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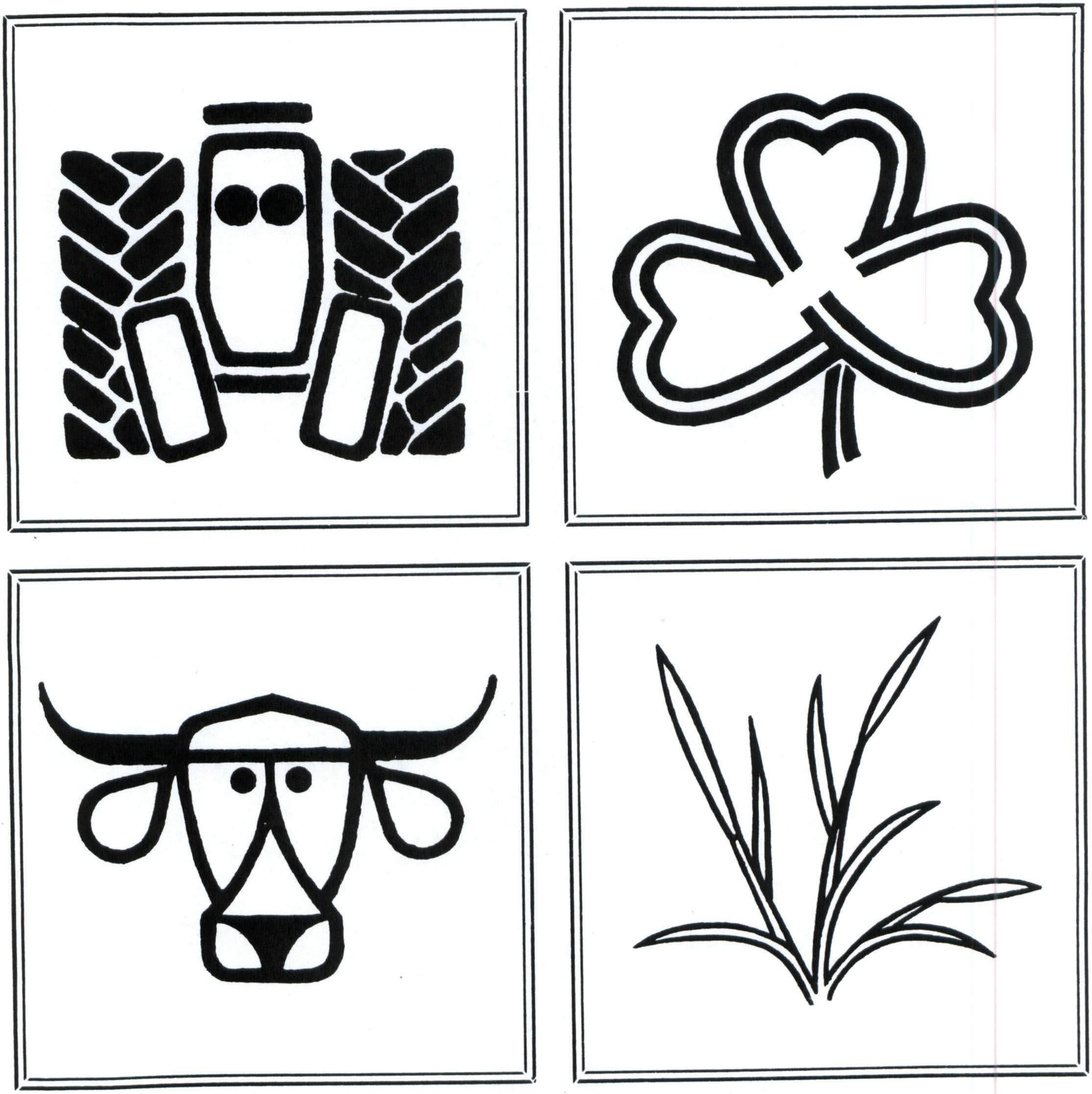

Forage Research in Texas

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Composition and Yield of Sorghum Grain Hybrids Grown at Bushland and College Station

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SUMMARY

The objective of this research was to gain a more complete understanding of yield and composition differences of sorghums grown at two Texas sites. Hybrid sorghums ORO-T and FS-1b were cultured at Bushland and College Station to estimate composition and yield of whole plant, leaf, head and stem at 10 harvest intervals (30 to 189 days post-planting). Whole-plant dry matter yield increased ($P<.001$) with advancing maturity with FS-1b accumulating 60% more dry matter than ORO-T. Plant maturity influenced percent crude protein of the whole plant and leaf ($P<.001$), neutral detergent fiber of the head ($P<.05$), cellulose content of the head, leaf and whole plant ($P<.05$) and the acid insoluble ash of the leaf ($P<.001$). Location x maturity interactions were observed for whole plant with acid detergent fiber ($P<.05$) and acid detergent lignin ($P<.01$). These results confirm that advancing plant maturity increases whole plant dry matter yield up to 150 days post-planting, but the optimum combinations of yield and nutritional potential for cattle is obtained as early as 100 days post-planting. Furthermore, composition of some plant portions if influenced by cultural conditions x maturity interactions, but not by variety.

INTRODUCTION

Plant maturity is commonly considered a major factor influencing composition and is widely used to characterize differences in nutritional potential of feeds. In order to fully optimize harvested forage for livestock feeding systems, consideration mustbe given to the intended utilization of the forage within given production systems. Knowledge of potential interactions of plant maturity upon composition of plant parts of different varieties grown under dissimilar conditions is not well established for sorghum grain.

PROCEDURE

Two commercial hybrid sorghum varieties were cultured at College Station and Bushland. Sorghum varieties were ORO-T, a tall sorghum for grain and FS-1b, an intermediate height sorghum for forage. Planting dates (1974) were April 17 and May 25 for College Station and Bushland, respectively. Harvest dates and corresponding physiological maturity of sorghums at each harvest are present in Table 1.

At College Station, 68 cm rows were used to maintain a population of 247,000 plants per ha for both hybrids. Plant populations were 258,000 and 274,000 plants per ha for ORO-T and FS-1b, respectively, at Bushland with a row width of 102 cm. Four months prior to planting 201 kg each, N, P and K per ha were applied to College Station while only 112 kg of N per ha was applied at Bushland. Weeds were controlled by both mechanical and chemical means at College

Station and by mechanical means at Bushland. Irrigation was provided for the crops at both locations as judged essential during the growing season.

Plants at each location were harvested 6 cm above ground level during the morning on each harvest date. The first harvest was processed as whole plant. Subsequent harvests were manually separated into leaf blade, stem (including leaf sheath) and head upon emergence. Immediately following harvest, plants were stored at 4°C before being separated, chopped three times, dried and ground for analysis.

Chemical analyses consisted of dry matter, neutral detergent fiber (NDF), acid detergent fiber (ADF), cellulose, acid detergent lignin (lignin) and acid insoluble ash (ash) following procedure of Van Soest.

The least squares method of analysis of variance according to Harvey (1960) was employed to test for homogeneity of treatment means and their first-order interactions. Significant responses are presented in graphic form.

RESULTS AND DISCUSSION

Whole plant dry matter yield per ha was influenced by plant maturity ($P<.001$). Head yield was influenced by location ($P<.001$), variety ($P<.05$) and maturity (:<.05) while leaf yield per ha responded ($P<.01$) to a location x harvest interaction (Figure 1). The influence of maturity and variety upon dry matter yields of aerial organs of sorghum and corn is well documented. The location x variety interaction for leaf yield has not been reported previously but represents an important consideration for forage-feeding systems.

Crude protein content for whole plant and leaves was only influenced ($P<.001$) by plant maturity (Figure 2). The average values across locations and varieties indicate that whole plant crude protein decreased from 23.5 to 6.2% from harvest 1 to 8, then increased to 7.5% by harvest 9. Crude protein of the head remained relatively constant from harvest 4 through 10 which is consistent with results from other published data.

Neutral detergent fiber (NDF) of leaf, stem or whole plant was not significantly influenced by variety, location or plant maturity (Figure 3), but percent NDF of the head was influenced ($P<.05$) by plant maturity. Following harvest 6, the NDF content of the head declined rapidly which also influenced percent NDF in the whole plant.

Percent acid detergent fiber (ADF) of whole plant differed ($P<.05$) by location with plant maturity (Figure 4). The ADF content of other plant portions did not express this location x plant maturity interaction observed for the whole plant.

Table 1. Harvest Intervals.

Harvest sequence	Location[a]	Harvest dates (1974)	Days post-planting	Physiological maturity of each variety: ORO-T	Physiological maturity of each variety: FS-1b
1	B	June 24	30	6 leaf	6 leaf
	CS	May 21	35	6 leaf	5 leaf
2	B	July 8	44	Flag	Flag
	CS	June 4	49	Flag	7 leaf
3	B	July 29	65	1/2 bloom	Immature
	CS	June 18	63	1/2 bloom	1/2 bloom
4	B	August 12	79	Soft dough	Prebloom
	CS	July 2	77	Soft dough	Soft dough
5	B	August 26	93	Hard dough	Soft dough
	CS	July 16	91	Hard dough	Soft dough
6	B	September 9	107	Hard dough	Hard dough
	CS	July 30	105	Mature	Hard dough
7	B	September 23	121	Mature	Hard dough
	CS	August 13	119	Fully Mature	Mature
8	B	October 7	135	Fully mature	Mature
	CS	August 27	133	Fully mature	Fully mature
9	B	October 22	150	Fully mature	Fully mature
	CS	September 24	161	Fully mature	Fully mature
10	B	November 5	164	Fully mature	Fully mature
	CS	October 22	189	Fully mature	Fully mature

[a] Coded: B = Bushland and CS = College Station.

Cellulose content of whole plant, leaf and head were each influenced by advancing maturity (P<.05) for both varieties at both locations (Figure 5). Cellulose in the head declined rapidly from harvest 4 to 8 followed by modest increases until harvest 10. Some bird predation of grain occurred between harvest 8 and 9 at both locations resulting in less head (grain) weight (Figure 1a, 1c, 1d) with a proportional increase in percent cellulose of the head.

A location x harvest interaction (P<.01) was observed for whole plant lignin indicating different maturity rates at each location (Figure 6 and Table 1). Increases in percent lignin with advancing maturity are well documented. This interaction was characterized by extreme lignin differences between College Station and Bushland at harvest 1, but by harvest 10, lignin was essentially equal at both locations. Maturity also influenced (P<.001) ash content of leaf (Figure 7).

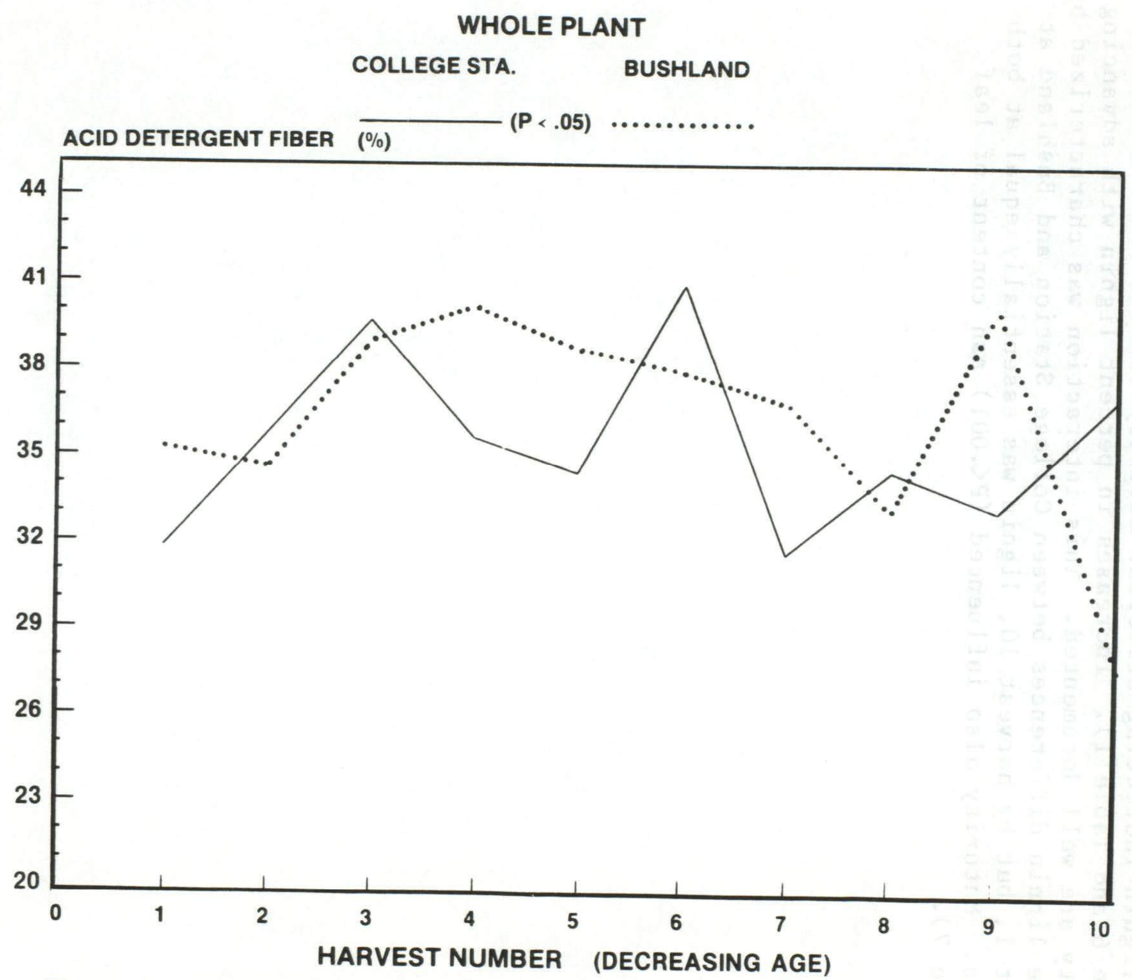

Figure 1. Average percent acid detergent fiber for whole plant for both varieties persented by location and harvest.

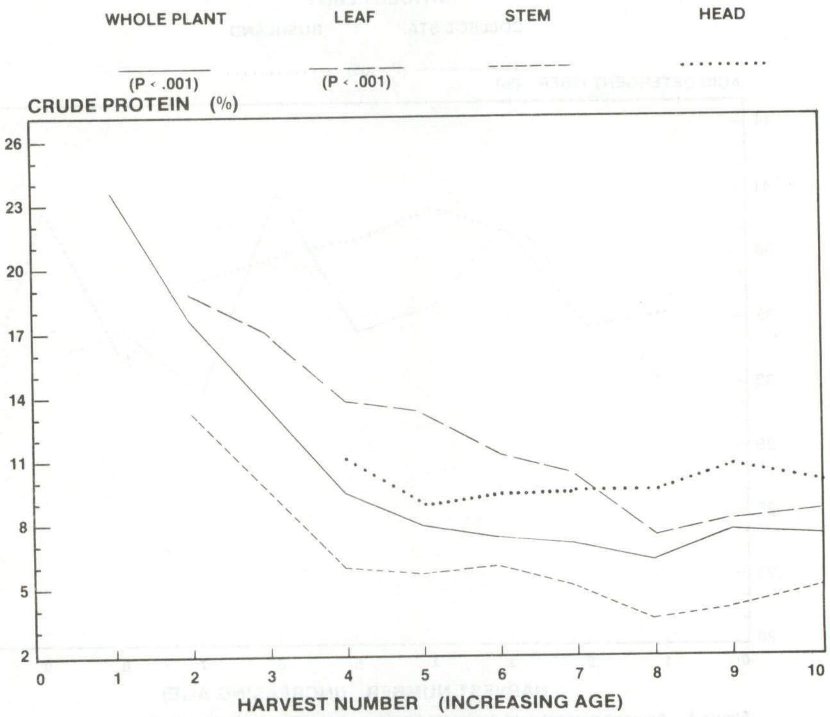

Figure 2. Average percent crude protein for both varieties and locations presented by plant portion and harvest.

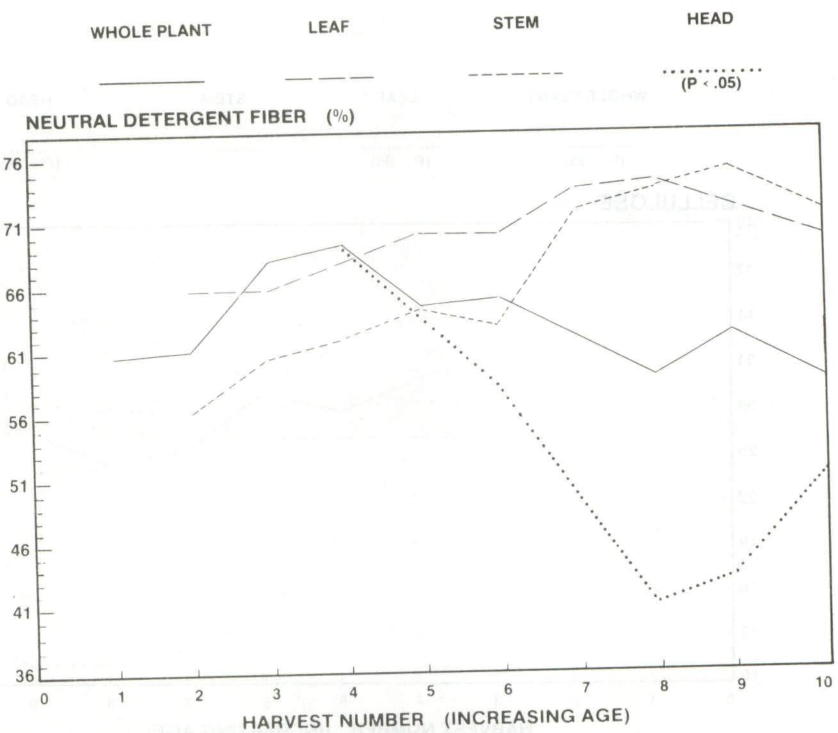

Figure 3. Average percent neutral detergent fiber for both varieties and locations presented by plant portion and harvest.

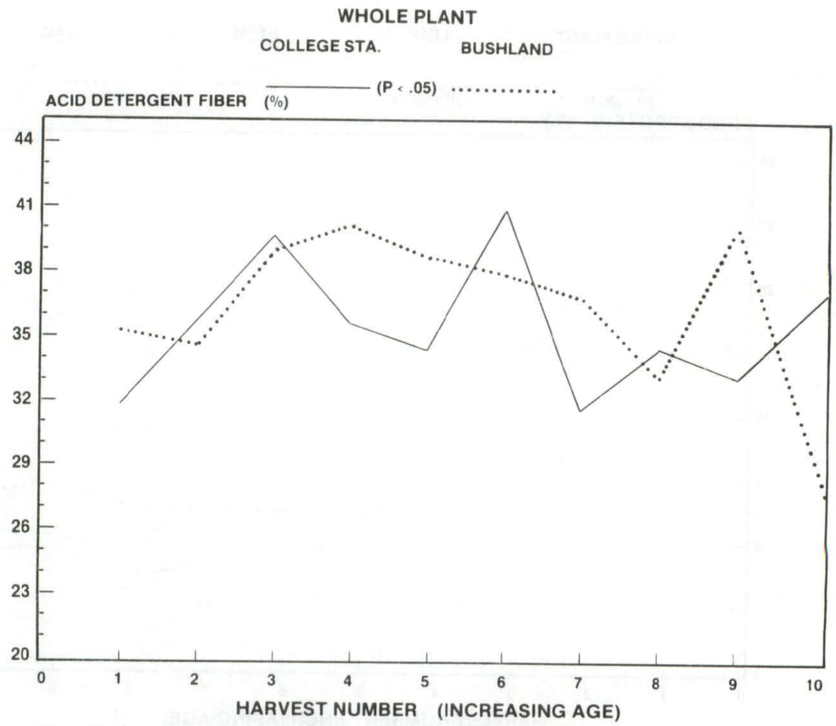

Figure 4. Average percent acid detergent fiber for whole plant for both varieties presented by location and harvest.

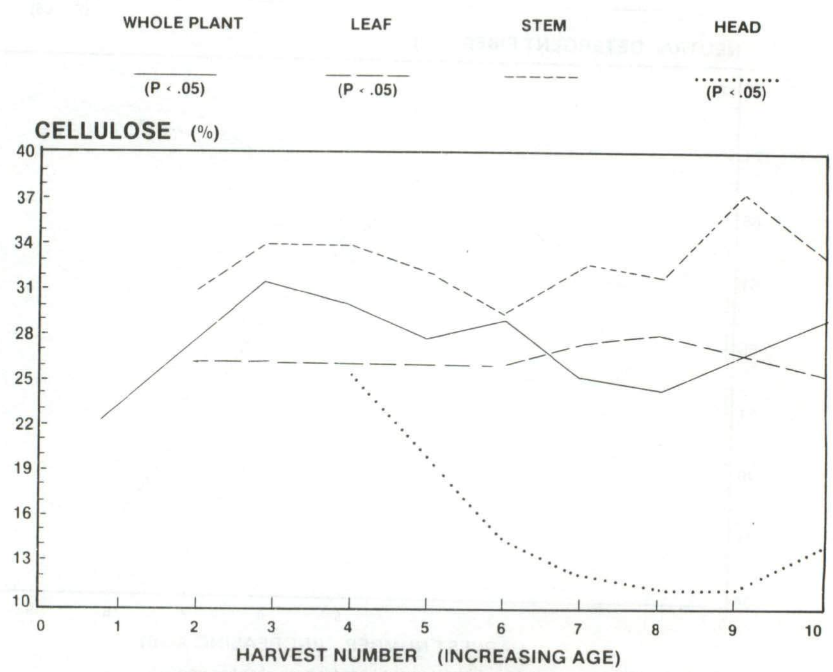

Figure 5. Average percent cellulose for both varieties and locations presented by plant portions and harvest.

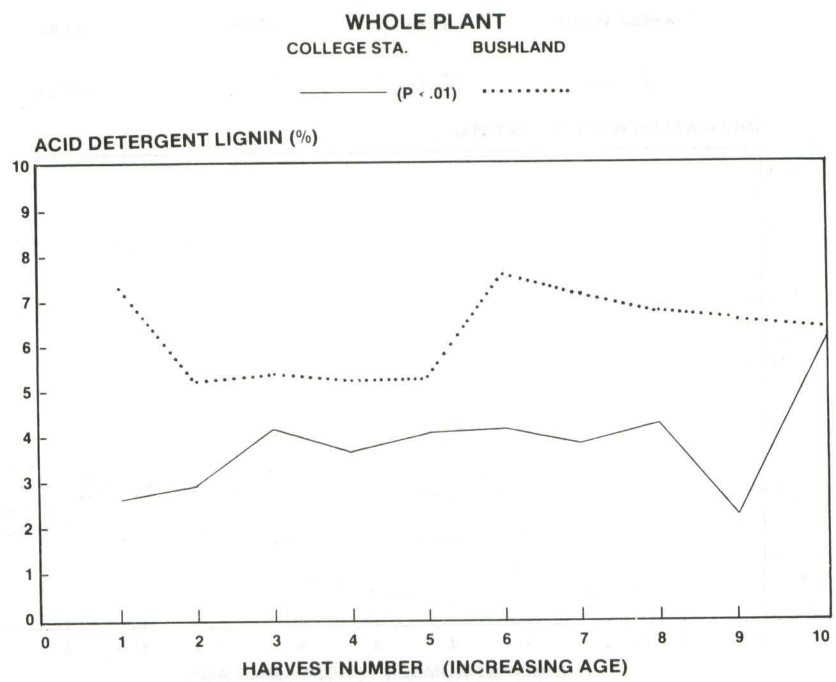

Figure 6. Average percent acid detergent lignin for whole plant of both varieties presented by location and harvest.

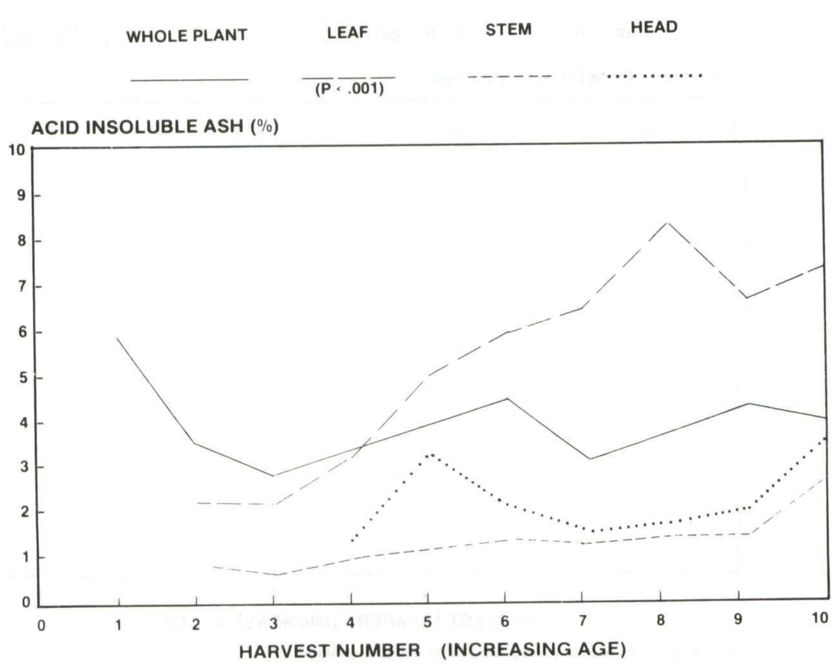

Figure 7. Average percent acid insoluble ash for both varieties and locations presented by plant portions and harvest.

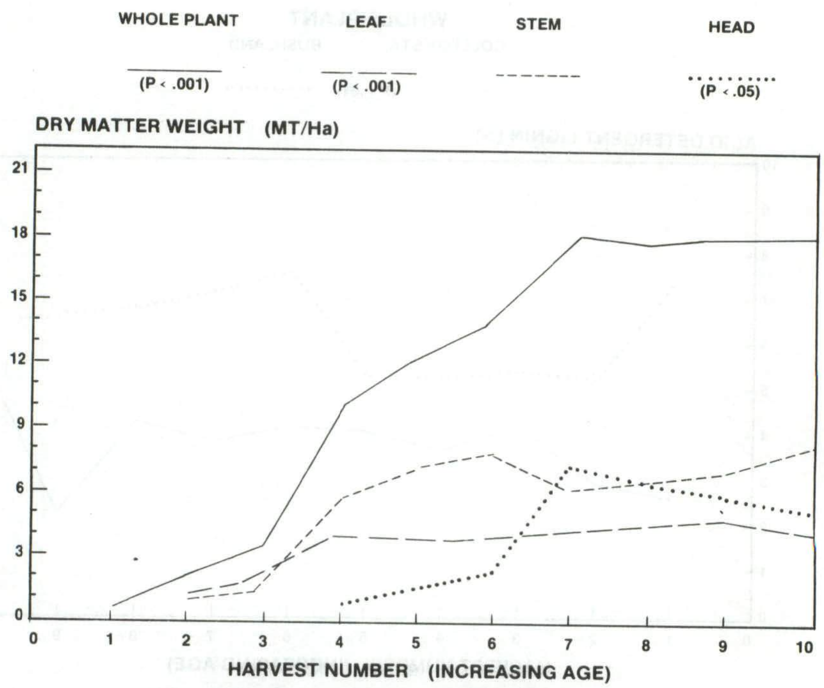

Figure 1A. Dry matter yield per ha (MT), FS-Ib, College Station.

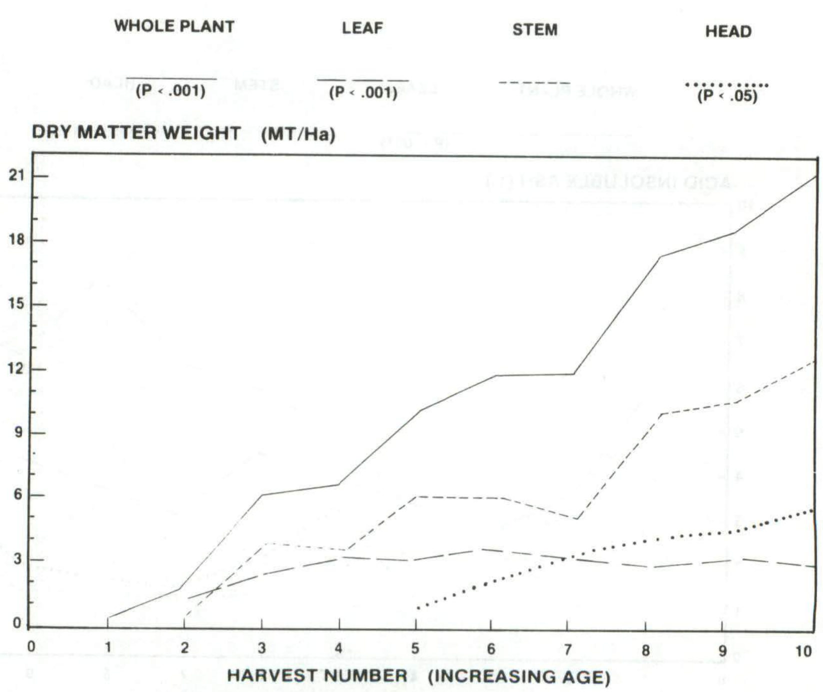

Figure 1B. Dry matter yield per ha (MT). FS-Ib, Bushland.

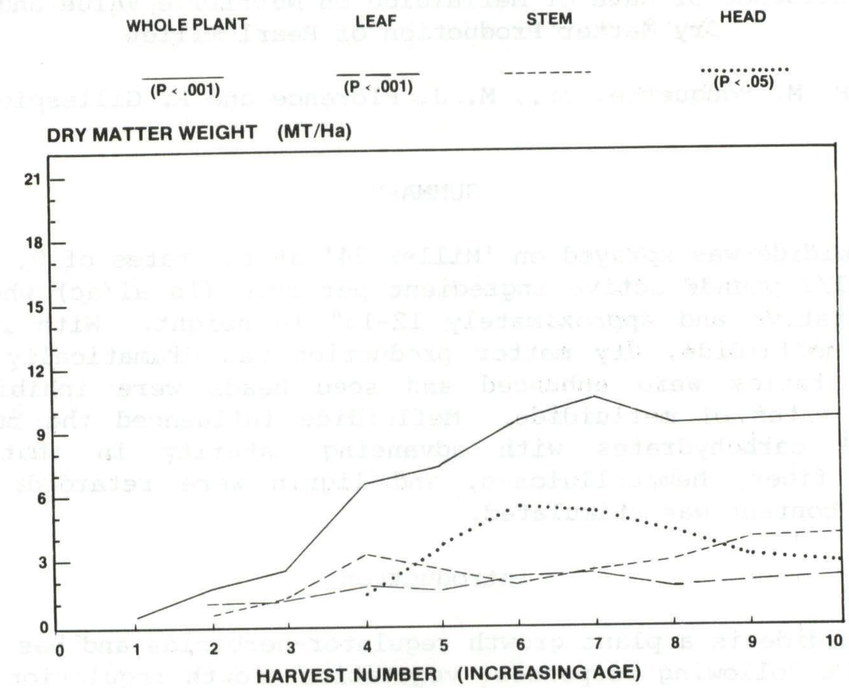

Figure 1C. Dry matter yield per ha (MT), ORO-T, College Station.

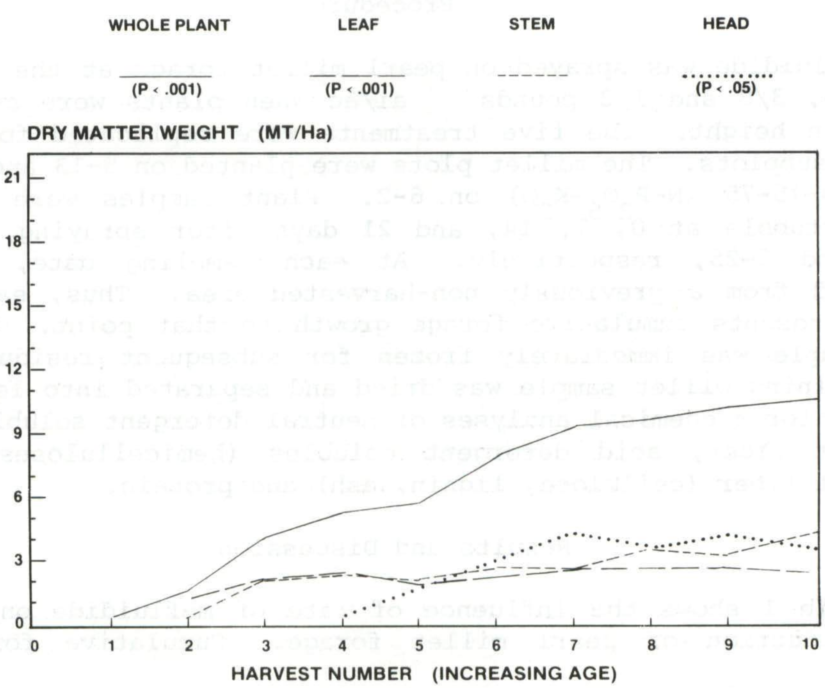

Figure 1D. Dry matter yield per ha (MT) ORO-T, Bushland.