

Nitrogen Leaching Patterns and Yield in Corn-Cover Crop Rotations

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Field experiments were initiated to determine the impact of rye and vetch cover crops, and their mixtures, on nitrate leaching, when rotated with sweet corn. Legumes seeded in combination with a cereal or alone will contribute nitrogen to the succeeding crop from the nitrogen fixation process. Also, a cereal winter cover crop reduces the potential for nitrate leaching by extracting water and absorbing nitrates that remain in the soil after the cultivated crop is harvested.

Cover crop-sweet corn rotations have been maintained on the same plots with the same treatments in this experiment since the 1990-91 season. The soil is a low organic matter fine sandy loam (coarse-silty, mixed, nonacid, mesic Typic Udifluent). The experiment is a comparison of N contribution from hairy vetch to contributions from rye and no cover, and the assessment of nitrate-N leaching with varying N fertilizer rates on sweet corn. From 1991 to 1994 hairy vetch was seeded in a mixture with winter rye. After four years of cover cropping with vetch-rye, we observed rye becoming more competitive, probably because of increased availability of soil nitrogen. Thus, in September 1994 we seeded vetch with oat to reduce the interspecific competition in spring since the cold winter temperatures kill oat.

The cover crop-corn treatments in 1994-95 were check (no cover crop), rye (1.12 lb/ac), and hairy vetch + oat (40 + 56 lb/ac) in combination with four nitrogen rates applied to the sweet corn crop (0, 60, 120, and 180 lb/ac). The sweet corn hybrid "Sweet Sal" was used as a bioassay for nitrogen response. Soil nitrogen status has been assessed by sampling plots, at varying soil depths and times during the growing season. Porous cup suction lysimeters were installed at depths of 2 and 4 feet for collection of water samples for nitrate-N analysis.

Five years of research at the University of Massachusetts have demonstrated that significant reductions in nitrogen fertilizer use can be achieved with the use of hairy vetch cover crops (Fig. 1). In this year without competition from rye, hairy vetch cover crops supplied sufficient N to sweet corn so that N fertilizer could be eliminated.

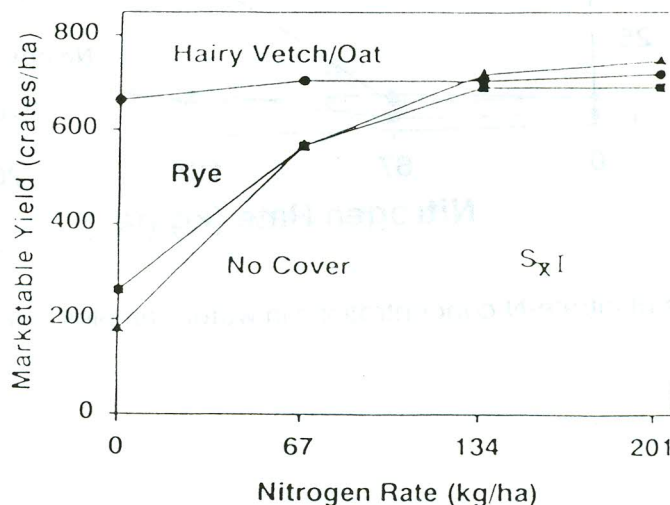


Figure 1. Yield of sweet corn in 1995 after incorporation of cover crops in late May.

Nitrate-N in soil water was low in all treatments for spring and summer water samples (Fig 2) However in the fall nitrate-N in soil water was above the clean water standard (10 ppm) in the hairy vetch and no cover crop systems when added fertilizer to the sweet corn exceeded 60 lb/ac (Figs. 2 and 3). Thus, if farmers are to take advantage of hairy vetch as an alternative N-fixing cover crop, they must be prepared to cut back on or eliminate the use of applied synthetic N fertilizer. This has both economic and environmental benefits. Failure to do so will result in wastage of fertilizer and pollution of ground water.

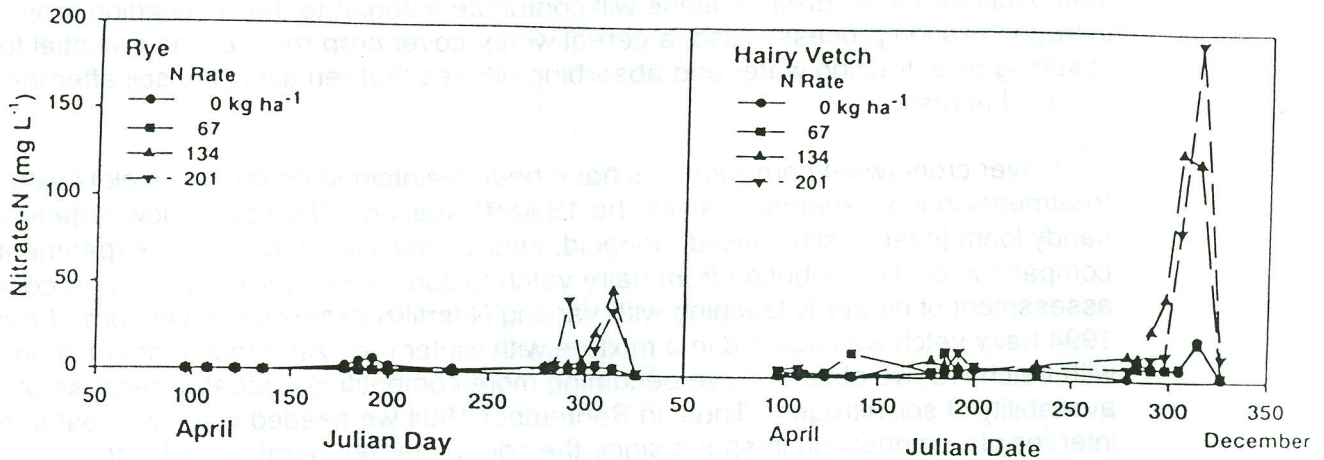


Figure 2. Nitrate-N concentrations for water at each sampling date, collected spring to fall.

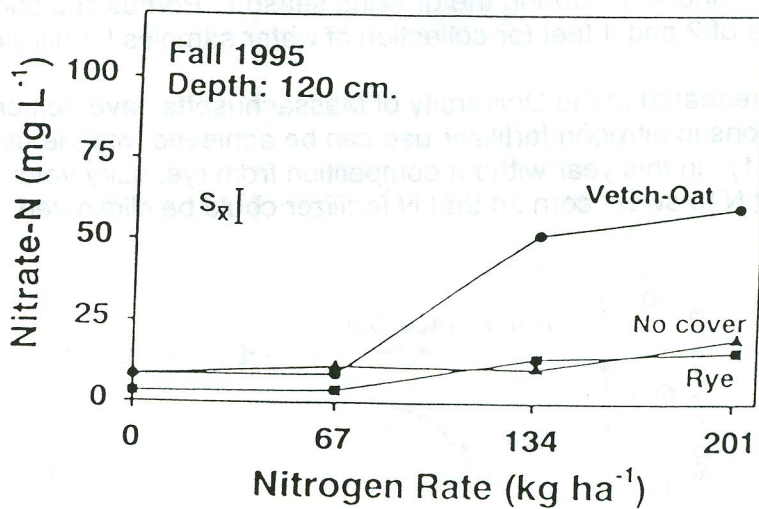


Figure 3. Means of nitrate-N concentrations in water samples collected in fall 1995.