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# MANAGEMENT OF EMERGING WEEDS WITHIN WESTERN AUSTRALIAN WHEAT BELT

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## ABSTRACT

A recent comprehensive survey on the changes in weed spectrum within the Western Australian (WA) wheat belt shows that some emerging weeds species are becoming more problematic. A study was conducted at two locations within WA over three years to develop management practices for barley grass, brome grass (great brome) and silver grass within the WA wheat belt. In the rotation trial to control barley grass, a lupin-wheat rotation provided more effective suppression of barley grass than a wheat-wheat rotation. The herbicides (simazine, metribuzin, Select®) used in the lupin crop in 2009 provided excellent suppression of barley grass. Consequently, the herbicides used in the wheat crop in 2010 (Sakura 850 WG and Monza®) after the 2009 lupin crop also effectively suppressed barley grass where weed density was effectively reduced in the 2009 lupin crop, leading to yield increases. Sakura 850 WG and Monza® herbicides provided poor control of barley grass where its density was high in 2009, probably due to dry seasonal conditions. In the brome grass (Great brome) control trials, Sakura 850 WG, Boxer Gold® and Triflur Xcel® provided comparable suppression of brome grass plants in a wheat crop in 2009. However, Sakura 850 WG provided the greatest suppression of brome grass seed head production, followed by Boxer Gold® and Triflur Xcel®. Boxer Gold® was more toxic to the wheat crop than Sakura 850 WG or Triflur Xcel® in disc sowing systems when stubble was present in brome grass trials. However, the grain yield of wheat was not affected by early crop damage from herbicides. In silver grass trials, Boxer Gold® suppressed silver grass more effectively than Triflur Xcel® or tank mixes with other herbicides and increased wheat yield by 7 to 17% compared to Triflur Xcel®. Sakura 850 WG was not included in silver grass trials.

**Key words:** Barley grass, brome grass, silver grass, crop rotation, sowing methods, Sakura 850 WG, Boxer Gold®

## INTRODUCTION

Barley grass (*Hordeum spp)*, brome grass (great brome) (*Bromus diandrus)* and silver grass (*Vulpia myuros*) have traditionally been considered to be minor weeds, occurring in patches in certain

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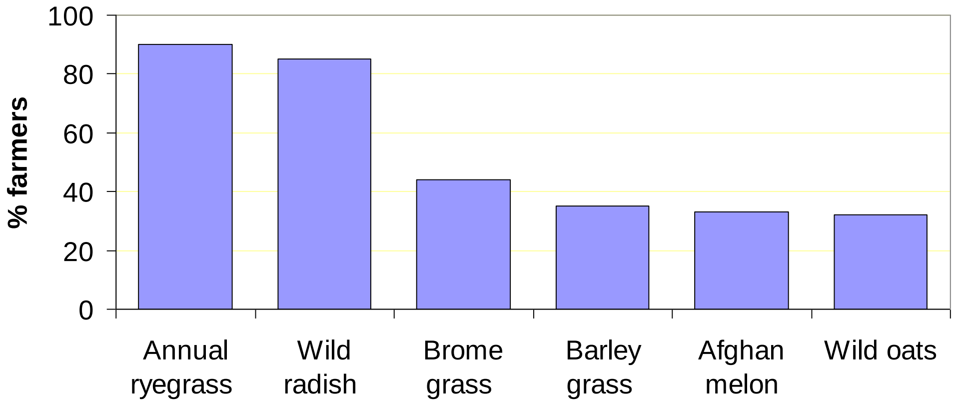
areas within the Western Australian (WA) wheat belt. A field survey conducted in 2008 revealed that while barley grass numbers have remained consistent, brome grass and silver grass have decreased in infestation within the wheat belt (Michael *et al*., 2009). However, according to the growers' responses in a postal survey in 2008, the ranking of the top worst weeds has changed within the wheat belt in the last decade. Barley grass and brome grass have moved from fifth and sixth positions in 1997 up to third and fourth positions in 2008, suggesting that these two species have become increasingly problematic between 1997 and 2008 (Fig. 1). Prolific annual seed production by these weeds is the main reason for their persistence rather than carryover of dormant seeds in the soil. It is important therefore to reduce the seed production in these weed species.



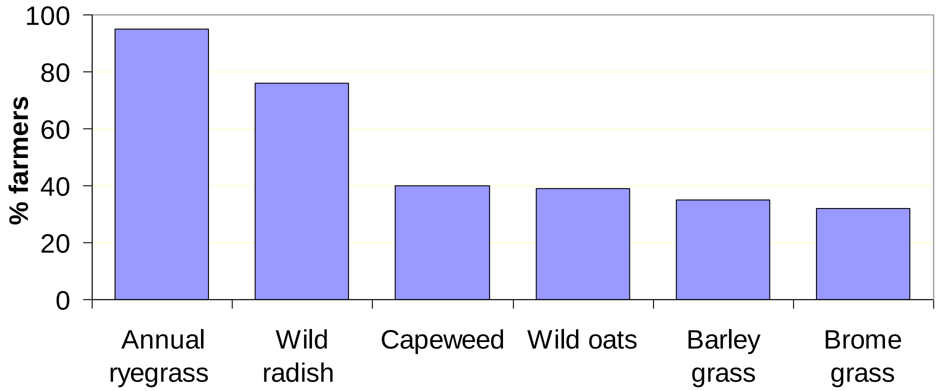




**Figure 1. Changes in the worst weed species between 1997 (left) and 2008 (right) based on the observations of 168 growers within Western Australia wheat belt (Michael *et al*., 2009).**

Some of these weeds have evolved resistance to ACCase herbicides and bipyridiliums in South Australia, New South Wales, Victoria and WA (Hashem *et al*., 2008; Heap, 2011). Evolution of herbicide resistance may be part of the reason why growers find these species to be increasingly problematic. New herbicides from groups with alternative modes of action and new crop varieties that are tolerant to herbicides with different modes of action are now available. So, a study was undertaken to develop management packages for these three weeds, incorporating the new weed management tools that are now available.

## MATERIALS AND METHODS

### Barley Grass Trials

A two-year rotation trial (2009 to 2010) was established in a Beverley WA field containing a naturally occurring infestation of barley grass. Crop rotations included lupin-wheat and wheat-wheat (wheat cv Eagle Rock (metribuzin-tolerant) in 2009 and Magenta in 2010, lupin cv Mandelup). Herbicide treatments are indicated in Table 1. Note that Sakura® is a registered product of Bayer. Sakura 850 WG is not currently registered in Australia but an application has been made for registration. The untreated control plots in 2009 remained as the untreated control plots in 2010. In both years, barley grass suppression was visually assessed at anthesis. Barley grass head number was counted in 2010. At harvest, grain yield of wheat and lupin was recorded in both years.

### Brome Grass Trial

A two-year trial (2009 to 2010) was established in a Northam WA field containing a naturally occurring infestation of brome grass (great brome). In 2009, herbicide treatments (Table 2) were applied and incorporated by sowing of wheat cv Wyalkatchem under three sowing methods (single disc, knife point or minimum tillage), in the presence or absence of wheat stubble. In 2010, Sakura 850 WG was incorporated by sowing wheat cv Magenta (using a disc sowing system) in all plots except the untreated control. Measurements in both years included brome grass plant number at five weeks after crop emergence, brome grass head numbers at the heading stage, crop phytotoxicity and crop grain yield.

### Silver Grass Trials

Two separate trials (2008 and 2009) were conducted in a Beverley WA field with a dense infestation of silver grass. A range of pre-seeding herbicide treatments (Table-3) were applied in the wheat crop during each year. Untreated control plots were included in both trials. In each trial, silver grass head number was counted at anthesis and grain yield was recorded at harvest.

## RESULTS AND DISCUSSION

### Barley Grass Suppression

Barley grass suppression in the lupin-wheat rotation was greater than that in the wheat-wheat rotation in 2009. As a result, yields of both crops in the lupin-wheat rotation were greater than their yields in the other rotation (Table-1). The herbicides used in the lupin crop (Metribuzin® @ 150 g/ha or simazine @ 1.1 kg/ha) followed by Select® @ 250 mL provided 87-92% suppression of barley grass in the lupin crop in 2009. This also resulted in significant reduction in barley grass in the subsequent wheat crop treated with Sakura 850 WG @ 118 g/ha in 2010. Poor barley grass control in the wheat-wheat rotation by Metribuzin® @ 150 g/ha followed by Monza® @ 25 g/ha or Triflur Xcel® @ 2 L/ha followed by Monza® @ 25 g/ha in 2009 also resulted in poor barley grass control in subsequent wheat treated with Sakura 850 WG @ 118 g/ha followed by Monza® 25 g/ha in 2010. It appears that where Sakura 850 WG @ 118 g/ha was used against a dense population of barley grass in wheat crops in the wheat-wheat rotation, weed suppression was poor. Sakura 850 WG @ 118 g/ha is usually highly effective against barley grass in normal seasonal conditions, and it is likely that Sakura 850 WG performance in 2010 was negatively affected by the dry conditions, making this herbicide less effective against dense populations of barley grass.

### Brome Grass Suppression

In the untreated plots, brome grass density was 156 and 125 plants/$m^2$ and brome grass head number was 298 and 226 heads/$m^2$ in 2009 and 2010 respectively. In 2009, all herbicides provided a comparable reduction in brome grass numbers, but seed head reduction was the greatest in Sakura 850 WG @ 118 g/ha, and greater in Boxer Gold® @ 2.5 L/ha compared to Triflur Xcel® @ 2 L/ha. In 2010 (when Boxer Gold® was not included in the trial), Sakura 850 WG @ 118 g/ha again provided effective suppression of brome grass. Weed suppression by Sakura 850 WG @ 118 g/ha in 2010 was slightly less effective where weed density was high due to poor suppression by Triflur Xcel® @ 2 L/ha in 2009. Herbicide effectiveness was generally reduced in 2010, probably due to the dry seasonal conditions. Herbicide application increased wheat grain yield by 10-16% in 2009 and 23-31% in 2010, compared to the untreated control (Table 2). Despite the early greater crop phytotoxicity observed in the disc sowing system in 2009, final grain yield for Boxer Gold® @ 2.5 L/ha was not significantly lower than for Triflur Xcel® @ 2 L/ha. In 2009, early crop phytotoxicity was apparent for all pre-seeding herbicide treatments in the retained stubble plots sown using a disc system, with 48% damage to the wheat crop from Boxer Gold® @ 2.5 L/ha, 18% from Triflur Xcel® @ 2 L/ha and 14% from Sakura 850 WG @ 118 g/ha.

**Table 1. Effects of herbicides in two crop rotations on initial barley grass suppression, barley grass head number and crop yield in 2009 and 2010 at Beverley, WA[1].**

| Crops and herbicides | | Weed suppression (%) | | Barley grass (heads /$m^2$) | Wheat or lupin yield (kg/ha) | |
|---|---|---|---|---|---|---|
| 2009 | 2010 | 2009 | 2010 | 2010 | 2009 | 2010 |
| Lupin-wheat rotation | | | | | | |
| 1. Lupin (Metribuzin®/ Select®) | Wheat (Sakura 850 WG/ Monza®) | 87 | 88 | 118 | 1619 | 2226 |
| 2. Lupin (Simazine®/ Select®) | Wheat (Sakura 850 WG/ Monza®) | 92 | 83 | 90 | 1298 | 2084 |
| 3. Untreated | Untreated | 0 | 0 | 859 | 481 | 370 |
| LSD (5%) | | 20.6 | 17.6 | 377.4 | 219.5 | 206.8 |
| Wheat-wheat rotation | | | | | | |
| 1. Wheat (Metribuzin®/ Monza®) | Wheat (Sakura 850 WG/ Monza®) | 51 | 50 | 802 | 1376 | 1353 |
| 2. Wheat (Triflur Xcel®/ Monza®) | Wheat (Sakura 850 WG/ Monza®) | 39 | 53 | 663 | 1246 | 1258 |
| 3. Untreated | Untreated | 0 | 0 | 1352 | 468 | 196 |
| LSD (5%) | | 7.7 | 9.4 | 525.2 | 246.1 | 236.8 |

[1]Metribuzin® @ 150 g/ha (metribuzin 750 g/kg), Monza® @ 25 g/ha (sulfosulfuron 750 g/kg), Select® @ 250 mL/ha (clethodim 240 g/L), Sakura 850 WG @ 118 g/ha (pyroxasulfone 850 g/kg), Simazine® @ 1.1 kg/ha (simazine 900 g/kg), and Triflur Xcel® @ 2 L/ha (trifluralin 500 g/L). Metribuzin®, Simazine®, Triflur Xcel®, and Sakura 850 WG were incorporated by sowing. Monza® and Select® were applied at post-emergence.

The knife point system did not cause a significant level of crop phytotoxicity (5% or less for all herbicides). Wyalkatchem wheat (grown in 2009) is a short coleoptile variety, and so is more prone to pre-seeding herbicide damage in years such as 2009, where rainfall causes movement of the herbicide into the seeding furrows, than a long coleoptile variety. This result highlights the need to maintain seeding depth selectivity of the herbicide. Phytotoxicity was not observed in 2010.

**Silver Grass Suppression**

Silver grass head numbers in the untreated control were 304/m$^2$ in 2008 and 651/m$^2$ in 2009. Boxer Gold® @ 2.5 L/ha suppressed 83% of silver grass heads in 2008 and 82% in 2009. Triflur Xcel® @ 1.45 L/ha suppressed 76% of silver grass heads in 2008 and 72% in 2009 (Table 3). The mixture of Triflur Xcel® @ 1.45 L/ha plus Avadex Xtra® did not improve silver grass head control compared to Triflur Xcel® @ 1.45 L/ha alone, in either year. Sakura 850 WG was not included in this study.

**Table 2. Effect of pre-seeding herbicides on the suppression of brome grass density, brome grass seed head production and wheat yield in a wheat-wheat rotation in 2009 and 2010 at Northam, WA[1].**

| Herbicide treatments | | Brome grass (plants/m$^2$) | | Brome grass (heads/m$^2$) | | Wheat yield (kg/ha) | |
|---|---|---|---|---|---|---|---|
| 2009 (wheat) | 2010 (wheat) | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| Boxer Gold® | Sakura 850 WG | 81 | 31 | 111 | 64 | 2531 | 1848 |
| Sakura 850 WG | Sakura 850 WG | 85 | 29 | 48 | 63 | 2781 | 1920 |
| Triflur Xcel® | Sakura 850 WG | 101 | 83 | 169 | 104 | 2590 | 1723 |
| Untreated | Untreated | 156 | 125 | 298 | 226 | 2332 | 1318 |
| LSD (5%) | | 27.8 | 18.1 | 56.2 | 36.4 | 195.8 | 200.1 |

[1]Boxer Gold® @ 2.5 L/ha (120 g/L s-metolachlor + 800 g/L prosulfocarb), Sakura 850 WG @ 118 g/ha (pyroxasulfone 850 g/kg), Triflur Xcel® @ 2 L/ha (trifluralin 500 g/L). All the herbicides were incorporated by sowing.

Weed control by Boxer Gold® @ 2.5 L/ha significantly increased wheat yield over the untreated control both in 2008 and 2009 (18-27%). Triflur Xcel® @ 1.45 L/ha or a mixture of Boxer Gold® @ 2.5 L/ha + Triflur Xcel® @1.45 L/ha increased wheat yield over the untreated control in 2009 only. The grain yield of wheat in the mixture of Boxer Gold® @ 2.5 L/ha + Triflur Xcel® @ 1.45 L/ha was significantly lower than the yield from Boxer Gold® @ 2.5 L/ha alone, even though this mixture provided better suppression of silver grass than Boxer Gold® @ 2.5 L/ha alone in 2008. Therefore, this mixture may have caused some crop damage, even though crop emergence and crop vigour appeared to be unaffected by this mixture in either year.

**Table 3. Effect of Boxer Gold® and other pre-seeding herbicides on the suppression of silver grass and yield of wheat in 2008 and 2009 at Beverley, WA.**

| Herbicide treatments | Silver grass head suppression (%) | | Wheat yield (kg/ha) | |
|---|---|---|---|---|
| | 2008 | 2009 | 2008 | 2009 |
| Boxer Gold® | 83 | 82 | 3822 | 3502 |
| Triflur Xcel® | 76 | 72 | 3550 | 2891 |
| Boxer Gold® + Triflur Xcel® | 92 | 85 | 3125 | 3029 |
| Triflur Xcel® 1.45 L/ha + Avadex Xtra® | 79 | 67 | 3543 | 2658 |
| Untreated | 0 | 0 | 3140 | 2569 |
| LSD (5%) | 4.9 | 9.2 | 561 | 296 |

[1]boxer gold® @ 2.5 l/ha (120 g/l s-metolachlor + 800 g/l prosulfocarb), avadex xtra @ 1.6 l/ha (triallate 500 g/l), and triflur xcel® @ 1.45 l/ha (trifluralin 500 g/l). all herbicides were incorporated by sowing.

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