United States Department of Agriculture

2014 STUDY REPORT
Aberdeen Plant Materials Center, Aberdeen, ID

CORN/COVER CROP INTERSEEDING TRIAL

Derek Tilley, PMC Manager, Aberdeen Plant Materials Center
Marlon Winger, State Agronomist, Boise, Idaho

INTRODUCTION

Post-harvest silage corn fields leave little residue which leaves the soil surface exposed to wind and rain, and increases the risk of soil erosion. The interseeding of cover crops has been seen as a potential way to introduce highly productive species to cover the soil and reduce erosion potential (Bosworth 2006). Interseeded cover crops like clover and cereal rye have also been used to augment fall and winter grazing (Bosworth 2006).

In general, small-seeded species with vigorous growth characteristics like legumes and brassicas are suitable for in-season seeding. Commonly used species in corn interseeding include cereal rye and clover species. Cereal rye, however, is highly invasive in the Intermountain Region and is generally avoided by farmers (Ogle et al 2012).

Interseeding into silage corn poses several challenges. First, the cover crop species must be vigorous enough to produce useful amounts of above-ground biomass, while not inhibiting corn production. Second, the cover crops have to be seeded late enough in the growing season to not impede corn establishment but early enough that there is still ample sunlight penetrating the corn canopy for development of the cover crop. Mutch and Martin (2010) indicate that planting the V4 to V8 corn stage provides enough light penetrating the canopy for seed germination and establishment.

Interseeding is often done with specialized equipment so young corn plants will not be damaged. High-clearance or aerial seeding equipment is necessary if the cover crop seeding takes place after canopy closure. Aerial seeding is becoming more popular due to its ability to cost-effectively seed a large number of acres in a timely manner; however, timing is critical as broadcast seeding into standing corn can result in large quantities of seed falling into the corn leaf axils never reaching the soil surface (pers. obs.). In order to place seed more precisely, some growers have converted high-clearance spraying or detasseling equipment into cover crop seeders. To accommodate for lost seed and for low establishment rates typical of broadcast seeding, aerial and high-clearance methods require higher seeding rates compared to other establishment methods; in some cases, 50 to 100% more seed is recommended relative to drilling. (Ogle et al 2012)

Specialized equipment like the Penn State Cover Crop Interseeder and Applicator has been developed to plant directly into established corn (Roth et al 2014). The Interseeder plants multiple cover crop rows between 30 inch corn rows, and simultaneously applies nitrogen and herbicide. These methods have been shown to effectively establish cover crops in standing corn; however the equipment is costly and uncommon in the Intermountain West.

In this trial we seeded a low-cost, simple cover crop mixture into established corn using techniques and equipment familiar to southern Idaho farmers to evaluate biomass production and forage yields at 3 seeding rates with two seeding methods.

MATERIALS AND METHODS

Roundup-ready corn was seeded with Planet Jr seeders on May 15 at 36 inch row spacing. The corn was irrigated regularly and allowed to reach a height of 8 to 10 inches. Then Glyphosate was applied at 32 oz/ac on June 16 to control emergent weeds.

The cover crop mix used consisted of turnip, oat, red clover and field pea at three rates using two seeding methods (table 1). The drill treatment was seeded at 10 lbs/acre. The two broadcast mixes were seeded at twice and four times the drill rate (20 lbs/ac and 40 lbs/ac respectively). The rates used were reduced from standard full stand cover crop seeding rates to account for the space given to corn establishment. Clover seed was pre-inoculated by the seed vendor with the appropriate strain of rhizobium.

Table 1. Species used and seed rate (lb/ac)

Species	Drill	BC2X	BC4X
Turnip	0.4	0.8	1.6
Oat	5	10	20
Field pea	4	8	16
Red clover	1	2	4
Total Mix	10.4	20.8	41.6
Estimated Cost/ac	$5.90	$11.80	$23.60

On June 23, the cover crop mixes were drilled or broadcast between corn rows by offsetting the Plant Jr seeders. The drill seeding was planted to a depth of ½ to ¾ inch. Broadcast rows were seeded by dropping the seed on the soil surface and allowing a packer wheel to press the seed lightly into the soil. Each treatment consisted of four cover crop rows nested in 5 corn rows. Treatment blocks were arranged in a randomized complete block design with six replications. No additional fertilizer was added to the planting.

On October 27 a ten foot section of the middle two rows was harvested beginning at 30 ft and again at 60 ft in each plot. Timing of the harvest corresponded with typical corn harvests in Southern Idaho. Harvested material was air-dried or, in the case of turnip roots, oven dried prior to weighing. Data were analyzed using the Statistix 8 Analytical software and subjected to an analysis of variance with a significance level of $p<0.05$.

RESULTS AND DISCUSSION

Corn establishment was uniform however we did observe differences in corn height and color throughout the field. These differences did not correlate with cover crop treatments, but were more likely reflections of soil inconsistencies due to previous year's plantings and fertilizer applications.

No significant differences were observed between seeding treatments for any species or for the combined cover crop mix (table 2). Red clover established from all treatments but differences were not statistically significant ($p=0.15$). Total production of red clover was minimal ranging from 3 lbs/ac from the drill seeded treatment to 20 lbs/ac from the 2X broadcast treatment. Field pea and oat establishment was only observed in the drill seeded plots, but treatment differences were not significant (p=0.40 and 0.20 respectively). Establishment of field pea in the drill rows was poor and resulted in only 4 lbs/ac of useable biomass. Oat establishment was also uneven in drill rows and yielded only 44 lbs/ac. Turnip seed established from all planting treatments, but there was no significant difference in biomass production between the treatments (p=0.67). Turnip yields ranged from 620 lbs/ac from the BC2X treatment to 1030 lbs/ac from the BC4X treatment. Total production of the mix added between 640 lbs (BC2X) to 1028 lbs (BC4X) of useable forage (p=0.68).

Table 2. Dried biomass production after 126 days.

		Red Clover	Field Pea	Oat	Turnip	Total Mix
Drill		3	4	44	764	816
BC2X		20	0	0	621	640
BC4X		10	0	0	1017	1028
	P=	0.15	0.40	0.20	0.67	0.68

CONCLUSION

Using conventional equipment and providing no supplemental fertilizer, our cover crop treatments added 640 to 1030 lbs of above ground biomass. The additional ground cover would effectively reduce erosion potential or provide forage for livestock grazing.

Oat and pea, both large seeded species that are typically planted ½ to 2 inches deep, had no establishment from broadcast seeding. Seed of those species was too large to get incorporated into the soil and was likely eaten off the surface by birds or rodents. Broadcasting however was effective for establishing the small seeded turnip which produced the majority of the observed biomass with abundant leaf growth and a large edible root. Clover establishment was surprisingly poor. The total forage added by clover, oat and pea were minimal even in the drill seeded treatment.

Drilling the cover crop mix at 10 lbs/ac did not differ significantly in biomass production from broadcasting at 20 and 40 lbs/ac. If drilling equipment is available, this seems to be the most cost effective means of establishing a cover crop mix into standing corn. Our results indicate that high seed rates are necessary to compensate for lost seed and poor seed to soil contact resulting from broadcast seeding. However the doubling the broadcast rate from 20 top 40 lb/ac did not significantly increase forage production in our study.

Corn plantings are typically done with 22 to 30 inch spacing. The tighter corn spacing means less sunlight is able to penetrate through the canopy to the cover crop; however, 30 inch spacing has been shown to be sufficient for cover crop establishment (Roth et al 2014). We used 36 inch row spacing due to equipment limitations, and assumed the increased light would improve germination and biomass production. More testing is needed to determine the effect of various row spacing on cover crop and corn production.

It is possible to use conventional seeding equipment to establish cover crops between corn rows in Southeast Idaho. Relatively low rates of seed (10 to 40 lbs/ac) can yield significant biomass for erosion control and fall grazing. Seeding method should be considered when choosing species. Large, deep-seeded species should not be used in broadcast seedings.


Interseeded cover crop between corn rows on August 20 (58 days after seeding).


Broadcast seeded cover crop at 40 lbs/ac on October 9 (108 days after planting).


A large turnip provides good ground cover and valuable forage.

REFERENCES

Bosworth, S. 2006. Using Cover Crops in Corn Silage Systems. University of Vermont Extension. Accessed online. 17 Oct 2014. http://pss.uvm.edu/vtcrops/articles/CoverCrops_for_CornSilage_FS.pdf.

Mutch, D.R. and T.E. Martin. 2010. Incorporating Cover Crops into Corn Systems. Michigan State University Extension. Accessed online. 17 Oct 2014. http://www.covercrops.msu.edu/systems/corn.html.

Ogle, D.O., St. John, L., Stannard, M. and L. Holzworth. 2012. Technical Note 24: Conservation Plant Species for the Intermountain West. USDA-NRCS. Boise, ID, Salt Lake City, UT, Spokane, WA. 57 p.

Roth, G.W., Curran, W.S., Dillon, C., Houser, C. and W.S. Harkcom. 2014. Cover Crop Interseeder and Applicator. Penn State Extension. Accessed online. 17 Oct 2014. http://extension.psu.edu/plants/crops/soil-management/cover-crops/interseeder-applicator.