Soybean Yield

- Seed Number x Seed Size = Yield
- Plants/A x Pods/Plant x Seeds/Pod = Seed Number
- Seeds/lb x lb/bu = Seed Size
### Soybean Yield

<table>
<thead>
<tr>
<th>Plants /A</th>
<th>Pods/Plant</th>
<th>Seeds/Pod</th>
<th>Seed Size, seeds/lb</th>
<th>Test Weight, lb/bu</th>
<th>Yield, lb/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>((140,000 \times 40 \times 2.5 )) / (5,000 \times 60)</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>((140,000 \times 60 \times 2.5 )) / (5,000 \times 60)</td>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>((140,000 \times 40 \times 2.5 )) / (4,000 \times 60)</td>
<td>58</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>((140,000 \times 60 \times 2.5 )) / (4,000 \times 60)</td>
<td>88</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plants /A</th>
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<th>Yield, lb/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>((140,000 \times 40 \times 2.5 )) / (5,000 \times 60)</td>
<td>47</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>((140,000 \times 83 \times 2.5 )) / (3,000 \times 60)</td>
<td>161</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>((140,000 \times 88 \times 2.5 )) / (3,000 \times 60)</td>
<td>171</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Common practices of high yield soybean plots

- Irrigate
- Manure
- Fertigate, including N
- Fungicide
- Insecticide
- Other products mentioned
  - Inoculants
  - Stimulants
  - Stress reducers
  - Stress inducers
  - Sugar

108.759 bu/A

- Perry Galloway
- Pioneer 46T21 RR
- 4/30/15
- 140,000 seeds/A
- 38 inch twin rows
- Dubbs soil
- PPST, Graph EX SA
- 2 tons poultry litter

- BioForge, Ureamate, Sugar Mover
- Valor, Gramoxone
- Pre-Fix, Dual, Blazer
- Lambda, Prevathon
- Priaxor, Quadris Top
- 6 x furrow irrigation
- Paraquat 0.5 pt/A

Chicken Litter: 55-55-45 (Highly variable)
108.717 bu/A

- Matt Miles
- Pioneer 47T46 RR
- 4/7/15
- 160,000 seeds/A
- 38 inch twin
- Silt loam soil
- Cruiser Max
- 1.75 T Chicken Litter, 150 lb K₂O/A, AMS at R3

- Leadoff, Touchdown
- Verdict, Touchdown
- Prefix, Touchdown
- Tundra, Acephate
- Priaxor, twice
- Furrow irrigation, 7x
- Salt + Sharpen harvest aid

Chicken Litter: 55-55-45
(Highly variable)

Soybean Seed Nitrogen Removal

<table>
<thead>
<tr>
<th>Yield, Bu/A</th>
<th>N</th>
<th>P2O5</th>
<th>K2O</th>
<th>Zn</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>90</td>
<td>33</td>
<td>66</td>
<td>99</td>
<td>132</td>
</tr>
<tr>
<td>60</td>
<td>180</td>
<td>180</td>
<td>270</td>
<td>165</td>
<td>450</td>
</tr>
<tr>
<td>90</td>
<td>360</td>
<td>360</td>
<td>360</td>
<td>132</td>
<td>450</td>
</tr>
<tr>
<td>120</td>
<td>360</td>
<td>360</td>
<td>360</td>
<td>132</td>
<td>450</td>
</tr>
<tr>
<td>150</td>
<td>450</td>
<td>450</td>
<td>450</td>
<td>132</td>
<td>450</td>
</tr>
</tbody>
</table>
Soybean Yield Limitations
My Opinion on Main Factors

1. Lack of water during seed fill
2. Soil Compaction
3. Potassium (K) deficiency
4. Weeds too big
5. Second fiddle to corn
6. SCN
7. Frogeye Leaf Spot

8. Delta Soils: too much water in the spring

High yield system

1. Productive soils (deep, adequate fertility, no compaction)
2. Adequate, timely rainfall (or irrigation)
3. Excellent genetics
4. Rotating crops
5. Planting on time (not necessarily early)
6. Planting in narrow rows (20 inches or less)
7. Adequate Population, but not overly excessive
8. Capturing 95% sunlight at by about R1
9. Getting excellent weed control (no trophy-hunting)
10. Scouting for diseases and pests
Agronomic Maximization of Soybean Yield and Quality
USB 1 “SOYA”: Systematic Optimization of Yield-Enhancing Applications

• Seed Treatements (ST):
  – Untreated control (UTC)
  – Fungicide seed treatment (Fung ST) ➔ Acceleron® (45ml/100 lb)
  – Fung ST + Insecticide ST + Nematicide & Biological ST
    ➔ Acceleron™ IX-409 (w/ Imidacloprid) (118ml/100 lb) + Poncho®/VOTIVO® (P/V) (59ml/100 lb)
  – Fung ST + Insecticide ST + Nematicide & Biological ST + LCO ST + LCO (at V4-V6) ➔ Acceleron™ IX-409 (w/ Imidacloprid) (118ml/100 lb) + P/V® (59ml/100 lb) + Optimize® (83ml/100 lb) + Ratchet™ (4oz/a)

• FOLIAR OR OTHER TREATMENTS:
  – Nitrogen ➔ Urea (75 lb/a) w/ Agrotain (3 qt/ton) + ESN® (75 lb/a) @ V4
  – Defoliant ➔ Cobra® (12 fl oz/a) @ V4
  – Foliar fertilizer ➔ Task Force®2 (64 fl oz/a) @ R1
  – Antioxidant ➔ Bio-Forge® (16 fl oz/a) @ R3
  – Foliar fungicide ➔ Headline® (6 fl oz/a) @ R3
  – Foliar insecticide ➔ Warrior II® (1.92 fl oz/a) @ R3
    • F and I - Priaxor and Endigo in 2013 and 2014
USB 1 “SOYA”: Systematic Optimization of Yield-Enhancing Applications

• COMBINATION TREATMENTS:
  – SOYA Complete
  – SOYA plus Defoliant @ V4
  – SOYA without Nitrogen
  – SOYA without Foliar fungicide
  – SOYA without Foliar fungicide & insecticide

Summary

• 60 total site years of data
  – 28 showed significant treatment effects
    • 2012- 5 locations
    • 2013- 11 locations
    • 2014- 12 locations
  – North: 15 out of 21 responsive site-years
  – Central: 5 out of 18 responsive site-years
  – South: 8 out of 22 responsive site-years
High-Yield Environments (>75.9 Bu/A)

*Red bars indicate statistically greater than UTC at p ≤ 0.05

Average Yielding Environments (n = 46)

Red bars indicate statistically greater than UTC at p ≤ 0.05
Conclusions SOYA Study #1

- Seed treatment and early season products show little value in increasing soybean yield
- Benefit from foliar insecticide and fungicide were greatest in the north
- There did not appear to be a yield level x management interaction
  - Higher yielding environments may not see additional benefit from intensive management
High yield system

1. Productive soils (deep, adequate fertility, no compaction)
2. Adequate, timely rainfall (or irrigation)
3. Using good genetics
4. Rotating crops
5. Planting on time (not necessarily early)
6. Planting in narrow rows (20 inches or less)
7. Adequate Population, but not overly excessive
8. Capturing 95% sunlight at by about R1
9. Getting excellent weed control (no trophy-hunting)
10. Scouting for diseases and pests

USB 2: Variety x management interactions

- Objectives:
  - Determine if cultivar selection interacts with input level
    - Does cultivar selection dictate which inputs to use?
  - Quantify input effects on yield components
**Treatments**

- **6 cultivars**
  - High-yield potential suitable for each location
- **3 input levels:**
  1. **Standard practice (UTC)**
     - University recommendations for fertilizer and weed control
     - No other external inputs
  2. **SOYA complete**
     - “complete” seed treatment
     - Ratchet® + nitrogen fertilizer @ V4
     - Foliar fertilizer @ R1
     - BioForge®, foliar fungicide, foliar insecticide @ R3
  3. **SOYA minus foliar fungicide**

---

**2012-2014 Yield**

[Bar chart showing yield comparisons between Standard practice, SOYA complete, and SOYA minus foliar fungicide.]

Columns with the same letter are not statistically different at $P \leq 0.05$.
SOYA Study #2 Preliminary Conclusions

• A good cultivar is a good cultivar.
  – Cultivar interacted w/ management at less than 6% of the sites.
• Biggest yield increase to SOYA in the northern region.
• Yield increases were from BOTH seed number AND seed size.

USB 3: Population x management interactions

• Objective:
  – Is there an interaction between soybean population and management
    • Do high-input systems require higher plant populations to maximize yield?
      -or-
    • Can high-input systems compensate for a low plant population?
**Analysis**

- Harvest plant populations were used for analysis
- Yield was standardized as a % of the maximum for each environment
  - 56 Environments total
- The “yield environment” variable was determined by comparison of location the mean to the grand mean (High>1 Std. Dev, Average±1 Std. Dev., Low<1 Std. Dev.)
- Mixed analysis was conducted to determine the effects of yield environment, population and management
  - SAS V9.3 (P<0.05)

### 2012-2014 Average Yield Env.

(43 Envs.)

- UTC: %Max=0.7916(1-e^{-0.000059\times}) R^2= 0.98
- SOYA: %Max=0.8524(1-e^{-0.000059\times}) R^2= 0.98

- 95% - 50775 ppa
- 99% - 78053 ppa
Harvest Plant Population (PPA)

% of Max Yield

2012-2014 High Yield Env. (8 Envs.)

%Max=0.8644(1-e^(-0.000062x)) R²= 0.99

95% - 48318 ppa
99% - 74276 ppa

Grouping  N  95% of Max  99% of Max

<table>
<thead>
<tr>
<th>Grouping</th>
<th>N</th>
<th>95% of Max</th>
<th>99% of Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Yield</td>
<td>8</td>
<td>48,000</td>
<td>74,000</td>
</tr>
<tr>
<td>Average</td>
<td>43</td>
<td>51,000</td>
<td>78,000</td>
</tr>
<tr>
<td>Low Yield</td>
<td>5</td>
<td>88,000</td>
<td>135,000</td>
</tr>
<tr>
<td>Responsive</td>
<td>17</td>
<td>UTC</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SOYA</td>
<td>53,000</td>
</tr>
</tbody>
</table>

Populations rounded to the nearest thousand.
SOYA Study#3 Conclusions

• No interaction between population and management
  – Separate analysis of 17 management responsive sites confirmed no interaction between population and management
• High yield environments achieved maximum yields at only slightly lower plant stands in comparison to average yield environments
  – 99% of Maximum at 74K compared with 78K (High and Average)
• Yield response to population was very small (non-existent) in low yielding environments indicating the presence of other yield limiting factors

Evaluation of Soybean Stress and Yield

Gary L. Gregg, Chad D. Lee, and John Orlowski
University of Kentucky | Department of Plant and Soil Sciences
Lexington, Kentucky
### 2012 Soybean Response to Various Herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate</th>
<th>Timing</th>
<th>Yield</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>untreated</td>
<td>......</td>
<td>.......</td>
<td>58.7</td>
<td>NS</td>
</tr>
<tr>
<td>Cobra 1x</td>
<td>V4</td>
<td>61.8</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Cobra 2x</td>
<td>V4</td>
<td>60.5</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Reflex 2x</td>
<td>V4</td>
<td>59.7</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Blazer 2x</td>
<td>V4</td>
<td>62.7</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Cobra 1x</td>
<td>V2</td>
<td>66.7</td>
<td>0.004</td>
<td>****</td>
</tr>
<tr>
<td>meristem removal</td>
<td>V4</td>
<td>58.2</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

Data averaged over 2 locations: Spindletop Farm, Lexington and LaRue County, KY, 2012.

---

### Experiment Design

- **Two Years:** 2013 & 2014
- **Three Locations**
  - Lexington (Spindletop Research Farm)
  - LaRue Co.
  - Princeton (UKREC)
- **Two Maturity Groups**
  - 2.8 RM
  - 4.5 RM
- **14 different treatments**
Results, 2013-2014, 6 site-years, 2 maturity groups

Yield Environment x Treatment Interactions

* = treatments significantly different from the UTC, $p < 0.10$

Discussion

• Treatment
  – Light interception equal during reproductive growth
    • 2013, R3, Hodgenville
      – 26 DAT, 2.8 RM
      – 33 DAT, 4.5 RM
    • 2013, R3, Lexington
      – 26 DAT, 2.8 RM
      – 34 DAT, 4.5 RM
    • Lee, et al., 2008
  – Lack of late season stress
    • Very low pressure from insects and disease
Conclusion: 2 seasons with good rainfall, reasonable temperatures

• Early season stress ineffective for increasing yield

• Attempting to relieve early season stress was ineffective for increasing yield

• Prescribed application of fungicide and insecticide was ineffective for increasing yield