2016 Forage Brassica Variety Trial

Dr. Heather Darby, UVM Extension Agronomist
Sara Ziegler, Nate Brigham, Julija Cubins, Hillary Emick, and Abha Gupta
UVM Extension Crops and Soils Technicians

Visit us on the web at: http://www.uvm.edu/extension/cropsoil

2016 FORAGE BRASSICA VARIETY TRIAL

Dr. Heather Darby, University of Vermont Extension

Heather.Darby[at]uvm.edu

Forage brassicas are very cold hardy and can extend the grazing season late into the fall. They grow extremely fast and provide very nutrient dense feed at times when growth is limited for many other species. Brassicas fit well into some annual crop rotations such as small grains or summer annual forages. Adding brassicas to a grazing plan can not only extend the grazing season but and can also reduce the reliance on expensive feed inputs. There are many different species of forage type brassicas on the market today including mustards, turnips, radishes, and kales. In 2016, the University of Vermont's Northwest Crops & Soils Program conducted a forage brassica variety trial to evaluate yield and quality of commercially available forage brassica varieties.

In 2016, a variety trial was conducted at Borderview Research Farm in Alburgh, VT, to evaluate seven forage brassica varieties (Table 1, Image 1).

Table 1. Seven forage brassica varieties, 2016.

Variety	Species
Appin	Turnip
Barkant	Turnip
Barsica	Rape
Eco-Till	Radish
Dwarf Essex	Rape
Purple Top	Turnip
T-Raptor	Brassica hybrid

Image 1. Eco-Till Radish at harvest, 2016.

The seedbed was prepared using standard local practices, including incorporating previous crop residue with a moldboard plow and finishing with disk and drag harrows (Table 2). The soil was a Benson silt loam. The experimental design was a randomized complete block with four replications. Plots were 5' x 20' and were planted with a Great Plains grain drill at a rate of 6 lbs ac^{-1} on 15-Aug.

Table 2. Agronomic and trial information, 2016.

Location	Borderview Research Farm-Alburgh, VT
Soil type	Benson silt loam
Previous crop	Spring barley
Tillage operations	Moldboard plow, disking, drag harrow
Plot size (ft.)	5 x 20
Replicates	4
Planting date	15-Aug
Seeding rate	6 lbs ac^{-1}
Harvest date	13-Oct

All plots were hand harvested in a 0.25m^2 area on 13-Oct to determine dry matter yields. At the time of harvest, heights were measured at three random locations in each plot. Dried vegetation was ground to 1mm using a UDY Corporation cyclone mill. Forage quality was analyzed by the University of Vermont Cereal Testing Lab (Burlington, VT) with an FOSS NIRS (near infrared reflectance spectroscopy) DS2500 Feed and Forage analyzer for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF) and 30-hour digestible NDF (NDFD).

The bulky characteristics of forage come from fiber. High fiber is negatively associated with forage feeding values since the less digestible portions of plants 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). 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. Recently, forage testing laboratories have begun to evaluate forages for NDF digestibility (NDFD). Evaluation of forages and other feedstuffs for NDFD is being conducted to aid prediction of feed energy content and animal performance. Research has demonstrated that lactating dairy cows will eat more dry matter and produce more milk when fed forages with optimum NDFD. Forages with increased NDFD will result in higher energy values and, perhaps more importantly, increased forage intakes. Forage NDFD can range from 20-80% NDF.

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 treatments is real or whether it might have occurred due to other variations in the field. All data was analyzed using a mixed model analysis where replicates were considered random effects. At the bottom of each table, a LSD value is presented for each variable (e.g. yield). Least Significant Differences (LSDs) at the 10% level (0.10) of probability are shown. Where the difference between two treatments 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 values. Treatments listed in bold had the top performance in a particular column; treatments that did not perform significantly worse than the top-performer in a particular column are indicated with an asterisk. In the example above, treatment A is significantly different from treatment C, but not from treatment B. The difference between A and B is equal to 400, which is less than the LSD value of 500. This means that these treatments did not differ in yield. The difference between A and C is equal to 650, which is greater than the LSD value of 500. This means that the yields of these treatments were significantly different from one another.

Variety	Yield
A	**1600***
B	1200*
C	950
LSD (0.10)	500

RESULTS

Weather data collected with an onsite Davis Instruments Vantage Pro2 Weather Station at Borderview Research Farm in Alburgh, VT, are summarized for the 2016 forage brassica growing season (Table 3).

Table 3. Summarized weather data for 2016 – Alburgh, VT.

Alburgh, VT	August	September	October
Average temperature (°F)	71.6	63.4	50.0
Departure from normal	2.9	2.9	1.9
Precipitation (inches)	3.0	2.5	5.0
Departure from normal	-0.93	-1.17	1.39
Growing Degree Days (base 32°F)	1224	949	559
Departure from normal	84	92	58

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.

From August through October there was a total of 2732 Growing Degree Days (GDDs) accumulated at a base temperature of 32°F. This is 234 more GDDs than the 30-year average. Temperatures were a few degrees above normal during this time. Precipitation was below normal by about 1 inch in both August and September but above normal in October by 1.39 inches. Despite the dry weather at planting, the brassicas germinated and grew rapidly.

Table 4. Yield and height of 7 forage brassica varieties, 2016.

Variety	Plant height	Dry Matter (DM)	DM Yield
	cm	%	lbs ac^{-1}
Appin	49.9	9.67	2821*
Barkant	50.9	11.5*	3066*
Barsica	**64.8**	**12.9**	**3136**
Dwarf Essex	55.2	12.8*	2388
EcoTill	46.8	8.51	2373
Purple Top	43.6	12.0*	2187
T-Raptor	56.2	11.4	2961*
LSD (0.10)	4.65	1.4	504
Trial mean	52.5	11.2	2705

Treatments indicated with an asterisk* performed similarly to the top performer in **bold.**

Brassica varieties differed significantly in height and dry matter yield (Table 4). The variety Barsica was the tallest at 64.8 cm, more than 8 cm taller than the next tallest variety T-Raptor. The shortest variety was Purple Top at 43.6 cm. The average height over all the varieties was 52.5 cm. Dry matter content also varied significantly. Dry matter ranged from 8.51 to 12.9% with an overall average of 11.2%. Dry matter yield was highest for the variety Barsica which produced 3136 lbs ac^{-1} dry matter. This was statistically similar to Barkant, T-Raptor, and Appin. Varieties also differ from one another within brassica types (Figure 1). For example, both Appin and Barkant turnips produced yields statistically similar to the highest yielding variety Barsica rape, and were considerably higher than Purple Top, the other turnip variety trialed. Likewise, Barsica rape, the top yielding variety producing 3136 lbs ac^{-1}, produced 748 lbs ac^{-1} more than the other rape variety, Dwarf Essex. These differences are important to note when choosing a brassica variety to use for forage in your own operation.

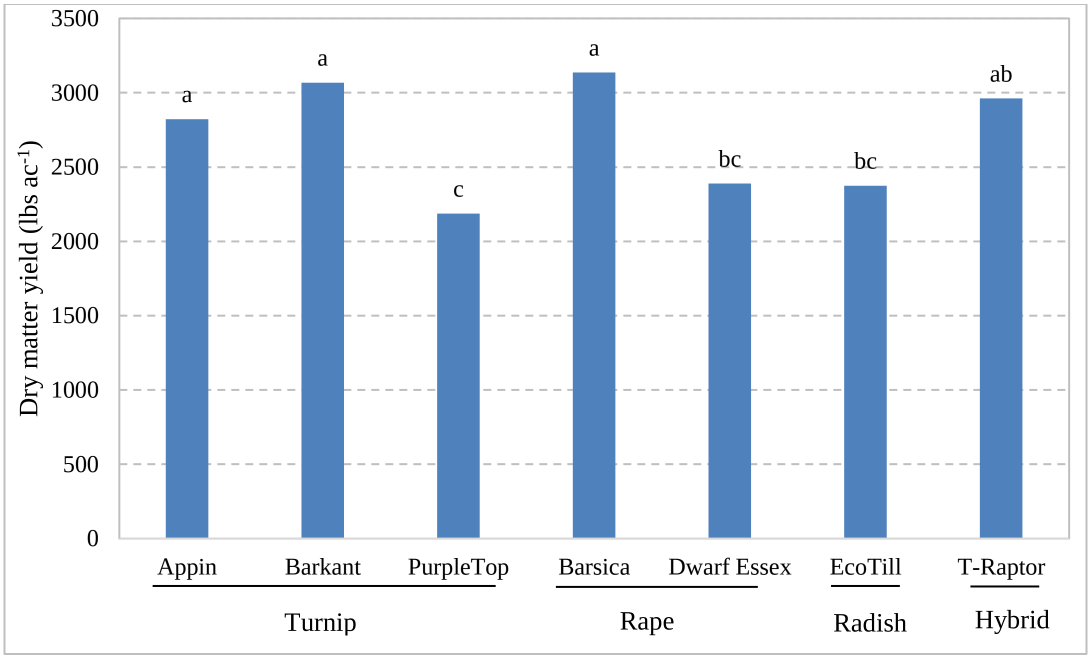

Figure 1. Brassica dry matter yields by type, 2016.
Treatments that share a letter performed statistically similarly to one another.

Brassica varieties also differed significantly in quality (Table 5). Protein content ranged from 16.9 to 24.7% with the highest produced by Barsica and Dwarf Essex. Barsica also produced the lowest ADF and NDF levels of 16.7 and 17.5% respectively. However, in terms of NDF digestibility, Purple Top and Appin turnips produced the highest levels of 84.8 and 84.0% respectively. NDF digestibility had a wide range across the varieties, from 70.5 to 84.8%. Dwarf Essex had the lowest digestibility but was statistically similar to all other varieties except for the top two performers. Interestingly, the top performers were both turnips, however, the third turnip variety, Barkant, had 8% lower digestibility levels than the other two (Figure 2). Both rape varieties were the least digestible. This is consistent with the fact that the rapes tend to grow taller with a higher proportion of stems compared to the leafier, and therefore more digestible, turnips.

Table 5. Quality of seven forage brassica varieties, 2016.

Variety	Crude Protein	ADF	NDF	NDFD 30 hr
	%	% of DM	% of DM	% of NDF
Appin	19.2	20.0	21.1*	84.0*
Barkant	16.9	19.2	23.2	76.3
Barsica	**24.7**	**16.7**	**17.5**	74.3
Dwarf Essex	23.1*	17.7*	19.3*	70.5
EcoTill	21.2	19.1	21.0*	75.8
Purple Top	18.4	18.9	21.2*	**84.8**
T-Raptor	17.5	22.7	24.3	76.3
LSD (0.10)	3.01	2.02	4.11	8.25
Trial mean	20.1	19.2	21.1	77.4

Treatments indicated with an asterisk* performed similarly to the top performer in **bold.**

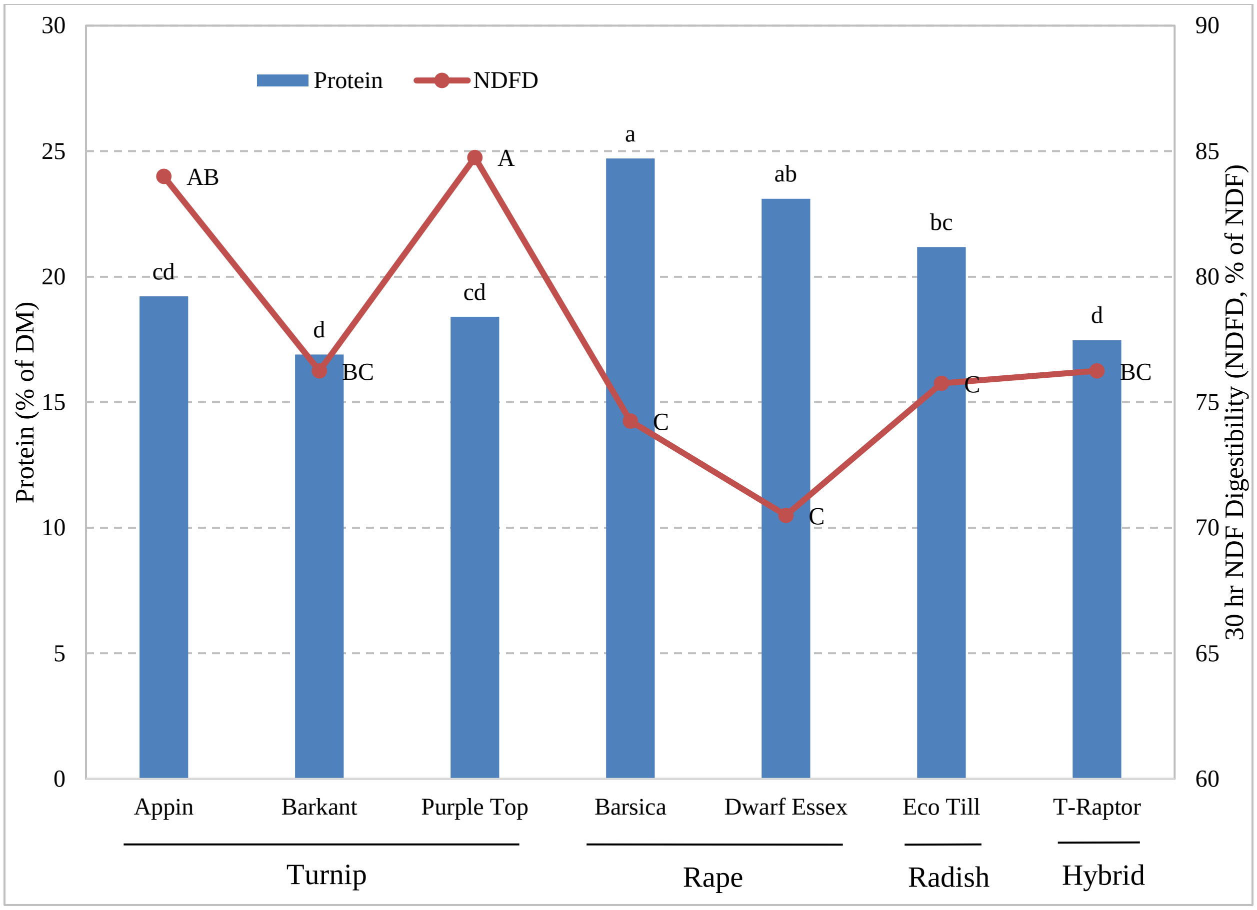

Figure 2. Protein and NDF digestibility of seven forage brassica varieties, 2016.
Treatments that share a letter performed statistically similarly to one another.

DISCUSSION

Overall, the brassicas performed exceptionally compared to previous years despite dry conditions. These data demonstrate that brassicas have the potential to produce large quantities of biomass in a short period of time in the northeast. Brassicas averaged 2705 lbs ac^{-1} dry matter with 20.1% protein and 77.4% NDF digestibility. These crops can be grazed or harvested in late October, and into November depending on weather, when there are not many other forage options for this kind of biomass production or quality. However, care should be taken if grazing animals on forage of this high quality as bloating and other health issues could occur. In addition, brassicas should be limited in lactating cow diets to limit off-flavors in milk. Due to their low fiber content, brassicas can be mixed with an annual grass, such as oats or annual ryegrass, or even with a winter grain such as rye or triticale. This can provide a more balanced forage than the brassicas alone. It is important to note that the data presented here reflect results from only one season and one location. This research should be combined with experience managing dairy animals and research from other regions and across years, as well as recommendations from nutritionists.

ACKNOWLEDGEMENTS

UVM Extension would like to thank Roger Rainville at Borderview Research Farm in Alburgh and his staff for their generous help with this research trial. We would also like to Erica Cummings, Julian Post, and Lindsey Ruhl for their assistance with data collection and entry. This information is presented with the understanding that no product discrimination is intended and no endorsement of any product mentioned, nor criticism of unnamed products, is implied.

UVM Extension helps individuals and communities put research-based knowledge to work.

UNIVERSITY OF VERMONT EXTENSION
CULTIVATING HEALTHY COMMUNITIES