Annual Forage Species Production on Delayed Seeding Areas in the Missouri Coteau Region of North Dakota

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Prevented seeding due to excessive soil moisture in spring has challenged row-crop producers in North Dakota in the last decade. Three problems are related to prevented seeding areas: weed invasion and the effects on subsequent weed management, increased soil erosion and reduced biological activity, and reduced land area in production. Annual forage species can be seeded as a cover crop in the prevented seeding area in early to midsummer. Planting these annual forages can be a measure to control weeds, improve soil health and extend the grazing season for livestock production. In this study, five each of annual cool-season grasses, warm-season grasses, legumes and brassicas were tested in a delayed seeding field trial. The information generated can be used for species selection and later for determining cover crop mixtures specifically targeted for prevented seeding areas.

Summary

Forage oats (Everleaf126), foxtail millet (Golden German), field peas (Granger), cabbage and radish (Bio Till) were the best choices for production of cool-season grasses, warm-season grasses, legumes, brassicas without large roots and brassicas with large roots, respectively.

Annual forages vary in dry matter content and maturity stage after the first killing frost. Seeding them as mixtures to balance dry matter content, production and quality is necessary for late-season grazing.

Introduction

We have been in a wet cycle in North Dakota for 20 years. Rising water levels, road reconstruction and prevented seeding due to excessive soil moisture in the spring are common in North Dakota, especially north of North Dakota Highway 200.

With prevented seeding, row-crop producers are facing several challenges. First, weeds, especially some glyphosate-resistant weeds such as kochia and waterhemp, can proliferate in these areas. A weed invasion not only looks bad, but it raises difficulties for next year's crop.

Second, soil erosion due to a shortage of vegetation cover is a problem. Other soil health factors such as reduced soil organic matter accumulation and biological activity, and increased salinity levels also will develop without good cover.

The third problem is the economic loss due to prevented seeding. Utilizing the land resources in a prevented seeding situation would be a net gain for the producer. Planting annual forages into prevented seeding areas is an option to control weeds, improve soil health and extend late-season grazing.

Annual forage species fit prevented seeding situations because they require a shorter growing season, establish quickly in warm and dry seedbeds, produce enough biomass to cover soils and foster microorganisms to act, and hold high forage quality in the late season after the first killing frost.

The plant material for this purpose should be tested in the field. Monocultures of these species also should be tested. Then we can mix them together to present a balance of production, quality and diversity.

The objective of this study is to test different annual forage species, including cool-season grasses, warm-season grasses, legumes and brassicas.

Procedures

The study was carried out at the Central Grasslands Research Extension Center in 2014. Five species/varieties each of annual cool-season grasses, warm-season grasses, legumes and brassicas were seeded on July 14 (Table 1). Each of these species/varieties was no-till drilled into field plots. Each plot was 5 by 20 feet. Before seeding, the existing weeds were sprayed with glyphosate, with no further weed control measures used. No fertilizers were applied for the delayed seeding situation in this trial.

Each plot was evaluated visually for seeded species establishment. The establishment scale was: failed (no seedlings of seeded species and covered by weeds), poor (sparse seedlings of seeded species and covered by weeds at least 50 percent), fair (regularly spaced seedlings of seeded species and covered by weeds at most 50 percent) and excellent (dense seedlings of seeded species and covered by weeds at most 25 percent).

Each plot was harvested on Oct. 16 after the first killing frost. Oven-dried sub-samples were used to calculate forage

production on a dry matter basis. The forage samples were ground in preparation for lab analysis of forage quality.

Results

All cool-season grasses were still green after the first killing frost, with a low dry matter content (Table 1). The oats, which are late-maturing cool-season grasses, produced more dry matter on a land area basis than the early maturing cool-season grasses.

The warm-season grasses were yellow after the first killing frost, with high dry matter content, compared with that of the other groups (Table 1). The only heading warm-season grass was foxtail millet due to its short growing season requirement. Correspondingly, its production was the highest in the warm-season grasses group.

Except winter peas (Granger) and biennial legume hairy vetch, the legumes were yellow after the first killing frost, with high dry matter content. Correspondingly, winter peas produced the most in the legume group. Legumes produced less biomass, compared with species in the other three groups.

Brassicas species without large roots such as cabbage and rape grew tall, had higher production and were blooming at the time of the first killing frost. However, brassicas with large taproots such as turnip and radish were still in the vegetative stage at the first killing frost.

Table 1. Delayed seeding annual forage species/varieties screened and evaluated at the CGREC in 2014.

Species/Variety	Height (inches)	Dry Matter Content (%)	Production (tons/acre dry matter)	Color	Maturity Stage
Cool-season Grasses					
Barley/Haybet	35	37	4.00	Green	Heading
Barley/Robust	34	41	3.82	Green	Heading
Oats/Everleaf126	29	26	4.75	Green	Vegetative
Oats/Streaker	43	39	5.15	Green	Heading
Triticale/Trical141	31	26	2.82	Green	Vegetative
Warm-season Grasses					
Foxtail millet/German	29	69	3.61	Yellow	Heading
Pearl millet/MS2500	21	62	2.35	Yellow	Vegetative
Sorghum/Sweetie	19	64	2.84	Yellow	Vegetative
Sudangrass/Piper	19	72	2.37	Yellow	Vegetative
Sorghum-sudan/Cow Conditioner BMR	18	59	2.65	Yellow	Vegetative
Legumes					
Berseem Clover/VNS	13	35	2.09	Yellow	Blooming
Peas/4010	8	58	2.55	Yellow	Vegetative
Peas/Granger	12	35	3.46	Green	Vegetative
Soybeans/Big Buck8L	16	77	1.28	Brown	Vegetative
Hairy Vetch/VNS	12	23	2.17	Green	Vegetative
Brassicas					
Brassica/Pasja	19	13	4.70	Green	Vegetative
Cabbage/Ethiopian	63	20	8.89	Green	Blooming
Radish/Bio Till	44	15	5.41	Green	Vegetative
Rape/Barnapoli	37	17	7.64	Green	Blooming
Turnip/Purple Top	15	26	2.84	Green	Vegetative

Discussion

Weather in the seeding year plays the most important role in the growth of delayed seeding annual forages. Soil moisture availability in the seeding season determines the success of these annual forage species. In 2014, the timely rainfall gave them a great start, and that may explain the high production level for every species we screened.

The growing season length determines the species selection for their maturity stage. The late frost date in 2014 favored the later-maturing cool-season grasses such as oats (Everleaf126). At the same time, early maturing foxtail millet produced more than later-maturing species such as sorghum and sudangrass and their hybrids.

Soybeans, a warm-season legume, produced poorly, compared with cool-season legumes, for the same reason. Brassicas are cold-tolerant, short-season crops. The heading species can produce more than other species in favorable

growing season conditions such as timely rainfall and a long growing season.

Seeding date plays another big role in crop performance. The timing of seeding is another issue to be considered for different species. We seeded in the middle of July to avoid excessive soil moisture and because of other farm management needs such as haying and preparing to harvest small grains.

If we seed the annual forage species earlier, such as the middle or end of June (too late for corn and soybeans), annual warm-season grasses may produce more than cool-season grasses due to the longer growing season (two to four weeks longer). However, if we seed at the end of July (two weeks later than our seeding), annual warm-season grass production may suffer.

Dry matter content is an issue for late-season grazing that affects livestock performance. Annual brassica production is high; however, animal gain may suffer due to the low dry matter content. We can solve this problem by mixing brassicas with annual warm-season grasses and legumes that are not as cold-tolerant but have higher dry matter content. Comparing forage mixtures will be our next research objective.

Delayed seeding annual forages should have higher forage quality due to the low temperatures in the fall, and harvesting or grazing at earlier maturity stages. However, we need lab analysis to justify this hypothesis. We will analyze the quality of the samples and report quality data in 2015. One year's data cannot promise comprehensive results, so we will continue this study in 2015.