IWM, comparing harvest weed management practices with Sakura® and Boxer Gold®

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Aim
Evaluation of the pre-emergent herbicide Sakura 850WG® compared to Boxer Gold® in combination with different IWM tools (chaff cart, Harrington Seed Destructor, narrow windrow burning) during harvest on a broad acre scale.

Background
To evaluate the commercial impact of the Harrington Seed Destructor (HSD) a series of field trials comparing harvest residue management systems have been established at 12 locations across the WA wheat belt during the 2010 harvest, one of which was the Liebe Long Term Research Site, west of Buntine. In each trial the HSD was compared with chaff cart and windrow burning residue management systems for its ability to effectively target weed seeds during harvest.

The collection of weed seeds at harvest is the last opportunity to attack the current seasons in-crop weed populations which have escaped or survived earlier weed management tactics. More importantly though, this is the first opportunity to target next seasons weed populations by intercepting weed seeds before they enter the seed-bank. Collecting and managing the weed seed bearing chaff fraction as it exits the header at harvest restricts seed-bank replenishment, leading to a reduction in next seasons weed populations. The Australian Herbicide Resistance Initiative (AHRI) has invested a significant amount of time assessing different harvest weed seed management techniques one of these being the HSD.

The Harrington Seed Destructor (HSD) is the brainchild of Ray Harrington, an innovative farmer from Darkan, Western Australia. Based on a cage mill crushing unit used in the mining industry, the HSD is a trail-behind unit complete with its own power supply which incorporates chaff and straw delivery systems. The HSD system has been progressively evaluated and developed since 2005 when Ray approached AHRI seeking support for his plans to construct the initial prototype. Subsequently with financial support from the GRDC, three HSD prototypes have been field tested by AHRI researcher Dr Michael Walsh for the efficacy of destroying weed seeds during harvest. Results from three seasons of testing have established that the HSD system can destroy 90-95% of annual ryegrass seed present in the chaff fraction.

As demonstration sites were being set up for the new pre-emergent herbicide Sakura, the Liebe Group took the opportunity to trial the use of this herbicide as well as Boxer Gold in conjunction with the harvest weed seed control options.

Details of these two herbicides are as follows:

- Sakura 850WG containing the new active ingredient pyroxasulfone is a pre-emergent herbicide now registered for use in wheat and triticale for the pre-emergent control of annual ryegrass, barley grass, phalaris, silver grass and toad rush at a use rate of 118 g/ha.
- Sakura 850WG is a Group K herbicide that works through both root and shoot uptake.

- Boxer Gold is registered for use in wheat and barley for the pre-emergent control of annual ryegrass and toad rush with a use rate of 2.5 L/ha.
- Boxer Gold is a Group J & K herbicide that works through both root and shoot uptake.

Trial Details

Property	Long Term Research Site, Buntine
Plot size & replication	11m x 20m. Harvest weed control replicated four times, herbicides replicated twice.
Soil type	Deep yellow sand
Soil pH ($CaCl_2$)	5.6 topsoil, 4.8 subsoil
EC	0.075 dS/m
Sowing date	1/6/11
Seeding rate	50 kg/ha Wyalkatchem
Fertiliser	1/6/11: 60 kg/ha K-Till Extra, 20 L/ha Flexi N 19/8/11: 40 L/ha Flexi N
Paddock rotation	2008 wheat, 2009 canola, 2010 wheat
Herbicides	19/3/11: 0.6 L/ha PowerMax, 0.4 L/ha Ester 680, 0.1 L/ha Garlon 31/5/11: 2 L/ha Glyphosate, pre-emergent as per treatment list 4/7/11: 1 L/ha Jaguar 26/7/11: 0.5 L/ha Precept
Fungicide	19/8/11: 50 mL/ha Emporer
Growing Season Rainfall	293mm

Herbicide Treatments
Sakura: 118 g/ha
Boxer Gold: 2.5 L/ha
Control: No pre-emergent

Harvest weed management treatments
Control: no weed management, chaff fraction spread evenly across plot
Chaff cart: chaff cart towed behind header
Windrow burn: spreaders removed, chaff in narrow row behind header and burnt in March.
HSD: the Harrington Seed Destructor, crushing seeds in the chaff fraction

Results

Table 1: Pre seeding ryegrass plant density as recorded on 23rd of May 2011 after harvest weed control mechanisms.

Treatment	Ryegrass plant density (plants/m^2)	Ryegrass reduction (%)
Control	221.50	
Chaff cart	94.13	57.67
Windrow burn	73.58	66.79
HSD	72.63	67.50

Site Comments

Weed numbers were high throughout the trial with some variability, the western end starting at around 200 plants per m^2 increasing across the site as you headed east with numbers above 600m^2.

Table 2: Average control of annual ryegrass panicles by IWM harvest tools and pre-emergent on 14/9/11.

	Control		Sakura 118 g/ha		Boxer Gold 2.5 L/ha	
Sample	**% Control**	***Std Err***	**% Control**	***Std Err***	**% Control**	***Std Err***
Control	0	0	88	1.2	73	3.0
Chaff Cart	14	5.6	89	1.4	75	3.1
Windrow	7	5.8	89	1.0	73	2.7
HSD	20	3.1	89	1.7	74	2.7

Comments
Assessment was conducted in mid September when the ryegrass panicles had reached maturity above the crop to gauge the most accurate measure of weed seed reduction. Values above are the mean control ratings from 8 replicates of each treatment.

Yield and grain quality
The use of different pre-emergent herbicides made no difference in grain yield or quality. Yield results were collected from plots which had used the Harrington Seed Destructor HSD) the previous harvest.

Table 3: Wheat yield and quality after using pre-emergent herbicides Sakura and Boxer gold, west of Buntine.

	Yield (t/ha)	*Standard error*	Hectolitre weight	Protein (%)	Screenings (%)
Boxer Gold	2.9	*0.39*	77	8.3	2
Sakura	3.0	*0.22*	77	8.3	1
LSD	*NS*		*NS*	*NS*	*NS*

* Yield displayed here are for plots where the Harrington seed destructor was used during the 2010 harvest.

IWM at harvest:
The windrows did not look like they had burned hot enough for sufficient time probably due in part to the row not being concentrated enough. There were patches that saw a reduction in numbers but the rest of the plot looked like the control (nil pre-emergent herbicide).

The chaff cart, also recorded mixed success at this site with numbers reduced in the middle of the plot but the outside edges of the plot had high numbers from ryegrass seed that was not captured.

Incorporating some form of harvest weed seed management (chaff cart, windrow burn or HSD) resulted in a reduction of early germinating weed numbers by over 57% (Table 1). However, due to an existing high weed seed bank, the harvest weed seed management tactics used were only able to control 7-20% of late germinating ryegrass.

Overall the plots where the HSD was used demonstrated the largest reduction in weed seed numbers of around 20%. However, given the high weed seed bank at this site, a harvest weed seed management treatment such as the HSD would be required for several seasons to drive the weed seed bank down.

Pre-emergent herbicides:
Sakura recorded the highest and most consistent level of control compared to Boxer Gold across the site, with little influence of any of the IWM methods recorded. A wet July resulted in high numbers of late germinating annual ryegrass which favoured Sakura's longer period of residual activity compared to Boxer Gold and resulted in an additional ~15% ryegrass control recorded from Sakura in this trial. This however, did not result in a significant yield difference.

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