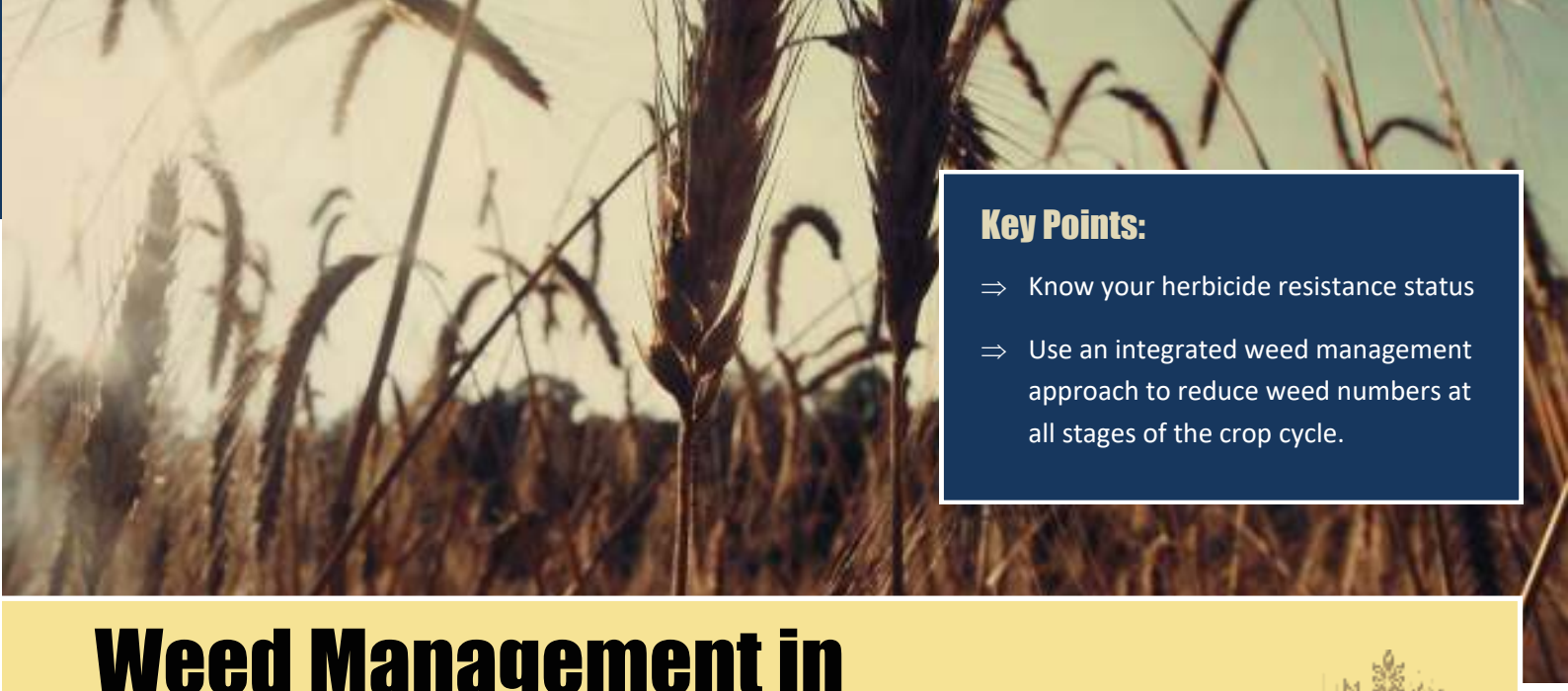

Key Points:

⇒ Know your herbicide resistance status

⇒ Use an integrated weed management approach to reduce weed numbers at all stages of the crop cycle.

Weed Management in Retained Stubble Systems

Background

With an increase in stubble retention and minimal cultivation, the number of cultural methods being used to control weeds has decreased. This has placed increasing pressure on chemical control in the knockdown phase and at pre-emergent and post-emergent timings. Recent sampling by the MFMG with the support of Bayer CropSciences has shown emerging resistance issues with the majority of annual ryegrass (ARG) populations sampled showing levels of Select (Clethodim) resistance making the management of ryegrass more difficult in break crops. This is placing increased reliance on pre-emergent herbicides, particularly in the cereal phase.

The need to ensure all herbicides (knockdowns, pre-emergent and post-emergents) are applied to maximise their efficacy is very important, and the label should always be followed. More information around pre-emergent and knockdown herbicide application - particularly in Stubble Systems can be found in the Herbicide Application Guideline[1].

Understanding the weed resistance status, and ensuring effective herbicide application with the correct product at the correct timing, at the right rate and under the right conditions has become imperative to ensure the ARG populations do not blow out. Incorporating other management strategies such as crop-topping, harvest weed seed capture (HWSC) techniques and maximising the use of break crops (including hay) to break the weed cycle is also becoming more important.

Introduction

This guideline has been developed for the MacKillop Farm Management Group (MFMG) as part of the project "Maintaining Profitable Farming Systems with Retained Stubble in the South-East and KI regions", funded by the Grains Stubble Initiative.

The Stubble Initiative involves farming systems groups in South Australia, Victoria, southern and central New South Wales and Tasmania, collaborating with research organisations and agribusiness to address challenges associated with stubble retention, including weeds, pests, disease, nutrition and the physical aspects of managing stubble.

Herbicide Resistance

The MFMG herbicide resistance results are strongly supported by the random crop survey data collected by the University of Adelaide shown in Table 1[2]. Samples are collected randomly from across the region every five years at harvest and seeds grown out to improve understanding of the population dynamics and resistance status across different cropping regions. Resistance is scored if population survival is >20%.

The presence, and rapid increase in ARG resistance across the region highlights the importance of understanding the resistance status on your farm and being aware of and able to implement strategies to manage the ARG weed seed bank.

Table 1. Incidence of paddocks with annual ryegrass resistance across the South-East. *(Source: C.Preston and P.Boutsalis, University of Adelaide[2])*

Herbicides	Year Sampled		
	2007	2012	2017
Trifluralin	43	78	41
Avadex Xtra			23
Boxer Gold			5
Sakura			5
Arcade			5
Butisan			9
Propyzamide			0
FOP's*	58	90	84
Sulfonyl Urea's	71	70	66
Intervix	-	60	52
Axial	53	80	84
Select 250ml/hs	43	43	19
Select 500ml/ha	-	-	19
Glyphosate	0	16	27
Paraquat	-	-	7

Why is the Weed Seed Bank so Important?

ARG is a prolific seeder; 100 plants/m2 can produce up to 45,000 viable seeds/m2. 80% of shallow seed will generally germinate at the break of the season after first two rain events that exceed 20mm. If the seed is buried or located in a darker space, then a second state of dormancy may be triggered for 10-20% of the seed.

Local work conducted by Sam Kleeman in conjunction with the MFMG has shown how effectively clethodim resistant ryegrass populations can be reduced by implementing various management strategies over a two year period[3]. This work was conducted in Victoria on RT canola, and demonstrates how quickly ryegrass weed seedbank dynamics can change with /without adequate ryegrass control. Table 2 shows the various treatments applied, and the results are shown in Figure 1 and 2.

Table 2. Management strategies used in long-term ryegrass trial at Frances in 2014 (RT-canola phase) and 2015 (wheat)[3].

Management strategy (MS)	RT-canola phase	Wheat phase
Low intensity (MS1)	Simazine (1.1 kg/ha) pre Atrazine (1.1 kg/ha) + Select (500 mL/ha) post	Sakura (0.118 kg/ha) pre
Medium intensity (MS2)	Simazine (1.1 kg/ha) pre RoundupReady (0.9 kg/ha) cotyledon RoundupReady (0.9 kg/ha) + Atrazine (1.1 kg/ha) 6-leaf	Sakura (0.118 kg/ha) + Avadex Xtra (2 L/ha) pre
High intensity (MS3)	Rustler (1 kg/ha) + Avadex Xtra (2 L/ha) pre RoundupReady (0.9 kg/ha) cotyledon RoundupReady (0.9 kg/ha) + Atrazine (1.1 kg/ha) 6-leaf Weedmaster DST (2.4 L/ha) crop-top	Sakura (0.118 kg/ha) pre Boxer Gold (2.5 L/ha) post

Figure 1. Effect of different management strategies on the weed seed bank, Neaurpurr[3].

Figure 2. Impact of MS3 (High intensity) on LHS vs. MS1 (Low intensity) on ryegrass populations after the initial canola phase.

Application Techniques

Effective application of knockdown herbicides pre-emergent herbicides is covered in the "Herbicide application in retained stubble systems" guideline[1]. An effective knockdown can control up to 80% of the ARG, with effective pre-emergent application controlling 70% of those weeds that remain after the knockdown phase.

Knockdown application

⇒ Double knock application; using a double knock (the use of glyphosate followed by paraquat or a paraquat/diquat mix 3 to 10 days later) can increase the level of knockdown control from 80% up to 95%. The double-knock may be utilised as an opportunistic option where there is an 'early break'. Where low levels of glyphosate resistance are identified, it should be implemented as standard practice to maximise the chance of resistant plants being controlled and so that they do not go through to produce viable seed.

Post-emergent herbicide application

⇒ Water rates, application method and water quality are all factors that can affect the effectiveness of the herbicide application. Using water sensitive paper to understand what level of contact is being achieved on the leaf is a useful technique. Small changes to the boom spray may be needed to maximise level of contact. The label should always be consulted with regards to water rates and adjuvant use. Water quality across the region varies greatly, and unless using a rainwater source from a metal/poly tank, water should be tested regularly to monitor the quality[1].

⇒ Avoid crop (and weed) stresses such as waterlogging and frost. These stresses can affect the uptake of herbicides and result in poor efficacy.

Other Strategies to Manage ARG in Retained Stubble Systems

⇒ **Delaying time of sowing**

A delay in the time of sowing provides a longer time period for the ARG to break its dormancy (the dormancy is slowly lost over summer. Delaying seeding in a high weed pressure paddock increases the chances of good knockdown control and reduces the pressure on the pre-emergent herbicide chemistry.

⇒ **Crop topping**

Effective crop topping reduces the seed set by around 70%. The challenge is getting the correct timing for weed control while making sure that the crop is mature enough that no grain yield loss occurs. Work conducted by the Southern Pulse Agronomy project at Bool Lagoon looked at the effect of timing of crop-topping to control ARG on faba bean quality (Fig2). Treatments were made based on the phenology of the ryegrass plant with timings being applied early (21 days prior to ARG Milky Dough Stage (RMDS)), mid (at RMDS), late (16 days after RMDS) and included a nil treatment. Bean maturity (cv. Farah) at each timing of application is shown in Fig.3[4]. These results show that although crop-topping can be very effective, caution is required so that grain yield loss doesn't result; particularly in longer season environments like the South-East and KI.

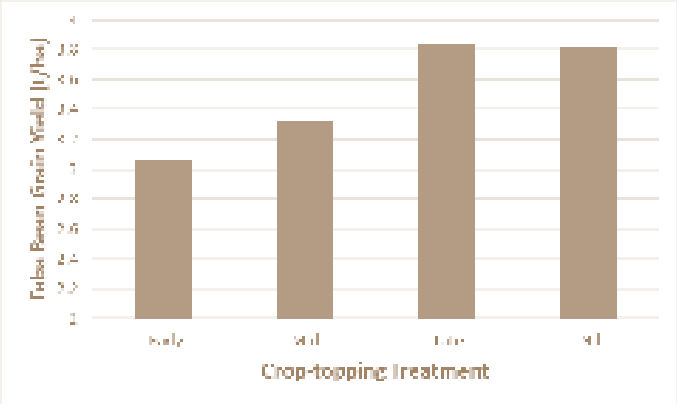

Figure 2. 2013 Southern Pulse Agronomy project results (yield impacts of spraying too early)[4]

Figure 3 (a-d). Farah faba bean Pod Maturity at Crop-topping timing

⇒ **Hay crops**

Hay crops can result in approximately 80% control of annual ryegrass; following up with heavy grazing or chemical control to reduce any regrowth can further increase control. Control will however depend on the hay crop being mature and ready to cut prior to the ryegrass maturing and shedding seed. At Conmurra in 2017, a Westminster barley hay crop was compared to Manning wheat for hay (as a salvage to reduce ryegrass numbers) and Manning wheat for grain. The number of ARG seeds shed prior to hay being cut and grain being harvested is shown in Table 3 showing the need for careful planning and being prepared to cut early to maximise weed control[5].

Table 3. ARG seeds shed prior to crop removal.[5]

Crop	Date mowed/harvested	ARG seeds shed/m2
Barley Hay	10/11/2017	0
Wheaten Hay	4/12/2017	28,000
Wheat Grain	4/01/2018	125,000

⇒ **Harvest weed seed capture**

Harvest weed seed capture (HWSC) techniques including the use of the Harrington Seed Destructor (HSD), narrow windrow burning (NWB), chaff carts and residue baling can all be utilised to reduce weed seed numbers at harvest. The effectiveness of these technologies will depend on the amount of seed that can be captured during the harvest process. The challenge in the high rainfall zone is being able to harvest the crop before the ryegrass lodges or sheds. More information on harvest weed seed capture techniques are included in the Harvest and Fallow Management Guidelines[6,7].

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- Jon Midwood, James Manson, Paul Breust, Southern Farming Systems
- Andrew Etherton, GRDC

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[1]MFMG Herbicide Application in Retained Stubble Systems, 2018

[2]P.Boutsalis, GRDC Updates, Naracoorte, 2018

[3]Kleeman, et. al. "Managing Select Resistant Ryegrass in Canola & Wheat, 2015 MFMG Trial Results Book

[4]Southern Pulse Agronomy Project (2012-2013). MFMG 2012 Annual Trial Results Book (p.85-88)

[5]SFS00032,

[6]MFMG Harvest Management in Retained Stubble Systems, 2018

[7]MFMG Fallow Management in Retained Stubble Systems, 2018

*FOP's = Aryloxyphenoxypropionate

Further Information

For more information on other Integrated Weed Management Strategies see the AHRI website.
www.ahri.uwa.edu.au

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