Brome grass management
Part II: paddock monitoring across the Mid-North

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Key findings

- Many techniques can be employed to deplete the brome seedbank but an integrated weed management (IWM) approach reduces reliance on herbicides (ie. imi's).
- In the best managed paddocks, two years of effective management reduce brome grass seedbank to <50 seeds/m^2 (8-32 seed/m^2).
- The most effective rotations for reducing brome populations incorporated oaten hay, break crops, legumes and CLF cereals.

Why do the trial?

Refer to Part I of this article.

How was it done?

Ten grower paddocks across the Mid-North were sampled pre-seeding for three consecutive years from 2013 to 2015 (Figure 5). Within each paddock a single fixed transect was established through a known brome infestation and sampled across each year. In some instances when brome plants had germinated prior to sampling, quadrat counts were also taken to account for the germinated plants.

Soil cores were taken every 20 paces, totalling 16 soil cores per site and bulked into two samples from each paddock. The soil samples were spread in trays and germinated brome seedling were counted and reported as brome seedbank/m^2.

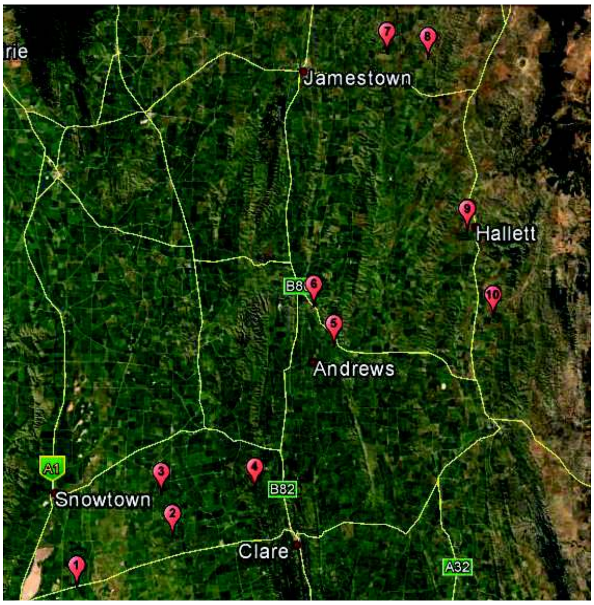

Figure 5. The location of grower paddocks sampled for brome seedbank monitoring in the Mid-North.

Results and discussion

Effective brome control

One of the main messages from the paddock monitoring was that two years of effective management reduced brome numbers to low levels (8-32 seeds/m^2) but did not completely exhaust the seedbank. A brief summary of the effect of different management practices used in the paddocks sampled has been presented in Table 1. The results showed the three best crop rotation and herbicide strategies were:

1) Cereals cut for hay

Hay production can quickly reduce brome and other weeds, by reducing the quantity of viable seeds set or removing viable seeds to prevent seedbank replenishment. In our study, oaten hay reduced brome seedbank by 69 to 86% when used effectively. Paddock one achieved a 69% reduction in brome population after oaten hay and proved more successful than CLF wheat at this location (Figure 6). A slightly better result was achieved with oaten hay in Paddock six where 86% control was observed (Figure 7). Cutting time is important for the best weed control and particularly important for brome grass as it can develop quickly, set seed early and shed seed before the crop is ready to be cut. Regrowth also needs to be controlled with a non-selective herbicide to prevent further seed set, particularly in wet years. This point is demonstrated well in Paddock nine where brome seedbank increased by 207% (from 187 to 574 seeds/m^2) when hay cutting was too late. These results align with previous work (Bowcher *et al*. 2005) which reported silage and hay offer 40 – 80% brome control (average 60%).

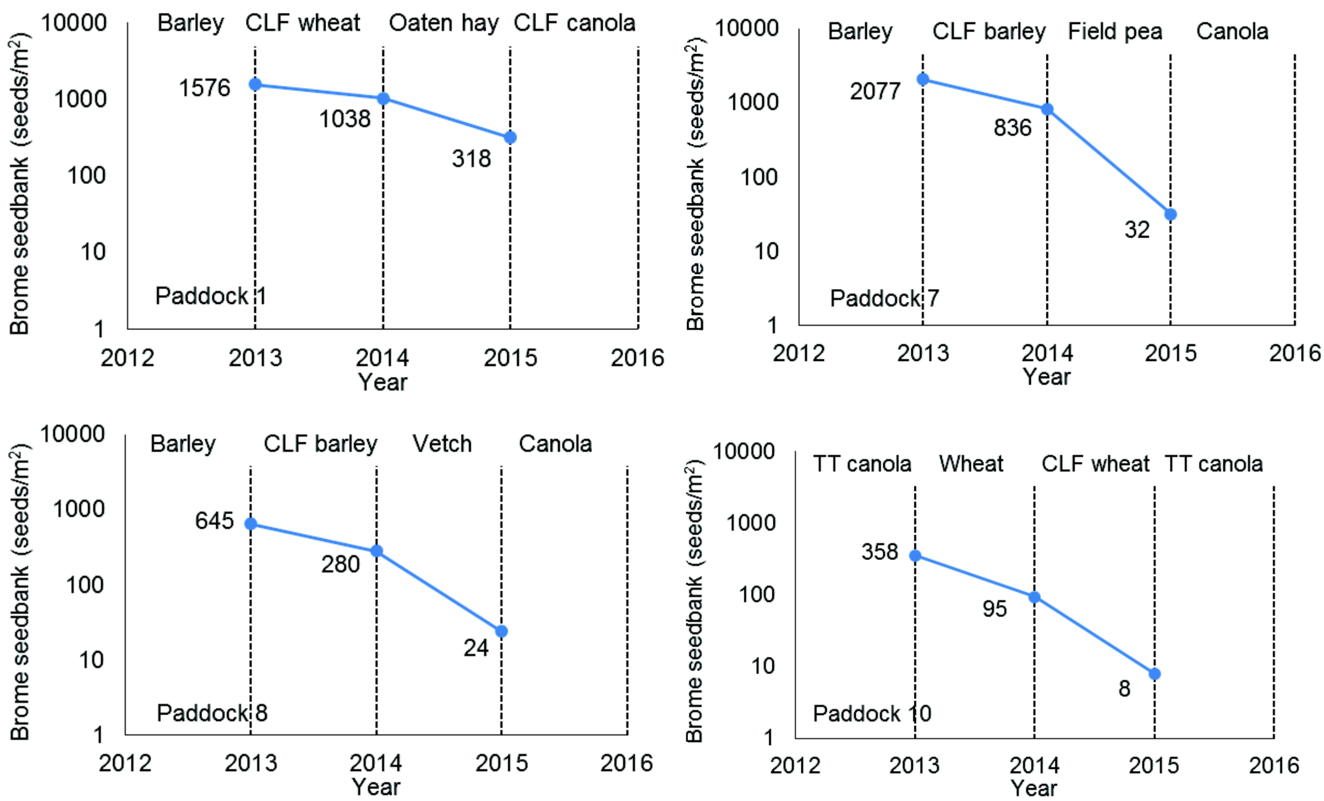

Figure 6. Paddocks monitored with effective rotations to reduce brome numbers over a three year period from 2013 – 2015.

2) Break crops

The benefit of break crops for brome control is their ability to increase the range of herbicide groups used in the rotation and at different crop growth stages which can aid control of later germinations of brome grass. Paddocks seven and eight were good examples of successful use of break crops (field pea and vetch), where brome seedbank declined by 91 to 96%.

Both paddocks were followed by canola, offering a second break crop in the management strategy. While the effects of this second break year were not assessed in this study, canola allows other herbicides and management techniques to be used. As discussed in Part I, Weedmaster® DST® is registered for use from 20% colour change in standing canola or under the cutter bar at windrowing. This earlier timing of glyphosate gives greater opportunity to control seed set in brome grass. Other weed seed capture techniques can be used such as narrow windrow burning and chaff carts, however they are dependent on the effective capture and burn of weed seeds.

3) Clearfield cereals

A common feature to all paddocks with a reduction in the brome seedbank was the use of CLF crops. In the paddocks presented here, the control ranged from 34 – 92% and on average CLF wheat or CLF barley provided 60% reduction in brome seedbank (Figures 6 and 7). It is one of the best tools for control, however Intervix® is at risk of developing herbicide resistance in brome and should not be used where other options are likely to work effectively. Growers in this study also followed the recommendation of not re-sowing a CLF variety in consecutive years. It is recommended that Intervix® not be used two years in a row, or at least without another weed control method.

Poor brome control

Cereals are not likely to be part of a strong three year rotation strategy to prevent brome seed set as they rely heavily on pre-emergent herbicides or selective Group B herbicides, and control levels can be low. The population in Paddock six was low early (2013), however a cereal phase in a paddock with a known brome issue increased the seedbank by ten-fold that season (Figure 7).

Many of the paddocks selected for this study were coming out of a cereal phase in 2012. Paddocks seven and eight were selected due to poor control during the barley phase in 2012 (Figure 6). The herbicide strategy for grass control in barley consisted of metribuzin and Boxer Gold. Metribuzin can give some control of brome in barley but its efficacy depends on soil type and seasonal conditions. It is most effective when applied in conditions with good soil moisture and with follow up rainfall within two weeks. Low metribuzin rates and insufficient rainfall in Paddocks seven and eight may have contributed to the poor control. Higher rates of metribuzin give better control but this needs to be balanced with the potential for crop damage. In light sandy soils that have a high pH, metribuzin is more available in the soil and can cause crop damage. Lower rates need to be used to prevent crop damage but often may not give adequate control.

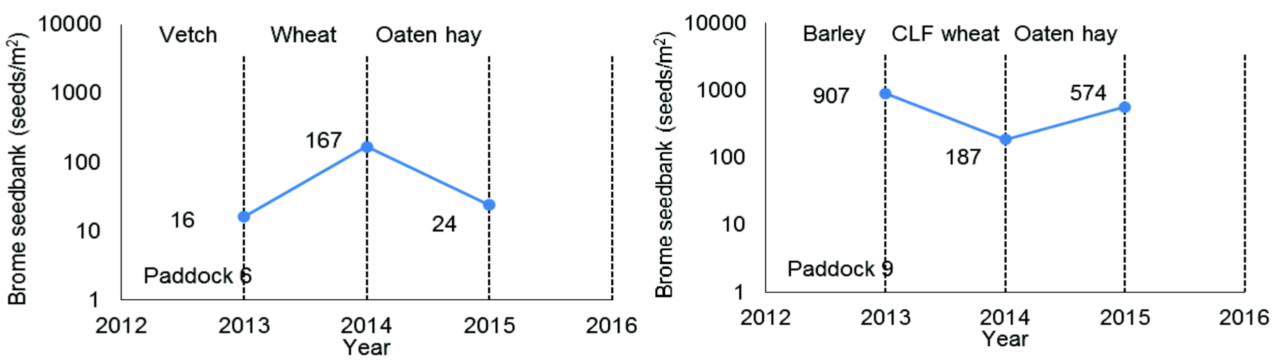

Figure 7. Grower paddocks where increases in brome seedbank were observed in the three year sampling period from 2013 – 2015.

The research conducted in part I and II of this study measured the effects of rotation and herbicide options on brome management. There are many other herbicide and cultural tactics listed in Table 2, which can be employed for controlling brome and may help in delaying herbicide resistance development.

Table 1. Summary of the change in brome grass seedbank in response to the management practices used by the growers in the Mid-North of SA.

Crop	Average seedbank reduction (%)	Range	Comments
CLF barley	58.2	57 to 60%	Consistent but moderate effect (2 paddocks)
CLF wheat	62.9	34 to 92%	Consistent performance in 2 paddocks but only 34% reduction in brome seedbank in Paddock 1 (3 paddocks)
Oaten hay	77.5	69 to 86%	207% increase in Paddock 9 which was excluded from the calculation; most likely related to late cutting and recovery (3 paddocks)
Legumes	93.8	91 to 96%	Consistent good performance (2 paddocks)
Wheat		73 to -944%	Inconsistent effect; 73% reduction to nearly ten-fold increase in brome seedbank

Table 2. Effectiveness of different management tactics and techniques for brome grass control (Source: Bowcher et al. 2005).

Tactic	Likely % control (range)	Comments on use
Burning residues	70 (60-80)	Sufficient crop residues are needed – not recommended on light soil types.
Autumn tickle	50 (20-60)	Depends on seasonal break. Seed burial through shallow cultivation enhances seed depletion through germination, especially in *B. diandrus* with its shorter dormancy and faster germination.
Delayed sowing	70 (30-90)	Depends on seasonal break and brome population - less effective for dormant brome.
Knockdown (non-selective herbicide)	80 (30-99)	If possible delay spraying until full emergence and youngest plants have two leaves.
Pre-emergent herbicide	80 (40-90)	Follow label recommendations, especially on incorporation requirements of some herbicides. Use triazines and trifluralin mainly in pulses.
Post-emergent (selective)	90 (75-99)	Apply when weeds have 2-6 leaves and are actively growing – consult label.
Pasture spray-topping	75 (50-90)	Timing is critical. Respray or graze survivors.
Silage & hay	60 (40-80)	Hay freezing works well. Silage is better than hay. Graze or spray regrowth.
Grazing	50 (20-80)	Graze infested areas heavily and continuously in Winter and Spring.
Residue collection at harvest	40 (10-75)	Works best on early harvested crops before weeds drop their seeds – less effective for *B. rigidus* because of its early maturity

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Above: germinated brome grass prior to sampling was assessed using a quadrat count.

Above: Ben and Ryan, University of Adelaide, soil sampling the brome monitoring paddocks in 2015.