

How many mechanisms of evolved glyphosate resistance are present in annual ryegrass (*Lolium rigidum* Gaud.)?

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Summary Glyphosate is a non-selective herbicide that is used extensively to control weeds in many situations. Glyphosate binds to and inhibits the action of 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS), a critical enzyme in the shikimate pathway responsible for the production of aromatic amino acids in plants. Evolution of glyphosate resistance has been confirmed in several weed species over the last few years including *Lolium rigidum* Gaud. in Australia. So far, in most glyphosate resistant populations from Australia, resistance correlates to differential translocation of glyphosate within the plant. Resistance in one population from Echuca, New South Wales has been shown to be correlated with an increase in EPSPS mRNA and enzyme activity levels.

A putative resistant population was collected from a vineyard in the Adelaide Hills, South Australia. Dose response experiments showed that this population was not as resistant to glyphosate as other resistant populations in Australia. One possible reason for the different

response to glyphosate of this population may be the possession of a different mechanism of resistance. Translocation of glyphosate in this population was studied by application of radiolabelled glyphosate to leaf tissue. This population did not show accumulation of glyphosate within the tip of the treated leaf and subsequent lower accumulation in the stem of the plant typical of other resistant populations tested. Instead, distribution of glyphosate within the plant more closely resembled that of susceptible populations. This indicates this population may have a different mechanism of resistance to glyphosate. One possibility is that this population contains a glyphosate-insensitive form of EPSPS. Sequence analysis of the EPSP synthase gene from this and other glyphosate resistant populations should determine whether an insensitive EPSP synthase is the mechanism of resistance.

Keywords *Lolium rigidum*, glyphosate resistance, EPSP synthase.