Ecology and competitive effect of two horseweed biotypes with young grapevines and established vineyards

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Introduction

Horseweed (*Conyza canadensis*) is an annual broadleaf plant that recently became a major pest in San Joaquin Valley vineyards. Early literature estimated horseweeds may produce at least 200,000 wind-disseminated seeds per plant (Weaver, 2001). Low commodity prices for raisins in the early 2000's forced some growers to abandon or reduce weed control. As a result, species such as horseweed multiplied rapidly and created large seed banks thus making it a dominant weed in many raisin vineyards in the central valley. Further, many growers and land managers increased reliance on relatively inexpensive broad-spectrum herbicides, such as glyphosate, to control weeds. Consequently, some horseweed populations evolved resistance and in 2005 a glyphosate-resistant horseweed was identified on a canal bank in the central valley (Shrestha et al., 2007). It is not known if glyphosate-resistant horseweed are present in the vineyards but growers have complained of poor control of this weed with glyphosate. Therefore, it is a strong possibility that glyphosate-resistant horseweed populations are present in the central valley vineyards. Preliminary greenhouse studies showed that the glyphosate-resistant (GR) horseweed biotype flowered one week earlier, and accumulated 30% more shoot dry mass than the glyphosate-susceptible (GS) horseweed biotype. This disparity in phenology and growth led us to hypothesize that the GR biotype may be more competitive than the GS biotype, and may have differential effects on grapevine growth, yield and fruit quality. Although this weed is now becoming ubiquitous, its role in vineyard ecology is not understood and its competitive effect on vine growth and cropping has not been measured. Therefore, we investigated the relative competitiveness of GR and GS horseweed biotypes with young grapevines, and the relationship between horseweed density and grapevine growth, fruit yield and quality in established vineyards.

Materials and Methods

Two experiments were conducted at Kearney Agricultural Center (KAC) in Parlier, CA to measure horseweed competitive effects with grapevines. In a greenhouse experiment, grapevine rootings were grown alone, or with a single GR or GS weed, and the two weed biotypes were also grown on their own. Seeds from existing pre-identified GR and GS populations were used. In April, each combination of grapevine rooting and weed seedling were planted in a different 8-liter pot, with five single-pot replicates of each treatment, for a total of 25 pots. The plants were subjected to similar water and fertilizer regimes, and grown for about 13 weeks. Weeds and grapes were harvested and divided into roots, stems, and leaves. Leaf area of grapevines were determined. Plant parts were oven dried, and dry mass of each organ determined.

A second experiment was conducted in a 40 year-old Thompson Seedless vineyard at the KAC. The experimental design was a randomized complete block, with four replications of each treatment. Vine rows were divided into six plots, each consisting of four consecutive vines. Each plot was then randomly assigned to one of five weed density treatments; 0, 10, 20, 30, 40, or 50 horseweed plants per vine. The horseweed densities were achieved by transplanting weed seedlings into the plots in late March. To help establish the weeds, the plots were hand watered for a few weeks after transplanting. Transplanted weeds were allowed to grow until September 13, 2006, harvested, oven-dried, and weighed. Grapes were harvested the same day. Immediately before harvest, berry samples were collected from each plot. The samples consisted of 100 berries that were weighed and then homogenized in a blender. Soluble solids of the filtered juice samples were measured with a temperature-compensating digital refractometer (Palette 101, Atago, Farmingdale, NY). All the fruit from each plot were harvested and weighed, and the number of clusters was counted. Time taken to hand-harvest each plot was also recorded. On February 2, 2007, pruning weights were also recorded for each plot.

Results and Discussion

Young grapevines were clearly affected by competition from either horseweed biotype. The GS and GR horseweed reduced grape aboveground dry mass by 56 and 63% respectively. The weeds significantly reduced the number of leaves on the grape, leaf area, and main stem length. However, no effect was observed in the root dry mass. Contrary to our hypothesis, the two biotypes did not differ in their ability to suppress grape aboveground biomass.

The first year results from the density experiment showed that horseweed densities did not affect grape yield, quality, or the time required to harvest the grapes. There was, however, a negative correlation between weed dry mass and pruning weights which suggests that high densities of annual weeds may reduce vegetative growth of established vines.

Acknowledgements

UC IPM program for funding this research.

References

1. Shrestha, A., K. J. Hembree, N. Va. 2007. Growth stage influences level of resistance in glyphosate-resistant horseweed. California Agriculture Vol 61. No. 2. 67-70.
2. Weaver, S. E. 2001. The biology of Canadian weeds. 115. *Conyza canadensis*. Can. J. Plant Sci. 81:867-875.