Introduction

- Productivity and stability of agriculture in the Southern High Plains depend on Ogallala aquifer.
- Irrigation well outputs are declining rapidly in the region.
- Extending aquifer life by judicious use of limited water is of prime importance in the region.
- Inclusion of drought resistant crops, such as safflower, in the cropping system will be beneficial to achieve this goal.
- Excessive rainfall or irrigation, especially after flowering, is reported to reduce safflower yield.
- With limited water availability, a better understanding of effect of water stress at particular growth stage on yield formation of diverse safflower cultivars will assist in better use of irrigation water.

Objective

- To assess drought physiology and yield formation of three spring safflower cultivars under growth stage based irrigation management.

Materials and Methods

- **Irrigation Treatment**
  - Irrigated (Iri) 1.5 5.0 5.0
  - Stress at Vegetative Growth (Vst) 1.5 0.0 5.0
  - Stress at Reproductive Growth (Rst) 1.5 5.0 0.0
  - Rainfed (Rain) 1.5 0.0 0.0

- **Sub-plot : Cultivars (3)**
  - PI8311, 99OL and Nutrisaff

- **Replications : 4**
- **Planting dates: April 30, 2013 and June 17, 2014 (Entire trial was replanted after severe hailstorm damage in 2014).**

Results

- **Table 1. Effect of irrigation treatments on yield and attributing characters of diverse spring safflower cultivars at Clovis, NM in 2013-14.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Heads plant(^1)</th>
<th>Seeds head(^1)</th>
<th>1000 Seed wt (g)</th>
<th>Biomass (kg ha(^{-1}))</th>
<th>Seed Yield (kg ha(^{-1}))</th>
<th>HI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irri</td>
<td>6.6 a</td>
<td>15.5 a</td>
<td>31.0 a</td>
<td>27.6 a</td>
<td>31.0 a</td>
<td>28.8 c</td>
</tr>
<tr>
<td>Rst</td>
<td>6.0 ab</td>
<td>13.3 b</td>
<td>28.3 ab</td>
<td>22.6 b</td>
<td>28.3 ab</td>
<td>28.0 c</td>
</tr>
<tr>
<td>Vst</td>
<td>5.6 bc</td>
<td>9.7 c</td>
<td>28.3 ab</td>
<td>26.8 a</td>
<td>28.3 ab</td>
<td>31.3 a</td>
</tr>
<tr>
<td>Rain</td>
<td>4.8 c</td>
<td>8.0 c</td>
<td>26.1 b</td>
<td>22.8 b</td>
<td>26.1 b</td>
<td>29.9 b</td>
</tr>
</tbody>
</table>

- **Cultivar**
  - 99OL
  - PI8311
  - Nutrisaff

- **Treat x Cul**

Fig.1. Pictures showing physical layout of the trial along with large buffer areas (aerial shot; right) and irrigation treatments application using a center pivot irrigation system (left).

Fig.2. Relationship of plant biomass with photosynthesis (left) and seed yield (right) obtained during 2013 and 2014 at Clovis, NM.

Fig.3. Irrigation treatment effects on growth of safflower cultivar PI8311 at Clovis, NM (2014).

Conclusions

- Farmers can skip irrigation after flowering to safflower in water scarce conditions as it is least detrimental to safflower yield formation.
- In addition to reducing water use by safflower, it will reduce irrigation need during peak water demand.
- Photosynthesis and plant biomass are the driving factors for yield formation in safflower.
- 99OL was the highest yielding cultivar followed by PI8311 and Nutrisaff.
- Lack of interaction in three diverse safflower cultivars indicates that skipping irrigation after flowering works for all safflower cultivars.

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