

Managing Tough Winter and Summer Weed Spectrums with Sequential Herbicide Programs. Brad Hanson, UC Cooperative Extension Specialist, UC Davis

As most orchardists and pest control advisors are well aware, glyphosate-resistant weeds have been one of the biggest weed management challenges in California orchard crops for several years.

Depending on where you are located in the Central Valley, your biggest challenges in the glyphosate-resistant weed department are probably one or more of the following winter annual weeds. In the San Joaquin Valley, hairy fleabane and horseweed (also known as mare's tail), dominate. While in the Sacramento Valley and in some North coast areas, annual or Italian ryegrass is more common. For an extra challenge, many growers have a mix of several of these, in addition to their other common orchard weed spectrums.

In developing management strategies for these winter annual weeds, we've typically focused our herbicide-based programs on timely applications of preemergence herbicides. Because preemergence herbicides generally work on germinating weed seed or very small seedlings, "timely" applications for these winter annual species usually means getting the herbicide treatments out in late fall or early winter. In normal rainfall seasons, this timing ensures water-incorporation of the herbicide at about the same time as the seeds germinate and, hopefully, good control. Mission accomplished, right?

Recently, we've been seeing new glyphosate-resistant weed challenges that require a different management approach. The species I mentioned a moment ago are all winter annuals, which means they typically germinate and emerge during our cool season and reach a reproductive stage by spring or early summer. However, several recently confirmed (or suspected) glyphosate-resistant species are summer annual grasses. Summer annual weeds typically germinate and emerge as our season warms up in the late spring and early summer and they grow well into the summer before reaching maturity. A few examples include junglerice, threespike goosegrass, and several other glyphosate-questionable species such as feather fingergrass, sprangletop, and witchgrass. So, how do these grasses present such a different challenge?

The challenge with glyphosate-resistant summer grasses is that even though we have a number of good preemergence herbicides that can work very well on grasses, these species emerge long after our typical orchard preemergence herbicide programs are applied. Thus, herbicide programs that are applied during mid-November to mid-February targeting winter annual weeds sometimes fail to control summer annual weeds that emerge in May-July. If spring applications of foliar materials like glyphosate fail because of resistance, problems can quickly become apparent. How can we use our existing preemergence herbicide tools to help address this problem?

To answer that question, it's useful to think about what happens to a preemergence herbicide when you apply it to the soil. Herbicides "dissipate" in soil, a term that encompasses a suite of processes by which the herbicide is either broken down or made unavailable. Chemists use terms like "half-life" to describe differences in dissipation rates but this doesn't exactly get at our interest in weed control performance. From a performance standpoint, it's more useful to think

of a herbicide concentration threshold. When the amount of herbicide in the soil solution is above the threshold for a certain weed, it remains effective on that weed. However, dissipation processes will eventually reduce the herbicide concentration below the threshold and the herbicide begins to “break”. The threshold may occur at different levels for different weed species and dissipation rates may vary in different areas of the fields (wet vs dry areas, for example).

So, how do we typically account for dissipation of preemergence herbicides in orchard crops? I tend to think of three general strategies:

- Use mixtures of more than one preemergence herbicide
- Apply a higher (labeled!) rate of a preemergence herbicide
- Use a sequential approach to preemergence programs in orchards.

Mixtures: Using herbicide mixtures, particularly products with different modes of action, is a great strategy for managing and delaying herbicide resistance but doesn’t really help in this situation. Because herbicide dissipation rates are affected primarily by the chemistry of the individual herbicide and the environmental conditions, a tankmix will not exactly help extend the residual control beyond what we’d expect from the longest-lasting material. Or, to say it another way: if you mix a short residual herbicide with a long residual herbicide, one will last a short time and the other a long time but the mix will not last longer.

Higher rates: Many, but not all, preemergence herbicide labels have a range rates registered in a crop to account for differences in soils, required level of control, weed spectrums, etc. Within the labeled rate, it stands to reason that given similar dissipation processes, a higher rate will result in the soil concentrations of the herbicide remaining above the efficacy threshold for a longer time than a lower rate. This is generally true and is a common approach when we only have one opportunity to make a preemergence herbicide application. However, I think this is an indirect way to approach the problem of summer grasses in orchard crops.

Sequential approach: In the orchard cropping system, some growers may want to consider using a sequential approach to available preemergence herbicides to tackle problems with glyphosate-resistant summer annual grass weeds. Conceptually, this approach simply moves a portion of the winter preemergence herbicide program to a bit later in the year to late winter or early spring. A preemergence herbicide with activity on summer grasses would be applied along with the grower’s spring burndown herbicide program and, thus, would be present in the soil solution much closer to the timeframe when summer grasses begin to germinate and emerge. Importantly, I think this could be achieved in many situations with no significant changes in cost, number of field operations, or negative environmental impacts.

Illustration: An almond grower who typically uses an effective preemergence program (pick your favorite program) applied around the first of December followed by a March “cleanup” treatment with glyphosate may still have difficulty managing glyphosate-resistant grasses. The grower knows that herbicides like oryzalin or pendimethalin (eg. Surflan or Prowl H2O) could help with grasses. Using the higher rate approach, the grower could use a high label rate one of these materials in December with the idea that it will persist long enough to control summer grasses emerging six months later. Using the sequential approach, the grower could move all or

part of the oryzalin or pendimethalin component of the program to the March timing to more directly target those summer germinating grasses, possibly at a the same or even lower total application rate.

Who might want to consider a sequential approach? This approach requires a bit of close management attention. First, because incorporation of preemergence herbicides is key to their performance, moving some of this product to late spring will require either timely rain or overhead irrigation capabilities. Growers with solid-set or micro sprinkler systems should have little problem with this, but single- or double-line drip irrigated orchards will need to get a rain and should not delay too late in the spring.

Second, moving all or part of the preemergence grass herbicide to late in the year requires that growers know their weed spectrum. If you know or suspect glyphosate-resistant summer weeds, this may be an approach to consider. You should also have an idea of what weeds you are managing during the winter season too and make sure that your winter program still addresses that part of the weed spectrum.

Weed management in orchard crops is complex and getting further complicated by new glyphosate-resistant weeds. Because of our relatively mild climate and seasonally variable temperature and moisture conditions, we encounter weed germination and emergence in every season. Strategies to manage one fraction of the weeds present in a given orchard may not work equally well for other species. Handling shifting weed problems may require different approaches in order to make the most effective use of existing weed management tools.