Evaluating Herbicide Drift on Dried Plum Early Growth and Vigor

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Herbicides are an important part of orchard floor management in dried plum orchards as well as in nearby cropping systems. Dried plum growers occasionally observe tree injury from inadvertent exposure to herbicides drifting from adjacent crop fields or from within-orchard applications. With support of the California Dried Plum Board from 2009-2011, Lanini, or Lanini and Hanson, and Hanson and Lanini conducted research to evaluate the effects of propanil and glyphosate drift on established plums. Over three fruiting years, no statistical differences in various yield parameters (buds, fruit set, harvestable fruit, and individual fruit weight) were observed (see previous reports for details).

It was suggested that the lack of clear response to simulated propanil and glyphosate drift in 2009-11 may have been due to the age (~15 yr) of the prune trees tested. In response to this in 2010, we proposed conducting a follow up experiment on younger trees. With support of the California Dried Plum Board and the cooperation of a local grower, we initiated a new field experiment in spring 2011 to evaluate the cumulative effects of annual simulated drift applications of propanil, glyphosate and several other common herbicides on young dried plum trees.

OBJECTIVES

1. Evaluate the symptoms associated with sub-lethal doses of glyphosate, propanil, penoxsulam, glufosinate, and oxyfluorfen on young French prune trees.
2. Determine the long term effects of these herbicides on dried plum yield parameters over three years.

PROCEDURES

A field trial was initiated in spring 2011 at Martinez Orchards, Winters, CA to evaluate the effects of several low-rate (simulated drift) applications of glyphosate, propanil, penoxsulam, and oxyfluorfen on canopy injury, flower and fruit set, fresh yield, and prune dry weight. Bare root French prune nursery stock was planted March 9, 2011 as “interplants” in a new orchard planted by the cooperating grower. The test trees will be removed when they grow large enough to interfere with the commercial orchard trees.

Each year, herbicide treatments will be applied above the tree canopy by research personnel using a CO_2-powered backpack sprayer, with 80015 nozzles, delivering 10 gal/A total spray volume. Individual plots are a single tree and each treatment is replicated five times. Glyphosate (Durango), propanil (Stam 80 EDF), penoxsulam (Tangent), glufosinate (Rely 280), and oxyfluorfen (Goal 2XL) will be applied at 0, 1/20, 1/10, and 1/5 of the herbicide use rates. The reference 1x herbicide rate is 1.5 lbs ae/A for glyphosate and 4.0, 0.03, 1.0, and 1.25 lbs ai/A for propanil, penoxsulam, glufosinate, and oxyfluorfen, respectively. Treatments were applied on August 10, 2011, July 10, 2012, and are planned for July 2013.

Data collection in the experiment will include annual trunk diameter measurements and visual estimates of foliar injury several times during the growing season. Beginning in 2013 (no flowering was observed in 2012 due to severe winter pruning), the number of flower buds will be counted on each tree (or representative portion thereof) prior to the first herbicide application and fruit set will be evaluated in mid-summer. Once fruit production begins, fruit on each tree will be counted and weighed and, if appropriate, a subsample will be dried and weighed to determine final prune yield and quality.

RESULTS AND DISCUSSION

Similar to the results in the first year of the study, one month after application (MAA), slight to moderate canopy injury were observed from all treatments in 2012. The injury symptoms most often noted were chlorosis of newly emerged leaves (glyphosate), yellowing or dying leaves (propanil), necrotic spots of varying sizes (oxyfluorfen), and chlorosis and necrosis of new and old leaves (penoxsulam). The greatest injury was observed in propanil and glufosinate simulated drift (Figure 1) one month after treatment. By 3 months after treatment, only the propanil treated trees still had high injury ratings. However, this is likely partially due to the propanil-injured leaves remaining on the tree (Figure 5). In fact, the propanil injury persisted on injured leaves but did not injure new leaves. Glufosinate tended to defoliate the treated branches and these areas did not seem to produce new leaves later in the season (Figure 4). Despite early season injury, trunk diameter measurements did not differ statistically among treatments although there appeared to be a trend in decreasing growth that may become more apparent over time (Figure 2). These trees were heavily pruned in winter 2011/12 and no yield parameters (flowers, fruit, etc) were collected in 2012.

The Winters site will be monitored in 2013 to evaluate the effects of simulated herbicide drift in 2011 and 2012 on bud and flower initiation. Treatments will be reapplied in 2013 and similar data will be collected. The trial is expected to continue through the 2013 growing season before being terminated. Results of this work will be presented to dried plum producers at Cooperative Extension meetings and field days as appropriate. If results warrant, scientific presentations and publications will be prepared. Additionally, photos of herbicide symptomology will be used in training of farm advisors as well as proving useful in diagnosing herbicide drift in prunes and other tree crops.

WEED SCIENCE PROGRAM:

Beyond this specific proposal, dried plum board support complements our statewide research and extension program that focuses on weed management in orchard and vineyard cropping systems. Our research covers several broad areas applicable to most California tree and vine systems: methyl bromide alternatives in nursery and orchard replant situations, chemical and non-chemical weed control in orchards and vineyards, biology and management of herbicide resistant weeds, and herbicide fate in plants and the environment. Results are routinely presented to growers and industry stakeholders in extension presentations, field days, and scientific meetings as appropriate as well as extended through the cooperative extension continuum.
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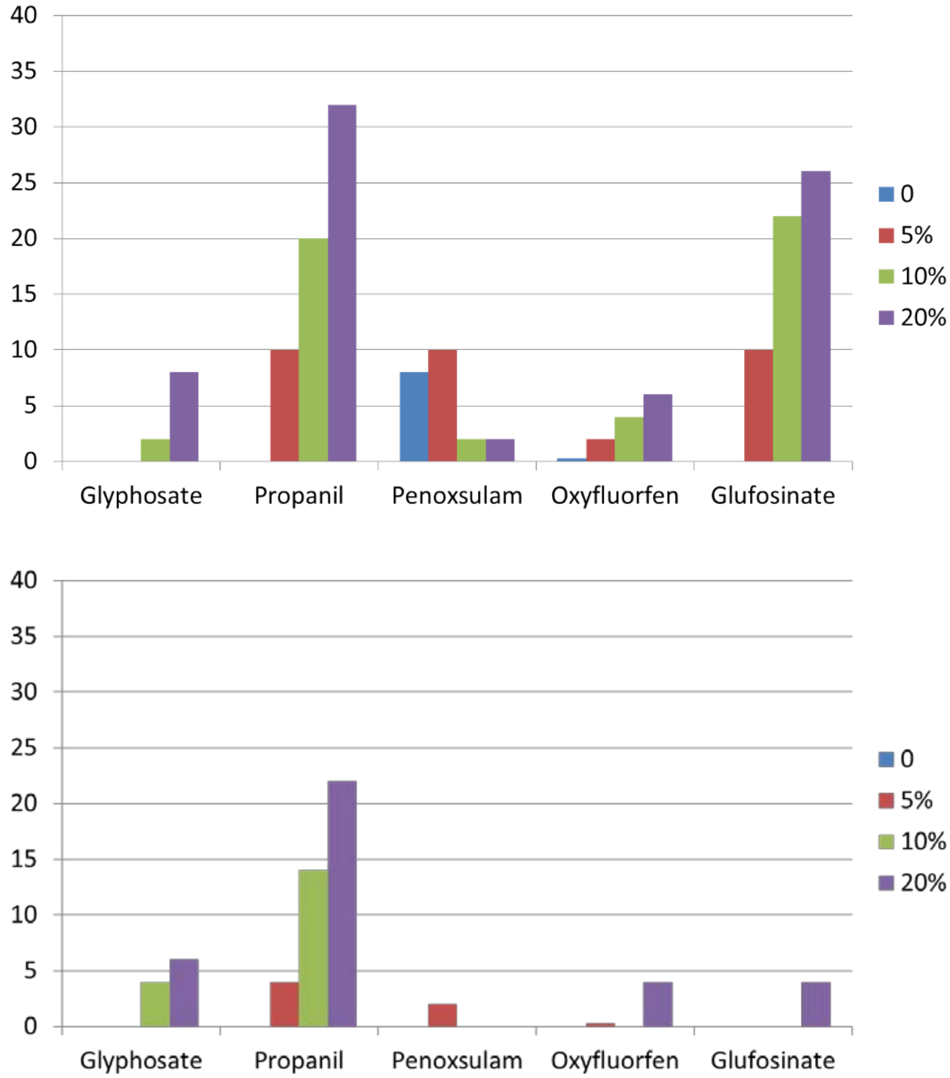

Figure 1. Visual injury to young French prune trees 36 days (top) and 92 days (bottom) after 2012 treatments. Trees planted in spring 2011 were treated with the 0, 5, 10, and 20% of field use rates in August 2011 and July 2012.

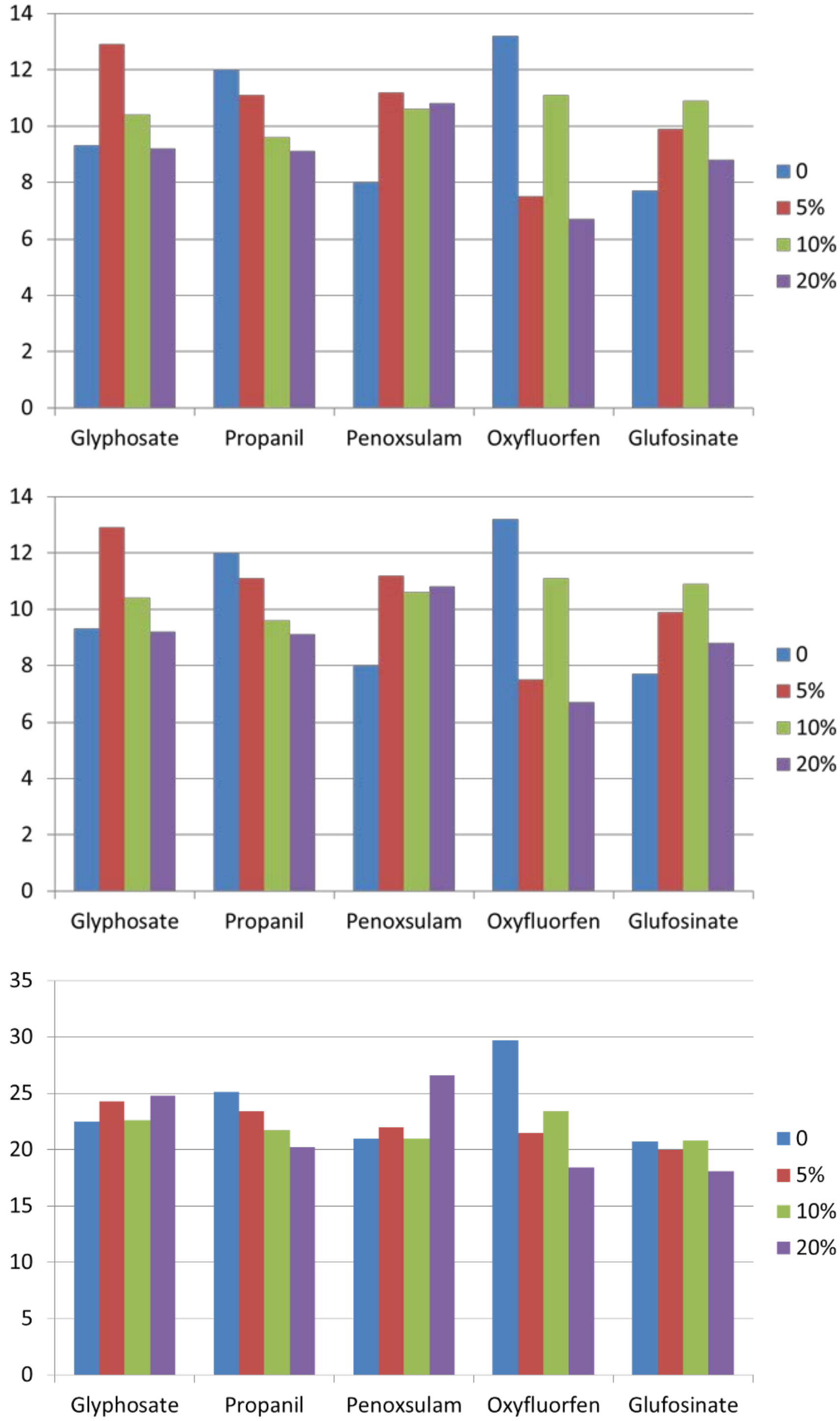

Figure 2. French prune trees trunk diameter (mm) change from planting to dormancy in year 1 (top), from winter year 1 to dormancy in year 2 (middle) and cumulative growth during the 2011 and 2012 growing seasons. Trees planted in spring 2011 were treated with the 0, 5, 10, and 20% of field use rates in August 2011 and July 2012.

Fig. 3. Prune nursery stock was interplanted into a newly planted commercial orchard near Winters, CA in spring 2011 and simulated herbicide drift treatments applied in Aug. 2011 and July 2012.

Fig. 4. Glufosinate injury was primarily defoliation of treated leaves. Injury symptoms persisted through the season.

Fig. 5. Propanil injury: Chlorosis of older leaves that later developed to necrosis. Chlorosis/necrosis starts at the edge of the leaf. Injured leaves generally did not drop but new leaves were not affected.