# Moderation is the Key to Preventing Herbicide Resistance

*by Mick Lane*

Remember that old adage about doing things in moderation? Well, it holds true in managing weed problems, too, insist Gordon Harvey and Marshall McGlamery.

Harvey, a University of Wisconsin agronomist and weed expert, has devoted much of his career to the study of herbicide-resistant weeds, starting with triazine resistance in Wisconsin. Likewise, McGlamery, a well-seasoned agronomist at the University of Illinois, is one of the foremost herbicide specialists in the United States.

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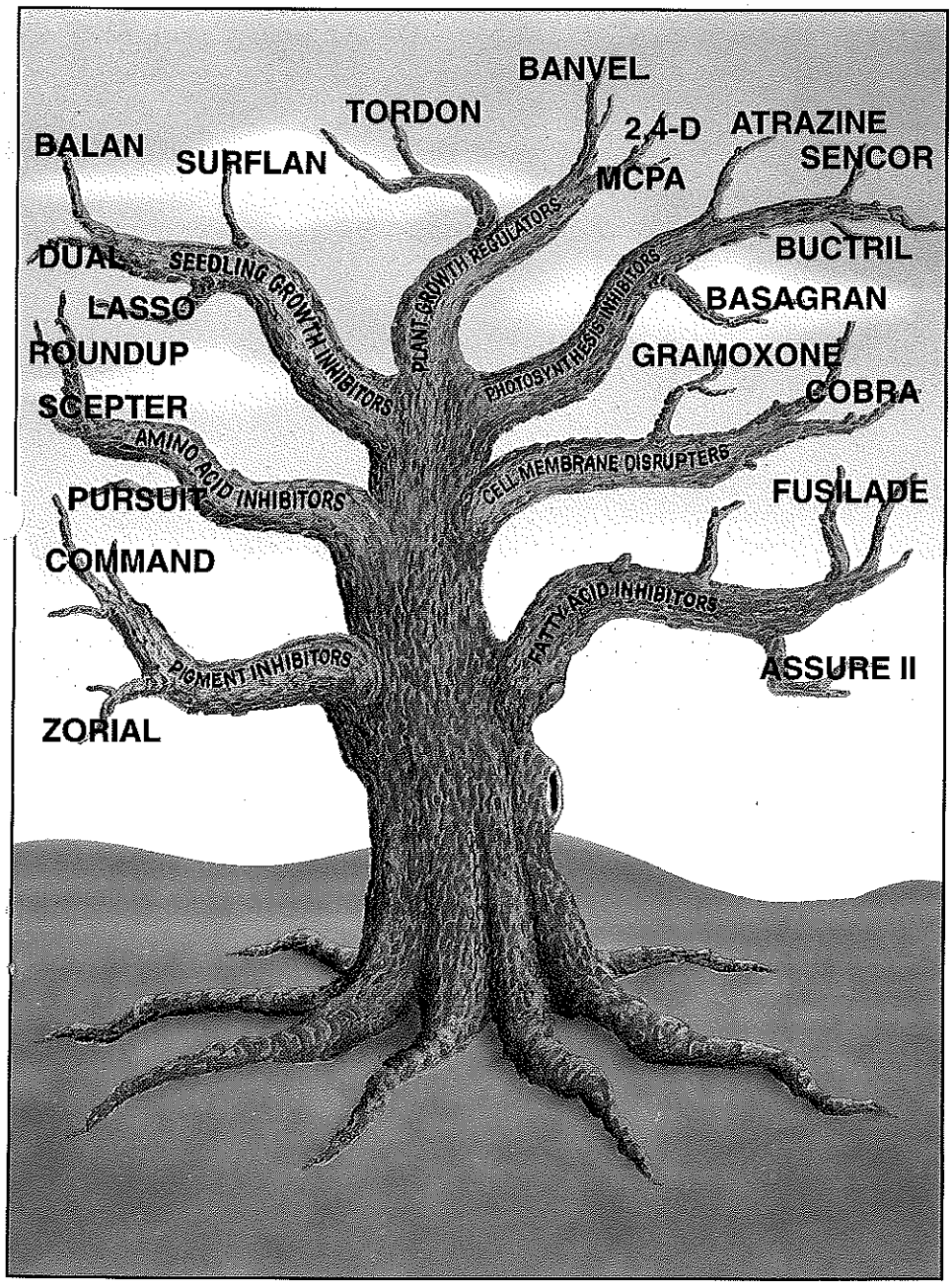
Both agree that moderation means an integrated approach to weed control that considers all control options and tools if we intend to save herbicides as a viable option for the future. The reason is, they say, herbicides have worked so well and have been so economical in the past, producers have used them to the exclusion of other weed control measures. The result has been a proliferation of weed species exhibiting resistance to a number of popular chemicals.

"Wisconsin farmers had fought quackgrass for years with little success when atrazine was introduced," Harvey says. "It was an immediate success here. But then we began to see resistance to atrazine in some weeds. We found some of the resistant weeds were also resistant to other members of the triazine family, even though other herbicides had not been used in the area.

"In the potato-growing area of the state, triazine resistance developed not from the use of atrazine, but from use of Sencor," he adds.

Meanwhile, red root pigweed resistant to Pursuit has been found in the Northeast. In the South, there have been a number of reports of Scepter-resistant cocklebur. "It's just a matter of time before we have weed resistance to the ALS inhibitors in the Midwest," McGlamery says.




*Recognizing the growing potential for herbicide resistance, weed experts recommend rotating chemical families and mode of action to prevent build-up of resistant weeds.*

## Sooner than later

He's also betting that it will be sooner than later. "The seed companies are already introducing Pursuit-resistant or tolerant corn hybrids. If man can produce herbicide-resistant plants, Mother Nature can do it too. We'll see sulfonylurea/imidazolinone-resistant shattercane in parts of the Western corn belt within five years," he predicts.

The reason is, there's a lot of continuous corn where irrigation is available in Nebraska, Kansas and Colorado. The sulfonylureas are highly effective and are already widely used. "Even where corn is rotated with soybeans, producers are likely to rotate between sulfonylureas and imidazonilinones, especially now that the imidazolinone-resistant hybrids are out," McGlamery says.

Recognizing the potential for weed resistance, herbicide experts have recommended rotating chemical families to prevent build-up of resistant weeds. But, McGlamery says, it's not just widespread use of a specific herbicide family that can lead to weed resistance. "We know that if a plant is resistant to one family of chemicals that affects a specif-

***An integrated approach to weed control, which calls for crop and herbicide rotation, tillage or cultivation and field scouting, is the key to reducing herbicide resistance.***

ic plant function (mode of action), it can also be resistant to other chemicals that have a similar mode of action," he continues.

When different chemical families have the same mode of action, Harvey agrees that just rotating herbicides may not be enough. "We have to rotate mode of action, and that means you must know what mode of action the herbicide uses. It's a good idea to also use combinations of herbicides with different modes of action during the same season, and even use cultivation, he notes.

Harvey relates that while no-till has been good for saving soil, he cautions farmers to think about what else it is doing. "It has increased our dependence on chemicals," he says, stressing that it is a mistake to rely solely on one form of control in weed management.

"A lack of duplicity in control methods allows nature to select survivors," McGlamery adds. "Those survivors are likely to be resistant weeds.

"Farmers are going to have to take this thing into their own hands," he adds "We can deal with the resistance issue if we select our weed management inputs carefully."

## Multifaceted approach

Harvey, too, recommends a multifaceted approach to weed management, including:

- Scouting fields regularly to identify weeds species and populations; and then using herbicides only when economic thresholds dictate;
- Rotating herbicides by both chemical family and mode of action;
- Using combinations of chemical families that have different modes of action to avoid leaving resistant escapes in the field;
- Including crops with varying life cycles in the rotation, such as summer annuals, like corn and soybeans; winter annuals, like winter wheat, and perennials, like alfalfa;
- Using new herbicide-resistant or tolerant crops judiciously, and using herbicides with the same mode of action on one field no more than two years in a row unless other effective control practices are also used in the management system;
- Using rotary hoeing, cultivation and tillage where appropriate;
- Cleaning tillage and harvest equipment before moving from one field to another to avoid accidental spread of nuisance or resistant weeds.

"Knowing which herbicides are related and which have similar modes of action will help producers develop weed management programs that will ensure their continued success in the long run," McGlamery concludes.

# Understanding Herbicide Mode of Action

While all herbicides kill plants, they do it in a number of different ways, or modes of action. Because of this, not all plants are affected in the same way by a particular herbicide.

Resistant weeds don't occur overnight. When one mode of action is used continuously, only resistant plants (escapes) produce seed. This form of genetic selection increases the number of resistant seeds in a field over years to the point that eventually most members of this plant species in the area will be resistant to the particular mode of action.

Following is a brief discussion of how the different families of herbicides affect sensitive plants.

### PLANT GROWTH REGULATORS

***Plant Hormones (auxin), foliar applied***

**Phenoxy** herbicides overload the normal plant hormone (auxin) balance, characterized by abnormal leaf curling, stem elongation and formation of callus tissue. Broadleaf plants are more susceptible than grasses.

*Common trade names:* Butoxone, Butyrac, Thistrol, Weedone, 2,4-DP.
*Common chemical names:* 2,4-D, MCPA, MCPP, 2,4-DB, diclorprop.

***Plant Hormones (auxin), foliar or soil applied***

**Pyridines** are readily absorbed by roots and foliage, are quickly translocated by both phloem and xylem to new growth where they accumulate, causing **phenoxy**-like symptoms.

*Common trade names:* Stinger, Tordon, Turflon, Garlon, Access.
*Common chemical names:* clopyralid, picloram and triclopyr.

**Benzoics** cause abnormal root and shoot growth by upsetting the plant hormone (auxin) balance. Uptake can occur through seeds or roots, when soil applied, or through leaves when applied post- emergence.

*Common trade names:* Banvel
*Common chemical names:* dicamba