giving a RATS

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

ARE WE SELLING THE RIGHT MESSAGE?

In an increasingly crowded media scene it is often hard to get our message noticed. To improve our chances of getting it 'out there' do we reduce the message to a slogan, a 'grab', a simple message, such as the "Life. Be in it." campaign? What can we lose by this approach? Can the message be misinterpreted? Humans often here the part of the message they like, while ignoring the rest, often losing context. However the sciences are never black and white, but full of grey (at least 51 shades), so it is often difficult to get the subtleties of problem solving across to our clients.

We consider our message important and needs to be heard (and adopted), yet we all need to look at the bigger picture and be aware of unintended consequences.

There have been a number of successful campaigns over the years that have had unexpected consequences - to the people running the campaign at least. One that has had a major affect on weeds and herbicide resistance is the program for conservation farming or the reduction in cultivation. The widespread adoption of reduced tillage has taken 30 years (and a drop in glyphosate price) and given huge benefits to farmers and the environment. However the simple message has lead to a mind-set with some farmers seeing cultivation to manage weeds as a betrayal of the one-true-way. This mind set delayed the adoption of better weed management and has lead to reactive cultivation, when those great tools, herbicides, start to fail.

Most people want simple answers to complex questions. If the problem looks too big, people give up and say "There is nothing I can do." Many farmers see herbicide resistance as "too big". Our messages need to be 'modular' and acceptable to farmers' values and beliefs and have an immediate benefit. This brings us back to the concept of the IWM toolbox. What we offer is a range of tools growers can choose to tweak their system to manage resistance and run a profitable business.

This edition of 'Giving a RATS' has some highly relevant pieces that are presented as tools to be used rather than a solutions. Where does most glyphosate resistance come from? That's right, fence lines and firebreaks. We present the results of two WA trials that have shown some exciting results…. but remember, as always, there are caveats.

Also we present the case study of how an Esperance farmer actually bought a property with annual ryegrass resistant to glyphosate and has lived to tell the tale. It all comes down to monitoring, persistence and expanding the rotation.

Hopefully we aren't creating any unforeseen problems!!

Remember – You may want simple answers, but you really have to know what questions to ask.

Andrew Storrie AGRONOMO

"Judge a man by his questions rather than by his answers." Voltaire 1694-1778

INDEX FOR THIS ISSUE

USING HERBICIDES AT HARVEST TIME – STICK TO THE LABEL AND KEEP YOUR MARKETS

Andrew Storrie AGRONOMO

There has been a lot of talk lately about Maximum Residue Limits (MRLs), particularly in relation to paraquat, and what if grain buyers and end-users detect pesticides above the MRL. This is a good opportunity to explain MRLs and the consequences of exceeding them by not following label or permit directions. If you have used herbicides off-label close to harvest consider using the grain on the farm to protect your markets.

What is the story with paraquat?

Paraquat is not registered for pre-harvest use on **canola, wheat and barley**. Using paraquat in these crops will give residues above the Australian MRL. The discovery of paraquat residues on grain has enormous marketing and trade implications. **DO NOT RECOMMEND IT or DO IT!!**

▶ READ MORE

What is an MRL?

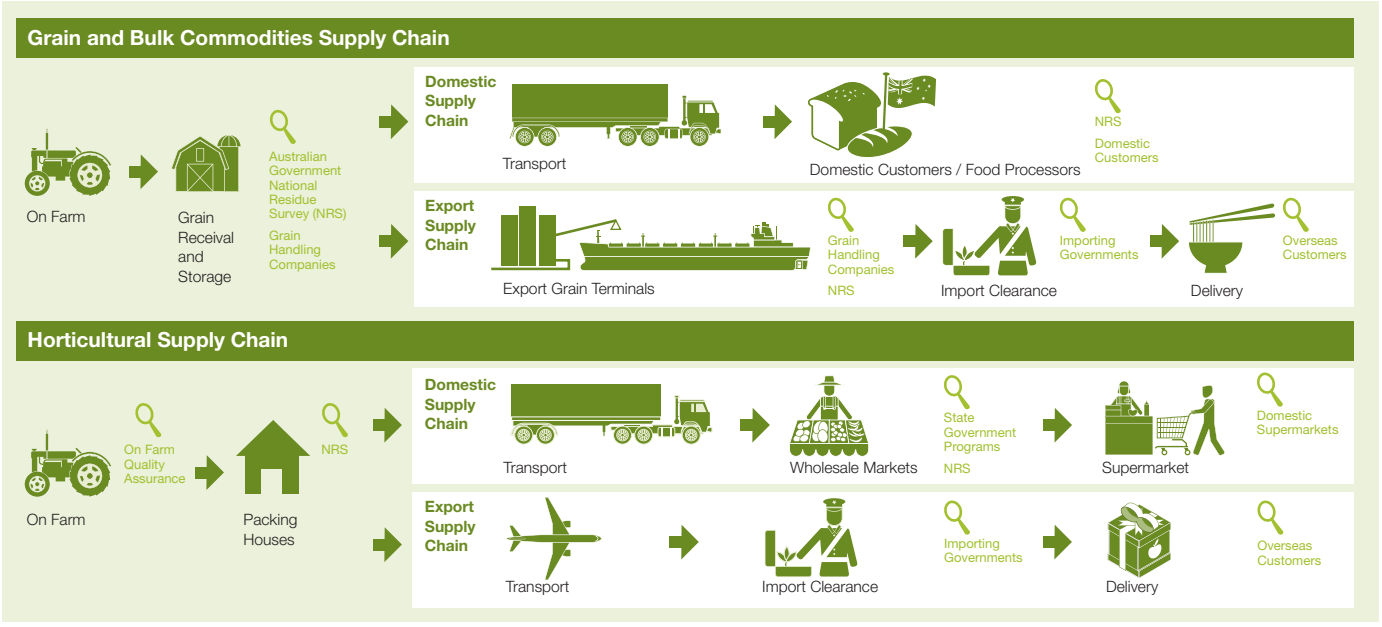
An MRL is a **Maximum Residue Limit**. This is the maximum allowable level of pesticide legally allowed in or on food, agricultural products or animal foodstuffs. It is not a measure of food safety but a determined standard to confirm pesticides have been used according to the label or permit.

Why have MRLs?

MRLs represent important measurable standards for trading products within and between countries. Within Australia, State and Territory laws state it is illegal to knowingly sell produce containing residues that exceed the domestic limit.

Overseas markets will have widely varying MRLs for a pesticide, so it is

Figure 1. Where testing for residues occurs in grain and horticultural supply chains. (Source: Syngenta)



important for traders and growers to know the allowed MRL for a particular product and market and ensure the product meets that specification. Failure to meet the standard can lead to products being rejected or destroyed and lead to loss of markets.

Where will produce be sampled for residue testing?

Grain will be sampled by grain handling companies, the Australian Government National Residue Survey and in the case of exported produce, the importing country.

How are MRLs determined?

When pesticides are being registered, trial data covering levels of control, environmental safety and presence of residues must be presented to the Australian Pesticides & Veterinary Medicines Authority (APVMA). The APVMA assesses whether the proposed label claims match the submitted data package.

The proposed use pattern is compared to the level of residues in the particular food or commodity. The level of residue must not exceed a predetermined MRL or a new MRL must be determined for a new product or use.

The maximum label rate is set so that when used with the use on the label the MRL will not be exceeded.

What factors affect the level of residue at harvest?

Two factors affect the level of pesticide residue at harvest:

- Amount of pesticide applied
- application machinery must be calibrated to prevent applying above the maximum rate for that use.
- Avoid overlapping applications
- Do not apply more times than specified on the label
- Time between pesticide application and harvest – label withholding periods specify the minimum allowable period

▶ READ MORE: For more information on not exceeding MRLs GRDC's 'Late season herbicide use fact sheet'.

▶ READ MORE: Syngenta's 'Avoiding residues when applying crop protection products'.

BETTER OPTIONS FOR WEED MANAGEMENT ALONG FENCE LINES

Sally Peltzer, DAFWA and Andrew Storrie, AGRONOMO

Main points:

- Different effective herbicide options are available to control weeds along fence lines and in non-crop areas.
- Knockdown herbicides alone have shown good initial control however later germinations reduce their effectiveness.
- A knockdown herbicide plus a residual give flexibility of management – farmers are not restricted to applying herbicides before the season break.
- Residual herbicides need soil moisture to be absorbed by weed roots and many have poor ability to control emerged weeds as many have poor foliar uptake and translocation towards the roots. Solubility of the herbicide strongly influences its' behaviour in the soil. Highly water soluble herbicides like hexazinone don't need much rain to move into the root zone, however they are a high risk for leaching through the profile and movement away from the area of application. A lower solubility herbicide like simazine needs more rain to move into the root zone however it has a lower likelihood of moving.
- Only use herbicides that are registered for fence lines and/or 'non-crop areas'. **READ AND UNDERSTAND the LABEL.**

Annual ryegrass is a major weed across Western Australia and the number of glyphosate resistant populations is increasing (82 out of the documented 347 sites with glyphosate resistant annual ryegrass in Australia are from fence lines). Weeds that grow on fence lines can move into cropping fields taking their resistance status with them and so their management is imperative.

The GRDC-funded herbicide resistance project (UA00124) was designed to help growers understand and manage glyphosate resistance (as well as resistance to paraquat and phenoxies). Part of this project, includes the establishment of advisor 'learning groups' and specifically two in WA.

Figure 2. Esperance trial site 11 September, 2012 (5 WAT). Sally Peltzer.

The Esperance Group and **The Northern Group** (Featured in first issue of 'Giving a RATS') decided to explore alternatives to glyphosate in fencelines. They chose to compare 13 herbicide treatments (applied as either single knockdown herbicides (paraquat, Amitrole® T, glufosinate or Alliance®) or as a mixture of a residual herbicide and a knockdown (paraquat or Alliance®) with glyphosate.
Trial 1 – Esperance Downs Research Station (EDRS) - shown at the SEPWA/EDRS Field Day on September 12.

Trial 2 –Liebe Group Dalwallinu Field Day Site – shown at the Liebe Group Field Day on September 13.

At both Field Days, growers were asked to 'blind rate' their top 3 treatments as well as answer some questions about their own fence line weed control.

Both sites were dominated by glyphosate-susceptible annual ryegrass. The EDRS site also had barley grass, a mixture of brome grass (*B. hordaceus* and *B. diandrus*), capeweed, clover, and some mallow and erodium. The Dalwallinu site also had wild radish and some capeweed.

Results of the Dalwallinu trial
6 weeks after treatment

Despite a prolonged dry period prior to trial commencement a number of residual herbicides (tank-mixed with paraquat) gave very high levels of control (Figure 3). Arsenal® Xpress, Trimac® + paraquat, hexazinone + paraquat and bromacil + paraquat gave good control of ryegrass and radish The other main ingredient of Arsenal® Xpress is imazapyr, a Group B herbicide, so resistance status needs to be closely monitored if using this product.

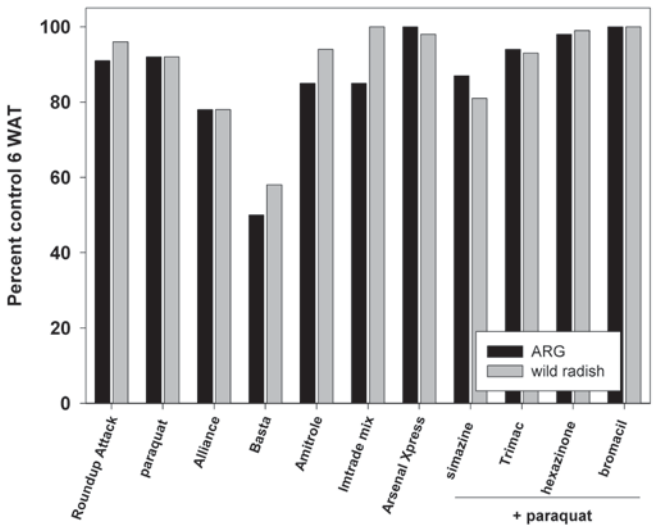


Figure 3. Control of glyphosate susceptible annual ryegrass and wild radish six weeks after treatment (WAT) at Dalwallinu, 2012.

Knockdown herbicides applied alone gave slightly lower levels of control at six week after treatment. Paraquat and glyphosate were applied at equivalent rates of active ingredient and gave equivalent control. Basta® performed better at Dalwallinu compared with Esperance, due to smaller weeds and the higher temperatures experienced.

Farmers at the Dalwallinu Liebe Group Field Day ranked the top treatments (everything dead) as bromacil + paraquat, hexazinone + paraquat and Arsenal® Xpress.

Results of the Esperance trial
5 weeks after treatment

Knockdown herbicides (except glyphosate) applied alone tended to perform poorly compared with residual herbicide mixes due to the large size of the weeds at the time of spraying. While Basta® gave good control of broadleaf weeds (data not shown) grass control was poor (Figure 4).

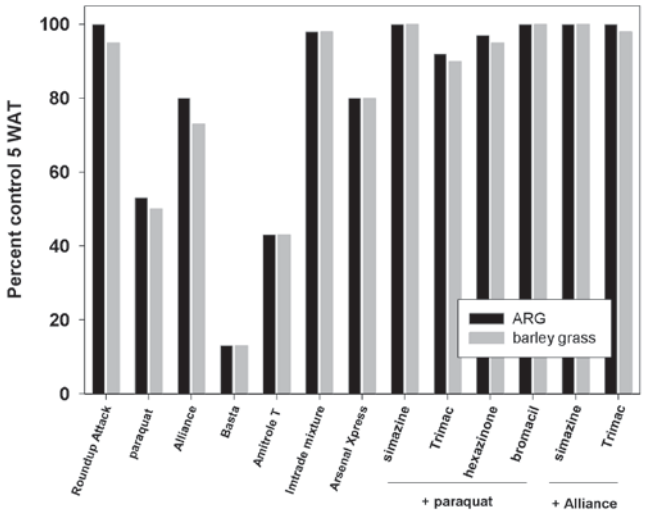


Figure 4. Control of glyphosate susceptible annual ryegrass and barley grass five weeks after treatment (WAT) at Esperance, 2012.

Mixes with Alliance® gave higher levels of control compared with mixes with paraquat, except for simazine which were equivalent. The amitrole in the Alliance® gives superior control of larger weeds as it is translocated, although it takes three to five weeks to show significant symptoms.

The Imtrade mix treatment needed significant rain before it started to kill the weeds suggesting low solubility.

Farmers at the SEPWA/EDRS Field Day ranked the top treatments (everything dead) as hexazinone + paraquat, bromacil + paraquat, Imtrade mix and Trimac® + Alliance®.

Treatments and rates used.

Figure 5. Herbicide treatments used in the trials

Herbicide treatment	Rate per ha	Mode-of-action
Roundup® Attack	1.6 L (900 g ai/ha)	M
paraquat	3.6 L (900 g ai/ha)	L
Alliance® (amitrole + paraquat)	4 L	Q + L
Basta® (glufosinate)	3.8 L	N
Amitrole® T	8.0 L	Q
Imtrade mixture	6 kg	C + C + Q
Arsenal® Xpress	6.3 L	B + M
simazine + paraquat	4 kg + 3.6 L	C + M
simazine + Alliance®	4 kg + 4 L	C + Q + L
Trimac® (sulfometuron + terbacil) + Alliance	1 kg + 4 L	B + C + Q + L
Trimac® + paraquat	1 kg + 3.6 L	B + C + L
hexazinone + paraquat	1 kg + 3.6 L	C + L
bromacil + paraquat	5 kg + 3.6 L	C + L

MYSTERIES OF 2,4-D RESISTANCE TO BE UNRAVELLED

Stephen Powles, AHRI, was recently successful in obtaining a three year ARC Linkage grant to work on identifying how wild radish achieves 2,4-D resistance (i.e. the biochemical basis of resistance).

NuFarm Australia P/L is the industry partner in this ARC Linkage grant. The grant will employ Dr Danica Goggin for three years from mid 2012 to mid 2015.

GLYPHOSATE RESISTANCE SYMPOSIUM AT THE 18TH AWC, MELBOURNE

Andrew Storrie and Chris Preston

Important points:

- Continued investment in research and development into alternative products is required, with sufficient protection of intellectual property.
- Extension effort is critical, as we have many of the answers to glyphosate resistance management, but they aren't being adopted.
- Australia will survive without glyphosate, but at what cost?

A "Glyphosate Resistance" symposium was held at the 18th Australasian Weeds Conference in Melbourne in early October to discuss the current 'state-of-play' of glyphosate resistance in different weed control sectors within Australia.

Chris Preston opened the proceedings by outlining numbers of populations of different species currently confirmed resistant to glyphosate. There are now so many resistant annual ryegrass populations across Australia University of Adelaide are only testing samples from previously unconfirmed herbicide use areas. See the Australian Glyphosate Sustainability Working Group web site for more information.

The fact that any weed can evolve glyphosate resistance is a wakeup call to weed managers. In the last issue of 'Giving a RATS' David Thornby highlighted the fact that one in ten weed species tested is at high risk of developing glyphosate resistance.

Rob Long, consultant from Moree, NSW, highlighted the fact that no-till farming systems are over-reliant on glyphosate and they need to get the integrated weed management message sooner than later. He felt grain production in northern systems would survive without glyphosate, but at considerable extra cost and threat to the resource base.

Main species to worry about in northern NSW and southern Queensland were the summer grasses: awnless barnyard grass (*Echinocloa colona*) and feathertop Rhodes grass (*Chloris virgata*), plus annual ryegrass, fleabane and sowthistle (*Sonchus oleraceus*).

No-till farming was using up to 7 applications of glyphosate

TEAM MEMBER PROFILE

GET TO KNOW THE TEAM...

Tony Cook

is the Technical Specialist Weeds with NSW Department of Primary Industries based at Tamworth Agricultural Institute. He has 22 years experience in weed research ranging from aquatic, pastoral, cropping and woody weed situations. His achievements in the field of resistance management include the development of selective spray-topping (wild oats) and determining alternative management of glyphosate resistant weeds - awnless barnyard grass, fleabane, annual ryegrass and Liverseed grass. He is active in two major projects funded by GRDC relating to glyphosate resistance management.
Tony is keenly involved in his childrens' pony club and is keen to take up horse riding himself.

Abul Hashem

is a Principal Research Scientist with Department of Agriculture Food WA. Abul has 31 years experience in research and extension of weed science and crop agronomy, publishing 36 peer reviewed papers in weed ecology, weed control, herbicide resistance and weed biology, 119 national and international conference proceedings, 28 semi-scientific papers in periodicals, numerous Newsletter articles and talks in field days and workshops on weed research and extension; Abul regularly contributes to national and international weed research.

Who is in the team?

▶ READ MORE to see who's in our team.

per field per year with the additional cost of $30 to $50 per hectare when glyphosate resistance was a problem. Extra spraying capacity is required on each farm to be able to apply additional sprays required to manage resistant weeds. The whole property needs to be sprayed in 10 days. This means another spray unit, costing $200,000-300,000 is required, plus additional labour. This is a large extra cost to maintain current production.

Graham Charles, NSW Department of Primary Industries, Myall Vale outlined the threats faced by the cotton industry. Graham added Roundup Ready® Flex cotton volunteers to the list of glyphosate resistant weeds and has also seen a shift to weeds never well controlled by glyphosate.

Ninety eight percent of the Australian crop is now Roundup Ready® Flex, which has simplified weed management and reduced production costs. Glyphosate resistant and tolerant weeds are being managed by re-introduction of components of the traditional system such as residual herbicides.

Peter Bothwell, Rail Infrastructure Maintenance Services manager with John Holland P/L in Western Australia said that weed management was a critical component of maintaining Australia's 44,000 kilometres of track. Many weeds move from adjacent agricultural land onto the tracks and glyphosate resistant annual ryegrass is an increasing problem. Grain loading terminals are weed hot-spots.

Herbicides are still the most cost effective management treatment because mechanical weed control on rail tracks costs $4,000 per kilometre. Currently his company is using Group B and C herbicides with glyphosate, however alternatives that pose little risk to the surrounding environment are needed.

Mark Slatter, Nufarm Australia P/L, gave a company perspective on the issues resistance to glyphosate are posing on the chemical industry. Mark considered the Australian chemical industry has a considerable commitment to stewardship of their products and gave examples such as support of the Australian Glyphosate Sustainability Working Group and development of management plans for herbicide resistant crops.

Mark also felt that there was a need for additional products for managing glyphosate resistant weeds. However, one issue is the difficulty for companies to recoup their investment in research and development with off-patent products and there may be a need for greater incentives to allow companies to benefit from broadening labels.

Figure 6. Roundup Ready Flex cotton showing excellent weed control.

NEW RIM SOFTWARE TO BE RELEASED IN FEBRUARY 2013

RIM, "Ryegrass Integrated Management" is software for evaluating the long-term profitability of ryegrass control methods for broadacre cropping. Designed to assist growers and agronomists, RIM is an innovative tool to assess diversified strategies for successful weed control, and the subsequent delay of herbicide resistance.

Now, with GRDC funding, AHRI Research Officer Myrtille Lacoste (see issue 2 of 'Giving a RATS'), supervised by Professor Stephen Powles, is upgrading RIM a decade after the tool was first developed. Management options will be entirely reviewed and updated and a new interface will feature enhanced functionalities.

RIM will be officially released in February 2013 for the international Global Herbicide Resistance Challenge Conference.

More information is available on ARHI's website:

- RIM features
- Conference program.

DON'T LET SANTA GET IN THE WAY OF GOOD CROPS AND A TAX LIABILITY - SUMMER SPRAYING TIME IS UPON US!!!

Andrew Storrie AGRONOMO

Harvest is under way and the pressure is on growers to get the grain off and the family are looking forward to some time on the coast, however there is another huge management decision to be made before domestic bliss can resume – control those fallow weeds!!!

Coming home to green paddocks at the end of January will cost you more money than maximum herbicide application rates and multiple sprays – loss of stored moisture and nitrogen will cap 2013 crop yield before you have pulled the camper-trailer out the farm gate!!!

To ensure you make every spray droplet counts under difficult conditions read the GRDC's *Summer Fallow Spraying Fact Sheet* developed in conjunction with Bill Gordon Consulting. The fact sheet includes information including application volumes, nozzle types and spray quality required for different herbicides and situations and all based on recent trial results.

The GRDC *Summer Fallow Spraying* Fact Sheet is available at http://www.grdc.com.au/GRDC-FS-SummerFallowSpraying and was included in the September-October edition of the GRDC magazine Ground Cover.

Figure 7. I wish I had sprayed before going on holidays!!!

MANAGING MULTIPLE RESISTANT ANNUAL RYEGRASS

"YOU DON'T HAVE TO BE CLEVER ABOUT MANAGING GLYPHOSATE RESISTANCE, JUST VIGILANT."

While many growers are coming to terms with the prospect of developing glyphosate resistance on their property, one grower in the Esperance region of WA purchased a property which already had resistance on it.

Chris Reichstein from Mt Burdett Farming Company purchased 'Warekila' in late 2008. It is a 860 hectare property, 45 kilometres north-east of Esperance (420 mm annual rainfall, 290 mm growing season rainfall) with soil types that are typical of the area (2/3 duplex soil and 1/3 Esperance sandplain).

After testing for resistance, Chris found that he had annual ryegrass resistant to glyphosate, Group A fops, clethodim (Select®) and pinoxaden (Axial®) and wild radish resistant to imazethapyr. He then implemented a strict program to manage his weeds across all his farms and has been so successful that weed numbers are very low with ryegrass numbers being less than one per square metre.

Chris's strategy is:

- Test for resistance and know what works

By testing, Chris knew what his resistance status was so he could pick out what chemicals are still effective.

- Use robust rates in good conditions

Chris knew that he had glyphosate resistance in small areas across the property. He adopted a strategy to spray with high rates glyphosate in good conditions with high rates of water (100 L/ha) and then come back with high rates of paraquat. He makes sure there are no survivors to set seed.

- Use rotations

To increase his IWM options, Chris used a rotation of two broadleaf crops in a row, a combination of canola and lupins or field peas depending on the soil type. He can change the herbicide mode-of-actions and optimise the effectiveness of remaining Group A herbicides while giving him the opportunity to crop-top in either the lupins or the peas. Due to the presence of glyphosate resistance, Chris will not grow Roundup Ready® canola on this property.

- Use different Mode-of-Action herbicide groups

Chris used Boxer Gold® in his cereals in 2012 with fabulous results. Boxer Gold® is another Mode-of-Action group (Groups J + K) compared to trifluralin (Group D). Chris may also incorporate Sakura® (Group K) in the cereal part of the rotation and trifluralin with Boxer Gold® into the double broadleaf rotation. Chris is evaluating the purchase of a WeedSeeker® so he can use other herbicide MOAs strategically in fallows.

- Harvest weed management

Chris narrow windrow burns his canola, barley and wheat phases and also swaths his canola. He has ordered 2 chaff carts for the 2013 harvest.

"IT'S ALL ABOUT KEEPING ANNUAL RYEGRASS NUMBERS LOW"

➲ Farm Hygiene

Chris is vigilant about keeping the annual ryegrass numbers low in all areas of his property. He concentrates on keeping the old fencelines clean as this is the most probable source of his glyphosate resistance.

He is also very particular about machinery hygiene. Any machinery used on this property gets a thorough clean before moving it to the home farm. All grain from that farm also goes to CBH (WA's grain receival and handling group) and is not saved for seed.

➲ Be vigilant

Chris believes that getting the glyphosate resistant annual ryegrass numbers down may have cost him more money due to his crop choices and robust herbicide rates but that it will pay off in the long run. When he first saw those survivors of the first summer knockdown, he was worried about what he could do. He now reckons it is easy, a short term economic cost driving the weed seedbank down makes him a long way ahead in the future.

▶ READ MORE

Case study by Sally Peltzer, DAFWA.

THE GLOBAL HERBICIDE RESISTANCE CONFERENCE SHINES THE LIGHT ON OUR FOOD PRODUCTION FUTURE

Global grain and fibre production is substantially underpinned by herbicide use, yet the evolution of herbicide resistant weeds threatens global crop productivity and food security.

The Global Herbicide Resistance Challenge conference, which takes pace at Freemantle, Western Australia next February, will investigate state-of-the-art science and address issues ranging from molecular evolution through crop science, agro-ecology, resistance management and socio-economics.

The conference will have leading world experts like Dale Shaner from the US Department of Agriculture who has been developing methods to detect glyphosate resistance in weeds with a leaf disc assay as well as conducting research on enhanced atrazine degradation in the soil.

Jason Norsworthy from Arkansas will talk about best management practices that mitigate the risks of herbicide resistant evolving in cotton and soybean crops and will demonstrate that it is a diversity of management practices is key to ensuring the long-term success of weed management programs.

Conference convenor, Stephen Powles from UWA, has without exception pulled together the leading authorities on herbicide resistance from across the globe. Until now, there has been no dedicated gathering of this science stream at an international level.

Field agronomists are invited to the Global Herbicide Resistance Conference on Thursday, 21st February to hear from experienced herbicide resistance researchers and global agrichemical corporations' senior representatives how other nations are tackling herbicide resistance in the major world crops. This applied day will include a wrap-up of the preceding three days, with keynote speakers exploring opportunities and challenges to combat herbicide resistance.

The conference, which runs from February 18th – 22nd, 2013, is hosted by the Australian Herbicide Resistance Initiative (AHRI), based at The University of Western Australia (UWA).

For Conference registration and more information, please visit the website.

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