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/](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%.

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

<table>
<thead>
<tr>
<th>HWSC SYSTEM</th>
<th>Est. Total* $/AC</th>
<th>Capital Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow windrow burn</td>
<td>$9.60</td>
<td>$1,000</td>
</tr>
<tr>
<td>Chaff Deck/Tramlining</td>
<td>$4.70</td>
<td>$25,000</td>
</tr>
<tr>
<td>Chaff cart</td>
<td>$6.74</td>
<td>$100,000</td>
</tr>
<tr>
<td>Bale Direct</td>
<td>$22.80</td>
<td>$300,000</td>
</tr>
<tr>
<td>Impact Mills</td>
<td>$5.50</td>
<td>$100,000</td>
</tr>
</tbody>
</table>

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

Source: Peter Newman, MyResearchAgro.com
ADOPTION IN AUSTRALIA

- Currently over 50% of all farmers use some form of HWSC.
- Forecasted to by 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%

<table>
<thead>
<tr>
<th>Year</th>
<th>1%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
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<tbody>
<tr>
<td>2011</td>
<td>319</td>
<td>266</td>
<td>210</td>
<td>143</td>
<td>125</td>
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<tr>
<td>2012</td>
<td>2709</td>
<td>1890</td>
<td>1179</td>
<td>309</td>
<td>247</td>
<td>13</td>
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<td>2013</td>
<td>1831</td>
<td>1197</td>
<td>692</td>
<td>209</td>
<td>168</td>
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<tr>
<td>2014</td>
<td>5611</td>
<td>3279</td>
<td>1593</td>
<td>487</td>
<td>350</td>
<td>1.4</td>
</tr>
<tr>
<td>2015</td>
<td>18210</td>
<td>9997</td>
<td>4204</td>
<td>266</td>
<td>191</td>
<td>0.7</td>
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<tr>
<td>2016</td>
<td>10954</td>
<td>5925</td>
<td>2378</td>
<td>86</td>
<td>59</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Source: Catherine Borger | Department of Primary Industries and Regional Development; Australia
EFFECT OF HWSC IN AUSTRALIA

Focus paddocks - surviving annual ryegrass in spring
Plus HWSC - 12 growers using HWSC in 38% of crops

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

<table>
<thead>
<tr>
<th></th>
<th>Low Weed Pressure</th>
<th>High Weed Pressure</th>
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</thead>
<tbody>
<tr>
<td>HWSC Costs/acre</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td>Yield increase</td>
<td>1-2%</td>
<td>10%</td>
</tr>
<tr>
<td>Hebicide Savings</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>Savings per acre</td>
<td>$5.00</td>
<td>$56.00</td>
</tr>
<tr>
<td>Cost per acre</td>
<td>$5.00</td>
<td>$5.00</td>
</tr>
<tr>
<td><strong>Net Benefit</strong></td>
<td><strong>$0.00</strong></td>
<td><strong>$51.00</strong></td>
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CHALLENGES FOR CANADIAN HWSC: HARVESTABILITY OF THE WEEDS

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10: <em>Taraxacum officinale</em> (dandelion)</td>
<td>P</td>
</tr>
<tr>
<td>9: <em>Crepis tectorum</em> (narrow-leaved hawk’s-beard)</td>
<td>P</td>
</tr>
<tr>
<td>8: <em>Chenopodium album</em> (lambsquarters)</td>
<td>G</td>
</tr>
<tr>
<td>7: <em>Galium spp.</em> (cleavers)</td>
<td>F-G</td>
</tr>
<tr>
<td>6: <em>Sonchus asper</em> (spiny annual sow thistle)</td>
<td>P</td>
</tr>
<tr>
<td>5: <em>Cirsium arvense</em> (Canada thistle)</td>
<td>F-P</td>
</tr>
<tr>
<td>4: Volunteer canola</td>
<td>G</td>
</tr>
<tr>
<td>3: <em>Polygonum convolvulus</em> (wild buckwheat)</td>
<td>F-G</td>
</tr>
<tr>
<td>2: <em>Avena fatua</em> (wild oat)</td>
<td>P</td>
</tr>
<tr>
<td>1: <em>Setaria viridis</em> (green foxtail)</td>
<td>G</td>
</tr>
</tbody>
</table>

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?
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)

Dr. Peter Newman – myresearchagro.com

Dr. Michael Walsh – University of Sydney

Dr. Adam Davis – University of Illinois
QUESTIONS
BACKUP
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/](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.

CANADIAN SEED RETENTION DATA

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Average Seed Retained (%)</th>
</tr>
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<tbody>
<tr>
<td>Aug 5</td>
<td>100</td>
</tr>
<tr>
<td>Aug 7</td>
<td>100</td>
</tr>
<tr>
<td>Aug 12</td>
<td>100</td>
</tr>
<tr>
<td>Aug 15</td>
<td>100</td>
</tr>
<tr>
<td>Aug 19</td>
<td>100</td>
</tr>
<tr>
<td>Aug 22</td>
<td>90</td>
</tr>
<tr>
<td>Aug 26</td>
<td>80</td>
</tr>
<tr>
<td>Aug 29</td>
<td>70</td>
</tr>
<tr>
<td>Sept 2</td>
<td>60</td>
</tr>
<tr>
<td>Sept 5</td>
<td>50</td>
</tr>
<tr>
<td>Sept 9</td>
<td>40</td>
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<td>Sept 12</td>
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</tr>
<tr>
<td>Sept 23</td>
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</tr>
<tr>
<td>Sept 26</td>
<td>0</td>
</tr>
<tr>
<td>Sept 29</td>
<td>0</td>
</tr>
</tbody>
</table>

Photo credit: Ryan Low

Slide Credit: Dr. Breanne Tidemann
WAYS TO INCREASE WEED RETENTION

- Early maturing crops
- Incorporation of swathing vs straight cutting