Controlling stacked resistant radish with herbicides

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Key messages

- Herbicide resistant wild radish can be controlled well by a range of herbicides if applied early when weeds are small.
- A two-spray strategy has proven to be very effective at controlling problem wild radish, particularly when the first spray is effective and is done as early as possible on small weeds with a reliable mode of action.

Aims

Determine what herbicide mode of action and application strategy will best control a known multiple herbicide group resistant wild radish population.

Method

1. Trial 1 (HUSBANDS) was at Paul Husbands farm in Northampton. This site was resistance tested by Elders and Plant Science Consulting and found have concerning levels of resistance to 4 herbicide groups. First Spray Treatments at 2-leaf of the wheat crop – applied with a TEEJET AIXR11002 nozzle at 60 L/Ha, 600KPA and 12 km/hr.

1. Nil 2. 1500 ml Bromicide® 200 3. 1000ml Jaguar® 4. 670ml Velocity® + 1% Hasten®

Table 1 Layout of first spray treatments (T1) applied at 2 leaf of the wheat crop.

	48m	buffer 6m	48m	buffer 6m	48m
9m	nil		Velocity®		Jaguar®
9m	Bromicide 200® @ 1.5L		nil		Velocity®
9m	Jaguar @1.0L		Bromicide 200®		nil
9m	Velocity® @670ml		Jaguar®		Bromicide 200®
	plots 1-14		plots 15 - 28		plots 29 - 52

The second spray treatments were applied at 5 leaf – applied with an AGROTOP AIRMIX 110 01 nozzle at 2 bar at 98 L/Ha at 4 km/hr. The second treatments were applied at right angles across the first spray treatments in what is known as a criss-cross trial pattern.

Resistance Profile of the trial site population:

Glass House Resistance tests by Plant Science Consulting / Belinda Eastough (Elders):

100% survival to 40g Logran® (B)

0% survival with 1400ml Bromoxynil (C)

0% survival with 500ml Velocity® (H,C)

45% survival to 2L Simazine (C)

85% survival to 200ml Brodal® (F)

60% survival to 650ml 2,4-D Ester (I)

Table 2 Second Spray treatments (T2) applied at 5-leaf of the crop, over the top of the 2-leaf treatments[1].

Trt	Herbicide Treatment and Adjuvant		Rate/Ha or % volume
1	nil		0
2	Velocity + Uptake		800ml + 0.5%
3	Flight 720 EC		720ml
4	Precept 150 + Lexone + amsul		1500ml + 60g +1%
5	Estericide 680 + Logran + Uptake		800ml + 10g + 0.5%
6	Tigrex + Ecopar		1000ml + 200ml
7	Precept 150 + Ecopar + Amsul		1000ml + 200ml + 1%
8	Jaguar + Agritone 570 LVE		500ml + 440ml
9	Jaguar + Estericide 680		1000ml + 800ml
10	Precept 150 + Bromicide MA + Uptake		1500ml + 1000ml + 0.5%
11	Velocity + Jaguar + Estericide 680		670ml + 500ml + 800ml + 0.5%
12	FMZ 1209 + Bromicide MA		250ml + 750ml
13	Velocity + Xpand + Uptake		670ml + 125g + 0.5%
14	Nil		

[1]This layout then achieved a trial that had 56 (4 x 14) treatments of 9m x 2m area, replicated 3 times. Some of the treatments above are currently unregistered.

Results

The data in Table 3 clearly demonstrates the success of the 2 spray strategy when Bromicide 200, Jaguar and Velocity were used at the early 2 leaf **(T1)** timing. When no late spray was used to clean up survivors, Velocity was the most reliable early spray, as indicated by 97% and 100% weed control in the two nil late spray treatments (Trt 1&14). At 10 days after Treatment 2 **(T2),** Velocity® at 800ml, Tigrex® + Ecopar® and Precept 150® + Ecopar® gave significantly higher crop phytotoxicity results ($p<0.05$) than the other treatments.

When there was no early spray applied, the later 5-leaf sprays **(T2)** were put under a great deal of pressure. With approximately 200 radish plants/m^2, there was shading of radish by other radish in many plots. If the treatment did not contain a systemic mode of action, then some of the contact only modes of action were put under more pressure. This is demonstrated by the one late spray of 800ml of Velocity® at 5-leaf achieving 93% control, but an early spray at the 2-leaf stage on much smaller weeds achieved 100% control. This trial also shows that most treatments recommended by the RCSN group were successful in controlling this population, even in light of the very high levels of resistance present in the test results.

Table 4 shows that a yield advantage of 400-500 kg/ha was consistently achieved if an early 2-leaf spray (T1) of either Bromicide 200®, Jaguar® or Velocity® is followed up with any number of the 5-leaf spray (T2) options. Yields ranged from 2.63 - 3.06t/ha when only one late T2 spray was applied. When the two-spray strategy (T1 & T2) was implemented, yields ranged from 3.1-3.64 t/ha throughout the trial. In one case, the combination of an early Bromicide 200® spray at T1 took the yield of treatment 12 (FMZ1209 + Bromicide MA® at 5-leaf) from 2.63t/ha to 3.64 t/ha, which was a yield increase of 1.01 t/ha. Given a radish density of 200 plants/m^2, these results demonstrate the importance of spraying early for improved efficacy and yield benefits.

Treatment 1 & 14 (no late sprays) shows how effective the early spray choice is on removing radish and preserving grain yield. In treatment 14, with no spraying at all, the crop yielded 1.91t/ha. The early Jaguar spray with no T2 treatment yielded 3.10 t/ha. Early Bromoxynil with no T2 yielded 3.21t/ha. The early Velocity® treatment with no T2 spray yielded 3.47 t/ha. This is similar to the project findings in 2012 that also showed that Velocity® was the preferred first spray for optimum yield.

Table 3 Crop Phytotoxicity (%) 11 Days after Application (DAA) of T2 Treatment and Efficacy (% plant death) at 11 and 105 Days after T2 Treatment at HUSBANDS Northampton.

			no early T1 spray			T1 1500ml Brom 200 z12			T1 1000ml Jaguar z12			T1 670ml Velocity z12		
No.	**T2 Treatments**	**Rate/Ha or % Volume**	**crop phyto 10 DAA (%)**	**EFFICACY 10DAA (%)**	**EFFICACY 64DAA %**	**crop phyto 10 DAA (%)**	**EFFICACY 10DAA (%)**	**EFFICACY 64DAA %**	**crop phyto 10 DAA (%)**	**EFFICACY 10DAA (%)**	**EFFICACY 64DAA %**	**crop phyto 10 DAA (%)**	**EFFICACY 10DAA (%)**	**EFFICACY 64DAA %**
1	Nil #1	0	**20**	0	0	20	93	73	20	94	90	**23**	96	**100**
2	Velocity + Uptake	800ml + 0.5%	**23**	54	93	**23**	**100**	**100**	**25**	**100**	**100**	**25**	**100**	**100**
3	Flight 720 EC	720ml	15	63	**100**	13	98	**100**	13	**100**	**100**	13	**100**	**100**
4	Precept 150 + Lexone + Amsul	1500ml + 60g	7	68	**100**	13	**100**	**100**	10	**100**	**100**	7	**100**	**100**
5	Estericide 680 + Logran + Uptake	800ml + 10g + 0.5%	7	17	**100**	7	93	**100**	4	98	**100**	7	99	**100**
6	Tigrex + Ecopar	1000ml + 200ml	**23**	69	**100**	**22**	**100**	**100**	**20**	**100**	**100**	**23**	**100**	**100**
7	Precept 150 + Ecopar + Amsul	1000ml + 200ml + 1%	18	66	98	18	**100**	**100**	**22**	**100**	**100**	**20**	**100**	**100**
8	Jaguar + Agritone 570 LVE	500ml + 440ml	8	31	91	8	97	**100**	7	**100**	**100**	8	**100**	93
9	Jaguar + Estericide 680	1000ml + 800ml	10	52	**100**	10	99	**100**	10	97	**100**	8	**100**	**100**
10	Precept 150 + Bromicide MA + Uptake	1500ml + 1000ml + 0.5%	7	82	**100**	10	99	**100**	10	**100**	**100**	8	**100**	**100**
11	Velocity + Jaguar + Estericide 680	670ml + 500ml + 800ml + 0.5%	13	90	**100**	13	**100**	**100**	12	**100**	**100**	12	**100**	**100**
12	FMZ 1209 + Bromicide MA	250ml + 750ml	12	28	77	15	98	**100**	12	**100**	**100**	12	**100**	**100**
13	Velocity + Xpand + Uptake	670ml + 125g + 0.5%	15	60	**100**	15	**100**	**100**	15	**100**	**100**	15	**100**	**100**
14	nil #2	0	0	0	0	0	88	67	0	81	75	1	99	97
			27	62	166	28	7	172	27	7	174	22	2	7
			20	46	123	20	5	127	20	5	129	16	1	5
			94	56	88	91	3	79	92	3	79	74	1	3

Table 4 Crop Yield (t/ha) and yield (%) compared to nil of all treatments at the HUSBANDS site at Northampton.

			no early T1 spray		T1 1500ml Brom 200 z12		T1 1000ml Jaguar z12		T1 670ml Velocity z12	
No.	**T2 Treatments**	**Rate/Ha or % Volume**	**YIELD %**	**YIELD T/HA**	**YIELD %**	**YIELD T/HA**	**YIELD %**	**YIELD T/HA**	**YIELD %**	**YIELD T/HA**
1	Nil #1	0	100	2.88	100	3.12	100	3.27	100	3.17
2	Velocity + Uptake	800ml + 0.5%	96	2.76	103	3.20	101	3.31	104	3.28
3	Flight 720 EC	720ml	95	2.73	103	3.22	103	3.37	104	3.29
4	Precept 150 + Lexone + amsul	1500ml + 60g	97	2.80	101	3.17	**106**	3.47	101	3.19
5	Estericide 680 + Logran + Uptake	800ml + 10g + 0.5%	91	2.63	98	3.05	103	3.37	102	3.24
6	Tigrex + Ecopar	1000ml + 200ml	94	2.71	107	3.34	100	3.26	104	3.31
7	Precept 150 + Ecopar + Amsul	1000ml + 200ml + 1%	93	2.69	**109**	3.41	97	3.16	105	3.33
8	Jaguar + Agritone 570 LVE	500ml + 440ml	91	2.62	105	3.29	**108**	3.53	98	3.11
9	Jaguar + Estericide 680	1000ml + 800ml	98	2.81	**112**	3.50	102	3.35	105	3.32
10	Precept 150 + Bromicide MA + Uptake	1500ml + 1000ml + 0.5%	95	2.73	**111**	3.48	101	3.32	**108**	3.43
11	Velocity + Jaguar + Estericide 680	670ml + 500ml + 800ml + 0.5%	95	2.74	**110**	3.43	104	3.39	101	3.19
12	FMZ 1209 + Bromicide MA	250ml + 750ml	91	2.63	**117**	3.64	99	3.23	101	3.21
13	Velocity + Xpand + Uptake	670ml + 125g + 0.5%	106	3.06	105	3.29	**107**	3.50	105	3.33
14	nil #2	0	66	1.91	99	3.10	98	3.21	**110**	3.47
			21	0.60	11	0.33	6	0.21	9	0.30
			15	0.44	8	0.25	5	0.15	7	0.22
			3.39	9.76	1.42	4.44	0.84	2.80	1.26	3.98

numbers in bold are significantly different (P<0.05) from trt 1.

Conclusion

The trial work conducted here fully supports the findings from year 1 of the Geraldton RCSN project (2012), that early spraying of small weeds followed by a timely second follow up spray, with a robust herbicide rate, is highly effective at controlling resistant radish populations. The 2013 data clearly shows that there are other options for the two spray strategy than two consecutive doses of pyrasulfatole (Group H). However, the data do show that herbicide mixes containing pyrasulfatole are highly effective and reliable in many conditions. The trial also shows that there are significant improvements in efficacy and grain yield by implementing a 2 spray strategy when radish density is high. This season had a significant dry spell for most of June, which may have emphasized the grain yield losses from late weed control. Yield gains of up to 1 t/ha were achieved at the Husbands site from doing the 2 spray strategy instead of only one.

The addition of 200ml Ecopar® (Pyraflufen-ethyl – Grp G) to Tigrex® and Precept150® (Trts 6 & 7) achieved consistently high radish control. Although giving concerning levels of crop phytotoxicity early, these treatments had recovered by 32DAA. However, the top 2 wheat leaves at the time of application had completely senesced and although there was not a significant yield loss in this dry season, yield losses could occur in a better season where more crop biomass leads to greater grain yields. If growers and advisers are willing to accept this crop effect then these treatments also become a very handy alternative.

The return on investment from these early spray treatments is significant. Including application costs, these early 2 leaf spray treatments cost between $19-$29 per hectare. Given the consistent yield improvements throughout the trial of between 400-500kg/ha of wheat ($290/t) when sprayed early and late, an increase in net profit of approximately $90-$130/ha was achieved. In the case of treatment 12, an increase of $260/ha grain returns was achieved by using 1.5L Bromicide 200® at T1 as well as the later T2 spray.

The data from the Husbands trial also ask a few questions rather than just providing answers. The resistance testing from this site identified a poor level of activity from group B, F and I, yet the treatment 5 (Estericide 680® and Logran® (I & B)) eventually achieved 100% control of radish when used stand alone or after an early spray. It was noted that this treatment took a very long time to achieve a complete kill of wild radish, however this does cast some doubt over the value of herbicide resistance testing as a sole determinant of a populations resistance status in a whole paddock. Actual in-paddock herbicide mode of action and rate response screens are a much more reliable method of determining a resistance status of a population.

Key words

Wild Radish, Herbicides, Multiple Herbicide Group Resistance

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