

Alfalfa Yield Response to Cutting Height and Cutting at Dawn and Dusk

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Summary

Alfalfa yield and quality can be affected by the height and timing of cutting. This research was conducted to determine if 1) raising cutting height from 2 to 4 inches could increase stem density particularly during the summer months, and if 2) alfalfa cut at dusk and the following dawn differ in dry matter yield. Alfalfa was harvested from small plots eight times during the year in an experiment conducted at the Maricopa Agricultural Center in 1999 on a third year stand. The 4 inch cutting height resulted in consistently lower yields compared to the 2 inch cutting height even during the summer despite having slightly higher stem density. The 2 inch cutting height produced 12.5 tons/acre over the year compared to 9.9 tons/acre for the 4 inch cutting height. Forage yield was 3.7% higher for alfalfa cut at dusk compared to the following dawn. Alfalfa cut at dusk and weighed the following dawn lost a similar amount of dry weight overnight compared to alfalfa left standing. Any yield advantage of cutting at dusk can only be realized by greenchopping and immediately feeding the forage.

Introduction

Cutting Height

The optimum cutting height for alfalfa varies from about 2 to 4 inches. Cutting height can be used to manipulate whether stems originate from crown or stem buds. Low cutting height stimulates crown bud development and high cutting height stimulates stem bud development. Crown buds are more productive than stem buds, so stimulation of crown bud development by lower cutting heights (i.e. 2 to 3 inches) is usually desirable. However, raising cutting height may be desirable 1) if crown bud development is suppressed by frequent or early cutting, 2) to avoid cutting crown regrowth buds if the alfalfa is cut late, or 3) possibly during the summer when crown bud development is low.

Dawn vs. Dusk Cutting

Plant physiologists reported early in this century that plants have higher sugar content in the late afternoon compared to the early morning. Deceased UA scientist Albert Dobrenz measured this effect in alfalfa. Dobrenz suggested that alfalfa cut in the late afternoon would have higher yield and quality than alfalfa cut in the early morning. USDA scientists in Idaho have recently measured increased preference and intake of PM vs. AM cut forage for cattle, sheep, and goats. The purpose of this research was to determine if alfalfa cut at dusk and the following dawn differ in dry matter yield.

Materials and Methods

An experiment was conducted at the University of Arizona Maricopa Agricultural Center on a third year stand of CUF 101 alfalfa on a sandy loam soil. The alfalfa received no fertilizer, herbicides, or insecticides. The plots were irrigated twice between cuttings. The alfalfa was cut eight times during the year and the cutting cycle was about 28 days during the warmer part of the year. The experimental design was a randomized complete block with 2 treatments and 8 replications. The treatments consist of 2 and 4 inch cutting heights (cut at dusk) and dawn vs. dusk harvests (cut at 2 inch height). The cutting heights represent the height of the sickle bar above the ground level. The height of the stubble was usually greater than the height of the sickle bar due to lodging, the way the forage was feed into the sickle bar, or undulations in the soil surface level. Alfalfa was cut and weighed 1 hr or less before sunset (dusk) or 1 hr or less after sunrise. The plots were 12 feet wide and 20 feet long. The center 4 feet of the plots were harvested with a small plot grain combine that was modified into a forage harvester. Moisture content was determined on a sample of the forage used to adjust yield to a dry weight basis. Stem density was determined after each harvest to compare the 2 and 4 inch cutting heights by counting number of cut stems in two 1 ft² areas of the plot.

Results and Discussion

Cutting Height

Raising the cutting height from 2 to 4 inches was did not increase yield during the summer, or any time during the season (Table 1). The 2 inch cutting height resulted in higher yields compared to the 4 inch cutting height for all harvests except for the last in December. The actual length of the stubble may have been closer to 3 and 6 inches for the 2 and 4 inch cutting height, respectively. Therefore, the difference in length of stem harvested was about 3 inches when comparing cutting heights. This amount of stem is considerable since the total length of cut stem may have only been 15 inches in some cases.

Stem density was slightly higher for the 4 inch cutting height, but the increase in stem density did not translate into yield (Table 2). Stems originating from stem buds are not as productive as those originating from crown buds. We may have encouraged stem bud development in the 4 inch cutting height, and an increase in stem buds may have decreased yields relative to the 2 inch cutting height.

Dawn vs. Dusk Cutting

Cutting at dusk resulted in 3.7% higher yields on average than cutting the following dawn (Table 3). Higher yields occur at dusk since carbohydrates are lost during the night to respiration and are at a low point at dawn. The crop accumulates dry weight during the day and loses dry matter during the night. If the crop is healthy, a net gain in weight occurs because the increase in weight during the day is greater than the loss during the night. If the alfalfa is cut at dusk and then weighed the following dawn, we found that the cut forage lost a similar amount of weight overnight compared to the standing forage. Any yield advantage of cutting at dusk can only be realized with greenchopping and immediate use of the forage since dry weight will be lost overnight whether or not the alfalfa is cut or left standing.

Table 1. Hay yields as affected by height of cutting.

Cutting Height	Hay Yield (0% moisture)								
	3/4/99	4/15/99	5/23/99	6/17/99	7/15/99	8/20/99	9/30/99	12/4/99	Sum
	tons acre ⁻¹								
2"	1.61	1.84	2.01	2.04	1.62	1.34	0.99	1.05	12.50
4"	1.00	1.38	1.79	1.57	1.42	1.01	0.85	0.91	9.93
Signif- icance	**	**	**	**	**	**	**	*	**

*,** = Significant at P=0.10 and 0.05, respectively.

Table 2. Stem density as affected by height of cutting.

Cutting Height	Stem density								
	3/4/99	4/15/99	5/23/99	6/17/99	7/15/99	8/20/99	9/30/99	12/4/99	Average
	stems foot ⁻²								
2"	36	78	51	47	41	24	33	37	43.4
4"	37	63	63	51	50	37	42	38	47.6
Signif- icance	NS	**	**	NS	**	**	**	NS	**

NS, ** = Not significant at P=0.15 and significant at P= 0.05, respectively.

Table 3. Hay yields as affected by time of cutting.

Time of cut	Hay Yield (0% moisture)								
	3/4/99	4/15/99	5/23/99	6/17/99	7/15/99	8/20/99	9/30/99	12/4/99	Sum
	tons acre ⁻¹								
Dawn	1.40	1.79	2.04	2.05	1.51	1.23	1.00	1.02	12.05
Dusk	1.61	1.84	2.01	2.04	1.62	1.34	0.99	1.05	12.50
Signif- icance	**	NS	NS	NS	NS	*	NS	NS	+

NS, +,*,** = Not significant at P=0.15 and significant at P=0.15, 0.10, and 0.05, respectively.

Table 4. Hay yields as affected by time of weighing.

Time of cut	Time of weighing	Hay Yield (0% moisture)								
		3/4/99	4/15/99	5/23/99	6/17/99	7/15/99	8/20/99	9/30/99	12/4/99	Sum
		tons acre ⁻¹								
Dusk	Dawn	1.53	1.77	1.94	2.02	1.42	1.10	1.02	1.02	11.82
Dusk	Dusk	1.61	1.84	2.01	2.04	1.62	1.34	0.99	1.05	12.50
	Signif- icance	**	**	NS	NS	**	**	NS	NS	**

NS,** = Not significant at P=0.15 and significant at P=0.05, respectively.