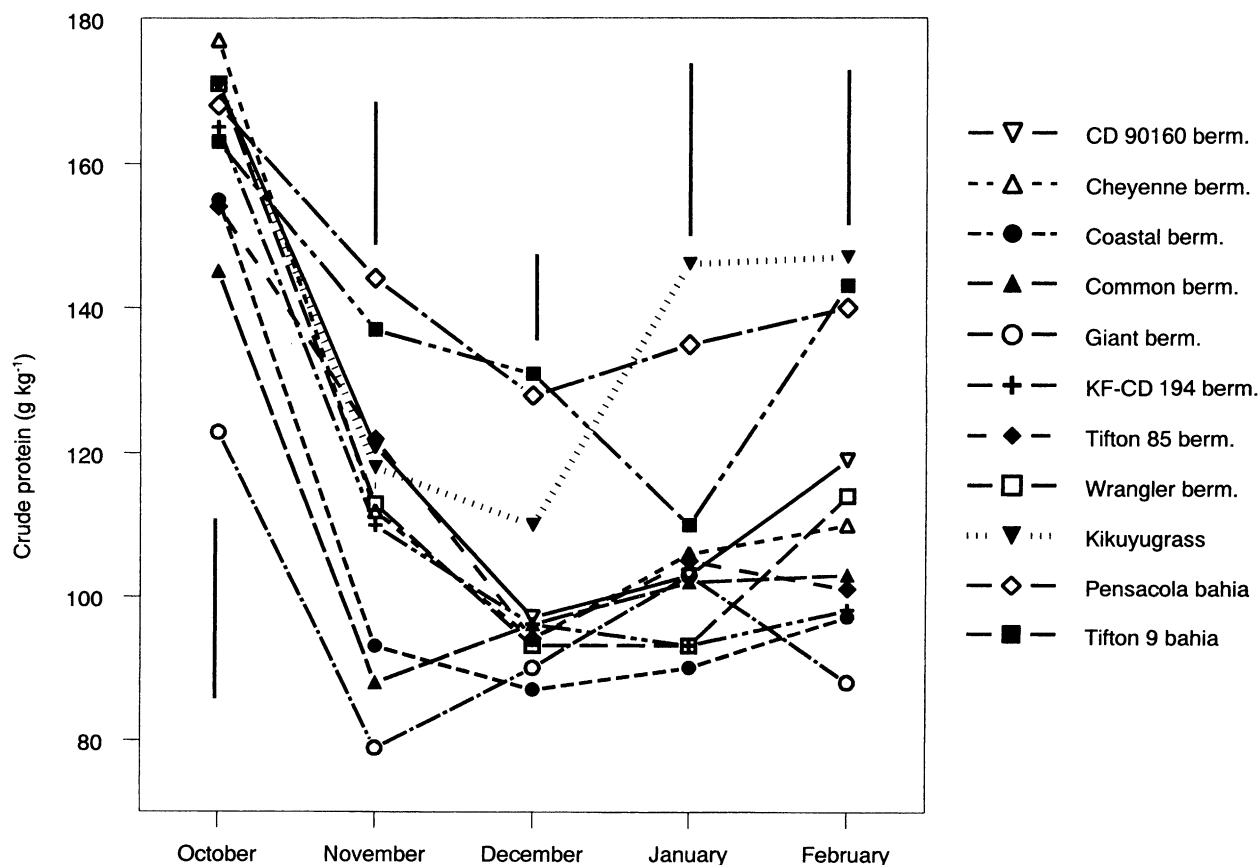


Fig. 4. Interaction of month and cultivar on crude protein of warm-season perennial grasses managed as a standing hay crop during the autumn and winter of 2001–2002 at Overton, TX. Vertical bars indicate LSD value ($P = 0.05$) within months.

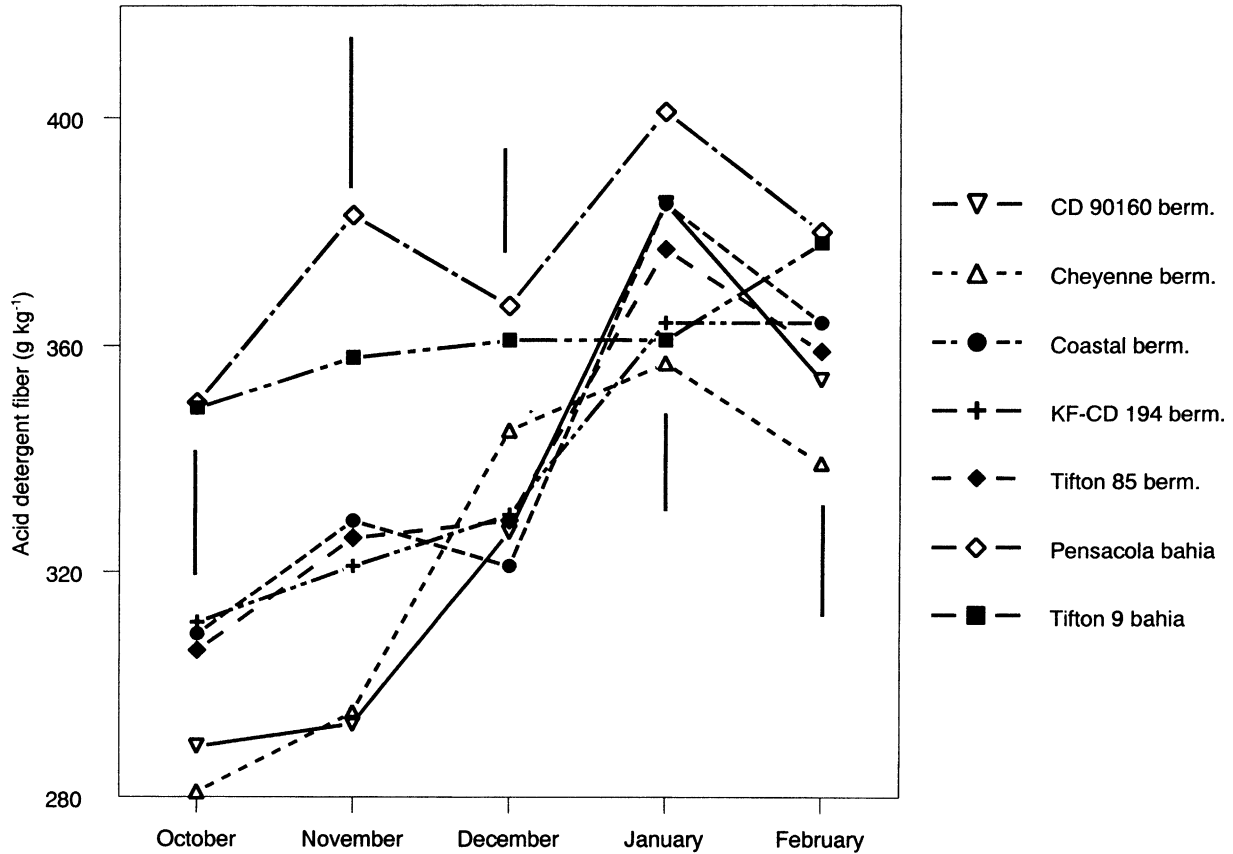


Fig. 5. Interaction of month and cultivar on acid detergent fiber of warm-season perennial grasses managed as a standing hay crop during the autumn and winter of 1999–2000 at Overton, TX. Vertical bars indicate LSD value ($P = 0.05$) within months.

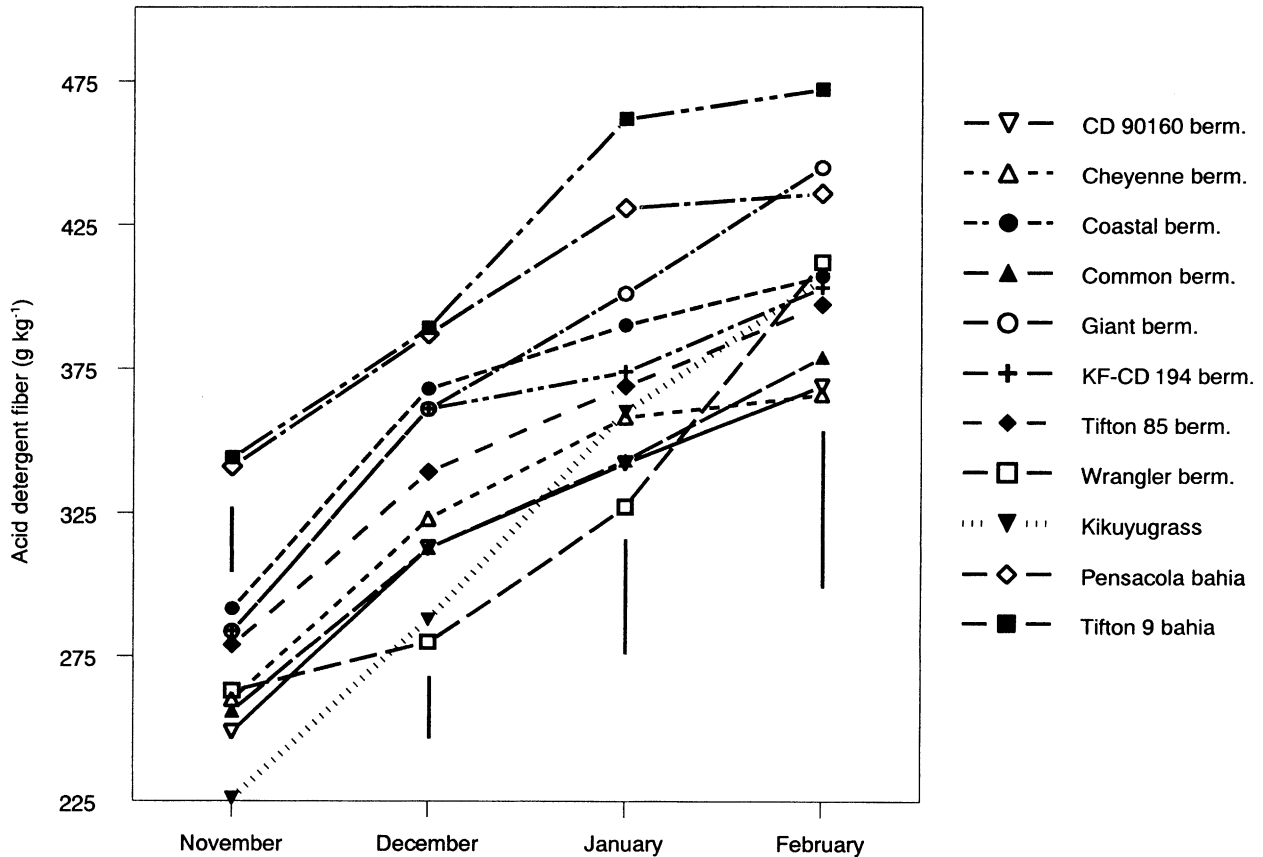


Fig. 6. Interaction of month and cultivar on acid detergent fiber of warm-season perennial grasses managed as a standing hay crop during the autumn and winter of 2000–2001 at Overton, TX. Vertical bars indicate LSD value ($P = 0.05$) within months.

Table 7. Influence of month and cultivar on acid detergent fiber of warm-season perennial grasses from October 2001 to February 2002 at Overton, TX.

	ADF
	g kg ⁻¹
Month	
Oct.	314
Nov.	311
Dec.	348
Jan.	349
Feb.	396
LSD 0.05	17
Cultivar	
Giant bermudagrass	382
Tifton 85 bermudagrass	374
KF-CD 194 bermudagrass	362
Tifton 9 bahiagrass	358
Pensacola bahiagrass	350
Common bermudagrass	341
Coastal bermudagrass	330
CD 90160 bermudagrass	328
Cheyenne bermudagrass	324
Kikuyugrass	324
Wrangler bermudagrass	307
LSD 0.05	20

action ($P < 0.05$) in the first 2 yr (Table 3). Of the seven entries in 1999 to 2000, bahiagrass cultivars had a high initial ADF of 350 g kg⁻¹ and then increased slowly across time (Fig. 5). Bermudagrass cultivars had lower initial ADF concentrations, but then increased rapidly with time to concentrations similar to bahiagrass cultivars by February. Both bahiagrass cultivars had the highest ADF concentration in October, November, and December. Only the Pensacola cultivar had a high ADF concentration in January. During January and February, some of the bermudagrass cultivars, particularly Coastal, had ADF concentrations similar to bahiagrass. Cheyenne and CD 90160 bermudagrass had low ADF concentrations in 4 of the 5 mo.

In 2000–2001, initial ADF concentrations were lower than 1999–2000, and the increase with time was more consistent for all entries (Fig. 6). Bahiagrass cultivars continued to have some of the highest ($P < 0.001$) ADF concentrations, especially in November. Except for two instances, all the other entries had lower concentrations than bahiagrass from November through January. In February there were fewer differences among entries because of a large LSD value. Most of the entries were not different from Pensacola bahiagrass. Kikuyugrass and Wrangler bermudagrass were the only entries that had low ADF concentrations all four months. Cheyenne, common, and CD90160 bermudagrass ADF concentrations were usually not different from Wrangler bermudagrass.

There was no interaction for ADF in 2001–2002, so the main effects of month and cultivar are presented in Table 7. As in the previous 2 yr, ADF concentrations increased with time. The sharp increase from November to December is probably the result of the first frost occurring after the November sampling. In contrast to the previous year, Giant bermudagrass had a higher ADF concentration than the bahiagrass cultivars. Tifton 85, KF-CD194, and common bermudagrass had ADF concentrations similar to bahiagrass cultivars. Cheyenne and Wrangler bermudagrass and kikuyugrass had the

lowest ADF concentrations which was consistent with the previous 2 yr.

In all 3 yr, the ADF concentrations increased with time for all cultivars, with the largest monthly increase usually occurring after December. This was probably the result of leaching of soluble nutrients after frost and is in agreement with reports by Scarbrough et al. (2001) and Wheeler et al. (2002). Bahiagrass cultivars had the highest ADF concentrations and kikuyugrass the lowest with bermudagrass being intermediate. Because of their prostrate growth habit, the harvested samples from bahiagrass and kikuyugrass were mostly leaves, which have higher nutritive value than the stems. The higher ADF concentrations for bahiagrass may result in forage that is too low in energy by midwinter to maintain a nonlactating pregnant cow. Of the bermudagrass cultivars, Cheyenne, DC90160, and Wrangler bermudagrass tended to have low ADF concentrations, and Giant bermudagrass had high ADF concentrations. The percentage of leaf vs. stem in the hand-harvested samples probably had some influence on ADF concentration. Cheyenne, DC90160, and Wrangler do not get as tall as Giant, Coastal, and Tifton 85, and therefore would have finer stems.

CONCLUSIONS

Bermudagrasses, especially Tifton 85, had greater autumn standing forage mass than bahiagrass and kikuyugrass. Good moisture condition during the autumn growing period was necessary to accumulate standing forage mass for stockpiling. Crude protein concentrations declined slowly from October to February and were always above the minimum requirements for a nonlactating pregnant cow. Acid detergent fiber concentration is a measurement of indigestible fiber and increased with time. Bahiagrass cultivars always had some of the highest ADF concentrations, which suggest they may not be the best warm-season perennial grass for stockpiling.

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