

Managing Weed Resistance

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It is a fact that differential death accomplishes the unwanted miracle. Every pesticide/biocide (including antibiotics, anti-cancer, and anti-retroviral drugs) selects for its own failure. History has shown that it is only a matter of time until resistance occurs somewhere – hopefully, not on the home quarter. It is also a fact that in the past 20 years, there has been only one new herbicide mode of action group commercialized worldwide (and this new herbicide group has not been commercialized in western Canada due the ‘lack of fit’ (selectivity) with the crops commonly grown). Therefore, herbicides should be considered a non-renewable resource that are rapidly being depleted, and each use of a herbicide should be carefully considered. There have even been instances in other countries of weeds evolving resistance to glyphosate (Table 1), so growing Roundup Ready™ crops frequently in the rotation is not a fail-safe, long term strategy to manage weed resistance. Recent herbicide use information for western Canada indicates that glyphosate is the most commonly used herbicide, with approximately one-half of the total cropped acreage in western Canada annually receiving at least one application of glyphosate (Source: 2003 Stratus Report – Herbicide Use). Because glyphosate can be used pre-seed ‘burndown’, in Roundup Ready™ crops, pre-harvest, and post-harvest, some fields receive more than one application of glyphosate per year. This is worrisome because farmers practicing low disturbance direct seeding are very dependent on glyphosate, and there are no good substitutes for glyphosate (and apparently no satisfactory alternatives to glyphosate under development, or at least in the latter stages of development).

Table 1. Instances worldwide of evolved glyphosate resistant weeds (to date).

Common name	Scientific name	Country/year of first report
Rigid ryegrass	<i>Lolium rigidum</i>	Australia 1996; California 1998; South Africa 2001
Italian ryegrass	<i>Lolium multiflorum</i>	Chile 2001; Brazil 2003
Goosegrass	<i>Eleusine indica</i>	Malaysia 1997
Canada fleabane /horseweed	<i>Conyza canadensis</i>	Delaware 2000 & 9 additional U.S. states
Hairy fleabane	<i>Conyza bonariensis</i>	South Africa 2003; Spain 2004
Buckthorn plantain	<i>Plantago lanceolata</i>	South Africa 2003

(Source: Dr. Ian Heap, November 2004 (Internet) [Http://www.weedscience.org](http://www.weedscience.org))

A number of strategies can be considered to manage herbicide resistant weeds. These strategies may not be popular, easy or inexpensive to implement, or ‘fit’ very well into current farm practices. However, to maintain the usefulness of our current herbicides (as mentioned above, few new herbicide groups are being commercialized) it is imperative that at least some of these strategies be implemented.

- 1) Most importantly, reduce reliance on herbicides and herbicide use. If you do not apply a herbicide, the chances of you getting herbicide resistant weeds are much reduced – the

resistant weed seed would have to blow onto your land, be spread by custom (hired) farm equipment, or be a contaminant in seedlots, manure, or granular fertilizer. There may also be some spread of weed seeds by wildlife. Practices that can reduce reliance on herbicides for weed control include using economic thresholds to guide decisions on herbicide application, growing competitive crops (crop and cultivar choice, fertility, fertilizer placement, seeding rate), and cultural controls (tillage, cross-harrowing, roguing).

- 2) It is a misconception to think that producers can continuously crop annual spring crops and NOT rely on herbicides as the primary method of weed control. Therefore, including perennial forage crops, winter crops, and green manure crops in the rotation is necessary to destabilize weed populations and reduce reliance on herbicides.
- 3) Keep detailed records for each field of crops grown, herbicides used, weed species and densities present (both before and after spraying), and approximate level of control achieved.
- 4) Clean equipment between fields (particularly harvest equipment). This is a good idea not just to avoid spreading herbicide resistant weeds, but to avoid spreading weeds in general. Consider using a chaff wagon behind the combine to catch chaff and weed seeds at harvest. To the extent possible, plant weed-free crop seed.
- 5) Scout your fields thoroughly after spraying to identify escaping weed patches. Well before weed maturity, minimize seed set in obvious weed patches by mechanical means – mowing, swathing, or tillage. Of all the strategies to minimize the adverse effects of herbicide resistant weeds, this scouting of fields and mechanical control of escaping weed patches is probably the easiest to implement and the least costly.
- 6) Practice rotation of herbicide groups (do not use herbicides from the same herbicide group year after year on the same field). Obviously, current use patterns for glyphosate, particularly by those farmers practicing zero tillage and low disturbance direct seeding, do not and cannot conform to this advice. Note that the rotation of herbicide groups is mentioned last in this list of herbicide resistance management strategies. In the past, there has been over-reliance on this strategy with rotation of herbicide groups being the cornerstone of resistance management practices. Instances of non-target site and multiple-group herbicide resistance in weeds are becoming more common – rotation of herbicide groups as a strategy is ineffective against these types of weed resistance.

Steps to Identify Weed Resistance in the Field:

- 1) Rule out adverse weather or application errors.
- 2) Field records indicate repeated use of the same herbicide (or herbicide group) in previous years.
- 3) Weed species now escaping control was well-controlled by the same herbicide (or herbicide group) in previous years.
- 4) Escapes cannot be attributed to emergence after application (for post-emergence herbicides).
- 5) Escapes occur in irregular-shaped patches while other weed species, that the herbicide has activity on, within the patch are well-controlled (i.e. the patch was sprayed and there was herbicide activity).
- 6) Collect some MATURE, DRY seed for resistance testing while preventing the majority of seed set in the patch (mowing, swathing, tillage). Place the seed in a paper bag in a well-ventilated area.

While implementing herbicide resistance management strategies may be costly and inconvenient, the lack of any action may ultimately be more costly. This is particularly the case for glyphosate where normal herbicide effectiveness is crucial to the very valuable and widely adopted agronomic practice of low disturbance direct seeding, and where there are no good substitutes for this herbicide. “. . . If we want the chemical [glyphosate] to work now and for the next generation, then respect it now as a precious resource and use it prudently so that it will be an option for future harvests” (Dr. Steve Powles, 2003, Weed Science Vol. 51, page 471).