Basics of Effective Herbicide Rotation

- Keep accurate records of both crop rotation and herbicide use. It's easy to remember what you did last year, but what about five or even ten years ago?

- Don't just switch to another herbicide with the same mode of action. Herbicides are divided into groups based on how they affect the target plant. See **Table 1** for a summary of herbicide groups. In order to employ effective herbicide rotation, you should rotate herbicide *groups*, not just the chemicals themselves.

- Use clean seed, preferably certified. This will reduce the amount of outside weed contamination entering your fields.

- If you are depending on the herbicide alone to control your weeds, follow label instructions exactly. Reducing herbicide rates should *only* be used when other agronomic practices (e.g. higher seeding rates) are being employed that will provide the same level of weed control as the full rate of herbicide. Lowering herbicide rates just to save money will eventually result in resistant weeds and end up costing you more.

- Use good sanitation practices. Avoid spreading crop seed, weed seed, crop residues or manure from suspicious or unknown fields

- Use mixtures or split applications of herbicides with different modes of action.

- Rotate crop types (cereals and broadleaves) and life cycles (annual, winter annual and perennial) to prevent selection for a specific type or species of weed.

- Scout your fields often so that you know what weeds are present and their stage before you spray.

- Spray effectively. Spraying at the proper rate, stage and weather conditions will eradicate the weeds as fast as possible and save you money on lost yield and over application.

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Increasing Adoption of Integrated Pest Management in Cereals

Part 2

Reducing Pesticide Risk (Resistance) by Practicing Herbicide Rotation

Canada

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Why Rotate Herbicides?

Generally, producers like to stick with what works for them. Farming is a business in which one untimely decision can cost you thousands of dollars, so it's understandable that when a producer finds a herbicide that works, he would want to use it every year.

Unfortunately, that is exactly the practice that causes herbicide resistant weeds. Some of the most notorious examples of herbicide resistance around the world are populations of rigid ryegrass in Australia (resistant to Groups 1,2,3,7,8,9,11 and15) and wild oats in western Canada (resistant to Groups 1, 2, 8, 25 and 26). Herbicide rotation is the best way to ensure weeds do not develop herbicide resistance.

How Do Weeds Become Resistant?

When a herbicide is used, often not every plant is killed. When a weed survives a herbicide application, it often has some measure of natural resistance to that herbicide. If that weed sets seed, the next generation will need higher amounts of the same herbicide to kill them. Generation after generation, these weeds survive and become more and more resistant to herbicides, until that particular chemical no longer affects them at all.

Keep accurate records of both crop rotation and herbicide use.

Table 1. A summary of herbicide groups and their modes of action.

Group	*Mode of Action*	*Example Herbicide*
1 – the grass herbicides	Inhibit the enzyme ACCase, which helps in the formation of lipids in the roots of grass plants.	Puma Super, Poast Ultra, Axial
2 – ALS/AHAS inhibitors	Block an enzyme called ALS/AHAS, which is essential in amino acid (protein) formation.	Pursuit, Ally, Refine Extra
3	Inhibit cell division in roots.	Edge, Treflan, Rival
4 – synthetic auxins	Disrupt plant cell growth in newly formed stems and leaves, causing malformed growth and tumors. See Figure 2.	2,4-D, MCPA, Lontrel, Banvel II, Curtail M
5	Interfere with photosynthesis, ultimately causing plant death.	Atrazine, Sencor
6	Inhibit photosynthesis	Basagran, Achieve, Buctril M
7	Inhibit photosynthesis	Linuron, Diurex 80W
8 – lipid synthesis inhibitors	Inhibit cell division in seedling shoots	Eptam, Fortress, Avenge 200-C
	before they emerge above ground.	
9 - glyphosate	Inhibit amino acid (protein) synthesis. See Figure 1	Roundup, Vantage, Glyfos, Touchdown iQ
10 - glufosinate	Inhibit an enzyme called glutamine synthetase.	Liberty 150 SN
11	Inhibit synthesis of carontenoids.	Amitrol 240
15	Inhibit cell growth and division.	Dual II Magnum
16	Unknown.	Nortron
20	Inhibits actively growing roots and stems, as well as seed germination.	Casoron
22	Disrupt the cell membrane and prevent cells from manufacturing food.	Gramoxone, Reglone

Figure1. Typical glyphosate herbicide damage on flixweed

Figure1. Typical Group 4 herbicide damage on dandelion (left) and Canada thistle (right)