

### HARVEST WEED SEED CONTROL STRATEGIES – BENEFITS AND LIMITATIONS IN THE RIVERINE PLAINS

As part of the [Demonstrating ryegrass control strategies project](#), Riverine Plains established a demonstration trial at Wahgunyah, Victoria during 2023 to look at the effectiveness of different ryegrass control strategies. The trial assessed various ryegrass control strategies over the 2023–2024 growing seasons, including the effect of chemical and cultural management techniques.

In 2023, the site was sown to a grazing wheat. Treatments included a control, high level chemistry, increased sowing rate by 50 per cent, cut for hay and harvest weed seed control (HWSC). Unfortunately, due to seasonal constraints, we were unable to source a HWSC-adapted header to harvest the trial, so the area was grazed instead.

Given the omission of the HWSC treatment from the trial, and the widespread use of HWSC measures in the Riverine Plains, we thought it timely to take another look at HWSC control options and how they are being used by farmers to reduce weed populations, especially ryegrass.

To learn more about the challenges and benefits of using HWSC measures, we interviewed several farmers currently using the [Seed Terminator](#) mill, as well as other HWSC techniques.

This article also re-visits outcomes from a previous Grains Research and Development Corporation (GRDC) project, [Harvest weed seed control for the southern high-rainfall zone](#) (2015–2018), in which Riverine Plains was a key partner.

#### BACKGROUND

A major premise of HWSC is that the targeted weed species retain a high proportion of their total seed production at crop maturity. However, at the time the original **Harvest weed seed control for the southern high-rainfall zone** project was established by Riverine Plains, there was little information about the number of weed seeds shed by plants, left behind or thrown over the back during the harvest of high yielding

#### HARVEST WEED SEED CONTROL

Harvest weed seed control (HWSC) — the collection and/or destruction of weed seeds at harvest — is a non-chemical control method which can be used to reduce the seedbank of weeds, such as annual ryegrass.

Techniques include mechanical weed destruction (i.e seed mills), or methods involving carting or baling chaff straight after harvest. Chaff can also be concentrated behind the header in a row, which is then left to mulch (chaff lining or decking) or concentrated in a narrow windrow behind the header and burnt (narrow windrow burning).

crops in the high rainfall zones. As part of this project, Riverine Plains established a replicated small-plot trial at Yarrowonga to examine ryegrass seed shedding during 2016 – 2017.

Some key findings from the [Riverine Plains trials](#) were that:

- There was no difference between a harvest cutting height of 30cm and 15cm in terms of the number of weed seeds returned to the soil
- In wheat crops with high annual ryegrass plant populations, a large percentage of the ryegrass seed matures and drops (sheds) in the month before wheat harvest, limiting the effectiveness of HWSC in the Riverine Plains region — in 2017, approximately 30% of total ryegrass weed seeds were removed by the harvest process
- HWSC can be used as one tool in a larger integrated weed management strategy in the Riverine Plains

Full results from the project, which incorporated trials from across the GRDC southern high rainfall zone, were presented in [Harvest weed seed control for the southern high rainfall zone](#). Key findings were that around 50 per cent of annual ryegrass seeds are shed before cereals are harvested, that 20 per cent of annual ryegrass seeds are found below a 15cm or 30cm harvest cut height and that a realistic target for annual ryegrass seed capture in cereals in the southern high rainfall zone is 30 per cent.

Overall, the project found that HWSC is a useful tool that can help control, but not drastically reduce, annual ryegrass numbers.

### **HWSC IN PRACTICE**

Since the original project was completed, a run of mixed seasons has made it hard for Riverine Plains region farmers to fully assess the impact of adopting HWSC measures. However, many farmers have seen benefits from targeting HWSC practices in areas with prolific weed growth. This was observed to increase efficiency and return on investment (ROI) from both labour and machinery investments, compared to using HWSC in areas with fewer weeds.

Picking up lower seeding annual ryegrass (i.e. from short plants) was identified as an ongoing challenge for farmers using HWSC. Farmers felt more confident using the technology when they could harvest as close to the ground as possible, so that weed seeds on flattened plants, shorter plants or seeds placed lower down the stem, are picked up and processed. When investing in a machine such as a seed mill, it's recommended farmers choose one that can process as much plant matter as possible, to maximise the effectiveness of the HWSC operation.

When using a mechanical method of seed destruction (ie the Seed Terminator), it's important to take the time to understand how the implement works in conjunction with your machine and how it operates across different crops, milling screens, speeds and power.

### **SUPPORTING HWSC THROUGH AN INTEGRATED WEED MANAGEMENT STRATEGY**

The growing season in the southern high rainfall zone, which includes the Riverine Plains, is often too long to prevent significant amounts of annual ryegrass seed being shed before cereal harvest begins, which impacts the effectiveness of HWSC measures.

**Riverine Plains' and GRDC research has shown that when using HWSC measures in crops with a large amount of biomass, a 30cm harvest cutting may be just as effective as a cutting height of 15cm.**

**This similarity between 15cm and 30 cm harvest cutting heights is likely due to the increased competition from vigorous crops typically found in the southern high rainfall zone, which has been found to increase the height at which annual ryegrass seeds are located in the canopy.**

**Given the similarity in effectiveness between cutting heights, farmers can consider a 30cm cutting height when using HWSC in bulky crops. This may help speed up the operation, improve efficiency and reduce the extra costs associated with HWSC, without significantly affecting the amount of weed seed being destroyed.**

Because there is no single silver bullet solution for annual ryegrass control, it's important farmers develop an integrated weed management plan that incorporates as many tools as possible, including HWSC measures, into their management program. This may include chaff or stubble burning, stubble baling, chaff lining, grazing, early season cultivation and chemical control. Just as effective cropping programs require a rotation of crops, varieties, pesticides and practices, effective ryegrass control requires the use of multiple tools at different times and in different parts of the rotation.

Assessing weed populations throughout the year will determine the most appropriate strategy for control. For example, where lower weed numbers are present, there may be scope to reduce the number of in-crop herbicide applications, while in other instances, there may be a decreased need for chaff lining or baling stubble after harvest.

Another way to reduce weed numbers is by the early sowing of highly competitive cereal varieties, which can be effective when there is enough early biomass to out-compete weeds. Results from the replicated GRDC small-plot project trials found that early sowing of appropriate high-yielding cultivars and cutting at 30cm was the best option.

## IS HWSC PROFITABLE?

The **Harvest weed seed control for the southern high rainfall zone** project found that the extra costs of HWSC can be justified for farm businesses in the region, despite only capturing around 30 per cent of annual ryegrass seeds. In general, the profitability of HWSC in the southern high rainfall zone is driven by the region's high yield potential, with the higher yields covering the additional costs.

A key message from the project was to only consider using expensive HWSC options on problem paddocks, using cheaper options in cleaner paddocks with low levels of herbicide resistance.

Trying to place a value on the investment was difficult for all farmers interviewed for this article. There are large, upfront costs associated with many types of HWSC machines, which often only get used for a short time each year. For some farmers, these costs were justified, while others were still yet to see results. Others did not see the purchase and operating costs as a worthwhile investment where low-cost alternatives such as stubble burning, haymaking and chemical control options were more effective for the business.

None of the farmers interviewed had undertaken a full \$ per hectare cost analysis to determine if there was a benefit to HWSC in the short term. All farmers using the Seed Terminator observed an increase in fuel consumption and decrease in harvesting speed due to the demands of the machine and equipment. Some farmers reported a small reduction in herbicide use since using seed mill, however this was not universal.

Before investing in HWSC, it's important to take a strategic approach to HWSC and work out how it will fit within your system. It's also important to understand the extra costs associated and consider ways to reduce the operating costs of HWSC technologies. Consider also efficacy on target weeds, extra fuel usage, extra wear-and-tear costs and depreciation.

HWSC technology often requires a decrease in harvest speed, so it's also important to understand how this might affect timeliness and labour requirements during harvest.

## RECOMMENDATIONS

Everyone's operation is different. While HWSC was considered by farmers to be a great 'tool in the toolbox' for the effective and strategic management of weed seed spread, it isn't a silver bullet solution.

It's also important to explore all the available tools, including chaff or stubble burning, stubble baling, chaff lining, grazing, early season cultivation and chemical control, which can be just as effective when used together, and in the right setting.

HWSC measures are a significant investment for farming businesses. Take the time to research solutions, considering existing labour and machinery resources, and how it can benefit your operation, before committing.

Also assess weed population zones throughout the season and in the lead up into harvest to determine high-priority paddocks that may benefit from HWSC, weighing up the additional time, labour and additional fuel costs required.

## CASE STUDY 1 (SEED TERMINATOR)

### Has HWSC been effective in your system?

Yes, more so than expected, given we didn't expect a result for a while. There was a noticeable visual reduction straight away in following years' paddock and crops, and the "mad patches" weren't as bad the following year.

### What changes have you seen from using HWSC?

We've changed rotation practices and the reduction in weeds means we can use less chemical and be more effective in the execution of herbicide on target species.

We were formerly using hay to help clean paddocks, but are moving away from this as paddocks are becoming more manageable, with less grass.

We're also changing our crop varieties to reduce chemical use on target weeds (i.e. changing from a Round-up ready canola to other varieties).

### What are your observations of using HWSC and do you have any recommendations?

It's not the be all and end all, but it is a tool that helps control the spread of seeds. We've found that harvest can be slowed, but it has improved outcomes in other areas. The acquisition of stripper front has brought back some productivity, so that it's closer to pre-Seed Terminator levels.

Any worries about the amount of extra fuel and horsepower used needs to be broken down to a \$/ha rate, to effectively see how the change has worked in the system.

## CASE STUDY 2 (SEED TERMINATOR)

### Has HWSC been effective in your system?

In most situations we've found it to be effective. However, where grass is laying down, we've had issues occur, so its effectiveness is on a paddock-by-paddock basis.

It's important to take the time to sit down and analyse and identify which areas or zones are getting the most grass put through, for example headlands are notorious and fairly consistent areas, as are former fencelines.

### What changes have you seen from using HWSC?

It's been on a season-by-season basis, but we've been selecting and correcting mills and increasing capacity as the years go by.

It's hard to place a \$/ha value on the process. We've seen value from planning and using the Seed Terminator in selective areas and using other machines (contractors/non HWSC set-up combines) in low-grass situations or clean zones throughout harvest.

Like all purchase, there is a depreciation value attached to equipment, so utilising it and running effectively helps to make its use worthwhile.

### What are your observations of using HWSC and do you have any recommendations?

Sitting down and planning helps highlight the existing problem areas; this also helps prioritise machine location when changing paddocks during harvest.

Dropping the deck onto the ground to harvest everything also means you're doing two jobs, not just one. It's important to use the technology and your resources effectively to help with the issue.

## CASE STUDY 3 (SEED TERMINATOR)

### Has HWSC been effective in your system?

We're only one year in, so it's hard to see as we've had inconclusive results so far.

### What changes have you seen from using HWSC?

We're seeing cleaner crops – but early usage indicators are hard to distinguish between whether it's a successful herbicide application or the Seed Terminator.

### What are your observations of using HWSC and do you have any recommendations?

It's noisy, but there are lower horsepower models available. Our header had it on it from the start, so we've no benchmark to compare it to. However, we're sticking by our decision to use it and look forward to seeing how the results show through.

We've been chaff lining for 20 years, but found that in wet years, the chaff lines would wash all over and would reset everything.

## CASE STUDY 4 (SEED TERMINATOR)

### Has HWSC been effective in your system?

We made the choice to pair with a Claas Lexion and it's been used for four seasons. The diminishing options surrounding control made purchasing a Seed Terminator a motivator.

Having a retrofitted piece of equipment that can cover a wide range of machines is never the most practical option, but for us, choosing a machine that can cover and work with the Terminator has been the most practical approach to harvesting.

Using the Seed Terminator isn't a quick process, with horsepower and fuel consumption both worth mentioning. This does affect speed (of harvest), but that is the compromise to be had.

Properly setting up, running and having knowledge of the machine can help ensure potential issues don't arise.

### What changes have you seen from using HWSC?

Whether it's profitable or not is complicated to answer – tentatively yes, with a “but” because changes to profitability have been hard to measure without a full gross margin analysis.

Our previous advice was that it would take five years to see results, and we've seen the spread of weeds diminish to a smaller area. Visually cleaner paddocks are being observed, though this hasn't been back-up by any official testing or counting of plants in designated areas.

The chemistry we're using when treating areas has also changed slightly with the diminishing areas.

Pasture rotation has proved tricky to manage, with selective herbicides being applied during the season. Years that have a more traditional cereal and canola rotation have provided a relief from these herbicides and allowed the Seed Terminator to manually destroy these plants.

### What are your observations of using HWSC and do you have any recommendations?

The machine runs at a slower pace, being down on horsepower and the fuel consumption has had a significant increase.

Its use has also thrown us another challenge and stressful process into a short window (harvest), where timings are important. But we need to trust the process and accept that it can help.

Harvesting the crop with a front that is (almost) on the deck helps ensure that all plants are being accounted for and processed.

Before investing, it's important to look at all the available tools. Revisiting boom-spray equipment (nozzles, output, testing water quality etc), cultivation practices, burning off, hay and chaff lining options are all worth exploring.

It's also important to accept that harvest may take longer than expected (time v effectiveness), coupled with potentially higher inputs, such as fuel. I'd also say that selecting an efficient combine that is able to keep up with high processing demands and using it effectively, working with the header rather than against it, is a key part.

## CASE STUDY 5 (NO CURRENT EXTERNAL ATTACHMENT)

### What are your observations of using HWSC and do you have any recommendations?

For us, the large upfront cost, combined with it being a depreciating asset meant it wasn't worth the risk for the business.

We are sticking with more traditional methods, such as cutting for hay as the season allows, chemically terminating problem areas, stubble burning, windrow and chaff lining, which we know are working.

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