the northern
HERBICIDE RESISTANCE Reporter

A Newsletter keeping you up to date with research and development in herbicide resistance in the Northern Region

Wild Oat Resistance in the Northern Grain Region

Through the GRDC-funded project UQ 138 'Detection, monitoring and management of herbicide resistance – northern region' seed from 598 weed populations has been collected. Most of this seed (96%) has been acquired through random sampling of in-crop and fallow paddocks in winter 2001, 2002, 2003 and summer 2002, 2003. The project has also provided a free herbicide-resistance testing service to farmers and the remaining 4% of seed has been acquired through this service. Samples have been taken from the Peak Downs shire north of Emerald and down throughout major cropping areas of the northern region to Narromine and Quirindi shires in NSW.

Dion Harrison (left) and Chris O'Donnell (right) examine a resistant wild oat plant from Croppa Creek that has survived and is setting seed after being sprayed with the Group A herbicide, fenoxaprop-p-ethyl, at 16 times the recommended rate.

Wild oats have accounted for 263 out of the 560 weed populations (47%) that were randomly collected and 24 out of the 38 populations (63%) submitted by farmers to the testing service. The wild oat species have been mostly *Avena sterilis* ssp. *ludoviciana*, commonly called 'ludo' wild oats, with a smaller proportion of *A. fatua*. Both species are commonly called 'black oats'.

Resistance testing for wild oats has been conducted using the 'Rothamsted Rapid Resistance Test' (RRRT) which is a Petri dish bioassay, and also standard pot-spraying trials. The RRRT works by germinating the wild oat seed on filter papers soaked in a very weak solution of Group A herbicide. If the wild oat seeds can readily germinate and produce green shoot material on the herbicide solution then this indicates some level of resistance. Known resistant and susceptible populations are included in the test for comparison.

A significantly higher percentage of wild oat populations submitted by farmers were resistant compared to random collections (Table 1). This highlights the important role that farmers, agronomists and other advisors play in assisting with the determination of the true extent of resistance in the region. Resistant populations have been located in southern Queensland and northern NSW (Table 2).

Most of the samples submitted by farmers have been strongly resistant to Group A 'fops' but not to Group A 'dims'. There has been one exception where the population showed cross-resistance to both 'fops' and 'dims' but was not resistant to the Group K herbicide Mataven®.

The project's molecular biologists, Dr Dion Harrison and PhD student, Ms Wenjie Liu, have found that the wild oat seed sent by farmers has been an invaluable source of biological material for their work investigating the genetic basis of herbicide resistance.

In this issue ...

Project UQ 138 concludes shortly and we regret that we are unable to accept any more seed for resistance testing. We still have several populations for testing and these will be completed by the end of May.

Table 1: Number and percentage of resistant wild oat populations.

Source of wild oat populations	Randomly collected	Sent by farmers
Total number	263	24
Number resistant	11	10
% resistant	4	42

Table 2: Locations where resistant wild oat populations have been found (*from a single farm).

Shires	(No. of resistant wild oat populations)
Randomly collected	Clifton (1), Gilgandra (1), Moree Plains (2), Wambo (3), Warren (1), Roma (1)
Sent by farmers	Tara (7*), Yallaroi (2), Waggamba (1)

Chris O'Donnell

MARCH 2004

Print Post Approved 424022/1517

Editorial

Awareness of the herbicide resistance threat in weeds of the northern region appears to be on the increase. Farmer groups and agronomists are wanting to know more about herbicide resistance and how the threat can be reduced. Recent presentations at GRDC updates and agronomist workshops by the team promoted useful discussion on the topic and there was particular concern raised about the repeated use of glyphosate in cropping systems. In line with this continued concern, several articles in this issue address glyphosate resistance. The next phase of the project, communicating the findings, will further increase awareness about herbicide resistance and promote strategies to avoid resistance.

In the mean time, the team continues to operate long-term field trials gathering information on preventive strategies for key at risk weeds. The 'Long-term trial update' article highlights where we are up to and which cropping phases are to be targeted next.

The team will be meeting next month to review project progress and plan for follow on research. As a reader interested in herbicide resistance, now is a great opportunity to let the team know what further research you think needs to be done on herbicide resistance. The team invites comments from readers and contact details are provided on the back of the reporter.

Michael Widderick/Kathryn Galea

Fleabane Biology and its Control

Fleabane has been recently identified as an emerging weed in northern NSW and southern QLD. Three *Conyza* spp., flaxleaf fleabane (*C. bonariensis*), Canadian fleabane (*C. canadensis*), and tall fleabane (*C. sumatrensis*) grow in Australia, with flaxleaf fleabane the most common species in dryland cropping systems. The fleabane problem is associated with a number of changes in farming practice, such as the adoption of no till farming, significant reduction in the use of group B herbicides in wheat, and the introduction of wide row spacing in sorghum.

Flaxleaf fleabane biology

Flaxleaf fleabane is an annual, tap-rooted plant in the Asteraceae – daisy family that grows up to 1 m, has deeply indented leaves and branches overtopping or equalling the main axis. The weed appears to emerge year round. Flushes of emergence can occur after significant rain events, resulting in the simultaneous presence of fleabane plants at various growth stages ranging from small seedlings to mature plants. Our results showed that one mature plant produces an average of 110,000 seeds. These seeds can be easily dispersed by wind due to its light weight and pappus. Fresh seeds are not dormant at maturity and can germinate whenever temperature and moisture conditions are favourable. Germination is promoted under light.

Overseas reports of herbicide resistance

Luckily, herbicide resistant biotypes of fleabane have not yet been documented in Australia. However, overseas research has identified biotypes of fleabane species resistant to a number of herbicides across different mode of action groups. Biotypes of flaxleaf fleabane have evolved resistance to Group B (chlorsulfuron), Group C (atrazine and simazine), and Group L (diquat and paraquat). Most alarmingly, a biotype of *C. bonariensis* resistant to glyphosate (Group M) has recently been confirmed in South Africa.

Management strategies

Variable efficacy has been reported in fleabane control, which could partly be attributed to the herbicides or mixtures used, the timing of application, weed size, soil and climatic conditions when spraying, and biotype differences across the region. To achieve effective control of fleabane, it is crucial to treat it when it is small at its early growth stages, actively growing, and before stem elongation. Control efficacy declines as plants mature.

Our current research has shown that glyphosate alone does not necessarily provide satisfactory control (Table 1). Control was only 13% with glyphosate sprayed on weeds >10cm diameter. Additions of 2,4-D ester, Grazon DS, Tordon 75D, Ally, Surpass, Atrazine and

Modelling the Risk of Glyphosate Resistance in Roundup Ready® Cotton

Glyphosate tolerant (Roundup Ready®) cotton was introduced in 2000 and now makes up approximately 40% of cotton plantings. This is likely to increase, especially with new Roundup Ready® technology on the horizon. Currently, there is no known glyphosate resistance in cotton systems in Australia. However, a concern with glyphosate tolerance crops is the increased use of glyphosate, leading to resistance, and weed species shifts.

A PhD student, Jeff Werth, at the Australian Cotton Research Institute in Narrabri is examining the likelihood of glyphosate resistance occurring in Roundup Ready® cotton. The project is funded by the Cotton CRC and the Weeds CRC. Experiments will be used to investigate the population dynamics of weeds in cotton systems, and the interactions between these dynamics and a range of treatments from a fully integrated weed management approach right through to using the Roundup Ready® technology only.

Results from these experiments will be used to develop a model that will predict the likelihood of glyphosate resistance evolution over a range of management strategies for a range of weed species. Along with a grower survey of management practices in Roundup Ready® and conventional fields, these findings will be used to produce recommendations for the prevention of resistance in Roundup Ready® systems. This will provide the ability to predict the likelihood and time frame for resistance evolution under different weed management options, and enable the possible altering of these to reduce the risks of resistance. For further information, Jeff can be contacted on 02 6799 2455 or by email Jeff.Werth@csiro.au

Jeff Werth

Primextra to glyphosate improved the control of fleabane to 90 – 99%. Glyphosate + Atrazine also gave very good residual control of the following flushes.

Regrowth of fleabane plants is very common after Spray.Seed treatment with recovery and new growth from auxiliary meristems within 2 to 4 weeks after treatment. However, a double knock technique with glyphosate followed by Spray.Seed has proved to achieve excellent control.

Non-glyphosate treatments of 2,4-D ester + Amitrole, Surpass + Amitrole and Surpass + Ally also provided very good control.

The importance of preventing seed set of weed survivors should not be underestimated. If not effectively managed, a small percentage of survivors in one single season are able to produce sufficient seeds to severely infest in subsequent crops or fallows. Our research has shown that Amitrole T could be strategically used as a late treatment to target mature survivors **(Photo 1).**

Photo 1. Amitrole T preventing seed development in maturing fleabane.

Its excellent damaging effects on elongated shoots and flowering heads greatly reduced the replenishment of new seeds into the soil, although it did not completely kill the plant.

The success of fleabane is attributed to prolific seeding, its ability to emerge throughout the year, and its relative tolerance to glyphosate herbicides. The best long-term management strategy for fleabane control is to treat weeds early and to reduce soil seedbank by effective control of weed survivors. The rapid development of herbicide resistance in fleabane species overseas suggests that an integrated management program would need to be implemented in order to prevent or retard its resistance to herbicides in Australia.

Hanwen Wu

Table 1. Herbicide control of flaxleaf fleabane. Early spraying was to weeds <5-8 cm across and late treatments to weed size >10 cm.

Herbicide treatment	Application Rate (product/ha)	Timing of application	% of control
Glyphosate	1.5 L	Early	88
Spray.Seed 250	**2.4L**	**Early**	**47**
Paraquat 250	1.3 L	Early	53
Glyphosate + Primextra	**1.5 L + 3.2 L**	**Early**	**95**
Glyphosate + Atrazine 600	1.5 L + 4 L	Early	97
Glyphosate	**1.5L**	**Late**	**13**
Glyphosate + Amitrole T	1.5 L + 2.5 L	Late	93
Glyphosate + Ally	**1.5 L + 7 g**	**Late**	**90**
Glyphosate + 2,4-D Ester 800	1.5 L + 700 mL	Late	94
Glyphosate + Surpass 300	**1.5 L + 3.33 L**	**Late**	**97**
Glyphosate + Tordon 75D	1.5 L + 1 L	Late	99
Glyphosate + Grazon DS	**1.5 L + 750 mL**	**Late**	**98**
Glyphosate + Cadence	1.5 L + 200g	Late	96
Glyphosate + Surpass 300 + Ally	**1.5 L + 7 g + 1.67 L**	**Late**	**93**
Glyphosate + Garlon 600 + Ally	1.5 L + 120 mL + 7 g	Late	96
2,4-D ester 800 + Amitrole T	**700 mL + 2.5 L**	**Late**	**98**
Surpass 300 + Amitrole T	3.33 L + 2.5 L	Late	94
Surpass 300 + Ally	**3.33 L + 7 g**	**Late**	**95**

Wheat Belt Places High Value on Glyphosate

(Exert from Ground Cover – Issue 47 November 2003)

Growers in WA's central wheat belt place an exceptionally high value on glyphosate in their farming system, according to University of WA researcher Rick Llewellyn.

A survey of wheat belt growers by Dr Llewellyn indicated that, on average, farmers would pay up to 41% less for land if they knew it had glyphosate resistant ryegrass.

In the survey, 60% of the 130 respondents reported using double-knockdown (glyphosate followed by paraquat) in the previous four years as a means of minimising the risk of glyphosate resistance. Three quarters of them expect to use double-knockdown in the next four years.

The growers were generally well aware of how quickly glyphosate resistance can develop under intense selection pressure, Dr Llewellyn said. "However, factors likely to limit adoption of management changes to prolong the useful life of glyphosate include optimism about the future availability of a new herbicide."

"Of the respondents to the survey, 52% believe there will be a new herbicide for ryegrass control with a new mode of action within five years."

NEXT ISSUE

The September 2004 Issue will include an article on the current extent of herbicide resistance in the Northern Region.

RESISTANCE is FUTILE

Workshop on Sustainable Glyphosate Usage

Glyphosate was released in the US in 1974 as a broadspectrum, nonselective herbicide that was cheap and safe to the user and environment. It was first sold in Australia in 1978 and developed for conservation tillage in 1983. It provides effective, low cost control of a wide range of annual and perennial weeds and now dominates the Australian knockdown herbicide market in dryland cropping. It is also used extensively for general non-selective weed control in areas such as roadsides, along fence lines and in horticulture.

In August 2003, GRDC organised a national workshop in Sydney with key researchers, growers and representatives of companies making glyphosate based products. Steve Walker and Andrew Storrie represented the researchers from the northern grain region.

At the time of the workshop there were 38 confirmed resistant annual ryegrass populations in Australia. Of these populations, seven are associated with dryland cropping in WA, Victoria, SA and southern NSW and 18 are on the Liverpool Plains of northern NSW. A further six of the resistant populations are in horticulture, seven are in no-till grain and four are in areas such as along fence lines and channels.

Overall, there was a strong consensus that it was imperative to act now to maintain the sustainability of glyphosate, which is being threatened with development of resistance. Currently, the group considered that glyphosate resistance in Australia is rare. However, further threat is very real.

The workshop resulted in:

- *A better understanding of the position of various stakeholders on priorities and directions for future glyphosate use;*
- *Opportunities for better collaboration between stakeholders particularly for researchers and companies;*
- *Strong recommendation for the development of sustainable use patterns for glyphosate in the different farming systems across Australia as well as other use situations;*
- *Strong recommendation for the development of a communication strategy with consistent messages;*
- *Strong recommendation for the development of a national database and standard testing procedures for glyphosate resistance in Australia.*

Participants in the workshop agreed three key factors lead to glyphosate resistance in weed populations:

- *Intensive use of glyphosate*
- *Exclusive use of glyphosate, and*
- *Little or no tillage.*

The release of glyphosate resistant (Roundup Ready) crops has expanded the role of glyphosate, making it a postemergent, incrop herbicide in those crops – while retaining its role as the preferred knockdown fallow chemical for most farmers. This use exposes a greater proportion of the weed population to the herbicide, exerting higher selection pressure.

An initiative to minimise the impact of glyphosate resistance in Australia is likely to include:

- *An industry group to develop and manage a glyphosate resistance minimisation program;*
- *A cohesive, science-based resistance management strategy, co-ordinated and managed by that body; and*
- *Communication of a coordinated, consistent message to all glyphosate stakeholders and user groups based on the agreed resistance management strategy.*

The workshop was very beneficial, and specific actions to maintain the long-term use of this important herbicide are likely in the near future.

Steve Walker/Michael Widderick

Resistance Confirmed the Old fashioned Way!!!

Evaluation of suspected herbicide resistant plants is primarily conducted by pot trials. Seeds or plants are planted out in pots, then grown out to an appropriate growth stage under ideal conditions, sprayed with a range of herbicides and assessed for levels of resistance or susceptibility. The plants are sprayed with the herbicide suspected of giving poor control along with other herbicides from other groups (to test for cross resistance) while some are also left as untreated controls. Plants are sprayed at the growth stage recommended on the label of the herbicide. As plants are kept well watered, given sufficient fertilisers, kept disease and pest free, there is almost no reason for herbicide failure, except herbicide resistance!

In July last year, a sample of wild oat plants originating north of Dubbo and known to have Group A 'fop' resistance, was sent to the NSW team for confirmation of Group A ('dim') resistance. The samples were kept moist and leaves were trimmed to prevent excessive moisture loss. Five plants were transplanted into each 15 cm pot and nurtured for several weeks until plants were ready for spraying (sufficient foliage). A total of 25 pots were used, comprising 5 replications by 5 treatments. Plants were sprayed with two treatments of Sertin® 186 (dim) (1 x and 2 x recommended rate) and two treatments of Verdict® 130 (fop).

Table 1. Wild oat herbicide resistance bioassay results

Treatment	Total number plants survived to set seed (max 25)	Number panicles per plant	Seeds set per plant (% control)
Sertin 186 1L/ha (dim)	1	0.12	1.1 (97)
Sertin 186 2L/ha (dim)	1	0.12	1.7 (96)
Verdict 500mL/ha (fop)	22	3.40	25.2 (39)
Verdict 1L/ha (fop)	10	0.80	3.8 (91)
untreated control	25	2.56	41.6 (0)

Herbicide Options for Group B Resistant Wild Radish

Wild radish (*Raphanus raphanistrum*) herbicide resistance is an increasingly important issue in northern NSW where some producers are experiencing resistance to Group B herbicides.

An on-farm experiment commenced in May 2003 in the Gunnedah district to test best weed management strategies for wild radish control in cereal crops. Wild radish at the site had been surviving the normal rate of Glean®, which had been utilised for many years by the grower as the main in-crop herbicide.

Ten treatments were applied, Glean® was applied pre-plant and the other 9 treatments were applied as post-emergent treatments to actively growing weeds at 53 days after sowing (DAS). These treatments represented 5 different herbicide modes of action (MOA) groups B, C, F, G and I, plus combinations of these.

The level of wild radish resistance to Group B was relatively high. Glean® at 20g/ha would normally achieve a very high level of wild radish control. However, in this paddock only 43% of the radish population was controlled (Figure 1). Over 50% had survived the normal rate of Glean® and produced seed returning a huge amount of resistant seed back to the soil seed bank.

The Group B products mixed with MCPA (Group I) significantly improved control, providing industry acceptable levels of control.

Both formulation of MCPA effectively controlled wild radish, especially when tank mixed with another herbicide. Group G (Hammer® and Affinity®) gave good control and as this group is not often used in cereal cropping, it adds another weapon to the farm manager's arsenal. Tigrex® (Group I & F) also provided effective control. Exposing wild radish to Groups F & G will lessen the chances of developing herbicide resistance.

These results show that there are viable herbicide alternatives to using Group B alone. By utilising herbicide from Groups F, G and I, wild radish can be effectively controlled while prolonging the effectiveness of Group B herbicides and minimising the spread of Group B resistance.

Paul Moylan

Effective control of wild radish with MCPA (top) and poor control with Glean (bottom)

Figure 1. Weed control (%) in sorghum with different herbicide treatments.

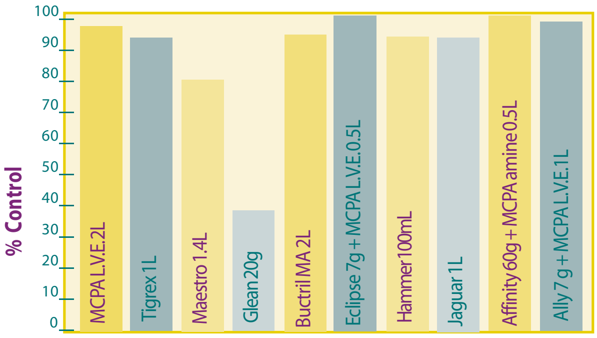

Photo 1. From left to right: Wild oats treated with Verdict 2x rate, 1x rate, untreated control, Sertin 1x rate and 2x rate.

Results in Table 1 and Picture 1, confirm that this source of wild oat plants is resistant to Group A (fop) herbicides. Although increasing the 'fop' rate to twice the recommended dose rate greatly reduced seed production, the level of seed produced will still ensure many resistant individuals persist for the next season, at the expense of more susceptible plants. It also highlights that increasing the rate of herbicide will not solve your resistance problem. There are concerns about this population of wild oats because the plants did not die and roughly one seed per plant was produced after 'dim' applications. This is enough to suspect low level Group A (dim) resistance.

The NSW team are not equipped to do large-scale free assessments of suspected herbicide resistant weeds. Please send samples of suspected herbicide resistant plants (as seeds) to

Rex Stanton
Charles Sturt University
Herbicide Testing Service
PO Box 588
Wagga Wagga 2678
Phone 02 6933 4037

***Tony Cook*, NSW Agriculture**

COMING EVENT

14TH AUSTRALIAN WEEDS CONFERENCE

6-9 September 2004
Charles Sturt University, Wagga Wagga, New South Wales

For more information check out the web site: www.csu.edu.au/special/weedsconference

Long-term Field Trial Updates

Central Queensland (Vikki Osten)

Good rain fell at our site during this summer, which finally allowed the CQ weed group to start implementing treatments. The trial was split into a sorghum phase in conjunction with a summer fallow phase. The rain stimulated several flushes of sweet summer grass to emerge plus some broadleaf weeds.

In the fallow phase, we applied the following treatments: Roundup CT 1.2 L + Surpass 300 mL/ha, Roundup CT 1.0 L followed by Flame at 200 mL/ha a week later, Roundup CT 1.0L + Hammer at 100 mL/ha, and SpraySeed 2.0 L + Ally at 7 g/ha. To date, all Roundup CT treatments have provided excellent control (>95 %) of the grass. Initially, SpraySeed treatment seemed effective, but the grass has started to re-grow.

In the crop phase, sorghum was planted in late January. The treatments are a combination of row spacing (for crop competition) and herbicides, which were applied immediately post-planting. The treatments are sorghum as 1m single skip with Roundup CT at 1.5 L/ha, sorghum as 1m solid with Roundup CT at 1.5 L/ha ± atrazine at 2 kg/ha, and sorghum as double skip with Roundup CT 1.5 L/ha plus atrazine at 2 kg/ha. The treatments with atrazine are a move towards better weed management, which will also utilise spot spraying of any escapes/survivors. On the evening of planting about 10 mm rain was received, which was ideal for atrazine incorporation and activation. Unfortunately, 3 days later a severe storm of 60mm resulted in flooding and soil erosion across the trial, affecting sorghum emergence.

Northern New South Wales (Paul Moylan)

Spring Ridge (Wheat 2003)

The target weeds were black bindweed, wild oat and annual ryegrass. Overall, treatments 1, 2, 3, 4 and 6 provided excellent weed control particularly for wild oat (**Table 1**), while treatment 5 gave an acceptable level but did not prevent a sizable amount of grass seeds replenishing the seed bank. Mataven applied as a selective spray topping application controlled any wild oats that escaped the initial early post-emergent herbicide. Rotating herbicide MOA groups with pre-emergent herbicides from group D & E also provided effective wild oat control. Treatments 3 and 4 were highly effective in controlling black bindweed, and Glean + Topik gave 100 % control of annual ryegrass

Coonamble (Wheat 2003)

The target weeds were black bindweed, annual ryegrass, and suspected Group A resistant wild oats. Several strategies were excellent in managing the wild oat population. The strategy of an early application of Topik followed up by a late application of Mataven (treatments 1, 2, and 6) will result in low wild oat numbers in the 2004 winter. Treatment 4 using Group D & E herbicides also provided acceptable control. The very dry conditions lead to plant stress and reduced herbicide efficacy, confusing the issue of poor control due to herbicide resistance. Wheat yields were very low because of the drought conditions, resulting in negative gross margins.

Spring Ridge (Summer Fallow 02–03)

Flame (Group B) was tested for residual

Table 1. Weed control, wheat yield and gross margins at Spring Ridge trial. SST = selective spray topping

Treatment	Rates (product/ha)	MOA	Yield (t/ha)	Control (%)	Gross Margin ($/ha)
Ally + MCPA LVE + Mataven SST	7g + 1L + 2L	B + I & K	4.59	98	682
Glean + Topik	20g + 200mL	B + A	5.19	95	747
Banvel + Mataven (SST)	1.5L + 2L	I + K	4.90	96	688
Trifluralin 400g/L + Tri-allate + Tordon242	1L + 1L + 1L	D + E & I	5.20	94	790
2,4-D amine	2L	I	4.44	83	679
Tordon®242 + Glean + Topik	1L+20g+200mL	I + B + A	5.21	99	735

Table 2. Weed control and wheat yield at Coonamble trial. SST = selective spray topping

Treatment	Rates (product/ha)	MOA Group	Yield (t/ha)	Weed Control % Broadleaf	Weed Control % Grass
Ally + MCPA LVE + Topik + Mataven SST	7g + 1L + 0.2L + 2L	B + I + A + K	0.76	89	90
Glean + Topik + Mataven SST	20g + 0.2L + 2L	B + A + K	1.14	93	95
Banvel + Topik	20g + 0.2L	I + A	0.91	82	88
Trifluralin + Tri-allate + Tordon242	1L + 1L + 1L	D + E + I	0.73	85	90
2,4-D amine 500 + Topik	2L + 0.2L	I + A	0.71	80	80
Tordon242 + Topik + Mataven SST	1L + 0.2L + 2L	I + A + K	0.62	86	90

Table 3. Fallow weed control in March 2003, and number of glyphosate and Flame applications between December 2002 and July 2003

Treatment	No of applications Glyphosate	No of applications Flame	Weed Control (%)
Glyphosate (450 g/L) 2L/ha	5		65-70
Flame® 0.2L/ha + glyphosate (450 g/L) 2L/ha	2	1	99

weed control in summer fallow as an alternative to several applications of glyphosate. The Flame treatment provided the best weed control in March 2003 (Table 3, Photo1). It reduces the reliance on group M in fallow by eliminating 3 applications of glyphosate.

Southern Queensland (Michael Widderick)

The SQ sites at Condamine and Billa Billa have now progressed through a winter crop and fallow phase. The sorghum phase was recently completed, and the summer fallow phase is nearing completion. This issue reports on the winter crop and the subsequent summer fallow phase.

Winter crop weed control

Weed control in the winter cereals was 100%, irrespective of treatment (Table 1). Barley effectively smothered weeds without any herbicide. Different crop density and species had no significant effect on crop yields at Billa Billa, but the preventive strategies (treatment 2) at Condamine tended to yield greater than district practice (treatment 1), and barley yield was lower.

Summer Fallow weed control

Weed control in fallow focussed on rotating out of group M herbicides and achieving maximum weed control. Weed control was 100% at Condamine for first and second flushes (Table 2). Only barnyard grass in the third flush was not totally controlled with a few mature plants escaping treatment with Sprayseed.

Photo 1. Flame (front) achieved better control than glyphosate (back) in a NNSW summer fallow.

Table 1. Weed control and crop yields at site 1 (Condamine) and site 2 (Billa Billa). Weeds at site 1 were sowthistle and African turnip weed, and sowthistle, African turnip weed, annual saltbush, volunteer chickpea and paradoxa grass at site 2. Topik at 125 mL/ha was also applied to treatments 2-5 at site 2 for paradoxa grass control.

Crop	Tillage	Herbicide and rate	MOA	Weed control (%)		Yield (t/ha)	
				Site 1	Site 2	Site 1	Site 2
Wheat 35 kg/ha	-	Ally 5g + MCPA LVE 1.5L	B + I	100	100	3.0	2.5
Wheat 35 kg/ha	**-**	**Ally 5g + MCPA LVE 2L**	**B + I**	**100**	**100**	**3.3**	**2.5**
Wheat 35 kg/ha	✔	Ally 5g + MCPA LVE 2L	B + I	100	100	3.1	2.4
Wheat 50 kg/a	**-**	**Ally 5g + MCPA LVE 2L**	**B + I**	**100**	**100**	**3.1**	**2.5**
Barley 40 kg/ha	-	Nil	Nil	100	100	2.4	2.7

Table 2. Herbicide treatments for summer fallow weed control at Condamine. Weeds targeted were sowthistle (flush 1); sowthistle, barnyard grass, volunteer mungbeans (flush 2); sowthistle, barnyard grass and volunteer mungbeans, caustic creeper (flush 3).

Flush 1	Flush 2	Flush 3
Roundup CT 1.2L	Roundup CT 1.2L	Roundup CT 1.2L
Roundup CT 1.2L	**Roundup CT 1.2L + Surpass 1.2L**	**Roundup CT 1.2L**
Roundup CT 1.6L	Roundup CT 1.2L	Roundup CT 1.2L
Flame 150mL + Sprayseed 1.6L	**Sprayseed 1.6L**	**Sprayseed 1.6L**
Roundup CT 1.6L	Roundup CT 1.2L	Roundup CT 1.2L
Flame 150mL + Sprayseed 1.6L	**Sprayseed 1.6L**	**Sprayseed 1.6L**
Roundup CT 1.6L	Roundup CT 1.2L	Roundup 1.6L
Flame 150 mL + Sprayseed 1.6L	**Sprayseed 1.6L**	**Sprayseed 1.6L**

Collecting Weed Seed for Herbicide Resistance Testing

The sampling technique to assess the presence of herbicide resistant weeds will depend on how advanced herbicide resistance is within the paddock being surveyed.

Early stages of herbicide resistance

These early stages are characterised by the appearance of clumps or patches of weeds not killed by the normal herbicide treatment. These patches should not be confused with incorrect herbicide application. Collect seed from enough patches to give a representative sample, with a minimum of 2000 to 3000 seeds per sample. This is the equivalent of 2 cups of ryegrass seed and 5 to 6 cups of wild oats (black oats). Seeds are easily collected by bashing the seed heads into a plastic bucket. This means mainly ripe seed will be in your sample.

More advanced stages of resistance i.e. hard to kill plants spread throughout the paddock

The later stages of herbicide resistance are characterised by usually only one or two weeds spread throughout the paddock. Walking across the paddock and hand sampling is the best way of collecting sufficient seed. Start sampling near the gate about 50 m into the paddock, being careful to avoid obvious spray application errors. A 'W' collection pattern across the paddock is preferred by most seed testing agencies.

Remember, 'the better the sample the better the result'.

General advice for seed collection

- Keep a map of the path taken across the paddock when collecting. This will assist with interpretation of the results.
- Only collect mature seeds
- Place seeds in a paper bag and keep dry.
- Keep sample out of the sun and heat.
- Store at room temperature and send in as soon as possible after collection.

Andrew Storrie

Editors

Michael Widderick (QDPI & F)

Phone: 07 4639 8856

PO Box 2282 Toowoomba Qld 4350

Email: michael.widderick@dpi.qld.gov.au

Kathryn Galea NRM (Condamine Alliance)

Phone: 07 4620 0101

PO Box 3477, Toowoomba,
Village Fair Qld 4350

Email: kathryngalea@netspace.net.au

For further information contact

Steve Walker (Project Leader - (QDPI & F)

Phone: 07 4639 8838

PO Box 2282 Toowoomba Qld 4350

Email: steve.r.walker@dpi.qld.gov.au

Steve Adkins (Project Leader - UQ)

Phone: 07 3365 2072

University of Queensland 4072

Email: s.adkins@mailbox.uq.edu.au

Vikki Osten (QDPI & F)

Phone: 07 4983 7406

LMB 6 Emerald Qld 4720

Email: vikki.osten@dpi.qld.gov.au

Andrew Storrie (NSW Ag)

Phone: 02 6763 1174

RMB 944 Tamworth NSW 2340

Email: andrew.storrie@agric.nsw.gov.au

Chris O'Donnell (UQ)

Phone: 07 5460 1345

University of Queensland 4072

Email: c.odonnell@mailbox.uq.edu.au

the northern HERBICIDE RESISTANCE Reporter

is proudly supported by ...

GRDC
Grains Research & Development Corporation

Queensland Government
Department of Primary Industries and Fisheries

NSW Agriculture

The University of Queensland
Brisbane, Australia

Condamine Alliance
COMPLETE CATCHMENT CARE

CRC Weed management

IF YOU KNOW OF ANYONE INTERESTED IN RECEIVING THIS NEWSLETTER, PLEASE SEND THEIR CONTACT DETAILS TO THE EDITORS

the northern HERBICIDE RESISTANCE Reporter

If undeliverable, return to
PO Box 2282, Toowoomba Qld 4350

Print Post Approved 424022/1517

SURFACE MAIL

POSTAGE PAID AUSTRALIA