Management of barnyard and liverseed grasses

Why are these weeds a problem?

Barnyard grass (*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 grass and liverseed grass have a high risk of developing resistance to glyphosate (Group M), particularly for growers practicing minimum or zero tillage. A population of barnyard grass in northern NSW was recently confirmed as having developed glyphosate resistance

Know your weed

Identification

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, also known as Urochloa, are easily distinguished because of their broad, pale yellow-green leaves with hairs on the leaf margins and sheaths.

Barnyard grass

Liverseed grass

Queensland Government
Department of Primary Industries and Fisheries

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 grass 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 seed-bank.

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

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

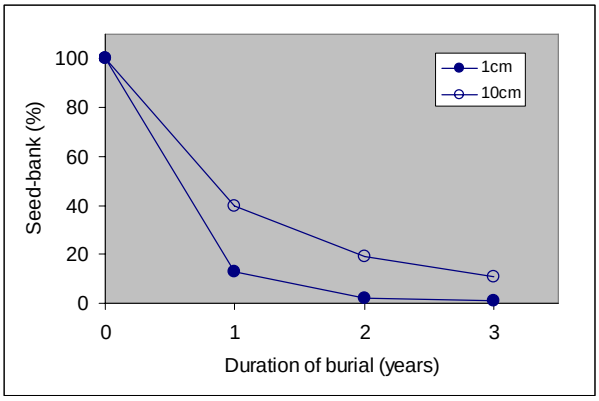

Figure 1. Persistence of barnyard grass seed increased with burial depth in soil

Strategic approach to better management

Improved weed management and reduced risk of herbicide resistance are based on good crop agronomy and integrated weed management (IWM) 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 seed-bank.
- ☑ 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.

Target all parts of the weed's lifecycle for best management…

Tactics to 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

Tactics to stop seed rain

Few effective options available during this part of the weed's lifecycle

SEED PRODUCTION

SEED RAIN

SEEDLINGS

Annual summer grass lifecycle

SEED-BANK

SEED FROM OTHER SOURCES

Tactics to 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

Tactics to 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

Tactics to deplete seed-bank

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)

Tactics for barnyard grass and liverseed grass

To deplete seed-bank

- If controlling seedlings with tillage, avoid burying seed as this will increase their persistence in the soil seed-bank (see 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 (see Figure 2).
- A range of residual herbicides are available for grass control in cotton.

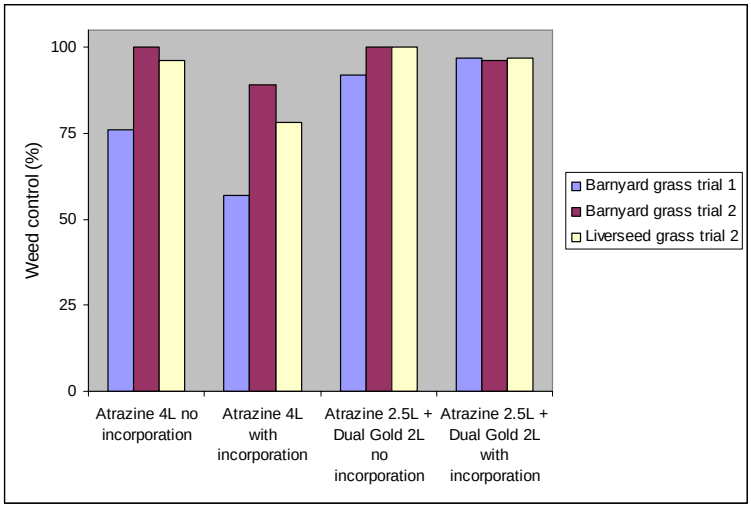

Figure 2. Excellent control of barnyard and liverseed grass achieved with atrazine + Dual Gold with incorporation

To control seedlings in fallow

- Glyphosate and paraquat products are more effective when applied to weeds prior to tillering (see 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 (see Table 1).
- Shallow tillage can be effective as the majority of seedlings emerge from the top 5cm.

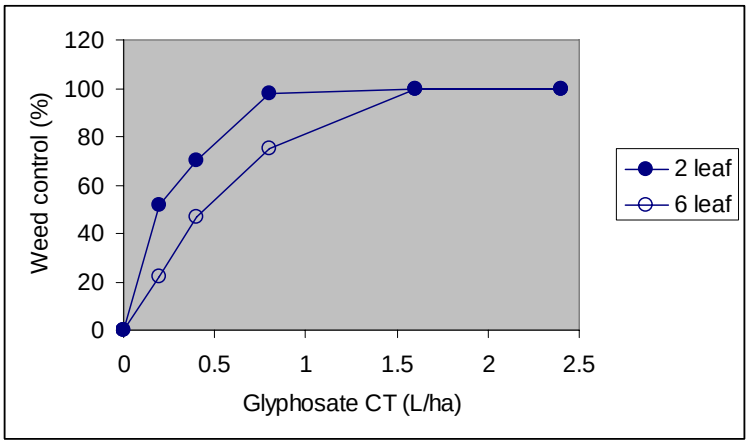

Figure 3. Control of liverseed grass seedlings decreased with increased weed size

Table 1. Barnyard grass control with glyphosate and paraquat at different rates and weed sizes, and with double knock using glyphosate followed by (⇨) paraquat 1 week later, when the weeds had grown from 2-3 leaves to 1-3 tillers

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

To stop seed production

- Seed production on 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 seed-bank by more than half (see Figure 4).
- Double knock at robust rates can reduce grass seed production on survivors from several thousand seeds per square metre to zero.

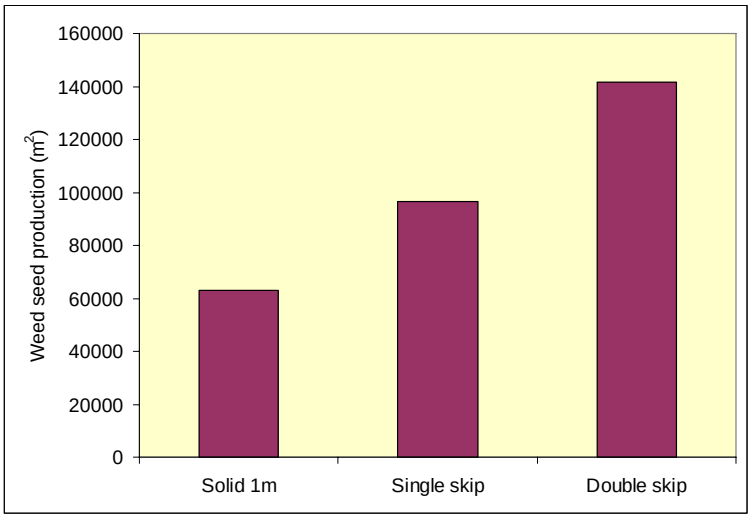

Figure 4. Barnyard grass seed production was greater in wider sorghum row spacing

Reducing the risk for glyphosate resistance

These summer grasses have a high risk of developing glyphosate resistance, particularly for growers practicing zero tillage in a pre-dominant winter cropping system. This risk is minimised greatly when IWM is used to keep weed numbers low and no survivors from the glyphosate sprayings are allowed to set seed.

Predictions, using a DPI&F 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 (see scenario 1 in figure 5).

Addition of regular summer crops using effective grass selective herbicides, such as atrazine in sorghum, increased the sustainable life of glyphosate by approximately 5-6 years (scenario 2). In addition, controlling the survivors in the first fallow flush (by tillage or double knock) further extended 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).

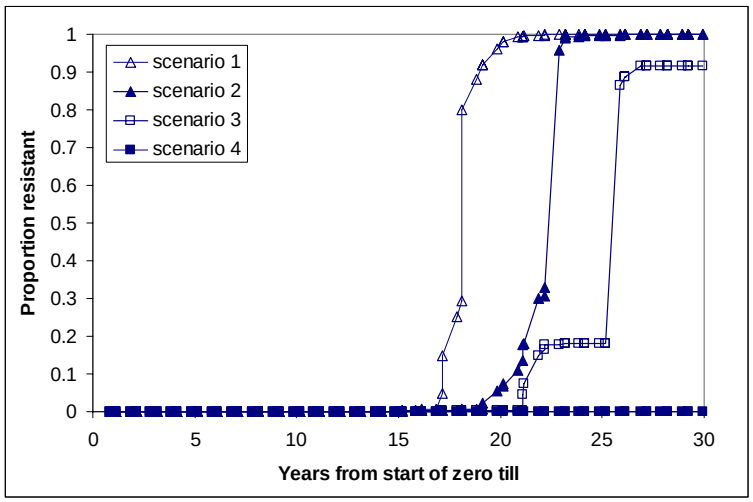

Figure 5. Predicted evolution of glyphosate resistance in barnyard grass in different cropping and weed management systems

Keeping the pressure on

The key to getting on top of these problem weeds is to attack all parts of the weed lifecycle. Do not just rely on chemical control of seedlings, but consider including other tactics in your weed management plan. Diligently stopping replenishment of the seed-bank will result in to substantially fewer problems in the future.

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.

For further information

- *Integrated Weed Management in Australian cropping systems – a training resource for farm advisers*. CRC for Australian Weed Management, Adelaide, South Australia www.weeds.crc.org.au/publications
- *Stopping herbicide resistance in southern Queensland* www.dpi.qld.gov.au/fieldcrops
- *WEEDpak* www.cotton.crc.org.au

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