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Nutrient Management Program

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Nutrient Management Program

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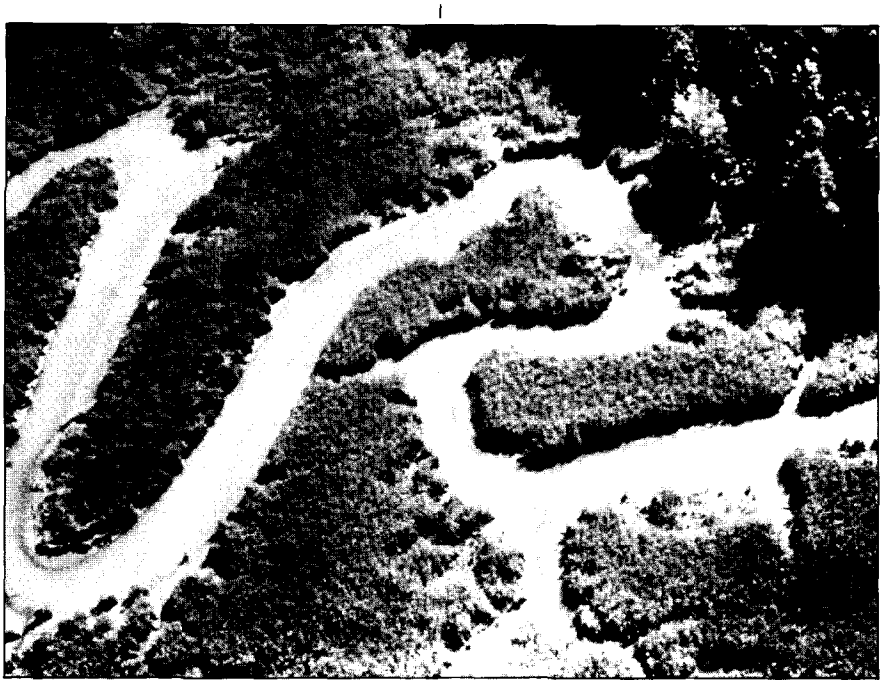
Nutrients and the Chesapeake Bay



Controlling the nutrient and sediment loads from Agriculture is crucial to Virginia's water quality program.

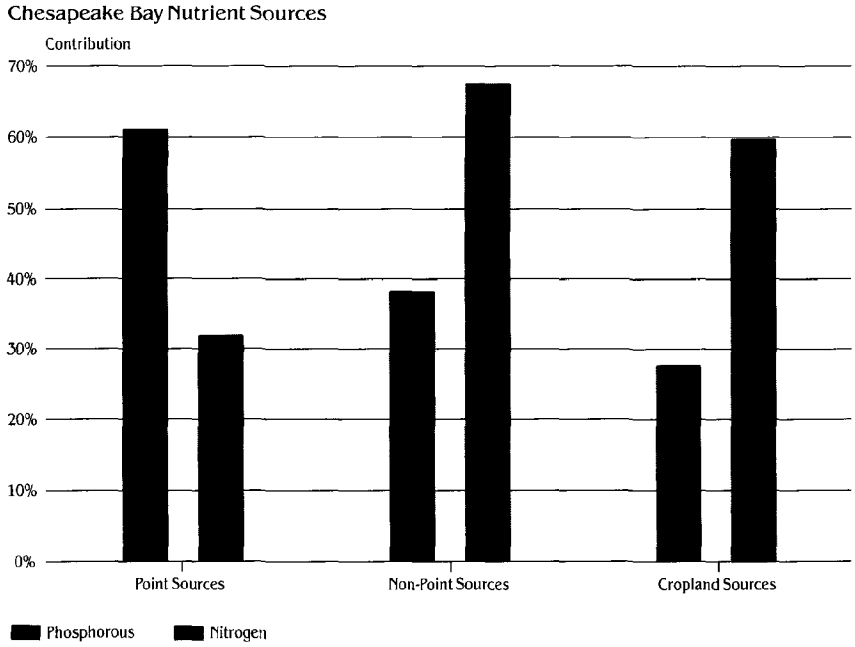
In 1983, a $27 million, six-year study by the U.S. Environmental Protection Agency revealed that runoff from farmland is contributing to water quality decline in the Chesapeake Bay. Other studies have shown that many other state waters are damaged by this form of pollution—termed nonpoint source (NPS) pollution—and that agricultural practices adversely affect groundwater as well as surface water.

NPS pollution doesn't come from a single point such as a sewage outfall or industrial discharge pipe. Nonpoint source (NPS) pollution includes excess nutrients, pesticides, sediment, heavy metals and toxic substances that, if not controlled, harm our environment and, potentially, human life itself.

Nutrients—in particular, phosphorus and nitrogen—are a major component of the agricultural NPS pollution problem. Bodies of water can tolerate a certain level of nutrients. In fact, life within rivers, streams, lakes and bays could not exist without nutrients. But too many cause ecological problems and can harm aquatic life. It is estimated that 67% of the nitrogen and 39% of the phosphorous entering the Bay originate from nonpoint sources *(see Fig. 1)*. Cropland agriculture itself is estimated as producing 60% of the nitrogen and 27% of the phosphorous entering the Bay. Every time it rains, another dose of these nutrients enters our waterways and further degrades the environment for the aquatic life within.

To assist in the reduction of agricultural NPS pollution in the bay, the Department of Conservation and Recreation,

Fig. 1 Agricultural sources contribute significantly to the nutrient load in Virginia's waters.



Division of Soil and Water Conservation (DSWC) developed a nutrient management program. The program helps farmers manage crop nutrients effectively. The goal of the program is to improve water quality in the Chesapeake Bay watershed.

The state program's primary focus is on water quality improvement not production. Still, as with many conservation activities, good nutrient management is also good economics. Nutrient management planning has proven profitable for many of Virginia's agricultural producers.

Commercial fertilizer management

Often more fertilizer is used than is necessary and is applied at a less effective stage of plant growth. Economically and environmentally sound commercial fertilizer management is based on these concepts:

- fertilizer application rates are based on soil test results and crop nutrient needs,
- the timing and method of fertilizer application maximizes crop uptake, and
- credit is given for the nutrients provided by previous crops and mineral fertilizers.

The first and most important step in nutrient management is to determine the fertility level of the soil by analyzing soil samples. Specific soil sampling techniques are required for accurate results. These sampling techniques include taking several random subsamples from an appropriate sampling depth. The subsamples are combined for analysis. At least one composite sample for every 10 acres of cropland is needed for a representative analysis.

Then a realistic yield expectation for the crop is determined. The yield potential may vary significantly by field due to the inherent productivity of each soil type *(see Fig. 2)*. Planning based upon the soil's productivity level takes this fact into account. The yield potential, soil test results and the specific crop's fertilizer needs indicate the rates of nitrogen, phosphorus and potassium which need to be applied.

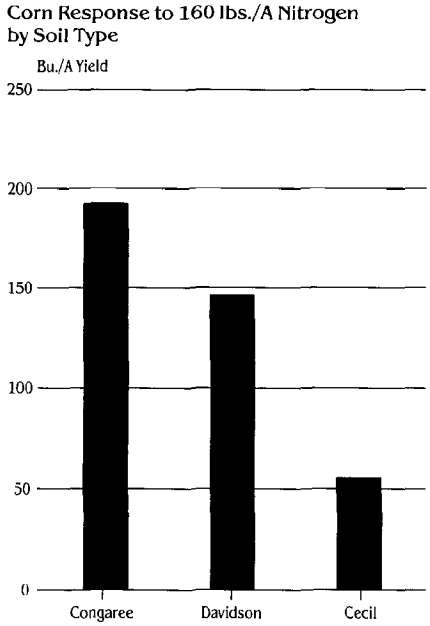


Fig. 2 Virginia soils vary considerably in their inherent ability to produce a crop.

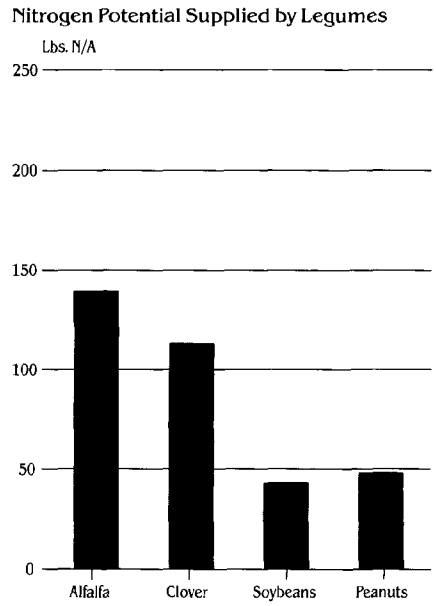
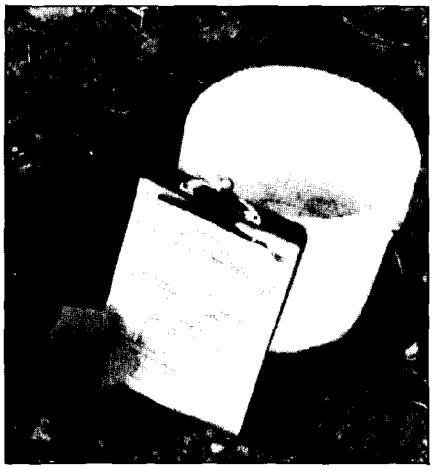


Fig. 3 Legumes can provide significant amounts of nitrogen to subsequent crops.

Next, nutrients supplied by the previous legume crops, manure, and/or sludge applications must be determined. For example, a corn crop following a 50 percent red clover/grass cover can benefit from up to 75 pounds of residual nitrogen per acre *(see Fig. 3)*. This is an important source of nitrogen which is often overlooked.

Gerald Garber of Augusta County, Virginia has reduced his production costs $100 per acre by applying Nutrient management principles on his farm.



Soil sampling is a simple and necessary first step in managing nutrients.

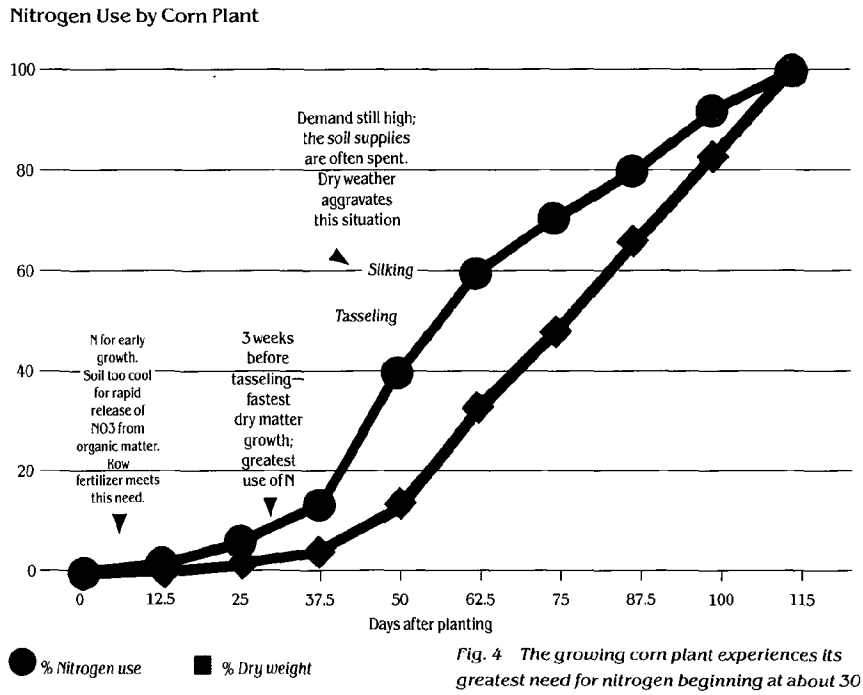


Fig. 4 The growing corn plant experiences its greatest need for nitrogen beginning at about 30 days after planting.

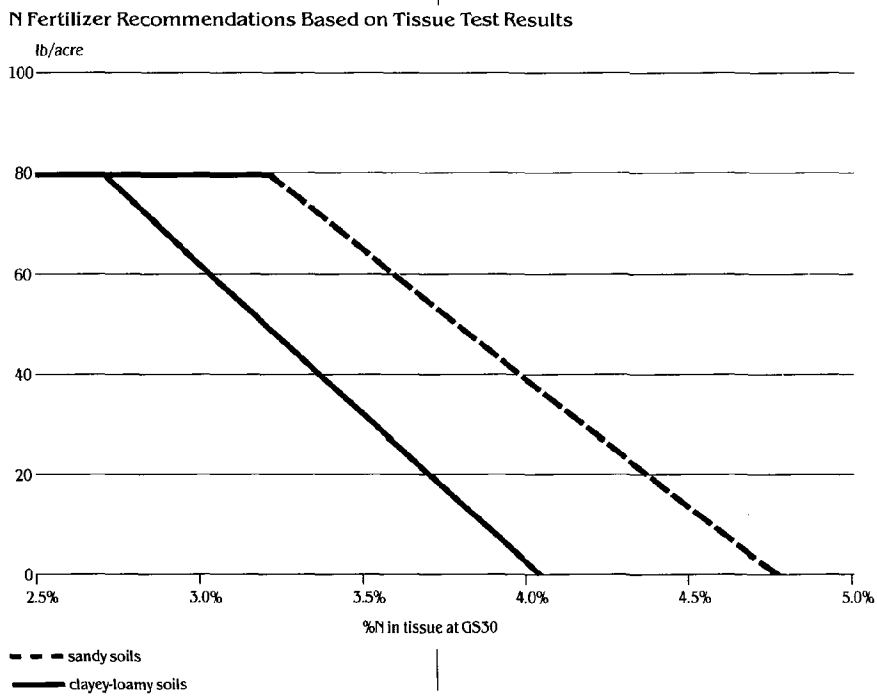
Winter cover crops such as rye can also be very important in preventing the loss of nitrates to groundwater. A small grain cover crop can utilize substantial amounts of the residual nitrogen in the soil and reduce the amount leaching beyond the reach of future crops.

By calculating these values, or "nutrient credits," the amount of nutrients available to the plant before adding any fertilizer can be determined. Once these calculations are completed, additional nutrient needs can be estimated based upon known crop response to applied fertilizer at a given soil productivity level.

Supplying nutrients when, where and how the plant will use them most efficiently is also important. Using starter fertilizers and split applications of nitrogen help deliver nutrients when the plant is growing rapidly and needs them most *(see Fig. 4)*. Fertilizers placed in the row or incorporated into soil are more likely to be used by the crop and less likely to be lost in water runoff from the farm.

Tissue testing can identify the most effective rate and timing of fertilizer application for small grains. A tissue analysis will determine if a crop has all the nutrients necessary to produce optimum yields *(see Fig. 5)*. If the analysis shows that a particular element is deficient, it can be applied. The DSWC, through a contract with the Virginia Cooperative Extension Service, is paying for the testing of plant tissue samples. The DSWC hopes to encourage the use of this new technology which will result in split applications that provide nitrogen when the crop needs it the most and prevent unnecessary losses from runoff or leaching.

Fig. 5 Wheat tissue samples at Growth Stage 30 can be used to obtain nitrogen fertilizer recommendations.



Animal waste management

A study of crop fertilization practices on farms with animal confinement systems in the state reveals a serious misunderstanding about the fertilizer value of manure. Frequently, commercial fertilizers are applied at rates that would supply all the nutrients needed by a crop. This is in addition to nutrients supplied by the manure also being used. Yet, these nutrients were seldom considered when determining fertilizer application rates. Why?

Animal confinement systems can produce a valuable nutrient resource when managed wisely.

Plant Availability of Inorganic Nitrogen In Liquid Dairy Manure

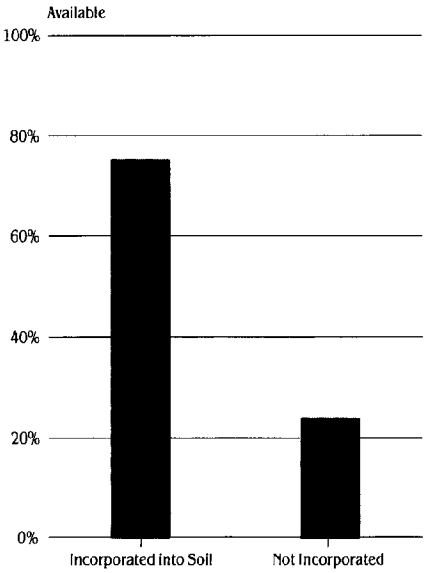


Fig. 6 Immediate incorporation makes 75% of the inorganic nitrogen available to the crop by preventing ammonia volatility losses.

By utilizing the poultry litter produced on his farm, Suffolk, Virginia farmer Parke Ashburn has gone without mineral fertilizer on some fields for over 10 years.

Until recently, there has not been dependable information available on the nutrient value of stored manure. The fact is that while the ammonia nitrogen value of manure decreases during storage and spreading *(see Fig. 6)*, additional nitrogen becomes available to growing plants as the organic portion of manure decomposes *(see Fig. 7)*. A nutrient management plan helps farmers understand these changes and determine the nutrients supplied through manure applications and if fertilizers are needed to provide additional nutrients.

Plant Availability of Organic Nitrogen In Liquid Dairy Manure

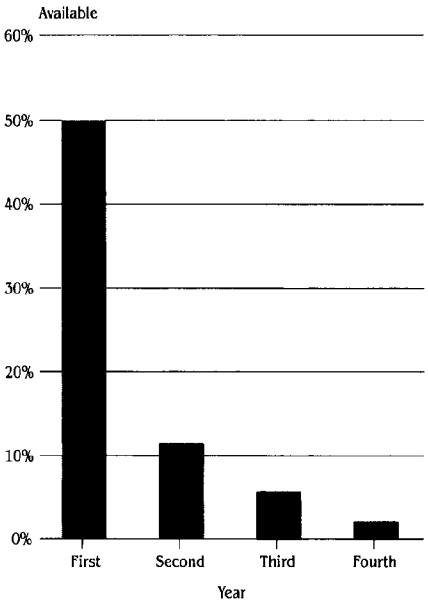
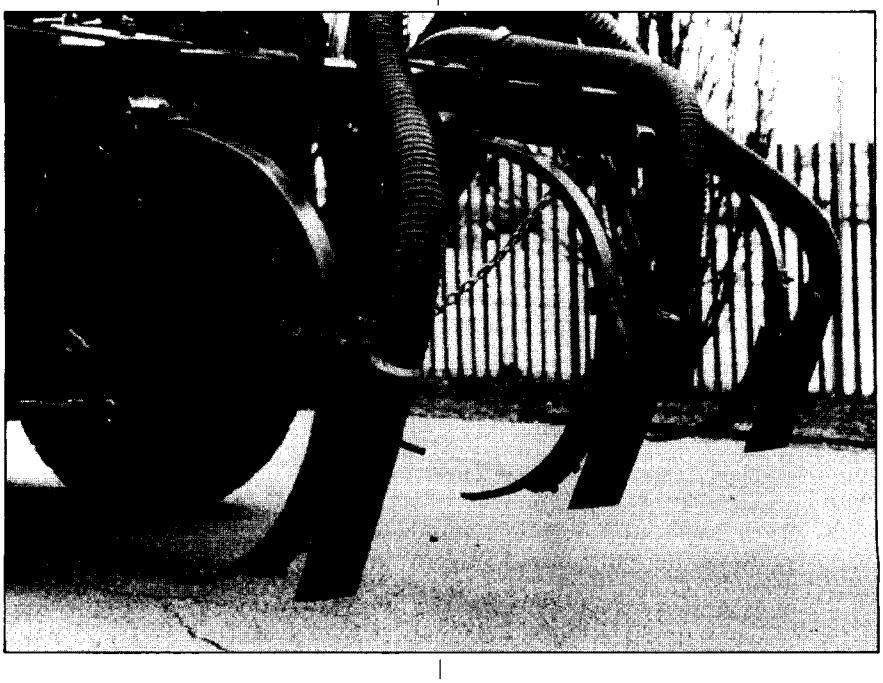
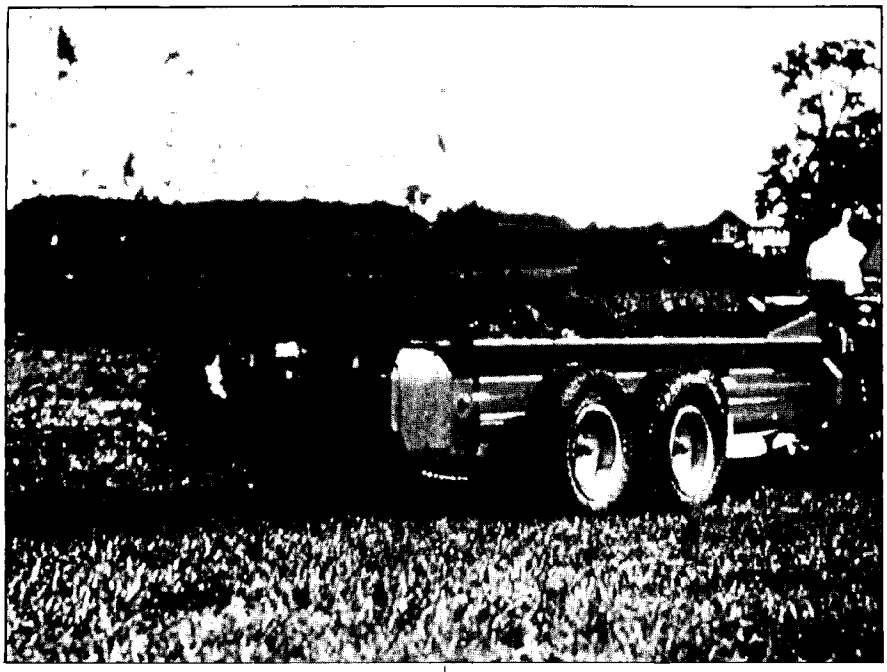


Fig. 7 In liquid dairy manure, 50% of the nitrogen in the organic form is available to the crop in the first year.

Efficient use of nutrients by crops is greatly improved by accurate placement and proper application timing.





Spreader calibration insures manures are applied at the proper rate.

A manure analysis is recommended each time a manure storage structure is emptied. After several analyses, a seasonal trend will usually be identified. Additional tests are needed only when there is a major change in animal feeding or bedding practices. Calibration of manure spreaders and a review of current cropping practices will be needed to assure efficient use of the manure.

With financial support from the DSWC, Virginia Polytechnic Institute and State University has started a manure testing laboratory. Manure testing is available to all Virginia farmers at no charge.

Developing a nutrient management plan

Developing a nutrient management plan requires these steps:

1. analyze soil samples.
2. determine crop yield potential for each field, based on the known productivity of the soil.
3. identify the total nutrient needs for this expected yield.
4. determine the plant-available nutrients in stored manure to be used, considering the type of manure and its method of application.
5. include residual effects or carryover from previous fertilizer and manure applications.
6. include credit for nitrogen provided by previous legume crop.
7. recommend application rates for manure and/or commercial fertilizer to supply the needed nutrients for optimal crop production.

The goal of any management plan is to provide the crop with necessary amounts of nitrogen, phosphorus and potassium leaving few, if any, nutrients to leach or runoff.

A good nutrient management plan is customized to meet the needs of each farm and each farmer.

Planning ultimately leads to a cleaner environment and a more efficient farm.

Considering our environment

Whether nutrients are supplied as commercial fertilizer or manure, environmental considerations are important. Factors such as controlling erosion, maintaining adequate distances from wells, streams and wetlands, and limiting nutrient applications on lands with high water tables and soils with a high potential for leaching to the groundwater are also a part of a complete nutrient management program. Maintaining well-vegetated buffer areas, implementing erosion control practices and choosing the right crop for the soil are all techniques which help protect water quality. All environmental impacts must be considered when developing a nutrient management system.

Virginia's Nutrient Management Program

Technical assistance

The Department of Conservation and Recreation, Division of Soil and Water Conservation is committed to providing technical assistance, information and education, research and agency coordination for the Nutrient Management Program. Nutrient Management Specialists have been hired who may concentrate on animal waste applications, commercial fertilizer use or a combination of both. In addition, they assist with the implementation of nutrient management plans. The specialists also help coordinate the Department's programs with ongoing Extension and Soil Conservation Service programs.

One of the most important jobs of the nutrient management specialist is to train and help others write nutrient management plans. To accomplish this goal, the specialists have developed a standard nutrient management plan for use as a guide.

To develop a nutrient management plan, farmers should contact a nutrient management specialist at one of the DSWC's eight regional offices, or call the local Soil and Water Conservation District. Technical assistance is also available through the Soil Conservation Service or local Extension offices.

Research

The Division's Nutrient Management Specialists are studying many types of test plots to identify better ways to provide crops with needed nutrients while decreasing costly nutrient losses and water pollution. They are also involved in evaluating new soil testing methods and in studying the significance of deep soil nitrogen concentrations.

The DSWC is funding several ongoing projects at VPI&SU. In the Department of Crop and Environmental Science, one project involves developing techniques to optimize the use of nitrogen in the production of winter wheat. Studying nitrogen in the production of winter wheat. Studying nitrogen management for corn grown under reduced tillage practices is another project now under study. The goal of these programs is to increase the understanding and efficient use of nutrients in crop production.

In the Department of Agricultural Engineering, two research watersheds are being studied to evaluate the effectiveness of intensely applied Best Management Practices and nutrient management. These long term monitoring projects will help predict the benefits of our water quality programs.

And, finally, significant progress is being made in the VALUES (Virginia Agricultural Land Use Evaluation System) system for the VPI&SU soil testing lab. This computerized program will correlate soil test levels, production potentials and soil leaching and runoff properties. From these soil characteristics, the VALUES system will recommend the source, rate, time and method of application for fertilizer and pesticide treatments for over 50,000 soil samples a year.

Many resources for assistance are available to farmers wishing to develop a plan.

Education and information

Since the key to solving nonpoint source pollution is education, DSWC is committed to providing information to those who need it.

A 22-minute video on "Nutrient Management for Today's Agriculture" has been developed by VPI&SU for DSWC and is distributed by Extension and other cooperating agencies.

Nutrient management specialists also tell leaders in agriculture and the agrichemical industry how they can incorporate nutrient management concepts into their activities and demonstrations.

And, through a contract with the Agricultural Engineering Department at VPI&SU, rainfall simulator demonstrations are conducted statewide to show the impact of conservation practices on our surface waters.

The rainfall simulator is one of the tools being used to educate landowners about water quality.

Providing nutrient management information to the farm community is the key to the program's success.

Urban nutrient management

Not all nonpoint source pollution affecting the bay is traced to agricultural practices. About seven percent comes from city streets, construction sites and suburban lawns. The DSWC funds the urban nutrient management program now underway in the Office of Consumer Horticulture at VPI&SU. The program's objective is to develop and deliver solutions to nonpoint source pollution from urban and suburban lawns and gardens.

One project developed by VPI&SU is a program which addresses home horticultural activities. It informs property owners about the proper rate and timing of fertilization, and alternatives to chemical fertilizers. Future efforts will include a pest management program. Instructional materials for this project are distributed through the Master Gardener Programs and local extension offices. The Virginia Gardener Calendar is one of the most popular of the publications.

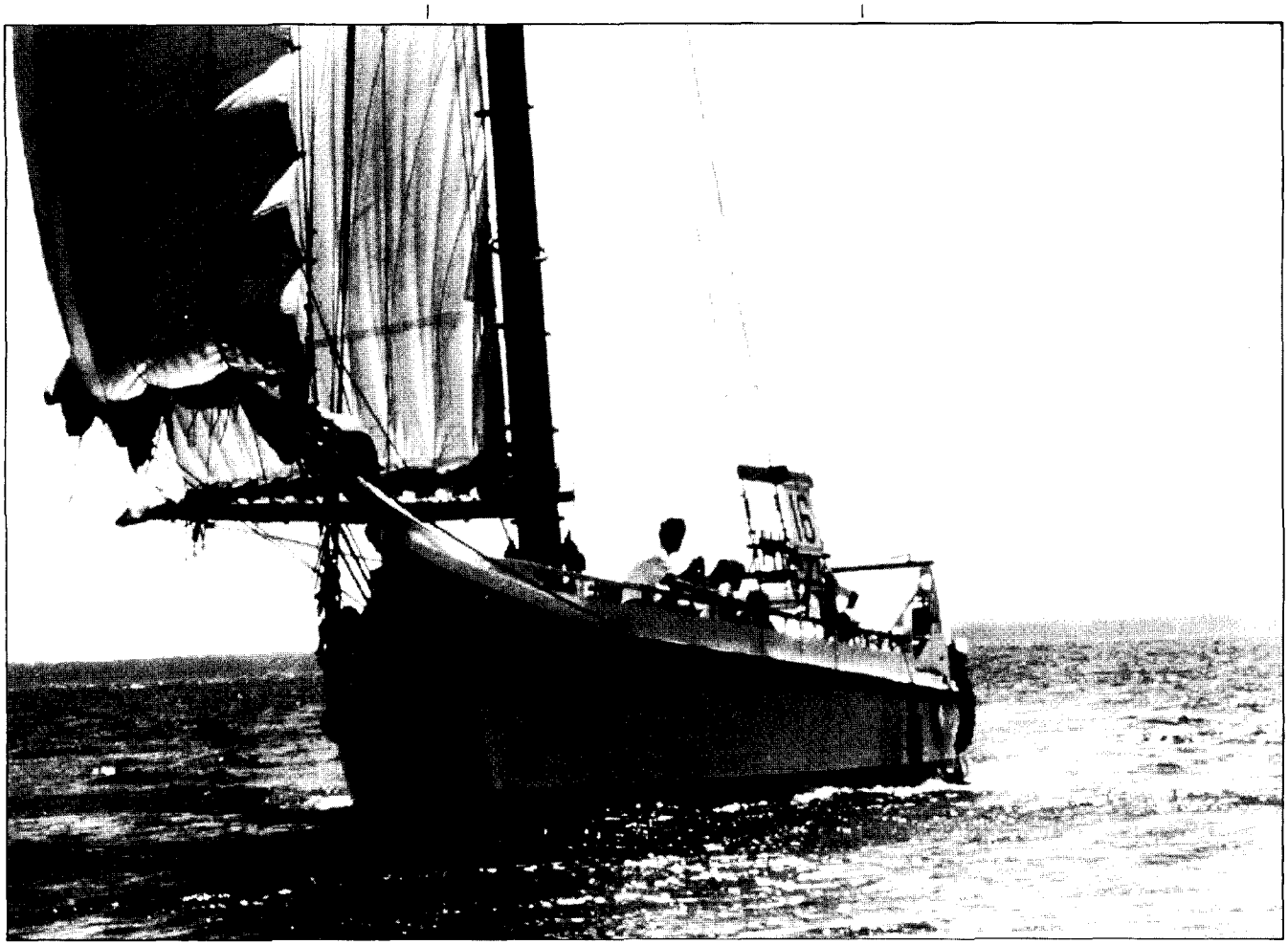
Teamwork

Several local, state and federal agencies are involved in programs to improve water quality in Virginia through nutrient management. They are the Division of Soil and Water Conservation, the Virginia Cooperative Extension Service, the USDA Soil Conservation Service, the State Water Control Board and the state's Soil and Water Conservation Districts. As the agency assigned the lead role in nonpoint source pollution control, the DSWC is working actively with all the other agencies, along with the agrichemical industry, to coordinate water quality efforts and track program results.

Virginia Cooperative Extension Service

The Extension Service works with DSWC nutrient management specialists to develop animal waste plans and provides educational programs to encourage nutrient management by farmers.

The urban nutrient management program addresses the contribution of the individual homeowners to non-point pollution.



Through teamwork, we can preserve the economic, environmental and recreational benefits of the Chesapeake Bay.

Funding has been provided by the DSWC for travel expenses and various research projects. The Extension Service co-sponsors training sessions in nutrient management plan development for agricultural agents throughout the state. Agents are also trained to calibrate spreaders, collect tissue samples and conduct both deep and shallow soil sampling.

The USDA Soil Conservation Service

The Soil Conservation Service also receives nutrient management training. SCS staff develops animal waste management plans on all new storage structures they certify.

SCS provides technical expertise to support the installation of Best Management Practices in the state cost-share program. In addition, SCS is the agency mandated by the 1985 Food Security Act to write "Farm Plans." Implementation of these plans is expected to significantly decrease nutrient loadings in our water.

Virginia's Soil and Water Conservation Districts

District personnel participate in the development of nutrient management plans and administer the Virginia Agricultural Best Management Practices Cost-Share Program. Districts, through funding provided by DSWC, provide technical assistance to the farming community.

Virginia State Water Control Board

This agency implements the Virginia Pollution Abatement permit program which contains provisions for concentrated and intensified animal feeding operations (over 1,000 or 300 animal units respectively). The requirements for a permit include the applicant's developing a nutrient management plan which must be approved by the DSWC. The facility must implement its nutrient management plan in order to comply with this permit.

Industry representation

Historically fertilizer dealers have helped farmers by recommending the amount and kind of fertilizer to use, as well as the best time to use it. Other industry representatives advise on everything from animal nutrition to crop yields. They will continue to play an important role as they help inform and educate the public on the use of plant nutrients. Dealers will help write nutrient management plans as well as help implement plan recommendations. The animal industries will expand their involvement in the redistribution or brokerage of animal waste and other related materials. In addition, the industry is asked for input regarding overall program direction.

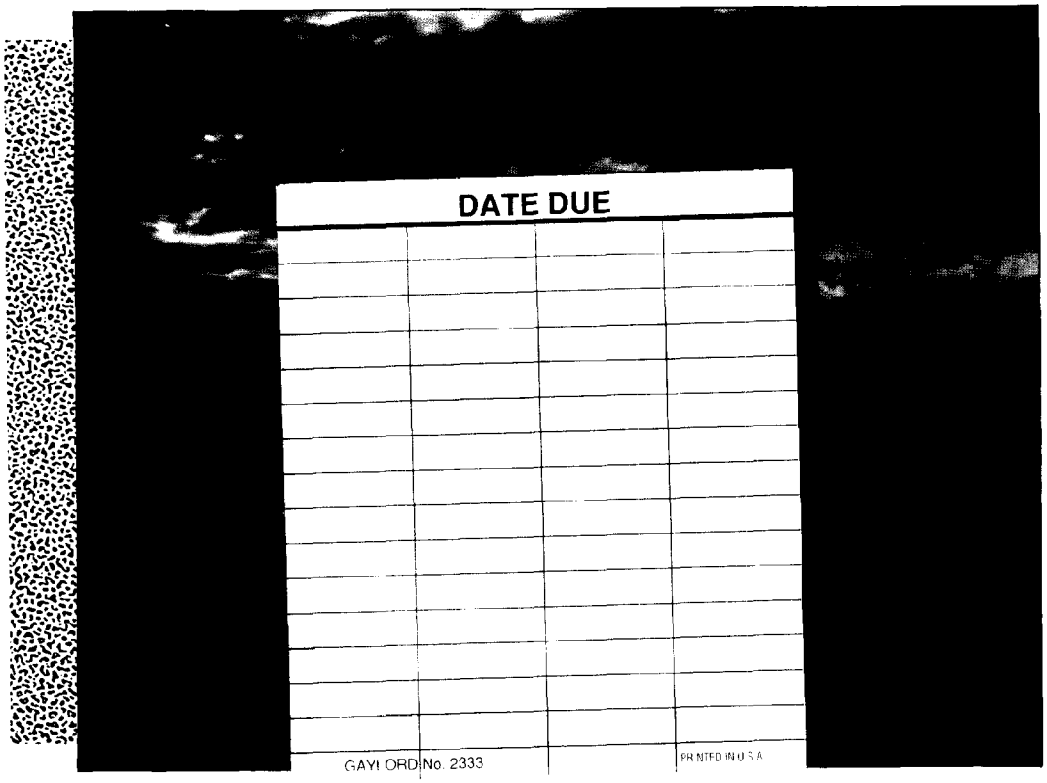
Protecting the future

As the Division of Soil and Water Conservation continues its efforts to reduce the amount of nutrients and other pollution entering Virginia's waters, additional steps will be necessary to reach the goal of a 40 percent reduction in nutrient loadings by the year 2000. New incentives such as the tax credit for precision pesticide and manure application equipment already are requiring a nutrient management plan. Additional strategies include establishing local nutrient management advisory committees, training fertilizer retailers to develop nutrient management plans, incorporating new practices in the state cost-share program and continuing research into tools such as a slow release fertilizer.

Ultimately, these combined efforts will mean not only better water quality for a healthier Chesapeake Bay but also a healthier and more efficient farm economy.

Developing closer cooperation with the fertilizer industry will greatly expand the influence of Virginia's nutrient management program.

Through cooperation and teamwork, Virginia will reap the benefits of a healthier Chesapeake Bay.



The purpose of the nutrient management program is to assist farmers and others in managing agricultural and other fertilizers and to prevent the misapplication, improper storage, discharge or other use of these products which may have an adverse affect on ground and surface water quality while still realizing agronomic and other benefits from their use. A secondary purpose is to emphasize the availability and value of animal manure in meeting nutrient needs. The goal of the program is to improve water quality while maintaining an efficient Virginia agriculture.

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