2022 Fall Annual Forages Trial

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

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THE UNIVERSITY OF VERMONT EXTENSION

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

In 2022, the University of Vermont Extension's Northwest Crop and Soils Program evaluated the performance of mixtures of peas with oats and triticale intended for use as forage for livestock. In the Northeast, cool season perennial grasses dominate pastures and hay meadows that farmers rely on. Often during the fall months, perennial pasture will decline in yield and quality. The addition of cool season annual forages into the grazing system during this time may help improve the quality and quantity of forage and potentially extend the grazing season. Depending on the species they may also be harvested for stored feed. Incorporating legumes into a mixture with grasses can help supply nitrogen, increase protein and fiber digestibility. However, forage legumes tend to be less aggressive and productive than grasses and therefore can be more challenging to establish in a mixture. We compared three varieties of oats and triticale in combination with three rates of forage peas to evaluate potential differences in forage yield and quality. While the information presented can begin to describe the yield and quality performance of these mixtures in this region, it is important to note that the data represent results from only one season and one location.

MATERIALS AND METHODS

The trial was established at Borderview Research Farm in Alburgh, VT, and the plot design was a randomized complete block with four replications (Table 1). The soil type was Benson rocky silt loam. The previous crop in the 2021 field season was perennial grass. Forage species, variety, and seeding rate information are summarized in Table 2.

Table 1. Annual forage trial management, Alburgh, VT, 2022.

Location	Borderview Research Farm – Alburgh, VT
Soil type	Benson rocky silt loam
Previous crop	Perennial grass
Tillage operations	Pottinger TerraDisc
Planting equipment	Great Plains Cone Seeder
Treatments (species/mixtures)	9
Replications	4
Plot size (ft)	5 x 20
Planting date	25-Aug
Harvest date	20-Oct

The seedbed was prepared with a Pottinger TerraDisc. The trial was planted with a cone seeder on 25-Aug into 5' x 20' plots. The seeding rate was 100 lbs ac^{-1} with pea inclusions of 0%, 25%, and 50%. On 20-Oct, plots were hand harvested by cutting the material within a 0.25m^2 quadrat within each plot. Wet yields were recorded and an approximate 1 lb subsample was collected and dried to determine dry matter content and calculate dry matter yield. The samples were then ground using a Wiley mill to a 2 mm particle size and then to 1 mm using a laboratory cyclone mill from the UDY Corporation.

Table 2. Treatment information, 2022.

Variety/Species	Pea inclusion %
Badger grain oat	0 25 50
Everleaf forage oat	0 25 50
Surge triticale	0 25 50

The samples were analyzed for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and 48-hour NDF digestibility (NDFD), non-fiber carbohydrates (NFC), relative forage quality (RFQ), net energy of lactation (NE_L), and total digestible nutrients (TDN) at the E. E. Cummings Crop Testing Laboratory at the University of Vermont (Burlington, VT) with a FOSS NIRS (near infrared reflectance spectroscopy) DS2500 Feed and Forage analyzer. Mixtures of true proteins, composed of amino acids, and non-protein nitrogen make up the crude protein 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. Chemically, this fraction includes cellulose, hemicellulose, and lignin. Because of these chemical components and their association with the bulkiness of feeds, NDF is closely related to feed intake and rumen fill in cows. Some of the NDF is digestible, however. This fraction is reported as NDFD and is represented as a percentage of the total NDF.

Results were analyzed using a general linear model procedure of SAS (SAS Institute, 2008). 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 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 varieties 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 (LSD's) at the 10% level of probability are shown. Where the difference between two varieties within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure in 9 out of 10 chances that there is a real difference between the two varieties. Treatments that were not significantly lower in performance than the highest value in a particular column are indicated with an asterisk. In this example, A is significantly different from C but not from B. The difference between A and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these varieties did not differ in yield. The difference between A and C 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 B was not significantly lower than the top yielding variety.

Variety	**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). Temperatures and precipitation were above normal in both September and October. A total of 1088 Growing Degree Days (GDDs) were accumulated during these months which is 133 above the 30-year normal. Ample rainfall and warm temperatures through late October provided ideal growing conditions prior to frost.

Table 3. Weather data for Alburgh, VT, 2022.

	September	October
Average temperature (°F)	62.8	54.4
Departure from normal	0.14	4.07
Precipitation (inches)	4.09	6.23
Departure from normal	0.42	2.40
Growing Degree Days (base 41°F)	655	433
Departure from normal	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 (1981-2010) from Burlington, VT.

Plots were harvested 56 days after planting on 20-Oct. The ideal growing conditions supported significant growth for the small grains and forage peas in this trial with dry matter yields averaging 1.27 tons ac^{-1} (Table 4). However, there was a wide range in yields from 0.9 to 1 ton ac^{-1} for treatments with triticale to over 1.5 tons ac^{-1} for the treatments with Badger oats. Triticale is generally slower growing and less productive than oats, however, winter triticale will survive the winter and can provide additional forage the following spring while the oats will winterkill. These data only reflect the biomass produced in the fall prior to frost. Triticale also has a more prostrate, or horizontal, growth habit compared to oats. This is clear in the height data, which show the triticale plots reaching heights of approximately 40 cm while the oat plots are 50-70 cm. Plots with the Everleaf forage oat were shorter than the plots with the Badger grain oats. Forage oats tend to grow shorter with wider leaves for higher forage biomass and quality compared to grain oats which grow more upright and put less energy into leaves to support higher grain yields.

At the 0% pea inclusion, the Surge triticale and Everleaf forage oat performed similarly in terms of dry matter yield as well as component and milk yield on a per acre basis. Badger oats with no peas produced approximately 0.30 tons ac^{-1} more dry matter, 0.1 tons ac^{-1} more digestible fiber, and would produce an additional 0.7 tons of milk per acre compared to the other small grains without peas. However, the small grain only treatments were similar in protein and water soluble carbohydrates (WSC) yields.

Table 4. Dry matter, component, and milk yield from 9 small grain/pea mixtures, 2022.

Variety/Species	Pea inclusion	Height	Dry matter yield	Protein yield	WSC yield	30-hr Digestible NDF yield	Milk yield
	%	cm			tons ac^{-1}		
Badger grain oat	0	**66.8a**†	1.44abc	0.260ab	0.264b	0.550ab	2.99abc
	25	66.3a	**1.80a**	0.317a	**0.337a**	**0.633a**	**3.69a**
	50	65.8a	1.54ab	**0.335a**	0.229bc	0.547ab	3.24ab
Everleaf forage oat	0	46.5bc	1.14cd	0.194b	0.220bc	0.418bcd	2.33cde
	25	49.9b	1.32bc	0.271ab	0.216bc	0.445bc	2.78bcd
	50	49.1b	1.34bc	0.301a	0.192cd	0.448bc	2.87abc
Surge triticale	0	35.5d	1.09cd	0.205b	0.174cde	0.443bc	2.31cde
	25	41.4c	0.848d	0.195b	0.130de	0.295d	1.92e
	50	42.1c	0.888d	0.189b	0.125e	0.331cd	1.98de
LSD p = 0.10‡		5.57	0.373	0.086	0.062	0.137	0.846
Trial mean		51.5	1.27	0.252	0.210	0.457	2.68

In each column the top performing treatment is indicated in **bold.**

†Treatments that share a letter performed statistically similarly to one another.

‡LSD; least significant difference at the p = 0.10 level.

Within each small grain treatment, dry matter yields were statistically similar across all pea inclusion rates (Figure 1). This means that no additional yield benefit was gained by increasing the forage pea inclusion up to as much as 50% of the mixture with the small grain. However, there were some differences in protein, digestible fiber, and WSC yields. Plots with Everleaf oats produced more protein per acre when peas were included in the mixture. However, increasing the pea inclusion above 25% with Everleaf oats did not result in higher protein yields per acre. The plots with Surge triticale did not benefit in yield or quality from the addition of peas, even at the 50% inclusion rate. This may indicate that the peas did not perform as well with triticale as when combined with oats. The more upright growth habit of the oats may provide better physical support for the climbing peas thus allowing them to gain ample sunlight and produce more biomass. Therefore, triticale with its more horizontal growth habit may be a less suitable companion for forage peas.

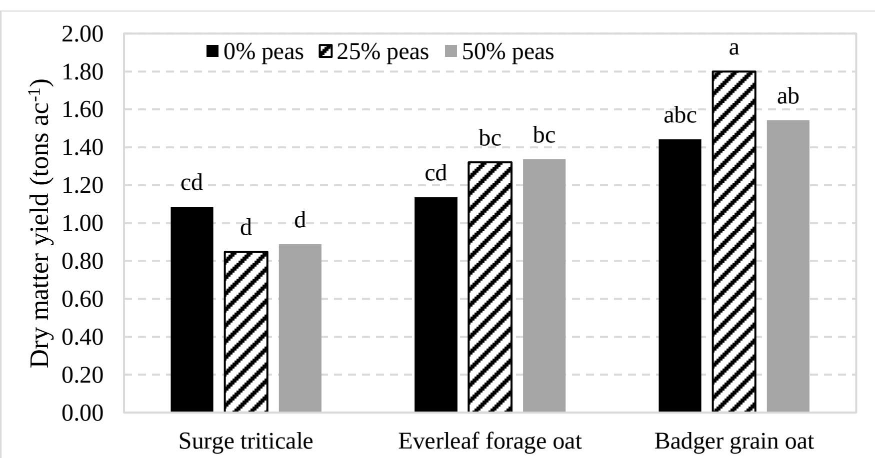

Figure 1. Dry matter yields of 3 small grains mixed with 0, 25, and 50% forage peas, 2022.
Treatments that share a letter performed statistically similarly to one another.

ACKNOWLEDGEMENTS

This trial was funded by the USDA OREI project #2018-51300-28515. UVM Extension would like to thank Roger Rainville and his staff at Borderview Research Farm in Alburgh for their generous help with the trials. We would like to acknowledge Anna Brown, John Bruce, Catherine Davidson, Hillary Emick, Lindsey Ruhl, Laura Sullivan, and Sophia Wilcox Warren for their assistance with data collection and entry. The information is presented with the understanding that no product discrimination is intended and no endorsement of any product mentioned or criticism of unnamed products is implied.

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