Wisconsin Regional Corn Conferences
1998

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Wisconsin Corn Growers Association
University of Wisconsin - Madison
10 Keys to Increased Corn Yield & Profitability

- Establish realistic corn performance goals
- Soil test and add fertilizer, if needed
- Hybrid selection
- Plant quality seed that is treated
- Rotation
- Plant early
- Use narrow rows
- Optimize seeding rate
- Control weeds
- Harvest carefully

Lauer, 1997
## 1997 Wisconsin Corn Hybrid Performance Trial Summary

<table>
<thead>
<tr>
<th></th>
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<td>Marshfield</td>
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<td>165</td>
<td>160</td>
<td>---</td>
<td>93</td>
<td>123</td>
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<td>Seymour</td>
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<td>Valders</td>
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<td>Spooner</td>
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<td>149</td>
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<td>127</td>
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<td>118</td>
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<tr>
<td>White Lake</td>
<td>68</td>
<td>101</td>
<td>65</td>
<td>47</td>
<td>63</td>
<td>87</td>
</tr>
</tbody>
</table>


White Lake average includes Antigo, 1987

Lauer, 1997
Specialty Corns

Marketing niches
- Amylomaize (high amylose)
- Waxy corn
- High-protein (lysine) corn
- High-oil corn
- White & Yellow Food corn
- HAP corn (high available P)
- Silage corn
- Sweet corn
- Popcorn

Management tools
- Imidazolinone resistant or tolerant (“IT/IR”)
- Sethoxydim resistant (“SR”)
- Glufosinate resistant (“Liberty Link”)
- “B.t.”
- Glyphosate resistant (“Round-up Ready”)

Lauer, 1997
"Yield lag" versus "Yield drag"

- **Yield lag (time factor)**
  - specialty traits not yet incorporated into the best inbreds of a seed company

- **Yield drag (bad genes)**
  - specialty traits causing yields to be lower regardless of genetic background

Lauer, 1997

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UW-Madison
High Amylopectin Corn
"Waxy corn"

- Single recessive gene
- Current production: 80 million bushels on 700,000 acres
- Value-added traits: Amylopectin: branched chain starch = 100%
  amylopectin (dent corn = 75%)
  - retrogrades back to crystalline form slowly
  - livestock feed
- Key problems
  - slightly reduced yields: 5%
Yield of “waxy” hybrids in Wisconsin trials

Lauer, 1997
High-oil Corn
"Energy-dense corn"

- Quantitative genes
- Current production: 26 million bushels on 200,000 acres
- Value-added traits
  - high-oil corn = >6% oil content (dent corn = 3.5 to 5%)
  - enhanced source of corn oil in margarine and oils
  - increased energy per unit of feed
- Key problems
  - reduced grain yield: 5 to 10%
  - increased moisture content at harvest
  - environment influences total oil content

Lauer, 1997
High Available Phosphorous / Low phytate
“HAP Corn”

- Single gene
- No current production
- Value-added traits: phosphorous more readily available to monogastric animals
  - less environmental pollution from manure
  - low phytic acid concentrate chelates less minerals
- Key problems
  - reduced grain yield: 10 to 20%

Lauer, 1997
Corn hybrid silage yield and quality in the south central production zone of Wisconsin.

Lauer, 1997

WCGA
UW-Madison
Yield of “IT/IR” hybrids in Wisconsin trials

Lauer, 1997

WCGA
UW-Madison
Yield of “SR” hybrids in Wisconsin trials

Frequency (%)

Above trial mean
Below trial mean

Top hybrids = 0%
n = 24

Lauer, 1997
Yield of “Liberty Link” hybrids in Wisconsin

Yield distribution in 1997:
- Above trial mean: 50%
- Below trial mean: 50%

Top hybrids = 11%

n = 18

Lauer, 1997

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UW-Madison
Yield of “Bt” hybrids in Wisconsin trials

Lauer, 1997

Top hybrids = 17%

n = 108

WCGA
UW-Madison
## Bt corn registrations as of January, 1997

<table>
<thead>
<tr>
<th>Company</th>
<th>Event</th>
<th>Protein</th>
<th>Brand</th>
<th>Refugia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciba/Mycogen</td>
<td>176</td>
<td>CryIA(b)</td>
<td>Maximizer</td>
<td>Suggested</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NatureGard</td>
<td></td>
</tr>
<tr>
<td>Northrup King</td>
<td>Bt11</td>
<td>CryIA(b)</td>
<td>YieldGard</td>
<td>Suggested</td>
</tr>
<tr>
<td>Monsanto</td>
<td>MON810</td>
<td>CryIA(b)</td>
<td>YieldGard *</td>
<td>Agreement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5% acres</td>
</tr>
<tr>
<td>DeKalb</td>
<td>DBT418</td>
<td>CryIA(c)</td>
<td>Bt-Xtra</td>
<td>5% acres</td>
</tr>
<tr>
<td>PGS/AgrEvo</td>
<td>Pending</td>
<td>Cry9(c)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Supplemental distributors: Cargill, DeKalb, Golden Harvest, ICI/Garst, Pioneer

Lauer, 1997
How good are you at picking top corn hybrids?

![Bar chart showing frequency of picking top corn hybrids](chart.png)

- Frequency (%)
- Above trial average
- Below trial average

Lauer, 1997

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Hybrid Selection Decisions

- Use **multi-environment** average data (wide range of locations and climates)
  - Begin with trials in zones nearest your farm
  - Compare hybrids with similar maturities within a trial
  - Compare performance in other unbiased trials
- Evaluate **consistency** of performance across environments
- Consider hybrid performance for other traits, i.e. standability, dry-down rate, grain quality, etc.
- **You are taking a tremendous gamble if basing your decision on one or two local test plots.**

Lauer, 1997
SELECT 97

A program for choosing crop varieties

http://corn.agronomy.wisc.edu

Lauer, 1997
Use **Multi-Environment** information to evaluate:
- Grain yield
- Moisture and maturity
- Standability

Use **Single- Environment** information to evaluate:
- Consistency of performance
- Test weight
- Dry-down rate
- Grain quality
- Ease of combine-shelling or picking

Lauer, 1997
Yield advantage of moldboard and chisel plow over no-till in Wisconsin

Derived from unpublished data Mueller et al. and Carter et al. (1980 to 1993)
Lauer, 1997

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UW-Madison
Materials and Methods

- **Fall Tillage**
  - 1) Control: None
  - 2) "Zone-builder"

- **Spring Tillage**
  - 1) 1 coulter
  - 2) 2 coulters; chisel
  - 3) 3 coulters

- **N Placement**
  - 1) 2" x 2"
  - 2) 2" x 15"

- **P & K Application Timing**
  - 1) Fall injected
  - 2) Spring
  - 3) None

Lauer, 1997
Grain yield response to fall and spring tillage in Wisconsin during 1995 and 1996

Grain yield (bu/A)

Chisel plow  Three coulters  One coulter

Spring tillage

Chisel plow  Three coulters  One coulter

Fall tillage

None  "Zone Builder"

Lauer, 1997

LSD(0.05)= 11

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Efficacy of Corn Seed Treatments

<table>
<thead>
<tr>
<th>Disease</th>
<th>Captan</th>
<th>Maxim</th>
<th>Apron</th>
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<tbody>
<tr>
<td>Rhizoctonia</td>
<td>G</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Fusarium</td>
<td>G</td>
<td>E</td>
<td>P</td>
</tr>
<tr>
<td>Pythium</td>
<td>P</td>
<td>P</td>
<td>E</td>
</tr>
<tr>
<td>Helminthosporium</td>
<td>G</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Penicillium</td>
<td>G</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Aspergillus</td>
<td>G</td>
<td>G</td>
<td>P</td>
</tr>
</tbody>
</table>

*derived from Pedersen, U. of Illinois*

Lauer, 1997
Seed Treatment Effect on Corn Plant Density After Initial Planting Rate of 32,000 seeds/A

1994-1996 LSD(0.05) = 4,700

Lauer, 1997
Corn Grain Yield Response to Seed Treatment

1994-1996

LSD(0.05) = 19

Grain yield (bu/A)

0 40 80 120 160

Captan  Captan+Apron  Maxim+Apron  Control

Lauer, 1997
Corn seed treatment effect on plant density in 1997

Lauer, 1997
Corn seed treatment yield response in 1997

Arlington
- Captan+Apron: 180
- Maxim+Apron: 185
- UTC: 11

Fond du Lac
- Captan+Apron: 170
- Maxim+Apron: 175
- UTC: NS

Janesville
- Captan+Apron: 165
- Maxim+Apron: 170
- UTC: 11

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Plant Arrangement in the Field

Square

- Between plants = 14.5 in
- Between rows = 14.5 in
- Plants per acre = 30,000

Hexagon

- Between plants = 14.5 in
- Between rows = 14.5 in
- Plants per acre = 30,000

Lauer, 1997
## Plant spacing for various plant densities and row spacings.

<table>
<thead>
<tr>
<th>Plant density plants/A</th>
<th>Row spacing inches between plants</th>
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<tbody>
<tr>
<td></td>
<td>30-in.</td>
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<tr>
<td>25000</td>
<td>8.4</td>
</tr>
<tr>
<td>30000</td>
<td>7.0</td>
</tr>
<tr>
<td>35000</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Lauer, 1997

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Corn Response to Row Spacing

Lauer, 1997

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Why do narrow rows work?

Not clearly understood why narrower rows work, but the response is consistent in northern corn belt.

Equidistant spatial arrangement provides:

- Decreased competition among plants within row. Every plant has equal access to resources (e.g. light, water, nutrients)
- Reduced competition from weeds.
- Increased efficiency of water use by shading the soil surface earlier and by more completely utilizing sub-surface moisture.
Materials and Methods

- **Row spacing**
  - Narrower: 15-, 20-, or 22-inches
  - 30-inches

- **Plant density (plants/A)**
  - 25000 (optional)
  - 30000
  - 35000
  - 40000 (optional)

Lauer, 1997
Corn response to row spacing & plant density in 1996 - Leverich, Monroe County.

Grain yield (bu/A)

LSD(0.05) = 9.5

Lauer, 1997
Corn response to row spacing & plant density in 1997 - Nehring, Rock County.

Grain yield (bu/A)

<table>
<thead>
<tr>
<th>Plant density</th>
<th>15 inches</th>
<th>30 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40,000</td>
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</table>

NS-**-NS

Lauer, 1997
Corn response to row spacing & plant density in 1997 - Dane County.

Lauer, 1997
Corn response to row spacing & plant density in 1997 - Leverich, Monroe County.

Lauer, 1997
Corn response to row spacing & plant density in 1997 - Rankin, Fond du Lac County.

Grain yield (bu/A)

<table>
<thead>
<tr>
<th>Plant density</th>
<th>15 inches</th>
<th>30 inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>35,000</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>40,000</td>
<td>170</td>
<td>170</td>
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</table>

NS-*-NS

Lauer, 1997

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Corn response to row spacing & plant density in 1997 - Thompson, Chippewa County.

Lauer, 1997
Corn response to row spacing & plant density in 1997 - Blonde, Waupaca County.

Grain yield (bu/A)

![Graph showing corn yield comparison between 20 inches and 30 inches row spacing at different plant densities.](image)

Lauer, 1997

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Corn response to row spacing & plant density in 1997 - Outagamie County.

Grain yield (bu/A)

**-**-NS

Lauer, 1997
Corn response to row spacing & plant density in 1997 - Hendrickson, Manitowoc County.

Grain yield (bu/A)

Lauer, 1997
Corn response to row spacing & plant density in 1997.

Grain yield (bu/A)

- Narrower
- 30 inches

Rock
Dane
Monroe
Fond du Lac
Chippewa
Waupaca
Outagamie
Manitowoc

Lauer, 1997
Disadvantages of narrow rows

- Equipment must be modified
  - Nature of corn production favors wider rows
  - Need narrow tractor tire size
  - Planter-cultivator-combine
- Under drought conditions, stress is observed earlier resulting in pollination problems
- Mechanical cultivation is difficult, if not impossible
- No-till residue management is difficult

Lauer, 1997
## Equipment changeover costs to narrow rows

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost Range</th>
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<tbody>
<tr>
<td>Replacing rims and tires</td>
<td>$4,800 to $8,000</td>
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<tr>
<td>Combine head</td>
<td>$1,200 to $1,600</td>
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<tr>
<td>Additional planter units</td>
<td>$3,000 to $5,000</td>
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<tr>
<td>Frame extensions &amp; reinforcement</td>
<td>?</td>
</tr>
<tr>
<td>Variable costs (fertilizer, fuel, etc.)</td>
<td>$5 to 10 per A</td>
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<tr>
<td>Tillage using residue clearing</td>
<td>?</td>
</tr>
<tr>
<td>Requires more time at planting</td>
<td>?</td>
</tr>
<tr>
<td>Cultivation difficult or impossible</td>
<td>?</td>
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Lauer, 1997

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Corn response to row spacing in 1997.

Grain yield (bu/A)

170
150
130
110
90

15-inch 15-Dual Plantback 30-inch Plantback to 15 30-Dual Plantback 30-inch

Plant density

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Corn plant density at each row position on a Kinze planter at Arlington in 1997.

Lauer, 1997
Corn plant density at each row position on a Kinze planter at Fond du Lac in 1997.

Lauer, 1997
Corn plant density at each row position on a Kinze planter at Arlington in 1997.

Lauer, 1997
Management interactions with row spacing

- Plant population
- Hybrid
- Weed control
Materials and Methods

- Plant density (plants/acre) 18000, 24000, 30000, 36000, and 42000
- Corn hybrids selected for similar maturity, silage yield, and grain yield.
- Hybrids differed for silage quality traits
Relationship between corn silage yield and plant density between 1994 and 1996.

Lauer, 1997
Relationship between corn silage neutral detergent fiber (NDF) and plant density between 1994 and 1996.

Lauer, 1997
Relationship between corn silage *in vitro* digestibility (IVD) and plant density between 1994 and 1996

Lauer, 1997
Relationship between corn silage Milk per ton and plant density between 1994 and 1996

Lauer, 1997
Relationship between corn silage Milk per acre and plant density between 1994 and 1996.

Lauer, 1997

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Relationship between corn silage Milk per ton and plant density between 1994 and 1996

Lauer, 1997
Corn hybrid silage yield and quality in the southern production zone of Wisconsin.

Lauer, 1997
GDU Accumulation during 1997 at Arlington, WI. GDU bars around 1961-90 average occur 4 of 5 years.

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