Emergence Uniformity in Corn: Is it Essential for Ear Size Consistency and Improved Yield?

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Accepted Hypothesis:

- Delayed Seedling Emergence
- Shorter Plants
- \( \uparrow \) Delayed Silk Emergence
- \( \uparrow \) Delayed Maturity
- Smaller ears at harvest

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Previous Research on Emergence

- Part of the stand planted 7-21 days later ↓ Yield 5-22%

Source: Nafziger et al. (1991), Ford & Hicks (1992)

- Effects of Emergence variability amongst plants planted on the same day ??????
E. Nafziger Coated Seed Study, 1999

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Yield Evaluation in Research?

Plot Combine

Individual Plant?

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Experimental Design & Methodology (2000-2001)

- **Design:** Split-plot design, 4 replications
- **Soil:** Drummers, silty clay loam, 3 to 4.5 % O.M.
- **Tillage System:** No-till
- **Rotation:** Corn/soybeans
- **Hybrids:** Fielder’s Choice 9307 & 8509 (106 and 109 days RM)
- **Planting Population:** 80,000 seeds/ha
Experimental Design in Year 2000

<table>
<thead>
<tr>
<th>Coating</th>
<th>UTC (Control)</th>
<th>Coating A 2% of seed weight</th>
<th>Coating B 3% of seed weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hybrid 8509</td>
<td>Hybrid 9307</td>
<td>Hybrid 8509</td>
<td>Hybrid 9307</td>
</tr>
</tbody>
</table>

**Planting Date**
- March 28
- April 14
- May 16

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Experimental Design in Year 2001

Planting Date

- April 2
  - UTC Control
    - Hybrid 8509
    - Hybrid 9307
  - Coating C
    - 2% of seed weight
    - Hybrid 9307
- April 19
  - Hybrid 8509
  - Hybrid 9307
- May 11
  - Hybrid 8509
  - Hybrid 9307

Coating D
- 2.5% of seed weight
- Hybrid 8509
- Hybrid 9307

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Measurements

- Daily emergence counts (0 to 100%).
- Plant populations (emergence & harvest).
- Plants heights and V-stages (4-6 & 6-8 weeks).
- Daily silk emergence (0 to 100 %).
- Grain yield.
Measurements

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Results
Emergence Profile

Planting Date: March 28, 2000

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Days to 50% Emergence in 2000

Hybrid 9307

Hybrid 8509

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Days from 10 to 90 % Emergence in 2000

Hybrid 9307

Hybrid 8509

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Days to 50% Emergence in 2001

Hybrid 9307

Hybrid 8509

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Days from 10 to 90% Emergence in 2001

Hybrid 9307

Hybrid 8509

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Population after complete emergence in 2000

Hybrid 9307

<table>
<thead>
<tr>
<th>Planting Date</th>
<th>UTC</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-Mar</td>
<td>67</td>
<td>71</td>
<td>72</td>
</tr>
<tr>
<td>14-Apr</td>
<td>71</td>
<td>71</td>
<td>70</td>
</tr>
<tr>
<td>16-May</td>
<td>66</td>
<td>68</td>
<td>66</td>
</tr>
</tbody>
</table>

Hybrid 8509

<table>
<thead>
<tr>
<th>Planting Date</th>
<th>UTC</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>28-Mar</td>
<td>77</td>
<td>76</td>
<td>75</td>
</tr>
<tr>
<td>14-Apr</td>
<td>78</td>
<td>79</td>
<td>78</td>
</tr>
<tr>
<td>16-May</td>
<td>75</td>
<td>73</td>
<td>75</td>
</tr>
</tbody>
</table>
2000 Grain Yields

Hybrid 9307

- UTC
- A
- B

Hybrid 8509

- UTC
- A
- B

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2001 Grain Yields

**Treatment Comparisons**

<table>
<thead>
<tr>
<th>Hybrid 9307</th>
<th>Hybrid 8509</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Within Hybrid 9307</strong></td>
<td><strong>Within Hybrid 8509</strong></td>
</tr>
<tr>
<td>PD 1 (C) vs PD 2 (UTC)</td>
<td>****</td>
</tr>
<tr>
<td>PD 1 (D) vs PD 2 (UTC)</td>
<td>*</td>
</tr>
<tr>
<td>PD 1 (UTC) vs PD 2 (UTC)</td>
<td>**</td>
</tr>
</tbody>
</table>

*, ** significant at 0.05 and 0.01 probability levels, respectively.

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Analysis of Individual Plant Data

1 Simple Linear Regression per Plot:

2000 = 3 PD x 2 Hybrids x 3 Coat.Treat. x 4 Reps = 72 plots

2001 = 3 PD x 5 Treat x 4 Reps = 60 plots
Linear Regressions of Individual Plant Yield for Early Planting in 2000

9307 UTC

- For Relative emergence time (days):
  - $y = -7.0274x + 185.35$
  - $R^2 = 0.1778$

- For Relative silking time (days):
  - $y = -0.7286x + 170.99$
  - $R^2 = 0.0014$

8509 UTC

- For Relative emergence time (days):
  - $y = -3.4173x + 163.99$
  - $R^2 = 0.1178$

- For Relative silking time (days):
  - $y = -2.4322x + 156.44$
  - $R^2 = 0.0395$

- For Final height (cm):
  - $y = 1.267x - 201.42$
  - $R^2 = 0.3044$

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Yield as a function of “x” (2000-2001)

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Significant Regressions (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>2000</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative emergence time</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>Relative silking time</td>
<td>46</td>
<td>63</td>
</tr>
<tr>
<td>Final Height</td>
<td>60</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2001</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative emergence time</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Relative silking time</td>
<td>38</td>
<td>54</td>
</tr>
<tr>
<td>Final Height</td>
<td>32</td>
<td>47</td>
</tr>
</tbody>
</table>

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Emergence Time in 2003
(average of 3 hybrids at West Lafayette)

Days from planting

Sd=2.0
Sd=2.5
Sd=1.4

Mar. 27 4-Apr 23-Apr

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Maximum and Minimum Soil Temperatures after Planting in 2003 (West Lafayette)

First planting March 27
Second planting April 3
Third planting April 23

Temperature (F)

25 35 45 55 65 75 85

28-Mar 4-Apr 11-Apr 18-Apr 25-Apr 2-May 9-May 16-May
Planting Date Effects on Corn Yield in 2003
(mean of 3 hybrids at West Lafayette)

Grain Yield
bu/acre

Mar. 27  4-Apr  23-Apr

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Relative Emergence for each Plant on each Planting Date

- Emergence Date for Plant – Mean for Emergence Date
- Standard Deviation for Emergence
Ear Yield vs. Relative Seedling Emergence

![Graph showing ear yield vs. relative seedling emergence with data points and linear trend lines for different planting dates. The R-squared values for each trend line are R² = 0.0075, R² = 0.0109, and R² = 0.0396.](image-url)

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Time to Silking vs. Relative Seedling Emergence

R2 = 0.0568

R2 = 0.045

R2 = 0.0044

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Yield vs. Relative Plant Spacing

\[ R^2 = 0.1258 \]

\[ R^2 = 0.0919 \]

\[ R^2 = 0.0911 \]

Planting Date 1
Planting Date 2
Planting Date 3

Linear (Planting Date 1)
Linear (Planting Date 2)
Linear (Planting Date 3)
Plant Grain Moisture vs. Relative Emergence

R² = 0.0377
R² = 0.0378
R² = 0.003

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Grain Moisture vs. Relative Time to Silk

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Individual Grain Yield vs. Relative Silking

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Consistency of Resource Availability in High Population Environments?

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Tentative Conclusions:

For consistent individual ear weights and high yields we need to make sure “No Plant Left Behind!”

Effect

- Emergence date

+ Silking Date & Plant Height
Implications:

- **Concern for emergence uniformity is overrated!**
- Although uniform seeding depth and seed placement are still desirable, it is more important to establish environments which lead to uniform growth and development of adjacent plants after emergence.
- **What can be done to insure all plants have uniform access to resources within the row?**
Acknowledgments

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