13. Protecting People and the Environment when Choosing and Using Pesticides

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Despite their usefulness, pesticides do pose varying degrees of risk to both people and the environment. We all need to make choices that keep these risks as small as possible. Of particular concern are keeping nutrients and pesticides out of both surface water and groundwater and reducing human and wildlife exposure to pesticides. The following sections describe some measures that tobacco producers and professional applicators can take to minimize the threat to water quality and to reduce pesticide exposure to humans and wildlife.

Minimize Pesticide and Fertilizer Use Where Possible

Pesticide use should be only one part of an overall pest management program for insects, diseases, suckers, and weeds. It makes good environmental and economic sense to rotate crops, destroy stalks and roots early, use thresholds where available, promote a healthy and vigorous crop with good cultural practices, and fertilize properly. This protects the environment and also saves money by reducing pesticide and fertilizer use. Refer to the sections on insect, disease, and weed management, and on sucker control for proper management of these pests.

Fertilizer use also affects both pest problems and water quality. Be sure to have your soil tested field by field and to apply only those nutrients recommended.

Select Pesticides Carefully

While cultural practices are important parts of a sound pest management program, pesticides often must still be used. When this is the case, take care to match the pesticide with the pest. First, identify the pest, then select an effective pesticide, rate, and

application method. Remember to consider potential effects on water and safety to humans and wildlife when choosing a pesticide.

A measurement called an LD_{50} is used to measure pesticide toxicity to humans and other mammals. The LD_{50} is the amount of a substance that will cause death in 50 percent of a target population (rats, mice, or rabbits are most commonly used). The lower the number, the more toxic the substance is. An LD_{50} can be used only to measure acute (short-term) toxicity and is not a measure of chronic (long-term) toxicity, such as the ability to cause diseases like cancer.

Information on acute toxicity can be found in Table 13-1 below. Information on chronic toxicity can be found on Material Safety Data Sheets (MSDS) that your pesticide dealer can provide. In general, it is best to choose the least toxic pesticide (to humans) that will do the job. Use extreme caution with pesticides that have low LD_{50}s, such as Temik, Di-Syston, Mocap, Nemacur, and Furadan.

Apply Pesticides Carefully

Care must be taken to make sure pesticides are applied only to the tobacco crop. This is especially important with aerial application. Field borders consist of ditches, hedgerows, and woods, which are all vital habitat for wildlife. Imprecise application can be detrimental to these areas, and contaminated water in ditches may find its way into larger bodies of water, such as ponds, lakes, and rivers, or into groundwater.

Most human exposure to pesticides occurs in one of three ways: (1) exposure to skin (dermal), (2) ingestion (oral), or (3) inhalation (breathing vapors). The use of protective clothing by handlers and applicators is the best defense against pesticide exposure and is specified on each pesticide label. These requirements should be followed carefully. The potential for harmful pesticide exposure is greater when handling concentrated pesticides (not mixed with water) than with using a diluted solution (mixed with water in a sprayer). Thus, be especially careful in the mixing/loading process. For example, pesticides should not be added to a spray tank by lifting the pesticide container above one's head to pour into the tank. If pesticide poisoning is suspected, contact the Carolinas Poison Center at 1-800-848-6946. The center provides 24-hour consultant service for diagnosing and treating human illness resulting from toxic substances.

Minimize Soil Movement and Leaching

As soil particles become dislodged, they carry pesticides and nutrients that may eventually find their way into a water source. To minimize contamination of our water resources, be sure to follow sound soil conservation practices, such as avoiding unnecessary disking and cultivation and using cover crops, waterways, and strip-cropping. Consult your local Natural Resources Conservation Service and Cooperative Extension agents for advice.

Pesticides commonly used on tobacco differ in their potential to contaminate surface water and groundwater. Predicting which pesticides may reach groundwater and where this is most likely to occur is very difficult because of differences in soil chemical and physical characteristics and in water table depth. Generally, rolling soils in the piedmont have more potential for surface water contamination through runoff, whereas the porous soils of the sandhills and coastal plain may be more susceptible to groundwater contamination through leaching. However, surface water contamination can occur even on slightly sloping soils in the coastal plain. The Natural Resources Conservation Service can help you determine the leaching and runoff potentials for your fields. There are also guidelines that help determine which pesticides may be at highest risk for runoff and leaching. These guidelines are based on knowledge of the chemical characteristics of different pesticides and are summarized in Table 13-1. This list includes most of the commonly used tobacco pesticides.

Two guidelines for pesticides are *surface loss potential* and *leaching potential*. Surface loss potential is broken into two categories: the risk of a pesticide running out of a field in solution with surface water (rain, irrigation, or flooding) and the risk of a pesticide adhering (being adsorbed) to soil or organic material and washing out of the field as erosion. A high rating in either category means the pesticide has a high tendency to move off the field, while a low rating means the pesticide has a low potential to move. Leaching potential indicates the tendency of a pesticide to move in solution with water and leach below the root zone. The ratings of very high, high, medium, low, and very low describe the potential for leaching. The symbol "NA" is used where information is not yet available. These are general guidelines and should be interpreted as such. Most pesticides will move into water in at least one of the ways described above. For example, a material that is not very leachable will tend to be adsorbed

to soil and move as erosion. Thus, your best choice will depend on the characteristics of the field and the measures you have taken to reduce the chance of runoff.

Protect Wells

Improperly constructed and protected wells offer the quickest pathway for pesticides to reach groundwater (and perhaps your drinking water). Direct flow through wells is most often the source of high levels of pesticide contamination in groundwater.

- Ensure that wells are properly constructed and sealed.
- Do not mix or load pesticides within 100 feet of a well.
- When filling spray tanks, be sure the hose or pipe is not at or below the surface of the water in the tank. Otherwise, it is possible to back-siphon the pesticide mixture directly into your water supply.
- Install back-flow prevention devices and inspect them frequently.

The footnoted columns in Table 13-1 should be interpreted as follows:

[a] Most common trade names; others may be in use as well.

[b] Surface loss may occur when pesticides go into solution in water and run off the field in surface water. Potentials by Natural Resources Conservation Service, 2004. NA = not available.

[c] Surface loss may also occur when pesticides are adsorbed to soil or organic materials and washed out of the field. Potentials by Natural Resources Conservation Service, 2004. NA = not available.

[d] Leaching occurs when pesticides are moved downward in solution. Potentials by Natural Resources Conservation Service, 2004. NA = not available.

[e] LD_{50}: The dose (quantity) of a substance that will be lethal to 50 percent of the organisms in a specific test situation. It is expressed in the weight of the chemical (mg) per unit of body weight (kg). The lower the number, the more toxic the chemical. When more than one LD_{50} for mammals was found in the literatur alues are from the Crop Protection Handbook 2003 *or material safety data sheets. * = Technical material. Technical material (pure active ingredient) may be more or less toxic than the formulated material. NA = not available.*

[f] Telone C-17 also contains chloropicrin.

Table 13-1. Water contamination potential and mammalian toxicity of commonly used tobacco pesticides

Common Name	Trade Name(s) [a]	Surface Loss Potential (Solution) [b]	Surface Loss Potential (Adsorbed) [c]	Leaching Potential [d]	Mammalian LD_{50} [e]	
					Oral	Dermal
acephate	*Orthene*	*Intermediate*	*Low*	*Low*	*1,030**	*10,250**
acetamiprid	*Assail*	*Intermediate*	*Low*	*Intermediate*	*1,064*	*>2,000*
acibenzolar-S-methyl	*Actigard*	*Intermediate*	*Low*	*Intermediate*	*> 5,000*	*> 2,000*
butralin	*Butralin*	*High*	*High*	*Low*	*891*	*> 2,000*
carbaryl	*Sevin XLR Plus*	*Intermediate*	*Low*	*Low*	*500*	*> 2,000*
carbofuran	*Furadan*	*High*	*Intermediate*	*High*	*8.0*	*> 3,000*

Table 13-1. (continued)

Common Name	Trade Name(s) [a]	Surface Loss Potential (Solution) [b]	Surface Loss Potential (Adsorbed) [c]	Leaching Potential [d]	Mammalian LD_{50} [e]	
					Oral	Dermal
chloropicrin	Chlor-O-Pic 100	Intermediate	Low	Low	NA Inhalation danger	NA
chlorpyrifos	Lorsban	Low	Intermediate	Low	96	2,000
clothianidin	Belay	NA	NA	NA	3,900	> 5,000
dichloropropene	Telone II, Telone C-17 f	Intermediate	Low	High	224 Inhalation danger	333
dimethomorph	Acrobat	High	Intermediate	Intermediate	3,900*	> 2,000*
disulfoton	Di-Syston	High	Low	Intermediate	3.3	9.2
emamectin benzoate	Denim	NA	NA	NA	1,516	> 2,000
endosulfan	Thiodan, Phaser	Intermediate	High	Very Low	23*	359*
ethephon	Prep, Super Boll, Mature XL	Low	Intermediate	Low	3,030	1,560
ethoprop	Mocap	Intermediate	Low	High	16	2.4
etridiazole	Terramaster	Intermediate	Intermediate	Low	1,077	> 5,000
fenamiphos	Nemacur	High	Intermediate	High	10.6	71.5
flumetralin	Prime+	Low	Intermediate	Low	3,100	NA

Table 13-1. (continued)

Common Name	Trade Name(s) [a]	Surface Loss Potential (Solution) [b]	Surface Loss Potential (Adsorbed) [c]	Leaching Potential [d]	Mammalian LD_{50} [e]	
					Oral	Dermal
imidacloprid	*Admire, Provado*	*High*	*Intermediate*	*High*	*4,143*	*> 2,000*
isopropalin	*Paarlan*	*Intermediate*	*High*	*Low*	*> 5,000*	*NA*
lambda-cyhalothrin	*Warrior*	*Low*	*Intermediate*	*Very Low*	*351*	*>2,000*
maleic hydrazide	*Several*	*Intermediate*	*Low*	*Low*	*> 5,000*	*> 5,000*
mancozeb	*Dithane*	*High*	*High*	*Low*	*> 5,000*	*> 5,000*
mefenoxam	*Ridomil Gold*	*High*	*Intermediate*	*High*	*1,172*	*> 2,020*
metaldehyde	*Metaldehyde*	*Intermediate*	*Low*	*Low*	*283*	*NA*
metam sodium	*Vapam*	*Intermediate*	*Low*	*Intermediate*	*1,891*	*> 3,074 Inhalation danger*
methomyl	*Lannate*	*Intermediate*	*Low*	*High*	*17*	*5,880*
napropamide	*Devrinol*	*High*	*Intermediate*	*Intermediate*	*4,640*	*NA*
oxamyl	*Vydate*	*Intermediate*	*Low*	*Low*	*5.4**	*2,960**
pebulate	*Tillam*	*Intermediate*	*Low*	*Low*	*1,675**	*> 2,000**
pendimethalin	*Prowl*	*Intermediate*	*High*	*Low*	*3,956*	*2,200*
pymetrozine	*Fulfill*	*NA*	*NA*	*NA*	*> 5,000*	*> 5,000*

Table 13-1. (continued)

Common Name	Trade Name(s) [a]	Surface Loss Potential (Solution) [b]	Surface Loss Potential (Adsorbed) [c]	Leaching Potential [d]	Mammalian LD_{50} [e]	
					Oral	Dermal
sethoxydim	*Poast*	*Intermediate*	*Low*	*Low*	*3,200*	*> 5,000*
spinosad	*Tracer*	*Low*	*Intermediate*	*Low*	*> 5,000*	*NA*
sulfentrazone	*Spartan*	*High*	*Intermediate*	*High*	*2,855**	*> 2,000**
thiamethoxam	*T-MOXX, Platinum, Actara*	*High*	*Intermediate*	*High*	*> 5,000*	*> 2,000*