

Straw Management and Crop Rotation Alternatives to Stubble Burning: Assessing Economic and Environmental Trade-offs



Principle Investigators

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Project Objectives

- Identify and economically assess crop rotations and sequences that benefit from retaining winter wheat residues in direct-seed systems
- Document effects of wheat straw management on weed seed survival
- Convey project findings through electronic and print media, field days, conferences and research site tours.

Cook Agronomy Farm

- **Fall burn, no burn (2013)**
- **No-till planted to:**
 - **winter wheat**
 - **spring wheat**
 - **garbanzos**
 - **spring barley**

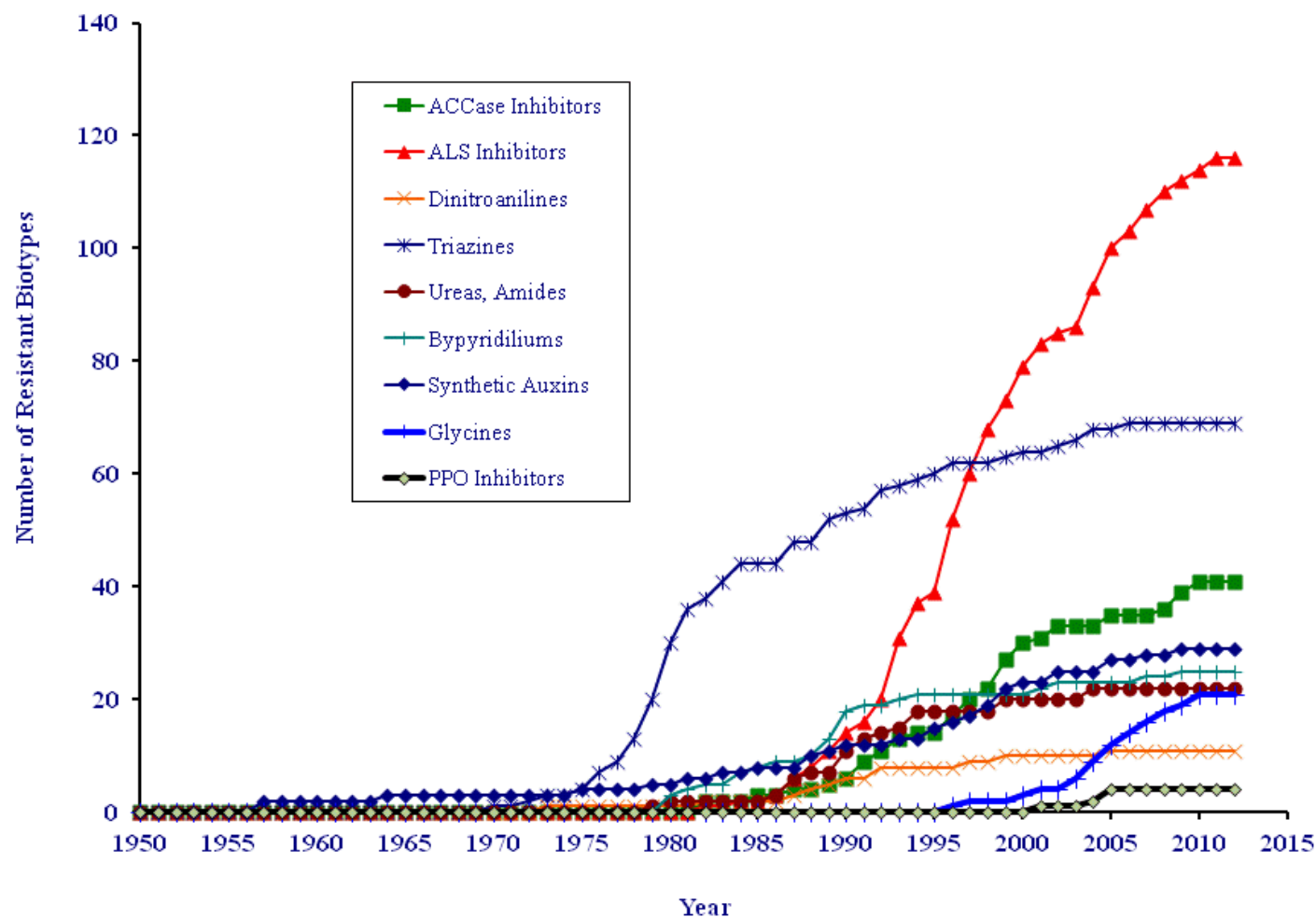


<div>  </div> Crop	Control	Fall	Control	Fall
	2012	Burn 2012	2014	Burn 2014
Winter Wheat Yield following Winter Wheat, (bu/ac)	82a	82a	71a	73a
Spring Wheat Yield following Winter Wheat (bu/ac)	59a	57a	50a	48a
Garbanzo Bean Yield following Winter Wheat, (lbs/ac)	1624a	1634a	1381a	1343a
Spring Barley Yield following Winter Wheat, (lbs/ac)	4733b	5234a	3132a	3574a

Conservation Farming and Herbicide Resistance

- Direct-seed and reduced tillage systems depend on herbicides for weed control
- Herbicide resistance is a growing problem worldwide and in the Pacific Northwest

History of Herbicide Resistance



Source: Ian Heap
<http://www.weedscience.com>

Weed Seeds at Harvest



**Majority of weed seeds exit in the
chaff fraction**

Narrow Windrow Burning

Concentrate residues at harvest

Burn residues in autumn



Narrow Windrow Burning



99% control of *Lolium* and *Raphanus*

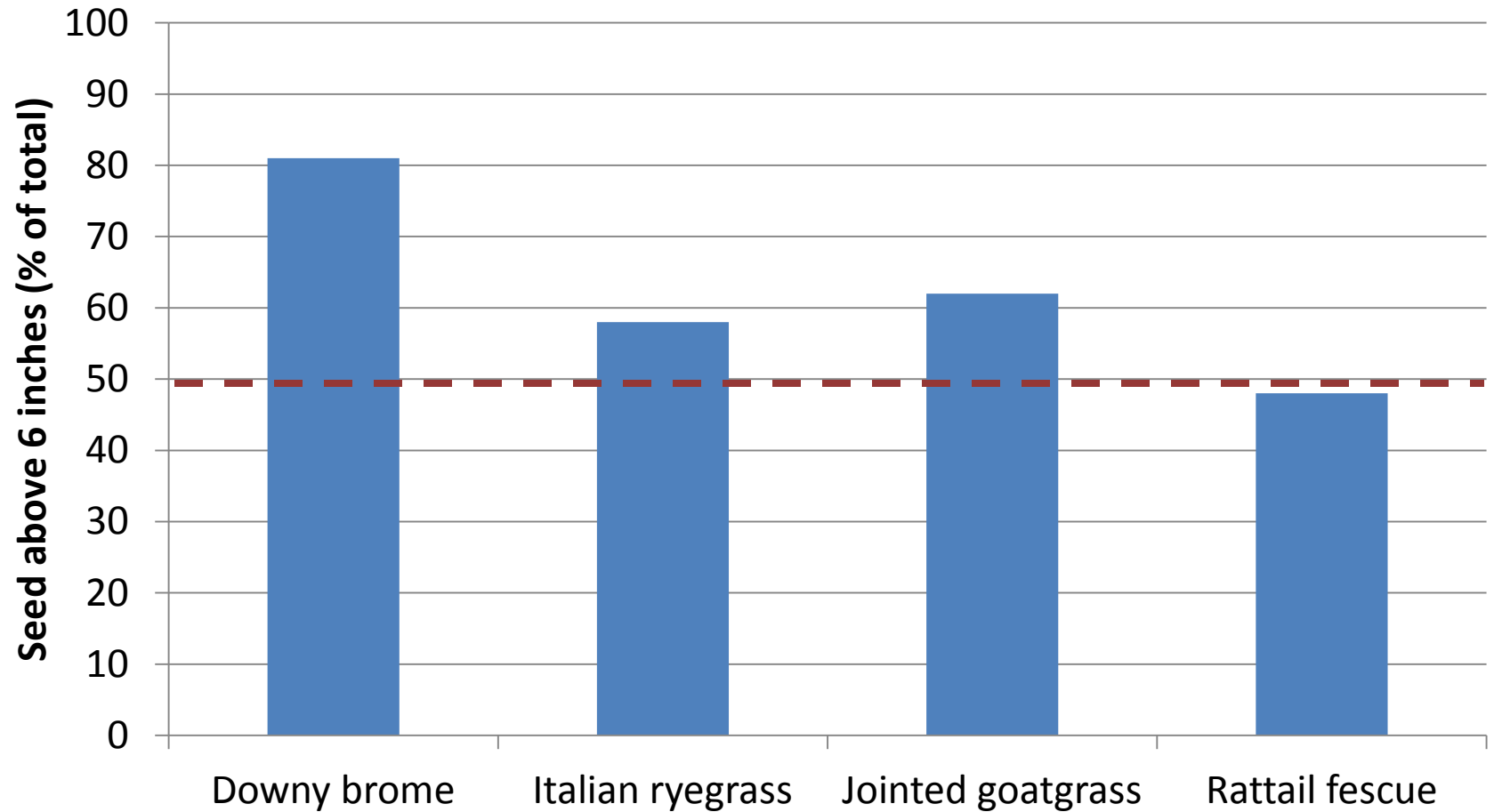
Most Western Australian growers use this technique

Harvest Weed Seed Control

- Biological attribute needed for system to work:
 - mature seed do not shatter before grain harvest, held above cutting bar height



Seed Retention at Harvest



Pullman Study

Windrows to be Burned



Weed Seed Tray Placement



Weed Seed Tray Prior to Burn



Thermocouple Wires & Data Logger



Burning Windrows



Burning All Crop Residue



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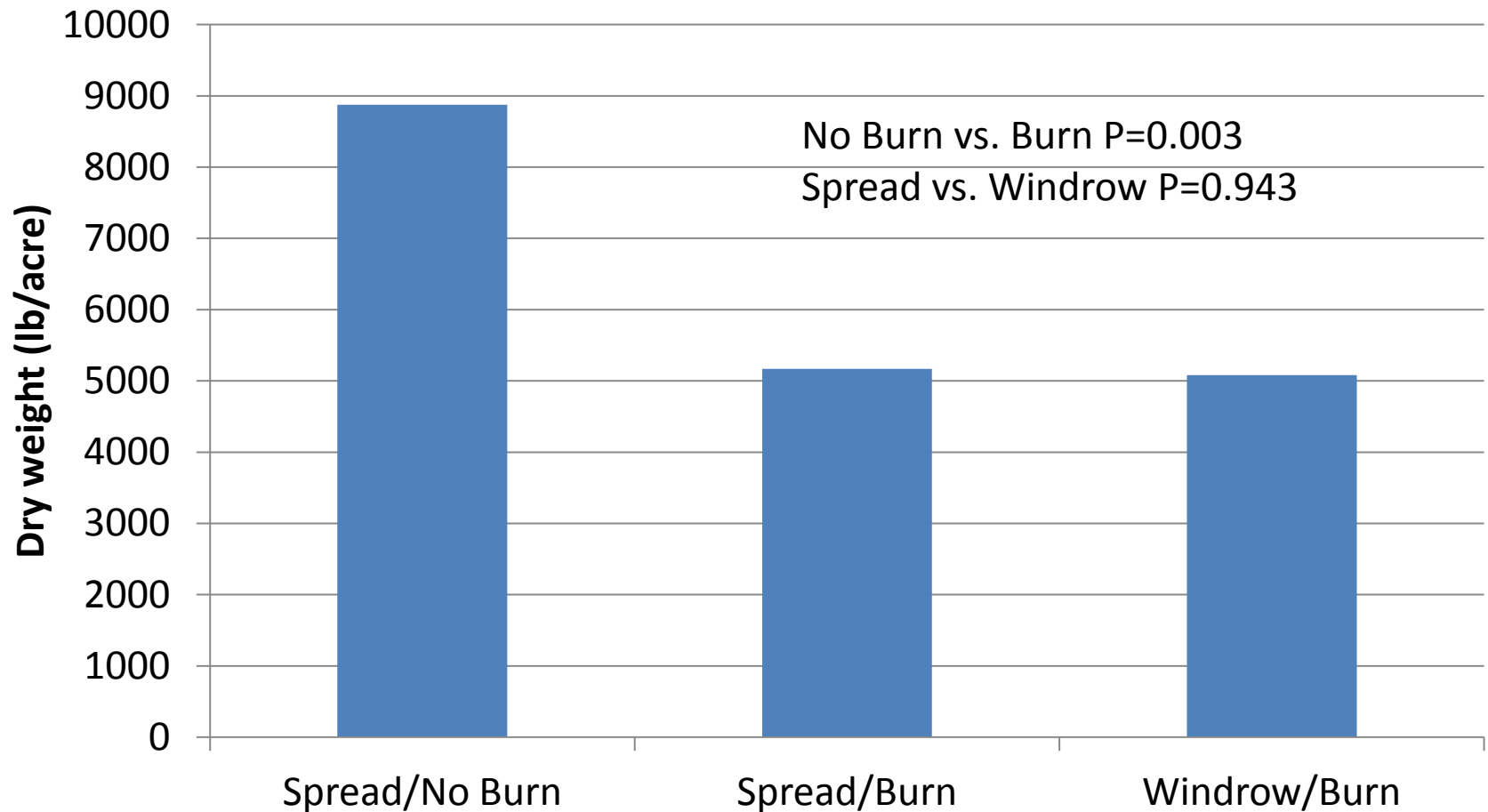
Three Weeks After Burning



Collecting Crop Residues



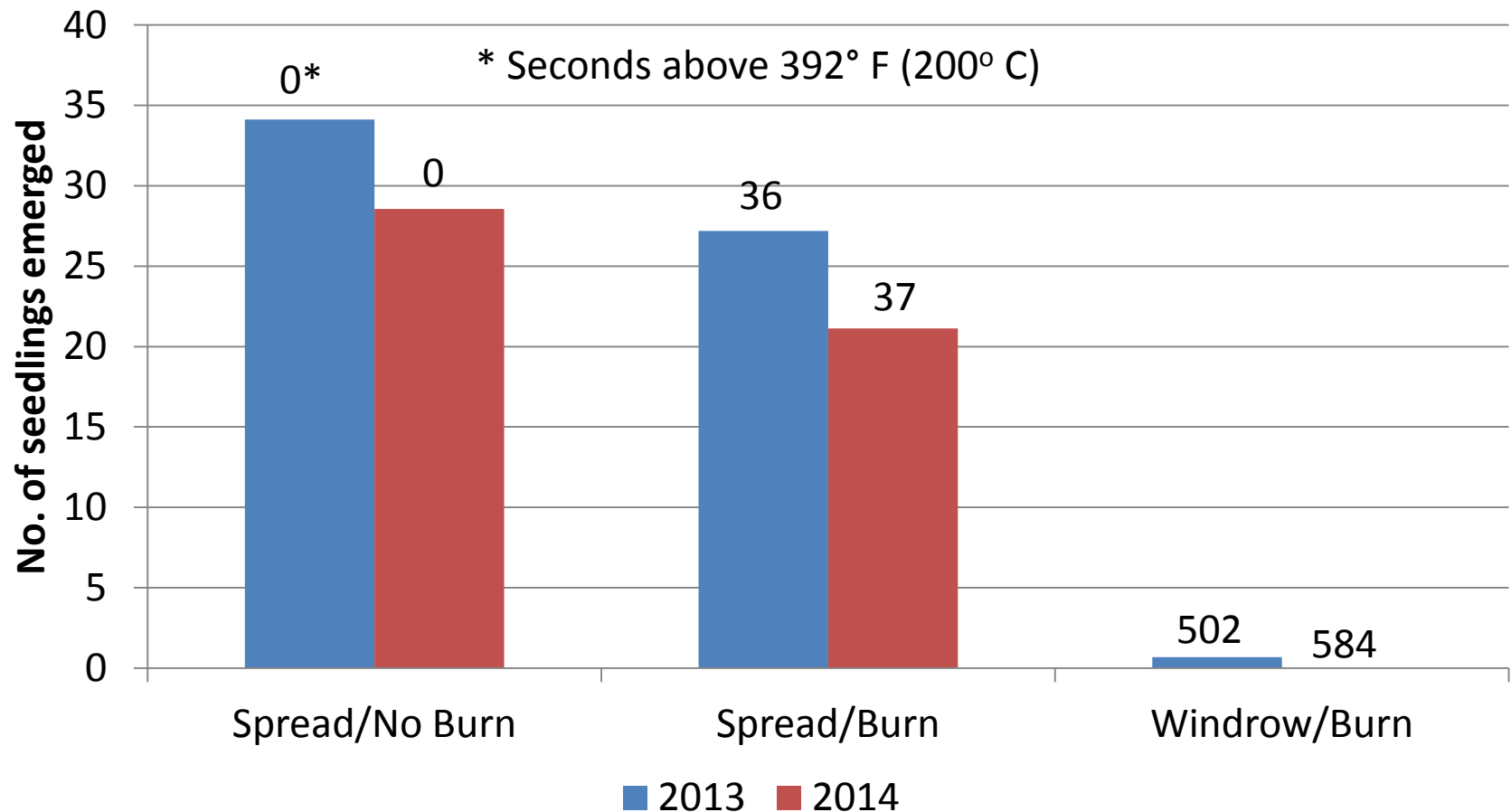
Crop Residue After Burning Averaged Across Years



Germinating Italian Ryegrass After Burning



Italian Ryegrass Seed Survival



No Burn vs. Burn $P=0.003$
Spread vs. Windrow $P=0.002$

No Burn vs. Burn $P<0.001$
Spread vs. Windrow $P<0.001$

Alternatives to Field Burning Chaff Collection



Up to 85% of *Lolium* and *Raphanus* seed collected and removed

Glenvar Bale Direct System

Up to 95% of *Lolium* seed collected and removed in baled harvest residues



Direct Bale System – Walla Walla

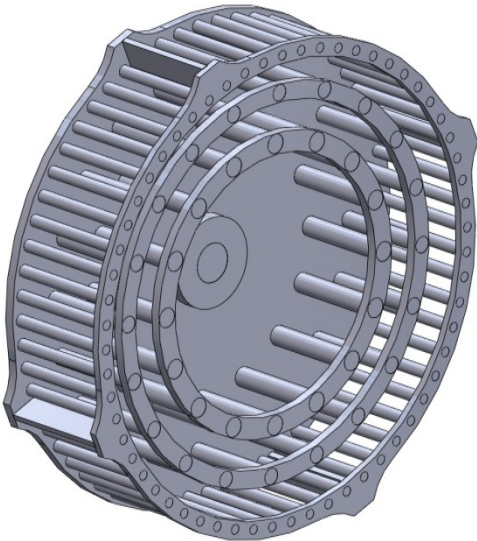




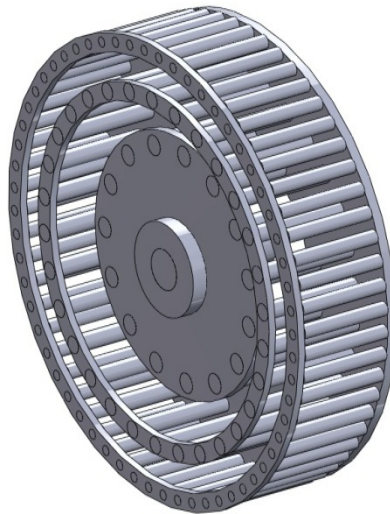
Harrington Seed destructor

Based on a cagemill used in the coal industry

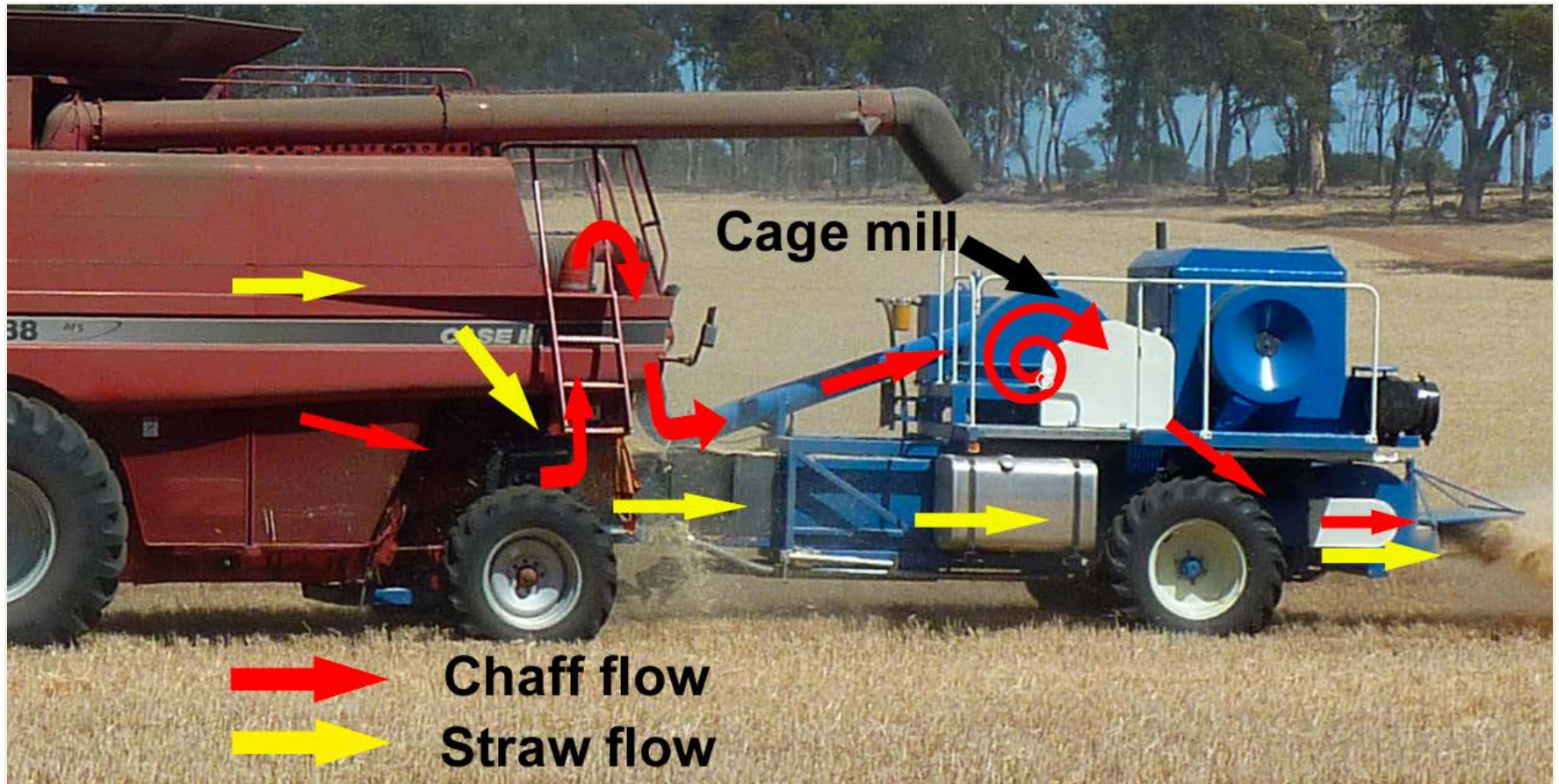
Outer cage



Inner cage



Harrington Seed Destructor



***Lolium* emergence - autumn 2012**

Averaged across 13 sites SE Aust.

Treatment	Reduction in <i>Lolium</i> emergence (%)
HSD	58
Chaff cart	55
Narrow windrow burn	55
LSD (P=0.05)	9

Weeds have the potential to evolve resistance to all forms of weed control



Low weed densities are the best insurance against resistance evolution

