Testing For Herbicides In Soils

FACT SHEET

The decision to suspect damage form herbicides is a difficult one to make when you consider the complexity of plant growth and how it is affected by so many environmental factors. Diagnosis of herbicide damage and the reasons for its occurrence requires a knowledge of the symptoms produced by the herbicide involved and the persistence, movement in soils and availability to plants. When a case of suspected herbicide damage occurs it is a good idea to obtain the advice of professionals trained tin herbicide chemistry. An understanding of the mode of action of an herbicide is important when deciding whether a soil sample or a plant tissue sample should e collected. This fact sheet provides some general information on herbicides in the soil environment and tips on collecting samples, interpreting results, and correcting a herbicide related problem.

Herbicides in The Soil

Crop damage from herbicides can occur in a variety of ways. Misapplication on a non-target crop, carryover form a previous crop, and application to a soil type not intended for use due to organic matter or soil pH can cause damage. Damage can even occur to crops when an herbicide is properly applied due to weather related factors such as abnormally cold or warm temperatures, and/or abnormally low or high amounts of precipitation. Soil characteristics such as texture can influence compaction or leaching potential allowing the herbicide to either concentrate in the seedling's root zone or move deeper into the soil where it can be taken up by plant roots not intended for the herbicide.

Herbicides are broken down in the soil by different processes, such as soil chemical reactions, photodegradation, and micro-organism activity. Breakdown by both soil microbes and chemical reactions is influenced to a great extend by soil temperature. Therefore, breakdown occurs more rapidly during summer months and slows during the winter. Cooler temperatures in the spring can cause crop damage by slowing the degradation process down in the soil allowing more of the herbicide to be taken in by the crop than what was intended as soil temperatures increase.

Many soil-acting herbicides are of low water solubility and are strongly adsorbed by soils. The adsorptive capacity of an herbicide influences it's rate of activity in the soil environment. The greater it's inclination to adsorb to a soil, the less residual soil activity it will have. This capacity is influenced by many factors in the soil, such as moisture, pH, organic matter, clay content, and the cation exchange capacity of the soil.

Soil pH plays a major role in the breakdown of some herbicides. Soils high in pH are at a greater risk for crop damage form the sulfonanilides, sulfonylureas, and triazines since the process that degrades these compounds is slowed down. Soils low in pH are at risk from the imidazolinone family of herbicides. Both of these situations pose a potential carryover risk to the next crop.

Soil moisture influences the breakdown process. A dry growing season can slow down herbicide degradation increasing the risk of carryover to the next crop. Soil moisture and temperature both affect the rate of transpiration of an herbicide.

A crop subjected to other stresses such as soil fertility or pest pressures can show damage even when an herbicide is applied correctly. Knowledge of the herbicide's chemistry and how it dynamically interacts with the soil environment is needed to diagnose herbicide damage or predict potential carryover problems.

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Sampling The Soil

Testing the soil for herbicide levels should be considered in cases of suspected herbicide carryover form the previous crop, misapplication of an herbicide, or to determine if the herbicide concentration is too high on a compacted soil or has moved deeper into the soil profile than what it should. Sampling the soil in a case of spray drift on an emerged crop is generally not advisable since the concentration of the herbicide in the soil will be so low.

If a sample is to provide a meaningful interpretation, it must be taken from the soil that is representative of the problem area. It is also advisable to collect a second sample from an unaffected area to aid in interpreting the results. Follow these general guidelines when collecting a soil sample:

1.Unless you are trying to diagnose a field showing a definite spray pattern, avoid questionable areas, overlaps or field borders. Consider organic matter content and soil texture when delineating an area.

2.Selecting the proper sample depth depends on factors such as time since application, soil texture, amount of rainfall since application, leaching potential of the herbicide, and tillage practices since application. Under most minimum tilled fields, a four inch core is suggested, If the field has been plowed since application, plow depth is recommended.

3. Collect 15 to 20 cores per sample area, Uniformly mix all the soil cores in a clean bucket and transfer approximately one cup of the composite sample to a sample bag. Ship the sample to the lab as soon as possible, if samples cannot arrive at the lab within a few days after collection, they should be frozen.

Interpretive Guidelines

Soil residue levels in Table 1 can be used to predict a general risk of injury to rotation crops. Because of the complex nature of assessing potential crop damage, the levels listed in this table are conservative. Other variables in addition to the test level which may influence the amount of injury observed in the field must be considered. These variable include varietal sensitivity, weather conditions after planting and other previously listed soil chemical factors. Use soil tests as a tool to aid in making rotational decisions, but remember that no one test can offer 100 percent certainty that damage will not occur.

Soil test for pesticide usually measure the active ingredient or parent compound only. Result are reported in units of ppm or ppb. Because of the complex variability of the adsorptive capacities of different herbicides in the soil environment, it is difficult to relate a ppm or ppb level found to an actual pound per acre application rate.

Table 1. Guidelines For Some Persistent Herbicides Common To Field Crops

Herbicide	Safe Level		Crop
	ppm(mg/kg)	ppb(ug/kg)	
Triazine (Atrazine, Simaazine)	<0.25	<250	Soybean
	<0.10	<100	Alfalfa, Oats,Wheat
	<0.04	<40	Sugar Beets
Dinitroanaline (trifluralin, Ethalfluralin)	<0.10	<100	Corn
Clomazone	<0.050	<50	Corn
	<0.02	<20	Wheat, Alfalfa
Imazaquin	<0.010	<10	Corn
	<0.037	<37	Wheat

Corrective Actions

The simplest solution to avoiding potential crop damage from herbicide carryover is to rotate to a no-risk crop or one labeled for use with that herbicide. If the herbicide is only present in the top 3-4 inches of the soil profile, plowing to a 10-12 inch depth will reduce the concentration in the seed bed. N cases of a mis-application to a small area, herbicides can be removed form the soil solution using activated charcoal. Incorporating 3.5 pounds of charcoal per 1000 square feet for every one ppm of herbicide in the soil is recommended.