

Herbicide Resistance – An Evaluation of Hard-to-Control Weeds and a Discussion of What Might Be Coming Our Way

*Brad Hanson, University of California, Davis, Cooperative Extension Specialist,
bhanson@ucdavis.edu*

The development of weed biotypes that are resistant to commonly used control measures is becoming an increasingly significant problem in California and around the world. As of January 2010, there have been 194 confirmed reports of herbicide resistance affecting 19 different herbicide mode of action families (Heap 2010). Of these cases, about 60% are broadleaf and 40% are grass or sedge weeds. In the U.S., 128 resistant species have been reported (also 60% broadleaf weeds) and 15 herbicide families are affected. California has 21 individual cases of resistant weeds impacting 7 herbicide families; however, in contrast to the rest of the world, two-thirds of California's resistant species are grasses and sedges due primarily to tremendous selection pressure for grass weeds in rice production.

When we consider what herbicide resistant weeds might become important in California in the future, we should focus on weeds that already have reports of resistance in other parts of the world. The 10 most important herbicide resistant species in the world (Heap 2010) are all present in California and can be problematic weeds even without herbicide resistance (Table 1). Four of those (three grasses and one broadleaf) are already known to be resistant to at least one herbicide in California. These 10 species have individual reports of resistance to many different modes of action (MOA) and we can expect that new cases may show up in this state over time. Additionally, other important weeds in these genera also are a likely risk for resistance in California (eg. *Lolium* spp., *Amaranth* spp., *Echinochloa* spp., and *Conyza* spp.).

A relatively recent trend in the development of herbicide resistant weeds has been the discovery of glyphosate-resistant weeds. Although glyphosate (the active ingredient in RoundUp, and others) has been used for nearly 40 years, no resistance was reported until 1996. However, since 1996, sixteen glyphosate-resistant biotypes have been reported around the world (Table 2). Nine of these are already in the U.S. and four are known to be widespread in California. Similar to the earlier discussion, many of these species or close relatives are common throughout the state and are of great concern with regards to losing efficacy of this important broad-spectrum herbicide.

While this discussion is simply one guess as to which herbicide resistant weeds may become problems in California in the future, we can be certain that resistance is likely to remain a significant problem. Rapid and committed adoption of resistance management practices is critical for the preservation of important tools like glyphosate and other herbicides.

Table 1. Worst herbicide resistant weeds worldwide (based on number of infested sites).

	Present in CA	Resistance outside CA	Resistance in CA
Rigid ryegrass (<i>Lolium rigidum</i>)	<input checked="" type="checkbox"/>	8 MOA	<input checked="" type="checkbox"/> glyphosate
Wild oat (<i>Avena fatua</i>)	<input checked="" type="checkbox"/>	6 MOA	<input checked="" type="checkbox"/> difenzoquat
Redroot pigweed (<i>Amaranthus retroflexus</i>)	<input checked="" type="checkbox"/>	3 MOA	
Common lambsquarters (<i>Chenopodium album</i>)	<input checked="" type="checkbox"/>	4 MOA	
Green foxtail (<i>Setaria viridis</i>)	<input checked="" type="checkbox"/>	4 MOA	
Barnyardgrass (<i>Echinochloa crus-galli</i>)	<input checked="" type="checkbox"/>	7 MOA	<input checked="" type="checkbox"/> ACCase, thiocarbamate
Goosegrass (<i>Eleusine indica</i>)	<input checked="" type="checkbox"/>	4 MOA	
Kochia (<i>Kochia scoparia</i>)	<input checked="" type="checkbox"/>	3 MOA	
Horseweed (<i>Conyza canadensis</i>)	<input checked="" type="checkbox"/>	5 MOA	<input checked="" type="checkbox"/> glyphosate, paraquat
Smooth pigweed (<i>Amaranthus hybridus</i>)	<input checked="" type="checkbox"/>	2 MOA	

Table 2. Worldwide reports of glyphosate-resistant weeds.

	Resistance USA	Resistance CA
Palmer amaranth (<i>Amaranthus palmeri</i>)	<input checked="" type="checkbox"/>	
Common waterhemp (<i>Amaranthus rudis</i>)	<input checked="" type="checkbox"/>	
Common ragweed (<i>Ambrosia artemisiifolia</i>)	<input checked="" type="checkbox"/>	
Giant ragweed (<i>Ambrosia trifida</i>)	<input checked="" type="checkbox"/>	
Hairy fleabane (<i>Conyza bonariensis</i>)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Horseweed (<i>Conyza canadensis</i>)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sourgrass (<i>Digitaria insularis</i>)		
Junglerice (<i>Echinochloa colona</i>)		
Goosegrass (<i>Eleusine indica</i>)		
Wild poinsettia (<i>Euphorbia heterophylla</i>)		
Italian ryegrass (<i>Lolium multiflorum</i>)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Rigid ryegrass (<i>Lolium rigidum</i>)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Ragweed parthenium (<i>Parthenium hysterophorus</i>)		
Buckhorn plantain (<i>Plantago lanceolata</i>)		
Johnsongrass (<i>Sorghum halapense</i>)	<input checked="" type="checkbox"/>	
Liverseedgrass (<i>Urochloa panicoides</i>)		

Heap, I. 2010. The International Survey of Herbicide Resistant Weeds. Accessed online January 11, 2010. Available at www.weedscience.com.