DROUGHT ADVISORY

EM4929E

Weed Management and Herbicide Performance During Drought Conditions

There is good reason to control weeds in cropland. Low soil moisture increases the competition for water between the weed and the crop. Therefore, weed control is even more important when water is scarce. Generally, when moisture is limiting, there may be fewer and less vigorous weeds and weed emergence may be delayed until rainfall occurs. Drought tolerant weeds, such as kochia, Russian thistle, and field bindweed develop extensive root systems early and take advantage of limited water, making them more competitive and difficult to control than when soil moisture is adequate.

Even with fewer weeds, their control is more difficult under dry conditions. Decreased yield potential in dry years may cause producers to question whether costs for herbicides are justified. In dry years, reliance on weed control methods other than herbicides may be necessary. A shallow, timely cultivation can effectively control small weeds while loosening crusted soil. However, cultivation may be detrimental due to further loss of critical soil moisture, resulting in poor crop stands and increasing the susceptibility to erosion.

Herbicide performance will also change under dry conditions. Efficacy of postemergence or foliage applied herbicides, particularly those that are translocated within the target weeds, is highly dependent upon active plant growth. Postemergence herbicides are less effective when weeds are stressed. Drought stressed plants produce thicker leaf cuticles (waxy covering), resulting in less herbicide absorption into the plant. Drought-stress affects many plant processes and growth, resulting in less movement of herbicide once it is in the plant, and less herbicide delivered to target sites, such as enzyme systems or growing points. Sugars produced by photosynthesis and their movement within the plant are restricted in drought stressed plants, therefore translocation of some herbicides that typically move with sugars is limited. Herbicide translocation is crucial for control of perennial weeds such as Canada thistle and field bindweed, where movement to underground and above-ground growing points of the plant is essential for lasting control. It may be best to delay herbicide applications to perennial weeds growing under extreme water stress until moisture conditions improve.

Low humidity also results in rapid drying of spray droplets in the air, which results in smaller droplets more prone to drift. Droplets that land on target weeds will dry faster under low humidity, resulting in less time for absorption into the leaf.

Do not skimp on herbicide rates when treating water-stressed weeds. Generally, more herbicide is needed to control drought-stressed weeds. Also, certain herbicide formulations may be more effective on drought-stressed weeds. For example, ester formulations of 2,4-D generally perform better on stressed weeds than amine formulations. In particular, the effectiveness of postemergence grass herbicides is reduced when grass weeds are water stressed. Applying postemergence grass and broadleaf herbicides in separate applications will also help improve grass control by reducing herbicide antagonism.

The addition of the proper adjuvant can improve control of drought-stressed weeds by improving herbicide coverage, retention, and uptake. Consult herbicide labels for the proper type and

amount of adjuvants to use under drought conditions. Individual herbicides may require different adjuvants for best performance. Choose tank mix partners that use compatible adjuvants under drought conditions. Adding, changing, or increasing adjuvants may reduce the degree of herbicide selectivity on crops, resulting in increased crop injury.

Contact foliage-applied herbicides, such as paraquat (Gramoxone), bromoxynil (Buctril), carfentrazone (Aim), and oxyfluorfen (Goal), are usually less affected by drought stress than the translocated herbicides, such as 2,4-D, glyphosate (Roundup, others), dicamba (Banvel, Clarity), clopyralid (Stinger, Lontrel), fluroxypyr (Starane), triclopyr (Garlon), and combinations.

How does drought stress affect the performance of herbicides applied to the soil? With soil-applied herbicides, placement of the herbicide in the weed seed germination zone or zone of emerging shoots is critical for uptake by seedling roots and shoots. Precipitation or overhead irrigation generally is required following a preemergence herbicide application to "activate" or move the herbicide into the soil, making it available for absorption by the emerging weeds. Activation is often best achieved by rainfall or irrigation. However, mechanical activation with a rotary hoe, tine harrow, or other implement may be required in dry years. Herbicides that are mechanically incorporated are not as dependent on overhead moisture, since the shallow tillage for incorporation will place the herbicide in the zone of weed-seed germination.

Activation is best achieved with knowledge of the weed, soil, and herbicide characteristics. Where should the herbicide be placed? Are the target weeds seedlings with shallow, slow growing roots or are they well-established perennials with deep roots? Herbicides are more mobile in sandy soil than in soils with high clay and/or organic matter, which tend to bind many herbicides. Herbicide mobility in soil is often related to the herbicide's water solubility, but not in all cases. Some herbicides are highly water soluble, but move little in the soil due to adsorption to soil particles. Herbicides are absorbed by plants from the soil water solution. Herbicides applied to dry soils may be so tightly bound that they become unavailable for uptake by weeds and less likely to be leached, whereas herbicides applied to moist soil are available for uptake by plants and for leaching. Dry soil conditions can also prevent chemical and biological processes that degrade herbicides, making them more likely to persist and injure subsequent crops.

If sufficient water is present to grow the crop, moisture should be adequate for placement of the herbicide into the soil. When irrigation is not available, rainfall is required to move the herbicide into the soil, especially in areas that are not normally tilled. When weeds are growing under extreme moisture stress and mechanical incorporation is not an option, it may be best to wait to apply herbicide until conditions improve.

Information on soil moisture monitoring and crop evapotranspiration from Washington's Public Agricultural Weather Stations (PAWS) and Washington Irrigation Scheduling Expert (WISE) are available on the Scientific Irrigation Scheduling (SIS): web page http://sis.prosser.wsu.edu

Drought advisories and other Washington State University Extension Bulletins are available online at http://pubs.wsu.edu
Type "drought" in the search box for downloadable files.

By Robert Parker, Ph.D, Extension Weed Scientist, Washington state University and Rick Boydston, Ph.D, Agronomist, US Department of Agriculture-Agricultural Research Service, Irrigated Agriculture Research and Extension Center, Prosser, WA

College of Agricultural, Human, and Natural Resource Sciences.

Issued by Washington State University Extension and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Published September 2005. Subject codes 373 and 270. EM4929E