Part 4

Pesticides Pollution Prevention

Pesticides are agents used to control unwanted insects, plants, rodents, fungi or bacteria. The focus of pollution prevention (P2) in regard to pesticides involves practices that eliminate, or where this is not feasible, use the least amount and the least toxic alternatives possible, to accomplish the needed control. Although progress has been made, research shows that many opportunities remain for pesticide pollution prevention.

The Office of Environmental Assistance (OEA) is responsible for pollution prevention (P2) technical, financial and educational assistance and for evaluating state progress in P2. *Pollution Prevention Evaluation Report* evaluates progress and opportunities to reduce pesticides through using P2.

Environmental monitoring data

Due to the risk pesticides present to public health, a number of government agencies monitor environmental concentrations of commonly used herbicides and insecticides. Although pesticides have been detected in the state's rain, surface and ground water, their concentrations are, for the most part, within the Minnesota Health Risk Limits (HRL) and federal drinking water Health Advisories standards.

A 1995-98 United States Geological Survey (USGS) study of commonly detected pesticides in streams and shallow ground water showed that most concentrations were within drinking water standards and aquatic life guidelines. However, not all of the pesticides detected currently have standards and guidelines.[1] One part of the study showed the Little Cobb River, an agricultural stream near Beauford, Minnesota, contained degradation products of four commonly used herbicides (acetochlor, alachlor, atrazine and metolachlor). The study concluded that total concentrations of the pesticides' degradation products were always greater than the summed parent compound concentrations. The effects of these degradation products on aquatic and human health are not known, but their persistence and relatively high concentrations are cause for concern.[1] Recent research by the University of California documented disruptions in the sexual development of frogs at concentrations of atrazine frequently found in the environment.[2] In contrast, earlier research indicated that the herbicide does not pose a risk to the aquatic environment.[3]

The Minnesota Department of Agriculture (MDA) is performing ground water testing in the sand plains of central Minnesota, and in the exposed limestone (karst) areas of southeastern Minnesota.[4] Monitoring results for the year 2000 show that atrazine, a corn herbicide, and its degradation products were most frequently detected, being found in 76 percent of the wells and 68 percent of the samples collected. Metolachlor and metribuzin and their degradation products have also been detected multiple times in multiple wells. The MDA *2001 Common Detection Report*, which provides information to the public on environmental concentrations of pesticides, states that a recommendation should be made regarding these pesticides (atrazine, metolachlor and metibuzin) and their possible candidacy for placement in "Common Detection Status," a designation for pesticides frequently found in the environment. The levels of atrazine, metolachlor, and metribuzin detected are within the current state HRL levels established by the Minnesota Department of Health (MDH), although atrazine has been frequently placed in Common Detection Status.[5]

A 1998 joint investigation by MDA, U.S. Geological Survey, University of Minnesota, and Minneapolis Park and Recreation Board found pesticides (alachlor, atrazine, cyanazine and metolaclor) in rainwater falling in the Lake Harriet watershed of Minneapolis.[8] Since these pesticides are commonly used in agriculture and are *not* approved for urban use in Minnesota, the report concludes that the chemicals were volatilized after application on crop land, transported through the atmosphere and subsequently deposited by rain.[6, 7] Because these same pesticides were detected in much lower concentrations in storm water runoff, the indication is that they tend to accumulate in the urban watershed. Concentrations of pesticides in storm water routinely exceed Minnesota Department of Health HRLs.[7, 8] In Europe, over 80 pesticides in current use have been detected in rainwater. The most commonly detected are the organochlorine insecticide lindane and triazine herbicides.[9]

The Minnesota Department of Health conducted a pilot study in 1997 to test methods of measuring children's exposure to pesticides. Researchers collected tap water, food, beverage, soil, dust, blood, urine and hair samples from 102 homes in urban and rural Minnesota that reported past use of pesticides. The most common pesticide found was chlorpyrifos, which was found in 95 percent of personal air samples, 67 percent of food samples and 62 percent of dust samples. The chlordanes, dieldrin, DDD, DDE and DDT were fairly common in both air and food. Two-thirds of the homes had measurable concentrations of the herbicides 2,4 D, MCPA and/or MCPP. Over 90 percent of the children in the study had measurable levels of TCPY, a metabolite of chlorpyrifos, in their urine. The MDH study concluded that, "Among the sampled households, no child's exposure reached a level of concern."[10] In June 2000, EPA announced an agreement with registrants to phase out nearly all household uses and most food uses of chlorpyrifos, also known by the trade names Dursban and Lorsban. This action was taken primarily for the purpose of protecting children's health.[11]

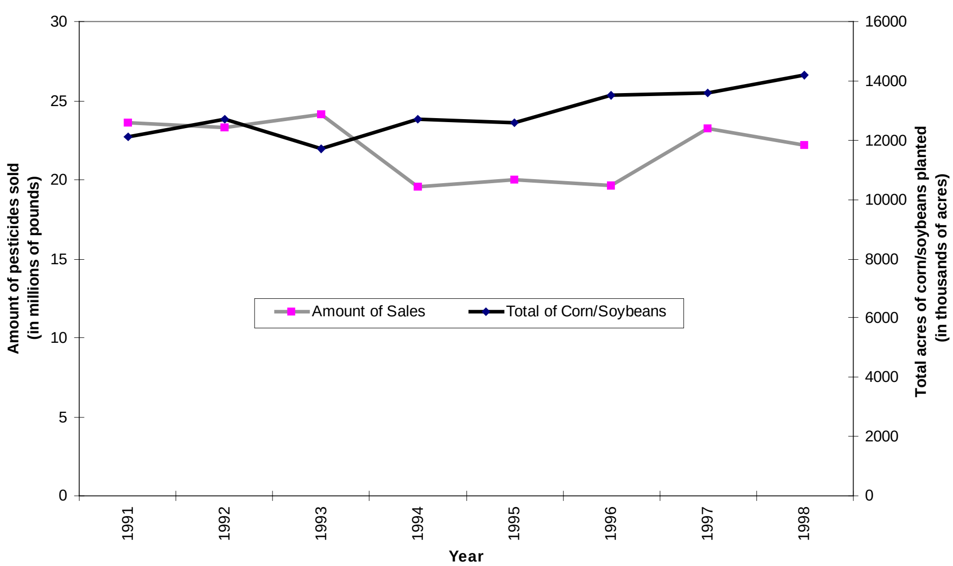
Progress in pesticide pollution prevention

Pollution prevention reduces the toxicity or the amount of a substance used to accomplish a task. The fact that pesticides move in measurable amounts from points of application means there are opportunities to reduce waste through pollution prevention. Recognizing this opportunity, a number of successful pollution prevention activities have occurred.

Agriculture

EPA estimates that about three-fourths of all conventional pesticide use in the United States is for agriculture.[12] Pollution prevention is most accurately determined by documenting the change in the amount of chemicals used to produce a product over time. Little data is available to make this determination in regard to pesticides. The following graph uses available data on the amounts of pesticides most commonly sold for use on soybeans and corn (Minnesota's largest crops) and the numbers of acres planted with them, so as to provide a general indication of progress in pollution prevention.[13, 14] The amounts of crop-specific pesticides sold, contrasted with the change in the number of acres planted in corn and soybeans over time shows that less pesticide is purchased per planted acre today than prior to 1994. This may indicate that pollution prevention has occurred.

Figure 4-1. Amounts of crop-specific pesticides sold compared to acres of corn and soybeans planted in Minnesota



Additional data are needed before a more statistically valid conclusion regarding progress in P2 can be made. Sales data does not mean the chemicals were actually used when purchased, or in fact, used in Minnesota. In addition, pesticides may have been purchased in adjacent states but used in Minnesota. Relative persistence, bioaccumulation and toxicity data are also not available. If more pounds of a less persistent, bioaccumulative and toxic pesticide are used versus fewer pounds of a more hazardous one, pollution prevention may have in fact occurred although more pounds of the less hazardous pesticide may have been sold.

P2 options to reduce pesticides

P2 options include practices that eliminate, or where this is not feasible, use the least amount and the least toxic alternatives possible, to accomplish the needed control.

Integrated pest management

One of the most inclusive methods of decreasing pesticide pollution is Integrated Pest Management (IPM). As defined in state statute (Chapter 17.114 Sustainable Agriculture Subd. 4), "Integrated Pest Management means use of a combination of approaches, incorporating the judicious application of ecological principles, management techniques, cultural and biological controls, and chemical methods, to keep pests below levels where they do economic damage."[15] IPM includes planning and setting action thresholds, monitoring sites for early detection and accurate assessment of pests, proper identification of pests, then deciding what actions to take after considering all the information.[15] Essays about a number of sustainable agriculture practices can be found in the *Greenbook*, published by the MDA.[16]

At five apple orchards in various locations throughout the state, IPM was implemented by using an insect pheromone or mating scent to attract male spotted tentiform leafminer insects to traps. This three-year MDA project showed that use of traps is a viable alternative in terms of effectiveness and economics to the application of insecticides.[17] In a University of Minnesota research project, scientists plan to release a parasitoid of the alfalfa blotch leafminer into alfalfa fields as a natural control for these insects.[18] The goal of this project is to alleviate the need for growers to apply pesticides to alfalfa fields. Many other promising IPM research projects such as timing cultivation to reduce herbicide use in ridge-till soybeans and experimenting with bio-based weed control using materials such as sheep wool or canola mulch to control weeds in strawberry beds are being conducted.

Organic farming

One method of decreasing pesticide use is to farm organically. In 1997 Minnesota ranked seventh overall in certified organic acreage in the United States, with 64,000 acres in production. Organic food is the fastest growing segment in the U.S. food industry, with sales in 2001 expected to reach $9.5 billion and a continuing overall annual growth of 20 percent.[19]

Crop rotation

Seasonal rotation of two or more crops on the same farmland can reduce pesticide use. Since pests are commonly crop specific, crop rotation serves to decrease breeding and break the multi-year cycle of plant disease, weeds and insect pests. Use of cover crops, perennial crops and weed competitive crops will help diversify crop rotations and minimize weed control problems.

Multi- versus mono-crop planting

Large tracts of the same crop are more susceptible to disease than those interspersed with different crops. Using multi- versus mono-crop planting can decrease the need for pesticide. Strip cropping can be used on an annual or rotational basis to reduce weed and insect pest problems.

Diversified varieties

Approximately 10 percent of common crop varieties remain as compared to the number of varieties available in 1700. The fewer varieties, the less genetic diversity available to resist changes in climate, insects and disease. Planting different varieties of the same crop can reduce the need for pesticides.

Precision farming techniques

Precision farming techniques, using computers to adjust the inputs of fertilizer and pesticides within a field, is being tested on a pilot farm by the MDA.[20] Precision farming uses satellite information through a global information system, which allows farmers to apply fertilizer and pesticides only in the areas where they are needed.

Use of less persistent, bioaccumulative and toxic pesticides

There is also progress with the types of pesticides being used. Due to their persistent, bioaccumulative and toxic nature, the insecticides aldrin, chlordane, DDT, dieldrin, mirex and toxaphene have been banned or voluntarily withdrawn from use in the United States. Efforts have been made to replace them with less persistent and less bioaccumulative insecticides. For the past several years, the U.S. EPA has been in the process of phasing out most registered uses of organophospate pesticides (such as chlorpyrifos, mentioned above), which substituted for the organochlorine pesticides mentioned here.

Due to the complexity of pesticides, it may take time to recognize unintended effects. The pesticide clopyralid has been detected in compost made from grass clippings and livestock bedding.[21] A recent study indicates that when two agricultural fungicides, paraquat and maneb, are used together they could have a synergistic effect triggering Parkinson's disease.[22, 23] Constant research takes place to develop less hazardous, newer generations of insecticides. Recent entries to the market are the pyrethroids (deltamethrin, permithrin).

Genetically modified crops

Research is taking place to increase use of food and fiber crops of genetically modified organisms (GMO) that are engineered, in part, to decrease the need for pesticides. The use of GMO soybeans in the United States increased to 68 percent in 2001. One quarter of the country's corn crop is genetically modified. Although use of pesticides with GMO crops was projected to decrease 30 percent, a recent study calculates that actual reductions may only be 0 to 10 percent.[24] A second study by Cornell and Iowa State University found that use of GMO corn is not being used as a replacement for insecticides but in addition to them.[25] Since the modified genetics have not occurred previously in nature, there is concern that introducing them into the environment could result in unforeseen consequences. Since monitored pesticide levels are commonly below human health risk standards, the relative risk between the technologies is a factor.

Residential, public and commercial sectors

There are programmatic examples of pollution prevention in these sectors, which indicates that progress in P2 is occurring, but a more quantified evaluation is not possible. A quantified evaluation would require data such as the number of acres of turf grass cultivated with the number of pounds of turf grass pesticides used, or the quantity of pesticide used in the same schools over time, or the changes in the quantity of pesticides used in the same homes over time. Programmatic examples of P2 follow.

Residential

During the best management practices study for the Lake Harriet and Lake Alimagnet watershed of South Minneapolis, a water-monitoring site was established at the point where storm water runs off from 700 households into the lake. Extensive education campaigns were conducted throughout the watershed. Master Gardener volunteers surveyed homeowners on a periodic basis, and the storm water was monitored to learn the effectiveness of the campaigns. As a result of the P2 education efforts, runoff from the Lake Harriet watershed showed decreases of 56 to 86 percent in the amounts of four commonly used lawn herbicides.[26] The educational materials developed in this project sponsored by the MDA and the Minneapolis Park Board have been used in other watersheds.

Public schools

The Parents' Right to Know Act of 2000 (Minn. Stat. §123B.575) requires all K-12 schools to issue notices to parents and school employees if the school plans to apply the pesticides specified in the law to prevent pest problems. The notice must provide that an application schedule is available at the school and offer that the parent may request to be notified by the school before application. It further must state that health effects on children from the application of such pesticides may not be fully understood. Although schools are not required to adopt Integrated Pest Management (IPM) plans, the MDH encourages schools to use IPM plans, which will reduce pesticide use.[27] Training of school personnel on IPM will be conducted by the Minnesota Department of Agriculture throughout Minnesota beginning in the spring of 2002.

A multi-agency work group coordinated by the Department of Agriculture has been formed to exchange information and plan and develop curriculum for the IPM in the Schools training. The group includes representatives from MDA, MDH, the Department of Children, Families, and Learning, the University Extension, school districts, the OEA, the St. Paul Neighborhood Energy Consortium, and pesticide service companies.

The St. Paul Neighborhood Energy Consortium in partnership with Advocates for Better Health and Environment received a grant from the OEA to conduct a pilot study for Integrated Pest Management in four Minnesota schools. The purpose of this project was to determine whether an effective IPM program is feasible in Minnesota schools. Project staff surveyed pesticide use and practices in four Minnesota schools, both before (baseline) and after (study year) IPM implementation. An IPM work team at each school identified and implemented the least toxic methods to manage pests in school buildings and on school grounds. The IPM teams received IPM training from national experts. Each school developed an IPM plan, which included both building practices and a guide for turf maintenance. In the second year, each school implemented its plan, beginning with an inspection of the building and grounds to identify issues that needed to be worked on.

After IPM implementation, the study schools appeared to be more conscious of sanitation, preventive maintenance practices and preventive food policies. The follow-up survey showed that team members were much more knowledgeable about IPM than they were at baseline. The project clearly succeeded in heightening awareness and concern about pesticide use and the importance of IPM in these schools. Furthermore, these schools showed that it was feasible to implement IPM without incurring additional costs. This project proved that any school could have a successful IPM program, with a little bit of technical assistance and the commitment to make changes.

Commercial

A number of Minnesota businesses are incorporating native landscaping at their facilities. Established native systems do not need the fertilizers, pesticides, and watering required to maintain imported species. Damon Farber, a Twin Cities commercial landscaping firm, estimates that of the 80 landscaping projects they do each year, 25 percent incorporates native plantings. Examples of facilities in the state that use native landscaping include State Farm Insurance regional facility building in Woodbury and the ADC Telecommunications manufacturing building in Shakopee. In addition to the complete elimination of pesticide use, there are also significant cost savings; 70 percent less installation costs and 80 percent less maintenance costs per acre are reported when natural landscaping is used.[28] Because native landscaping can take up to three years to establish, both employees and clients must be educated in process of native landscaping as it develops. Some companies have removed native landscaping due to this delay.

OEA P2 actions and opportunities to reduce pesticides

Consultants

Crop consultants have become key advisors to farmers in the area of crop management. An important aspect of P2 with regards to pesticides is to continually supply consultants with information regarding the most recent advances in alternatives to chemical pesticides for agriculture. The OEA will determine if a grant to develop educational resources is warranted.

Native landscaping

Residents, businesses, builders and architects need to be educated on the natural beauty and benefits of using native landscaping. The OEA will provide educational resource links to native landscaping web sites through the Green Building portion of its Internet site.

Integrated Pest Management (IPM)

Continued research and education in the area of Integrated Pest Management should be supported. The wide array of IPM projects currently being implemented by the Minnesota Department of Agriculture demonstrates successful use of IPM on a number of types of crops. The OEA will continue to be involved in the multi-agency work group on IPM in the Schools, which is coordinated by the Department of Agriculture. The OEA will put the results of the IPM in the Schools pilot study on its web site and look for ways to use the materials throughout Minnesota.

Interagency cooperation

As the relationships between the health of the environment and the health of the public continue to be explored, new studies with regard to human pesticide exposure are yielding new findings. The OEA will participate with efforts to improve communication between OEA, MDH, MDA and County Extension to increase distribution of information relating to pesticide use.

Dissemination and availability of public information on pesticides

The OEA participates in the Minnesota Pesticide Resource Center board and has provided grant support to develop a web site for MPRC. This web site, hosted by the Institute for Agriculture and Trade Policy, will serve as a central access point, with links, for example, to state and federal agency web sites on pesticide use, environmental monitoring data, and information on health effects.

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