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The Effect of Interval and Intensity of Defoliation on Quality of Warm-Season Perennial Grasses

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Summary

There were significant differences in the leaf-stem ratio and IVDDM among grasses due to frequencies of harvest and cutting heights. The maximum values for leaf-stem ratio and IVDDM were obtained at a frequency of 21 days and 12 inches cutting height. Leaf-stem ratio alone was a poor indicator of digestibility differences. The less digestible grasses showed the highest leaf-stem ratio.

KEYWORD: Bunchgrass/cutting height/cutting frequency/digestibility.

Introduction

Warm-season grasses are known to have a high dry matter production but low quality. Also, it is well established that the yield of grass dry matter increases as the frequency of cutting decreases. On the other hand, as the growth period of grasses increases nutritive value decrease.

The maintenance of a balance between yield production and quality is a major factor affecting productivity. Both yield and quality, are important for the development of any pasture program; however, quality is highly important because of its direct relation on animal performance.

This paper reports the results of an experiment utilizing twelve warm-season perennial grasses to estimate quality when defoliated at different frequencies and intensities.

Materials and Methods

Seedlings of 12 warm-season grasses— Pretoria-90 (*Dicanthium annulatum*, Stapf), Lauresa (*Pennisetum orientale*), Old World Bluestem (*Bothriochloa* spp.), Verde and Klein-75 (*Panicum coloratum* L.), Wilman Lovegrass (*Eragrostis superba*), Nueces and Llano Buffelgrass (*Cenchrus ciliaris* L.), Morpa and Renner Lovegrass (*Eragrostis curvula*), Bell Rhodesgrass (*Chloris gayana*), and Alamo Switchgrass (*Panicum virgatum* L.)—were started in peat pots in the greenhouse in January 1985 and transplanted into four 20-inch rows, 20-ft long in April 1985.

Forage was harvested at two intervals (21 and 42 days) and two stubble heights (4 and 12 inches). Measurements included leaf-stem ratio and in vitro digestible dry matter (IVDDM).

Leaf and stem parts were separated from a single plant to determine leaf-stem ratio. Clipped samples were dried at 60°C in a forced air drying oven, ground in a Wiley mill to pass 1 mm screen and analyzed for in vitro digestible dry matter (IVDDM) by the method of Goering and Van Soest (1970).

All these data were subjected to analysis of variance and means were separated using Duncan's Multiple Range Test.

Results and Discussion

The leaf-stem ratios by years are shown in Table 1. There were significant differences in leaf-stem ratio among grasses. Lauresa and Morpa Lovegrass had the highest average leaf-stem ratio followed by Pretoria-90 Bluestem, Llano Buffelgrass, and Renner Lovegrass. These grasses all produced more than twice as many leaves as stems.

Leaf-stem ratio decreased approximately 40 percent as the harvest interval increased from 21 days to 42 days (Table 2). The increased harvest interval resulted in in-

TABLE 1. LEAF-STEM RATIO INFLUENCED BY YEARS

Grasses	Years 1985	1986	Mean Average
Lauresa	2.39 ab[1]	2.41 a	2.40 a
Pretoria-90	2.10 bc	2.09 c	2.09 b
Verde Kleingrass	1.24 ef	1.51 de	1.38 e
Klein-75	1.40 ef	1.30 f	1.35 e
Wilman lovegrass	1.03 f	1.50 de	1.26 f
Nueces buffelgrass	1.82 cd	1.56 d	1.69 c
Llano buffelgrass	1.89 cd	2.12 bc	2.01 b
Morpa lovegrass	2.80 a	2.29 ab	2.54 a
Renner lovegrass	2.07 bc	1.97 c	2.02 b
Rhodesgrass	.99 f	1.39 ef	1.19 f
Old World Bluestem	1.66 cde	1.54 de	1.60 cd
Alamo switchgrass	1.66 cde	1.61 d	1.63 cd
Mean	1.75	1.77	

[1]Values within a column followed by the same letter are not significantly different at the .05 level, Duncan's Multiple Range Test.

TABLE 2. MEANS OF LEAF-STEM RATIO ACROSS GRASSES AS INFLUENCED BY DEFOLIATION TREATMENTS

Frequency days	Leaf-stem ratio Height (in.) 4	12	Average
	1985		
21	2.09	2.29	2.19 a*
42	1.26	1.38	1.32 b
Average	1.67 a	1.84 a	
	1986		
21	1.96	2.49	2.22 a
42	1.22	1.42	1.32 b
Average	1.59 b	1.96 a	
	1985-86		
21	2.02	2 39	2.21 a
42	1.24	1.40	1.32 b
Average	1.63 b	1.89 a	

*Mean values on the same line or in the same column within a year followed by the same letter are not significantly different at the .05 probability level, Duncan's Multiple Range Test.

creases in stem elongation and many tillers entered the reproductive phase. The leaf-stem ratios for all cultivars decreased significantly with advancing maturity.

Means in leaf-stem ratio as effected by clipping height are also shown in Table 2. As may be noted during the establishment year clipping height did not have a significant influence on the leaf-stem ratio; however, in the second year there were differences. By clipping to 4 inches the leaf-stem ratio was reduced approximately 19 percent. The overall reduction considering both years was about 14 percent.

The IVDDM for the 12 grasses by years are shown in Table 3 and 4. Pretoria 90, the two Kleingrasses, and the two buffel entries were consistently of the highest quality whereas the two lovegrasses, Morpa and Renner were the lowest.

TABLE 3. SEASONAL TRENDS IN PERCENT IVDDM OF TWELVE GRASSES, 1985

	Harvest Dates 8/5	8/26	9/17	10/10	11/07	Mean
Lauresa	50.5	49.1	47.1	52.9	52.4	50.4 e
Pretoria-90	57.3	56.4	53.8	57.2	58.4	56.6 a
Verde K	56.1	57.7	53.9	60.1	58.2	57.2 a
Klein-75	54.6	55.3	55.3	57.3	58.3	56.2 a
Wilman L.	54.4	51.6	50.3	52.6	57.8	53.3 cd
Nuces B.	54.7	52.9	52.9	58 8	58.0	55.5 b
Llano B.	54.2	50.5	51.3	57.3	57.0	54.1 c
Morpa L.	40.5	39.1	37.3	40.0	41.4	39.7 f
Renner L.	40.7	39.7	39.2	40.7	40.9	50.2 f
Rhodes	48.9	51.0	49.4	49.9	50.6	40.0 e
Old World	53.0	51.6	52.4	53.8	53.7	52.9 d
Alamo	52.9	48.7	50.6	45.6	51.9	49.9 e
	51.5	54.4	53.7	56.0	53.1	

TABLE 4. SEASONAL TRENDS IN PERCENT IVDDM OF TWELVE GRASSES, 1986

	Harvest Dates 6/16	7/13	8/2	8/30	10/08	Mean
Lauresa	57.8	60.3	52.4	56.3	51.4	55.6 cd
Pretoria-90	60.6	65.0	57.0	58.3	56.3	59.4 a
Verde K	60.7	64.3	51.7	62.0	55.8	58.9 b
Klein-75	59.0	63.2	55.2	64.7	55.4	59.5 ab
Wilman L.	56.6	59.7	52.5	56.2	55.9	56.2 c
Nueces B.	57.9	63.5	54.3	57.6	56.6	58.0 b
Llano B.	57.4	63.6	55.6	58.8	57.3	58.5 b
Morpa L.	41.0	41.8	39.7	41.3	37.2	40.2 h
Renner L.	41.3	41.3	40.4	42.7	40.5	41.2 g
Rhodes	56.1	56.9	50.4	52.7	50.1	53.2 f
Old World	53.8	59.4	49.2	52.2	54.8	53.8 ef
Alamo	58.1	57.0	51.3	53.0	53.3	54.4 de
	59.9	62.8	55.1	54.7	52.1	

This study also showed that digestibility was affected by sampling dates within the season. In general, digestibility declined from spring to summer and recovered in late summer and early fall. This seasonal pattern in digestibility may be due to chemical composition of the plants rather than morphological characteristics because the leaf-stem ratio of these plants did not show any specific pattern during the growing season. The digestibility pattern could also have been due in part to environmental stress during the summer, which tends to accelerate the maturation processes.

Frequency of harvest, as would be expected, had a marked influence on the IVDDM (Table 5). IVDDM decreased 12 percent as harvest interval increased from 21 days to 42 days. The average decrease was 6.8 digestibility units which amounted to a decrease of .32 units per day between 21- and 42-day-old material.

Digestibility increased as the height of clipping was increased. This pattern was consistent during both years in all 12 grasses. This can largely be explained by the high proportion of dead leaf tissue at the bottom of the plants and the lower cell wall content in the young leaves at the top of the plants. The maximum values for in vitro dry matter digestibility was with a harvest interval of 21

TABLE 5. MEANS IN PERCENT IVDDM ACROSS GRASSES AS INFLUENCED BY CUTTING HEIGHT AND FREQUENCY

	IVDDM (%)		
Frequency days			
	1985		
	Height		
	4 inches	12 inches	
21	52.58	53.72	53.15a*
42	48.06	48.59	48.32 b
Average	50.32 b	51.16 a	
	1986		
21	55.90	57.79	56.84 a
42	47.56	48.56	48.06 b
Average	51.73 b	53.17 a	
	1985-86		
21	54.24	55.76	54.99 a
42	47.81	48.57	48.19 b
Average	51.03 b	42.16 a	

* Mean values on the same line or in the same column within a year followed by the same letter are not significantly different at the .05 probability level, Duncan's Multiple Range Test.

days and cutting height of 12 inches. The lowest value was with a 42-day interval and cutting height of 4 inches.

In summary, it appears that the leaf-stem ratio alone was a poor indicator of digestibility differences. Morpa having the highest mean leaf-stem ratio had the lowest digestibility value. These results indicate that grasses with high leaf-stem ratios do not always have high digestibility as there are other factors such as cell wall structure, and the level of lignin present which have an influence on digestibility yet may be independent of leaf-stem ratio.

Literature Cited

1. Goering, H.K. and P.J. Van Soest. 1970. Forage fiber analysis. USDA-ARS Handbook 379. 20 pp.
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