

Sub-lethal rates can 'kill' herbicides

While growers may be tempted to apply herbicides at levels below the registered label rate, recent research has reinforced the dangers of this strategy. Grains Research and Development Corporation (GRDC) funded trials have shed more light on how herbicide resistance can rapidly develop in weeds such as ryegrass when low herbicide rates are used repeatedly.

The field trials have been conducted by Western Australian Herbicide Resistance Initiative (WAHRI) researchers including post doctoral fellow Dr Roberto Busi, PhD student Sudheesh Manalil and Professor Stephen Powles.

"The study demonstrates, for the first time in the field in a commercial wheat crop, the potential for reduced rates of herbicides to result in rapid resistance evolution," Roberto said.

"When herbicides are used at low rates, this can rapidly lead to resistance and also cross-resistance which may be a serious problem depending on the herbicide being used."

Roberto said the research had led to improved knowledge of the evolutionary process leading to herbicide resistance when 'sub-lethal' rates were used.

"This knowledge will be used to help prevent, or minimise, resistance and cross-resistance development in the future when new chemicals hit the market," he said.

Low rates used in Australia

The research is important given herbicide rates used in Australia are very low by world standards, and there has been a culture of rate-cutting below the registered label rate.

WAHRI researchers believe the evolution of resistance when low herbicide rates are used is more likely to occur in cross-pollinated species such as ryegrass compared with self-pollinated weeds such as wild oats.

Previous GRDC-funded research at WAHRI using ryegrass in pots had already shown how herbicide susceptible ryegrass plants subjected to consecutive selection cycles with the Group A chemical diclofop-methyl, applied at low rates, led to very high resistance levels after only three generations.

The research was repeated in the field from 2006 with the aim of finding out if this phenomenon could also occur in commercial crop conditions.

"The outcome of the field research was resistance evolving after two years, at a slower pace compared with the pot trials, with a lower yet still substantial final resistance level, than that of ryegrass grown in the pots," Roberto said.

While twice field-selected ryegrass progeny exhibited a four-fold increase in survival, twice selected progeny in the pot trials exhibited a 17-fold increase in survival.

The twice selected generations of ryegrass in the wheat field and pot studies also revealed the evolution of cross-resistance to different herbicide modes of action.

The weeds showed a substantial level of resistance to two other Group A herbicides – haloxyfop and fluazifop-butyl – and cross-resistance to Group B herbicides chlorsulfuron and imazethapyr.

Maximise herbicide life

"We want to maximise the life of each chemical we still have," Roberto said.

"The bottom line for growers is to use herbicides at the full label rate and then rotate different herbicide rates as much as possible."

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This trial graphically illustrates the effect of cutting the herbicide dose rate on herbicide resistance evolution in annual ryegrass. A herbicide-resistant progeny (population) was selected after just three years of recurrent selection at low glyphosate rates (left) from herbicide-susceptible parental plants (right).



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