Improving IWM practice in the Southern Region - Emerging weed issues

Summary
This project addressed emerging weed issues in the Southern Region, identifying the reasons why these issues are arising and providing practical recommendations for management where applicable. It also investigated how to use pre-emergent herbicides safely with disc seeders. Better control of emerging weeds and herbicide resistant weeds will increase the profitability of grain growers through reducing the impact of these weeds on yield. The major beneficiaries of this project will be grain growers.

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Conclusions

Important summer weeds of southern Australia (fleabane, hairy panic and windmill grass) tend to germinate in spring. They are present in crops prior to harvest and would be most effectively controlled with residual herbicides in crop. They can be controlled in the summer fallow, but this is difficult and requires high rates of herbicides and double knock approaches.

Herbicide resistance in barley grass to the post-emergent herbicides is increasing in South Australia (SA). Barley grass can be controlled by pre-emergent herbicides with pyroxasulfone® (Sakura®) the best option in wheat. Propyzamide® (Rustler®) and Sakura® can be effective in field peas (and other pulse crops). These products are yet to be registered in pulse crops.

Several alternatives to Group B and Group I herbicides exist for the control of herbicide resistant wild radish in wheat and canola. The best treatments include multiple active ingredients from Groups C, F, H and I in wheat and Group C in triazine® tolerant (TT) canola.

Harvest seed management of annual ryegrass in the Southern Region will be variable, as only an average of 47% of ryegrass seed is in a position to be harvested. Harvest weed seed management will have to be conducted for several years in a row to reduce annual ryegrass seed banks. These practices will not be effective for barley grass.

Cereal crop residues left on the soil surface over summer reduce summer weed emergence. There is little impact of cereal crop type or variety; however, residues from crops established with narrow row spacing are more effective than those on wider row spacing. Canola residues are less suppressive than wheat; however, there were differences among canola varieties that may be exploited.

Pre-emergent herbicides can be safely used in wheat sown with disc seeding equipment provided sufficient herbicide-treated soil is moved away from in front of the sowing disc. This is done most effectively with a wavy coulter, but ground-engaging residue managers are also effective. Boxer Gold® can be used with disc seeders; however, management of crop safety risks is required. Sakura® requires a label change to allow disc seeders to be used and information has been provided to Bayer to facilitate such a change. Trifluralin® is unsuitable for use with disc seeding equipment.

Recommendations

Controlling fleabane after harvest in the southern region requires a double knock in which the first herbicide application provides more than 60% control. High rates of glyphosate® mixed with a phenoxy® herbicide are the most appropriate first knock.

Fleabane and hairy panic mainly germinate in the spring in southern Australia. Controlling these weeds in-crop with a residual herbicide would be more effective than attempting to control them in the summer fallow. Group I pyridine® herbicides can be used with fleabane for this purpose, but alternative products are needed for fleabane and hairy panic.

Sakura®® is the most effective pre-emergent herbicide for control of barley grass in wheat.
Herbicide mixtures from Groups C, F, H and I offer the best control of wild radish resistant to Group B and I herbicides in the Southern Region. It is essential that these herbicides are applied to small wild radish plants. This may require two applications of different products within a season.

To use Boxer Gold® safely in disc sown wheat, herbicide-treated soil needs to be moved from in front of the sowing disc with either a wavy coulter or a ground-engaging residue manager.

**Outcomes**

**Economic benefits**

Weeds cost the grains industry at least $1.1 billion a year. In addition, summer weeds reduce moisture availability for the crop and controlling summer weeds effectively can increase water use efficiency (WUE) by 60%. This project identified the germination patterns for fleabane, hairy panic and windmill grass and identified effective control practices for fleabane and hairy panic in the Southern Region. Increasing herbicide resistance in weeds will increase the costs associated with residual weeds in crops. This research identified control practices for herbicide resistant barley grass in wheat and field peas and for wild radish in wheat in the Southern Region.

**Environmental benefits**

No-till has major environmental benefits not limited to better soil structure, reduced erosion, better water infiltration, lower energy costs and better soil health. No-till farming systems are very reliant on herbicides to control weeds during the crop phase. In addition, no-till favours surface-germinating weeds that can be difficult to control. Herbicide resistant weeds and difficult to control summer weeds pose a risk to no-till farming systems and the environmental benefits of these systems. This project identified effective control practices for fleabane and hairy panic in the Southern Region and for herbicide resistant barley grass in wheat and field peas and for wild radish in wheat. In addition, the project identified how to use pre-emergent herbicides safely with disc seeding equipment, which is likely to facilitate greater use of disc seeders by Australian growers.

**Achievements/Benefits**

Seven experiments conducted at Roseworthy, South Australia (SA), and Wagga Wagga, Temora and Condobolin in New South Wales (NSW) examined fleabane emergence patterns and phenology. In SA, fleabane germinated in late winter and early spring with no germination over summer. In southern NSW, fleabane germinates mainly in spring with small cohorts germinating through to February. These different germination patterns point to different tactics being required to manage fleabane in different regions. Fleabane emerged from seed at depths from on the soil surface to 1cm below the surface.

Five experiments conducted at Wagga Wagga examined hairy panic emergence patterns and phenology. Hairy panic emerged at Wagga Wagga between October and December. The species quickly produces seed.

Two experiments conducted at Roseworthy and Wagga Wagga examined emergence of windmill grass. Windmill grass at Roseworthy emerged within three weeks of a suitable rainfall event in summer. Windmill grass emerged from up to 4cm below the soil surface at Wagga Wagga. Seedling emergence is stimulated by light in this species. More germination occurs at higher temperatures. At Roseworthy, viability of seed in the soil declined rapidly over six months regardless of depth.

Seventeen trials were established at Bute, Pinnaroo, Roseworthy, Warnertown, SA; Kooloonong, Swan Hill, Victoria (VIC), and Wagga Wagga, Temora and Condobolin to identify fleabane control practices. Trials examined mechanical and chemical options. Rolling in summer provided no additional control of fleabane. In summer trials in SA, some double knock applications improved control, but only where the first knock was greater than 60% effective. Glyphosate# at robust rates as a single knock provided the greatest control. Summer trials in NSW found double knock applications with paraquat# or saflufenacil# effective. Winter trials in NSW showed Group I pyridine# herbicides in winter could reduce fleabane over summer, but Group B herbicides were not effective.

Three hairy panic management trials at Wagga Wagga found glyphosate mixtures and high rates of glyphosate could control hairy panic over summer.

Trials were established at Ariah Park, NSW to determine management practices to control windmill grass. However, lack of spring and summer rain resulted in limited and sporadic emergence. Trials at Wagga Wagga in wheat and canola found no difference in windmill grass emergence in spring following application of residual herbicides in crop.
Four trials have been conducted examining management options for barley grass. Two trials were conducted examining herbicide options for management of barley grass in wheat at Buckleboo and Minnipa, SA. At both sites, the barley grass in the paddock showed extended dormancy compared with barley grass from fence lines. Sakura® was the most effective herbicide. Controlling barley grass increased wheat yields at both sites. Two trials at Baroota, SA on Group A resistant barley grass identified pyroxasulfone® and propyzamide® as potential controls for Group A resistant barley grass in peas, pending their possible registration. Raptor® (imazamox®) also provided highly effective control of these barley grass populations. A survey of fields in the Upper North and Eyre Peninsula of SA showed 48% of populations in the Upper North and 6% of populations of the Eyre Peninsula contained individuals with resistance to Group A herbicides. The increasing extent of Group A resistance in barley grass will make this weed harder to control. This survey also identified 4% of barley grass populations from Eyre Peninsula as containing individuals resistant to Group B herbicides.

Two trials were conducted at Corack, VIC to examine alternatives to Group B and Group I herbicides for control of wild radish in wheat. In the first trial, picolinofen® + bromoxynil® + MCPA®, pyrasulfatole + bromoxynil, diflufenican + bromoxynil and carfentrazone® + MCPA were the herbicides that provided the most effective wild radish control in wheat. A two-spray strategy would be required to control later germinations of wild radish. In the second trial, the effect of application timing on activity was examined. Most herbicide treatments were effective against small wild radish plants but only pyrasulfatole® + MCPA, picolinofen + bromoxynil + MCPA and diflufenican® + bromoxynil + MCPA were effective at the later timing. An in-crop survey of potentially resistant wild radish populations in the VIC Wimmera and Mallee showed that Group B and Group I resistance was likely present at several sites. Several herbicide mixtures containing herbicides from Groups C, F, H and I were effective controls on these populations. Two application strategies and mixtures of Group C herbicides were required to control wild radish in TT canola.

An experiment conducted at Roseworthy with wireweed demonstrated that trifluralin® at a rate of at least 480g/ha was able to limit emergence of this weed species.

Pot studies with windmill grass showed that pyroxasulfone (Sakura®) and S-metolachlor® (Dual Gold®) at a quarter of the field rate were able to inhibit emergence of this species but trifluralin was ineffective. These results suggest that the residual effect of Sakura® applied in wheat may be effective in reducing germination of windmill grass in the spring.

A trial conducted on statice (Limonium lobatum) at Birchip, VIC demonstrated several broadleaf herbicide mixtures were effective for the control of this species in wheat. Effective products included Precept® (pyrasulfatole + MCPA), Velocity® (pyrasulfatole + bromoxynil), Velocity + MCPA and Igran® (terbutryn®) + MCPA.

A trial conducted on fumitory (Fumaria spp.) at Quambatook, VIC demonstrated that newer post-emergent herbicides based on pyrasulfatole (Precept® and Velocity®) were more effective at controlling fumitory in wheat than older more standard broadleaf weed products. However, no treatment provided 100% control of this species.

Three years of trials have been conducted to determine the amount of ryegrass seed available for harvest time seed collection in low, medium and high rainfall sites in SA. Results showed an average of 47% of ryegrass at harvest could be captured. A higher percentage of ryegrass was captured at low rainfall sites than at high rainfall sites. Less than 1% of barley grass seed was available for capture. The Harrington seed destructor (HSD) was trialled on 14 farm properties in the Mid-North of SA during 2012 harvest. In early 2013, the Hart Field Site group (HFSCG) tried to assess the annual ryegrass population in areas of the paddock where the HSD had and had not been operated. However, the HSD was only trialled in sections of the paddock with high annual ryegrass (ARG) numbers, so a comparison with seed numbers in areas where the HSD was not used was biased because the numbers where the HSD was used were extremely high.

A series of trials were established to investigate the impact of winter crop residues and their management on subsequent summer weed emergence at Wagga Wagga and Condobolin. There was no difference between grazing cereals and grain cereals in subsequent emergence of hairy panic or fleabane in summer. However, cereals tended to reduce fleabane establishment more than canola, pasture or bare ground. None of the sowing rate or stubble management practice used at or after harvest had any impact on the subsequent emergence of hairy panic or fleabane. Sowing wheat on narrower row spacing at Wagga Wagga reduced the number of hairy panic plants emerging over summer. The stubble of different canola varieties varied in their suppression of summer weeds and this could be exploited to gain better summer weed control.

A long-term trial was established at Lake Bolac, VIC comparing grower practice with stubble burning with knock down, light autumn harrow with knockdown and summer mouldboard ploughing on annual ryegrass emergence, ryegrass populations
in crop, crop establishment and crop yield. This trial demonstrated that effective pre-emergent herbicides were required to keep ryegrass numbers low, even after a mouldboard plough operation. Failure to manage the remaining ryegrass led to rapid replenishment of the seed bank. Attempting to manage resistant ryegrass in continuous cereals was difficult due to the lack of tactics available. Intensive use of pre-emergent herbicides led to reduced ryegrass numbers at harvest, but the seed bank did not decline.

Disc seeder trials examining the relationship between soil throw and crop damage have demonstrated triple disc seeders with wavy coulters throw sufficient soil to be generally safe with all registered pre-emergent herbicides in wheat. Unmodified single discs are unsafe with trifluralin and often unsafe with prosulfocarb® + S-metolachlor (Boxer Gold®). The addition of residue managers or coulters that throw soil out of the seed row make single disc seeders safer to use with Boxer Gold®. Shallow seeding with disc seeders resulted in more crop damage. The type of closing wheel had minimal impact on herbicide safety with disc seeding machines. Annual ryegrass was always well controlled by pyroxasulfone (Sakura®) or Boxer Gold® regardless of seeding system. However, failure to incorporate trifluralin resulted in poor control of annual ryegrass.

Addendum

Since this report was written, Sakura has been registered for chickpeas, lentils, field peas and lupins.

Other research

The project identified several emerging weeds for which there was insufficient information available about their control. These include windmill grass and the related feather-top Rhodes grass. Both species are difficult to control with glyphosate®. Feather-top Rhodes grass is currently on roadsides throughout NSW and into SA. It is only a matter of time before it invades summer fallows.

Emerging winter weed issues include multiple herbicide resistant Indian hedge mustard. Sow thistle (milk thistle) and prickly lettuce (whip thistle) are increasing problems in crops at harvest due to herbicide resistance and both species now have resistance to glyphosate. Herbicide resistant annual ryegrass remains difficult to control in high rainfall zones due to the lack of seed set control options.

Intellectual property summary

Data on pre-emergent herbicides and disc seeders have been shared with Bayer and Syngenta. The Boxer Gold® label does not prohibit use with disc seeders but crop safety issues occur with incorrect seeder set up. The planned fact sheet should provide advisers and growers with strategies to minimise crop damage. Data have been shared with Bayer to facilitate a label change for Sakura®.

Data on the use of pre-emergent herbicides on windmill grass and feather-top Rhodes grass have been shared with Bayer and Syngenta.

Fleabane management trials have been conducted following discussions with Nufarm, Dow, Sumitomo and BASF. Data have been shared with these companies.

Results from the project have been delivered to growers and farm advisers through GRDC Updates, field days, crop walks and grower talks to facilitate adoption.

Additional information


