

HARVEST WEED SEED CONTROL

Another Tool for Resistance Management

WHAT IS HWSC

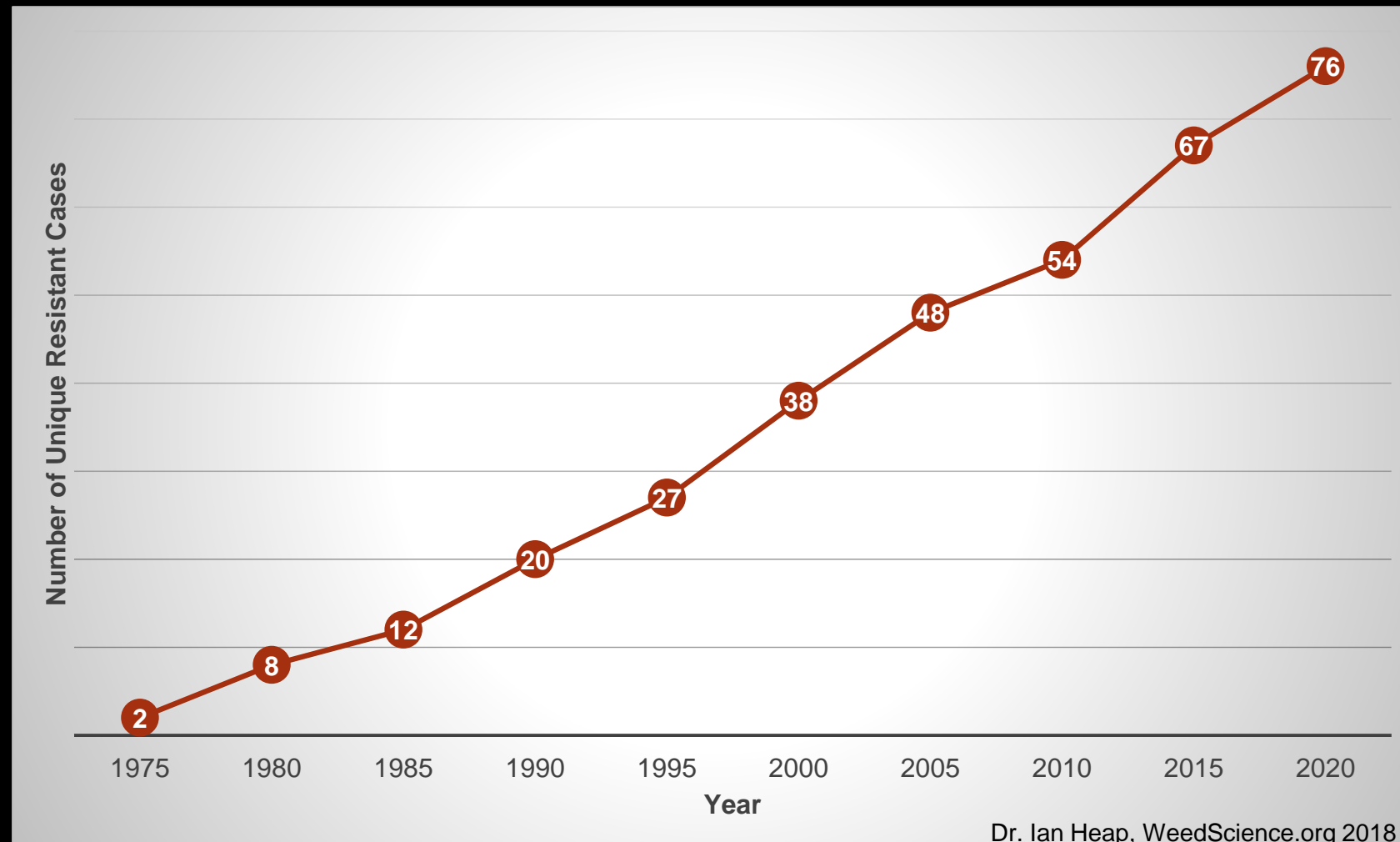
- Another tool to manage weed populations in our fields.
- Started in Australia in the 80's, but really started to ramp up in the early 2000's due to increased herbicide resistance.
- All the HWSC tools today attempt to manage the weed seeds that pass through the combine and exit in the chaff.
- To be effective;
 - Weed seeds must be retained at the time of crop harvest
 - Produced at a height where they will be collected by the combine

WHY SHOULD WE CARE?

Weed resistance in Canada continues to grow:

- Acres with herbicide resistance
 - 2001 = 10.9 million acres
 - 2016 = 38+ million acres
- Saskatchewan field survey's
 - 2003 - 10% of fields had HR
 - 2014/15 – 57% had HR

INCREASE IN UNIQUE RESISTANT WEEDS IN CANADA



Dr. Ian Heap, WeedScience.org 2018

ECONOMIC LOSS OF WEEDS

Research shows that pulse crops commonly suffer yield losses of 20 to 40 per cent, but that number can climb up to 80 per cent in a bad year.

- Source: <https://saskpulse.com/resources/magazine/pulse-research/articles/weed-control-in-pulses/>

Canola and cereals, while more competitive, can still have yields cut by 20-25%.

- Source: <https://www.cargillag.ca/expert-network/expert-blog/the-real-impact-of-herbicide-resistance-on-yield-and-rotations>

HWSC OPTIONS

- Narrow windrow burning
- Chaff Decks / tramlining
- Chaff carts
- Bale direct
- Mill system



NARROW WINDROW BURNING

- Principle is to control the weeds by concentrating the chaff and burning.
- Kills weeds seeds through fire.
- Loss of nutrient value and environmental impact to be considered.
- Capital Costs: \$1,000



CHAFF DECKS / TRAMLINING

- Principle is to control the weeds by lining the chaff in the wheel tracks of the combine.
- Primarily used by control traffic farmers.
- Does not kill weeds, but rather collects weeds and concentrates them.
- Control is gained through focused spray and/or compaction in tramlines and decomposition.
- Capital Costs: \$25,000



CHAFF CARTS

- Control the weeds by collecting chaff and dumping in piles for future management.
- Does not kill the weeds.
- Extra step to fully manage the residue is required. Either burn, graze or bale the chaff pile.
- Capital Costs: \$60,000



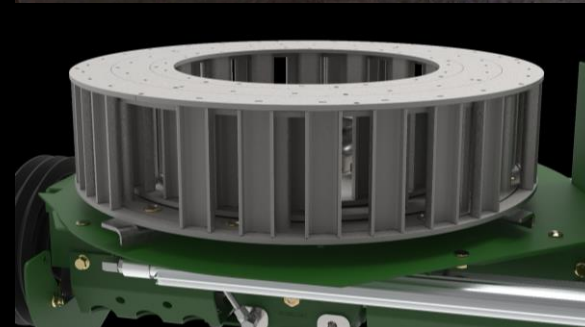
BALE DIRECT

- Principle is to control the weeds by baling the residue and relocating off the field.
- Does not kill weeds, just relocates them – hopefully far away from your field.
- Lost residue/nutrient value from the field.
- Capital Costs: \$300,000



IMPACT/MILLS

- Control the weeds by milling the chaff/weeds.
- If weed seed can be impacted at least 4 times then the seed is devitalised.
- >95% kill rate on most common weeds
- Capital Costs: \$100,000



COST SUMMARY

HWSC SYSTEM	Est. Total* \$/AC	Capital Cost
Narrow windrow burn	\$9.60	\$1,000
Chaff Deck/Tramlining	\$4.70	\$25,000
Chaff cart	\$6.74	\$100,000
Bale Direct	\$22.80	\$300,000
Impact Mills	\$5.50	\$100,000

*Total costs include assumptions on nutrient removal, depreciation, maintenance and operating costs based on Australian cropping conditions.

ADOPTION IN AUSTRALIA

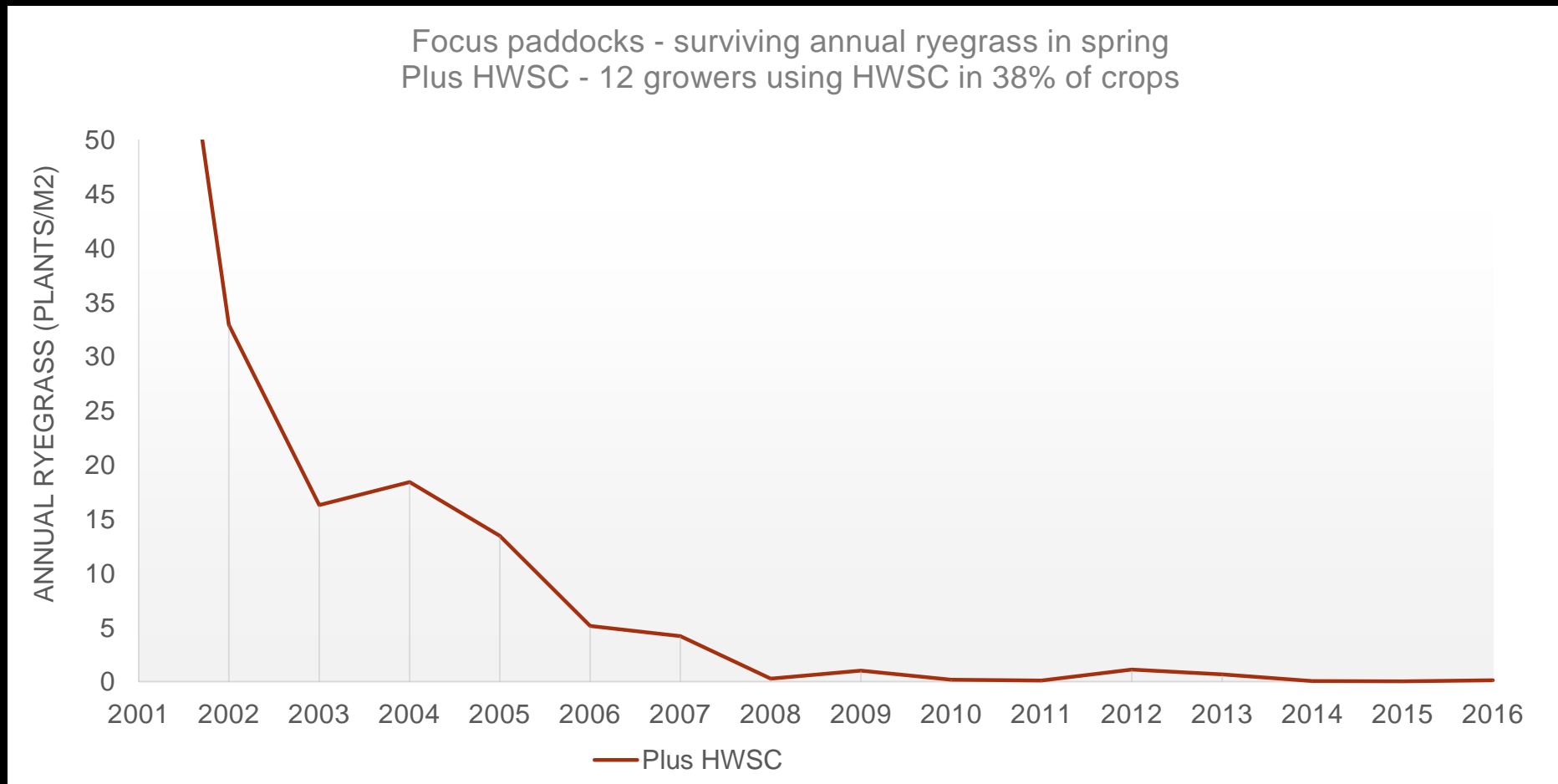
- Currently over 50% of all farmers use some form of HWSC.
- Forecasted to be over 95% by 2022.
- Top options today; chaff lining/tramlining and narrow windrow burning.
 - Both methods are on the decline.
- Top option by 2022; impact mills
 - In 2019; estimated that over 200 impact mills were sold in Australia

EFFECT OF HWSC IN AUSTRALIA

- Six year rotation, with normal harvest (1% of brome seed removed),
- HWSC at 20%, 40%, 60%, 80% and 100%

	HWSC LEVEL VS. BROME GRASS					
Year	1%	20%	40%	60%	80%	100%
2011	319	266	210	143	125	42
2012	2709	1890	1179	309	247	13
2013	1831	1197	692	209	168	5.2
2014	5611	3279	1593	487	350	1.4
2015	18210	9997	4204	266	191	0.7
2016	10954	5925	2378	86	59	0.1

EFFECT OF HWSC IN AUSTRALIA



Source: Dr. Brianne Tidemann presentation Nov/2019

BOTTOM LINE FOR THE AUS FARMER

- They adopt it because they know the risks of not managing the weeds.
- They are less worried about the short term economics or payback and are focused on the long term benefits of HWSC.



HOW WILL THIS WORK IN CANADA

- Lots of questions still to be answered.
 - Limited work with chaff decks has been done – best suited for control traffic.
 - Handful of seed mills have been running in SK now for three years.
- Potential Benefits:
 - Control herbicide resistant weeds
 - Increased yields
 - Control of volunteers
 - Rotation flexibility
 - Reduction of competitive pressure from weeds/volunteers
 - Reduction in herbicide costs

ECONOMIC BENEFIT

	Low Weed Pressure		High Weed Pressure	
		\$/acre		\$/acre
HWSC Costs/acre		\$5.00		\$5.00
Yield increase	1-2%	\$5.00	10%	\$50.00
Herbicide Savings	0%	\$0.00	10%	\$6.00
Savings per acre		\$5.00		\$56.00
Cost per acre		\$5.00		\$5.00
Net Benefit		\$0.00		\$51.00

CHALLENGES FOR CANADIAN HWSC: HARVESTABILITY OF THE WEEDS

Top 10 weeds in Saskatchewan: 2014-15 surveys (pre-harvest, 2,242 fields)	Harvestability Rating
10: <i>Taraxacum officinale</i> (dandelion)	P
9: <i>Crepis tectorum</i> (narrow-leaved hawk's-beard)	P
8: <i>Chenopodium album</i> (lambsquarters)	G
7: <i>Galium</i> spp. (cleavers)	F-G
6: <i>Sonchus asper</i> (spiny annual sow thistle)	P
5: <i>Cirsium arvense</i> (Canada thistle)	F-P
4: Volunteer canola	G
3: <i>Polygonum convolvulus</i> (wild buckwheat)	F-G
2: <i>Avena fatua</i> (wild oat)	P
1: <i>Setaria viridis</i> (green foxtail)	G

Source: Dr. Beckie/Dr. Tidemann

CONCLUSION

- Problem in Canada is real and growing.
- HWSC; early days, but options exist for Canadian farmers.
- To use HWSC there will be challenges and we need to prove out the economics in Canada
- How long do we/should we wait before we adopting HWSC solutions?

SOURCES FOR MORE INFORMATION

- In Canada Dr. Breanne Tidemann with AAFC is our resident expert.
- Kondinin Group in AUS – published a complete overview of HWSC
- WeedSmart.org.au – great tools to learn more about the space
- Australian Herbicide Resistance Initiative (AHRI)
 - <https://ahri.uwa.edu.au/spoiled-rotten/>
 - <https://ahri.uwa.edu.au/spoiled-rotten-the-sequel/>
- Dr. Peter Newman – myresearchagro.com
- Dr. Michael Walsh – University of Sydney
- Dr. Adam Davis – University of Illinois

QUESTIONS

BACKUP

SUPPORT

- As a result of the lack of control options, the impact of weeds in pulses can be devastating. Research shows that pulse crops, the most susceptible crops to weed interference, commonly suffer yield losses of 20 to 40 per cent, but that number can climb up to 80 per cent in a bad year.
 - Source: <https://saskpulse.com/resources/magazine/pulse-research/articles/weed-control-in-pulses/>

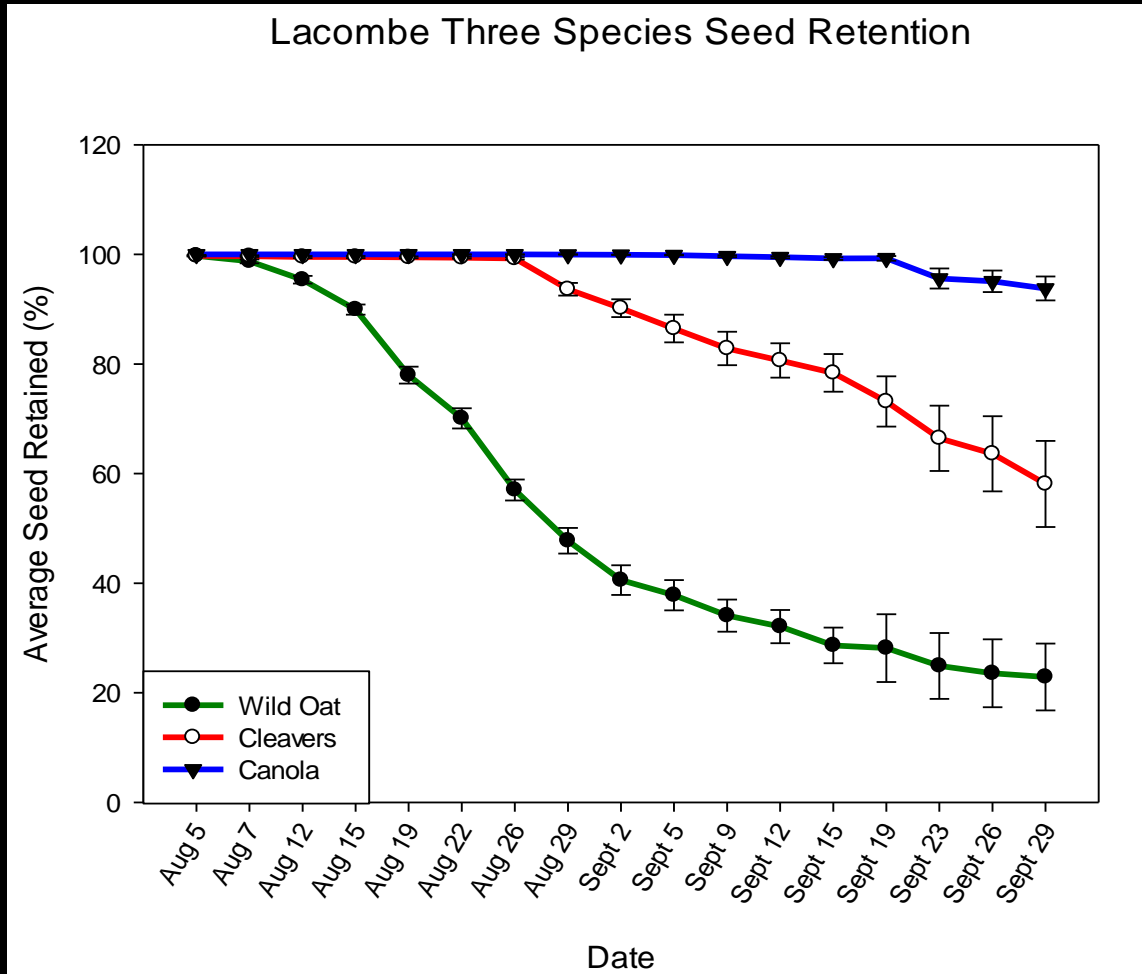
Know the yield loss from herbicide resistant weeds

Here's a quick summary of how weed competition affects your crops' yield potential:

- Crops like corn, soybeans and edible beans can take a 50% yield loss, depending on the year and situation.
- Canola and cereals, while more competitive, can still have yields cut by 20-25%. Plus, some weeds pose a bigger threat to crops than others:
 - Green foxtail at a population of 5 plants/square metre can cut yields by less than 10%.
 - Pigweed and lamb's-quarters at 5 plants/square metre can reduce yields by 30%.
 - In the case of our Saskatchewan flax farmer, wild oats at a population of 10 plants/square yard can reduce yields by 20%.
- Nobody wants to take that kind of hit, so it's important to keep your weed control options open.

Source: <https://www.cargillag.ca/expert-network/expert-blog/the-real-impact-of-herbicide-resistance-on-yield-and-rotations>

CANADIAN SEED RETENTION DATA



• Kochia

- Seeds only mature after harvest so high levels of retention
- Over 5000 seeds can be retained below cutting height

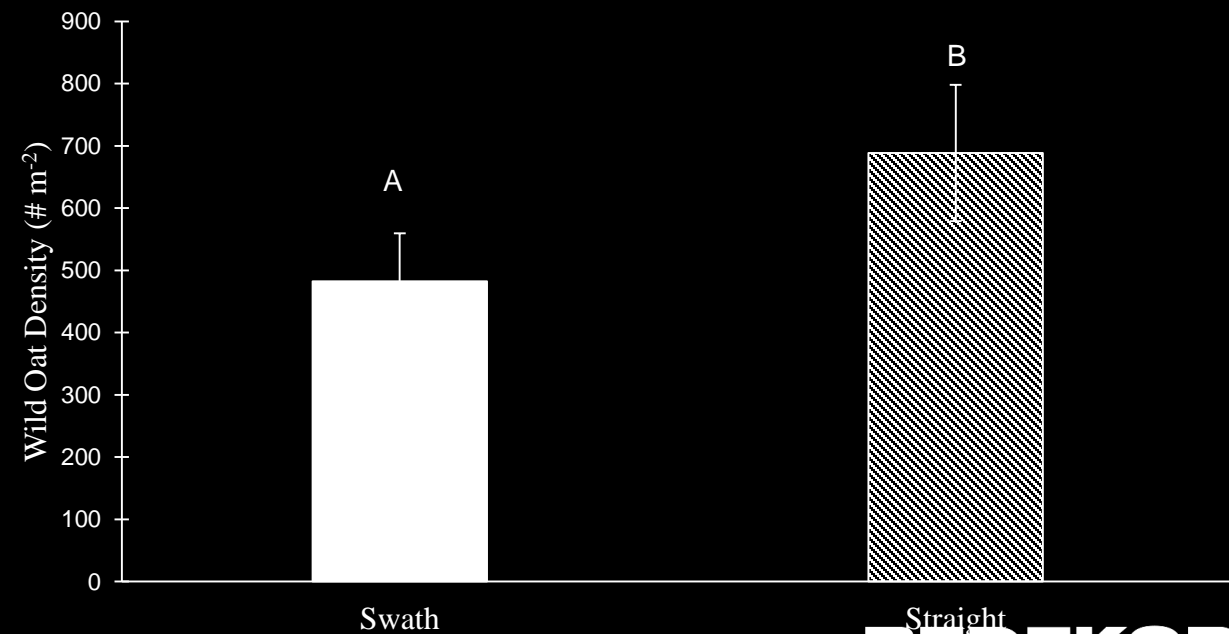
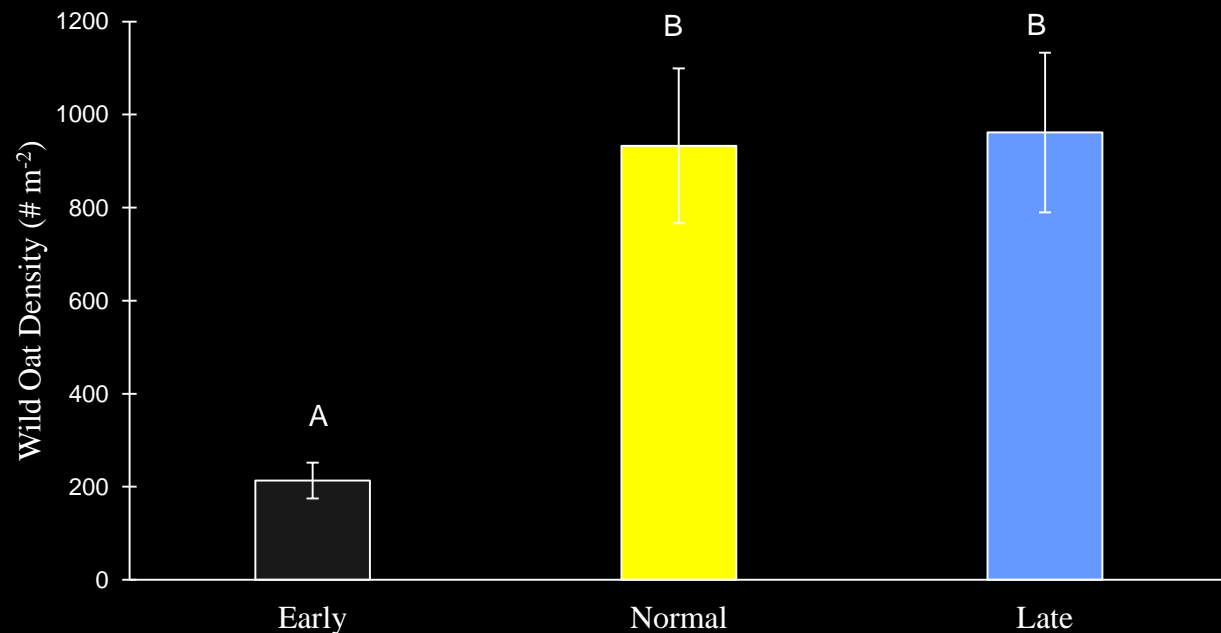


Photo credit: Ryan Low

Slide Credit: Dr. Breanne Tidemann

WAYS TO INCREASE WEED RETENTION

- Early maturing crops
- Incorporation of swathing vs straight cutting



Slide Credit: Breanne Tidemann