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Herbicide Resistance and Weeds

Herbicide resistance can affect the performance of any herbicide, but its impact on weed control can be limited by combining the use of both chemical and non-chemical techniques into your cropping system.

Herbicide resistance is relatively rare; an incredibly small percentage of plants have the genetic make-up that allows them to survive treatment that normally kills others of that same species. The risk lies in the fact that the resistant weed produces seed and creates an infestation that is resistant not to just one herbicide but to others with a similar mode of action (members of the same herbicide group). In western Canada, for example, at least one field in six has wild oats resistant to either Group 1 or 2 herbicides. Many weed populations have been found that are resistant to more than one herbicide group.

By using a multi-pronged approach, producers can put selection pressure on the weed populations so herbicide-resistant weeds don't have a chance to thrive.

Herbicide resistant weeds in Alberta include:



Wild Oats

Common Hempnett

False Cleavers

Kochia

Field Penny Cress



Ball Mustard

Green Foxtail

Spiny Sowthistle

Wild Mustard

Common Chickweed

Rotate crops to destabilize weed populations

It is important for producers to include several weed management options in their crop rotation. A rotation between broadleaf and cereal crops, for instance, allows for the use of different herbicides. At the same time, in-crop herbicides from the same group should not be used more than once in three years (particularly Group 1 and 2 products).

Producers can also grow crops with different seeding or harvest times. By applying weed control at different times in the growing season, you can change the selection pressure and shift the resulting make-up of the weed populations.

Winter wheat and fall rye are very competitive crops and may not need herbicide treatment. Silage crops harvested before weeds set seed can significantly cut weed populations. Early harvest also provides a wide window for post-harvest weed control. Perennial forages dramatically alter the weed population of a field; alfalfa, as an example, has been particularly effective in cutting numbers of wild oats, green foxtail, cleavers and Canada thistle.

Cover crops can control weeds during a fallow period, even if the land is only left in fallow for part of the growing season. In dry areas, sweet clover can cut broadleaf weed populations while in wetter areas, red clover can be effective.

Give the crop the edge

There are numerous methods that will allow producers to give crops an opportunity to out-compete weeds for moisture, nutrients and sunlight.

- Choose competitive crops such as barley
- Seed at the ideal time (in narrow rows and with minimal disturbance)
- Seed shallowly if moisture permits
- Use high seeding rates of clean, treated seed with good vigor
- Band fertilizer so it is only accessible to the crop

A competitive crop may not need herbicide treatment. If the crop is well-established, healthy and of normal height with adequate fertility, producers can use weed density and staging to compare the potential yield loss and the cost of spraying. At the same time, don't skip herbicide application for crops without a strong competitive advantage.

Controlling weed seedlings with a pre-seeding burn-off can also give the crop a few days growth before weeds emerge, which can often prove to be a big advantage.

Practice good sanitation

Any field can have weeds with the genetic potential for herbicide resistance even if chemicals have never been used. Resistant seeds can be carried into a field on equipment and in seed, or by wind, birds or other wildlife.

To limit the spread of resistant weeds, you should use only clean seed. Make sure to thoroughly clean equipment, particularly combines, before moving between fields (see Figure 1). A chaff collector behind the combine can also remove significant amounts of weed seed from the seed bank.



Figure 1: Thoroughly clean combine to ensure minimal chance of weed seed transfer between fields

Use weed records

A proven technique in weed control is to carefully record all the details about herbicide application. Be sure to include:

- weed species and stage
- weather and crop conditions
- chemical used
- the rate of application
- the volume of water
- whether adjuvant was used
- whether or not the sprayer was calibrated and working well

Add the observations of your post-treatment weed assessments, including locations and species of suspicious weed patches. These herbicide application and evaluation records can be invaluable for future weed control plans and in identifying fields where you need to be especially vigilant.

You should scout fields two or three weeks after spraying to assess herbicide performance; by harvest, it is impossible to tell whether weeds either survived herbicide treatment or germinated later. A realistic assessment of potentially resistant weed populations requires serious scouting (about two hours per quarter).

Before considering resistant weeds, you should check whether the weeds were present at spraying or if they were the result of later flushes (dense populations). Resistant weeds are usually in irregular patches.

If resistance seems likely, eradicate the weeds by mowing, burning or applying a non-selective herbicide. You may want to keep some of the plants or seed for further testing.

Manage herbicides to lower resistance risk

The fewer applications of herbicide a field receives, the less likely it is that resistant weed populations will develop.

In order to keep the risk of resistance low, you should choose lower risk products (group 4 and 9) rather than high risk herbicides (Groups 1 and 2). Don't apply high risk herbicides to dense populations of weeds. In southern Alberta, for example, assume kochia is Group 2 resistant and control it with another product.

In-crop herbicide application puts your crops at higher risk for resistance than pre-plant or post-harvest applications of the same product. This is because the soil disturbance during seeding results in weed flushes.

Tank mixes of products that control the same weed species but belong to different herbicide groups lower the risk of resistant weeds spreading.

Rotating amongst herbicide groups is critical; simply switching active ingredients is not adequate. You need to switch from one mode of action, or group, to another to reduce the selection pressure.

The risk of resistance varies between herbicide groups and weeds targeted for control. Groups 1 and 2 products are high risk so you should use products in either group no more than once in three years. Herbicides in other groups are considered moderate or low risk.

Herbicide-tolerant crops

Glyphosate resistance is of special concern because of its importance in direct seeding. In Canada, glyphosate resistance in weeds has not been detected, in part because our only glyphosate-tolerant crop is canola (disease issues for that crop limit its frequency in crop rotation).

In order to lower the risk of glyphosate resistance, rotate among herbicide systems in canola. As long as you've used a pre-plant burn-off, only one in-crop application of herbicide is needed in the herbicide-tolerant canola. A second application is only cosmetic and has no effect on crop yields.

Conclusion

Although herbicide resistant plants are rare, producers must take care to ensure that those weeds that do escape traditional treatment are not given the opportunity to spread through fields and infest other areas. Using strategies including crop rotation, the use of competitive varieties, careful seeding practices, good sanitation of planting and harvesting equipment, accurate records of herbicide use, and careful management of herbicides, you can minimize the opportunities for the creation and spread of weeds that reduce crop yield, an important factor in maximizing your profit.

Support for this publication was provided by:



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Agri-Food Canada

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