factsheet

On farm solutions

Management of barnyard and liverseed grasses

Project: best weed management strateges for dryland cropping systems with cotton

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Location: central and southern Queensland and northern NSW

VET sector resource: RTC3401A Control weeds; RTD5402A Develop a strategy for the management of target pests

Keep the pressure on!

The key to getting on top of barnyard and liverseed grasses is to attack all parts of the weed lifecycle and keep the pressure on weed seedbanks, according to new Weeds CRC research.

Adopting an integrated weed management strategy that includes non-chemical tactics for controlling seedlings, and diligently stopping replenishment of the seedbank, will result in substantially fewer problems in the future.

Why are these weeds a problem?

Barnyard grasses (*Echinochloa* spp.) and liverseed grass (*Urochloa panicoides*) are the most common summer grass weeds of cropping in southern Queensland and northern New South Wales (NSW). They are also present in central Queensland.

These grasses are favoured in reduced tillage systems, and have increased in prevalence in the last two decades.

They are prolific seeders, are not consistently controlled with commonly used herbicides, and can be highly competitive.

When uncontrolled, these weeds can reduce sorghum yields by 25-40%.

Several populations of liverseed grass in southern Queensland, and one population of barnyard grass in northern NSW, have been confirmed as resistant to atrazine (Group C).

Barnyard and liverseed grasses have a high risk of developing resistance to glyphosate (Group M), particularly for growers practising minimum or zero tillage.

A population of awnless barnyard grass (*Echinochloa colona*) in northern NSW was recently confirmed as having developed glyphosate resistance.

Uncontrolled summer grass weeds like barnyard and liverseed grasses can reduce sorghum yields by 25-40 per cent.
Photo: Weeds CRC

Know your weed

There are two common barnyard grass species, which are distinguished by presence or absence of awns attached to the seed.

These are known as barnyard grass (*Echinochloa crus-galli*), and awnless barnyard grass (*Echinochloa colona*), which is the more common weed of cropping in the northern region.

The two species tend to respond the same to different control tactics.

Purple-red bands are sometimes seen on awnless barnyard grass leaves, particularly when the plant is stressed.

Seedlings of liverseed grass (*Urochloa panicoides*), are easily distinguished because of their broad, pale yellow-green leaves with hairs on the leaf margins and sheaths.

Top to bottom: barnyard grass (*Echinochloa colona*) and liverseed grass (*Urochloa panicoides)* seedlings
Photos: Bruce Wilson

When they emerge

Newly shed seed of these grasses exhibit strong dormancy, and thus most of this seed will not germinate until the following season.

Barnyard grasses emerges in a number of flushes following germinating rain throughout late spring and summer, whereas liverseed grass will mostly emerge in one large flush in late spring.

Germination of barnyard and liverseed grasses is favoured when temperatures are greater than 25 C.

Emergence of these grasses is predominantly in the first year following seed rain, with smaller flushes in the second and third year.

Thus, it is essential to monitor and manage each flush during the warmer months for several years after replenishment of the seedbank.

How long do seeds persist in the soil?

Seed of these two grasses only remain viable for a short time in the soil surface layers, but persistence increases with depth of seed burial.

Only 1-2% of seed remain viable after two years of burial at the 1-2cm soil depth, in contrast to approximately 20% remaining after two years of burial at 10cm depth (Figure 1).

Thus, effective management over 2-3 years in zero tilled systems can reduce the seedbank to minimal levels.

Top to bottom: flowering stems of barnyard grass (*Echinochloa crus-galli*) and awnless barnyard grass (*Echinochloa colona*). Note the purple-red bands on awnless barnyard grass.
Photos: flickr.com, Andrew Storrie

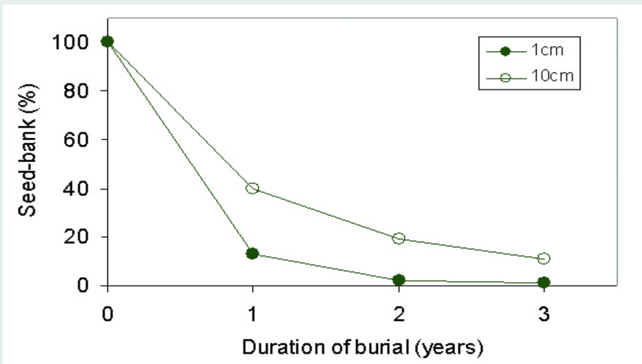


Figure 1. Persistence of awnless barnyard grass (*Echinochloa colona*) seed increases with burial depth in soil.

Tactics for barnyard grass and liverseed grass management

For optimal control of barnyard and liverseed grasses, the Weeds CRC recommends attacking all parts of the weed lifecycle.

An integrated weed management strategy that combines chemical and non-chemical tactics to stop seed production and seed rain, prevent the introduction of new seeds, deplete the weed seedbank and control seedlings will significantly reduce the impact of these weeds.

Strategies are summarised below and in a diagram on page 6.

To deplete seedbank

- If controlling seedlings with tillage, avoid burying seed as this will increase their persistence in the soil seedbank (Figure 1).
- Delay sowing of early summer crops, as most liverseed grass seedlings emerge in one large flush in mid-spring to early summer.
- Fallow application of Flame® in spring can control several flushes (prior to sowing wheat).
- Prior to sorghum, a winter/spring fallow application of atrazine can effectively control germinating barnyard grass for several months, provided rainfall is received within 1-2 weeks of spraying to incorporate the herbicide.
- Alternatively, atrazine plus Dual Gold® incorporated at sowing consistently gave >95% control of both barnyard and liverseed grass in seed safened sorghum (Figure 2)
- A range of residual herbicides are available for grass control in cotton.

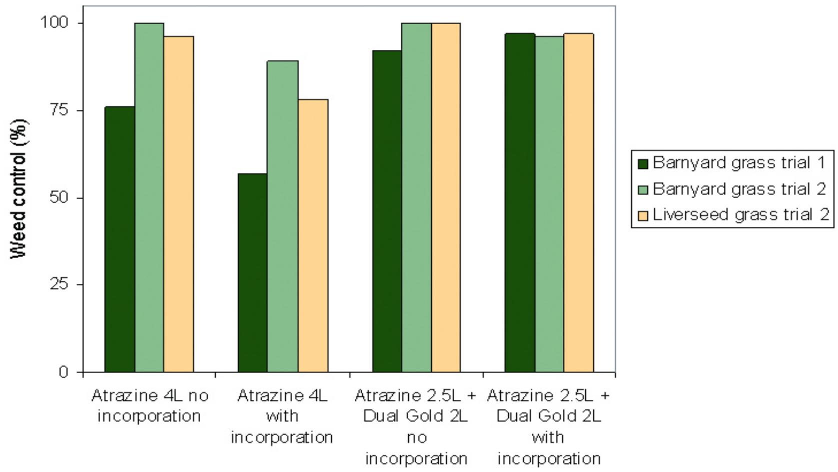


Figure 2. Excellent control of barnyard grasses (largely *Echinochloa colona*) and liverseed grass is achieved with atrazine + Dual Gold with incorporation.

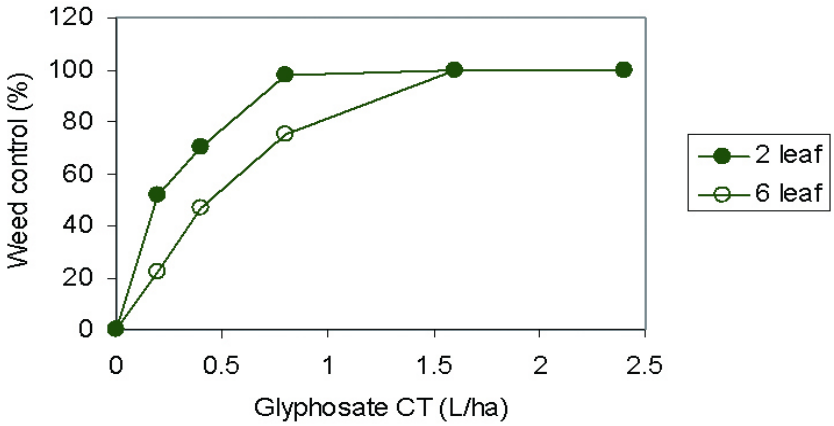


Figure 3. Control of liverseed grass seedlings decreases with weed size.

Herbicide	Product rate (ha)	Weed size	Control (%)
Glyphosate CT 450	0.8L 0.8L 1.6L 1.6L	2-3 leaves 1-3 tillers 2-3 leaves 1-3 tillers	98 67 100 87
Paraquat	1.2L 1.2L 2.0L 2.0L	2-3 leaves 1-3 tillers 2-3 leaves 1-3 tillers	97 82 99 93
Glyphosate ⇨ Paraquat	0.8L ⇨ 1.2L 0.8L⇨ 2.0L 1.6L ⇨ 1.2L 1.6L ⇨ 2.0L	2-3 leaves ⇨ 1-3 tillers 2-3 leaves ⇨ 1-3 tillers 2-3 leaves ⇨ 1-3 tillers 2-3 leaves ⇨ 1-3 tillers	100 100 100 100

Table 1. Control of barnyard grasses (largely *Echinochloa colona*) with glyphosate and paraquat at different rates and weed sizes, and with double knock using glyphosate followed by (⇨) paraquat one week later, when the weeds had grown from 2-3 leaves to 1-3 tillers.
Source: Grains Research and Development Corporation, Project DAN00079

To control seedlings in fallow

- Glyphosate and paraquat products are more effective when applied to weeds prior to tillering (Figure 3).
- Rates of knockdown products need to be increased for moisture-stressed or tillering weeds.
- Double knock with glyphosate followed by a paraquat product is highly effective (Table 1).
- Shallow tillage can be effective as the majority of seedlings emerge from the top 5cm.

To stop seed production

- Seed production of surviving weeds can be markedly reduced by increasing crop competition, such as sowing sorghum in solid 1m rows and increasing the seeding rate. This tactic can reduce replenishment of the seedbank by more than half (Figure 4).
- Double knock at robust rates can reduce grass seed production on survivors from several thousand seeds per square metre to zero.

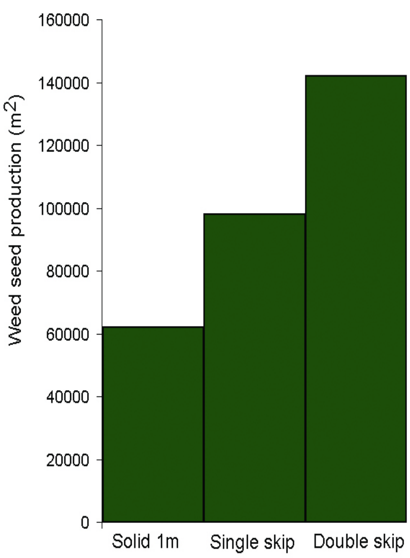
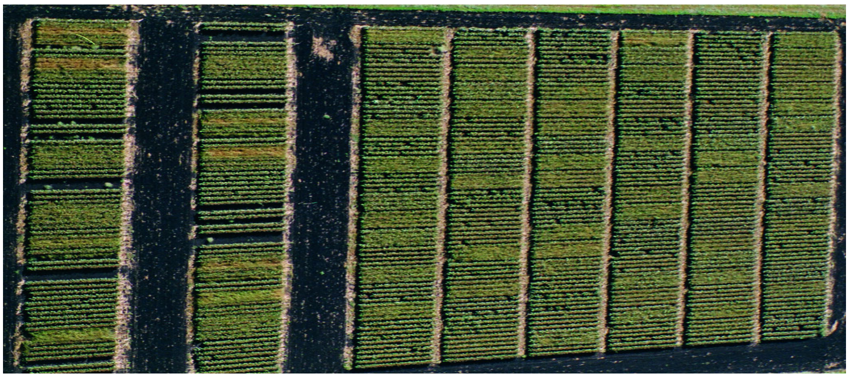


Figure 4. Seed production of barnyard grass (*Echinochloa crus-galli*) is greater in wider sorghum row spacing.



Aerial view of a sorghum competition trial. Seed production of surviving weeds can be markedly reduced by increasing crop competition, such as sowing sorghum in solid 1m rows and increasing the seeding rate
Photo: Weeds CRC

Strategic approach to better management

Improved weed management and reduced risk of herbicide resistance are based on good crop agronomy and integrated weed management principles, as outlined below.

- Keep accurate paddock records of herbicide application and regularly monitor paddocks for levels of weed control achieved.
- Use a variety of chemical and non-chemical tactics to avoid weeds escaping treatment, changes in weed flora, and potential development of herbicide resistance.
- Rotate between the different herbicide groups, and/or tank mix with an effective herbicide from another mode of action group. It is important to use robust rates for both herbicides in the mix.
- Aim for maximum herbicide effectiveness to keep weed numbers low. The primary aim of weed control is to minimise their impact on productivity, and resistance is much less likely to develop in paddocks with fewer weeds than in heavily infested paddocks.
- Use a selection of cultural weed control tools. Sowing different crops and cultivars provide opportunities to use different weed management options on key weeds. Tillage is useful when it targets a major weed flush and minimises soil inversion, as buried weed seed persist longer than on the soil surface. Competitive crops will reduce seed production on weed survivors.
- Ensure survivors do not set seed and replenish the soil seedbank.
- Avoid introduction or spread of weeds by contaminated seed, grain, hay or machinery. Also, manage weeds in surrounding non-crop areas to minimise risk of pollen and seeds moving into adjacent paddocks.
- Review the control of weeds achieved, and adjust future management strategies accordingly.

Reducing the risk of glyphosate resistance

Barnyard and liverseed grasses have a high risk of developing glyphosate resistance, particularly for growers practising zero tillage in a pre-dominant winter cropping system.

This risk is minimised greatly when integrated weed mangement is used to keep weed numbers low and if survivors from the glyphosate sprayings are prevented from setting seed.

Predictions generated using a Qld Department of Primary Industries and Fisheries model, show that barnyard grass in a winter cropping system may develop glyphosate resistance within 15-20 years of commencing zero tillage, when summer fallow weed control relies exclusively on glyphosate and survivors are not controlled (scenario 1, Figure 5).

Addition of regular summer crops using effective grass selective herbicides, such as atrazine in sorghum, increases the sustainable life of glyphosate by approximately 5-6 years (scenario 2).

Awnless barnyard grass (*Echinochloa colona*) was confirmed in 2007 as Australia's second glyphosate resistant weed.
Photo: Andrew Storrie

In addition, controlling the survivors in the first fallow flush (by tillage or double knock) further extends the useful life of glyphosate (scenario 3).

When survivors in following flushes in the summer fallow are managed, the model predicts that the barnyard grass population remains susceptible to glyphosate for more than 30 years (scenario 4).

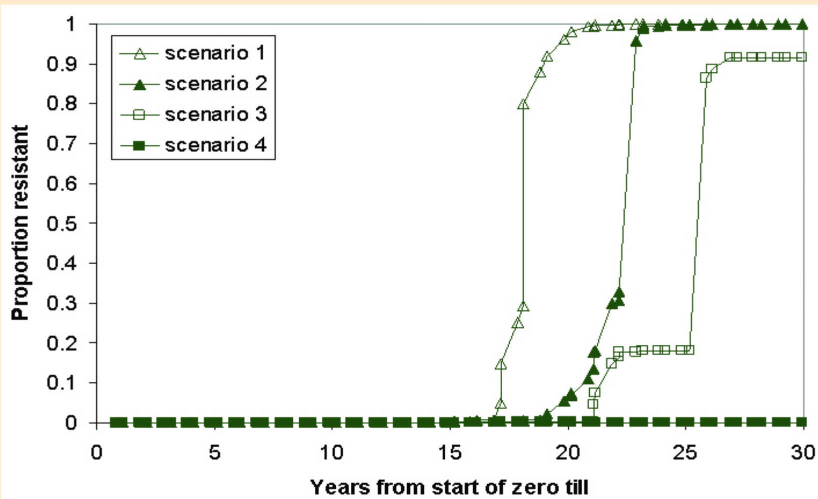


Figure 5. Predicted evolution of glyphosate resistance in awnless barnyard grass (*Echinochloa colona*) in different cropping and weed management systems.
Source: Grains Research and Development Corporation, Project DAQ00079

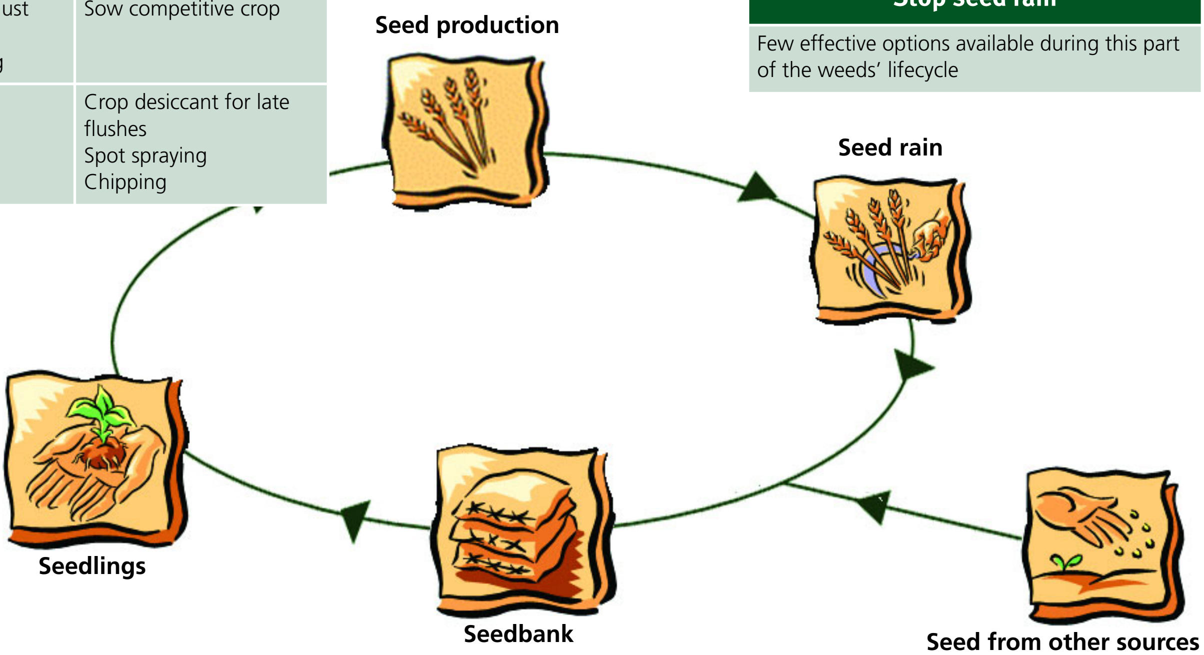
Hints for better management with herbicides

- Target small weeds (2-3 leaves) when using knockdown herbicides, particularly paraquat and Sprayseed® in fallows.
- Use higher glyphosate rates for moisture stressed weeds.
- Use double knock technique with glyphosate followed by paraquat or Sprayseed® for dense populations.
- Be aware of potential antagonism with tank mixes of glyphosate and atrazine for populations mixed with grasses and broadleaf weeds. Apply sequential sprays or increased rates.
- Apply pre-plant atrazine as close as possible to the next rain for effective incorporation.
- Add Dual Gold® to atrazine to improve annual grass control particularly for liverseed grass.
- Incorporate mechanically pre-emergence applications of atrazine and Dual Gold® for maximum effectiveness.

Management tactics which target the annual summer grass lifecycle

Stop seed production	
Fallow	Spot spraying Grazing Chipping
At and just prior to planting	Sow competitive crop
In-crop	Crop desiccant for late flushes Spot spraying Chipping

Stop seed rain
Few effective options available during this part of the weeds' lifecycle



Control seedlings	
Fallow	Cultivation Knock-down herbicides Double knock
At and just prior to planting	Sowing with full disturbance Knockdown herbicides Double knock Sow competitive crop
In-crop	Selective post-emergent herbicides (overall/banded over row) Inter-row cultivation Shielded spraying of knockdown herbicides

Deplete seedbank	
Fallow	Residual herbicides
At and just prior to planting	Pre-emergent residual herbicides Band application of residual herbicides Delayed sowing
In-crop	Lay-by application of residual herbicides (directed/shielded)

Prevent introduction of new seeds	
Fallow	Manage adjacent non-crop areas Machinery hygiene Stop movement with stock
At and just prior to planting	Manage adjacent non-crop areas Sowing weed-free seed Machinery hygiene
In-crop	Manage adjacent non-crop areas Machinery hygiene

For further information visit the Weeds CRC's website: www.weeds.crc.org.au

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Further reading: Integrated Weed Management in Australian cropping systems - a training resource for farm advisers. CRC for Australian Weed Management, Adelaide, South Australia.

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