

## Glyphosate resistance a major concern

KATHERINE MAITLAND

**G**lyphosate resistance in annual ryegrass and other weeds is fast becoming a major issue for farmers, who need to be aware of resistance and monitor areas where the herbicide is being used repeatedly, said Peter Boutsalis.

Dr Boutsalis, Director of Plant Science Consulting Pty Ltd and Post-doctoral Fellow at the University of Adelaide, recommends that farmers check sprayed areas for survivors three to four weeks after application.

Any plant that has survived the herbicide application should be tested to check whether or not resistance was the reason for the survival, he said.

And all survivors should be destroyed to eliminate the risk of them becoming the parents of a herbicide-resistant weed population.

One option for control of glyphosate survivors is spraying with robust rates of a herbicide another mode of action such as paraquat, Dr Boutsalis said.

And farmers who routinely use glyphosate should consider changing to another herbicide with a different mode of action or use non-chemical forms of control to give glyphosate a 'break', he said.

"This will slow down the selection for resistance."

Researchers in the University of Adelaide's Weed Science team headed by Associate Professor Christopher Preston have conducted a series of trials exploring herbicide resistance, particularly glyphosate resistance in annual ryegrass.

One set of trials, conducted over three years at fence-line sites where glyphosate-resistant ryegrass populations had been identified, was designed to test the efficacy of different herbicides including glyphosate mixes on glyphosate-resistant weed populations.

Results from that work show that, in general, glyphosate mixes do not control ryegrass that are resistant to glyphosate.

"It is best to rotate to another herbicide with a different mode of action herbicides. We have identified several herbicide combinations with knockdown and



THE EFFECTS OF GLYPHOSATE RESISTANCE. RESISTANT PLANTS ARE ABLE TO THRIVE WITHOUT COMPETITION FROM SUSCEPTIBLE PLANTS THAT ARE KILLED BY THE HERBICIDE. (PHOTO PLANT SCIENCE CONSULTING)

residual activity on glyphosate-resistant ryegrass. These include mixtures of paraquat and Basta with residual herbicides, which give good control of glyphosate-resistant ryegrass.

"Some of the chemicals used in these trials are not registered for these applications and we are working closely with industry to get them registered."

Paraquat, Spray.Seed and Revolver are all alternatives to glyphosate, Dr Preston said.

"The recent toxicity concerns raised about paraquat have made some farmers reluctant to use it," he said, "but if instructions on its use are followed it is safe to use." And, he suggests, it may be better to use paraquat sparingly now to help avoid glyphosate resistance than be forced to use it more often by development of weed populations with glyphosate resistance.

"If farmers get resistance to glyphosate they are likely to have to use paraquat more frequently than they would need to now as part of a program to avoid glyphosate resistance developing."

Another element of the University of

Adelaide trials aimed to assess whether or not resistance could spread from fence lines into adjoining paddocks.

Some of this work was done on Neil Bridger's farm near Hilltown, in the Mid North, where sampling revealed resistant plants in a paddock adjacent to a fenceline population of glyphosate-resistant annual ryegrass.

"This is of great concern," Dr Boutsalis said.

"In three locations where glyphosate resistance was identified along a fence line we sampled ryegrass within the paddock up to 50 metres from the fence.

"At all three locations we were able to detect glyphosate resistance at 50 metres into the paddock. This suggests the resistance has spread from the fence line, probably by a combination of seed and pollen movement."

It is not just SA where glyphosate resistance is emerging and not just ryegrass that is developing resistance to the herbicide, Dr Boutsalis said.

"Glyphosate resistance has been

confirmed in other species including brome grass (near Maitland, SA), windmill grass, fleabane and awnless barnyard grass and liverseed grass in northern NSW and southern Queensland.

“Feathertop Rhodes grass is the next weed we expect to be confirmed as developing resistance to glyphosate.”

Farmers across Australia have been using glyphosate for more than 30 years, with many using it as the only control measure year after year. This has resulted in a buildup of weed resistance along fence lines, roadsides and in crops.

Resistance to glyphosate in ryegrass was first detected in Australia in 1995 in an orchard near Orange in NSW, Dr Boutsalis said.

“That ryegrass population was confirmed resistant in pot trials in 1996.

“Since then, glyphosate resistance has been identified in numerous non-cropping situations including fence lines, firebreaks, roadsides and driveways. It’s also been observed in fallows, vineyards, orchards and within cereal paddocks.

“Resistance has developed because farmers have used the same herbicide repeatedly over a long time; in many cases every year, sometimes several times a year.

“In most cases glyphosate is applied in areas with no crop, so if a plant survives because it is resistant to the herbicide it gains easier access to resources such as water, nutrients and light as the susceptible plants around it dies and is able to produce large quantities of seed.

“Glyphosate is a non-selective broad-spectrum, post-emergence herbicide with low mammalian toxicity. It works by inhibiting a single enzyme called EPSP, which is involved in the production of three essential amino acids: phenylalanine, tyrosine and tryptophan.

“If used properly and if there is no resistance, glyphosate kills a wide spectrum of annual and perennial broadleaf and grass weeds. It has no residual action and is most effective when applied on young, actively-growing plant tissue.”

## Fleabane

In what Dr Boutsalis described as an alarming result, more than half the roadside populations of fleabane sampled in a recent Australia-wide survey were resistant to glyphosate.

Most of the sampled populations from



MANY POPULATIONS OF FLAXLEAF FLEABANE ARE RESISTANT TO GLYPHOSATE.

northern and southern NSW, southern Queensland and the SA Riverland were resistant but none of the samples from Victoria or WA were resistant.

The survey, by the University of Adelaide’s Weed Science Team, involved collecting and germinating seed from 100 roadside sites where it was thought glyphosate had been used for weed control.

## Numbers game

Neil Bridger has been battling glyphosate-resistant ryegrass on his 1,610 ha Hilltown property for the past eight years.

“We first identified resistance to glyphosate on our property in 2004,” Neil said. “It was only a small area along the fence line, but the herbicide wasn’t killing the weeds. We knew something was wrong and the next year we had a resistance test done.

“We didn’t change a lot of what we were doing at the time. We were applying glyphosate at a rate of 1.5L/ha but noticed, with the wet summers and water logged soils, that the situation was getting worse, not better.

“The resistance test showed that in one area our weeds were nearly 50% resistant to glyphosate. Six years later we had another test done and the worst of the areas showed up to 80% resistance.

“We were rotating crops and hay, three years hay, two years cropping, but after two years of cropping again the weeds were starting to survive the spray. Even weeds in the good paddocks were showing resistance to herbicide. At that stage we increased the glyphosate rate to 2 L/ha and followed the glyphosate spray

with an application of paraquat.

“Our agronomist, Phil Holmes, sent samples from our property to Plant Science Consulting and in 2011 the team from Adelaide came up and conducted a series of field tests on site. They trialled individual paddocks, with different chemicals and it was clear that the weeds were showing resistance to glyphosate and other chemicals.”

The tests were a real eye opener that prompted him to start implementing other strategies, not just spraying more herbicide, Neil said.

“We changed a few things that we were doing and started a double knock strategy with paraquat. We also starting burning,



HILLTOWN FARMER NEIL BRIDGER





OBVIOUS. GLYPHOSATE-RESISTANT RYEGRASS ALONG A CLARE FENCELINE. (PHOTO PLANT SCIENCE CONSULTING)

growing less cereal crops in the bad paddocks, although this puts more pressure on other blocks, and working to improve our soil health,” he said.

“We wanted to improve the structure and performance of our soils, which are red brown earth, to avoid ryegrass spreading. We also increased our hay production by 25% over five years (Neil grows clover

hay, vetch, oats and a clover and vetch mix) and continued a grazing program with our cattle (mostly Murray Greys, Angus and Limousine cross for feedlot).

“With our wheat this year we didn’t use trifluralin; replacing it with Boxer Gold and Sakura in some paddocks because Boxer Gold has a different mode of action and Sakura brings exciting new chemistry

into the battle.

“It is too expensive and we don’t have the time to spray all the time and chemicals were not the answer. We had to find other ways to get the ryegrass numbers down.

“Another change was to spread lower rates of lime more often. We used to spread 2 t/ha of lime at each application but we now spread 1 t/ha every three or four years.

“Lime is effective in bringing the trace elements into balance.”

Next year they will keep an eye on the weeds and spray them before they get to the tillering stage.

“There are always different weeds, and sometimes by eradicating one weed, you open up a gap for another one. I think it’s important to be vigilant and always look and know your crops.

“The first step to monitoring weed control is to see what is dying and what isn’t and do something about it before the issue gets out of control.

“It can get expensive using herbicide all the time, and if it’s not effective then you need to think outside the square and look at the other methods that might reduce weed problems,” he said.



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