

Growth of Rye, Oat and Vetch Cover Crops and Sweet Corn Yield

Betsey M. O'Toole, Stephen J. Herbert and Sarah Kelley
 Dept. of Plant and Soil Sciences

Nitrogen management in cover crop-sweet corn (*Zea mays rugosa* Bonaf.) systems is a dynamic process and requires the observation and analysis of N inputs and an assessment of the N recovery by the crop as is evidenced by the corn yield. Two years of data were collected in tracking spring growth of cover crop biomass and N concentration through the spring growth period prior to incorporation and preceding sweet corn planting, and sweet corn yield in this long-term experiment, where the same treatments of winter cover crops and sweet corn rotation were repeated on the same plots for 8+ years. The treatments consist of fall-planted cover crops [hairy vetch (*Vicia villosa* Roth), rye (*Secale cereale* L.), oat (*Avena sativa* L.)] and ammonium nitrate (NH_4NO_3) fertilizer in sweet corn ('Sweet Sal') production (Table 1). Ammonium nitrate fertilizer was applied as a sidedress application to the corn when the corn was 30 cm high. A low, medium, or a high seeding rate of hairy vetch was planted with oat and separately with rye, to help determine the most economical seeding rate. Treatments of hairy vetch + oat were planted to ascertain whether this combination was a superior replacement for a hairy vetch + rye companion planting. Rye is winter hardy; however, oat dies at the time of the first severe or killing frost.

Table 1. Cover crop treatments and N applied to the sweet corn crop.

Treatment	Seeding Rate			N applied [†]
	Vetch	Oat	Rye	
	kg ha ⁻¹			
1	20	40	0	0
2	30	40	0	0
3	40	40	0	0
4	20	0	56	0
5	30	0	56	0
6	40	0	56	0
7	0	0	0	0
8	0	0	90	0
9	0	0	0	140
10	0	0	90	140

[†] as NH_4NO_3 sidedress to the corn

The presence of rye in companion planting with hairy vetch caused vetch biomass to be suppressed, and reduced N contribution upon incorporation, compared to plots where vetch was planted with oat. Amount of N contributed by the hairy vetch residue did not increase with seeding rate at the time of cover crop incorporation in early June. Rye

biomass was significantly higher in plots where there had been a pre-sidedress N application to the corn in the previous year than in plots of rye + vetch with no added fertilizer N. Figure 1 shows a combined two-year analysis for cover crop N contribution at the final sampling date in each year. No significant differences in N contribution from rye occurred among treatments containing rye, but the amount of N contribution from vetch grown with oat was significantly higher than N contribution from vetch grown with rye. Based on this study, oat rather than rye is the preferred companion cover crop for hairy vetch and there is no benefit to increasing seeding rate of hairy vetch above 20 lb ac⁻¹.

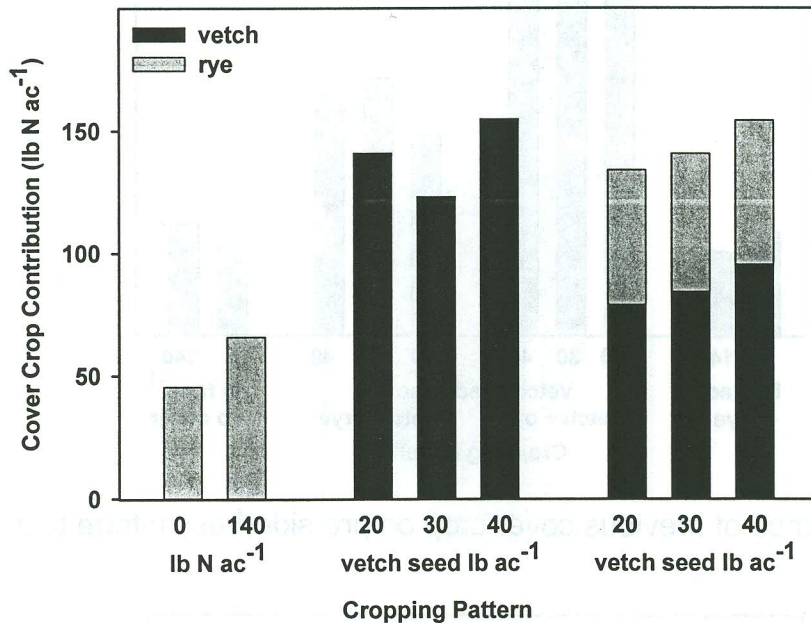


Figure 1. Nitrogen contributed by the hairy vetch and rye cover crops on the final sampling dates.

Use of the pre-sidedress soil nitrate test (PSNT) revealed that only the hairy vetch + oat treatments met or exceeded 25 mg NO₃⁻-N/ kg soil, which is the recommended sufficiency level for sweet corn (Figure 3). This again supports the conclusion that oat is the preferred companion cover crop for hairy vetch in long-term cropping sequences with winter cover crops.

Corn Yield

Corn yield measurements were taken at harvest and analyzed to determine which cover crop treatment resulted in the highest corn yield. Marketable ear number is most often used as a unit of measure for yield of sweet corn. Five dozen ears or 19 kg equals one crate. Marketable ear number showed (Figures 3 and 4), as in earlier years, that the hairy vetch + oat treatment replaced the need for chemical N fertilizer. Generally, sweet corn yield from vetch + oat plots was greater than or equal to plots without a cover crop and which had a sidedressed application of 140 lb N ac⁻¹ to the corn. Also, there was

no significant increase in sweet corn yield with an increase in seeding rate of hairy vetch above 20 lb ac⁻¹. Treatments of vetch + oat gave higher yield than treatments of vetch + rye. Fertilizer N sidedressed plots produced higher marketable ear mass yield than unfertilized plots, with rye or without cover crop.

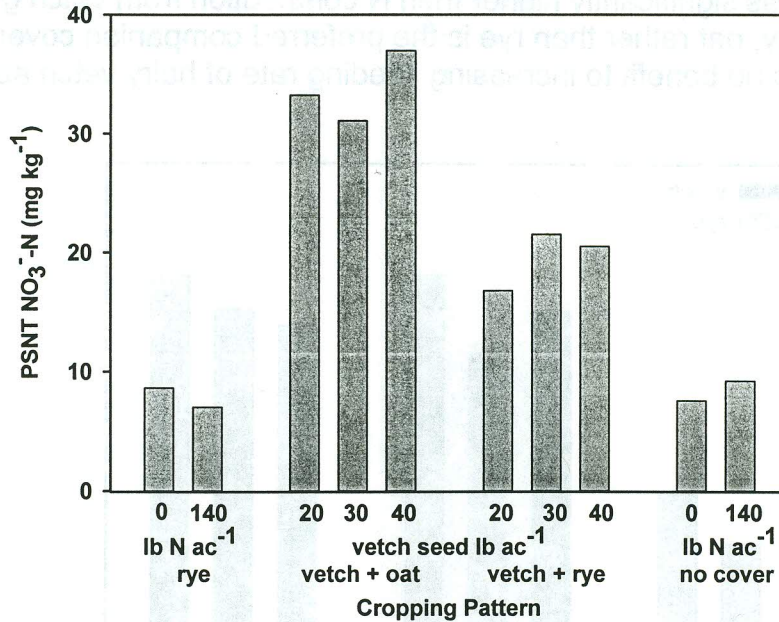


Figure 2. Influence of previous cover crop on pre-sidedress nitrate test.

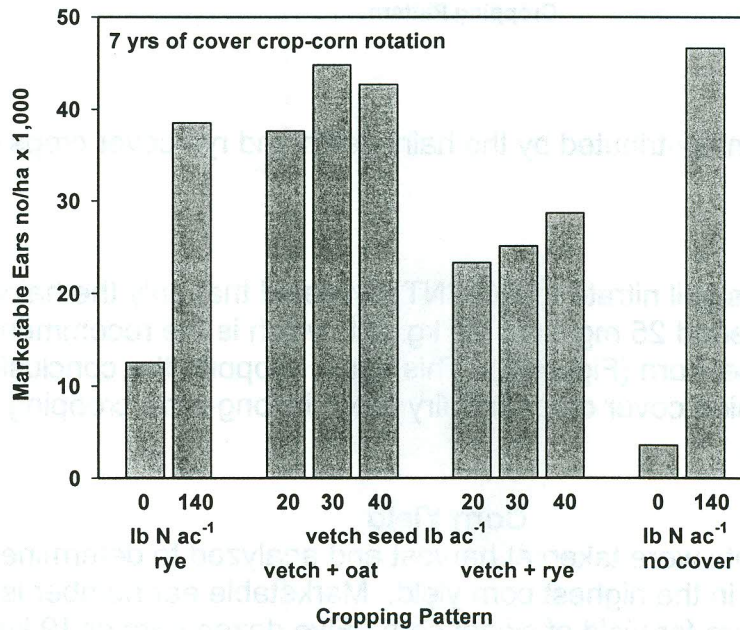


Figure 3. Marketable ear number in the 7th year of a cover crop-corn rotation.

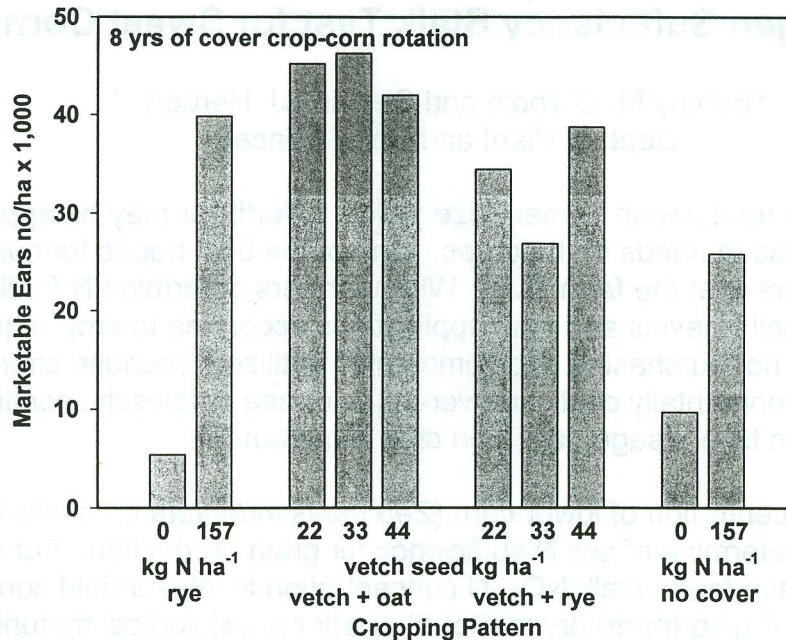


Figure 4. Marketable ear number in the 8th year of a cover crop-corn rotation.

In conclusion, vetch has positive benefits for the growth of sweet corn. Productivity following vetch is better than following fertilizer N with or without rye. Also oat was found to be a better companion crop for vetch than rye. Our results support findings by other researchers that yield in grain corn was greater following hairy vetch than following rye-containing cover crops, regardless of cover crop management method. Also, in work performed by other researchers, corn grain yields were not significantly different between treatments of hairy vetch plowed under without added N fertilizer and treatments of corn residue or rye plowed under with fertilizer N. However, they found that the addition of fertilizer N (to corn) in treatments where hairy vetch was grown as a cover crop increased corn grain yield significantly, whereas we found no added benefit from fertilizer N.