Weed Management Studies in Sunflower

Funded by GRDC and DPI through the Central Queensland Sustainable Farming Systems Project (CQSFSP)

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Covering:

Basic background – weed control in sunflower

Recent trial work (2002 & 2003)
  - herbicide efficacy and tolerance screening
  - weed~crop competition study

Future DPI trials on weed management in sunflower
Background

Several effective grass herbicides are registered (fairly costly)

- fluazifop (Fusilade®)
- haloxyfop (Verdict®)
- and more

Few registrations for broad-leaf weed control

- trifluralin (various)
- paraquat (Gramoxone®)
- pendimethalin (Stomp®)

Impractical to the cropping system (zero till v. incorporation need; application timing)

Many do not use in-crop herbicides
Fixed transect monitoring on-farm sunflower crops (CQSFSFSP)

- crops started clean but no in-crop herbicide used
- weed numbers increased from 0.2 to 14.6 plants m\(^{-2}\) within the season
- following summer this had increased to 44 plants m\(^{-2}\)

⇒ potential to build the weed seed bank
⇒ increased future costs of weeds
Sunflower – currently a weak link for weed management in farming systems

- remain as such until weed management is improved
Recent & current DPI trials

Our aim:

To develop effective integrated weed management strategies for sunflower that are appropriate to the farming systems.

Our research questions:

Can sunflower agronomy be manipulated to improve crop competitiveness?....can this be used in conjunction with herbicides to improve weed management?
Trial work continued……

Two trials to date:


Located on Emerald Research Station (DPI)

- 1-1.3 m deep vertosol
- irrigable sites
- replicated small plots
  - plot size: 4 m x 15 m (trial 1); 4 m x 16 m (trial 2)
- both trials planted in March
- heads bagged to protect from birds
Herbicide efficacy / tolerance trial

3 herbicides x 2 rates + controls

- Stomp (pendimethalin) 2 & 4 L ha⁻¹
- Authority (sulfentrazone) 250 & 500 g ha⁻¹
- Frontier (dimethenamid) 0.7 & 1.4 L ha⁻¹
- Controls weedy & weed-free

Treatments applied 6 days prior to planting

- boom output 61 L ha⁻¹
- irrigated immediately after spraying

Sunflower (var. Pioneer 65A25) planted on 1 m row spacing @ 4 seeds m⁻¹
Efficacy / tolerance trial continued....

We measured & recorded:  \( \text{(DAP = days after planting)} \)

- crop establishment  \( (14 \text{ DAP}) \)
- early crop biomass  \( (22 \text{ DAP}) \)
- visual weed control assessments  \( (15, 43, 114 \text{ DAP}) \)
- actual weed counts  \( (58 \text{ DAP}) \)
- crop yield  \( (127 \text{ DAP}) \)
## Results

### Impacts of the herbicides on sunflower

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Crop establishment (plants m⁻¹)</th>
<th>Early crop biomass (g m⁻²)</th>
<th>Crop yield (t ha⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authority 250 g</td>
<td>3.2</td>
<td>5.54</td>
<td>2.16</td>
</tr>
<tr>
<td>Authority 500 g</td>
<td>2.8</td>
<td>3.34</td>
<td>1.92</td>
</tr>
<tr>
<td>Frontier 0.7 L</td>
<td>3.2</td>
<td>6.39</td>
<td>1.86</td>
</tr>
<tr>
<td>Frontier 1.4 L</td>
<td>3.6</td>
<td>5.34</td>
<td>1.83</td>
</tr>
<tr>
<td>Stomp 2.0 L</td>
<td>2.8</td>
<td>6.02</td>
<td>2.19</td>
</tr>
<tr>
<td>Stomp 4.0 L</td>
<td>3.0</td>
<td>5.52</td>
<td>1.54</td>
</tr>
<tr>
<td>Nil herbicide weed-free</td>
<td>2.5</td>
<td>6.85</td>
<td>2.14</td>
</tr>
<tr>
<td>Nil herbicide weedy</td>
<td>2.5</td>
<td>4.85</td>
<td>1.76</td>
</tr>
<tr>
<td>LSD (P = 0.05)</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
</tbody>
</table>
**Efficacy / tolerance trial continued….

## Results

### Impacts of the herbicides on the weeds

<table>
<thead>
<tr>
<th>Treatment (with rate ha(^{-1}))</th>
<th>Visual Weed Control (% kill)</th>
<th>Actual counts @ 58 DAP (number m(^{-2}))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 DAP</td>
<td>43 DAP</td>
</tr>
<tr>
<td>Authority 250 g</td>
<td>89</td>
<td>88</td>
</tr>
<tr>
<td>Authority 500 g</td>
<td>100</td>
<td>95</td>
</tr>
<tr>
<td>Frontier 0.7 L</td>
<td>93</td>
<td>95</td>
</tr>
<tr>
<td>Frontier 1.4 L</td>
<td>93</td>
<td>99</td>
</tr>
<tr>
<td>Stomp 2 L</td>
<td>99</td>
<td>98</td>
</tr>
<tr>
<td>Stomp 4 L</td>
<td>98</td>
<td>98</td>
</tr>
<tr>
<td>Nil herbicide weed-free</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Nil herbicide weedy</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>LSD (P &lt; 0.001)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Efficacy / tolerance trial continued….  

Conclusions

- no herbicide significantly affected the sunflower
- majority treatments gave commercially acceptable weed control for the crop duration
- all herbicides reduced seed-bank replenishment
- weed spectra controlled were similar
- no advantage of Authority or Frontier over Stomp but offer alternative modes of action (groups G & K respectively) [herbicide resistance avoidance]
- Stomp is very effective when applied pre-plant using the planting rain for incorporation
2002 trial  Stomp 2 L ha\(^{-1}\) (foreground)  Photo by Glen Wright, DPI
Weed-crop competition study

2 varieties x 2 populations x 2 row spacings x 2 weed conditions

- Hysun 38 and Hysun 47
- 30 000 and 45 000 plants ha\(^{-1}\)
- 50 and 100 cm rows
- weedy and weed-free

Immediately post-planting, glyphosate used to create the weed-free condition; then maintained by hand weeding

Weedy plots had small weeds @ planting
Competition study continued….

We measured and recorded:

- crop establishment (23 DAP)
- weeds in weedy plots mapped (41 DAP)
- weed biomass (43 DAP)
- crop biomass (48 DAP)
- crop yield will be measured in July
## Competition study

### Results

<table>
<thead>
<tr>
<th>Treatment factor</th>
<th>Crop establishment (plants m⁻²)</th>
<th>Crop biomass (g m⁻²)</th>
<th>Weed biomass (g m⁻²)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variety:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysun 38</td>
<td>5.44</td>
<td>175.0</td>
<td>82.8</td>
</tr>
<tr>
<td>Hysun 47</td>
<td>3.26</td>
<td>75.1</td>
<td>99.2</td>
</tr>
<tr>
<td>LSD (P=0.05)</td>
<td>0.71</td>
<td>30.09</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Target population:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 000 plants ha⁻¹</td>
<td>3.66</td>
<td>117.8</td>
<td>87.6</td>
</tr>
<tr>
<td>45 000 plants ha⁻¹</td>
<td>4.69</td>
<td>132.2</td>
<td>94.4</td>
</tr>
<tr>
<td>LSD (P=0.05)</td>
<td>0.71</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Row spacing:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 cm</td>
<td>4.69</td>
<td>123.2</td>
<td>84.4</td>
</tr>
<tr>
<td>100 cm</td>
<td>4.02</td>
<td>126.9</td>
<td>97.6</td>
</tr>
<tr>
<td>LSD (P=0.05)</td>
<td>ns</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Weediness:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weedy</td>
<td>4.20</td>
<td>94.7</td>
<td></td>
</tr>
<tr>
<td>weed-free</td>
<td>4.51</td>
<td>155.3</td>
<td></td>
</tr>
<tr>
<td>LSD (P=0.05)</td>
<td>ns</td>
<td>30.09</td>
<td></td>
</tr>
</tbody>
</table>
Competition study

Conclusions

- Weeds did not impact on establishment
- Weeds did reduce crop biomass by 39%
- Variety had no significant impact on the weeds (Hysun 38 had 16% less weed matter)
- Crop population had no significant impact on weeds
- Row spacing had no significant impact on the weeds (narrower rows had 14% less weed matter)
- Irrespective of the weeds, Hysun 38 is more robust than Hysun47 (for an early March planting)

⇒ No crop competitive advantages evident for the agronomic attributes studied (but this is only one trial !)
2003 trial weed-free 1 m v. weedy 0.5 m

Photo by Glen Wright, DPI
2003 trial weed-free 1 m v. weedy 0.5 m Photo by Glen Wright
Future sunflower weed work by DPI

Yes…..we still need more information in order to answer our research questions.

We intend to:

- further explore herbicide based weed management
  - fine tune application timing of pendimethalin
  - post-plant, post-emergence studies with various herbicides (including Frontier, Authority + others)
- conduct more competition studies
  - utilising different weed emergence times
  - examine more row spacings and crop populations
- tie the two together for integrated strategies
  - could allow reductions in herbicide rates ???
Thank you. A happy crop! Photo by Glen Wright, DPI