

Nutrient Management Certification for Delaware: Developing a Water Quality Curriculum

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ABSTRACT

Water quality is a critical environmental, social, and political issue in Delaware. In the late 1990s, a series of events related to water quality issues led to the passage of a state nutrient management law. This new law required nutrient management planning and established a state certification program for nutrient users in the agricultural and nonagricultural sectors. Extension Nutrient Management Specialists from University of Delaware Cooperative Extension had a lead role in the development and delivery of this program. The law requires affected individuals to attend between 6 and 12 credits (hours) of nutrient management certification classes. Classes focus on the specific requirements of the law, the relationship between nutrients and water quality, and best management practices for storing and applying nutrients. Since January 2001 more than 2300 individuals have attended certification classes. These classes have generally been very well received, which has helped to defuse the anxiety and animosity that characterized many early discussions with stakeholders and has set the stage for an effective program that can address important environmental issues in the state.

NONPOINT SOURCE POLLUTION of surface and ground waters has been a major environmental issue in the Mid-Atlantic region for more than 30 years (Belval and Sprague, 1999; USEPA, 1997). In Delaware nitrogen and phosphorus from agricultural operations, which occupy nearly one-half of the state's land area, have been identified as a major cause of water quality impairment (DNREC, 2002). Agriculture is also Delaware's number one industry, generating more than \$860 million annually (Delaware Dep. of Agric., 2001). Poultry is the primary agricultural segment in the state constituting more than 70% of agricultural receipts and producing 248 million broiler chickens annually (Delaware Dep. of Agric., 2001).

In the late 1990s, a series of events led to the passage of a state nutrient management law in Delaware. These events included: (i) public concerns and media coverage of fish kills in the summer of 1997, reportedly caused by *Pfiesteria* spp., a toxic dinoflagellate that had been implicated in earlier, more extensive fish kills in North Carolina and also in human health problems (Glasgow et al., 1995); (ii) passage of nutrient management laws in Maryland (1998) and Virginia (1999); (iii) a 1997 consent decree resulting from a lawsuit filed the previous year (American Littoral Society, et al. v. EPA, et al., No. 96-330) that mandates implementation of watershed-based "pollution control strategies" associated with the total maximum daily load provisions of the Federal Water Pollution Con-

trol Act (Clean Water Act); (iv) adoption by USDA-NRCS, in 1999, of a "national nutrient policy" that required comprehensive nutrient management planning and implementation of plans for many farmers; and (v) the December 1998 Draft Unified Strategy for Animal Feeding Operations issued by the USEPA and the USDA.

The cumulative impact of these events was a regional shift from traditional programs that focused on voluntary practices and cost share to a more regulatory approach (Lanyon, 2000). The first step in this new approach for Delaware was the formation of the Governor's Agricultural Industry Advisory Committee in 1998. This committee was charged to: (i) examine the relationship between agricultural nutrient management practices and water quality; (ii) recommend effective voluntary measures; (iii) evaluate the relative effectiveness and economic impact of various nutrient management options; (iv) evaluate the effectiveness of public policies of other states and the federal government; and (v) provide advice on additional outreach efforts the state should take to obtain input from the agricultural community. Recommendations from this committee formed the basis of House Substitute 1 for House Bill 250, which was passed unanimously by the Delaware General Assembly on 9 June 1999 and signed by Governor Carper on 17 June 1999.

THE DELAWARE NUTRIENT MANAGEMENT ACT

House Bill 250 became Title 3: Chapter 22 of the Delaware Code (Delaware Code, 1999). This law, commonly referred to as the Nutrient Management Act (NMA), affects

...all persons who operate any animal feeding operation in excess of 8 animal units (8000 lb) or apply nutrients to lands in excess of 10 acres (~4ha) as a component of a commercial venture.

Thus, not only farmers, but commercial nutrient applicators (e.g., fertilizer companies), golf courses, school districts, lawn care companies, and landscaping firms are included. All affected operations are required to develop and implement nutrient management plans. In addition, at least one person from each operation must become nutrient management certified by attending a minimum of 6 and up to a maximum of 12 hours of classroom instruction (depending on the type of operation). This certification was to be completed by 1 Jan. 2004. However, classes are ongoing to certify individuals who missed the deadline and new or changing operations.

The NMA established the Delaware Nutrient Management Commission (DNMC) consisting of 15 voting members. The DNMC is charged to

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Table 1. Summary of Delaware Nutrient Management classes conducted and attendance.

Class	No. of classes conducted	No. of individuals attending
I. Agriculture	57	2084
II. Poultry (agriculture)	52	1276
II. Nonlivestock (agriculture)	13	261
II. Other animal (agriculture)	7	414
II. Equine (agriculture)	3	39
III. Agriculture	38	1302
I. Nonagriculture	10	221
II. Nonagriculture	8	190
III. Nonagriculture	9	174
IV. Nutrient consultants	5	59
IV. Commercial nutrient handlers	6	61

...regulate activities involving the generation and application of nutrients to help improve and maintain the quality of Delaware's ground and surface waters and to meet or exceed federally mandated water quality standards, in the interest of the overall public welfare.

The law establishes four categories for certification based on the type of operation. These categories are:

1. *Nutrient Generator*: a person who operates a facility that produces organic or inorganic nutrients.
2. *Private Nutrient Handler*: a person who applies organic or inorganic nutrients to land he or she owns, leases, or otherwise controls.
3. *Commercial Nutrient Handler*: a person who applies organic or inorganic nutrients to land as a component of a commercial or agricultural business in exchange for a fee or service charge.
4. *Nutrient Consultant*: a person who is engaged in the activities of advising or consulting on the formulation, application, or scheduling of organic or inorganic nutrient applications.

One of the first priorities of the DNMC was to establish the specific requirements for certification in these four categories. The focus of this article is the development of this certification program.

DEVELOPMENT AND DELIVERY OF THE CERTIFICATION PROGRAM

In October 1999, Dr. Dave Hansen and Dr. Greg Binford, nutrient management specialists from University of Delaware Cooperative Extension, submitted a proposal to the DNMC for the development and delivery of the nutrient management certification classes. This proposal included support for supplies (e.g., notebooks, printing costs), meeting room rentals, and other costs associated with conducting certification classes. It also included funding for two extension associates; one whose primary focus is coordination of field demonstration projects and another whose focus is the day to day record keeping and organization of the nutrient management certification materials. This funding is reviewed and renewed annually by the DNMC.

Given the diversity in background and expertise of individuals requiring certification, a multidisciplinary approach to education has been a central feature of this program. Although they were the primary instructors for all of the nutrient management classes, Hansen and Binford worked with ex-

tension specialists from a variety of disciplines including poultry production, livestock and equine systems, and horticulture to develop the curricula. They also interacted with researchers throughout the USA to ensure that the educational materials reflect the latest scientific understanding of the principles and practices of nutrient management and water quality protection.

The nutrient management certification effort is divided into two main tracks; agriculture and nonagriculture. Basic information covered in the certification classes is similar for the two tracks. However, the examples used to illustrate important concepts (nutrient losses, etc.) are varied between the tracks to make the material more useful and understandable. The objective of the classes are: (i) to provide a description of the relationship between water quality and nutrients; (ii) to present an overview of the nutrient management law; and (iii) to discuss best management practices (BMPs) for the protection of water quality in Delaware.

Nutrient management certification is offered as a series of 3-credit classes (1 credit equals approximately 1 hour of classroom instruction). Nutrient Generators are required to attend six credits of classroom instruction, Private Nutrient Handlers are required to attend nine credits of classroom instruction, and both Commercial Nutrient Handlers and Nutrient Consultants are required to attend 12 credits of classroom instruction.

Commercial Nutrient Handlers and Nutrient Consultants are also required to pass a written test and pay a registration fee to the Delaware Department of Agriculture (Nutrient Generators and Private Nutrient Handlers are not required to pass a test or pay a registration fee). The tests consist of 30 multiple choice questions for Commercial Nutrient Handlers and 100 multiple choice questions for Nutrient Consultants. A score of 70% is required for passing. The registration fee is \$150 for a 3-year certification for Commercial Nutrient Handlers and \$100 for a 1-year certification for Nutrient Consultants.

A total of 11 different classes have been developed for the certification program. There are two versions of Classes I and III (agriculture and nonagriculture) and five versions of Class II (four for agriculture and one for nonagriculture). Class IV is the same for both agriculture and nonagriculture tracks. However, there are two versions of Class IV; one for Commercial Nutrient Handlers and one for Nutrient Consultants (Table 1).

The focus in Class I (agriculture and nonagriculture) is to describe current water quality issues in the region, show the potential connection of land application of nutrients with these issues, describe the challenges associated with managing nitrogen and phosphorus, and provide an overview of the Delaware Nutrient Management Act. Class I in the agriculture track addresses more general concepts associated with management of nutrients (e.g., elements of nutrient management planning) while Class I in the nonagriculture track includes a discussion of basic cycles of nitrogen and phosphorus in soils.

Class II focuses on best management practices for reducing the impact of nitrogen and phosphorus in the environment. Individuals following the agriculture track have an additional option (beyond simply following the agriculture or nonagriculture track) of taking one of four different "agriculture" versions of Class II. These versions were developed to address

the major types of agricultural operations in Delaware; poultry, large animal (swine, dairy, etc.), nonlivestock (grain or vegetable), and equine. Individuals following the agriculture track were allowed to select the class option that they felt would be most useful to them. Examples discussed in Class II are specific to the type of operation. For example, the challenges facing turf operations (e.g., proper rate, timing, and form of fertilizer) are very different from the challenges facing a poultry operation (e.g., manure storage, feed additives, etc.).

Class III for the agriculture track focuses on nitrogen and phosphorus cycling in soils, management of organic inputs, and issues associated with soil testing such as sample collection and interpretation of laboratory results. Class III in the nonagriculture track focuses on soil testing issues and considerations for using various types of fertilizers (nitrogen and phosphorus cycling were covered in Class I for nonagriculture). Both the agriculture and nonagriculture tracks include discussions of equipment calibration and important considerations in nutrient management planning.

Class IV is the same for both the agriculture and nonagriculture tracks. However, it is divided into two versions based on whether the individual is seeking certification as a Commercial Nutrient Handler or a Nutrient Consultant. Class IV for Commercial Nutrient Handlers focuses on calibration of equipment, and calculations for determining rates of fertilizers or manures based on nutrient recommendations and available materials. Class IV for Nutrient Consultants focuses on required elements of nutrient management plans, considerations for making nutrient recommendations, and calculations for determining rates of fertilizers or manures based on nutrient recommendations and available materials. Both classes also include a review of water quality issues and important elements of the Delaware Nutrient Management Act.

Individuals requiring certification must first decide which track (agriculture or nonagriculture) and which of the four certification categories (Nutrient Generator, Private Nutrient Handler, Commercial Nutrient Handler, and Nutrient Consultant) best describes their operation or activities. All four categories are possible for individuals involved in agriculture. However, the Nutrient Generator category (which is designed for animal operations) is not an option within the nonagriculture track. Within each track individuals then progress through the required number of 3-credit classes, beginning with Class I and ending (in the case of Commercial Nutrient Handlers and Nutrient Consultants) with Class IV.

For example, within the agriculture track an individual requiring certification as a Private Nutrient Handler would attend Classes I, II, and III. If they had a grain and poultry operation they would choose the poultry version of Class II (Fig. 1). They would then have completed the requirement for certification as a Private Nutrient Handler. Within the nonagriculture track an individual requiring certification as a Commercial Nutrient Handler, such as a lawn care professional, would attend nonagriculture Classes I, II, and III, and attend Class IV for Commercial Nutrient Handlers (Fig. 2). They must then pass the Commercial Nutrient Handler examination and pay the \$150 registration fee to the Delaware Department of Agriculture. They would then have completed the requirement for certification as a Commercial Nutrient Handler.

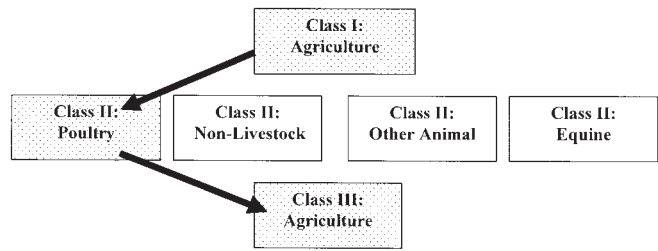


Fig. 1. Normal progression of nutrient management classes for an individual involved in raising poultry, growing row crops (agriculture track), and applying nutrient only to land they own or manage (Private Nutrient Handler).

Certification activities include classroom instruction, web-based dissemination of information, numerous publications, and on-farm demonstration/research. Classes have been offered at a variety of times and in more than 15 locations across the state. Two separate notebooks containing course materials and supplementary information have been prepared for the two tracks. Publications include a series of information sheets ("Delaware Nutrient Notes") that explain the Nutrient Management Act and various other associated topics (notes are accessed through the Delaware Department of Agriculture website: www.state.de.us/deptagri/nutrients/nm_news1.htm (verified 15 Sept. 2004). Educational programs have also been presented to many farm and nonfarm groups on topics of particular interest to these groups.

The nutrient management program initially estimated that 3000 individuals would require certification. Since its initiation in January 2001, approximately 2300 individuals have participated in more than 220 certification classes (Table 1). To date, 606 individuals have completed their certification as Nutrient Generators, 1326 as Private Nutrient Handlers, 54 as Commercial Nutrient Handlers, and 90 as Nutrient Consultants. Individuals certified as Nutrient Generators and Private Nutrient Handlers are required to attend 6 credits of continuing education every 3 years, Commercial Nutrient Handlers must attend 9 credits in 3 years, and Nutrient Consultants must attend 8 credits each year.

RESPONSE TO THE CERTIFICATION PROGRAM

Participants in the certification classes were asked to provide written evaluations of the content and quality of each class, the need for additional topics to be added, and suggestions for improvement. Overall evaluations average 4.32 out

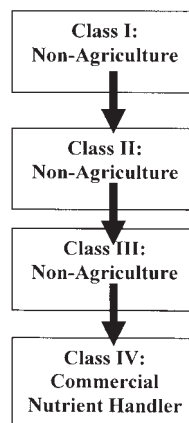


Fig. 2. Normal progression of nutrient management classes for an individual involved in the lawn care industry (nonagriculture, Commercial Nutrient Handler).

of a possible 5 points (a ranking of 1 means *very unhelpful* and a ranking of 5 means *very helpful*). Many attendees include additional comments. Although some comments are critical, the majority of comments are overwhelmingly positive. Examples of these comments include:

Great presentation—moved right along; very organized and clear.

This class is great! And very helpful, thanks.

I feel the entire program was very helpful and very informative.

If you think this program is nonsense and heavy-handed you haven't been to a class!

The educational impact of the certification effort has been critical to the success of the nutrient management program. In addition to soliciting evaluation comments we conducted a limited number of pre- and post-tests to assess the effectiveness of the learning experience. This test was similar in content to nutrient management examinations administered to nutrient consultants. Average percentage of correct responses for the pre-test, which was conducted at the beginning of the first class, was 46% ($n = 100$), while the average percentage correct on the post-test, administered at the end of the third class, was 61% ($n = 105$). Although not a rigorous evaluation, these results suggest that participants increased their knowledge of basic nutrient management principles as a result of taking these classes.

Verbal feedback from participants, results from evaluations, and improvements in test scores all suggest that the certification program has significantly advanced the state-wide level of understanding of the science, policy, and practice of nutrient management. The program was featured in newspaper articles (Silva, 2000; Anonymous, 2003) and on a television news program (WBOC Channel 16 News, Delaware Farmers Go Back to School, Lisa Spicer reporter, 2001). Hansen and Binford also received the Epsilon Sigma Phi Cooperative Extension Outstanding Program Award in 2003.

FUTURE EFFORTS

Future efforts in the certification program will include periodic offerings of the certification classes, as well as a stronger emphasis on continuing education. Continuing education credits will be offered primarily by University of Delaware Cooperative Extension, but other groups, organizations, or busi-

nesses will likely submit materials for continuing education activities.

The certification program will be evaluated in terms of instructional effectiveness and impact on land-use practices through the use of a survey instrument. This survey will be a thesis project for a University of Delaware Master's student. Results from this survey will guide future nutrient management efforts in the state.

The education and certification classes have resulted in a more positive dialogue on the issue of water quality as related to nutrients between the various stakeholders in Delaware. This improved dialogue should help to achieve the purpose stated in the NMA of maintaining agricultural profitability while improving water quality.

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