

Glyphosate resistant palmer amaranth found in Georgia

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Palmer amaranth (*Amaranthus palmeri*) appears to be the newest weed species that has developed resistance to glyphosate. The resistant population was found in Georgia in a field that had repeatedly been planted with Roundup ready cotton since 1999. According to the press release, this field used no other form of weed management except glyphosate during this time period. Palmer amaranth was becoming noticeably more difficult to manage by 2002-3 therefore resistance could have developed in as short as 4-5 years. The University of Georgia's Cooperative Extension Weed Scientist Dr. Stanley Culpepper along with Monsanto scientists has evaluated this population in field and greenhouse studies and shown this population to be resistant to glyphosate. Further studies are being conducted to confirm resistance, determine the mechanism responsible for resistance, and evaluate the heritability of this trait.

While resistance is uncommon, more and more resistant populations have been appearing due to the higher use of glyphosate in agronomic crops. Currently, Italian ryegrass (1996), rigid ryegrass (2001), buckhorn plantain (2003), goosegrass (1997), horseweed (2000), hairy fleabane (2003), common ragweed (2004), and now palmer amaranth (2005) have populations that are resistant to glyphosate. It is important to realize that while we haven't found any resistant populations in New Mexico, ALL of these species can be found within our borders. This means that the genes necessary for glyphosate resistant weeds are likely present in our state.

For those who are not familiar with glyphosate, it is the active ingredient in Roundup, Rodeo, Glyphomax, Touchdown, and many other herbicides. Glyphosate is used widely throughout the United States because of its low cost, wide range of plants it can control, its environmental safety, and consistent results in a wide range of climactic conditions. While glyphosate has been around for decades, its use has increased dramatically over the past 10 years since the creation of roundup resistant crops (roundup ready cotton, soybean, corn, and just recently alfalfa).

While the use of glyphosate without any other form of weed management is NOT recommended it is commonly practiced throughout the United States. This is not recommended as the use of only one management method causes a huge selection pressure and what can result are plants that are either tolerant or resistant to glyphosate. What's the difference between resistant and tolerant plants? Herbicide tolerant plant species have always been difficult to control with the herbicide in question, while resistant plants have historically been controlled, but overtime specific populations of plants have become resistant to normal doses of this herbicide. For example, morningglory species have always been difficult to manage with glyphosate; these plants are considered tolerant to glyphosate. In contrast, palmer amaranth is typically easy to manage, but this population in Georgia can survive doses that kill typical palmer amaranth when applied at the recommended stage. Weed scientists have developed specific definitions of these terms to avoid confusion as each plant is quite different (other disciplines have not, and this can cause added confusion to the matter). The important point is that neither tolerant nor resistant plants are desirable, and several things can be done to prevent their development.

Why should we care? Glyphosate is an excellent tool that is used to manage weeds along roadsides, backyards, parking lots, wildland areas, and agriculture and no resistance to glyphosate has been observed in New Mexico. Tolerant species do exist in New Mexico, but if managed correctly, their populations can be kept small. Thus we can prevent the formation of resistant species and limit the spread of tolerant species. How? By altering weed management strategies to prevent the selection

of plants with these traits. These are a few things to consider when developing a management plan to prevent glyphosate resistance from occurring.

HOW TO PREVENT OR DELAY HERBICIDE RESISTANCE

1. Herbicide rotation: Periodically rotate the mode of action of the herbicide used to manage weeds. This doesn't mean using Roundup Pro one year and Glyphomax the next as both products have the same active ingredient (glyphosate). Select herbicides with other active ingredients that target different pathways in the plants. This strategy will manage any new establishing resistant plants, preventing them from growing larger populations. Consult the label or your local county agent for assistance in determining what the mode of action the herbicides used in your production system.
2. Crop rotation: Plant a crop having a different season of growth, different registered herbicides with a different mode of action, and/or for which there are alternate methods of weed control.
3. Monitor after herbicide application: Check for weedy patches in patterns consistent with application problems and manage by other means than the herbicide typically used. If resistant plants are thought to be present, DO NOT let plants go to seed!
4. Non-herbicidal control techniques: Use a non-herbicidal form of weed management such as cultivation, hand-weeding, mowing, disking, or flaming. By integrating these mechanical methods, newly resistant plants will be removed before their populations have time to develop, preventing large-scale spread into your field.
5. DO NOT spray below labeled rates. While several mechanisms are responsible for resistant plants, one of them is the enhanced ability of plants to breakdown the herbicide into a nontoxic form. Spraying at lower than label rates can allow plants that can tolerate these reduced rates to survive. While these plants can still be controlled by the label rate, if not managed they can reproduce with other plants that are slightly tolerant and produce a highly resistant biotype.

How can you tell if you have resistant weeds? This can be very difficult, as lack of control can result from many things. I recommend collecting several pieces of information, as this will help you to determine if you have resistant weed populations.

1. Field history: If the field has only used one herbicide to manage weeds for many years, the chances of resistance are greatly increased. If you remember the suspected plants historically being managed with the same herbicide applied at the same rate at the same growth stage, this also indicates potentially resistant plants.
2. Observing the level of weed control in the field: Compare the level of weed control between the implicated species and other susceptible species. If you see dead plants adjacent to the suspected resistant weeds which are actively growing this is a strong indicator that you could have resistant populations.
3. Look at where the suspected plants are: Remember, that misapplications of herbicides can frequently look like herbicide resistance. If you see distinct strips of plants not controlled, this may be an application error, and not weed resistance. Resistant plants are typically found in discrete patches, and not along linear strips.

With planning and diligence resistant weeds can be prevented from establishing, allowing herbicide effectiveness and its life as a tool to be extended. If anyone believes they have a resistant population of any weed species to any herbicide they should contact their local extension agent as soon as possible to confirm that populations are resistant, and to prevent it from spreading throughout the state.