

4. Weed Management

A weed management program combines cultural, mechanical and chemical methods appropriate to the situation. Effective weed management depends on weather conditions, soil type and the cropping history. Before attempting corrective action, identify problem weeds and learn about their growth habits. For an every-growing knowledge base of weed information, see www.weedinfo.ca.

In April 2009, the Ministry of Environment amended the *Pesticides Act* with the *Cosmetic Pesticides Ban Act, 2008* and Ontario Regulation 63/09. Pesticides are now classified for sale and use under 11 different classes. Note that agriculture (including nursery production) is exempted. For more information on the legislation, see the Ministry of the Environment's website at www.ontario.ca/pesticideban.

Once the weed population has been assessed, minimize potential problems before planting. Eliminate possible weed sources and prevent weeds from establishing.

Weed Control Principles

Many weed problems can be avoided by using weed-free crop seeds and transplants and by preventing weeds from going to seed. Monitor weed growth in both crop areas and the surrounding non-crop areas. Enhancing the activity of soil organisms (i.e., bacteria, fungi, earthworms, insects) creates a strong defense against weeds by increasing crop vigour while making weed seeds decay faster in the soil. Practices that increase soil biological activity (e.g., applying composted plant waste, composted manure, cover crops) can reduce weed problems.

Reducing Weeds Before Planting

Use Cover Crops for Weed Suppression

If a nursery field is removed from production, plant a cover crop or green manure crop before

replanting the field. Plow-down crops such as rye, red clover, buckwheat, sudan grass, millet and oilseed radish are typical cover crops. Cover crops suppress weed growth through crop competition and allelopathy (exuding chemicals to prevent weed seed germination). Cover crops also reduce wind erosion of the soil, and their residues increase soil organic matter. Improved soil tilth is quite evident in the first crop after a cover crop. See "Cover Crops" on page 9.

Controlling Perennial Weeds

Many perennial weeds can present problems for nursery crops. These weeds include quack grass, bindweed, vetch, wild grape, perennial nightshade, thistles, ground ivy, burdock, horsetail, toadflax, milkweed, asters, nut sedge, willow herb and goldenrod. Consider the following points:

- Always attempt to minimize (or eliminate) perennial weeds in the preplanting year.
- If necessary, apply a systemic herbicide such as Roundup to perennial weeds in the preplanting year. Follow directions on the product label, and always use the recommended application rate for the weed in question. To achieve long-lasting management, apply herbicides at the proper stage of weed growth (for most perennial broadleaf weeds, this is just before blooming).
- It can be difficult to control perennial weeds among established plantings because of crop sensitivity to some herbicides and the inability to practise clean cultivation in established nurseries.
- Repeated cultivation will control some perennial weeds, such as bindweed. Clean weed debris from the cultivator before entering weed-free soils.
- Use non-selective herbicides (such as Gramoxone and Roundup) before planting a green manure crop and before plowing it under. Short-residual herbicides such as 2,4-D may be used with tolerant green manure crops. However, avoid herbicides that leave a soil residue in the planting year (e.g., Simadex).

Crop Rotation

Crop rotation is an important part of any long-term weed control strategy. After plowing a cover crop, it is best to replant the field with different nursery stock. For example, if the previous crop was conifers, plant deciduous stock. This permits a change in tillage methods, row widths, harvesting and herbicide selection. Crop rotation helps break weed cycles and minimizes weed population increases. Short rotations using several crops will increase the yield and profit of individual crops. Choose a crop that competes well with the problem weeds identified.

Stale Seedbeds

The stale seedbed technique involves preparing seedbeds early in the growing season. Allow the weeds to germinate. Several weeks later, control the weeds using glyphosate or paraquat. Once the weeds die, seed or transplant the crop into the bed, disturbing the soil as little as possible.

Preparing Container Beds

Prepare container bed areas with a gravel layer and/or ground coverings such as opaque materials woven from plastic. These surface coverings must exclude light to prevent weed-seed germination. Ground coverings may be reused for several years before it is necessary to replace them. Keep container beds and roadways weed-free by physical removal or chemical mowing. Remove all pulled weeds and discard them well away from the growing area. Do not allow seeds into nearby containers.

Remove existing weeds from container stock before the weeds bloom. Flowering weeds can disseminate hundreds of seeds by wind or by catapulting the seeds. Many container weed species are annuals that produce several generations of seedlings per year since their seeds do not need to overwinter before germinating. Every fall, thoroughly remove actively growing weeds from container stock as polyhouses are covered. This will help to prevent the weed population from successfully overwintering in the

protected environment of the polyhouse. Be sure to remove the rosettes of winter annuals such as shepherd's-purse and Canada fleabane. Also remove the established plants and seedlings of common and mouse-eared chickweed. If not removed, these plants will flower by May or earlier.

Managing Weed Sources

Minimize weed sources using the following mechanical, cultural and/or chemical weed control measures:

- Control seed escapes using mechanical removal or chemical mowing before the weeds set seed.
- Prevent weeds from setting seed in adjacent non-cropped areas.
- Mow at regular intervals to prevent weeds from flowering.
- Use string trimmers in appropriate areas, such as along fences.
- Find the source of weeds that disseminate into the field or container yard. These include poplars, willows, willow herb and Canada fleabane.
- Control weeds around irrigation ponds to avoid sowing small-seeded weeds into container stock with each watering.
- Establish a thick grass cover around irrigation ponds to help reduce weeds while stabilizing the bank.
- Install a filtering system in the irrigation line to remove weed seeds from irrigation water.

Mechanical Weed Control

Mechanical weed control methods can reduce weeds and weed sources. Plant only weed-free seedlings and transplants. Do not bring weeds from one field to another. Keep equipment free from weed debris when moving it between fields. Cultivate weedy fields last.

Rotary Hoes

Rotary hoes have fingers that lift and mix the soil, uprooting small weeds. Rotary hoes tend to damage

crops less than harrows do. The hoes break up soil crusts and incorporate surface-applied herbicides into the soil. This activates the chemicals and improves the weed control. Use rotary hoes during late-morning or afternoon hours. Crop plants are more pliable at these times, reducing injuries, and the hot sun can dry out the uprooted weeds.

For good results, maintain sufficient speed (generally 10–20 km/hr). Cultivating at slow speeds will not generate enough force to lift weeds out of the ground, and it may cause more crop damage. On light soils or in loose soil conditions, keep rotary hoes shallow.

Inter-Row Cultivation

Inter-row cultivation or scuffling of row crops uproots small weeds and cuts off larger ones. Many kinds of equipment can perform this task. When using shovels, allow 50% overlap for thorough weed control. Keep the cultivation shallow and use shields to protect small crops. The first cultivation is crucial, since weeds escaping this pass usually grow to maturity. Row cultivation works well alongside herbicide applications. Shallow cultivation (2.5–5.0 cm) reduces the disturbance of any herbicides applied (conserving the herbicide layer will prevent weed seedlings from emerging and establishing themselves in the soil).

Mowing

Mowing and cutting help to control weeds. Mow perennial weeds at the bud stage, when root reserves are low and seeds have not set. If a herbicide is to be applied later in the season, allow enough time for weed regrowth after mowing.

Managing Herbicide Resistance

More than 120 herbicide-resistant weed species exist throughout the world. See the OMAF Factsheet *Herbicide Resistant Weeds Order* for a list of weeds that show resistance in Ontario. Use herbicides conservatively.

Delaying Herbicide Resistance

Repeated use of the same herbicide tends to create resistant weeds. Resistance develops at different rates with different herbicides, weed species and weed populations. To help minimize resistant weeds, follow these strategies:

Identify and monitor weeds. Resistant weeds look exactly like susceptible weeds, but they do not experience the injury and mortality that happens to other members of the population. These “escapes” are common after herbicide applications. Sometimes 10%–30% of a weed population can become resistant before the issue is noticed. Survey fields regularly and apply diagnostic methods to catch problems as they arise.

Prevent weed spread. Clean all implements when leaving a field, and never allow resistant weeds to go to seed.

Use alternatives to chemical controls. Use mechanical weed controls, such as rotary hoeing or cultivation, wherever possible.

Rotate crops and herbicides. Do not use the same herbicides every year. Rotate crops and spray the new crop with herbicides from a group with a different mode of action or site of action. Where registered, use tank or formulated mixtures with multiple active ingredients that kill the same weed in different ways.

Keep records. Keep accurate records of crop rotation and herbicide usage for each field. Long-term weed control planning is easier with good records.

Communicate. Consult with farmer organizations, universities, extension specialists, agribusinesses, friends and neighbours about herbicide resistance problems. Inform the provincial weed inspector or industry contacts of any resistance issues that arise so they can act to prevent weed spread.

Diagnose. Resistance is not the only reason that weeds may survive a herbicide application. It is important to rule out other factors that can affect herbicide performance. Examples include misapplication, unfavourable weather conditions, improper application timing and weed flushes

following a non-residual herbicide application. If resistance appears possible, check for the following:

- Did the product control other weeds listed on the label? Chances are only one weed species will prove herbicide resistant in a given field situation. If several other weed species that are normally susceptible also survived, other factors probably caused the lack of weed control.
- Did the same herbicide(s) from the same group with the same action site fail in the same field area last year?
- Have you used the same herbicide(s) from the same group year after year?

If at least one of these situations applies, the weed escapes may be resistant to the herbicide. Try controlling the weeds with a herbicide from another group or use appropriate non-chemical weed control methods. Do not let the weeds go to seed. Contact the Provincial Weed Inspector, as well as the herbicide supplier and the appropriate chemical company, to develop a comprehensive management program.