

Charles Sturt University

2010 Herbicide Resistance

Testing Service Report

Samples Received

The testing service screened 130 samples in 2010. This was an increase over each of the last three years of approximately 20%, but still less than had been screened in other years since 1996. Every year from 1997 to 2006 had seen at least 150 samples received.

As is always the case the majority of these samples were annual ryegrass (89) but several wild oat and wild radish samples were received (Table 1).

Table 1: Total number of samples received since 2007

	2007	2008	2009	2010
Annual ryegrass	66	79	69	89
Wild oats	32	13	23	28
Wild radish	9	15	11	12
Brome grass	0	0	0	0
Others	3	2	1	1
Total	110	109	104	130

Summary of Results

The results obtained from the 2010 resistance screening are similar in the majority of cases to the results from previous years.

Annual ryegrass

This year, 89 annual ryegrass samples were received, of which 74 were tested to the standard cross-resistance test (Table 2). Of these samples, 15 were also tested to an additional herbicide. A total of ten samples was tested to glyphosate, five to achieve, four to Axial and two each to Sertin, Verdict and Intervix. Fifteen samples were tested to a herbicide or combination of herbicides other than the standard cross-resistance test.

Table 2: Number of samples tested to each of five herbicide groups

	2006	2007	2008	2009	2010
A (fops)	246	61	67	63	70
A (dims)	264	68	78	70	79
B	268	59	71	67	70
C	238	51	76	65	71
D	241	57	75	65	71

Ninety percent of all samples tested to a 'fop' herbicide were classed as either resistant or developing resistance to that herbicide (Table 3). This is within the normal range experienced in previous years.

Twenty six percent of samples tested to a 'dim' herbicide were classed as resistant or developing resistance (Table 3). This was a slight increase on last year and 2006 but lower than both 2007 and 2008. Three samples were tested to Sertin (one resistant) and seven to Achieve (four resistant). Ten samples were screened to Axial with seven of them resistant and five to Fusion of which one was resistant.

Ninety three percent of samples were resistant to Group B herbicides. This was a similar level to the last three years results which were over double the level of previous years. One sample was resistant to simazine (Group C), the first since 2003, and 13% were resistant to trifluralin (Group D) similar to last year (Table 3).

Table 3: Percentage of samples resistant or developing resistance to each of five herbicide groups

	2006	2007	2008	2009	2010
A (fops)	97	91	93	90	90
A (dims)	16	41	58	16	26
B	87	81	85	91	93
C	0	0	0	0	1
D	5	7	19	12	13

Cross and Multiple Resistance

Of the 74 samples submitted for the standard cross resistance test, 85% were resistant or developing resistance to two or more herbicides, a similar level to that recorded the last three years. This reflects the major increase in the level of resistance to the group B herbicides since 2005.

Compared to last year there was a slight increase in the number of samples resistant to three herbicide groups; this reflects the increase in the level of 'dim' resistance compared to last year and an increase in the number of samples tested to Sertin and Achieve. One sample was resistant to four of the groups tested (Table 4).

Table 4: Results of cross resistance screening showing percentage of samples resistant or developing resistance to different groups.

No. of groups	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)
5	0	0	0	0	0
4	0.4	0	6.7	0	1.4
3	12.1	32.7	40.0	21.5	27.0
2	69.0	50.9	38.7	60.0	56.8
1	17.4	16.4	13.3	16.9	13.5
0	1.1	0	1.3	1.6	1.3
No. of samples	245	55	75	65	74

Only one sample tested to the five herbicide group cross resistance test was susceptible to all herbicides.

Herbicide Groups

Among all samples there were major differences between the various groups and in some cases within the different herbicide groups.

Group A herbicides

While Hoegrass and Select were the main herbicides tested, a number of samples were also screened to Verdict, Sertin, Achieve, Fusion and Axial (Table 5).

Group B herbicides

Glean was the major herbicide screened from the Group B herbicides (Table 6). Small numbers of samples were also screened to Logran, Hussar, Intervix and Crusdaer.

Table 5: Results for ryegrass samples showing percentage resistant (Res) or developing resistance (DR) to individual Group A herbicides.

	Tested	Res	DR	%	Susc
<u>'fops'</u>					
Hoegrass	71	59	5	91	6
Verdict	3	2	0	67	1
<u>'dims'</u>					
Select	77	10	7	22	60
Sertin	3	1	0	33	2
Achieve	7	4	0	57	3
<u>'den'</u>					
Axial	10	7	0	70	3
<u>'fop' & 'dim'</u>					
Fusion	5	1	0	20	4

The level of resistance to Glean was similar to last three years results, despite the level of resistance comparative to previous years increasing markedly in 2005 (Table 7).

Table 6: Results for ryegrass samples screened to individual Group B herbicides

	Tested	Res	DR	%	Susc
Glean	61	52	7	96	2
Logran	5	5	0	100	0
Hussar	1	0	1	100	0
Intervix	3	0	0	0	3
Crusader	2	1	1	100	0

Table 7: Level of resistance to Glean and Logran (percentage of samples tested), ** too few samples tested

	2006	2007	2008	2009	2010
Glean	91	84	98	93	96
Logran	83	89	70	**	100

Other herbicides

Annual ryegrass samples were screened to four other herbicides, simazine, atrazine, trifluralin, Stomp and Roundup. The observed incidence of resistance to these herbicides was lower than the resistance to the higher risk Group A and B herbicides (Table 8).

Two samples were found to be resistant or developing resistance to Roundup. These add to the more than 40 confirmed cases of annual ryegrass resistance to Roundup in Australia and this herbicide needs to be treated carefully due to its importance in Australian agriculture.

Table 8: Results for ryegrass samples screened to other herbicide groups.

	Tested	Res	DR	%	Susc
<u>Group C</u>					
Simazine	69	1	0	1	68
Atrazine	3	0	0	0	3
<u>Group D</u>					
Trifluralin	76	3	7	13	66
Stomp	2	0	0	0	2
<u>Group M</u>					
Roundup	15	2	0	13	13

State by State

Samples were received from five states in similar numbers to last year, with the exception of Western Australia which provided significantly more samples this year compared to 2009. For the third consecutive year samples were received from Tasmania (Table 9).

Table 9: Number of ryegrass samples received from each state.

	2006	2007	2008	2009	2010
NSW	122	23	22	32	27
Vic	48	3	22	6	10
SA	3	3	3	2	1
WA	92	37	26	27	44
Tas	0	0	6	2	7

With the very low number of samples received from South Australia and Tasmania the data for these states has not been analysed separately (Figure 1).

Twenty nine percent of samples from Western Australia were resistant to 'dim' herbicides compared to twenty six percent from New South Wales and seventeen percent from Victoria. All New South Wales samples were resistant to Group B herbicides. More samples from Victoria and Western Australia had Group D resistance compared to New South Wales samples (Figure 1).

Similar to the last five years but in comparison to the prior to 2005 the level of group B resistance has increased markedly. The reason for this is unknown however the availability and use of the newer group B (On Duty, Hussar and Atlantis) herbicides may be a factor. Another reason could be that the failure of a Group B herbicide is now acting as a critical factor in the decision to supply a sample for resistance testing.

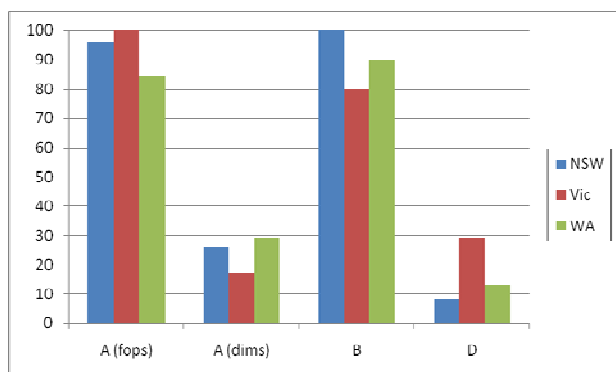


Figure 1: Percentage of ryegrass samples resistant and developing resistance for each state.

Wild Oats

The number of wild oat samples (28) received was similar to three of the last four years on a percentage of total samples basis (Table 10). All wild oat samples came from New South Wales.

Table 10: Number of wild oat samples received and percentage of total samples

	2006	2007	2008	2009	2010
Total	350	110	109	104	130
Wild oats	55	32	13	23	28
Percentage	15.7	29.1	11.9	22.1	21.5

The level of 'fop' resistance among the samples was 84%, significantly higher than last year but similar to previous years (Table 11). Last year 11 samples were screened to both Verdict and Wildcat, this year only three samples were screened to Verdict and 21 to Wildcat. Over the last two years there has been a difference between the two 'fop' herbicides tested. None of the samples screened to Verdict were classed as resistant compared to many of the samples screened to Wildcat.

Some of the samples screened to Verdict over the last two years had significant survival levels at half the recommended rate but were well controlled at the recommended rate and therefore classed as susceptible. Investigations are being undertaken to examine any differences in efficacy of Verdict in glasshouse trials compared to field evaluations.

For the 'dim' herbicides, none of the samples were resistant to Select (24 samples) or Achieve (one sample). Two of the six samples were found to be resistant to Axial while one sample was classed as developing resistance to Atlantis (Table 11).

Three of twenty one samples were found to be either resistant or developing resistance to Mataven, formerly Group K now a Group Z herbicide (Table 11).

Table 11: Group A resistance percentage for wild oat samples since 2004 (number tested in brackets)

	2007 % (no.)	2008 % (no.)	2009 % (no.)	2010 % (no.)
'fops'	100 (22)	69 (13)	27 (22)	84 (25)
'dims'	15 (33)	14 (14)	0 (24)	0 (25)
B	8 (13)	0 (1)	11 (9)	17 (6)
Z	13 (15)	30 (10)	32 (22)	14 (21)

Other grass species

One sample of barley grass was received. It was susceptible to Crusader.

Broadleaf species

Twelve wild radish samples were provided for resistance screening. All of them were from Western Australia.

Fifty eight percent of samples were resistant to Group B herbicides with five samples screened to

Glean (three resistant), three to Logran (one resistant) and four to Intervix (three resistant). No samples were found to be resistant to Brodal (11 tested), Simazine (6 tested) or Ester 680 (five tested), but for both Atrazine (six tested) and 24D Amine (6 tested) one sample was found to be resistant. The only sample tested to bromoxynil was classified as susceptible.

Final Observations

- The number of samples received increased by 20% compared to last year but markedly lower than years prior to 2007 showing the extent and degree of the drought.
- Samples of annual ryegrass were received from five states (NSW, Vic, Tas, SA and WA) but both wild oats and wild radish were only received from one state, NSW and WA respectively.
- For ryegrass samples the level of resistance remained constant for 'fops' and Group B but increased for the 'dims'.
- The level of Group B resistance has not changed over the last five years; all five years were markedly higher than prior to 2005.
- The level of trifluralin resistance in Western Australia has remained higher than NSW levels for the second consecutive year.
- The level of resistance in wild oats to group A 'fop' herbicides returned to levels similar to 2008 and before, however all samples screened to Verdict were susceptible as happened in 2009.
- The number of wild oat samples resistant to Mataven continues to increase.
- Wild radish samples were resistant to three of the herbicide groups (B, C and I) tested.

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