PUBLICATIONS
1998

THE INFLUENCE OF HARVEST TIMING ON FORAGE SORGHUM SILAGE YIELD AND QUALITY

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Summary

A field trial was conducted in 1998 at the Texas A&M University Research and Extension Center in Stephenville to evaluate the influence of harvest timing on forage sorghum (cv. ‘FS 5' and ‘NK 300') silage yield and quality. NK 300 produced greater total yields than FS 5 but was later maturing. A significant interaction between harvest timing and variety was observed for the yields of two harvests. Total yields were greatest when harvested at the soft dough stage of growth. Generally, crude protein, acid detergent fiber, and neutral detergent fiber were lowest at soft dough. No differences in lignin composition were observed

Key words: acid detergent fiber, ADF, lignin, neutral detergent fiber, NDF.

Introduction

Forage sorghum is a common crop grown in the southern United States, due to its high yield, drought tolerance, and adaptability to late planting after winter cereal harvest. However, acceptance of this forage for lactating dairy rations has been limited due to its higher ADF and lignin levels than corn grown for silage. These higher fiber levels reduce forage digestibility and may compromise milk production.

Forage quality determines the extent of use in dairy rations. Quality can be manipulated by reevaluating traditional harvesting schedules. Research has illustrated higher nutritive value in forage sorghum harvested in the vegetative state rather than at later stages of maturity (McCormick et al., 1995). Data from Georgia (Cummins, 1980) suggests the early dough stage to be the best compromise between yield and quality. Reduced yields with an early harvest will occur unless a ratoon or second harvest is also achievable; however, this adds the cost of an additional harvest. Manipulation of harvest schedules must enhance forage quality to warrant an increase in price to compensate the forage grower for reduced yields and/or increases in harvest costs.

Much of this research on harvest stage has been done in other states (i.e., Georgia and Louisiana), while little has been done under Central Texas growing conditions. If the proper compromise between yield and quality can be determined, price can be adjusted accordingly to make sorghum silage production attractive for both dairy and forage producers. The objective of this study was to evaluate the influence of harvest timing on yield and quality of forage sorghum silage.

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Procedure

Two forage sorghum varieties (FS 5 and NK 300) were planted on April 8, 1998 at the Texas A&M University Research and Extension in Stephenville with a Max-Emerge 7300 planter calibrated to deliver 102,000 seeds/acre. The soil type at this location is a Windthorst fine sandy loam. The experimental design was a split-plot with sorghum variety as the main plot and harvest timing (boot, early heading, soft dough) as the sub-plot. Individual plot size was 12' (4/36" rows) X 25' with 3 replications per treatment. Prior to planting, the field was fertilized with 200-50-0 lbs/A and received an additional 50-0-0 lbs/A on August 4. The plot area was kept weed-free with a combination of mechanical and hand-cultivation. In addition to any rainfall that occurred, the plot area was irrigated with 1" of water when required throughout the growing season using a center pivot irrigation system.

At the appropriate stage of growth, a 10' section of row in each plot was harvested by hand. Specific dates of these harvests are found in Table 1. Five plants from this sample were removed, chopped, and oven-dried at 50^{O} C for 3 days to determine dry matter content. Yields were converted and expressed in tons/acre at 35% dry matter (DM). Additionally, this 5 plant sub-sample was used for quality analysis. Traditional wet chemistry techniques were utilized to analyze samples for crude protein, ADF, and NDF.

All data were subjected to an analysis of variance and means separated using Fisher's Protected LSD test at the 0.05 level of probability.

Results and Discussion

1st Harvest Yield: Yield results of the 1st harvest can be found in Figure 1. A significant interaction was observed between harvest timing and variety. No yield differences between varieties were observed when harvested at the boot or early heading. NK 300 had higher yields than FS 5 when harvested at soft dough. For FS 5, early heading and soft dough yields were greater than boot yields but not different from each other. For NK 300, no differences in yield were observed between the boot and early heading stage. However, soft dough yields of this variety were greater than either boot or early heading yields.

2nd Harvest Yield: Yield results of the 2nd harvest are presented in Figure 2. Again, a significant interaction was observed between harvest timing and variety. NK 300 yields were greater than FS 5 yields when harvested at boot or early heading. The yields of these varieties were not different when harvested at soft dough. For FS 5, there were no differences in yield between boot and early heading but soft dough yields were greater than both. For NK 300, there were no differences in yield between boot and early heading and early heading and soft dough. Boot yields were higher than soft dough yields.

Total Yield: Combined yields of both the 1st and 2nd harvests are in Figure 3. No interaction between harvest timing and variety was observed. NK 300 produced more silage than FS 5. However, NK 300 was later maturing, which would influence timely planting of winter pastures. The 2nd soft dough harvest of this variety did not occur until October 18. Total yields were higher when harvested at the soft dough (Figure 4).

1st Harvest Protein: Protein content of 1st harvest silage yields is found in Figure 5. A significant interaction between harvest timing and variety was observed. When harvested at soft dough, NK 300 was higher in protein than FS 5. For FS 5, higher protein levels were obtained when harvested at boot For NK 300, no differences in protein content were observed.

2nd Harvest Protein: No interaction between harvest timing and variety was observed. Protein content was lowest when harvested at soft dough (Figure 6).

Silage ADF: No interaction between harvest timing and variety was observed. For both harvests, ADF content was lowest when harvested at soft dough (Figure 7).

Silage NDF: No interaction between harvest timing and variety was observed. NDF content was lowest when harvested at soft dough for both harvests (Figure 8). FS 5 had a lower NDF content than NK 300 at the 2nd harvest (Figure 9).

Silage Lignin: No interaction was observed between variety and harvest timing. Additionally, there were no significant differences in lignin content between variety or harvest timing. When averaged over harvest timings, lignin contents for the first harvest of DK FS5 and NK 300 were 3.51 and 3.56, respectively, and 3.79 and 4.12, respectively, for the second harvest. When averaged over variety, lignin composition of sorghum silage harvested at the boot, early heading , and soft dough was 3.26, 3.64, and 3.71 for the first harvest and 3.68, 4.09, and 4.12 for the second harvest.

Generally, harvesting at soft dough produced higher yields as well as more desirable (lower) levels of both ADF and NDF. However, harvest at soft dough reduced crude protein at the second time of harvest. Additionally, producers who intend to plant a small grain winter pasture must select a forage sorghum variety that, when harvested twice at soft dough, will mature by the end of August or early part of September.

Acknowledgments

The authors would like to gratefully acknowledge the technical assistance of Paul Buxkemper, Corey Hodges, Jason Ott, Robbie Rudder, Jason Stroup, and Richard Wolfe.

Literature Cited

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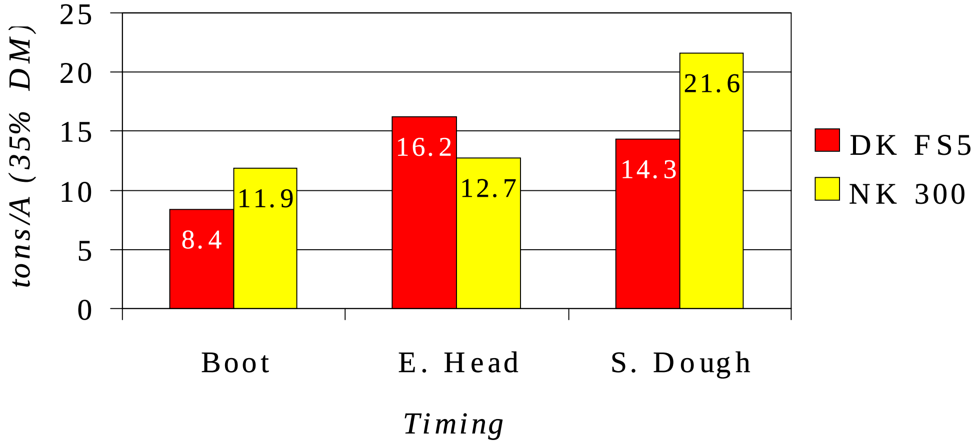
McCormick, M.E., D.R. Morris, BA. Ackerson, and D.C. Blouin. 1995. Ratoon cropping forage sorghum for silage : yield, fermentation, and nutrition. Agronomy Journal 87:951-957.

Table 1. Harvest dates of forage sorghum silage, Stephenville, TX, 1998.

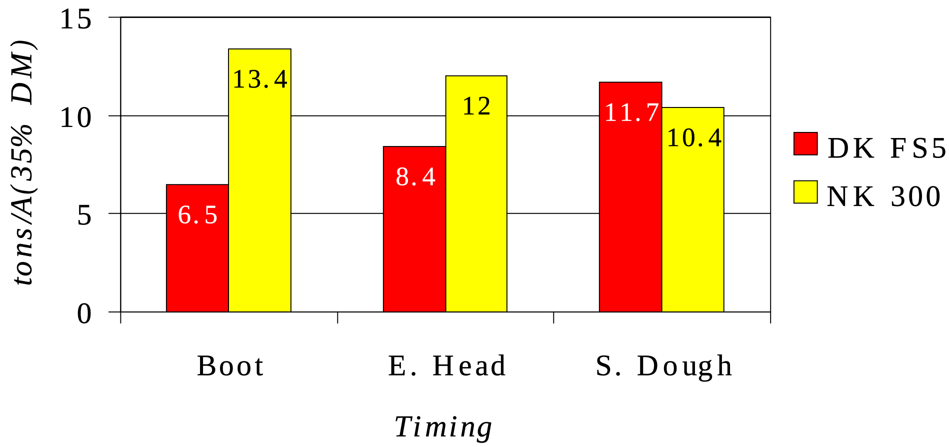
Variety	Boot		Early Heading		Soft Dough	
	1st Harvest	2nd Harvest	1st Harvest	2nd Harvest	1st Harvest	2nd Harvest
FS 5	June 18	August 10	June 25	August 20	July 6	September 18
NK 300	June 23	September 7	June 30	September 18	July 17	October 16

Figure 1. The influence of harvest timing on irrigated sorghum silage yield, *Stephenville, TX 1998.*



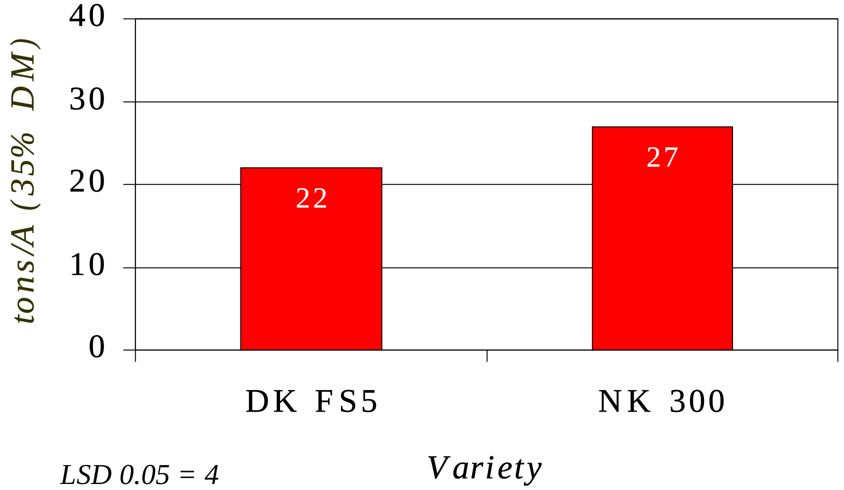
LSD 0.05 = 4.8 (variety X timing) 1st Harvest

Figure 2. The influence of harvest timing on irrigated sorghum silage yield, *Stephenville, TX 1998.*



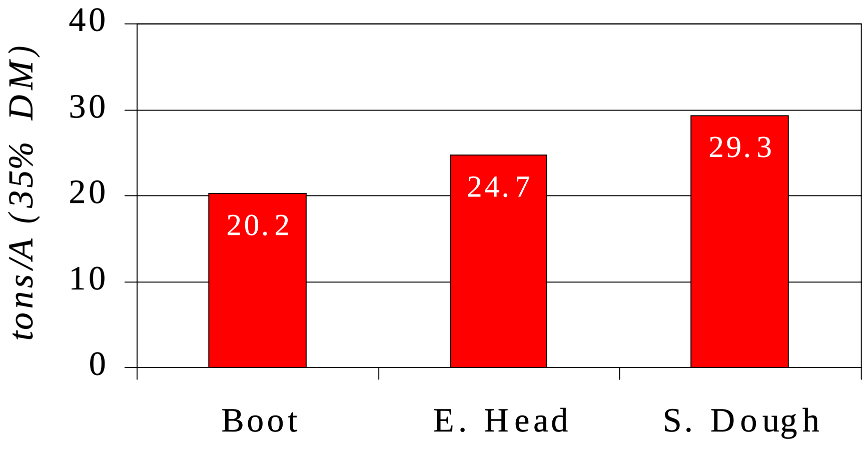
LSD 0.05 = 2.7 (variety X timing) 2nd Harvest

Figure 3. The influence of variety on total irrigated sorghum silage yield, *Stephenville, TX, 1998.*



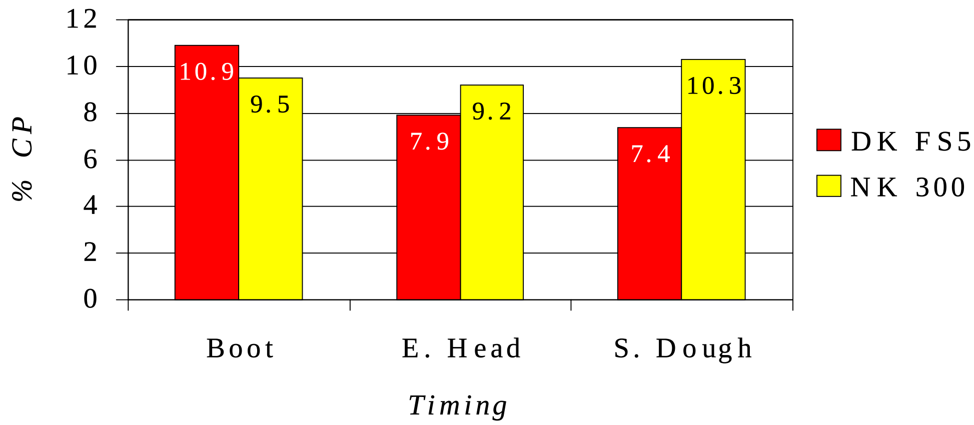
LSD 0.05 = 4

Figure 4. The influence of harvest timing on total irrigated sorghum silage yield, *Stephenville, TX, 1998.*



LSD 0.05 = 4.3

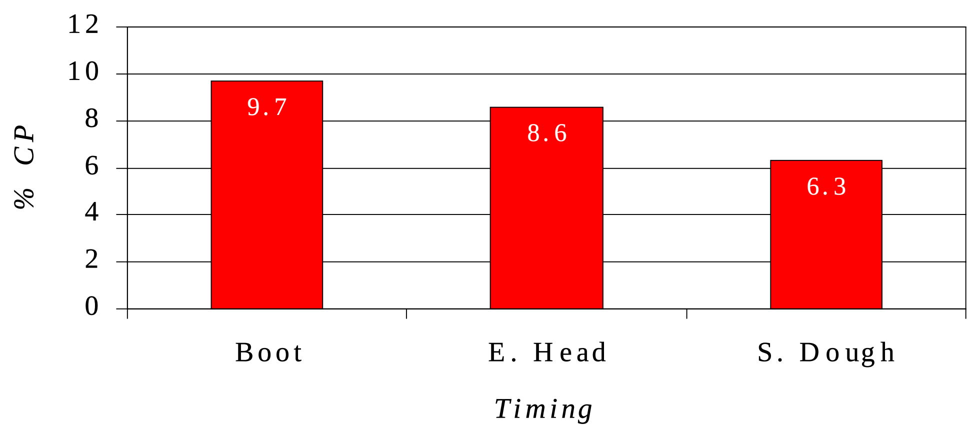
Figure 5. The influence of harvest timing on irrigated sorghum silage protein, *Stephenville, TX, 1998.*



LSD 0.05 = 2.4 (variety X timing)

1st Harvest

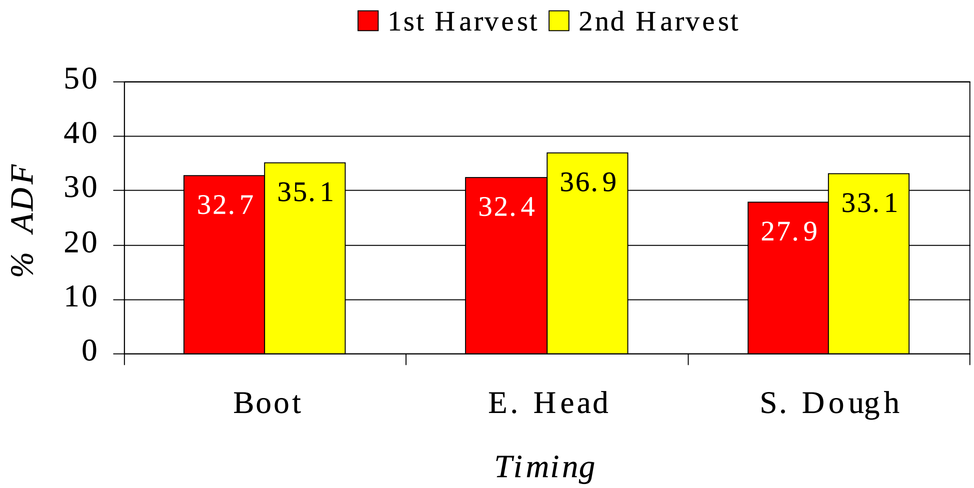
Figure 6. The influence of harvest timing on irrigated sorghum silage protein, *Stephenville, TX, 1998.*



LSD 0.05 = 1.3

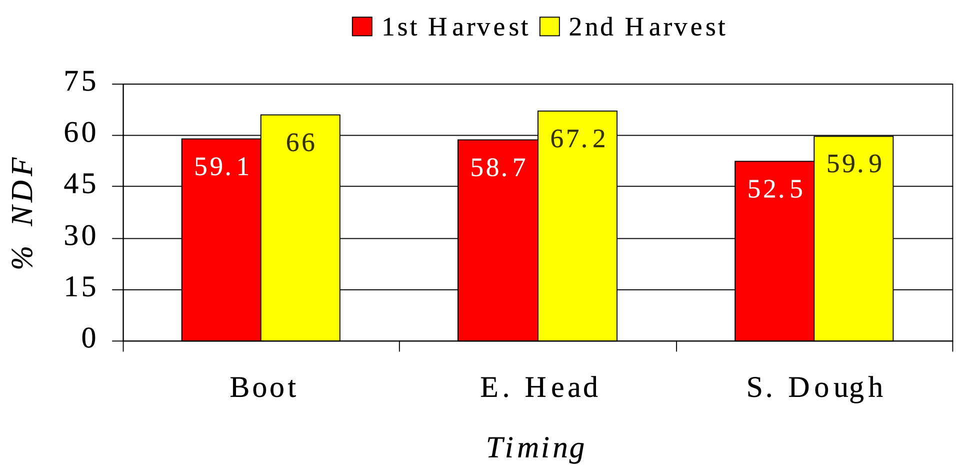
2nd Harvest

Figure 7. The influence of harvest timing on irrigated sorghum silage ADF, *Stephenville, TX, 1998.*



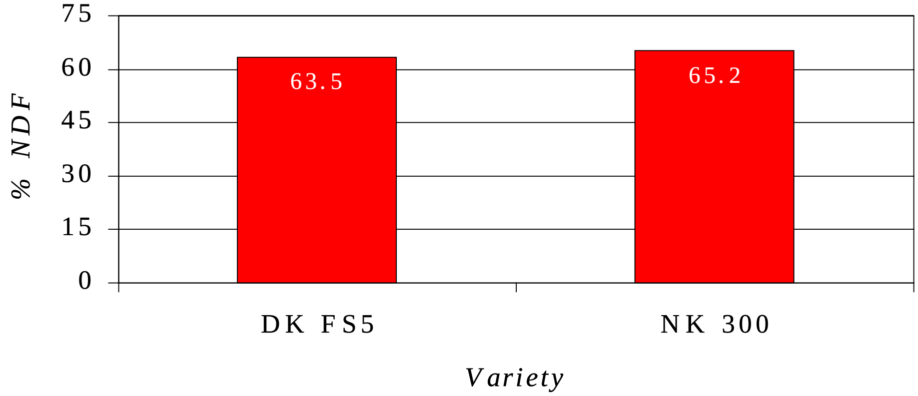
LSD 0.05 = 1.7 (1st) *LSD 0.05 = 1.7 (2nd)*

Figure 8. The influence of harvest timing on irrigated sorghum silage NDF, *Stephenville, TX, 1998.*



LSD 0.05 = 2.7 (1st) *LSD 0.05 = 1.5 (2nd)*

Figure 9. The influence of variety on irrigated sorghum silage NDF, *Stephenville, TX, 1998.*



LSD 0.05 = 0.2

2nd harvest