Impacts of Drought on Weed Management

Kurt Hembree, UCCE, Fresno County

2008

Weed management in California's Central Valley can be challenging, given the diversity of cropping systems and weeds encountered. Prolonged periods of dry conditions affect weed growth, alter herbicide performance, and complicate weed management strategies.

Weeds compete with crop plants for soil moisture, nutrients, and light. Competition for water between crops and weeds increases as soil moisture becomes limited, so weed control is even more important when water is scarce. Fewer weeds are usually observed during dry conditions and they tend to be less vigorous. However, some weeds like Russian thistle and field bindweed develop extensive root systems early and take advantage of limited surface soil moisture, making them more competitive and difficult to control. Other weeds, like hairy fleabane and horseweed, can adapt to both wet and dry conditions. While their vigor and size may be reduced under dry conditions, they can still produce a lot of viable seed.

When soil moisture is adequate, a properly timed shallow cultivation can be use to control weeds. However, during dry conditions, tillage can result in a loss of soil moisture, limiting crop stand and growth. An effective means of supplying water to the crop while limiting weed growth is to use sub-surface drip irrigation. Here, drip tubing is buried about nine-inches deep to supply adequate moisture to the crop, while eliminating weed seed germination in the top few inches of the soil. This gives the crop a competitive advantage over the weeds.

In California, herbicides play a vital role in weed management and help sustain economic crop production. It's important to realize that pre- and postemergence herbicide performance changes under dry conditions.

Preemergent herbicides require moisture for activation and movement into the weed seed zone. Sunlight degrades the herbicide from the soil surface if it is not activated by water and moved into the soil. This is not usually a concern in annual crops where irrigation water is used for crop stand development and herbicide activation. Mechanically incorporating preemergent herbicides into the soil with a power-driven mulcher or other appropriate equipment at the time of treatment reduces the concern of sunlight degradation.

In tree and vine crops, growers rely upon rainfall for herbicide activation and incorporation. Product labels specify how long the herbicide can remain on the soil surface after treatment before rainfall must occur. Some loss of the herbicide by sunlight degradation can be expected once the herbicide is applied to the soil surface. During dry years, preemergent treatments should be applied as close to a rainfall event as possible to ensure adequate activation and residual control. Sprinkler, basin-flood, or furrow irrigation can also be used to activate the herbicide in lieu of rainfall.

Soil microbes also play an important role in how long herbicides remain active in the soil. In moist warm soils, soil microbes can breakdown preemergent herbicides, shortening residual

weed control. The length of residual activity is especially important in annual cropping systems, as it affects weed control and subsequent crops. If it is to dry and soil microbes are limited, the carry-over of herbicide is lengthened, increasing the risk of injury to subsequent crops.

Performance of postemergent herbicides also changes during dry conditions. Herbicides that require translocation through weeds are especially impacted under droughty conditions. Examples of herbicides commonly affected include 2,4-D, glyphosate, sethoxydim, and MCPA. Water-stressed weeds have thicker waxy leaves (cuticle), reducing herbicide absorption into the plant. Plant growth processes are also altered, reducing movement of herbicides within the target weeds to sites of action (such as growing points). If the movement of herbicides with the sugars or water stream within the target weeds is reduced, control is likely to be reduced.

Contact-type herbicides do not require movement within the target weeds to be effective and are less likely to be affected by drought conditions. However, drought-stressed weeds with spindly shoots and/or leaves may not be as easily controlled. Examples of herbicides commonly affected include carfentrazone, paraquat, and oxyfluorfen. Using a higher label rate and appropriate spray adjuvant can help increase weed control under drought-stressed conditions. Using an N-based additive (like ammonium sulfate) and/or a crop oil adjuvant may help increase absorption into the targeted weeds, but may also increase the risk of crop injury. Apply the spray mixture in enough water to adequately cover the weeds and increase the chance of absorption and/or contact activity. Making applications toward the end of the day as the temperature begins to decrease often aids efficacy.

Achieving effective weed control can be difficult during conditions of drought. Weed growth will be altered, making them less susceptible to control. In annual cropping situations, provide enough irrigation to ensure adequate soil moisture and microbes are present to reduce herbicide carry-over and replant intervals. In tree and vine crops, apply preemergent treatments as close to rainfall as possible, otherwise consider irrigation as a source of herbicide activation. Postemergent herbicide performance, especially translocated-type herbicides, is often reduced under dry conditions. Apply these herbicides when weeds are young and succulent to improve control. In some cases, it may be better to wait to make postemergent treatments after the weeds receive moisture and are less stressed. Also, using N-based additives and/or certain adjuvants can help aid in control. If at all possible, spray later in the evening when the temperature begins to decrease.