

GRDC Northern Adviser E-newsletter

E-newsletter #2, (Northern newsletter number 56)

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Patterns of resistance in wild oats to Group A herbicides

If you have paddocks where Group A herbicides have failed to kill wild oats and resistance is suspected, what you test for can be very important. It is false to assume that once one fop fails on wild oats that all fops will fail.

According to Dr Chris Preston from Adelaide University, when Group A resistance in wild oats is selected using primarily Wildcat[®] (fenoxaprop - Group A) and Topik[®] (clodinafop- Group A) in about 40% of situations the resistance gene selected acts to detoxify the herbicides via a metabolic detoxification pathway. This is different from a target site resistance where one or more structural changes occur on the herbicide binding site on the ACCASE enzyme.

Metabolic resistance can be a good or a bad thing compared to a target site resistance. The down side is that metabolic resistance in wild oats is also likely to confer cross resistance to the herbicide flamprop-methyl (Mataven[®] - Group K). The upside however, is that the ACCASE target site is still open for attack and other Group A herbicides like Verdict[®] (haloxyfop) may still work.

The bottom line is that unless you conduct a seed or live plant test to see what still works, you won't know what to use with confidence. As the old saying goes "the spray that costs is the one that does not work".

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Seed testing for resistance

There are three main types of test to determine resistance and more importantly to identify what herbicides are likely to work in the future. These are:

1. [Seed tests](#)
2. [Live plant tests](#)
3. [In-situ spray tests](#)

Seed tests

Seed tests can be used to test for resistance to both pre and post emergent herbicides. In every test, samples are compared to both known resistant and susceptible populations.

How you sample will depend on the situation. If resistance appears to be widespread across the paddock, then collect seeds following a W shaped transect and sample plants every 10-20m.

However, if weeds have survived in patches (as is usually the case in early stages of resistance development) then it is these patches where your resistance problem is most likely to be coming from for next season - so sample selectively from these areas. Be aware that it is possible that different patches could have different resistance profiles. If resistance to selective in-crop herbicides occurs in patches and weeds are sampled in a fallow, resistance could be missed.

Be sure to collect seed from a large number of plants and to keep the sample representative by collecting a similar number of seeds from each plant.

After harvest sampling can be done by collecting from between the crop rows or from header screenings.

To conduct a 4-8 herbicide resistance test, you will need: about one cup of ryegrass, or 3 cups of wild oat seeds, or a 2L ice-cream container of wild radish seeds.

A down side of seed tests is that seed dormancy must first be broken and thus they take 8-12 weeks before results are generated.

Live plant tests – the Syngenta Quick Test

The Quick Test or Live plant test works on all GRASS weed species at growth stages from seedling - late tillering. With a turnaround time of 4-6 weeks, it is far quicker than the seed test and may be back in time to enable decisions on management to be made in the same season as the spray failure. As with the seed test, samples are compared to both known resistant and susceptible populations

Live plant samples are taken – roots and all from areas where grass weeds have survived a herbicide. The Quick-Test can also be used to test young plants prior to

the application of a selective in-crop herbicide. If resistance is not widespread throughout the paddock, one must consider that there is a chance that resistant plants can be missed. However, the test is particularly useful when resistant plants are confirmed because this provides valuable information as to the most effective herbicide program.

For a 4 herbicide test, between 50 -100 plants are needed.

Plants should be separated and washed to remove all traces of soil. DO NOT add any more water. Avoid wet foliage as this can result in rotting! Plants should be dry with slightly moist roots (from the washing procedure). It is best to send plants in slightly too dry than too damp. More specific instructions are included on the website.

In-situ tests

Weeds that have survived a herbicide can be sprayed in small plot test strips to see what still works. Such testing provides the fastest feedback to confirm resistance and provide feedback on what still works. Unlike the Seed and Quick-Tests, there are no known resistant and susceptible populations to compare the paddock sample to. This may make interpretation of the results difficult.

By the time a herbicide failure is noted, it is generally 3 or more weeks past the optimum date for spraying. Weeds will be bigger, potentially affected by temperature or moisture stress and may also be suffering stress from previously applied herbicides. It is thus important when conducting in-situ test strips that robust rates for the weed size and conditions are used, particularly for products such as some Group B herbicides which are only active on younger growth stage weeds. You do not want to be left wondering if weeds sprayed in an in-situ test strip did not die because they were too big or stressed and you did not put on a sufficient rate to kill them.

Further information:

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Tillage in no-till fallows – one step forward three steps back?

Tillage that redistributes weed seed in the soil to depths of 10 cm could significantly prolong the seed bank life of problem weeds such as awnless barnyard grass (*Echinochloa colona*). Shallow tillage is more likely to be a useful management tool as it will act to stimulate short term emergence with less promotion of seed bank dormancy.

Resistance to glyphosate in several key grass weeds in northern no-till fallow is increasing fast. This coupled with species shift to more difficult to kill grass weeds such as feather top Rhodes grass, and the potentially glyphosate resistant windmill grass, is leading many agronomists and growers to evaluate where and how tillage could be re-introduced into no-till systems. While it is true that MOA Group S (for steel) does not have resistance, there could be some very nasty implications for weed seed bank dynamics if not implemented correctly.

It is likely that any tillage in a no-till system will have potentially negative impacts on soil structure and water storage. Thus the main motivation to use tillage for weed management is to provide better management of problem weeds.

In reintroducing tillage in a no-till system, it is important to understand the interaction of tillage and seed bank burial on the life of the weed seed bank.

Seed bank decay is for most weeds at its highest when weeds are left on the surface and are exposed to daily fluctuations in temperature, moisture and predation by surface active insects such as ants.

Any tillage in such a system will act to bury weed seed and this has implications for managing the weed seed bank.

Small seeded surface germinating weeds such as milk thistle (*Sonchus oleraceae*) and fleabane (*Conyza bonariensis*) and to a lesser extent feather top Rhodes grass (*Chloris virgata*) and windmill grass (*Chloris truncata*), do not germinate well if buried below 1 cm depth.

With the exception of small surface germinators like milk thistle and fleabane, a shallow tillage operation of 1-3 cm will stimulate the germination of most weed seeds. This occurs by placing the seed in better contact with the soil and in some weeds, the physical effect of scarifying the seed coat helps the seed imbibe water and then to germinate. Older hands will recall the autumn tickle where a shallow harrowing was used to help stimulate a germination of grass and broadleaved weeds which were then killed by tillage or knockdown herbicides prior to sowing. This process has the capability to greatly reduce the in-crop weed burden and thus the pressure on in-crop selective herbicides and can result in a rapid depletion of the seed-bank – provided there is no replenishment of weed seed from surviving weeds.

But care is needed that weed seed is not buried too deep as this can greatly prolong weed seed survival.

For example – awnless barnyard grass (*Echinochloa colona*) mainly germinates from the 0-2 cm zone, with little seed germinating from depths of greater than 10 cm. However if buried, seed is far more likely to stay viable and pose a problem for longer as the following trial data shows.

Table 1: Survival of awnless barnyard grass after 12 months burial (Darling Downs)

Depth of burial (cm)	% of seed surviving
0	13%
5	25%
10	40%

Similar results are reported for many weeds where tillage and seed burial promote seed bank dormancy - making it harder to run the weed seed bank down fast.

Table 2: Duration of burial of wild radish and % seed survival as affected by depth of burial

Depth of burial (cm)	Duration of burial (years) and % wild radish seed survival				
	0.5	1	2	3	4
0	43	19	5	4	5
1	10	12	16	5	3
5	55	47	52	27	21
10	75	57	53	44	43

Source G Code

The implications for management of northern no-till fallow are that if we can leave weed seed on the surface then natural seed bank decay rates are generally optimised. If we need to insert tillage into the system, it is critical that the tillage used is shallow and does not lead to seed burial below the top 3-4 cm. Shallow soil disturbance is likely to stimulate weed emergence on the next rainfall and plans need to be in place to deal with this.

Further Information:

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The IWM Weed Management Manual can be downloaded from:

www://glyphosateresistance.org.au/manual.htm

GRDC code: ICN00009

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Seed bank dormancy – 2010 seed to hang about longer than usual

With wet conditions hampering timely use of post-emergent herbicides in many crops in 2010, a lot of weed seed will be set. The highly favourable 2010 seasonal conditions are likely to result in elevated levels of weed seed bank dormancy, when compared to a more average season with a tougher finish.

Higher levels of seed bank dormancy will mean a smaller percent of the weed seed bank is likely to germinate on autumn rains in 2011, with more germination in later cohorts during the season and into the next.

In addition to normal management tactics, the use of competitive crops and agronomy as well as effective pre-emergent herbicides are useful tactics for combating weeds with successive and dense germinations.

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Fallow options for barnyard grass should not include Group A

Group A herbicides do a remarkable thing and in recent times we seem to have forgotten just how remarkable that is! They selectively remove grass weeds from a wide range of broadleaved crops – providing us not only with a range of rotational crop options, but also crops in which we can both make money and drive down a grass weed seed bank.

In much of the Northern Grains Region we have not as yet placed too high a selection pressure for Group A resistance in summer annuals such as awnless barnyard grass or liverseed grass (*Urochloa panicoides*). We know that the frequency of genes for Group A resistance are such that about 6 years of selection where survivors are allowed to set seed will lead to resistance. Efficacious Group A herbicides help provide easy options for broadleaved summer crops and drive down the weed seed bank and if looked after, can do this for years to come.

Well managed fallows help crops make money – they are however a cost to the system and do not in themselves make money!

All effort should be made to avoid premature sacrifice of Group A herbicides. They should NOT be used in the fallow.

Tactics for consideration in paddocks where glyphosate resistance is present in summer annual grass weeds include combinations of:

- Less sorghum and more mungbean or soybean using both residual and in-crop herbicides for grass control
- Double knock the barnyard grass with glyphosate followed by paraquat or use a two spray program of paraquat or Spray.Seed®
- More residual herbicides in the fallow – i.e. Imazapic – (Flame® - Group B)
- WeedSeeker to make more frequent use of maximum label rates of paraquat more affordable
- Tillage in the fallow and re-instatement of shallow sweeps at sowing – taking care to keep seed incorporation shallow and have a plan to deal with an increased number of weeds on the first rainfall after disturbance

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GRDC code: ICN00009

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