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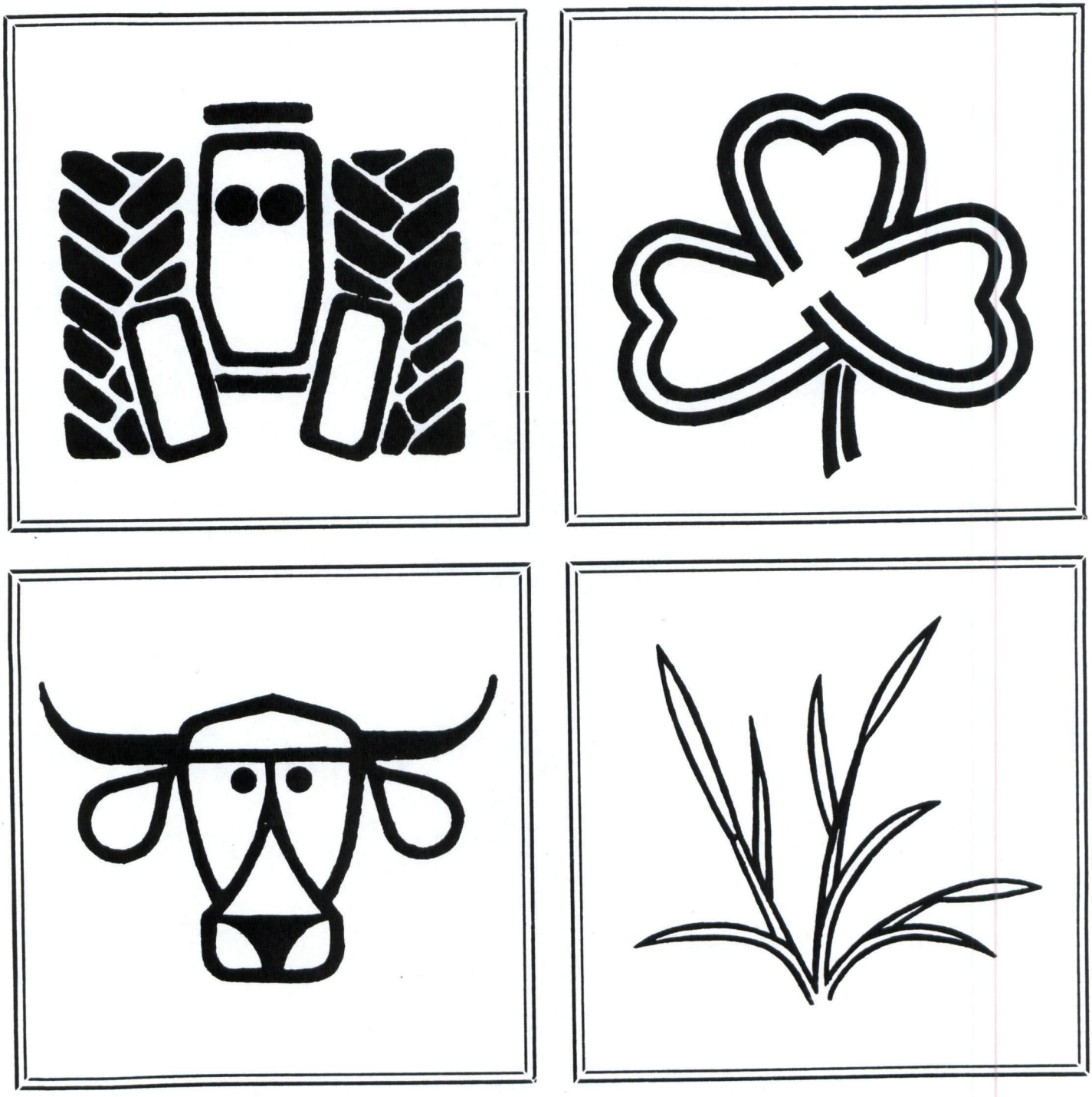

Forage Research in Texas

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Season, Age and Cultivar Effects on Bermudagrass Forage Production and Quality

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SUMMARY

Five bermudagrass cultivars were harvested for yield and sampled for forage quality at ages of 2, 4, 6 and 8 weeks in each of 3 discrete 8-week seasons in 1979 and 1980. Cultivars differed in dry matter yield, Coastal = S-83 $\geq$ S-16 $\geq$ 74-68 > Callie; while cultivar digestibility differences followed the pattern 74-68 > S-16 = Callie = S-83 > Coastal. Dry matter digestibility decreased with age from 2 weeks to 8 weeks at the rate of 0.15 digestibility units daily. Digestibility declined from spring (April-May) to summer (June-July) in both years and continued to decline in the fall (Sept. -Oct.) of 1979, but increased in the fall of 1980. Cultivar responses were about the same to age and season. In other words, cultivars that were highest in IVDMD at a young age or in the spring were also highest at advanced ages or in the summer. However, all cultivars declined in digestibility with advancing age and in the summer.

INTRODUCTION

Previous research has shown that both frequency of harvest (age) and cultivar have a profound effect on forage production and quality. A seasonal pattern of quality has been demonstrated but the effects of age and season usually cannot be separated. Similarly previous studies have provided no test for a possible season-variety interaction. Given that forage quality generally decreases with age and that summer quality is below spring quality, an important consideration is whether all genotypes respond similarly to both ageing and season. A test was initiated in 1979 to provide information on these points.

MATERIALS AND METHODS

Five bermudagrass genotypes (varieties) (Coastal, Callie, S-16, 74-68 and S-83), representing a wide range in known dry matter digestibility, were established in a randomized block design with four replications in 1978. Each main plot was 24 x 25 feet. Beginning with the initiation of growth in 1979, four clipping treatments were superimposed on each variety in subplots 6 x 25 feet.

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KEY WORDS: Bermudagrass /cultivars /forage / IVDMD /age /season/ temperature /rainfall

The clipping treatments were designed so that forage of 2, 4, 6 and 8 weeks of age could be collected in each of three discrete seasons; April-May, June-July, August-September. Separate plots were clipped to a two-inch height one time at 2, 4 or 6 weeks of age and all plots were clipped at 8 weeks. Samples for in vitro dry matter digestibility analyses were collected by hand at the 2-inch cutting height every two weeks from all plots harvested on that date or on any previous date in that season. Thus, at successive 2-week intervals, forage samples of 2; 2 and 4; 2, 4 and 6; and 2, 4, 6 and 8 weeks of age were hand collected in each season. Forage ages of 2, 4, 6 and 8 weeks were represented by 4, 2, 2 and 1 sample within each season for each variety-replication. Samples of the same age within a season were analyzed separately but averaged to give a season average for that age and variety.

Forage samples were dried at 60°C, ground through a 2 mm screen and analyzed by the two-stage in vitro fermentation procedure using neutral detergent in the second stage.

RESULTS

Forage Yield - Forage yields are given in Table 1 primarily to show the variety and year differences. Coastal produced the most forage and Callie the least. The hybrids were intermediate in yield including 74-68 which is a very high quality genotype but which lacks winter hardiness for this area. Production in 1979 exceeded that in 1980 by 75%. Summer rainfall in 1979 was average or better for this area. There was no effective rainfall in 1980 between May 20 and September 7. Temperatures also were above average. Yield differences between the two years reflect the moisture deficit in 1980.

Harvest frequencies were used to provide forage of different ages and, except for 4 and 8 week harvests, do not reflect true frequencies of harvest. The 2 and 6 week frequencies represent periods of 2 followed by 6 weeks of regrowth and 6 followed by 2 weeks of regrowth, respectively. The highest production was with 8 weeks of growth with a single harvest in each 2-month season with little difference among the other treatments, each of which was harvested two times in each 2-month season.

Forage Quality - Forage quality started off very high in the spring in young forage and declined both with age and with season. The pattern of quality of young forage (2 weeks of age) is shown in Figure 1. There is a sharp contrast between the two years. Forage quality declined in 1979 until mid-June followed by an increase in late June. In contrast quality declined until late August in 1980 and then increased dramatically in early September. We think the high temperature and moisture stress in the summer of 1980 is the cause of the pattern as contrasted to the much milder summer of 1979.

Forage quality averaged within seasons for the same age is shown in Table 2. Season within years had a major effect on forage quality (Table 2, Figure 2), and the seasonal pattern differed between the two years. Digestibility declined from spring to summer to fall in

1979, but declined from spring to summer followed by an increase in the fall of 1980. The increase in 1980 occurred in samples collected on September 15 and October 1 following rains on September 6-8. Very little growth was made between August 4 and September 8, thus most of the growth, even on 6 and 8 week old samples was no more than 3 weeks old even on October 1. The predominantly young forage for all ages may account for some of the general increase in digestibility, but new growth following an extended stress period also seems to be more digestible than that made under continuously favorable growth conditions.

The fact that most of the growth sampled on September 15 and October 1 was no more than 1 to 3 weeks old, even though on 6 and 8 week plots, accounts for 6 and 8 week old forage having average digestibility approximately equal to 2 and 4 week old forage in fall, 1980 (Table 2, fall 1980).

Age is known to be a factor in forage quality. The results of this study agree with the age pattern reported previously. The relationship of age to forage quality is shown in Figure 3 with varieties, seasons and years averaged for each age. Digestibility decreased approximately 2 units, with each increase in age of 2 weeks, or a daily decrease of 0.15 digestibility units. While the pattern is the same as that generally observed, the actual amount of decrease is less than usually observed.

The range in dry matter digestibility among varieties was generally from 8 to 12 digestibility units (Table 2). There were three 8-week samplings at which the range was 14 or 15 digestibility units. Coastal was always lowest and 74-68 always highest; Callie, S-16 and S-83 averages across seasons, ages and years did not differ significantly but S-83 tended to be below Callie and S-16.

There was essentially no variety x season interaction (Figure 4). One of the primary areas of interest was whether varieties differing in digestibility followed the same pattern with changing environmental conditions. These data indicate that varieties that are higher in digestibility under favorable conditions are also higher under stress conditions, but that they do decrease in digestibility under environmental stress conditions.

There is some indication that the varieties did not respond the same to advancing age. Variety-age comparisons for year averages are shown in Figure 5 for selected varieties. The difference between Coastal and 74-68 was about 10 digestibility units at all 4 ages in both years, while the difference between Callie and 74-68 tended to increase from about 4 units at 2 weeks age to 8-10 units at 8 weeks of age.

Table 1. The influence of variety and age at first harvest on bermudagrass forage yield, 1979-80.

Variety	Age at first harvest within season-weeks 2	4	6	8	Average
	Pounds of dry forage per acre				
			1979		
Coastal	18,390	12,340	16,180	20,300	16,802
Callie	10,520	8,900	10,370	11,300	10,272
S-16	13,480	9,010	11,090	12,930	11,627
74-68	14,125	11,290	13,550	14,910	13,469
S-83	14,080	13,620	14,130	20,070	15,475
Average	14,119	11,032	13,064	15,902	13,529
			1980		
Coastal	11,800	8,690	7,720	14,460	10,668
Callie	6,990	5,310	4,030	6,690	5,755
S-16	9,060	6,470	5,830	11,200	8,140
74-68	7,570	6,100	2,460	7,190	5,830
S-83	8,360	8,120	5,740	10,570	8,198
Average	8,756	6,938	5,156	10,022	7,718
			1979-80 Average		
Coastal	15,095	10,515	11,950	17,380	13,735 a
Callie	8,755	7,105	7,200	8,995	8,013 b
S-16	11,270	7,740	8,460	12,065	9,884 ab
74-68	10,847	8,695	8,005	11,050	9,649 ab
S-83	11,220	10,870	9,935	15,320	11,836 a
Average	11,437 a	8,985 b	9,110 b	12,962 a	

[1] Values within a line or column followed by same letter are not significantly different (5% level).

Table 2. Bermudagrass forage quality.

Variety	% IVDMD - 1979					% IVDMD, 1980				
	Age - weeks[1]					Age - weeks[1]				
	2	4	6	8	Avg.	2	4	6	8	Avg.
			Spring					Spring		
Coastal	61.2	60.3	57.0	55.8	58.6	54.6	51.6	52.6	49.8	52.1
Callie	66.0	62.8	60.6	59.2	62.2	61.9	57.2	57.6	56.5	58.3
S-16	65.2	64.0	61.3	62.0	63.1	61.2	55.9	56.3	55.0	57.1
74-68	70.2	69.1	67.5	61.6	67.1	66.5	63.9	64.0	63.6	64.5
S-83	63.3	62.7	59.6	60.0	61.4	56.7	54.2	56.4	51.5	54.7
Average	65.2	63.8	61.2	59.7	62.5a[2]	60.1	56.6	57.4	55.3	57.3b
			Summer					Summer		
Coastal	57.9	56.3	55.1	52.4	55.4	51.7	52.3	51.2	48.4	51.0
Callie	65.7	61.0	56.1	53.1	59.0	55.7	54.4	53.0	49.6	53.2
S-16	66.1	60.7	55.8	54.6	59.3	56.6	56.2	53.5	47.6	53.5
74-68	70.9	67.2	67.8	67.8	68.4	62.0	61.0	62.4	57.8	60.8
S-83	63.6	60.5	58.8	57.4	60.1	53.2	51.7	52.0	50.1	51.7
Average	64.8	61.1	58.7	57.1	57.1b	55.8	55.1	54.4	50.7	54.0c
			Fall					Fall		
Coastal	59.1	52.3	48.6	46.8	51.7	55.3	53.4	58.1	54.8	55.4
Callie	64.7	56.1	52.5	46.2	54.9	62.4	57.9	61.4	61.7	60.8
S-16	63.2	56.5	51.3	48.9	55.0	62.0	57.9	62.7	59.1	60.4
74-68	68.3	62.8	57.9	56.8	61.4	67.7	64.7	69.4	68.5	67.6
S-83	61.8	56.6	51.0	51.6	55.2	60.8	58.5	59.2	57.1	58.9
Average	63.2	56.9	52.3	50.1	55.6c	61.6	58.5	62.2	60.2	60.6a
			1979 Average					1980 Average		
Coastal	59.4	56.3	53.6	51.7	55.2c[2]	53.9	52.4	54.0	51.0	52.8c[2]
Callie	65.5	60.0	56.5	52.8	58.7b	60.0	56.5	57.3	55.9	57.4b
S-16	64.8	60.4	56.1	55.2	59.1b	59.9	56.7	57.5	53.9	57.0b
74-68	69.8	66.4	64.4	62.1	65.6a	63.5	63.2	62.6	63.3	63.2a
S-83	62.9	59.9	56.5	56.3	58.9b	56.9	54.8	55.8	52.9	55.1b
Average	64.5a	60.6b	57.4c	55.6d	59.5	59.2a	56.7b	57.4b	55.4b	57.2

[1] Values represent averages of 4, 2, 2 and 1 harvests, respectively, at 2, 4, 6 and 8 weeks of age within an 8-week season.

[2] Values for season averages within years or within a line or column for year averages followed by same letter are not significantly different (5% level).

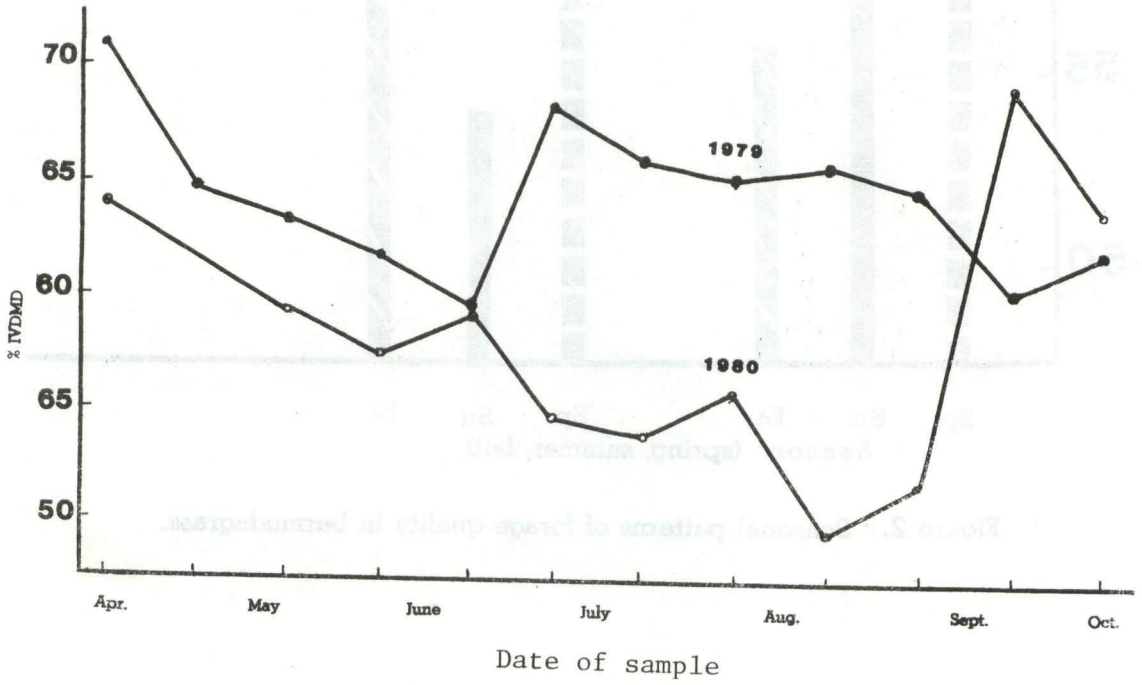

Figure 1. Forage quality pattern of 2-week old forage in 1979 and 1980.

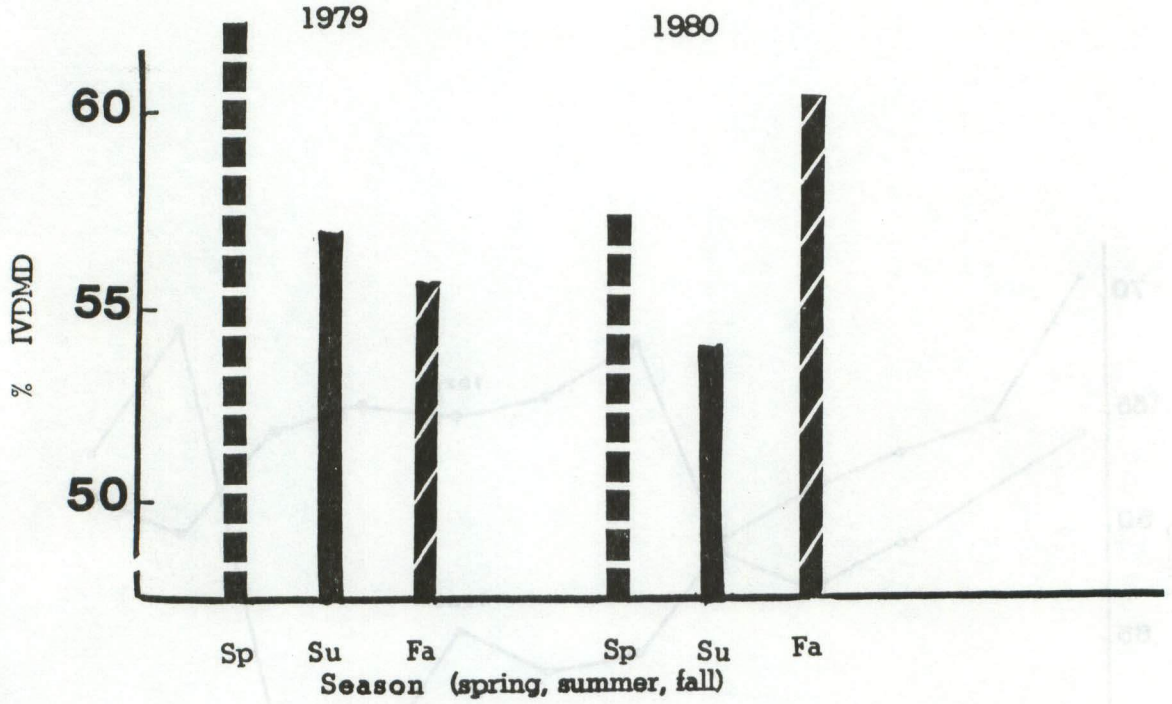

Figure 2. Seasonal patterns of forage quality in bermudagrass.

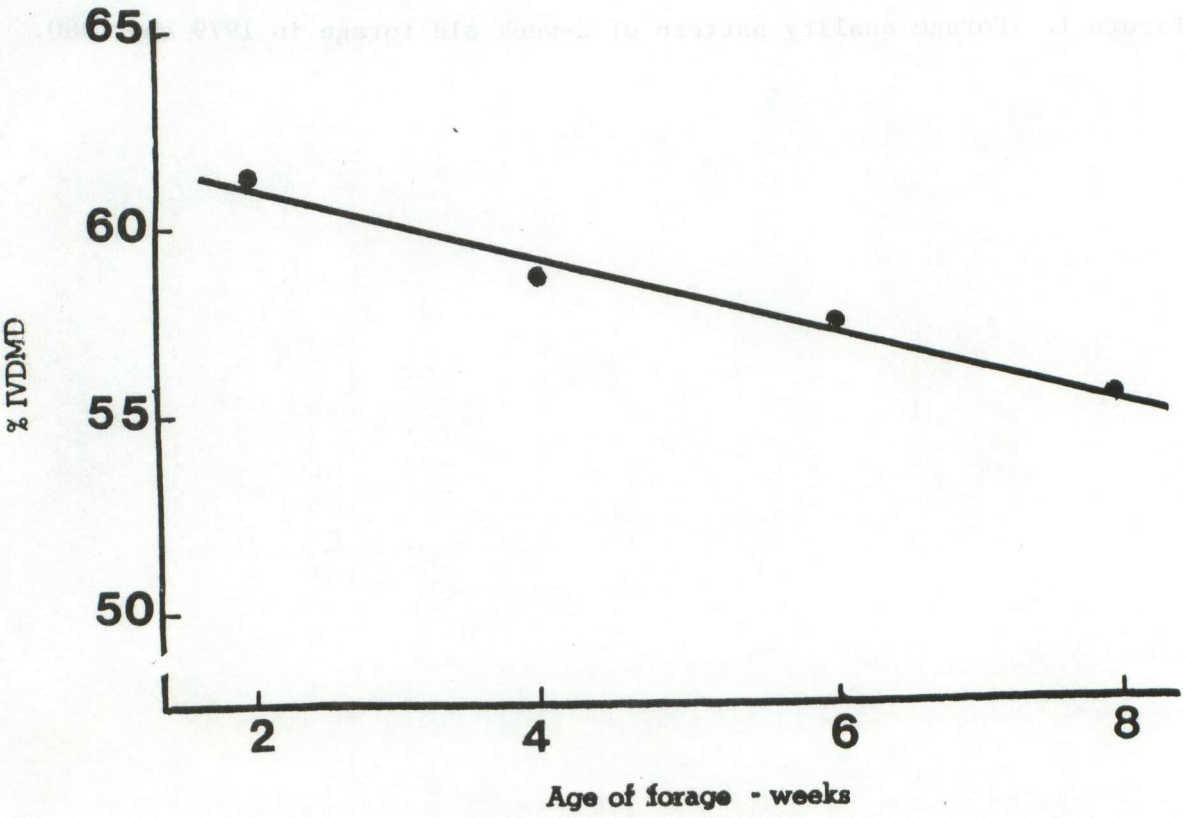

Figure 3. The relationship of forage digestibility to age in bermudagrass.

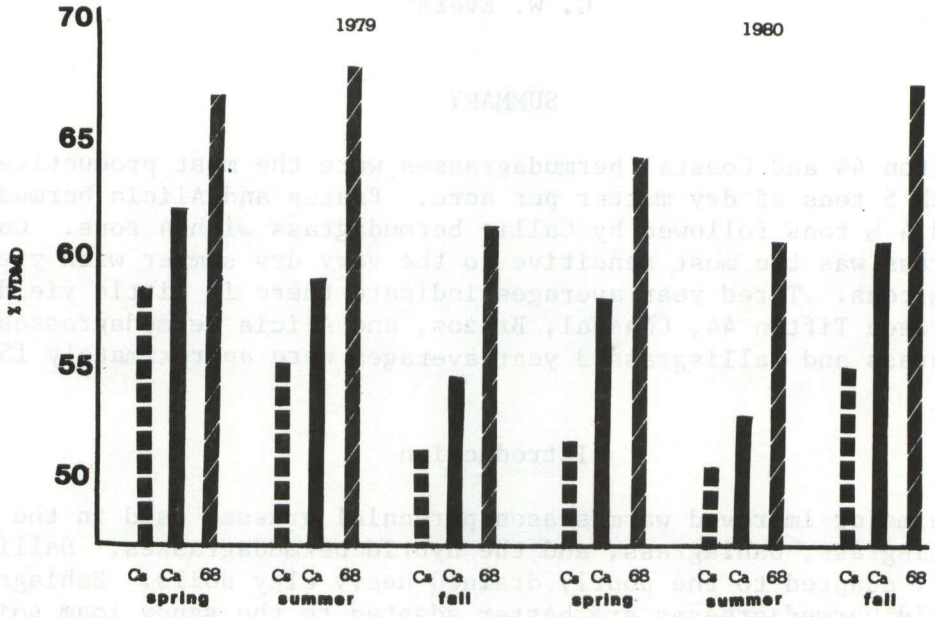

Figure 4. Bermudagrass variety quality patterns within seasons and years.

(Cs=Coastal, Ca=Callie, 68=74-68).

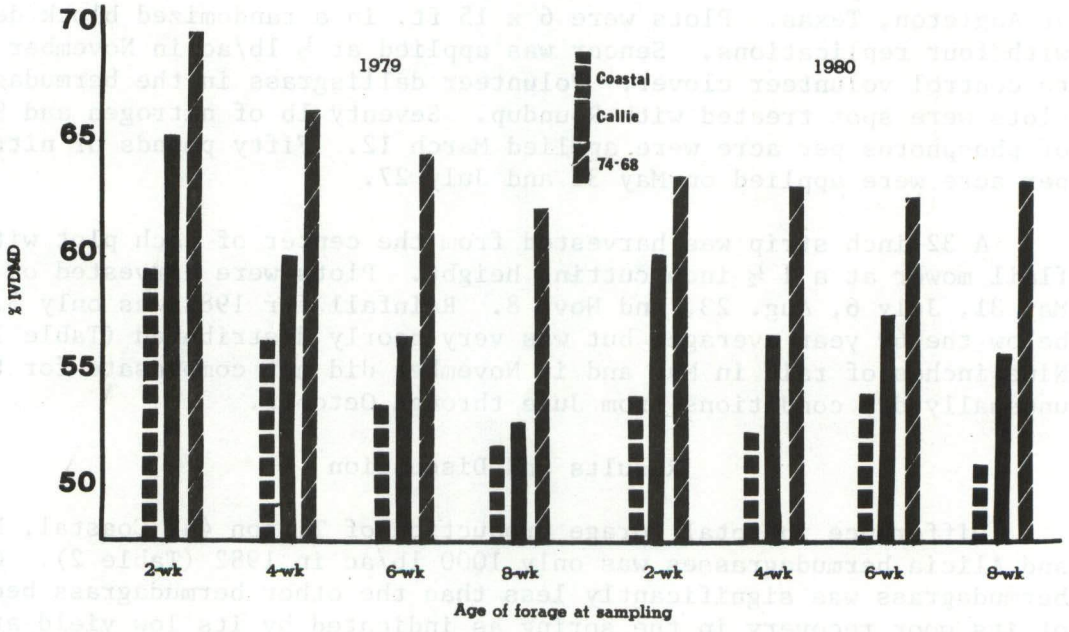

Figure 5. Bermudagrass variety quality responses to age of tissue.