Integrated management of jointed goatgrass in the Pacific Northwest

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Jointed Goatgrass: A Grower’s Nightmare & A Researcher’s Dream
Cooperating Scientists

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Palouse Region

- Steep topography
- Winter precipitation (Mediterranean climate)
- Severe erosion
- Winter wheat yield
Information to Share

1. Spring-germinating JGG study
2. Imi-wheat study
3. Plow study
4. Integrated weed management study
5. JGG resistance study
Spring-Germinating JGG Study

The primary purpose of spring crops in JGG management systems is to prevent viable weed seed production and to facilitate the depletion of the soil weed seedbank.

Spring-germinating JGG can produce viable seed.....*need to delay planting 2 wks past optimum*
Based on question: “What can I do, when I am not growing winter wheat, to expedite my return to winter wheat production?

Treatment 1

Treatment 2

Treatment 3

Treatment 4
Plow Study, Cntd.

- No-till SW ↓ JGG populations and spikelets more rapidly than ChF/C®WW.

- One-time spring deep plowing followed by no-till SW ↓ JGG populations more rapidly than continuous no-till SW.

- In identical crop sequences, shallow pre-plant tillage annually after one-time spring deep plowing ↓ JGG populations and spikelets compared to no-till crops after one-time plowing.
Objective: Identify a stable crop production system that reduces JGG infestations based on time and frequency of the introduction of C®WW.

Location:

High rainfall zone – WW-SB-SL (3 cycles)

Low rainfall zone – WW-Fallow (3 cycles, 2 locations)
Based on crop yield, JGG populations and spikes produced:

**Treatments**

- C®-C®-C®
- C®-C®-N
- C®-N-C®
- N-C®-C®
- N-C®-N
- N-N-C®
Goal: A project designed to utilize the information generated from the many single component jointed goatgrass research studies conducted in the PNW.
1. Develop an IWMS for JGG in WW.

2. Stubble burning, length of rotation, and integrated WW planting practices.

3. Identify profitable and economically stable crop production systems.
IWM Locations
Idaho – light
Washington – light to moderate
Oregon – heavy

Treatments
- Stubble burning
- Length of crop rotation
- Integrated planting - WW
Stubble Burning

- > 90% Control
- Soil surface
- High population

Rotation

- WW-Fallow – 1 yr
- WW-SB-Fallow – 2 yr
- SW-Fallow-WW-Fallow – 3 yr
IWM For Winter Wheat

**Standard**
- ✓ Fertilizer
- ✓ Standard cultivar
- ✓ Normal seed lot
- ✓ Normal density
- ✓ Double disk/Deep furrow

**Integrated**
- ✓ Fertilizer
- ✓ Competitive cultivar
- ✓ Increased seed size
- ✓ Increased density
- ✓ Hoe - drill
Oregon Site

- Highest weed population
  - Same wheat variety
  - F-WW-F-WW & F-SW-F-WW
Materials And Methods (Initial)

- Weed seed sampling (August 96')
- Stubble burn (August 96')
- Weed seed sampling (August 96')
Baseline jointed goatgrass populations in ID, WA, and OR (#)

<table>
<thead>
<tr>
<th>Depth</th>
<th>ID</th>
<th>WA</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>4</td>
<td>51</td>
<td>245</td>
</tr>
<tr>
<td>0 to 10cm</td>
<td>6</td>
<td>4</td>
<td>34</td>
</tr>
<tr>
<td>10 to 20cm</td>
<td>3</td>
<td>&lt;1</td>
<td>3</td>
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</table>
Stubble burning effect on jointed goatgrass (#)

<table>
<thead>
<tr>
<th>Site</th>
<th>Burn</th>
<th>Spikelets</th>
<th>Seed</th>
<th>Viable</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>Y</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>6</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>WA</td>
<td>Y</td>
<td>20</td>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>50</td>
<td>65</td>
<td>60</td>
</tr>
<tr>
<td>OR</td>
<td>Y</td>
<td>200</td>
<td>225</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>275</td>
<td>375</td>
<td>360</td>
</tr>
</tbody>
</table>
Materials & Methods
(1st Crop)

Winter Wheat
- Primary tillage (F 96')
- Fertilized (S 97')
- Tilled as needed
- Planted WW (F 97')

Spring Wheat
- Chem fallow (F 96' - S 98')
- No-till SW (S 98')
• HSU’s multiple comparison used to select best treatment combinations with 95% confidence level

• Allows growers to identify the best combination of treatments for optimum production
### Best combination of treatments for optimum yield and reduced dockage in 1998

<table>
<thead>
<tr>
<th>Burn</th>
<th>Rotation</th>
<th>Practice</th>
<th>Yield (kg ha(^{-1}))</th>
<th>Dockage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>WW</td>
<td>S</td>
<td>3495</td>
<td>1.69</td>
</tr>
<tr>
<td>Y</td>
<td>WW</td>
<td>I</td>
<td>4255**</td>
<td>0.36*</td>
</tr>
<tr>
<td>N</td>
<td>WW</td>
<td>S</td>
<td>3190</td>
<td>3.07</td>
</tr>
<tr>
<td>N</td>
<td>WW</td>
<td>I</td>
<td>4190*</td>
<td>0.48*</td>
</tr>
<tr>
<td>Y</td>
<td>SW-WW</td>
<td>S</td>
<td>3225</td>
<td>0.18*</td>
</tr>
<tr>
<td>Y</td>
<td>SW-WW</td>
<td>I</td>
<td>3135</td>
<td>0.04**</td>
</tr>
<tr>
<td>N</td>
<td>SW-WW</td>
<td>S</td>
<td>2655</td>
<td>0.32*</td>
</tr>
<tr>
<td>N</td>
<td>SW-WW</td>
<td>I</td>
<td>2905</td>
<td>0.67*</td>
</tr>
</tbody>
</table>
Materials And Methods
(2nd Crop)

Standard
- Summer fallow (F 98’ - F 99’)
- Fertilized (S 99’)
- Planted - 76 kg ha^{-1}

Integrated
- Summer fallow (F 98’ – F 99’)
- Fertilized (F 99’)
- Planted - 118 kg ha^{-1}
## Best combination of treatments for optimum yield and reduced dockage in 2000

<table>
<thead>
<tr>
<th>Burn</th>
<th>Rotation</th>
<th>Practice</th>
<th>Yield (kg ha(^{-1}))</th>
<th>Dockage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>WW</td>
<td>S</td>
<td>2505</td>
<td>8.5</td>
</tr>
<tr>
<td>Y</td>
<td>WW</td>
<td>I</td>
<td>3005*</td>
<td>4.1*</td>
</tr>
<tr>
<td>N</td>
<td>WW</td>
<td>S</td>
<td>2250</td>
<td>19.5</td>
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<tr>
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<td>WW</td>
<td>I</td>
<td>2905*</td>
<td>6.3</td>
</tr>
<tr>
<td>Y</td>
<td>SW-WW</td>
<td>S</td>
<td>2585</td>
<td>4.0*</td>
</tr>
<tr>
<td>Y</td>
<td>SW-WW</td>
<td>I</td>
<td>2840*</td>
<td>1.4**</td>
</tr>
<tr>
<td>N</td>
<td>SW-WW</td>
<td>S</td>
<td>2705</td>
<td>8.3</td>
</tr>
<tr>
<td>N</td>
<td>SW-WW</td>
<td>I</td>
<td>3110**</td>
<td>4.3</td>
</tr>
</tbody>
</table>
### Best combination of treatments for optimum reduction of JGG density in 2001

<table>
<thead>
<tr>
<th>Burn</th>
<th>Rotation</th>
<th>Practice</th>
<th>Plants (m(^{-2}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>WW</td>
<td>S</td>
<td>103</td>
</tr>
<tr>
<td>Y</td>
<td>WW</td>
<td>I</td>
<td>75*</td>
</tr>
<tr>
<td>N</td>
<td>WW</td>
<td>S</td>
<td>173</td>
</tr>
<tr>
<td>N</td>
<td>WW</td>
<td>I</td>
<td>122</td>
</tr>
<tr>
<td>Y</td>
<td>SW-WW</td>
<td>S</td>
<td>38*</td>
</tr>
<tr>
<td>Y</td>
<td>SW-WW</td>
<td>I</td>
<td>24**</td>
</tr>
<tr>
<td>N</td>
<td>SW-WW</td>
<td>S</td>
<td>80*</td>
</tr>
<tr>
<td>N</td>
<td>SW-WW</td>
<td>I</td>
<td>60*</td>
</tr>
</tbody>
</table>
One-time stubble burn, F-SW-F-WW rotation using integrated WW management practices
Preliminary: Possible development of some resistant JGG biotypes although manifestation of resistance in these plants is not holding with the typical genetic ratios.
Remember
Keep in mind why you are doing what you are doing.
QUESTIONS?

Integrate, Integrate, Integrate!
Statements by expert witnesses

Zemetra
*Wheat and JGG Genetics

“Not sure”

Mallory-Smith
*Herbicide Resistance

“No idea”

Shaner
*Imidazolinones

“Beats me”