SEEING IS BELIEVING: HANDS-ON TOOLS FOR EDUCATION ON NON-POINT SOURCE POLLUTION

Julia W. Gaskin[1], Gary L. Hawkins[2], Tina W. Pagan[3], and L. Mark Risse[4]

AUTHORS: [1]Land Application Specialist, Department of Biological & Agricultural Engineering, UGA, Athens, GA 30602. [2]Crop Pollution Prevention Specialist, Department of Biological & Agricultural Engineering, UGA, Tifton, GA 31793. [3]Farm*A*Syst Coordinator, Department of Biological & Agricultural Engineering, UGA, Athens, GA 30602. [4]Cooperative Extension Water Quality Coordinator, Department of Biological & Agricultural Engineering, UGA, Athens, GA 30602.

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Abstract. It is sometimes difficult for people to understand that they are contributing to non-point source pollution because it is by definition diffuse and it is difficult to visualize. Over the past several years, the Agricultural Pollution Prevention program of the University of Georgia, College of Agricultural and Environmental Science, Cooperative Extension Service has used hands-on educational tools to show people the connections between everyday activities and water quality problems. These tools include: groundwater models illustrating the connections between septic tanks, wells, lakes, and groundwater; a table-top rainfall simulator comparing erosion on soils with different amounts of cover; in-stream water quality monitoring with high school and community groups; and on-farm workshops demonstrating whole-farm management practices to reduce non-point source pollution. These tools have been effective in helping people identify sources of non-point source pollution and understand practices they can use to reduce impacts. A demonstration during the exhibits will showcase several of these tools as a companion to this paper. The Agricultural Pollution Prevention program has these tools available for people to use in educational programs.

INTRODUCTION

Agriculture is one of the causes of non-point source pollution (NPS). As populations of people and farm animals increase and farming practices intensify, some of the traditional agricultural management techniques may overload natural systems. It is important for farmers and rural residents to understand NPS pollution, but because it is by definition diffuse, it is sometimes difficult to see how certain activities can contribute to the problem.

Most farmers are good stewards. When they understand the problem and understand the potential management techniques to address these problems, they are very creative in finding solutions that fit their farm. However, when people do not understand the processes or activities that cause NPS pollution, they often do not think they are part of the problem. Over the past several years, the Agricultural Pollution Prevention (AgP^2) program has used hands-on educational tools and workshops to show people the connections between everyday activities and water quality problems in Georgia. Many tools were developed in other states but have been modified for Georgia conditions. These educational efforts have targeted farmers, rural residents, and youth.

PROCESS MODELS

Agricultural and rural residents can contribute to NPS pollution in several ways, including erosion, excess nutrients from fertilizers, animal manures, septic tanks, and/or pesticides. Understanding the basic hydrologic processes can help people rethink how certain practices might contribute to NPS pollution.

Most people are not aware of how groundwater and surface water interact. The AgP^2 program has used a plexiglass groundwater model, modified by Dr. Matt Smith for Georgia conditions, to illustrate groundwater hydrologic processes. Dyes are used to show how contaminants from wells or septic tanks can move through the soil and enter both groundwater and surface water (Figure 1). The model has been used with farmers and students to further their understanding of how contamination may occur.

Figure 1. Student using the groundwater model to understand potential pollution threats.

Figure 2. The tabletop rainfall simulator showing the importance of soil cover in reducing erosion and sedimentation.

A surface water model, developed by Dr. Richard Lowrance and Dr. George Vellidis, is used in a similar manner. This landscape model shows farm fields, lakes, streams, and houses. Students "contaminate" surface water by overfertilizing lawns, improper construction or farming activities.

Erosion and sedimentation is a major source of NPS pollution. Keeping a vegetative cover on the soil can dramatically reduce erosion and sedimentation. The AgP[2] program has recently built a small rainfall simulator based on a design developed by Mr. Clyde Mermis of the United States Department of Agriculture, National Resources Conservation Service (USDA NRCS) in Kansas to illustrate this point. The tabletop simulator mimics a severe storm to allow differences in runoff and erosion under different soil conditions to be seen quickly. Several pans with different soil conditions are used to illustrate possible erosion. Runoff is collected with clear jars so the amount of sediment and runoff from each soil condition can be demonstrated. Figure 2 shows a simulation with bare soil, 30% rye cover, 100% straw cover, and sod cover. This is a dramatic demonstration of how important keeping cover on the soil is for reducing the amount of runoff and sediment entering streams.

MONITORING

Stream monitoring has been shown to be an effective way of educating people about potential water quality problems. "Low-Cost" monitoring kits that measure pH, dissolved oxygen, nitrate, phosphate, fecal coliforms, and temperature are a good tool for allowing students or farmers direct experience with monitoring streams. These kits have been used with over 400 school children in south Georgia as part of a water quality education program.

ON-FARM WORKSHOPS

Several on-farm workshops have been conducted at the Northwest Georgia Research and Education Center's Redbud Farm over the past four years. These on-farm workshops stressed a whole-farm management approach for pollution prevention. A limited amount of classroom time was used to cover the basics of water quality and agricultural impacts. Most of the workshop was conducted at the farm at various field stations. Field stations included farm water quality, riparian buffers, alternative water sources, grazing management, forages, proper use of poultry litter as fertilizer, and poultry litter spreader calibration.

For example, grazing management is an important topic emphasizing the importance of whole farm management to reduce NPS pollution. Good vegetative cover on pastures and hayfields reduces runoff and erosion, which in turn reduces water quality impacts. As part of the on-farm workshops, Dr. Holli Kuykendall from the USDA NRCS showed farmers and County Extension Agents how to use a forage stick to estimate the grazing days available before a pasture is overgrazed.

To complement that presentation, Dr. Mary Miller-Goodman of Auburn University demonstrated how grazing effects roots. Dr. Goodman provided sets of pots with several different forages clipped to simulate overgrazing, proper grazing height, and no grazing. The forage was removed from the pots and the roots washed

Figure 3. Demonstration showing grazing effects on root growth.

Figure 4. Poultry litter spreader calibration.

to look at root growth (Figure 3). There were very few roots in the overgrazed pot, while roots extended all the way down to the bottom of the pot for the correct grazing height. This demonstration hammered home the point that deeper roots promote better growth, allows the plants to live during dry periods, and consequently gives better vegetative cover on the pastures. Better vegetative cover improves filtering capacity.

Another station examined using poultry litter to fertilize pastures. The presenters discussed the importance of maintaining a good vegetative cover by using fertilizers properly. Data from small test plots at the Redbud Farm had been collected to evaluate hay production, hay quality, changes in soil nutrients, and changes in surface water runoff due to various poultry litter treatments and commercial fertilizer. This data showed both the environmental impacts of poultry and how it compared as a fertilizer. The data indicated that doubling the application rate did not double the growth, increased potential nitrate toxicity, and more than doubled the average phosphorus concentration in the surface runoff. This data reinforced the point that overapplication of poultry litter increases the environmental risk without increased return in terms of hay production.

Because applying the proper amount of litter is critical, the workshop taught farmers and County Extension Agents how to calibrate a poultry litter spreader. Poultry litter spreader calibration includes weighing the amount of poultry litter on the large tarps to determine how many tons per acre are applied and checking the spread pattern (Figure 4). The presentation also covered equipment adjustments that can be made to improve accuracy such as leveling spinners, moving spinners forward or backward, adjusting the gate, and the speed of the spreader.

These workshops also showed farmers and County Extension Agents how to use the Georgia Farm*A*Syst assessments. These tools are non-regulatory self-assessments that identify potential sources of pollution, provide information on corrective actions, and encourage an action plan to address concerns. A series of questions about management practices allows a farmer to identify high risk practices. The Farm*A*Syst assessments cover such topics as beef cattle production, dairy production, cotton integrated pest management, pesticide handling and storage, and drinking water quality.

SUMMARY

Educational tools and workshops about NPS pollution help people understand how changes in behavior or management practices can make a difference and improve water quality. The AgP[2] program has found the most successful educational approaches actively involve the audience and are based on sound technical information. The approaches stress evaluating the whole farm system to find ways to prevent pollution and understanding the basic processes that can contribute to pollution. This allows people to help develop solutions that fit their particular farm. The tools discussed in this paper are available for educational programs across the state. For more information, contact the authors or the Agricultural Pollution Prevention Program in the Biologicaland Agricultural Engineering Department at the University of Georgia.

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