2013

Forage Brassica Variety Trial

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2013 FORAGE BRASSICA VARIETY TRIAL
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Forage brassica can provide a near-concentrate type diet late in the grazing season. This allows for an extra grazing opportunity after annual row crops are harvested, and establishes forage to fill a gap in feed quality and supply. These crops can provide a high-quality feed in a short period of time, fitting well into rotations of other crops, extending the grazing season, and reducing reliance on expensive commercial feed inputs. In 2013, the University of Vermont's Northwest Crops & Soils Program conducted a forage brassica variety trial to evaluate yield and quality of this annual crop.

MATERIALS AND METHODS

In 2013, a variety trial was conducted at Borderview Research Farm in Alburgh, VT, in order to evaluate seven forage brassica varieties (Table 1, Figure 1). All varieties were purchased from King's Agriseed, Ronks, PA.


Figure 1. Appin turnip just before harvest.

Table 1. Forage brassica varieties, 2013.

Variety	Species
Appin	Turnip
Barkant	Turnip
Bonar	Rape
Nitro	Radish
Purple Top	Turnip
Rangiora	Rape
T-Raptor	Brassica hybrid

The seedbed at Borderview Research Farm was prepared using standard local practices, including incorporating spring wheat 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 three replications. Each plot was 5' by 20,' and a Great Plains grain drill was used to plant brassicas at a rate of 6 lbs per acre on 23-Aug.

Table 2. Agronomic and trial information for the 2013 forage brassica variety trial.

Location	Borderview Research Farm-Alburgh, VT
Soil type	Benson silt loam
Previous crop	Spring wheat
Tillage operations	Moldboard plow, disking, drag harrow
Plot size (ft.)	5 x 20
Replicates	3
Planting date	23-Aug
Seeding rate	6 lbs ac^{-1}
Harvest date	5-Nov

All plots were hand harvested on 5-Nov to determine dry matter yields. Samples were dried and ground and a subsample was retained for chemical analysis. Forage quality was analyzed at Cumberland Valley Analytical Services in Hagerstown, Maryland using wet chemistry techniques. Plot subsamples were analyzed for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF) and 30-hour digestible NDF (NDFD). The CP content of forages is determined by measuring the amount of nitrogen and multiplying by 6.25. 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, nonprotein 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 at right, 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

Using an onsite Davis Instruments Vantage Pro2 Weather Station at Borderview Research Farm in Alburgh, VT, weather data are summarized for the 2013 forage brassica growing season (Table 3). August and September were slightly cooler than the historical average (1981-2010), while October was slightly warmer. The warm October resulted in 98 more growing degree days than the 30-year average, as calculated with a base temperature of 32°F. The 2013 fall growing season was also drier than the historical average, with 4.32 fewer inches of rain than normal between August and October.

Table 3. Summarized weather data for 2013 – Alburgh, VT.

Alburgh, VT	August	September	October
Average temperature (°F)	67.7	59.3	51.1
Departure from normal	-1.1	-1.3	2.9
Precipitation (inches)	2.41	2.20	2.22 *
Departure from normal	-1.50	-1.44	-1.38
Growing Degree Days (base 32°F)	1112	825	600
Departure from normal	-27	-33	98

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.
*October 2013 precipitation based on National Weather Service data from cooperative stations in South Hero, VT.

Average plant height differed significantly between varieties (Table 4, Figure 2). The tallest variety was Rangiora at 38 cm. This was statistically similar to Bonar (36.0 cm), Appin (33.3 cm), and Barkant (32.8 cm), but statistically different from T-Raptor (26.6 cm), Nitro (25.7 cm) and Purple Top (23.8 cm).

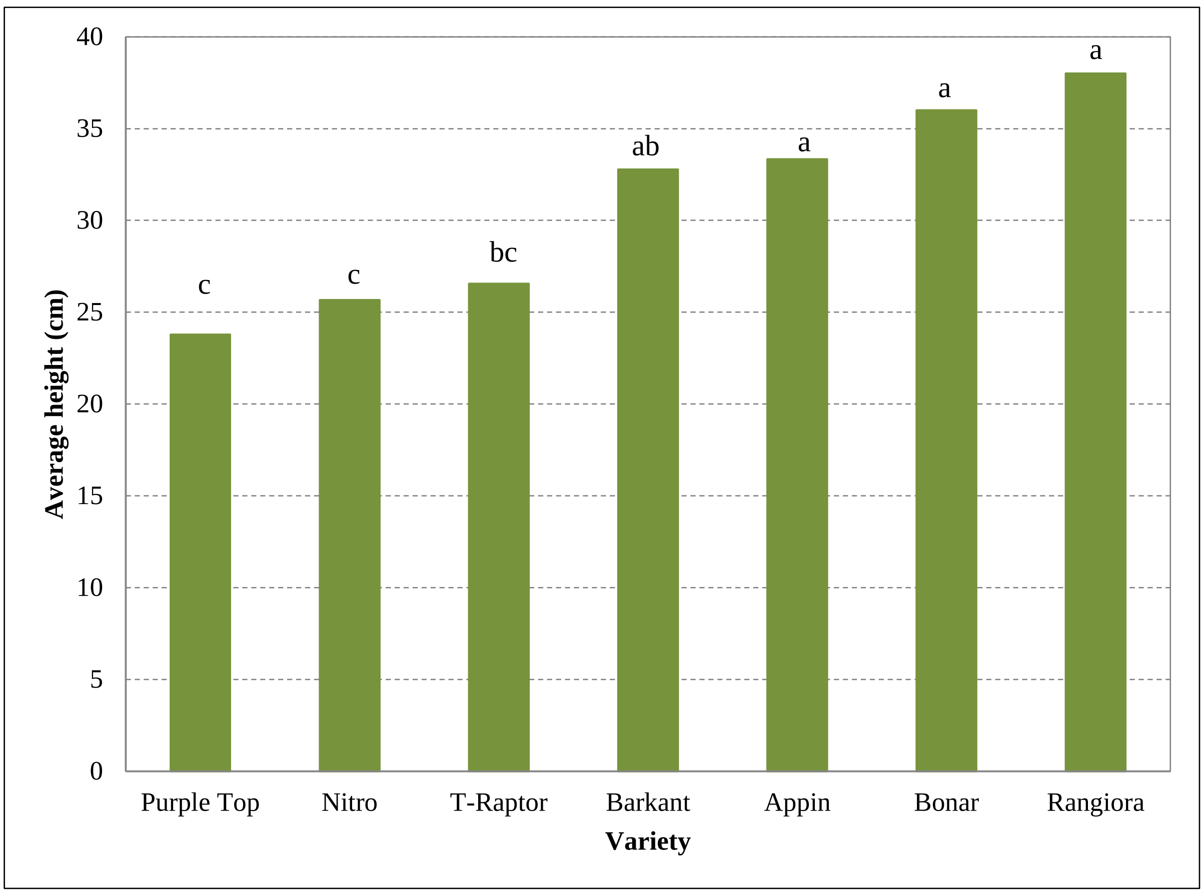

Figure 2. Average plant height for seven forage brassica varieties, Alburgh, VT, 2013.Treatments with the same letter did not differ significantly from one another (p=0.10).

Brassica varieties did not differ significantly in forage quality characteristics, yield or harvest dry matter (Table 4). The average yield for the brassica trial was 2243 lbs of dry matter per acre. The CP concentrations average 21.6%. The low fiber levels and high fiber digestibility are characteristic of this crop.

Table 4. Yield, dry matter content and forage quality characteristics for seven forage brassica varieties, Alburgh, VT, 2013.

Variety	Plant height	Harvest dry matter (DM)	DM yield	Forage quality characteristics			
				CP	ADF	NDF	NDFD
	cm	%	lbs/ac^{-1}	% of DM	% of DM	% of DM	% of NDF
Appin	33.3*	16.5	**2762**	21.5	18.8	20.1	64.9
Barkant	32.8*	16.3	2346	20.5	18.1	19.5	70.2
Bonar	36.0*	16.8	2474	20.9	17.0	18.0	71.0
Nitro	25.7	16.0	1968	24.5	**19.5**	20.5	71.0
Purple Top	23.8	**16.8**	2050	19.8	19.3	**21.5**	68.7
Rangiora	**38.0***	16.1	2030	**25.3**	17.6	19.5	**73.7**
T-Raptor	26.6	14.0	2073	18.6	15.8	17.1	71.8
LSD (0.10)	6.4	NS	NS	NS	NS	NS	NS
Trial mean	30.9	16.1	2243	21.6	18.0	19.5	70.2

Treatments indicated in **bold** had the top observed performance.
* Treatments indicated with an asterisk did not perform significantly lower than the top-performing treatment in a particular column.
NS – No significant difference was determined between treatments.

DISCUSSION

Forage brassicas have great potential as an additional grazing crop in the Northeast. With average dry matter yields of over a ton, this study demonstrated that any of the trialed forage brassica varieties could be a strong addition to a feeding plan, providing valuable nutrition during seasonal feed shortages and reducing the need for imported feed. While statistically insignificant, the turnip species Appin had the highest dry matter yield (2762 lbs per acre).

Forage brassicas are known for the high CP content, energy and level of digestibility. The variety with the highest CP was the rape species Rangiora. However, this did not differ significantly from any of the other varieties. The average CP for this trial was 21.6%. The average ADF for this trial was 18.0%, the average NDF was 19.5%, and the average NDFD was 70.2%. While the top varieties for these characteristics were Nitro, Purple Top, and Rangiora respectively, these varieties did not differ significantly from other varieties.

Yield and quality should both be taken into consideration before selecting a variety. The high overall levels of crude protein show that most forage brassicas have the potential to be a welcome addition to a fall grazing system. This highly digestible feed should be complemented with a more fibrous feed. This brassica crop would likely be grazed in short time increments to reduce the potential for herd health issues associated with highly digestible feed. 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.

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