Weeds and resistance – considerations for awnless barnyard grass, Chloris spp and fleabane management

Richard Daniel, Northern Grower Alliance

Key words

Awnless barnyard grass, fleabane, feathertop Rhodes grass, windmill grass, double-knock

GRDC code

NGA00003: GRDC Grower Solutions for Northern NSW and Southern Qld

UQ00055: Improving IWM practices in the Northern region

UQ00062: Improving IWM practices in the Northern region

GOA00001: GRDC Grower Solutions for Central West NSW

Take home messages

1. Glyphosate resistant and tolerant weeds are a major threat to our reduced tillage cropping systems

2. Although residual herbicides will limit re-cropping options and will not provide complete control, they are a key part of successful fallow management

3. Double-knock herbicide strategies (sequential application of two different weed control tactics) are useful tools but the herbicide choices and optimal timings will vary by weed species

4. Incorporate other weed management tactics e.g. crop competition to assist herbicide control

5. Cultivation may need to be considered as a salvage option to avoid seed bank replenishment

The issue

Weed management, particularly in reduced tillage fallows, has become an increasingly complex and expensive part of cropping in the northern grains region. Why? - Our heavy reliance on glyphosate has selected for species that were either naturally more glyphosate tolerant or selected for glyphosate resistant populations. The four key weeds that are causing major cropping headaches are:

1. Awnless barnyard grass
2. Flaxleaf fleabane
3. Feathertop Rhodes grass (*Chloris virgata*)
4. Windmill grass *(Chloris truncata)*

Although this paper will focus on chemical management of these weeds, it is clear we need to better understand and employ other weed management tactics to successfully and economically control these significant threats to cropping.

1. Awnless barnyard grass (ABYG)

Barnyard grass has been a key summer grass issue for many years. It is a difficult weed to manage for at least three key reasons:

1. Multiple emergence flushes (cohorts) each season
2. Easily moisture stressed, leading to inconsistent knockdown control
3. Glyphosate resistant barnyard grass populations are more frequently found

Resistance levels

Prior to summer 2011/12, there were 21 cases of glyphosate resistant ABYG. Collaborative survey work was conducted by NSW DPI, DAFF Qld and NGA in summer 2011/12 with a targeted follow-up in 2012/13. Agronomists from the Liverpool Plains to the Darling Downs and west to areas including Mungindi collected ABYG samples that were tested at the Tamworth Agricultural Institute with Glyphosate CT at 1.6 L/ha at a mid-tillering growth stage. Total application volume was 100 L/ha.

The key point from this survey work was that the number of 'confirmed' glyphosate resistant ABYG populations had nearly trebled. Selected populations were also evaluated in a separate glyphosate rate response trial. This experiment showed that some of these populations were still only suppressed when sprayed with 12.8 L/ha.

The days of relying on glyphosate alone for ABYG control are behind us.

Residual herbicides (fallow and in-crop)

There are a range of active ingredients registered in either summer crop e.g. metolachlor (e.g. Dual Gold®) and atrazine or in fallow e.g. imazapic (e.g. Flame®) that provide useful management of ABYG. The new fallow registration of isoxaflutole (e.g. Balance®) can provide useful suppression of ABYG but has stronger activity against other problem weed species. Few, if any, residuals give consistent complete control. However they are important tools that need to be considered to reduce the weed population exposed to knockdown herbicides as well as to alternate the herbicide chemistry being employed. Use of residuals together with camera spray technology (for escapes) can be a very effective strategy in fallow.

Double-knock control

This approach uses two different tactics applied sequentially. In reduced tillage situations, it is frequently glyphosate first followed by a paraquat based spray as the second application or 'knock'. Trials to date have shown that **glyphosate followed by paraquat has given effective control even on glyphosate resistant ABYG**. NB most effective results will be achieved from paraquat based sprays by using higher total application volumes (100 L/ha), finer spray quality and targeting seedling weeds.

A number of Gp A herbicides haloxyfop (e.g. Verdict®) and clethodim (e.g. Select®) are effective on ABYG but should be used in registered summer crops e.g. mung beans. Even on glyphosate resistant ABYG, a glyphosate followed by paraquat double knock is an effective tool. In the same situations there has been little benefit from a Gp A followed by paraquat application. NB it would also appear that Gp A herbicides are more sensitive to ABYG moisture stress. Application on larger mature weeds can result in very poor efficacy.

Timing of the paraquat application for ABYG control has generally proven flexible. The most consistent control is obtained from a delay of ~3-5 days when lower rates of paraquat can also be used. Longer delays may be warranted when there ABYG is still emerging at the first application timing, shorter intervals are generally required when weed size is larger or moisture stress conditions are expected. High levels of control can still be obtained with larger weeds but paraquat rates will need to be increased to 2.0 or 2.4 L/ha.

Key points ABYG

- Glyphosate resistance is widespread. **Tactics against this weed must change from glyphosate alone**
- Utilise residual chemistry wherever possible and aim to control 'escapes' with camera spray technology
- Try to ensure a double-knock of glyphosate followed by paraquat is used on one of the larger early summer ABYG flushes
- Restrict Gp A herbicides to ABYG management in crop and aim for strong crop competition

2. Flaxleaf fleabane

For more than a decade, fleabane has been the major weed management issue in the northern cropping region, particularly in reduced tillage systems. Fleabane is a wind-borne, surface germinating weed that thrives in situations of low competition. Germination flushes typically occur in autumn and spring when surface soil moisture levels stay high for a few days. However emergence can occur at nearly all times of the year.

One of the key issues with fleabane is that knock-down control of large plants in the summer fallow is variable and very expensive.

Resistance levels

Glyphosate resistance has been confirmed in fleabane. There is a large amount of variability in the response of fleabane to glyphosate with many samples from non-cropping areas still well controlled by glyphosate whilst increased levels of resistance are found in fleabane from reduced tillage cropping situations. The most recent survey has focused on non-cropping situations with a large number of resistant populations found on roadsides and railway lines etc where glyphosate alone has been the principal weed management tool employed.

Residual herbicides (fallow and in-crop)

One of the most effective strategies to manage fleabane is the use of residual herbicides in fallow or in-crop. Trials have consistently shown good levels of efficacy from a range of residual herbicides commonly used in sorghum, cotton, chickpeas and winter cereals.

There are now at least three registrations for residual fleabane management in fallow:

Residual (and knockdown) in fallow:

FallowBoss® Tordon® (2,4 D + picloram + aminopyralid) at 700 mL/ha + atrazine (600 g ai/L) at 3-5 L/ha, at least 4 months prior to planting sorghum

Residual control only:

Balance at 100 g/ha

Terbyne® (terbuthylazin) at 1.0-1.4 kg/ha

Prior to 2012, diuron was the most consistent residual herbicide option for fleabane management but non-crop use has been halted by the APVMA.

Additional product registrations for in-crop knockdown and residual herbicide use, particularly in winter cereals, are still being sought. There are a range of commonly used winter cereal herbicides with useful knockdown and residual fleabane activity. Trial work to date has indicated that increasing water volumes from 50-100 L/ha may help the consistency of residual control with application timing to ensure good herbicide/ soil contact also important.

Knockdown herbicides (fallow and in-crop)

Gp I herbicides have been the key products for fallow management of fleabane with 2,4 D amine the most consistent herbicide evaluated. Despite glyphosate alone generally giving poor control of fleabane, trial work has consistently shown a benefit from tank mixing 2,4 D amine and glyphosate in the first application. Registrations for knockdown management in fallow or crop include:

Knockdown in fallow:

Amicide® Advance at 0.65-1.1 L/ha + Roundup® Attack at a min of 1.15 L/ha, followed by Nuquat® at 1.6 -2.0 L/ha

FallowBoss Tordon at 700 mL/ha + Ripper® (480 g ai/L glyphosate) at 1.5-2.25 L/ha (can also be followed with Spray®Seed at 1.6 L/ha as a double-knock)

Tordon® 75 D (2,4 D + picloram) at 0.7 L/ha

Sharpen® (saflufenacil) at 17-34 g/ha + Roundup Attack at a min of 1.15 L/ha (only up to 6 leaf)

Knockdown in crop:

Amicide Advance at 1.4 L/ha (winter cereals)

FallowBoss Tordon at 300 mL/ha (winter cereals)

Double-knock control

The most consistent and effective double-knock control of fleabane has involved including 2,4 D in the first application followed by paraquat as the second. Glyphosate alone followed by paraquat will result in high levels of leaf desiccation but plants will nearly always recover.

Timing of the second application in fleabane is generally aimed at ~7-14 days after the first application. However the interval to the second knock appears quite flexible. Increased efficacy is obtained when fleabane is actively growing or if rosette stages can be targeted. Although complete control can be obtained in some situations e.g. summer 2012/13, control levels will frequently only reach ~70-80%, particularly when targeting large flowering fleabane under moisture stressed conditions. The high cost of fallow double-knock approaches and inconsistency in actual control level of large mature plants is a key reason that proactive fleabane management should be focussed at other growth stages.

Key points fleabane

- Utilise residual chemistry wherever possible and aim to control ‘escapes’ with camera spray technology
- Thrives in situations of low competition; avoid wide row cropping unless effective residual herbicides included
- 2,4 D is a critical tool for consistent double-knock control

- Successful growers have increased their focus on fleabane management in winter (crop or fallow) to avoid expensive and variable salvage control in the summer

3. Feathertop Rhodes grass (FTR)

FTR has emerged as an important weed management issue in southern Qld and northern NSW since ~2008. It is another small seeded weed species that germinates on, or close to, the soil surface. It has rapid early growth rates and can become moisture stressed quickly. Although FTR is well established in central Qld, it is still largely an 'emerging' threat further south. Try to aggressively treat the patches to avoid whole of paddock blow-outs.

Residual herbicides (fallow and in-crop)

FTR is generally poorly controlled by glyphosate alone even when sprayed under favourable conditions at the seedling stage. Trial work has shown that residual herbicides generally provide the most effective control, a similar pattern to that seen with fleabane. A wide range of currently registered residual herbicides are being screened and offer promise in both fallow and in-crop situations. The only product currently registered for FTR control is Balance at 100 g/ha for fallow use.

Knockdown herbicides (in-crop)

Currently the only registrations for knockdown of FTR are from the use of Gp A herbicides in cotton, mungbeans and other broadleaf summer crops.

Double-knock control

A glyphosate followed by paraquat double-knock is a very effective strategy on barnyard grass, however the same approach is variable and generally disappointing for FTR management. In contrast a small number of Gp A herbicides (all members of the 'fop' class) can be effective against FTR but need to be managed within a number of constraints.

- Although they can provide high levels of efficacy on fresh and seedling FTR, they need to be followed by a paraquat double-knock to get consistent high levels of final control
- Gp A herbicides have a high risk for resistance selection, again requiring follow up with paraquat
- Many Gp A herbicides have plantback restrictions to cereal crops
- Gp A herbicides generally have narrower windows of weed growth stage for successful use than herbicides such as glyphosate ie Gp A herbicides will generally give unsatisfactory results on flowering and/or moisture stressed FTR
- Not all Gp A herbicides are effective on FTR

A permit (PER12941) has been issued, in Qld only, for the control of FTR in summer fallow situations prior to planting mungbeans. It is for Verdict at 150 mL/ha followed by paraquat at a minimum of 1.6 L/ha, within 7-14 days after the first application.

Timing of the second application for FTR is still being refined but application at ~7-14 days generally provides the most consistent control. Application of paraquat at shorter intervals can be successful, when the Gp A herbicide is translocated rapidly through the plant, but has resulted in more variable control in field trials. Good control can often be obtained up to 21 days after the initial application.

Key points

- Glyphosate alone or glyphosate followed by paraquat generally poor.

- Utilise residual chemistry wherever possible and aim to control 'escapes' with camera spray technology
- A double-knock of Verdict followed by paraquat can be used in Qld prior to planting mungbeans where large spring flushes of FTR occur
- Treat patches aggressively, even with cultivation, to avoid paddock blow outs

4. Windmill grass (WG)

FTR has been a grass weed threat coming from Qld and heading south, WG is more of an issue in central NSW but is spreading north. WG is a perennial, native species found throughout northern NSW and southern Qld. The key cropping threat appears to be from the selection of glyphosate resistant populations with control of the tussock stage providing most management challenges.

Resistance levels

Glyphosate resistance has been confirmed in WG with three documented cases in NSW, all located west of Dubbo. Glyphosate resistant populations of WG in other states have all been collected from roadsides but in central west NSW, two were from fallow paddock situations.

Residual herbicides (fallow and in-crop)

Preliminary trial work has shown a range of residual herbicides with useful levels of efficacy against WG. These herbicides have potential for both fallow and in-crop situations. **Currently there are no products registered for residual control of WG.**

Double-knock control

Similar to FTR, a double-knock of a Gp A herbicide followed by paraquat has provided clear benefits compared to the disappointing results usually achieved by glyphosate followed by paraquat. Similar constraints apply to double-knock for WG control as they do for FTR.

- Although some Gp A products can provide high levels of efficacy on fresh and seedling WG, they need to be followed by a paraquat double-knock to get consistent high levels of final control
- Gp A herbicides have a high risk for resistance selection, again requiring follow up with paraquat
- Many Gp A herbicides have plantback restrictions to cereal crops
- Gp A herbicides generally have narrower windows of weed growth stage for successful use than herbicides such as glyphosate ie Gp A herbicides will generally give unsatisfactory results on flowering and/or moisture stressed WG

A permit (PER13460) has been issued, in NSW only, for the control of WG in summer fallow situations. It is for quizalofop-p-ethyl (e.g. Targa® 99.5 g ai/L) at 0.5-1.0 L/ha followed by paraquat at a minimum of 1.6 L/ha, within 7 days after the first application. Use of 200 g ai/L quiazalofop-p-ethyl formulations is also permitted at 0.25-0.5 L/ha. First application should be at WG growth stages between 3 leaf and early tillering.

Timing of the second application for WG is still being refined but application at ~7-14 days generally provides the most consistent control. Application of paraquat at shorter intervals can be successful, when the Gp A herbicide is translocated rapidly through the plant, but has resulted in more variable control in field trials and has been clearly antagonistic when the interval is one day or less. Good control can often be obtained up to 21 days after the initial application.

Key points

- Glyphosate alone or glyphosate followed by paraquat generally poor.
- Preliminary data suggests that residual chemistry may provide some benefit
- A double-knock of quizalofop-p-ethyl (e.g. Targa) followed by paraquat can be used in NSW

Conclusions

Double-knock herbicide strategies are useful tools but there is 'no one size fits all treatment'. The interval between double-knock applications is a major management issue for growers and contractors. Shorter intervals can be consistently used for weeds where herbicides appear to be translocated rapidly (e.g. ABYG) or when growing conditions are very favourable. Longer intervals are needed for weeds where translocation appears slower (e.g. fleabane, feathertop Rhodes grass and Windmill grass). Critical factors for successful double-knock approaches are to apply the first application on small weeds and ensure good coverage and adequate water volumes particularly when using products containing paraquat. Double-knock strategies are certainly NOT bullet proof and rarely effective for salvage weed control situations unless environmental conditions are exceptionally favourable.

Acknowledgments

Thank you to Steve Walker (QAAFI), Tony Cook (NSW DPI) and Maurie Street (GOA) for their input and provision of trial data.

® Registered trademark

Contact details:

Richard Daniel
Northern Grower Alliance
Ph: 07 4639 5344
Email: richard.daniel@nga.org.au

Reviewed by