2025 Influence of cutting height and frequency on forage productivity and quality

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2025 INFLUENCE OF CUTTING HEIGHT AND FREQUENCY ON FORAGE PRODUCTIVITY AND QUALITY

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Harvest management is an integral component of producing high-quality forage. Often harvest timing and speed are discussed, but equally important cutting height and frequency. While many grazing farmers have adopted the practice of leaving more ungrazed material in the pasture and waiting to regraze once plants have fully recovered, many hay fields are still harvested as low and frequently as possible. Over time this can cause significant stress leading to a decline in plant density, increases in weed pressure, and subsequent reductions in stand productivity and quality. Cutting at a higher height can help the plants recover faster and keep the ground cooler during hot and dry conditions. But how does this compare under different harvest intervals? In 2025, the University of Vermont Extension Northwest Crops and Soils Program initiated a trial to evaluate the impact of varying cutting heights and frequencies on forage yield and quality to better understand the cost and value of these management strategies.

MATERIALS AND METHODS

The trial was conducted in 2025 at Borderview Research Farm in Alburgh, VT. The experimental design was a randomized block with four replicates where treatments included three cutting heights and three harvest frequencies (Table 1). Plots were blocked by harvest frequency to facilitate mechanical harvest.

Table 1. Harvest management treatments, 2025.

Harvest height	Harvest Interval
1.5 inches	30 days
	34 days
	38 days
3 inches	30 days
	34 days
	38 days
6 inches	30 days
	34 days
	38 days

The trial was imposed on a plot of orchardgrass that had been established in the late summer of 2024 (Table 2). The site soil type was Covington clay that had previously grown small cereal grains. The trial was initiated at first harvest on 30-May where all plots were mowed according to their assigned height using a New Holland discbine. Because harvest frequency treatments were not yet imposed, yield and quality data were not collected, and all material was removed from the trial area. After 30, 34, and 38 days of regrowth, plots were harvested again. Swaths approximately 10’ x 50’ were then chopped into a forage wagon equipped with scales. Wet forage yield was recorded for each plot and an approximate 1 lb subsample collected. Subsamples were dried and weighed to determine dry matter content and correct wet yields to a dry matter basis for comparison. This process was repeated for a third harvest after 30, 34, and 38 days of regrowth. Due to dry conditions over the course of the trial, a fourth harvest was not made.

Table 2. Trial information and agronomic information 2025.

Location	**Borderview Research Farm - Alburgh, VT**
Soil type	Covington silty clay loam, 0-3% slopes
Previous crop	Cereal grain
Plot size (ft)	10 x 50
Seeding rate (lbs ac^{-1})	20
Replicates	4
Planting date	17-Aug 2024
Harvests	3

Mixtures of true proteins, composed of amino acids, and non-protein nitrogen make up the crude protein (CP) content of forages. The bulky characteristics of forage come from fiber. Forage feeding values are negatively associated with fiber since the less digestible portions of the plant are contained in the fiber fraction. The detergent fiber analysis system separates forages into two parts: cell contents, which include sugars, starches, proteins, non-protein nitrogen, fats and other highly digestible compounds; and the less digestible components found in the fiber fraction. The total fiber content of forage is contained in the neutral detergent fiber (NDF) which includes cellulose, hemicellulose, and lignin. This measure indicates the bulky characteristic of the forage and therefore is negatively correlated with animal dry matter intake. The portion of the NDF fraction that is estimated to be digestible after 30 hours of fermentation in rumen fluid is represented by the 30- hour NDF digestibility. Forages also contain non-fiber carbohydrate compounds (NFC) including the true simple sugars (ESC) and other sugar-like compounds such as fructans (WSC). These become the energy source for the microbes responsible for the fermentation of ensiled forages. Ash represents the inorganic content in the forages, including minerals. Levels outside typical ranges for grass and legumes indicate soil contamination. Finally, these quality parameters can be utilized to predict milk yield from each ton of forage fed and each acre of forage grown.

Data were analyzed using a general linear model procedure of SAS (SAS Institute, 1999). Replications were treated as random effects, and treatments were treated as fixed. Mean comparisons were made using the Least Significant Difference (LSD) procedure where the F-test was considered significant, at $p<0.10$. Variations in genetics, soil, weather, and other growing conditions can result in variations in yield and quality. Statistical analysis makes it possible to determine whether a difference between treatments is significant or whether it is due to natural variations in the plant or field. At the bottom of each table, an LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. This means that when the difference between two varieties within a column is equal to or greater to the LSD value for the column, there is a real difference between the varieties 90% of the time. Varieties that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In the example to the right, variety C was significantly different from variety A, but not from variety B. The difference between C and B is 1.5, which is less than the LSD value of 2.0 and so these varieties were not significantly different

Variety	**Yield**
A	6.0
B	7.5*
C	**9.0**
LSD	2.0

in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these varieties were significantly different from one another. The asterisk indicates that variety B was not significantly lower than the top yielding variety, indicated in bold.

RESULTS

Weather data were recorded with a Davis Instruments Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT. Temperature, precipitation, and accumulation of Growing Degree Days (GDDs) are consolidated for the 2024-2025 growing season (Table 3). Temperatures following planting were above normal through November 2024 combined with below average precipitation. Temperatures and precipitation remained below normal from December 2024 through February 2025. In March, temperatures warmed above normal by almost 3 degrees. Precipitation returned and was above normal for April and May delaying timely first harvest for many farmers in the region. However, precipitation remained below average for the rest of the season with severe drought conditions reported across much of the region. There was a total of 4,775 accumulated Growing Degree Days (GGDs) during the 2024-2025 growing season, which is 275 above the 30-year normal.

Table 3. Weather data and GDDs for forages in Alburgh, VT, 2024-2025.

	2024					2025						
Alburgh, VT	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Average temperature (°F)	64.7	52.1	42.2	26.4	19.0	18.7	35.0	45.1	57.5	67.8	73.2	69.0
Departure from normal	2.02	1.81	2.93	-1.81	-1.92	-4.18	2.69	-0.47	-0.93	0.35	0.82	-1.67
Precipitation (inches)	2.61	2.00	1.75	1.83	0.32	0.37	1.63	3.71	5.78	2.38	3.76	1.50
Departure from normal	-1.06	-1.83	-0.95	-0.67	-1.81	-1.40	-0.61	0.64	2.02	-1.88	-0.30	-2.04
Growing Degree Days (base 41°F)	711	380	152	24	0	2	110	229	514	810	985	858
Departure from normal	59	76	70	24	0	2	88	14	-25	17	12	-62

Based on weather data from a Davis Instruments Vantage Pro2 with WeatherLink data logger.
Historical averages are for 30 years of NOAA data (1991-2020) from Burlington, VT.

Interactions

There were no significant harvest height x frequency interactions for any yield or quality metrics. This suggests that, altering harvest height and timing resulted in similarly performing harvest management scenarios in terms of forage yield and quality. It is important to note that this was the first season managing this stand under these different management scenarios. Impacts on yield and quality may be the result of compounding effects of such management over several more harvests across multiple seasons. Future season will provide further insights into these impacts.

Impact of harvest height

Forage yield and quality were significantly impacted by harvest height (Table 4). Total dry matter yield was highest in the 1.5-inch treatment although statistically similar to the 6-inch treatment. Protein content was approximately 2% points higher in plots harvested at the 3- and 6-inch heights compared to the 1.5-inch treatment. Conversely, fiber content was approximately 2% points higher in the 1.5-inch treatment compared to the 3- and 6-inch height treatments. The digestibility of the fiber fraction was highest in the 3-inch treatment although this was statistically similar to the 1.5-inch treatment. Overall, fiber digestibility across the trial remained high. Despite some numerical differences, NFC and ash contents did not statistically differ across harvest heights. Predicted milk yield per ton of forage is an estimate of the overall quality of forage and ability to support milk production. Milk yield per ton increased with increasing cutting height suggesting higher quality forage was produced at higher cutting heights. However, considering both yield and quality, the predicted milk yield per acre shows no difference between the cutting heights.

Table 4. Yield and quality metrics for three harvest heights, Alburgh, VT, 2025.

Cutting height	Total DM yield	CP	NDF	NFC	Ash	30-hr NDFD	Predicted milk yield	
	tons ac^{-1}	% of DM				% of NDF	lbs ton^{-1}	lbs ac^{-1}
1.5 inches	**1.73a**†	13.3b	58.8b	16.9	11.1	61.6ab	3517b	**6052**
3 inches	1.31b	**15.6a**	**56.4a**	**17.9**	**10.7**	**62.4a**	**3665a**	4760
6 inches	1.45ab	15.1a	57.2a	17.1	10.7	61.5b	3620a	5246
LSD (p = 0.10)‡	0.298	1.24	0.949	NS§	NS	0.761	74.4	NS
Trial mean	1.49	14.6	57.5	17.3	10.8	61.8	2676	5353

†Within a column, treatments that share a letter performed statistically similarly to one another. Top performing treatment in **bold**.
‡LSD- Least significant difference (p=0.10).
§NS; No significant difference between treatments.

Impact of harvest frequency

Forage yield and quality were also significantly impacted by harvest frequency (Table 5). Despite numerical differences, dry matter yields did not differ statistically across harvest frequencies. Protein content varied widely across frequency treatments with the highest levels (16.8%) produced by the 30-day frequency followed by the 34-day (14.8%) and then the 38-day treatment (12.3%). Conversely, fiber content was approximately 2% points higher in the 1.5-inch treatment compared to the 3- and 6-inch height treatments. The digestibility of the fiber fraction was highest in the 30 – and 34-day treatments. Non-fiber carbohydrate content was lowest in the 30-day frequency and increased with decreasing harvest frequency. Ash content did not differ statistically across harvest frequencies. Predicted milk yields both per ton of forage and per acre did not differ statistically across harvest frequencies.

Table 5. Yield and quality metrics for three harvest frequencies, Alburgh, VT, 2025.

Harvest frequency	Total DM yield	CP	NDF	NFC	Ash	30-hr NDFD	Predicted milk yield	
	tons ac^{-1}	% of DM				% of NDF	lbs ton^{-1}	lbs ac^{-1}
30 days	**1.93**	**16.8a**†	58.5b	14.8c	10.9	62.2a	3593	**5882**
34 days	1.42	14.8b	**56.9a**	17.1b	10.8	**62.6a**	**3630**	5212
38 days	1.59	12.3c	57.1a	**20.0a**	**10.7**	60.7b	3579	4964
LSD (p = 0.10)‡	NS§	1.24	0.949	1.62	NS	0.761	NS	NS
Trial mean	1.49	14.6	57.5	17.3	10.8	61.8	2676	5353

†Within a column, treatments that share a letter performed statistically similarly to one another. Top performing treatment in **bold**.
‡LSD- Least significant difference (p=0.10).
§NS; No significant difference between treatments.

DISCUSSION

In general, increasing harvest heights decreased total dry matter yields 16-24% while increasing harvest frequency had no impact (Table 6). Increasing cutting height produced higher quality forage as evidenced by increased protein content, decreased NDF content, and increased milk yield per ton. Increasing harvest frequency also produced forage with higher protein content, and higher NDF digestibility but increased fiber content and decreased carbohydrate content. Increasing harvest frequency had no impact on milk yield per ton. These data suggest that increasing harvest height and frequency may be a strategy to support yields of high-quality forages. However, monitoring these stands over several years will help us better understand the long-term impacts of these management scenarios on stand productivity, quality, and longevity.

Table 6. Impact of increasing cutting height and harvest frequency on forage yield and quality metrics, 2025.

Metric	Higher cutting height	More frequent harvests
DM yield	Decreased	No change
Protein content	Increased	Increased
NDF content	Decreased	Increased
NDF digestibility	Variable	Increased
NFC content	No change	Decreased
Ash content	No change	No change
Milk yield per ton	Increased	No change
Milk yield per acre	No change	No change

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