Phytotoxicity thresholds for crop seedlings exposed to soilborne residues of diuron and imazapic are regulated by soil type

Michael Rose[1], Annie Ruttledge[2], Jesse Muller[2], Kelvin Spann[1], Lukas Van Zwieten[1], Michael Widderick[2]
[1]NSW Department of Primary Industries, Wollongbar, Australia,
[2]Queensland Department of Agriculture and Fisheries, Toowoomba, Australia
(michael.widderick@daf.qld.gov.au)

Summary In the northern grains region of Australia, up to 45% of the cropped area routinely receives a pre-emergent herbicide application. This is largely in response to observed increase in resistance to glyphosate in summer weeds including feathertop Rhodes grass, flaxleaf fleabane, common sowthistle and awnless barnyard grass. In particular, the pre-emergent herbicides imazapic and diuron are now commonly used in summer fallows for the control of these weeds. Although residual herbicides provide a longer control period for certain weeds, their persistence in the soil for lengthy periods (12 – 24 months) may impede the growth of subsequent winter (e.g. barley, wheat, chickpea, lentils, field peas, lupins) or summer (e.g. maize, sorghum, mungbean) crops.

Soil analysis for herbicide residues can be performed through commercial laboratories, however, interpretation of results can be challenging for several reasons. First, there are very few publicly available crop toxicity thresholds that can be used to assess the soil residue concentrations. Second, herbicide bioavailability in different soils depends on the physicochemical properties of both the soil and herbicide of interest, and toxicity thresholds will vary depending on these relationships. We conducted numerous dose-response bioassays for several summer and winter grain crops exposed to residues of diuron or imazapic in different soil types. We report the toxicity threshold values for these crop-herbicide combinations and demonstrate that the soil-specific threshold can be suitably predicted through an understanding of the sorption behaviour of each herbicide in the different soils. The framework used here can be used to derive toxicity thresholds for other priority herbicide-crop combinations prone to carryover damage and the information can be used in decision making to minimise crop loss.

Keywords Herbicide residues, bioavailability, toxicity thresholds, imazapic, diuron