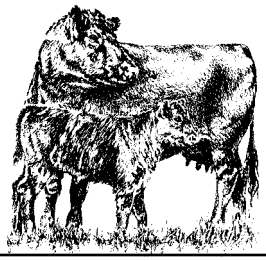

Western Beef Resource Committee *Fourth Edition*

Cattle Producer's Handbook

Range and Pasture Section 528

Forage Brassicas and Fodder Radishes: Turning Vegetables into Beef

Chanda Engel, Research Specialist-Animal Science
Carrington Research Extension Center, North Dakota State University

Turnips, kale, and radishes may be common supermarket produce and may even grace a dinner plate as a complementary entrée to a juicy T-bone steak. What about using these menu items for beef cattle?

Forage brassica (*Brassica* spp.) and fodder radish (*Raphanus sativus*) are cold tolerant, fast growing, high yielding, and high quality crops that have been used extensively as a forage resource for grazing livestock in Europe, Great Britain, New Zealand, and, to some degree, in the United States. Depending on the variety of brassica and fodder radish, production takes between 80 to 150 days from seeding to grazing. Their unique cold hardiness trait makes them well suited to variable growing environments, as they can generally handle temperatures as low as 20°F. Brassicas also maintain high nutritional quality, even as they mature, which allows for stockpiling forage.

Brassica and Fodder Species

Turnips are probably the most widely used brassica crop for forage in the United States, and the one most familiar to people. Livestock can use both turnip tops and fleshy roots. They are fast growing and can reach maximum production between 60 and 80 days post seeding. Generally, turnip tops are higher in crude protein (10-14%) than roots (9-11%); however, the roots stockpile better than the tops. The proportion of tops to roots depends on variety and stage of growth. Initially, turnips put most of their growth into the tops, then after about 45 days, the fleshy roots grow more rapidly.

Kales are more cold tolerant and do not produce fleshy roots like turnips. Leafy kale varieties vary greatly in their winter hardiness and rate of maturity. Stemless varieties establish faster and can be grazed by 60 to 90 days after establishment and, if grazed appropriately, can allow for two grazing cycles. On the other hand, narrow stem varieties require between 150 to 180 days before they can be grazed.

Rape is a fibrous root, multi-stemmed, leafy brassica that can provide forage ready for grazing by 60 days, however, this is variety dependent. Giant and dwarf varieties, depending on variety, can provide multiple grazing opportunities.

Swedes, like turnips, produce a large fleshy root with minimal leafy growth. Swedes are more of a long season, stockpiling forage source. They need between 150 and 180 days to reach maximum production but make for excellent late season stockpiled grazing.

Fodder radishes (aka Japanese radishes) are not part of the brassica family but have been used in many countries as a forage source and break crop for nematode suppression. Like turnips, radishes produce both aboveground leafy growth and fleshy root growth for grazing.

Additionally, several brassica hybrid crosses exist. Many are crosses between turnip and rape or kale and of Chinese cabbage, rape, turnip, or swede. The grazing hybrid varieties are generally developed to improve leafy yield and reduce bulb production. Many tolerate multiple gazing if grazing is managed and environmental conditions are conducive.

Potential Uses

Depending on the forage production system and needs, brassicas and fodder radishes can be used to fit a variety of situations. These alternative forages can be spring seeded and summer grazed, allowing for pasture rest or an opportunity to harvest grass pastures for hay. Brassicas also work nicely as a break crop for alfalfa. Fodder crops can effectively use residual nitrogen from the old alfalfa stand, thus allowing summer grazing with fall replant of alfalfa.

Brassicas and fodder radishes can also be seeded into permanent pastures or meadows. This scenario requires temporary chemical suppression of the sod to

successfully establish the brassicas. This option may be desirable if pasture renovation is going to occur.

The option with probably the greatest potential is to extend fall grazing using brassica and fodder radishes as a second crop after small grain hay or grain production. Using a shorter season brassica after small grain hay or grain harvest can provide extended grazing in the fall and early winter.

Forage Yield and Quality

Brassica dry matter yield is dependent on species, seeding date, and soil type. Measured yields have ranged between 0.5 to 8.0 tons of dry matter (DM)/acre. In fall 2009 seven varieties of brassica and fodder radish were planted at three different planting dates (August 1, August 15, and September 1) in small plots at the Klamath Basin Research and Extension Center, OR, after harvest of wheat for hay (Figs. 1, 2, and 3). Yields were measured both at 60 and 90 days after seeding. The highest yields were observed in the first planting date and diminished over the later planting dates and ranged from 3.34 down to 0.83 tons/acre (Table 1).

Brassica forages tend to have nutritional quality more similar to grain or concentrate feeds than other more traditional type forages. Work done at the Powell Research and Extension Center, WY, as well as other research in Virginia and South Dakota, has shown brassicas to have high quality, with crude protein ranging from 7 to 23 percent and *in vitro* dry matter digestibility in excess of 80 percent. Bulbs tend to be lower in quality than the leaves.

Brassica and fodder radishes are high in moisture (13-30% DM) and low in fiber (Table 2) and should be limited to 75 percent of the diet. This can be accomplished by providing access to low-quality forage or limiting grazing access to a few hours per day (Fig. 4). Limiting access to brassica crops with electric fencing can increase utilization and help manage the crop if subsequent grazing is desired.

Grazing brassicas is possible until heavy snow prevents animal access, as brassicas maintain forage quality quite well. A study in Pennsylvania reported 160 cow grazing days per acre and work in Wyoming reported yearling gains of 1.6 to 1.8 pounds per day with 600 to 700 pounds of beef produced per acre. Also, work in North Dakota comparing fall planted turnips and other annual forages to winter range found turnips

Fig. 1. Brassica and fodder radish plots at the OSU Klamath Basin Research and Extension Center, OR.

Fig. 2. No-till seeding brassica and fodder radishes into small grain stubble at the OSU Klamath Basin Research and Extension Center, OR.

Fig. 3. Turnip bulbs from plots at the OSU Klamath Basin Research and Extension Center, OR.

Table 1. Dry matter yields of brassica and radish varieties over three planting dates at the OSU Klamath Basin Research and Extension Center, Klamath Falls, OR.[1]

Variety	Planted August 1		Planted August 15		Planted September 1	
	Dry matter yield	Standard error	Dry matter yield	Standard error	Dry matter yield	Standard error
	(tons/acre)		(tons/acre)		(tons/acre)	
Winifred brassica (hybrid)	3.34[a]	0.21	2.21[a]	0.13	2.00[a]	0.19
Pulsar rape	3.18[a,b]	0.21	2.37[a]	0.13	1.59[a,b,c]	0.18
Hunter brassica (hybrid)	2.56[b,c]	0.21	2.23[a]	0.13	1.75[a,b]	0.18
Purple top turnip	2.47[c]	0.21	1.82[b]	0.13	1.78[a,b]	0.18
Graza radish	2.45[c]	0.21	1.63[b]	0.13	0.83[d,e]	0.19
Dwarf Siberian kale	2.35[c]	0.23	2.33[a]	0.14	1.81[a,b]	0.18
New York turnip	2.17[c,d]	0.21	1.83[b]	0.13	1.83[a,b]	0.18
Triticale	1.65[d]	0.25	1.12[c]	0.13	0.64[e]	0.21

[a,b,c,d]Means within columns with differing superscripts are different (P<0.05).

Table 2. Nutritional composition of rye, turnip tops, and turnip bulbs.[1]

Item	Dry matter basis[2]		
	CP (%)	NDF (%)	ADF (%)
Rye	18.0	40.8	21.3
Turnip tops	23.5	14.9	13.2
Turnip bulbs	13.9	13.7	11.8

[1]Smart and Pruitt 2006.
[2]CP = crude protein, NDF = neutral detergent fiber, ADF = acid detergent fiber

to be a viable and economical alternative for grazing beef cows in the fall (Table 3).

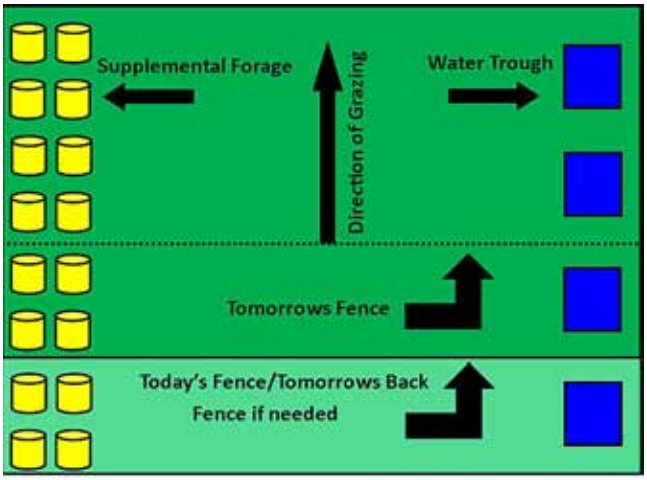

Fig. 4. Diagram showing example of how to graze a brassica or fodder radish field to obtain the best utilization; also showing bale placement for low-quality forages used to alleviate effects of low fiber.

Health Concerns

Brassicas are used extensively in grazing-based livestock production around the world but must be managed properly to alleviate potential health concerns. Photosensitization can occur if crops are grazed too early. This is most commonly the case with rape and kale, less so with turnips, swedes, and hybrid brassicas. Brassicas, similar to small grains, can accumulate nitrates if soil nitrogen levels are high and environmental conditions disrupt growth. Glucosinolates, compounds found in brassicas, can disrupt iodine metabolism causing goiter (enlarged thyroid) problems. Thus, supplemental iodine and/or copper may be provided to prevent and alleviate this problem.

Kale has also been associated with anemia (sometimes called redwater). It can occur with other brassicas but

Table 3. Cow performance while grazing annual forages, turnips, and native range in the fall, Streeter, ND.[1]

Item	Café[2]	Foxtail millet	Native range	Turnips[3]	Standard error	Treatment *P* value
Initial BW[4], lb	1,178.8[a,b]	1,185.0[a]	1,170.6[b]	1,170.6[b]	2.2	.005
Final BW[4], lb	1,261.3	1,254.6	1,258.2	1,265.9	9.6	0.85
ADG[5], lb	1.9	1.7	2.1	2.3	0.2	0.29
Initial BCS[6]	5.3	5.3	5.4	5.2	0.1	0.15
Final BCS[6]	5.6	5.6	5.5	5.5	0.1	0.31
BCS[6] change	0.8	0.6	0.2	0.6	0.1	0.10
Cost, $/hd/day	$1.80	$0.75	$1.27	$0.83	----	----

[1]Neville et. al 2008.
[2]Mixture of turnip, forage radish, cowpea, soybean, sunflower, and foxtail millet.
[3]Free choice wheat straw provided.
[4]BW = body weight
[5]ADG = average daily gain
[6]BCS = body condition score
[abc]Means within rows are different at P<0.05.

is most commonly seen with kale. The disorder is due to excess levels of S-methyl Cysteine Sulphoxide (SMCO), an amino acid compound in the plant. The SMCO causes appetite suppression and reduced hemoglobin concentrations in the animal. Low soil phosphorus along with high nitrogen and sulfur levels tend to be associated with the condition.

Moving animals from dry forage to green lush brassica pastures can also cause respiratory problems, such as pulmonary edema. Bloat can also be a problem if cattle are hungry when placed on brassica pastures. Choking, although rare, can also be a concern, particularly with turnip and swede bulbs. Brassicas are high in moisture, around 80 to 90 percent water. This can cause problems with animals being able to reach adequate levels of dry matter intake, potentially affecting performance.

Using varieties that have been developed for grazing as well as slowly introducing animals to brassica pastures, avoiding abrupt changes from dry to lush pastures, and not placing hungry animals on brassica pastures can help alleviate many potential health problems with grazing brassicas and fodder radishes. Providing a well-balanced mineral supplement, paying special attention to copper and iodine, is important to prevent SMCO and goiter problems. Only allowing 75 percent of the diet to come from brassicas, by providing supplemental baled low-quality forage or allowing access to grass pastures while grazing brassicas, can also alleviate potential health problems.

Agronomic Management

Brassica seeds are relatively small and can be planted on a wide variety of soil types. A variety of seeding methods can be used. Drilling into a tilled seedbed, no-till seeding into stubble, or aerial seeding have potential to be successful. Seeding rates vary from 1.5 to 6 pounds/acre depending on seeding method used. Radish seeds are slightly bigger than brassica seeds and should be seeded at a rate of 4 to 7 pounds to the acre. Seeding depth should not exceed 0.5 inch. Seeding dates and variety choices vary depending on planned crop usage. Brassicas and fodder radishes need sufficient water and do not do well in dryland areas with low annual precipitation.

Fertilizer applications should be based on soil test results and previous crop history, with around 50 to 100 pounds of nitrogen per acre applied at seeding or shortly after. Sulfur is an important nutrient for brassica crops and should be provided at a rate of 20 pounds/acre. The soil phosphorus and potassium levels should also be monitored. Brassicas require both and at similar levels to small grains. Additionally, although they are frost tolerant, young seedlings can be vulnerable to frost. Well established brassica stands form a canopy that helps them compete well with weeds, however, young immature plants do not perform well under weed pressure.

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