2021 Perennial Grass Stockpiling Trial

Dr. Heather Darby, UVM Extension Agronomist
Sara Ziegler, John Bruce, Catherine Davidson, and Ivy Krezinski
UVM Extension Crops and Soils Technicians
(802) 524-6501

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2021 PERENNIAL GRASS STOCKPILING TRIAL

Dr. Heather Darby, University of Vermont Extension
heather.darby[at]uvm.edu

Stockpiling is the practice of deferring grazing or harvest of perennial forage stands in order to extend the grazing season later into the fall/winter. While this practice can be a useful tool in managing grazing livestock, there is limited research on forage species performance, quality, and other management factors in the Northeast region. As more farms in the region seek strategies to manage forages and livestock under challenging climatic conditions, more information is needed to support decision making and farm viability. To address these information gaps, the University of Vermont Extension Northwest Crops and Soils Program initiated a trial evaluating forage yield and quality of several perennial grass species paired with various nitrogen treatments including planting in combination with legume species. The 2021 growing season was the first full season after establishment for the trial. The plots will continue to be monitored over multiple years to evaluate yield, quality, and other characteristics that will help identify the best management practices for stockpiling perennial forages in the Northeast.

MATERIALS AND METHODS

Forage species and variety information for the trial is summarized in Table 1. The plot design was a randomized complete block with split plots and five replications. Main plots were grass species and sub-plots were nitrogen treatments which consisted of one of two legume species, synthetic nitrogen applied early in the season, or synthetic nitrogen applied later in the season.

Table 1. Trial treatment information.

Treatment	Species	Variety	Seeding rate lbs ac^{-1}	Nitrogen source
Fescue only	Tall fescue	Kora	25	None
Orchardgrass only	Orchardgrass	Echelon	25	None
Fescue + alfalfa	Tall fescue	Kora	10	Alfalfa
	Alfalfa	Enhancer II	15	
Orchardgrass + alfalfa	Orchardgrass	Echelon	10	Alfalfa
	Alfalfa	Enhancer II	15	
Fescue + clover	Tall fescue	Kora	15	Red clover
	Red clover	Juliet	10	
Orchardgrass + clover	Orchardgrass	Echelon	15	Red clover
	Red clover	Juliet	10	
Fescue + early N	Tall fescue	Kora	25	Urea in early August
Orchardgrass + early N	Orchardgrass	Echelon	25	Urea in early August
Fescue + late N	Tall fescue	Kora	25	Urea in late August
Orchardgrass + late N	Orchardgrass	Echelon	25	Urea in late August

The soil type at the Alburgh location was a Benson rocky silt loam (Table 2). The seedbed was moldboard plowed, disked, and finished with a spike tooth harrow. The previous crop was summer annual forages.

Plots were 5’ x 20’ and replicated 5 times. Plots were seeded on 29-Apr 2020 and were managed throughout 2020 as is typical of a new seeding in the area. No data were collected. In early 2021, plots were inspected for establishment and winter survival. Due to low presence of tall fescue across the trial, tall fescue in all treatments was reseeded on 7-May 2021. Through the summer of 2021, plots were mowed simulating timing of harvest for stored forage production. After being mowed in late July, the plots were not mowed again until harvest on 9-Nov 2021. Plots receiving the early and late urea nitrogen treatments were fertilized with urea (46-0-0) at a rate of 40 lbs N ac^{-1} on 6-Aug and 27-Aug respectively.

Table 2. Trial management, Alburgh, VT.

Location	Borderview Research Farm – Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Summer annual forages
Tillage operations	Moldboard plow, disk and spike tooth harrow
Planting equipment	Great Plains small plot drill
Replications	5
Plot size (ft.)	5 x 20
Planting date	29-Apr 2020 and 7-May 2021 (just fescue)
Harvest date	9-Nov 2021

An approximate 1 lb subsample of the harvested material was collected and dried to calculate dry matter yield and forage quality. At the time this report was published, quality analyses were not yet completed, therefore only yield results are reported.

Yield data and stand characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and mixtures were treated as fixed. Treatment mean comparisons were made using the Least Significant Difference (LSD) procedure when the F-test was considered significant ($p<0.10$). Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among hybrids is real or whether it might have occurred due to other variations in the field. At the bottom of each table a LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. Where the difference between two hybrids within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure that for 9 out of 10 times, there is a real difference between the two hybrids. Hybrids that were not significantly lower in performance than the highest hybrid in a particular column are indicated with an asterisk. In this example, hybrid C is significantly different from hybrid A but not from hybrid B. The difference between C and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these hybrids did not differ 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 hybrids were significantly different from one another. The asterisk indicates that hybrid B was not significantly lower than the top yielding hybrid C, indicated in bold.

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

RESULTS

Weather data was recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 3). Generally, the 2021 season was warmer and drier than normal. Temperatures were above normal for all months except for February and July. Similarly, precipitation was below normal for all months except for April, September, and October. May was exceptionally dry, accumulating only 0.66 inches through the entire month, which was more than 3 inches under the 30-year normal. These conditions continued through August with more moderate rainfall arriving in September, with October seeing more than 2 inches above average for precipitation accumulation. Throughout the trial period, the region was categorized as experiencing abnormally dry or moderate drought conditions (Drought.gov). Warmer temperatures led to above average Growing Degree Days (GDDs) being accumulated with a total of 4757; 337 above the 30-year normal.

Table 3. 2021 weather data for Alburgh, VT.

	2021									
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Average temperature (°F)	21.5	19.8	33.2	48.1	58.4	70.3	68.1	74.0	62.8	54.4
Departure from normal	0.64	-3.07	0.93	2.52	-0.03	2.81	-4.31	3.25	0.14	4.07
Precipitation (inches)	0.39	0.47	0.97	3.52	0.66	3.06	2.92	2.29	4.09	6.23
Departure from normal	-1.74	-1.30	-1.27	0.45	-3.10	-1.20	-1.14	-1.25	0.42	2.40
Growing Degree Days (base 41°F)	0	1	126	284	546	866	840	1006	655	433
Departure from normal	0	1	104	69	6	72	-134	86	3	130

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.

Impact of Species

The species treatments in this trial differed statistically in yield (Table 4). The mixture of orchardgrass and tall fescue yielded 0.27 tons ac^{-1} higher than the tall fescue alone. However, the mixture was not statistically different to orchardgrass alone. Therefore, some of the difference in yield may be due to poorer establishment of the tall fescue. Tall fescue plots were reseeded due to poor establishment in the spring and, due to dry conditions, may not have filled in as densely as the orchardgrass plots.

Table 4. Dry matter yield by species, 2021.

Grass species	DM Yield tons ac^{-1}
Orchardgrass	1.11ab†
Orchardgrass/Tall Fescue	**1.27a**
Tall Fescue	1.00b
LSD (p = 0.10) ‡	0.168
Trial mean	1.13

Top performer treatments are in **bold.**
†Treatments that share a letter performed statistically similarly to one another.
‡LSD; least significant difference at the p=0.10 level.

Impact of Nitrogen Treatment

The five nitrogen treatments evaluated in this trial differed statistically in yield (Table 5). As expected, the control treatment that received no additional nitrogen produced the lowest yield of 0.607 tons ac^{-1}.

Table 5. Dry matter yield by nitrogen treatment, 2021.

Nitrogen treatment	DM Yield
	tons ac^{-1}
Early N	**1.40a**†
Late N	1.10b
Alfalfa	1.35a
Clover	1.20ab
None	0.607c
LSD (p = 0.10) ‡	0.217
Trial mean	1.13

Top performer treatments are in **bold.**
†Treatments that share a letter performed statistically similarly to one another
‡LSD; least significant difference at the p=0.10 level.

Interestingly, the early applied urea, alfalfa, and clover treatments all produced statistically similar yields. Furthermore, there was no grass species by nitrogen treatment interaction which suggests that the same response to the nitrogen treatments would be seen regardless of which grass species planted alone or in a mixture was used. This suggests that planting orchardgrass or tall fescue with alfalfa or red clover can replace an early application of urea for stockpiling. The reduction in yield produced by the later application of nitrogen compared to the earlier application could be due to having more time for the nitrogen to make its way to the plant roots and be utilized for dry matter production. While weather conditions at the time of fertilizing can influence losses due to volatilization or leaching, conditions were the same at both fertilizing times. Therefore, the results are likely a function of the timing of application.

While the inclusion of legumes produced similar yields as the early urea application, it is important to consider the cost and therefore return of each of these treatments. Using price estimates for urea and seed at the time this report was written, the red clover treatment appears to be a slightly lower cost option (Table 6).

Table 6. Cost by nitrogen treatment, 2021.

Treatment	Cost	
	\$ ac^{-1}	₵ lb DM^{-1}
Grass + early N	101	3.61
Grass + late N	101	4.59
Grass + alfalfa	103	3.81
Grass + clover	94	3.75
Grass only	70	5.77

While the cost per acre of an unfertilized grass stand is the lowest, because of its significantly lower yield, its cost per pound of dry matter produced is significantly higher than the other nitrogen treatments. With the volatile prices of seed and fertilizer, it is important to consider the costs in your area.

DISCUSSION

Stockpiling perennial grasses for later grazing can be a successful strategy for this region to extend the grazing season. When left to grow for approximately 3 months following the second harvest in late July, stockpiled orchardgrass and tall fescue produced over 1 ton ac^{-1}. Similar yields could be attained by either applying 40 lbs ac^{-1} N in the form of urea in early August or planting the grasses with alfalfa or red clover. Depending on the cost of fertilizer and seed, the cost and subsequent return of these nitrogen treatments may vary, however, not providing fertilizer or a legume to the grass will result in a higher cost per pound of dry matter produced and overall lower yields. This report will be updated with forage quality data as it becomes available. It is important to recognize that these data only represent one year and should not alone be used to make management decisions.

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