

Effects of Method of Initiating Stockpiling on the Nutritive Value of Forage for Winter Grazing

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Introduction

As feeding of stored feeds is the largest cost in beef cow-calf production, profitability of a cow-calf enterprise may be improved by extending the grazing season into the fall and winter. One resource for an extended grazing season is forage that is stockpiled in the summer and fall. Generally, it is recommended stockpiling of forages not begin before early August, and the forage be harvested by mechanical mowing followed by removal of the forage by hay harvest. Although this process results in a uniform removal of forage before stockpiling, it does require either purchase or leasing of harvest equipment or paying for custom hay harvest.

Because high density grazing systems such as mob or strip grazing may result in more uniform forage removal than grazing at lower stocking densities, these systems may be used as an alternative to hay harvest for initiating stockpiling of forages. Some producers in Iowa have utilized high density grazing in the spring to initiate stockpiling for the following winter. Although this system would likely increase forage yield, the increased maturity of the forage would likely reduce forage quality and increase the concentration of toxic alkaloids in common tall fescue varieties. In contrast, high-density grazing in late summer might result in similar yields and nutritional quality of stockpiled forages to hay harvest.

The objective of this study was to determine whether strip-grazing in late summer would result in similar quantities and nutritional qualities of stockpiled forage to a late summer hay harvest.

Materials and Methods

In 2015, nine 1-acre paddocks containing tall fescue, smooth brome grass, and reed canarygrass at the ISU McNay Research Farm, Chariton, Iowa, were divided into three blocks. On May 15, 2015, and May 16, 2016, (spring grazing) and July 14, 2015, and July 22, 2016, (summer grazing), live forage yield was estimated with a falling plate meter and one paddock in each block was stocked by 10 pregnant Angus cows (mean BW, 1,316 lb) to graze in strips at a daily forage allowance of 2.4 percent of body weight. Cows were removed from the paddocks to initiate stockpiling May 22, 2015, and June 1, 2016, in the spring grazing treatment and August 7, 2015, and August 5, 2016, in the summer grazing treatment. Although the plan was to take two hay harvests from the forage in the remaining paddock in each block, excess precipitation in 2015 prevented hay harvest until August 18, 2015, (summer hay). In 2016, first harvest hay was harvested June 28, but second harvest regrowth of these cool-season grass paddocks was limited. Therefore, forage was mowed August 5, but not baled. As a result, stockpiling of the summer hay treatment was initiated August 18, 2015, and August 5, 2016. Each paddock was fertilized with 100 lb urea and 155 g urease inhibitor September 3, 2015, and August 10, 2016.

Beginning October 24, 2015, and October 22, 2016, forage was sampled monthly through January by hand-clipping at a height of 1 in. at six 0.25 m² locations and pooled by paddock for each month. Samples were weighed, dried

at 65°C for 48 hours, weighed again for determination of dry matter (DM) concentration and mass, and ground through a 1-mm screen. Samples were analyzed for crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), and *in vitro* dry matter digestibility (IVDMD). Digestible DM mass was calculated by multiplying the DM mass by the IVDMD concentration. To evaluate the effects of a grazing system on ergovaline concentrations in tall fescue, 100 tall fescue tillers were collected from each paddock October 22, 2016, and January 19, 2017, placed on ice, and immediately sent to the University of Kentucky Veterinary Diagnostic Laboratory for analysis of ergovaline.

After the January sampling, cows were allowed to graze the stockpiled forage to remove residual forage.

Results and Discussion

Ambient temperatures differed little from the 66-year average over the summer of either year (Figure 1a). However, temperatures during the sampling period equivalent to the grazing period were 0 to 10 degrees greater than the monthly averages. Monthly precipitation May through July was considerably above average in 2015 (Figure 1b). However, precipitation was at or below normal during stockpiling August through October of both years. There was greater than average precipitation in November and December, 2015.

As expected, the mass of forage stockpiled after strip-grazing in the spring was greater than either strip-grazing or hay harvest in late summer at sampling October through December (Figure 2). However, there were no differences in the masses of forage stockpiled after summer strip-grazing or hay harvest in any sampling month.

Similarly, in January, there were no differences in forage mass stockpiled after strip-grazing in either spring or summer.

Dry matter concentrations of forages stockpiled after strip-grazing in spring or late summer were greater than forage stockpiled after late summer hay harvest in November (Table 1). This implies a greater proportion of vegetative forage in paddocks where stockpiling was initiated by a late summer hay harvest, rather than by strip-grazing. Crude protein concentration of forage stockpiled after spring strip-grazing was lower than forages stockpiled after late summer strip-grazing or hay harvest at the initiation of sampling in October. However, in October, there was no difference in CP concentration between forages stockpiled after late summer strip-grazing or hay harvest. Unlike October, there were no differences in CP concentration between forage stockpiled after spring or late summer strip-grazing or late summer hay harvest in other sampling months, likely due to weathering losses.

The NDF concentration of forage stockpiled after spring strip-grazing was greater than forage stockpiled after late summer strip-grazing or hay harvest October through December. There were no differences in the NDF concentrations of forages stockpiled after strip-grazing or hay harvest in late summer.

Similar to NDF, ADF concentration of forage stockpiled after spring strip-grazing was greater than forage stockpiled after late summer strip-grazing or hay harvest October through December. However, unlike NDF, ADF concentration of forage stockpiled after late summer strip-grazing was greater than forage stockpiled after late summer hay harvest in October and November. As a result of these differences in composition, the IVDMD concentration of forage stockpiled after spring strip-grazing was lower than

forage stockpiled after late summer strip-grazing or hay harvest in any sampling month. However, there were no differences in forages stockpiled after late summer strip-grazing or hay harvest in any sampling month. Because of these trends in IVDMD concentration, the digestible dry matter mass of forage stockpiled after spring strip-grazing was greater than forage stockpiled after late summer hay harvest in October. However, there were no differences in digestible dry matter mass between treatments for months other than October (Figure 2).

In spite of the differences in forage maturity, the variability in data resulted in no statistical differences in the concentration of ergovaline in tall fescue tillers of forage stockpiled after either of the three treatments in October (Figure 3). As observed in other reports, weathering reduced the concentrations of ergovaline between the October and January samples. However, in January, the ergovaline concentration of forage stockpiled after spring strip-grazing was greater than forages stockpiled after either late summer strip-grazing or hay harvest.

Conclusions

Although stockpiling after strip-grazing in spring resulted in greater forage mass at all sampling dates than stockpiling after strip-grazing or harvest in late summer, the increased maturity of forage stockpiled after spring strip-grazing resulted in lower quality forage than forages stockpiled after late summer strip-grazing or hay harvest. As a result, digestible DM mass of forage stockpiled after spring strip-grazing was only greater than forage stockpiled after late summer hay harvest in October. Furthermore, in spite of the greater DM mass, the higher NDF and lower IVDMD concentrations of forage stockpiled after spring strip-grazing compared with forages stockpiled after late summer strip-grazing or hay harvest would

likely result in lower DM intakes, smaller body weight gains, or lower condition scores of cows grazing this forage.

In addition, the higher ergovaline concentrations of forage stockpiled after spring strip-grazing than summer strip-grazing or hay harvest would increase the susceptibility of cows grazing the stockpiled forage to tall fescue toxicity.

In contrast to spring strip-grazing, DM mass and the concentrations of components other than ADF differed little between forages stockpiled after strip-grazing or hay harvest in late summer. Therefore, grazing at a high stocking density system like mob- or strip-grazing in late summer is an acceptable method to initiate stockpiling of forage for winter grazing. Although a high density grazing system would not require hay harvest equipment, the numbers of grazing animals needed to graze the number of acres needed for winter grazing in a short time period would present a challenge. In this experiment, it took 7 to 24 days for the 10 cows to strip-graze one acre at a daily forage allowance of 2.4 percent of bodyweight. If 2 to 2.5 acres of stockpiled forage is required to maintain a cow over winter, it would take 20 to 25 grazing cattle to remove the forage from the land area of stockpiled forage needed to maintain one cow over winter. However, initiating stockpiling by summer strip-grazing may be more practical if integrated with either rotational grazing or hay harvest. If the 2 to 2.5 acres of stockpiled forage needed for winter maintenance of one cow were rotationally grazed to a height of 4 in. during May through July, it would take 2.5 to 3.0 grazing cattle to remove the forage from that area over a 14-day period prior to the initiation of stockpiling. These extra cattle might be supplied as stocker steers, developing heifers, or cows from neighboring producers. Another approach would be to

mow some of the acres and graze the remainder. This system would require equipment, but might make custom harvesting more cost effective.

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Table 1. Composition over fall and winter of forage stockpiled after initiation by spring strip-grazing, summer strip-grazing, or summer hay harvest at the ISU McNay Research Farm, Chariton, IA.

Initiation system	Sampling month			
	October	November	December	January
	Dry matter (DM), %			
Spring strip-grazing	30.8	37.2 ^a	45.8	35.9
Summer strip-grazing	27.2	35.6 ^a	41.8	32.4
Summer hay	24.5	31.8 ^b	39.8	29.1
	Crude protein (CP), % of DM			
Spring strip-grazing	11.8 ^a	10.4	10.1	10.5
Summer strip-grazing	13.7 ^b	11.6	11.4	11.1
Summer hay	14.5 ^b	11.5	10.3	11.3
	Neutral detergent fiber (NDF), % of DM			
Spring strip-grazing	59.7 ^a	60.0 ^a	63.6 ^a	63.7 ^a
Summer strip-grazing	55.3 ^b	57.6 ^b	59.2 ^b	63.6 ^a
Summer hay	54.9 ^b	56.1 ^b	57.8 ^b	60.4 ^b
	Acid detergent fiber (ADF), % of DM			
Spring strip-grazing	31.1 ^a	31.7 ^a	34.1 ^a	34.3 ^a
Summer strip-grazing	29.3 ^b	29.4 ^b	30.5 ^b	34.2 ^a
Summer hay	27.0 ^c	27.2 ^c	29.1 ^b	31.4 ^b
	In vitro dry matter digestibility (IVDMD), % of DM			
Spring strip-grazing	49.2 ^a	49.6 ^a	40.9 ^a	41.7 ^a
Summer strip-grazing	58.0 ^b	60.0 ^b	56.3 ^b	48.1 ^b
Summer hay	61.8 ^b	62.7 ^b	58.4 ^b	52.9 ^b

^{abc}Differences between means with different superscripts are significant, $P < 0.05$.

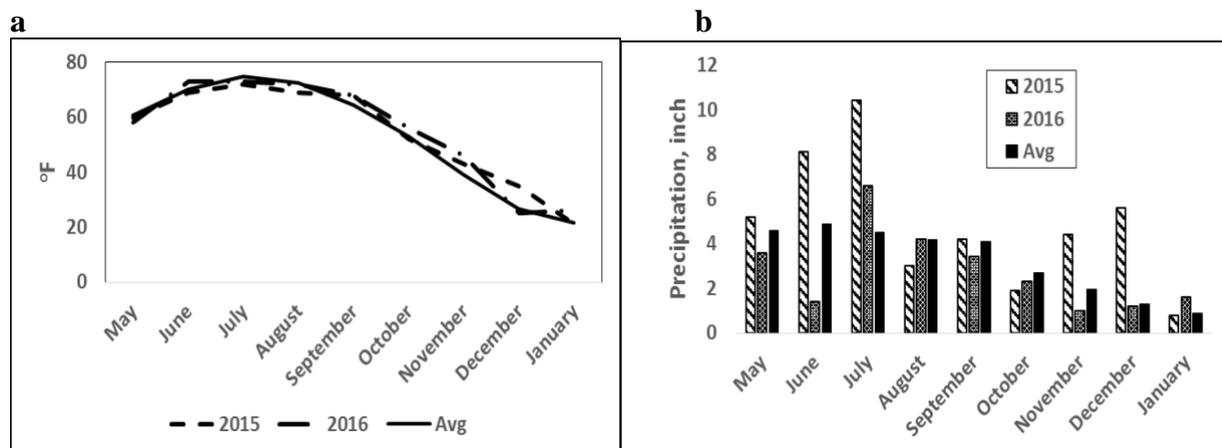
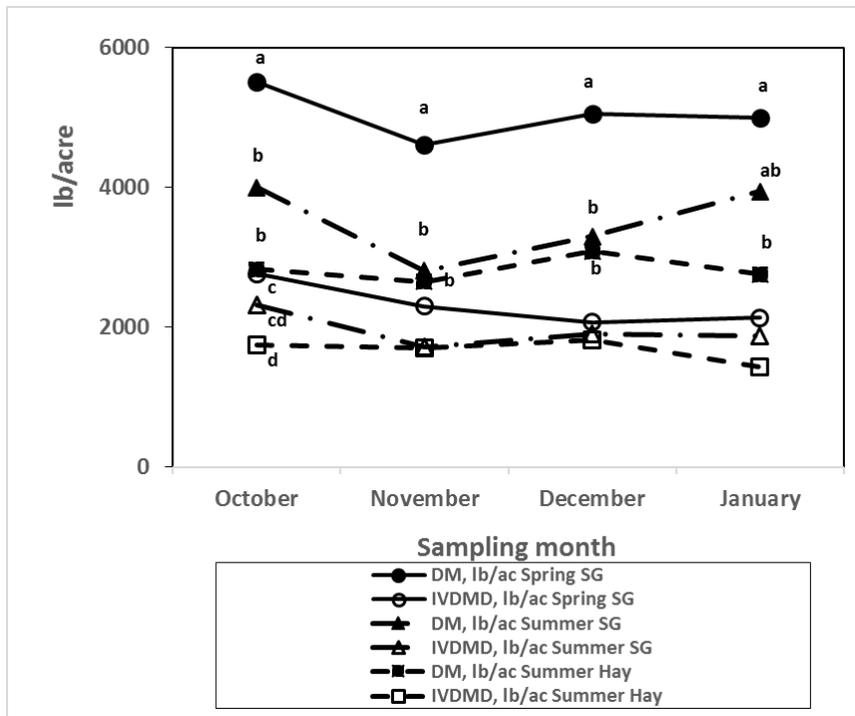


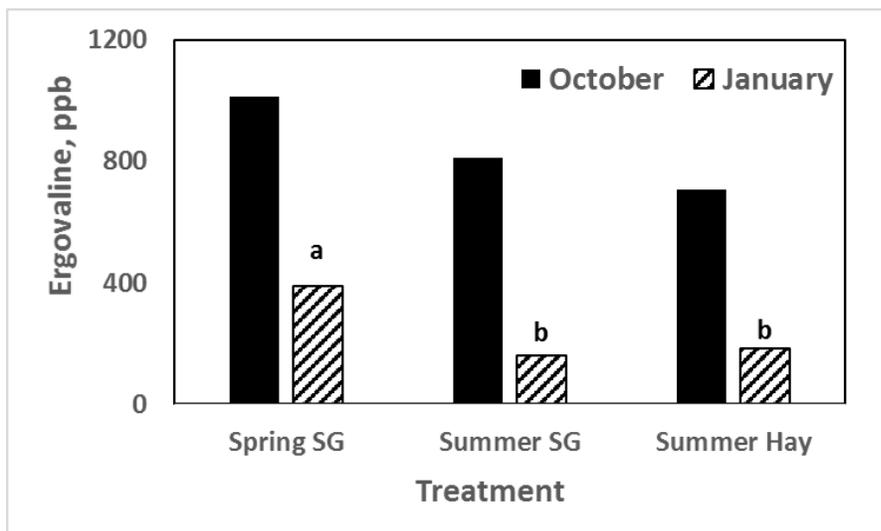
Figure 1. Mean temperature (a) and total precipitation (b) in months during production and sampling of stockpiled forage at the ISU McNay Research Farm, Chariton, IA.



^{ab}Differences between DM means with different superscripts are significant, $P < 0.05$.

^{cd}Differences between IVDMD means with different superscripts are significant, $P < 0.05$.

Figure 2. Total and digestible dry matter masses over fall and winter of forage stockpiled after initiation by spring strip-grazing, summer strip-grazing, or summer hay harvest at the ISU McNay Research Farm, Chariton, IA.



^{ab}Differences between means in January with different superscripts are significant, $P < 0.05$.

Figure 3. Ergovaline concentration of tall fescue tillers in forage stockpiled after initiation by spring strip-grazing, late summer strip-grazing, or late summer hay harvest in October and January at the ISU McNay Research Farm, Chariton, IA.