Simazine (e.g. Princep) is a commonly used herbicide in California perennial crops including citrus, grape, stonefruit due to its broad-spectrum, long duration control of weeds, and relatively low cost. Although most herbicides are primarily degraded in soil by the activity of microorganisms, there have been reports of “rapid” degradation of some herbicides following repeated use of the same material due to the buildup of microbial populations that are able to use the herbicide as a carbon source.

This project was initiated to determine if: 1). Rapid simazine degradation occurs in California orchards and vineyards; 2). Degradation rates are directly correlated to simazine use histories; 3). Microbial degradation is the cause of the rapid degradation; and, 4). If rapid degradation in lab assays correlates to weed control efficacy in field situations. 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 simazine 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.

In a laboratory experiment, simazine was added to each soil, and degradation was monitored over time. The simazine degradation curves clearly indicate that simazine degradation rate is more rapid in soils with a history of simazine use compared to soils with no recent simazine use (Figure 1). These data also suggest that rapid degradation can develop after relatively few years of simazine treatment and that a short break may slow the degradation rate but does not fully reset degradation to the level seen in non-adapted fields.
The second year of the research focused on laboratory research to verify that degradation, and not some other mechanism such as binding to soil, accounts for simazine disappearance and to verify that microbial activity was responsible for the degradation. Experiments were conducted to determine the fate of simazine in soils classified as either adapted to simazine use or non-adapted based on our previous experiments. Results of the mineralization assays indicate that the disappearance of simazine from the adapted soils was indeed due to degradation of the parent compound into component elements (Figure 2). Degradation assays conducted with live and sterile soil clearly indicate that microbial activity is the primary contributor to simazine degradation. There was no difference in simazine degradation rate between sterilized adapted and non-adapted soils while live adapted soil quickly degraded simazine below our analytical detection limits (Figure 3).

The 2nd and 3rd year of the project has been focused on correlating simazine degradation and weed control in a field experiment. Preliminary data from this experiment are shown in Figures 4 and 5 and suggest that there is a significant difference in simazine degradation between the two fields (Figure 4) and that weed control duration is shortened in the field with annual simazine use (Figure 5). The field experiment will be repeated in 2009 before final conclusions are drawn.

Note: The Research results included in this publication are summary reports for the benefit of the Citrus Research Board and the growers it serves. They are not to be taken as recommendations from either the individual reporting or the agency doing the research. Some of the materials and methods mentioned are neither cleared nor registered for identified. Both technical names and registered trademarks of materials are used at the discretion of the authors and do not constitute any endorsement or approval of the materials discussed. Questions on possible applications should be directed to the local University of California Extension Specialist, a licensed PCA, or the appropriate regulatory agency.