Herbicide Tolerance of New Oat Varieties

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AIMS

The aim of the trial was to identify herbicide sensitivities of new oat varieties and thus reducing their potential yield losses due to herbicide (s) damage.

METHOD

Trial Year and No	2015 and 15KA50
Location	Katanning Research Facility, DAFWA, Katanning. (Paddock 20)
Soil Type pH ($Cacl_2$) and OC (%)	Sandy loam (Gravelly)
Trial design	Criss-cross, every 5th plot as untreated control.
Varieties	Bannister, Carolup, Kojanup, WAOAT2Q302-9 and Williams
Plot size (net) and replications	10 X 1.1 m (5 rows at 22 cm row spacing) and 3 reps. To convert plot yield to kg/ha, 1.8 m plot width was used (plot to plot centre).
Seeding date and rate	18 June and 75 kg/ha
Seeding machinery and depth	Coneseeder with knife points and press-wheels and 2-4 cm deep.
Fertilizer (at seeding)	K-Till Extra 100 kg/ha.
Soil moisture at seeding Method used Rainfall within in 2 WAS* Rainfall within in 4 WAS	0-10 cm: 12.3 %, 10-20 cm: 7.7 % Volumetric method (Moisture metre) 54.7 mm 57.8 mm
Treatment application date: Pre-seeding, Z12-Z13, Z13-Z14 and Z15-Z16.	17 and 18 June, 21 July, 24 July and 24 August.
Herbicide application machinery	Spray rig with shields on boom at a width of 1.5 m. Air induction nozzles and 75 L/ha water volume used.
Visual observations scale:	0 to 100 %, where 0 = no visible injury & 100 = complete plant death.
Visual observation dates:	20 August and 15 October 2015.
Hay cut date	14 October 2015. Hay was cut from an area of 1 m length and 3 rows (66 cm) per plot (one spot/plot) at a height of 15 cm from the ground. The samples were oven dried at 60^{o}c for 72 hrs and then weighed.
Number of heads	The hay samples after weighing from pre-emergent treatment plots were used to count the number of oat heads per 100 cm x 66 cm quadrat and then converted to heads m^{-2}.
Harvesting date (for grain)	15 December 2015
Grain quality analysis	Standard procedures will be followed to determine the grain protein, 1000 grain weight, hectolitre weight and small grain screenings.
Data analysis	ANOVA using GenStat program.

Rainfall (mm) :	May	June	July	Aug	Sept	Oct	Nov	Total
2015	29	60	39	52	26	18	12	236

* WAS = Weeks after sowing.

Crop safety margins: Higher than label rates of some the herbicides were included in the trials to determine the crop safety margin of the herbicides at the maximum label rates. Good crop safety margin means that a herbicide at its maximum label rate and at the higher rate(s) was tolerated well by a crop variety. Whereas, low crop safety margin for a herbicide indicates that the variety tolerated the maximum label rate well, but at higher than the label rate(s) there was significant yield loss. A low crop safety margin implies that when spraying under less than optimal conditions, herbicide damage and yield loss may occur. For example, when overlapping herbicide; spraying under wet conditions (for soil active and residual herbicides) and /or there are stressed plants due to abiotic/biotic factors.

RESULTS

The effect of herbicides during early crop growth stages, at anthesis time, on hay yield (Table 1), number of heads m^{-2} (Table 2) and grain yield (Table 3) of oat varieties was as follows:

- None of the pre and post-emergent herbicide treatments produced any visual symptoms except higher rate of Terbyne® Xrteme® + TriflurX® (2.4 kg + 4 L/ha) that caused 15-20% biomass/height reduction (visually) across all the varieties (as observed on 20-8-2015).
- Higher rate of Terbyne® Xrteme® + TriflurX® also reduced hay yield of Kojanup significantly and number of oat head m^{-2} in Bannister. However, this mixture didn't have any negative effect on grain yield of the oat varieties.
- Glean® (Chlorsulfuron) at 20 g/ha + BS1000 0.1% caused significant yield loss across all varieties except Bannister. For Carolup and Williams, this negative result is in line with the previous results. Bannister also showed good tolerance to Glean® in the previous 3 years' trials.
- Amicide® Advance 700 at 1.15 L/ha had no significant negative effective on hay yield and number of heads m^{-2}, but reduced grain yield of Williams significantly. The Williams result is in line with the previous trial results.
- Correlation co-efficient between hay and grain yield in this trial was very poor or negative (Bannister, Carolup, Kojanup, WAOAT2Q302-9 and Williams registered 0.09, -0.29, -0.32, -0.18 and -0.43 respectively)
- Terbyne® Xtreme® 875 WG (terbuthylazine, group C) was registered on cereals for control or suppression of certain grass and broadleaf weeds in 2014.
- Aptitude®, a mixture of metribuzin (group C) and carfentrazone (group G), is a new herbicide registered on cereals for control of weeds like wild radish, marshmallows, capeweed, fumitory, bedstraw, etc.
- Paradiam®, a mixture of halauxifen (group I) and florasulam (group B), is also a new herbicide registered on cereals for control of broadleaf weeds.
- Based upon the work done at DAFWA in the current and previous GRDC funded herbicide crop tolerance projects, an application to get permit for trifluralin use on oats is under APVMA review.

CONCLUSION

- For hay yield, all the varieties tolerated all the herbicides or herbicide mixes well with good crop safety margin except Kojanup registered low crop safety margin for Terbyne® Xrteme® + TriflurX® at 1.2 kg + 2 L/ha rate.
- For grain yield, Carolup, Kojanup, WAOAT2Q302-9 and Williams registered significant yield loss with label rate of Glean® (20g/ha) and Williams with Amicide® Advance 700 (1.15 L/ha). Rest of the herbicide treatments were tolerated well with good crop safety margin.

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Table 1: Effect of herbicides on hay yield (% of untreated control) of oat varieties at Katanning during 2015 (15KA50).

No	Herbicides	Rate/ha	Timing	Bannister	Carolup	Kojanup	WAOAT2Q302-9	Williams
0	Untreated Control >>>>>>Hay yield (t/ha)			100 4.0	100 4.1	100 4.4	100 4.2	100 4.1
1	Diuron 900 + Dual Gold® X1	556 g + 0.5 L	Pre- seeding	119	91	99	92	91
2	Diuron 900 + Dual Gold® X2	1.1 kg + 1 L	Pre- seeding	105	100	105	103	100
3	TriflurX® X1	2 L	Pre- seeding	102	116	115	110	111
4	TriflurX® X2	4 L	Pre- seeding	117	104	100	105	101
5	Terbyne® Xtreme® X1	1.2 Kg	Pre- seeding	108	109	101	105	102
6	Terbyne® Xtreme® X2	2.4 Kg	Pre- seeding	118	98	101	102	105
7	Terbyne® Xtreme® + TriflurX® X1	1.2 kg + 2 L	Pre- seeding	109	90	102	112	88
8	Terbyne® Xtreme® + TriflurX® X2	2.4 kg + 4 L	Pre- seeding	105	99	**82**	102	101
9	Glean® + BS1000	20g + 0.1%	Z12-Z13	116	104	105	104	114
10	Aptitude® + MCPA amine 500 X1	200 g + 0.5 L	Z13-Z14	114	99	98	101	103
11	Aptitude® + MCPA amine 500 X2	400 g + 1 L	Z13-Z14	106	107	98	115	92
12	Paradiam® + MCPA LVE 600 + Lontrel™ Adv X1	25 g + 400 mL + 75 mL	Z13-Z14	107	99	94	105	95
13	Paradiam® + MCPA LVE 600 + Lontrel™ Adv X2	50 g + 800 mL + 150 mL	Z13-Z14	112	95	96	103	85
14	Amicide® Advance 700	1.15 L	Z15-Z16	85	102	109	113	108
lsd (0.05) Control vs Herbicides (1-tail)				17	16	15	16	16
lsd (0.05) Herbicides vs Herbicides (1-tail)				21	20	19	20	21
CV (%)				16	15	14	15	15

Figures in **BOLD** are significantly lower than untreated control. TriflurX® = trifluralin 480 g/L.

Table 2: Effect of herbicides on number of heads m^{-2} (% of untreated control) of oat varieties at Katanning during 2015 (15KA50).

No	Herbicides	Rate/ha	Timing	Bannister	Carolup	Kojanup	WAOAT2Q302-9	Williams
0	Untreated Control >>>>>>Heads m^{-2}			100 170	100 170	100 154	100 192	100 147
1	Diuron 900 + Dual Gold® X1	556 g + 0.5 L	Pre-seeding	95	91	99	98	96
2	Diuron 900 + Dual Gold® X2	1.1 kg + 1 L	Pre-seeding	98	89	98	**80**	116
3	TriflurX® X1	2 L	Pre-seeding	104	106	95	95	106
4	TriflurX® X2	4 L	Pre-seeding	103	90	98	93	102
5	Terbyne® Xtreme® X1	1.2 Kg	Pre-seeding	87	114	96	98	116
6	Terbyne® Xtreme® X2	2.4 Kg	Pre-seeding	95	98	100	99	110
7	Terbyne® Xtreme® + TriflurX® X1	1.2 kg + 2 L	Pre-seeding	89	86	107	90	101
8	Terbyne® Xtreme® + TriflurX® X2	2.4 kg + 4 L	Pre-seeding	**77**	93	97	97	110
lsd (0.05) Control vs Herbicides (1-tail)				14	14	16	13	16
lsd (0.05) Herbicides vs Herbicides (1-tail)				16	16	18	14	19
CV (%)				12	12	13	11	14

Figures in **BOLD** are significantly lower than untreated control. TriflurX® = trifluralin 480 g/L.

Table 3: Effect of herbicides on grain yield (% of untreated control) of oat varieties at Katanning during 2015 (15KA50).

No	Herbicides	Rate/ha	Timing	Bannister	Carolup	Kojanup	WAOAT2Q302-9	Williams
0	Untreated Control >>>>>Grain yield (kg/ha)			100 1561	100 1572	100 1644	100 1559	100 1976
1	Diuron 900 + Dual Gold® X1	556 g + 0.5 L	Pre- seeding	105	109	98	105	111
2	Diuron 900 + Dual Gold® X2	1.1 kg + 1 L	Pre- seeding	103	101	103	97	102
3	TriflurX® X1	2 L	Pre- seeding	103	97	95	100	99
4	TriflurX® X2	4 L	Pre- seeding	103	108	99	93	108
5	Terbyne® Xtreme® X1	1.2 Kg	Pre- seeding	103	110	98	106	104
6	Terbyne® Xtreme® X2	2.4 Kg	Pre- seeding	102	97	101	101	106
7	Terbyne® Xtreme® + TriflurX® X1	1.2 kg + 2 L	Pre- seeding	110	110	107	107	110
8	Terbyne® Xtreme® + TriflurX® X2	2.4 kg + 4 L	Pre- seeding	100	102	102	102	99
9	Glean® + BS1000	20g + 0.1%	Z12-Z13	95	**77**	**81**	**85**	**80**
10	Aptitude® + MCPA amine 500 X1	200 g + 0.5 L	Z13-Z14	94	97	96	103	92
11	Aptitude® + MCPA amine 500 X2	400 g + 1 L	Z13-Z14	108	97	98	97	97
12	Paradiam® + MCPA LVE 600 + Lontrel™ Adv X1	25 g + 400 mL + 75 mL	Z13-Z14	101	100	96	97	97
13	Paradiam® + MCPA LVE 600 + Lontrel™ Adv X2	50 g + 800 mL + 150 mL	Z13-Z14	100	101	94	91	92
14	Amicide® Advance 700	1.15 L	Z15-Z16	97	101	92	93	**90**
lsd (0.05) Control vs Herbicides (1-tail)				11	11	10	11	9
lsd (0.05) Herbicides vs Herbicides (1-tail)				14	14	13	14	11
CV (%)				10	10	10	10	8

Figures in **BOLD** are significantly lower than untreated control. TriflurX® = trifluralin 480 g/L. Being an early variety, there was around 20% bird damage in WAOAT2Q302-9 (Photo 2).

Photo 1: Left to right Untreated Control, TriflurX® 2 L/ha (Centre) and TriflurX® 4 L/ha. Photo was taken on 8 weeks after the trial seeding on 21-8-2015 at Katanning. The variety at the front was Williams and at the back was WAOAT2Q302-9.

Photo 2: Showing bird damage in an early maturing variety WAOAT2Q302-9. The photo was taken on 15-10-2015 at Katanning. No bird damage was noticed in the other varieties.