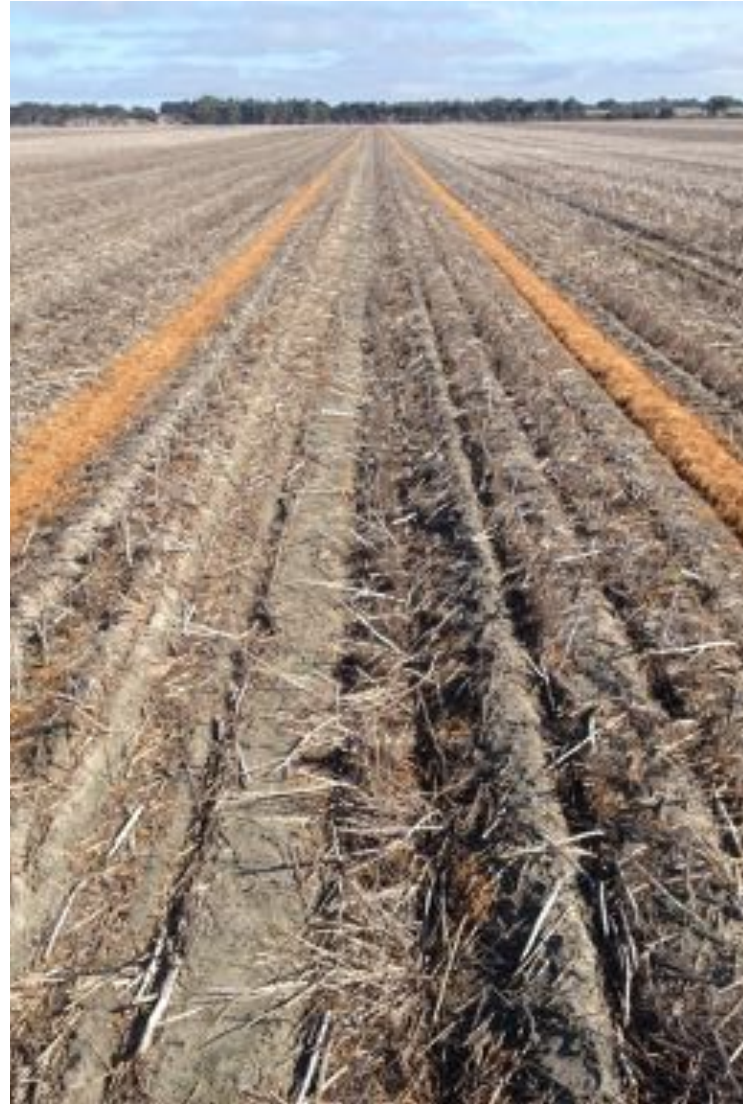




# Investigating the harvest weed seed control tools chaff lining and chaff tramlining (chaff deck) in the Esperance area



## Grower case studies from the Esperance Port Zone.

An initiative of the Esperance Port Zone Regional Cropping Solutions Network Prepared by Nick McKenna and Peter Newman, Planfarm.



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## **ACKNOWLEDGEMENTS**

Firstly a big thank you to all of the growers who agreed to feature in the case studies in this book. It is a big ask to give up your time and share your ideas and knowledge with an agronomist who comes knocking on the door, and you all contributed without hesitation.

Thank you also to Planfarm agronomist, Nick McKenna who travelled to Esperance and conducted the interviews for this case study book. It was a big job and Nick took it on without giving it a second thought.

Finally thank you to the GRDC and the Esperance Regional Cropping Solutions Network for making it happen.

**COVER PHOTO CREDITS: (R) MIC FELS (L) NICK MCKENNA**

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## BACKGROUND

Australian grain growers are the world leaders in harvest weed seed control (HWSC), and it could be argued that they are the world leaders in the management of herbicide resistant weeds. There are now six different HWSC tools available to farmers, and all were ultimately invented by Australian farmers.

The two tools reported on in this book, chaff lining, and chaff tramlining, are no exception. The growers have developed these tools, commercial products have evolved, and now the research must catch up.

Currently there is almost no research into the efficacy of these tools and hence the growers of the Esperance GRDC RCSN requested these case studies so that we can learn more about these tools.

## ADOPTION

Not so long ago harvest weed seed control (HWSC) was only used by a minority of early adopting grain growers, now it has gone mainstream and pretty soon just about everyone will be doing it. Every few years GRDC invest a large grower practices telephone survey. The most recent survey was conducted by CSIRO in 2014, and they collaborated with Dr Michael Walsh from University of Sydney to design the HWSC questions.

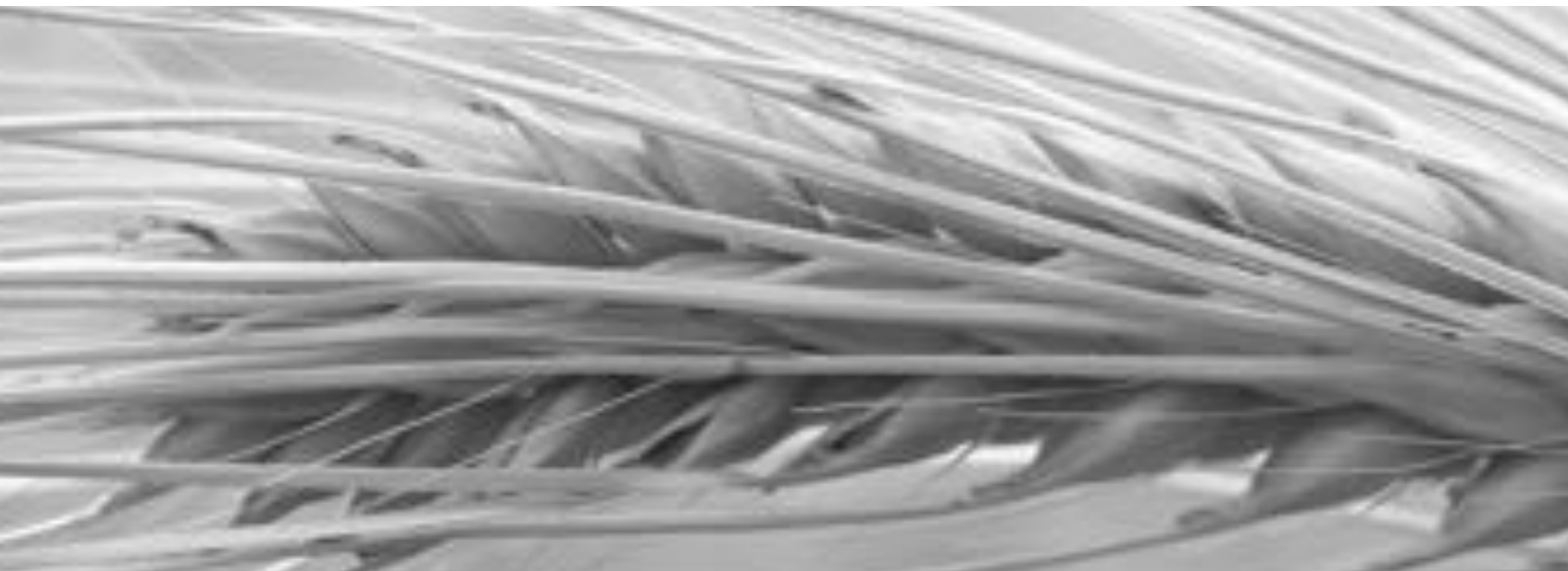
Michael has now reported on the results in a recent scientific publication. The survey revealed 43% of Australian grain growers are currently practicing HWSC and this is set to double within the next five years.

Narrow windrow burning is currently the most commonly used practice by 30% of growers and is likely to remain as such. However there are some new kids on the block that are being taken up by Australian grain growers, namely chaff tramlining and the integrated Harrington Seed Destructor (iHSD).

It took 30 years to get to 43% adoption, so it is an interesting result that this could double in the next five years.

## PERCENTAGE OF TOTAL CROP

If we do the math from this survey we can ascertain that about 16% of the entire Australian grain crop is treated with one of the HWSC practices.







## FUTURE ADOPTION

In 2017 the Weedsmart team conducted a national online survey with just four questions using survey monkey, promoted through twitter, to determine current grower practices and their future intentions for the adoption of HWSC. There were 269 respondents in total, 112 from Western Australia, 61 from New South Wales, 59 from South Australia, 36 from Victoria, one from Queensland and none from Tasmania.

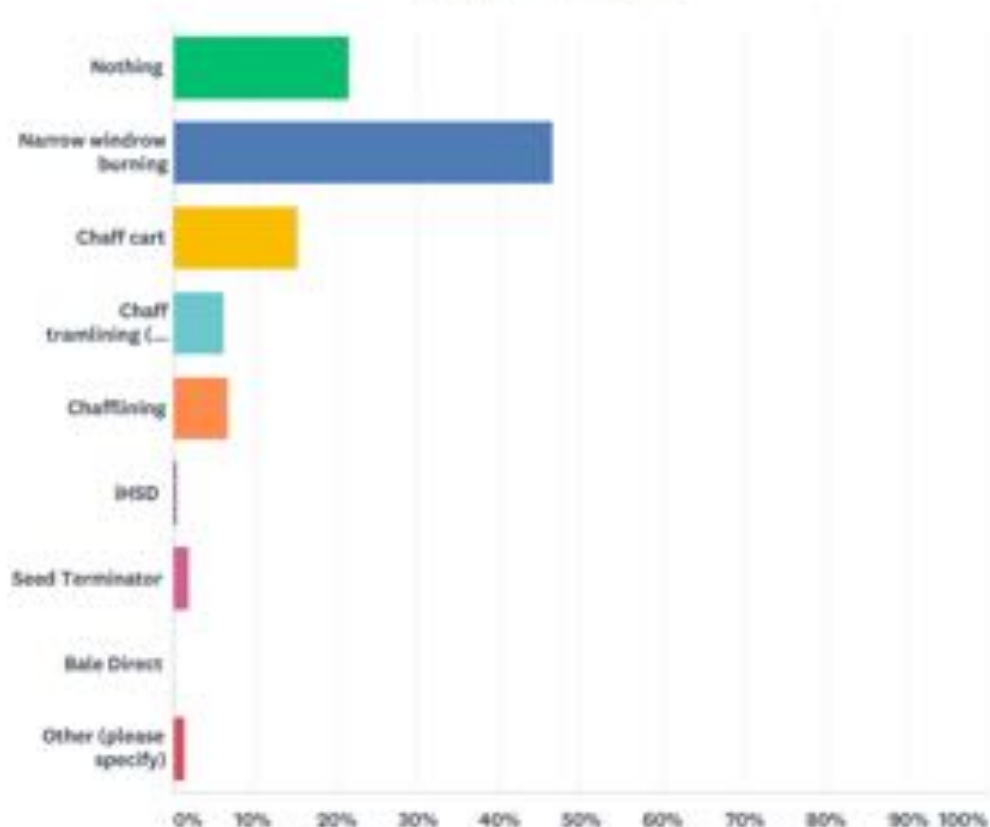
The results of this survey may be skewed a little towards growers who are interested in HWSC as the survey was only promoted via Twitter to growers who were following Weedsmart and the members of the Weedsmart team. However, the results are extremely encouraging.

The survey was conducted in spring 2017, just before harvest. The first question related to HWSC practices that growers used in 2016 (last year). Narrow windrow burning was most popular with 46% of growers using the practice (similar to the GRDC / CSIRO led survey).

Twenty two percent of growers were not using any HWSC tools in 2016.

### Q2 Which harvest weed seed control tool did you use last year (2016 harvest)?

Answered: 269 Skipped: 0



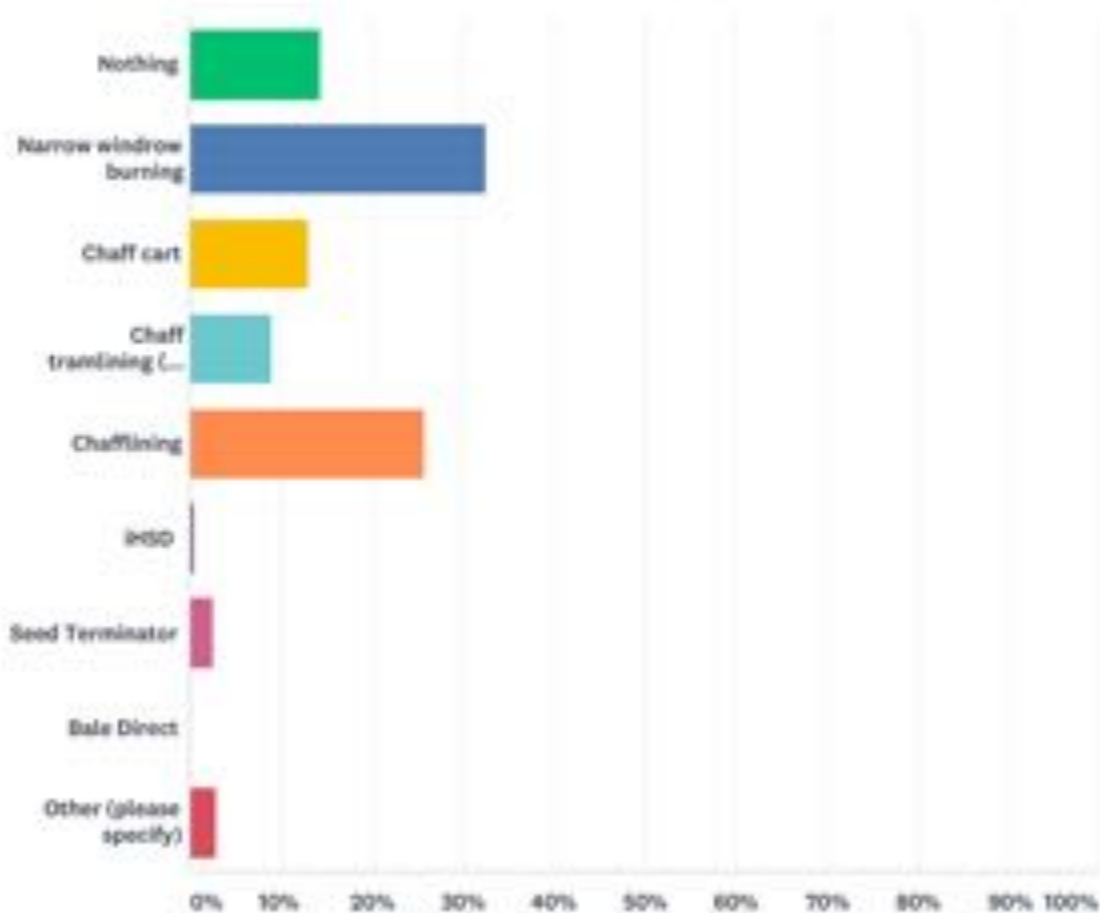
The next question asked growers what they planned to use during the 2017 harvest, a couple of months after the survey was conducted.

This reveals a big change in one year with the main trend being many growers dropping windrow burning and switching to chaff lining.

There are also fewer growers doing nothing.

### Q3 Which harvest weed seed control tool are you using this year (2017 harvest)?

Answered: 259 Skipped: 0



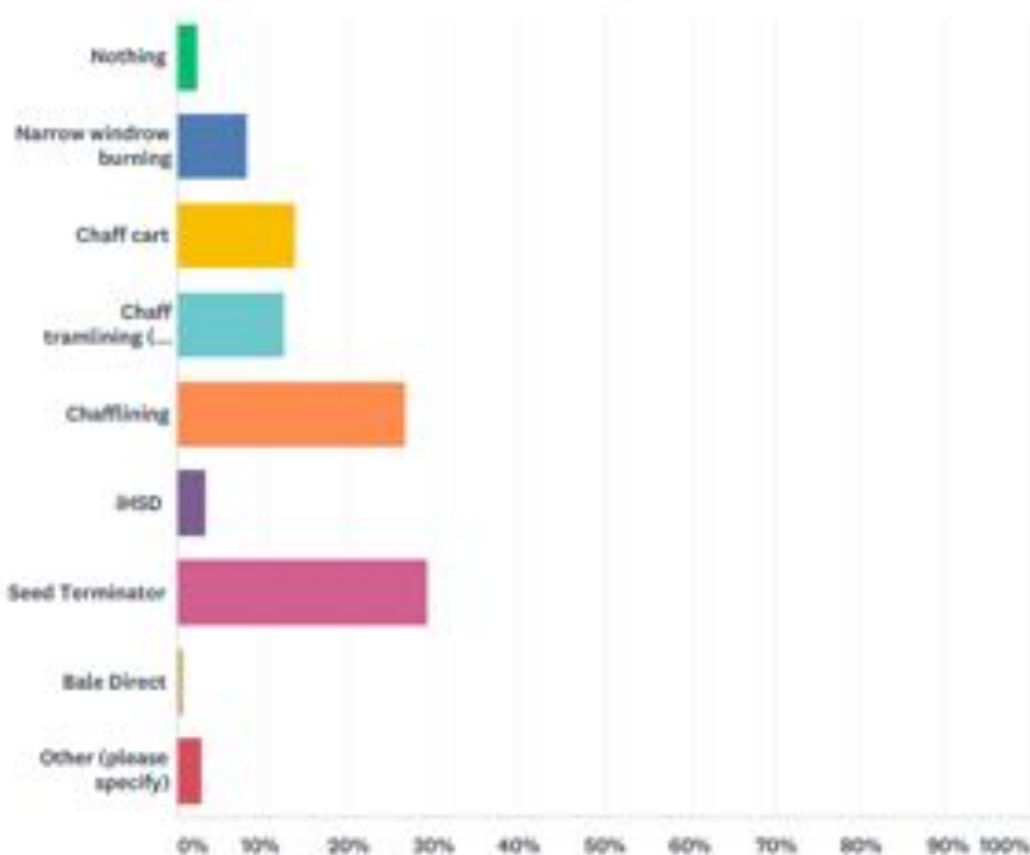
The final question was aspirational, asking growers which tool they plan to be using in 2020. Once again we see a major shift away from narrow windrow burning towards more chaff lining and seed destroying mills (iHSD-PN and Seed Terminator).

The Seed Terminator is the more popular of the two mills, likely due to reduced cost (\$120K versus \$165K for the iHSD), and the mechanical drive of the Seed Terminator is favoured by growers over the hydraulic drive of the iHSD.

The other trend we see here is a big reduction in the number of growers planning to do nothing with only 2% of respondents indicating that they will not be using HWSC in three years (2020).

## Q4 Which harvest weed seed control tool do you plan to be using in three years time?

Answered: 209 Skipped: 0



For Australian farmers we are seeing a trend of increasing adoption in favour of the tools that do not require any burning, namely the iHSD, Seed Terminator, chaff tramlining (chaff deck) and chaff lining. There will also continue to be ongoing use of the chaff cart, particularly for mixed farmers with grazing animals (sheep).

Given that growers are moving away from narrow windrow burning that is generally only used over a portion of their crop, and moving towards tools that target just the chaff fraction and can be used over the entire crop, we are likely to see a much greater proportion of the Australian grain crop treated with HWSC in the coming years. About 16% of the Australian grain crop is currently treated with HWSC and this could be as high as 50% by 2020 if current trends continue.

## FUTURE RESEARCH

With this significant adoption of chaff lining and chaff tramlining there is clearly a need for research to measure the efficacy of these tools. Research investigating the rotting of weed seeds under chaff lines and chaff tramlines has commenced by Dr. Michael Walsh, as well as some other small demonstration sites being conducted by agronomists and state government development officers. We know from other tools focused on the chaff the percent of weed seeds that we can expect to divert from standing in the crop to within the chaff line or chaff tramline with a well set up harvester. The research will therefore focus on the fate of the weed seeds once they enter the chaff line or chaff tramline.



## Seed destruction mills

Within the pages of the case studies that follow you will read that most of the Esperance grain growers are generally very pleased with chaff lining or chaff tramlining. What is surprising is that most of these growers then go on to say that they would like to adopt a seed destroying mill such as an iHSD or Seed Terminator in the future. These tools are seen as the ultimate given that the weed seeds are destroyed rather than weed seeds remaining in the paddock within the chaff line or chaff tramline.

### CHAFF LINE v. CHAFF TRAMLINING

The table below was prepared by Planfarm Agronomist Nick McKenna based on his observations while compiling the case studies. These are useful observations, but should not be taken as fact as they are based on anecdotal evidence.

	<b>Chaff line (in centre of harvester)</b>	<b>Chaff tramlines (on permanent wheel tracks)</b>
<b>Weediness</b>	Doesn't get driven over, no seed soil contact, doesn't germinate	Gets driven over, including multiple times before seeding, so get lots of seed soil contact leading to frequent germinations.
<b>Chaff breakdown</b>	Slower. Can hold onto moisture from below, but due its low density it stays relatively dry, so it tends to persist through the year.	Much faster, as the frequent passes with sprayer ensure it gets a bit moister and therefore mulches down faster.
<b>Seeding through</b>	No reports of it being difficult to seed through, but it would be slightly harder, as it has 2x concentration of material than chaff tramline. Harder with a disc machine than with a tine.	No reported problems, even with poor trash flow machines.
<b>Ease of fit</b>	Cannot be beaten. An afternoon in the workshop. Even easier on machines that already have chaff and straw separated such as Claas / New Holland.	A bit harder. Kits available for \$12000 to \$20,000. Again, easier on machines that have a pre-installed separation of chaff and straw such as Claas / New Holland.
<b>Wheel slip in difficult conditions</b>	None	Scattered reports of wheel slip, mainly on very heavy soils in moist conditions.
<b>Dust suppression at spraying</b>	None	Good. Although when dealing with misses in the wheel-tracks, it could be due to air disturbance and not dust. But, having less dust could also lead to other benefits, such as cleaner air filters etc.
<b>Fit for sheep</b>	Strong. Having the chaff, weed seeds and grain losses concentrated in the one line improves feeding efficiency.	Strong. As with a chaff line

## CASE STUDY

### Mick Shutz

Mick's farm ranges from Grass Patch to Salmon Gums, between 70 and 100kms north of Esperance. He uses chaff decks to place weed seed bearing chaff on permanent tramlines for his harvest weed seed control.

Although he did not have a serious problem with weeds in his cropping program, he was aware of the problems they could cause. For this reason he adopted a system that could be applied to his program with little fuss.



Having been chaff tramlining for 6 years, he said his motivation for using the system has changed, since realising the added benefit of dust suppression during summer spraying. Further, as he is on a fully matched 3:1 controlled traffic system a chaff cart posed another logistical issue. Over summer the chaff piles would be present on the tramlines, including the high traffic ones, meaning he would need to drive around them, defeating the purpose of a CTF system. Further, burning chaff piles at the beginning of each season is inherently problematic. Compounded by the variable weather in Esperance, of cool and damp nights followed by hot windy days, burning in a controlled manner is difficult.

"We never really contemplated going for a chaff cart. They were not even looked at. They slow the header down as well." Another added benefit Mick had noticed was being able to better control volunteer wheat in barley and barley in wheat.

"They are on pretty hostile tramlines and tend to only get small heads on them." This has since reduced the need to control the volunteers though chemical means.

With regards to the efficacy of controlling weeds, Mick says that the decks 'definitely work.' The whole idea of his CTF system was to make the tramlines the weedy parts of the paddock, and it is even more effective having the chaff placed there also. He said lots of the ryegrass seed that is placed there tends not to germinate, based on gut feel about how much goes into the chaff tramline and how many germinate. Further, the survivors then tend not to be vigorous. He puts it down to the constant wheel damage and soil compaction that they cannot compete with the crop.

*The additive benefit of controlling volunteers, managing weeds and reducing dust during spraying means the chaff deck is a great option for Mick.*







**IMAGES (L-R)** (1) Mick's chaff deck. (2) The belt running across the back of the machine, showing the cover between the left and right side belt. (3) The baffle/dividing plate to separate the chaff from the straw. Note the 'bull nose', designed to minimise stems lodging on the leading edge.

For summer spraying in his operation Mick said that he will often put 2-3 knockdowns over his paddocks before April. For his first application he will use a blanket spray and follow it with a detector spray to take out any survivors. However, as detector sprays have a poor ability to detect 1-2 leaf grasses, and as most of his grass weeds (volunteer cereals and rye grass) having his grass weeds mostly concentrated in his wheel tracks, he has nozzles over his wheel tracks permanently on to kill any weeds present.

This system works well, as the weeds across the rest of the paddock tend to be fleabane in various stages of maturity, at a density that it is cost effective to use a detector spray. When designing his decks, he was able to keep it cheap and simple. Mick runs John Deere S series harvesters, with chaff decks he designed and built himself. The baffle (to divide the chaff from the straw before it is placed onto the decks) is made from a single plate, and only moves the straw chopper 100mm back from its normal working position.



**IMAGES (L-R)** (1) Looking up the shroud at the end of the deck. (2) Designed with ease of access in mind, all electrics have plugs so the deck can be easily removed. (3) Speed sensor on the conveyor belt.

One of the common commercially available decks requires the chopper to be moved back approximately 700mm from the back of the sieve, which Mick said can interrupt airflow and thus the cleaning capacity of the header.

Also, his deck is quite simple to remove if need be, with quick release couplings on all hydraulic lines, plugs for the speed sensors and only 4 bolts holding the whole thing on. With all of this, it is able to be removed in about 15 minutes. Given the deck needs to be removed to access the sieves, it is a necessity.





*Weeds germinate more densely in the chaff line, leaving more of the paddock clean.*

As for the future, Mick said he would be looking at integrated mills 'with interest.' As the mills deal with the seeds so they are 'out of sight, out of mind' it would go a long way to prevent germinations of seeds and further reduce the seedbank. But, for the time being, Mick was happy with the chaff decks as a tool.

"It's not the ultimate for controlling weeds, but it's about being one step ahead."

**UPDATE:**

Since speaking to Mick during harvest of 2016, he had purchased 3 integrated seed destructing mills for his machines and used them for the 2017 harvest.

# CASE STUDY

## Adrian Perks

Adrian farms east of Esperance and has been using a chaff deck for a number of years. Coming from a mixed cropping/livestock program, he had been using narrow windrow burning to control weeds at harvest. He has since moved to a 100% cropping program and found weed control easier now that he is not dealing with the weeds from the pasture phase. However, due to the logistical challenges of burning, he now uses chaff decks to control weeds at harvest.



"With a wet summer and residue from 3 or 4t/ha cereal crops, the rows were becoming hard to burn." Seeing that weeds were going to continue to be an issue for cropping, Adrian moved to chaff decks for his headers as a low-hassle form of HWSC.

Adrian runs New Holland harvesters (a CR9080, CR6090, and CR970) all which deliver the chaff to the spinners and the straw to the chopper separately. As his harvesters have a pre-existing baffle to separate straw and chaff, he has not had to modify them in any way. However, he has added trailing rasp bars and peaks to his rotors to help barley thresh better, and felt that this would help thresh ryegrass seed out of the straw and into chaff. This in turn would mean more weeds end up going through the chaff decks and fewer going out with the straw.

Adrian said that he has not necessarily seen a decrease in weed numbers, but where he had issues before, he has shifted the distribution. "Now, they are in places where we can deal with them."

Adrian has recently changed the way he manages the chaff tramlines through the year.

"For the first years, the chaff lines were unseeded, so the weeds there had no competition and were setting too much seed. It worked out to about 5% of the paddock not being sown. Now, we use disc modules in place of the tines, so we wouldn't throw too much chaff around like we thought we would with a tine. But the tines don't throw much chaff around anyway, as it just flows around the point so we are contemplating using a normal tine in the wheel tracks to get better crop establishment."



*The past three summers have been dry for Adrian, and he is confident that he can sow into cereal stubbles without getting a blowout of wild radish or ryegrass.*

*He attributes this to getting rid of the pasture phase and his perennial use of harvest weed seed control (HWSC).*

**IMAGE:** *The EMAR chaff decks have not required much maintenance.*



"The chaff lines just get seed and no fertiliser to slow the weeds up a little bit. In the heavy country the disc just runs along the top and the crop in those rows doesn't get a good establishment. Where you have good crop establishment, the weeds are generally small and down the bottom of the canopy and shaded out. Where you have poor crop establishment they get all the sunlight and have a chance to make it to the top."

As for operational problems while using the decks, Adrian says that there are no big issues. The chaff can block in damp harvest conditions, especially against the dividing baffle inside the machine. "We have cameras on the decks to monitor them, as the chaff can begin to pile up if the machine stops suddenly whilst harvesting". As for other benefits, Adrian said that they rarely get a spray failure during summer spraying that can be attributed to dust, as the chaff in the wheel tracks suppresses dust.

Adrian also sharecrops a block with a neighbour who runs sheep on the stubbles over summer. Adrian said the chaff lines get selectively grazed over summer by the sheep, and there is a stark difference between where the sheep have grazed and where they haven't. Adrian wasn't sure if having sheep grazing the lines lead to a greater weed germination the following year, as it could vary depending on the season.



**IMAGE:** *Shown is where chaff was excluded from the wheel track.*

Based on his gut feel, he said that there must be some rotting of weed seeds in the chaff tramlines.

"Anywhere that you have a thick patch of weeds that are brought to the tramline, they must not be all germinating. It just doesn't seem like there are enough weeds germinating. Generally, if you don't have a wet spring, you don't see late weeds in the chaff tramlines in crop, except for where you drive the sprayer. They get squashed into the dirt and get good seed soil contact. But, we have had other issues. We have had canola come up in the chaff tramlines 2 years after growing canola. The chaff lines had stayed dry enough and did not rot. And it makes sense that if the canola can last that long then the weeds could too."

Looking to the future, Adrian said that ideally, he would like to move to an iHSD, but not until it has been proven in the paddock for a number of years, and when it was time to replace his harvesters. One of Adrian's grievances with the chaff deck system was that it wasn't destroying the weed seeds and are still relying on chemicals to reliably kill all the weeds.



# CASE STUDY

## Col de Grussa

Col de Grussa farms at Gibson, 20km north of Esperance running a continuous cropping program.

He farms in an area that can easily become too wet leading to weed blowouts, so he has added a harvest weed seed control option to stay on top of weeds.



Colin has used chaff tramlining for a number of years, and has found that using it with a fully matched controlled traffic system is paramount to achieving success. For his controlled traffic farming plan, Colin uses a 36m sprayer, a 12m header and a 12m seeding rig. All of his wheel tracks are the same every year, and although the machinery widths fit into a CTF system, the wheel tracks of the seeding machine don't match with his header. He originally had a chaff lining set up on his previous header, and then swapped machines just before harvest. Due to time constraints, he did not re-install a chaff line kit on that machine. Col then had a few years where he did not use chaff tramlining at harvest, before coming back to it on his current harvester. His specific set up differs to others; although he places the chaff residue in the wheel tracks, he uses a chute design rather than conveyor belts to achieve this.

Originally, Colin had a John Deere 9750 STS harvester which did not separate the chaff and straw before being spread onto the paddock. In order to use chaff tramlining, Colin had to install a baffle in the back of the harvester, which he said required 'a lot of stuffing around'. The baffle they installed impeded airflow through the cleaning sieves, and required modifying to regain sieving capacity. The solution they came up with was to put holes in the baffle to allow air to move through it. However, this would have reduced the efficacy of weed seed capture as weed seeds could also travel through these holes. Despite this Colin estimated that it was still capturing about 80% of the weed seeds.

After dividing the chaff and straw, Colin used a metal frame with rubber panels to direct the chaff into a single row. He then switched machines to a Massey Ferguson 9540, which delivers chaff and straw to the spreaders separately. With this machine Col found it much easier to use chaff tramlining. His strategy was to put rubber around the chaff spinners and then direct it into the wheel tracks of the sprayer, which worked well with his CTF system.

As far as ongoing hassles with his system, Colin said that the rubber deflectors inherently catch a lot of air, so when the machine is running and stationary he said that the chaff can get blown around a fair bit. Aside from that, it was just getting all of the machinery onto the right run lines.

Since using chaff tramlining, Colin says that he has not really seen a decrease in weed numbers, but more a change in distribution. He thought that a few more years of chaff tramlining would be needed to really change the distribution of weed seeds into the chaff tramlines, and to get the numbers down. When asked to ponder the effect of a wet or dry summer, he said that he usually gets a wet summer and so couldn't comment about the difference. "I'm not sure about rotting over summer, but it will germinate. Normally we get multiple germinations over summer, and those chaff tramlines will germinate, and you can spray them out, or you can get some hot weather and they die anyway. I think the rows hold the moisture better, because it's like a mulch. It's definitely useful, because I think we get a better germination in the chaff lines than if the seeds were just cast across the paddock. On our non-wetting sands, the seeds can sit there a while."



When asked if it had saved him a spray application, he said ‘not yet.’ ‘It is a part of the whole tool box. You don’t do this to stop doing something else. I think if you’re combining everything you have a better chance of getting on top of (the weeds). It’s just another thing that you are doing in addition to whatever else.’

More so, his motivation for chaff tramlining is for the future. ‘In the long term we are better off. I think we will never be able to move way from using herbicides, it just means that they will last longer.’



In terms of cost, Colin said that the chaff tramlining kit itself only cost a few hundred dollars, but as he sees fully repeatable controlled traffic as paramount to the success of the operation, that would be an added cost to consider if growers were not already moving toward that. Further, he said that ideally growers would move toward a boom spray with only selected nozzles turned on, and concentrating a spray onto only that part of the paddock.

*"We probably need a few more years of it I think, and to do something more with the weeds we are collecting. Like anything, it is a numbers game, and it will take us a while to get the numbers down."*

## CASE STUDY

### Carl Rasic + Henry Barlow

Carl Rasic farms at Scadden and Cascades, North and NW of Esperance. Their 100% cropping business operates on a detailed, fully matched CTF system, which is complemented by the use of chaff decks. The motivation for getting involved was part of a long term strategy for managing weeds.



Herbicide resistance was appearing, and the logic was that it would be easier to control weeds if you know where they are. They had previously burned narrow windrows in the past, but wanted to preserve as much stubble as possible. To them, the logistics of being able to safely burn windrows without having the fire escape and burn the stubble meant that it would not be looked at. Chaff carts were also considered and rejected as it seemed that casual staff driving harvesters would have been risky to the machinery, as well as trying to contain burning chaff piles in autumn. A single narrow chaff line was excluded as it was thought that using their tined seeding machine and interrow seeding would have been too much of a hassle, and that the resulting disturbance of the chaff line would lead to more germination of weeds.

Carl originally started using chaff decks in 2009, after borrowing the principle from Colin Hutchinson of Mount Madden. The design Carl used was different to what he saw in practice at Colin Hutchinson's farm, but the end result is the same. Carl uses a design similar to the commercially available EMAR chaff decks, with 2 diagonal conveyor belts to catch material coming off the sieve and direct it into the wheel tracks. Originally, the conveyors were uncovered, but they have since shielded them to prevent wind disturbing the chaff and carrying it away.

Carl uses a 1:2:3 compromised CTF system, with a 13.6m harvester front, 27.2m seeding bar and 40.8m sprayer, all on 3.2m centres. As his CTF system is fully matched and fully repeatable, he has modified his seeding bar to accommodate the chaff lines. Originally, Carl operated with the tines that align with the chaff lines removed. However, they decided that skipping a seeding row forfeited too much area of the program and let too much sunlight through the canopy to encourage weed growth. The system then evolved to use 2 disc seeding modules that run either side of the chaff tramline, and also adjusted the spacing of the crop rows so that the chaff tramlines are not disturbed. This leaves the chaff less prone to disturbance, reducing weed germination, and also means that the crop germinating in those rows is not on the wheel tracks.



*On account of their fully matched CTF system, they are able to use their seeding set up to complement their chaff tramlines and to reduce the germination of weeds in the chaff row.*

**IMAGE:** Carl made his own chaff decks, with a similar design to the current EMAR deck.



**IMAGES:**

*L-Disc modules are set up to straddle the chaff line and leave it as undisturbed as possible.*

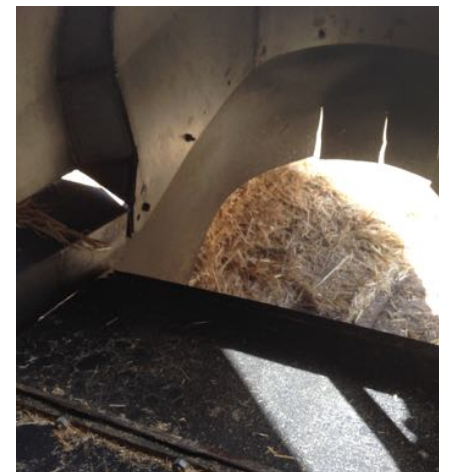
*R-If the need arises, they have a small boom they can use to spray just the wheel tracks.*

In terms of performance, they are happy with how effective the chaff tramlines are. On account of the wetter than average year, there had been a blowout of ryegrass in the trams according to an employee, Henry Barlow, with the ryegrass tillers pushing through the rest of the crop. This illustrated that the system was working to confine weeds to narrow rows. On account of the CTF system, the repetitive traffic was working to breakdown the weed seeds.

"Because you are putting 45ft widths into two spaces that are each 600mm wide, they out compete each other a lot. With our first summer rain, you get a bit of germination. They out compete each other so starve each other a bit, and then you spray them and knock them all. You see after a couple of years of good build up a lot more rot away. The first year they get compacted back into the soil a bit, and it's just getting that rotting action. You are quite reliant on summer rain as well to get it to work to get that rotting action."

It has also had other, smaller benefits for being able to manage weeds on the farm. After a summer with no rainfall, he experienced a lot of volunteer wheat coming up in his barley. In order to preserve purity of the seed, he was able to accurately remove the wheat by spraying only the tramlines. Had he not been using chaff tramlining, the volunteer wheat would have been evenly spread through the paddock, and therefore not been able to be managed.

As for future aspirations, Henry said that they were quite happy with their current system. Although they are attracted to the idea of the iHSD and think it is a great idea, Henry said "the chaff decks are a lot cheaper. Ray (Harrington) has a great design, but it's just a bit cost prohibitive at the moment."

**IMAGES:**

*(1) The shroud for the deck. (2) The tractor mounted boom, for spraying chaff lines. (3) Inside the deck, looking at the exit.*



## CASE STUDY

### D Marshall & Co

Steve Marshall, of D Marshall and co., have used chaff decks on their Cascade and Dalyup properties for almost 10 years.

Cropping 4800ha with no stock on the property, weed control is paramount to keep paddocks in crop.



First copying the principle of Colin Hutchinson, Steve made the chaff deck himself and had the hydraulics plumbed to suit his new Holland CR headers. Installation was comparatively easy, as the hydraulics for the chaff spinners were already there and so were able to be used with little modification. He has since switched to running John Deere headers, which he said was a bit more involved. It required plumbing into the Powercast hydraulics and also running the straw chopper further back from the machine in order to fit the baffle and decks in. Once the chaff lands on the hydraulic belts, it is moved to one of the wheel tracks.

As the John Deere harvesters deliver the chaff and straw together to the back of the machine, Steve needed to modify the harvester by installing a 'baffle' so he could still deliver the straw to the chopper while directing the chaff onto the decks. Steve said that he 'went as hard as he could to split it' in order to capture as much of the chaff material as possible as it came off the sieve. To avoid material catching on the front edge of the baffle, Steve used a length of 5" diameter stainless pipe, originally intended for an exhaust. However, he said that the New Holland required none of this work as the machine already separated the straw and chaff and had a roller at the start of the divider to keep the front edge clean of residue.

To that end, he has installed a camera monitoring the chaff throughput so the operator is aware of a blockage, before it becomes too big of a problem. To resolve this issue, the newer EMAR chaff decks have a hydraulic roller on the front of the baffle, which keeps the diving plate free from residue and thus prevents blockages.

As for motivation to get involved in harvest weed seed control (HWSC), Steve said it was driven by the results of research. "All the work that has been done with (Peter) Newman was showing that if you do nothing at harvest time you won't have any impact on weeds. If you get a year like this, where it is significantly wet for the whole year, and the weeds go haywire, the seed bank will go back to where it was. But, if you do something at harvest time you keep low weed seed numbers." Because of this, chaff tramlining looked to be a good choice. "I wanted something that wouldn't slow us down that could still manage the weeds. That you can know where they are, without having to run around burning stuff over summer."

*With his current set up, Steve said that in good conditions there are 'no issues whatsoever.' However, green canola plants or a patch of immature radish dictate that the operator be vigilant and monitor the sieves to make sure the machine does not block up.*

#### IMAGE:

*The decks are not covered, but still have shrouds to direct the chaff to the ground and prevent wind interference.*



The response to the chaff tramlining is visible, although it does take a few years says Steve. "If you just keep at it, it certainly has a big effect." Encouragingly, it seems that there is not a 100% germination of weeds in the lines, and that they don't end up being much weedier than the rest of the paddock. On the high traffic tramlines, Steve said that the continual traffic from the sprayer means that the seeds there make good contact with the soil, and therefore get a good germination.

But, they also suffer from being on the compacted tramlines and being run over multiple times during the year. As for the other, low intensity tramlines, Steve said that if you don't disturb the chaff, a 'bank' builds up and there ends up being a lot less weeds compared to the rest of the paddock. "A competitive crop is the best weed control method I know." Limiting the traffic damage to areas with an inherently higher weed burden looks to be a positive move.



#### IMAGES:

*(1) The decks come out diagonally from the machine.*

*(2) To fit everything in, the straw chopper has been moved rearward.*

*(3) With weeds concentrated in a narrow band, spray applications can be targeted. Here, ~8% of the paddock was sprayed.*

This overall reduction in weed burden has also had more tangible benefits for the business. Having a generally lower weed burden has meant that they are able to sow earlier with more confidence of getting weed control without a knockdown application.

Also, having both volunteer crops and other weeds coming up in known locations has given him the opportunity to target some of his herbicide applications. In one particular instance, he was able to apply herbicide to just the trams, meaning that he only sprayed approximately 8% of his paddock. This represented a significant cost saving for that application.

On a broader scale, Steve said that it has helped them maintain a 100% cropping program. "We had lots of resistance to the commonly used herbicides, so I actually thought 10 years ago we might do something different to remain farming in a non-livestock, total cropping operation. You have got to be doing something. If you're not doing some weed seed management at harvest time, it's just not going to be a long term thing, to remain continually cropping."

As for plans for the future, Steve said that a seed destructor looks to be the ultimate for harvest weed seed control, and sees that in the future a seed impact mill of some description will be standard equipment. As for the cost, Steve said that it did have a large price tag associated with it, but "so do weeds". For the mean time, he said that he would be happy with a roller on the front of the baffle to keep the leading edge clear of ropy canola stems.



## CASE STUDY

### Elliot Marshman

Elliot Marshman has a 100% cropping program spread between Scaddan, Grass Patch, as well as a small block at Gibson with livestock, all north of Esperance.

Running a canola, wheat, wheat, barley rotation, staying on top of weed numbers is paramount for him.



Elliot had tried narrow windrow burning, but saw that it was not a viable long term strategy. However, he felt that he should be doing something to manage weeds at harvest time, and so looked into other options.

"I really liked the idea of the chaff decks, because once it's done, it's done; there is no burning. Chaff carts might be better because you actually destroy the seeds by burning, but with a deck you are at least doing something. It's got to be better than doing nothing, and its easy, and that's why I went down that path."

Having seen first-hand some creeping glyphosate resistance in annual ryegrass on one of his cropping blocks, Elliot knew that something had to change. Knowing that an integrated approach could be part of a solution to the problem, he wanted to get involved in something that could 'keep the whole program in check.'

While there are other HWSC options that also fit this description, Elliot said that the other options such as a chaff cart or burning narrow windrows still necessitated burning prior to seeding, which was highly unappealing to him. Also, when he started using the decks to put weed seeds on permanent tramlines, the Harrington Seed Destructor was only available in a tow along unit. Irrespective of that, he said that he would prefer to let the integrated mills evolve a bit before he committed to one.

By contrast, the use of chaff decks didn't require any management after harvest, and seemed easy and cheap to both install and run.

"When it was delivered it was all installed and ready to go, and has been working ever since."

When asked if there had been any hassles with the decks, he said that during one season, the blades on his straw chopper had worn, and were making the chopper vibrate. This was causing the deck to also vibrate, which in turn caused some cracking around the mounting points for the decks. 'It wasn't due to any fault of the decks, and once we fixed the straw chopper and re-welded the decks it was right again. Aside from that I haven't had any dramas."

*"I got into a new header (2 years old), which was a significant upgrade for me. I decided I would go down the route of a chaff deck, so I told the dealer that I wanted chaff decks on the machine, so they got James Buttle from EMAR to install it."*



In terms of decreasing the weed burden, Elliot said that it was hard to gauge it properly as he hasn't done any density measurements or weed counts. But, he said he has definitely seen a concentration of weeds in the wheel lines where we are putting the chaff and weed seeds. "To me, that proves that it is working; stopping it getting spread across the whole width of the comb. All in all, I am confident it is doing what it should, and helping the weed numbers as a whole." This observation was reinforced when Elliot was swathing canola and noticed how much the density of ryegrass stubble varied across the width of the swath. "In what was typically a weedy area of the paddock, the wheel tracks were riddled with ryegrass stubble, but the rest of the width of the swath was nowhere near as bad."

Come seeding time, Elliot is not finding any problems with trashflow either. "Last year we had quite good crops, so this year's seeding would have been a good test for it. I don't think there was any difference in the chaff tramlines compared to the rest of the bar either for crop establishment. We did have blockages from the heavy stubble load, but I don't think the chafflines made it any worse."

However, one negative point about the chaff decks that Elliot has noticed is that after summer rain and the first round of summer spraying, the wheel tracks can germinate again. "Because you have the thick layer of mulch, it holds onto moisture, so you can get green wheeltracks which would have otherwise not been there." He had also heard of other people having the decks block up, but he presumed that was in high moisture environments, but he has never had these issues.



As for future aspirations, "The ultimate is the integrated seed destructor (iHSD) no doubt they come with a hefty price tag, and there could be all sorts of complications that people no doubt didn't think about. For the price of putting the decks on, I would still go down that path if I was even a little bit worried about going for the seed destructor."

“

*I can't see any real negatives to the chaff decks really. I don't think it's the ultimate way and burning probably removes more of the actual seeds themselves, but it's a good easy way, you are doing something, and I am happy to go with it.*

”

~ E Marshman

# CASE STUDY

## Mic Fels

Mic Fels farms at Wittenoorn Hills, north east of Esperance. Running a 100% cropping program, Mic originally got involved in Harvest weed seed control through narrow windrow burning, which he would use after his barley rotation. But, after hearing about others that were using chaff lines over the majority of their program, he spoke to them and then decided to give it a go.



For his hardware, Mic made his own chutes from plastic, which he shaped himself using a heat gun. With each sheet costing approximately \$300, he was able to run through several iterations quite cheaply and make alterations where necessary. The main problems he faced during the design process was to make the chute steep enough so that chaff wouldn't catch on it and block up, which he says is mainly due to the high humidity and low temperatures he often sees during harvest in Esperance. Also, he had to ensure that the chute would catch all of the chaff coming off the sieves, and not let too much chaff escape.

Mic's main issue is that chaff lines can be a 'nuisance' where he sows the crop. "Because the chaff lines spread out a bit, I don't get good establishment in the chaff lines." Although Mic uses a disc seeder, he says that the poor establishment is from not getting good seed soil contact, and not from residue hair-pinning. Although this is causing some problems, Mic has played with both seeding the chaff rows and leaving them undisturbed. "Not seeding through the chaff lines keeps them tighter, but it leaves more gaps in the crop. Seeding through the lines gives less gaps. Sometimes the seed comes up where you seed through, and I'd rather have crop growing there than not. It's extra competition."

Another negative that Mic is also finding is that the chaff lines provide a good habitat for earwigs to live, which attack his emerging canola. To manage this issue, he says an insecticidal seed dressing seems to be the best.

As well as earwigs, he said that sheep also seem to enjoy the chaff lines, though they don't negatively impact his crop! "We lease some country from a neighbour, who runs sheep. He grazes the stubbles over summer, and you might as well have troughs every 40ft up the paddock. The chaff lines are just about all gone by the end of summer- it's like a feed lot, they love it! It's pretty good quality feed, a bit like chaff dumps. If you are running sheep, both chaff dumps and chaff lines are good."

Unlike other people on a fully matched CTF system, Mic said that he went for a single chaff line over a deck for simplicity, and as a form of insurance also. "One of the things I was worried about when I started was creating a monster, a concentrated band of weeds in the paddock that I couldn't get rid of. If I put it in the middle, besides being cheaper and easier, I could also drop a narrow windrow on it and burn it, and it's all gone again."

*Despite there being some drawbacks to the chaff lining system, Mic said that it is his preferred option at the moment.*

**IMAGE:**  
*Operating on the KISS principle, Mic's thermoplastic chutes are cheap and cheerful.*





But, Mic said that the chaff decks are better suited in other ways. Namely, that when used in a CTF system there will be good dust suppression during summer spraying. Also, he said that there seemed to be a trade-off between the chaff decks and the chutes between the speed of chaff breakdown and the number of germinations of weeds from the chaff.

"Actually driving on the chaff lines will make them breakdown faster. Because I don't drive on mine, they stay light and fluffy, and they don't hold moisture. So, they don't mulch as quickly, and I think that's part of the trouble I have at seeding. But, because they are light and fluffy, they don't hold moisture, and they get fewer weeds germinate. So even though we are losing out by having the chaff persist for longer and having some dramas at seeding, you get fewer germinations." Although his chaff lines are persisting longer than those using decks, they are still fairly decomposed three years down the track. "Three year old residue is rotten, two years is half rotten and one year old is definitely there."

Despite there being some drawbacks to the chaff lining system, Mic said that it is his preferred option at the moment. "I don't expect to get all the weed seed down here, so I don't see the point of going to extreme lengths to get it all. By the time the crop is barely ripe, probably a third of the ryegrass seed is on the ground as it is shattered. That's why I haven't gone for a chaff cart- they don't really appeal that much to me because I only get a portion of the seed anyway. So there is no point busting my arse trying to collect all the seed when I lose a percentage anyway. I can achieve the same with a \$300 piece of plastic as I can with a HSD."



*Where the paddock is waterlogged, the weeds are much more competitive, and there seems to be a better germination of the chaff.*



*Mic ran through many iterations to get a design that worked, trying to overcome the problems of chaff blocking the chute.*



*Green ryegrass can make it through the machine un-threshed, so having the option to put everything into windrows for burning works well for Mic.*



Although Mic doesn't have a problem with wild radish on his farm, he said that using a 'chaff only' system wouldn't be the best to manage that weed burden. As he often harvests while the wild radish is still green, Mic said that he would likely see the radish pods not end up in the chaff. But, he said that the brome grass response to chaff lining was highly visible. On some of his ex-cattle country that typically grew nothing but brome and silver grass, he said that he now has 39 feet of clean crop, then a foot of brome where the chaff lines are. "I'm really happy with that, because I now have 39/40ths of my paddock that is clean, whereas before it would have been brome every year." Also, he said that brome grass tends to survive better in the chaff line than does ryegrass, as he will often see brome grass emerge in chaff lines, whereas the ryegrass never really seems to come up.

**IMAGES:**

*Crop competition is key. Despite the chaff going in the middle, the wheel tracks tend to be weedier.*



All in all, Mic is positive about the effects of chaff lining on his farm. For him, the main strengths of it are that it doesn't cost him any time at harvest or before seeding, and that he can easily switch to narrow windrow burning when he needs to. "Everyone has an opinion about what's better; wants to argue that chaff carts are better than chaff decks, or chaff decks are better than windrows. I don't think it matters a stuff, just so long as you are doing something! I think the only stupid thing is not doing anything at all. Everything works, whatever spins your wheel, but spreading it out on the paddock is just madness."



## CASE STUDY

### Con Murphy

Con Murphy manages the Warrakirri cropping program at Condingup, 100km east of Esperance, with 12800 arable hectares.

Having worked on farms in Western Australia for 10 years, Con was exposed to a number of different Harvest Weed Seed Control methods, and has first-hand experience with herbicide resistant weeds.



When he started as the manager at Warrakirri, he said that much of the land had only seen about 7 crops, having been pasture prior to that. Because of the low cropping intensity, there was very little herbicide resistance. "Being given a blank sheet to start with, you need to keep it clean. A stitch in time saves nine, and I wanted to get in before we had any issues." Running a 100% cropping program, his rotation consists of canola, then wheat, then barley into canola. Con also has a spading program to ameliorate non wetting soils, and said that the barley was very useful to sow after country has been spaded to rapidly gain groundcover. For selective control of ryegrass in crop, he was very happy with clethodim and propyzamide in canola, and Sakura® in wheat. The Boxer Gold® was not as highly praised for ryegrass control in barley. Being virgin country he said that much of the chemistry worked really well for weed control. "I don't think Hoegrass® works, but clethodim in canola works really well."

As Con was also trying to set up a controlled traffic program on Warrakirri, he decided that a chaff deck was the logical choice.

This worked well, as the contractor Con uses for his harvesting developed the EMAR chaff deck. This meant that all of the hardware was already in place to begin chaff tramlining and his controlled traffic program.

With one more season left in their contract, he said he would like to move to 40ft seeding rigs, to complete the transition to controlled traffic farming. This would also give him the opportunity to change the design of the bar, as he was finding that trash flow under the bar was an issue with his heavy stubble loads. Despite all of the straw residue, he said that the chaff tramlines would likely not pose an issue. But, in having fully matched wheel tracks and machinery widths he said that it would give him an opportunity to make the wheel tracks as firm and 'hostile' and possible, to prevent the germination of weeds. He said that if this eventuates, he would consider getting a shielded sprayer set up, so that he could target just the wheel tracks if they warranted a spray.



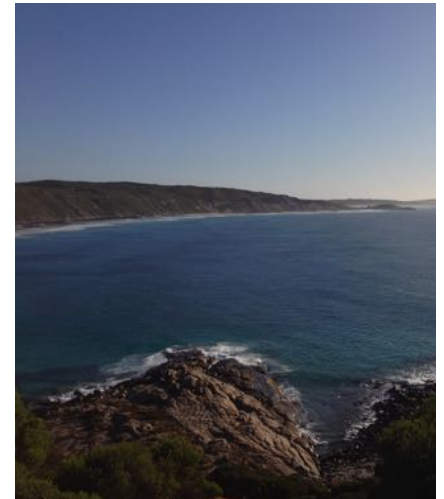
*At the time of the interview, he said he had 40ft harvester fronts, on both owned and contractor operated machines, and an 80ft seeding rig, operated by a contractor also.*

**IMAGE:** The EMAR chaff deck in action.

Aside from the ease of implementing the strategy across his program, Con had also eliminated other tactics based on their drawbacks. "Chaff carts have piles that need burning, and it's a risky, dangerous job, at the wrong time of year when you are trying to get ready for seeding." Further, due to the climate and being so close to the coast, he said that windrow burning can realistically only be used for a fraction of the program. Burning is impeded by how damp the windrows can actually get.

As for a seed impact mill, such as the iHSD, the price would be prohibitive, given he is using contractors for a large part of his harvesting program. "It's too much of a hassle trying to convince (contractors) to buy a mill, and then up the price. Also, it's another thing hanging off the back of the machine, and the fewer things you have hanging off the machine, the better." But, he admitted that it could be something he would investigate, if he doesn't find success with the chaff decks.

"If we were doing it ourselves, we might dabble with it and install it on one header and then use that machine to target the weediest paddocks. But to have 6 of them running around- you wouldn't even think about it."



As Con was interviewed during the first harvest since the chaff decks were adopted, he couldn't comment on how much they move the weed seeds from one area to another. But, he was confident that it would yield positive results, based on what he had seen on other farms.

For now, with little herbicide resistance, and a very proactive attitude, Con is confident the Warrakirri program will find success, either using chaff decks or otherwise.

*“I’ve come from doing windrow burning, and finding that to be really successful, but we are limited down here, because it doesn’t really fit the environment. I think the decks do fit the environment, so I hope we are on the right track.”*

”



## CASE STUDY

### Patty Barber

Patty Barber farms at Gibson, 30km north of Esperance. Cropping 100% of his program, Patty originally installed chaff decks because he was struggling to gain control of ryegrass on his property, which he said was exacerbated by long seasons, non-wetting soils, and waterlogging.



Using a disc as well as a tine seeder, and a John Deere 9660 and a New Holland 9090, along with a wheat-barley-canola rotation has given him a good handle on how the cropping systems interact with the chaff residue. "We have been tramlining for probably 12 years, 120ft boom, and a 40ft seeder and header. We have widened out our row in the middle, on both seeders to about a 500mm gap. The chaff from the header falls into that gap. We find that a good barley crop will hold the stubble there in the row, but the canola can fall out." The wider gap in the centre row was to make it easier to leave the chaff line undisturbed, as running a tine through it could 'impede trash-flow.'

Deciding to use a single chaff chute instead of a deck, he said it was due to the simplicity of operation and installation, to minimise the weed rows in the paddock, and the ability to use narrow windrow burning to complement the practice. "We can burn the row if we desire, and I would rather have one weedy row than two weedy rows. That's my reckoning - if you went to a chaff deck, it's about \$20,000 and a fair bit of hassle. Whereas this is a few hours in the workshop, and a bit of thought." Further, he said that on his soil types, he would not expect to see great control of weeds from purely driving over them.

"On heavier country I think its because they can drive on it and kill the weeds, but on our soil, here on the sandplain, it just doesn't seem to happen."

This might also be followed by a knockdown application prior to seeding, and then a desiccant spray prior to harvest to increase harvestability and to prevent the formation of ergot. Knowing that he was placing a large selection pressure on glyphosate, he saw using a chaff chute as a way to gain non-chemical control of weeds. As for in season control, he had not had legitimate testing done but felt that it was not as effective at controlling ryegrass as it used to be in canola. However, he was finding great results with Sakura® in the wheat rotation to control ryegrass. "Our canola crops used to be clean, and our cereals dirty, but now it's the other way around."

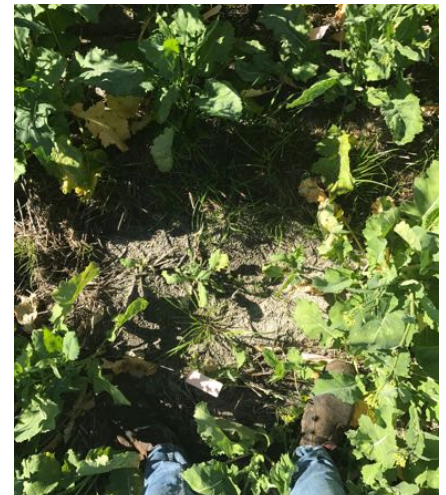


*Given the large weed burden he was dealing with, Patty also had concerns about herbicide resistance in his weed populations. On account of summer rain, Patty said that he will often spray up to three times over summer, with the brews containing glyphosate.*

**IMAGE:** *Patty places the chaff in a narrow band in the middle of the machine using a chute.*

Having been using chaff lining for a number of years, Patty has noticed that in general the chaff lines look weedier than the rest of the paddock and said this is why it would be good to use a narrow windrow burn every three years. However, a demonstration trial set up on his property found that there was not a significant difference of ryegrass panicles between the chaff line and the rest of the crop. As for plans for the future, Patty was excited by the prospect of an integrated mill, saying they would be 'way better than this (chaff lining)'.

Since speaking to Patty during harvest of 2016, he decided to stop chaff lining as he was finding that he was not achieving clean crops.



**IMAGES:** The chaff lines are left bare at seeding, with the idea being to reduce the germination by not disturbing the chaff.

## TRIAL

*During harvest of 2016, a small demonstration trial was set up on Patty's farm to estimate the level of control achieved by chaff lining. Method Quadrats were randomly placed to estimate ryegrass plant numbers on an area basis, and to assess the average number of seed bearing spikes per ryegrass plant. Ryegrass spikes were then sampled to be analysed later to estimate the average number of seeds per spike, which could then be used to estimate the average number of seeds per plant, and thus estimate the number of seeds per unit area.*

*Next, a length of marine carpet was placed in the paddock, in front of the harvester, and in line with where the chaff would be deposited in the line. The carpet measured approximately 1m x 0.4m, designed that it could collect chaff without being accurately placed in front of the machine. The location of the carpet was marked with a GPS and the corners of the carpet were marked with pegs. As the harvester moved over the top of the carpet, the chaffline was placed on top of the carpet. Although the chaff was falling in between two rows of stubble with a 60cm gap between them, the chaff itself was deposited into a row approximately 25cm wide. This residue was then collected and later analysed to count the number of ryegrass seeds.*

*The chaff collected in this fraction represented the chaff present in an area the length of the carpet and the width of the harvester's cutter bar. This was then compared to the number of grass seeds present in the crop to estimate how effective the harvester was at depositing weed seeds in the chaff line.*

*As the carpet location was marked, the site was returned to in July of the following year to measure the ryegrass burden in the chaff line, and the ryegrass burden where there was no chaff placed from the 2016 harvest.*

*The ryegrass density in the adjacent crop was not measured. This was compared to the amount of weed seeds present in the crop, based on the ryegrass density and average seed yield per plant.*





**IMAGES:** (1) The materials used in setting up the trial. (2) Excluding chaff shows how much the residue degrades over the course of the year. (3) Flags were placed on the corners of the plot to find them the following winter.

## DATA

Rep	RG seeds collected on carpet in 2016 (0.4m <sup>2</sup> )	RG seeds germinating in chaffline in 2017	RG seeds germinating in 2017 from where the carpet was held the previous year (no 2016 chaff)
1	6821	120	140
2	19225	60	60
3	20765	130	285
<b>Average</b>	<b>15604</b>	<b>103</b>	<b>162</b>

The measurements for the number of ryegrass germinating in the chaff line was adjacent to where the carpet was placed, and taken over an identical area.

## DISCUSSION

The limitations of this trial are that the weed density was only estimated at one stage during the year, in July. This is after the application of pre-emergent (trifluralin) and in crop (clethodim, quizalofop & atrazine) herbicides. However, observations from other farmers indicate that it tended to be more successful to not remove tines, as the crop competition seemed to do a good job at controlling the weeds. As the chaff lines were not seeded, there was essentially no crop competition adjacent to the chaff, and there were many ryegrass plants emerging. By comparison, the crop had a much lower weed burden. Because of these variables, it is not clear if the chaff lines were weedy and the crop clean because there were many weed seeds placed there during harvest of the following year, or because there was ample sunlight and moisture due to the lack of crop.

In the distance the machine moved the length of the carpet, it would have collected approximately 80,000 seeds of ryegrass. However, on average across the 3 replicates, only 15000 were collected in the chaff line. However, these measurements were taken on a cool, humid day so it would have been difficult to adequately thresh the residue, possibly leading to more ryegrass not being threshed and exiting the machine via the straw chopper. Despite these late germinations, it seems that the chaff has a strong tendency to inhibit germination of ryegrass. After all, approximately 15000 seeds were deposited in an area approximately 40cm x 25cm, and only 103 germinated when it was checked in July. This may be considered the mulching effect that many growers have observed.





**IMAGES:** *Following a wet summer, autumn and winter, there was a strong germination of weeds in the chaff line.*

## CONCLUSION

*Although it isn't perfect, it does seem that the chaff line is effective at confining weeds to a narrow row. Using the available data, which is admittedly not extensive, indicates that about 19% of the weed burden was deposited into a narrow band, about 2% of the width of the swath. This represents a significant concentration of weed seeds.*

*Given the attitude of many of the growers was to simply 'play the numbers game,' being able to deal with any proportion of the weed seeds would be an advantage, especially if the mulching effect of having a concentrated band of chaff is as strong as it appears in this data set.*

*John Broster (Charles Sturt University) and Michael Walsh (University of Sydney) concluded that a machine is able to divert as much as 97% of weed seeds into the chaff fraction when working at harvest, if set up properly and working in optimal conditions. Thus, chaff lines may be more effective if being used under better harvesting conditions, as they would be able to concentrate a larger proportion of weed seeds into the chaff line.*





## CASE STUDY

### Mark and Hayley Wandel

Name: Mark and Hayley Wandel, "Ainsley Park"

Location: Scaddan, Lort River, and Beaumont

Area: 8100ha

Rotation: Legume, Wheat, Canola, Wheat, Barley



Mark and Hayley Wandel, of Ainsley park, first started using a chaff deck in 2006. Mark had already set up a fully repeatable controlled traffic system, so to him it was common sense. "It was just the principle of taking the weeds seeds off the most productive part of the country, and putting them on our least productive parts. Seeing as we were already handling the weed seeds, it made sense. And as everything is repeatable with controlled traffic, we know exactly where they are, and we can control them that way, and make them compete against each other as well."

For his chaff deck set up, Mark has a conveyor running at 90° to the direction of travel, which places the chaff in only 1 wheel track. A switch in the header cab controls which side of the machine the chaff is placed on. As his tramlines run mostly North-South, they arbitrarily decided to place the chaff on the west wheel track. The header operator simply flicks a switch on the headland, and they get it right 'most of the time.'

The logic for only putting the chaff in one wheel track was that Mark's CTF system is based on a 9m working width. This meant that if the weeds ended up germinating, he would only end up with 1 row of weeds every 9m, as opposed to 2, and give him a greater proportion of the crop that is not competing with weeds.

Although Mark has been using the chaff lining system since 2006, the means of achieving it has evolved over time. "We initially started with John Deere headers, and a chaff cart blower, then blowing it into a cyclone and putting it on one wheel track. We started with that for 4 or 5 years, then we bought New Holland CR headers and we built these decks that go on the back for them."

As for the chaff itself, Mark said that it breaks down once it gets wet, and that barley and canola stubbles attract and retain moisture better than wheat. As such the wheat chaff lines tend to be the weediest, although the influence of pre-emergent herbicide options through the rotation may influence this. As for the influence of summer rain, Mark said that after a wetter summer, the chaff lines tend to have less weeds in winter, as they have rotted down or germinated earlier. But, after a dry summer there tends to be more weeds coming up on the chaff lines during winter.

*Despite having a highly concentrated band of chaff, Mark says the chaff doesn't provide a barrier at seeding. 'The seeding tine just flows straight through the chaff. Because there is no straw for it to grab and catch, it just flows around. Its fluffy and everything flows. It's not like straw that wraps and grabs and pulls.'*





**IMAGES:** *The conveyor belt is continuous, and runs at 90° to the direction of travel.*

In his continuous cropping operation, Mark has zero tolerance for weeds. "We have to keep hammering them, but we are definitely getting on top." Whereas previously, he had been blowing areas out and cutting hay to get control of weeds, he has now not cut any hay for 10 years. But, he said, "We have to keep hammering the ryegrass, at every opportunity we get, to reduce the numbers."

For the majority of his farm, the main weed pressure comes from ryegrass. Wild radish is not really an issue, and brome grass has become less of an issue since his soil amelioration has begun to take effect. "We have had some brome grass on some sandy soil, but since we have clay spread and ameliorated that the issue has gone away and the herbicides are working brilliantly, and there aren't staggered germinations like we used to get. So that has fixed the problem, by fixing the soil up."

As far as plans for the future, Mark says that he is quite happy to stick with the deck for the time being, as it is simple and cheap. However, he was interested in having an integrated mill. "In our current system, we are still exposing the weeds to chemicals, so it would be good to have a mechanical tool in the system. We might get to the stage where we really want to get down and have a mechanical control tool, so instead of cultivation it's probably the best mechanical weed control we have got there at the moment."

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# Comments from Nick McKenna Planfarm Agronomist

## *Learnings from the Esperance trip*

*I was fortunate enough to travel to Esperance to do the leg work for this GRDC project, and have tried to summarise what I gathered from the experience below.*



I spoke to 10 growers, and they all said that they got involved with chaff lining or chaff tramlining because they felt they had to do something to help manage weeds. One grower said he felt he would be forced to reintroduce livestock into his system in order to sustain his business if he didn't get on top of his weed problem.

The chaff deck seemed to be a highly popular option for HWSC in Esperance for a number of reasons. Most of the farmers really liked the simplicity of the deck. No one I spoke to had any dramas with the operation of chaff decks even after multiple years of use. The only maintenance I heard of was replacing the rollers for the belt, which was upgraded to a self-aligning model.

In and around Esperance, a few people had used narrow windrow burning and chaff carts in the past. The reasons they had moved to the chaff lining system was that it was always difficult to get a clean and safe burn on the residue, either because summer rain had made them too damp, or because the risk of fire escaping meant it required too much attention to burn safely. In this sense, chaff lining was a no brainer, as it required no further effort to get a kill on the weeds.

Other reasons they gave me for adopting the chaff deck was that it made it much less dust during spraying, as there was always a carpet of chaff between the sprayer tyres and ground. This gave them better coverage behind the boom, especially in hot conditions.

However, one or two people said they occasionally had more wheel slip during seeding, but this was only on certain soil types and after enough rain to make the chaff slippery. It is important to note that this only applies in situations where the header and sprayer run on the same A-B lines and are on the same wheel spacing.

In terms of differentiating between the chaff deck and chaff lining chutes, there are a few key differences:

**Cost:** Everyone I spoke to knocked up their chaff chutes themselves at minimal cost. One person had plastic chutes that they moulded with a hot air gun and some tek screws. The advantage of this was that it could be tweaked to give the best performance in any situation, it was dead easy to repair them if they reversed into something. Others were made out of metal, and looked sturdier but probably offered no benefit over the plastic ones. In each case, they were mostly attached with pins and R-clips, making them dead easy to drop off to access the rear of the header. Sheets of heat moulding plastic cost about \$300. Perhaps put the total cost at \$1000 to account for labour.

The chaff decks were a bit more expensive. The decks made by EMAR or Primary Sales cost about \$19000 or \$20000 when they came fitted to new headers. These ones had two conveyor belts running at an angle to the header, and involved moving the chopper a fair way back to make room for the hardware.



There was another grower who made his own chaff decks specifically for John Deere S670, S680, S690 headers. These had two conveyors running across the back of the header, and did not involve as much work at the back of the header. It looked to be a simpler system, and was about \$13000.

As far as grower perceptions go, most people said they got better germination of seeds on the high traffic trams when using chaff decks (many people were dead keen on their CTF system). As a result, they were often able to get a solid knockdown on the grass that had germinated in these tramlines, but had less of an impact on the less frequently trafficked trams. Growers using chaff chutes echoed these observations, and said they had very little grass germinate in the chaff lines. I think this was partly because they had very little seed soil contact in the fluffy chaff fractions, and also because the chaff lines did a good job of shedding water off them. The take home message I got from this is that it was not necessary to use a CTF system. It seemed almost better to have one chaff line that was not getting ryegrass to germinate than too have many that did. Ryegrass was practically the only weed growers spoke about during my trip.

**Seeding:** No-one I spoke to had any issues with pulling the bar through at seeding. From all accounts, the chaff was quite light and flowed readily around tines. Some growers didn't like the weed germination they got by disturbing the chaff lines, so elected to adjust their seeder bars to avoid the chaff lines. This forfeited too much space to the chaff line, so they then moved back towards the original by including disc units to run either side of the chaff tramline. This maximised the crop coverage, minimised chaff line disturbance, and provided competition to the weeds that did germinate in the chaff line.

If growers did have an issue with ploughing through chaff lines with the seeder, or the chaff not flowing smoothly, it would be an idea to move to a chaff deck, as it would spread the chaff over a larger area (two chaff tramlines instead of one chaff line).

Everyone I spoke to said it didn't save them a spray application in crop, but it did let them sow early with confidence knowing they wouldn't have problem numbers of weeds to come up later. They also said it was not their intention to save a spray application, but to maintain the overall long term profitability of the system.

One point growers made was to ensure they always moved the header backwards when they stopped harvesting, similar to how you would when making narrow windrows. Apparently casual labour usually only takes once to remember to do it after cleaning out the back of a header. Interestingly, most growers I spoke to were still keen to get their hands on a iHSD, as it seemed to be the ultimate in HWSC.

~ Nick McKenna, 2018







