# Soybean and Corn Production Update

www.ag.ndsu.edu/CarringtonREC/agronomy/extension-outreach

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Projected 2019 soybean acres:

2018: 6.860 K (harvested) x 6% decrease = 6.450 K acres

# ND farmer:

“What production advice can you provide from NDSU research and recommendations to make money with soybean in 2019?”

- Start with high yield potential
  - **Variety selection**
  - **Plant establishment and nutrition**
- Protect yield potential
  - Manage weeds, disease and insects


# CREC 2018 Annual Report p. 96

**Soybean - Dryland, Roundup Ready Varieties** — **Wishek**

| Brand | Variety | Mat. Group[1] | Days to PM[2] | Pod Ht | Plant Ht | Plant Lodge | Seeds/ pound | Seed Oil[3] | Seed Protein[3] | Test Weight | -- Seed Yield -- 2018 | 3-yr. Avg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | inch | inch | 0 to 9 | | % | % | lb/bu | ----- bu/ac | ----- |
| Channel | 0819R2X | 0.8 | 105.5 | 4.1 | 27.0 | 1.0 | 3097 | 16.9 | 38.4 | 57.5 | 40.3 | -- |
| Channel | 1117R2X | 1.1 | 108.0 | 3.4 | 26.8 | 1.0 | 2845 | 18.0 | 37.1 | 57.1 | 40.9 | -- |
| Channel | 1219R2X | 1.2 | 105.3 | 3.0 | 28.7 | 1.5 | 3571 | 17.9 | 36.9 | 57.5 | 42.7 | -- |
| Dairyland | DSR-1509R | 1.4 | 110.0 | 4.6 | 24.5 | 1.5 | 3067 | 16.6 | 39.4 | 57.5 | 30.7 | -- |
| Legacy Seeds | LS-0738N RR2X | 0.7 | 104.5 | 4.3 | 28.1 | 1.0 | 3123 | 17.5 | 38.0 | 57.6 | 39.2 | -- |
| Legacy Seeds | LS-0935N RR2 | 0.9 | 107.3 | 4.9 | 28.2 | 1.0 | 2885 | 17.7 | 37.2 | 56.8 | 48.5 | 51.6 |
| Legacy Seeds | LS-1138N RR2X | 1.1 | 108.0 | 4.8 | 27.4 | 1.3 | 2783 | 17.7 | 38.4 | 57.2 | 44.2 | -- |
| LG Seeds | LGS0774RX | 0.7 | 106.8 | 2.5 | 27.0 | 2.3 | 2956 | 17.0 | 37.7 | 57.2 | 39.3 | -- |
| LG Seeds | LGS0886RX | 0.8 | 106.0 | 4.5 | 26.9 | 1.0 | 3043 | 17.0 | 38.8 | 57.7 | 38.2 | -- |
| LG Seeds | C1000RX | 1.0 | 108.8 | 5.0 | 23.9 | 1.5 | 2671 | 17.4 | 38.8 | 57.3 | 36.1 | -- |
| LG Seeds | C1337RX | 1.3 | 108.8 | 4.1 | 29.1 | 1.3 | 2901 | 17.6 | 37.5 | 57.2 | 40.4 | -- |
| LG Seeds | LGS1575RX | 1.5 | 109.8 | 3.5 | 29.0 | 1.3 | 2899 | 16.9 | 38.1 | 56.6 | 44.9 | -- |
| NDSU | ND17009GT | 00.9 | 92.5 | 4.7 | 28.7 | 1.0 | 3561 | 16.6 | 40.4 | 59.1 | 33.4 | -- |
| Nutech | 6097R2 | 0.9 | 103.5 | 2.9 | 27.5 | 1.3 | 3058 | 19.1 | 35.8 | 57.3 | 40.8 | 47.9 |
| Nutech | 6136X | 1.3 | 107.8 | 4.8 | 26.5 | 1.3 | 2461 | 17.9 | 37.7 | 56.9 | 34.7 | -- |
| Peterson Farms Seed | 18X08N | 0.8 | 105.3 | 4.2 | 26.9 | 1.0 | 2905 | 17.5 | 38.1 | 57.7 | 40.7 | -- |
| Proseed | XT70-60 | 0.7 | 104.3 | 3.6 | 29.5 | 1.0 | 3167 | 17.8 | 36.1 | 57.1 | 41.1 | -- |
| Proseed | XT 80-80 | 0.8 | 106.3 | 4.6 | 30.4 | 1.0 | 2897 | 17.3 | 38.6 | 57.7 | 45.1 | -- |
| Proseed | 30-80 | 0.8 | 106.8 | 4.9 | 30.1 | 1.8 | 2890 | 17.5 | 37.8 | 57.1 | 40.8 | -- |
| REA | RX0516 | 0.5 | 99.8 | 4.3 | 27.1 | 0.8 | 3129 | 17.4 | 38.0 | 57.6 | 37.7 | -- |
| REA | RX0628 | 0.6 | 103.3 | 3.7 | 26.2 | 0.8 | 3090 | 17.5 | 38.3 | 56.8 | 38.1 | -- |
| REA | RX0719 | 0.7 | 102.3 | 4.6 | 25.2 | 1.3 | 3004 | 18.1 | 37.4 | 57.1 | 38.4 | -- |
| REA | RX0929 | 0.9 | 105.8 | 3.5 | 30.4 | 1.0 | 2919 | 16.9 | 38.4 | 57.2 | 49.0 | -- |
| REA | RX1027 | 1.0 | 107.3 | 4.2 | 28.6 | 1.0 | 2868 | 17.2 | 37.8 | 57.5 | 43.2 | -- |
| | MEAN | | 104.7 | 4.1 | 28 | 1.2 | 3053 | 17.4 | 38.0 | 57.4 | 39.9 | -- |
| | C.V. (%) | | 1.3 | 30.7 | 10.4 | 68.8 | 4.2 | 2.0 | 1.8 | 0.8 | 15.1 | -- |
| | LSD 0.10 | | 1.6 | NS | 3.4 | NS | 150 | 0.4 | 0.8 | 0.5 | 7.1 | -- |
| | LSD 0.05 | | 1.9 | NS | NS | NS | 179 | 0.5 | 1.0 | 0.6 | 8.5 | -- |

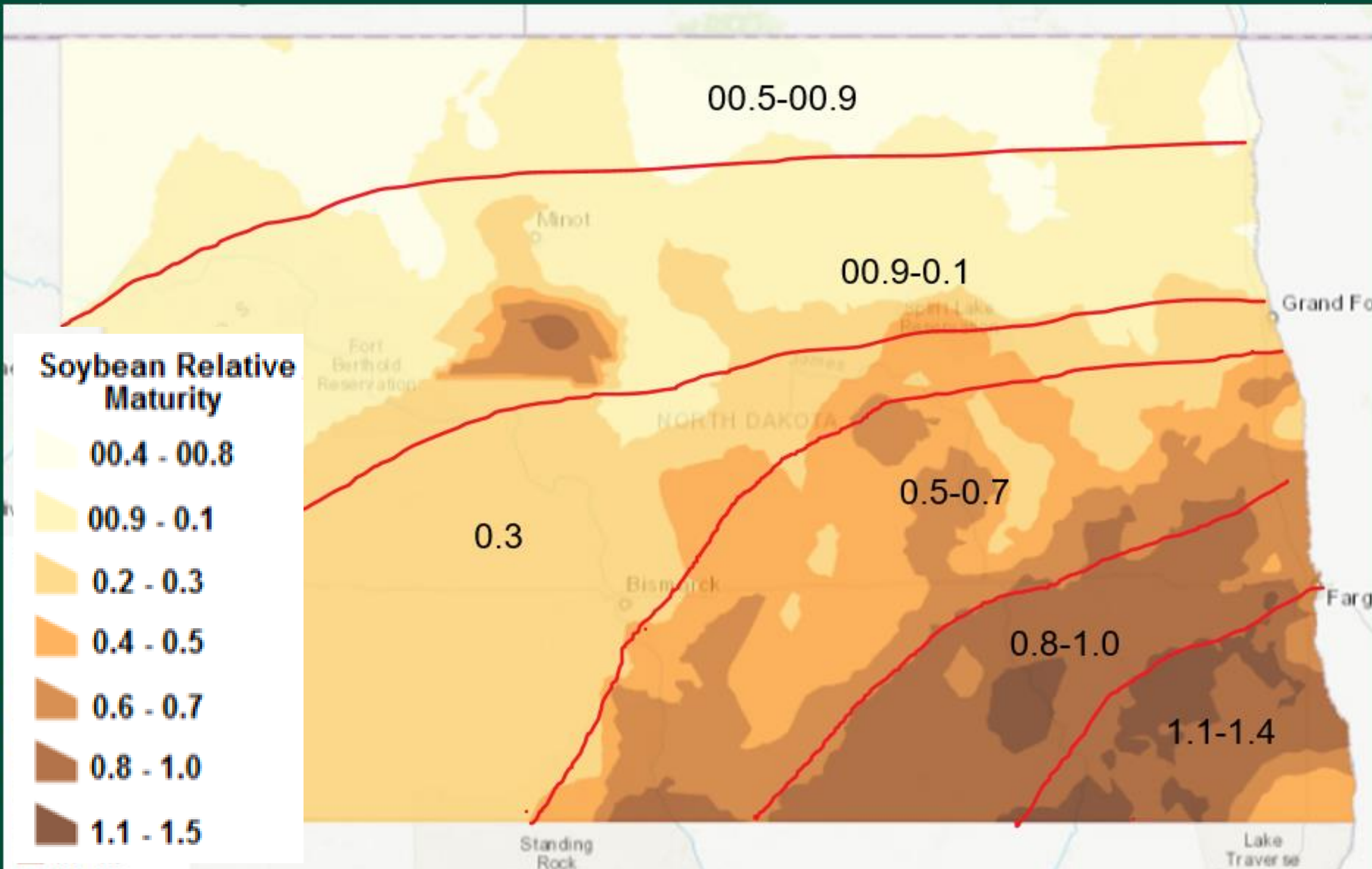
**Planting Date = May 25 ; Harvest Date = October 16 ; Previous Crop = Spring Wheat**

[1] Maturity group based on data provided by seed company.

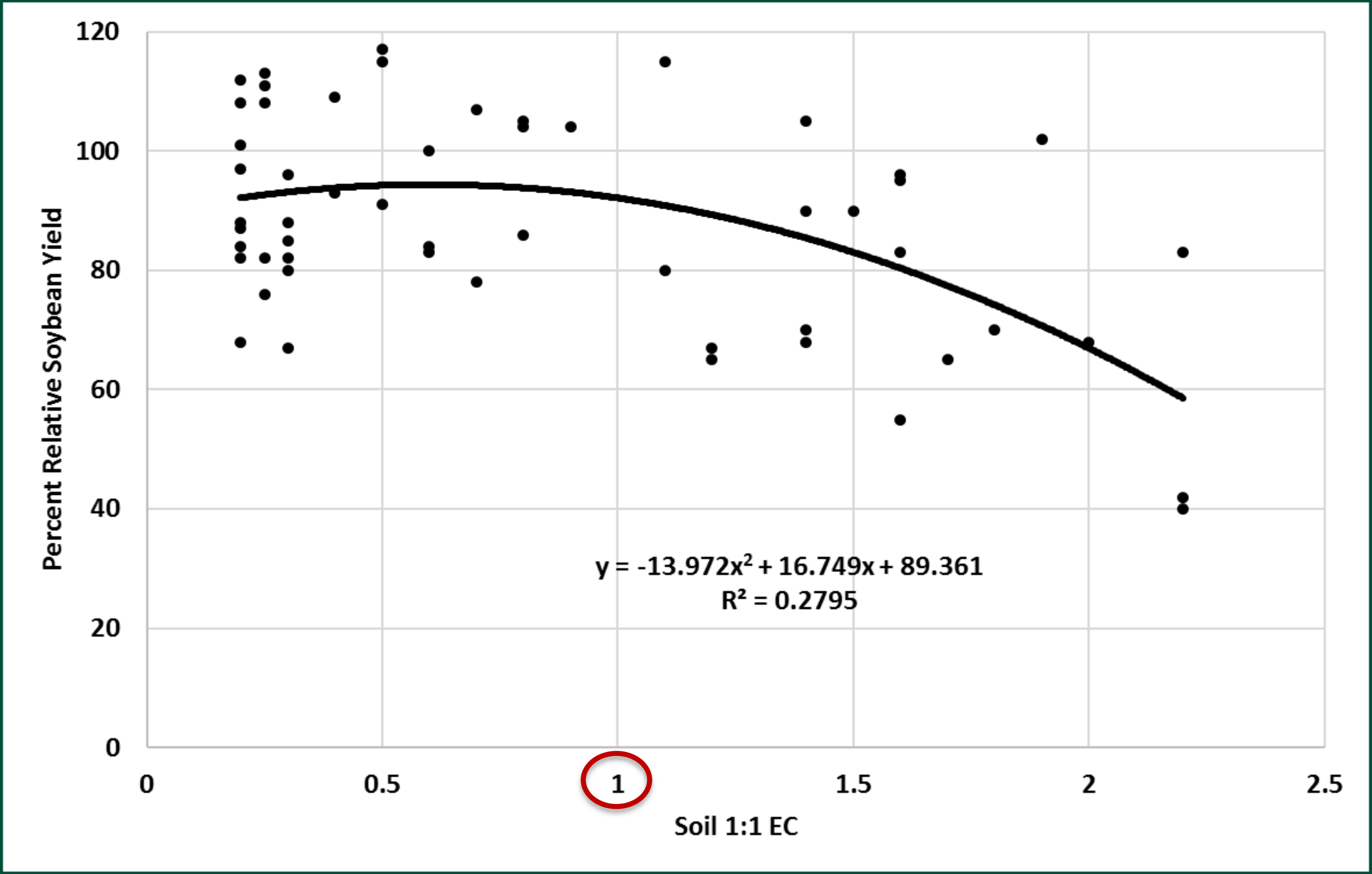
[2] Days to PM: average of 105, equates to September 7.

[3] Seed oil and protein contents reported at 13% moisture.

# Maturity group map 2014-2017



# Soybean yield reduction with increasing soil EC



## NDSU Research Summary of Soybean Plant Establishment Factors (Dec. 2018)

| Factor | Option A | A Yield > B (%) | Option B | NDSU trials (conducted during 1999-2018) |
|---|---|---|---|---|
| **Tillage system** | reduced till | **4** | conventional till | 37 |
| **Previous crop** | wheat | **5** | soybean | 6 |
| **Planting date** | ≤ early May | **8** | mid May | 9 |
| **Planting rate (pls/A)** | 150-175,000 | **6** | 100-130,000 | 44 |
| **Row spacing (inches)** | 14-21 | **4** | 28-30 | 24 |
| **Seed fungicide** | yes | **6** | no | 29 |
| **Seed inoculation with soybean history** | yes | **2** | no | 16 |
| **P app at planting time** | broadcast | **0.5** | band (away from seed) | 7 |
| **Timing of initial weed control** | at planting | **5** | early POST (2- to 4-inch weeds) | 8 |

Compiled by Greg Endres, Extension Agronomist

# Benchmarking Soybean Production Systems in the North Central US

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Wisconsin Soybean Marketing Board

Nebraska Soybean Checkoff

Extension
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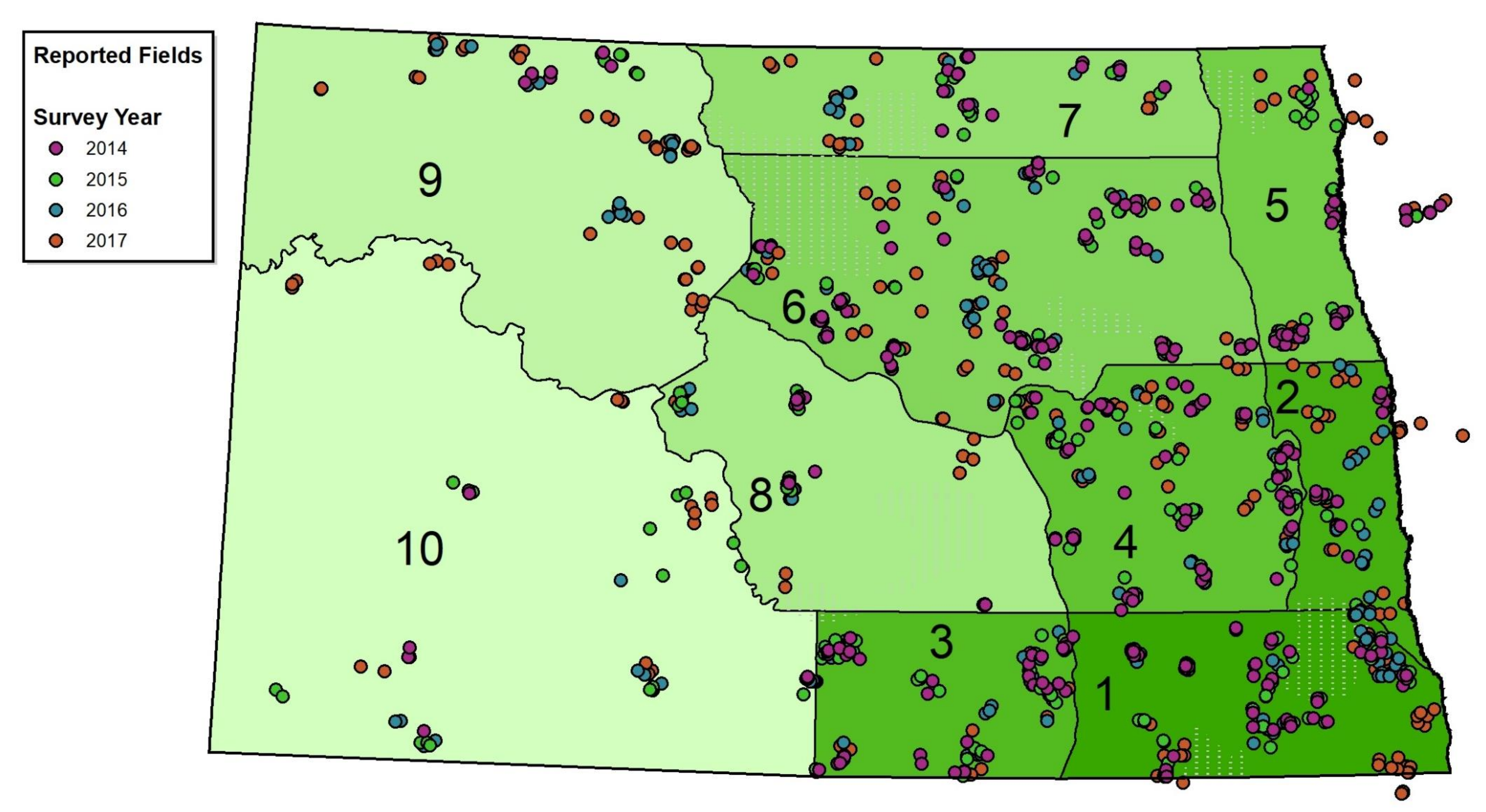
NCSRP North Central Soybean Research Program

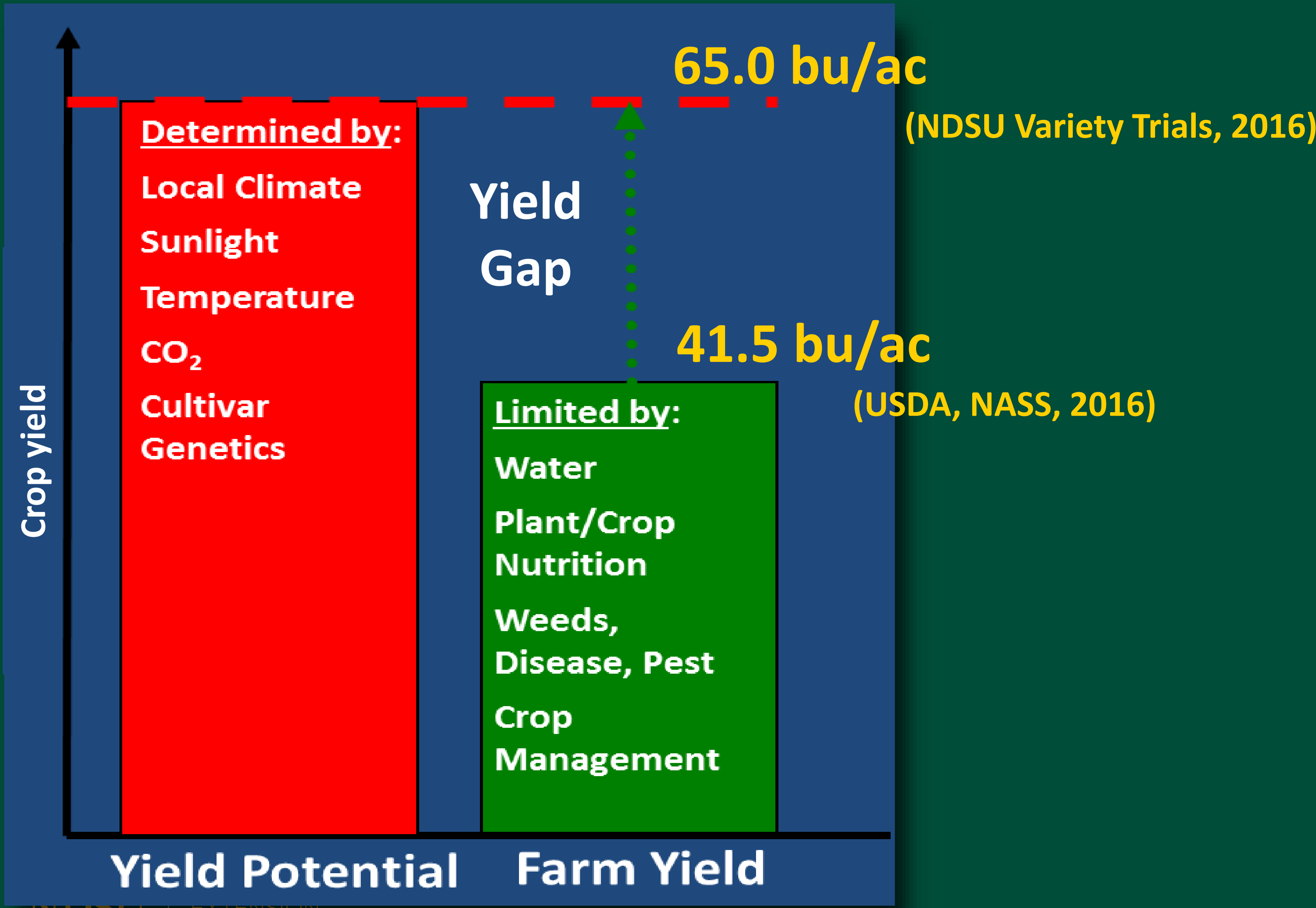
# ND Soybean Growing Regions and observatins 2014-2017




NDSU | EXTENSION

Cartographer: J. Stanley

# Current Production



# Benchmarking Soybean Production Systems in the North Central US

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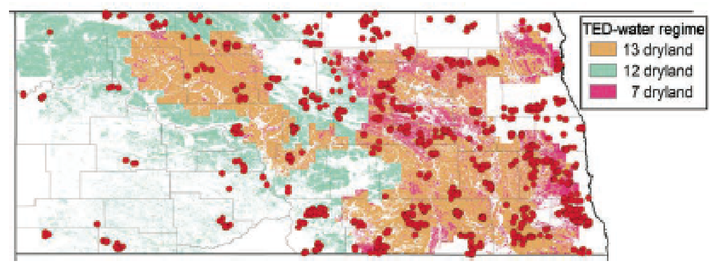
NCSRP North Central Soybean Research Program

## Summary of the North Dakota Soybean Benchmarking and Yield Gap Surveys

North Dakota accounted for about 7% of the U.S soybean harvested acres over the past five years (www.nass.usda.gov). North Dakota participated in a multi-state project to assess soybean yield gaps and the management practices responsible for them. The yield gap is defined as the difference between yield potential, as determined by climate and soil, *versus* producer average yields. Producers were asked to provide field-specific information from fields planted with soybean from 2014 to 2017. Collected data included field location, yield, crop management, and applied inputs from 1,002 North Dakota fields.

Fields were grouped into regions called TEDs (technology extrapolation domains), which represent regions within which climate and soil are reasonably similar. Specifically, TEDs are based on annual growing-degree day accumulation, precipitation, and temperature fluctuations, as well as plant available water-holding capacity in the rooting zone. In our analysis, we only included fields located in TEDs that represent >5% of soybean area within the state and TEDs that have at least 100 surveyed fields. In the case of North Dakota, there were a total of 3 TEDs meeting these criteria (see map below).

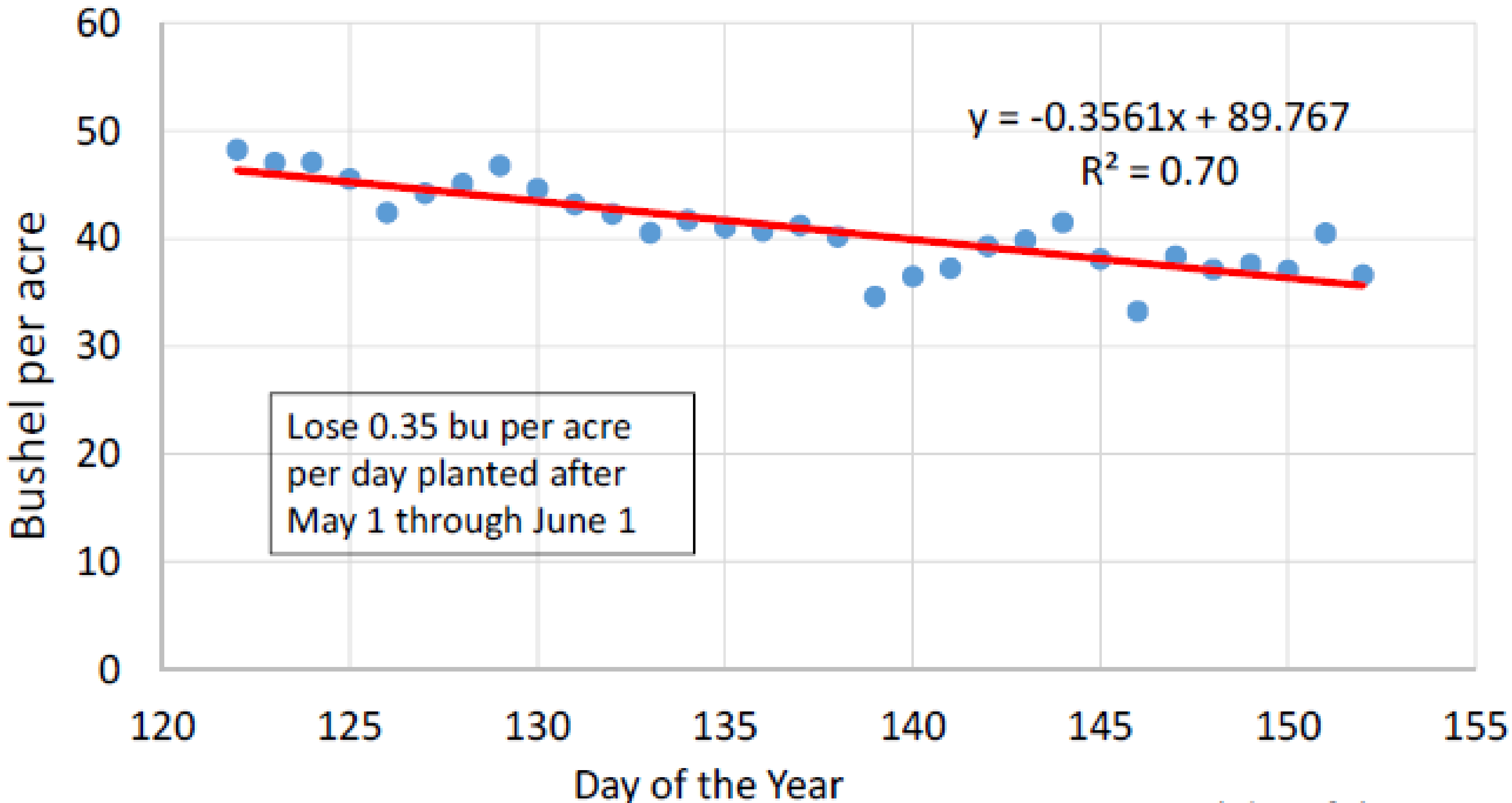



Within each TED, fields were sorted into two groups based on their yields: the highest third were assigned to the 'high yield' (HY) and the lowest third to the 'low-yield' (LY). Then, average management practices implemented by the two groups were compared to identify the management practices responsible for the yield gap within a TED. Details on methodology can be found (details on methodology can be found on page 8).

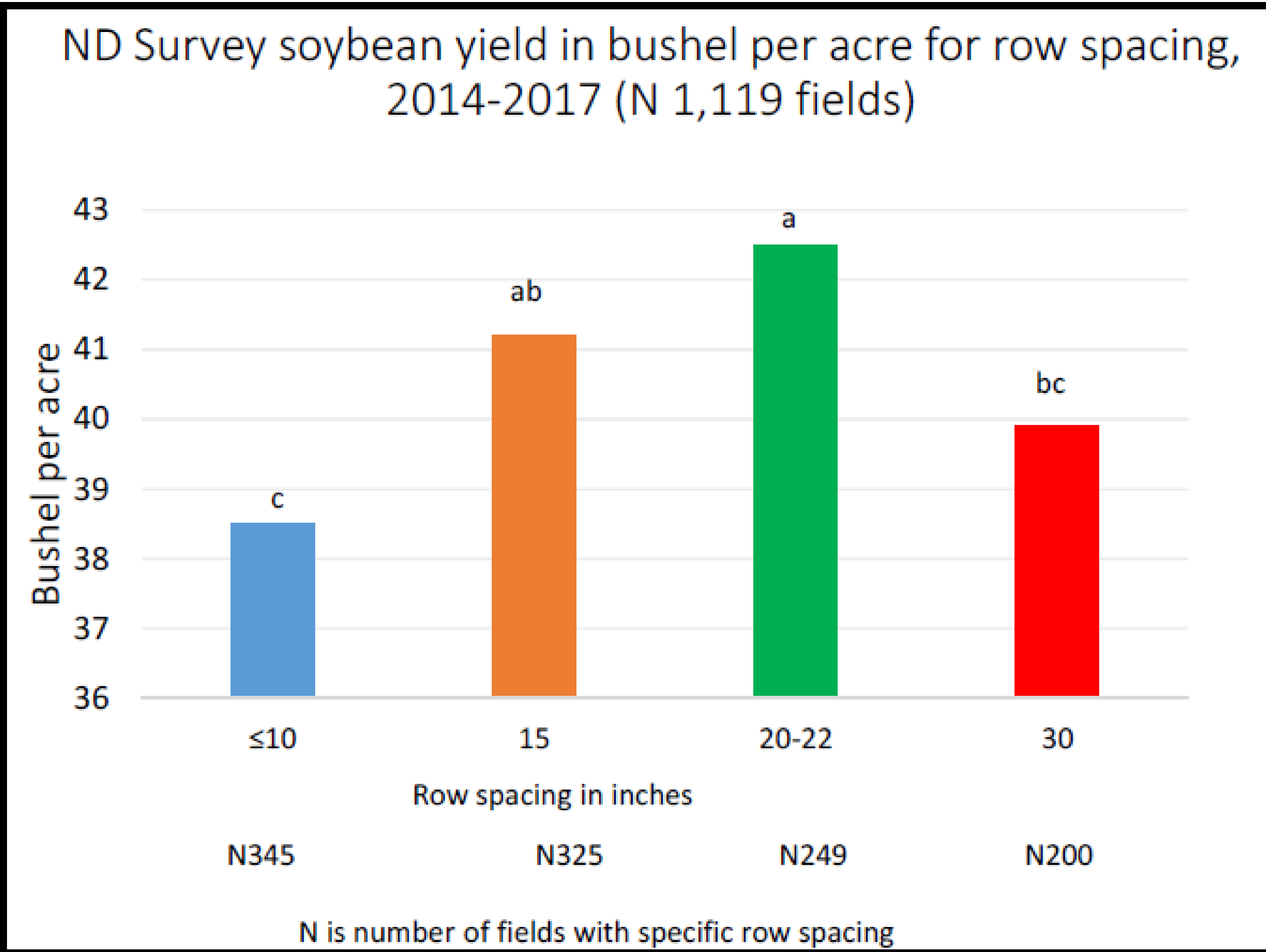
In most TEDs in North Dakota (2-3 out of 3), the high-yield category (significantly higher yield p ≤0.10) consisted of fields with earlier planting date and those treated with foliar insecticide and/or fungicide. In one TED, high-yield fields were also associated with tillage and artificial drainage. In TEDs 7D and 13D, there were more fields with 15-inch row spacing in the HY group compared to the LY group while in TED 12D there were more fields with 7.5-inch row spacing in the HY group (see the table Management Practices Comparison Between High- and Low-yield Fields on next page).

Our study focused on those management practices with greatest yield impact; there may be other reasons for adopting (or not) a given practice, e.g., economic and logistic consideration, pest resistance, soil erosion, etc.

# Planting day of the year vs yield in bushel per acre 2014-2017 (1023 fields)




1 May = 121$^{st}$ day of the year.
4 June = 155$^{th}$ day of the year.


ND Survey soybean yield in bushel per acre for row spacing, 2014-2017 (N 1,119 fields)
Bushel per acre
43
42
41
40
39
38
37
36
c
ab
a
bc
≤10
15
20-22
30
Row spacing in inches
N345
N325
N249
N200
N is number of fields with specific row spacing

Kandel, Herman | Kandel, Herman | 2 | Wed 3

Final Report - ND Soybean Benchmark Study

2019_Soybean_Benchm... 3 MB

results for ND growers.... 741 KB

# Results Soybean Survey 2014-17

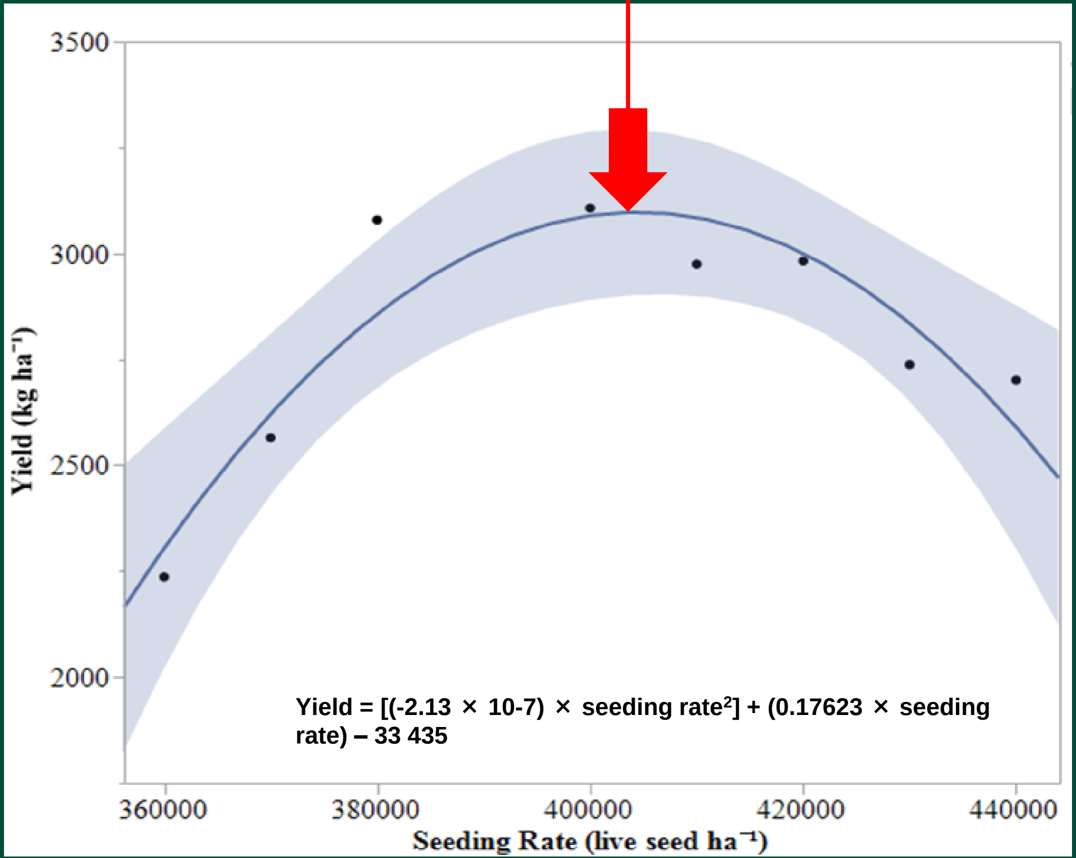
**Conclusions based on the grower survey data (See Attachment):**

1. **Growing soybean after corn resulted in about 5 bushel higher yields compared to growing soybean after soybean. Rotation is important.**
2. **An established soybean plant stand of 150,000 plants per acre is recommended.**
3. **Planting soybean before mid-May, if conditions are favorable, provided the highest soybean yields. Delaying planting, between May first and June first, based on 2014 to 2017 data, resulted in an average reduction of 0.35 bushel per acre per day.**
4. **Selecting the latest maturing soybean adapted for your growing region may increase yields.**
5. **Row spacing 15-22 inch provided the highest yields during the period 2014 to 2017.**
6. **Seed treatments resulted in higher yields during the period 2014-2017.**
7. **There are difference in yield responses with different seed treatments.**
8. **Fields with iron deficiency chlorosis (IDC) issues had 0.8 bushel per acre lower yield than fields without IDC. It is critical to pick the right varieties (tolerant to chlorosis) for fields with IDC issues.**
9. **On average, 12.3% of planted seeds did not result in an established soybean plant.**
10. **There is a positive relationship between established stand and soil cover by the soybean crop.**
11. **There is about a 6.3% stand loss between stand establishment and the end of the season population.**

# Seeding Rate Effect on Yield

## Field Visit

| Seeding Rate (live seeds $ac^{-1}$) | Yield (bu $ac^{-1}$) |
|---|---|
| 167 511 | 45.0 |



# Economic Analysis

| Seeding Rate | Market Price ($ bu$^{-1}$) | | | | |
|---|---|---|---|---|---|
| | 8.00 | 8.50 | 9.00 | 9.50 | 10.00 |
| live seed ac$^{-1}$ | | | | | |
| 80 000 | 334c | 355c | 377c | 399c | 420c |
| 100 000 | 337bc | 360bc | 381bc | 404bc | 426bc |
| 120 000 | 341abc | 364abc | 386abc | 409abc | 431abc |
| 140 000 | 345ab | 368ab | 391ab | 414ab | 437ab |
| 160 000 | 343abc | 366abc | 389abc | 412ab | 435ab |
| 180 000 | 349a | 372a | 396a | 419a | 443a |
| 200 000 | 347ab | 370ab | 394a | 418a | 441a |
| LSD (0.05) | 11 | 11 | 12 | 13 | 13 |

‡Soybean seed prices were estimated as $52 for 140 000 seeds (Duffy, 2018).

# Soybean summary

- Do your homework on variety selection
- Use reduced tillage system and manage salt-affected soil areas
- Plant early and narrow at adequate rate
- Keep plant nutrition simple

SF1164 (Revised February 2018)

# Soybean Soil Fertility

D.W. Franzen photo

**D.W. Franzen**
Extension Soil Science Specialist

Soybeans need 14 mineral nutrients: nitrogen (N), phosphorus (P), potassium (K), sulfur (S), calcium (Ca), magnesium (Mg), copper (Cu), iron (Fe), manganese (Mn), zinc (Zn), boron (B), chloride (Cl), molybdenum (Mo) and nickel (Ni).

Of these, North Dakota soils provide adequate amounts for soybean production except for N, P, K, S and Fe.

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## Nitrogen

### Nodulation

Although the atmosphere is 78 percent nitrogen gas, plants cannot use it directly. Plants can use only ammonium-N or nitrate-N. Soybean is a legume and normally should provide itself N through a symbiotic relationship with N-fixing bacteria of the species *Bradyrhizobium japonicum*. In this symbiotic relationship, the plant supplies carbohydrates and minerals to the bacteria, and the bacteria transform nitrogen gas from the atmosphere into ammonium-N for the plant to use.

Soybean infection by N-fixing bacteria and symbiotic N fixation is a complex process between the bacteria and the plant. The right species of N-fixing bacteria must be present in the soil, either through inoculation of the seed or the seed zone at planting.

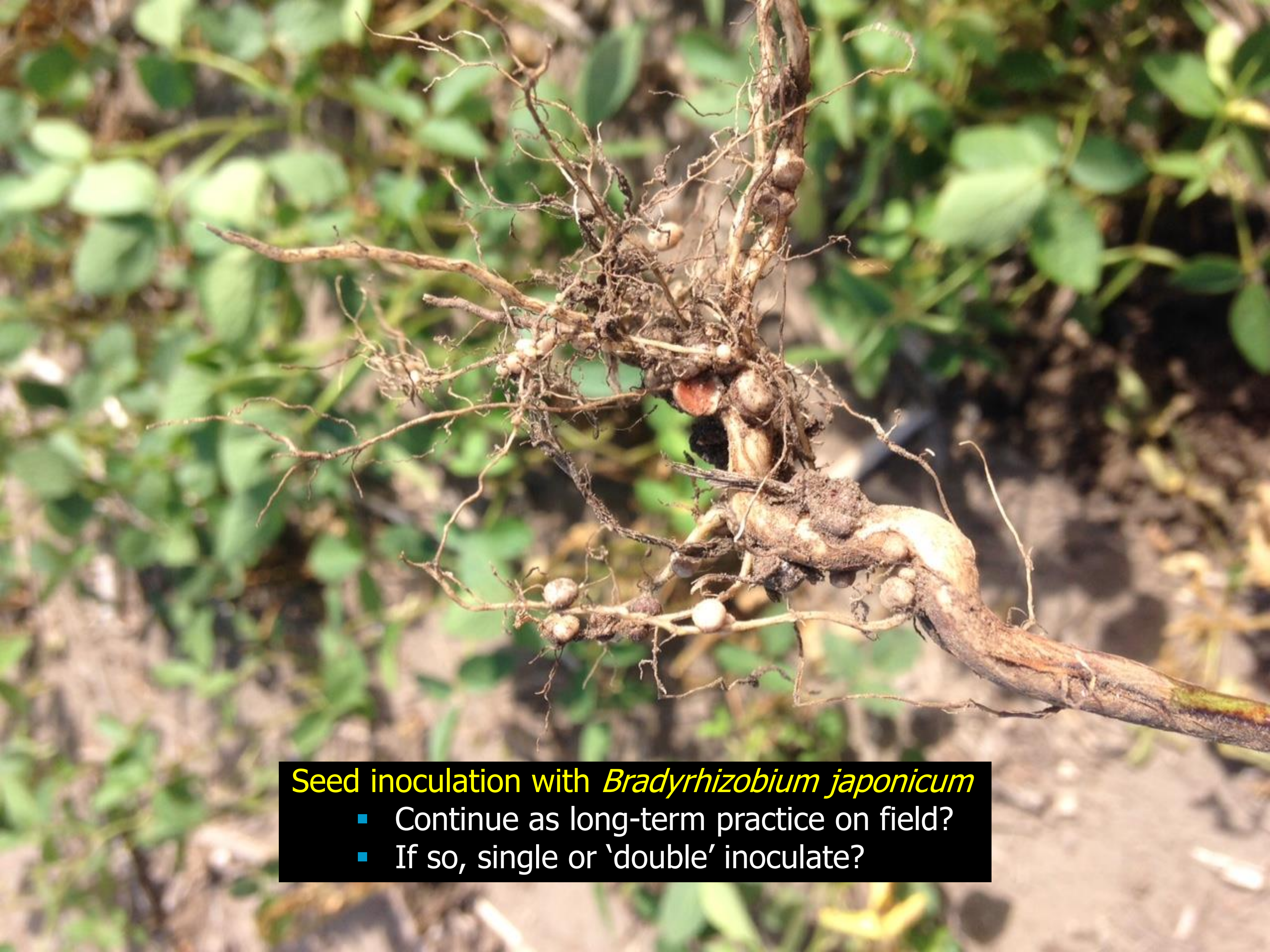
N-fixing bacteria are attracted to soybean roots by chemical signals from the soybean root in the form of flavenoid compounds (1). Once in contact with the root hairs, a root compound binds the bacteria to the root hair cell wall. The bacteria release a chemical that causes curling and cracking of the root hair, allowing the bacteria to invade the interior of the cells and begin to change the plant cell structure to form nodules (2)(3)(4) **(Figure 1, Page 2)**.

The bacteria live in compartments, up to 10,000 in each nodule, called bacteroids **(Figure 1)**. Each bacteroid is bathed in nutrients from the host plant, and the bacteroid takes nitrogen gas from the soil air and converts it to ammonium-N using the enzyme nitrogenase, which consists of one Fe-Mo (iron-molybdenum)-based protein and two Fe (iron)-based proteins. In this region, iron deficiency chlorosis (IDC) may result in poor nodulation and may contribute to N deficiency as well as iron deficiency.

**Table 1. Nutrient content of several crops at selected yield levels. Field measurements will vary depending on environmental conditions and soil nutrient levels.**

| Crop and Portion Analyzed | Weight Removed (lb/A) | Yield per Acre | Nutrients accumulated in crops at harvest, lb/A | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | N | $P_2O_5$ | $K_2O$ | Ca | Mg | S | Cl | B | Cu | Fe | Mn | Zn |
| Alfalfa hay | 12000 | 6 T | 270 | 60 | 270 | 168 | 32 | 29 | 41 | 0.09 | 0.09 | 1.20 | 0.66 | 0.63 |
| Barley, grain | 3840 | 80 bu | 70 | 30 | 20 | 2 | 4 | 6 | 6 | 0.08 | 0.06 | 0.30 | 0.06 | 0.12 |
| Barley straw | 4000 | 2 T | 30 | 10 | 60 | 16 | 4 | 8 | 1 | 0.01 | 0.02 | 0.01 | 0.64 | 0.10 |
| Canola seed | 2000 | 40 bu | 124 | 22 | 15 | 9 | 7 | 24 | 0.6 | 0.03 | 0.01 | 0.10 | 0.08 | 0.10 |
| Corn, grain | 8400 | 150 bu | 135 | 64 | 42 | 15 | 22 | 14 | 2 | 0.12 | 0.06 | 0.15 | 0.09 | 0.15 |
| Corn stover | 9000 | 4.5 T | 101 | 36 | 144 | 27 | 18 | 11 | 1 | 0.05 | 0.03 | 1.00 | 1.50 | 0.30 |
| Oat, grain | 3200 | 100 bu | 63 | 25 | 19 | 3 | 4 | 6 | 1 | | 0.04 | 0.80 | 0.15 | 0.36 |
| Oat, straw | 5000 | 2.5 T | 31 | 19 | 100 | 10 | 10 | 11 | 1 | | 0.04 | 0.15 | 0.15 | 0.36 |
| Pea, vines and pods | 5000 | 2.5 T | 120 | 31 | 121 | 175 | 15 | 12 | 8 | 0.04 | 0.06 | 0.60 | 0.40 | 0.02 |
| Potato, tubers | 40000 | 40 cwt | 133 | 50 | 250 | 6 | 10 | 10 | 26 | 0.09 | 0.07 | 0.89 | 0.15 | 0.09 |
| Sorghum, grain | 5000 | 100 bu | 81 | 44 | 25 | 5 | 6 | 6 | | | 0.01 | | 0.05 | 0.05 |
| Sorghum, stover | 7500 | 3.75 T | 106 | 31 | 156 | 36 | 23 | | | | | | | |
| Sugarbeet, root | 40000 | 20 T | 16 | 20 | 32 | 240 | 40 | 40 | 8 | | | | 0.20 | 0.08 |
| Soybean, seed | 3000 | 50 bu | 188 | 44 | 66 | 9 | 9 | 5 | 1 | 0.06 | 0.05 | 0.50 | 0.06 | 0.05 |
| Soybean, straw | 5000 | 2.5 T | 127 | 30 | 76 | 56 | 25 | 15 | 20 | 0.03 | 0.01 | 1.00 | 0.50 | 0.30 |
| Sunflower, seed | 2000 | 1 T | 52 | 8 | 12 | 2 | 5 | 4 | | 0.03 | 0.03 | 0.06 | 0.03 | 0.10 |
| Sunflower, stover | 3000 | 1.5 T | 35 | 3 | 51 | 37 | 19 | 7 | | 0.10 | 0.01 | 0.46 | 0.08 | 0.10 |
| Wheat, grain | 3600 | 60 bu | 75 | 38 | 23 | 2 | 9 | 5 | 1 | 0.06 | 0.05 | 0.45 | 0.14 | 0.21 |
| Wheat, straw | 4500 | 2.5 T | 30 | 8 | 53 | 9 | 5 | 8 | 20 | 0.02 | 0.02 | 1.95 | 0.24 | 0.08 |

Data from Table 1 accumulated from various sources. NFSA Liquid Fertilizer Manual, 1967; Frank, 1995, Blamey, et al., 1987; Grant and Bailey, 1993, Mengel and Kirby, 1987.


Seed inoculation with *Bradyrhizobium japonicum*
- Continue as long-term practice on field?
- If so, single or 'double' inoculate?

# NDSU Research Summary of Soybean Plant Establishment Factors (Dec. 2018)

| Factor | Option A | A Yield > B (%) | Option B | Number of NDSU trials (2004-18) |
|---|---|---|---|---|
| **Seed inoculation with soybean history** (1-3 years separating soybean crops) | yes | **2** | no | 16 |

| Base yield | Yield increase at 2% | Max inoculant cost with $8/bu soybean |
|---|---|---|
| **bu/A** | **bu/A** | **$/A** |
| 40 | 0.8 | 6.40 |
| 50 | 1.0 | 8.00 |

## Soybean seed yield with bacteria inoculation of seed options on ground with previous soybean production, Carrington and Wishek, 2015-18 (6 site-years)

| **Inoculation option** | **Seed yield (bu/A)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | Carr 2015 | Wish 2015 | Wish 2016 | Carr 2017 | Wish 2017 | Carr 2018 | **6 site-yr average** |
| untreated check | 30.8 | 22.4 | 57.6 | 68.0 | 40.2 | 41.9 | 43.5 |
| liquid | 28.7 | 22.2 | 56.7 | 65.0 | 45.9 | 46.5 | 44.2 |
| granular | 25.3 | 24.5 | 56.8 | 61.0 | 45.8 | 49.4 | 43.8 |
| liq+gran | 27.1 | 25.4 | 58.0 | 69.5 | 45.3 | 44.1 | 44.9 |
| LSD (0.05) | NS | | | | | | NS |
| Years separating soybean | 1 | 1 | 1 | 2 | 1 | 3 | |
| Prior 4 years with soybean | 1 | 2 | 2 | 1 | 2 | 1 | |

SF882 (Revised)

# North Dakota Fertilizer Recommendation Tables and Equations

**D.W. Franzen**
NDSU Extension Soil Specialist

The following soil test recommendation tables are based on field research data obtained in North Dakota, South Dakota, western Minnesota and the Canadian Prairie Provinces. In the case of some crops, data in the literature also were used to supplement data available from this area.

**This publication contains major changes from previous publications. Please dispose of older editions. Changes to tables were based on new or re-evaluated data.**

This publication contains several major changes from previous versions, including revised potassium recommendations for alfalfa, corn and sugar beet, and the elimination of yield-based nutrient recommendation formulas.

## Recommendation Tables

Fertilizer needs should be determined after evaluating the current fertility level of the soil through soil testing, preferably using a site-specific zone sampling approach, as well as the nutrient needs of the crop to be grown, and knowing the historic productivity of the soil.

The most important reason for abandoning yield goal as a consideration in fertility recommendations is that the data from modern fertilizer rate trials indicate that a similar rate of nutrient results in the highest yield regardless of the maximum yield in any experiment. In other words, the rate of nutrient resulting in the highest yield in a low-yield environment was similar to the rate that resulted in the highest yield in a high-yield environment.

A logical way to explain this is that in a low-yield environment resulting from too wet or too dry conditions, nutrient use efficiency is quite low, so a greater rate of nutrient is required to produce a unit of yield. In a high-yield environment, nutrient use efficiency is quite high because release from the soil is maximized, root growth is maximized and the movement of nutrient to the root is maximized, so a lower rate of nutrient is required to produce a unit of yield. Therefore, the recommended N-rate table values should be utilized regardless of what yield a grower believes will result from the barley cultivation.

Several of our N recommendations are "capped" at a maximum rate. In years that support higher yields, our data indicate that greater N release from the soil and greater ability of crops to capture available soil N will support these higher yields without requiring supplemental N fertilizer greater than capped rates. In addition, sunflower N recommendations are capped due to greater lodging risk as the N rate increases.

### Nitrogen

Nitrogen (N) recommendations for most crops except some legumes are based on the amount of nitrate N ($NO_3$-N) in the top 2 feet of soil and the yield potential. Omission of the 2-foot nitrate-N analysis results in random numbers for the N recommendation.

**The 2-foot nitrate-N soil test is extremely important in this region for optimal N recommendations and to promote N-use efficiency, greater farm profitability and environmental stewardship.**

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February 2018

## Table 23. Soybean.

| Olsen Soil Test Phosphorus, ppm | | | | | Soil Test Potassium, ppm | | | | |
|---|---|---|---|---|---|---|---|---|---|
| VL | L | M | H | VH | VL | L | M | H | VH |
| 0-3 | 4-7 | 8-11 | 12-15 | 16+ | 0-40 | 41-80 | 81-120 | 121-150 | 150+ |
| ---------- lbs/acre $P_2O_5$ ---------- | | | | | ---------- lbs/acre $K_2O$ ---------- | | | | |
| 78 | 52 | 52 | 26 | 0 | 90 | 90 | 60 | 30 | 0 |

**Can you apply needed P for previous crop and let soybean feed on the residual?**

**Yes if you have high (>15 ppm) P tests**

**No for most growers.**

Dave Franzen, March 2019

# Soybean response to special inputs[1], Carrington, 2005-12

**FERTILIZER**
- farmer fertilizer blend
- Quickroots; Liquid sufl/can/soy mix
- 6-0-0-9 (Zn)
- 9.5-0-0-5-10 (Zn)
- Max-In; Max-In MnNF; Winfield Solutions experimentals
- UAN
- CoRon; zinc
- Micro500; Sure-K
- EB mix
- sugar
- MicroMix
- Moly

**PESTICIDES**
- Headline (+ Fastac)
- Stratego Pro/YLD (+ Leverage)
- Priaxor (+ Fastac)
- Quilt Xcel (+ Warrior T)
- Evito (+ Leverage)
- Cobra
- Makaze Yield Pro *(GP)*

**GROWTH PROMOTERS**
- Ratchet
- Soil Builder; Ag blend
- Bin Buster XP; KQ-XRN
- X-tra Power; Sugar Mover
- MegaGro; HappyGro
- SeedProd; CropProd
- BTN+; T1
- BioForge; Golden Harvest Plus GA
- NBS
- N-Hibit; ProAct
- Foliar Blend

[1]RR soybean: 2005-06=RG200RR, 2007=NT-0090, 2008-12=DSR0401.

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# Selected Management Factors for Economically Increasing Soybean Yield


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Photos by Greg Endres and Hans Kandel

NDSU | EXTENSION

North Dakota State University
Fargo, North Dakota

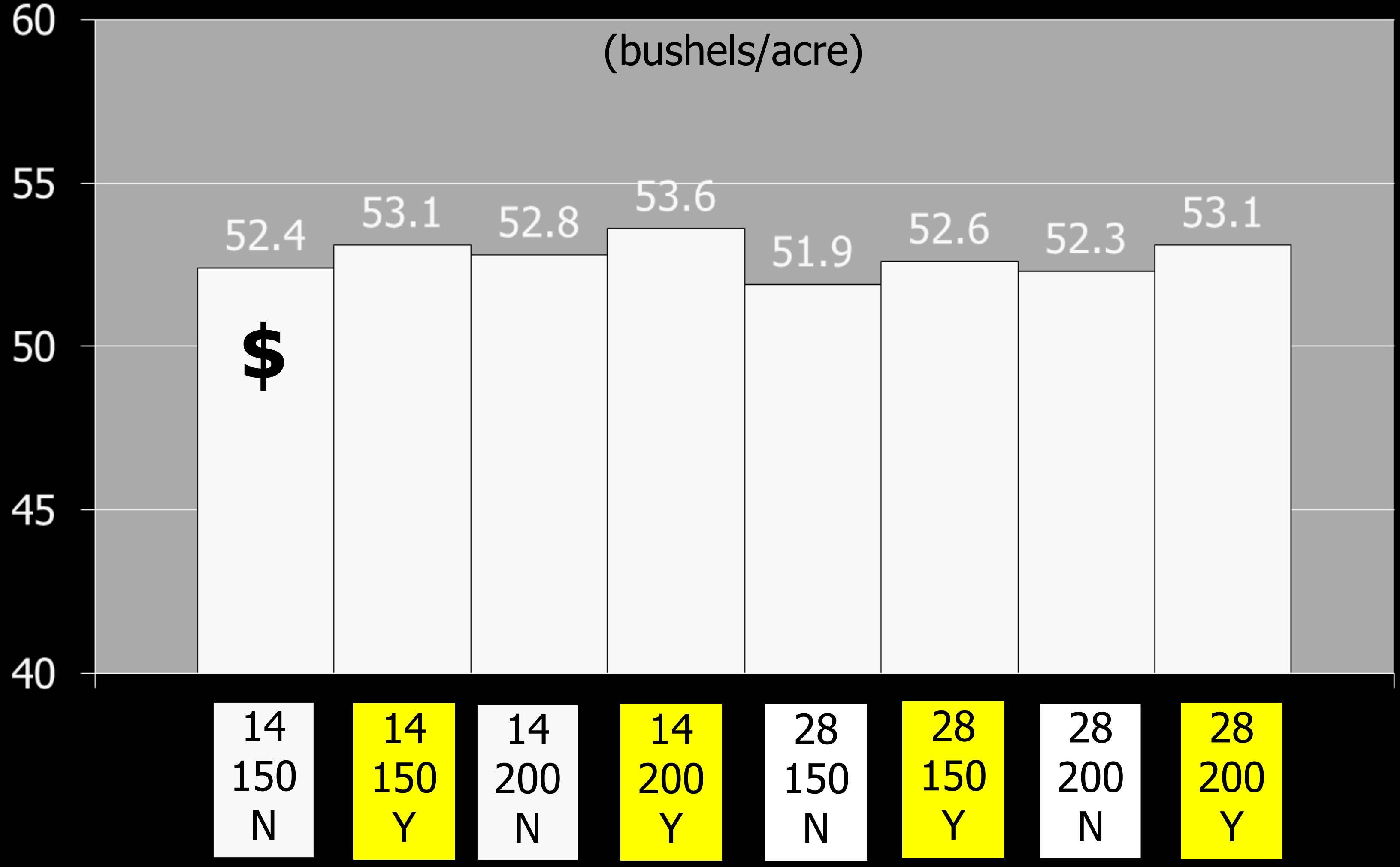
About 3 million acres of soybean were planted in North Dakota in 2003. That number reached 4.7 million acres a decade later in 2012. The growth in acreage can be attributed to the relative ease in producing the crop and its profitability.

Based on NDSU Extension crop budgets, projected return to labor and management during 2012-14 ranged from $73 to $114/acre in the east-central region and $63 to $122/acre in the southern Red River Valley.

Opportunities exist for farmers to increase soybean yield and profitability by improving plant establishment practices. Also, numerous special inputs that may add to soybean profits are being marketed.

**A study was conducted by NDSU with selected intensive management practices and inputs to examine potential increases in yield and profit.**

## Soybean intensive mgmt study, NDSU, 8 site-yr (2008-11)[1]: SEED YIELD and HIGHEST NET RETURN with row spacing, planting rate and foliar inputs.




[1]LSD (0.05) = NS for each site-yr

*Endres, Kandel et al.*

# Soybean plant nutrition summary

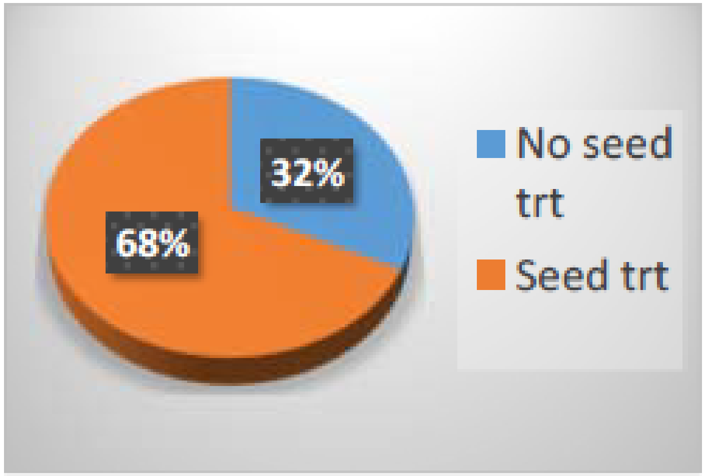
- With recent production (1-3 years between soybean crops), limited yield response with continued inoculation of soybean seed.
  - no statistical (or economic) response with double inoculation
- Use fertilizer $ on P and K if soil analysis indicates need for these nutrients
- IDC – use tolerant varieties
- Carefully scrutinize use of specialty fertilizers – are you confident of ROI?

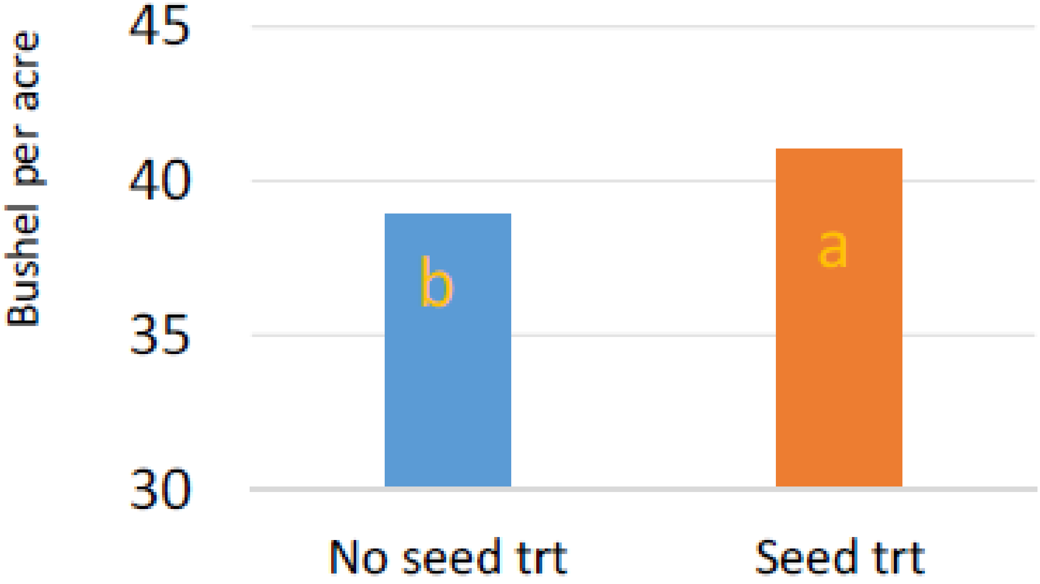
# ND farmer:

"I don't anticipate soil insect problems but should I use fungicide plus insecticide seed treatment?"

# ND 2014-17 Survey farmers using seed treatment in percent (total fields 1120) and yield in bushel per acre

Percent fields with seed chemical treatment applied

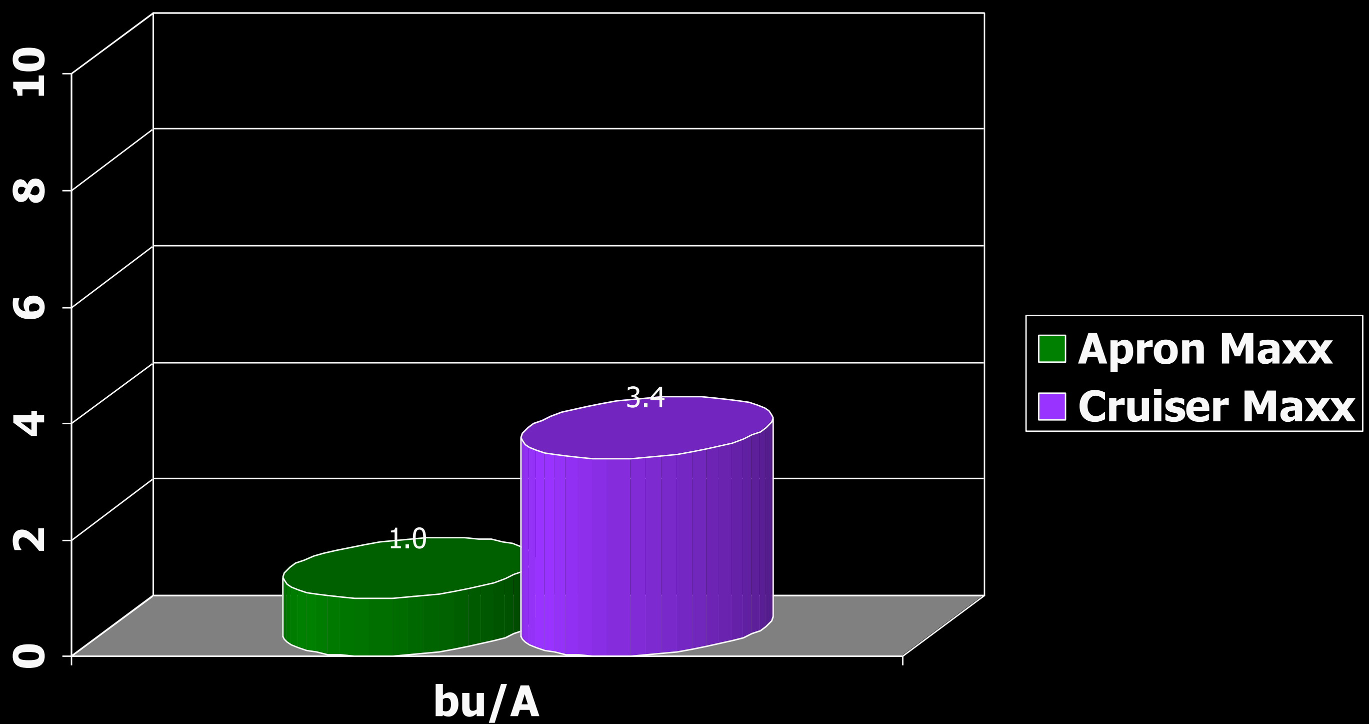


NDSU Research Summary of Soybean Plant Establishment Factors

| Factor | Option A | A Yield > B (%) | Option B | NDSU trials (conducted during 1999-2016) |
|---|---|---|---|---|
| **Seed fungicide** | yes | **6** | no | 29 |

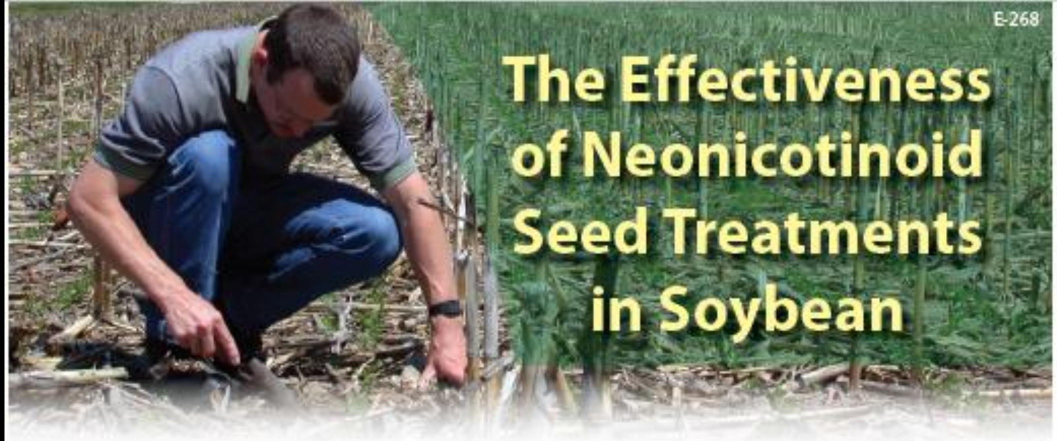
**Soybean yield response to <u>fungicide and fung+insecticide seed treatment</u> compared to untreated check, eastern ND*, 2012-15 (11 site-years)**




*locations: Casselton, Emerado, Harwood, Leonard, Mapleton

*J. Knodel and P. Beauzay*

E-268



# The Effectiveness of Neonicotinoid Seed Treatments in Soybean

Neonicotinoid insecticides are highly water soluble, and plants can absorb them and move them through their "circulatory system" from the root zone up into leaves and other tissues. This quality has made neonicotinoids a popular insecticidal seed treatment of many crops (Figure 1). In 2011, more than 80 percent of corn, more than 50 percent of cotton, and about 40 percent of soybean acres were planted with neonicotinoid-treated seed, a total area described as "roughly the size of California." (Douglas and Tooker 2015). Neonicotinoid seed treatments of soybean rank only behind corn in total acreage.

This publication reviews the current research regarding the efficacy of these neonicotinoid seed treatments, their non-target effects, and the potential role for neonicotinoid seed treatments in soybean production.


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Figure 1. Neonicotinoid-treated soybean seed before soil covering.

## Do Neonicotinoid Seed Treatments Work in Soybean?

Neonicotinoid seed treatments offer soybean plants a narrow window of protection — a maximum of three weeks after planting (McCornack and Ragsdale 2006). **As such, they can be useful for managing early-season pests in targeted, high-risk situations.**

Examples of such high-risk situations include:

- *Fields transitioning to soybean production from pasture, Conservation Reserve Program (CRP) land, or grassland to soybean production.* Such fields tend to have higher populations of long-lived soil pests, such as wireworms or white grubs, which cannot be controlled with foliar insecticides.

North Dakota
Soybean Council
*Our World Is Growing.*

Projected 2019 corn acres:

2018: 2.930 K (harvested) x 30% increase = 3.810 K acres

# Critical corn yield development stages

- V3; V4-5
  - Ears initiated; and develop
- V4-7
  - Kernel rows per ear determined (genetics > env)
- V6 (V12-14) to 1-2 weeks prior to tassel
  - Number of kernels per row determined (env > genetics)
- R1 (= silking)
  - Kernel formation and development
    - early grain fill: kernel depth
    - late grain fill: test weight

# An Update to Corn Plant Populations in Central North Dakota

*Mike Ostlie, Blaine G. Schatz, and Greg Endres*

Many surrounding states have recently conducted research to update recommendations for corn plant populations using modern hybrids. Much of that research has come to the similar conclusion that recommendations haven't changed much from the 1980s-1990s. Yet with ever increasing input costs, including seed, managing to the optimum economic advantage needs to be considered rather than yield alone. Purdue University did a nice job of examining plant populations economically (https://www.agry.purdue.edu/ext/corn/news/timeless/CornPopulations.pdf). Using this as a template, a similar table can be generated for North Dakota with local data.

(dryland)

From 2012-2014 a plant population study was conducted at the Carrington Research Extension Center. Each year of the study was conducted under dryland management. The study was arranged as a split-plot randomized complete block design with four replicates. Hybrid maturity and plant population were the two factors being evaluated. The four relative maturities (RM) in the trial were 83, 85, 87, and 90 day. Hybrids were chosen based on the best performing hybrid within each maturity from the previous season hybrid trial. Each hybrid was tested from 20K to 44kK established plants per acre, with 4K plant increments (seven populations total). Plots were hand thinned to ensure optimum spacing of plants.

For simplicity, the first comparison will be about yield alone. Table 1 shows the plant population that resulted in the maximum yield within each maturity group. Importantly, the trend is that with longer maturities, maximum yield is reached at a lower population than shorter maturities. In fact if population were plotted from maturities of 85-90, it would show that for each day increase in maturity, roughly 1000 less plants were needed to maximize yield. Table 2 is a complimentary dataset that emphasizes the effect of plant maturity on needed population. In this case, *average* yield is considered rather than maximum. It took only 19K plants/ac to reach the average yield at RM 90 (16K plants/ac less than

**Table 3. The plant population that gives maximum economic return based on seed cost / unit (80,000 seeds) and grain price for corn varieties ranging from RM 83-RM 85. 95% stand establishment is assumed.**

| Cost of seed | Price/bushel of grain | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $ / unit | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 |
| 150 | 32,230 | 33,070 | 33,660 | 34,100 | 34,440 | 34,710 | 34,930 | 35,120 |
| 175 | 31,390 | 32,370 | 33,070 | 33,580 | 33,980 | 34,300 | 34,560 | 34,780 |
| 200 | 30,530 | 31,670 | 32,470 | 33,070 | 33,530 | 33,870 | 34,190 | 34,440 |
| 225 | 29,650 | 30,960 | 31,870 | 32,550 | 33,070 | 33,480 | 33,820 | 34,100 |
| 250 | 28,760 | 30,240 | 31,270 | 32,020 | 32,600 | 33,070 | 33,440 | 33,750 |
| 275 | 27,840 | 29,500 | 30,650 | 31,490 | 32,140 | 32,650 | 33,070 | 33,410 |
| 300 | 26,900 | 28,760 | 30,030 | 30,960 | 31,670 | 32,230 | 32,700 | 33,070 |
| 325 | 25,920 | 28,000 | 29,400 | 30,420 | 31,200 | 31,810 | 32,310 | 32,730 |

**Table 4. The plant population that gives maximum economic return based on seed cost / unit (80,000 seeds) and grain price for corn varieties ranging from RM 87-RM 90. 95% stand establishment is assumed.**

| Cost of seed | Price/bushel of grain | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $ / unit | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 |
| 150 | 29,490 | 30,320 | 30,910 | 31,340 | 31,680 | 31,950 | 32,170 | 32,360 |
| 175 | 28,640 | 29,630 | 30,320 | 30,830 | 31,230 | 31,550 | 31,800 | 32,020 |
| 200 | 27,810 | 28,940 | 29,730 | 30,320 | 30,780 | 31,140 | 31,430 | 31,680 |
| 225 | 26,950 | 28,230 | 29,140 | 29,800 | 30,320 | 30,730 | 31,060 | 31,340 |
| 250 | 26,070 | 27,520 | 28,530 | 29,280 | 29,860 | 30,320 | 30,690 | 31,000 |
| 275 | 25,170 | 26,800 | 27,930 | 28,760 | 29,400 | 29,910 | 30,320 | 30,660 |
| 300 | 24,250 | 26,070 | 27,320 | 28,230 | 28,940 | 29,490 | 29,940 | 30,320 |
| 325 | 23,300 | 25,320 | 26,700 | 27,700 | 28,470 | 29,080 | 29,570 | 29,980 |