

Herbicide Resistance: What Vegetable Growers Need to Know

Julie R. Kikkert, Cornell University Cooperative Extension, Regional Vegetable Program, 480 N. Main St., Canandaigua, NY 14424.

BACKGROUND

Herbicide resistance is an inheritable trait of weed biotypes to survive an herbicide application to which the original population was susceptible. Resistance is confirmed by collecting seeds or propagules from suspect plants and testing young plants in a greenhouse for susceptibility to different concentrations of an herbicide application. If a population is resistant, it will often take 50 or 100X the normal 1X concentration to kill the weeds. A non-resistant population is used as a control. Researchers, who confirm resistance, can submit new cases to the International Survey of Herbicide Resistance Weeds website at <http://weedsience.org/>.

While there has been a lot of hype about glyphosate (RoundUp™) resistance, these actually represent only a handful of the cases overall. As of January 21, 2016, there have been a total of 462 unique cases of resistance globally (International Survey of Herbicide Resistant Weeds). This includes 248 weed species (144 dicots and 104 monocots). Of the 25 known herbicide site of actions, there is resistance to 22 of them. This includes 157 different herbicides where resistance has been documented. The number of herbicide resistant species has been climbing at a steady rate since the 1970's (Figure 1). Fourteen cases have been reported in vegetable fields. As shown by the light blue line in Figure 2, resistance to glyphosate (EPSP Synthase Inhibitor) was first reported in 1996 and has increased steadily. As alarming has been the dramatic increase in resistance to Photosystem II inhibitors (dark blue line) and Acetolactate Synthase (ALS) Inhibitors (red line). ALS inhibitors commonly used in vegetable production include Pursuit, Raptor and Sandea.

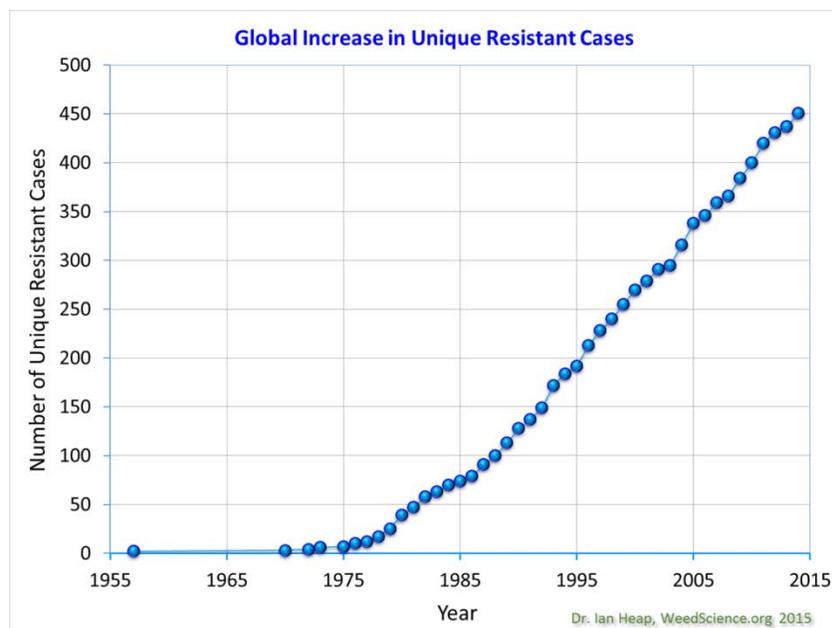


Figure 1. The number of unique cases of herbicide resistance reported each year. Dr. Ian Heap, International Survey of Herbicide Resistance Weeds, WeedScience.org.

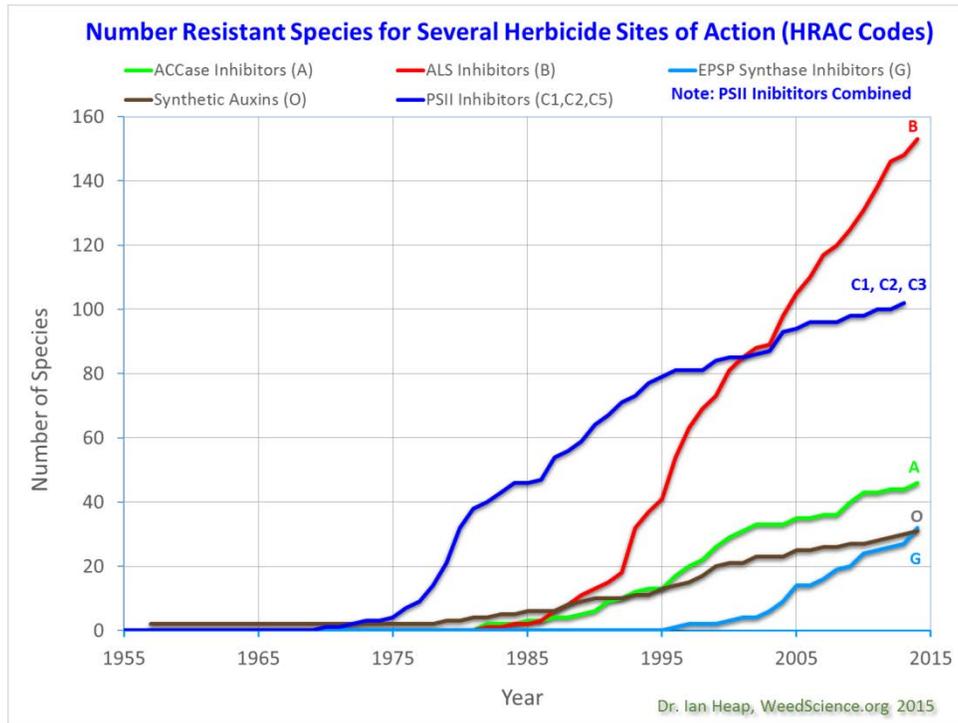


Figure 2. Number of resistant species by herbicide site of action. Dr. Ian Heap, International Survey of Herbicide Resistant Weeds, WeedScience.org

DOCUMENTED CASES IN NEW YORK

The documented cases for New York that have been added to the International Survey of Herbicide Resistant weeds are:

Year	Weed	Site of Action	Herbicides
1977	Common lambsquarters	PS II (C1/5)	atrazine, cyanazine, simazine
1980	Smooth pigweed	PS II (C1/5)	atrazine, metribuzin, simazine
1991	Common groundsel	PS II (C1/5)	atrazine, simazine
1993	Common ragweed	PS II (C1/5)	atrazine, cyanazine, simazine

In addition, linuron (Lorox) resistant pigweed (*Amaranthus powelli*) was documented in 2015 in a carrot production region by Kikkert, Bellinder and Heap. Dr. Russell Hahn at Cornell has also been testing for glyphosate resistance in marestail (*Conyza canadensis*), also known as horseweed or Canada fleabane and waterhemp (*Amaranthus tuberculatus*) collected from New York field crops production regions. Results of these tests if positive will be posted to the Weedsience.org website.

WHAT CAN BE DONE TO DELAY HERBICIDE RESISTANCE?

The Weed Science Society of America is a professional organization for weed scientists and there is a wealth of information about herbicide resistance management on their website <http://wssa.net/weed/resistance/>. A combination of weed management tactics is recommended to reduce the risk of selecting difficult to control weeds, and specifically, herbicide resistant weeds. Recommended practices to delay herbicide resistance include:

1. Use of careful planning so that products with different mechanisms of action (MOA), or unique group numbers, and activity on the same target weeds, are intentionally combined for sustainability. For example, in season 1 use a Group 9 plus 4; season 2 use a Group 9 plus 14; season 3 use a Group 1 plus
2. Integrate mechanical means of weed control into the cropping system
3. Utilize cultural practices such as:
 - Crop rotation
 - Plant population
 - Row spacing
 - Planting date
 - Fertilizer placement
 - Cover crops
4. Scout after an herbicide application
 - Begin 7-14 days after application
 - Observe and record weed species, spatial patterns of weeds, and herbicide symptomology on weeds.
5. If weeds are present after an application, determine the reason. Rule out other factors before suspecting herbicide resistance.
6. If resistance is suspected, contact your local Cornell Cooperative Extension Educator for assistance in confirmation.

CONCLUSIONS

Herbicides are an important tool in the weed management toolbox for conventional growers. However, there have been no new herbicide mechanisms of action developed since the 1980's, when sulfonylureas were developed. Additionally, the number of new active ingredients in the development pipeline continues to be reduced. For instance there were 70 in the year 2000 and only 28 in 2012. The bottom line is that we need to be good stewards of the herbicides we do have registered. An integrated weed management program where many tactics are used over a long-period of time is the best strategy to use.