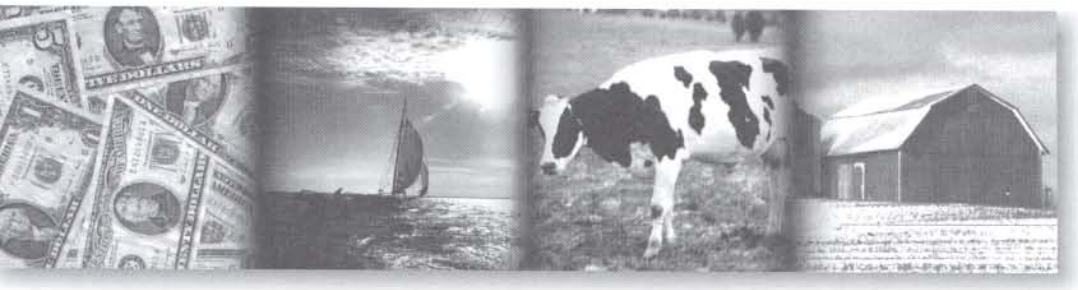


MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK • EASTERN SHORE

VOLUME 2,
ISSUE 2
WINTER 1995

NUTRIENT MANAGER

Newsletter of the Maryland Cooperative Extension Agricultural Nutrient Management Program

FOCUS ON COVER CROPS

Heavy rainfall that saturates fields and moves down through the soil profile can cause nitrogen to leach below the root zone, away from plants, and possibly into ground water and the Chesapeake Bay. Nitrogen loss not only wastes farm dollars, it also threatens water quality.

CONSERVING NITROGEN

Before Harvest

From the time a corn crop is planted until it is approximately a foot tall and the canopy starts to close, leaching can be substantial. From canopy close until fall harvest, leaching is minimal. Farmers can minimize losses that may occur before the canopy closes by carefully balancing a crop's nitrogen needs with available soil, fertilizer, legume, and manure nitrogen sources. Soil testing, manure analysis, split-application, and pre-sidedress nitrate testing (PSNT) are nutrient management tools that can help farmers use their hard-earned dollars efficiently. The goal is to apply the right amount of fertilizer, where it is needed, when it is needed.

After Harvest

Under favorable conditions, a corn crop will take up approximately 60 percent of fertilizer nitrogen. Under adverse conditions, such as drought, unused soil nitrate levels can be high, especially when fertilizer nitrogen rates are excessive. This means there may be a considerable amount of leftover, or **residual nitrogen**, usually in the water-soluble form of nitrate, in the field after harvest. When there is no winter crop to utilize it, nitrate can leach from fields. **Farmers can keep nitrate from leaching during the winter by planting a winter cover crop to conserve residual nitrogen in roots and top growth.**

WHAT EXACTLY IS A COVER CROP?

A cover crop is a living ground cover that is planted in the fall following a main, or summer, crop. If the cover crop is grown to take up excess soil nitrogen, it is not fertilized. The cover crop may be grazed during the winter or harvested as haylage the following spring. It can be killed by plowing under or with a contact herbicide before planting the main crop.

Many farmers use a cover crop to protect soil from wind and water erosion over the winter. Paul Petersheim of Fox Hollow Farm in Garrett County raises corn for feed, vegetable crops, and registered Jersey cows. He believes strongly that the accumulation of organic matter

and winter erosion protection from cover crops improves the overall performance of the soil.

In addition to protecting the soil, cover crops can also be chosen and managed for their **water quality benefits**. A cover crop can provide water quality protection in two ways: (1) by scavenging nitrogen out of the soil and recycling it into plant material, and (2) by holding some soil water, and the nitrate in it, in the root zone.

Just a Few of the Numerous Benefits of Cover Crops

Water Quality Protection—Leachable soil nitrate is conserved within the roots and top growth of cover crops, especially grasses.

Soil Erosion Protection—Roots anchor soil and top growth slows water and wind movement.

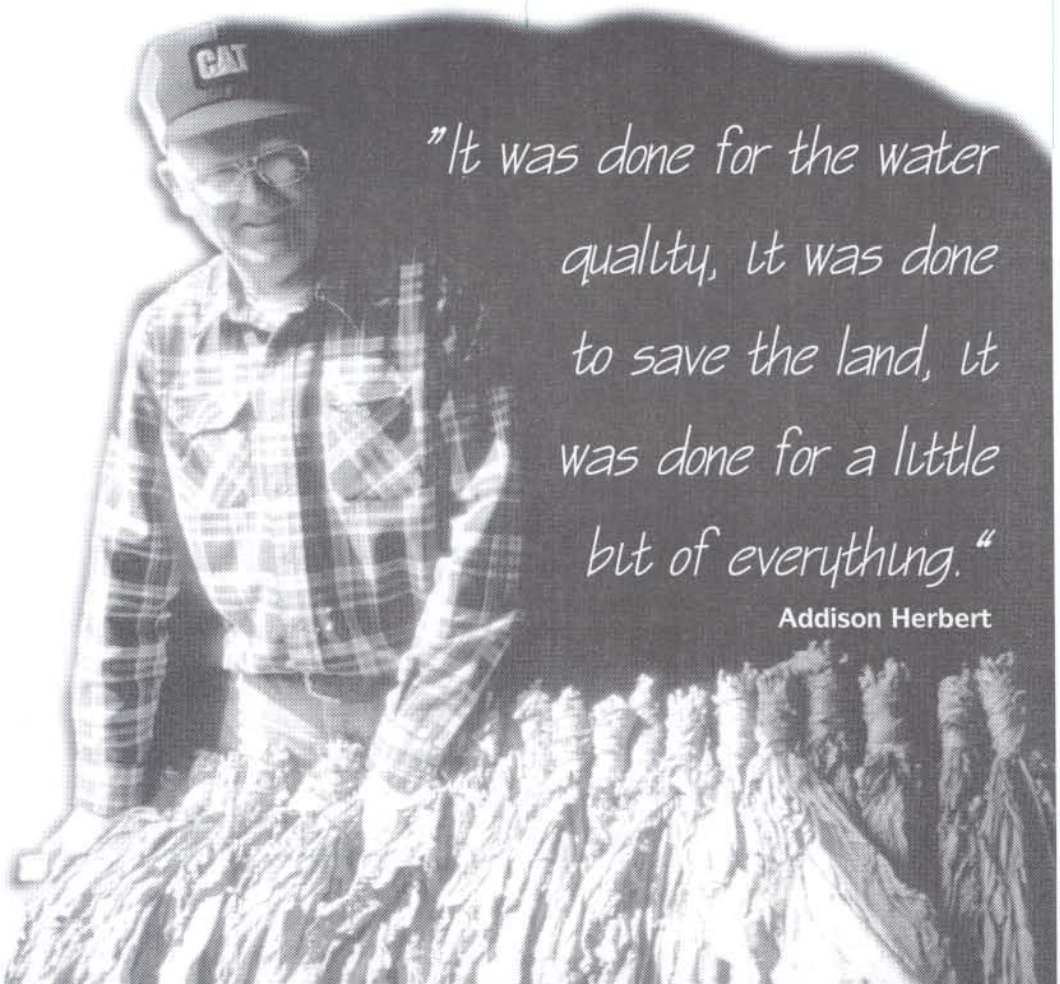
Soil Tilth Improvement—Roots and top growth contribute soil organic matter, which improves water-holding capacity, fertility, aeration, and microbial activity.

Soil Moisture Conservation—Cover crop mulch left on the soil surface reduces runoff, which increases water infiltration, and shades the soil, which reduces evaporation.

Addison Herbert has been growing tobacco followed by a rye cover crop in Charles County for more than 40 years. Over that time, he has seen attitudes toward cover crops change. "My dad [and other farmers], years and years ago, they didn't believe in cover crops. They cut tobacco off and that was it.... You'd go out sometimes in the spring and have these little channels where the water was taking the soil away. So, I started planting cover crops...to save the soil, plus it helps use some of the nutrient and what's left over from tobacco... some of the nitrogen...." Mr. Herbert also recognizes many of the other benefits of planting a winter cover crop. "It was done for the water quality, it was done to save the land, it was done for a little bit of everything. That's why we plant it."

Cover Crops and Water Quality Research

Corroborating what local farmers have found, agricultural research in Maryland indicates that cover crops protect water quality. A 2-year study conducted at the Lower Eastern Shore Research and Education Center (LESREC) at Poplar Hill near Salisbury reported that, following a heavily fertilized corn crop, a rye cover crop reduced the concentration of nitrate in shallow ground water from 17 parts per million (ppm) to 12 ppm, or 29 percent, compared to no cover. (The U.S. Public Health Service recommends that nitrate in ground water not exceed 10 ppm.)



Decisions

A farmer must make management decisions that fit a cover crop into the crop rotation system. The cover crop must provide one or more benefits (for instance, taking up residual nitrogen or reducing soil erosion), without adversely affecting the main crop's performance. The unique conditions of each farm, such as climate, soil type, crop rotation, and equipment, will influence the selection and management of the cover crop. There are four major decisions associated with successful cover crop usage:

1. What crop to plant
2. When to plant it
3. How to plant and manage it
4. When and how to kill it

Decision Number One: How to Choose a Cover Crop

The first and most critical management decision is the selection of the best cover crop for each field in the cropping system. Of the numerous grass and legume species evaluated in Maryland for their nitrogen uptake, nitrogen contribution, fall growth, early soil coverage, disease and insect resistance, and winter hardiness, **cereal rye, wheat, hairy vetch, crimson clover, and Austrian winter peas** were found to be best suited for this region's conditions.

Cereal rye, a grass cover crop, scavenges residual nitrogen more effectively than other annual grass or legume cover crops because it has greater winter hardiness, produces more winter growth, and has a more extensive root system. When the residual soil nitrogen level is known to be high and water quality protection is the major goal, a grass cover crop should be chosen. If the residual soil nitrogen level is known to be low, a pure legume

COVER CROP	Pure Legume Stand	Pure Grass Stand	Grass/ Legume Mixtures
BENEFITS	*Provides nitrogen for the crop that follows it *Provides substantial mulch	*Excellent nitrogen scavenging ability *Tolerant of low temperatures *Variable mulch cover depending on residual nitrogen	*Good strategy for combining a reduced level of nitrogen conservation with some nitrogen contribution to following crop *Summer moisture conservation is greater than grass alone *Immobilization is less than grass alone
CONSIDERATIONS	*Less effective than grasses as a nitrogen scavenger *Kill date is important	*Provides little nitrogen to the following crop *Kill date is important *Typically requires 25 to 50 pounds of starter nitrogen for subsequent crop due to immobilization	*Does not provide as much nitrogen as pure legume stand or conserve as much nitrogen as pure grass stand

crop, such as hairy vetch, should be selected.

Residual Nitrogen and a Grass/Legume Cover Crop Mixture. Unfortunately, due to the dynamic nature of nitrogen in the soil, a farmer cannot know how much leachable nitrate is present following the fall harvest of the main crop. A grass/legume mix provides some of the nitrate scavenging benefits of a pure grass with some of the nitrogen contribution of a legume.

Pure grasses, pure legumes, and grass/legume mixes all have benefits and drawbacks. Grass/legume mixtures are self-modulating, that is, **under high nitrate conditions, when ground water quality could be at risk, the grass component of the mix will outcompete the legume component, utilizing excess nitrate. In a nitrogen deficient system, the legume component will outcompete the grass and provide nitrogen through nitrogen fixation.** For example, studies at the Central Maryland Research and Education Center (CMREC) and the LESREC show that in a hairy vetch/cereal rye mixture, as fertilizer nitrogen levels increase, the uptake of nitrogen by the hairy vetch component of the mix decreases and the uptake of the nitrogen by the rye component increases. See Figure 1, "Amount of nitrogen in rye and vetch when grown together.

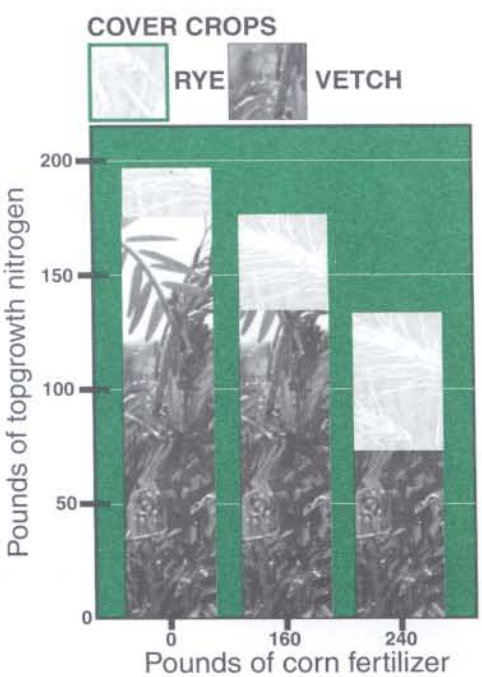


Figure 1. Amount of nitrogen in rye and vetch when grown together.

Decision Number Two: When to Plant a Cover Crop

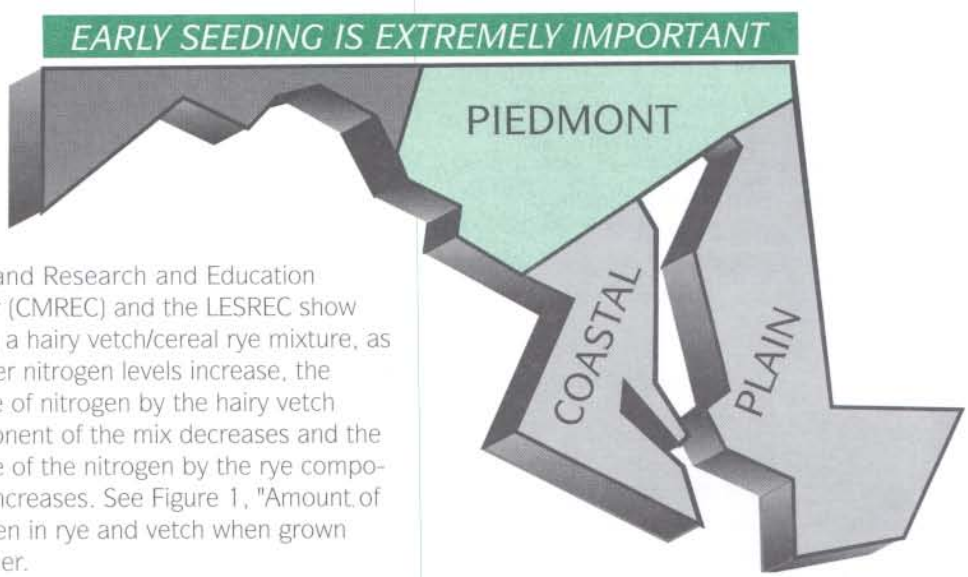
Seed as early as possible for maximum ground coverage, nitrate uptake, root and foliage growth, winter hardiness, and enhanced spring regrowth. The goal of early planting is to lengthen the time the cover crop is actively taking up nitrate and protecting the soil. Grasses can be seeded later than legumes because of their greater winter hardiness, but planting too late sacrifices cover and uptake time. Choosing an early maturing corn hybrid or harvesting corn as silage may give a farmer more flexibility. Optimal planting dates for the three typical cover crop categories are

	Piedmont	Coastal Plain
Pure Grass Stand	9/10–10/1	9/20–10/15
Pure Legume Stand	9/10–10/1	9/20–10/15
Grass/Legume Mix	8/20–10/1	9/1–10/15

Decision Number Three: How to Plant and Manage a Cover Crop

Grass and vetch can be seeded using a conventional or no-till drill or by broadcasting. Chiseling or light disking before conventional drilling or broadcasting is recommended. Drilling produces more consistent stands than broadcasting even if it is delayed until after corn harvest because broadcasting cannot ensure good seed-to-soil contact.

Generally, there is a sufficient nutrient supply from the previous crop for adequate cover crop establishment and growth. **Addition of nitrogen fertilizer in the fall defeats the purpose of utilizing a cover crop for water quality protection.** However, cover crop establishment is an ideal time for lime addition.



Cover crops can be grazed or clipped during the growing season. Periodic removal of top growth stimulates nitrogen fixation in legumes. Removal of excessive growth reduces foliar disease. When the

cover crop is grazed, 60 to 70 percent of the nitrogen and potash are returned to the field as manure.

Decision Number Four: When and How to Kill a Cover Crop

Timing is everything. **Kill grasses by early April. Kill legumes by late April or early May.** Cover crop spring kill dates are extremely critical. The goal should be to kill late enough to maximize legume nitrogen fixation and grass soil nitrogen recycling while minimizing soil moisture depletion. Studies at LESREC and CMREC indicate that the soil moisture conservation benefits generated by a cover crop mulch in the summer outweigh any detriments from soil moisture depletion a cover may cause early in the spring.

Chemically killing a cover crop maintains a moisture-conserving residue. Consult your county agent or University of Maryland Agronomy Mimeo No. 34, March 1992, for specific herbicide recommendations.

Immobilization

Microorganisms that are consuming mature grass material need nitrogen. They will consume, or immobilize, soil nitrogen plus some fertilizer nitrogen. To reduce immobilization do any one of the following three things: wait 5 to 15 days after killing a grass cover before planting the main crop; plant a grass/legume mixture; or kill a grass when it is less mature.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, University of Maryland, College Park, and local governments. Thomas A. Fretz, Director of Maryland Cooperative Extension, University of Maryland.

ALLEGANY COUNTY
112 Baltimore Street, Suite 204
Cumberland, MD 21502
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HOME AND GARDEN INFORMATION CENTER
12005 Homewood Road
Ellicott City, MD 21042
1-800-342-2507

Nutrient Manager is published by Maryland Cooperative Extension, University of Maryland College Park and University of Maryland Eastern Shore. This issue was co-authored by former Communications Coordinator Elizabeth Kirchner-Parr and is in its third printing.The masthead sailing photo is courtesy of Skip Brown.

Patricia Steinhilber
Program Coordinator

Jennifer Salak
Communications Coordinator

Address comments about this newsletter to
Nutrient Manager, NRSL
ANMP, Plant Sciences Building
College Park, MD 20742-4452
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August, 2001

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