Assessing Simazine Degradation
Patterns in California Citrus
Orchards with Different
Simazine Use Histories

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Simazine (e.g. Princep) is a commonly used herbicide in California citrus orchards where 27% of orange, 5% of lemon, and 6% of grapefruit acres are treated annually (USDA-NASS 2004). Simazine also is an important weed management tool in other California orchard and vine crops, particularly in grapes where simazine is second only to glyphosate in total pounds of active ingredient used. Herbicides containing simazine have been used for many years in orchard and vine crops because of broad-spectrum weed control, long duration of weed control, and the relatively low cost of the material.

Triazine herbicides like simazine are primarily degraded in soil by microorganisms (Barriuso and Houot 1996). Repeated use of simazine can select for soil microbial populations that utilize the herbicide as a carbon source which can lead to faster degradation of the herbicide (Kodama et al. 2001; Redondo et al. 1997; Santiago-Mora et al. 2005). The phenomenon of rapid degradation has resulted in poor or erratic weed control in many cropping systems and increased weed management costs.

This research project was initiated to determine if rapid simazine degradation occurs in California citrus orchards and if degradation rates could be correlated to simazine use history.

In the first year of the project, 27 orchards in the central valley and Ventura County with different simazine use histories were identified and soil samples were collected. The targeted use histories included: (1) long-term annual simazine use; (2) short-term, recent simazine use; (3) no recent simazine use after period of annual use; and, (4) no simazine use for at least 15 years. Simazine was added to each soil, and degradation was monitored over time in a laboratory experiment.

The simazine degradation curves clearly indicate that simazine degradation rate is much more rapid in soils with a history of simazine use compared to soils with no recent simazine use (Figure 1). The data in Figure 1 also suggests that rapid degradation can develop after relatively few years of simazine treatment.

A break of 2 to 7 years after annual simazine treatment appears to slow the degradation rate but not back to the level of longer (~15 yr) period without simazine. The calculated half-lives (time to degrade ½ of the applied material) also demonstrate that rapid simazine degradation can occur in California orchards with an average half-life of 3.1 vs 19.4 days for annual use and no recent use soils, respectively) (data not shown).
The second year of the project includes additional laboratory studies on soil collected from several of the previously tested orchards and a field experiment designed to monitor simazine degradation and weed control under real-world conditions. Simazine is an important weed management tool in California citrus orchards, and results from this research will be used to determine if herbicide rotation can reduce simazine degradation rate and increase weed control efficacy with this important herbicide or if alternate weed control techniques need to be implemented.

Figure 1. Preliminary simazine degradation rates from citrus orchards with various simazine use histories. Data are from laboratory experiments and are expressed as a percentage of the amount of simazine applied. Annual use means at least 13 consecutive years of simazine treatment, recent use only means less than 7 years annual use, short break means 2-5 years since ending annual use, no recent use means at least 15 years since last simazine application.

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