Diversifying Soybean Production Risk Using Maturity Group and Planting Date

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Diversifying Soybean Production Risk Using Maturity Group and Planting Date

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Introduction

- A long planting window for soybeans leads to a large range of planting date (PD) and soybean maturity (MG) choices. Soybean cultivars are grouped by MG to reflect different time requirements until harvest.
- Early planting often results in greater expected returns but increases return risk for producers (drought avoidance and early to market)
- Optimization of risk-return options can be pursued using portfolio theory where the cost of risk reduction associated with a producer moving from a return-maximizing MG × PD combination to a planting portfolio with less risk can be quantified by estimating an efficient frontier where returns are maximized subject to a given level of risk
- Data from planting date trials using soybean from MG III to VI across nine locations are used to show risk-return “tradeoffs” for MG and PD

Objectives

- Demonstrate production risk reduction by diversifying from the profit-maximizing MG × PD choice to a portfolio of several MG × PD
- Illustrate similarities and differences in risk-return tradeoffs across nine locations with variation in production environment

Samples of MG × PD Choices in Risk-Return Space Along with Efficient Frontiers across Select Environments

Data

- Seven locations in '12 and nine locations in '13 & '14
- Four cultivars per MG III, IV, V and VI at each location and each year
- Location latitudes ranged from 30.6°N to 38.9°N
- Four PD with two middle PD spaced as evenly as possible between earliest and latest PD typical PD for a particular location
- Soil water deficits calculated using weather data from each location, with soil-specific deficit thresholds trigger irrigation applied

Seed yield, oil and protein concentration are tracked to measure quantity and quality of production in conjunction with a seasonally adjusted 10 yr avg soybean, soybean oil and meal prices.

Methods

- Using yield, harvest week, oil and protein concentration, irrigation amount and other production cost that did not vary by location, MG or PD, producer returns were estimated for approx. 7,250 plot obs.
- Sixteen MG × PD choices were aggregated across years by location (A)
- Possible portfolio risk among sixteen MG × PD choices was minimized using quadratic programing and an efficient frontier was mapped (B)
- A mid-variance point on the efficient frontier, \( V_{MID} \), was solved for to compare risk reduction costs across location

Results & Discussion

- Observations reaching harvest maturity before the 37th wk of the year received a premium based on seasonal price effect
- Early planting resulted in higher average producer risk

### Results & Discussion

<table>
<thead>
<tr>
<th>Location</th>
<th>Yield (Mg-ha⁻¹)</th>
<th>Harvest Week</th>
<th>PAdj Oil and Protein</th>
<th>Expected Returns (Ea)</th>
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</thead>
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<tr>
<td>Columbia, MO</td>
<td>2.2</td>
<td>2.2</td>
<td>$878 $286</td>
<td>$131 $313</td>
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<tr>
<td>Portageville, MO</td>
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<td>$863 $266</td>
<td>$134 $314</td>
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<td>Milan, TN</td>
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<td>$74 $142</td>
<td>$113 $222</td>
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<tr>
<td>Keiser, AR</td>
<td>1.4</td>
<td>1.4</td>
<td>$116 $222</td>
<td>$163 $318</td>
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<tr>
<td>Verona, MS</td>
<td>1.8</td>
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<td>$146 $287</td>
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<tr>
<td>Rohwer, AR</td>
<td>2.3</td>
<td>2.3</td>
<td>$170 $364</td>
<td>$217 $412</td>
</tr>
</tbody>
</table>

For the most part, early-planted MG III and IV were more profitable and received a premium based on seasonal price effect

Future Work

- Interactive decision tool utilizing simulated data with multiple constraints to make recommendations across a greater range of choices
- Include effects of seed grade on MG × PD choice

Legend

- Efficient Frontier
- E Minimizing Frontier
- PD1 MG III
- PD2 MG III
- PD3 MG III
- PD4 MG III
- PD1 MG IV
- PD2 MG IV
- PD3 MG IV
- PD4 MG IV
- VMid
- Average E & V

Acknowledgment

- The authors of this poster gratefully acknowledge financial support for this research from the United Soybean Board and the U.S. Midsouth Soybean Board

### References


### Additional Notes

- For the most part, early-planted MG III and IV were more profitable and received a premium based on seasonal price effect
- Early planting resulted in higher average producer risk

### Table

<table>
<thead>
<tr>
<th>Location</th>
<th>MG</th>
<th>PD</th>
<th>PAdj Oil and Protein</th>
<th>Expected Returns (Ea)</th>
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<td>VI</td>
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<td>$170 $364</td>
<td>$217 $412</td>
</tr>
</tbody>
</table>

### Figures

- Figures A, B, C, and D illustrate the efficient frontier and corresponding risk-return tradeoffs for different MG × PD combinations.

### Images

- Images 747x362 to 786x392 and 975x48 to 2023x296 depict graphs and charts illustrating the results and discussions.