Spring 2014

giving a RATS

GRDC
Grains Research & Development Corporation

INTRODUCTION

Newsletter of :
"GRDC Project UA00124 – Understanding and management of resistance to Group M, Group L and Group I herbicides"

This edition of Giving a RATS looks at the need for diversity in management strategies and knowing what you are dealing with.

To start with we have the "How to guide" for burning windrows in higher yielding crops. Farmers in higher yielding areas have been told it isn't a technique for them, but with planning and attention to detail you can have the benefits of better weed control and keep your ground cover.

Central western NSW is the location for some important research into managing 2,4-D resistant wild radish, and glyphosate resistant, windmill grass, fleabane and sowthistle.

While we are losing herbicides to resistance hand over fist you might be surprised to know that only a small number of farmers test for herbicide resistance. We discuss the possible reasons and how we might improve the adoption as the window for seed testing is rapidly approaching.

Fleabane and sowthistle are weeds of conservation farming that are becoming increasing problems in southern Australian winter crops, fallows, roadsides and non-crop areas. Glyphosate resistant populations are also becoming more common. Reasonable spring rains in many areas flag the need for some in-crop surveillance now so infested paddocks can be targeted for control either just before, or immediately after harvest.

Erstwhile colleague and erudite companion David Thornby gives an Australian's view of the horrendous Palmer amaranth problem in the southern USA following a recent study tour. There is some excellent advice… and timely warnings for our farmers.

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> ***Science is a way of thinking, much more than it is a body of knowledge.***
>
> *Carl Sagan 1934 -1996*

BURNING WINDROWS FROM BIG CEREAL CROPS CAN BE DONE

Doug Smith crops 2500 hectares of wheat (50%), barley (20%) and canola, field peas and lupins (30%) at Pingrup, Western Australia with 250 to 275 mm growing season rainfall. All his crops are sown no-till with one-pass knife points and press wheels. He also has an on-farm agricultural supply business where he plans and supplies chemical and fertiliser programs for 60 clients.

Doug believes narrow windrow burning keeps the lid on weed populations and he and his neighbours have shown you can burn successfully 5 t/ha barley crop windrows if you plan and pay attention to detail.

Figure 1. Doug's header during the 2013 harvest

How to set up windrows - Size and type of windrows and over-threshing.

- ➔ Aim to keep rows to about 500-600 mm wide
- ➔ Make sure chutes capture all chaff and weed seeds into windrow
- ➔ Do not over thresh crops. This leads to rows with little or no airflow making rows smoulder rather than burn. Rows that smoulder do get hot enough to kill weed seeds.
- ➔ Make sure your chute does not restrict air flow from the cleaning fan of the harvester. Most chutes need to open back and front and closing the front leads to reduced harvest capacity in 4 t/ha plus crops.
- ➔ Try not to run over rows with headers/chaser bins etc as this crushes the rows giving the same result as over threshing.
- ➔ Slow the harvester ground speed at the end of the runs so you empty the sieves at the same time as the rotors. This prevents tails of seeds with no straw mixed in to burn.
- ➔ The use of stubble mats to protect the front tyres of the harvester can help in forming a mini fire breaks along each side of the rows. The mats tend to lay down stubble at harvest when it is hot (generally it does not stand back up) so it is less prone to light up due to radiant heat coming from the rows when burning.
- ➔ Make sure the header knife is in good condition. This is very important if crops are lodged because blunt knives tend to pull and lay ryegrass down in cool conditions rather than cut.
- ➔ Harvest the same direction the crop is sown. This is very important in heavy crops because the fire will carry down the individual rows that run away from the windrows.
- ➔ The exception to the above rule is if using old stubble rows to guide seeder bar steering (i.e. when using I-TILL, you need to harvest at about 15 degrees to the way the crop was seeded. This is so you don't end up with any rows left for the paddle to work with for a full run.
- ➔ Wider header fronts allow you to get better windrows in lighter crop years but can prove challenging when it comes to burning 5t/ha crop windrows. But the results are worth the effort.

Figure 2. Windrow chute

Figure 3. Burnt windrows at Doug's

Varieties and crop types

- Wheat varieties vary greatly in the type of residue that comes out of headers.
  - Yitpi produces excellent rows with good retained straw size.
  - Gladius produces finer residue that requires careful harvesting to achieve a reasonable burn.
  - Wyalkatchem produces very poor windrows of almost powder like residue making it unsuitable for windrowing.
  - Mace if treated right with the harvester will produce good rows, but is susceptible to over threshing in the heat of the day.
  - Canola and lupins produce rows that will burn at the highest temperature for the longest period of time. Great results.
  - While some types of barley produce good rows it can be tricky not to burn the whole paddock. The low fluffy flag can carry the fire between the rows.
  - Doug has learned that even 4-5 t/ha Scope and Buloke barley crops can be burnt very successfully, but you need to do everything right. With barley the conditions are the most important factor, with the humidity needed to be at 75 per cent, the wind <12 kms/hr and temperature around 12°C. In our area these conditions generally occur between 9pm and 3am. One 120 ha paddock on Doug's mate's place this year took 6 hours to burn. There was a fair bit of stopping-starting waiting for the conditions to be right.

Burning and lighting

We use the FESA McArthur Index, a scale used to calculate the fire danger in grassland using temperature, humidity and the wind speed to calculate an index. The scale gives us a guide to the best windrow-burning conditions. There is also the Pocketfire® app for that can do the same thing for iPhones and iPads.

As a rule of thumb, a Fire Danger Index of;

- Less than 15 will give a reasonable burning result, but there is a risk of burning inter–row if windy.
- 8-10 is good and probably ideal.
- 2 and lower will not give a good result as it is too cold and humid. At this level the rows smoulder and will flare up when conditions warm up the following day burning the paddock bare.
- Greater than 15 carries the risk of the fire getting out of control.
- THERE IS NO MAGIC NUMBER IT CHANGES EVERY YEAR DEPENDING ON FUEL LOAD.

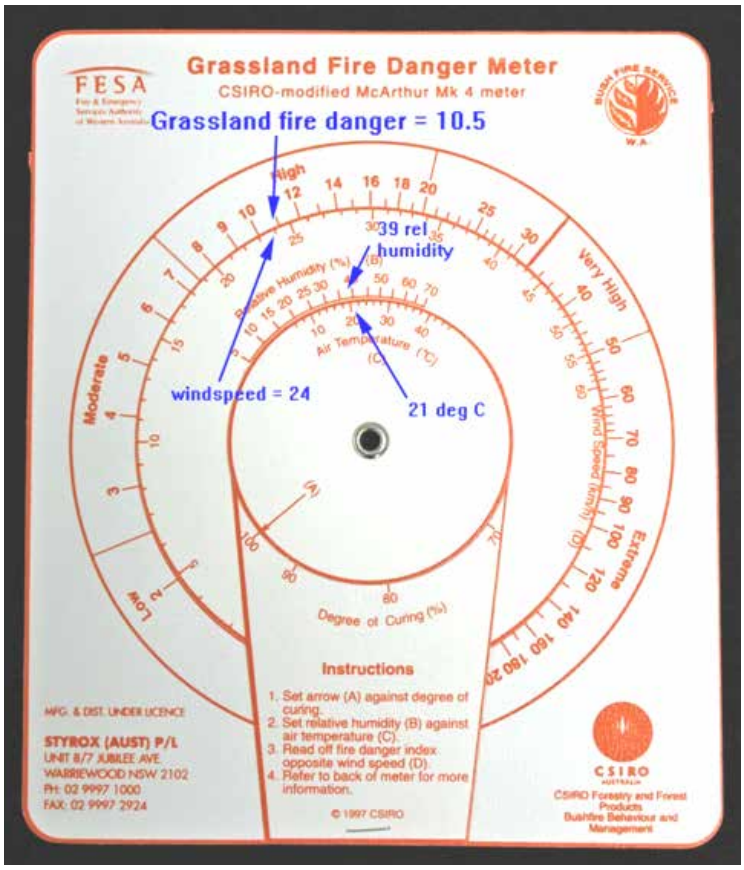

Figure 4. McArthur Grassland fire danger meter

Figure 5. 5 tonne ha barley crop yield successfully windrow burned in March 2014.

- ➔ Light windrows at 90 degrees across or diagonal to the windrow, rather than along the row as this prevents the fire developing a face which can carry between the rows. Ideally rows should burn to meet each other in 75 metre segments. In good conditions this only takes 25-30 minutes.
- ➔ Light up across the windrows every 75 metres in good conditions and plan to light much closer as conditions cool down. The fires will burn to meet each other.
- ➔ Best burning conditions in southern WA are in the second half of March.
- ➔ Plan to commence burning just on dark when it is cooler but also plan to be finished burning when the dew falls (this limits stubble smouldering and subsequent flare-ups during the next day). This time constraint means that only 200-300 ha (per team) can be burnt each night.
- ➔ Invest in a good fire lighters Doug uses a gas/diesel powered unit mounted on a 650cc quad bike with a lighting speed of 30-40km/hr.

To read the full article and see diagrams and images of chutes go to http://www.agronomo.com.au/storage/newsletters/Doug_Smith_Burning_big_crops_web.pdf

For further information on Harvest seed management http://www.ahri.uwa.edu.au/news/AHRI-insight/Spoiled-rotten

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RESEARCH PUSH INTO CENTRAL WEST NSW: TACKLING THREE EMERGING ISSUES

Figure 6. Wild radish experiment at Nyngan

The Central West Region of NSW was highlighted as a potential hot spot for herbicide resistance In edition 7 of Giving a RATS. This region is at the interface between classic winter dominant rainfall cropping systems and those of more northern summer rainfall dominant regions. As such, this region has a good mix of winter and summer growing weeds with a range of resistance profiles.

Of particular interest is the new outbreak of 2,4-D (Group I) resistant wild radish near Nyngan. While this is a single population, it is likely more cases will soon be found as growers still rely heavily on 2,4-D to control wild radish.

Glyphosate resistant ARG is widespread and can be seen growing throughout most of the region as manageable patches, often in non-cropping areas such as irrigation channels and areas adjacent to crops.

The hard to control weeds of summer fallows, glyphosate resistant windmill grass and fleabane are on the increase and persist along fence lines, producing seed that is blown back into paddocks.

This season's research for the National resistance project will therefore focus on these three issues; Group I resistant wild radish, patchy glyphosate resistant ARG and improving management of wind-blown weed species along fence lines.

Alternative herbicides for Group I resistant wild radish

The aim of the experiment is to find which other modes-of-action herbicides can be used to control wild radish. Herbicides treatments are from groups B, C, F, G, H, I and M. Although the infestation is current in a wheat crop, some wheat damaging herbicides such as glyphosate, atrazine, Spinnaker®, and Balance® were used to show growers that crop sequence changes can be made and thus other modes-of-action can be used. Other treatments include the standard Western Australian option of Velocity or an early post-emergence application of 2,4-D amine.

The early assessment has revealed that treatments that use a Group F, H or M herbicide give excellent control of smaller wild radish rosettes while the larger ones (8-10 leaves) may survive.

Farmers in this region need consider other herbicides Modes-of-action which will mean looking at a more diverse rotation. In the near future, this project will look at the current Western Australian wild radish management strategy of two post emergent herbicide applications – at two to 3 leaf radish followed by the second at 5 leaf stage of the cereal crop.

Patch management of glyphosate resistant ARG

The objective of this research is to show that by preventing ryegrass seed set for two years the seedbank can be virtually eliminated. A patchy strip of glyphosate resistant ARG adjacent to a crop of canola was sprayed with different treatments of glyphosate, Alliance®, clethodim, paraquat + atrazine, combinations of bromacil and imazapyr and hand weeding.

Control of ARG by clethodim was very poor, indicating resistance. The standard glyphosate treatment gave 20 per cent control. The better treatments included paraquat, Alliance®, hand weeding, paraquat + atrazine or combinations of bromacil and imazapyr.

Seed production and plant survival assessments will be measured and the detailed results of this demonstration will be reported in a future edition of Giving a RATS.

Management of weeds with wind-borne seed on fence lines

The purpose of this work is to highlight the need to keep fence lines free of weeds so that species with wind borne seeds don't infest cropping areas.

A large replicated experiment comparing combinations of bromacil and imazapyr at various rates commenced at Nyngan in early August. Weeds along the fence line were fleabane, windmill grass and sowthistle, wild radish, barley grass and wild oats.

Despite no assessments having been taken it is expected that fleabane control will be excellent, as good rain fell soon after application which is ideal for soil active herbicides. The real test will be if any treatment is able to control the established windmill grass while preventing seedling establishment.

Another trial investigating crop row orientation (north-south versus east-west) was established at Trangie Agricultural Research Station. We hope to prove that an east-west crop row direction will better compete with weeds due to better light interception by the crop. This research is vital in developing better non-chemical weed management strategies for the northern region.

Tony Cook
NSW DPI
Tamworth

Figure 7. Patch management of glyphosate resistant ARG, a site adjacent to a canola crop at Narromine.

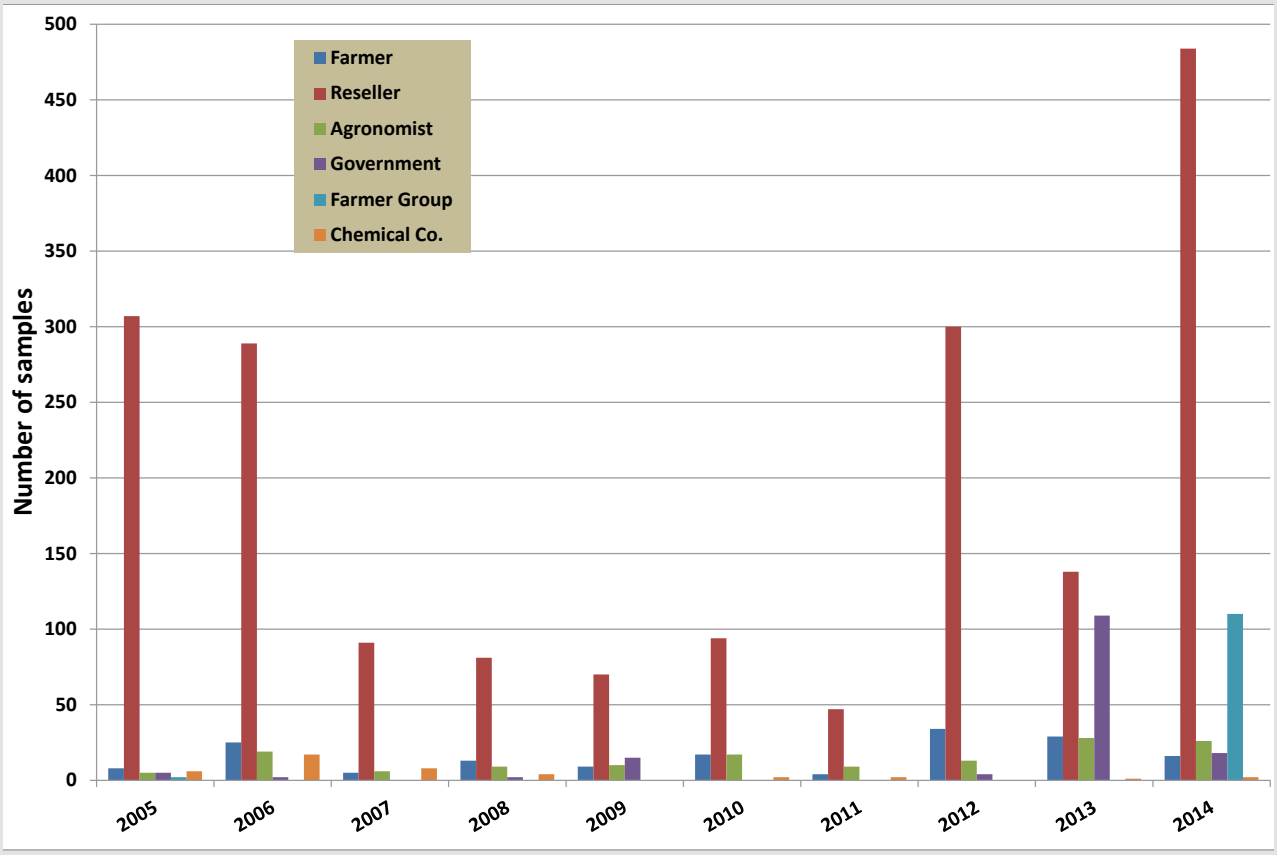
Figure 8. A fence line experiment with a good early control of weeds.

Why aren't farmers testing for herbicide resistance?

While herbicide resistance was first discovered in Australia in the 1980's the majority of farmers still wait for a spray failure, and then sometimes repeated spray failures before acting on a probable resistance problem. Surveys of growers who have attended integrated weed management workshops have shown that formal testing for resistance is very low. The agronomist's or farmer's gut instinct might tell them it is resistance to a particular herbicide mode-of-action, however experience shows these assumptions can be wrong. Also this does not tell the farmer which herbicides are still effective in each paddock.

A review of two testing services has shown that agricultural resellers are by far the most active users of testing services (Fig 9). Currently less than 5 per cent of samples submitted for testing come from individual growers. So why do farmers fail to use these valuable services?

Figure 9. Break up of those using the herbicide resistance testing service at Charles Sturt University, Wagga Wagga. J. Broster.



Has the testing message been badly sold? Herbicide resistance usually comes across as a negative message. Is there some way of turning the message into a positive one? Is it too difficult for farmers to collect samples for testing or do they consider testing too costly?

Several farmer surveys have shown that many growers strongly believe in two things:

1. A new herbicide will be developed to solve the problem, in the interim at least.
2. Herbicide resistance is caused by someone else and not by their management.

If this is widespread thinking it is not a surprise that most growers are reactionary when faced with resistance.

Survey of agronomists

A survey of Victorian agronomists attending the "Herbicide resistance update" in Bendigo in July 2014 as well as telephone interviews with agronomists from across Australia came up with the following points regarding why herbicide resistance testing is not widely used by growers.

- ➔ In the early years of herbicide resistance in Australia it was promoted as "bad news" to try and get farmers' attention and get them to change their management. If you don't change your ways farming will be next to impossible. However different herbicides came onto the market to enable them to keep the weeds at manageable levels.
- ➔ Growers are "too busy" to collect samples and send them to the testing service. Around harvest the priority is to get the crop off and delivered to the silo while after early post emergent spraying they are busy with top dressing and pest and fungicide application. Growers therefore do not appreciate the value of testing and how it can be used to improve their weed management.
- ➔ Some growers think they already know herbicide resistance status of their paddocks. While history of herbicide use can give good indicators of likely herbicide resistance risk record keeping can be poor and it also does not allow for differences between chemical classes within a mode-of-action such as fops versus dims. It is also impossible to 'know' the variability (genetic) of herbicide resistance within a weed species on a paddock by paddock scale without rigorous sampling and testing. Also spray failure can be due to plant stress, poor application technique and multiple tank mixes reducing efficacy of some components.
- ➔ Testing needs to be sold as a weed management tool

A growing number of agronomists and reseller companies are collecting samples and sending them for testing on their clients' behalf so they can give more accurate and professional weed management advice (Fig 10). Some consultants will not take on new clients unless they agree to a resistance testing program.

How can you give good advice unless you know what you are dealing with? Herbicide resistance testing needs to be seen as a regular part of management along with soil testing.

Regardless of what is said, it means farmers will have to spend more money and change management if they wish to keep ahead of crop weeds.

Andrew Storrie, AGRONOMO

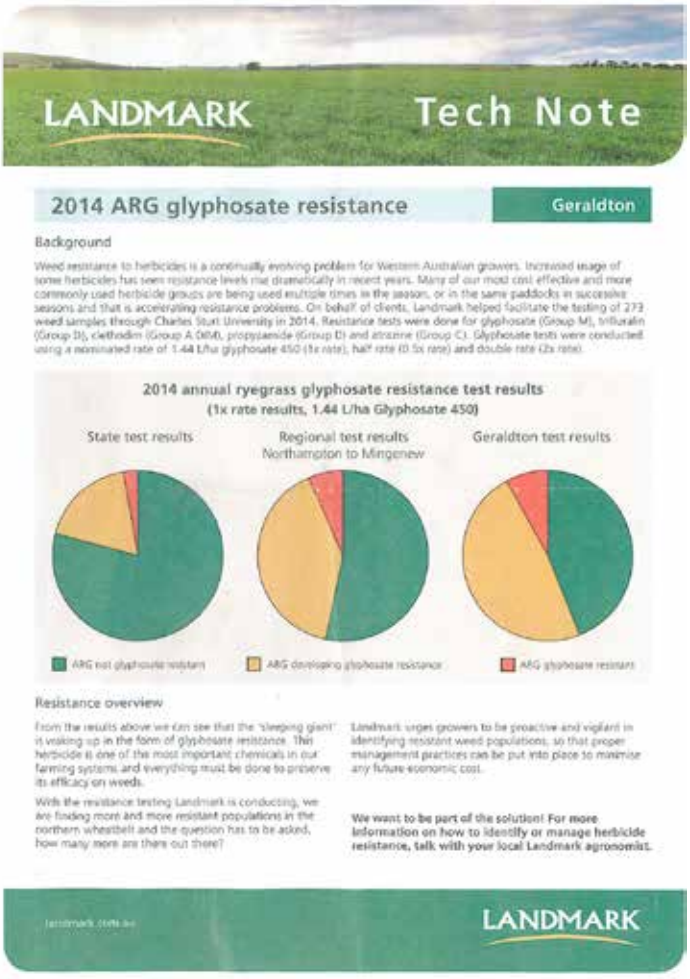


Figure 10. Landmark Tech note with the results of their 2013 testing of clients' paddocks for glyphosate resistance.

Resistance Testing Services

Charles Sturt University, Wagga Wagga

Contact: John Broster jbroster@csu.edu.au

http://www.csu.edu.au/research/grahamcentre/people/wwg/strategies/herbicide-resistance.htm

Plant Science Consulting, Adelaide

Contact: Peter Boutsalis 0400 66 44 60

http://www.plantscienceconsulting.com/

Syngenta RISQ Test

http://www.syngentacereals.com.au/RISQtest

To read the full article go here: http://www.agronomo.com.au/storage/newsletters/Low_levels_Herbicide_resistance_testing_full.pdf

CHECK THOSE CROPS FOR FLEABANE AND SOWTHISTLE NOW!

Flaxleaf fleabane (*Conyza spp.*) and sowthistle (*Sonchus spp.*) are becoming significant problems in southern and western no-till farming systems. These difficult-to-control weeds infest winter crops, pastures, fallows and roadsides. Populations of both species are also resistant to glyphosate in Queensland, NSW and South Australia.

One of the big problems with these species is that they often germinate in winter crops after post emergent herbicides are applied. These weeds then grow through to the summer fallow after the winter crop is harvested. These weeds are much harder to control post harvest due to size and temperature stress so will require a pre-harvest salvage spray at top label rates or a post harvest double knock strategy to get high levels of control. Failure to control weeds immediately post harvest can reduce next year's crop yield the through loss of stored soil moisture, especially in years with a dry summer.

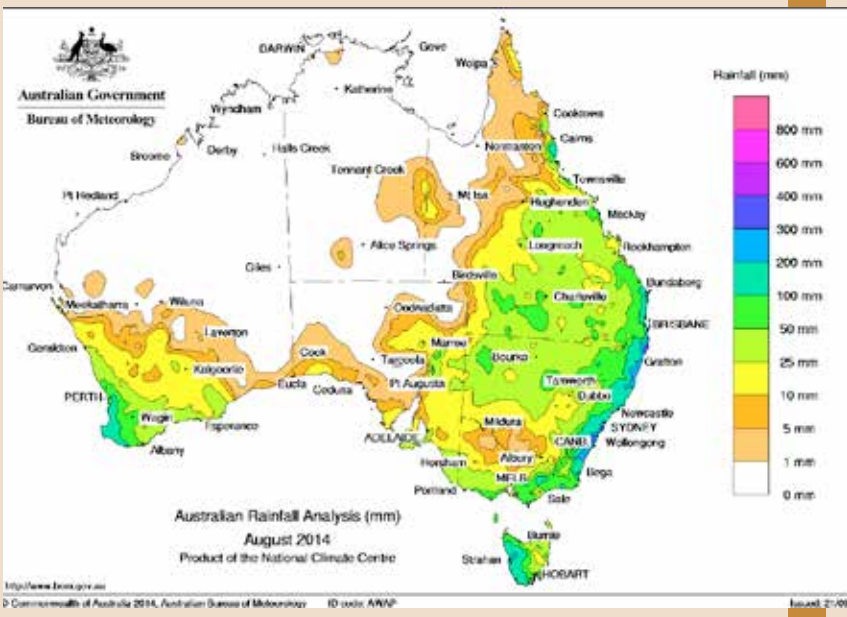


Figure 12. Mean rainfall during August 2014 means indicates many areas could have in-crop germinations of fleabane and sowthistle.

To get ahead of the game with these weeds we need to follow the check list below to target the paddocks where they might be lurking?

- ➔ Did you have paddocks that had fleabane or sowthistle infestations in the past two years?
- ➔ Do you have fleabane or sowthistle along fences or roadways?
- ➔ Have you received rain in the past four to six weeks that kept the soil surface moist for at least three consecutive days?

If so, these paddocks should be checked for infestations so they can be targeted with a pre-harvest salvage spray or post harvest double knock. At this time most winter cereals will be too advanced for a late post emergent application of 2,4-D.

Factors that will reduce the level of risk from these species include:

Figure 13. Fleabane immediately post harvest following spring rains.

- ➔ If the field was cultivated this year.
- ➔ You have grown triazine-tolerant canola – fleabane is sensitive to atrazine.
- ➔ You applied clopyralid to canola at the 8 leaf stage, there could be some residual control of weed seedlings.
- ➔ Crop row spacing is less than 25 cm which increases crop competition, particularly in cereals.

Figure 14. Close-up of fleabane post harvest – often doesn't offer much of a spray target.

For more information on the biology of fleabane and sowthistle see Section 6 Common Weed Profiles of the Integrated weed management manual http://www.grdc.com.au/IWMM

For information of herbicides for salvage/pre-harvest spraying Google – 'GRDC Late Season Herbicide Use Fact sheet'

Andrew Storrie AGRONOMO

THE VIEW FROM GROUND ZERO: A(NOTHER) TOUR OF PALMER AMARANTH COUNTRY

To view first hand the scourge of glyphosate-resistant Palmer amaranth and to see how the American industry was responding, the Australian cotton industry's three weeds musketeers Graham Charles, Jeff Werth, and David Thornby, took a trip across the globe in July. They toured several farms and research stations across the US cotton belt, visiting Arkansas, Mississippi, Tennessee, and Missouri, and spoke to growers, agronomists, researchers, biotech companies, and representatives of US cotton industry bodies.

What we found on the ground:

Summer cropping in the US, including cotton, is threatened by glyphosate-resistant Palmer amaranth. This is a difficult species to deal with due to very rapid growth (up to several centimetres a day) and seed production up to a million seeds per plant. It is also prone to rapid evolution on a regional scale, because it is an out-crosser, and susceptible biotypes (pre 2006) were quite easy to kill with glyphosate, even when large. The industry is now at the point of assuming that all Palmer amaranth is resistant to glyphosate. Other herbicides work, but they're not as effective, and the post-emergent options will only control small seedlings.

Figure 15. Very clean cotton crop... but at a price.

The US response has been to switch to a program of very frequent residuals (every second week!) and glufosinate-resistant crop cultivars. This, along with chipping, is costing affected growers somewhere around $100-$400 extra per acre, on modest yields of around two bales per acre. Most fields we saw seemed to be very clean, suggesting that the current approach is working, though it is only being applied to in-crop areas. There was little evidence to suggest they are looking for opportunities to diversify the farm system such as using tillage or shielded spraying of alternative knockdowns. Switching to corn is considered the best strategy, since closely-planted corn competes more effectively with the weed than either cotton or soybeans.

Figure 16. Palmer amaranth infesting soybean crop.

The cotton area appears to be declining, but large growers who own gins are tied to cotton so maintain their acreage despite the disadvantages. These growers are making large investments in machinery such as multiple boom sprays to cope with the new requirements for controlling Palmer amaranth. On more than one occasion, we were told that 'We're not farming cotton any more; we're farming against Palmer amaranth.'

Palmer amaranth is now such a problem that the glyphosate-resistant crowsfoot grass, barnyard grass, and Johnson grass we saw were not much more than an afterthought. While these species are being currently being controlled with the heavy residual herbicide program used for Palmer amaranth, multiple-resistant grasses will almost certainly appear at some point. The use of new glufosinate plus Group I resistant crops will not control these grasses.

The new approach from the technology providers appears to rely on a strategy of:

- ➔ development of RNAi technology to make glyphosate effective again (see Giving a RATS No4),
- ➔ rapid commercialisation of transgenic varieties with stacked resistance to glyphosate, glufosinate, and dicamba/2,4-D,
- ➔ subsidising the use of residual herbicides to keep glyphosate-resistant crops effective.

As a simple message for delivery to industry they have developed fixed packages of herbicide applications to use with the 'stacked-trait' varieties. While there are advantages in providing simplicity in what is a more complicated system than Roundup Ready®, we were concerned that US growers will not gain decision-making skills that would prepare them for the (almost inevitable) evolution of resistance to one or more of the herbicides in the new system. The Australian industry needs to guard against the disadvantages of the fixed package approach here.

On cats and bags:

The American growers we spoke to all lamented their previous lack of diversity of weed control tactics. They all recognised that relying entirely on glyphosate was a mistake, but said 'the cat's out of the bag, and it won't go back in.' For American growers who've had the ability to switch to new tools, such as glufosinate, it's vital that they keep the glyphosate lesson in mind. Weed managers both in the US and in Australia need to remember not to treat glufosinate, or their best residual, or dicamba, or RNAi, or even a crop variety with stacked herbicide resistance, as a new cat and a new bag. Diversity is our only option, but the good news is that it's an option that's still available to just about everyone here.

David Thornby,

Innokas Intellectual Services (former UA00124 Team Member)

Machinery Imports

The importation of high-value second-hand equipment (principally cotton round bale pickers) from the US carries a large biosecurity risk. Given how much of this importation has occurred recently, and how difficult the large machines are to clean effectively, some visiting Australian growers believed it is very likely we have already imported some glyphosate-resistant Palmer amaranth seed.

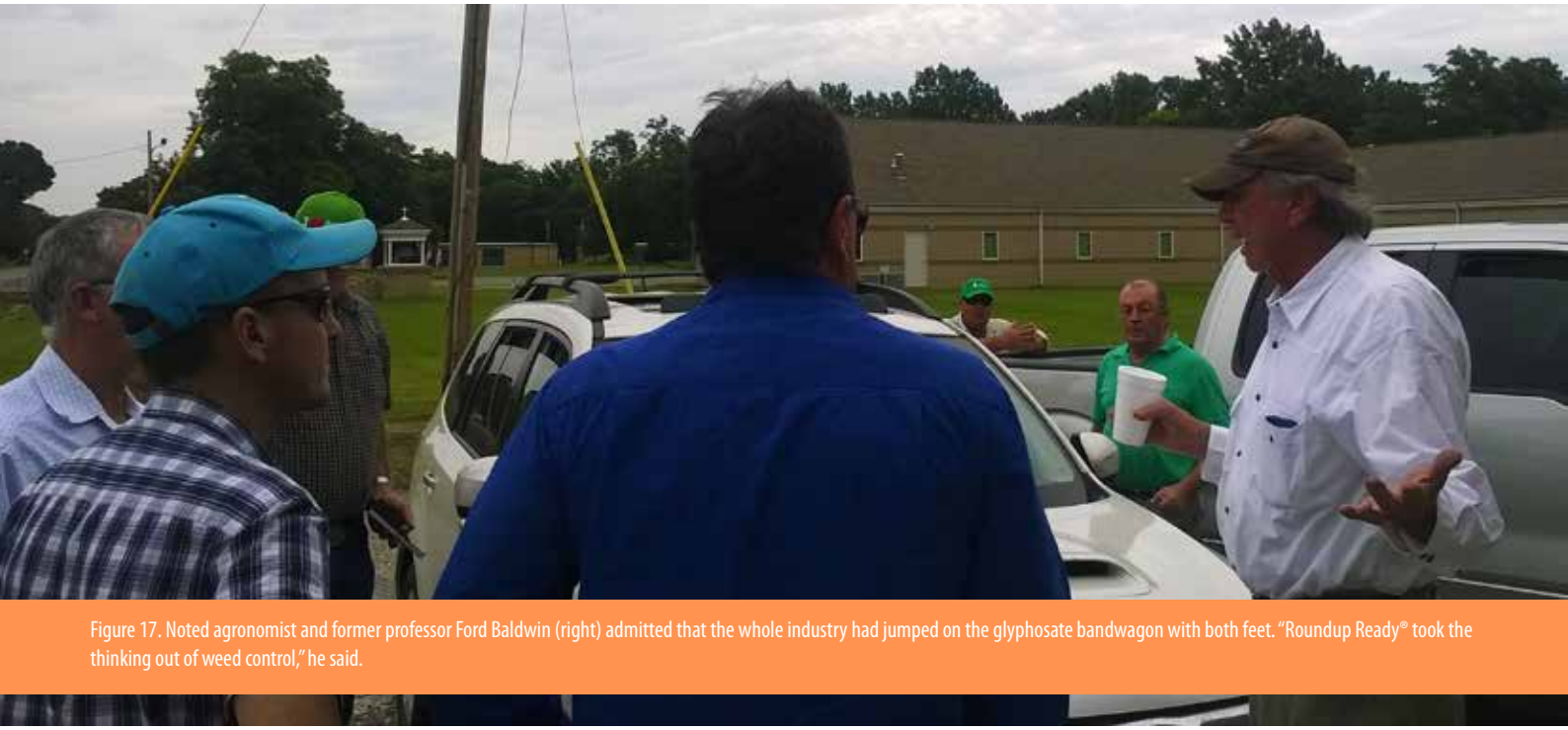


Figure 17. Noted agronomist and former professor Ford Baldwin (right) admitted that the whole industry had jumped on the glyphosate bandwagon with both feet. "Roundup Ready® took the thinking out of weed control," he said.

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