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Changes in the Fiber Content of Tallgrass and Shortgrass Species During Maturation

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ABSTRACT

The study of fiber is very useful in animal nutrition. Since fiber is a major part of forage plants, it is very important to know the portion that it comprises. Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) were the methods of fiber determination used in this study. The analyses were done with an Ankom Fiber Analyzer. The purpose of this study was to compare changes in the fiber content of short grass species with that of tall grass species. Tall Dropseed and Side Oats Gramma were used to represent the short grasses and Big Bluestem and Indiangrass were used to represent the tall grasses. Each species was sampled eight times, starting in June and ending in October. The data suggests that early in the season tall grasses are lower in both ADF and NDF than short grasses. However, tall grasses and short grasses appear to have similar amounts of ADF and NDF at the end of the season.

INTRODUCTION

The study of fiber has been an ongoing process in the world of animal science. Fiber is a major part of forage plants and affects their ability to be utilized by animals. The determination of fiber can be accomplished through several methods. The two commonly used measurements are Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF). ADF contains cellulose, lignin, heat-damaged proteins, and silica (Church, 1991). NDF is a fraction containing mostly cell wall constituents of low biological availability. NDF contains hemicellulose, cellulose, lignin, heat-damaged proteins, and silica (Church, 1991). Hemicellulose is only moderately utilized by ruminant animals, while cellulose utilization is low. Lignin, heat-damaged proteins and silica are not used by animals (Church, 1991).

The purpose of this study was to compare the changes in ADF and NDF content of short and tall grass species over the growing season. Sideoats Grama and Tall Dropseed represented the short grasses, and Indiangrass and Big Bluestem represented the tall grasses.

MATERIALS AND METHODS

The native grasses, Tall Dropseed (*Sporobolus asper*), Sideoats Grama (*Bouteloua curtipendula*), Big Bluestem (*Andropogon gerardi*) and Indiangrass (*Sorghastrum nutans*) were sampled. All grasses were all sampled at the same site, NW1/4, Sec. 31, R. 25, T. 7, in Graham County, KS. Samples were taken on June 9, July 6, July 26, August 8, August 19, September 6, September 23 and October 9, 1995. Grasses were sampled by cutting off the plants at ground level with a knife. Samples were allowed to air-dry before being placed in plastic bags. The samples were then ground in a Wiley Mill with a 1.0 mm screen.

The dry matters of all samples were determined by oven-drying a 2.0 gram sample at 102 degrees Celsius for 24 hours. The fiber analysis was done with an Ankom Fiber Analyzer. All samples were analyzed in duplicate. The Ankon Fiber Analyzer is a new modification of the Van Soest method of fiber analysis. There is no statistical difference between the results of fiber analysis on the same sample by the two methods (Komarek, 1993).

The ADF method involves placing 0.5 gram samples into a filter bags. The bags are then heat-sealed and placed into a standard Acid Detergent solution. The sample is agitated in the solution for 70 minutes at a temperature of 100 degrees Celsius. Following this step, the bags are rinsed five times with two liters of 90+ degree C rinse water. The bags are then placed in acetone for five minutes. The bags are then removed and allowed to air dry, before being placed in a drying oven overnight. After drying, the bags are weighed to determine fiber percentage. The fiber is determined by comparing the final weight to the starting weight.

The NDF method is very similar to the ADF method. Bags containing 0.5g samples are placed into a standard Neutral Detergent solution. The bags are kept in the solution for 80 min at 100 degrees C. Sodium sulfite (0.5g/sample) is added the to the ND solution, to help improve accuracy. The bags are then treated in the same manner as the ADF samples.

All values were converted to a dry matter basis. Hemicellulose was calculated as NDF minus ADF.

RESULTS

ADF and NDF increased for all species between the first and the last sampling dates. Tall Dropseed ADF and NDF percentages increased from 46.1 to 59.1and from 77.7 to 84.7, respectively (Fig 1,2). Sideoats Grama ADF and NDF percentages increased from 49.7 to 58.9 and 80.9 to 82.5, respectively (Fig 1,2). Big Bluestem ADF and NDF percentages increased from 42.5 to 58.4 and 67.8 to 85.9, respectively (Fig 1,2). Indiangrass ADF and NDF percentages increased from 39.6 to 55.3 and 71.9 to 82.3, respectively (Fig 1,2).

Hemicellulose tended to decrease between the first and the last sampling dates.

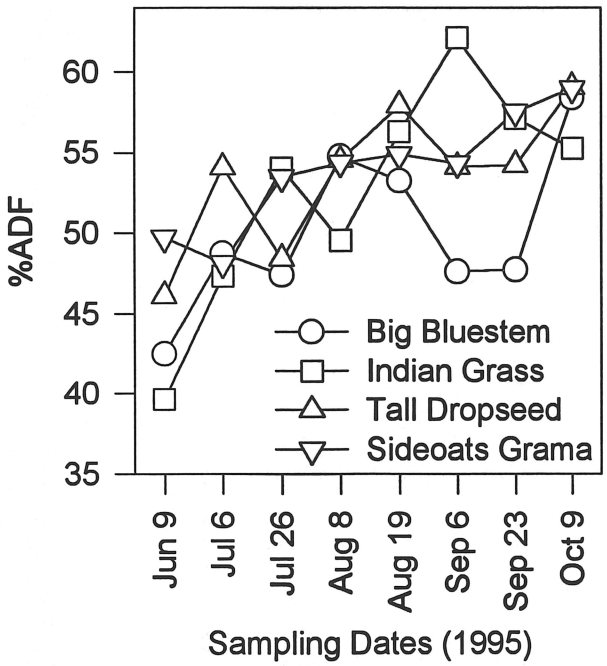

Figure 1. Changes in ADF of Big Bluestem, Indiangrass, Tall Dropseed, and Sideoats Grama over the growing season.

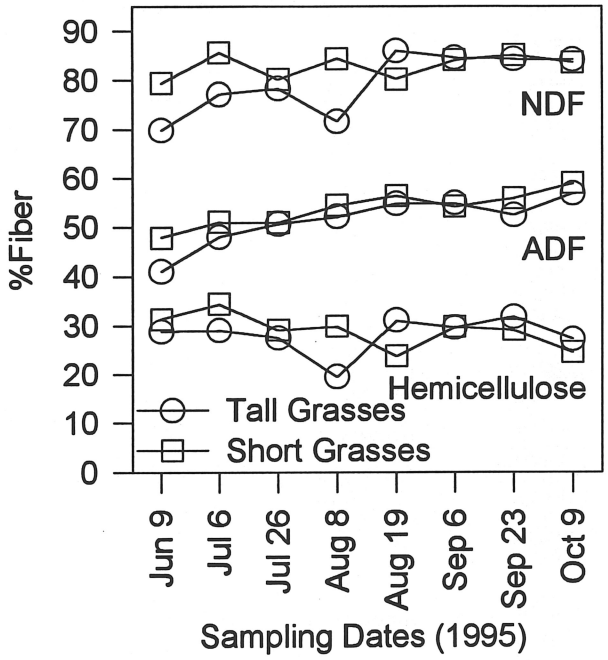

Figure 3. Changes in NDF, ADF and hemicellulose of tallgrass species and shortgrass species over the growing season.

DISCUSSION

There were no significant differences between the tall and short grasses in their fiber contents. However, the two tall grass species did have a lower average ADF and NDF content at the starting date of June 6. This lower average was maintained throughout most of the study (Fig 3). These results differ from the results of other studies. Vanzant, 1992; Twidell, 1988; and Vona, 1984 all concluded that the short grass species were lower in ADF and NDF. The differences in all three of these studies were statistically significant.

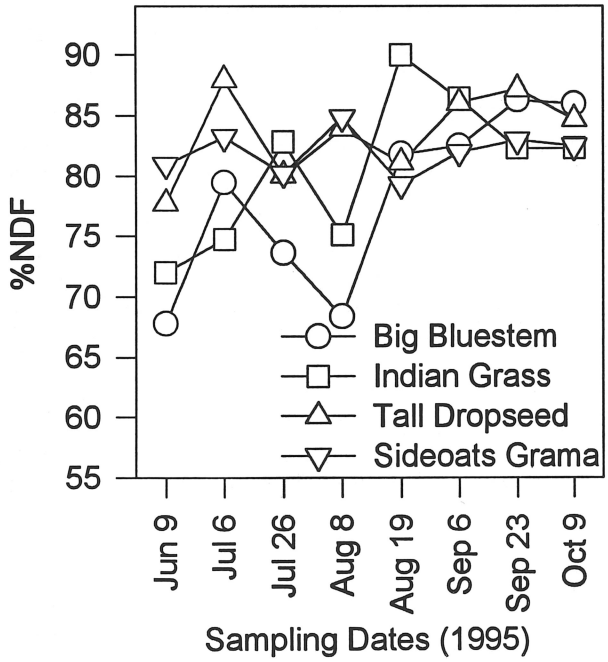

Figure 2. Changes in NDF of Big Bluestem, Indiangrass, Tall Dropseed, and Sideoats Grama over the growing season.

The main reason that this study was not able to statistically differentiate between tall grass species and short grass species, was that not enough samples were taken at each collection date. The study was designed before the purchase of the Ankom Fiber Analyzer, which enables many more samples to be run in less time. The older equipment that was replaced could only analyze six samples at one time, while the new machine can analyze 24 samples at one time. Since all samples were run in duplicate, it would take a long time to run very many samples using the older equipment.

ADF increases for both the short and tall grass species were almost linear (Fig 3). This is very similar to the results that Vanzant achieved in his study in 1992. NDF and hemicellulose percentages fluctuated over time. NDF in the tall grass species decreased between July 26 and August 8, followed by a sharp increase on August 19. Hemicellulose levels followed the same pattern. The short grass species did not fluctuate as much in either NDF or hemicellulose. The fluctuations in the percentages of NDF and hemicellulose are difficult to explain. These differences could be due to differences in the grass samples of the

same species. Because only one sample was taken of each species at each date, variation within species could explain the fluctuations. However, the percentages of NDF and ADF did increase, while the percentage of hemicellulose decreased for both groups. This is in agreement with other studies as fiber percentages increased as plants matured (Vanzant, 1992; Twidell, 1988; Jung, 1992, and Vona, 1984).

LITERATURE CITED

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