

Barnyard grass responses to glyphosate – the importance of morphological traits

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Summary The genus *Echinochloa* includes the species *E. colona* (L.) Link and *E. crus-galli* (L.) Beauv. Both are common summer weeds in farming systems of the northern grain region of Australia. Commonly referred to as barnyard grasses, these species are widespread problems within the region. Glyphosate is commonly relied upon for fallow control of these species. However, farmers are achieving variable control of barnyard grass with glyphosate. In addition, management of barnyard grass in Australia has become an important issue due to the development of populations resistant to glyphosate.

Barnyard grass populations are variable in morphology and this may be a cause for differences in glyphosate efficacy. Field surveys found that within populations, individual plants had differences in characteristics such as growth form, culm thickness, and the presence/absence of banding on the leaves. Plants were categorised into one of five growth forms: erect, semi-erect, or prostrate and two intermediary forms, semi-erect/erect or semi-erect/prostrate. The aim of this study was to assess the relationship between plant morphology and their response to glyphosate.

A morphological study was established using seed collected in the field and the progeny of 30 *E. colona* and 31 *E. crus-galli* populations were grown to maturity. Data were recorded of morphological traits including plant height, panicle length and width, flag leaf length and width, presence/absence of banding of the leaves at three growth stages (emergence of panicle, primary flag leaf extended, onset of maturity). Cluster analyses using the Euclidian metric to assess dissimilarity revealed no clearly defined clustering between the species or between populations from the same regions.

To investigate glyphosate efficacy, 18 populations each of *E. colona* and *E. crus-galli* were subjected to four rates of glyphosate. The populations were established from seed collected in the field and were selected to duplicate plants grown in the morphological study. Seeds were germinated in an incubator and the seedlings planted into pots to establish 16 replicates of each population.

At three weeks after planting, morphological characteristics including banding, growth habit, culm thickness and culm pigmentation were recorded and the herbicide treatments were applied. The treatments consisted of nil herbicide (control), two sub-lethal doses (0.25 and 0.50 recommended rate), and a lethal dose (recommended rate). Treatments of glyphosate (RoundUp® CT 450 g L⁻¹) were applied using a manually pushed spray-bike at a walking rate of 1 m s⁻¹. The air-pressurised sprayer, set at a pressure of 200kPa, was equipped with flat fan nozzles (TT110-01) and delivered a spray volume of 85 L ha⁻¹. All plants had 6–10 leaves emerged or emerging at the time of application. At 14 days after herbicide application, the plants were hand harvested by cutting off at the base and fresh and dry weight biomass recorded.

The majority of *E. colona* plants could be classified as having a semi-erect (48%) or erect (36%) growth form, while *E. crus-galli* plants were predominantly erect (78%) followed by semi-erect/erect (18%). Preliminary analysis of the dry weight biomass data for these growth forms indicated no relationship between the plant growth form and the response to glyphosate.

Keywords *Echinochloa*, morphology, herbicide tolerance, glyphosate.