

DAIRY AND FIELD CROPS NEWS

INSIDE THIS ISSUE:

Selection of Glyphosate-resistant Weeds	1
Heavy Glyphosate Use May Be Leading to Weed Species Shift	2

Editors Note:

I am not aware of any glyphosate-resistant weeds in New York and at this time the potential for them in the six county area is low but increasing. The use of Roundup Ready corn is increasing, and the soybean acreage (largely Roundup Ready) has grown. On the horizon is Roundup Ready alfalfa which may have some potential in our area. Although we have traditionally seeded alfalfa and grass mixes we may see shorter corn-alfalfa rotations develop.

Some of the weeds mentioned in these articles are not commonly found in our area. Horseweed or marestalk is an annual common to no-till soybean situations in the Midwest. This should not be confused with the bottle brush-looking horsetail, a common perennial in Central New York.

Selection of Glyphosate-resistant Weeds

Christy Sprague and Jim Kells, Michigan State University, Chris Boerboom, University of Wisconsin, Kevin Bradley, University of Missouri, Jeff Gunsolus, University of Minnesota, Bob Hartzler, Iowa State University, Bill Johnson, Purdue University, Mark Loux, Ohio State University, Dawn Nordby, University of Illinois, Micheal D. K. Owen, Iowa State University, Bryan Young, Southern Illinois University

It is well known that glyphosate-resistant horseweed (also known as marestalk) populations have been selected in Roundup Ready soybean and cotton cropping systems. Resistance was first reported in Delaware in 2000, a mere five years after the introduction of Roundup Ready soybean. Since that initial report, glyphosate-resistant horseweed is now reported in 12 states and is estimated to affect 1.5 million acres in Tennessee alone.

A person could ask if this is any indication of what might lie ahead. On one hand, it has been proposed in a popular advertisement that glyphosate-resistant weeds are unlikely to occur if glyphosate is frequently used, as long as glyphosate is applied at full rates. The comments in this advertisement, in part, are based on several long-term university studies of Roundup Ready cropping systems. However, the question that a person should ask about these studies is whether or not they can prove that resistance will or won't happen. It is our belief that these studies are not large enough to test if resistance will develop. For example, the University of Wisconsin has a 7-year Roundup Ready cropping system trial. This trial has horseweed in the no-till plots. Despite burndown and in-crop treatments with glyphosate, glyphosate-resistant horseweed has not developed in these plots. Since this trial did not find glyphosate-resistant horseweed, does this mean that glyphosate-resistant horseweed cannot develop? Does it mean that the resistant horseweed in Ohio, Tennessee, or Delaware is not truly resistant? Obviously not. Small-scale trials cannot prove that some event will not occur when a larger scale is considered. In total, these Roundup Ready cropping system trials may only be testing continuous glyphosate use on perhaps 50 acres, which is an extremely small fraction relative to total glyphosate. The true real test to determine if a rare event like glyphosate-resistant weeds will develop is actually being tested on the tens of millions of acres of Roundup Ready corn, soybean, and cotton that are sprayed each year.

Many weed scientists across the Midwest have warned of the potential for additional glyphosate-resistant weeds if a "high selection pressure" is maintained. In this case, "high selection pressure" refers to the repeated use of glyphosate without interruption by herbicides with other modes of action or other weed management practices. This potential was confirmed this week at the North Central Weed Science Society Meeting where glyphosate-resistant common ragweed weed was reported. This is the first report of glyphosate-resistance for common ragweed. It was identified in a Missouri no-till soybean field that has been in continuous soybean production (with some double crop wheat) for many years and in Roundup Ready soybean since 1996. The common ragweed in this field had a high selection pressure for glyphosate with one or more glyphosate applications per year. This is the second example of a glyphosate-resistant weed that has developed in a Roundup Ready cropping system with high selection pressure. We do not know which glyphosate-resistant weed will be the next to develop or when it will occur, but high selection pressure will likely result in additional cases of resistance.

Midwest weed scientists believe in the value that glyphosate and Roundup Ready crops offer to growers. We hope that growers and crop advisors will evaluate how they use glyphosate and the Roundup Ready technologies to gain the value of these technologies without increasing the risk of resistance.

Ideally, we recommend:

1. Tank mixing glyphosate with another mode of action like 2,4-D in burn down treatments when glyphosate will be applied in the subsequent crop,
2. Alternating glyphosate use with other herbicide modes of action between years, and
3. Incorporating appropriate integrated weed management practices such as cultivation.

Heavy Glyphosate Use May Be Leading to Weed Species Shift

Stevan Knezevic, Extension Integrated Weed Management Specialist

University of Nebraska Institute of Agriculture and Natural Resources Cooperative Extension

Given that more than 90% of soybean fields in Nebraska are planted with glyphosate-tolerant varieties (e.g. Roundup Ready® varieties), soybean producers must clearly realize the benefits from this technology. However, widespread and repeated use of glyphosate-based herbicides (brand names and generics) raises several concerns from the practical standpoint, such as the potential for weed resistance and shifts in weed species.

Currently, we don't know of any glyphosate-resistant weeds being found in Nebraska; however, it appears that our fields are experiencing a slow shift in weed species. In the last three years, university weed extension specialists have been receiving phone calls and complaints on glyphosate failing to control certain weed species, including some "new weeds."

Weed species shift is not a new thing -- it has happened since man started cultivating crops. Weedy and invasive species easily adapt to changes in production practices to take advantage of the change. Species that do not adapt become "less frequent" compared to those that do adapt. Despite the fact that glyphosate controls many weed species, especially grasses, many broadleaf species are naturally tolerant to label rates of glyphosate. It appears that as a result of repeated use of glyphosate in Nebraska, there is a slow shift in weed species from those easily controlled by glyphosate to those more tolerant of this herbicide.

Based on phone calls and questions from producers, crop consultants and agronomists, we compiled the following list of species which appear to be taking advantage of this shift and becoming more numerous: marestalk (horseweed), morningglory (common and ivyleaf), wild buckwheat, Pennsylvania smartweed, lady's thumb, venice mallow, yellow sweetclover, field bindweed, waterhemp, kochia, Russian thistle, primrose and volunteer Roundup Ready® corn.

If these weeds are not controlled, their seeds will be a major problem in the future, especially in no-till systems, due to lack of tillage as a tool for weed control. Such shifts in weed populations to more tolerant weeds is already resulting in increased weed control costs due to additional herbicide applications or increased glyphosate rates.

Research on glyphosate rates

This article summarizes preliminary data from studies conducted at Concord and North Platte in 2004 to determine the appropriate dose of glyphosate to control these weed species.

We tested seven rates of Roundup WeatherMax® ranging from 4.6-60.0 oz with 2% v/v AMS. Each glyphosate rate was applied at three growth stages of the weed, targeting 1) 2- to 5-inch tall weeds (early POST), 2) 6- to 12-inch weeds (mid POST) and 3) 12- to 20-inch weeds (late POST). Visual ratings of percent weed control were conducted about 21 days after glyphosate treatment, based on a scale from 0 to 100 (where 0 = no injury and 100 = plant death).

Most of these weeds survived the label rate of Roundup WeatherMax (22 oz/acre). Weed size was the most important factor that determined the level of control for each species (Table 1). Ivyleaf morning-glory and sweet clover were the hardest species to control. For example, the 22-ounce rate provided only 50% control of ivyleaf morningglory that was 4 inches tall. The control level was further reduced with taller morningglory, resulting in 30% and 21% control for 8- and 12- inch tall plants, respectively (Table 1). A similar trend was observed for other weed species (Table 1). The label rate of Roundup WeatherMax provided good control (more than 85%) of kochia and Russian thistle, regardless of plant height (Table 1).

Since the label rate of WeatherMax did not provide adequate control of most species over 3 inches tall, we developed dose response curves (not shown) to determine how much glyphosate is needed to achieve at least 90% control of taller plants (6 to 20 inches tall). This information also will help determine rates for late glyphosate applications in

Roundup Ready soybeans (not an uncommon practice in Nebraska). Based on our data from the dose response curves, to achieve at least 90% control of taller weeds, much higher rates of Roundup WeatherMax ranging from 1.5- 4 times the label rate are required. About 1.5-2 times the rate was needed to control 3- to 6-inch tall wild buckwheat, Venice mallow, velvetleaf, waterhemp, sweet clover, ivyleaf mornigglory and field bindweed. About 3-4 times the rate was needed to control 12- to 15-inch tall ivyleaf morningglory and yellow sweetclover. For weed sizes and respective rates, see Table 1.

This data reaffirms what many practitioners have observed, that glyphosate used alone does not work as well today as it did five to six years ago. The label rate of glyphosate did not provide adequate control of most problem weed species tested. If the trends in weed shifts continue, glyphosate used alone will no longer be a viable tool for weed control in Roundup Ready systems. Mixing glyphosate with other post-emergence broadleaf herbicides, or using soil-applied herbicides after soybean planting, indicates a potential to effectively control most of these species.

Using various weed control tools is not a new thing, we only “forgot” about it since the introduction of Roundup-Ready crops. Changing modes of actions in your herbicide program is also one of the basic ideas in an Integrated Weed Management (IWM) program, especially to combat weed resistance/tolerance issues. Integrated Weed Management provides a system for integrating several tools for weed control.

I believe that Roundup-Ready technology only fits well when used with other weed control methods under the umbrella of an IWM system. The value of this technology can be preserved only by proper management and reduced overuse. It is easy to fall into a trap of overusing glyphosate when one glyphosate-tolerant crop is grown after another. Proper use of this technology, as a component of an IWM program, is the key to preserving the long-term benefits of this technology while avoiding many of the concerns about its use or overuse.

Table 1. Weed species and their heights at the time of herbicide application, levels of weed control with 22 oz rate of Roundup WeatherMax (at 21 days after application), and the rate of Roundup WeatherMax rate needed to provide 90% control of respective species at Concord in 2004 (preliminary data). Note that while rates higher than the labeled rates were used in this research, always read and follow the label.

Weed species	Weed height (inches)	Weed control with 22 oz of WeatherMax (%)	Rate of WeatherMax needed to achieve 90% control (in fl. oz)
Field bindweed	3	95%	22
	6	70%	35
	9	60%	35
Ivyleaf morningglory	4	50%	37
	8	30%	50
	12	21%	>60
Kochia	4	100%	15
	12	95%	20
	20	90%	22
Russian thistle	5	100%	12
	10	90%	22
	15	90%	22
Yellow sweetclover	4	50%	35
	8	35%	48
	14	10%	>60
Velvetleaf	5	85%	28
	10	65%	34
	21	60%	40
Venice mallow	6	70%	32
	10	50%	40
	18	45%	58
Common waterhemp	4	98%	16
	9	90%	28
	14	85%	30
Wild buckwheat	3	70%	28
	6" tall/ 12" runners	60%	33
	6" tall/ 24" runners	45%	40



Cornell University is an equal opportunity affirmative action educator and employer.
Cornell Cooperative Extension and the staff assume no liability for effectiveness of results of any chemicals for pesticide use. No endorsement of any products is made or implied. Every effort has been made to provide correct, complete, and current pesticide recommendations. Nevertheless, changes in pesticide regulations occur constantly and human errors are still possible. These recommendations are not substitutes for pesticide labeling. Please read the label before applying any pesticide. Where trade names are used, no discrimination is intended and no endorsement is implied by Cornell Cooperative Extension.

**Dairy and Field Crops Team of
Cornell Cooperative Extension
In Chenango, Fulton,
Herkimer, Montgomery, Otsego
and Schoharie Counties**

**Cornell University
Cooperative Extension**

Dairy Management
Dave Ballban
(518) 762-3909
drb23@cornell.edu

Field Crop Management
Kevin Ganoe
(315) 866-7920
kng2@cornell.edu

***DAIRY, LIVESTOCK AND
FIELD CROPS NEWS***

Volume 12 Issue 4
June 2005
Extra Edition

**Cornell Cooperative Extension of Herkimer County
5657 State Route 5
Herkimer, NY 13350**

**NON PROFIT PRST STD
US POSTAGE PAID
Herkimer, NY 13350
Permit No. 25**

**Dairy and Field Crops Team of Cornell Cooperative Extension
In Chenango, Fulton, Herkimer, Montgomery, Otsego and Schoharie Counties**