DROUGHT ADVISORY

EM4858

What Happens to Herbicides in the Soil under Drought Conditions?

When you select and apply herbicides, your immediate concern is minimizing or eliminating weed competition at a reasonable cost without causing crop injury. If you take a longer range perspective, however, you will quickly add another objective to the list. It is also in your best interest to prevent herbicide carryover to rotation crops. Herbicide carryover to succeeding crops not only can affect health, vigor, and subsequent yield, but also can result in an unmarketable product.

Whether you achieve the goal of no carryover to rotational crops depends largely on how well you manage the use of herbicides. Following label instructions is the first, most obvious thing you can do. Always check the guidelines concerning crop rotations.

Once the herbicide has been applied, it begins to break down in the soil. Several processes are possible, but the two most important ones are *microbial* breakdown and *chemical* breakdown. Knowing something about these processes and what affects them can help lessen the chance of having herbicide carryover.

Microbial Breakdown

You might expect manufactured chemicals, such as herbicides, to be antagonistic to microorganisms. Fortunately, that is not true, as these chemicals are composed of natural elements. Naturally occurring soil microbes actually feed on many herbicides, digesting and changing them to forms having no herbicidal properties. If they are unable to use the herbicide as a food source, microbes may produce enzymes that break down herbicides.

Were it not for microbes in the soil, most herbicides would remain in the soil considerably longer than they do now. By carrying over from one year to the next, herbicides would cause serious problems even under the most ideal conditions.

Some herbicides decompose rapidly, within 1 to 4 weeks for chemicals like 2,4-D. On some soils where the same herbicide or class of herbicides was used over a period of years, the persistence of the herbicide may be even shorter than expected. This phenomenon has occurred particularly where the microorganisms appear to use the herbicides as a food source. Nature has a way of increasing populations to correlate to the supply of food.

Like all living organisms, microbes are affected by their environment. They are most active in warm, moist soils. The ideal soil temperature range for efficient herbicide breakdown is approximately 80˚F to 100˚F. At extreme ends of the temperature spectrum—below 50˚F and above 110˚F—organisms become nearly inactive. However, regardless of the temperature, microbial activity almost stops when the soil is extremely dry.

Soil texture also enters the formula. Herbicides are more tightly held to soil particles when the soil is dry. Adsorbed herbicides are less available for microbial breakdown than are herbicides in wetter soils. Adsorbed herbicides are more likely to carryover.

Chemical Breakdown

Of several types of chemical breakdown, hydrolysis is the most important. Hydrolysis causes the

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chemical structure of a herbicide to change, usually to an inactive form as it reacts with water in the soil. Even though hydrolysis is a water-based reaction, it can occur in what appears to be a relatively dry soil; the reaction stops when the soil is dry. Thus, more carryover is likely to occur in dryer soils.

Plant Breakdown

A factor not often thought of is the breakdown of chemicals by weeds and crop plants. Plants take up and metabolize soil-applied herbicides. The more actively the plants are growing, the more herbicide they will absorb. Moisture stressed plants will take up less herbicide, resulting in more potential for herbicide carryover.

The lack of overhead moisture can also contribute to carryover when not enough moisture occurs to move the herbicide into the soil. Unless the herbicide is subject to weathering or photodecomposition, it may remain on the soil surface, or very close to it. Little microorganism activity, chemical breakdown and root absorption take place on the soil surface, especially when dry. Those products subject to photodecomposition unless incorporated into the soil mechanically will break down. This break down can result in reduced weed control.

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

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