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Annual Cool-Season Forages for Late-Fall or Early-Spring Double-Crop

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Planting cool-season annuals following grain or corn silage harvest is an economical way to produce high-quality forage. This publication provides information about how to use small grains and brassicas to produce forage within cash cropping systems.

Planting cool-season annuals following grain or corn silage harvest is an economical way to produce high-quality forage. Two types of cool-season annual forages that are well-suited to produce double-cropped forage are small grain cereal grasses, such as oats, cereal rye, triticale and wheat (*Figure 1*), and brassicas which include turnip and radish (*Figure 2*).

For fall forage, the general concept is to take advantage of the potential growing degree-days following grain harvest (*Figure 3*). Ideally, planting a forage double-crop would occur as soon as possible following grain harvest since the growing degree days available for plant growth rapidly decline through the late summer into early fall. The risk of failure increases with later planting dates. However, establishment costs are often low enough for many of these forages that the successful years often outweigh the years in which failure occurs. Usually, establishment failures are due to low soil moisture coupled with lack of timely precipitation, which delays seed germination and early establishment. When irrigation is available, risks of failure are greatly reduced. The cropping systems that offer the greatest chance of success for realizing fall forage production from a forage double-crop are those following wheat, hybrid seed corn, and corn silage.

Forage Double-Crop Options Following Hybrid Seed Corn Production

Producers have successfully used forage double-crops in hybrid seed corn production for many years. Commonly, a brassica and/or small grain forage is planted in late July or early August when the male rows are removed. Grazing can begin soon after the hybrid seed is harvested in late August or early September. However, delaying grazing to later in the fall will increase forage yield.

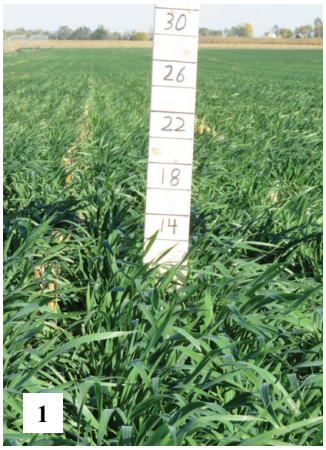

Figure 1. Oats in early November after being planted in early September following corn silage harvest.

Figure 2. Daikon oil seed radish (left) and purple top turnip (right) in early November after being planted in mid-August.

Forage Double-Crop Options Following Wheat

Including wheat as a component of a crop rotation allows for increased opportunity to produce a forage double-crop in the fall. When planning on planting a forage double-crop following wheat harvest, the decision for selecting a species to plant likely depends on the planting date, and when the forage is needed. If you are going to plant after Aug.10, cool-season annuals are a better option than warm-season (summer) annuals. However, if you plan to graze during October and can get the forage planted before Aug. 10, a warm-season annual will likely produce more biomass than cool-season annuals and will have adequate nutritional quality for dry cows. For additional information on planting, management, and harvest of warm-season annuals, see NebGuide G2183, *Summer Annual Forage Grasses* and/or G2172, *Summer Annual Forages for Beef Cattle in Western Nebraska.*

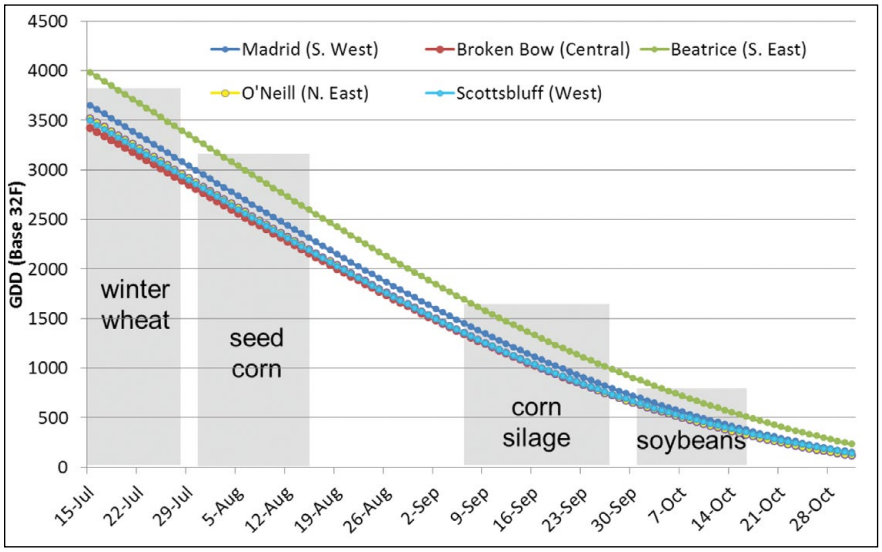

Figure 3. Potential growing degree days (GDD) accumulation during the summer and fall. Growing degree days are commonly used to predict plant growth potential. Gray boxes indicate common range in harvest dates for winter wheat, corn silage, or soybean, and male row removal in hybrid seed corn.

Forage Double-Crop Following Corn Silage

Corn for silage is harvested early enough that winter-sensitive species such as oats and brassica can be planted with enough time to accumulate adequate growth for fall grazing. If planting occurs before or during the first week of September, fall grazing is a viable option. However, if planting is delayed until after that, the best option is to plant a winter-hardy annual small grain, such as cereal rye or winter triticale, and graze in early spring. Research conducted in Iowa suggests that the accumulation of 1000 GDD (base 32°F) following fall planting will maximize spring yield potential of either triticale or cereal rye. For most of Nebraska, this means a planting date no later than Sept. 16 (*Figure 3*). However, planting with as little as 520 GDD (base 32°F), as late as Oct. 5 for most of Nebraska (*Figure 3*), may still result in improved yield over spring planting.

Forage Double-Crop Options Following Soybean

When planting a forage double-crop following soybean harvest, it is unlikely that adequate growing degree days remain to produce any appreciable amount of fall forage. Planting a winter-hardy species such as cereal rye or winter triticale in the fall can result in greater spring forage production than spring planting.

Small Grains as Forage

Typically, fall forage yield for small grain forages is negatively correlated with winter hardiness. This means that oats and winter-sensitive (spring) varieties of triticale, wheat, and barley will yield more in the fall than cereal rye or winter-hardy varieties of triticale, wheat, or barley. Full seeding rate of small grain forages typically ranges from 100 to 120 lb of seed per acre with seed cost of approximately $30 to $40/ac. Planting depth should be at least 1 inch deep.

In terms of fall forage production, small grain forages planted from mid-August through early September are highly digestible with energy values ranging from 60 to 70 percent TDN. The CP will vary from 10 to 20 percent, depending on the amount of nitrogen (N) available for plant uptake.

In terms of spring forage production, cereal rye matures earlier than triticale or wheat. If you plan to graze or harvest before mid-May, it is likely that cereal rye will have greater yields. If you plan to harvest after mid-May, triticale may produce greater yields. However, cereal rye can become a weed (feral rye) in wheat fields, reducing yield and grain quality. Therefore, cereal rye may not be suitable for regions where wheat is produced.

In the spring, the nutritional value of small grain forages declines and DM yields increase as the plant matures. When small grain forages are at boot stages (seedhead is still enclosed within the sheath of the flag leaf), the TDN ranges from 70 to 80 percent. However, by early dough the TDN decreases to 50 to 60 percent.

Brassicas

Brassicas can rapidly produce high-quality forage. Turnip, rape, kale, and radish are all brassicas. The full seeding rate for turnip, rape, and kale is 3 to 5 lb/ac. Daikon oil seed radish seeds are slightly larger, which increases the full seeding rate up to 8 to 10 lb/ac. Brassicas should be seeded no deeper than ½ inch. Seed germination of brassicas is likely to be decreased to the point of failure if timely precipitation does not occur or if irrigation is not applied. However, with adequate soil moisture, they can produce substantial amounts of high-quality forage at a low cost. Seed cost of purple top turnip at 5 lb/ac would be approximately $9 to $10/ac. Kale and hybrid turnip seed have greater cost ($13 to $18/ac) at the same seeding rate (5 lb/ac). Many of the radish varieties currently marketed are large-rooted selections of daikon-type oilseed radish. They have become popular for the channels created by the roots that tend to remain open at the soil surface. Seed costs often range from $25 to $36/ac when planted at 10 lb/ac.

Turnip is the fastest growing brassica and both the leaf (top) and bulbs (roots) can be grazed. Cattle seem to graze turnip leaves first, and if the cows remain on a field, they will go back and consume the bulb (roots) after the tops have been removed. Kale is slower to mature than other brassicas but has greater cold tolerance.

Hybrid crosses of turnips and oriental vegetables, rape, or kale are also available. Three that are readily available in Nebraska are Winfred, Hunter, and Pasja. These tend to grow rapidly like turnip but produce more leaf relative to root, which is similar to kale or rape. If planted after winter wheat in early August, the top growth of these hybrids may be greater than purple top turnips. However, with later planting dates, yield of top growth appears to be similar to the purple top turnip. This is because purple top turnips produce mainly leaf during early growth, but as they mature they start putting more energy toward root development. When planted the first week of September and harvested in late October in Southeastern Nebraska, purple top turnips were 85 percent top and 15 percent bulb on a DM basis but were 62 percent top and 28 percent bulb when planted in the first week of August.

Nitrogen Fertilization

One of the key determinations of biomass yield for a double-cropped forage is the amount of residual N remaining following the previous crop. When planting after hailed out corn or seed corn, the response to additional N will be minimal since adequate residual N should be available. However, with a double-cropped forage following wheat, corn silage, or soybean, an increase in biomass yield would be expected to the first 30 to 50 lb N/ac of N under normal growing conditions.

Potential Forage-Related Cattle Disorders

There are several key management strategies that will reduce complications from forage-related disorders to consider before incorporating brassicas or small grain forages into your system.

Brassicas are high in energy because they contain 10 to 20 percent water-soluble carbohydrates, and the fiber is highly digestible due to the low content of lignin (*Table I*). Dry matter digestibility generally exceeds 80 percent and is often just slightly less than corn grain. Unlike most forages, dry matter digestibility of brassicas does not decrease greatly with increasing plant maturity. With their high digestibility and low fiber content, brassicas should actually be considered more like a "concentrate" rather than "forage." The small amount of fiber they do contain is not adequate for optimal rumen function. The current recommendation is to include a cool-season annual small grain such as oats in the mixture to increase the fiber content of the diet.

The high sulfur content, coupled with the highly fermentable carbohydrates present in brassicas, can result in polioencephalomalacia, commonly called "brainers." Including a small grain forage when planting brassicas will decrease the risk. Additionally, properly adapting cattle to the forage or delaying grazing until a few days after a damaging freeze will reduce the likelihood of this occurring.

The biggest health risk with grazing brassicas and small grain forages is bloat. As with any lush, green forage, animals need an adjustment period prior to grazing. The simple method to accomplish this is to feed long-stemmed hay or straw for several days prior to turning out and for the first few days after grazing begins. Feeding a free-choice mineral with an ionophore (such as Rumensin® or Bovatec®) can also reduce the risk of bloat. Waiting for a few days after a damaging freeze to begin grazing will also reduce the likelihood of bloat becoming a problem. For more information on bloat, see NebGuide G2018, *Bloat Prevention and Treatment in Cattle.*

Both small grain grasses and brassicas can accumulate nitrates, especially when fertilized with high N levels. Forage testing is the only way to be sure that toxic levels are not present. For more information on nitrate testing and management, see NebGuide G1779, *Nitrates in Livestock Feeding.*

Table I. Nutritive value of 'Daikon' oilseed radish, 'Purple top' turnip, and oats planted as a mixture in early August in Southeast Nebraska[1]. Samples were harvested in late October following accumulation of approximately 3000 GDD (base 32°F).

	Radish		*Turnip*		*Oats*
	Leaves	Root	Leaves	Root	
DM, %	5.9	6.0	8.4	8.5	15.0
	% on DM basis				
Crude Protein	18.2	8.2	13.5	8.4	9.6
TDN	81.2	90.0	82.9	85.1	58.6
NDF (Fiber)	21.7	14.9	19.9	16.5	60.9
Sugar	12.7	22.8	17.2	22.7	9.6
Sulfur	0.69	0.61	0.57	0.53	0.20
Proportion of plant	60.5	39.6	63.6	36.4	-

[1]Forage yield 2.27 tons DM/ac with 39, 35, and 26 percent of DM being radish, turnip, and oats, respectively. Planted after wheat harvest at a rate of 2 lb of radish, 3 lb of turnip, and 40 lb of oats per acre. Fertilized with 50 lb of N/ac.

Brassicas also contain compounds (goitrogens) that prevent the uptake of iodine by the thyroid gland. This can result in goiter and decreased growth rates. Feeding an iodized salt-trace mineral mix will reduce the likelihood of this problem. Also, including a small grain forage in the mixture at planting will dilute the concentration of these compounds and further reduce the likelihood of this occurring.

Grass tetany can occur when grazing small grain forages or brassicas. These forages contain high levels of potassium, which interferes with magnesium absorption. Grass tetany is especially prevalent in mature lactating cows. However, feeding a free-choice mineral that has 12-15 percent magnesium with a target intake of 3 to 4 ounces/d and can reduce the incidence of grass tetany.

Although rare, cattle have been known to choke on turnip bulbs of purple top turnips. In spite of the potential risks associated with grazing forage brassicas and small grain forages, this combination has potential for substantial beef production. Mixtures containing brassicas (turnips and radishes) and oats have produced from 1 to 3 tons DM/ac when planted in August and September. When stocked at a rate of one 600 lb calf/ton of DM and grazed for 50 to 60 days beginning in early November, calves (*Figure 4*) have gained 1.5 to 2 lb/hd/d and resulted in beef production from 100 to 150 lb of gain/ac.

Figure 4. Calf grazing an oats-brassica mix near Clay Center, Neb., in January. Calves grazing on oats-brassica mixes in the fall have gained between 1.5 and 2.0 lb/d.

Figure 5. A pivot fence used to control grazing of an oats-brassica mix. Giving daily allocations can significantly improve grazing efficiency. Given the high nutrient content of cool-season annuals, this is an option that will allow limit feeding of dry cows and extend the grazing season.

Figure 6. Oats-brassica mix in a corn silage field in early December after several freeze- thaw cycles during November. Although the forage is flat (less than 3 inches tall) and yellow, 1.5 tons/ac of high-quality forage remain in this field.

Freezing Effects

Following a few hard freezes, fall-sown small grain forages and brassicas will turn yellow and wilt, which makes it look like little forage is available (*Figure 6*). However, to assess available forage, producers need to walk through the field and stand up the forage to see how much remains. It is also important to note that the nutrient content of oats and brassicas do not seem to rapidly decline over the winter (*Table II*), although the energy content does decrease due to some loss of water-soluble carbohydrates (i.e. sugar).

Grazing Management

Typically, 40 to 60 days is needed to produce sufficient growth for grazing of cool-season annuals. Thus, when grazing double-cropped cool-season annuals planted in mid-August, grazing could begin in early October. However, delaying until late October or early November will allow for the most forage yield and will not result in significant loss of quality.

If planning to use winter sensitive cool-season annuals such as oats and brassicas for feeding dry cows in the fall, producers should consider limiting the cows' access as the nutrient content is much greater than their requirement. Using a pivot fence is a good option for limit feeding cows (*Figure 5*).

Winter hardy species such as cereal rye or winter triticale can be grazed in the fall if growth reaches 6 inches or greater. However, cattle should be pulled when the grass is 4 inches high, if spring harvest/grazing is desired. When grazing in the spring, begin grazing when the grass is 6 to 8 inches high. Remove the cattle when it is grazed down to 4 inches to maintain sufficient leaf area for growth and recovery. This is because annuals do not have the ability to store significant quantities of energy for regrowth like perennial species can.

Table II. Nutritive value of 'Daikon' oilseed radish, 'Purple top' turnip, and oats planted in early September in South Central Nebraska (1400 GDD; base 32°F) and harvested early November and December.

	Radish leaves		*Oats*		*Turnip leaves*	
	Nov.	Dec.	Nov.	Dec.	Nov.	Dec.
DM, %	11.0	64.1	18.3	58.8	12.0	59.0
	% on DM basis					
Crude Protein	28.2	27.3	19.4	20.6	28.7	26.8
TDN	81.9	77.4	73.5	64.9	84.9	78.7
ADF	16.0	20.2	24.0	32.2	13.1	19.0
NDF	20.4	34.7	37.8	49.5	17.9	33.0
Sugar	10.7	6.2	18.2	8.3	13.3	7.6

Forage yield, 1.68 tons DM/ac with 21, 27, and 52 percent being radish, turnip, and oats, respectively. Planted after corn silage at a rate of 2 lb of radish, 1.5 lb turnip, and 84 lb oats seed per acre. Fertilized with 48 lb N/ac.

Herbicide Considerations

If you want to grow a forage double-crop following a grain crop, it is necessary to check crop rotation intervals (plant back restriction) listed on the herbicide label. If the rotation restriction is listed on the label but not for the desired forage double-crop, follow the restriction listed for "other crops" or the longest rotation restriction listed on the label. Unfortunately, this often limits the use of brassicas since they are not often listed on the herbicide label, and for many herbicides the plant back interval is 18 months for "other crops." Restrictions may be due to potential toxicity to the grazing animal or may be due to other concerns such as problems with the chemical residues in the meat.

Sometimes, studies were actually conducted to know if there was a safety concern. In other cases, chemical companies have chosen not to conduct all the studies required for a specific label. Without suitable testing, the risks for toxicity or accumulation of herbicide residues in meat are not known. In these instances, governmental regulations require the strongest restrictive language be placed on the label. Thus, beef producers should follow these restrictions as part of their Beef Quality Assurance Program, thereby "ensuring a safe, wholesome, and healthy beef supply."

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