Soybean and Field Pea Production

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Area Extension Agronomist
NCR EC, Minot
Field Pea

- Cool-season grain legume
- Efficient water user (fallow replacement)
  - 75% of the root biomass is contained in the top two feet of the soil surface
- “Nitrogen fixer”
- Maturity: Grain types; 80 to 95 days from planting
- Adapted to all areas of the state
Field Pea

- Adapted statewide
  - Part of the new farm program
    - LDP/loan issues finally resolved
  - Lower cost of production than other pulses
  - Easier to manage, less risk (disease)
  - Excellent fit in tight rotations with other broadleaves
    - Low sclerotinia threat
Acreage of field pea in North Dakota (FSA), 1991-2003

Acreage

<table>
<thead>
<tr>
<th>Year</th>
<th>1991</th>
<th>1993</th>
<th>1995</th>
<th>1997</th>
<th>1999</th>
<th>2001</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Soybean

- Warm-season grain legume, “Nitrogen fixer”
- Acres moving north and west
- Early maturing Roundup Ready varieties now widely available
- Easier to manage, less risk (disease) than other broadleaves
  - Excellent fit in tight rotations with other broadleaves
    - Low sclerotinia threat
ND soybean acreage (FSA)
North Central*, ND
Field Pea and Soybean Acreage (FSA)

* Bottineau, Renville, Ward, McHenry, Pierce Counties
1993 - 2003 Field Pea and Soybean Yields
North Central Research Extension Center

Yield bu/acre

*  Soybean trial lost due to cool August/early frost
** Soybean variety trial planted on Fallow
10 year (93-02) average Field Pea and Soybean Yields. NCREC, Minot, ND

Yield bu/acre

10 yr ave. Field Peas 41 Soybeans 21
Field Pea Production

Food Grade vs Feed
Food Grade vs Feed

- **Starts with high quality seed**
  - Green or yellow
    - Contrasting classes is a major issue for human food grade peas (Beware of bin run seed quality)

- **% Germination very important**
  - 85-90% considered good
  - Vigor issues becomes important with seed below 75 – 80%

- **PVP list important to know**
Current PVP Listings for Field Pea (as of 01/1/2004)

- **Green Peas:**
  - Espace
  - Majoret
  - Toledo
  - Crusier
  - Ariel
  - SW Parade
  - Stratus
  - Nitouche

[www.ars-grin.gov/cgi-bin/npgs/html/pvplist.pl](http://www.ars-grin.gov/cgi-bin/npgs/html/pvplist.pl)
Current PVP Listings for Field Pea (as of 01/1/2004)

Yellow Peas:
- Swing
- Carneval
- Grande
- Highlight
- Integra
- SW Circus
- SW Capri
- Cebeco Eclipse
- DS-Admiral

www.ars-grin.gov/cgi-bin/npgs/html/pvplist.pl
Field Pea Variety Selection

- **Field pea PVP list changes frequently**
  - Example: Nitouche green pea
    - Late 1990’s through 2002 not protected could have been sold as common (bin run) seed
    - As 2003 PVP now applied for; can not be sold as a common class of seed anymore

- **Human food market or feed pea**
  - Contact potential buyer(s) if the variety meets human food grade specs
Field Pea Selection Criteria:

- **Harvest Ease:**
  - straw strength/standability very important consideration for straight combining
  - *Ex. CDC Mozart:* high yielding pea, short vine; however, susceptible to lodging

- **Powdery Mildew Resistance:**
  - has the potential of being the most serious disease in field pea (planting date issue)
  - Yellow pea: resistant varieties available
  - Green pea: no” true” resistant varieties yet
Food Grade vs Feed

- **Harvest: most critical factor**
  - On time (Malt barley?)
  - Acres per combine?
  - Green vs yellow:

Food Grade vs Feed

- Harvest needs to be on time for quality
  - Harvest issues come up:
    - Malt barley or peas?
  - Peas should be combined at 16% moisture, 18% the high end
  - Once dry: below 13% splitting can occur
    - handling issues to avoid cracking (augers, etc.)
Green peas need timely harvest to avoid the potential of bleach

- “Green peas can be compared to raising durum”
  - More quality issues
- ‘Yellow peas are like raising spring wheat”

What to grow? Green or yellow

- Most processors will say raise one type to avoid contamination
- “Yellow” the best choice if raising considerable amount of malt barley
Food Grade vs Feed

- **Powdery Mildew:**
  - 2003: more of a harvest issue than a yield loss issue
    - Should not affect seed quality or germination
Seed Treatment Considerations:

- **2002/2003: Isolated seed rot issues**
  - Cold, wet May: delayed emergence
  - Tight rotation: peas on canola
    - Fusarium, Rhizoctonia, and Pythium caused isolated problems and reduced pea stands

- **Seed Treatment Options:**
  - NDSU Extension Service circular PP622
    - North Dakota Field Crop Fungicide Guide
    - Apron, Allegiance: pythium
    - Apron/Max: pythium, fusarium, rhizoc
Field Pea Seeding Date Trials
Carrington 96-98, Minot 97-98, Langdon 98

Bu/acre

Early May | Mid May | Late May | E-M June
---|---|---|---
Carrington | Minot | Langdon

Graph showing the yield (Bu/acre) for different seeding dates and locations.
Rolling Peas

- Should one roll right after planting or after crop emergence
- Depends on tillage system
  - No-till; anytime
  - Conventional; after emergence
  - Peas 1 - 2 inch height
- Soil type:
  - Heavy soil
    - best to wait after emergence
Seeding Rate/Optimum Stand

- Seeding rate of 300,000 PLS/acre
  - Equates to 7 plants/square foot
- Minimum stand: 3 to 4 plants sq/ft
  - Will lead to increased weed pressure, uneven maturity and lodging issues
# Impact of N Fertility Strategy on Field Pea Seed Yield

Carrington Research Extension Center Studies, 1995-97.

<table>
<thead>
<tr>
<th>N Fertility Strategy</th>
<th>Seed Yield Bu/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Inoculant + 0 N Fertilizer</td>
<td>50.3</td>
</tr>
<tr>
<td>Inoculation (Dry)</td>
<td>63.8</td>
</tr>
<tr>
<td>Inoculation + 45# N</td>
<td>59.8</td>
</tr>
<tr>
<td>Nitrogen Fertilizer (90#N)</td>
<td>61.5</td>
</tr>
</tbody>
</table>
Fertility Recommendations

- Soil test of >30 lbs N: Inoculate and go!!
- Seed is sensitive to fertilizer salts
- Lack of response to phosphorus and starter fertilizer
  - No pea yield response to phosphorus across 9 sites years on very low testing phosphorus soils in ND
Field Pea Diseases

- **Sclerotinia:**
  - Not as susceptible as sunflower, canola or dry bean
  - Semi-leafless field pea similar tolerance or even better tolerance than soybean
  - Can be successfully used with other broadleaf crops in “stacked” rotations
Field Pea Diseases

**Powdery Mildew:**
- Most significant disease in pea
- Causes white “powdery” spots on leaves
- Wet, heavy dews help spread the disease to the pods
- Infected plants will not mature normally
- Can result in harvest problems, seed size issues and yield loss
Field Pea Diseases

**Powdery Mildew:**
- Most often a problem with late plantings (mid-May or later)
- Infection typically occurs late in the season (late July-August)
- Yield loss typically doesn’t occur unless infection occurs prior to pod set
- Resistant varieties becoming available
- Quadris fungicide labeled for control
  - 2004 research trials planned Mohall/Minot
New Developments

- **US Pulse Breeding Program:** USDA-ARS, WSU
  - Kevin McPhee, Fred Muehlbauer
    - NDSU is now an active part of their programs

- NDSU cooperating in joint releases with USDA-ARS; WSU; IDAES
    - Breeders seed increased in 2003
    - Foundation seed will be planted at REC’s in 2004
    - 2005 Foundation seed available
Variety Selection

- Most crucial decision
  - Maturity Group
  - Seed size
  - Herbicide tolerant vs conventional
Maturity Groups

(Early) 000

(Mid-early) 00.0 → 00.5 → 00.9

(Mid) 0.0 → 0.5 → 0.9

(Late) 1

Note: For each decimal point consider 0.75 day later maturity!!
## Soybean Performance in Central, North and Western North Dakota

<table>
<thead>
<tr>
<th>Location</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>AVE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carring.</td>
<td>49.8</td>
<td>53.9</td>
<td>40.0</td>
<td>46.6</td>
<td>47.5 bu.</td>
</tr>
<tr>
<td>Minot</td>
<td>11.6</td>
<td>22.6</td>
<td>16.7</td>
<td>19.3</td>
<td>17.6 bu.</td>
</tr>
<tr>
<td>Langdon</td>
<td>48.0</td>
<td>49.0</td>
<td>37.5</td>
<td>37.2</td>
<td>42.9 bu</td>
</tr>
<tr>
<td>Williston</td>
<td>14.0</td>
<td>11.0</td>
<td>11.0</td>
<td>12.5</td>
<td>12.1 bu.</td>
</tr>
<tr>
<td>Hetting.</td>
<td>11.6</td>
<td>----</td>
<td>Frosted</td>
<td>26.1</td>
<td>12.6 bu.</td>
</tr>
</tbody>
</table>

(No-Till)
## 2001-2003 Soybean Performance
### NCREC, Minot, ND

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th>2002*</th>
<th>2003*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>34 bu/A</td>
<td>53 bu./A</td>
<td>26 bu/A</td>
</tr>
<tr>
<td></td>
<td>24 var.</td>
<td>9 traditional</td>
<td>10 traditional</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35 RR var.</td>
<td>55 RR var.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 yr. Ave.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>38 bu/A</td>
</tr>
</tbody>
</table>

* Planted on fallow
August rainfall, Minot

Inches

- 2000 (light blue)
- 2001 (dark blue)
- 1999 (gray)
- 1998 (dark red)
- 1997 (red)

- Data for the years 1997 to 2003 are shown.
- The bar chart represents rainfall in inches for various years.
- The average rainfall for each year is indicated.
Water Needs of Soybeans

60% of soybeans water needs occur from flowering through pod fill
Soybean water use scheduling for irrigation

Total water needs: 14.1 inches

- First 8 weeks: May 20 - July 20 (40%)
- Next 6 weeks (Flower - Pod fill): July 20 - Sept 1 (60%)
The Mandan ARS Lab has measured crop water use by alternative crops from 1995 to 1997. The results of this study are drawn out below.

### Average Yearly Water Use By Crop

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total Water Used (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunflower</td>
<td>14.4</td>
</tr>
<tr>
<td>Safflower</td>
<td>14.1</td>
</tr>
<tr>
<td>Soybean</td>
<td>13.3</td>
</tr>
<tr>
<td>Dry Bean</td>
<td>10.6</td>
</tr>
<tr>
<td>Dry Pea</td>
<td>10.5</td>
</tr>
<tr>
<td>Crambe</td>
<td>9.8</td>
</tr>
<tr>
<td>Canola</td>
<td>9.0</td>
</tr>
</tbody>
</table>

Source: Mandan USDA-ARS 1995-1997
No-Till Soybeans

The graph shows the comparison of soybean yield (bushels/acre) between conventional (Conv) and no-till (No-till) systems at Minot and Washburn locations.

- **Minot**:
  - Conv: 15 bushels/acre
  - No-till: 19 bushels/acre

- **Washburn**:
  - Conv: 21 bushels/acre
  - No-till: 28 bushels/acre

The data indicates a higher yield in the no-till system compared to the conventional system at both locations.
Soybean yield with tillage systems, NCREC, 1998-2002

![Graph showing soybean yield with tillage systems from 1998 to 2001, comparing Conv-Till and No-Till systems. The 4 Year Avg is also included.](image)

24% yield advantage with no-till.
Fertility

- Inoculate new fields of soybean.
  - Have seen poor N-fixation with dry July conditions in north central, ND.
  - May benefit from 2X labeled rates of inoculum.
- Inoculate as routine procedure on all fields
- Soybean/Soybean rotation
Apply 20 to 40 lbs of N if soil levels are less than 40 lbs. per Acre.

- Can’t rely solely on N-fixation (as with pea) for soybeans in low N testing soils, especially in western ND

- Limited N fertilizer with the seed

10% yield advantage with narrow vs. wide rows
Narrow row spacing comparison for impact on soybean yield, Carrington and Minot, 2002.

10% yield advantage with solid-seeded
## Seeding Rate of Early Soybean

<table>
<thead>
<tr>
<th>Seeding rate (seeds/acre)</th>
<th>Yield (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150,000</td>
<td>39.5</td>
</tr>
<tr>
<td>200,000</td>
<td>43.8</td>
</tr>
<tr>
<td>250,000</td>
<td>44.9</td>
</tr>
</tbody>
</table>

Ave. 4 Varieties-6 sites, 1998 & 1999