Tolerance of narrow-leaved lupin (Lupinus angustifolius L.) to isoxaflutole and carfentrazone-ethyl

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Summary  Weed control is the top agronomic issue for narrow-leaved lupin (Lupinus angustifolius L.) production in Western Australia. Lupin growers demand cultivars with tolerance to alternate herbicides to combat herbicide-resistant weeds. Isoxaflutole and carfentrazone-ethyl are alternate chemistry herbicides capable of controlling sulfonylurea herbicide resistant populations of wild radish. However, they are not registered in narrow-leafed lupin. Research has been undertaken to identify lupin genotypes tolerant to these herbicides in order to use them for the management of the herbicide resistant wild radish.

Large genotypic variation in tolerance to isoxaflutole at 75 g ha⁻¹ applied pre-emergent was observed among 23 lupin cultivars grown in a sandy medium. The recently released cultivar Mandelup was the most tolerant with only 5% plants showing some bleaching in cotyledons (foliage damage index = 5), whereas Kalya had 50% plants showing symptoms in cotyledon and leaves (index = 50). The tolerant chickpea cv. Sona had no symptoms (index = 0); whereas the very sensitive canola cv. Karoo were all dead (index = 100) at this rate of herbicide. As tolerance in the lupin cv. Mandelup was close to chickpea, Mandelup has been used to induce mutation as a way to improve lupin tolerance to isoxaflutole.

Identification of tolerant mutant plants was initially carried out in a very large M₂ population of Mandelup origin in the field at 225 g ha⁻¹ isoxaflutole. Tolerant M₂ plants were harvested individually and reselected again in M₃ lines under glasshouse conditions. We kept the 30 M₄ lines most tolerant to isoxaflutole. Dose response study of M₄ mutants showed improved tolerance to isoxaflutole. At the seedling stage, several M₄ mutant lines were equal to chickpea cv. Sona in tolerance to isoxaflutole.

In the case of carfentrazone-ethyl, large differences in tolerance were again observed between lupin and canola in a dose response study with the herbicide applied to lupin plants at the four leaf stage. At the recommended rate of 20 g ha⁻¹ carfentrazone-ethyl, all plants of cv. Tanjil and cv. Mandelup survived and canola had nil survival at one week after treatment. At two weeks after treatment, lupin plants had about 70% of the dry weight of untreated plants, whilst canola seedlings were 14% of the dry weight of untreated plants. All lupin plants survived carfentrazone-ethyl rates as high as 160 g ha⁻¹ with 40% dry weight of untreated plants, whilst no canola survived this rate of herbicide. The large differential between lupin and canola holds some promise that this herbicide may be used in lupin if the tolerance is improved.

Keywords  Herbicide tolerance, genotypic variation, mutation breeding, lupins.

Acknowledgments  The Grains Research and Development Cooperation (GRDC) provided financial support. We are grateful to Mr John Quealy for technical assistance.