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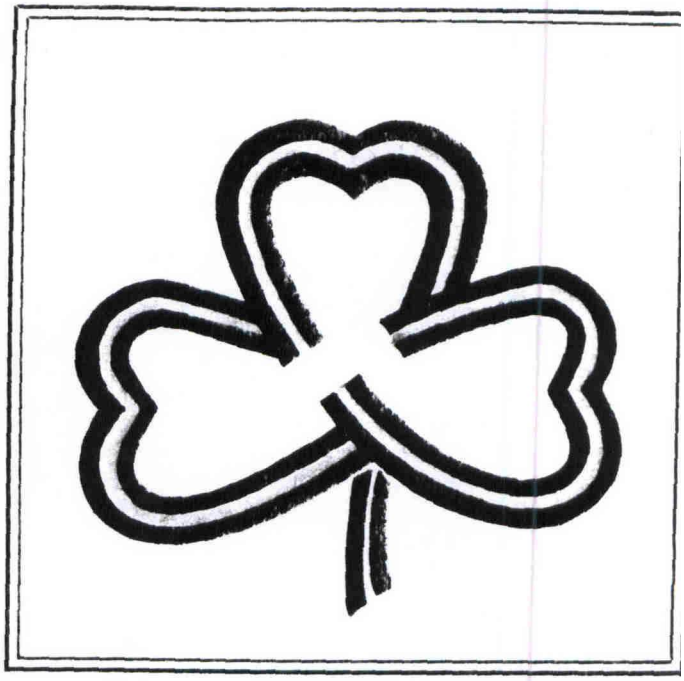

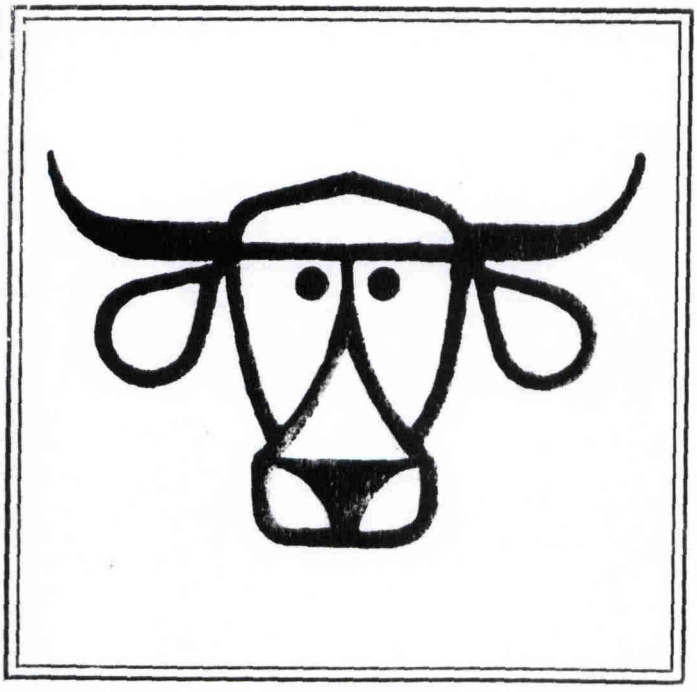

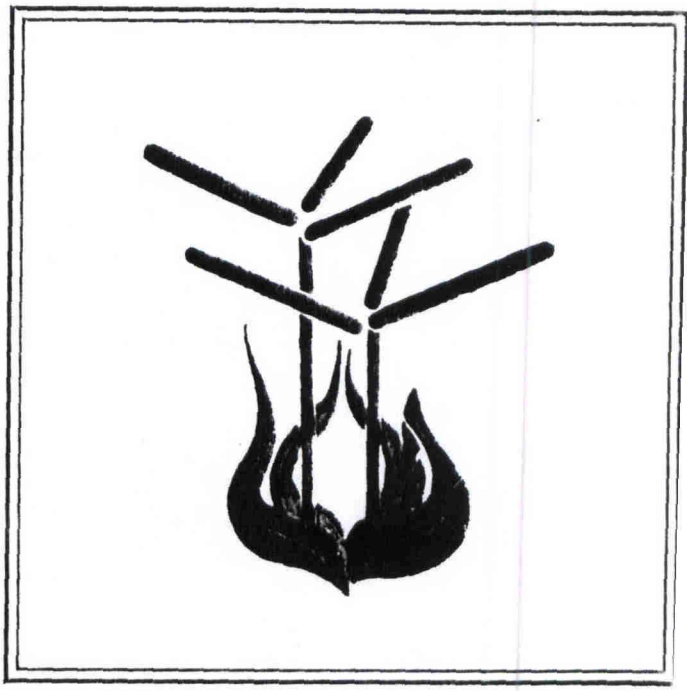

Forage Research in Texas

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TOTAL STRUCTURAL AND SOLUBLE CARBOHYDRATE (CHO) CONTENT AND PROTEIN LEVELS IN DIPLOID AND TETRAPLOID RYEGRASS FORAGE

SUMMARY

Forage quality of 18 ryegrass varieties were studied at Overton, Texas over a 3-year period from 1976-1977 through 1978-1979. Our objective was to determine if there were differences in nutritive value between and within diploid and tetraploid varieties. As expected, we found that there was a seasonal decline in both total soluble carbohydrate content (neutral detergent solubles, NDS) and protein percent. The chemical analyses also indicated differences in NDS among varieties, and that these differences were most apparent during April and May. The differences likely are related to maturity levels of individual varieties since earlier maturing varieties tended to have higher levels of neutral detergent fiber (NDF). Since the tetraploids in this study were generally about 2-weeks later in maturation, as a group they were significantly lower in percent NDF components in April and May.

Protein levels decreased during the growing season from about 25% in December to about 13% in late May. No significant differences were observed between varieties or between diploids versus tetraploids for protein content.

OBJECTIVES

This study was conducted to determine the variation in protein content and total structural and soluble carbohydrate content of nine diploid and nine tetraploid ryegrass varieties as influenced by season. Additionally, chemical comparisons were made between diploid and tetraploid varieties.

PROCEDURE

Samples to be analyzed were collected from forage variety ryegrass tests for the three growing seasons of 1976-77, 1977-78 and 1978-79. The forage had been clipped at a uniform height of 2 inches with a Lawn Genie flail-type harvester. The forage samples were oven dried and ground in a

Wiley mill through a 40-mesh screen. Plots were harvested four times the first 2-years and five times on the third year of the study. In 1976-77, analyses were run on 3 replications of each variety per harvest. In 1977-78 and 1978-79, an analysis was run on samples from 2 replications. Duplicate analyses were run on any samples which appeared abnormally high or low in either neutral detergent fiber (NDF) contents or in protein levels. In 1978-79, duplicate samples were run on all samples and an average data point was calculated for each replication.

Ryegrass varieties were planted into conventionally tilled seedbeds prior to mid-September each year. A broadcast application of fertilizer at a rate of 60-60-60 (N-P_2O_5-K_2O) lbs/ac was applied in late August. Additional nitrogen was applied in split application in November and February for a total N rate of about 210 lbs/acre.

All forage samples were analyzed for protein via micro-Kjeldahl technique. An estimate of total structural and total soluble carbohydrates was obtained by subjecting forages to the Van Soest neutral detergent fiber extraction procedure.

RESULTS

Structural Carbohydrates

Results from the neutral detergent fiber (NDF) analysis (Table 1) indicated significant changes in nutritive value of varieties with a change in season. The data indicated that early in the growing season (December and March) nutritive value was very high. Cell wall constituents or NDF are primarily made up of cellulose, hemicellulose and lignin, all of which have variable digestibility percentages. Later in the growing season, percent NDF increased to about 45% in April and to nearly 55% in May. This was especially apparent when the grass began to form seed heads and much of the available forage was made up of stems.

In comparing differences between varieties (Table 1), there were no real differences until April. During the April harvest, the highest soluble carbohydrate content was produced by the varieties Billion and Tetragulf which had a NDF content of 39.3 percent. Florida Rust Resistant had the highest NDF content with 48.7 percent. The primary reason for the increase in NDF or structural carbohydrate was that early maturing varieties such

as Florida Rust Resistant were beginning to form seed. Therefore, a higher proportion of the forage available was in the form of stems rather than leaves.

In the early and late-May harvests, we continued to observe significant differences between varieties due to maturity. Later maturing varieties such as Ninak, Tetragulf, Billion, Charleston, Tetrone and NAPB-28 generally had less NDF components and higher neutral detergent solubles (NDS) or cellular constituents.

In comparing NDF means for diploid versus tetraploid varieties, a significant difference was observed in both the April and early May harvests. This difference was 4.6% for April and 8.1% for early May. Since the tetraploid varieties were usually later in maturity, their nutritive value remained higher into early May. By late May no real differences existed since both the diploid and tetraploid varieties were no longer vegetative. The above results probably explain why the tetraploids have been reported as having produced higher animal gains. It should be pointed out that in this paper we are not discussing forage yields, which would also affect gains.

Protein

Percent protein levels (Table 2) show important differences for time of harvest; however, no statistical differences were observed among varieties or between diploids and tetraploids. Generally, the earlier a forage plant is harvested, the higher it's protein content will be. Protein levels of nearly 25% were found for the December harvest. The March protein levels decreased to about 22%, and by April to 17 percent. A low of 12% was noted for early May and a slight increase of about 14% for late May. The slight increase may have been caused by warm season weed species which were beginning to make good growth in some plots by late May.

Table 1. Neutral detergent fiber (NDF) contents of ryegrass forage over a 3-year period.

Variety	Years Tested	December[1]	March	April	Early May	Late May[2]
Gulf	3	35.2a[4]	38.4a	44.7abc	60.7ab	58.1ab
Magnolia	2	29.1a	39.3a	46.5ab	59.1a-c	54.4bc
Common	2	39.4a	37.2a	47.0ab	59.7a-c	54.8bc
Marshall	1	32.5a	31.3a	48.0a	57.6a-d	56.3bc
Tx-O-R-78-2	2	32.4a	36.2a	45.3abc	56.9a-d	63.7a
Tx-O-R-78-3	2	32.3a	33.7a	45.2abc	57.0a-d	60.8ab
Florida Rust R.	1	---[3]	42.3a	48.7a	64.3a	---[3]
Exp Col Sta 171-1[5]	1	---	39.7a	47.3a	64.0ab	---
Exp Col Sta 29-27[5]	1	---	43.3a	48.3a	58.7a-c	---
Ninak[6]	2	30.6a	32.3a	41.1c	50.3de	49.9c
Tetragulf	1	31.9a	30.7a	39.3c	44.8e	---
Billion	1	32.5a	30.5a	39.3c	49.1de	---
Tetrablend 444	2	29.6a	49.9a	46.2ab	57.2a-d	60.0ab
Charleston	1	26.9a	32.0a	41.2bc	47.9de	---
Tetrone	2	30.9a	33.0a	41.7bc	49.0de	57.3ab
Furone	1	---	45.7a	40.7c	55.3b-c	---
Aubade	1	---	43.7a	43.0abc	59.3a-c	---
NAPB-28	1	---	38.3a	47.0ab	52.7c-e	---
Diploid mean		33.5a	37.9a	46.8a	59.8a	58.0a
Tetraploid mean		30.4a	36.2a	42.2b	51.7b	55.7a

[1] December data are from last 2 years of study only.

[2] Late May data are from 1979 only.

[3] Variety not tested.

[4] Yields followed by the same letter are not significantly different at the 5% level as judged by Duncan's multiple range test.

[5] Varieties above dotted line are diploid varieties.

[6] Varieties below dotted line are tetraploid varieties.

Table 2. Percent protein of ryegrass forage over a 3-year period.

Variety	Years Tested	December[1]	March	April	Early May	Late May[2]
Gulf	3	24.7[4]	22.8	18.4	12.7	11.4
Magnolia	2	25.8	22.2	16.1	13.1	14.2
Common	2	28.5	22.0	16.6	12.1	13.7
Marshall	1	23.6	23.4	19.3	16.9	13.7
Tx-0-R-78-2	2	26.4	25.4	19.5	16.9	13.1
Tx-0-R-78-3	2	24.1	23.4	17.2	15.5	14.1
Fla Rust Res.	1	---[3]	21.4	14.0	8.3	---[3]
Exp Col Sta 171-1[5]	1	---	21.4	17.3	8.8	---
Exp Col Sta 29-27[5]	1	---	17.6	15.0	9.8	---
Ninak[6]	2	24.6	25.2	21.7	17.7	14.3
Tetragulf	1	23.8	24.5	18.5	13.1	---
Billion	1	23.7	22.8	20.4	14.0	---
Tetrablend 444	2	26.1	22.8	14.7	11.9	1.40
Charleston	1	22.6	24.5	21.9	12.7	---
Tetrone	2	24.5	24.3	19.1	16.1	15.2
Furone	1	---	19.6	14.2	8.3	---
Aubade	1	---	18.6	14.1	8.5	---
NAPB-28	1	---	20.5	12.9	8.3	---
Diploid mean		25.5	22.2	17.0	12.7	13.4
Tetraploid mean		24.2	22.5	17.5	12.3	14.5

[1] December data are from last 2 years of study only.

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Tetrone	2	24.5	24.3	19.1	16.1	15.2
Furone	1	---	19.6	14.2	8.3	---
Aubade	1	---	18.6	14.1	8.5	---
NAPB-28	1	---	20.5	12.9	8.3	---
Diploid mean		25.5	22.2	17.0	12.7	13.4
Tetraploid mean		24.2	22.5	17.5	12.3	14.5

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