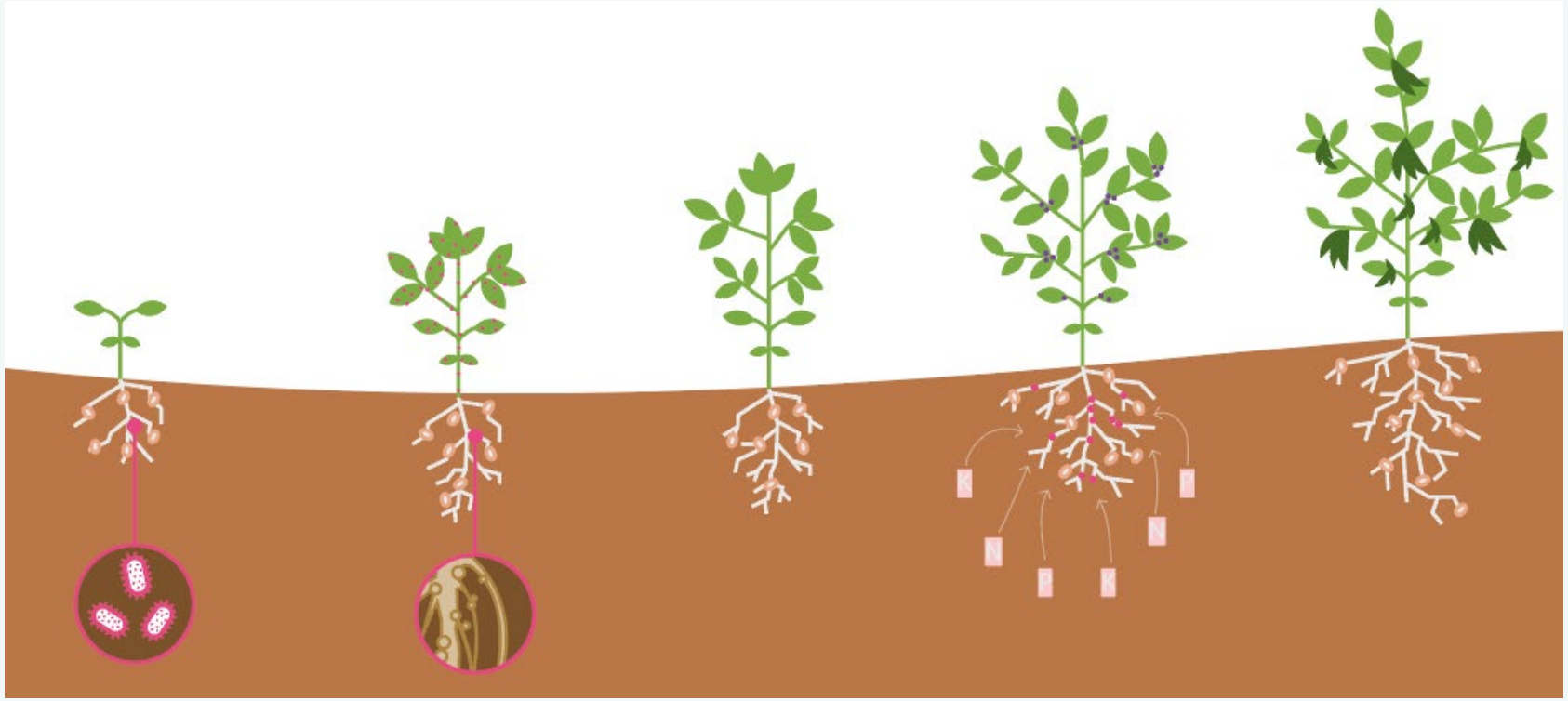
TS201 for CORN ROOTWORM

February 7, 2024

- **PPFM Technology Overview**
- **TS201 for Corn Rootworm**
  - 2023 On-Farm Trials
  - How Does it Work?
    - Priming the plant's defenses
    - Changing larval feeding behavior
    - Promoting re-growth after damage
    - Changing overall root system architecture
- **NewLeaf Precision**
  - Analysis support available for on-farm side by sides

PPFM TECHNOLOGY OVERVIEW

HOW PPFMs WORK



COLONIZATION

As broad plant colonizers, PPFMS spread from the seed surface across a plant's roots and leaves.

METHANOL CONSUMPTION

PPFMs colonize at zero energy cost to the plant, leaving more energy available to the plant for nutrient uptake, resulting in increased chlorophyll content and enhanced photosynthetic efficiency, both of which translate to increases in yield.

NUTRIENT UPTAKE

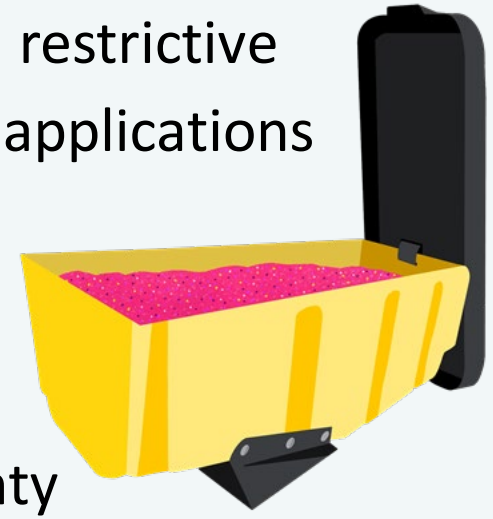
They also secrete beneficial molecules into the root zone that can bind and transport yield-enabling micronutrients.

ROOT ESTABLISHMENT

PPFMs improve nutrient uptake by populating plant roots which promotes higher numbers of root tips and overall root mass in turn enhancing nutrient acquisition.

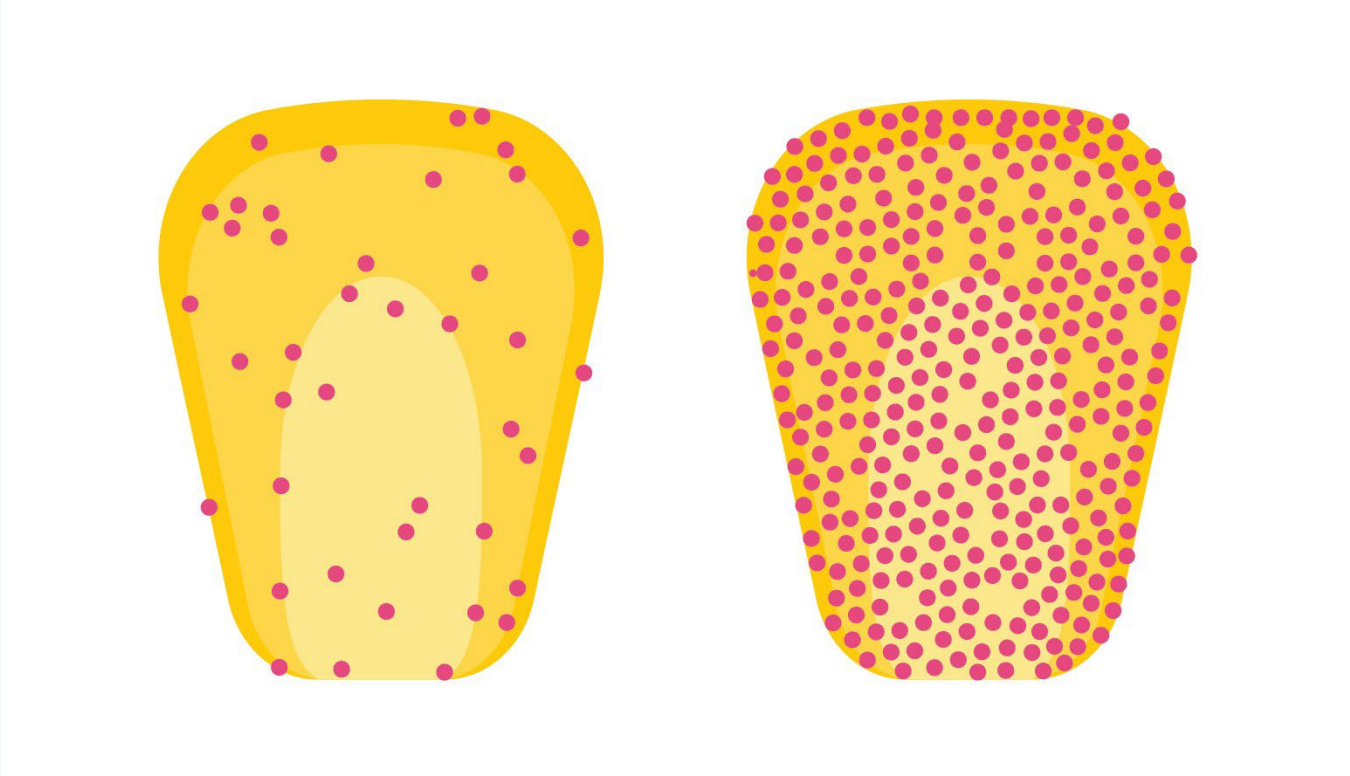
PPFM TECHNOLOGY - PLANTER BOX APPLICATION

- PPFM technology can be safely blended with DUST with no negative impact on viability
- Planter box application enables the delivery of viable PPFMs at target concentrations to the seed
- Planter box removes the need to pre-slurry with water, eliminating a restrictive 24 hr use window once wetted up for in-furrow and seed treatment applications
- Doesn’t require specialized equipment for application
- Enables downstream treatment of corn without voiding seed warranty



Planter Box

HIGH LEVEL OF COVERAGE ON SEED



Traditional Product Application
Recovered Live Cells per Seed: 1,000

Planter Box Application
Recovered Live Cells per Seed: 10,000

Product spec:

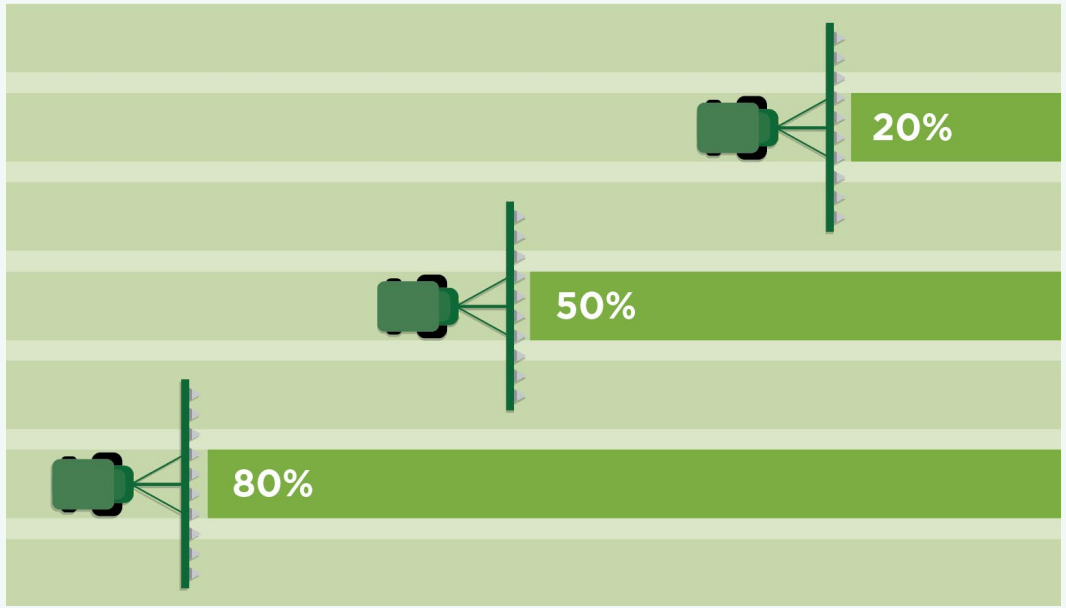
- Minimum of 1,000 live cells per seed (1E3 or 1 X 10^3 CFU/ seed)

Planter box application:

- Avoids pre-slurry wetting process that can lead to cell die off
- Achieves **10X live cells** per seed 10,000 live cells per seed (1E4 or 1 x 10^4 CFU/ seed)
- Consistent across planter types

Source: 2021 Ag Ingenuity Partners trials

PLANTER BOX: CONSISTENT COVERAGE ON SEED



Source: 2021 Ag Ingenuity Partners trials

OVER 10,000 LIVE CELLS PER SEED AT EACH STAGE OF PLANTING

LIVE CELLS PER SEED WITH TERRASYM FOR CORN

20% planted = 40,228

50% planted = 37,735

80% planted = 40,212

LIVE CELLS PER SEED WITH TERRASYM FOR SOYBEAN

20% planted = 39,914

50% planted = 38,312

80% planted = 38,591

CONSISTENT IMPROVED EMERGENCE AND EARLY VIGOR

SOYBEANS

Commercial soybeans treated with Terrasym 401**

CORN

Commercial corn treated with Terrasym 450**.

LEAFY GREENS

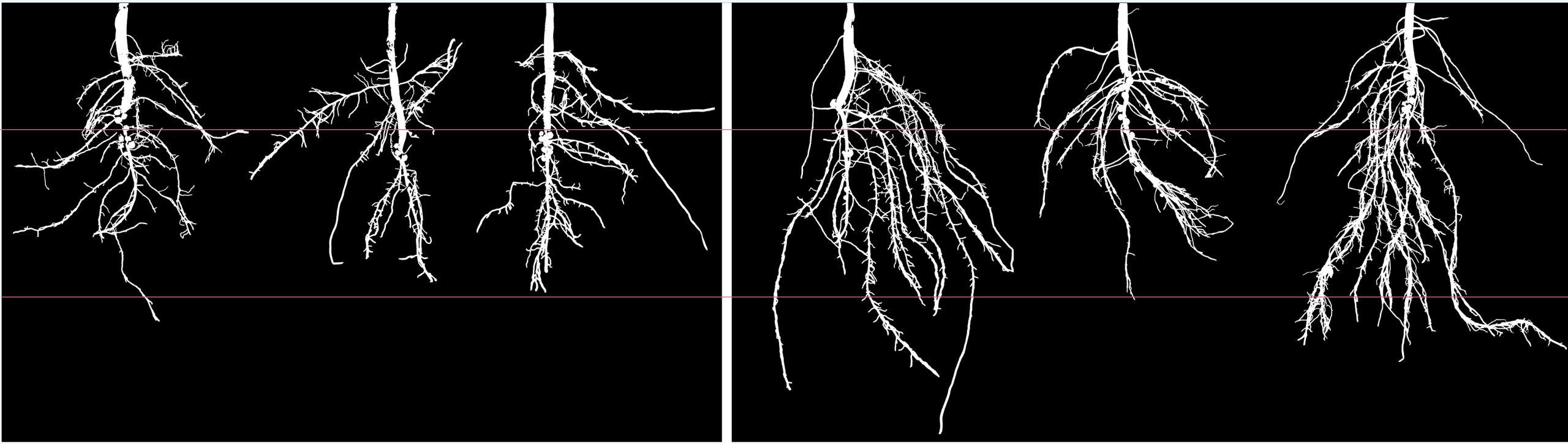
Spinach greenhouse assay treated with proprietary pipeline PPFM strain, shown 21 days after planting.

CULINARY HERBS

Rosemary commercial greenhouse trial treated with proprietary pipeline PPFM strain utilizing drench application method at sticking, shown 28 days after planting.

***Source: 2020 INTENT FarmerTrials and 2021 Ag Ingenuity Partners Farmer Trials*
**Untreated/Non-treated check displayed on the left side of each photo*

ROOTING ANALYSIS IN SOYBEAN



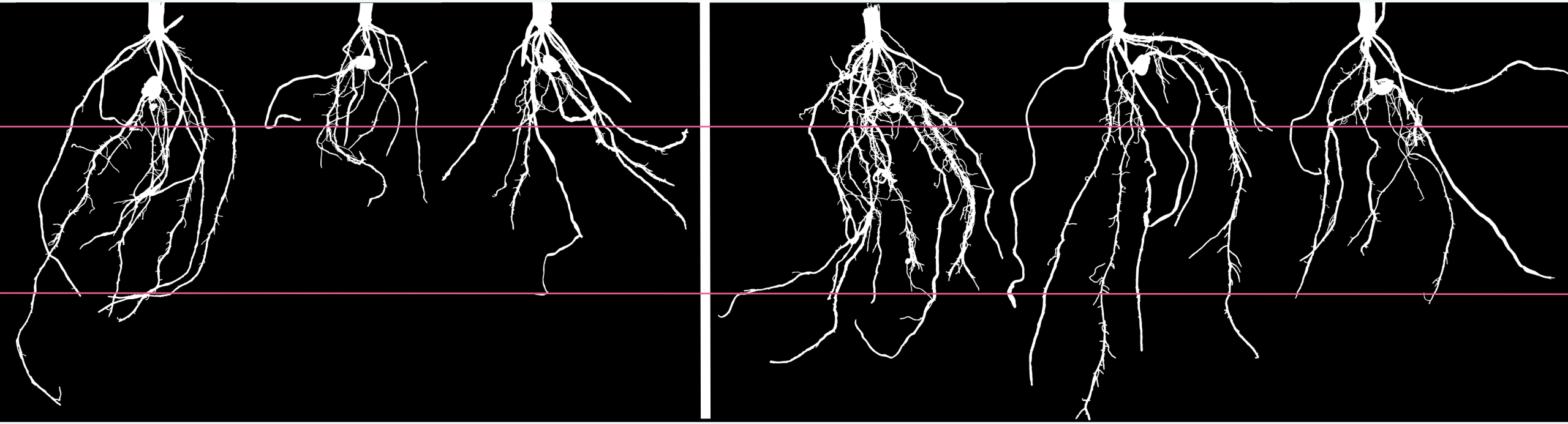
UTC

TERRASYM 401

Location: Morocco, IN

Source: 2020 IN10T FarmerTrials; All untreated checks and PPFM treatments have base fungicide and insecticide application

ROOTING ANALYSIS IN CORN



UTC

Location: Rosedale, IN

TERRASYM 450

Source: *2020 INTENT FarmerTrials; All untreated checks and PPFM treatments have base fungicide and insecticide application; Images reported for Terrasym 450 applied in furrow.*

ON FARM TRIAL RESULTS

TERRASYM FOR SOYBEANS

70% win-rate

+3.7 Bu/A win advantage

+9.6% Total root area

+5.7% Rooting depth

+19.4% Leaf tissue iron concentrations (ppm)

+21.5% Leaf tissue manganese concentrations (ppm)

Source:
***Soybean**: Yield and win rate, 2020 – 2023 on-farm trials n=83; root characterization and leaf nutrients, 2020 INTENT FarmerTrials; Root trends reported for Terrasym 401 (V2-V4, 16 locations, 10 plants per treatment, per location). Nutrient data reported for Terrasym 401 (V5-V6, 19 locations, 10 plants per treatment per location)*

TERRASYM FOR CORN

71% win-rate

+7.6 Bu/A win advantage

+6.2% Total root area

+5.2% Rooting depth

+9.0% Nodal root length

+17.5% Leaf tissue iron concentrations (ppm)

+12.6% Leaf tissue manganese concentrations (ppm)

***Corn:** Yield and win rate, 2020 – 2023 on-farm trials, n=144; root characterization and leaf nutrients, 2020 INTENT FarmerTrials; Root trends reported for Terrasym 450 (V2-V4, 19 locations, 10 plants per treatment, per location); Nutrient data reported for Terrasym 450 (V5-V6, 24 locations, 10 plants per treatment per location)*

TS201 for CORN ROOTWORM

TERRASYM 450 + DUST & TS201 Bioinsecticide

NewFields Ag™
Innovations In Your Fields

NEW to the NewFields Ag BioStax™ lineup!

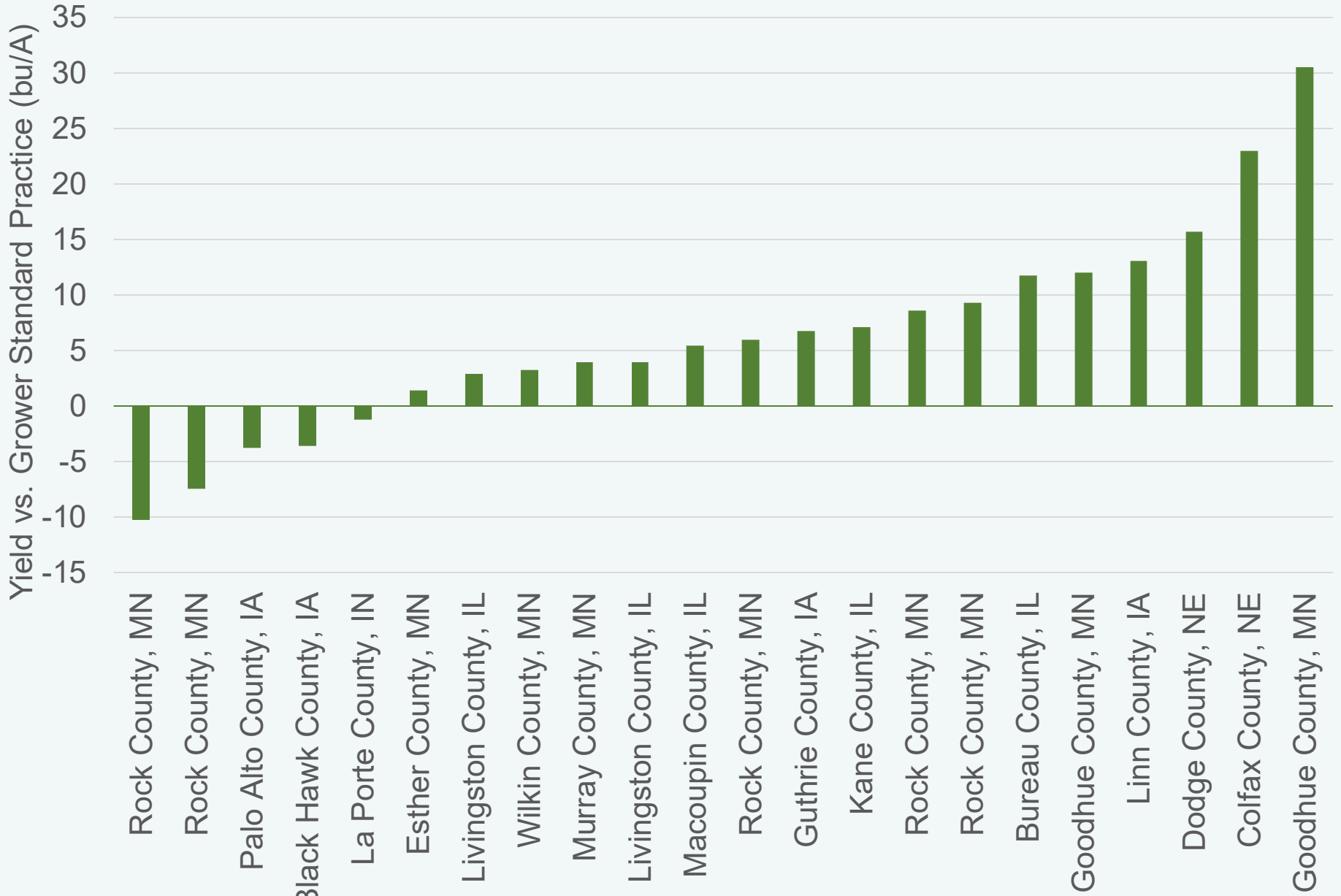
ROOT REGROWTH AFTER LARVAL PRUNING - In situations where roots are fully pruned by larval feeding, TS201 treated roots demonstrate aggressive re-growth at the site of damage.

SEASON-LONG BIOCONTROL PROTECTION • Novel mode of action for insect biocontrol • Excellent complement to other management tools • TS201 Bio-protection co-packed with Terrasym 450 + DUST provides increased plant health and yield response under varying insect pressure.

DUST PROVIDES A HIGH LEVEL OF COVERAGE ON SEED - carrier for live microbes is 10X better than a liquid seed treatment carrier.

INDUCED SYSTEMIC RESISTANCE - Quicker and larger defense response in primed plants = less damage/stunting and higher eventual yields.

2023 TRIAL RESULTS: TERRASYM 450 + DUST & TS201



22 Data Points

77% Win Rate

+ 6.3 bu/A Performance

+ 9.7 bu/A Win Performance

Product performance as of 2/05/24, Aggregates include 10 acre strip trials run internally through CROs and run externally through NewLeaf's distribution partners and their individual trialing networks. Data types include weigh wagon values as well as precision yield monitor data and full spatial data analyzed internally with NewLeaf Precision.

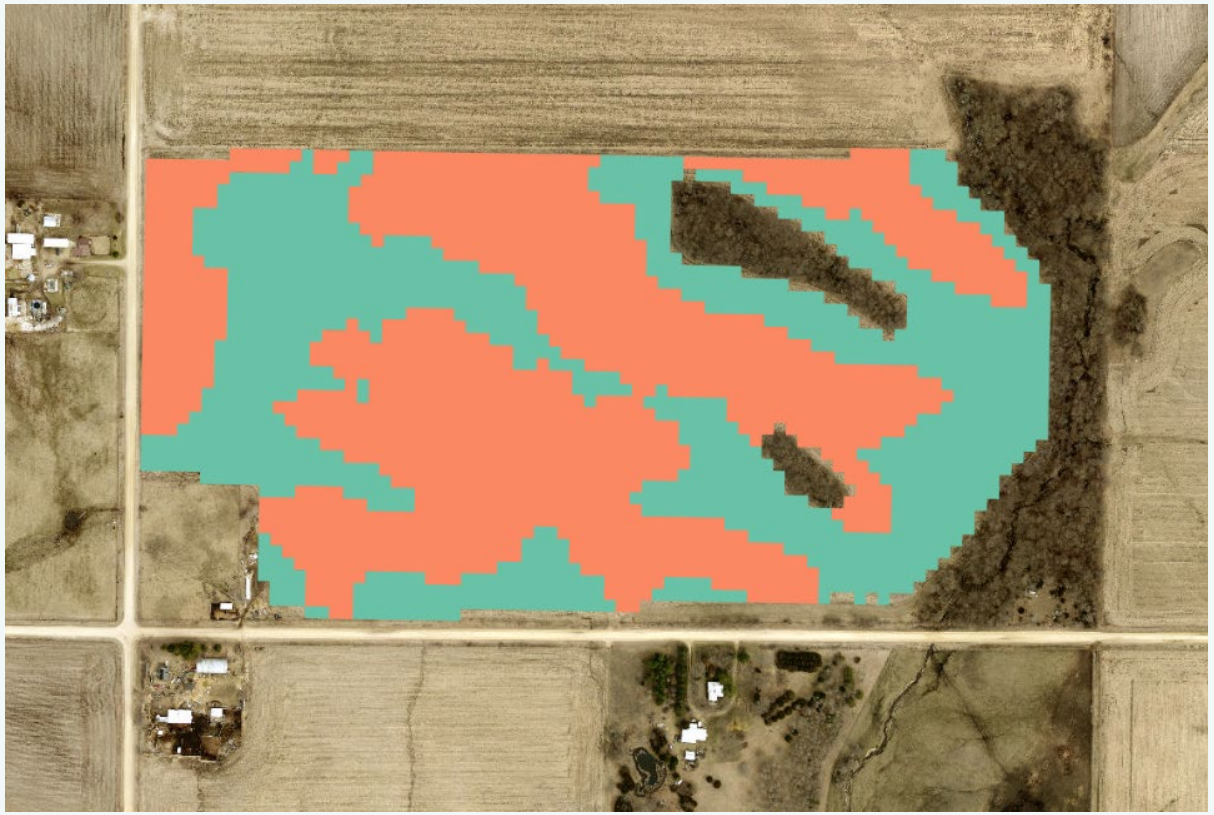
CASE STUDY IN LINN COUNTY, IA

Treatments

Grower standard practice (GSP)

GSP + Terrasym 450 + DUST & TS201

Management zones

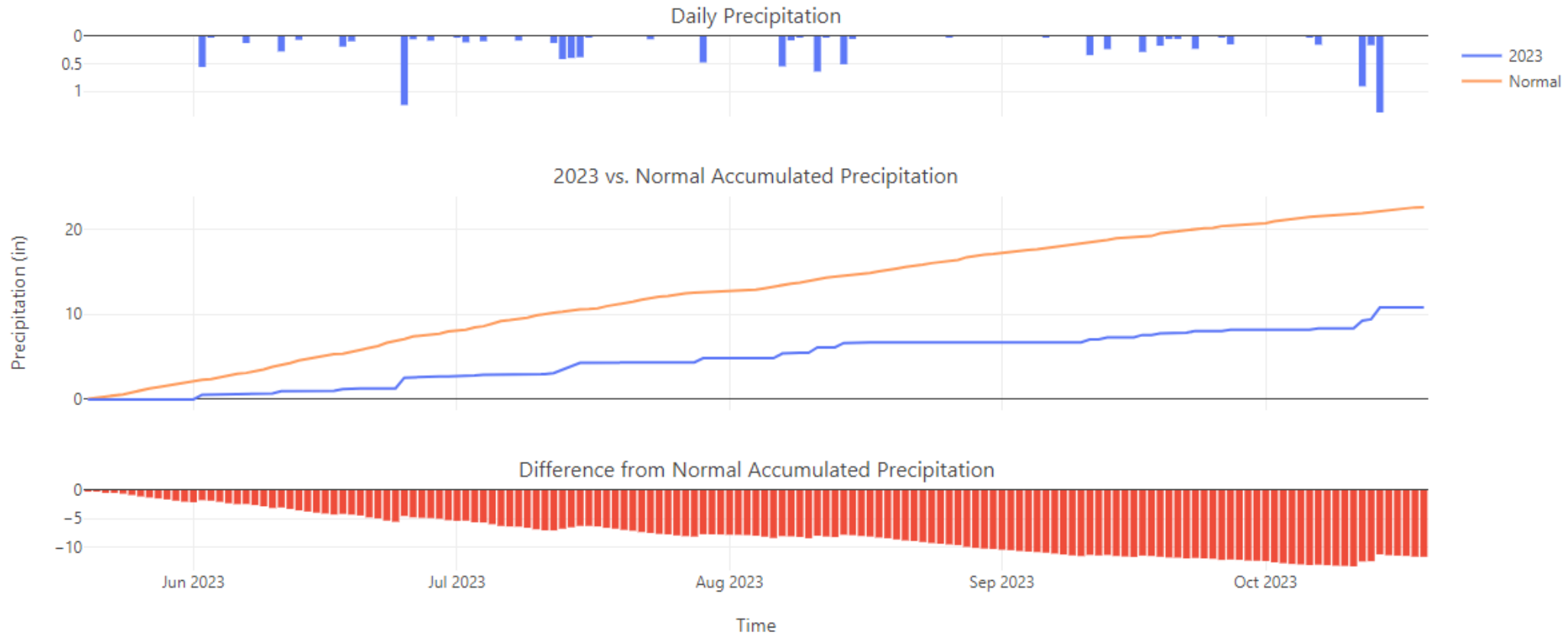


Higher areas

Lower lying areas

CONSISTENT DROUGHT CONDITIONS

This field experienced an 11 inch precipitation deficit compared to expected



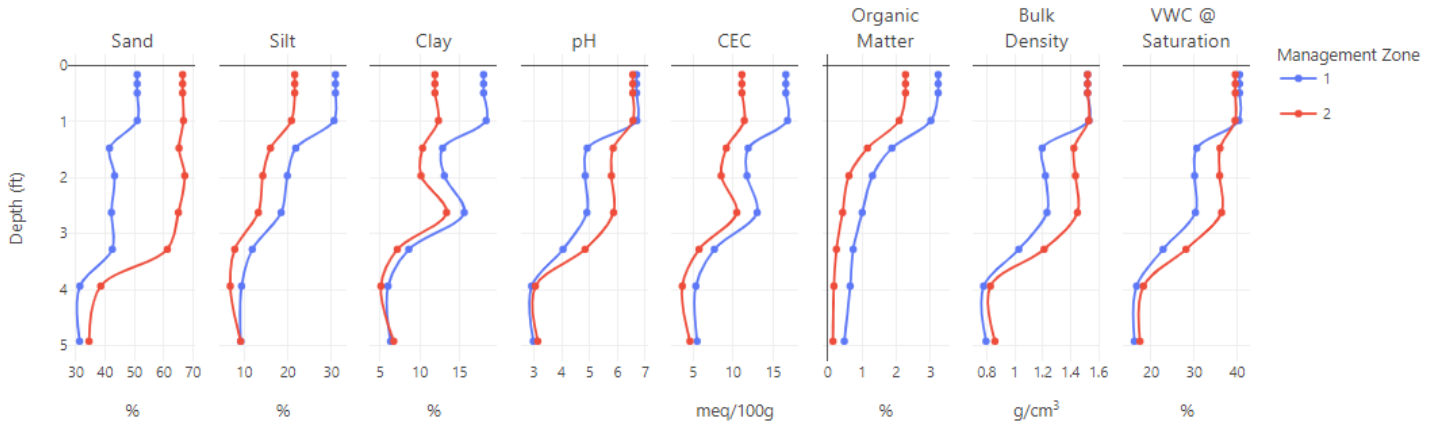
MANAGEMENT ZONE CHARACTERIZATION

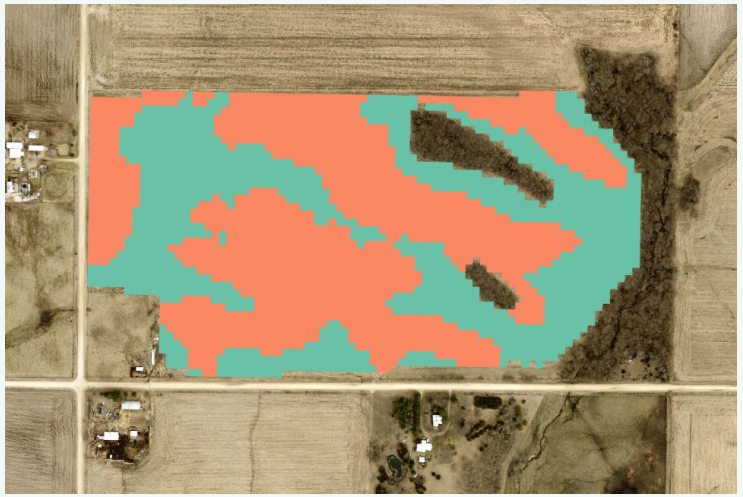
Topography

Topographic properties for each zone derived from the elevation data.

Soil

Soil properties throughout a depth of 0-5 feet for each zone. Data was acquired from the United States Department of Agriculture Natural Resources Conservation Service Soil Survey Geographic Database.



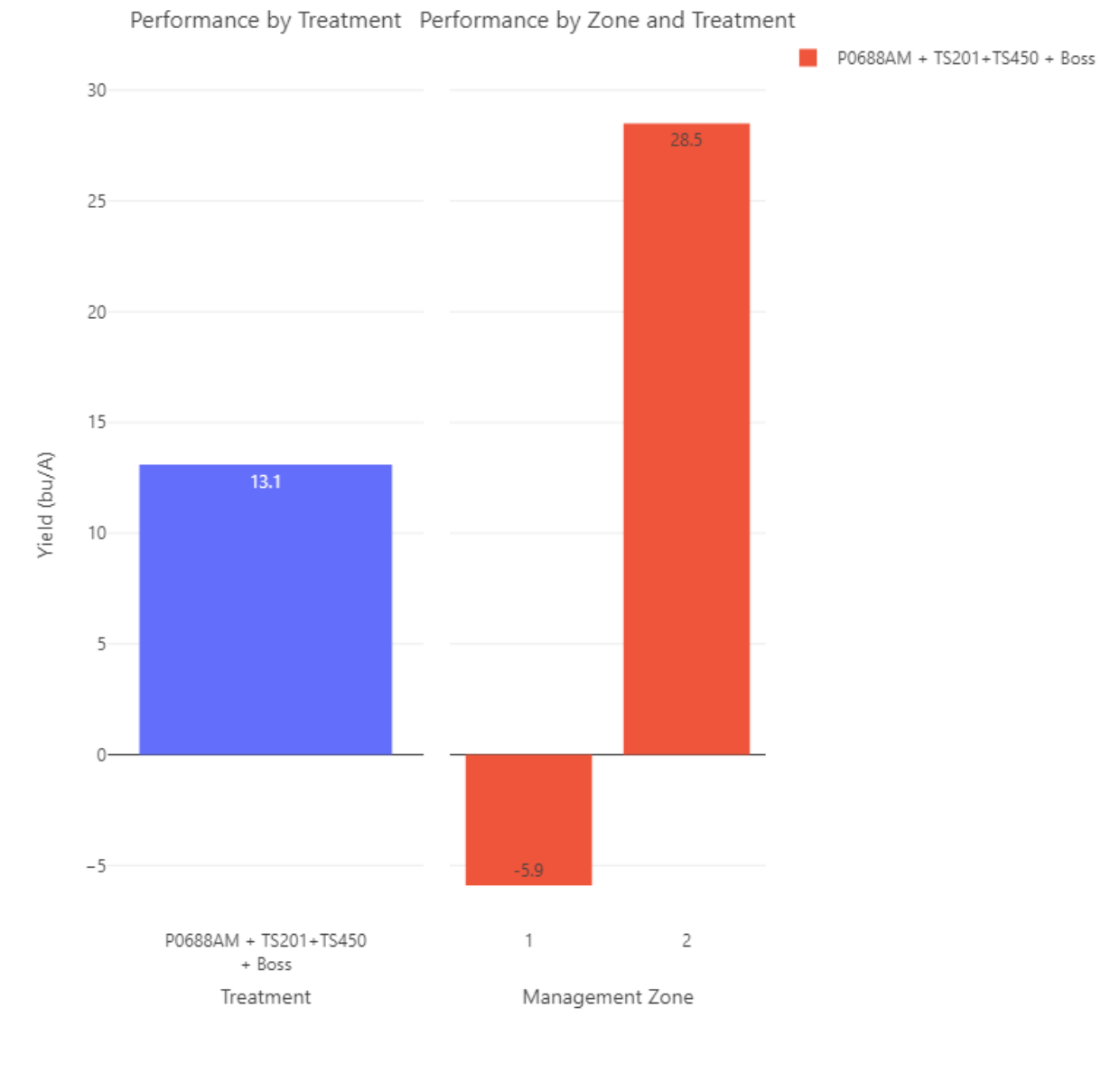


Lower lying areas (management zone 1)

Higher areas (management zone 2)

Management zone 2 has higher sand content, less silt, clay and organic matter (better drainage) and lower moisture availability (topographic wetness index)

TERRASYM 450 + DUST & TS201 provided a +13.1 bu/A advantage



Terrasym 450 + DUST & TS201 provided the strongest benefit in higher, better drained areas of the field that had high sand content (management zone 2)

These areas likely experienced a significant level of drought stress on top of corn rootworm feeding

The overall benefit compared to grower standard practice was +13.1 bu/A

“Prolonged drought can exacerbate root injury and cause additional yield loss.”

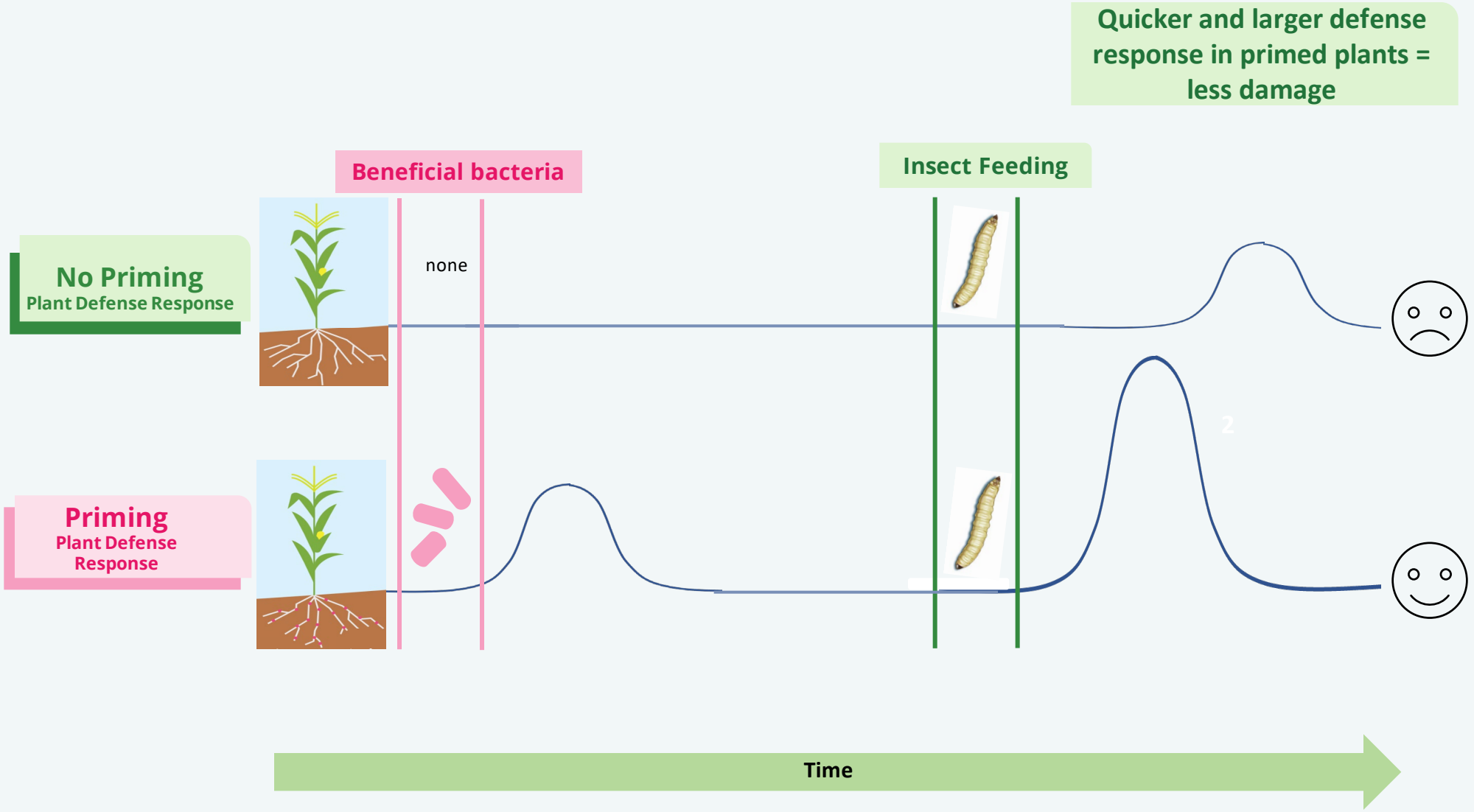
https://crops.extension.iastate.edu/cropnews/2022/06/corn-rootworm-egg-hatch-behind-schedule-year

HOW DOES TS201 WORK?

A PLANT HAS TO BALANCE BETWEEN GROWTH & DEFENSE

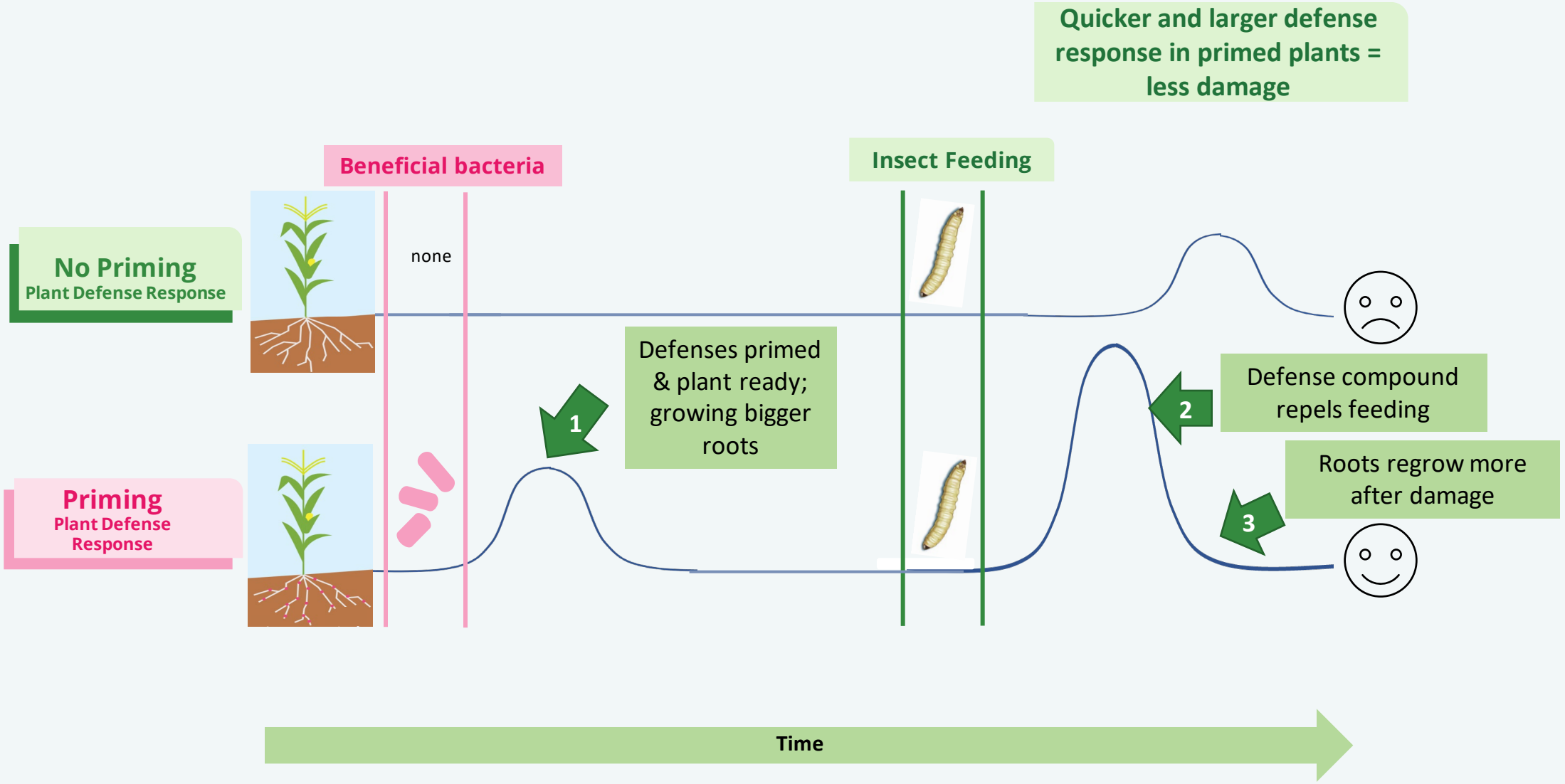
TS201 PRIMES PLANT DEFENSES TO BE READY WHEN NEEDED

Induced Systemic Resistance (ISR)



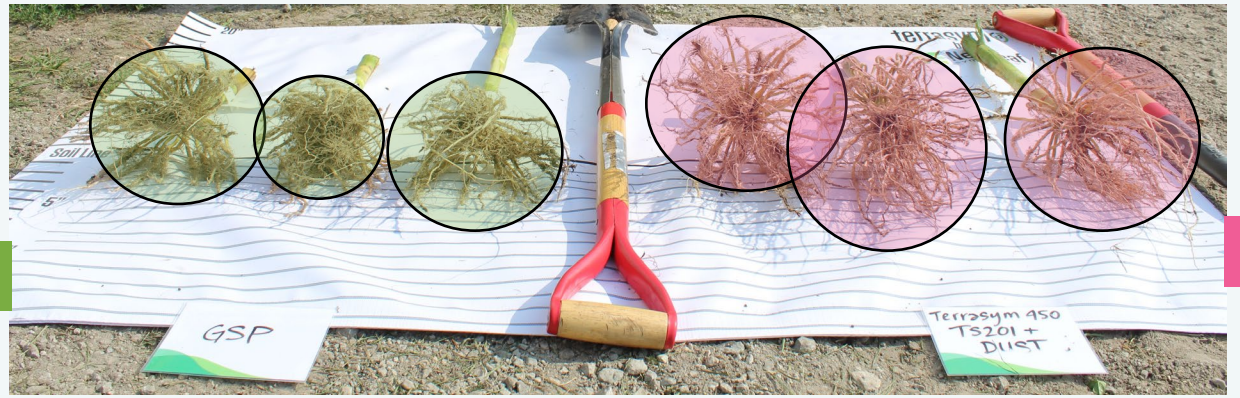
TS201 PRIMES PLANT DEFENSES TO BE READY WHEN NEEDED

Induced Systemic Resistance (ISR)



1) TS201 HELPS PLANTS GROW BIGGER WIDER ROOTS

- Longer root, further soil depth and anchorage
- Broader circumference of root, greater standability



Grower Standard Practice	Terrasym 450 + DUST & TS201

ROOT PHENOTYPING

RhizoVision Explorer

Intact crowns and individual roots dissected at each node

Specimen photography

Specimen photograph

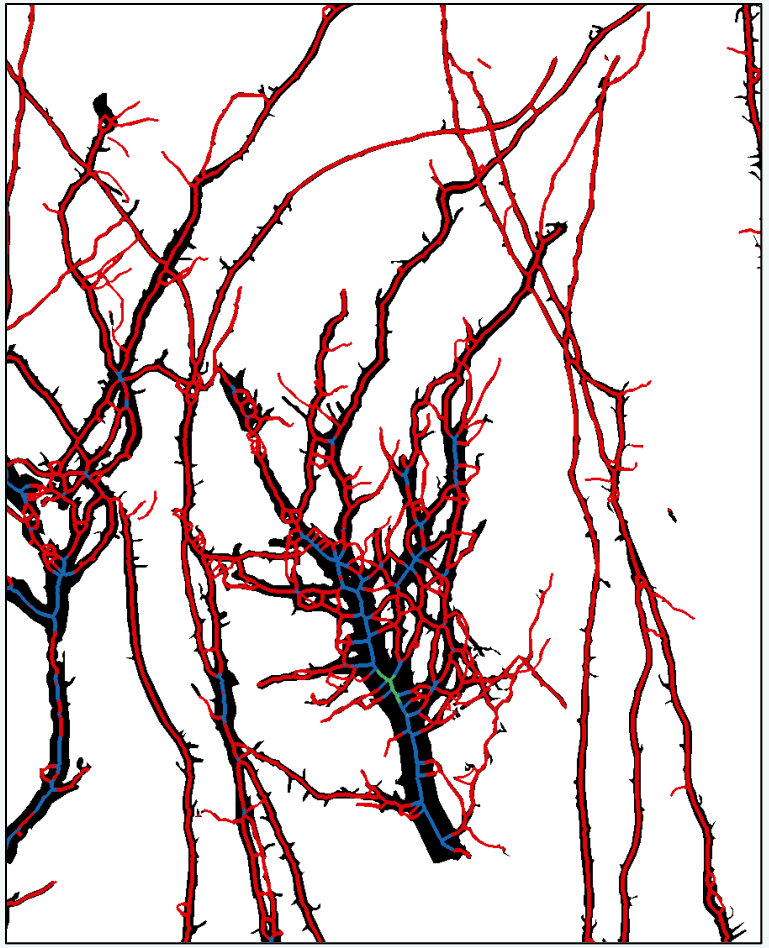


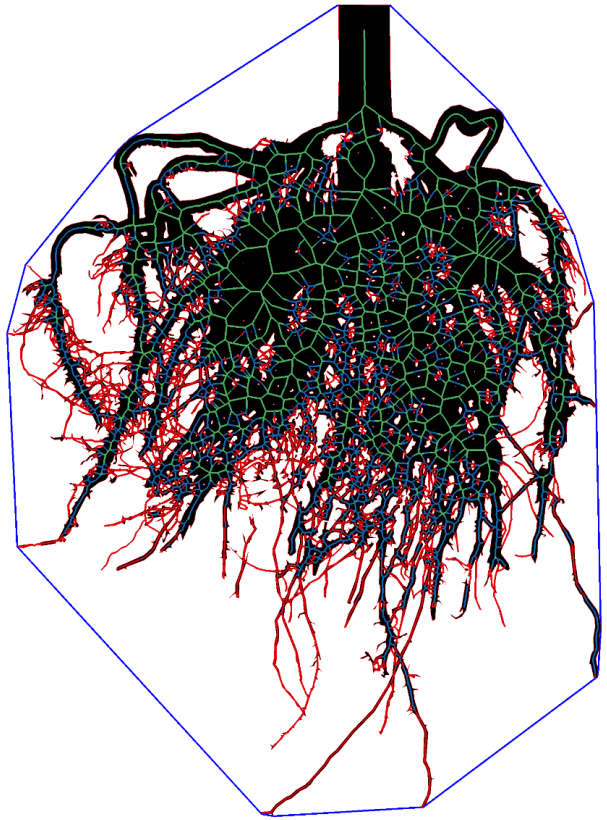
Image analysis in software

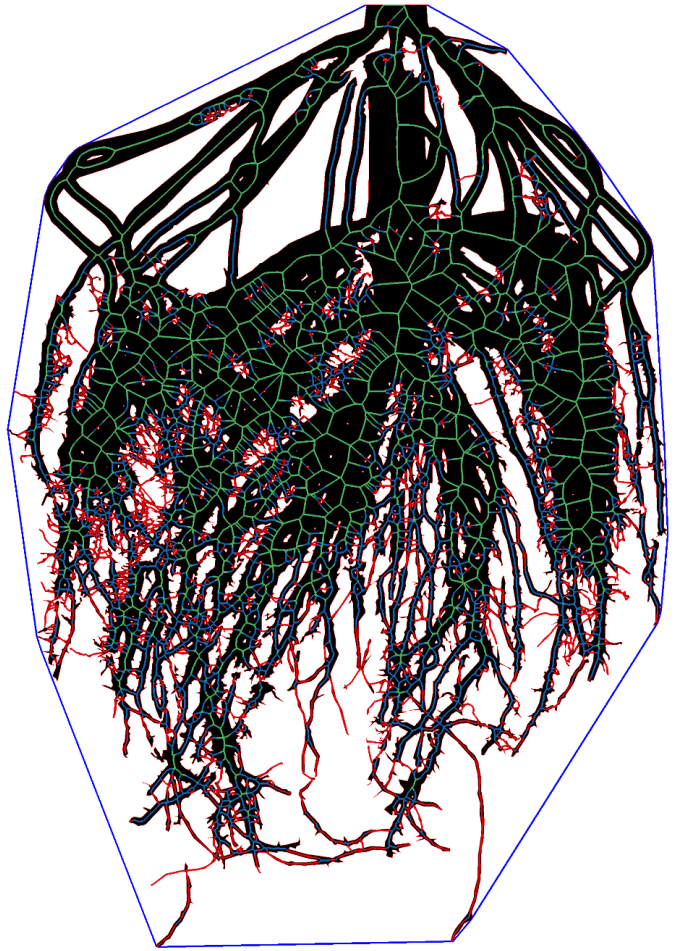
IMPROVED ROOT STRUCTURE

TS201 treated roots demonstrate improved root structure

TS201 TREATED CORN SHOWED IMPROVED ROOT SYSTEMS

RhizoVision Explorer





- +9.8% in density
- +15.7% in surface area*
- +10.4% in root length
- +8.5% in number of root tips
- +8.9% in fine roots (0-2mm diameter)
- +4.3% in steep rooting angle
- -4.2% in shallow rooting angle*

*$p < 0.05$ statistically significant effect

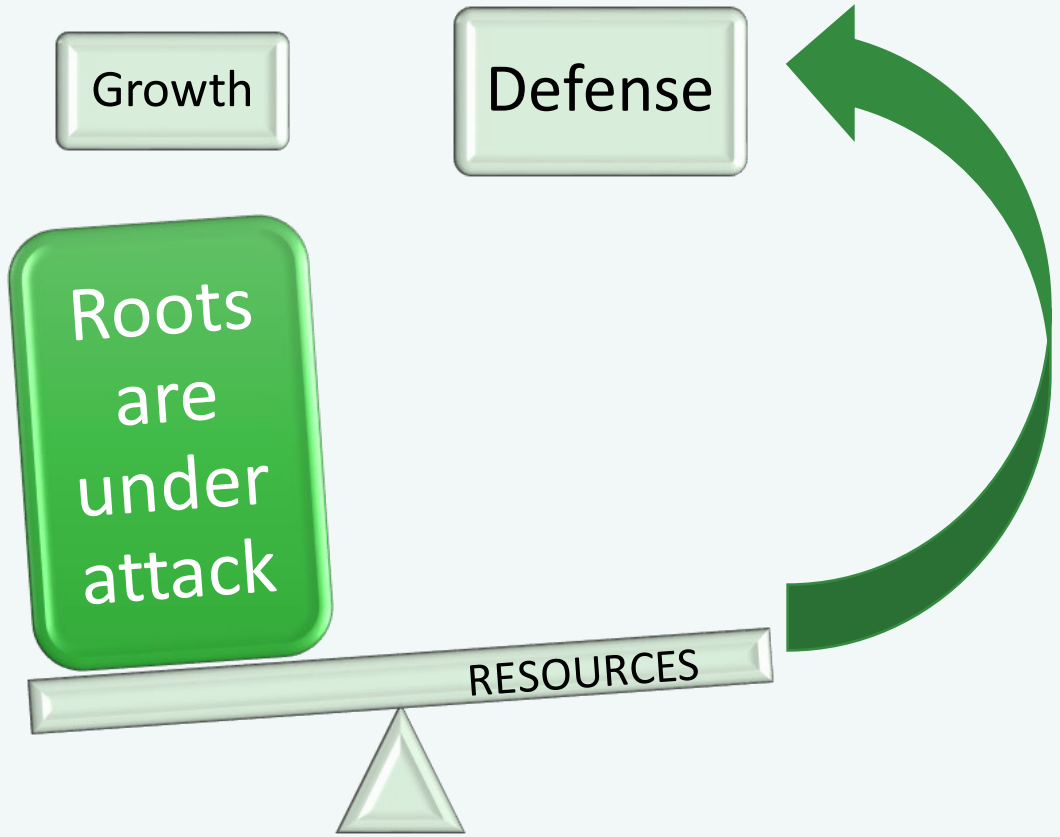
Grower Standard Practice	Terrasym 450 + DUST & TS201

TS201 HELPS PLANT DEFEND ITSELF WHEN NEEDED

Grower Standard Practice

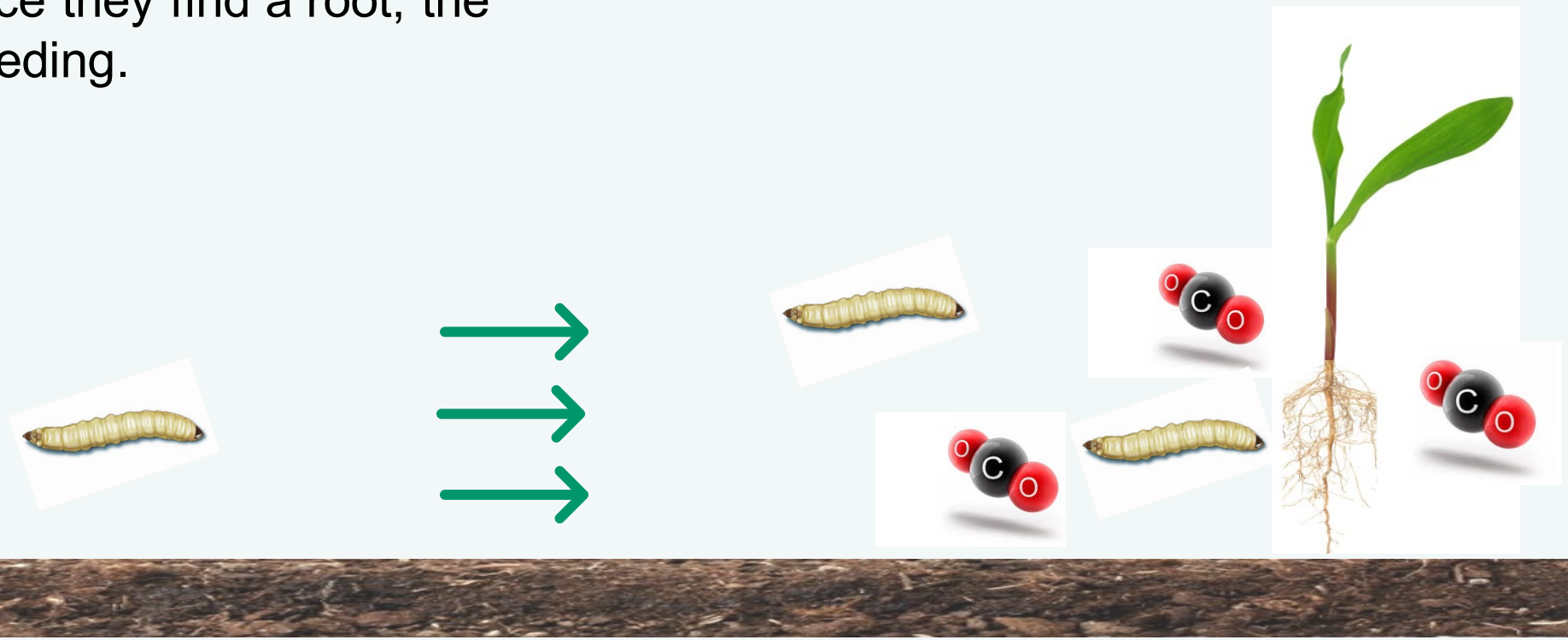
TS201-treated

- Experiments used roots under CRW attack in the field
- Found TS201 treatment turned on genes to help plant
    2. Produce defense compound that repels CRW larvae from feeding
    3. Regrow roots after damage



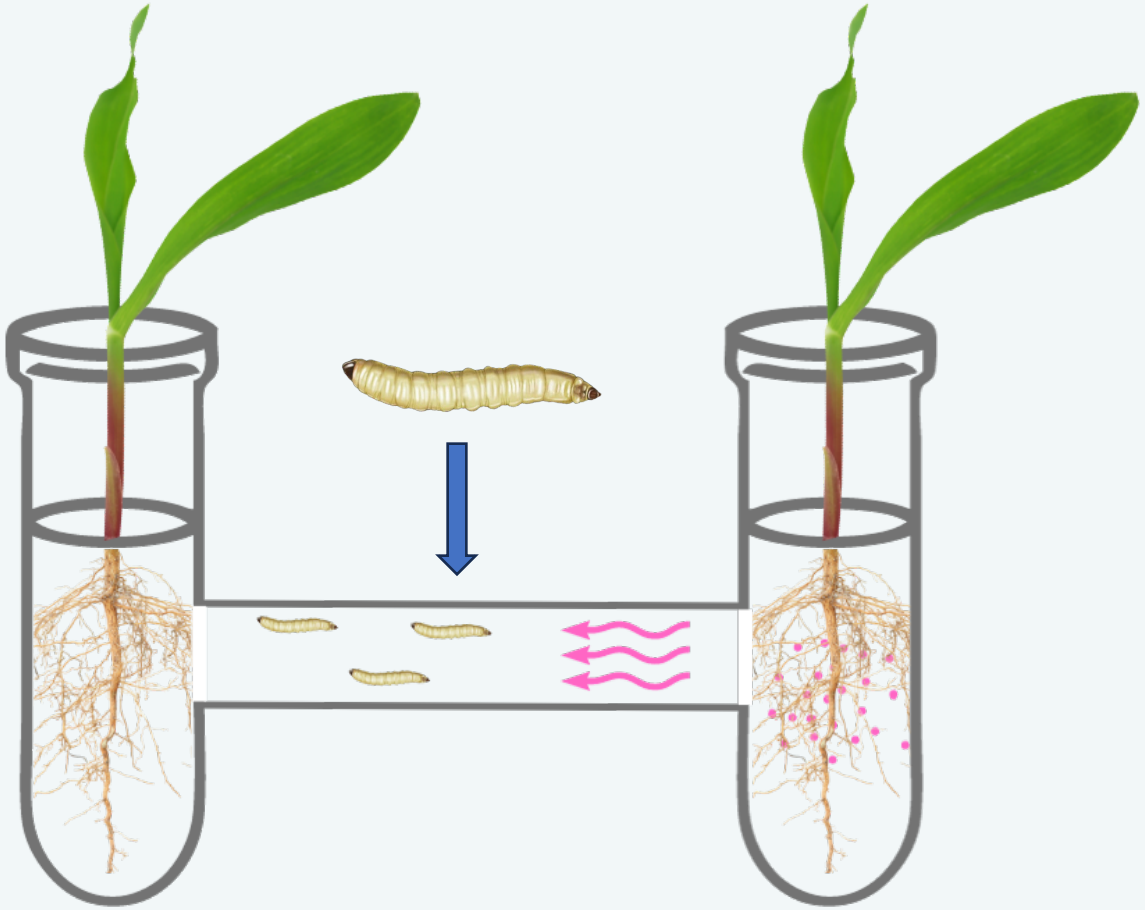
HOW DO CORN ROOTWORM LARVAE FIND ROOTS?

Once eggs hatch, they are attracted to the carbon dioxide (CO_2) released into the rhizosphere soil from roots through respiration. Once they find a root, the larvae begin feeding.



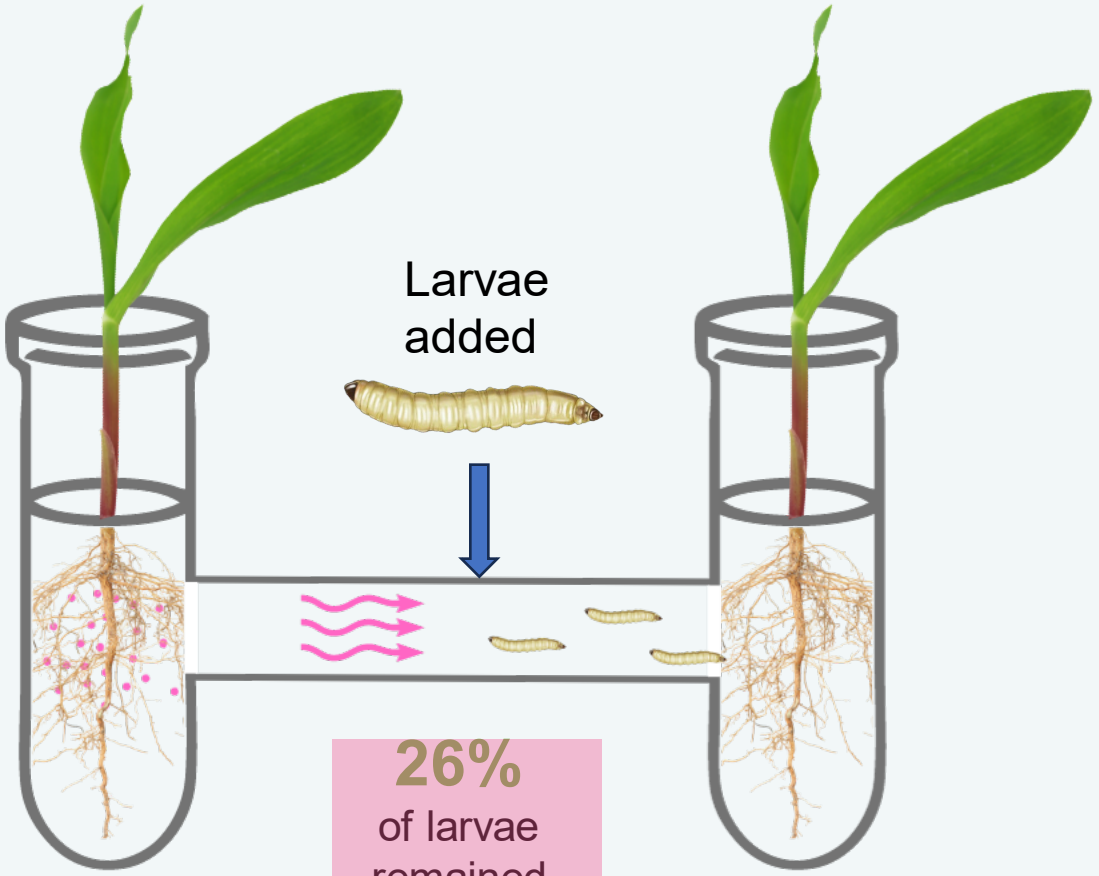
FEEDING CHOICE ASSAY TESTS IF DEFENSE COMPOUNDS ARE AFFECTING LARVAL BEHAVIOR AS EXPECTED

- Grow plants with and without TS201 treatment
- Let ISR defense priming get established
- Give CRW larvae choice of roots
  - See if larvae are repelled by TS201-treated roots



2) TS201 TREATMENT IS REPELLING LARVAL FEEDING

When given a choice between TS201-treated & untreated, most choose untreated



4%
of larvae chose the PPFM-treated roots

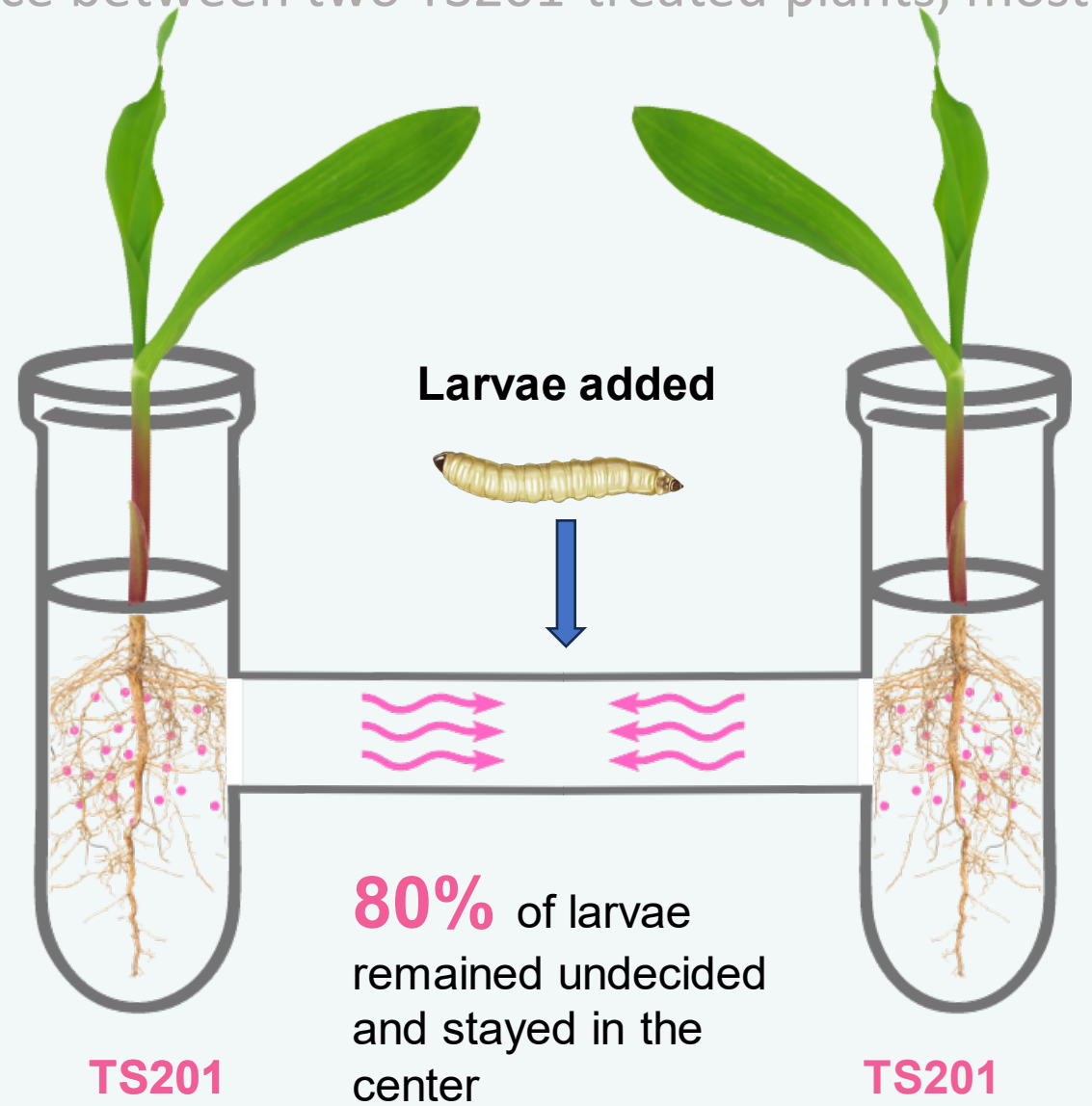
26%
of larvae remained undecided and stayed in the center

70%
of larvae chose the untreated roots

Assay conducted at the University of Missouri 2023: Neonate larvae of Western Corn Rootworm were introduced in the center of the apparatus and given time to move to one of the roots, n = 120 larvae over 3 separate runs of the assay with 4 replicates each

2) TS201 TREATMENT IS REPELLING LARVAL FEEDING

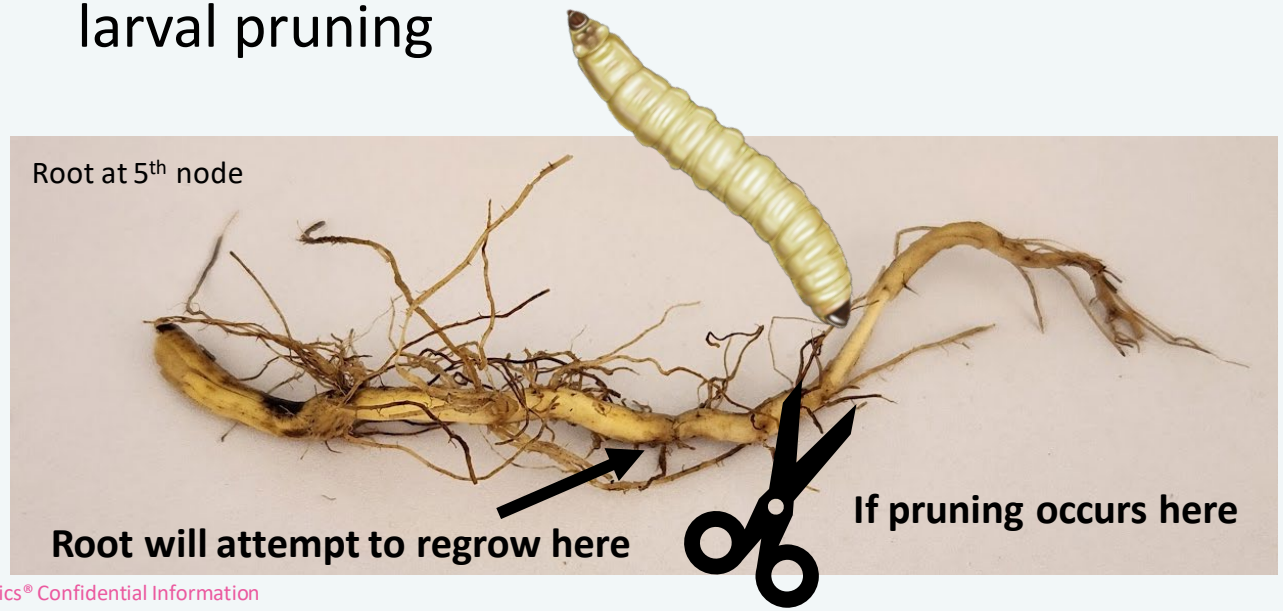
When given a choice between two TS201-treated plants, most don't find a root

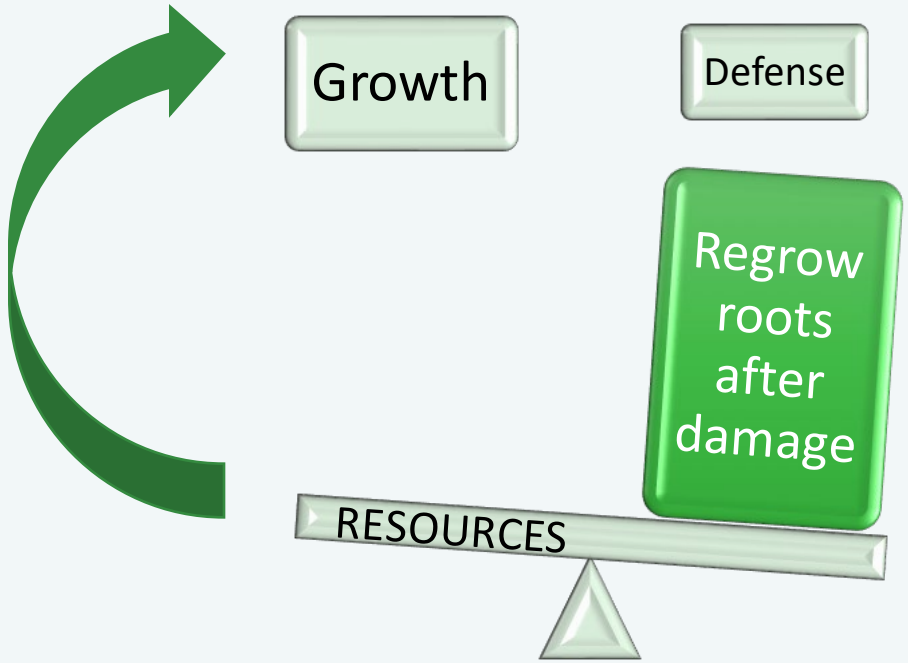


Assay conducted at the University of Missouri 2023: Larvae were introduced in the center of the apparatus and given time to move to one of the roots, n = 120 larvae over 3 separate runs of the assay with 4 replicates each

3) TS201 HELPS PLANTS REGROW AFTER DAMAGE

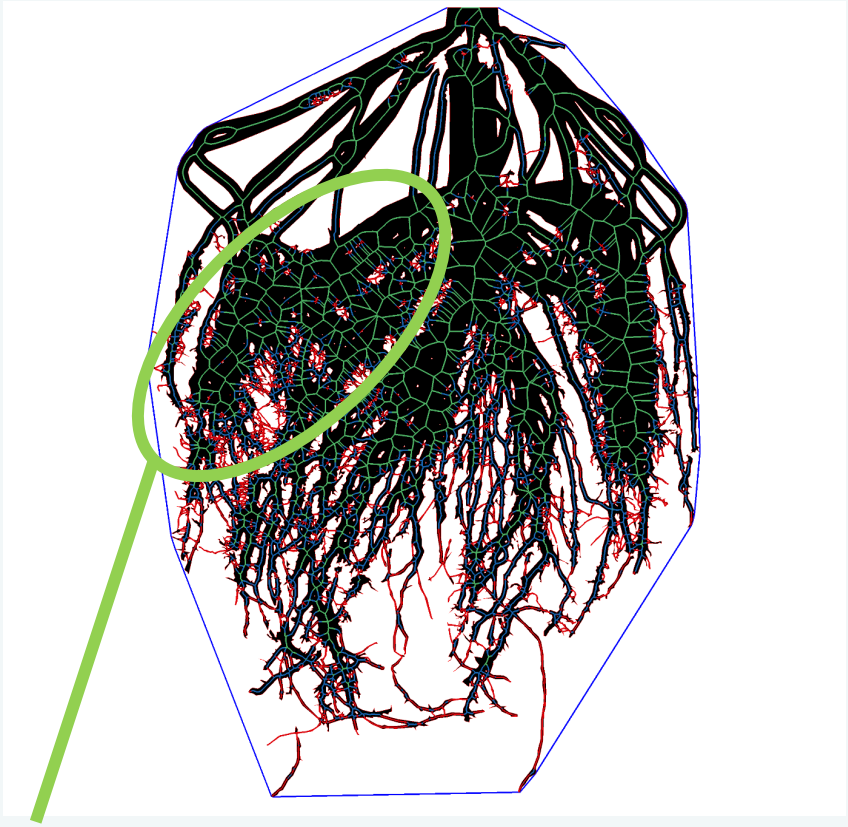
- Larvae damage roots through surface feeding and as they grow larger and stronger, full pruning
- Once a root is pruned, the plant will attempt to re-grow fine roots above the site of the damage
- TS201 promotes aggressive re-growth after larval pruning





TS201 HELPS PLANTS REGROW AFTER DAMAGE

Deer Grove, IL case study



Individual roots from 5th node dissected out for a closer look

GSP

Terrasym 450 + DUST & TS201

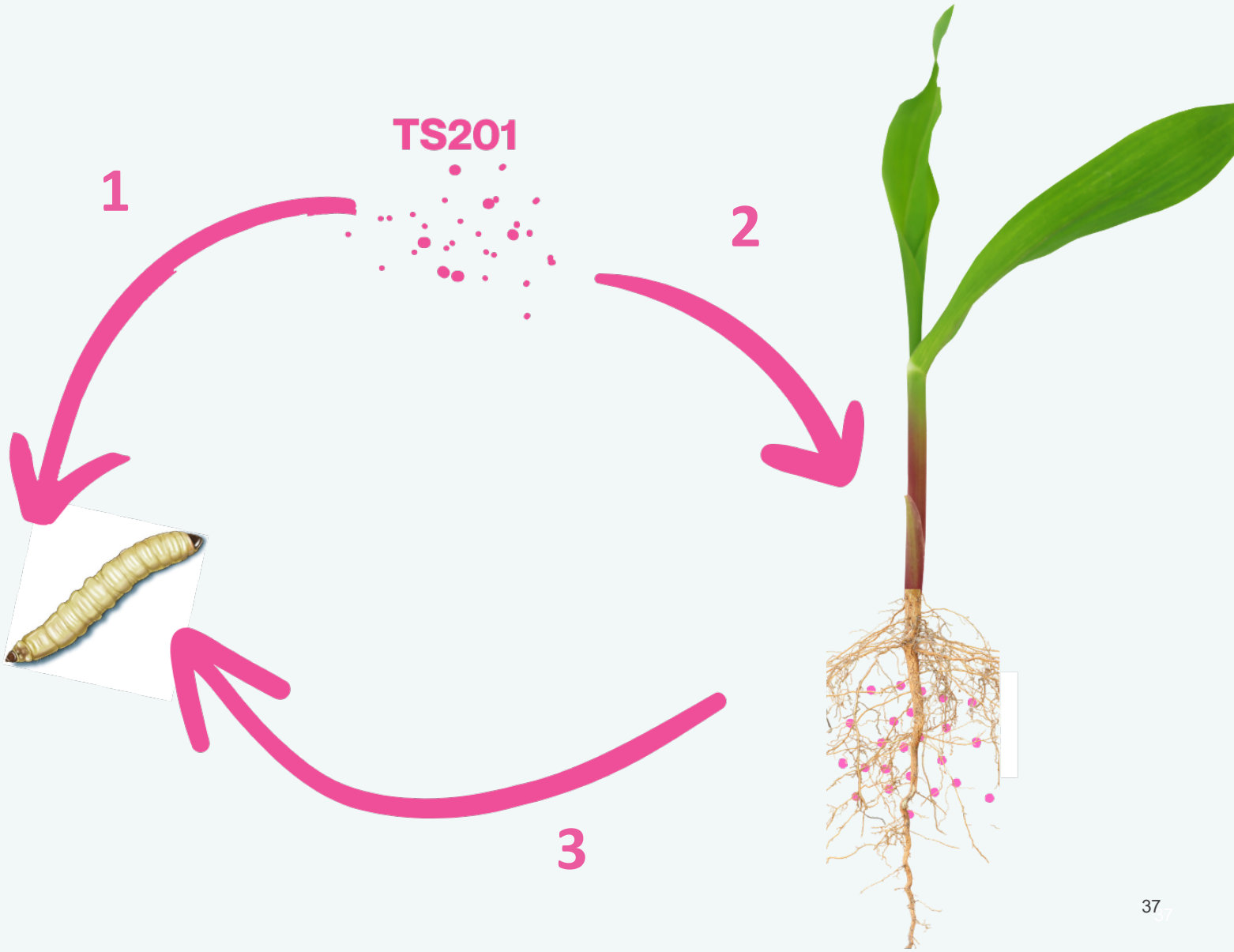
In situations where roots are fully pruned by larval feeding, TS201 treated roots demonstrate aggressive re-growth at the site of damage

MODES OF ACTION for TS201

1. No direct negative impact on larvae

2. TS201 primes plant defenses, improves root structure and stimulates re-growth after damage

3. The plant's increased defenses in turn decrease larval feeding



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