Water Use Efficiency in Sunflowers – an on farm perspective. How do Sunflowers compare with other summer crops.

Rob Long
B&W Rural Moree
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Background

- Biggest Sunflower plant in northern NSW for 25 years.
  - Heavy June/July rain closed the winter planting window
  - Contracts for mono Sunnies @ $430 del Newcastle.
- 05/06 was a very hot summer. Rainfall patchy.
- Rutherglen Bugs were prolific.
- Sunflower yields suffered – light test weights and low oil%. Sorghum suffered similarly.
- I suspect Starting Soil Water levels may not have been as full as growers anticipated.
Method of assessment

- “Oodnadatta”, 30 km north east of Moree
- Soil type is a heavy grey cracking clay. Some sodicity and chloride at depth.
- Water use assessed using
  - Neutron Probes (NSW DPI)
  - C-Probes (B&W / Agrilink)
  - Gravimetric soil cores (NSW DPI)
- Sorghum and Cotton grown in adjacent paddocks
Soil details, Field 15

- 71 kg N available 0 – 100 cm
- P colwell 13ppm 0 – 10 cm

<table>
<thead>
<tr>
<th>Buffer</th>
<th>Chloride mg/kg</th>
<th>ESP%</th>
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<tbody>
<tr>
<td>0-10</td>
<td>37</td>
<td>9.2</td>
</tr>
<tr>
<td>10-40</td>
<td>41</td>
<td>12</td>
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<td>40-70</td>
<td>230</td>
<td>17</td>
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<tr>
<td>70-100</td>
<td>700</td>
<td>9.2</td>
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<tr>
<td>100-150</td>
<td>1200</td>
<td>15</td>
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Field 15, Crop details

- Variety: Sunoleic 06
- Planting Date: 18th August 2005
- Planting rate: 2.5 kg/ha x 14,000 seeds/kg
- Solid (1 metre) row configuration
- Establishment: 3.0 plants/metre (30,000 ha)
- Fertilizer: 80 kg/ha Urea, 23 l/ha Flowphos Z in furrow at planting.
- Nutrient status – refer to soil tests.
- Herbicides: No residuals applied.
- Weeds: Scattered Fleabane.
- Insects: RGB, sprayed 3 times 9th Nov, 21st Nov, 8th Dec.
Crop results

**Sunflower**
- Yield 1.86 t/ha
- Oil: 42.9 – 46.0%
- Avge T/W 40-42kg/hL
- Harvested 14/02/06

**Sorghum**
- Yield 4.1 t/ha
- Avge T/W 69 kg/HL
- Harvested 15/02/06
05/06 Sunflower Water Use - All depths
Neutron Probe graphs - Sunflowers

Oodnadatta Sunflower

Volumetric Water Content

Depth in cm

PAWC

(0-70) 104
(0-110) 120
(0-130) 133
(0-170) 154

5/10/2005
22/11/2005
30/11/2005
19/12/2005
6/01/2006
Estimated WUE – Solid Sunflowers

- Starting Soil Water (0-130) 133mm PAWC
- Total in-crop rain 545mm
- Effective in-crop rain est. 220mm
- Total avail water = 133+220 = 353 mm
- Peak Water Use 7.5mm per day
- Yield 1.86t/ha
- WUE = 1860kg / 353mm = 5.3 kg per mm.
  i.e. every 100mm (4 inches) should add 0.5 t/ha
05/06 Sorghum Water use - Summed

Diagram showing water usage over time with key stages labeled: flowering, grain fill, heatwave, and harvest.
Estimated WUE – Single Skip Sorghum

- Starting Soil Water (0-110): 93mm PAWC
- Total in-crop rain: 531mm
- Effective in-crop rain: est. 280mm
- Total avail water = 93 + 280 = 373 mm
- Peak Water Use: 4.4mm per day
- Yield: 4.1t/ha
- WUE = 4100kg / 373mm = 11.0 kg per mm.
  i.e. every 100mm (4 inches) should add 1.1 t/ha
Take Home Messages

- Sunflowers use soil water earlier than sorghum or cotton – a function of fast early growth and higher leaf area. Maximising Plant Available Water at planting reduces production risk.
- Sunflowers can use up to 7.5 mm/day during Peak Water Use at flowering.
- Sunflowers can extract water from soil with Chloride levels of 1200ppm and sodicity (ESP) of 17%.
Take Home Messages

- The relative yield and quality performance of summer crops in the Moree district depends on the amount of Plant Available Water and the evaporative demand at flowering and early grainfill.
- Water Use Efficiency of summer crops is of limited value unless some account is taken of “rainfall effectiveness”.
- Further work should be done to monitor water use patterns and WUE for Sunflowers on wider row configurations.