

Preliminary evaluation of chaff lining with the Northern Agri Group (NAG)

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Key messages

- Chaff lining is an evolving harvest weed seed control method
- It presents as a low cost, easy weed management tool
- It is considered a good control for ryegrass and radish but not as successful for brome grass

Background to the activity

Removing weed seeds at harvest is an important tool to reduce weed seed banks. The collection and management of the weed seed bearing chaff fraction at harvest time can result in significant reductions in annual weed population densities.

Chaff lining is an evolving method of harvest weed seed collection which involves placing a chute on the rear of the harvester that concentrates the chaff in a single line in the centre of the header. The straw is chopped and spread as usual. This system can be designed for implementation in Controlled traffic farming (CTF) systems with repeated placement of chaff lines in the same place each year.

Anecdotally growers around the Esperance area using this practice are finding these chaff lines are often a lot less weedy than they would expect and believe that a lot of the weed seeds rot. However, there is currently no data in the Northern Agricultural region to confirm this observation.

Gaining an understanding of the efficacy of chaff lining in different environments and the breakdown of weed seeds in this system is important to adoption of this practice.

Location

The five paddocks used for the chaff lining monitoring study are located in the Geraldton port zone, within the Northern Agri Group region (Table 1). Paddock selection was based on growers in the Northern Agri Group who are using chaff lining as a Harvest Weed Seed Control (HWSC) method and who were willing to participate.

Table 1. Paddock details for chaff lining monitoring study

Site	Locality	Crop	2017 paddock yield (t/ha)
P1	Nolba/Balla (Johnson)	Canola	0.9
P2	Ogilvie/Nolba (Johnson)	Lupins	1.0
P3	Balla (Burns)	Lupins	0.7
P4	Binnu (Dieperveen)	Lupins	1.2
P5	Ogilvie (Suckling)	Wheat	2.0

Methods

Samples were taken from sections of the paddocks that had high weed densities. In late October and early November 2017, four carpet mats (70 cm x 40 cm) were set up

in a line to be harvested over and have chaff dropped onto them (Figure 1). The four corners of the mat were marked with pink pins and the GPS location was recorded. This collected chaff was sorted through in January 2018 to obtain the average weed seed numbers that fell into the chaff fraction.



Figure 1. a) Marine carpet placed in position for chaff to fall on top, b) chaff residue collected from mat and four corners marked.

The average weed density of each paddock was calculated by averaging the number of the most common weed plants counted in $20 \times 0.5\text{m}^2$ quadrat randomly placed in the pre-selected “weedy patch” of the paddock. Weeds were counted in an approximate radius of 100m in the weedy patch in areas where the chaff line measurements were taken (not in the chaff line or wheel track)

Weed samples were collected to conduct weed biology measurements to determine the seed set per plant. Samples of weeds were collected from several paddocks and processed to determine seed production per plant



Figure 2. Process of determining the number of weed seeds per m of chaff line at harvest 2017. (Left) Marine carpet placed in position for chaff to fall on top, (Middle) chaff residue collected on the mat (Right) weed seeds picked out of chaff residue and counted.

In June 2018, the sites were revisited to count the weed germinations within the chaff line and in the crop outside of the chaff line.

Results

Weed density

The average pre-harvest weed density in ‘weedy patches’ of the paddock and estimated weed seed production are shown in Table 2. There was high variability in seed number produced per plant for wild radish and insufficient plants were sampled to produce reliable data.

Table 2. Pre harvest average weed densities in “weedy patches” of the paddock.

Site	Paddock	Crop	Weed species present in paddock	Weed density (plants/m ²)	Est seeds/m ²	Est seeds header swathe (12 m x 1 m)
P1	Nolba/Balla	Canola	Brome grass	0.5	n/a	
P2	Ogilvie/Nolba	Lupins	Brome grass	36.4	1619.8	19437.6
P2	Ogilvie/Nolba	Lupins	Wild radish	2.6	n/a	
P3	Balla	Lupins	Annual ryegrass	1.8	1712.7	20552.4
P4	Binnu	Lupins	Wild radish	0.15	n/a	
P5	Ogilvie	Wheat	Annual ryegrass	2.75	5896.3	55317.6
P5	Ogilvie	Wheat	Brome Grass	2.15	364.21	4370.5

Weed seed capture at harvest 2017

Samples collected on the mats were processed and weed seeds were counted. Table 3 identifies the weed seed collected per metre of chaff line. Future work could include the proportion of weed seed captured in the chaff line.

Table 3. Weed seeds per metre of chaff line from samples collected at harvest

Site	Paddock	Crop	Weed species present in paddock	Weed seeds/mat	Weed seeds/m chaff line
P1	Nolba/Balla	Canola	Brome grass	430	1075
P2	Ogilvie/Nolba	Lupins	Brome grass	1310	3275
P2	Ogilvie/Nolba	Lupins	Wild radish	55	137.5
P3	Balla	Lupins	Annual ryegrass	1003	2507
P4	Binnu	Lupins	Wild radish	211	527.5
P5	Ogilvie	Wheat	Annual ryegrass	174	435
P5	Ogilvie	Wheat	Brome Grass	29	72.5

Weed emergence June 2018

Table 4 shows the weed emergence counts conducted on 13 June 2018. “Weeds per metre chaff line that emerged June 2018” is the number of surviving weeds counted in the chaff line in June 2018.

Figure 3 illustrates the high density of brome grass emerging in the chaff line. “Weeds emerged in crop June 2018” is the average number of weeds per m² from 20 quadrats in crop.

Table 4. Weed emergence counts on 13 June 2018.

Site	2017 crop	2018 crop	weeds present	weed seeds per metre chaff line harvest 2017	weeds per m chaff line that emerged	weeds emerged off chaff line/ in crop
P1	canola	wheat	brome grass	1074	630	62
P2	lupins	wheat	brome grass	3275	1623	49
P3	lupins	wheat	ryegrass	2507	5	44
P4	lupins	wheat	wild radish	475	2	3
P5	wheat	canola	ryegrass/ bromegrass	435	180	20



Figure 3. Emerging brome grass in a lupin chaff line.

Conclusions

Chaff lining is an evolving weed control tool. Growers involved in this study believe it is working well for wild radish and ryegrass. However, brome grass is proving difficult to capture as plants are either growing too short or are too prostrate to be cut by the header, or they are lodging early and shedding their seeds before harvest. There is also an emerging challenge for pre-emergent herbicides to kill weeds (mainly brome grass) in the chaff line.

Tactics are evolving to deal with the high concentration of weeds emerging in the chaff lines. One such tactic is 'weedlining' — spraying chaff lines with a special boom set-up which is an efficient way to cut back on chemical costs and target problem areas. One nozzle can be used in a narrow row, and by spraying these lines, only 8% of the paddock needs spraying. If two nozzles are used, approximately 12.5% of the paddock needs to be sprayed. The nozzles on chaff lines are 25% larger. Any surviving weeds will not set seed per plant as they would in crop.

Due to the increasing interest in chaff lining in the region, it would be valuable to collect further data to investigate the 'mulching' effect of chaff lines as a physical barrier for weed seed germination.

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