

Combinations of crop rotations and herbicides for effective management of brome grass (Poochera, SA)

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control and either eliminated panicle production by brome grass or reduced it to a very low level.

Why do the research?

Brome grass is currently ranked as the second worst weed in grain crops in Australia, causing annual revenue loss of \$42 million (Ouzman et al. 2025). Brome grass tends to be difficult to control with the pre-emergent herbicides currently registered for use in cereal crops. Development of herbicide tolerant cereal varieties has increased options for growers to manage brome grass effectively in the cereal phase of the rotations. Integration of herbicide tolerant cereals with break crops such as pulses and canola offer opportunities to effectively deplete brome grass seedbank and minimise the risk of buildup in its populations. It is important to demonstrate to growers the effectiveness of carefully considered cropping sequences for the management of brome grass in different agroecological environments. To achieve this objective, a 3-year field trial was initiated near Poochera on the upper Eyre Peninsula during the 2024 growing season. The study aims to identify rotations and herbicide programs that effectively suppress brome grass populations and minimise seedbank replenishment while maintaining crop productivity.

How was it done?

A field trial was established in a randomised complete block design on a commercial farm

near Poochera on the upper Eyre Peninsula. This farm has calcareous grey sandy loams soil which are favoured by brome grass.

The trial was sown with a no-till cone seeder with 25 cm row spacing and seeding width of 1.5 m (Table 1). There were two seeder runs per plot, and the plots were 15 m long. There was one buffer plot between all experimental plots to minimise the risk of herbicide spray drift and dispersal of weed seeds to neighbouring plots during crop harvest or by wind dispersal. All pre-emergent herbicides were sprayed just prior to crop sowing and incorporated by the no-till seeding tines (IBS). Data was analysed by using GenStat 23rd Edition.

Information on herbicide products, active ingredients and label rates can be found in Table 2.

The summer of 2025 was extremely dry with only 26 mm rainfall from January to May. Crops were sown dry on 2 June, but some rainfall (6 mm) was received on 6 June and then subsequent light rains on 8 and 9 June. Total rainfall in June was slightly higher than the long-term average for this area. The season had a real turnaround in July when 102 mm rainfall was received, which is more than double the long-term average for the site. However, August and September were drier than average, but October was slightly higher than average. Overall rainfall for the year and the growing season was well below the long-term average of 308 mm and 230 mm, respectively.

Key messages

- **Sole reliance on pre-emergent herbicides led to a substantial increase in brome grass plant density (60%) and panicle density (33%) in 2025.**
- **One-year break from brome grass seed set was achieved by growing Titan AX barley or Clearfield (CL) wheat in 2024 (System 2 and System 3). Both systems prevented a rebound in brome grass plant and panicle density in wheat treated with Sakura + Avadex Xtra in 2025.**
- **Two-year breaks provided highly effective brome grass**

Table 1. Trial details for 2025.

Project duration	2024–2026 (3-years)
Trial location	Poochera, SA (EP)
Plot size	12 m x 1.5 m (paired)
Replications	3
Soil type	Calcareous sandy loamy
Sowing date	2 June 2025
Target crop density (plants/m ²)	Wheat 180, barley 150 and lentils 120
Fertiliser	75 kg/ha MAP at sowing; barley and wheat also had 50 kg/ha urea at GS14 (9 July)
Herbicides	See Table 2
Crop-topping	glyphosate 2 L/ha DST 470 (system 6) on 27 October
Harvest date	5 December

Table 2. Information about the herbicides used for brome grass control in 2025 at Poochera.

Product name	Active ingredient	Label rate
Sakura	Pyroxasulfone (850 g/kg)	118 g/ha
Treflan	Trifluralin (480 g/L)	1.5–3.0 L/ha when used as incorporated by sowing (IBS) in no-till knifepoint press wheel system (KP PW)
Avadex Xtra	Triallate (500 g/L)	2.6–3.2 L/ha when used IBS with KP PW
Intervix	33 g/L Imazamox and 15 g/L Imazapyr	375–750 mL/ha for brome grass
Targa	Quizalofop 100 g/L	375 mL/ha
Ultro	Carbetamide 900 g/kg	1.1–1.7 kg/ha (IBS)

In this trial report, the term ‘break’ refers to the year where crop × herbicide combinations are expected to effectively prevent brome grass seed production (Table 3).

No-break system (S1): Calibre wheat treated with Sakura + Avadex in 2024 was followed by Combat barley sprayed with pre-emergent herbicide mixture of Treflan + Avadex Xtra in 2025. This system is expected to allow considerable brome grass seed production each year and weed density is likely to remain high.

1-year break systems (S2 and S3): Titan AX barley (S2) or Tomahawk CL Plus (S3) in 2024 were followed by wheat sprayed with pre-emergent herbicides Sakura + Avadex Xtra in 2025. These management systems are expected to lead to a rebound in brome grass populations due to weed establishment from the residual seedbank.

2-year break systems (S4 and S5): Brome grass was controlled in 2024 in Titan AX barley (S4 and

S5), which was followed in 2025 either by Thunder lentil sprayed with carbetamide (Ultro PRE) and quizalofop (Targa POST) (S4) or Tomahawk CL Plus wheat sprayed with Intervix (S5). Both systems are expected to provide effective brome grass control in 2024 and 2025.

3-year break system (S6): Titan AX barley in 2024 was followed by Thunder lentil in 2025 (S6) to provide an effective second break from brome grass. Lentil were sprayed with carbetamide (Ultro PRE) followed by quizalofop (Targa POST) for brome grass control. In 2026, CL plus wheat will be grown to achieve 3 consecutive years of effective weed control.

What happened?

Crop establishment

Even though the seedbed was dry at crop sowing, rains received within a few days after sowing allowed excellent establishment of wheat, barley and lentils in various systems (Table 5). Crop density in wheat and barley-based systems in 2025 ranged from 140 to 170

plants/m², which was close to the target density of 150 plants/m² for barley and 180 plants/m² for wheat. Importantly, these plant densities are adequate to produce high grain yields and to provide competition with brome grass that survive herbicide treatments. The local grower group participating in this trial was keen to assess the suitability of lentils in this environment where growing seasons tend to be short. Crop establishment in lentils in system 4 and 6 was also close to the target density of 120 plants/m².

Brome grass plant and panicle density

Sole reliance on pre-emergent herbicides in System 1 led to an increase in brome grass plant and panicle density in 2025 as compared to 2024 (Table 4). Presence of high panicle density of brome grass (222 panicles/m²) in System 1 is likely to have a negative impact on barley grain yield in 2025 and is likely to increase the weed seedbank for 2026.

Table 3. Crops, varieties and herbicide input programs (per ha) in the field trial at Poochera, in 2024 and 2025.

System	2024	2025
S1 (no break)	Calibre wheat PRE: Sakura 118 g + Avadex Xtra 2.4 L	Combat barley PRE: Treflan 2 L + Avadex Xtra 2 L
S2 (one-year break)	Titan AX barley PRE: Treflan 1.2 L POST: Aggressor AX 200 mL	Calibre wheat PRE: Sakura 118 g + Avadex Xtra 2 L
S3 (one-year break)	Tomahawk CL Plus wheat PRE: Treflan 1.2 L POST: Intervix 600 mL	Tomahawk CL Plus wheat PRE: Sakura 118 g + Avadex Xtra 2 L
S4 (two-year break)	Titan AX barley PRE: Treflan 1.2 L POST: Aggressor AX 200 mL	GIA Thunder lentils PRE: Ultro 1.4 kg POST: Targa 375 mL
S5 (two-year break)	Titan AX barley PRE: Treflan 1.2 L POST: Aggressor AX 200 mL	Wheat Tomahawk CL Plus PRE: Treflan 2L POST: Intervix 600 mL
S6 (3-year break)	Titan AX barley PRE: Treflan 1.2 L POST: Aggressor AX 200 mL	GIA Thunder lentils PRE: Ultro 1.4 kg POST: Targa 375 mL

Table 4. Densities of brome grass plants and panicles across crop rotation sequences and herbicide input programs in 2024 and 2025. Crop names in bold indicate the phase, in 2025. Refer to Table 3 for information on herbicide treatments. Means followed by a different letter indicate statistical significance ($P=0.05$).

System	Rotation sequence	Brome density 2024 ¹ (plants/m ²)	Brome density 2025 (plants/m ²)	Brome panicles 2024 ¹ (panicles/m ²)	Brome panicles 2025 (panicles/m ²)
S1 (no break)	Wheat - Barley - Wheat (PRE herbicides - weak system)	102 bc	166 c	173 c	222 b
S2 (1-year break)	AX barley - Wheat - wheat	35. a	5 ab	0 a	0 a
S3 (1-year break)	CL wheat - Wheat - wheat	143 c	9 b	18 b	4 a
S4 (2-year break)	AX barley - Lentil XT - wheat	27 a	0 a	0 a	0 a
S5 (2-year break)	AX barley - CL wheat - wheat	51 ab	5 ab	0 a	7 a
S6 (3-year break)	AX barley - Lentil XT - CL Wheat	33 a	1 ab	0 a	0 a
P-value		<0.001	<0.001	<0.001	<0.001

¹Plant and panicle density data were square root transformed before performing ANOVA.

One-year break from brome grass seed set was achieved by growing Titan AX barley or CL wheat in 2024 (S2 and S3). Use of Sakura® + Avadex® Xtra in wheat in 2025 in these systems was able to prevent a rebound in brome grass plant and panicle density (Table 4). Even a single year of effective weed control in 2024 in herbicide tolerant crops followed by moderate control with pre-emergent herbicides in 2025 is likely to maintain future infestation of brome grass at a low level at this site.

In this trial, the two-year break from brome grass seed set was achieved by growing Titan AX barley in 2024 and lentil or CL wheat in 2025. These systems were able to provide highly effective brome grass control and either eliminated panicle production (S4) or reduced it to a very low level (S5 & S6) (Table 4). Any brome grass which establishes in these management systems in 2026 is likely to come from its persistent seedbank.

Overall, there was a clear separation between the management systems in terms of plant and panicle density with System 1 having significantly higher brome grass than all other management systems. However, the impact of 1-, 2-year breaks on brome grass panicle density in 2025 was similar. Use of lentils offered an opportunity to use an effective pre-emergent herbicide (Ultro®/carbetamide) and post-emergent herbicide (Targa®/quizalofop), which effectively killed all brome grass and prevented panicle production.

Table 5. Grain yield of crops in response to brome grass management systems at Poochera in 2025. Crop names in bold indicate the phase, in 2025. Refer to Table 4 for information on herbicide treatments. Means followed by a different letter indicate statistical significance ($P=0.05$).

Treatment	Rotation sequence	Grain yield (kg/ha)
S1 (no break)	Wheat - Barley - Wheat (PRE herbicides - weak system)	2289 d
S2 (1-year break)	AX barley - Wheat - Wheat	1817 b
S3 (1-year break)	CL wheat - Wheat - Wheat	2061 c
S4 (2-year break)	AX barley - Lentil XT - Wheat	16 a
S5 (2-year break)	AX barley - CL wheat - Wheat	2185 cd
S6 (3-year break)	AX barley - Lentil XT - CL Wheat	27 a

Crop grain yield

Even though lentil establishment in this trial was excellent and close to the target density, it failed to produce commercially viable grain yield (Table 5). It appears that below average rainfall at the site in August and September imposed severe water stress on the crop during its flowering and podding period. As a result, there was very little pod set and grain yield. It is also possible that lentils are not well adapted to the calcareous sandy soil at the trial site.

Wheat and barley are widely recognized as being more tolerant to dry spring conditions and this was clearly seen in this trial with grain yields over 2000 kg/ha (Table 5). Combat barley in System 1 was the highest yielding treatment, which may be associated with superior weed competitive ability and water use efficiency of barley than wheat. For reasons which are unclear, Tomahawk CL (S3 and 5)

produced higher grain yields than Calibre wheat in System 2 (Table 5).

What does this mean?

Even though the seedbed was dry at crop sowing, rains received within a few days after sowing allowed excellent establishment of wheat, barley or lentils in all systems. Sole reliance on pre-emergent herbicides in System 1 led to an increase in brome grass plant and panicle density in 2025 as compared to 2024. Even a one-year break from brome grass seed set, which was achieved by growing Titan AX barley or CL wheat in 2024 (S2 and S3), followed by moderate weed control with Sakura + Avadex Xtra in wheat in 2025 was able to prevent a rebound in brome grass plant and panicle density. This result varies from other trial sites where 1-year break allowed brome grass density to rebound in the next year. As expected, the two-year break from brome grass

seed set with Titan AX barley in 2024 and lentil or CL wheat in 2025 either eliminated its panicle production (S4) or reduced it to a very low level (S5,6).

References

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