PARAMETERIZATION OF THE BARNYARDGRASS (*Echinochloa crus-galli* L.) RESISTANCE MODEL FOR COTTON

Muthukumar V. Bagavathiannan
Jason K. Norsworthy
University of Arkansas
Fayetteville, AR
Kenneth L. Smith
University of Arkansas – Monticello
Monticello, AR
Paul Neve
Warwick HRI
Wellesbourne, UK

Abstract

Herbicide-resistant weeds pose a serious threat to sustainable cotton production in the Midsouth. Glyphosate-resistant horseweed (*Conyza canadensis*) and Palmer amaranth (*Amaranthus palmeri*) are already widespread in cotton, and it appears that barnyardgrass is a potential candidate in the list. A resistance simulation model is being developed to i) simulate the risks of barnyardgrass resistance to glyphosate under current management regimes in Roundup Ready® cotton and ii) to identify proactive strategies that will slow the evolution of glyphosate-resistant barnyardgrass in cotton. The model considers the biology of barnyardgrass (i.e. overall demography), population genetics of resistance (including mode of inheritance, dominance, and fitness), and different management options (including the timing and frequency of application) utilized for barnyardgrass control in cotton. Barnyardgrass seedlings were assigned to respective cohorts based on the timing of management operations, and the proportion of seedlings to be assigned to each cohort was calculated based on the cumulative emergence pattern of barnyardgrass in Arkansas. Efficacies for each management option for each cohort were determined based on expert opinion. The model represented a 60-ha cotton field with an initial barnyardgrass seedbank density of 2000 viable seeds m^{-2}. For each run, the initial frequency of resistant alleles was drawn from a lognormal distribution ranging between $5e^{-8}$ and $1e^{-7}$. The initial genotype composition (SS, Rr, and rr) was calculated based on Hardy-Weinberg equilibrium. Simulations were carried out for a 30-year period, and 250 model runs were summarized for interpretations. Resistance is considered to have evolved if the proportion of resistant barnyardgrass seeds is >20% of the total barnyardgrass seeds in the seedbank. More details on model parameterization are described in the poster. The model will be a valuable tool for addressing the issue of glyphosate-resistant barnyardgrass in cotton. At this stage, the model does not account for new mutations, seed immigration, and crop rotation. Future efforts will continue to refine the model and test different 'what if' scenarios in order to better understand the factors that contribute most to the evolution of resistance and thereby devise appropriate strategies to slow resistance evolution.