THE EVALUATION OF COVER CROP ON YIELD AND QUALITY OF SUGARBEET

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Introduction/Objectives

Wind storms are quite common in the Red River Valley and many soils in this region are prone to blowing and crops of these soils are susceptible to wind damage and occasionally must be re-seeded if spring wind events occur before seedlings (especially sugarbeet seedlings) are large enough to resist wind and abrasion damage. Wind erosion problems persist in this area despite conversion of many farmers to less intensive plowing methods. The Red Valley of ND and Mn report that soil losses due to wind exceed 5 tons/acre/year for some soils (USDA, 2000).

Sugarbeet crops are negatively affected from wind storms in several respects. Damage ranges from minimal to complete and can result in a need to re-seed entire fields. Re-seeding is a particularly great ecomomic loss when Roundup Ready sugarbeet seed are used. The use of cover crops has become more widely adopted in ND and Mn as a way to reduce damage from wind events on soils that are prone to blow. Selecting a cover crop that is effective at reducing wind damage, is easy to manage and kill and will not compete with the crop for nutrients, water and light is critical for off-setting the extra time, effort and expense involved in the work of planting and managing the crop. It is also important to select a cover crop that can be purchased economically and may add additional available nitrogen is also desirable.

Materials and Methods

Three field experiments were established in the fall of 2008. One at a research site near Prosper, ND, A second near Amenia, ND, with cooperator Rich Cedarburg and a third location south of Amenia and west of Casselton, ND on land farmed by cooperator Herb Ulmer. Tillage and planting of the cover crops were done later than idea because of heavy rain and wet soil conditions in the fall of 2008. Fall cover crops were planted week of September 8 at all three locations. Spring cover crops were planted May 20 at Prosper and Ulmers and May 29 at Cedarburg's due to a very wet plot site.

Treatments ranged from 1)no cover crop check, 2)spring strip tillage check, 3)10 lb/a fall rye, 4)8 lb/a fall rye + 20 lb/a fall barley, 5)8 lb/a fall rye + 40 lb/a fall legume (arvika pea) 6) 36lb/a spring barley and one additional treatment of spring seeded oat was planted at the Ulmer and the Prosper research site. The pea used was arvika forage pea, selected because it grows quickly in the fall to provide more growth and nitrogen-fixing capacity than other legumes during the short growth period between cover crop planting and freezing.

The trials were planted into a smooth, moist to wet, seedbed in spring 2009. Planting dates ranged from May 21 at Ulmer's and Prosper and June 1 at Cedarburg's. Planting was arranged in a randomized complete block design with four replications. Individual treatment plots measured 11 feet wide and 30 feet long. Soil nitrogen levels were adjusted with fertilizer to approximately 130 lbs/acre of available residual soil test plus added fertilizer N.

Rhizomania resistant variety Hilleshog 4012 RR was planted with a John Deere MaxEmerge II planter. Sugarbeet was placed 1.25 inches deep, and was planted to stand at a 4 ½ -inch in-row seed spacing. A 22-inch wide row spacing was used. Counter insecticide was surface band applied at 10.9 lbs/A, and incorporated with a drag chain at planting. Stand count were taken after germination. Round up was applied three times for weed control. Two fungicide applications, Eminent and Headline were applied for Cercospora leaf spot control. Harvest of the middle two rows of each six row plot, was completed on October 10/2009. Yield determinations were made and quality analysis performed at the American Crystal Sugar Quality Lab, East Grand Forks, MN.

Results and Discussion

No major wind storms occurred at the research locations in 2009, so there was minimal representation of the benefit of cover crops for wind protection. Sugarbeet response to cover crop treatments differed between locations, so data is displayed separately for each of the three locations (Tables 1-3).

Table 1 displays effects of cover crop on sugarbeet yield and sugar quality at the Prosper location. Because of the poor seedbed created by spring strip tillage, the strip tillage treatment displayed significantly lower final stand and tonnage than other treatments. Despite having high sugar content and low loss to molasses, the strip tillage treatment still produced significantly lower RSA than any other treatment. This data indicates that spring strip tillage is not a recommended practice in the Red River Valley under typical early spring soil conditions. The spring oat cover crop resulted in lower sugarbeet root yield relative to other cover crops. Among cover crop treatments, the fall rye+barley resulted in good tonnage and greater net sugar than any other fall-seeded cover crop. Spring-planted barley and spring oats also resulted in high net sugar; spring barley displayed high root yields, but spring oats resulted in 1.6 ton per acre lower root yield than the check. In general, the best cover crop treatments at this location were fall rye+pea, fall rye+ barley, and spring-seeded barley.

Table 2 displays effects of cover crop on sugarbeet yield and sugar quality at the Casselton location. The fall rye+pea treatment gave the greatest sugarbeet root yield of all treatments at this location, resulting in 3-10% greater yield. Spring-seeded barley produced high root yield, as well, and additionally yielded high gross sugar content with low sugar loss to molasses (SLM), resulting in the highest net sugar content in the study (15.20%). These two treatments, fall rye+pea and spring-seeded barley, yielded the greatest recoverable sugar per acre (RSA) of any treatments at this location. As expected from the high tonnage, plant stand was also higher for these treatments than most other treatments. Strip tillage tonnage was similar to other treatments at the Casselton location, and was substantially better than measured at the Prosper site, but low gross sugar and high SLM resulted in low net sugar for this treatment, probably due to low and uneven sugarbeet stand, which, again, resulted from poor seedbed conditions in the spring strip tilled field. The best cover crop treatments at this location were fall rye+pea and spring-seeded barley.

Table 3 displays effects of cover crop on sugarbeet yield and sugar quality at the Amenia location. As seen at the other two locations, spring-seeded barley was a very promising cover crop at the Amenia location. It also yielded high sugar and low SLM, resulting in high net sugar, and the highest RSA and second-highest RST. Fall rye+pea performed well at this site, also providing high yields and high sugar. Strip tillage resulted in a root yield similar to the cover crop treatments despite a lower stand count at harvest.

Comments

In general, spring seeded cover crops resulted in greater plants per 100 feet of crop row at harvest. These crops were also observed to have greater seedling emergence after planting, perhaps as a result of breaking the soil crust ahead of the sugarbeet seedlings in the spring. Fall rye+barley and fall rye+pea were very good fall-seeded cover crops. Strip tillage performed poorly in this study, probably a reflection of the uneven seedbed created as a result of strip tillage that was performed in the spring.

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Table 1. Prosper Location - Main effect of cover crops and strip tillage on sugarbeet yield and quality compared to conventional chisel plow tillage; LSD values indicate the least significant statistical difference between treatments.

Treatment	Root Yield (Tons/a)	Sugar (%)	SLM (%)	Net Sugar (%)	RSA (lb/a)	RST (lb/ton)	Beets 100ft
Conventional	35.2	15.23	1.2500	13.98	9855	279.50	186
Strip Tillage	30.2	15.65	1.1375	14.51	8770	290.25	124
Fall Rye	35.2	15.25	1.3050	13.95	9815	278.90	174
Fall Rye + Barley	34.8	15.58	1.2050	14.37	9950	287.45	169
Fall Rye + Pea	35.6	15.10	1.2200	13.88	9867	277.60	166
Spring Barley	34.9	15.48	1.2425	14.23	9935	284.65	182
Spring Oats	33.6	15.38	1.2475	14.13	9470	282.55	191
LSD (P<0.10)	**2.48**	**0.427**	**0.0799**	**0.477**	**618**	**9.546**	**13**

Table 2. Casselton Location - Main effect of cover crops and strip tillage on sugarbeet yield and quality compared to conventional chisel plow tillage; LSD values indicate the least significant statistical difference between treatments.

Treatment	Root Yield (Tons/a)	Sugar (%)	SLM (%)	Net Sugar (%)	RSA (lb/a)	RST (lb/ton)	Beets 100ft
Conventional	36.4	16.19	1.1659	15.03	10937	300.53	155
Strip Tillage	36.0	14.87	1.2471	13.62	9799	272.41	134
Fall Rye	36.0	16.03	1.1674	14.86	10695	297.25	150
Fall Rye + Barley	35.8	16.09	1.1905	14.90	10664	297.99	162
Fall Rye + Pea	38.8	16.05	1.2429	14.80	11499	296.09	164
Spring Barley	37.5	16.28	1.0802	15.20	11387	304.00	178
Spring Oats	34.8	15.86	1.0955	14.76	10289	295.24	170
LSD (P<0.10)	**2.09**	**0.363**	**0.1093**	**0.445**	**647**	**8.896**	**12**

Table 3. Amenia Location - Main effect of cover crops and strip tillage on sugarbeet yield and quality compared to conventional chisel plow tillage; LSD values indicate the least significant statistical difference between treatments.

Treatment	Root Yield (Tons/a)	Sugar (%)	SLM (%)	Net Sugar (%)	RSA (lb/a)	RST (lb/ton)	Beets 100ft
Conventional	31.8	15.02	0.9643	14.06	8965	281.11	212
Strip Tillage	29.8	14.94	0.9587	13.98	8317	279.58	174
Fall Rye	30.0	14.98	0.9341	14.05	8425	280.97	224
Fall Rye + Barley	27.8	15.10	0.9225	14.18	7859	283.55	200
Fall Rye + Pea	29.3	15.42	0.9196	14.50	8502	290.01	233
Spring Barley	32.3	15.27	0.9337	14.33	9243	286.68	214
LSD (P<0.05)	1.85	0.484	0.0542	0.507	536	10.146	14