



## HERBICIDE TOLERANCE

### A BEST MANAGEMENT PRACTICES GUIDE

## Controlling Herbicide Tolerant Volunteers in a Succeeding Crop

The agricultural industry today is very different from the one that our parents knew. It has adopted innovations as significant as those of the Industrial Revolution. One important development that has garnered a lot of notice is the introduction of crops that exhibit tolerance to specific herbicides. The advent of these Herbicide Tolerant (HT) crops allows producers the flexibility to use effective herbicides that previously would have killed those crops.

The crop science industry has developed a number of HT crops including canola, sunflower, cotton, corn, wheat and soybeans. These crops have tolerance to herbicides including glyphosate (Group 9), glufosinate (Group 10), imidazolinones (Group 2), sethoxydim (Group 1), and sulfonyleureas (Group 2). All HT crop varieties approved for commercial production have been thoroughly assessed for safety to humans and the environment. As with any technological advance though, there are considerations that must be addressed to realize the full benefit of the technology. As has always been the case in agriculture, the foundation for dealing with these considerations is good agricultural stewardship.

In any field crop, volunteers from the previous year's crop are undesirable because they compete with the crop for light, water and nutrients. This reduces the yield and quality of the crop. Volunteers result from harvest escapes in the field from the previous season. Seed remaining



on or just below the surface of the soil as a result of harvest losses can germinate in the following year, causing volunteer problems in the succeeding crop.

Many of the tools for managing herbicide tolerant volunteers are the same tools used in the management of conventional volunteers. The most important of these tools is the responsible stewardship practice of the producer.

There are several strategies to manage volunteers from HT crops:

The best long-term solution for control of volunteers is an effective crop and

herbicide rotation. Sound agronomic practices are just as important – if not more so – in HT crops as they are in conventional varieties. Growers should rotate crops, rotate chemical weed control and rotate herbicide tolerant traits. Good rotation helps manage diseases and insects, reduces soil compaction and improves the overall health of the soil while reducing the risk of weed resistance and minimizing the concern of herbicide tolerant volunteers in subsequent crops. Field records are important in managing crop and herbicide rotations. Use weed control publications to determine which herbicides are effective. To control a herbicide tolerant volunteer, eliminate the herbicides that the volunteer is tolerant to.

Tillage is also an excellent measure for reducing volunteers in subsequent years, whether a crop is herbicide tolerant or not. Post-harvest tillage for corn and soybeans will help to disperse seed that has dropped to the ground and will aid in the decomposing process. However, for canola and wheat, do not till after harvest. This will allow the seeds to stay on the surface and allow more germinated plants to be exposed to winterkill. Tillage prior to planting will remove any seeds that have already germinated. For some crops, it may also be possible to use inter-row cultivation in wide row crops to help reduce the presence of volunteer plants from previous crops.



## Beyond Herbicides

In addition to herbicides, other methods to help control volunteers include:

- Ensiling and plow down to control volunteers<sup>1</sup>.
- Scouting fields for volunteers which are not controlled by herbicide application. Early detection allows time for control before seed set<sup>1</sup>.
- Growing competitive crops. Boost seeding rates, choose competitive varieties, seed early, and place a balanced fertilizer close to the seed<sup>1</sup>.
- Using certified seed. Pedigreed seed use reduces the probability of multiple herbicide tolerant volunteers due to outcrossing<sup>1</sup>.

<sup>1</sup>Thomas, P. 2002. Outcrossing between canola varieties – a volunteer control issue. Alberta Agriculture, Food and Rural Development. Website: <http://www.agric.gov.ab.ca/crops/canola/outcrossing.html>

# Volunteer Specific Management R

## Canola

Canola volunteers, whether conventional or HT, can be numerous and can occur for several years after growing the crop. The same techniques used for managing conventional canola volunteers can be used to manage herbicide tolerant canola volunteers. These techniques include, prevention of harvest losses, chemical fallow, and pre-crop and in-crop herbicides.

To minimize volunteer canola, it is important to reduce harvest losses. Canola should be swathed at between 20-35 percent seed colour change on the main stem of the plant<sup>1</sup>. The key to reducing the longevity of canola volunteers is to prevent dormancy. Leaving canola seeds on or near the soil surface as long as possible after harvest will promote germination of seeds in the fall allowing winterkill to control the volunteers. If fall tillage is completely avoided, a higher frequency of canola volunteers may occur the following spring, and volunteers in subsequent years are likely to be less frequent.

Control of volunteer canola in chem fallow situations is easily managed using traditional weed control practices – with one exception: where Roundup Ready® Canola has been grown in previous years, it should be assumed that any volunteers would not be controlled with a single application of glyphosate (Group 9). Instead, use an appropriate tank mix partner, (like 2,4-D Group 4), with a different mode of action to control volunteer canola.

In cereal crops, consider using or adding 2,4-D (Group 4) as a post-emergent

application to control plants that have emerged after planting. This is especially important if volunteer canola plants are suspected to contain the imidazolinone (Group 2) tolerant trait as this trait provides tolerance to ALS inhibitor herbicides, such as sulfonylureas (Group 2).

In crops such as peas and dry beans, where pre-harvest applications are part of typical crop management, diquat (Group 22) or paraquat (Group 22) may be considered. This application will provide the function of maturing the crop for harvest, controlling existing weeds present, as well as controlling any volunteer canola whether they are HT or not.

## Corn

Volunteer crops such as corn often grow in clumps when multiple kernels germinate from an ear. In denser clumps of volunteer corn, some plants may be shielded by others during post-emergence spraying operations. Reduce this problem by using higher spray volumes with correct nozzle types and proper alignment to provide good spray coverage.

Volunteer corn in a commercial field of grain corn is a particular challenge if the grain from the crop is intended for uses other than on-farm feeding. If corn is grown after corn, use an alternate herbicide tolerant trait to allow for more options to control any volunteer concerns.

If a non-herbicide tolerant corn hybrid is grown in the year following any herbicide tolerant corn hybrid, the only in-crop control available for volunteer plants

Rotate Rotate Rotate

## Crop, Chemistry and Traits

Use provincial crop protection guides to determine the herbicides appropriate for control of volunteer plants such as canola, wheat or corn. For further detail on appropriate rates and optimum timing of application, always refer to the product label. If the volunteer plant is suspected to be from a herbicide tolerant crop from previous years, do not include products from the group of chemicals that the herbicide tolerant crop belongs to.

Pay careful attention to HT crop rotation. For example, if a glyphosate (Group 9) tolerant corn hybrid is grown one year and followed by a glyphosate (Group 9)

tolerant soybean variety the next, assume that the volunteer corn will be tolerant to an application of glyphosate (Group 9). Therefore, consider one of the many other recommended volunteer corn control options. Similarly, if volunteer canola is present in cereals where imidazolinone (Group 2) tolerant canola was grown previously, assume that the volunteer canola will not be susceptible to Group 2 chemistry and consider alternative controls or tank mixes. A chart of HT crops and control options is available at [www.croplife.ca/english/resourcecentre/resourcecentrebio.html](http://www.croplife.ca/english/resourcecentre/resourcecentrebio.html)

# Recommendations

is mechanical via inter-row cultivation. Communication with local grain elevators is important to inform them of any potential concerns of volunteer plants that may contain non E.U. approved traits if the grain was intended for exports markets.

## Soybeans

Growers who use a pre-emergence herbicide for soybeans may have fewer problems with volunteer corn. Several pre-emergence products provide suppression or control of this weed.

Soybean seeds usually end up on the ground from pods splitting before harvest, pod placement too close to the ground for the combine head to collect or combine settings improperly adjusted. Volunteer soybeans in the following crop are usually not a concern for several reasons. For the most part, these seeds that are left in the field will germinate within a few weeks after harvest and will be killed with the onset of winter or from fall or spring tillage. Any plants that do happen to make it into the rotational corn or cereal crop will be controlled by most of the standard herbicide programs currently available. If volunteer soybeans appear in a field in the spring at significant levels, it is best to review the corn or cereal weed control program with an ag chem retailer to ensure that the volunteer soybeans will be controlled.

## Wheat

Volunteer wheat is primarily a result from grain lost during harvest operations due to improper mechanical setup or spillage. Wheat seed is also spread in areas of the field where lodging occurs. Three factors

commonly associated with lodging are poor weather conditions later in the growing season, disease pressures and late harvest. When any of these factors exist, it indicates that volunteer wheat should be considered in any weed control activities.

Minimum tillage is an excellent management practice in the control of volunteer wheat. Fallen seed should be left in the stubble in the fall. To help minimize the volunteer pressures, it is best to leave the wheat seeds near the soil surface after harvest. Maximum germination of wheat seed left on the surface will occur prior to planting the following spring. The seed that germinates in the fall is often controlled by frost. The volunteer cereal that germinates in the spring can easily be controlled by spring tillage, burndown, or pre-seed herbicide application.

There are also many other options available for in-crop herbicide applications to control volunteer wheat. Refer to label rates and application instructions for each specific product and each specific crop.

## Herbicide Considerations

For post-emergence herbicides, the rate depends on the height of the volunteer plants and the herbicide used. Growers should wait approximately 10 days after initial application of herbicide before assessing its effect on volunteer plant control. If other weed species listed on the herbicide label are not controlled, it is possible that a herbicide or application problem may have occurred. In this case, some issues to consider include the rate applied, the size of the weeds (including corn) at application,



Photo from AIS Communications.

the gallons/acre of spray solution applied, adjuvants and additives used, tank mix partners included, coverage obtained (type of nozzle, spray pressure, etc.), weather conditions before and after application, and the growing conditions at time of application. If a herbicide performance issue is suspected, questions should be referred to the herbicide dealer/representative.

Controlling volunteer plants of any sort prior to planting in the spring is an excellent option if the volunteers have emerged. Granted, this may be more of a challenge for volunteer corn, as the soils may not have warmed up enough to stimulate germination prior to planting. However, with the presence of emerged volunteers, several options can be used to remove these volunteers with the same application intended to control perennial weeds and winter annuals, or simply with normal spring tillage.

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## Unexpected Volunteers

Producers expect volunteers in the field next year whenever they plant herbicide tolerant crops as a result of shattering or seed spillage before or during harvest and factor that into their weed management practices. With widespread adoption of HT crops however, more and more producers must anticipate the presence of HT volunteers even in fields that were not previously planted to HT crops. Sources of unexpected volunteers include commingling in seeding and harvesting equipment or adventitious presence\* in seed. Fortunately, both expected and unexpected HT volunteers can be managed with the same attention to agronomic stewardship that characterizes good conventional agricultural practice.

### Equipment and Handling

Thoroughly clean planters and harvesters after an HT crop to remove all remaining grain. When using both non-HT varieties and HT varieties, segregate seed supply by trait so as to minimize any potential risk of planting the wrong seed in the wrong area.

### Adventitious Presence and Seed Purity

It is virtually impossible to state that any bag of certified seed is 100% pure due to the manner in which seed production occurs and the potential movement of pollen. According to the Canada Seeds Act, the production of certified seed allows for a minimum level of off types. Reduce the presence of HT volunteers by using certified seed.

## The Fundamentals Apply

To minimize the presence of unexpected HT volunteer plants, consider the following, if applicable, when planning:

- 1) Review the choice of herbicide chemistry for burndown prior to planting.
- 2) Integrate the use of post-harvest cultivation.
- 3) Utilize control measures that may be considered in non-crop areas.
- 4) Grow Certified Seed.

For managing unexpected volunteers in-crop, use the same techniques for those expected volunteers as listed above.

When it comes right down to it, the best management practice for controlling volunteers – whether they are from herbicide tolerant or conventional crops – is through an integrated weed management approach. Elements should include: crop rotation, herbicide group rotation, rotation of herbicide tolerant traits, rotation of timing of herbicide applications, and tillage.

\* adventitious presence is a term coined by the seed industry to refer to the unintended presence of genetically modified traits.

Contributing writer:  
Gabriele Ferguson, CCA – Certified Crop Advisor.



For more information,  
please contact

CropLife Canada

21 Four Seasons Place

Suite 267

Etobicoke, Ontario M9B 6J8

Tel: (416) 622-9771

Fax: (416) 622-6764

Website: www.croplife.ca

