Irrigation Management Considerations For Deficit Irrigated Canola and Camelina


WSU Oilseed Production and Marketing Conference January 22-23, 2013
What happens with deficit irrigation?

- Stress develops during season
- Stress leads to ET reduction
- Linear yield-ET relationship = yield reduction
- Irrigation efficiency is not constant = nonlinear yield-irrigation production function
- You have a planning problem and a management problem
Yield Response to Irrigation Water

- **Full Yield**
- **Non-Irrig Yield**

**IRRIGATION WATER APPLIED**

**YIELD**

- LINEAR PORTION
- DIMINISHING RETURN

Little Yield Reduction with Over Irrigation

Maximum Irrigation Requirement
Effect Of Irrigation Efficiency On Crop Response And Evapotranspiration (ET)
Yield vs Evapotranspiration

Slopes are not static.
Change with time
Change with aridity
Relative values between crops are key

Corn
Wheat
Sunflower
Dry Bean
Soybean
Winter Wheat-Corn-Dry Bean-Canola Rotation Initiated 2005 Growing Season

Wheat, Beans, Canola: 4", 8", 12"

Corn: 5", 10", 15"

Wheat – Corn – Dry Beans – Canola
## Cultural Practices Canola

<table>
<thead>
<tr>
<th></th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td><strong>Planting Date</strong></td>
<td>April 15-20</td>
</tr>
<tr>
<td><strong>Herbicide</strong></td>
<td>Roundup in bean stubble, Roundup (16 oz@ 6 leaf)</td>
</tr>
<tr>
<td><strong>Seeding Rate</strong></td>
<td>7-8#/acre, Plant ~ April 15</td>
</tr>
<tr>
<td><strong>Variety</strong></td>
<td>Hyola 357 RR, Helix treated f flea beetle</td>
</tr>
<tr>
<td><strong>Fertilizer</strong></td>
<td>Preplant 21-0-0 @ 65# (15#S) N based on YG &amp; soil test 0-80#N</td>
</tr>
<tr>
<td><strong>Harvest</strong></td>
<td>Early August</td>
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</tbody>
</table>
Plant April 22

Dry year

Flower

Weeks after Planting

IRRIGATION (INCHES)
IRRIGATION (INCHES)

2009 LICT CANOLA 4” IRRIGATION

Plant April 22

Flower

Wet year

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

WEEK

0.00 0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00

4”
Plant April 22

Dry year

Flower
Plant April 22

Wet year used only 4.5"

Flower
Plant April 22

Dry year

Flower

Weeks after Planting

2007 LICHT CANOLA 12” IRRIGATION
Plant April 22

Wet year used only 4.5"

2009 LICT CANOLA 12” IRRIGATION
University of Nebraska Research
Spring Canola Yields

<table>
<thead>
<tr>
<th>Irrig</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>6-year avg</th>
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<tbody>
<tr>
<td>In.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>0</td>
<td>1000</td>
<td>1000</td>
<td>1050</td>
<td>2450</td>
<td>1800</td>
<td>1800</td>
<td>200</td>
<td>1510</td>
</tr>
<tr>
<td>4</td>
<td>2050</td>
<td>2040</td>
<td>2390</td>
<td>2650</td>
<td>2140</td>
<td>2710</td>
<td>610</td>
<td>2330</td>
</tr>
<tr>
<td>8</td>
<td>2120</td>
<td>2485</td>
<td>3030</td>
<td>2630</td>
<td>2010</td>
<td>2830</td>
<td>660</td>
<td>2520</td>
</tr>
<tr>
<td>12</td>
<td>2150</td>
<td>2740</td>
<td>3500</td>
<td>2650</td>
<td>1995</td>
<td>2880</td>
<td>820</td>
<td>2650</td>
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<tr>
<td>Irrig</td>
<td>2007 Actual</td>
<td>2007 Calculation</td>
<td>2007 Relative Yield</td>
<td></td>
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<tr>
<td>In.</td>
<td>Actual and Relative Yields</td>
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</tr>
<tr>
<td>0</td>
<td>800</td>
<td>800/2740</td>
<td>17.4%</td>
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<tr>
<td>4</td>
<td>2040</td>
<td>2040/2740</td>
<td>56.3%</td>
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<tr>
<td>8</td>
<td>2485</td>
<td>2485/2740</td>
<td>80.8%</td>
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</tr>
<tr>
<td>12</td>
<td>2740</td>
<td>2740/2740</td>
<td>100%</td>
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Setting Boundaries

- Select production function from the wettest and driest years
- These ‘boundary’ values provide an upper and lower production limit and a range of water productivity
- 2007 & 2012 were as dry as any year in last century
- 2009 was one of the wettest
- Both years ‘frame’ the expected range of response and expected irrigation required to produce maximum yield
2006-10 Relative Canola Yields

Relative Yield - %

Inches of Irrigation

2006 2007 2008 2009 2010

- 2006
- 2007
- 2008
- 2009
- 2010
2006-10 Relative Canola Yields

Relative Yield - %

Inches of Irrigation

2008

2009

4 “ in wet years

10” in dry years
Help answer some questions

1. Which crop should I irrigate?
2. How many acres should I irrigate?
3. What net return can I expect?
4. What are the tradeoffs between yield per acre and the area irrigated?
http://agecon.unl.edu/web/agecon/wateroptimizer/download.html
Suite of Models

Single Field – Single Year

Single Field – Multiple Years

2012
2013
2014
2015

Whole Farm Multiple fields in a single year

- All models are built into Excel
- Use generic solver to optimize
- Workbook for average users.
Crops Included

- Corn
- Soybean
- Grain sorghum
- Winter Wheat
- Dry Beans
- Sunflower
- Sugar Beets
- Alfalfa

- Canola
- Camelina

- Under Development
  - Potatoes
  - Cool season grasses
  - Warm season grasses
Deficit Irrigation Considerations

- When you have significantly less (50-80% of full ET) water, you have to modify your ‘normal’ irrigation practice based on weather station ET values.

- Apply to get the most ________ (Yield, income?)

- How will your strategy vary based on your crop and your water source supply (surface vs. ground water).
Deficit Irrigation Considerations

- When you are in a true deficit irrigation mode, you have to think like a ‘drylander’
  - Conserve all the moisture early (no-till or reduced), excellent weed control
  - Modify plant populations and fertilization level to some expected yield for ‘average’ reduced expectations
  - Good stand and start (first 6 weeks)
  - Forget about regular weekly scheduling based on ET or a percentage of ET
  - Let the crop go into early stress without killing it
  - Apply the limited amount of water around early reproductive stage till you run out
Fertilizer

- Develop your plan for your crops, acreage and water amount/division to meet financial goal
- Develop fertilizer plan to match expected yield
  - Immobile nutrients (P, Zn) follow soil tests
    - No penalty for over application as some residual value for future years, but more cost in dry year
  - N should be based on yield goal (corn, beets, beans)
    - N for an 80% yield will be OK for 90% if more rain
- Question the use of other nutrients that provide less response: K, other micronutrients, S
My Relative Corn Yield

Relative Yield - %

Inches of Irrigation

Dry

Wet

0

5

10

15

20

0

20

40

60

80

100

10”

14”
Keeping up with changing times!
The future: pioneering efforts still needed

Scottsbluff National Monument

Questions???