Integrated Pest Management

Integrated pest management (IPM) combines chemical control with cultural and biological practices to form a comprehensive program for managing pests. This approach emphasizes preventative measures to maintain pests below the economic threshold while using the minimum amount of pesticide necessary.

Pest management decisions affect both producer profitability and the environment. Determining whether or not a pest control measure is warranted and which control method is best, is the basis of a sound pest management program. Integrated pest management follows a decision making process that helps producers arrive at the best answer to their pest problems.

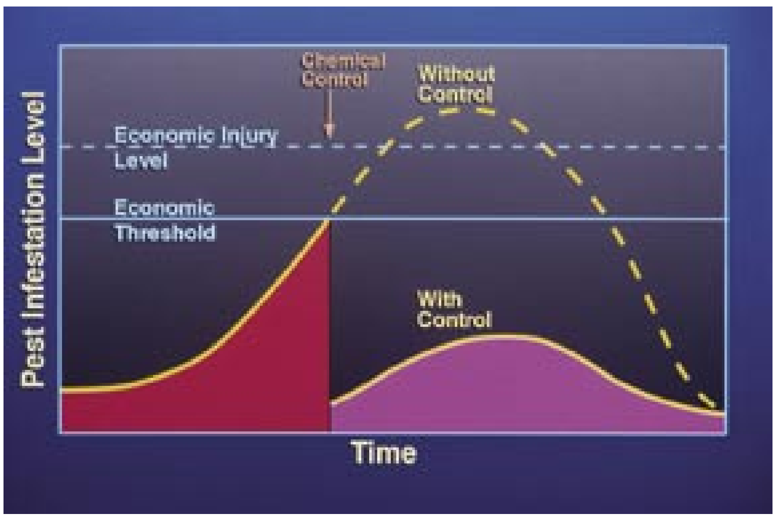

Figure 10. Economic or action threshold is the pest infestation level at which it usually pays to take remedial action.

Effective IPM programs include practices such as:

- monitoring pest and natural enemy populations
- selecting crops and varieties that are resistant to pests
- timing planting and harvest dates to minimize pest damage
- rotating crops
- using beneficial insects and other biological controls

Ask these questions to reach a pest management decision.

- Will increased yield significantly offset the cost of control?
- Are non-chemical control methods available and practical?
- If pesticide application is the only method available, are there choices of products to consider?
- Can the pesticide be applied in a way that reduces rate, maximizes effectiveness, and minimizes harm to natural beneficial organisms, pollinators, and nontarget species?
- Does the product label contain ground water advisories or other environmental caution statements?
- Are chemicals and control methods rotated to avoid buildup of pest resistance?

Scouting Methods

Systematic record keeping is essential to a successful management program. A field history, including past crops, pests, weed infestations, compaction, fertility and irrigation problems is helpful before beginning a scouting program. These records will be combined with the current year's records to develop a complete field history. Knowing field history and trouble spots can be helpful in planning an appropriate scouting route. Record keeping and scouting take time and organization and a grower should candidly assess their capacity to perform the tasks and, if necessary, hire a consultant.

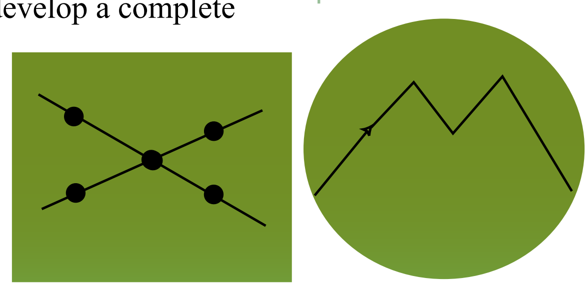

Figure 11. Most fields should be walked in a zigzag or M-shaped pattern, taking time to get well into the field. After corn tassels, it is often more efficient to use an "X" pattern, moving up or down rows to sample at least five unique points. Only checking field edges can give a misleading indication of crop status.

Checking the youngest corn and the oldest corn on your farm can alert you to early indications of pest problems.

Photo F.B. Peairs

Useful equipment for field scouting includes:

- record sheets, pencil and clip board
- field map
- GPS unit
- pocket knife
- soil probe (for checking soil moisture, irrigation uniformity, compaction, or collecting samples)
- magnifying glass
- plastic bags (for collecting plant, soil or pest samples)
- pliers (for digging seed, etc.)
- camera
- shovel
- cooler (to keep samples fresh)
- reference materials

Rotation with Other Crops

Continuous cropping of any single crop species eventually limits yields due to build up of soil insects, disease organisms and weeds. In Colorado, the need for soil insecticide treatment for western corn rootworm is eliminated by rotating fields on which corn is grown. Goss's wilt is becoming a more important disease problem in some areas of Colorado, and like stalk rot, inoculum can be transmitted from previous crop residues. Continuous no-till corn production is especially problematic when conditions favor the development of these diseases. Genetic resistance, coupled with rotation and tillage are currently the most effective tools for managing these two diseases. Stalk rot in corn is also more commonly seen on continuous corn fields with soil compaction problems.

Advantages of growing corn in rotation include:

- better weed control and fewer difficult to control weeds
- ability to rotate herbicides and other pesticides to avoid pest resistance
- reduced buildup of soil insect and disease organisms
- genetic identity is preserved by eliminating volunteers
- reduced N fertilizer requirement following legumes

Disadvantages of rotation may include:

- increased management, equipment and labor costs
- reduced market opportunities for alternative crops

Research in the Midwestern U.S. shows that corn grown following soybean will yield 10 to 15% higher than corn grown following corn. The other crop in the rotation with corn is usually not important for obtaining the benefits of rotation, but benefits are most pronounced following legumes such alfalfa, especially in reduced tillage systems on poorly drained soils.

Dryland considerations

Continuous corn is not recommended in dryland situations. Dryland corn can be successfully grown in a variety of rotations, but research has shown that corn following wheat is a good rotation, allowing for 9 to 10 months of moisture storage before planting (e.g. wheat-corn-fallow; wheat-corn-proso millet-fallow). Weed control following wheat harvest until fall is critical in this scenario. Consider any combination of crops well adapted to your environment, equipment, budget and overall livestock feed requirements.

Pesticides

Pesticides (insecticides, herbicides, nematicides and fungicides) are important tools for most corn producers, but they must be handled cautiously. Unfortunately, pesticides often are found in surface waters receiving agricultural runoff, particularly after a heavy spring rainfall. Fortunately, a number of corn management and pesticide application practices can be used to reduce potential contamination of water supplies.

Pesticide label
All pesticides are regulated by the U.S. Environmental Protection Agency and the chemical label is, in effect, the law. In most cases, the precautions on the chemical label are adequate to protect water resources from contamination. However, it is possible for a pesticide to reach ground or surface water, even when used according to the label. Chemicals that have a higher potential to contaminate water are identified on the label by a ground or surface water "Advisory Statement". Producers should take special care when using these chemicals and observe the prescribed use restrictions around wells, surface water or shallow groundwater.

Pesticide fate in the environment

Pesticide properties only indicate the probability of leaching or runoff; soil, site, and management factors must also be considered. Even if pesticide properties indicate little environmental risk, they may still end up in water supplies if other factors favor movement. However, in most cases, good management will keep water contamination to a minimum.

Sites with vulnerable water resources require selection of pesticides least likely to move off-target, or alternative pest management measures. Proper management of soils, water, and pesticides by agricultural producers can help reduce adverse water quality impacts.

Pesticide runoff and leaching

Focus pesticide management on good practices at application. Additionally, land management practices such as reduced tillage are important for protecting surface water quality. Establish grass filter strips and waterways on the down gradient side of fields that drain directly to streams and lakes.

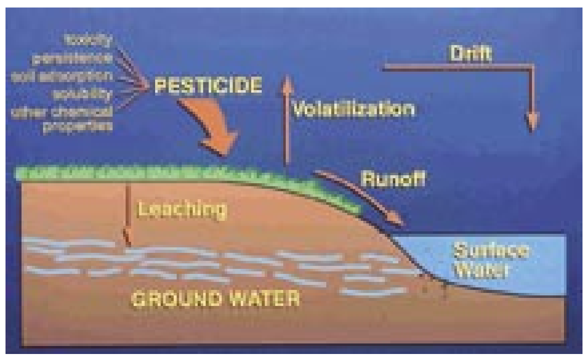

Figure 12. Pesticides may volatilize, break down, be held on plant tissue, or be carried away to surface water after application. After reaching the soil, they may be taken up by plants, adsorbed to soil particles, broken down to other chemicals, or in some cases be moved off-target to water resources.

Conservation tillage practices that increase the amount of crop residues on the soil surface can reduce runoff volume and velocity, resulting in less erosion and pesticide movement. Strongly adsorbed chemicals tend to adhere tightly to soil particles and will move only on eroding sediments. Reduced tillage systems are highly recommended on all erosive soils. However, in some cases increased pore size and infiltration, coupled with increased herbicide use, may favor pesticide leaching. Where groundwater is shallow and domestic wells are nearby, these trade-offs should be assessed.

The application method used to apply pesticides can influence leaching or runoff potential. Soil injection or incorporation makes the pesticide most available for leaching, but less likely to cause surface water contamination. In general, preplant and pre-emerge treatments on clean tilled soil are more subject to surface loss than post-emerge treatments when crop cover reduces runoff.

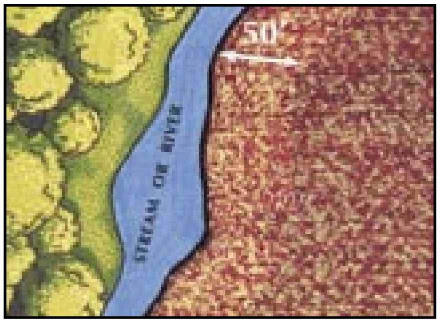

Figure 13. Surface water proximity should be considered prior to pesticide application. Observe a setback or buffer zone a safe distance from wells, streams, ponds and lakes where no chemicals are applied. The actual setback required will depend upon the mobility of the chemical, slope, and likelihood of runoff.

On farm mixing and loading pads can help protect workers and the environment.

BMP
Maintain pesticide application equipment in good working condition and calibrate equipment frequently to ensure recommended rates are applied. See page 86 for calibration guidelines.

Pesticide storage

Storage, mixing and loading of pesticides and fertilizers in their concentrated forms poses the highest potential risk to surface or ground water from agricultural chemicals. In the past, the common procedure was to mix and load chemicals at a single, uncontained location with little thought to surface or ground water proximity. Farmers may be liable for cleanup of these sites, even after selling the property, if mishandling of agricultural chemicals results in environmental contamination.

Avoid site contamination by mixing and loading chemicals at the application site.

- Take a nurse tank to the field for mix and wash water.
- Stay a safe distance from any wells or surface water.
- Avoid mixing repeatedly at the same spot in the field.
- Take precautions to prevent spills of chemicals during field mixing.

Minimize agricultural chemical waste.

- Purchase only the amount of chemical needed for each season.
- Avoid overwinter storage by returning unused chemicals to the dealer.
- Mix only the exact amount of chemical needed for the immediate job.
- Properly calibrate sprayer at least annually.
- Use compatible rinsate as make-up water for the next spray batch.
- Use mini-bulk and two-way containers to eliminate container waste.
- Reduce rinsate water by mixing chemicals and cleaning equipment at the application site.
- Recycle empty pesticide containers whenever possible.
- Reduce pesticide waste by using direct injection spray systems and mini-bulk containers.
- Reduce storm water handling problems by roofing mixing pads and secondary containment.
- Keep good records to track chemical supply and need.