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Project Name: Risk assessment and management of paraquat resistance in the pasture seed industry

RISKS OF PARAQUAT RESISTANCE IN THE PASTURE SEED INDUSTRY

The issue

Herbicide resistance in weed species is an increasing problem for farming systems throughout the world. Both glyphosate and paraquat are used extensively for weed control in many farming systems including the pasture seed industry. Paraquat is the main alternative non-selective herbicide to glyphosate and if weed populations evolve resistance to both paraquat and glyphosate, weed management in many industry sectors will become much more difficult.

The repeated use of paraquat in pasture seed production means this industry is at high risk for the evolution of paraquat resistant weeds. The discovery of paraquat resistant annual ryegrass in the pasture seed industry threatens the viability of weed management in that industry and may affect other sectors. The spread of paraquat resistant annual ryegrass from the pasture seed industry, for example through seed contamination, would have significant impacts on other industries.



Annual ryegrass surviving applications of both glyphosate and paraquat in an irrigated former pasture seed production field (left). Glyphosate resistance can be selected in non-crop areas, such as irrigation channels (right) and move into cropped fields.

Annual ryegrass (*Lolium rigidum* Gaud.) is the most important weed of southern Australian agriculture. Many pasture species do not compete well with annual ryegrass and adequate control is important to allow the establishment of the crop and to reduce contamination of seed crops. Paraquat resistance has previously evolved in barley grass, capeweed and silver grass in lucerne

production. Despite the long history of paraquat use in Australia, no paraquat-resistant annual ryegrass has been reported, until now. There is a need to determine the extent of resistance in this area and the risks of resistant populations being dispersed to other agricultural sectors, as well as within the pasture seed industry.

Latest research

In this research Annual ryegrass populations were collected from cropping fields in the South East region of South Australia to test for resistance to paraquat. The populations were sprayed in a dose response experiments where plants at the three leaf stage were sprayed with a range of rates of Gramoxone® + 0.2% BS1000.

These studies showed 9 of the populations collected were resistant to paraquat at varying degrees. These findings have confirmed the first documented annual ryegrass populations resistant to paraquat in Australia. Two of the populations were found to have resistance to both paraquat and glyphosate.

The identification of annual ryegrass populations with multiple non-selective herbicide resistance poses a threat to the sustainable use of these herbicides in weed management. Management strategies that minimise the risk of resistance evolving, as well as resistant populations spreading, should be employed.



A paraquat resistant annual ryegrass population (top) and susceptible population (bottom) three weeks after application of paraquat (Gramoxone 250).

A survey of pasture seed grower practices identified frequent clover seed production, frequent paraquat use and limited use of other herbicides or weed control practices were correlated with paraquat resistant annual ryegrass evolving. In contrast, frequent lucerne production was not correlated with paraquat-resistant annual ryegrass, but with paraquat-resistant barley grass. Rotating crops and increasing use of alternative weed management practices could reduce the incidence of paraquat resistant weeds.

Implications

Pasture seed producers can reduce their risks of paraquat resistant weeds evolving by rotating their crops, employing alternative herbicides where available and adopting non-chemical weed management practices.