



Nutrient Management Annual Report

2011



University of Maryland College of Agriculture and Natural Resources

Helping citizens manage nutrients since 1989

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The 2011 Nutrient Management Annual Report highlights the efforts of programs within the University of Maryland's College of Agriculture and Natural Resources (AGNR), which include nutrient management in field and vegetable crops, animal production, nursery and greenhouse industries and home landscapes and park lands.

The guiding principle behind nutrient management planning and implementation, as outlined in the Maryland Water Quality Improvement Act of 1998, is that nutrients applied in any form should balance with plants' nutrient needs. In agricultural production systems, managing nutrients to meet, not exceed, crop needs may increase profitability and is crucial to the health of the Chesapeake Bay and its tributaries.

Improperly or excessively applied nutrients can leach into the groundwater or exit the field via runoff from precipitation, and then migrate into Maryland's waterways. Once in the water, excess nutrients upset the Bay's ecological balance by causing algal blooms and contributing to eutrophication and degradation of wildlife habitat.

For more information on the College of AGNR, visit www.agnr.umd.edu.

2011 Training and Cooperative Education Accomplishments

Continuing Education

- The Maryland Department of Agriculture (MDA) and the College of AGNR co-sponsored continuing education programs to assist certified nutrient management consultants in meeting their continuing education requirements.
 - Thirty-two (32) face-to-face workshops had 656 attendees and the two online sessions had 201 attendees.
 - Workshop topics included: "Practical Experiences in Nutrient Management," "How to Write a Nutrient Management Plan," "Phosphorus Site Index (PSI)," "PSI Field Training," "Explore the Features of RUSLE2," "Pre-Sidedress Nitrate Testing," and "Organic Grain, Forage, and Vegetable Production."
- Options for certified nutrient management consultants and certified farmers to earn continuing education credit online were introduced in FY'11.
 - Sessions on lime requirement procedures, fall wheat nitrate test, Total Maximum Daily Loads (TMDLs), nitrogen management and basic soils were offered via the College of AGNR's web conference system during winter of 2011.
 - In addition, University of Maryland Extension (UME) coordinated with other organizations sponsoring online continuing education (American Society of Agronomy's Certified Crop Advisor Program and eXtension's Livestock and Poultry Environmental Learning Center) to provide continuing education opportunities for Maryland certified clients.

Pre-certification Exam Training

- Sixty-one (61) individuals attended "Fundamentals of Nutrient Management"—a course designed to help participants prepare for the MDA nutrient management certification exam.

Nutrient Applicator Training

- Thirty-nine (39) face-to-face Nutrient Applicator Training sessions were held and 1,116 operators either received or renewed their nutrient applicator vouchers.
- One online session was held and 15 operators either received or renewed their nutrient applicator vouchers.

Farmer Training and Certification

- Seventy-one (71) farmers were certified through the Farmer Training and Certification (FTC) initiative to write their own nutrient management plans. To date, 402 farmers have become certified through this training initiative.
- After initial certification, farmers receive assistance with plan updates and software use from University of Maryland nutrient management specialists.
- Nutrient management plan writing support was offered to certified farmers at four locations. These sessions provide an opportunity for farmers to get help with plan updates and software use.
- Four Annual Implementation Report help sessions were offered to demonstrate and assist farmers with the use of software designed to simplify the reporting process.



FTC Survey

Multiple FTC training sessions have been offered annually since 2002. This year a survey was conducted to:

1. gain a better understanding of the effectiveness of FTC;
2. determine if continuation of FTC is warranted; and
3. guide the improvement of training materials and design of future training opportunities to best meet the needs of this audience.

Surveys were distributed electronically and via the United States Postal Service for those without electronic access.

- There was a 36% response rate.
- The majority of respondents (81%) said they continue to write their own nutrient management plans.
- Of the respondents, 61% said they have made management changes as a result of the training. These changes include calibrating manure spreaders, having manure analyzed annually and keeping better records.
- Forty-one (41) percent of respondents said they saved money annually on fertilizer as a result of following their nutrient management plan.
- Of those who indicated a cost savings, 11% saved between \$101 and \$500, 11% saved between \$501 and \$1000, 10% saved between \$1001 and \$3000 and 9% saved more than \$3000.

FTC Survey (continued)

The responses imply that the FTC program is effective, is valued by past participants and should be continued.

Future training topic suggestions include pasture and forages, soil science, updates on nutrient management regulations, Phosphorus Site Index, composting, newer sources of fertilizers available (both commercial fertilizer and manure) and training on nutrient management planning software (NuMan Pro).

Agricultural Nutrient Management

The University of Maryland Extension's (UME) Agricultural Nutrient Management Program (ANMP), which is funded by MDA, provides (1) nutrient management planning services to Maryland farmers through a network of nutrient management advisors located in all county Extension offices and (2) continuing education and technical support to certified nutrient management consultants and certified farm operators via nutrient management specialists. For more information on the ANMP, visit www.anmp.umd.edu.

2011 Priorities

Nutrient management planning priorities for the ANMP are stated in a formal agreement between MDA and the University of Maryland. The priorities for Fiscal Year 2011 were as follows:

1. farmers who have filed a Notice of Intent (NOI) as a Confined Animal Feeding Operation (CAFO) and whose Comprehensive Nutrient Management Plan (CNMP) is currently being prepared by their Soil Conservation District;
2. farmers who have filed an NOI as a CAFO and who need an updated nutrient management plan to remain in interim compliance while they await the development of the CNMP for their operation by their Soil Conservation District;
3. farmers with pollution problems or referred as non-compliant by MDA through an enforcement procedure;
4. farmers participating in the Manure Transport Project and those with a Maryland Agricultural Cost Share Program (MACS) application pending for animal waste storage and poultry mortality composters;
5. updating nutrient management plans for the existing clientele with animal operations and expired plans developed by the nutrient management advisors; and
6. first come, first served for any other farmer who must comply with the Water Quality Improvement Act.

ANMP Web Site

The ANMP web site (www.anmp.umd.edu) is maintained on AGNR's server. This web site provides users with access to general information about the program, training materials, publications and resources for nutrient management plan development. The ANMP also maintains a web page of training opportunities and current events on the social media site, Twitter (www.twitter.com/UMANMP).

Progress and Achievements

- Plans for 14 Manure Transport Project clients were written, which allowed for the transport of manure to over 2,004 acres.
- Plans for 99 CAFO or Maryland Animal Feeding Operations (MAFO) clients were written to partially fulfill permit requirements.
- The Phosphorus Site Index was performed for 337 clients on 1943 fields.
- Nutrient management advisors performed 33 yield checks and calibrated 31 manure spreaders.
- The Pre-Sidedress Nitrate Test was performed for 58 producers totalling over 8,190 acres. This resulted in an estimated reduction of over 122,000 pounds (or approximately 15 pounds per acre) of nitrogen applied to Maryland corn fields.
- Four hundred twenty-one (421) new nutrient management plans were written for 208 Maryland producers for more than 19,500 acres. Five thousand, five hundred seventeen (5,517) plans were updated for 1,387 clients for approximately 271,000 acres (see Figure 1 below).

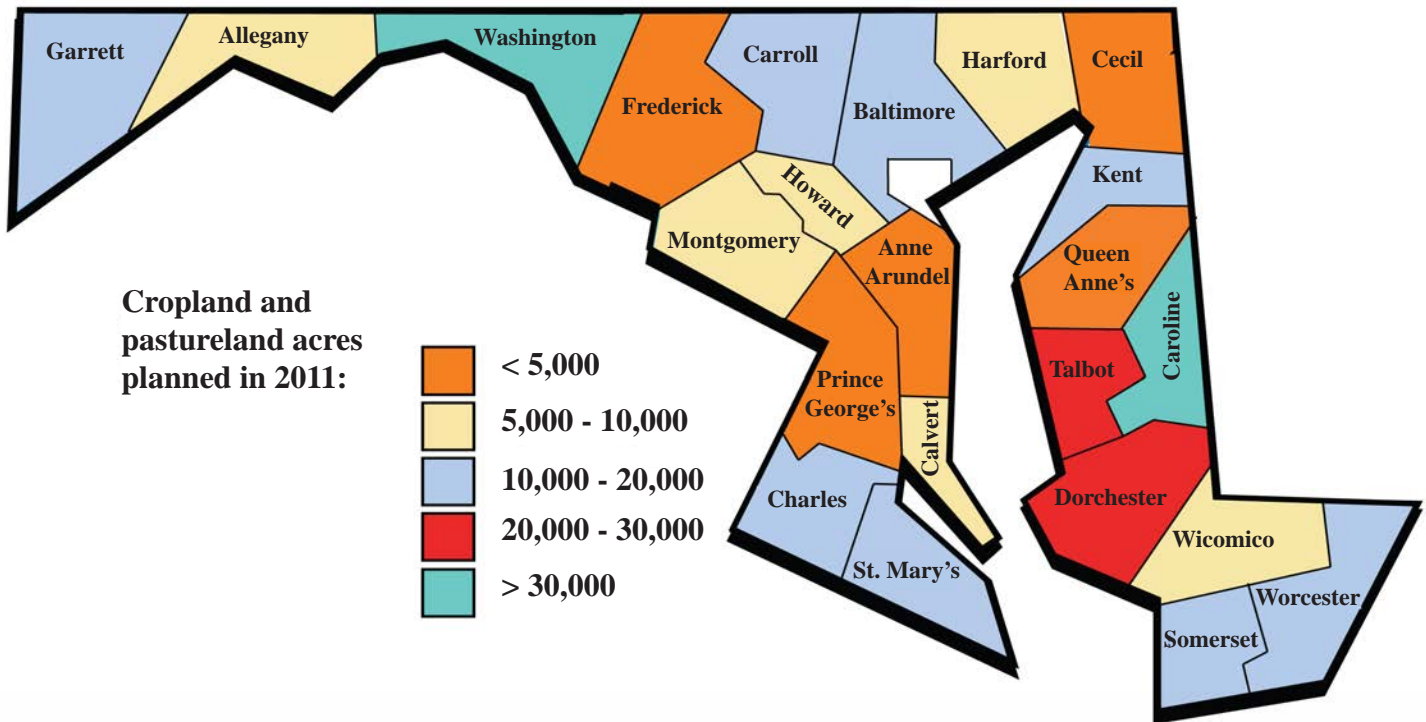


Figure 1. Farmland acres planned per county in Fiscal Year 2011 by University of Maryland Extension nutrient management advisors.

Poultry Farm Management Workshop

The University of Maryland Extension, in cooperation with several other agencies (i.e., Soil Conservation Districts, USDA Natural Resources Conservation Service (NRCS), Delmarva Poultry Industry, Maryland Department of the Environment and MDA) offered a Poultry Farm Management Workshop and Certification course designed to help new and existing poultry growers receive their National Pollutant Discharge Elimination System (NPDES) Concentrated Animal Feeding Operation (CAFO) permit.

Topics discussed during the workshop included: basic farm management; site management and maintenance of poultry houses, pump rooms, manure sheds, composters, etc.; manure and mortality handling; vegetative environmental buffers; nutrient management and financial record-keeping; the CAFO permitting process; comprehensive nutrient management planning; and the Environmental Protection Agency inspection process. Six (6) continuing education credits were awarded to Maryland certified farmers, certified consultants and applicator voucher holders for attending this workshop.

This workshop's material was condensed and translated for Korean and Vietnamese poultry growers on the Eastern Shore of Maryland.

In 2011, three (3) poultry farm management workshops were held on Maryland's Eastern Shore with over 70 participants in attendance.



Maryland poultry house (Photo source: UME ANMP)

Nutrient Management Publications

The following publication was released this year by the Department of Animal and Avian Sciences:

- *Nutrient Management Plans for Maryland Horse Farms.*

Nutrient Management Software

The latest versions of Nutrient Management for Maryland Professional Edition (NuMan Pro), version 3.1 and 3.2, were released in August 2010 and March 2011, respectively. In addition to all of the features found in NuMan Pro 3.0, these latest versions include the following new features and capabilities:

- updated small grain recommendations;
- updated soil files for five counties;
- crop codes that allow phosphorus removal rates for manure applied on small grain to meet fall and winter manure application restrictions;
- ability to enter nitrate concentrations in organic waste analyses for materials that contain significant levels of nitrate; and
- clarification of timing of manure application for many crop codes.

Nutrient Management Research for Agronomic and Vegetable Crops

Agronomic Crops

The following projects are ongoing:

- development of a second-generation Phosphorus Site Index for predicting the relative risk of phosphorus transport from agricultural land;
- effectiveness of in-situ treatment of agricultural drainage ditch water to remove nutrients and other pollutants and reduce off-field nutrient transport;
- long-term evaluation of corn yield response to nitrogen fertilizer rates;
- study on the performance of stabilized nitrogen fertilizer products (i.e., Agrotain™, N-Serve™, Agrotain Plus™ and Nutrisphere-N™) for corn;
- determination of the economic optimum nitrogen rate for corn varieties;
- examination of long-term effects of cropping system choice (forage versus grain) on soil phosphorus concentrations ranging from optimum to excessively high;
- determination of transport mechanisms for nutrients leaving stockpiled poultry litter and means to inhibit losses;
- evaluation of variable rate nitrogen application in winter wheat using active optical sensors;
- utilization of variable rate nitrogen application in the Mid-Atlantic to increase nitrogen use efficiency in corn;
- use of rainfall simulation to estimate relative nutrient loss efficiencies from various best management practices used in nutrient management planning;
- construction of an agronomic nutrient mass balance for nitrogen and phosphorus in Maryland;
- evaluation of soil and tissue tests as tools to determine appropriate sulfur fertilizer rates; and
- evaluation of floating treatment wetlands to reduce nitrogen and phosphorus losses from poultry CAFOs.

Completed Research Projects

Cover Crops and Soil Physical Properties

The inclusion of winter annual cereal cover crops in grain crop rotations is a common management practice promoted to protect soil resources and enhance water quality. The long-term effects of winter cover crops on soil physical properties was evaluated via two long-term (12 years) grain crop rotations at three locations (Queenstown, Poplar Hill and Clarksville) in Maryland.

In both rotations, continuous corn was the summer grain crop.

Rotations:

- corn to winter fallow; and
- corn to rye

These soil physical properties were measured during the corn and rye/fallow growing seasons:

- bulk density
- air permeability
- water infiltration rate
- hydraulic conductivity
- aggregate stability
- total and labile organic matter

When measured during the winter sampling season at two Coastal Plain locations, soils under winter cover crops displayed significantly improved soil physical properties in comparison to the same soils under winter fallow conditions. The heavier-textured soils at the Piedmont location exhibited no consistent differences attributable to the winter cover crop. Despite the transient nature of the physical properties, results indicate use of winter cover crops in grain rotations promote sediment retention and soil quality.

Fall Wheat Nitrate Test

The results of this multi-year study established that a fall nitrate soil test could determine the need for fall starter fertilizer nitrogen for wheat. If the soil nitrate concentration was above 10 parts per million (ppm), the research indicated a 25% probability for a profitable response with fall fertilizer nitrogen. If the soil nitrate concentration was 10 ppm or less, the research found the probability for a profitable return with fall fertilizer nitrogen improved to approximately 50%. The UME fall starter fertilizer nitrogen recommendation for wheat is the use of 30 pounds of nitrogen per acre when the fall soil nitrate test concentration is 10 ppm or less.



(Photos courtesy of Anastasia Vvedenskaya, ANMP Communications Specialist)

Vegetable Crops

The following projects are ongoing:

- utilization of real-time measurements of nitrate concentrations in plant petiole sap of water-melons at a critical developmental period using a portable meter to fine-tune nitrogen fertilizer application rates without reductions in yield or fruit quality;
- determination of appropriate amount of nitrogen needed to grow ethnic vegetables that meet taste and quality expectations of customers. Preliminary results show that to achieve quality yield the following ethnic vegetables could be grown with 30-50% less N than currently recommended: Callaloo, melons (Amarillo Oro, Petit Gris de Rennes, Thai Golden Round, Baghdad Long, Thai Long, Tigger), and eggplant varieties (Red China, Thai Round Purple, Malaysian Dark Red); and
- effectiveness of the inclusion of cover crops and manure in organic vegetable production systems.

To learn more about vegetable production practices and on-going vegetable research at the University of Maryland, visit <http://mdvegetables.umd.edu>.

Economic Factors in Nutrient Management

In April 2010, researchers in the Department of Agricultural and Resource Economics (AREC) at the University of Maryland collected information from Maryland agricultural producers regarding nutrient management and conservation efforts. The University of Maryland Best Management Practice (BMP)/ Cost Share Survey of 2010 was conducted by the Maryland Field Office of USDA's National Agricultural Statistics Service (NASS).

The survey responses, expanded to the population of farm operations in the state of Maryland, indicate:

- approximately 12% of farms are not required to have a nutrient management plan because they either have less than eight animal units or a gross agricultural annual income of less than \$2,500;
- of the remaining 88% of farm operations in the state, only 64% reported having a nutrient management plan;
- compliance with the nutrient management planning requirement was extremely high among large farms:
 - 95-98% of farms with annual sales of at least \$250,000 had nutrient management plans, and
 - 85-89% of farms with annual sales between \$40,000 and \$250,000 had nutrient management plans;
- in contrast, the majority of farms with less than \$10,000 in annual sales did not have nutrient management plans even though the law required them to; and

Economic Factors in Nutrient Management (Continued)

- additionally, 30-40% of farms with annual sales between \$10,000 and \$40,000 reported being without nutrient management plans.

These results suggest that the greatest opportunities for increasing compliance with the nutrient management planning provisions of the Water Quality Improvement Act lie with small farm operations with annual sales less than \$40,000.

Of those respondents who had plans:

- UME had the largest role in developing plans (approximately 60% of plans); and
- independent crop consultants and chemical dealers/employees had the second and third largest percentages (14 and 10 respectively).

Farms with \$1 million or more in annual sales were more likely to have plans developed by independent crop consultants. Farms with annual sales between \$250,000 and \$1 million were also more likely to have plans developed by independent crop consultants, albeit to a lesser extent than farms with annual sales of \$1 million or more. UME developed plans for the majority of farms with annual sales under \$100,000.

The AREC Department continues to analyze data from this survey. The final report will be available in late 2011. For more information on the Department, visit www.arec.umd.edu.

Animal Nutrient Management

Researchers in the University of Maryland's Department of Animal and Avian Sciences are studying how nutritional factors and feed management interact to effect phosphorus and nitrogen digestibility and retention in animals. For more information, visit <http://ansc.umd.edu>.

Poultry

The following projects are ongoing:

- use of the dietary imprinting concept where changes in early nutrition could improve the broilers' ability to:
 - perform well when low phosphorus diets are fed in the finisher and withdrawal phases, and
 - deposit breast muscle such that breast yield does not change when low protein diets are fed in the finisher and withdrawal phases. This would allow producers to decrease the amount of phosphorus and nitrogen in 70% of the broiler feed without negatively impacting performance. The ultimate goals are to decrease phosphorus and nitrogen in litter;
- effectiveness of currently used and new forms of phytase in decreasing phosphorus in diets fed to broilers;
- investigation into proteases that might help improve protein availability from diets, thus allowing formulation of diets with lower protein. This would in turn result in lower excreted nitrogen and lower nitrogen volatilization;
- examination of amino acid digestibility in diet ingredients, their variability and how proteases can increase their utilization by poultry; and
- exploration of how management tools such as lighting programs and diet particle size can be used as tools to improve diet nutrient utilization by broilers. This complements the goal of maintaining or improving productivity while decreasing the excretion of nutrients.

Equine Rotational Grazing Demonstration Site

The mission of the Equine Rotational Grazing Demonstration Site, which has been in operation since spring 2009, is training horse farm operators to adopt environmentally-friendly best management practices (BMPs) for horse pastures to help reduce their farm's negative environmental impact.

In 2011, UME hosted four evening educational events and one full-day seminar featuring a variety of forage, horse, and conservation experts. Event topics included soil fertility, pasture management BMPs, rotational grazing, and manure management. Specific skills taught were soil sampling, assessment of vegetative cover, weed identification, weed control, calibration, estimating pasture height, and seeding depth and preparation.

There were a total of 162 participants for the year with 17 individuals coming to multiple events. Post-event surveys indicate that participants gained the most knowledge in:

- determining the proper plant species to integrate in horse pastures;
- establishing proper timing for seeding horse pastures;
- verifying weed control methods; and
- designing a rotational grazing system.

The majority of participants indicated that their top three farm priorities after attending the educational events were to:

- maintain vegetative cover of 50% or higher in pastures;
- renovate pastures to thicken the stand; and
- assess vegetative cover.



Nursery and Greenhouse Nutrient Management Program

Under provisions of the Water Quality Improvement Act of 1998, Maryland's nursery and greenhouse operations must develop water and nutrient management plans to ensure that nitrogen and phosphorus are not lost to surface and groundwater from production sites in the state. The University of Maryland's Nutrient Management Program for the Nursery and Greenhouse Industry works with the industry to help develop these plans and promotes other sustainable practices that minimize environmental impacts through education and research.

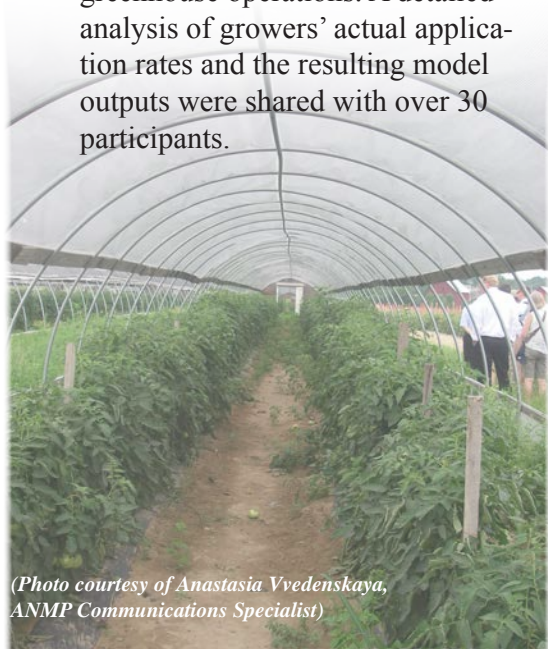
Training

A number of nutrient management initiatives were offered for nursery and greenhouse operators and certified consultants during 2011:

- **Farmer Certification Training**, where growers became certified to write their own nutrient management plans. During summer 2011, seven operators and consultants were certified.
- **Substrate, Irrigation and Nutrient Management for Nursery and Greenhouse Operations**: This online course (four modules) was offered during spring semester 2011 for credit or continuing education purposes. A total of 18 students and three growers/consultants passed one or more modules.
- **Advanced Applicator and Consultant Training**. Two twilight grower meetings were held during 2011, to showcase the new decision support models that estimate water and nutrient runoff from nursery and greenhouse operations. A detailed analysis of growers' actual application rates and the resulting model outputs were shared with over 30 participants.

Research and Extension

- **Wireless Sensor Networks for Irrigation and Nutrient Management**: A number of commercial nursery and greenhouse operations are actively involved in research using wireless sensor networks, including Raemelton and Waverley Farms, and Flowers by Bauers Greenhouse. These sensor networks are used for daily irrigation and nutrient management decisions, and provide data on irrigation scheduling and water use by various plant species. Other research sites, including a large green roof experimental site at the University of Maryland, are also a part of this project.
- **Integrated Management of Zoosporic Pathogens and Irrigation Water Quality for a Sustainable Green Industry**: Containment ponds and irrigation systems are being actively monitored for water quality and pathogen status at three operations in Maryland (Moon, Homestead and Bauers) to understand the dynamics of nutrient loading on water quality and pathogen survival. The overall goal is to elucidate better disease management and water treatment strategies, since this is a key barrier to using recycled water for many growers. More information at <http://www.irrigation-pathogens.info>
- **Decision Support Models for to Nutrient and Water Management Use and Efficiency**: Three water and nutrient use models (container-nursery, field nursery and greenhouse operations) were developed to provide tools for producers to input their specific nutrient applications for various management units. Validated models were then used to run a number of what-if scenarios, based on a database of production practices that was gathered from 48 nursery and greenhouse operations in Maryland. This research provides growers and researchers with a tool to assess and understand the cultural and environmental impact of current practices and identify ways to optimize and change practice to help achieve the most efficient and profitable implementation strategy. More information at the Smart-Farms knowledge center <http://www.smart-farms.net>
- **Knowledge Center for Water, Nutrient and Plant Health Management**: There are currently over 900 registered users in the Knowledge Center. General information on the project can be found at <http://waternut.org> and learning modules can be accessed at <http://waternut.org/moodle>



(Photo courtesy of Anastasia Vvedenskaya, ANMP Communications Specialist)



Top and bottom photos: Master Gardeners are trying forage radish as a fall cover crop. The large roots help to aerate tight, clayey soils. The tops of the plants are winter-killed in most of Maryland and decompose in place.



Crimson clover in bloom ready to be tilled under in a backyard vegetable garden.

(Photos courtesy of Mr. Jon Traunfeld, Extension Specialist and Director of the Home & Garden Information Center)



Urban Nutrient Management

Master Gardener Program

In order to help alleviate concerns about the potential impact of fertilization of urban lands on water quality in Maryland, the UME relies upon its Master Gardener program to “educate Maryland residents about safe, effective, and sustainable horticultural practices that build healthy gardens, landscapes, and communities.” For more information about the Master Gardener program, visit www.mastergardener.umd.edu.

- Currently there are active programs in 19 of 23 counties and Baltimore City.
- Master Gardener trainees receive basic and advanced training in soils, fertilizers, and composting.
- One thousand, five hundred twenty-eight (1,528) active volunteers donated over 91,899 hours of volunteer service to the state of Maryland.
- Master Gardeners operated 15 compost demonstration sites to educate homeowners about recycling yard and food waste. Three hundred eleven (311) compost bins were distributed around the state.
- With the help of college student videographers, the Home and Garden Information Center (HGIC) produced six new video clips: (1) “Types of Raised Beds”, (2) “How to Build Raised Beds”, (3) “Composting for Your Garden”, (4) “Composting: Varieties of Composting Bins”, (5) “Vermicomposting: Using Worms to Make Compost for Your Garden”, and (6) “Vermicomposting: Varieties of Bins for Composting with Worms.” These videos can be accessed at www.growit.umd.edu or www.youtube.com/user/UMDHGIC.

UME Master Gardeners and the gardening public often refer to the “Protect & Improve Your Soil with Cover Crops” fact sheet on the Grow It Eat It website for practical tips on improving soil quality with cover crops: http://www.growit.umd.edu/GE006_CoverCrop2.pdf

Bay-Wise Landscape Management

Bay-Wise training in 2011 focused on the history and condition of the Chesapeake Bay, hydrology, wells and septic systems, lawn fertilizers and the Bay, Asian tiger mosquito control, critical areas and coastal zone management, soil compaction, stormwater management, integrated pest management, and ecologically sound landscape maintenance. For more information about the Bay-Wise Landscape Management Program, visit www.baywise.umd.edu.

- One hundred three (103) new Master Gardener volunteers were trained in Bay-Wise Landscape Management techniques. To date, 966 Master Gardeners from 20 counties and Baltimore City have been trained in Bay-Wise techniques.
- Twenty-three (23) additional Bay-Wise Master Gardeners had their personal landscapes certified as Bay-Wise by the Urban Nutrient Management Program, bringing the total to 397.
- To date, 706 private properties (residential landscapes) have been certified as Bay-Wise by Master Gardeners in several Maryland counties. An additional 80 public landscapes have also been certified as Bay-Wise by Master Gardeners throughout the state.



Dr. Stu Schwartz demonstrating how to use soil compaction measuring tools for a Master Gardeners group during a Bay-Wise Advanced Training in Dorchester County (Photo courtesy of Ms. Wanda MacLachlan, Extension Area Educator)

In Closing

In 2011 the College of Agriculture and Natural Resources' nutrient management programs continued to conduct research on nutrient utilization in agronomic and horticultural crop production and animal nutrition as well as educate the public on farm management and sustainable horticultural practices. These research and education efforts allow the College's nutrient management initiatives to continue achieving their goal of improving and protecting the health of the Chesapeake Bay and Maryland's tidal and nontidal waterways while maximizing the state's economic potential.

Contributors

Dr. Roselina Angel, Dr. Gerald Brust, Dr. Amy O. Burk, Dr. Frank J. Coale, Dr. Robert Hill, Ms. Heather Hutchinson, Dr. Robert Kratochvil, Dr. John D. Lea-Cox, Dr. Erik Lichtenberg, Ms. Wanda MacLachlan, Dr. Joshua M. McGrath, Dr. Patricia Steinhilber, Ms. Jennifer L. Rhodes, Dr. Jennifer R. Timmons, and Mr. Jon Traunfeld.

Report prepared by Ms. Anastasia Vvedenskaya, Communications Specialist, Agricultural Nutrient Management Program

Photo Credits

Front Cover (top to bottom):

Maryland corn; Stream; CMREC Upper Marlboro Farm Field Day (*Anastasia Vvedenskaya*).

Back Cover (top to bottom):

Mid-Atlantic Precision Agricultural Equipment Field Day; Stream (*Anastasia Vvedenskaya*); Poultry research (*Edwin Remsberg, AGNR Photographer*).



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