Harvest weed seed collection in broad acre paddocks

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Location
Minnipa
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm

Location
Mudamuckla
Rainfall
Av. Annual: 291 mm
Av. GSR: 219 mm

Key messages

- **Harvest weed seed collection showed barley grass is harder to capture using harvest weed seed collection techniques due to its habit of shedding seed early.**
- **Burning windrows decreased the number of weed seeds present in the soil seedbank at Minnipa in 2017.**
- **Harvest weed seed collection allows for the capture of ryegrass weed seed and cereal screenings, potentially increasing feed utilisation for stock when placed in chaff dumps or rows.**

Why do the demonstration?

Barley grass and ryegrass are the major grass weeds in cereal cropping regions on upper Eyre Peninsula. An integrated approach to weed management (IWM) is required to slow the development of herbicide resistance and aims to lower the weed seed bank with the use of non-chemical techniques such as harvest weed seed management, including narrow windrows, chaff cart dumps and burning stubble. This is a summary of paddock surveys of harvest weed seed collection samples taken in 2016, 2017 and 2018 as a part of the GRDC Stubble Initiative project ‘Maintaining profitability in retained stubbles on upper Eyre Peninsula’ (EPF00001).

How was it done?

Samples were collected post-harvest each season, with both soil and chaff samples taken to be assessed in weed seed trays during the following growing season. In-crop paddock monitoring for grass weed populations was undertaken and grass weeds were assessed at 10 GPS points along transects for weed density with six counts taken at each sample point.

Assessing weed seed capture and burning in narrow windrows

Soil samples for weed seed banks were collected in February 2017 along a transect across the paddocks comprising of 10 GPS-located sampling points. The core soil sampling method was described by Kleemann *et al*. (2014). Prior to narrow windrows being burnt, a 5 m section of chaff was removed (non-burnt area) within each paddock (see EPFS Summary 2015, p150-151 for further details) and weed seeds in soil or chaff were germinated in 2017. Germinating trays, 35 cm x 29 cm, were partially filled with sterilised soil mix and the collected weed seed bank soil or chaff was then spread over the top to 1-2 cm depth, with another light coating of the sterilised soil mix spread over the soil or chaff. The trays were placed in a rabbit proof open area and watered if required during the season. Trays were assessed for weed germination approximately every four weeks. Counted weeds were removed from the trays. Control plots with barley grass seed collected from Minnipa Agricultural Centre (MAC) oil mallee area (sprinkled into trays) were located across the germination area to assess timing of barley grass germination relative to a non-cropped population.

Assessing weed seed capture in chaff dumps after harvesting

Chaff was collected from chaff dumps with 10 samples per dump, taken approximately 40 cm into the dump (which were approximately 1 m high), to determine the weed seed species being collected at harvest. Fifty grams of chaff were added to each germination tray with three replications.

What happened?

The weed populations were generally lower in the paddocks sampled (Table 1), except Paddock 33 at Mudamuckla which had higher levels of ryegrass present (33 plants/m^2) and the Tcharkuldu paddock in 2017 had high levels of barley grass (259 plants/m^2). MAC generally had low levels of ryegrass and some barley grass present.

Table 1 Plant counts at Mudamuckla and Minnipa before harvest 2016, and at Tcharkuldu in 2017

Location	Barley grass (plants/m²)	Rye grass (plants/m²)	Cereal crop (plants/m²)
Paddock 33	5.3	33	93
Paddock 95	0.4	12	99
MAC S4	6.9	0.3	110
MAC S1	7.4	0.1	110
MAC S7	4.3	1.3	87
MAC Airport	2.3	1.7	115
Tcharkuldu	259	0.6	190

Table 2 Mean weed seed counts in 2017 weed seed trays from chaff dumps and soil collected from Mudamuckla at harvest 2016

Location	Barley grass (plants/50 g chaff or soil)	Rye grass (plants/50 g chaff or soil)	Self-sown cereal (plants/50 g chaff or soil)	Brome grass (plants/50 g chaff or soil)
Paddock 33 chaff dumps	0.3	12.2	14.6	0.04
Paddock 95 chaff dumps	1.4	3.8	18.3	0.6
Paddock 33 soil	7.0	12.3	0	0
Paddock 95 soil	0.7	1.2	0	0.07

Table 3 Weed seed counts in 2017 weed seed trays from chaff dumps and soil collected at harvest 2016 from Minnipa Agricultural Centre windrows (burnt in autumn 2017)

Paddock	2016 Crop	Sample	Barley grass (plants/50 g soil)	Rye grass (plants/50 g soil)	Self-sown cereal (plants/50 g soil)
MAC S4	Trojan Wheat	Inter row (before burning)	2.6	0.2	0.5
		In row before burning (soil collected before burning)	0.6	0.2	0.1
		In row burnt (soil collected after burning)	0.8	0.2	0.5
MAC S1	Mace Wheat	Inter row (before burning)	2.6	0.2	0.5
		In row before burning (soil collected before burning)	0.6	0.2	0.1
		In row burnt (soil collected after burning)	0.5	0	0.3
MAC S7	Mace Wheat	Inter row (before burning)	5.1	0.1	0.1
		In row before burning (soil collected before burning)	0.5	0.3	0.8
		In row burnt (soil collected after burning)	0	0	0
MAC Airport	Wheat	Inter row (before burning)	1.6	6.5	0.1
		In row before burning (soil collected before burning)	0.8	0.4	0.5
		In row burnt (soil collected after burning)	0	0.2	0.1
Oil Mallee	Uncropped	Barley grass check plots	144	0	0

Table 4 Weed seed counts in 2018 weed seed trays from chaff dumps and soil collected from Tcharkuldu at harvest 2017

	Barley grass (plants/50 g chaff or soil)	Rye grass (plants/50 g chaff or soil)	Self-sown cereal (plants/50 g chaff or soil)
Chaff dumps	30	1.7	13.5
Soil near chaff dump	40	0.3	0.2
Soil off header row (paddock)	27	1.5	0
In header row soil and chaff	34	1.2	2.2

The weed seed tray results from Mudamuckla (Table 2) show there were greater barley grass numbers in the paddock than collected in the chaff dump, indicating seed had dropped before harvest or shattered at harvest time and did not enter the header to be captured. The ryegrass weed seed numbers in the soil were similar to those in the chaff dump indicating mature plants had either dropped seed heads which avoided harvest or small plants were lower than the harvest height. The self-sown cereal was greater within the chaff dumps than in the paddock soil, indicating the screenings were collected into the chaff fraction of the harvest system.

The weed seed trays from the MAC paddocks (Table 3) show the inter row or general paddock area has greater barley grass weed seed numbers than in-row with the chaff fraction. Burning the chaff rows decreased the weed seed numbers, except in MAC S4.

In the paddock at Tcharkuldu (Table 4) with a high barley grass population there was little difference in the barley grass numbers in the chaff dumps or in the header chaff row than in the nearby paddock soil, indicating the barley grass had shed seed before harvest or was too low (less than 15-17 cm) to be collected at harvest. There were more cereal screenings within the chaff dump.

What does this mean?

The harvest weed seed collection results have showed that barley grass, due to its habit of dropping seed early, is harder to capture using harvest weed seed collection techniques. The ability to detect barley grass within the chaff dumps as easily as other seed may also be a factor as barley grass has a burrowing habit, which may result in seed being potentially located lower in the chaff dump/closer to the soil than other seed. More research on the distribution of weed seeds species in chaff dumps could be undertaken in the future. Burning windrows decreased the number of weed seeds present in the soil seedbank at Minnipa in 2017.

Harvest weed seed collection allows for the capture of ryegrass and cereal screenings, and placing the plant material into rows potentially allows for greater feed utilisation for stock rather than grain and straw being distributed randomly across the paddock. Again further research into farming systems efficiencies of harvest windrows, chaff dumps and livestock needs to be undertaken to effectively reduce weeds in low rainfall farming systems.

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