Effects of Nitrogen Fertilizer Rate and Clipping Frequency on the Yield and Quality of Four Bermudagrasses

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Story in Brief

This research was initiated to assess the productive potential and quality of three experimental bermudagrass hybrids plus 'Midland' bermudagrass when grown under several management regimes. The 4 grasses were established in ¼ acre plots and fertilized at rates of 15, 45 and 135 lbs. N/A. Sections within each plot were identified for harvest at 3, 5, 7, 9, or 11 week intervals. Before each harvest, samples were collected for laboratory determination of digestible dry matter (IVDMD), and crude protein (CP). The results are intended to provide livestock producers with information needed to develop effective management programs for the use of Midland bermudagrass as well as the newly released 'Oklan' variety (Strain 69 in this study). In addition, the results allow the stockman to compare the merits of the new variety to those of Midland.

Introduction

Scientists at Stillwater and other locations have established many times that forages with increased cold hardiness, drought tolerance, and dry matter yields, can be bred and/or selected from the genus *Cynodon* (bermudagrass). Since 1967 several experimental bermuda hybrids have been vigorously tested until it was evident that they were superior to Midland bermudagrass in several characteristics of economic importance. With public release of one or more of these strains seemingly imminent, the experiments described herein were designed to provide producers with information on how these grasses should be managed for highest quantity and quality of production.

Materials and Methods

Arrangement of treatments were in a split plot design with four grasses as main plots (strains 15, 23, 69 and Midland bermudagrass), subplots were fertilizer levels (15, 45 or 135 lbs. nitrogen/acre), and sub-subplots were clipping frequencies (3, 5, 7, 9 and 11 week clipping intervals). Grasses, fertilizer levels and clipping frequencies were randomized within main plots, subplots and sub-subplots, respectively. Nitrogen

fertilizer was applied as ammonium nitrate in a single spring application. All plots were mowed on May 21, 1973 and clipping intervals started from that date.

The 22 week growing season (May 21 to October 22, 1973) allowed 8, 5, 4, 3 and 3 harvests for 3, 5, 7, 9 and 11 week clipping frequencies, respectively (the no. of harvests includes the initial harvest of all plots).

Yield of fresh grass was determined, then adjusted for percent dry matter (DM). A hand-clipped sample was collected before each harvest for determination of percent DM. Crude protein content of each hand-clipped sample was determined in duplicate by the standard macro-Kjeldahl procedure (A.O.A.C. 1965). *In vitro dry-matter digestibility* (IVDMD) was determined in duplicate samples by the methods of Tilley and Terry (1963). The data were analyzed statistically by standard factorial procedures as outlined by Steel & Torrie (1960).

Results and Discussion

Average DM yield, IVDMD and CP values for each variety across all treatments are shown in Table 1. Strain 15 showed on average over Midland (MD) in yield (P.05), a slight advantage in IVDMD (P.05) and was not different (P.05) in CP content. The value for average total dry matter yield of variety 23 is misleading whereas this strain established poorly and much of the DM harvested came from weedy species. IVDMD and CP values for strain 23 were derived from hand-clipped samples of bermudagrass and thus are valid estimates of quality. Strain 69 (Oklan) produced 21 percent more total DM than did MD (P .01). This is an impressive increase, particularly whereas Strain 69 establishes more rapidly than MD. In addition, the average IVDMD value for 69 was 6.9 percent higher than that for MD.

Nitrogen fertilization at increasing levels caused highly significant (P.01) increases in dry matter yield (Table 2) as one would expect. IVDMD also increased with increasing levels of N fertilizer. Generally

Table 1. Effect of variety on the average yield, IVDMD, and CP of bermudagrass - Fort Reno, 1973.[1]

Var.	DM Yield (lbs./A)	IVDMD (%)	CP (%)
MD	7474 a	54.43 a	10.37 ab
15	7472 a	56.72 b	9.96 a
23	10224 b[2]	56.56 b	11.21 b
69	9412 b	58.18 c	10.31 ab

[1] Values followed by different letters are significantly different (P<05).
[2] Variety 23 established poorly; much of the DM yielded was from weeds.

it is felt that N fertilization does not play as important a role in changing the digestibility of a forage as does stage maturity. Often times the application of N fertilizer brings about better or no change in IVDMD. Content of CP increased in linear fashion (P .01) with increasing levels of N fertilizer.

The "younger" a grass is physiologically, the higher is its nutritive value. As the forage matures, however, yield increases. The optimum time to harvest a forage, then, is when you can realize the maximum amount of digestible dry matter (DDM) and CP, per acre. The results of clipping frequency studies are shown in Table 3. The values presented are averaged across all N levels and varieties. Note that while there is a dramatic increase in DM yield when forage is allowed 5 weeks for regrowth instead of 3 weeks, there is no drop in digestibility of the forage and only a slight drop in protein content. When longer periods were allowed for regrowth, as in the 7, 9, and 11 week frequencies, no real advantage in yield was apparent and quality of the forage (IVDMD and CP) dropped considerably. The results suggest that bermudagrass grown under conditions similar to those in this study should be harvested about every 5 weeks as long as sufficient moisture for plant growth is available.

Having established that the optimum clipping interval was 5 weeks, and that the superior strain was 69, it was decided that a more in-depth look at effects of N fertilization and the season-of-year on this variety

Table 2. Effect of N fertilization level on the average yield, IVDMD, and CP of bermudagrass varieties Fort Reno, 1973.[1]

N Level	DM Yield (lbs/A.)	IVDMD (%)	CP (%)
15 lbs. N/A	4874 a	55.67 a	9.67 a
45 lbs. N/A	7953 b	56.57 ab	10.20 b
135 lbs. N/A	13109 c	57.17 b	11.52 c

[1] Values followed by different letters are significantly different (P<05).

Table 3. Effect of clipping frequency on the average yield, IVDMD and CP of bermudagrass varieties - Fort Reno, 1973.[1]

Frequency (wks.)	DM yield (lbs./A)	IVDMD (%)	CP (%)
3	6005 a	57.65 c	12.04 c
5	8957 bc	57.57 c	10.63 b
7	9244 c	55.18 b	8.71 a
9	8586 b	52.31 a	8.12 a
11	10434 d	53.14 a	7.93 a

[1] Values followed by different letters are significantly different (P<05).

and MD was desirable. The seasonal distribution of DM production for 69 and MD clipped at 5-week intervals is shown for each level of N in Table 4. It is apparent from the data that MD begins growth earlier in the spring than does 69, but when N fertilizer is applied at increasing levels, the new variety produces more forage on a seasonal total basis.

IVDMD values for 69 and MD clipped at 5-week intervals are shown for each level of N and each clipping date in Table 5. The new variety shows a consistently higher IVDMD value regardless of N level. Over all nitrogen levels & frequencies, the advantage is about 6.9 percent. This approximate 7 percent increase in the dry matter digestibility of 69 over MD should amount to an approximate 17 percent increase in average daily animal gains assuming equal intake of the two grasses. Burton *et al* (1967) selected a bermuda hybrid with 12 percent higher DMD than Coastal. They predicted, on the basis of the 12 percent increase in DMD, a 30 percent increase in average daily animal gain. Subsequent steer grazing trials comparing the two grasses confirmed this prediction (Chapman *et al*, 1971).

Table 4. Average DM yield of varieties 69 and MD grown at 3 levels of N fertilizer and harvested at 5-week intervals - Fort Reno, 1973.

	69			MD		
Date	LN	MN	HN	LN	MN	HN
5-21	247	827	1505	692	1170	2149
6-25	1347	4244	8093	2390	3157	7049
8- 1	1591	2205	4367	1147	2704	2161
9- 3	1209	1177	1958	859	2049	1160
10- 8	417	569	307	171	238	429
Total	4811	9022	16231	5259	9318	12948

Table 5. Average % IVDMD of varieties 69 and MD grown at 3 N levels and harvested at 5-week intervals - Fort Reno, 1973.

	69			MD		
Date	LN	MN	HN	LN	MN	HN
5-21	61.09	63.19	65.45	59.35	62.25	63.12
6-25	58.89	61.21	64.13	57.20	56.86	58.58
8- 1	56.45	54.96	57.07	52.44	56.16	54.38
9-11	56.99	59.05	57.65	53.37	54.79	54.05
10- 8	58.79	61.56	61.45	53.80	57.32	55.35
Average	58.44	59.99	61.15	55.23	57.48	57.10

Table 6. Average % CP of varieties 69 and MD grown at 3 N levels and harvested at 5-week intervals - Fort Reno, 1973.

	69			MD		
Date	LN	MN	HN	LN	MN	HN
5-21	13.30	13.74	15.50	10.56	14.38	16.12
6-25	7.95	9.03	12.64	8.73	10.32	11.28
8- 1	8.37	8.14	9.18	9.21	10.22	9.27
9-11	8.70	8.66	10.03	9.54	10.45	9.09
10- 8	12.31	13.45	14.02	11.54	14.50	13.00
Average	10.13	10.60	12.27	9.92	11.97	11.75

CP values for 69 and MD clipped at 5-week intervals is shown for each level of N and each clipping date in Table 6. MD had higher levels of CP when N fertilizer was applied at higher levels, but both grasses provided adequate protein for the cow-calf operation.

References

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