Field testing of glyphosate-resistant awnless barnyard grass (*Echinochloa colona*) in northern NSW

Tony Cook[1], Andrew Storrie[1], Paul Moylan[1] and Bill Adams[2]
[1] NSW Department of Primary Industries, Tamworth Agricultural Institute, 4 Marsden Park Road, Calala, New South Wales 2340, Australia
[2] Syngenta Australia, PO Box 34, Moree, New South Wales 2400, Australia
Email: andrew.storrie@dpi.nsw.gov.au

Summary Awnless barnyard grass (*Echinochloa colona* (L.) Link) is a major weed of cropping in summer-dominant rainfall areas of Australia. In northern NSW one population was confirmed resistant to atrazine (Group C) in 2004. A risk assessment analysis in 2004 found this species to be at high risk of developing glyphosate (Group M) resistance.

Three field experiments were established near Bellata, NSW in a fallow field infested with 300–3000 predominantly glyphosate-resistant *E. colona* plants m^{-2}. The experiments investigated 1) glyphosate rate-response, 2) pre-emergent and 3) post-emergent herbicides (other than glyphosate). All experiments were randomised complete blocks with three replicates. Plots were 10 × 3 m and the treatments were applied with a hand-held boom with Hardi™ 110-14 nozzles delivering 150 L ha^{-1}. Seedlings in the rate response and post emergent experiment were sprayed at Z11–12. Continued emergence of seedlings following rain made accurate assessment of control difficult in all three experiments.

In Experiment 1 (rate-response), there were nine rates of glyphosate applied (450 g a.i L^{-1} product at 0, 1, 1.5, 2, 3, 4, 6, 8 and 10 L ha^{-1}) and plants were visually assessed at 13 days after treatment (DAT).

Experiment 2 (pre-emergent herbicides) contained 19 treatments that included a range of broad acre and cotton herbicides from mode-of action (MOA) groups B, C, D, E + K, K and F. Dinitroaniline herbicides (Group D) were not fully incorporated due to rain falling during herbicide application. Visual control assessments were conducted 9 and 22 DAT.

The post-emergent herbicide experiment (Experiment 3) consisted of seven selective grass herbicide treatments (MOAs A and B) with five combinations of knockdown herbicides as consecutive 'double knock' treatments applied five days apart, and eight knockdown herbicide treatments applied alone. Visual control assessment and plant counts (m^{-2}) were conducted at 13 DAT.

There was no difference ($P < 0.05$) in the level of awnless barnyard grass control between 4 and 10 L ha^{-1} rates of glyphosate with the latter giving 97% control (Experiment 1). The rates below this gave poor control due to the resistance component of the population. The recommended rate for *E. colona* is 360–720 g a.i. ha^{-1}.

In Experiment 2, there was no statistical difference ($P < 0.05$) between the herbicides in the control of *E. colona*, but there were visual field differences that may have implications for management. The herbicides, s-metolachlor (0.96 and 1.92 kg a.i. ha^{-1}), imazapic (48 g a.i. ha^{-1}), imazethapyr (98 g a.i. ha^{-1}), s-metolachlor + atrazine (928 g and 1184 g a.i. ha^{-1}), s-metolachlor + prosulfocarb (420 g and 2800 g a.i. ha^{-1}) and atrazine (3000 g a.i. ha^{-1}) all gave good levels of control (<10 *E. colona* plants m^{-2}). The water soluble herbicides gave high levels of control due to rainfall following application while the efficacy of the dinitroanalines was reduced due to the lack of incorporation.

The post-emergent herbicides (Experiment 3) applied five days apart ('double-knock') and all selective grass herbicides gave 100% control. Single applications of paraquat (600g a.i. ha^{-1}) and Nufarm Alliance® (250 + 250 – 500 + 500 g a.i ha^{-1} paraquat + amitrole – applied five days after the paraquat treatment) gave 99% control. Single applications of glyphosate gave less than 95% control.

Where treatments do not give 100% kill, many *E. colona* plants successfully set seed and replenish the seedbank. Due to multiple establishment events, rapid growth and ability to set seed when small or stressed, management tactics must be combined in an integrated weed management program. These tactics can include non-glyphosate knockdown herbicides, residual herbicides in summer fallow, competitive broadleaf crops, pre and post emergent crop herbicides and crop desiccation. These trials showed that the glyphosate-resistant *E. colona* population was susceptible to the modes-of-action A, B, C, D, E + K, F, K, giving growers a range of potential management options.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the financial support of the Grains Research and Development Corporation.