National Screen of Biological Seed Treatments

Laura Lindsey
Indiana CCA Conference
December 19, 2023

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

1

2

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

What is Science for Success?

- Agronomists at land-grant institutions across the US delivering soybean Best Management Practices
- Summarize existing and ongoing QSSB-supported soybean checkoff research
- Collaborate on national research trials
  2019 and 2020: Foliar fertilizers and soil-applied N and S fertilizers
  2021 and 2022: N-fixation, biologicals, and soil health
- Amplify our state-level research and Extension knowledge into National Extension impact

https://soybeanresearchinfo.com/

@SoybeanScience1

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

3

CFAES

National Screen of Commercially Available Biological Seed Treatment for Soybean

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

4

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Biological Seed Treatment Market

COMMODITY CLASSIC · Sunbelt AG EXPO · WORLD AG EXPO · FARM PROGRESS SHOW

Huge number of biological seed treatment for soybeans on the market

Trade show at 2022 Commodity Classic

- 22 Companies
- 40 Different products
- Multiple active ingredients
  - *Bradyrhizobium*
  - *Azospirillum*
  - *Bacillus*
  - *Pseudomonas*
  - … and more!

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

5

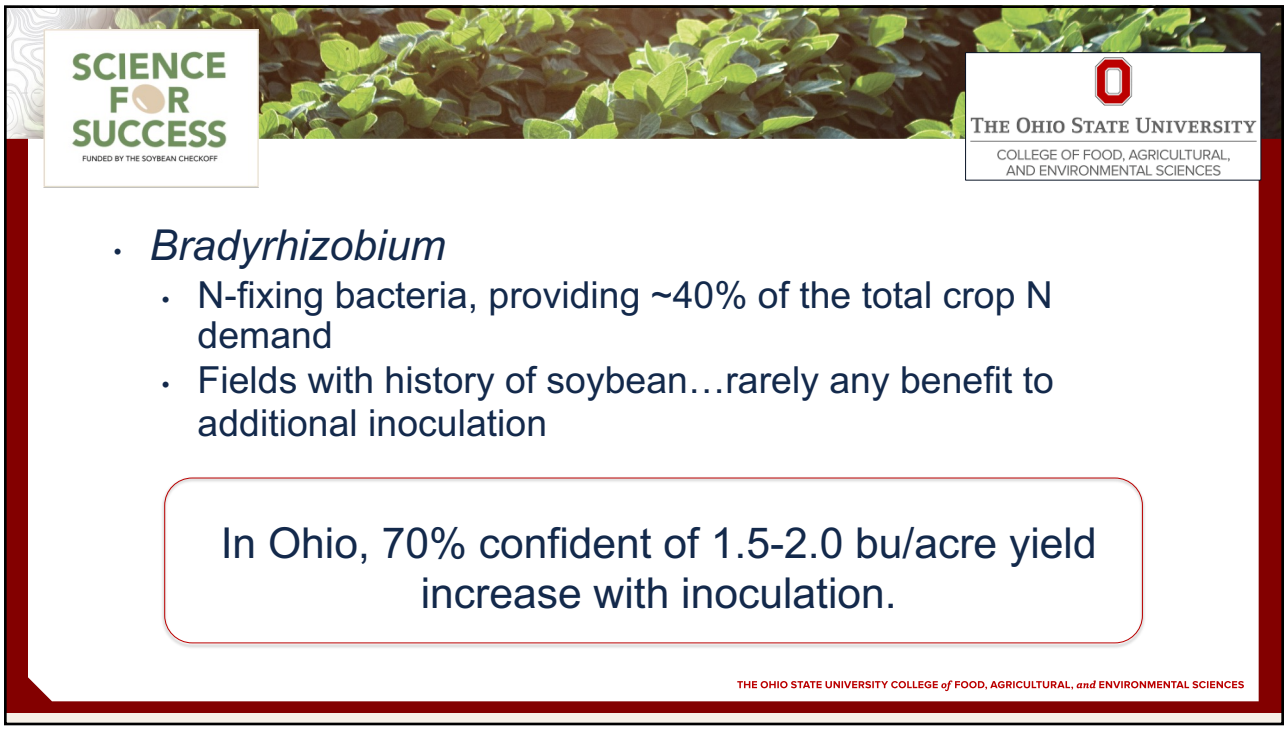
SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

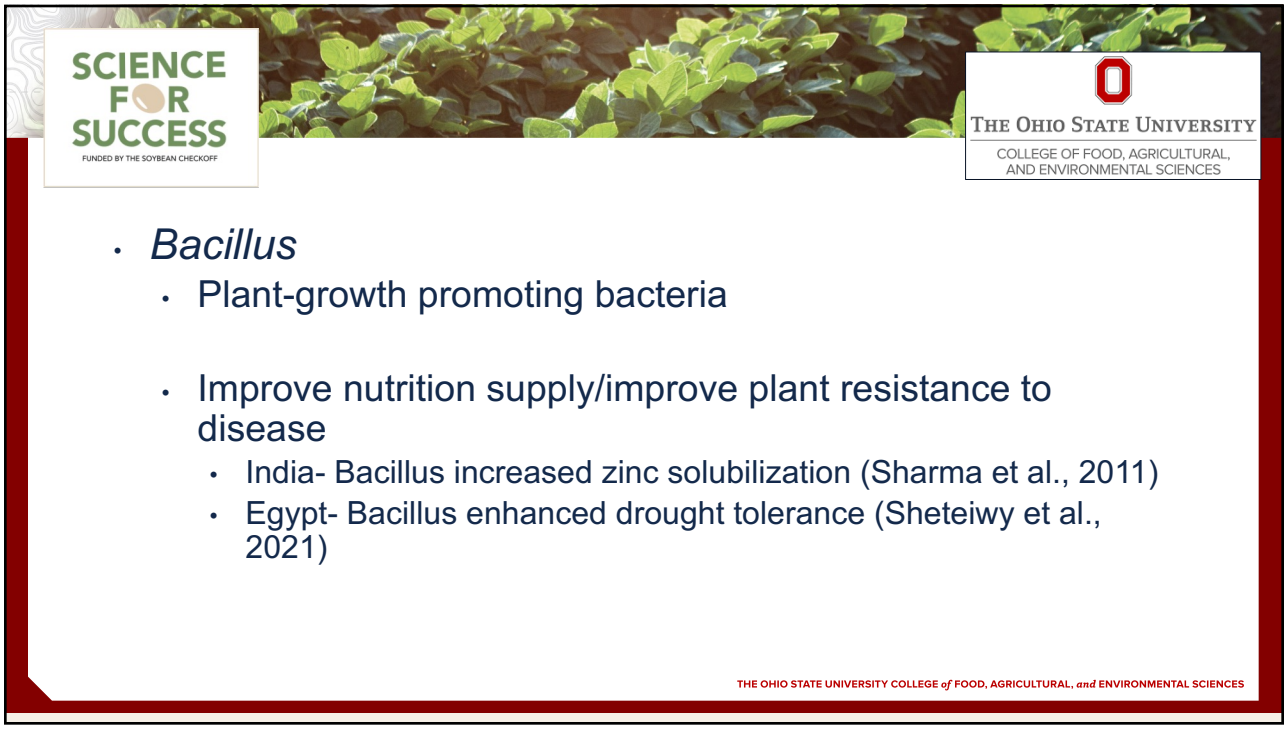
- *Bradyrhizobium*
  - N-fixing bacteria, providing ~40% of the total crop N demand
  - Fields with history of soybean…rarely any benefit to additional inoculation

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

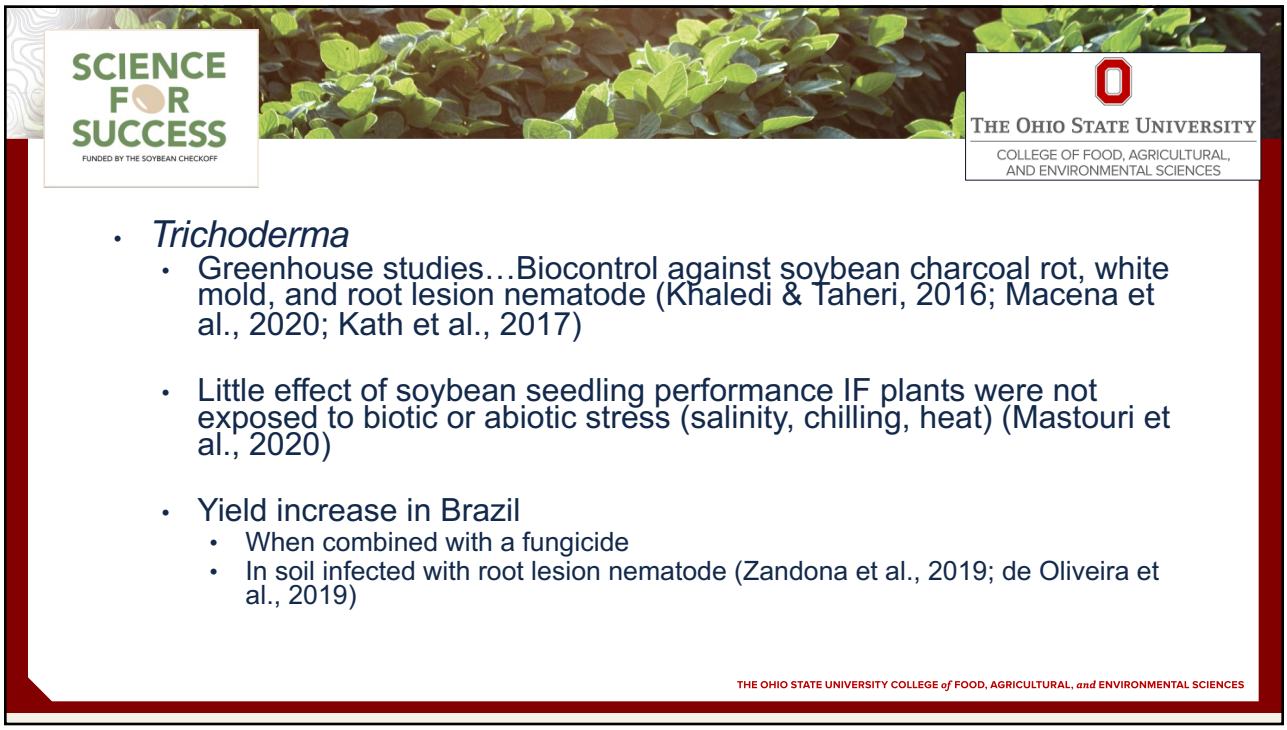
6


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Bradyrhizobium*
• N-fixing bacteria, providing ~40% of the total crop N demand
• Fields with history of soybean…rarely any benefit to additional inoculation
In Ohio, 70% confident of 1.5-2.0 bu/acre yield increase with inoculation.
THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

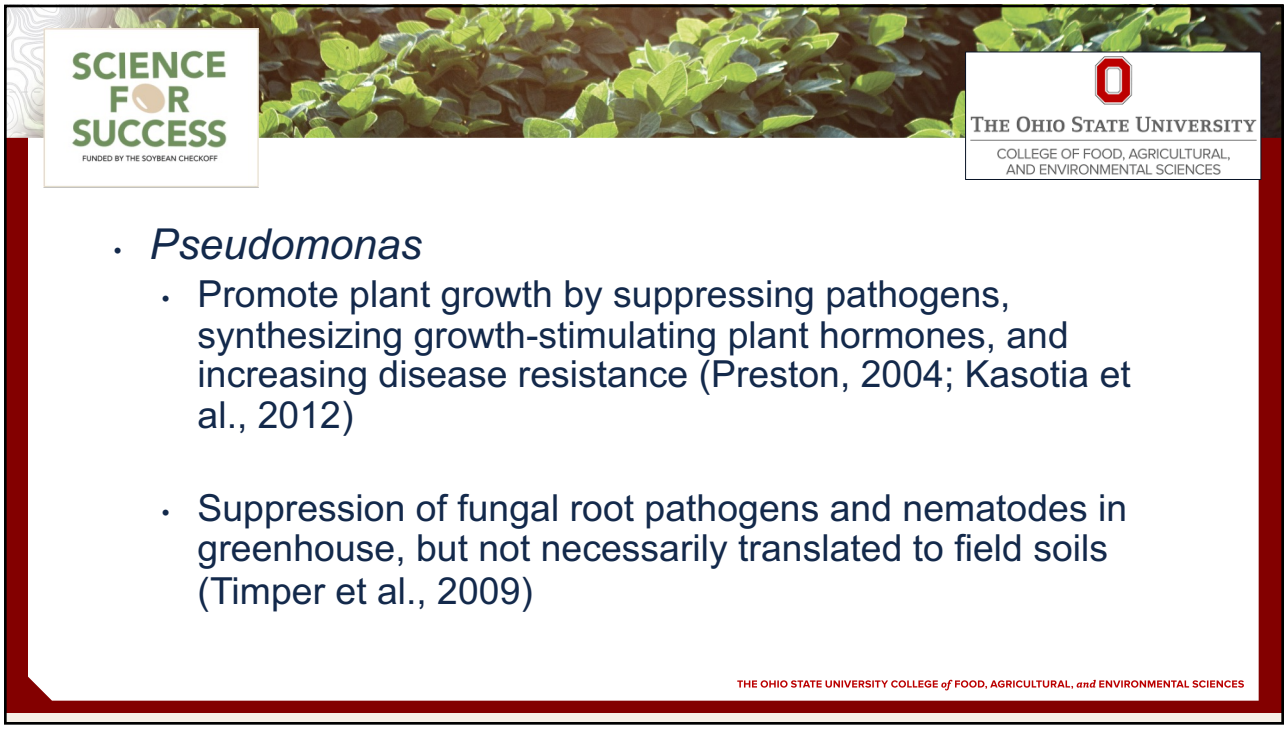
7


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Bacillus*
• Plant-growth promoting bacteria
• Improve nutrition supply/improve plant resistance to disease
• India- Bacillus increased zinc solubilization (Sharma et al., 2011)
• Egypt- Bacillus enhanced drought tolerance (Sheteiwy et al., 2021)
THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

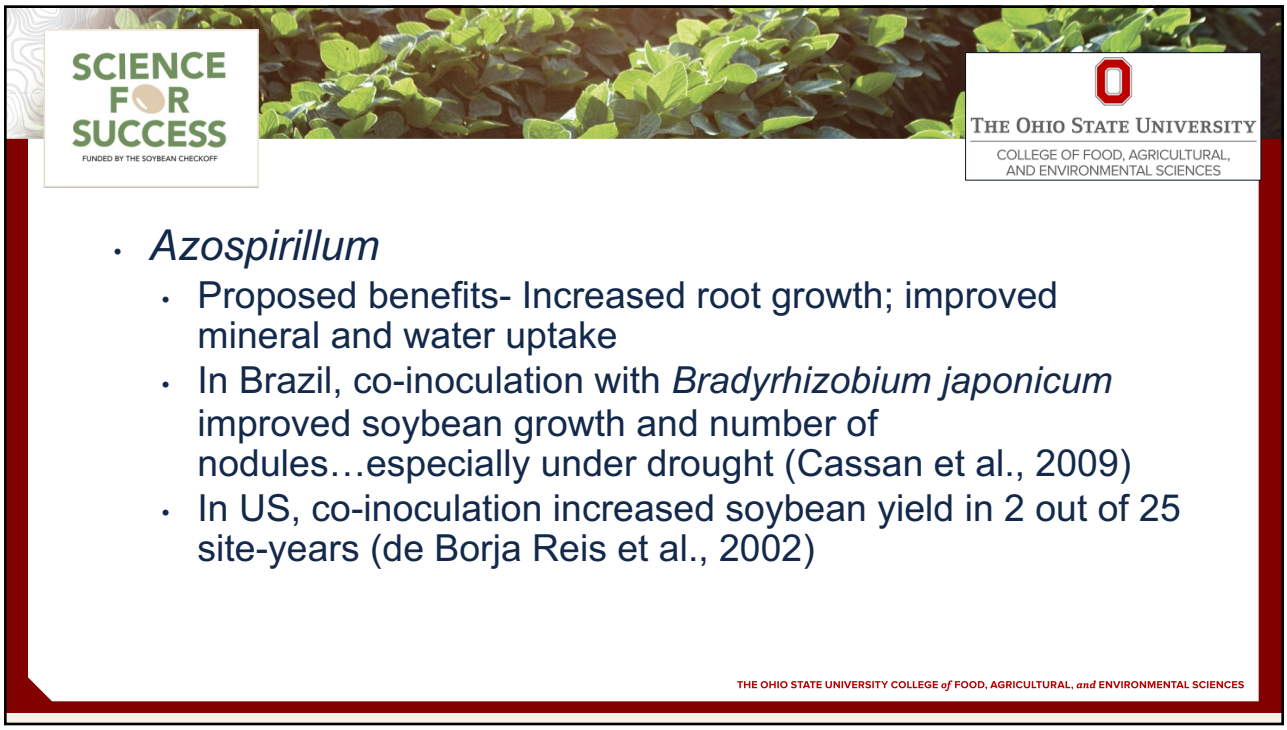
8


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Trichoderma*
• Greenhouse studies…Biocontrol against soybean charcoal rot, white mold, and root lesion nematode (Khaledi & Taheri, 2016; Macena et al., 2020; Kath et al., 2017)
• Little effect of soybean seedling performance IF plants were not exposed to biotic or abiotic stress (salinity, chilling, heat) (Mastouri et al., 2020)
• Yield increase in Brazil
• When combined with a fungicide
• In soil infected with root lesion nematode (Zandona et al., 2019; de Oliveira et al., 2019)
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

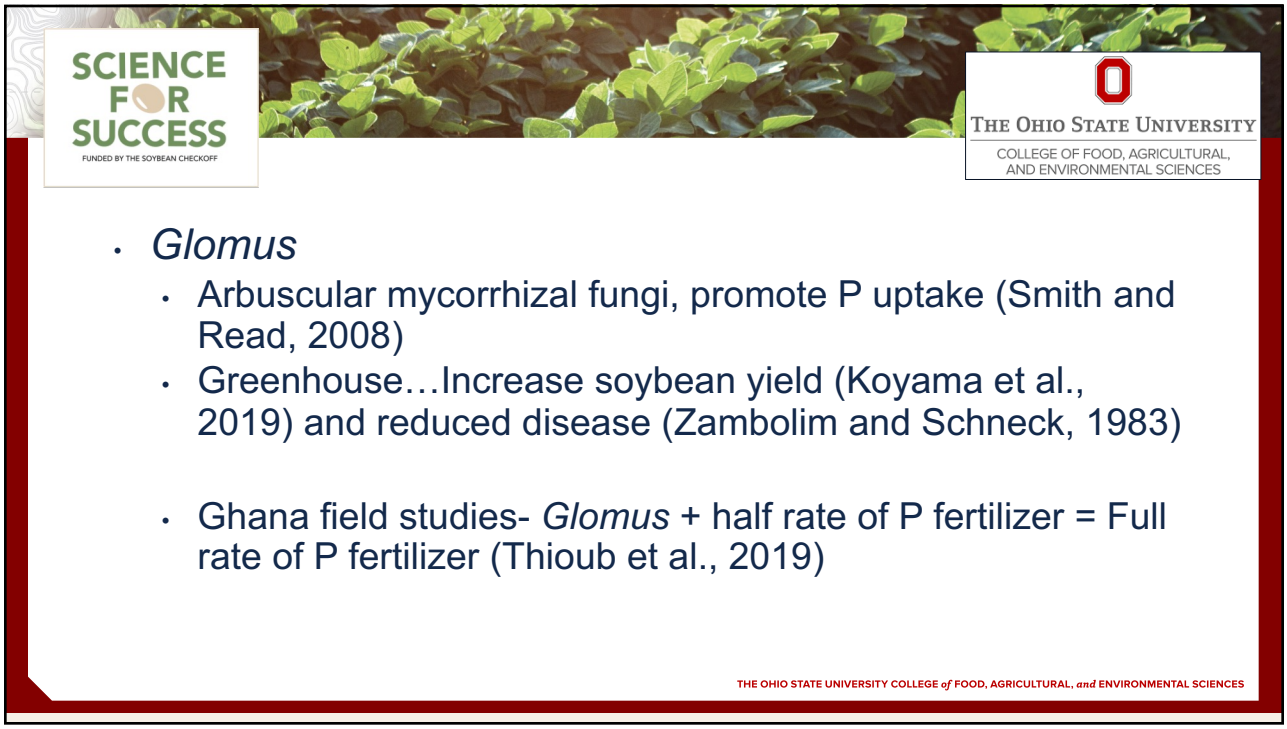
9


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Pseudomonas*
• Promote plant growth by suppressing pathogens, synthesizing growth-stimulating plant hormones, and increasing disease resistance (Preston, 2004; Kasotia et al., 2012)
• Suppression of fungal root pathogens and nematodes in greenhouse, but not necessarily translated to field soils (Timper et al., 2009)
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

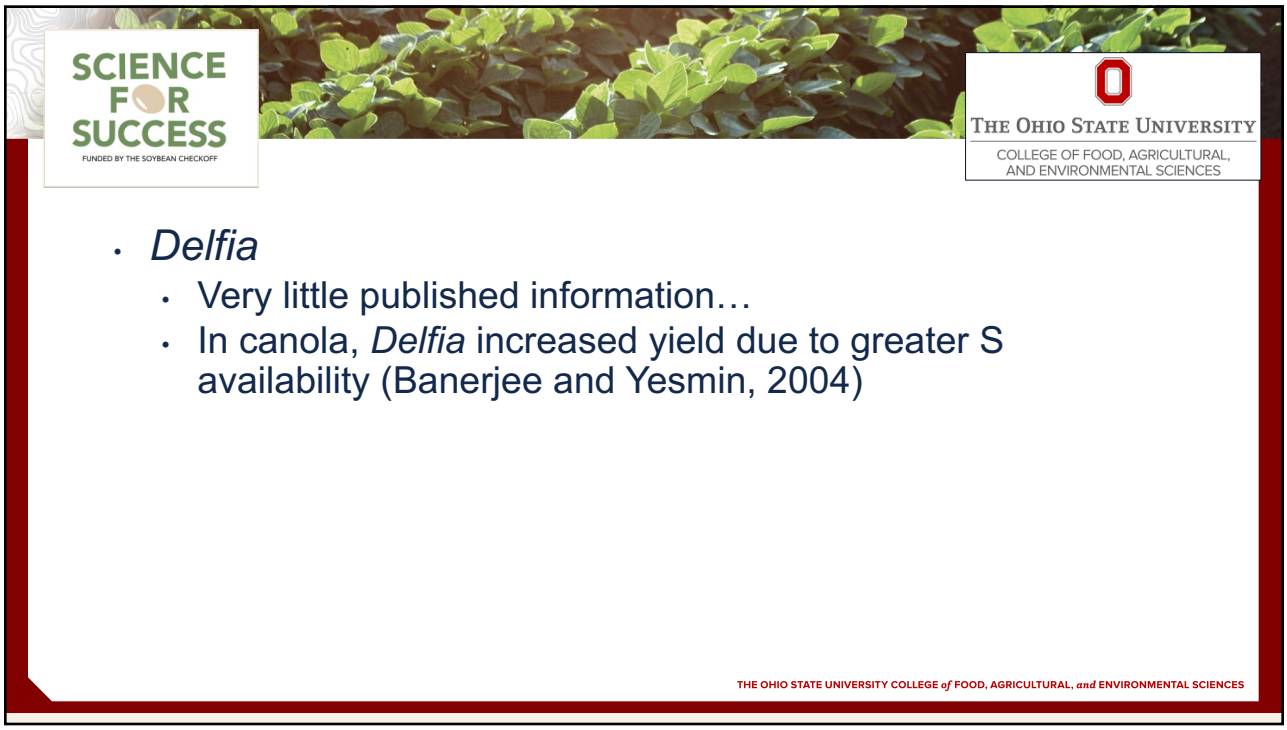
10


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Azospirillum*
• Proposed benefits- Increased root growth; improved mineral and water uptake
• In Brazil, co-inoculation with *Bradyrhizobium japonicum* improved soybean growth and number of nodules…especially under drought (Cassan et al., 2009)
• In US, co-inoculation increased soybean yield in 2 out of 25 site-years (de Borja Reis et al., 2002)
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

11


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Glomus*
• Arbuscular mycorrhizal fungi, promote P uptake (Smith and Read, 2008)
• Greenhouse…Increase soybean yield (Koyama et al., 2019) and reduced disease (Zambolim and Schneck, 1983)
• Ghana field studies- *Glomus* + half rate of P fertilizer = Full rate of P fertilizer (Thioub et al., 2019)
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

12


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Delfia*
• Very little published information…
• In canola, *Delfia* increased yield due to greater S availability (Banerjee and Yesmin, 2004)
THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

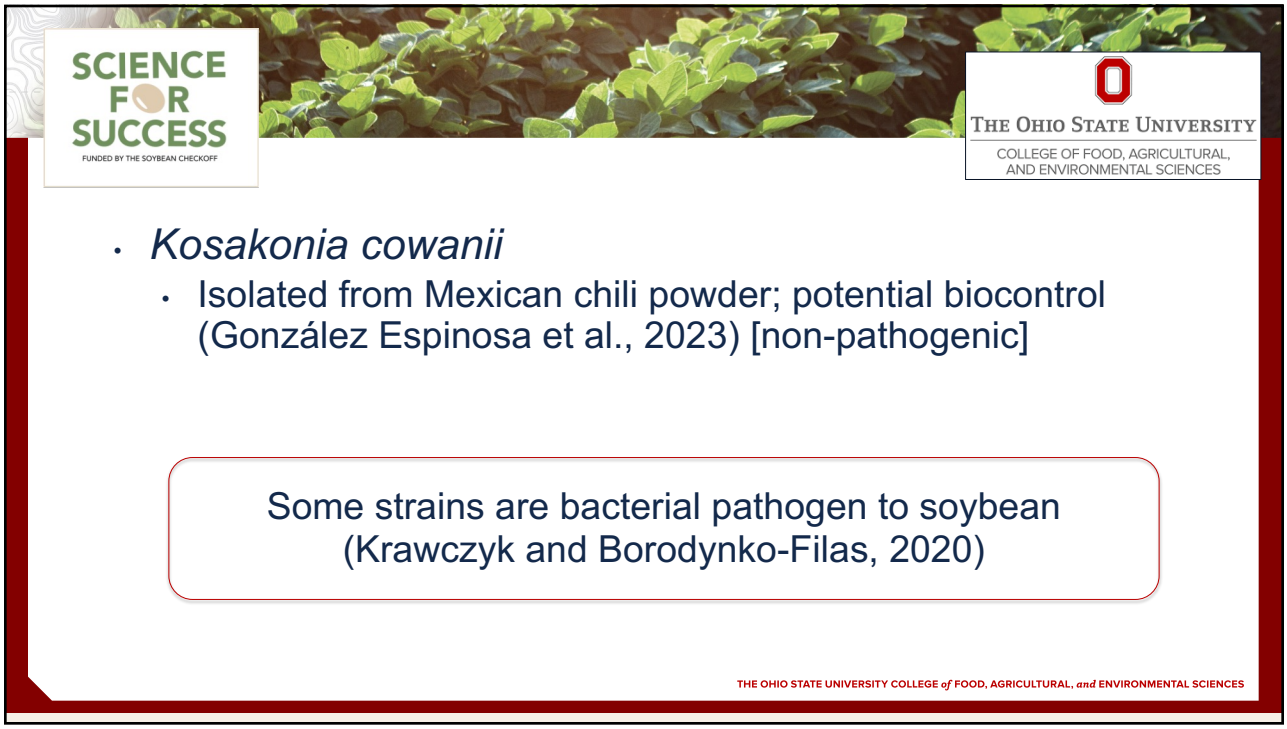
13


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Methylobacterium hispanicum*
• Isolated from drinking water in Seville, Spain
• Almost no field research/agronomic research published
THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

14


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Kosakonia cowanii*
• Isolated from Mexican chili powder; potential biocontrol (González Espinosa et al., 2023) [non-pathogenic]
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

15


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
• *Kosakonia cowanii*
• Isolated from Mexican chili powder; potential biocontrol (González Espinosa et al., 2023) [non-pathogenic]
Some strains are bacterial pathogen to soybean (Krawczyk and Borodynko-Filas, 2020)
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

16

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

- What are the gaps?
  - Studies from Brazil…also Middle East, India, Africa
  - Efficacy is shown in greenhouse or lab environments
  - Work in more 'stressful' environments?

17

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Objectives

The **objectives** of this project are:

A. To identify situations where biological seed treatments improve soybean grain yield and profitability

B. To evaluate the influence of biological seed treatments on soybean plant nutrient status

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

18

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Objectives

The **objectives** of this project are:

A. To identify situations where biological seed treatments improve soybean grain yield and profitability
B. To evaluate the influence of biological seed treatments on soybean plant nutrient status

19

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Methodology

In 2022:

- 17 states
- 49 locations in the USA

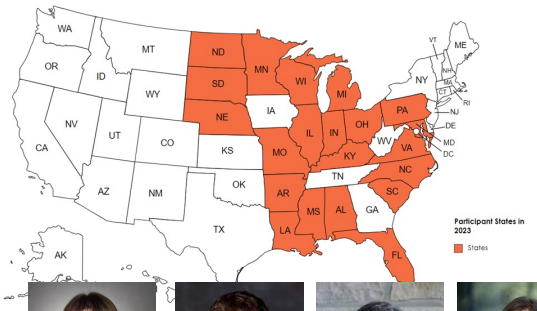
- Small plot trials
- Randomized complete block design with six to eight replications at all sites

20

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

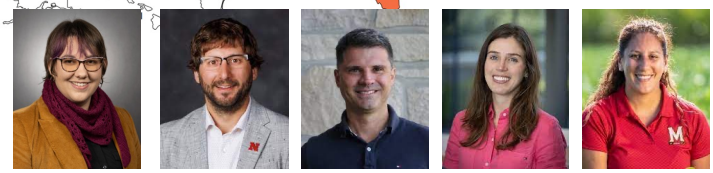
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Methodology



In 2023:

- 21 states
- 55 locations in the USA



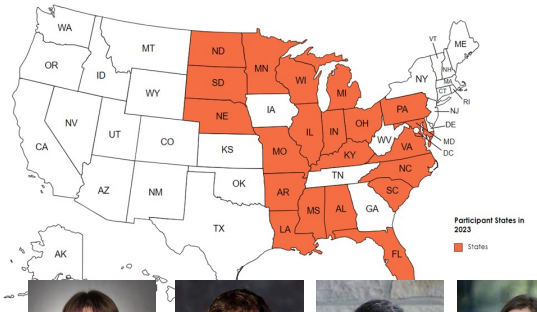
THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

21

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

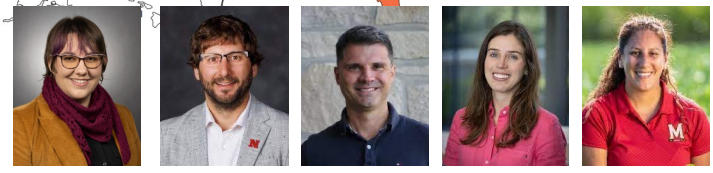
THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Methodology



In 2023:

- 21 states
- 55 locations in the USA



104 environments over a two-year period

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

22

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

List of treatments (products) and active ingredients in each biological product, 2022

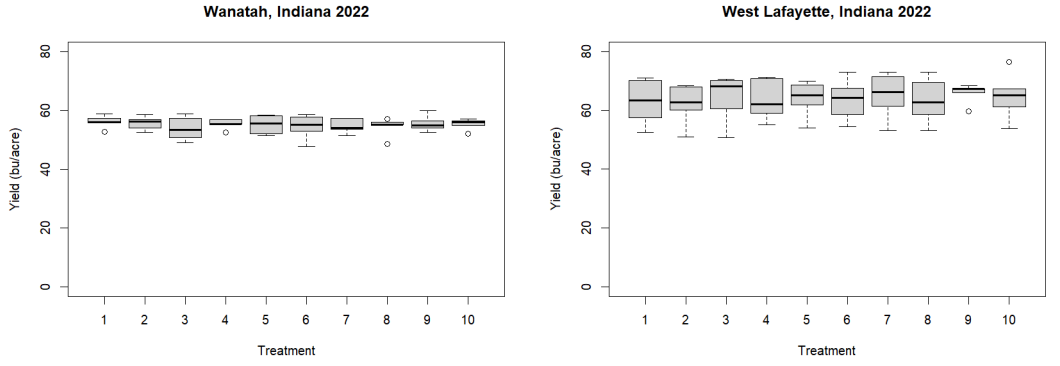
Treatment (product)	Active ingredients
1	*Azospirillum brasilense, Bacillus licheniformis, Bacillus amyloliquefaciens, Bacillus subtillis, Pseudomonas fluorescens, Rhizobium*
2	*Trichoderma virens*
3	*Bradyrhizobium spp.*
4	*Bacillus subtillis, Bacillus amyloliquefaciens, Bradyrhizobium japonicum*
5	*Pantoea agglomerans*
6	*Pseudomonas brassicacearum*
7	*Bradyrhizobium elkanii, Delftia acidovorans + Bacillus velezensis*
8	*Bacillus velezensis*
9	*Glomus intraradices, Glomus mosseae, Glomus aggregatum, Glomus etunicatum*
10	Untreated Control – seeds treated with fungicide + insecticide only

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

23

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Indiana



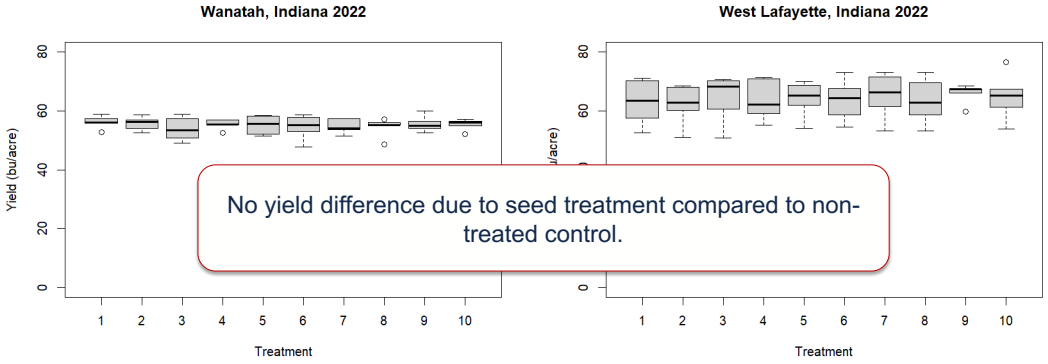
Trial by: Dr. Shaun Casteel

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

24

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Indiana

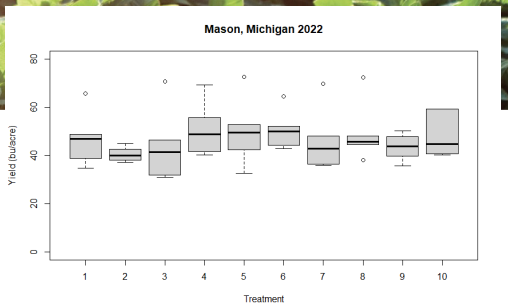


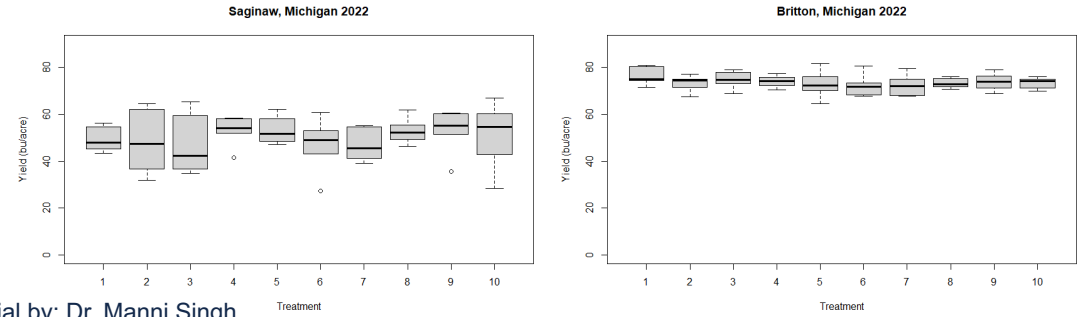
No yield difference due to seed treatment compared to non-treated control.

Trial by: Dr. Shaun Casteel

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Michigan

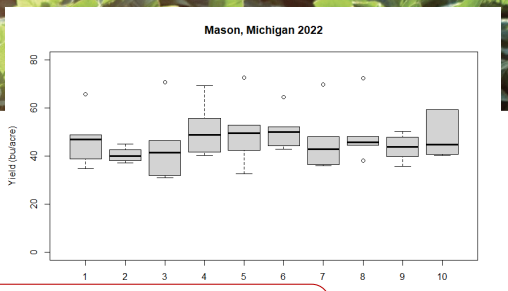




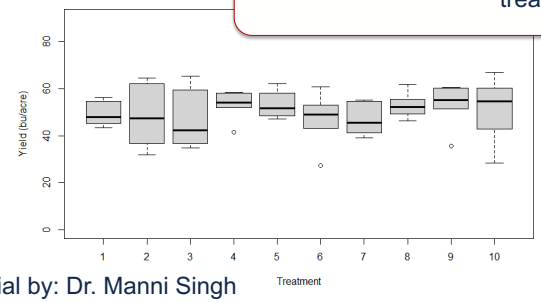
Trial by: Dr. Manni Singh

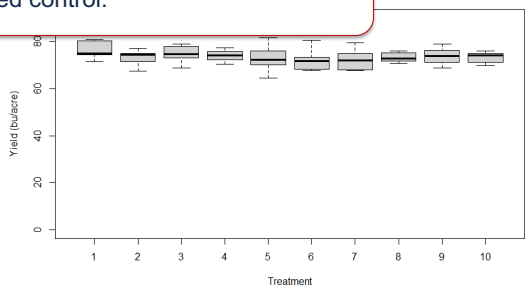
SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Michigan



No yield difference due to seed treatment compared to non-treated control.





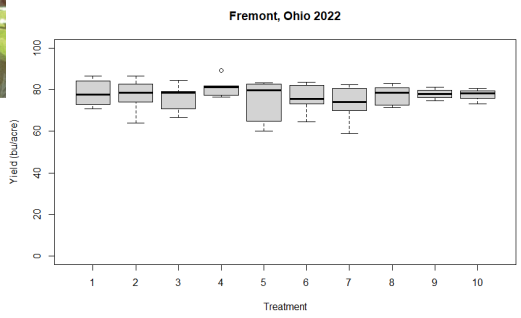
Trial by: Dr. Manni Singh

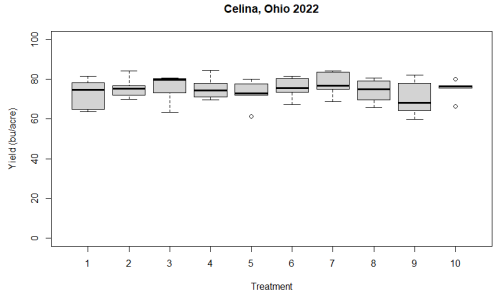
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

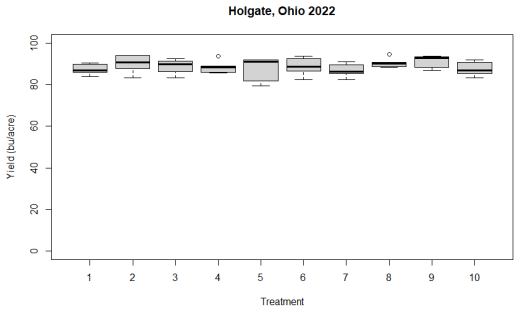
27

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Ohio





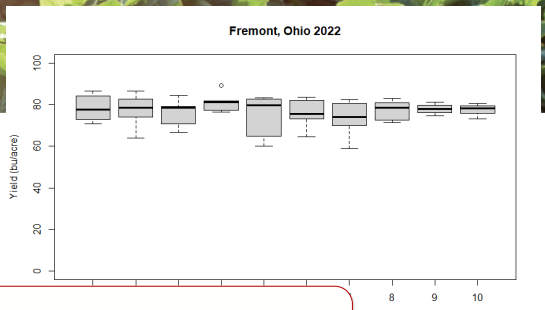


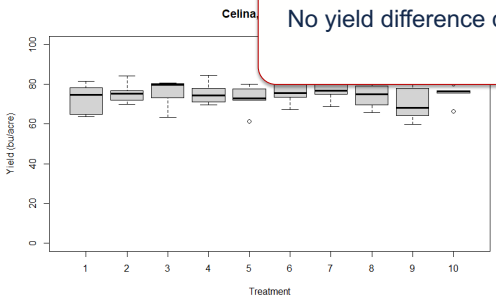
AL SCIENCES

28

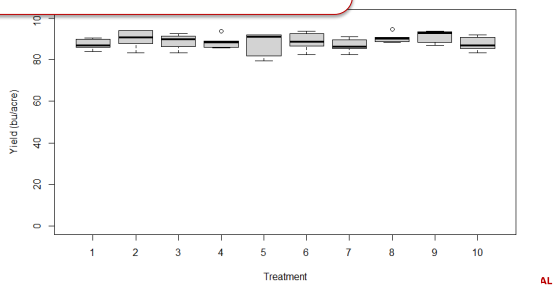
SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Ohio





No yield difference due to seed treatment compared to non-treated control.

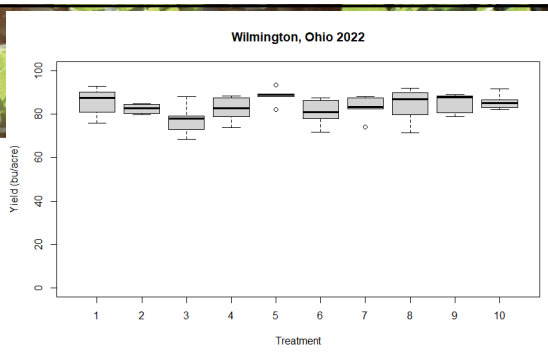


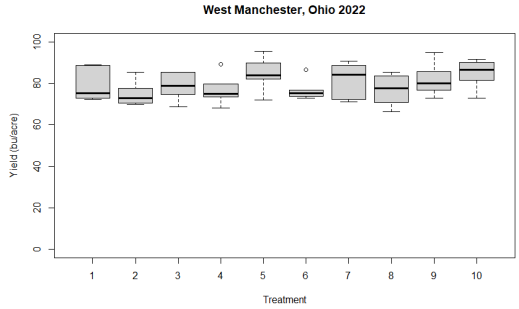
AL SCIENCES

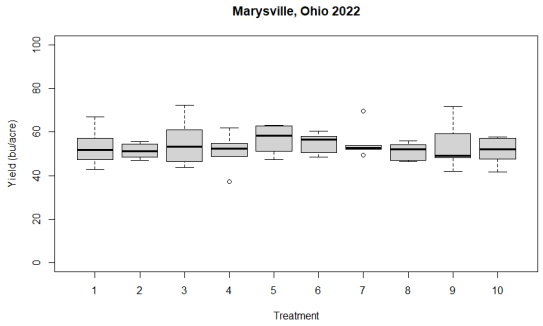
29

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Ohio





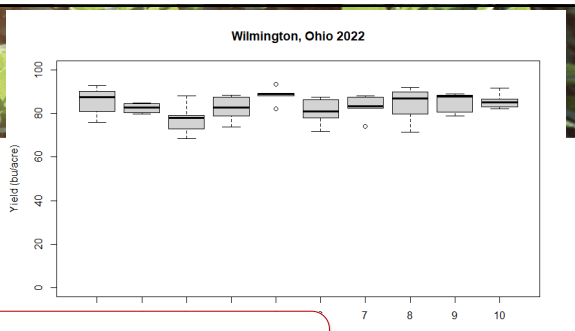


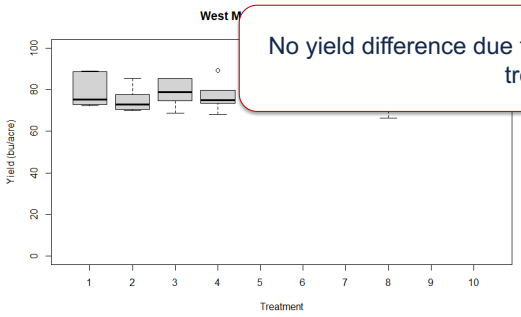
ES

30

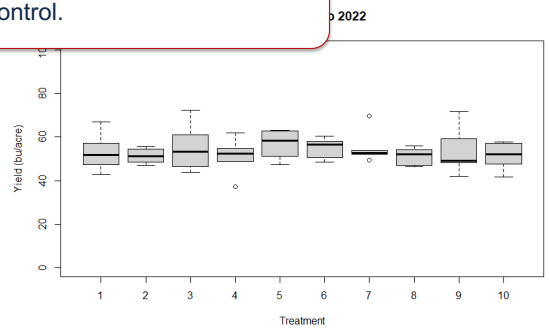
SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2022- Ohio





No yield difference due to seed treatment compared to non-treated control.



31

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

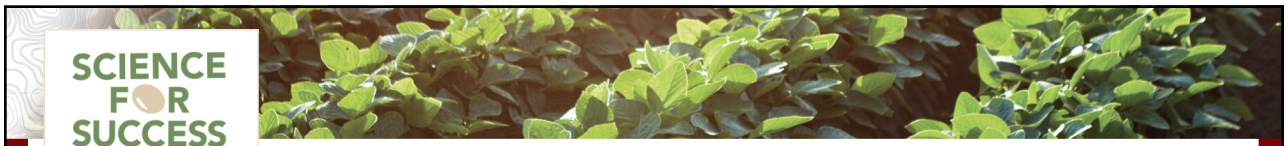
Preliminary Results

In 2022:

- Indication of a treatment by location effect (p = .10)
- Higher probability of positive response in southern states

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

32

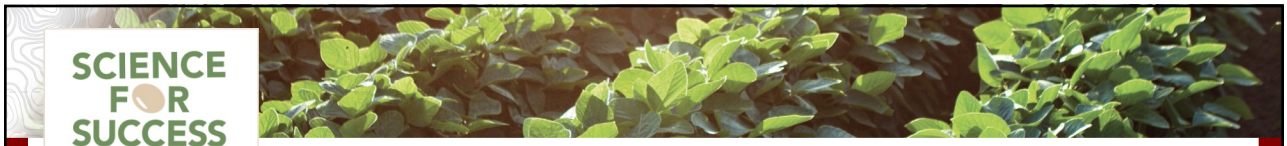


Preliminary Results

In 2022:

- Indication of a treatment by location effect (p = .10)
- Ohio, Iowa, and South Dakota did not have any treatments with a probability of response >60%.

33



Preliminary Results

In 2022:

- Treatment #2 (*Tricoderma virens*) showed higher probability of response compared to the other treatments
  - Range of 0.5-2.3 bpa compared to non-treated control
  - States: Arkansas, Louisiana, Mississippi, South Carolina, Virginia, and Wisconsin

34

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

Preliminary Results

In 2022:

- Treatment #4 (*Bacillus, Bradyrhizobium*) showed higher probability of response compared to the other treatments in northern environments
  - Range of 0.4-1.6 bpa compared to non-treated control
  - States: Louisiana, Michigan, Mississippi, North Dakota, Wisconsin

35

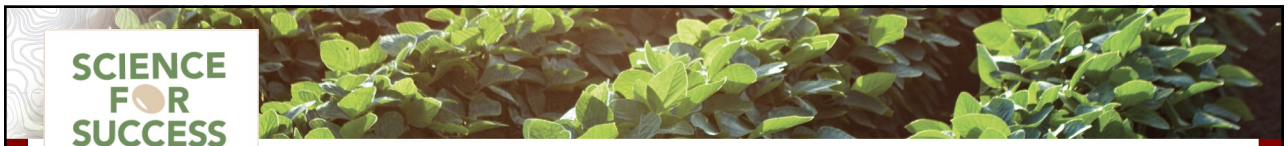
SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

List of treatments (products) and active ingredients in each biological product, 2023

Treatment (product)	Active ingredients
1	*Azospirillum brasilense, Bacillus licheniformis, Bacillus amyloliquefaciens, Bacillus subtillis, Pseudomonas fluorescens, Rhizobium*
2	*Kosakonia cowanii* strain SYM00028
3	*Bradyrhizobium spp.*
4	*Bacillus subtillis + Bradyrhizobium japonicum*
5	*Bacillus amyloliquevaciens* strain PTA-4838
6	*Methylobacterium hispanicum*
7	*Bradyrhizobium elkanii, Delftia acidovorans + Bacillus velezensis*
8	*Bacillus velezensis*
9	*Glomus intraradices, Glomus mosseae, Glomus aggregatum, Glomus etunicatum*
10	Untreated Control – seeds treated with fungicide + insecticide only

36

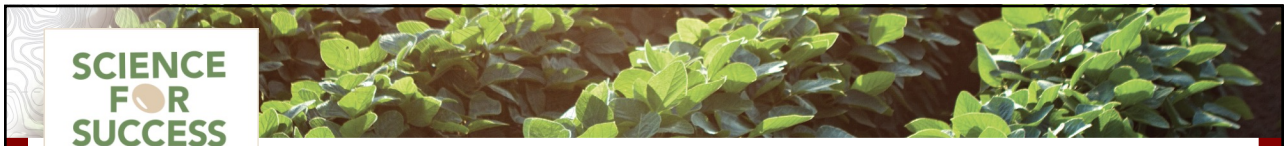


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

2023 Results

- Still receiving harvest data…
  - 25 locations analyzed
  - 2 locations with positive yield response (VA & WI)

37

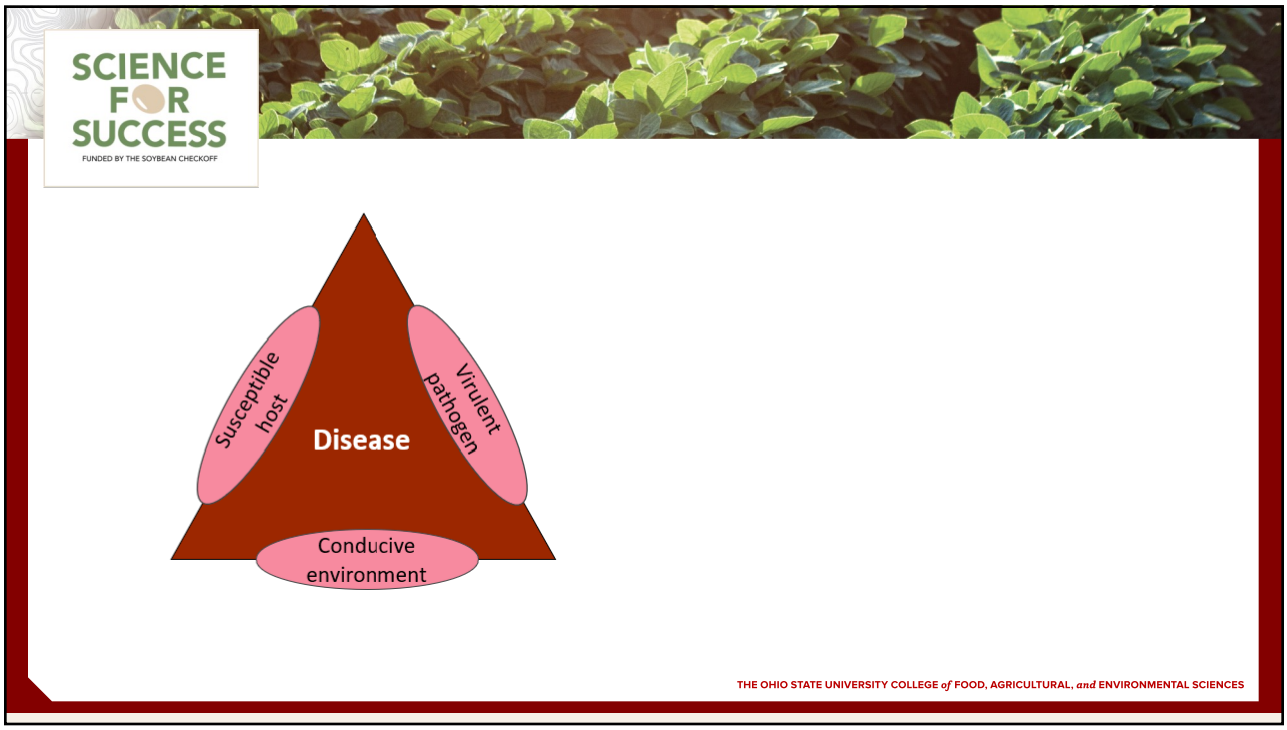


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

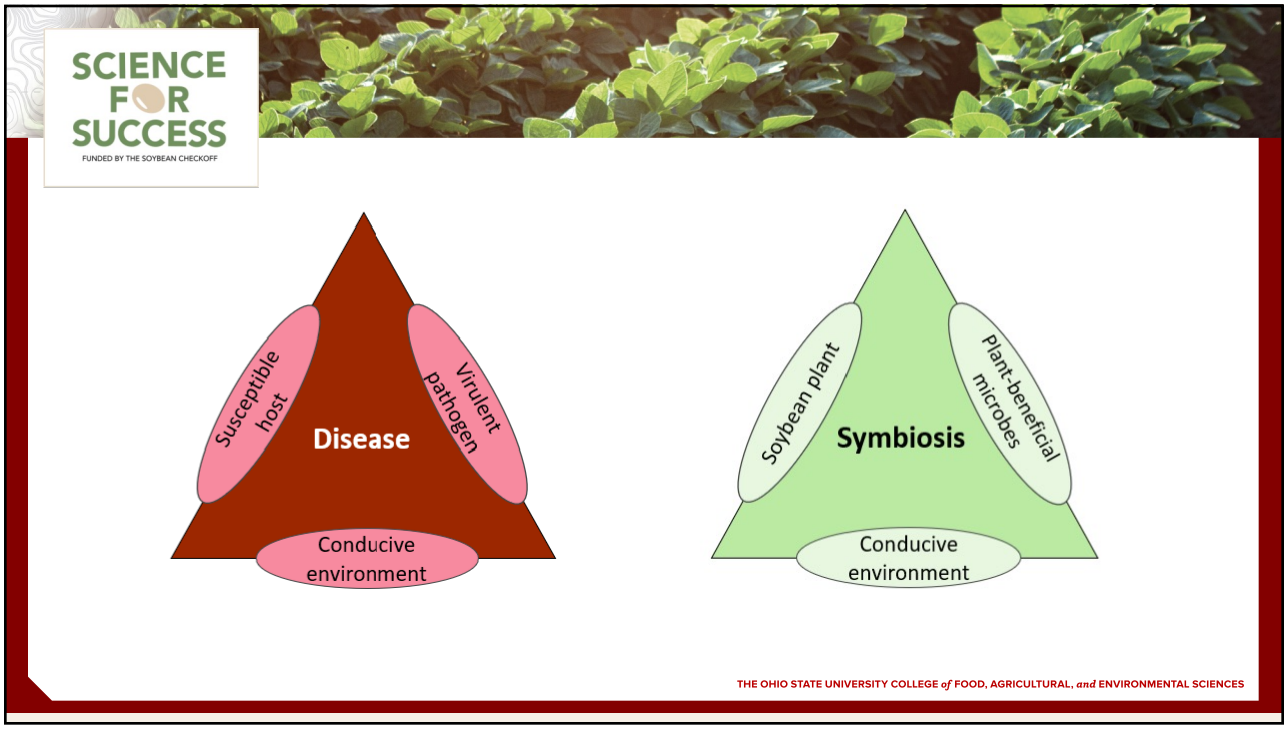
Key Take-Aways…So Far

- More likelihood of response in south vs north?
- Responsive locations had overall small yield response <2.5 bu/acre

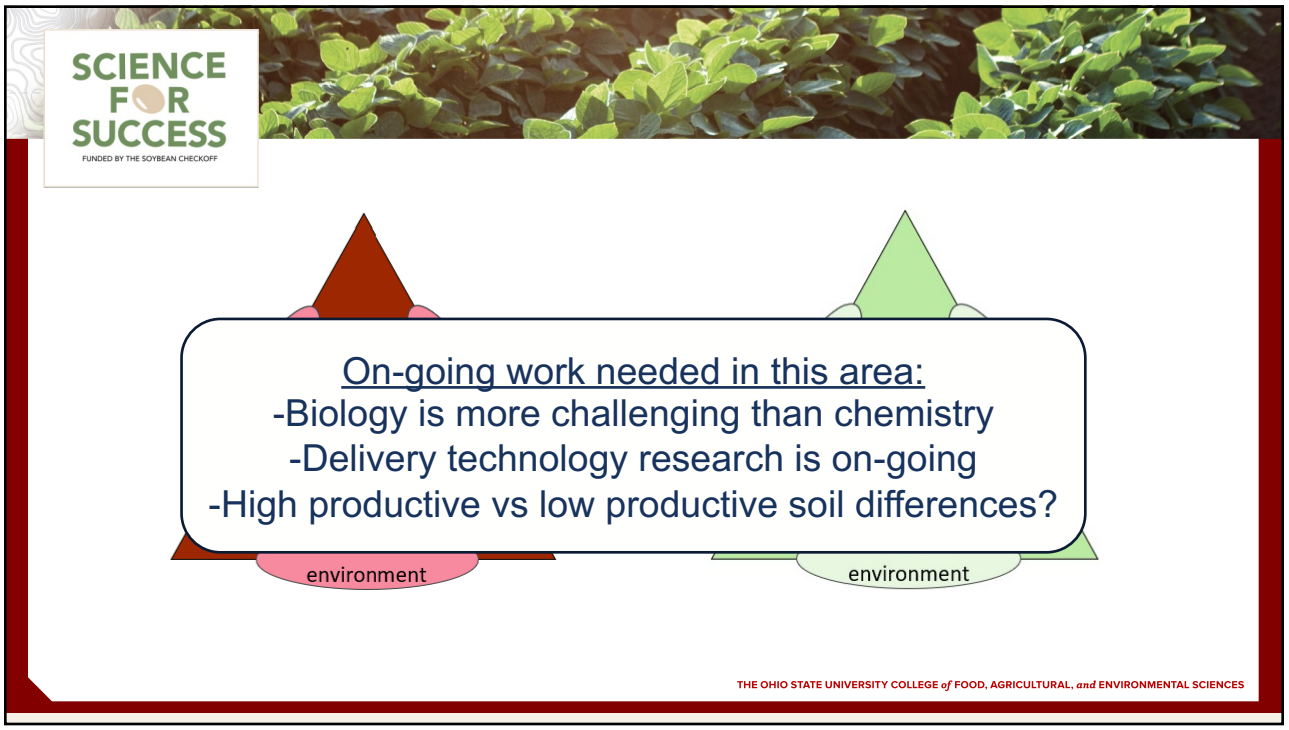
38


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
Susceptible host
Virulent pathogen
Disease
Conducive environment
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

39


SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
Susceptible host
Virulent pathogen
Disease
Conducive environment
Soybean plant
Plant-beneficial microbes
Symbiosis
Conducive environment
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

40

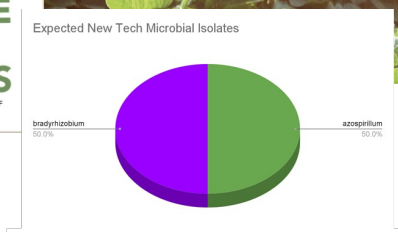

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
On-going work needed in this area:
-Biology is more challenging than chemistry
-Delivery technology research is on-going
-High productive vs low productive soil differences?
environment
environment
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

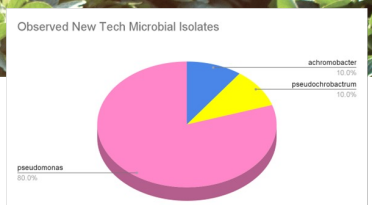
41

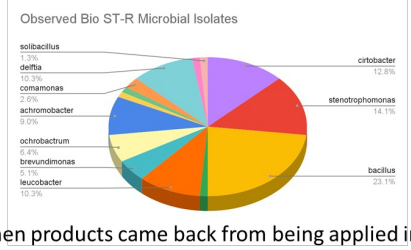

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF
Key Reminders…
• Biological seed treatments…Need to be delivered at high concentration and need to be alive
• Some will die along the way
• Make sure you follow label instructions and handle products appropriately
THE OHIO STATE UNIVERSITY COLLEGE of FOOD, AGRICULTURAL, and ENVIRONMENTAL SCIENCES

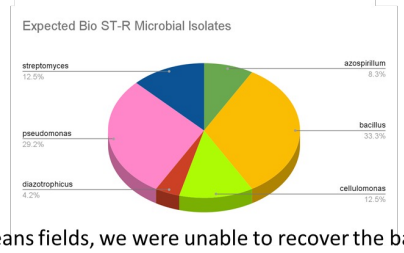
42

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF









When products came back from being applied in soybeans fields, we were unable to recover the bacteria that were supposed to be present in them.

Where did these other bacteria come from? Why were they so much easier to isolate?

Source: Michigan State University

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

Upcoming research at Michigan State

- We obtained fresh products from companies to sequence what comes from them directly.
- These products were used for the 2023 field experiments, as well as a contamination experiment to understand where these other microbes come from by testing different:
  - **Water sources** for rehydration (sterile, distilled to tap)
  - **Containers** they were mixed in (sterile to dirty)
  - **Storage temperature** (-20C freezer, fridge, and room temperature)
  - **Storage location** (lab, greenhouse, Agronomy farm headhouse)
  - **Storage time** (1 hour, 1 day, 1 week)

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

Next Steps

- Continue to collect 2023 data
- Look at other management and location information (till vs no-till, planting date, pH, CEC, texture…)

45

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

Next Steps

- Hiring statistician to look at various growing environments vs grouping by state boundaries

46

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

Keep following Science for Success as we continue to work on this project!

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

47

SCIENCE FOR SUCCESS
FUNDED BY THE SOYBEAN CHECKOFF

UNITED SOYBEAN BOARD

USDA NIFA

United States Department of Agriculture
National Institute of Food and Agriculture

48

CFAES

THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

49

CFAES

NEW PROJECT FOR 2023

- What should you plant first? Corn or Soybean?
- Results- Virtual Meeting- Friday, February 2, 2024
- Registration: go.osu.edu/cornsoy
  - $10 for entire day
  - CEU credits will be available
- Subscribe to CORN newsletter to stay up to date

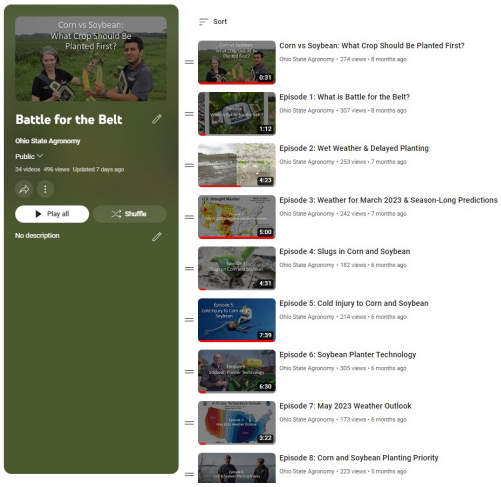
THE OHIO STATE UNIVERSITY COLLEGE *of* FOOD, AGRICULTURAL, *and* ENVIRONMENTAL SCIENCES

50

CFAES

Ohio State Agronomy YouTube Channel

- 33 videos
- Slugs, cold injury, seedling disease, insect pests, drought response, herbicide injury, growing degree day calculations, tar spot, Palmer amaranth ID, yield estimates…



51

CFAES

Subscribe to OSU Extension's Crop Observation and Recommendation Network (CORN) Newsletter

Subscribe to OSU Extension's Ohio State Agronomy YouTube channel

Follow Laura Lindsey (@stepupsoy) and Osler Ortez (@OrtezCornCrops) on Twitter!

52

Locations

- Northwest Agricultural Research Station
  - Custar, Wood County
- Western Agricultural Research Station
  - South Charleston, Clark County
- Wooster Campus
  - Wooster, Wayne County

CFAES

53

CFAES

54

Locations

- Northwest Agricultural Research Station
  - Custar, Wood County

Planting Date	Yield (bu/acre)
4/12/23	85 A
4/26/23	84 A
5/11/23	81 B
5/25/23	78 B
6/8/23	71 C

CFAES

THE OHIO STATE UNIVERSITY COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

55

Locations

- Western Agricultural Research Station
  - South Charleston, Clark County

Planting Date	Yield (bu/acre)
4/12/23	92 A
4/26/23	87 A
5/11/23	88 A
5/25/23	70 B
6/8/23	69 B

CFAES

THE OHIO STATE UNIVERSITY COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

56

CFAES

Locations

- Wooster Campus
  - Wooster, Wayne County

57

CFAES

NEW PROJECT FOR 2023

- What should you plant first? Corn or Soybean?
- Results- Virtual Meeting- Friday, February 2, 2024
- Registration: go.osu.edu/cornsoy
  - $10 for entire day
  - CEU credits will be available
- Subscribe to CORN newsletter to stay up to date

58

CFAES

This material is based upon work supported by USDA-NIFA under Award Number 2021-70027-34694.

NORTH CENTRAL EXTENSION RISK MANAGEMENT EDUCATION

USDA National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

59

CFAES

Research funding provided by Ohio Soybean Council and CFAES Internal Grant Program.

OHIO SOYBEAN COUNCIL

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

60