

## DIAGNOSING HERBICIDE RESISTANT WEEDS

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Determining if a weed control failure is due to resistance or some other factor is an investigational process that involves asking a lot of questions in order to rule things out. It's important to remember that weed control failures are usually not an indication of resistance development. Weed control failures can and do occur from multiple and interacting factors including weather and application errors. Resistance should not be assumed to be the cause of a weed control failure; other reasons must be investigated first. This paper presents information that can help you determine if herbicide resistance should be suspected for a weed control failure, or if it is due to other factors.

One of the first things you need to determine is if a field is at risk for the development of herbicide resistance. Do field records indicate that the same herbicide mode of action has been used in previous years? If herbicide modes of action have been rotated consistently from year to year, it is less likely herbicide resistance has developed (unless introduced by contaminated equipment, manure, etc.). Secondly, make note of the weed species that have escaped control. Are there multiple weed species present, or just one? Since it is unlikely that resistance will show up in several weed species at the same time, multiple weed species escaping control suggests other reasons may be the cause. On the other hand, if only a single species escapes control, a species that has normally been controlled, resistance could be a concern.

The first set of questions that you need to ask will rule out herbicide application errors. Check to make sure that the correct herbicide and herbicide rate and adjuvant were applied and that it was applied within the recommended weed growth stage. For postemergence applications, was the weed present at time of application or did it emerge after the application? For preemergence applications, was an activating rainfall received before weed emergence or had the weed already emerged prior to the application? Was the sprayer equipment clean and in good working order, including nozzles (i.e. no plugged or worn nozzles)? Was the sprayer calibrated properly? Was the recommended water volume used for application?

Secondly, rule out the effects of weather. Certain weather conditions shortly before, during or after application can affect herbicide activity. It takes moisture to activate some herbicides. Lack of moisture can decrease herbicide activity. Further, a weed under heat, cold, or moisture stress may not absorb enough herbicide to be effective. Conversely, rainfall shortly after a post-emergence application can wash off the herbicide before it enters the weed.

After ruling out application errors and weather effects, make sure to carefully note field observations. Were the weeds in the field actually a second flush of weeds? Did the weed escapes appear in irregular patches rather than in strips or in a pattern that would indicate an application problem? Have you noticed a general decline in weed control over recent years? Are weed escapes in the same area of the field as in previous years and this area appears to be getting larger? Has the uncontrolled weed been successfully controlled in the past by the herbicide used this year? Did the same herbicide mode of action fail in the same area of the field in the previous year? Is weed control poor on only one or two weed species, but good on others? Do you see healthy weeds mixed with controlled weeds of the same species? Do the healthy weeds appear to

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be of the same age as the ones that were controlled? Are there resistant weeds in an adjacent field or farm? Answering yes to many of these questions raises the suspicion that herbicide resistance could be or has developed in that field.

If you suspect that you have a case of a herbicide resistant weed, what is your next step? Contact your local crop consultant or extension agent, state weed specialist, and the appropriate chemical company to further investigate the reason for the escaped weeds. They may try to confirm herbicide resistance in the field using a spot test. A spot test treats both a susceptible population of weeds and the weeds species that escaped, with the same herbicide that was used in the field. It's important that both weed populations be of the growth stage. If the susceptible population of weeds dies but the escaped weeds remain alive, for all practical purposes, the escaped population is resistant to that herbicide. If resistance is confirmed with a spot test, control the weeds with a herbicide having another site of action or use an appropriate nonchemical weed control methods to prevent the weeds from going to seed.

One last point needs to be made on diagnosing herbicide resistance in the field and that is the level of resistance. Weeds resistant to herbicide modes of action such as ALS and ACCase inhibitors express a very high level of resistance to those herbicides, often surviving rates 50 times higher the normal field rate. Weeds resistant to glyphosate express lower levels of resistance, in the neighborhood of 4 to 8 times the normal rate. Low levels of resistance can easily be confused with non-performance. The only way to distinguish between low level resistance and herbicide performance problems is to carefully investigate and rule out factors relate to non-performance as outlined. If you suspect glyphosate resistance, contact your local crop consultant, extension agent, state weed specialist and the appropriate chemical company for confirmation.

Hopefully you won't have to investigate escaped weeds for herbicide resistance. By practicing good herbicide stewardship you may be able to delay the development herbicide resistance in your fields. The following practices can help to delay the development of herbicide resistant weeds.

- 1) Rotate crops. Crop rotation usually means using a diverse herbicide program, making it difficult for resistant weeds to increase.

- 2) Rotate and tank mix herbicides. Using herbicides with different modes of action keeps weeds in check with little opportunity for them to go to seed. Strongly consider using a preemergence herbicide program with a postemergence herbicide program. Preemergence herbicides reduce the number of weeds being sprayed by the postemergence herbicide. The fewer weeds sprayed with the postemergence herbicide the less chance for them to become resistant.

- 3) Use short-residual rather than long-residual herbicides. Herbicides that last for a long time in the soil increase the selective pressure on resistant weeds. The longer susceptible types are suppressed and resistant ones allowed to grow, the more likely resistant weeds will increase enough to dominate the species.

- 4) Where practical, use tillage in conjunction with herbicides. The best weed management program uses a balanced variety of control methods, including herbicides with different modes of action and tillage.