EXTENDING KNOWLEDGE ›› CHANGING LIVES

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# Dry Bean Management Getting it Right production meeting

Hans Kandel

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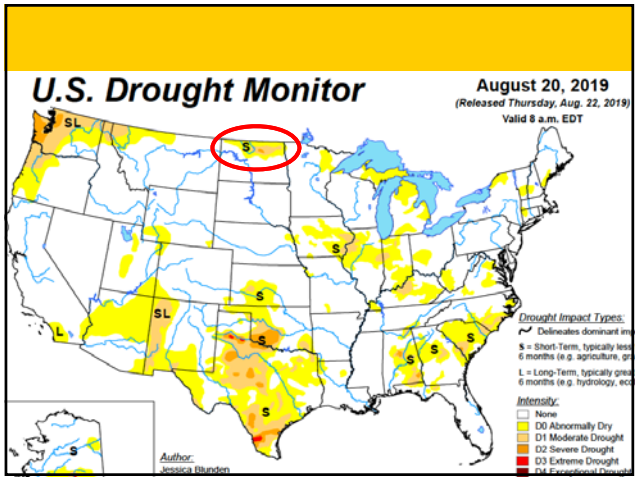
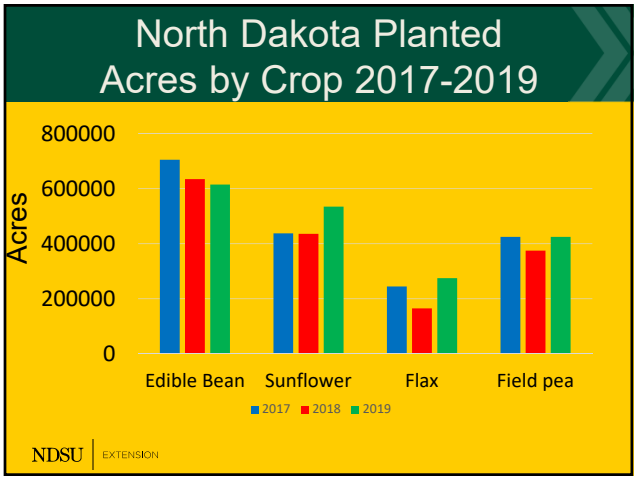
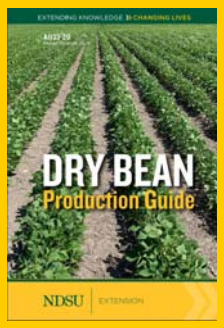


## Revised Production Guide




- Dry bean types and development stages Pg 8 - 13

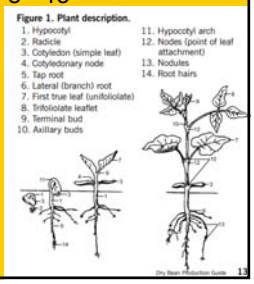


Figure 1. Plant description.
1. Hypocotyl
2. Radicle
3. Cotyledon (simple leaf)
4. Cotyledonary node
5. Tap root
6. Lateral (branch) root
7. First true leaf (unifoliolate)
8. Trifoliolate leaflet
9. Terminal bud
10. Axillary buds
11. Hypocotyl arch
12. Nodes (point of leaf attachment)
13. Nodules
14. Root hairs

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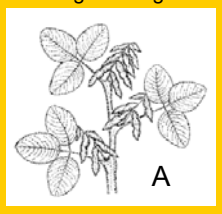
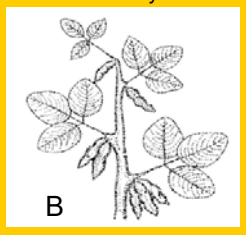
## Plant Growth Forms

- Determinate (A)
  - Growth terminates at an inflorescence
- Indeterminate (B)
  - Vegetative growth continues indefinitely

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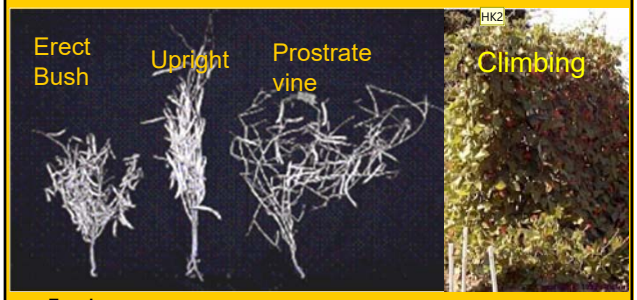
**Plant Architectural Classification**

| Genetics | Type | Type Refined | Description |
|---|---|---|---|
| ***Determinate*** | I | Ia | Erect Bush |
| | | Ib | |
| ***Indeterminate*** | II | IIa | Upright short vine |
| | | IIb | Upright vine |
| | III | IIIa | Prostrate Vine |
| | | IIIb | |
| | IV | IVa | Climbing |
| | | IVb | |

Source: Ciat.org.

## Plant Architecture




Type I | Type II | Type III | Type IV

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Source: Kelly, J.D.

## Disease Avoidance

- White Mold (*Sclerotinia sclerotiorum)* in type I and II vs type III
  - Upright
  - Increase Air Flow
  - Decrease moisture retention

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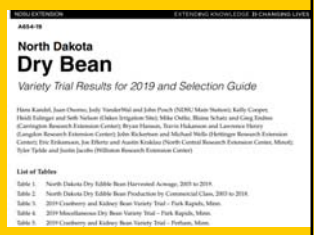
## Extension Bulletin A-654-19

- Look for trends instead of a single year/location
- Use LSD to make realistic comparisons
- CV: Coefficient of variation
  - Less than 20% for yield

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## Slow darkening gene

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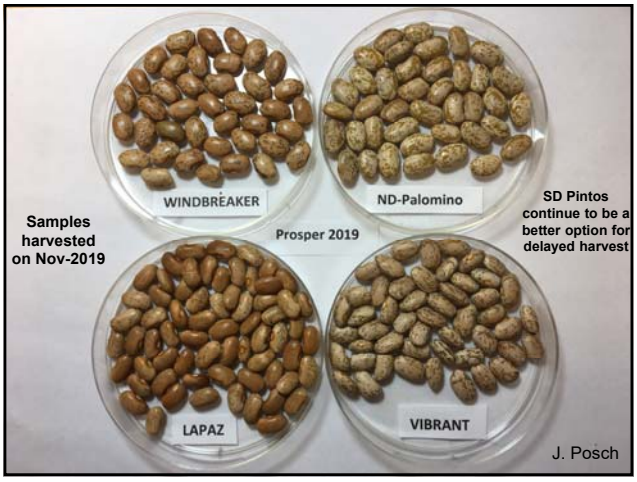
J. Posch



## Slow darkening gene

- Public perception:
- - Consumer: dark beans = old – longer cook time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## Slow darkening gene

- Seed darkening negatively affects prices
- Several factors may cause seed darkening:
- -Environment: Light, Temperature, Rainfall
- -Storage
- -Variety
- -Diseases


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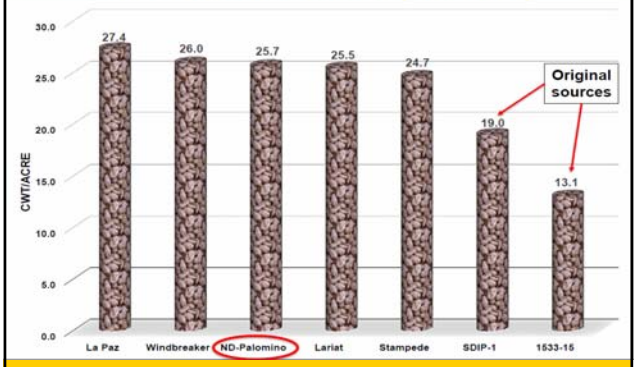
## Seed Yield (Cwt/Acre) of Pinto Bean Varieties Across 54 Environments (2012-2017)

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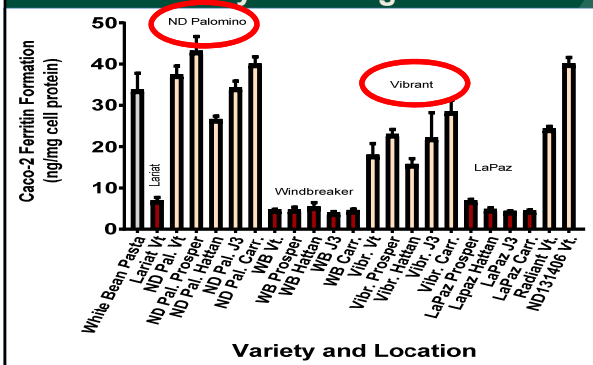
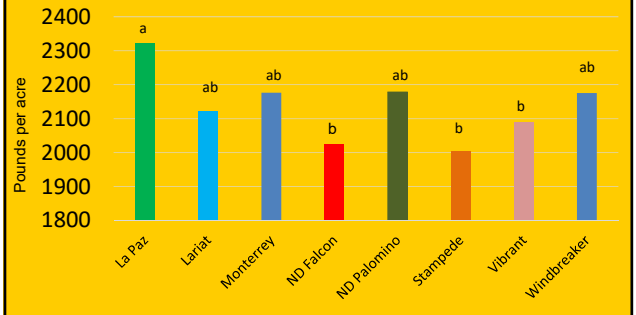
Osorno, 2019

## SD Pintos Have 4X Higher Iron Bioavailability than Regular Pintos!




Glahn, Wiesinger, and Osorno, 2019

## NDSU 2019 pinto bean yield 9 environments

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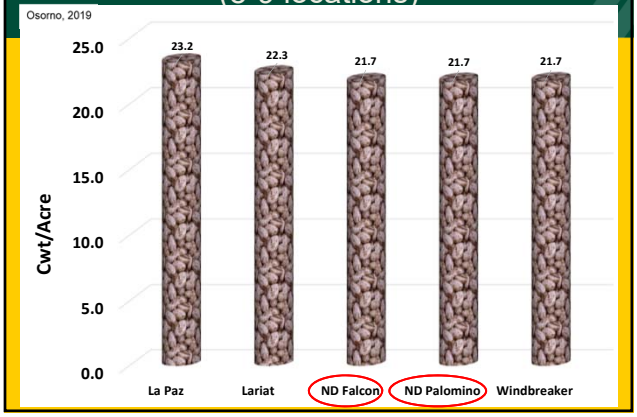
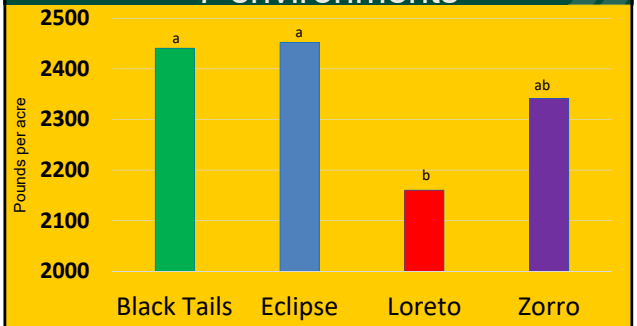
Minot, Hettinger, Langdon, Carrington, Park Rapids, Perham and Oaks, Williston and Carrington irrigated

## 2019 Seed Yield of Pinto Varieties (8-9 locations)




## NDSU 2019 black bean yield 7 environments

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Minot, Hettinger, Langdon, Carrington and Oaks, Williston and Carrington irrigated

## ND Twilight? (NDF120287) Black Bean

- Uniform dry-down (similar to Eclipse)
- 2-3 days earlier than Eclipse
- Upright plant architecture
- Resistance to Bean common mosaic virus
- Resistance to rust (race 20-3)
- Intermediate resistance to Soybean cyst nematode and Common bacterial blight

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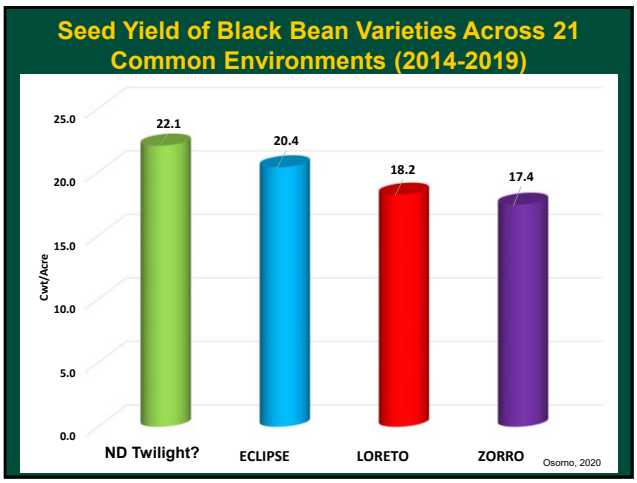
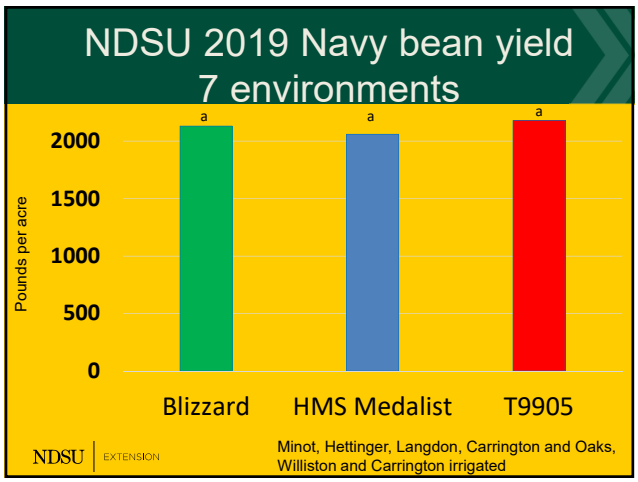
Osorno, 2020


ND Twilight?
Zorro
Loreto
Eclipse
J. Posch


Seed Yield of Black Bean Varieties Across 21 Common Environments (2014-2019)
Cwt/Acre
25.0
20.0
15.0
10.0
5.0
0.0
22.1
20.4
18.2
17.4
ND Twilight?
ECLIPSE
LORETO
ZORRO
Osorno, 2020


NDSU 2019 Navy bean yield 7 environments
Pounds per acre
2000
1500
1000
500
0
a
a
a
Blizzard
HMS Medalist
T9905
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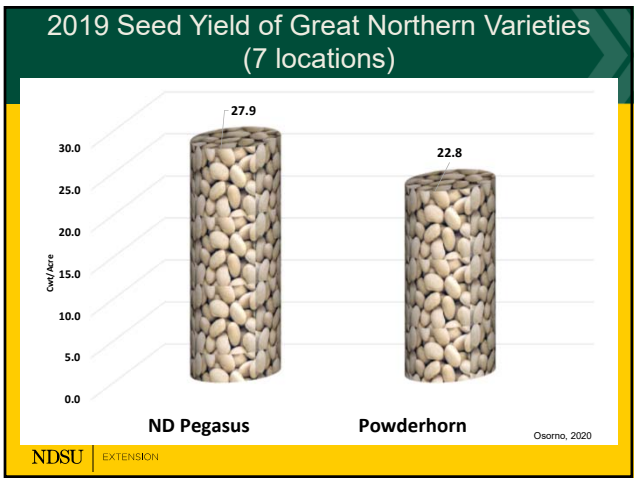
Minot, Hettinger, Langdon, Carrington and Oaks, Williston and Carrington irrigated


2019 Seed Yield of Great Northern Varieties (7 locations)
Cwt/Acre
30.0
25.0
20.0
15.0
10.0
5.0
0.0
27.9
22.8
ND Pegasus
Powderhorn
Osorno, 2020
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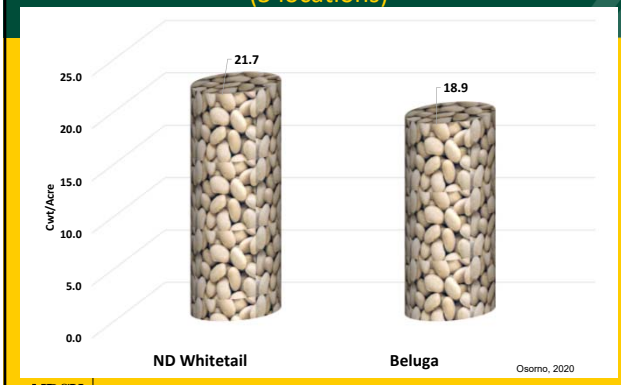
## 2019 Seed Yield of White Kidney Varieties (3 locations)

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## Bin Run Seed: High Risk

- Seeding Quality?
- Consider:
  1. Cost of owing inventory
  2. Genetic purity/disease borne seed
  3. Germination and seedling vigor (stand)
  4. Cleanout costs (conditioning)
  5. Value of cleanout

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## Bin Run Seed: High Risk

- Seeding Quality?
- Consider:
  6. Seed treatment costs
  7. Transportation (hauling in and out)
  8. Labor cost
  9. Multiple tasks at busy time of year

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## Seeding Management Tips

- Treat seed to maximize emergence/stand counts if planting early in cool soils.
- Watch seed/fertilizer placement to maximize stands.
- Do stand counts.

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## Seeding Management Tips

- Adjust seeding rate for each seed-lot based on seed count and germination percentage.
- Consider rate adjustments based on moisture conditions and planting date.

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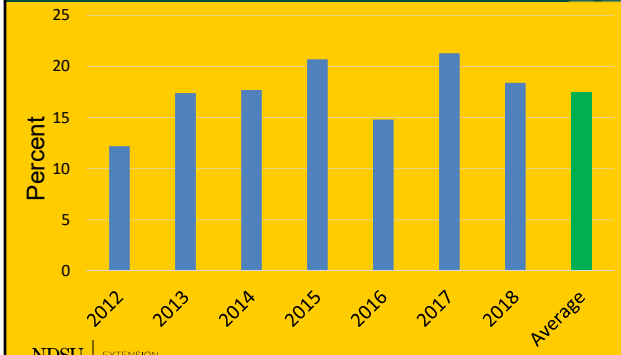
## Dry Bean Grower Survey Use of Inoculant in Percent of Respondents

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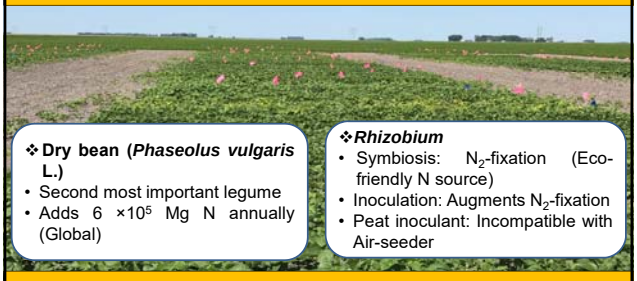
## Biological Nitrogen Fixation in Dry Bean Cultivars Inoculated with *Rhizobia*



❖ **Dry bean (*Phaseolus vulgaris* L.)**
- Second most important legume
- Adds 6 $\times 10^5$ Mg N annually (Global)

❖ ***Rhizobium***
- Symbiosis: $N_2$-fixation (Eco-friendly N source)
- Inoculation: Augments $N_2$-fixation
- Peat inoculant: Incompatible with Air-seeder

Osorno, 2020

## Hypotheses

- *Rhizobia* inoculation has a potential to increase Biological Nitrogen Fixation
- Screen Dry bean cultivars: Potential $N_2$-fixer
- 'Liquid' inoculation: Potential alternative inoculant

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## Treatment: Inoculants (Liquid, Peat, and Cultivars


| | 2016 | 2017 |
|---|---|---|
| Pinto | Lariat, Wind breaker, ND307, La Paz | La Paz, Windbreaker, Lariat, ND307 |
| Navy | Avalanche, T9905, Ensign, Medalist | |
| Kidney | Foxfire, Redhawk, Pink Panther, Montcalm | Montcalm, Pink Panther, Foxfire, Redhawk |
| Black | Zenith, Loreto, Eclipse | |

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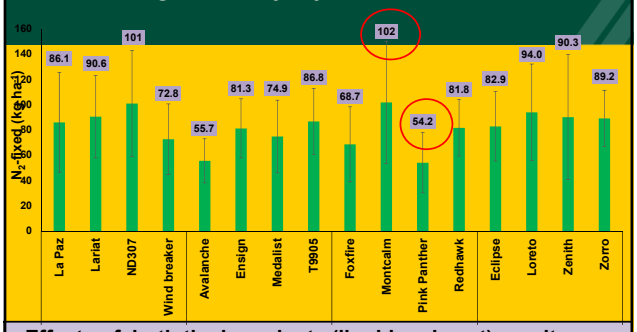
## Nitrogen Fixed by Dry Bean Cultivars in 2016




- Effects of both the inoculants (liquid and peat) on nitrogen fixed by dry bean cultivars were statistically similar

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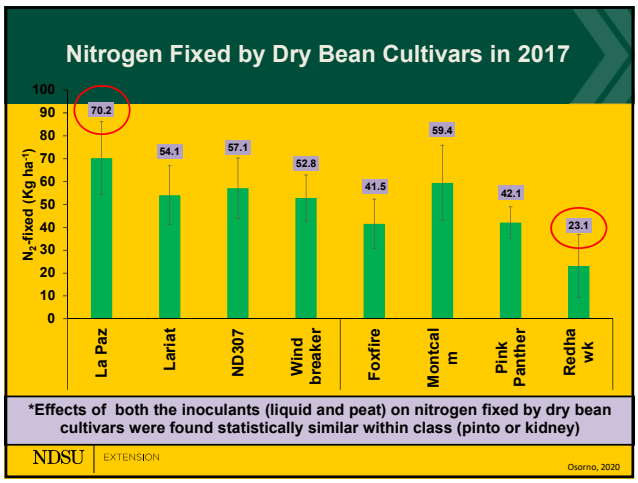


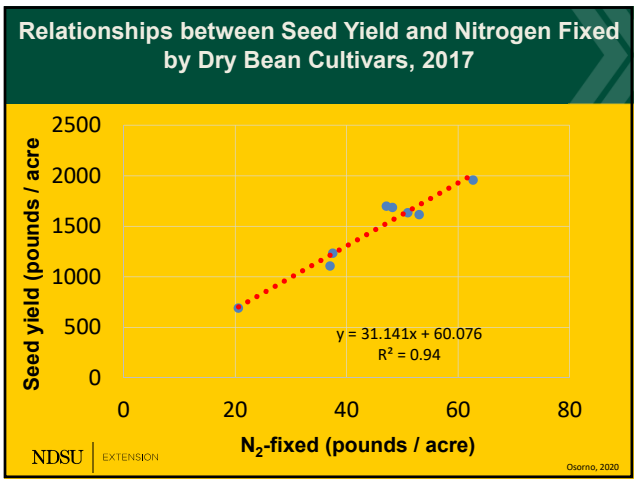


## Additional Research

- Varieties Lariat (pinto), Eclipse (black) and Vista (navy).
- Two commercial inoculants compared with a non-inoculated control.
- Two N availability levels,
  - 50 lb N / acre (based on soil test)
  - 100 lb N/ acre (based on soil test + 50 lb N fertilizer.

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## Additional N Fertilizer 50 lb /a

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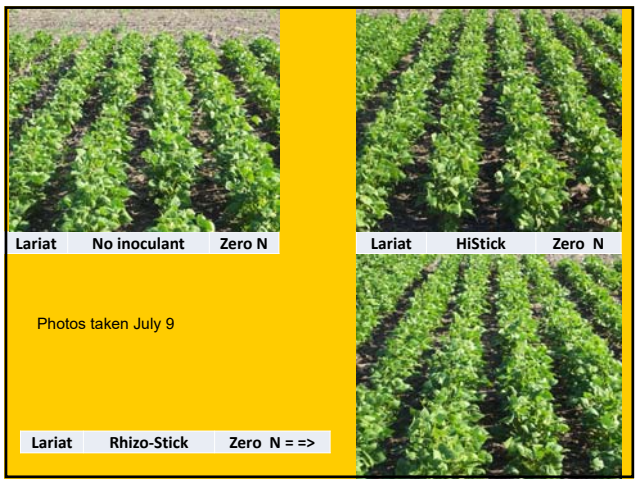


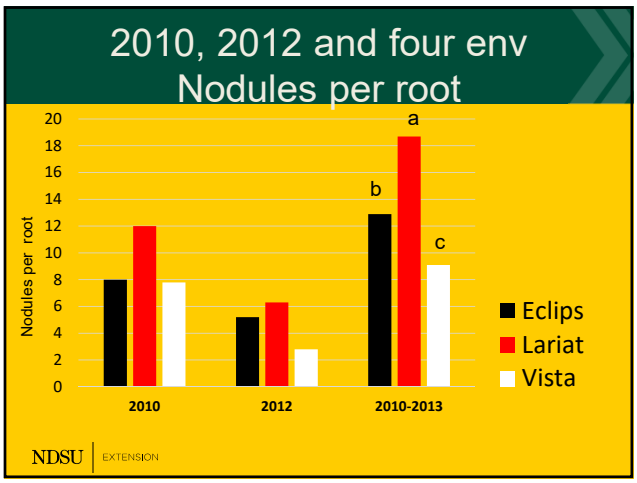


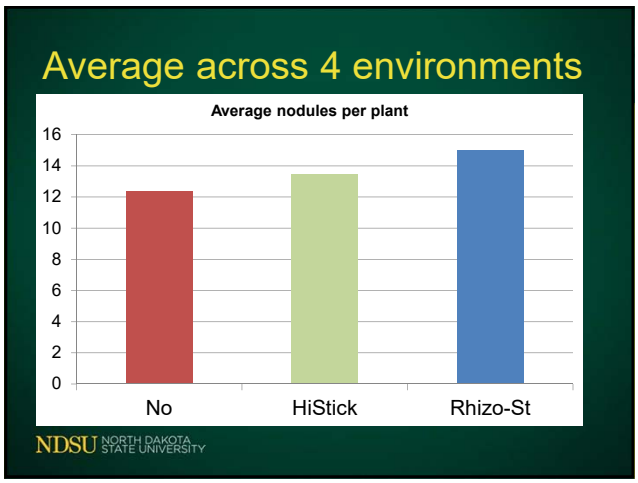


## Inoculant study Prosper

| Inoculant | Nodules | Average Yield |
|---|---|---|
| | (per root) | (lb/a) |
| No | 4.6a | 2505a |
| Histick | 4.3a | 2451a |
| Rhizo-Stick | 5.5a | 2646a |

## Inoculant study Park River

| Inoculant | Nodules | Average Yield |
|---|---|---|
| | (per root) | (lb/a) |
| No | 10.7b | 2317b |
| Histick | 16.2a | 2599a |
| Rhizo-Stick | 15.8a | 2364ab |

## Dry Bean Harvest Methods

- Conventional
- Direct Harvest

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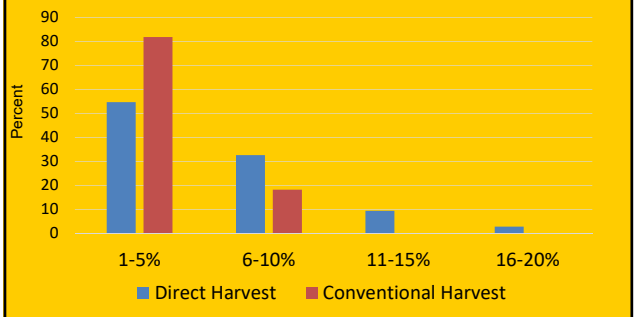
## Estimated yield loss in beans 2018 (dry bean survey)

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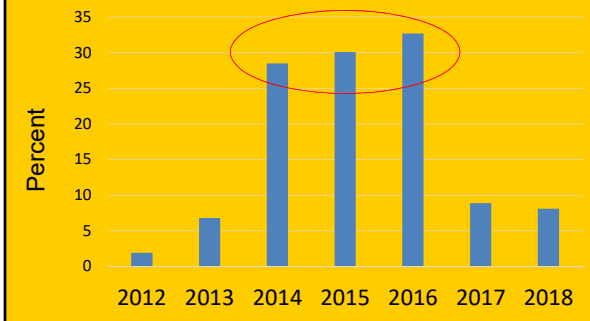
## Dry Bean Grower Survey Acres Water Damaged in Percent

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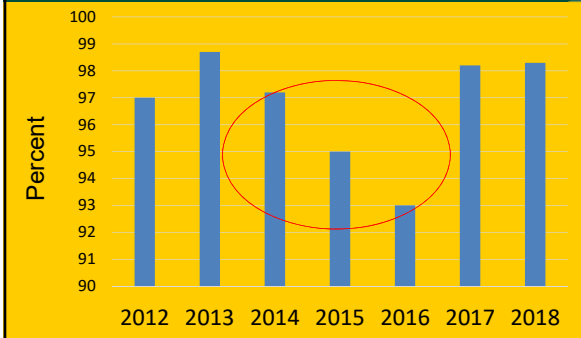
## Dry Bean Grower Survey Acres Harvested in Percent

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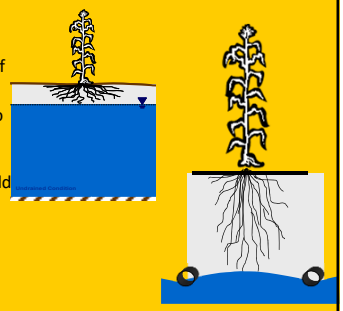
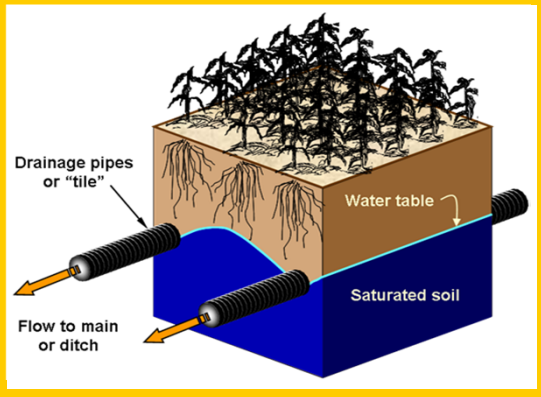
## Why do water logged conditions after planting cause crop damage?

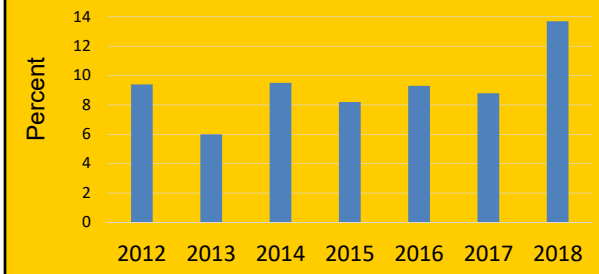
- Under water-logged conditions, the availability of oxygen is decreased
- When roots are subjected to low oxygen conditions, changes occur in the plant that generally decreases yield
- Root growth is restricted
- De-nitrification increases






Source: G. Sands

## Dry Bean Grower Survey Acres Tiled in Percent

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## Dry bean very sensitive to salts

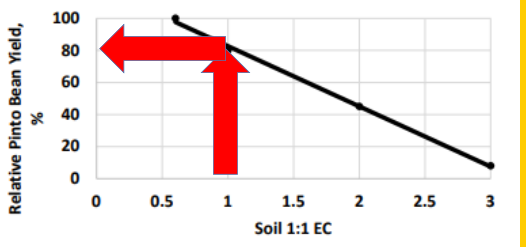


**Figure 2. Relative yield loss of pinto beans from soil salinity (1:1 EC measurement).** From Colorado data.

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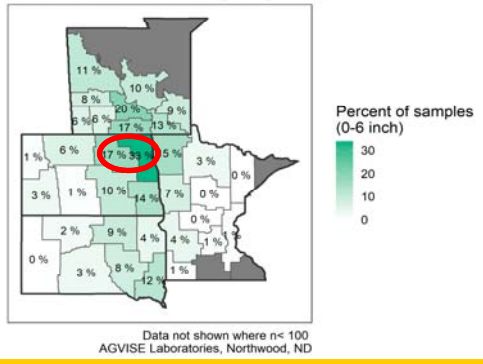
## Soil samples with soil salinity above 1.0 dS/m (1:1) in 2019




Data not shown where n< 100
AGVISE Laboratories, Northwood, ND

AGVISE LABORATORIES