Farrer Centre

2003 Herbicide Resistance

Testing Service Report

Samples Received

For the 2003 resistance testing 769 samples were received, a decrease of 14% on the previous year but still four times that received in 2000. This was the result of the Dow WeedSense (WS) program, which provided 607 samples. The Farrer Centre (FC) received 162 samples direct from farmers or agents, this was approximately half the samples received last year.

The majority of these samples were annual ryegrass (643, 512 WeedSense and 131 Farrer Centre) but a large number of wild oat (86) and wild radish (30) samples were received (Table 1).

Wild oat sample receivals were slightly lower than last year but still markedly higher than any other year. More wild radish samples were received this year than any other year, this is mainly due to these weeds being included in WeedSense (wild oats - 62 and wild radish - 28) but also a result of increased resistance concerns with these species.

Table 1: Number of samples received since 2000

	2000	2001	2002	2003
Annual ryegrass	159	555	735	643
Wild oats	32	20	126	86
Wild radish	1	4	21	30
Brome grass	2		4	4
Others			9	6
Total	194	579	895	769

Summary of Results

The results obtained from the 2003 resistance screening differ markedly in some areas from years prior to 2001 as they have done since the onset of the WeedSense program in 2001.

Prior to 2001 all samples received for testing were from paddocks where resistance was **suspected** and the testing was to confirm initial suspicions. Since 2001 a large number of samples have been provided through the WeedSense program and while resistance would have been suspected in some of these paddocks in many cases the sample was provided for testing because the tests were provided **free** to the farmer upon meeting certain conditions.

Annual ryegrass

WeedSense provided 512 ryegrass samples and 131 were sent direct to the Farrer Centre. As a result 633 samples were tested to the standard cross-resistance test (Table 2). In addition, all WeedSense samples and a number of the Farrer Centre samples were tested for resistance to Roundup. Ten 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

	2000	2001	2002	2003
A (fops)	149	537	722	631
A (dims)	147	531	734	653
B	132	357	722	658
C	126	330	690	637
D	125	342	683	633

Seventy-four percent of all samples tested to a 'fop' herbicide were classed as either resistant or developing resistance to that herbicide (Table 3). This is markedly below the results of years prior to 2001 but similar to 2002. However, 81% of samples provided direct to the Farrer Centre were either resistant or developing resistance to a ‘fop’, compared to 72% via WeedSense (Figure 1).

Eighteen percent of samples tested to a ‘dim’ herbicide were classed as resistant or developing resistance. There was no difference between WeedSense samples and Farrer Centre samples in the level of resistance to ‘dim’ herbicides (Table 3, Figure 1).

Forty-three percent of samples were resistant to Group B herbicides. This was lower among the Farrer Centre samples (36%) than the WeedSense samples (46%). One percent of samples were resistant to simazine (Group C) with four percent were resistant to trifluralin (Group D) (Table 3, Figure 1).

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

	2000	2001	2002	2003
A (fops)	98	65	76	74
A (dims)	15	34	19	18
B	32	31	38	43
C	1	1	0	1
D	10	8	7	4

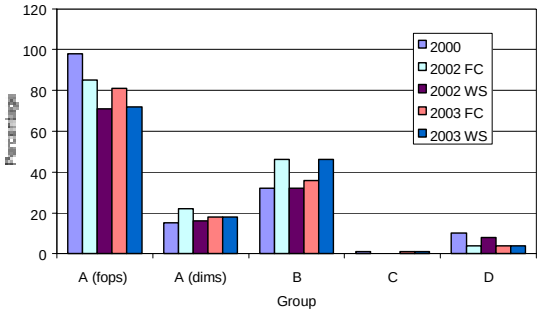

Figure 1: Percentage of samples resistant or developing resistance to each of five herbicide groups from two sample sources

Figure 1 shows that the level of resistance to the 'fop' herbicides was lower in the WeedSense samples than in the Farrer Centre samples, this is similar to both 2001 and 2002. The level of 'dim' resistance detected was similar for both sample sources, as was the situation in 2001. A slight reduction in the level of 'fop' resistance of the Farrer Centre samples was detected this year while the level detected in the WeedSense samples has remained the same as last year.

The level of group B resistance for samples from both sources was five percent higher this year than last year, an increase of 13 % in the last two years. However for the first time resistance to the Group B herbicides was higher in the WeedSense samples than in Farrer Centre samples. (Figure 1).

Cross and Multiple Resistance

The samples received can be divided into two categories (WeedSense or Farrer Centre cross-resistance) when determining the level of cross or multiple resistance.

633 samples were tested to five herbicide groups (WeedSense and Farrer Centre cross resistance tests). 528 samples were also tested to Roundup in addition to the five herbicides, all but nine WeedSense samples plus 23 Farrer Centre samples. Of the 633 samples, 43% were resistant or developing resistance to two or more herbicides with four samples resistant to four of the groups tested. These samples can be further divided into the two different tests with 512 samples in the Dow tests and 121 from the Farrer Centre tests (Table 4).

Table 4: Results of cross resistance screening showing percentage of samples resistant or developing resistance to different groups and number of tests in each group.

		2002		2003	
No. of groups	2000 (%)	FC (%)	WS (%)	FC (%)	WS (%)
6	0	0	0	0	0
5	0	0	0	0	0
4	2.5	0.4	0.4	0	0.4
3	10.8	10.5	7.9	6.6	8.8
2	35.8	40.4	27.3	32.2	34.8
1	48.4	41.2	48.2	47.1	40.8
0	2.5	7.5	16.2	14.1	15.2
No. of samples	120	228	469	121	512

The level of cross-resistance in samples sent direct to the Farrer Centre decreased compared to previous years. In 2002 over 50% of samples were resistant to two or more herbicide groups while this year it was only 39%. In addition, there was nearly a doubling in the percentage of samples susceptible to all herbicides (7.5% compared with 14%). In comparison although WeedSense samples returned similar results for resistance to greater than three groups and susceptible to all herbicides there was an eight percent increase in resistance to two groups.

State by State

Samples were received from four states with major decreases in numbers received from three states, however the number of samples received from South Australia more than doubled (Table 5).

Table 5: Number of samples received from each state.

	2001	2002			2003		
	Total	FC	WS	Total	FC	WS	Total
NSW	**201**	100	165	**265**	29	94	**123**
Vic	**149**	36	147	**183**	17	103	**120**
SA	**127**	46	84	**130**	48	224	**272**
WA	**74**	84	73	**157**	37	91	**128**

The level of 'fop' resistance detected was highest in Victorian samples, with the other states returning similar results. This difference was the result of a higher level of 'fop' resistance in the WeedSense samples as there was minimal difference in 'fop'

resistance among samples sent direct to the Farrer Centre.

As was the case in 2002, Western Australia had the highest 'dim' and group B resistance overall with New South Wales samples having a similar resistance level to group B herbicides. New South Wales also had a similar level of resistance to 'dims' in samples sent direct to the Farrer Centre.

As was also the case last year South Australian and Victorian samples had the highest level of resistance to group D. The samples resistant to group C herbicides came from Victoria (WeedSense) and Western Australia (Farrer Centre) while all samples resistant to group D sent direct to the Farrer Centre came from South Australia.

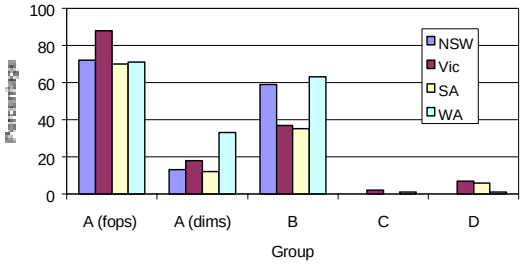

Figure 2: Percentage of samples resistant and developing resistance for each state.

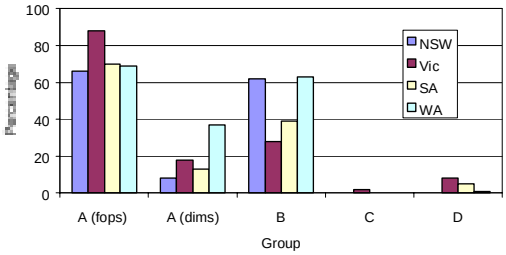

Figure 3: Percentage of WeedSense samples resistant and developing resistance for each state.

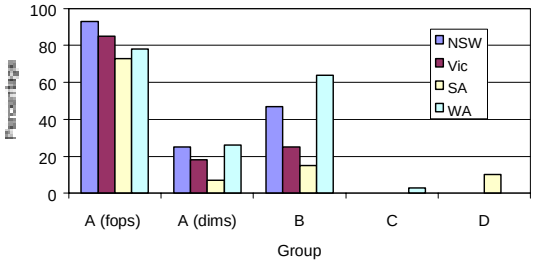

Figure 4: Percentage of samples sent direct to Farrer Centre resistant and developing resistance for each state.

Group A herbicides

The data below for Hoegrass and Verdict appear different. Previous Farrer Centre trials have shown **100% correlation** between Hoegrass and Verdict resistance in annual ryegrass. The difference here is the result of the different methods via which the samples were provided. All Hoegrass samples were provided direct to the Farrer Centre while all but six Verdict samples came through WeedSense. A comparison of Figure 1 and Table 6 confirms this explanation.

While Hoegrass, Verdict and Select were the main herbicides tested, a number of samples were also screened to Sertin, Achieve, and Fusion. A single sample was screened to Targa and two to Aramo will all three being resistant (Table 6).

Table 6: Results for individual Group A herbicides showing percentage resistant (Res) or developing resistance (DR) to each herbicide.

	Tested	Res	DR	%	Susc
'fops'					
Hoegrass	110	78	9	**79**	23
Verdict	507	314	55	**73**	138
'dims'					
Select	604	44	44	**14**	516
Sertin	22	13	0	**59**	9
Achieve	16	10	2	**75**	4
'fop' & 'dim'					
Fusion	8	1	1	**25**	6

Group B herbicides

Glean, Logran, On Duty and Hussar were screened from the Group B herbicides with resistance detected to all herbicides (Table 7).

Table 7: Results for individual Group B herbicides

	Tested	Res	DR	%	Susc
Glean	278	61	55	**42**	162
Logran	343	79	74	**45**	190
On Duty	3	0	1	**33**	2
Hussar	12	2	6	**67**	4

Other herbicides

Annual ryegrass samples were screened to five other herbicides, Dual gold (two samples, both Susc), simazine, atrazine, trifluralin and Roundup. As these are low risk herbicides for the development of resistance the level of resistance was lower than for the Group A and B herbicides (Table 8).

Table 8: Results for other herbicides

	Tested	Res	DR	%	Susc
Group C					
Simazine	550	0	4	**1**	546
Atrazine	83	0	0	**0**	83
Group D					
Trifluralin	618	7	17	**4**	594
Group M					
Roundup	528	2	0	**0.4**	526

Wild Oats

The number of wild oat samples received decreased in 2003. 86 samples were received compared to 126 in 2002. Of the samples, 62 were provided via WeedSense and as such the possibility of resistance for these was expected to be lower as was experienced with the annual ryegrass (Table 9).

The level of 'fop' resistance among the Farrer Centre samples was 89%, similar to last year and increase on previous years while only 20% of WeedSense samples had 'fop' resistance. Three samples were developing resistance to 'dim' herbicides, two to Select and one to Sertin. No samples were found to be resistant to any of the other tested herbicide groups (B, C, D, E, K or M).

Table 9: Level of group A resistance (%) and number of wild oat samples since 2000 (FC = Farrer Centre, WS = WeedSense).

	2000	2002 FC	2002 WS	2003 FC	2003 WS
	% (no.)	% (no.)	% (no.)	% (no.)	% (no.)
'fops'	77(27)	87(31)	23(93)	88(24)	20(60)
'dims'	4(25)	0(29)	2(93)	5(20)	3(58)

Other weed species

Thirty-three broadleaf weed samples (wild radish and Indian hedge mustard) were provided for resistance screening in 2003. Wild radish samples resistant to group B herbicides, Glean (1 out of 5) and Logran (6 out of 25) were detected while Indian hedge mustard samples were found to be resistant to group B herbicides (Glean and Logran).

Four brome grass samples were received, two of which were found to be resistant to both 'fops' and 'dims'.

Three barley grass samples were received and tested to Roundup (two – both susceptible) and SpraySeed (one – susceptible).

Final Observations

- Two samples were found to be resistant to Roundup.
- There was a large reduction in samples received from New South Wales, Victoria and Western Australia but an equally large increase in sample receivals from South Australia.
- Among the Farrer Centre samples resistance levels declined comparative to 2002 apart from the group C and D.
- The level of 'fop' resistance was lower among the samples provided via WeedSense compared to samples provided direct to the Farrer Centre. However, group B resistance was higher in WeedSense samples.
- Victoria had the highest level of 'fop' resistance with the other three states having similar levels.
- The level of 'dim' resistance was highest in Western Australia
- New South Wales and Western Australian samples exhibited at 50% higher level of resistance to group B herbicides compared to Victoria and South Australia.
- Higher trifluralin resistance in South Australia and Victoria.
- The level of resistance in wild oats to group A 'fop' herbicides has remained constant in samples sent direct to the Farrer Centre.

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