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GRDC
GROWNOTES™

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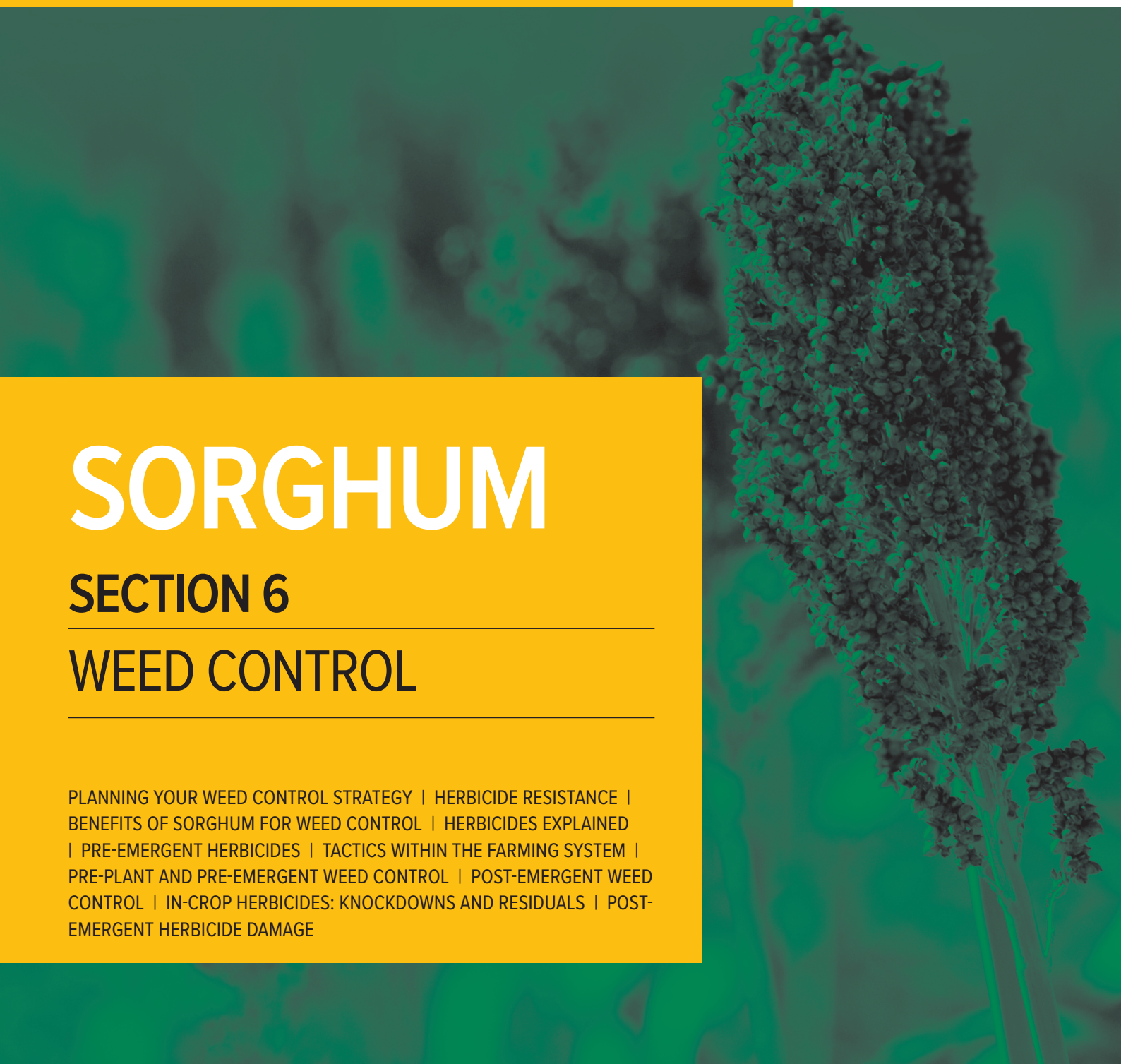
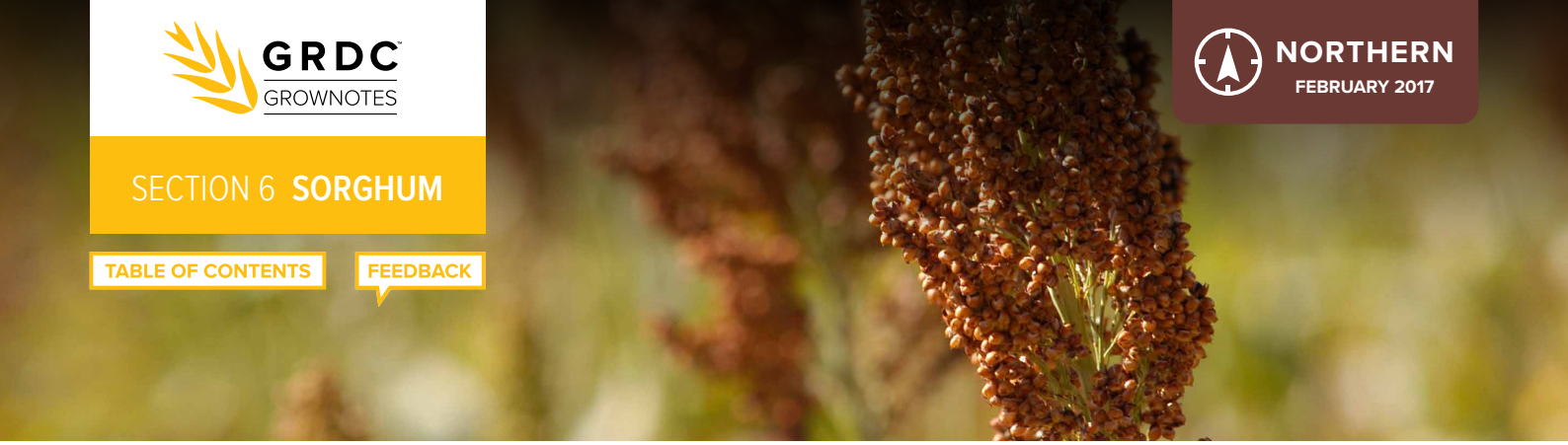


SORGHUM

SECTION 6

WEED CONTROL

PLANNING YOUR WEED CONTROL STRATEGY | HERBICIDE RESISTANCE | BENEFITS OF SORGHUM FOR WEED CONTROL | HERBICIDES EXPLAINED | PRE-EMERGENT HERBICIDES | TACTICS WITHIN THE FARMING SYSTEM | PRE-PLANT AND PRE-EMERGENT WEED CONTROL | POST-EMERGENT WEED CONTROL | IN-CROP HERBICIDES: KNOCKDOWNS AND RESIDUALS | POST-EMERGENT HERBICIDE DAMAGE



Weed control

Weeds are estimated to cost Australian agriculture A$2.5–4.5 billion per annum. Consequently, any practice that can reduce the weed burden is likely to generate substantial economic benefits to growers and the grains industry. See more at www.grdc.com.au/weedlinks. [1]

Weed control is essential if growing the crop on summer rainfall, and to prevent weed seeds from contaminating the grain sample at harvest. Weed management should be planned well before planting and options considered such as chemical and non-chemical control. [2]

The Grains Research and Development Corporation (GRDC) supports integrated weed management. Download the Integrated Weed Manual.

Weed control is important, because weeds can:

- rob the soil of valuable stored moisture
- rob the soil of nutrients
- cause issues at sowing time, restricting access for planting rigs (especially vine-type weeds such as melons, tarvine or bindweed, which wrap around tines)
- cause problems at harvest
- increase moisture levels of the grain sample (green weeds)
- contaminate the sample
- prevent some crops being grown where in-crop herbicide options are limited, i.e. broadleaf crops
- be toxic to stock
- carry disease
- host insects

6.1 Planning your weed control strategy

1. Know your weed species. Ask your local adviser or service provider or use the Sydney Botanic Gardens plant identification service, which is free in most cases (see link).
2. Conduct in-crop weed audits prior to harvest to know which weeds will be problematic the following year.
3. Ensure wheat seed is kept from a clean paddock.
4. Have a crop-rotation plan that considers not just crop type being grown but also what weed control options this crop system may offer, e.g. grass control with triazine-tolerant (TT) canola.

6.2 Herbicide resistance

Herbicide resistance is an increasing threat across Australia's northern grain region for both growers and agronomists. Already 14 weeds have been confirmed as herbicide-resistant in various parts of this region, and more have been identified at risk of developing resistance, particularly to glyphosate.

MORE INFORMATION

https://grdc.com.au/Resources/IWMhub/Section-2-Agronomy-to-enhance-weed-management

MORE INFORMATION

The Royal Botanic Gardens Plant Identification & Botanical Information Service: https://www.rbgsyd.nsw.gov.au/science-conservation/plant-id-disease-diagnostic-services

MORE INFORMATION

GRDC Fact Sheet: Group A Herbicides in Fallow

1 GRDC (2005) Weed Links, Integrated weed management. GRDC, www.grdc.com.au/weedlinks

2 QDAF (2012) Wheat—planting information. Department of Agriculture, Fisheries and Forestry, Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/wheat/planting-information

In northern NSW, 14 weeds are confirmed resistant to herbicides of Group A, B, C, I, M or Z (see Table 1). As well, barnyard grass, liverseed grass, common sowthistle and wild oat are at risk of developing resistance to Group M (glyphosate) herbicides (see Table 2). Glyphosate-resistant annual ryegrass has been identified within ~80 farms in the Liverpool Plains area of northern NSW. [3]

Table 1: *List of confirmed resistant weeds in northern NSW (current at November 2016).*

Weed	Herbicide group and product/chemical (examples only)	Areas with resistance in NSW	Future risk	Detrimental impact
Wild oats	A. Topik® and Wildcat® B. Atlantis® Z. Mataven®	Spread across the main wheat-growing areas. More common in western cropping areas	Areas growing predominantly winter crops	High
Paradoxa grass	A. Wildcat®	North and west of Moree	Areas growing predominantly winter crops	High
Awnless barnyard grass	C. Triazines M. Glyphosate	Mainly between Goondiwindi and Narrabri	No-till or minimum tilled farms with summer fallows	High Very high
Charlock, black bindweed, common sowthistle, Indian hedge mustard, turnip weed	B. Glean®, Ally®	Spread across the main wheat growing areas	Areas growing predominantly winter crops	Moderate
Annual ryegrass	M. Glyphosate B. Glean® A. Verdict®	Group M widespread in Liverpool Plains. Group A and B resistance in central west NSW	Areas with predominantly summer fallows. Winter cropping areas	High High
Fleabane	M. Glyphosate	Spread uniformly across the region	Cotton crops and no-till or minimum tilled systems	Moderate
Wild radish	I. 2,4-D amine	Central west NSW	Continuous winter cereal cropping	High
Windmill grass	M. Glyphosate	Central west NSW	Continuous winter cropping and summer fallows	High
Liverseed grass	M. Glyphosate	A few isolated cases	No-till or minimum tilled systems	Moderate
Sowthistle	M. Glyphosate	Liverpool Plains	Winter cereal dominated areas with minimum tillage	High
Feather-top Rhodes grass	M. Glyphosate	Widespread, more common in the north	No-till or minimum tilled systems, sorghum and cotton crops	High

Table 2: *List of potential new resistant weeds in northern NSW (as at November 2016).*

Weed	Herbicide group and product/chemical (examples only)	Future risk	Detrimental impact
Barnyard, liverseed and windmill grasses	A. Verdict® L. Paraquat	No-till and minimum tilled systems	Very high Very high
Common sowthistle	I. 2,4-D amine	Winter cereals	High
Paradoxa grass	B. Glean®, Atlantis®	Western wheat growing areas	High
Other brassica weeds including wild radish	B. Glean®,, Ally®	Areas growing predominantly winter crops	Moderate
Annual ryegrass	L. Paraquat	Areas with predominantly summer fallows	Very high
Wireweed, black bindweed, melons and cape weed	I. 2,4-D amine, Lontrel®, Starane®	Areas growing predominantly winter crops	High
Fleabane	I. 2,4-D amine	Cotton crops and no-till or minimum tilled systems	Very high
Other fallow grass weeds	M. Glyphosate	No-till or minimum tilled systems	High

3 A Storrie *et al.* Managing herbicide resistance in northern NSW, NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/155148/herbicide-resistance-brochure.pdf

Testing services

For testing of suspected resistant samples, contact:

Charles Sturt University Herbicide Resistance Testing
School of Agricultural and Wine Sciences
Charles Sturt University
Locked Bag 588
Wagga Wagga, NSW 2678
02 6933 4001
http://www.csu.edu.au/weedresearchgroup/herbicide-resistance

Plant Science Consulting
22 Linley Ave
Prospect, SA 5082
0400 664 460
info@plantscienceconsulting.com.au
www.plantscienceconsulting.com

6.2.1 Be a WeedSmart farmer

Figure 1: *WeedSmart logo.*

The Australian grain industry stands at the crossroads with two options. Which direction will it take?

One road is for every grower to make herbicide sustainability their number one priority so that it influences decision-making and practices on all Australian grain farms. Armed with a clear 10-point plan for what to do on-farm, grain growers have the knowledge and specialist support to be WeedSmart.

On this road, growers are capturing and/or destroying weed seeds at harvest. They are rotating crops, chemicals and modes of action. They are testing for resistance and aiming for 100% weed kill, and monitoring the effectiveness of spray events.

In addition, they are not automatically reaching for glyphosate, they do not cut on-label herbicide rates, and they carefully manage spray drift and residues. Growers are planting clean seed into clean paddocks with clean borders. They use the double-knock technique and crop competitiveness to combat weeds.

On this road, the industry stands a good chance of controlling resistant weed populations, managing difficult-to-control weeds, prolonging the life of important herbicides, protecting the no-till farming system and maximising yields.

The other option is for growers to think resistance is someone else's problem, or an issue for next year, or something they can approach half-heartedly.

If herbicide resistance is ignored, it will not go away. Managing resistance requires an intensive but not impossible effort. Without an Australia-wide effort, herbicide

MORE INFORMATION

www.weedsmart.org.au

VIDEOS

Richard Daniel, NGA Discusses Herbicide Resistance Tactics: http://www.weedsmart.org.au/bulletin-board/rethinking-weed-control/

resistance threatens the no-till system, land values, yields and your hip pocket. It will drive down the productivity levels of Australian farms.

Jump on board WeedSmart and take the road of least resistance. [4]

6.2.2 Ten ways to weed out herbicide resistance

1. Act now to stop weeds from setting seed.
   - » Destroy or capture weed seeds.
   - » Understand the biology of the weeds present.
   - » Remember that every successful WeedSmart practice can reduce the weed seedbank over time.
   - » Be strategic and committed—herbicide resistance management is not a 1-year decision.
   - » Research and plan your WeedSmart strategy.
   - » You may have to sacrifice yield in the short term to manage resistance—be proactive.
   - » Find out what other growers are doing, and visit www.weedsmart.org.au.
2. Capture weed seeds at harvest. Options to consider are:
   - » Create and burn narrow windrows.
   - » Produce hay where suitable.
   - » Funnel seed onto tramlines or silage in controlled traffic farming (CTF) systems.
   - » Use a green or brown manure crop to achieve 100% weed control and build soil nitrogen levels.
3. Rotate crops and herbicide modes of action:
   - » Look for opportunities within crop rotations for weed control.
   - » Understand that repeated application of effective herbicides with the same mode of action (MOA) is the single greatest risk factor for evolution of herbicide resistance.
   - » Protect the existing herbicide resource.
   - » Remember that the discovery of new, effective herbicides is rare.
   - » Acknowledge that there is no quick chemical fix on the horizon.
   - » Use break crops where suitable.
4. Test for resistance to establish a clear picture of paddock-by-paddock weed status:
   - » Sample weed seeds prior to harvest for resistance testing to determine effective herbicide options.
   - » Visit the WeedSmart website, www.weedsmart.org.au or www.ahri.uwa.edu.au for more information on herbicide-resistance survey results.
   - » Collaborate with researchers by collecting weeds for surveys during the double-knock program (northern region).
5. Aim for 100% weed control and monitor every spray event:
   - » Stop resistant weeds from returning into the farming system.
   - » Focus on management of survivors in fallows (northern grains region).
   - » Where herbicide failures occur, do not let the weeds seed. Consider silage, chipping, fallowing or brown manuring the paddock.
   - » Patch-spray areas of resistant weeds only if appropriate.
6. Do not automatically reach for glyphosate:
   - » Use a diversified approach to weed management.
   - » Consider post-emergent herbicides where suitable.

4 WeedSmart, http://www.weedsmart.org.au

- » Consider strategic tillage.

7. Never cut the on-label herbicide rate and carefully manage spray drift and residues:
   - » Use best management practice in spray application. The GRDC has produced a series of Fact Sheets, available at www.grdc.com.au.
   - » Consider selective weed sprayers such as WeedSeeker or WeedIt.
8. Plant clean seed into clean paddocks with clean borders:
   - » It is easier to control weeds before the crop is planted.
   - » Plant weed-free crop seed to prevent the introduction of new weeds and the spread of resistant weeds.
   - » A recent Australian Herbicide Resistance Initiative (AHRI) survey showed that 73% of grower-saved crop seed was contaminated with weed seed.
   - » The density, diversity and fecundity of weeds are generally greatest along paddock borders and areas such as roadsides, channel banks and fence lines.
9. Use the double-knock technique:
   - » Double-knock is the use of any combination of weed control that involves two sequential strategies; the second application is designed to control survivors of the first method of control used.
   - » Access GRDC research results at www.grdc.com.au or www.nga.org.au.
10. Employ crop competitiveness to combat weeds:
    - » Consider narrow row spacing and seeding rates.
    - » Consider twin-row seeding points.
    - » Use barley and varieties that tiller well.
    - » Use high-density pastures as a rotation option.
    - » Consider brown manure crops. [5]

MORE INFORMATION

www.weedsmart.org.au

http://www.ahri.uwa.edu.au

https://grdc.com.au/Resources/IWMhub/Section-1-Herbicide-resistance

6.3 Benefits of sorghum for weed control

Crop rotation, especially with summer crops, can be an effective means of managing a spectrum of weeds that result from continuous wheat cropping.

The use of rotations that include both broadleaf and cereal crops may allow an increased range of chemicals—say three to five MOAs—or non-chemical tactics such as cultivation or grazing. For the management of wild oats, the inclusion of a strategic summer crop such as sorghum means two winter fallows, with glyphosate an option for fallow weed control. Grazing and/or cultivation are alternative, non-chemical options.

Where continuous summer cropping has led to development of Group M resistant annual ryegrass, a winter crop could be included in the rotation and a Group A, B, C, D, J or K herbicide used instead, along with crop competition and potential harvest management tactics.

For summer grasses, consider a broadleaf crop such as mungbean, because a Group A herbicide and crop competition can provide good control.

Strategic cultivation can provide control for herbicide-resistant weeds and those that continue to shed seed throughout the year. It can be used to target large mature weeds in a fallow, for inter-row cultivation in a crop, or to manage isolated weed patches in a paddock. Take into consideration the size of the existing seedbank and the increased persistence of buried weed seed, but never rule it out.

Most weeds are susceptible to grazing. Weed control is achieved through reduction in seed-set and competitive ability of the weed. The impact is optimised when the timing of the grazing occurs early in the life cycle of the weed. [6]

5 WeedSmart, http://www.weedsmart.org.au

6 GRDC (2012) Herbicide resistance, http://www.grdc.com.au/Media-Centre/Hot-Topics/Herbicide-Resistance

6.4 Herbicides explained

6.4.1 Residual *v.* non-residual

Residual herbicides remain active in the soil for an extended period (months) and can act on successive weed germinations. Residual herbicides must be absorbed through the roots or shoots, or both. Examples of residual herbicides include imazapyr, chlorsulfuron, atrazine and simazine.

The persistence of residual herbicides is determined by a range of factors including application rate, soil texture, organic matter levels, soil pH, rainfall/irrigation, temperature and the herbicide's characteristics.

6.5 Pre-emergent herbicides

Choosing herbicides for weed control will depend on the specific weed species present in the paddock and the crop being grown. Consult your agronomist to discuss specific strategies.

Good weed control management in summer crops such as sorghum is essential for the production of high-yielding and profitable crops.

Weeds lower crop yields by competing for soil water, nutrients, space and light. In dryland crops where water is often severely limited, competition for water is the most critical factor in reducing yields. For irrigated crops, competition for light and nutrients is more important. Cropping options can also be restricted by the difficulty or inability to control weeds in some crops, such as burrs and thornapples in sunflower.

Growers should aim to reduce weed numbers and keep them low with an ongoing control program. Management practices that combine all of the available methods are the key to successful weed control.

Weed control starts in the previous crop or pasture where weeds should not be allowed to set seed. No single herbicide will control all weeds. Combinations of herbicides and/or cultivations may be needed. A missed herbicide spray or tillage operation can seriously reduce the effectiveness of a weed control program.

Control of weeds along fences, contour banks, waterways, irrigation channels and other non-cropped areas is also important. [7]

6.6 Tactics within the farming system

- Crop rotation—a well managed rotation in each paddock with broadleaf and cereal crops alternated is a very useful weed control technique. For example, grasses are more easily and cheaply controlled by chemicals in broadleaf crops, while broadleaf weeds are easier to control in cereal crops. In northern NSW, alternating of summer and winter crops is an important weed control strategy. Good crop rotation management can substantially reduce the overall cost of chemical weed control.
- Haymaking or silage-making—these fodder conservation methods can be effective in reducing weed burdens as weed seeds are removed from the paddock in the hay or silage.
- Pasture management techniques including pasture topping by mowing or using herbicides, spray-grazing, strategic heavy grazing or burning and can play a role in weed control programs.
- Good agronomic practices such as using weed free seed and timely sowing with optimal plant populations and adequate nutrition contribute to good weed control management.

VIDEOS

Chris Preston University of Adelaide discusses strategies behind managing weeds around paddock boundaries and along fencelines. Video: Weed control on paddock boundaries and fencelines

7 http://www.dpi.nsw.gov.au/content/agriculture/pests-weeds/weeds/weed-control/summer

- Timely cultivation is a valuable method of killing weeds and preparing seedbeds. Most growers use varying combinations of mechanical and chemical weed control to manage their fallows or stubbles.
- Fallow weed control—the basis of a successful dryland summer crop is a weed free fallow. No-till and minimum-till fallows have become the norm, no-till has enabled crops to be sown at the optimum time and to be sown when it is too dry to sow into a cultivated fallow. Also, no-till has often reduced operating costs to less than those for cultivated fallows, with significant machinery and tractor-time savings.

Opportunity double-cropping following winter cereals has succeeded where there is sufficient soil moisture. In no tillage systems, stubble retention is vital for improving soil structure, reducing soil erosion and degradation, storing soil moisture and having a wetter seedbed. Farmers have moved away from cultivating fallows to minimum and no tillage by substituting knockdown and residual herbicides. [8]

6.7 Pre-plant and pre-emergent weed control

Pre-plant or pre-emergent weed control of grasses is essential in sorghum and maize and preferable in broadleaf crops. Similarly, broadleaf weed control is preferable at this stage. In seeking flexible cropping options, farmers are often avoiding the use of residual herbicide, especially for grass control. [9]

6.8 Post-emergent weed control

Weeds should be removed from: sorghum and maize within three to four weeks of emergence to prevent yield loss; soybeans within four to seven weeks of planting; sunflower within two to three weeks of emergence. Adzuki bean, mungbean and pigeon pea are more sensitive to weeds than soybeans. Similarly, millets are more sensitive to weeds than sorghum.

The extent of yield reduction depends on the weed species, weed and crop density and the size of weeds when control measures are applied. The stage of weed and crop growth are vital factors when planning successful post-emergent herbicide use. Read herbicide labels carefully for these details and information on optimum conditions for spraying. [10]

Significant yield losses occur if weeds are not killed until 4–5 weeks after planting. For effective control of most weeds, apply atrazine either before planting, at planting or immediately after planting. Apply Primextra® Gold, Dual® Gold or other metolachlor products as a pre-emergent spray for grass control, especially liverseed grass. Treat seed with Concep®II seed safener when using Primextra® Gold, Dual® Gold or other S-metolachlor products.

No-till and minimum-till fallowed crops where atrazine and glyphosate have been used, should have excellent weed control at planting and during crop growth. These fallows conserve more soil moisture and should improve the chances of planting crops at the optimum time.

Atrazine residues prevent the planting of crops other than sorghum or maize for 18 months after application of 2.5–6.5 L/ha of atrazine 500 g/L, 1.4–3.3 kg/ha of atrazine 900 g/kg or more than 3.2 L/ha of Primextra® Gold. Check the herbicide label. Where residues occur on soils with a pHCa greater than 7, a small field test, pot test or an analytical test should be done before planting susceptible crops. Pennisetum forages, white french millet, faba bean, chickpea and cowpea (in order of decreasing tolerance) may tolerate limited residues. Most other crops are highly sensitive. Herbicide resistance is an emerging problem in most grain producing areas. Producers should target their weed control carefully so that the correct rate

8 http://www.dpi.nsw.gov.au/content/agriculture/pests-weeds/weeds/weed-control/summer
9 http://www.dpi.nsw.gov.au/content/agriculture/pests-weeds/weeds/weed-control/summer
10 http://www.dpi.nsw.gov.au/content/agriculture/pests-weeds/weeds/weed-control/summer

and timing of application is achieved and rotate herbicide groups. This is particularly important for harder to kill weeds such as barnyard grass, liverseed grass, fleabane and bindweed. [11]

6.8.1 Avoiding crop damage from residual herbicides

When researching the residual activity and cropping restrictions following herbicide application, the herbicide label is the primary source of information and it should be read thoroughly. The information below provides an explanation of how herbicides break down and extra notes on some specific herbicides used in broadacre cropping.

What are the issues?

Some herbicides can remain active in the soil for weeks, months or years. This can be an advantage, as it ensures good long-term weed control. However, if the herbicide stays in the soil longer than intended it may damage sensitive crop or pasture species sown in subsequent years.

For example, chlorsulfuron (Glean®) is used in wheat and barley, but it can remain active in the soil for several years and damage legumes and oilseeds.

A real difficulty for growers lies in identifying herbicide residues before they cause a problem. Currently, we rely on information provided on the labels about soil type and climate. Herbicide residues are often too small to be detected by chemical analysis, or if testing is possible, it is too expensive to be part of routine farming practice. Once the crop has emerged, diagnosis is difficult because the symptoms of residual herbicide damage can often be confused with, and/or make the crop vulnerable to, other stresses, such as nutrient deficiency or disease. [12]

An option for assessing the potential risk of herbicide residues is to conduct a bioassay involving hand planting small test areas of crop into the field in question.

Which herbicides are residual?

The herbicides listed in Table 3 all have some residual activity or planting restrictions.

MORE INFORMATION

Hear US herbicide residue specialist Dr Dale Shaner explain the effects soil-applied herbicides to crop residues: http://www.grdc.com.au/Media-Centre/GRDC-Gallery/Video/3tnKn3qn4BA

For a recording of Dr Shaner's full GRDC webinar '*Stubble and soil binding of pre-emergent herbicides*' (13 Dec. 2013), visit: https://grdc.com.au/Resources/IWMhub/Weed-Webinars/Stubble-and-soil-binding-of-pre-emergent-herbicides.

11 http://www.dpi.nsw.gov.au/agriculture/broadacre-crops/summer-crops/sorghum/general/summer-crop-production-guide

12 DEPI (2013) Avoiding crop damage from residual herbicides, Department of Environment and Primary Industries Victoria, http://www.depi.vic.gov.au/agriculture-and-food/farm-management/chemical-use/agricultural-chemical-use/chemical-residues/managing-chemical-residues-in-crops-and-produce/avoiding-crop-damage-from-residual-herbicides

Table 3: *Active constituent by herbicide group(may not include all current herbicides).*

Herbicide group	Active constituent
Group B: Sulfonylureas	Chlorsulfuron (Glean®), iodosulfuron (Hussar®), mesosulfuron (Atlantis®), metsulfuron (Ally®), triasulfuron (Logran®)
Group B: Imidazolinones	Imazamox (Raptor®), imazapic (Flame®), imazapyr (Arsenal®)
Group B: Triazolopyrimidines (sulfonamides)	Florasulam (Conclude®)
Group C: Triazines	Atrazine, simazine
Group C: Triazinones	Metribuzin (Sencor®)
Group C: Ureas	Diuron
Group D: Dinitroanilines	Pendimethalin (Stomp®), trifluralin
Group H: Pyrazoles	Pyrasulfotole (Precept®)
Group H: Isoxazoles	Isoxaflutole (Balance®)
Group I: Phenoxycarboxylic acids	2,4-Ds
Group I: Benzoic acids	Dicamba
Group I: Pyridine carboxylic acids	Clopyralid (Lontrel®)
Group K: Chloroacetamides	Metolachlor
Group K: Isoxazoline	Pyroxasulfone (Sakura®)

How do herbicides break down?

Herbicides break down via chemical or microbial degradation. The speed of chemical degradation depends on the soil type (clay or sand, acid or alkaline), moisture and temperature. Microbial degradation depends on a population of suitable microbes living in the soil to consume the herbicide as a food source. Both processes are enhanced by heat and moisture. However, these processes are impeded by herbicide binding to the soil, and this depends on the soil properties (pH, clay or sand, and other compounds such as organic matter or iron).

For these reasons, degradation of each herbicide needs to be considered separately and growers need to understand the soil type and climate when trying to interpret recropping periods on the product label for each paddock. [13]

How can I avoid damage from residual herbicides?

Select a herbicide appropriate for the weed population you have.

Make sure you consider what the recropping limitations may do to future rotation options.

Users of chemicals are required by law to keep good records, including weather conditions, but particularly spray dates, rates, batch numbers, rainfall, soil type and pH (including different soil types in the paddock). In the case of unexpected damage, good records can be invaluable.

If residues could be present, choose the least susceptible crops (refer to product labels). Optimise growing conditions to reduce the risk of compounding the problem with other stresses such as herbicide spray damage, disease and nutrient deficiency. These stresses make a crop more susceptible to herbicide residues. [14]

13 DEPI (2013) Avoiding crop damage from residual herbicides, Department of Environment and Primary Industries, http://www.depi.vic.gov.au/agriculture-and-food/farm-management/chemical-use/agricultural-chemical-use/chemical-residues/managing-chemical-residues-in-crops-and-produce/avoiding-crop-damage-from-residual-herbicides

14 DEPI (2013) Avoiding crop damage from residual herbicides, Department of Environment and Primary Industries Victoria, http://www.depi.vic.gov.au/agriculture-and-food/farm-management/chemical-use/agricultural-chemical-use/chemical-residues/managing-chemical-residues-in-crops-and-produce/avoiding-crop-damage-from-residual-herbicides

Group B: Imidazolinones

The imidazolinones are very different from the sulfonylureas, as the main driver of persistence is soil type, not soil pH. They tend to be more of a problem on acid soils, but carryover does occur on alkaline soils. Research has shown that in sandy soils, such as on the Eyre Peninsula, they can break down very rapidly (within 15 months in alkaline soils), but in heavy clay soils in Victoria they can persist for several years. Breakdown is by soil microbes. Oilseeds are most at risk. Widespread use of imidazolinone-tolerant canola and wheat in recent years has increased the incidence of imidazolinone residues.

Group C: Triazines

Usage of triazines has increased to counter Group A resistance in ryegrass, in particular in triazine-tolerant canola. Atrazine persists longer in soil than simazine. Both generally persist longer on high pH soils, and cereals are particularly susceptible to damage. Recent research in the US indicates that breakdown rates tend to increase when triazines are used regularly, as the number of microbes able to degrade the herbicide can increase. This may mean that breakdown can take an unexpectedly long time in soils that have not been exposed to triazines for some years.

Group D: Trifluralin

Trifluralin tends not to leach through the soil, but it can be moved into the seedbed during cultivation or ridging. Trifluralin binds strongly to stubble and organic matter and is more likely to be a problem in paddocks with stubble retention. Be particularly careful with wheat, oats and lentil. Barley is more tolerant. Use knife-points to throw soil away from seed and sow deep; not suited to disc seeders.

Group H: Isoxazoles

Persistence in acid soils (pH <7) has not been fully tested, but research has shown that isoxazole persistence is expected to be longer than the label recommendations for legume crops and pastures. Isoxazoles will also persist longer in clay soils and those with low organic matter. Cultivation is recommended prior to recropping.

Group I: Phenoxys

Clopyralid and aminopyralid can be more risky on heavy soils and in conservation cropping as they can accumulate on stubble. Even low rates, they can cause crop damage up to 2 years after application. They cause twisting and cupping, particularly for crops suffering from moisture stress.

2,4-D used for fallow weed control in late summer may cause a problem with autumn-sown crops if plant-back periods are not observed. Changes have been made to the 2,4-D label recently and not all products can be used for fallow weed control—check the label.

The label recommends that you not sow sensitive crops, especially canola, until after a significant rainfall event. Oilseeds and legumes are very susceptible to injury from 2,4-D.

Group K: Metolachlor

Metolachlor is used in canola crops. The replanting interval is 6 months. [15]

15 Dual Gold® herbicide, http://www.herbiguide.com.au/Descriptions/hg_Dual_Gold.htm

Group K: Pyroxasulfone

Pyroxasulfone relies on microbial degradation, which is favoured by in-season rainfall. Label plant-back periods are important particularly for oats, durum wheat and canola. Residues will lead to crop stunting. [16]

For more information, visit www.apvma.gov.au.

6.9 In-crop herbicides: knockdowns and residuals

When selecting a herbicide, it is important to know crop growth stage, weeds present and plant-back period. For best results, spray weeds while they are small and actively growing. Herbicides must be applied at the correct stage of crop growth, or significant yield losses may occur. Check product labels for up-to-date registrations and application methods.

How to get the most out of post-emergent herbicides:

1. Consider application timing—the younger the weeds the better. Frequent crop monitoring is critical.
2. Consider the growth stage of the crop.
3. Consider the crop variety being grown and applicable herbicide tolerances.
4. Know which species were historically in the paddock and the resistance status of the paddock (if unsure, send plants away for a 'Syngenta Quick-Test' (see link).
5. Do not spray a crop stressed by waterlogging, frost, high or low temperatures, drought or, for some chemicals, cloudy/sunny days. This is especially pertinent for frosts with grass-weed chemicals.
6. Use the correct spray application:
    - » Consider droplet size with grass-weed herbicides, water volumes with contact chemicals and time of day.
    - » Observe the plant-back periods and withholding periods.
    - » Consider compatibility if using a mixing partner.
    - » Add correct adjuvant.

For information on cereal growth stages, see Section 4: Plant growth and physiology.

6.10 Post-emergent herbicide damage

Crop yield can be compromised by damage from herbicides, even when products are applied according to the label rate.

Factors that can contribute to herbicide damage are:

- crop variety grown
- weather conditions at time of application
- mixing partner
- growth stage of crop
- nutritional status of crop

MORE INFORMATION

Syngenta Quick-Test: http://www.plantscienceconsulting.com

http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/weed-control-winter-crops

www.apvma.gov.au

16 DEPI (2013) Avoiding crop damage from residual herbicides, Department of Environment and Primary Industries Victoria, http://www.depi.vic.gov.au/agriculture-and-food/farm-management/chemical-use/agricultural-chemical-use/chemical-residues/managing-chemical-residues-in-crops-and-produce/avoiding-crop-damage-from-residual-herbicides