Herbicide Detection in Soils via Bioassays

Bioassays Have Strengths and Weaknesses

Dr. Michael Pfeiffer

Detection of herbicides in soils via a bioassay is a relatively inexpensive technique for screening soils for a wide range of herbicides. The presence or absence of herbicides is based on whether indicator plants grown in the soil show symptoms of herbicide injury. Bioassays are designed to detect bio-available amounts of herbicides in soil; that amount which is readily available for plant uptake. The bio-available amount and total amount of herbicides in a specific soil often vary considerably. Total amounts of herbicides are generally determined by quantitative analysis usually involving solvent extraction of the herbicide followed by instrumental analysis. Quantitative analysis may indicate phytotoxic levels of herbicide are present in soil when in reality equilibria processes in the soil, soil solution and plant severely limit the bio-availability of the herbicide.

Time needed to complete analyses via bioassays is dependent on time of year, assays performed and the soil type. Generally bioassays can be completed in 30-45 days. The minimum sample volume needed for analysis is 750 cc (approx. 0.75 quart) of finish soil; soil minus rock and gravel. As indicated previously, the bioassay techniques are designed ONLY to assess the presence or absence of herbicides. They are not designed to assess the presence or absence of any other type of organic or inorganic contaminants or biohazards.

Although a bioassay can be a valuable tool for detecting herbicides, there are limitations associated with this technique. With the bioassay technique, the exact herbicide present in the soil often can not be determined. Herbicides in the same chemical class often produce the same symptoms on test plants. For example, Simazine, Atrazine and Prometon which are all triazine type herbicides produce symptoms on test plants which are indistinguishable. Normally herbicides detected via bioassays can only be placed in general chemical classes based on the symptoms exhibited by the test plants. Bioassays are not well suited for analysis of coarse textured soils: soils with a high percentage of sand. Herbicides can leach readily in these coarse textured soils and thus are not likely to be detected which results in a "false" negative assessment of the presence of herbicides in that sample. Soil sampling can influence the reliability of certifying a particular geographic location free of herbicides. In soil, herbicides are distributed three dimensionally. The spacial location of herbicides in the soil profile can be affected by numerous factors. The chemical characteristics of the individual herbicide, formulation, amounts applied, date of application, rate of transformation, soil texture and structure and amounts of rainfall or irrigation are some of the parameters which affect spacial distribution of herbicides in soil. It is often difficult to know where to take samples from and how many samples to take to be assured of actually obtaining a sample of soil with herbicide in it assuming herbicides are present. Assessing whether herbicides are present or absent in specific geographic locations often is only as good as the sampling technique employed.

PESTICIDE TRAINING RESOURCES

2525 East Seneca Tucson, Arizona
85716-3018
520-323-3135
www.ptrpest.com

© 2004 PESTICIDE TRAINING RESOURCES