

## Cover Crop Systems for Reducing Herbicides and Nitrates in Groundwater

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The possible leaching of agricultural chemicals into the groundwater is of great concern in farming systems. The public is very much aware of the recent groundwater contamination of Temik and EDB (ethylene dibromide) here in Massachusetts. Many herbicides and nitrate also pose an environmental hazard because of their potential to leach from the root zone and percolate down into the groundwater. The high rates of nitrogen used in corn and vegetable crop production are also of concern because of the inherent mobility of nitrate in soil. In addition, erosion of top soil from these annually tilled fields has the potential to pollute surface waters with both pesticides and plant nutrients. The public regulatory agencies are intent upon actions to preclude any further contamination.

Erosion from continuous corn can be reduced by 60% when winter cover crops are used, and to an even greater extent when coupled with conservation tillage practices. The effective use of cover crops in the fall can remove from the soil much of the nitrogen that was not taken up by the previous crop. This will reduce the potential for nitrate contamination. An added benefit to cover crops is that they can 'smother' weeds and with certain cover crop species there is release of alleochemicals that inhibit the germination and growth of many weed species. Legume cover crops can further reduce nitrogen fertilizer input by their ability to fix atmospheric nitrogen.

Improved cover crop systems are needed to improve establishment in the short fall growing period before winter. The importance of early seeding is shown in Figure 1. Oats establish slightly faster than winter rye in the fall but are killed by freezing temperatures in winter. Even though rye may make considerable spring growth, soil will be left exposed for much of the winter and spring if rye is not seeded early.



Figure 1. Growth of Ogle oat seeded every 10 days beginning August 26, with the last seeding October 5. Samples photographed November 4.

We are examining alternative cover crop strategies using biological and mechanical control mechanisms that will lessen dependence on herbicides and inorganic nitrogen. Species examined previously in preliminary studies have been hairy vetch, lupine, oat and rape. Current field studies will compare several potential cover crop species, including three vetch species (hairy, lana, purple), lupine, subterranean clover, Austrian pea and oat, with winter rye and no cover controls. In these experiments corn will be grown as a bioassay crop under conditions of full and reduced nitrogen fertility and herbicide rates. Cover crops will be examined for winter survival, biomass accumulation, weed suppression and nitrogen contribution. Cover crop establishment studies will examine methods for early seeding, seeding rates, seeding dates and nitrogen nutrition, nitrogen recovery and adequate cover for protection of soil from erosion.

Cover crop studies in 1989 that have been established include:

1. Nitrogen recovery and contribution and weed suppression by rye and hairy vetch plus rye cover crops (Five experiments).
2. Early seeding for fall growth and nitrogen contribution for early spring crops.
3. Seeding date comparison for cover establishment, nitrogen contribution, mow killing susceptibility and weed suppression.
4. Interaction of cover crop seeding density and nitrogen contribution.
5. Establishment of cover crops by overseeding.
6. Subterranean clover winter survival.