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EFFECT OF DATE OF HARVEST ON THE YIELD AND NUTRITIONAL QUALITY OF NATIVE GRASS HAY

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Summary

Native grass hay meadows in three Kansas Flint Hills counties were sampled at 2-week intervals during the 1997 and 1998 growing seasons to determine the effect of harvest date on forage quality and dry matter (DM) yield. Each sample was weighed and analyzed for crude protein (CP), acid detergent fiber (ADF), and phosphorus (PHOS). The CP and PHOS contents declined, whereas ADF and DM yield increased as harvest date progressed. Although CP, ADF and DM yield were related highly to harvest date, the association for PHOS content was only moderate. Because harvest date of native grass hay can significantly influence supplemental protein needs for beef cows, mid-July harvesting appears to be the best compromise between yield and forage quality.

(Key Words: Native Grass, Hay, Forage Quality, Cows.)

Introduction

Native grass hay is an important roughage source for wintering beef cattle in Kansas. Harvest date is the most important management factor for native grass hay meadows, because it has a major impact on DM yield, forage quality, and subsequent plant vigor. Native hay harvest in the Flint Hills region normally occurs in mid-July, although it can take place from late June through September.

Because forage quality decreases and DM yield per acre increases with advancing plant maturity, the optimum harvest date for native grass hay involves a compromise between DM yield (tons/acre) and forage quality. Additionally, sufficient time must be permitted for perennial, warm-season grasses to replenish their root carbohydrate reserves prior to winter dormancy.

Our objective was to document and develop prediction equations for changes in yield and nutritive value of native-grass hay harvested at progressively later dates throughout the growing season.

Experimental Procedures

Native-grass hay meadows in Butler, Cowley and Marion counties were used. Meadows consisted of mixed species of perennial, warm-season grasses and forbs that are dominant in the Kansas Flint Hills. Growing conditions were near normal in 1997 at all three locations. In 1998, however, both the Butler and Cowley locations experienced drought conditions during much of the growing season (June to mid-August).

A 35 ft. long by 3 ft. wide plot was established at each county location. Within each plot, 12 blocks corresponding to harvest dates were established. A 30-in. x 30-in. sample was hand clipped from the center of each block leaving a 4-in. stubble height. Samples were harvested at 2-week intervals from June 3 to November 4, 1997, and June 2 to November 3, 1998.

Immediately after clipping, forage samples were sealed in an airtight bag and submitted to a commercial forage testing laboratory for chemical analysis. Samples for each harvest date were analyzed for dry matter (DM), crude protein (CP), acid detergent fiber (ADF), and phosphorus (PHOS). In

1998, samples were weighed prior to shipping, and DM yields (lb/acre) determined. Regression equations were developed to describe the relationships between harvest date and CP, ADF, PHOS, and DM yield. Julian calendar date (JCD) was included as the independent variable (June 1=day 153, November 3=day 308). Feed costs were estimated for lactating beef cows consuming native grass hay of various CP content.

Results and Discussion

Individual county data for both years (1997 and 1998) were combined and pooled into one overall regression equation for CP and PHOS. Only combined county data from 1998 were available to pool and develop an overall regression equation for DM. Because of a significant year effect, regression equations for ADF were developed for each year. Harvest date accounted for the majority of the variation in CP (R^2=.84). As anticipated, CP content declined with advancing maturity (Figure 1), where %CP= 25.75-(.1461 x JCD) + (.00025 x JCD^2). Average CP contents ranged from 10.46% on June 3 to 3.58% on November 4 in 1997 and from 8.48 % on June 2 to 4.64% in 1998. CP content tended to be higher in 1997 than 1998, particularly early in the growing season.

The ADF content increased by 1 percentage unit every 12 days (%ADF=21.75 + [.0836 x JCD]) in 1997 and by 1 percentage unit every 18 days (%ADF=29.84 + [.0557 x JCD]) in 1998, within the window of the sampling period (Figure 2). Drought stress at two of the four locations in 1998 reduced early season plant growth and development. This resulted in greater variation in ADF values and a stronger relationship between harvest date and ADF in 1997 (R^2=.81) than in 1998 (R^2=.62).

Harvest date was less effective in predicting PHOS content (R^2=.40) for the 2-year period (Figure 3). However, PHOS content tended to decline with advancing maturity and ranged from .18% to .04% (%PHOS= .1783 - [.00034 x JCD]). In 1998, average dry matter yield ranged from 783 lb/acre on June 2 to 2138 lb/acre on November 3 (Figure 4). Drought conditions at two of the four locations influenced DM yield. During the sampling period, DM increased by 500 lb/acre every 55 days (DM = -563.5 + [9.14 x JCD]), (R^2=.61).

Because the CP content of the base forage influences the amount of supplemental protein needed, beef cows or stockers fed forages harvested beyond the optimum date will require more supplemental protein. Table 1 illustrates the influence of harvest date and CP content of native hay on the supplemental protein requirements for a 1,100 lb lactating beef cow.

In this example, cows consuming 4.0% CP native grass hay would require an additional .88 lb of protein supplement at an added cost of $.24/day, compared to cows consuming 8.0% CP hay. Represented another way, an approximate cost savings of $3.54 per cow occurs for each percentage unit improvement in CP between 4.0 and 8.0%. Based on the results of this study, native hay meadows harvested by mid-July would be an acceptable compromise between forage quality and dry matter yield, while allowing adequate time for range grasses to replenish root carbohydrate reserves prior to fall dormancy.

Table 1. Influence of Harvest Date and Crude Protein Content of Native Grass Hay on Supplemental Protein Cost[1]

Date	% CP Content of Native Grass Hay	Pounds of Supplemental CP Required[2]	Cost/Day of Supplemental CP Source[3]	Total Supplement Cost[4]
7/1	8.0	.84	$.23	$13.57
7/15	7.0	1.06	$.29	$17.28
7/29	6.0	1.28	$.35	$20.81
8/26	5.0	1.50	$.41	$24.19
9/23	4.0	1.72	$.47	$27.73

[1]CP requirements for 1,100 lb mature, lactating beef cow of superior milk production (20 lb/day), 3-4 months postpartum=2.6 lb CP/day.
[2]After accounting for CP content in native grass hay; assuming dry matter intake=22 lb/day.
[3]38% commercial protein cube ($210/ton).
[4]For the postcalving period February 15 to April 15 (59 days).

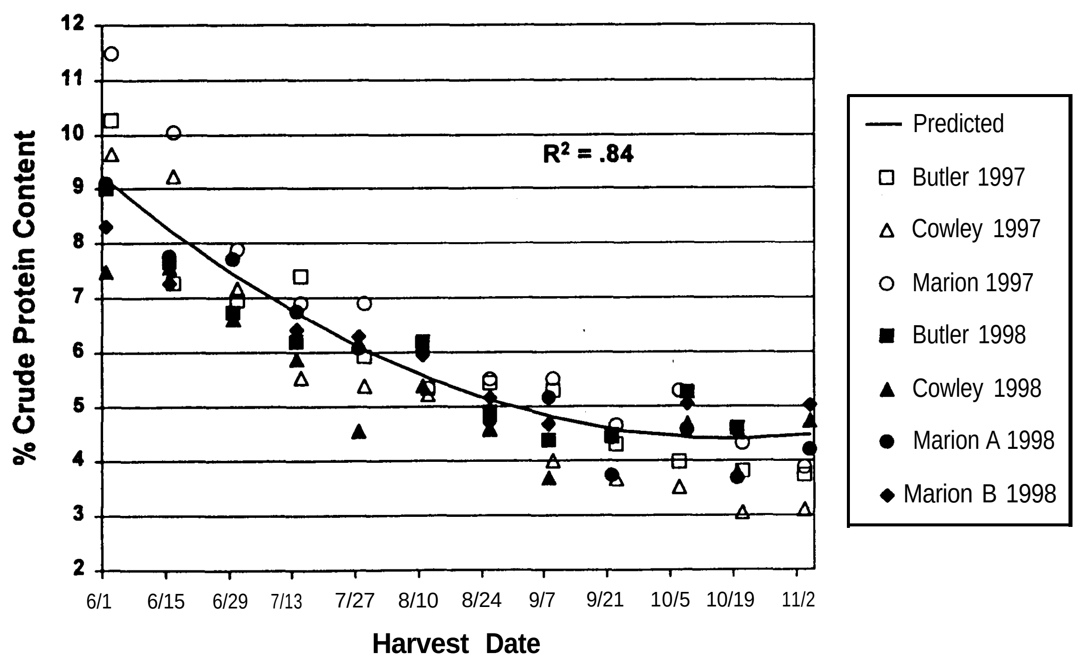
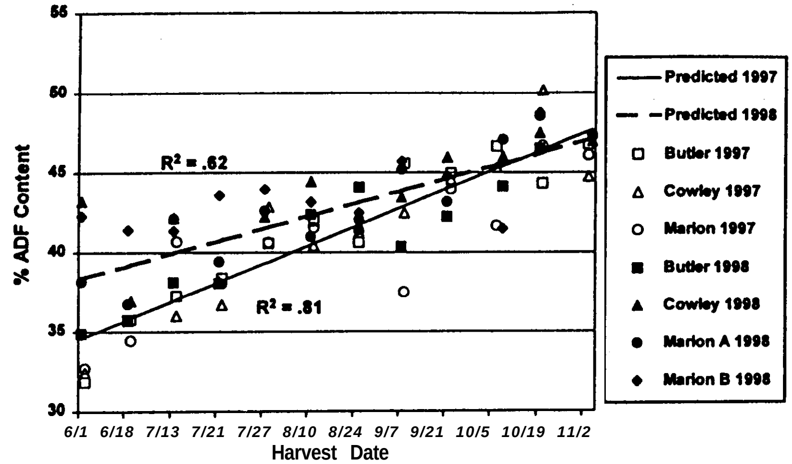
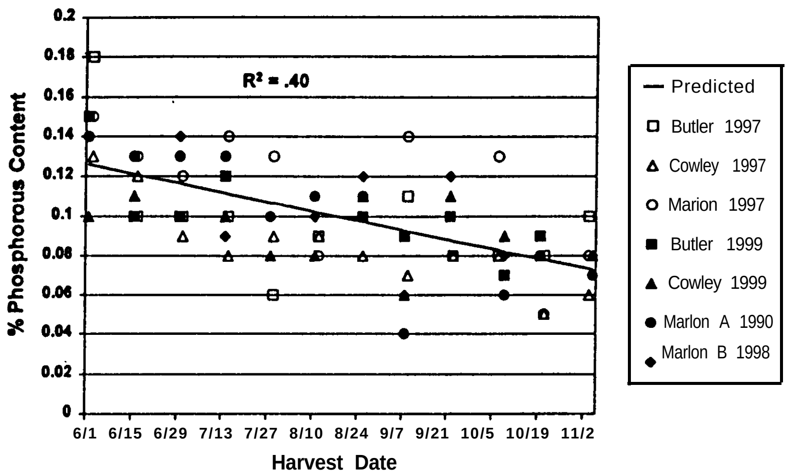


Figure 1. Crude Protein Content of Native Grass Hay.



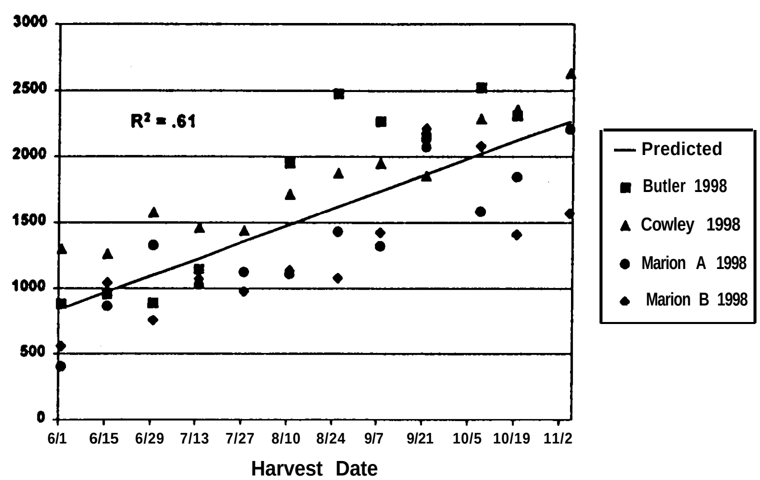
ADF (1997) = 21.75 + (.0836*Julian Date). ADF (1998) = 29.84 + (.0557* Jullan Date)

Figure 2. Acid Detergent Fiber Content of Native Grass Hay.



Phosphorous - .1783 - (00034*Jullian Date)

Figure 3. Phosphorous Content of Native Grass Hay.



Dry Matter = -563.5 + (9.14*Julian Date)

Figure 4. Dry Matter Yield of Native Grass Hay.