

## CULTURAL AND CHEMICAL WEED CONTROL PRACTICES

The terms listed below are used in this folder to describe herbicide applications:

**Active ingredient (ai)**—The chemical in a herbicide formulation primarily responsible for its phytotoxicity and which is identified as the active ingredient on the product label.

**Acid equivalent (ae)**—Expresses the rate or quantity as the herbicidally active parent acid. For example, 2,4-D acid is formulated with either sodium, an amine, or an ester to make the active ingredient salt sold as a formulated product. The active acid equivalent per gallon of a widely used ester formulation is 3.8 lb ae/gal while the active ingredient is 6.0 lb ai/gal.

**Band application**—Herbicide applied to a narrow strip centered over the crop row.

**Broadcast application**—Herbicide applied over entire area.

**Directed spray application**—Herbicide applied to a band along the row that includes the base of crop plants and the weeds in the row. Spray is directed across the row from nozzles positioned near ground level on each side of the row. This type of application allows use of chemicals that will injure the crop plant if more than a small part of the plant is contacted by spray. Special units that guide from the ground or mount on cultivators must be used.

**Drop-nozzle application**—Herbicide applied by means of nozzles mounted on extensions below the spray boom to avoid spraying upper parts of the crop plant.

**Formulation**—Refers to the form in which a herbicide is purchased. Common forms are liquids, granules, and wettable powders which contain added ingredients to improve storage, mixing, or application characteristics of the herbicides.

**Postemergence application**—Herbicide applied to the crop and weeds after they emerge.

**Preemergence application**—Herbicide applied after a crop is planted but before it or weeds emerge.

**Preplanting application**—Herbicide applied before the crop is planted.

**Rate**—The amount of active ingredient or acid equivalent of an herbicide applied to the area treated, that is, on a broadcast basis.

**Soil incorporation**—Mechanical mixing of the herbicide with the soil. Chemicals may be incorporated 2 to 4 inches with a disk or rotary tiller, 1 to 2 inches with a harrow or rotary hoe, or slightly covered with planter attachments. The desired depth of incorporation depends on characteristics of the chemical being used.

### INTEGRATED WEED CONTROL

Effective weed control usually results from a combination of cultural, mechanical, and chemical practices. The ideal combination for each field will depend on a number of considerations including: 1) the crop being grown, 2) the kinds of weeds, 3) the seriousness of the weed infestation, 4) the soil type, 5) the cropping system, and 6) the availability of time and labor.

**Cultural practices** that are optimum for crop growth should be followed. These practices include adequate fertility, optimum stands and row width, and proper seeding date. Tillage operations, if used, should be timed to destroy weeds. Tilling the soil immediately before planting will kill weeds that have germinated, thus giving the crop a competitive advantage and often improving weed control from chemicals that do not control weeds that have germinated.

Early cultivations when weeds are small are most effective. Use a rotary hoe, harrow, or cultivator as soon as weeds begin emerging and are in the "white stage," even if herbicides have been applied. Set cultivators for shallow operation to avoid crop root pruning and to reduce the number of weed seeds brought to the surface. Throw enough soil into the row to cover small weeds. Shallow cultivation should be repeated as necessary to control newly germinated weeds.

Mowing is an effective weed control practice in perennial forage crops and non-cropland areas. To be effective, mowing must be done before seeds are formed which means you must mow by the time weeds are in the bud stage or just beginning to bloom. Earlier mowing will reduce weed competition and improve crop yield more than later cutting.

### Selecting Chemicals

Selection of an appropriate chemical or combination of chemicals should be based on consideration of the following factors:

- Label approval for use
- Ground and surface water pollution concerns
- Use of the crop

- Crop and variety tolerance
- Potential for soil residues that may affect following crops
- Kinds of weeds
- Soil texture
- pH of soil
- Amount of organic matter in the soil
- Formulation of the chemical
- Application equipment available
- Potential for drift problems
- Tillage practices
- Herbicide performance
- Herbicide cost
- Herbicide resistant crop

The information in this publication and on product labels will help you select and use chemicals properly according to the above factors. Proper application of chemicals is essential for obtaining satisfactory results. Follow the suggested rates on labels for specific soil and weed situations carefully. Apply herbicides at the times specified. Delayed applications usually result in poorer weed control and may injure the crop.

Weather conditions will affect herbicide performance. Weed control from soil-applied herbicides may be poor if there is insufficient rain soon after treatment, which will make timely cultivation necessary to control emerging weeds. If rainfall is very heavy, some herbicides may be moved downward in the soil, resulting in poor weed control and/or crop injury. Temperature and moisture conditions affect the weed control and crop injury resulting from herbicides applied postemergence. Observe label precautions regarding weather conditions and crop and weed size when applying herbicides.

## GROUND AND SURFACE WATER CONCERNS

The potential for ground and surface water pollution with pesticides is a growing concern in Minnesota. Good land stewardship dictates that herbicide characteristics must be assessed in relation to their ground or surface water pollution potential, in addition to choosing the most effective and economical weed control. Growing public concern and increasing frequency of detections of minute levels of pesticides in groundwater will result in regulatory action if corrective measures are not taken.

Particularly sensitive areas are the karst topography in southeast Minnesota and permeable sands with shallow water tables found in central Minnesota and along glacial outwash areas. Atrazine is the most commonly detected herbicide in well monitoring studies. Sinkholes and shallow soil over porous, fractured limestone bedrock poses a real problem for managing certain herbicides such as atrazine in the karst area. The same situation also exists where permeable sands over shallow water tables occur. Alternatives to atrazine should be considered in these areas to reduce pollution concerns. Also, other herbicides have ground or surface water advisory statements on their labels. Use these compounds in sensitive areas only after assessing site specific pollution potential.

The levels of pesticides being detected in groundwater are generally in the parts per billion (ppb) range and are below current health advisory levels considered safe for drinking water. These levels often represent less than 1/1000th of the amount applied to the field, alluding to the difficulty in managing pesticide pollution. Point source concerns are often suspect if levels in a well are over a few ppb are detected.

Point source problems are those directly attributable to a confined area, event, or site such as mixing or manufacturing sites. Point source contamination may be responsible for a large portion of pesticide detections in wells in some areas of the state. They are relatively easy to correct. Point source problems can be reduced by the following:

- Mix chemicals in the field using a 'water only' nurse tank thereby keeping pesticides away from wells and water sources.
- If chemicals must be mixed at the well site, use hoses to maintain at least a 150 ft. buffer from the well to the spray tank, 100 ft. buffer with safeguards, or 50 ft. with safeguards and a roof present.
- Keep filling hoses out of the spray tank, use check valves, and **Do Not** leave tanks unattended while filling to avoid back siphoning or overflow.
- Never dump rinsate or concentrated product in a localized area. Dispose of rinsate by applying to a labeled crop site.
- Triple rinse herbicide containers before disposal or return.
- Properly construct, grout, and case new well construction. Properly cap and seal abandoned wells.

The MDA has information regarding pesticides at their web site, [www.mda.state.mn.us](http://www.mda.state.mn.us). Spills of any consequence have the potential to contaminate ground or surface water unless handled properly and promptly. **Report all spills immediately, no matter how small, to the Minnesota Department of Agriculture (MDA) and local authorities. Call the MDA at:**

(651) 297-5387 (Monday-Friday, 8:00 a.m. to 4:30 p.m.)

OR: 24 Hour Emergency Number  
(651) 649-5451 (Metro area)

## 1-(800)-422-0798 (Non-metro areas)

MDA staff can answer concerns and provide assistance on the need for corrective action, and if so, how to go about it.

**Waste pesticides should be properly disposed of. The MDA Pesticide Waste Collection Hotline can provide further information on disposal and container recycling: (651) 282-6804 (metro area) or 1-800-657-3986**

Nonpoint source pollution occurs over a broad, generally ill-defined area and the direct cause of contamination may not be readily apparent. Leaching or surface runoff from general field applications within labeled guidelines would be nonpoint source pollution. This problem is more difficult to correct or even identify. Steps to reduce nonpoint pollution from pesticides would be to:

- Select herbicides with short residual half-lives, low solubility in water, and strong adsorption to soil.
- Leave buffer strips around sinkholes, streams, and bodies of water.
- Band apply herbicides as opposed to broadcast applications to reduce the overall pesticide load on the environment. Use herbicides with higher unit activity as well.
- Properly calibrate sprayer equipment to avoid over application.
- Use practices such as crop rotation, rotary hoeing, cultivation, and cover crops in addition to, or in lieu of, herbicides.
- Apply herbicides only when necessary.
- Delay postemergence herbicide applications if rainfall is imminent.
- Use good soil conservation practices to reduce off site herbicide movement that occurs with surface runoff.

**Atrazine is currently a restricted use product** due to water quality concerns. Fall applications of atrazine are not allowed. **See paragraph C16 for details about atrazine restrictions to reduce ground and surface water pollution concerns.**

Reducing water pollution will help ensure agricultural chemicals will remain as an integral part of crop production options while protecting valuable water resources for domestic and agricultural uses.

## REDUCING WEED CONTROL COSTS

There are many possibilities for reducing weed control costs while still attaining good weed control. Wise selection of weed control practices and herbicides to fit specific field situations is the key. Identify your weeds and develop an effective, low cost control program that is suitable for the crop you plan to grow. Using band applications of herbicides in row crops, supplemented with cultivation, may save you money. Reducing herbicide rates below those recommended increases the possibility of costly weed control failure. On the other hand, applying herbicides at greater than recommended rates adds unnecessarily to your weed control costs and may result in crop injury or herbicide carryover. Applying herbicides at the proper time and rate with a carefully calibrated applicator provides the best return on your herbicide investment.

## HERBICIDE MIXTURES

Herbicide mixtures are used to overcome limitations of single chemicals. Certain mixtures may (1) control more kinds of weeds, (2) give more consistent performance with variable soils and weather conditions, (3) lessen soil residue problems, (4) increase persistence enough to give full-season weed control, or (5) reduce crop injury.

Only those mixtures that have been field tested under local conditions should be used. Use of some mixtures may result in poor weed control or crop injury. Growers or applicators may be responsible for chemical residues in crops, crop injury or lack of weed control resulting from use of unlabeled mixtures.

## SAFETY PRECAUTIONS

Always follow the precautions and use restrictions on the label carefully to help protect the operator, avoid crop injury, and prevent harmful residues in food and feed crops. Use herbicides only on crops specified on the label. Use only the recommended amount of herbicide; applying too much of a herbicide may damage the crop, may be unwise if the crop is to be used for food or feed, and is costly. Apply herbicides only at times specified on the label; observe the recommended intervals between treatments and pasturing or harvesting of crops. Wear goggles, rubber gloves, and other protective clothing as recommended on the label. Prevent drift onto nearby susceptible plants. Return larger quantities of unused herbicides in unopened containers to the manufacturer or store them properly until used. Dispose of empty containers in a safe manner:

- Triple rinse container thoroughly with water and use the rinse water in the sprayer.
- Bury small and decomposable containers in approved and supervised sanitary landfills.
- Send empty metal pesticide containers of 15 gallon capacity or more back to the manufacturer or to professional drum reconditioners.
- Observe special label instructions relating to disposal.