Our Experiences with Cover Crops

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Cover crops protect soils and plants against wind erosion. Producers using spring seeded cover crops are considering fall seeded cover crops to extend the window of protection against wind erosion in winter and early spring. Is it too dry to seed cover crops in fall 2021? Why consider fall seeded vs. spring seeded cover crops?

Key Points

1. Fall seeded cover crops protect against soil erosion caused by high winds in winter and early spring.
2. Cover crops may not germinate until rainfall when seeded into dry soil conditions and may not become established in the fall.
3. At this time, seeding rate should target protection from wind and water erosion and not waterhemp suppression.

Introduction

Producers in American Crystal Sugar Coop, Minn-Dak Farmers Coop and Southern Minnesota Beet Sugar Coop used spring seeded cover crops as a companion crop with sugarbeet on 49% of the sugarbeet acreage in 2015, according to results from the annual growers' survey of weed control and production practices (2016 Sugarbeet Research and Extension Reports, 47:7-17). Producers seed cover crops to protect sugarbeet from high winds or blowing soil. Cover crops, especially fall seeded cover crops, may also suppress waterhemp. Researchers at the University of Missouri reported fall seeded cereal rye suppresses waterhemp germination and emergence by 97% when cereal rye was terminated before stem elongation compared with no cover crop.

Our Current Knowledge of Spring and Fall Seeded Cover Crops

Much of our experience is with spring seeded cover crops. Barley, oat, and spring wheat were broadcast at 36, 32, and 45 lb/A and incorporated into the soil before sugarbeet planting in 2015 and 2016. However, cover crops need to be carefully managed after emergence at these seeding rates. Sugarbeet cooperative agriculturalists recommend terminating cover crops when sugarbeet are at the 2 to 4-leaf stage. Extension sugarbeet research supports their recommendation, especially considering time allotment for postemergence herbicide to kill cover crop (Table 1). Additionally, cover crop species are actively growing during spring weather conditions and create a mat of high albedo reflection that rob heat units from slower growing sugarbeet seedlings. Cover crops also create a very heavy below ground root mass, analogous to an 'iceberg' in ocean waters, that is competing with the sugarbeet plant for moisture and nutrients. Finally, cover crops will continue to protect sugarbeet seedlings from wind or blowing soil even after they have been terminated with herbicide. That is, the carcasses from dead cereal grasses will protect the sugarbeet seedling several weeks or until the sugarbeet plant is able to withstand wind and blowing soil.

Table 1. Sugarbeet yield, percent sucrose, and extractable sucrose in response to spring wheat timing of removal, Prosper, ND, 2015[a].

Sugarbeet stage at wheat termination	Wheat Height at Termination	Wheat Growth Stage	Yield	Sugar	Extractable Sucrose
no. of leaves	inches	NA	ton/A	%	lb/A
No Cover Crop	n/a		35.3 ab	17.0	11,051 ab
2	2	3	36.0 a	16.9	11,253 a
3	4	3	36.6 a	16.5	11,173 ab
4	6	4-5 (tillering)	35.5 ab	16.8	10,929 abc
5	8	Jointing	33.8 b	16.7	10,373 c
6	10-12	Jointing	34.0 b	16.9	10,644 bc
LSD (0.10)			1.6	NS	542
CV			5	3	6

[a]Means within a main effect not sharing any letter are significantly different by the LSD at the 10% level of significance.

Spring environmental conditions often dictate timing for cover crop establishment. Unfortunately, there are seasons when wind events occur before cover crop establishment. Thus, spring seeded cover crops is often a compromise between seeding rates, to rapidly establish ground cover, and termination date, to prevent interference and sugarbeet yield loss.

Stordahl and Dexter evaluated fall seeded cereal rye to reduce soil movement and to protect sugarbeet from wind from 1990 to 1992 at NDSU. Sugarbeet yield and quality was greatest when glyphosate was banded over the row at sugarbeet planting and when cereal rye seeded at 7.5 to 22.5 lb/A was terminated within three weeks of sugarbeet planting. More recently, fall seeded cover crops have been considered for weed suppression. Cereal rye at 50 lb/A suppressed hairy nightshade, common lambsquarters, and redroot pigweed better than winter wheat at 60 lb/A but weed suppression was confounded by incomplete cover crop burndown control in some treatments (Table 2).

Table 2. Visual weed suppression in response to cereal rye or winter wheat stubble, by cover crop termination date, Prosper, ND, 2017[a].

Termination date	Cereal rye	Winter wheat
	%	%
April 17	91 a	39 c
April 21	96 a	51 c
April 25	93 a	71 b
Mean	93 a	54 b
No Cover Crop	55 b	54 b
LSD (0.05)	**18**	**18**

[a]Means within a main effect not sharing any letter are significantly different by the LSD at the 10% level of significance.

However, seeding rates were too great. Cereal rye and winter wheat at 20, 40, and 80 lb/A, terminated at flag leaf emergence, reduced sugarbeet stand and biomass compared to sugarbeet planted without cover crop at Hickson and Moorhead in 2021 (data not presented).

Field Selection, Operations and Cover Crop Designs

I can think of at least three different scenarios where fall cover crops might shelter soils against losses caused by wind. I categorize them as follows:

- Cover crop after small grains and before sugarbeet.
- Cover crop after corn or soybean and before sugarbeet.
- Cover crop seeded between preharvest sugarbeet cut-outs and headlands and following sugarbeet.

At this point, we have the most knowledge and experience when cover crops follow small grains and proceed sugarbeet, mostly due to timing of small grains harvest, although we encourage producers to seed sugarbeet cut-outs and headlands to prevent blowing in sugarbeet stubble. Field preparation is conducted at the discretion of the producer. Most producers use two or three tillage operations. Fertilizer (NPK) is applied according to soil test, usually before the final tillage pass. A word of caution, tillage to level fields and prepare the seedbed is conducted with fall tillage. Spring tillage, after fall seeded cover crops, loosens soil for plant but usually is not designed to level fields or prepare the seedbed.

What type cover crop should I seed and how confident are you cover crop will germinate and emerge in these dry 2021 fall conditions? Cereal rye is seeded between 3 and 15 pound per acre. Cereal rye is a drought-tolerant small grain species so it should establish under dry soil conditions. If dry conditions prevent germination after seeding, cereal rye seed will remain viable and germinate later once there is adequate moisture. Seeding in late August to mid-September is preferred for cereal rye, although cereal rye should have enough fall growth to survive the winter and continue to grow next spring, if seeded before October 1. Winter wheat is rarely used for fall seeding by growers although we have had good success with winter wheat as a fall seeded cover crop in my research.

Consider herbicide rotation restrictions since our dry weather conditions likely reduced microbial degradation of soil residual herbicides. Iowa State University and the University of Wisconsin (www.ipcm.wisc.edu/download/pubsPM/2019_RotationalRestrictions_final.pdf) publish guidelines for herbicide rotational restrictions for cover crops under their environmental conditions but local conditions will influence microbial breakdown of soil residual herbicides and supersede recommendations in these regional publications.

I am aware of at least three techniques producers have used to apply cover crops in small grains stubble. They are:

- Broadcast cover crop seed uniformly across fields
- Broadcast cover crops in strips at intervals across fields
- Seed cover crops in rows between sugarbeet

Many producers broadcast cover crop with fall fertilizers or drill cover crop with an air seeder or planter. Cover crop usually is seeded less than 15 lb/A depending on broadcast technique. Probably the easiest way to seed cover crops is to add with fall fertilizer and have your ag-retailer broadcast with a floater (Figure 1). However, be certain your ag-retailer adequately mixes the seed and fertilizer before field application.


Figure 1. Cereal rye broadcast at 15 lb/A with fertilizer

Use a harrow packer to lightly till the field in spring before sugarbeet planting. A producer applied ethofumesate (Nortron, Ethotron, Willowood 4SC) over cover cereal rye in spring 2021 and used the harrow packer to lightly incorporate ethofumesate into the soil to finalize the seed bed for sugarbeet planting. Ethofumesate will not injure emerged cover crops.

Fall seeded cover crop broadcast across the field can create clumps that may affect sugarbeet seeding depth and uniformity of stands, especially when high speed planters are used to seed sugarbeet. An adaptation to reduce exposure is to broadcast cover crops in strips at intervals in fields (Figure 2). The distance between intervals is at the discretion of the producer. Those using this technique suggest strips should be seeded from 60 to 100 feet apart.

Figure 2. Cover crop broadcast in strips at 80ft intervals across the field in 2020.

In spring, a supercoulter was used to loosen soil before planting sugarbeet diagonally across the field. Planting configuration was designed to protect against wind exposure and to reduce planter 'bounce' during sugarbeet plant (Figure 3).


Figure 3. Sugarbeet planted diagonally across fall seeded cover crop.

Fall seeded cover crop was planted with the sugarbeet planter at approximately 3 lb/A (60,000 seeds per acre) using the sugarbeet plates and planter after fall tillage and fertilizer application. In the spring, field was prepared for sugarbeet planting using a super coulter after ethofumesate application. Finally, sugarbeet were seeded between cover crop rows (Figure 4).

Cover Crop Termination

Actively manage fall seeded cover crops, especially cereal rye, since they grow very quickly during our spring conditions. Cover crops extract excess moisture from the soils in a wet year but also extract much needed moisture from soils in a dry year, which affected sugarbeet germination and emergence in 2021 (Figure 5). Producers need to carefully manage cover crop growth and terminate cover crops in a timely manner. In 2021, most cover crops were terminated before they were 12-inch tall.

Actively managing the cover crops is especially important for producers that broadcast cover crop seed since some seed will be near sugarbeet. We suggest banding glyphosate or perhaps glyphosate plus ethofumesate over the sugarbeet row to ensure cover crop does not interfere with sugarbeet growth and development.

Cover crops were terminated with glyphosate at 28 to 32 fl oz/A alone or in tank-mixures in May, 2021 (Figure 6). Glyphosate provided slow and less than effective control of cover crop in research conducted in 2017 near Amenia, ND. However, the objective of the 2017 experiment was to terminate

Figure 4. Sugarbeet seeded between cover crop rows in spring 2021.

Figure 5. Cover crops extract moisture from the soil, opening the seed furrow after plant, Hickson, ND 2021.


Figure 6. Sugarbeet after cover crop termination.

cover crops before planting resulting in air temperature ranging from 48 to 62F when the glyphosate application was made.

A snowfall event occurred after application with one application timing. Glyphosate efficacy is best when daytime air temperatures are in the 60s or greater and night time temperatures are above freezing. That stated, using full glyphosate rates for control of cover crop is critical.

Conclusions and Recommendations

Fall seeded cover crops are an excellent technique to reduce winter erosion, especially in fields with fall tillage in preparation for 2022 sugarbeet planting. Fall seeded cover crops have been successfully established using several different techniques by producers. We recommend either winter wheat or cereal rye planted in late August to mid-September at less than 15 lb/A seeding rate. I realize many producers might consider cover crops seeded after corn or soybean harvest in late September in west central and possibly, southern Minnesota? I think in many years we would be okay with plantings at these calendar dates.

At this point, we do not recommend planting cover crops at greater seeding rates to suppress spring emerging waterhemp since the system has not been optimized. Cover crop must be actively managed in the spring as they will extract moisture from the soil, especially in dry environments. We recommend

terminating cover crops in the spring using glyphosate at full rates before they reach 12-inch height. However, spring conditions will dictate actual termination date.