Group B Herbicide Tolerance Discovery in Chickpea

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To make full use of in-crop rainfall, stored soil moisture and nutrients, and prevent weed seed contamination, the control of weeds during a chickpea rotation phase is essential. Currently, there are limited pre- and post-emergent control options for weeds in chickpea, particularly broadleaf weeds. The primary chemical control options for broadleaf weeds in chickpea are the active ingredient herbicides terbuthylazine (Terbyne®), isoxaflutole (Balance® or Palmero®) and simazine. Although these herbicides provide effective control options for a wide range of broadleaf weeds, there are a number of common weeds that are not effectively controlled. When this issue is coupled with the poor competitive ability of chickpea, these common weeds may turn problematic, resulting in major management issues. Herbicides are the primary method of weed control in broad-acre cropping systems and limited control options for broadleaf weeds in chickpea and the presence of possible herbicide residues from previous crops are major reasons that producers do not include the crop in their rotations. Since no major new mode of action herbicides have been introduced into the marketplace for decades, the development of tolerance to existing herbicide chemistries has become an attractive method to overcome these issues and expand broadleaf weed control options. To advance this concept in chickpea, mutagenesis techniques were initiated to include tolerance to acetohydoxyacid synthase (AHAS) inhibitor herbicides (Group B), a highly effective and relevant broad spectrum herbicide group to key weed species in Australian chickpea production systems where there are currently limited in-crop options available. Mass field screenings of M_3 populations of desi and kabuli chickpeas occurred in 2015 to identify germplasm with improved Group B tolerance. Significant levels of improved tolerance were confirmed in one desi and seven kabuli lines to imazapyr and sulfometuron methyl (Oust®), respectively. Dose response and cross tolerance studies conducted in 2017/2018 confirmed the desi selection had a high level of tolerance to imidazolinone and the kabuli selections had high levels of tolerance to sulfonylurea herbicides. Sequencing of the AHAS gene in the chickpea genome has identified target site tolerance in all lines. Preliminary field studies conducted at Pinery, SA in 2018 compared the IMI tolerant desi selection D15PAHI002 with control cultivar PBA HatTrick for tolerance to the imidazolinone herbicide Intervix® (imazamox/imazapyr), and sulfonylurea herbicides Ally® (metsulfuron) and Glean® (chlorsulfuron). D15PAHI002 demonstrated a high level of tolerance to post emergent applications of Intervix® (including four-fold the recommended field rate). Improved tolerance to residue levels of the sulfonylurea herbicides were also found in the tolerant selection. While these results indicate a favourable level of tolerance to imidazolinone herbicides in chickpea, further field evaluation studies will be required to determine the agronomic and commercial potential of this trait.