Managing Hard to Control Weeds
Lessons from the field

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A host of weeds are fast becoming problematic for tree and vine growers to control in California. Many of these are exhibiting tolerance and or resistance to glyphosate. Some of the resistant weeds listed include ryegrass (*Lolium* spp.), Horseweed, and Hairy Fleabane (*Conyza canadensis and bonariensis*) (Hembree and Shrestha. 2004), (Simarmata et al. 2003). An increase in the diversity in weed management strategies are needed to deter the evolution of glyphosate tolerant and or resistant weeds. The use of alternative modes of action in tank mix with glyphosate and or rotation from it every few years can be crucial to maintaining its effectiveness (Rousch, RT. 2006).

Glyphosate has been claimed as the most important herbicide in agriculture. The first cases of resistance to glyphosate were detected in 1996 in ryegrass in Australia (Powel, et al. 1998). Since then, documentation of resistance to the herbicide has been noted in goose grass (*Eleusine* indica), ryegrass (*Lolium spp.*) in California, Brazil, and Chile, buckhorn plantain (*Plantago* lanceolata), and Conyza species (Rousch, RT. 2006). The mechanism for resistance in ryegrass is due to a single gene which results in the reduction of translocation of the herbicide to roots and meristematic tissues in leaves (Lorraine-Colwill et al. 2003). According to presentations by Hembree and Shrestha, resistance by Conyza species appears to be similar to ryegrass.

Control Strategies

The critical first step in managing glyphosate resistant/tolerant weeds is to recognize that they occur in your field, than limit their spread. Control options should be implemented with the understanding that limiting the weeds production of new seed is the top priority. This will likely be attained by managing the weeds both mechanically/physically and through well timed herbicide applications with multiple modes of action that work on the target weeds.

Mechanical – Numerous in-row equipment are available that can be used to control weeds in orchards and vineyards if timed properly. Time the operation when weeds are small and when soil is slightly moist. The best control is achieved when allowing for the top 2-3 inches of soil to be disturbed and the weeds dried out (Hembree and Shrestha. 2004).

Herbicides - Several pre and post emergent herbicides are available and up and coming for tree and vine growers (see table 1). It is important that applications be made according to directions on the herbicide label. Pre-emergent herbicides are most effective when applied prior to the weed germinating. Post emergent herbicides always work better on juvenile weeds than

large wolfy weeds. However, in some cases an increase in herbicidal activity has been noted in the field when tank mixing post and pre-emergent herbicides (see figures 1 and 2).

Table 1. Helpful modes of action for the control of glyphosate resistant/tolerant weeds in orchards and vineyards.

Trade Name	Common Name	MOA
Unison*	**2,4-D**	**Auxin Growth Regulator**
Poast	**sethoxydim**	**ACCase**
Matrix*	**rimsulfuron**	**ALS**
Gramoxone Inteon	**paraquat**	**Cell Membrane Disruptor**
Rely	**glufosinate**	**Cell Membrane Disruptor**
Surflan	**oryzalin**	**DNA**
Prowl H2O	**pendimethalin**	**DNA**
Round-up	**glyphosate**	**EPSPS**
Rage*	**glyphosate + carfentrazone**	**PPO + EPSPS**
Shark	**carfentrazone**	**PPO**
GoalTender	**oxyflurofen**	**PPO**
Goal	**oxyflurofen**	**PPO**
Chateau	**flumioxazin**	**PPO**
Spartan*	**sulfentrazone**	**PPO**

* Registration pending.

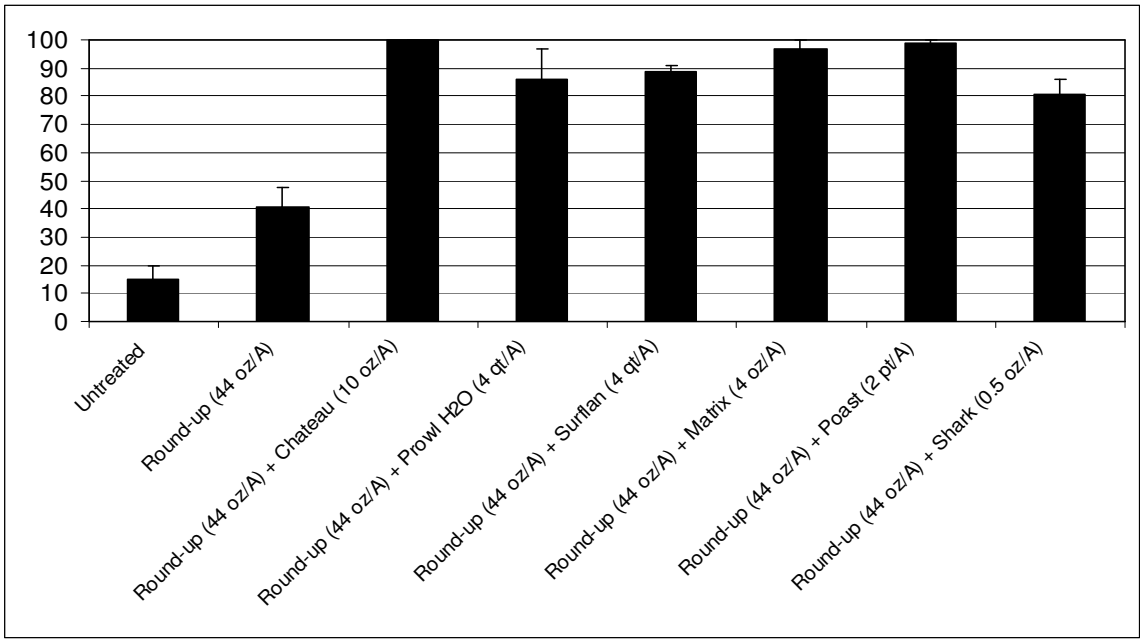

Figure 1. Tank mix options for controlling glyphosate resistant ryegrass (*Lolium* spp.)

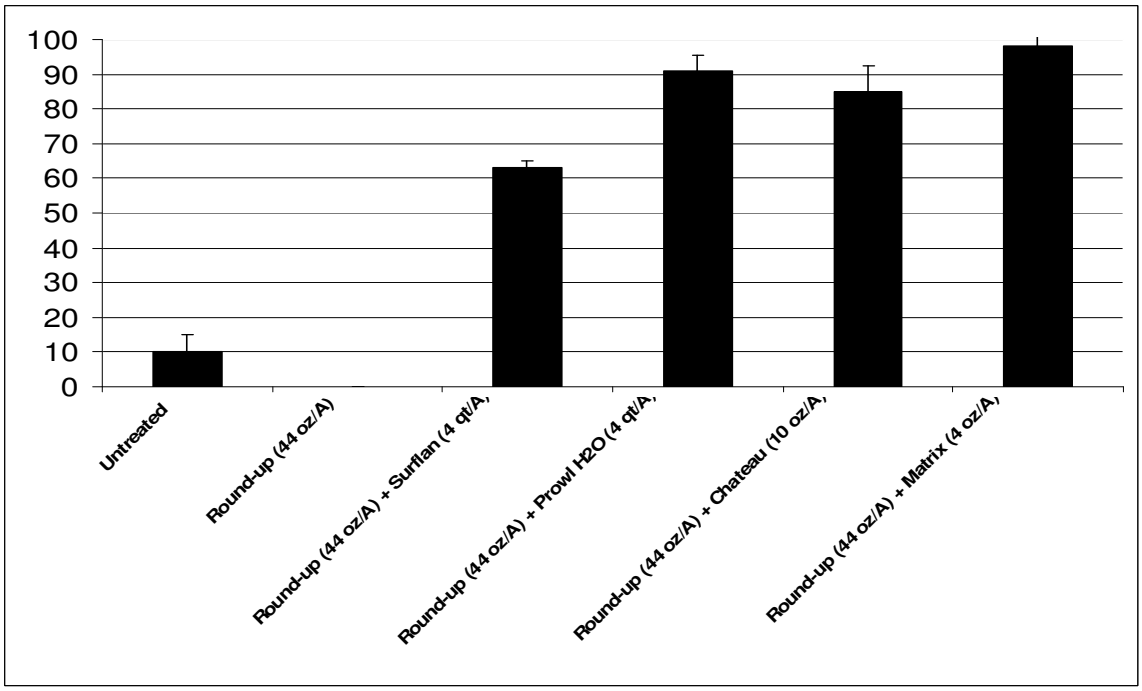

Figure 2. Tank mix options for controlling glyphosate tolerant Hairy Fleabane (*Conyza bonariensis*).

References Cited

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