Soybean Irrigation Management

Lyndon Kelley
MSU Extension / Purdue University Irrigation Management Agent
St. Joseph Co. MSU Extension, 612 E. Main St., Centreville, MI 49032
Cell 269-535-0343, kellyl@anr.msu.edu, 269-467-5511

http://msue.anr.msu.edu/resources/irrigation
https://engineering.purdue.edu/ABE/Engagement/Irrigation
Treat your irrigated field like star performers

Re-think your management practices and inputs

- Soil pH
- Variable rate lime applications
- P and K rate and placement
- N rate and timing
- Sulfur placement, rate and timing
- Zinc placement, rate and timing
- Weed control
- Crop herbicide risk / damage
- Weed resistance
- Herbicide carry-over issues

- Drainage
- Crop rotation
- Seed selection
- Seeding rate and placement
- Planting date
- Emergence
- Pest scouting
- Pest management thresholds
- Residue management
- Compaction issues
Tried & True vs. Lead Dog

Not all technologies are ready for your farm

- Cover crop seeded at sidedress
- Remote start equipment
- Variable rate irrigation
- Field scale trickle irrigation
- Sub-surface drip
- Soil moisture monitoring
- Soil surfactants
- .................
Think of your soil as a bank

Water holding capacity: The soil (bank) can hold only a given volume of water before it allows it to pass lower down.

Soil type:
Heavier soil can hold more water / foot of depth than light soils.

Intake rate:
Water applied faster than the soil intake rate is lost.

Rooting depth:
The plant can only get water to the depth of its roots.

Deletion:
Plants can pull out only 30 - 60% of the total water.

Water lost from the bottom of the profile can wash out (leach) water soluble nutrients and pesticides.
Nearly 100,000 acres of soybeans are grown under irrigation in Michigan. Yield increases due to irrigation water applications are common in Michigan. However, the yield increases have been highly variable and lower than expected. This fact sheet summarizes soybean irrigation research conducted in Southwest Michigan from 2001 to 2003. Utilizing this information will help producers improve irrigated soybean yields.

different irrigation schedules. 3) learn how irrigation affects weed control with glyphosate and 4) learn how irrigation affects soybean aphid populations.

**Materials and Methods**
Five irrigation treatments were identified and implemented in each year of the project. The irrigation treatments were based on soybean
Summary

Based on the three years of data, it appears that maximizing soybean yields in Michigan is dependent on maintaining adequate soil moisture beginning at full bloom (R2) or beginning pod (R3), provided that the soil water deficit does not exceed 75% prior to that growth stage.

Waiting to irrigate until pod elongation (R3-R4) maximized water use efficiency in two of the three years as long as the soil water deficit never reached 75%.
R3: Beginning Pod
Any pod that is \(~3/16\) inch long and is on one of the four uppermost nodes of the main stem.

Developing pods, withering flowers, open flowers, & flower buds can all be found during this stage.
Summary – con’t
Waiting to irrigate until pod elongation (R3-R4) maximized water use efficiency in two of the three years as long as the soil water deficit never reached 75%.

In two of the three years, an emergency irrigation water application was required to prevent the soil water deficit from reaching 75% so waiting until pod elongation may not be recommended in some years.

Use data from irrigated soybean variety performance trials to select high-yielding, disease resistant/tolerant varieties that resist lodging to maximize irrigated soybean yields.
Irrigation Scheduling

Checkbook Method

Full water holding line

Allowable depletion line (25% of available water)

Allowable depletion line (50% of available water)
<table>
<thead>
<tr>
<th>Date</th>
<th>Root Depth (inches)</th>
<th>Rainfall (inches)</th>
<th>Irrigation added (inches)</th>
<th>Potential ET (inches)</th>
<th>% Canopy Cover (Kc)</th>
<th>ET modified for crop (inches)</th>
<th>Capacity of root zone (inches)</th>
<th>Available Water in root zone (inches)</th>
<th>% capacity filled</th>
<th>Drainage (inches)</th>
<th>Additional capacity of root zone (inches)</th>
<th>Proj ETO</th>
<th>Proj ET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Aug</td>
<td>24.0</td>
<td>0.4</td>
<td>0</td>
<td>0.17</td>
<td>0.96</td>
<td>0.16</td>
<td>3.15</td>
<td>2.62</td>
<td>83</td>
<td>0.00</td>
<td>0.53</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>2-Aug</td>
<td>24.0</td>
<td>0.4</td>
<td>0</td>
<td>0.17</td>
<td>0.97</td>
<td>0.08</td>
<td>3.15</td>
<td>2.94</td>
<td>93</td>
<td>0.00</td>
<td>0.21</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>3-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.18</td>
<td>0.98</td>
<td>0.08</td>
<td>3.15</td>
<td>2.76</td>
<td>88</td>
<td>0.00</td>
<td>0.39</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>4-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.17</td>
<td>0.99</td>
<td>0.17</td>
<td>3.15</td>
<td>2.59</td>
<td>82</td>
<td>0.00</td>
<td>0.56</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>5-Aug</td>
<td>24.0</td>
<td>0.3</td>
<td>0</td>
<td>0.08</td>
<td>1.00</td>
<td>0.08</td>
<td>3.15</td>
<td>2.51</td>
<td>80</td>
<td>0.00</td>
<td>0.64</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>6-Aug</td>
<td>24.0</td>
<td>0.3</td>
<td>0</td>
<td>0.09</td>
<td>1.02</td>
<td>0.09</td>
<td>3.15</td>
<td>2.62</td>
<td>83</td>
<td>0.00</td>
<td>0.53</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>7-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.14</td>
<td>1.01</td>
<td>0.14</td>
<td>3.15</td>
<td>2.48</td>
<td>79</td>
<td>0.00</td>
<td>0.67</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>8-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.32</td>
<td>74</td>
<td>0.00</td>
<td>0.83</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>9-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>10-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>11-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>12-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>13-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>14-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>15-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>16-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>17-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>18-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
<tr>
<td>19-Aug</td>
<td>24.0</td>
<td>0</td>
<td>0</td>
<td>0.16</td>
<td>1.00</td>
<td>0.16</td>
<td>3.15</td>
<td>2.16</td>
<td>68</td>
<td>0.00</td>
<td>0.99</td>
<td>0.17</td>
<td>0.00</td>
</tr>
</tbody>
</table>

http://www.agweather.geo.msu.edu/mawn/irrigation/
Scheduler- MSU Mawn-irrigation 2013, Constantine, rain fall 14.5”, 110 growing days, May 1 emergence.

Irrigation applications of 0.5” in June, 0.75 early/mid July, 1.0” August, 0.5 September

75%/50% depletion:
• planting to July 20th - soil allowed to dry to 75% depletion before irrigating.
• July 20th till harvest 55% depletion as threshold to irrigate.

![Table](http://www.agweather.geo.msu.edu/mawn/irrigation/)
## Preview Schedule - 2013 soybean 50% rain + all season irrig.

- **Schedule Calculated For**: Sep 20, 2013
- **Evapotranspiration Rate**: 0.05 in.
- **Soil Profile Moisture Content**: 1.70 in.
- **GDDs Since Emergence**: 2,746

### Day  | Date  | Temp High (°F) | Temp Low (°F) | Precip (in.) | Irrigation (in.) | ET (in.) | Excess Water (in.) | Soil Moist (relative) | Avail. N (lbs/acre) | N Loss (lbs/acre) | N Uptake (lbs/acre) |
--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
93   | Aug 1 | 80 | 59 | 0.57 | 0.16 | 1.06 | ++ | 7 | 56 |
94   | Aug 2 | 79 | 55 | 0.01 | 0.17 | 1.46 | +++++++ | 7 | 56 |
95   | Aug 3 | 80 | 59 | 0.57 | 0.17 | 1.30 | +++ | 7 | 56 |
96   | Aug 4 | 77 | 53 | 0.18 | 0.17 | 1.12 | +++ | 7 | 56 |
97   | Aug 5 | 75 | 51 | 0.16 | 0.17 | 0.95 | + | 7 | 56 |
98   | Aug 6 | 80 | 63 | 0.45 | 0.17 | 1.24 | +++++ | 7 | 56 |
99   | Aug 7 | 82 | 68 | 0.41 | 0.17 | 1.48 | +++++++ | 8 | 56 |
100  | Aug 8 | 79 | 64 | 0.16 | 0.17 | 1.31 | +++ | 8 | 56 |
101  | Aug 9 | 81 | 64 | 0.18 | 0.17 | 1.13 | +++ | 8 | 56 |
102  | Aug 10 | 81 | 64 | 1.00 | 0.16 | 0.13 | ++++++++ | 7 | 57 |

### Note
- **Water That Can Be Safely Added**: 0.04 in.
- **If No Rain, You Can Add 1 in. In 20 days**
- **Excess Water To Date**: 5.82 in.
- **Inefficiency Loss To Date**: 1.53 in.

---

[http://www.purdue.edu/agsoftware/irrigation/](http://www.purdue.edu/agsoftware/irrigation/)
**Iris Scheduler- Purdue Agronomy**

2013, Goshen Airport, rain fall 14.5 ″, 110 growing days, May 1 emergence.

Irrigation applications of 0.5″ in June, 0.75 early/mid July, 1.0″ August, 0.5 September

**75%/50% depletion:**
- planting to July 20th - soil allowed to dry to 75% depletion before irrigating.
- July 20th till harvest 55% depletion as threshold to irrigate.

<table>
<thead>
<tr>
<th>Management Practice</th>
<th>Irrigation</th>
<th>Total E.T.</th>
<th>Excess Water</th>
<th>5 day total E.T. July 1-5/August 1-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rain only</td>
<td>0.0</td>
<td>13.5</td>
<td>1.0</td>
<td>0.89″ / 0.65″</td>
</tr>
<tr>
<td>50% depletion</td>
<td>15.2</td>
<td>22.5</td>
<td>5.8</td>
<td>0.91″ / 0.84″</td>
</tr>
<tr>
<td>75%/50% depletion</td>
<td>8.75</td>
<td>19.9</td>
<td>2.5</td>
<td>0.89″ / 0.85″</td>
</tr>
</tbody>
</table>

[http://www.purdue.edu/agsoftware/irrigation/](http://www.purdue.edu/agsoftware/irrigation/)
Irrigation Scheduling

• Method to determine the appropriate amount of water to be applied to a crop at the correct time to achieve healthy plants and conserve water

• Can measure soil moisture

Or

• estimate evapotranspiration (ET) using weather data

Potential ET estimated originally by weighing lysimeter
Weighing Lysimeter

Rain and Irrigation increase weight
Evapotranspiration decrease weight
Avoid elongated internodes:
## Available Water Holding Capacity

**Soybeans rooting depth - 24”**

“Not much room from wet to dry”

<table>
<thead>
<tr>
<th>Soil Type / depth</th>
<th>Bronson</th>
<th>Capac</th>
<th>Oshtemo</th>
<th>Spinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0” to 6”</td>
<td>.84”</td>
<td>1.2”</td>
<td>.75”</td>
<td>.54”</td>
</tr>
<tr>
<td>0” to 6”</td>
<td>.84”</td>
<td>1.2”</td>
<td>.75”</td>
<td>.54”</td>
</tr>
<tr>
<td>6” to 12”</td>
<td>.86”</td>
<td>1.2”</td>
<td>.75”</td>
<td>.54”</td>
</tr>
<tr>
<td>0” to 12”</td>
<td>1.70”</td>
<td>2.4”</td>
<td>1.50”</td>
<td>1.08”</td>
</tr>
<tr>
<td>12” to 18”</td>
<td>.90”</td>
<td>.99”</td>
<td>.87”</td>
<td>.54”</td>
</tr>
<tr>
<td>0” to 18”</td>
<td>2.60”</td>
<td>3.39”</td>
<td>2.37”</td>
<td>1.62”</td>
</tr>
<tr>
<td>18” to 24”</td>
<td>.90”</td>
<td>.99”</td>
<td>.93”</td>
<td>.54”</td>
</tr>
<tr>
<td>0” to 24”</td>
<td>3.50”</td>
<td>4.38”</td>
<td>3.30”</td>
<td>2.16”</td>
</tr>
<tr>
<td>24” to 30”</td>
<td>.58”</td>
<td>.99”</td>
<td>.93”</td>
<td>.42”</td>
</tr>
<tr>
<td>0” to 30”</td>
<td>4.80”</td>
<td>5.37”</td>
<td>4.23”</td>
<td>2.58”</td>
</tr>
<tr>
<td>30” to 36”</td>
<td>.34”</td>
<td>.93”</td>
<td>.86”</td>
<td>.36”</td>
</tr>
<tr>
<td>0” to 36”</td>
<td>5.14”</td>
<td>6.45”</td>
<td>5.06”</td>
<td>2.94”</td>
</tr>
</tbody>
</table>
From Minnesota Extension bulletin “Irrigation Scheduling”, assuming temperature 80-89
### Table 2. Average water use for CORN in inches/day

<table>
<thead>
<tr>
<th>Temperature F</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-59</td>
<td>.01</td>
<td>.02</td>
<td>.03</td>
<td>.04</td>
<td>.05</td>
<td>.06</td>
<td>.08</td>
<td>.09</td>
<td>.10</td>
<td>.10</td>
<td>.10</td>
<td>.09</td>
<td>.07</td>
<td>.06</td>
<td>.05</td>
<td>.04</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>.02</td>
<td>.03</td>
<td>.04</td>
<td>.06</td>
<td>.08</td>
<td>.09</td>
<td>.11</td>
<td>.12</td>
<td>.13</td>
<td>.15</td>
<td>.14</td>
<td>.13</td>
<td>.11</td>
<td>.09</td>
<td>.07</td>
<td>.06</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>70-79</td>
<td>.03</td>
<td>.04</td>
<td>.05</td>
<td>.07</td>
<td>.10</td>
<td>.12</td>
<td>.15</td>
<td>.16</td>
<td>.17</td>
<td>.19</td>
<td>.18</td>
<td>.17</td>
<td>.14</td>
<td>.11</td>
<td>.09</td>
<td>.07</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td>80-89</td>
<td>.03</td>
<td>.05</td>
<td>.07</td>
<td>.09</td>
<td>.13</td>
<td>.15</td>
<td>.18</td>
<td>.20</td>
<td>.22</td>
<td>.24</td>
<td>.23</td>
<td>.22</td>
<td>.21</td>
<td>.17</td>
<td>.14</td>
<td>.11</td>
<td>.09</td>
<td>.06</td>
</tr>
<tr>
<td>90-99</td>
<td>.04</td>
<td>.06</td>
<td>.08</td>
<td>.11</td>
<td>.15</td>
<td>.18</td>
<td>.21</td>
<td>.24</td>
<td>.26</td>
<td>.28</td>
<td>.27</td>
<td>.26</td>
<td>.25</td>
<td>.20</td>
<td>.17</td>
<td>.13</td>
<td>.11</td>
<td>.07</td>
</tr>
</tbody>
</table>

Corn growth stages:
- 3rd leaf
- 8th leaf
- 1st silk
- Blister
- Kernel
- Early dent
- Dent

### Table 3. Average water use for SOYBEANS in inches/day

<table>
<thead>
<tr>
<th>Temperature F</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-59</td>
<td>.02</td>
<td>.02</td>
<td>.04</td>
<td>.04</td>
<td>.06</td>
<td>.07</td>
<td>.08</td>
<td>.09</td>
<td>.09</td>
<td>.09</td>
<td>.08</td>
<td>.07</td>
<td>.05</td>
<td>.05</td>
<td>.03</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>.02</td>
<td>.03</td>
<td>.05</td>
<td>.07</td>
<td>.09</td>
<td>.10</td>
<td>.11</td>
<td>.13</td>
<td>.13</td>
<td>.13</td>
<td>.13</td>
<td>.11</td>
<td>.10</td>
<td>.08</td>
<td>.07</td>
<td>.04</td>
<td>.02</td>
</tr>
<tr>
<td>70-79</td>
<td>.03</td>
<td>.05</td>
<td>.07</td>
<td>.09</td>
<td>.12</td>
<td>.13</td>
<td>.15</td>
<td>.17</td>
<td>.18</td>
<td>.17</td>
<td>.15</td>
<td>.13</td>
<td>.11</td>
<td>.10</td>
<td>.09</td>
<td>.05</td>
<td>.03</td>
</tr>
<tr>
<td>80-89</td>
<td>.04</td>
<td>.06</td>
<td>.10</td>
<td>.13</td>
<td>.16</td>
<td>.19</td>
<td>.20</td>
<td>.21</td>
<td>.22</td>
<td>.22</td>
<td>.21</td>
<td>.18</td>
<td>.16</td>
<td>.13</td>
<td>.11</td>
<td>.06</td>
<td>.03</td>
</tr>
<tr>
<td>90-99</td>
<td>.05</td>
<td>.07</td>
<td>.11</td>
<td>.14</td>
<td>.17</td>
<td>.20</td>
<td>.22</td>
<td>.25</td>
<td>.26</td>
<td>.26</td>
<td>.25</td>
<td>.22</td>
<td>.19</td>
<td>.16</td>
<td>.13</td>
<td>.08</td>
<td>.05</td>
</tr>
</tbody>
</table>

Soybean growth stages:
- 3rd trifoliate
- 1st full flower
- Upper pod filling
- 1st yellow pod
Three factor reducing effective water application

1. Irrigation Runoff
   (comparing irrigation application rate to soil infiltration rate) 0 -30 % loss

2. Lack of system uniformity
   • 5-35% loss in effectiveness

3. Evaporative loss to the air
   • Minimal loss in our humid area
   • 0 – 6%
   • Estimated 4-6% loss in Nebraska
Do I have enough capacity?

- Maximum water use for most crops is 0.27 - 0.32 in./day
- 3 gal/minute/acre pump capacity = 1”/week
- 5 gal/minute/acre pump capacity = 0.25 in./day
- 7 gal/minute/acre pump capacity = 0.33 in./day, 1” every 3 days

500 gal/minute pump can provide 1” every 4 days on 100 acres
Limited Water Supply Irrigation Management

- Diversify the crops sharing the water supply between high and low water use. (? Potato and soybeans ?)
- Diversify the crops sharing the water supply and peak water use times (? corn and soybeans ?)
  - Start irrigating early to bank water ahead. 
    (Soybeans lack rooting depth to make bank ahead work well)

Nebraska limited water plan:
- R3
- R6
- Sizing (soybean seed production concern)
Ideal Irrigation Application Volume

• wet at least top half of root mass
• allow room for a predictable rain fall – 1”
• never wet below the root zone
• large enough to minimize the number of times soil surface and crop are wetted. (save water / reduce disease)

Typical applications:
• May to mid July 0.3” to 0.5”
• July 0.5” to 0.7”
• August 0.7” to 1.0”
• September 0.3” to 0.7”
Irrigate to assure the best plant stand possible. “It’s an ART”

- Irrigate, if necessary, to make sure to get maximum germination and uniform emergence.
- ½ inch in most irrigated soil within five days of planting. Monitor crusting issues.
- Maintain a moist surface, 0.10” to 0.20” applications, (rotary hoe if necessary).

Are you ready to irrigate the day you plant?
Using irrigation to get the most from pesticides and nutrients

Timely application of irrigation water:

• Improves incorporation of herbicides.
• Improves activation of herbicides.
• Humid irrigated environment slow some insects.
• Reduces nitrogen volatilization.
• Maximizes yield to utilize the resources.

(Water stressed weed to get better glyphosate kill)
Monitoring soil wetted front -12 hrs. after irrigation

If your 1” application did not go down as far as it did last week ???
- your irrigation is not keeping up.
Scheduling by comparison

Irrigated portion of field should look better than the dry corners/area

Over water observation area should not look significantly better than the adjacent irrigated portion of field.

Probe and compare:
- Dry corners
- Over irrigated
- Normal irrigated field

- Soaker hose attached at pivot point
- 100% higher output sprinkler
Too much water and/or N can lead to White Mold concerns
Minimize overlap
Minimize dry corners

Overlap and dry corners are bad for the environment and your profits.
Lodging and knock down issue vary greatly with gun design.
### Estimated Annual Irrigation cost/acre, 10 yr. at 7” of irrigation

From [http://www.msue.msu.edu/stjoseph](http://www.msue.msu.edu/stjoseph) 12/2013 survey of five irrigation suppliers

<table>
<thead>
<tr>
<th>Type of System</th>
<th>Ownership cost</th>
<th>Operating cost</th>
<th>Total Cost / Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 Acre Center Pivot</td>
<td>100.70</td>
<td>33.25</td>
<td>$133.32</td>
</tr>
<tr>
<td>Corner Arm System 160 Field</td>
<td>100.74</td>
<td>33.25</td>
<td>$133.99</td>
</tr>
<tr>
<td>Traveler System Soft Hose</td>
<td>99.56</td>
<td>70.00</td>
<td>$187.06</td>
</tr>
<tr>
<td>40 Acre Two Circle Towable System</td>
<td>149.43</td>
<td>38.50</td>
<td>$187.93</td>
</tr>
<tr>
<td>160 Acre Drag Pod</td>
<td>133.70</td>
<td>45.50</td>
<td>$196.70</td>
</tr>
<tr>
<td>Single Tower Towable, 5 circles</td>
<td>148.33</td>
<td>45.50</td>
<td>$197.33</td>
</tr>
<tr>
<td>Traveler System Hard Hose</td>
<td>125.69</td>
<td>70.00</td>
<td>$213.19</td>
</tr>
<tr>
<td>80 Acre Center Pivot</td>
<td>208.65</td>
<td>33.25</td>
<td>$241.90</td>
</tr>
<tr>
<td>40 Acre Center Pivot</td>
<td>241.51</td>
<td>33.25</td>
<td>$274.76</td>
</tr>
</tbody>
</table>
What is your cost to Irrigate?
Energy + Labor
For many one bu. increase would pay for 2-3” of irrigation

Indiana Average energy cost / acre” = $3.50

Extremely variable - ($1.67 to $14.70)

Cost per acre inch of irrigation water - Average fuel cost for pumping NE.

<table>
<thead>
<tr>
<th>Energy source Pressure</th>
<th>Electric</th>
<th>Diesel / propane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low &lt;35 psi</td>
<td>$1.76</td>
<td>$2.56 / 2.30</td>
</tr>
<tr>
<td>Med. 35 to 95 psi</td>
<td>$2.48</td>
<td>$3.76 / 3.27</td>
</tr>
<tr>
<td>High &gt;100psi</td>
<td>$3.56</td>
<td>$4.87 / 3.90</td>
</tr>
</tbody>
</table>

2007 census of Agriculture