Interseeding cover crops

(adapted from Nutrient and Soil Health Management for Sweet Corn in Western Oregon, Sullivan, Peachey, Heinrich, Brewer and Donaldson, Jan 2020)

Background

Interseeding is the practice of seeding the fall cover crop when corn plants are small enough to allow sufficient light penetration for cover crop establishment. An interseeded cover crop is typically planted into corn in June or July instead of after corn harvest.

Grower goals for interseeding include:

- Establishing a cover crop without reducing corn yield,
- Maintaining acceptable weed control and
- Minimizing time and expense required for cover crop establishment.

Here we describe general findings from a series of interseeding trials conducted from 2015 through 2018.

Objectives

1. Evaluate cover crop biomass and N uptake with interseeding versus current practice (fall cover crop seeding).
2. Evaluate the suitability of interseeding in meeting grower goals for weed control and corn yield.
3. Evaluate the effectiveness of interseeding in reducing soil erosion.

Methods

Field trials were established in the fall of 2015–2018 at the OSU Vegetable Research Farm in Corvallis and in grower fields in the Willamette Valley. Cover crop species varied with field location and grower preference.

Cereals were interseeded with a high-clearance drill at the V6 growth stage for corn. Red or crimson clover was broadcast and then lightly cultivated to incorporate seed.

The performance of the interseeded cover crop was compared to alternative cover crop establishment methods: (1) no cover crop, (2) fall cover crop seeded with a drill after tillage to prepare a seedbed and (3) fall cover crop direct-seeded with a no-till drill. Not all of these management strategies were included in each field trial.

Biomass and N uptake of cereal and legume cover crops was measured at corn harvest, in December following corn harvest and in the following spring (prior to killing the cover crop).

Soil erosion within field plots was estimated by collecting soil and runoff water from microplots (Figure 10). Three microplots (11 square feet, 1 square meter) were placed within each cover crop treatment plot (approximately 300 square feet). Microplots were installed by pushing 6-inch metal strips into soil to a depth of 3 inches around the plot perimeter, leaving an opening on the downhill side to allow runoff to exit. Water was collected using a 1.5-inch diameter plastic pipe connected to a plastic tub. Runoff water volume and sediment weight in the tubs were measured following major precipitation events.

Photos: Ed Peachey

Figure 10. Microplots were used to estimate the effect of cover crop establishment method on soil erosion.

Results

Cover crop biomass with interseeding versus current practice (fall cover crop seeding)

Interseeded cover crops were successfully established in corn at the six-collar growth stage (V6; see figures 11 and 12). Cover crop seeding was also evaluated at the V4 and V8 growth stages at some locations (data not shown). In general, compared to the V6 seeding, the V4 seeding occasionally resulted in too much competition from the cover, while cover crop establishment was less successful with V8 seeding because of shading by the corn canopy. Growers (especially growers producing under organic certification) often preferred to interseed after V6, so that weeds could be controlled just ahead of corn canopy closure.

Fall growth and survival of the interseeded cover crops were strongly affected by October rainfall. Typical October rainfall occurred in 2015 and 2017, allowing the interseeded cover crop to grow successfully (Figure 13, page 23). Interseeded cover crop growth was limited in 2016 because of too much rain in October (13 inches) and in 2018 because of drought in October (less than 0.5 inch of rain).

Nitrogen uptake by interseeded cover crops

At corn harvest in September, interseeded cover crops contained less than 10 lb N/acre. In years with good fall cover crop growth, interseeded cereal cover crops contained 20–50 lb N/acre in aboveground biomass in December. Thus, the interseeded cover crop took up 10–40 lb PAN from the soil that would otherwise be subject to leaching (Donaldson, 2019).

Suitability of interseeding in meeting grower goals for weed control and corn yield

In conventional systems, successful in-corn weed control was generally achieved with postemergent herbicides such as Laudis and Impact (Group 27, 4-HPPD inhibitors) without affecting the cover crop stand. These herbicides have very little soil residual activity and allow most cover crops to establish. Broadleaf and grass weed control was good to excellent, but crabgrass was not controlled effectively by these herbicides in one trial. Soil herbicides such as Dual Magnum and Outlook will seriously injure most interseeded cereal cover crops. Atrazine also must be avoided. In organic systems, weed control was acceptable when cover crops were interseeded following

Photo: Ed Peachey

Figure 11. Triticale growth in March 2019 (left) when interseeded at V6 into 'Devotion' sweet corn. Corn yielded 12 ton/acre and was machine harvested.

Photos: Ed Peachey

Figure 12. Winter cover crop (mix of triticale and crimson clover) in mid-December 2017. Cover crop was interseeded at the six-collar growth stage (V6, left) or established after corn harvest by conventional tillage and seeding with a drill (right).

Photos: Ed Peachey

Figure 13. Growth of interseeded cover crops on April 11, 2016. Top to bottom: spring oats, crimson clover, triticale, Lana vetch. Cover crops were interseeded (Aug. 8, 2015) into organic sweet corn that was planted on July 8 (V8+).

cultivation at the six- to eight-collar growth stage for sweet corn.

Across field locations, corn ear yields with interseeding averaged from the same to about 5 percent lower than conventional yields. This amounts to a loss of 0.5 ton/acre of ear yield, assuming a typical corn yield of 10 ton/acre.

Reducing soil erosion with interseeding

Interseeded cover crops reduced soil erosion that accompanied the first heavy rains in the fall (figure 14). Reduced soil erosion with interseeding was particularly evident in years when fall seeding was delayed due to dry or saturated soil conditions.

Soil disturbance by fall tillage or by the no-till drill coulters (when direct-seeding in the fall) resulted in increased soil erosion (Figure 14). Soil was not disturbed in the fall in the interseeded plots or in the no-cover control plots, thereby limiting soil erosion.

Surface stormwater runoff was also reduced by interseeding. For the scenario shown in Figure 14, cumulative fall runoff (through Nov. 17) with interseeding was 60% of that for the no-cover control. With fall-seeded cover crops, cumulative runoff was 119%–123% of the no-cover control.

Conclusions

Interseeding is a viable method for reliable establishment of a winter cover crop. Interseeding transfers the work of cover crop seeding from fall to June/July. It is a good option to reliably establish a cover crop when corn harvest occurs after Oct. 1.

A high-clearance drill may be needed for interseeding cereals or other large-seeded cover crop species such as common vetch. Red or crimson clover can be successfully interseeded by broadcasting seed and lightly raking to establish seed-to-soil contact.

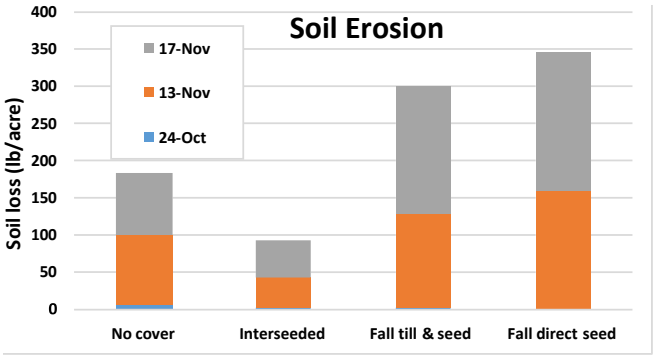

Figure 14. Effect of cereal cover crop establishment method on cumulative soil loss in the fall (through Nov. 17, 2017). Relative soil loss was estimated using microplots (Figure 10). Winter wheat was interseeded into corn at V6, was seeded conventionally (fall tillage and seeding) or was fall seeded with a no-till drill (direct-seeded). Wapato silty clay loam soil (3%–5% slope).

Interseeding reduces soil erosion and captures nitrate-N that otherwise would be lost during winter months to leaching. Cover crop biomass, measured in December, was always greater with interseeding than with fall seeding. Early fall soil cover is critical because severe soil erosion can occur in late October or in November.

Cover crop biomass in early April was often similar with interseeding or fall seeding. With interseeding, no cover crop is planted in the corn row, so only about 75% of the field surface area is planted, limiting production of spring cover crop biomass (Figure 15).

Triticale, winter wheat and oats were the most reliable cover crops for interseeding in this project. Triticale is especially well adapted to interseeding. It produces many tillers, covers soil rapidly and can survive extreme conditions (for example, seasonal flooding or freezing). Use of triticale or wheat as a cover crop may be prohibited by some corn processors due to concerns about allergen contamination of corn products by wheat or triticale by pollen or seed production before corn harvest.

Across field locations, corn ear yields were approximately 5% lower with interseeding than without interseeding. However, corn variety and other site-specific factors had a much greater impact on corn yield than did interseeding.

Successful interseeding requires adaptation of weed control practices. In conventional systems, most preemergence herbicides must be avoided or rates greatly reduced. In these trials, a combination of postemergence herbicides provided adequate weed control. In organic systems, where a final cultivation just before corn canopy closure is needed, consider using interseeding with corn varieties that produce less vegetative growth and less shading of the interseeded cover crop.

Acknowledgments

Financial support for the interseeding project was provided by the Meyer Memorial Trust, Oregon Processed Vegetable Commission, Western Sustainable Agriculture Research and Education and the Agriculture Research Foundation.

M.S. candidate Andrew Donaldson provided technical support.

Reference (interseeded cover crops)

Donaldson, A. 2019. Weeds with a purpose: interseeding cover crops into sweet corn in western Oregon. Master's thesis, Oregon State University, Corvallis. ir.library.oregonstate.edu /concern/graduate_thesis_or_dissertations /vd66w559b.

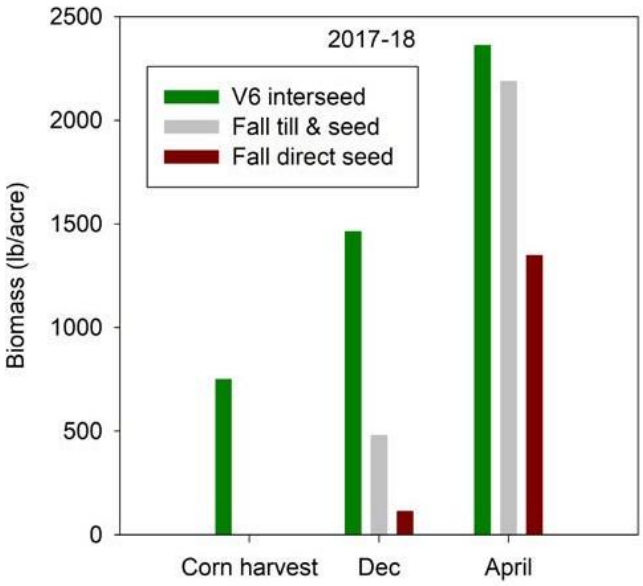

Figure 15. Biomass of cover crops at corn harvest (Sept. 7, 2017), in December and in the following spring (April 2018). The interseeded cover crop (crimson clover and triticale mixture) was drilled into corn at the V6 growth stage. Fall-seeded cover crops were drilled following conventional tillage or were direct seeded with a no-till drill on Sept. 28. OSU Vegetable Research Farm, Corvallis, Oregon, Chehalis silty clay loam soil.