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CONSIDERATIONS FOR USING ANNUAL FORAGES COST EFFECTIVELY

M. E. Drewnoski, D. D. Redfearn, and J. Parsons
Departments of Animal Science, Agronomy and Horticulture, and Agricultural Economics,
University of Nebraska Lincoln

Introduction

The high pasture rental rates in Nebraska have led to some cattle producers asking if there are alternative forage options available that might lower costs. Like pasture rental rates, cash rent for crop ground is also quite high, especially for irrigated ground. Making forage production cash flow on this ground compared to other cropping options can be difficult (Parsons et al., 2018). However, there are opportunities. In the eastern part of the state double cropping a forage crop after a cash crop may be possible on both irrigated and dryland ground (Drewnoski and Redfearn, 2015). The lower rainfall in the western part of the state, causes double cropping in dryland situations to be high risk or virtually impossible. However, rental rates for dryland acres are lower and incorporating annual forages into the cropping rotation may work (Berger, 2017). Additionally, double cropping a forage crop after a cash crop is possible on irrigated ground (Jenkins et al., 2016).

Selecting Annual Forages

While there are many annual forage options available, the potential window for planting and/or the window in which the forage is needed will narrow down the options. The use for grazing and desire for re-growth vs. use for hay, silage, or stockpile grazing can also impact species selection. Annual forages can be broken down into three main types: 1) cool-season, winter hardy (winter types), 2) cool-season, winter sensitive (spring types), and 3) warm-season, summer annuals. The type of annual forage selected should be based on planting date and forage need (Table 1). Cool-season, winter hardy forages can be planted in fall and used in the early spring. Cool-season, winter sensitive forages can be planted in spring and used in late spring/early summer or can be planted in late-summer for fall or winter forage. Warm-season, summer annual forages are planted in late spring/early summer for late summer, fall, or winter forage. Within a type there are differences among species and even within species (variety) in their growth and productivity. Grasses will produce the greatest biomass and are usually the most cost effective annual forage source, although strategic use of brassicas in a mix with cool-season, winter sensitive small grains can be cost effective (Redfearn and Drewnoski, 2018).

Table 1. Guidelines for establishment of annual forage in Nebraska (adapted from Drewnoski and Redfearn, 2017).

Annual Forage	Forage Type	Full Rate lbs/ac	Seed Depth, inch	Planting Date	Winter Hardy
Fall planting (April-June grazing)					
cereal rye: Elbon	CG	65	1.5	8/1-11/1	to -30º F
cereal rye: VNS	CG	70	1.5	8/1-11/1	to -30º F
triticale, winter	CG	70	1	8/1-11/1	to -20º F
wheat, winter	CG	70	1.25	8/15-10/15	to -20º F
vetch, hairy	CL	20	1	8/1-9/15	to -20º F
Spring planting (May-July grazing)					
oats, spring	CG	90	1	3/15-5/1	No
triticale, spring	CG	70	1	3/15-5/1	No
barley, spring	CG	80	1.25	3/15-5/1	No
pea, spring forage	CL	40	2.25	3/15-4/15	No
forage collards	Br	5	0.5	3/15-5/10	No
rapeseed	Br	7	0.5	3/15-5/10	No
hybrid grazing turnip	Br	8	0.5	3/15-5/10	No
Late spring planting (July-Sept grazing)					
millet, pearl	WG	15	0.5	5/15-8/1	No
sorghum	WG	10	1	5/15-8/1	No
sudangrass	WG	20	1	5/15-8/1	No
sudan-sorghum hybrid	WG	25	1	5/15-8/1	No
millet, foxtail	WG	15	0.5	5/15-8/1	No
cowpea	WL	42	1.25	5/15-7/15	No
soybean	WL	50	1.25	5/1-7/15	No
Summer planting (Sept-Jan grazing)					
oats, spring	CG	90	1	8/1-9/1	No
triticale, spring	CG	70	1	8/1-9/1	No
barley, spring	CG	75	1.25	8/1-9/1	No
turnip, Purple top	Br	5	0.5	7/15-8/20	No
rapeseed	Br	5	0.5	7/15-8/20	No
hybrid grazing turnip	Br	5	0.5	7/15-8/20	No
forage collards	Br	5	0.5	7/15-8/20	No
Do not plant legumes (CL or WL) or brassicas (Br) alone for grazing, mix with a grass. For mixes target the percent of full seeding rate of the species to add to 100 to 150%. For instance if Elbon rye was planted at in a mix with hairy vetch at 50 lbs rye (50/65 = 77%) with 9 lb vetch (9/20 = 45%) then seeding rate would be 122%.					

Spring forage production

Earliest spring grazing (starting in April) can be achieved through fall planting of winter hardy cool-season species like cereal rye or winter triticale.

Cereal rye is a popular choice for planting as a double-crop within cash cropping systems. One of the main reasons for its popularity is that it is the most winter hardy small cereal and it tends to have greater yields earlier in the spring than other options. This is especially true for southern varieties such as Elbon since they break dormancy earlier in the spring (Redfearn et al., 2016). This can be beneficial when the window for their use is relatively narrow, but this also results in earlier spring maturity. Thus, the harvest window is narrow and can make grazing management more difficult because forage quality can rapidly decrease. Much of the cereal rye available is variety not stated (VNS) and with this comes greater variability in growth from year to year that is due to plant genetics. Planting can be done as late as early November with cereal rye. However, spring yields will be lower with late planting. Ideally, planting of winter hardy small grains should occur before October 1.

In general, wheat tends to have slower growth, which can result in lower forage yields, when harvested in early spring. However, wheat also has a longer harvest window and does not mature as rapidly. Another advantage of wheat is that the seed can be low cost with varieties available that have been tested across the state.

Triticale is a hybrid of cereal rye and wheat. It has many advantages as a forage, and like wheat there is an active breeding program in Nebraska. This means improved varieties are available that have been tested across the state. While its growth does not start as early as cereal rye, it is not far behind. Its yields are as good as or better than cereal rye (especially if allowing the forage to grow later into the spring). Like wheat, triticale maintains it forage quality better through the spring than cereal rye. Compared to cereal rye, triticale also has a lower potential to produce volunteer plants the next year. This is especially important if triticale will be grown in fields where a wheat cash crop is in the rotation.

One of the challenges with using annuals for forage is that they tend to grow and mature rapidly making timely management key. However, there are some ways that producers can "lengthen" the window. Using multiple species to take advantage of their differing growth patterns when planting multiple fields can help distribute the growth and need for harvest (grazing or cutting) over a wider window of time. For instance, planting cereal rye on one field and triticale on another can result in both early (cereal rye) and late (triticale) spring forage being available for grazing.

Later spring grazing (starting in May) can be gained through planting winter sensitive, cool-season species like oats, spring barley, or spring triticale in mid to late March. Oats have been one of the traditional spring-planted forage species. However, there are improved spring varieties of barley and triticale available. In the spring, using later maturing varieties, often called "forage type" can improve spring yields and again lengthen the harvest window as they do not mature as rapidly as "grain" type small grains. If grazing is the goal, brassicas can be included with the small grains forages. Brassicas, such as turnip, rapeseed and collard, tend to be high energy and high in crude protein even when mature. However, there are anti-quality factors in some brassicas that tend to increase with maturity. The forage varieties are often selected for regrowth potential and may be more valuable when rotational grazing is being used. Brassicas grow well in the eastern and central part of the state, but are more variable in western NE. This is likely due to the shallow planting depth and potential for low surface soil moisture.

Summer forage production

Warm-season annual grasses can be planted in late spring or early summer to provide mid- and late-summer grazing or stockpiled and used for winter grazing (Anderson and Volesky, 2013).

Sudangrass is a rapidly growing warm-season grass, with good regrowth potential. It usually contains lower levels of prussic acid than sorghum-sudangrass hybrids, but it is also slightly lower yielding. It is a good option for grazing during the growing season.

Sorghum-sudangrass hybrids closely resemble sudangrass, but the hybrids are taller, have larger stems and leaves, and generally produce higher yields. However, regrowth can be slower and thus it may not be the best option for grazing during the growing season. Sorghum-sudangrass hybrids are more likely to contain toxic levels of prussic acid when immature than sudangrass. Sorghum-sudangrass hybrids are often used for silage, hay, or stockpiled for winter windrow grazing.

Pearl millet has smaller stems than sorghum-sudangrass hybrids, is leafier and does not produce prussic acid. It is a good option for hay and winter grazing. There are commercial varieties adapted to Nebraska. While forage yields are typically less than sorghum-sudangrass, pearl millet is a close second. It has slower regrowth and may not be as well suited to grazing during the growing season as sudangrass.

Foxtail millet can be a good option for hay production in western Nebraska because it has low water requirements and is fine stemmed. Foxtail millet does not yield as well as sorghum-sudangrass hybrids, pearl millet, or sudangrass. However, its seed cost is usually about 1/3 of other summer annuals making it a lower investment risk in western dryland systems (Jenkins et al., 2017). Foxtail millet reaches maturity faster and fits well into short growing windows. It is shallow rooted and is not well suited to grazing.

If winter feed is needed, cutting and windrowing sorghum-sudangrass or pearl millet in the fall, then swath grazing in the winter is a good option, especially in western NE (Berger and Volesky, 2012).

Fall forage production

Late fall and winter grazing can also be achieved through planting of winter sensitive cool-season species like oats, spring triticale, or spring barley in late summer. These winter sensitive species will out yield winter hardy species in terms of fall forage production (Redfearn et al., 2016). Unlike spring and early summer planted annuals, forage maturity and quality with late summer planting is generally not as big of an issue. In fact, there may be no advantage of planting a "forage" type over a "grain" type when planting in late summer. However, if planting in early to mid-August there is likely a forage quality advantage with the "forage" varieties.

Brassica can also be included with winter sensitive small grains. While there are forage varieties, use of non-improved varieties such as purple top turnip or rapeseed may be the most cost effective for late summer planting, especially if multiple grazing is not planned. Nutritive value of brassicas, when planted in the mid- to late-summer does not appear to vary much among brassica species (Villalobos and Brummer, 2015; Lenz et al., 2018). The brassicas are low in fiber and high in both energy and crude protein, with nutritive value more similar to concentrates than forages. In general, brassica and small grains both maintain their quality well into the winter (Lenz et al., 2018). Given their cost, either purple top turnip or rapeseed, can reduce seed cost compared to a small grain monoculture while simultaneously improving feeding value of the forage (Riley et al., 2019). Some producers have concerns about cattle choking on the root

(bulb) of purple top turnips. Using a non-bulb brassica like rapeseed maybe more attractive in this instance.

Nutritive value of late summer planted small grain forages with or without brassicas is high and suited to the requirements of lactating cows or growing calves. Weaned calves grazing stockpiled oats and brassicas have gained between 1.5 and 2.2 lb/d.

The shorter the growing window, the lower the likelihood that adding nitrogen fertilizer will pay. With late summer planting, high nitrate content of both small cereals and brassicas have been observed (Lenz et al, 2019). Thus, if planting winter sensitive species in late August, it is not recommended to add supplemental nitrogen. However, with low soil residual N and earlier planting (early to mid-August) 30 to 50 lb N/acre may improve forage production.

Planting a mixture of winter hardy and winter sensitive forages to have both fall and spring forage from a single planting often results in lower fall and spring yields than winter sensitive or winter hardy monocultures, respectively, but similar total (fall plus spring) forage yield (Volesky, 2018).

Implications

Annual forages can be cost effective that can fit into some cropping systems. One of the most important drivers of forage productivity and cost effectiveness of annual forages is planting date. Planting dates outside of the recommended planting window is unlikely to result in desired growth. For instance, planting cool-season winter sensitive annuals like oats in mid-September is likely to result in reduced growth with little return on investment. Using annual forages as a double-crop is not fool-proof and can have major challenges. Having realistic expectations of planting date is one of the keys to proper species selection.

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Mary Drewnoski is a Beef Systems Specialist with the University of Nebraska-Lincoln. Prior to joining UNL in 2014, she spent time learning and working in cattle systems in many locations across the U.S. including: Kentucky, North Carolina, Iowa, and Idaho. She is a beef cattle nutritionist with expertise in forage-based production systems and is a part of an interdisciplinary team evaluating Economical Systems for Integrated Crop and Livestock Production in Nebraska.

Jay Parsons is an agricultural economist with the University of Nebraska-Lincoln. He specializes in farm and ranch management decision analysis, risk management, and production systems analysis. He teaches Advanced Farm Management and Linear Programming and is a part of an interdisciplinary research and extension team evaluating economical systems for integrated crop and livestock production in Nebraska. Dr. Parsons has almost 20 years of experience helping farmers and ranchers understand risk and emerging management tools.