

Samples Received

The testing service screened 351 samples in 2012. This was an increase compared to last years of over 500%, and more than had been screened in other years since 2006. With the exception of the years when samples were received through WeedSense this was only the third year out of 19 years when sample numbers exceeded 350. Much of this increase can be attributed to the large number of samples received from the Delta Agribusiness stores who supplied 163 samples.

As is always the case the majority of these samples were annual ryegrass (256) but large number of wild oat and wild radish samples were also received (Table 1).

Table 1: Total number of samples received since 2009

	2009	2010	2011	2012
Annual ryegrass	69	89	42	256
Wild oats	23	28	11	73
Wild radish	11	12	8	18
Brome grass	0	0	0	0
Others	1	1	1	4
Total	104	130	62	351

Summary of Results

The results obtained from the 2012 resistance screening are similar in the majority of cases to the results from previous years.

Annual ryegrass

This year, 256 annual ryegrass samples were received, of which 240 were tested to five or more herbicides (Table 2). However, only 48 of these were tested to the standard cross-resistance test (Groups A 'fop', A 'dim', B, C and D) with only 67 of the 240 samples being screened to a Group A 'fop' herbicide. In many cases a second Group A 'dim' or a 'den' herbicide replaced the Group A 'fop' herbicide in the selected herbicides.

Ninety seven samples were also tested to a sixth herbicide and one to seven and one to eight herbicides. Of the 99 samples, 89 were tested to Roundup with the other herbicides being a variety of Group A or B herbicides.

Ninety six 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 range experienced in previous years.

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

	2008	2009	2010	2011	2012
A (fops)	67	63	70	36	75
A (dims)	78	70	79	42	394
A (dens)	15	2	10	1	42
B	71	67	70	35	172
C	76	65	71	39	218
D	75	65	71	39	236
M	11	8	15	23	186

Fifty percent of samples tested to a 'dim' herbicide were classed as resistant or developing resistance (Table 3). This was an increase on the last two years but similar to 2008. With the higher proportion of samples screened to Achieve this was the expected result, with 25% of samples resistant or developing resistance to Select compared to 93% to Achieve. Of the 42 samples screened to Axial 81% were resistant or developing resistance.

Eighty five percent of samples were resistant to Group B herbicides, a similar level to three of the last four years. Two samples were developing resistance to atrazine (Group C), and 5% were resistant to trifluralin (Group D) lower than three of the last four years (Table 3).

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

	2008	2009	2010	2011	2012
A (fops)	93	90	90	83	96
A (dims)	58	16	26	43	50
A (dens)	87	100	70	100	81
B	85	91	93	74	85
C	0	0	1	0	1
D	19	12	13	3	5

Cross and Multiple Resistance

Of the 240 samples screened to five or more herbicides, 156 were screened to five different herbicide groups 80% were resistant or developing resistance to two or more herbicides, a similar level to that recorded the last four years. This reflects the major increase in the level of resistance to the group B herbicides since 2005. Two samples were resistant to four of the groups tested and two samples were susceptible to all herbicides (Table 4).

Among the 76 samples tested to four herbicide groups, 45% were resistant to two groups and 50% to one herbicide group. This reflects the removal of the Group A ‘fop’ and/or Group B ‘SU’ from the test and its replacement with a ‘dim’ and/or ‘den’ herbicide.

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

No. of groups	2008 (%)	2009 (%)	2010 (%)	2011 (%)	2012 (%)
5	0	0	0	0	0
4	6.7	0	1.4	5.6	1.3
3	40.0	21.5	27.0	19.4	12.8
2	38.7	60.0	56.8	47.2	66.0
1	13.3	16.9	13.5	27.8	18.0
0	1.3	1.6	1.3	0	1.9
No. of samples	75	65	74	36	156

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, samples were also screened to Verdict, Achieve, Axial, Factor, Fusion and Decision (Table 5).

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	70	63	5	97	2
Verdict	4	3	0	75	1
<u>‘dims’</u>					
Select	242	33	28	25	181
Achieve	141	115	15	92	11
Factor	10	2	5	70	3
<u>‘den’</u>					
Axial	42	30	4	81	8
<u>‘fop’ & ‘dim’</u>					
Fusion	4	4	0	100	0
Decision	2	2	0	100	0

Group B herbicides

A similar number of samples were screened to Glean and Logran (Table 6). Samples were also screened to Atlantis, Intervix, Hussar and Crusader.

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

	Tested	Res	DR	%	Susc
Glean	62	46	4	80	12
Logran	55	53	1	98	1
Atlantis	14	6	1	50	7
Hussar	5	3	0	60	2
Intervix	18	14	2	89	2
Crusader	17	16	1	100	0

Other herbicides

Annual ryegrass samples were screened to six other herbicides, simazine, atrazine, trifluralin, Sakura, Roundup and Sprayseed. The observed incidence of resistance to these herbicides was lower than the resistance to the higher risk Group A and B herbicides (Table 7).

Sixteen samples were found to be resistant or developing resistance to Roundup. This adds 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. Additionally the single herbicide tested to Sprayseed was found to be resistant to that herbicide.

Table 7: Results for ryegrass samples screened to other herbicide groups.

	Tested	Res	DR	%	Susc
<u>Group C</u>					
Simazine	93	0	0	0	93
Atrazine	125	0	2	2	123
<u>Group D</u>					
Trifluralin	236	3	9	5	224
<u>Group K</u>					
Sakura	6	0	0	0	6
<u>Group L</u>					
Sprayseed	1	1	0	100	0
<u>Group M</u>					
Roundup	186	12	4	8	170

State by State

The majority of samples came from New South Wales with Western Australia also supplying a significant number of samples. Victoria, Tasmania and South Australia only provided nine samples between the three states (Table 8).

Table 8: Number of ryegrass samples received from each state.

	2008	2009	2010	2011	2012
NSW	22	32	27	25	196
Vic	22	6	10	2	5
SA	3	2	1	0	1
WA	26	27	44	15	50
Tas	6	2	7	0	3

With the very low number of samples received from Victoria, South Australia and Tasmania only the data for New South Wales and Western Australia has been analysed separately (Figure 1).

Similar results were found for samples from New South Wales and Western Australia with 96% of samples from both states resistant to 'fop' herbicides. The proportion of samples resistant to Group B herbicides was 88% for New South Wales samples and 86% for the Western Australian samples while for the 'dim' herbicides it was 51% and 45% respectively. Group D resistance was much lower with 5% of samples from New South Wales resistant compared to 2% from Western Australia (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.

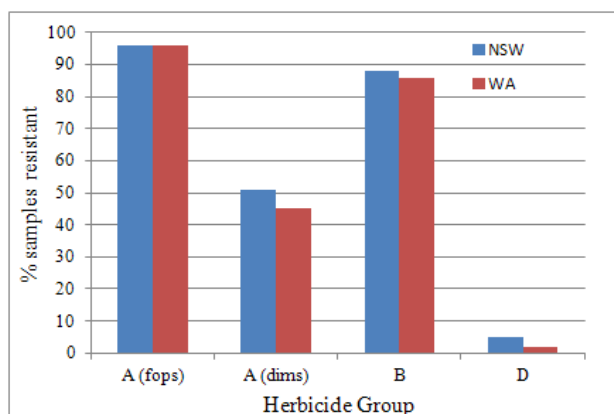


Figure 1: Percentage of ryegrass samples resistant and developing resistance for NSW and WA.

Wild Oats

The number of wild oat samples (73) received was higher than any year since 2003 when 86 samples were received and the third highest ever. On a percentage basis for the 15 years when more than 100 samples of all species have been received this

was only the fourth year when wild oats comprised more than 20% of total samples received (Table 9). All but one of the wild oat samples came from New South Wales, the other sample was supplied from Queensland.

Table 9: Number of wild oat samples received and percentage of total samples

	2008	2009	2010	2011	2012
Total	109	104	130	62	351
Wild oats	13	23	28	11	73
Percentage	11.9	22.1	21.5	17.7	20.8

The level of 'fop' resistance among the samples was 74%, lower than the last two years but with a marked increase in the numbers tested (Table 10). Forty five samples were tested to Wildcat (40 resistant), 15 to Topik (8 resistant), eight to Verdict (2 resistant) and 3 to Hoegrass (all resistant).

For the 'dim' herbicides, three out of seventy samples tested were resistant to Select and two out of five were resistant to Achieve. There was a vast increase in the number of samples tested to Axial, 51, six of these samples were resistant (Table 10).

Forty five samples were tested to Atlantis with five resistant and one of the six samples tested to Crusader was resistant while the only sample tested to Midas was susceptible. Three samples were tested to Mataven (Group Z), two of which were resistant (Table 10). All of the 43 samples tested to Avadex were susceptible.

Table 10: Percentage of wild oat samples found to be resistant since 2009 (number tested in brackets)

	2009 % (no.)	2010 % (no.)	2011 % (no.)	2012 % (no.)
'fops'	27 (22)	84 (25)	89 (9)	74 (71)
'dims'	0 (24)	0 (25)	0 (8)	7 (75)
'dens'	0 (3)	33 (6)	50 (4)	12 (51)
B	11 (9)	17 (6)	0 (4)	12 (52)
Z	32 (22)	14 (21)	13 (8)	67 (3)

Broadleaf species

Eighteen wild radish and two Indian hedge mustard samples were provided for resistance screening. Fourteen of the wild radish samples were from Western Australia and four from New South Wales. Both Indian hedge mustard samples were from New South Wales.

Seventy five percent of samples were resistant to Group B herbicides with six samples screened to Glean (four resistant), three to Logran (two resistant), two to Hussar (both resistant), eight to Intervix (seven resistant) and one to Broadstrike (susceptible). One sample was found to be

developing resistance to Brodal (seventeen tested). No samples were resistant to 24D Amine (ten tested), MCPA Amine (three tested), Ester (nine tested), Simazine (seven tested), Atrazine (seven tested) or Roundup (twelve tested).

Final Observations

- The number of samples received increased by more than 500% compared to last year, the most since 2006. This increase in numbers from the last few years means care needs to be taken if only using the percentage of samples resistant to specific groups without considering the number tested.
- Samples of annual ryegrass were received from six states (NSW, Vic, and WA) with wild radish and wild oats received from two states and Indian hedge mustard from NSW only.
- For ryegrass samples the level of resistance remained constant for all herbicide groups compared to last year except for Group M (Roundup).
- A larger percentage than normal of the ryegrass samples were resistance to Roundup. However several of the samples were from the high risk areas of irrigation channels and road sides.
- The level of Group B resistance has not changed over the last six years; all years were markedly higher than prior to 2005.
- The level of resistance in wild oats to group A 'fop' herbicides was slightly lower than 2010 and 2011, perhaps a reflection of the higher number of samples tested.
- Wild radish samples were resistant to three herbicide groups (B, C and I) compared to two last year (B and I) but the same as 2010 (B, C and I).

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Testing forms and annual reports are available at:

<http://www.csu.edu.au/research/grahamcentre/producers/herbicideresistancetesting.htm>

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