Site Specific Weed Management (SSWM) - South Australian experience

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Site Specific Weed Management SSWM - what is it?

“Targeting the right weed treatment to the right place”

Nothing new … but GPS now makes it possible

Benefits
Less herbicide applied - cheaper
Expensive herbicides targeted only at tough weeds
Less yield loss from crop phytotoxicity
Better weed control
Environmental – European driver (legislated)

Research
Worldwide: growing interest and effort
Australia: little research so far - increasing

SSWM - components

Weed mapping/sensing
Treatment decision
Treatment application
Documentation

Ryegrass – can it be sensed?

N-Sensor
Crop Circle
Greenseeker

NDVI = \frac{NIR - Red}{NIR + Red}

NDVI: Normalised difference vegetation index
Ryegrass – can it be sensed?
- Remote control camera plane
- Satellite/aerial imagery

Sensing ryegrass in lentils

Ryegrass pre-sowing

Ryegrass in Canola

What else is in the pipeline?
- Can we sense individual species?
  - Hyper-spectral
    - 256 wavebands (very expensive)
    - Waveband "drift" problem
  - Machine vision/image analysis
    - Shape/reflectance recognition
    - Complex and specialised research

Patch management of ryegrass
- Why bother?
  - To limit weed populations to acceptable density thresholds
  - Herbicide resistance
  - Overlapping plants
- Options
  - Pre-emergent herbicides
  - Selective grass herbicides
  - Crop desiccation
  - Seeding rates
- Benefits
  - Herbicide savings through variable rate technology
    - On/off or
    - Low dose/high dose
  - Improved weed management
Variable rate ryegrass control – treatment list

- Nine treatments
  - Nil
  - 1 L/ha trifluralin (480 g/L)
  - 1.5 L/ha trifluralin
  - 2 L/ha trifluralin
  - 1 L/ha trifluralin + 1 L/ha triallate (Avadex Xtra)
  - 1.5 L/ha trifluralin + 1 L/ha triallate
  - 1 L/ha trifluralin + 1.6 L/ha metolachlor (Dual, 720 g/L)
  - 1 L/ha trifluralin + 1 L/ha triallate + 0.7 L/ha metolachlor

- Trial repeated under different levels of grass weed pressure

Variable rate ryegrass control

Ryegrass Control in Wheat

<table>
<thead>
<tr>
<th>Seeding rate (kg/ha)</th>
<th>Herbicide</th>
<th>Ryegrass heads/sq m</th>
</tr>
</thead>
<tbody>
<tr>
<td>75kg/ha</td>
<td>Trifluralin 1L/ha</td>
<td>112</td>
</tr>
<tr>
<td>75kg/ha</td>
<td>Trifluralin 1L/ha + AvadexXtra 1.5L/ha</td>
<td>52</td>
</tr>
<tr>
<td>150kg/ha</td>
<td>Trifluralin 1L/ha</td>
<td>40</td>
</tr>
<tr>
<td>150kg/ha</td>
<td>Trifluralin 1L/ha + AvadexXtra 1.5L/ha</td>
<td>19</td>
</tr>
</tbody>
</table>

Trifluralin resistance levels

<table>
<thead>
<tr>
<th>Region</th>
<th>Moderate resistance (% of samples)</th>
<th>High resistance (% of samples)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA – Lower North</td>
<td>44</td>
<td>8</td>
</tr>
<tr>
<td>SA – Mid North</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>SA – Yorke Peninsula</td>
<td>84</td>
<td>22</td>
</tr>
<tr>
<td>Vic – Winlura</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Vic – Mallee</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

Variable rate ryegrass control - Select

<table>
<thead>
<tr>
<th>RG plant counts (plants/m²)</th>
<th>RG head counts (heads/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High RG</td>
<td>Low RG</td>
</tr>
<tr>
<td>906 a</td>
<td>71 a</td>
</tr>
<tr>
<td>Select 150 m/ha</td>
<td>50 b</td>
</tr>
<tr>
<td>Select 250 m/ha</td>
<td>12 c</td>
</tr>
<tr>
<td>Select 500 m/ha</td>
<td>3 d</td>
</tr>
</tbody>
</table>

- Treatments repeated in a high and low density ryegrass population.
- Different letters indicate treatments that are significantly different at the 5% level of significance.
Direct Injection Technology

- Chemical injected directly into spray line.
- Ability to variable rate control.
- Can add extra chemicals only where they are needed.
- No tank mix.

Cerberus 3 tank sprayer, Stuttgart

What could I do with my current boom?

- Vary rates of tank mix
  - Need to compensate with changes in speed or use a second line
  - Does not allow the addition of extra chemicals
- Do an extra pass

Ryegrass patches – are they stable?

- Weed seed dispersal
  - Natural dispersal
  - Spread by harvesters
  - Spread by tillage
- Seasonal expansion and contraction of patches

Other uses for crop sensors

- Variable rate fertiliser applications
- Variable rate fungicide applications
- Variable rate growth regulant applications

Summary

- Ryegrass is patchy, herbicides are expensive, but technology has improved.
- Results indicate benefits for patch management of ryegrass.
WeedSeeker for fallow spraying

How a WeedSeeker® sensor works

1. “Light emitting diodes” (LEDs) produce a combination of invisible infrared and visible red light which is projected onto the target approximately 2 feet below the sensor.

2. The light reflected from the target is captured by a detector at the front of the sensor.

3. Sophisticated electronics inside the sensor analyze the reflected light and determine when it matches the light reflected by green plants.

4. When green plant’s reflectance is identified, the sensor waits until the plant is under the spray nozzle and then triggers a fast-fire solenoid valve which sprays the plant.

WeedSeeker use in NSW conditions

Local experience indicates a reduction in area sprayed of 80-90%, but it depends on how weedy the paddock is.

WeedSeeker Costs

<table>
<thead>
<tr>
<th>Width (m)</th>
<th>Price/metre (AUD$)</th>
<th>Price (AUD$)</th>
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</thead>
<tbody>
<tr>
<td>9</td>
<td>4,900</td>
<td>44,100</td>
</tr>
<tr>
<td>12</td>
<td>4,792</td>
<td>57,500</td>
</tr>
<tr>
<td>18</td>
<td>4,622</td>
<td>83,200</td>
</tr>
<tr>
<td>24</td>
<td>4,442</td>
<td>106,600</td>
</tr>
<tr>
<td>27</td>
<td>4,537</td>
<td>122,500</td>
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<td>32</td>
<td>4,422</td>
<td>141,500</td>
</tr>
<tr>
<td>38</td>
<td>4,381</td>
<td>157,700</td>
</tr>
</tbody>
</table>

WeedSeeker comments

- Will hit coke can size weeds at 16-18 km/h 100% of time.
- Can hit 20c piece size weeds at 16 km/h, but potential for less reliable job.
- Better at night, no shadow effect from natural light.
- Needs recalibrating every now and then on a weed free patch to correct for background soil and stubble.