NW CROPS & SOILS PROGRAM

UNIVERSITY OF VERMONT EXTENSION

CULTIVATING HEALTHY COMMUNITIES

2010 Forage Brassica Performance Trials

Dr. Heather Darby
UVM Extension Agronomic Specialist
Rosalie Madden, Erica Cummings, Amanda Gervais, and Philip Halteman
802-524-6501

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

2010 Organic Forage Brassica Performance Trials

Dr. Heather Darby, UVM Extension
heather.darby[at]uvm.edu

In 2010, the University of Vermont Extension continued their research evaluating annual forage models that would best compliment cool season grass pasture. The overall goal of this project is to help organic dairy producers reduce their reliance on expensive concentrates through the production of a variety of high quality annul forages. Brassicas, such as forage turnips and rape, are a cool season crop. Hence these crops can thrive in the late fall months and potentially provide late season grazing. Brassica crops are known for their ability to provide a near concentrate type diet late in the season. UVM Extension conducted a trial in 2010 to evaluate the yield and quality of commercially available forage brassica varieties. Additional research was conducted on interseeding brassica crops with spring cereal grains and summer annuals. The results from these trials can be found at www.uvm.edu/extension/cropsoil.

TESTING PROCEDURE

The trial was located at Borderview Farm in Alburgh, VT. All plots were managed with conventional tillage practices. Conventional tillage included moldboard plow, disking, and field finishing with a drag harrow. Dairy manure was applied in the spring at 7000 gallons per acre. The application rate was to meet the nitrogen needs of the previous small grain crop. The experimental design was a randomized complete block with three replicates. The treatments were five commercially available brassica varieties (Table 1). Plots were seeded with a John Deere grain drill at a seeding rate of 6 lbs per acre on August 16, 2010. The plots were harvested once with a Jari Mower on October 18, 2010. The brassica were on average about 22 inches in height at the time of harvest. A subsample of approximately 1 lb was taken to determine moisture and quality. All data was analyzed using a mixed model analysis where replicates were considered random effects. The LSD procedure was used to separate cultivar means when the F-test was 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 (LSD) at the 10% level of probability are shown in the results. Where the difference between two hybrids within a column is equal to or greater than the LSD value you can be sure 9 times out of 10 that there is a real difference between the two hybrids.

Table 1. Forage brassica variety and seed source.

Seed Source	Type	Variety
AMPAC	Forage turnip	Appin
Barenburg	Forage turnip	Barkant
AMPAC	Forage rape	Bonar
AMPAC	Forage turnip	Pasja
Barenburg	Forage rape	T-raptor

Figure 2. Brassica varieties from left to right; T-raptor, Pasja, Barkant, Bonar, Appin.

WEATHER DATA

Seasonal precipitation and temperatures recorded at a weather station in close proximity to the 2010 research sites are shown in Table 2. This year presented above average temperatures and precipitation for the fall months.

Table 2. Temperature, precipitation, and Growing Degree Day summary, Alburgh, VT.

	August	September	October
Average Temperature (°F)	70.4	64.0	50.6
Departure from Normal	1.40	3.60	1.80
Precipitation (inches)	5.48	4.32	*
Departure from Normal	1.63	0.86	
Growing Degree Days (base 50°)	634	419	129
Departure from Normal	45.0	107	26.4
Growing Degree Days (base 32°)	1192	959	578
Departure from Normal	45.0	107	57.4

*missing data

Based on National Weather Service data from cooperative observer stations in close proximity to field trials. Historical averages are for 30 years of data (1971-2000).

SILAGE QUALITY

Silage quality was analyzed by Cumberland Valley Analytical Forage Laboratory in Hagerstown, Maryland. Plot samples were dried, ground and analyzed for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and various other nutrients. The Nonstructural Carbohydrates (NSC) and Total Digestible Nutrients (TDN) were calculated from forage analysis data. Performance

indices such as Net Energy Lactation (NEL) were calculated to determine forage value. Mixtures of true proteins, composed of amino acids, and nonprotein 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). Chemically, this fraction includes cellulose, hemicellulose, and lignin. The NSC or non-fiber carbohydrates (NFC) include starch, sugars, and pectins.

RESULTS

The brassica varieties differed significantly in yield (Table 3). Bonar rape had the highest dry matter yield of 3160 lbs/ac, although it was not statistically different from Appin turnip, Barkant turnip, or Pasja turnip (Figure 1). With the exception of CP, the brassica varieties did not differ in forage quality. Overall, the forages had low fiber contents compared to cool season grasses that commonly have NDF values of 40% or higher. Forage brassica varieties differed significantly in calcium (Ca), phosphorus (P), zinc (Zn), and copper (Cu). Appin Turnip had the highest Ca and Cu content of all varieties. The forage brassica varieties did not differ significantly in potassium (K), magnesium (Mg), iron (Fe), and manganese (Mn).

Table 3. Dry matter yields and forage quality of 5 forage brassica varieties.

Variety	DM at harvest	DM yield	Forage quality characteristics						
			CP	ADF	NDF	TDN	NFC	NEL	RFV
	%	lbs/ac	%	%	%	%	%	Mcal/lb	
Appin turnip	8.37	2660*	20.7*	19.9	20.6	61.9	38.7	0.63	332
Barkant turnip	**9.63**	2420*	18.8	19.2	19.9	63.6	**42.5**	**0.66**	346
Bonar rape	9.37	**3160***	**23.8***	20.0	20.7	**64.2**	37.6	**0.66**	330
Pasja turnip	8.63	2790*	19.4	**18.9**	19.9	61.4	40.1	0.63	347
T-Raptor rape	9.13	1900	20.0	19.0	**19.7**	63.2	41.0	0.65	**351**
LSD (0.10)	NS	781	3.33	NS	NS	NS	NS	NS	NS
Means	9.03	2590	20.5	19.4	20.2	62.9	40.0	0.65	341

**indicates that the forage brassica is not significantly different than the top variety.*
NS; no significant difference among the brassica varieties.

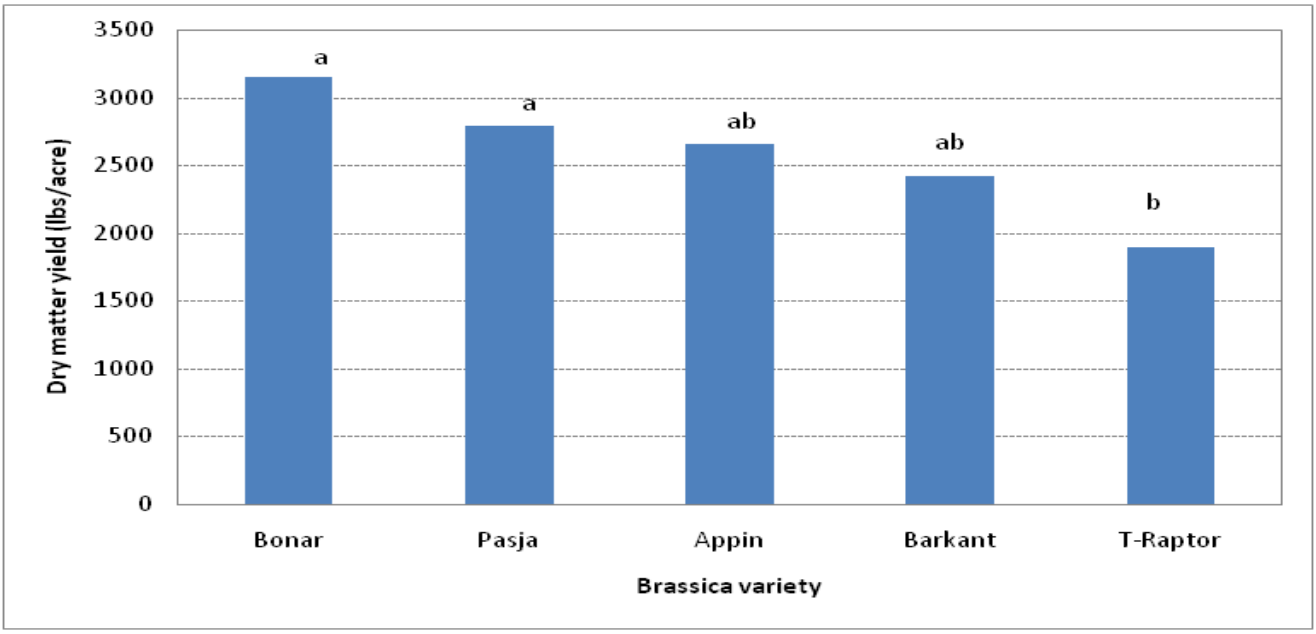

Figure 1. Dry matter yield of 5 forage brassica varieties.

Table 4. Macro and micronutrient content of 5 forage brassica varieties.

Variety	Ca %DM	P %DM	Mg %DM	K %DM	Fe ppm	Mn Ppm	Zn ppm	Cu ppm
Appin turnip	**2.20***	**0.74***	0.21	7.48	175	24.7	**30.7***	**8.00***
Barkant turnip	2.15*	0.66	0.20	6.65	172	27.7	25.0	6.33
Bonar rape	1.68*	0.61	0.21	6.81	149	24.3	24.7	5.00
Pasja turnip	2.17*	0.65	0.20	7.76	158	25.3	30.0*	6.00
T-Raptor rape	2.01	0.57	0.19	7.13	94.0	25.0	30.0*	5.33
LSD (0.10)	0.34	0.06	NS	NS	NS	NS	2.04	0.83
Means	2.04	0.64	0.20	7.17	150	25.4	28.1	6.13

**indicates that the forage brassica is not significantly different than the top variety.*
NS; no significant difference among the brassica varieties.

DISCUSSION

Brassica crops have the potential to provide high quality forage late in the fall. It is also possible that these crops could extend to grazing season in the Northeast. The brassica varieties could potentially be planted following the harvest of cereal grains for forage or grain. The potential to double crop helps to produce more forage yield and quality per acre. In this trial, the brassica crops were only harvested once due to limited funding for the project. However, it is feasible to think that the crop could be grazed more than once per season. The low fiber content of the brassica forages might mean that more fiber will need

to be fed in the barn after grazing. Other studies on forage brassica as a grazing crop have recommended that animals be allowed to graze for short periods of time. The high K content of the forages would also limit their feeding to dry cows. Overall, the feed was very high quality and certainly would supplement or extend the normal grazing season in the Northeast.

The UVM Extension Crops and Soils Team would like to thank Borderview Research Farm for their generous help with the trials and acknowledge Organic Valley FAFO fund for their financial support.

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

The UNIVERSITY of VERMONT EXTENSION