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Utilizing Annual Crops for Forage in Western South Dakota

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Perennial forages provide most of the livestock feed in western South Dakota. However, frequent droughts in the past years have resulted in a shortage of feed, driving up demand for alternative feed sources.

Annual crops can be of great value in developing a year-round forage system. They can provide early grazing before perennials are available, extend the grazing period, or increase hay and silage production.

Annual crops differ in growth habit and in forage quality. Selection of a particular crop for forage should be based on intended end use. A brief production summary for some annual crops with potential for forage production is given here, but detailed information on yield and quality of some of the forage species is missing. Further research and adaptation studies under local conditions are required.

Cool-season winter and spring small grains

Potential forage crops in this category include wheat, triticale, rye, oats, and barley. Winter annuals are planted in the fall and grow in the cool season and are less likely to encounter drought. Small grains can provide excellent fall or early spring pasture. Spring-seeded small grains can provide late-summer pasture.

Small grains are high in nutrients from early green-up to jointing stage. It is recommended that cereal grains not be grazed until plants are 6-8 inches tall.

Grazing early, before jointing, allows for continual leaf development and a longer grazing season. Cereal grains can provide adequate forage for 4 to 6 weeks, depending on the nature of the growing season and stocking density.

Successful grazing of small grains requires several precautionary measures.

In drought years, cereal grains can have high nitrate levels, especially early in the growing season. In dry years, producers should send forage samples for nitrate analysis before pasturing livestock.

Grass tetany is another potential problem when grazing small grains. Grass tetany is caused by nutrient imbalances resulting in magnesium and calcium deficiencies, and often occurs when lush immature grass or cereals are grazed. Delaying grazing until cereals are about 6 inches tall can reduce the risk of grass tetany. A daily magnesium supplement starting a week before grazing will also prevent grass tetany.

Both winter and spring small grains can be used as hay, silage, or green chop. Haying is, however, difficult due to the long drying time required to reduce moisture content. Rough awns or beards of cereal grains can reduce the palatability of the forage. Oats have the advantage of being awnless or beardless. For hay production, choose varieties of small grains that have smooth awns or are beardless. The ensiling process can soften rough awns.

Nutrient composition of the different small grains is similar when harvested at similar stages of maturity, i.e., maturity affects nutrient composition more than does species. The nutritional value of small grain forage declines rapidly with increasing maturity.

Small grain forage harvested in the preboot stage has about 20% crude protein (varies with N fertilizer applica-

tion), 40% NDF, 30% ADF, and in vitro digestibility of about 80%.

Small grain forage harvested in the boot stage has energy concentration similar to corn silage but greater crude protein (CP). Small grain forage harvested at boot stage has more energy and about the same CP content as high quality alfalfa. Nutrient content average at the milk stage are: CP 12%, NDF 48%, ADF 35%, and in vitro digestibility 62%.

In the milk stage, small grains typically have about 10% less energy than corn silage but 3 to 4 percentage units more CP. Compared with alfalfa, milk stage small grain forage has about the same energy content but lower CP.

When harvested in the boot stage, dry matter yields can range between 1.5 and 2.5 tons per acre. When harvested at the milk stage, yields range from 3 to 4 tons per acre.

The comparative relative feed value (RFV) of small grain silage using corn as a standard (100%) is as follows: barley 90-100%, wheat 70-90%, oats 60-80%, triticale 50-70%, and rye 50-65%.

Warm-season annual grasses

Potential forage crops in this category include sorghum, sorghum-sudangrass, foxtail millets, pearl millet, and corn. In western South Dakota, corn will be more suitable under irrigated conditions. Warm-season annuals grow best in the warm summer months and should be planted in moist soils after the first of June. A soil temperature of 65 to 70 degrees F at planting is recommended for faster germination and quick stand establishment. Nutritional composition is similar to small grains (Table 1) but may vary depending on crop developmental stage at harvest.

Foxtail millets. This group includes common German, Siberian, and Hungarian millets. Foxtail millets are generally grown for a hay crop. They are shallow rooted and will respond well to small summer rains. Siberian millet is the most drought tolerant of the foxtail millets and has a finer stem than the other millets, making it suitable for hay production. Foxtail millets produce a hay crop in a short period of about 8 weeks. Foxtail millets have little or no regrowth after being cut and therefore are not well suited for grazing.

Pearl millet. This is a relatively new forage in the northern Great Plains. Pearl millet, however, has been utilized extensively for high quality grazing in the southern Great Plains. It provides a wide range of alternative uses when grown as an annual forage. Pearl millet has a relatively thick stem and may be cut for hay, silage, or green-chop or be used for pasture. Regrowth potential after cutting is similar to that of sudangrass and much greater than that of foxtail millets. Research from the NDSU Carrington Research Extension Center has shown that pearl millet can provide higher tonnage silage than corn or grain sorghum and has good nutritive value. Pearl millet will provide good quality hay when properly cured. It is easier to dry than sorghum or sudangrass but more difficult than foxtail millets. Pasture potential is similar to sudangrass. Pearl millet will regrow after harvesting due to tiller growth after defoliation.

Sudangrass. This crop can be used for hay, silage, or pasture. It can withstand prolonged dry periods though it is not as drought tolerant as foxtail millets. It regrows faster than the millets and other sorghums. It is leafy and has thin stems and thus is more suitable for hay than other sorghum species. Sudangrass also makes a good supplementary summer pasture crop. Drought and freezing injury may result in buildup of prussic acid in sudangrass. Rotational grazing may reduce the risk of prussic acid poisoning. Sudangrass silage is comparable to sorghum or corn silage in nutritional composition, and ensiling will usually eliminate the prussic acid problem.

Sorghum-sudangrass hybrids. The hybrids tend to have fewer leaves and thicker stems than sudangrass varieties. They have high forage yield but are generally less palatable than sudangrass. The thick stems make them less suitable for hay than sudangrass and more suited for green chop or silage. Sorghum-sudangrass hybrids have slower regrowth than sudangrass. Prussic acid levels vary with hybrid and can be a problem in drought or freeze injured crops.

Forage sorghums. Forage sorghums generally come from a cross between sweet cane and grain sorghums. They tend to have elevated levels of prussic acid and, thus, should not be used for pasture. Forage sorghums are generally tall and mature late in the growing season. They have thicker stems than sudangrass and are best suited for silage or green chop.

Producers should be aware that forage sorghum, sorghum-sudan hybrids, and sudangrass all have potential to produce prussic acid under drought or frost stress, resulting in prussic acid poisoning of livestock. Sorghum species contain a non-toxic compound called dhurrin that is converted to toxic prussic acid by a process of cyanogenesis under drought or frost conditions. After stress, prussic acid tends to accumulate in rapidly growing shoots at the base of plants. As plants mature or age, the amount of dhurrin decreases. Field drying liberates 50-70% of the prussic acid. Conditioning helps increase liberation of prussic acid due to enzymatic breakdown of dhurrin and evaporation of prussic acid during drying.

Annual legumes

In recent years annual legumes have increased in importance as forages. They are generally lower yielding than cereal forages but are capable of supplying higher crude protein and higher fiber digestibility and palatability than cereal grains (Table 1).

Some annual legumes are commonly sown in mixtures with small grains while others can be utilized as sole crops. Crops suited for western South Dakota conditions in this category include field pea, cowpea, and mungbean.

Field Pea. Field pea is a cool-season legume commonly grown in mixtures with cereal forages to increase crude protein levels and improve digestibility of the forage. Field pea can be mixed with oats, barley, or triticale.

Forage pea varieties are preferred in mixtures rather than grain types and can be used for hay or silage. Cereal/pea mixtures should be harvested based on developmental stage of the grain. If the desired use is for dairy cows, mixtures should be harvested at boot stage. For heifers and beef cattle, harvest at soft dough stage. It is important to identify pea and cereal grain varieties that match well in maturity; otherwise, maximum production potential will not be reached. The pea in the mixture at harvesting should be at early to mid-podding stage.

Forage varieties of winter and spring pea are increasingly being grown as monocrops. They are best suited for silage and can be used for hay but are difficult to dry. Winter pea can be mixed with winter cereals or grown alone to provide high quality forage from May to early June, allowing deferment of range grazing.

Cowpea. This warm-season crop also known as black-eyed pea is widely grown in the southern U.S. Research at SDSU has shown that cowpea is well adapted to South Dakota conditions. The crop is more drought tolerant than field pea and therefore has a special fit to western South Dakota conditions.

Cowpea can be used for hay or silage. When used for hay, cut when most pods are fully formed. Dry matter yield in South Dakota has ranged from 1.9 to 3.1 tons per acre.

Mungbean. In the U.S., most of the mungbean crop is grown in Oklahoma for a variety of food products as well as for green manure and forage. Mungbean is a warm season legume that tolerates heat and drought but has lower dry matter yields than cowpea. Research at SDSU indicates that this crop is well adapted to local conditions, with yields ranging from 0.8 to 1.8 tons per acre.

All summer annuals and cool-season annuals can cause nitrate poisoning. This is particularly a problem when plants are growing under drought or frost stress. Unlike prussic acid, nitrate does not break down over time in hay forage, but can be reduced by 50% through ensiling.

If in doubt, have your forage tested before feeding to livestock. Grazing drought damaged crops should be avoided.

Table 1: Forage nutritive value of annual forages.*

	Crude protein	ADF	NDF	IVDDM
	% dry wt			
Barley	9-11	43	65	64-69
Oats	8-10	34	65	56-74
Triticale	8-10	36	66	53-70
Rye	7-9	27	49	50-56
Wheat	9-11	32	60	58-64
Sorghum	8-10	30	59	72-78
Foxtail millet	8-13	32	61	53-73
Cowpea	19-24	22	36	69-78
Pea	16-21	33	40	65-71
Mungbean	16-23	-	-	60-78

* Cereals were harvested at the dough stage and legumes at early to mid-podding.

Sources: MFA Forage Focus May 2004 p.2; and Twidwell et al., 1992.

Table 2: Rating of annual crops for best suitability for forage type.

	End use			
	Pasture	Hay	Silage	Green chop
Winter annuals				
Wheat	1	2	4	4
Triticale	1	2	4	4
Rye	1	1	4	4
Pea	3	2	1	3
Spring annuals				
Wheat	2	1	4	4
Barley	2	3	4	4
Oats	1	1	2	4
Warm season annuals				
Foxtail millets	4	1	4	3
Pearl millet	2	1	2	2
Sudangrass	1	1	2	2
Sorghum-sudangrass	1	3	2	2
Forage sorghum	4	4	1	1
Annual legumes				
Field pea/cereal mixture	3	2	2	3
Field pea	3	2	1	4
Cowpea	3	2	1	4
Mungbean	2	2	1	4

Ranking: 1 = Best suitability; 4 = Poor suitability.

Table 3: Suggested planting dates, seeding rates and harvesting times for annual forages.

			Harvest time		
	Planting date	Seeding rate	Pasture	Hay	Silage
Winter annuals					
Wheat	Sept. 10–Oct.10	1.0 bu/A	Up to jointing	Boot-Milk	Soft dough
Triticale	Sept. 1-10	2.0 bu/A	Up to jointing	n/a*	Boot
Rye	Sept. 1-10	1.5 bu/A	Up to jointing	Pre-boot	Soft dough
Pea	Sept. 10–Oct. 10	80– 160 lb/A**	-	25-50% podding	Blossom stage
Spring annuals					
Wheat	April 1-30	1.5 bu/A	Vegetative	Soft dough	Boot-Dough
Barley	April 10-30	2.0 bu/A	Vegetative	Soft dough	Boot-Dough
Oats	April 1-30	2.0 bu/A	-	Boot-Early heading	Milk-Dough
Summer annuals					
Foxtail millets	June 1- July 10	12-15 lb/A	Pre-boot	Soft dough	Soft dough
Pearl millet	June 1-July 10	12-15 lb/A	Pre-boot	Late milk	Soft dough
Sudangrass	June 1-July 1	20-25 lb/A	Pre-boot	Soft dough	Soft dough
Sorghum-sudangrass	June 1-July 1	15-20 lb/A	Vegetative-18 inch tall	Soft dough	18 inch tall or 10 days after frost
Forage sorghum	June 1 – June 24	8-15 lb/A	-	Soft dough	Mid-dough
Annual legumes					
Field pea/cereal mixture	April 1-30	Half rate for each crop	- -	Early heading	Boot-Dough
Field pea	April1-30	80-160 lb/A *	-	25-50% podding	Blossom stage
Cowpea	June 1- July 10	50-80 lb/A	n/a	25-50% podding	n/a
Mungbean	June 1 – July 10	15-20 lb/A	n/a	50% podding	n/a

* n/a: Not available.

** Seeding rate varies depending on seed size.

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