

Understanding Trichoderma

takes a little
digging ...

Rooted in
superior genetics,

ABM has selected and
developed strains that are
unparalleled in the industry.

It is critical to understand that our superior Trichoderma strains colonize roots. The good strains **GROW** and **MULTIPLY** greatly, resulting in a bigger root mass and higher yields. Take a fresh new look at Trichoderma from our end of things and contact an ABM representative today.



ADVANCED BIOLOGICAL MARKETING

USA | 877.617.2461 | ABM1st.com



Get ready to grow more.

Biological Enhancements for Agricultural Crops

An American Company Producing Global Results for Agriculture.

**SHE'S GOT A GREAT PERSONALITY:
WHY WHAT'S ON THE INSIDE MATTERS**

Molly Cadle-Davidson, Ph.D.



WHAT'S ON THE INSIDE

- Endophytic symbionts: *Trichoderma*, *Bradyrhizobium/Rhizobium*
- Root-associated symbionts: *Bacillus*
- Plant gene expression
 - Responses to biotic/abiotic stresses
 - Responses to endophytic symbionts
- Microbial gene expression → production of signal molecules



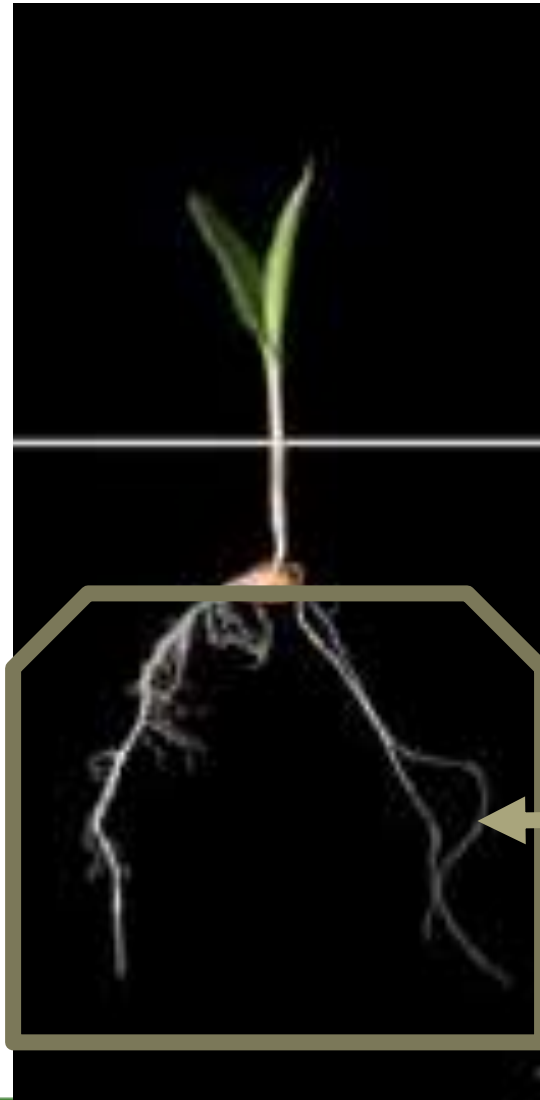
OUR STRAINS COLONIZE ROOTS, GROW AND PROLIFERATE

= RHIZOSPHERE COMPETENCE

- CFUs on the seed are only the starter inoculum
- *Trichoderma* or our other organisms colonize the emerging roots
- As our organisms grow the plant physiology is modified
- Effects are increased yields, stress resistances, and other benefits

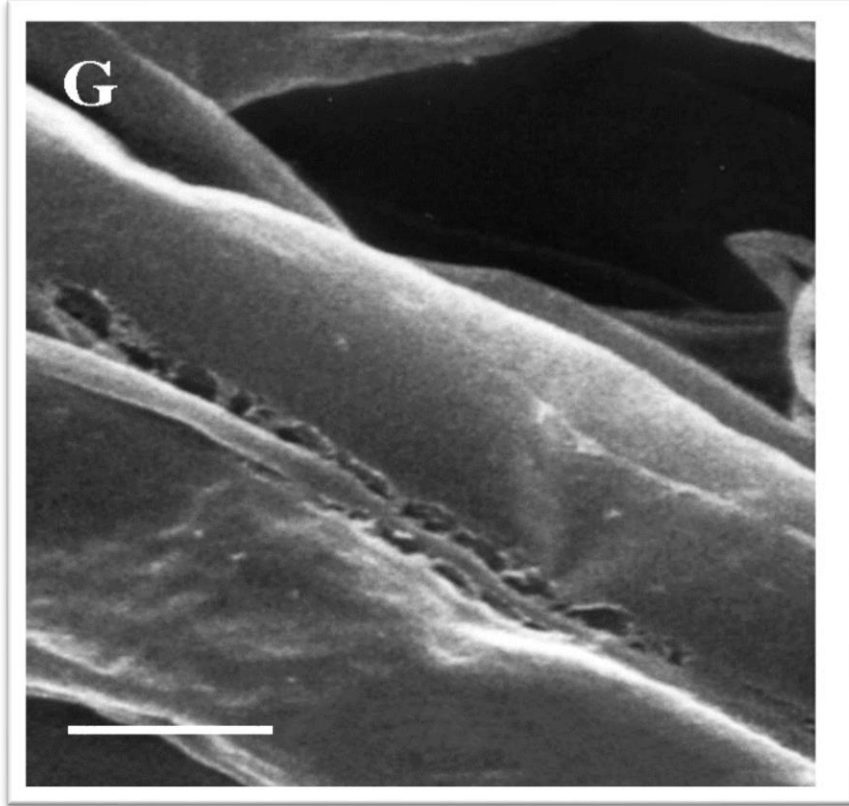
← This is where the action is; where the important events occur.

Only a few strains do this...



OUR STRAINS GROW INTO THE PLANT, PROVIDE LONG-TERM BENEFITS

=ENDOPHYTIC COMPETENCE



- Establishes communication between *Trichoderma* and the plant
- Fungus becomes a functional part of the plant
- Changes the physiology of the plant
- Strains provide broad benefits, even in stressful soil conditions (e.g. drought stress, salt stress) because they are protected within the root environment

Only a few strains do this...

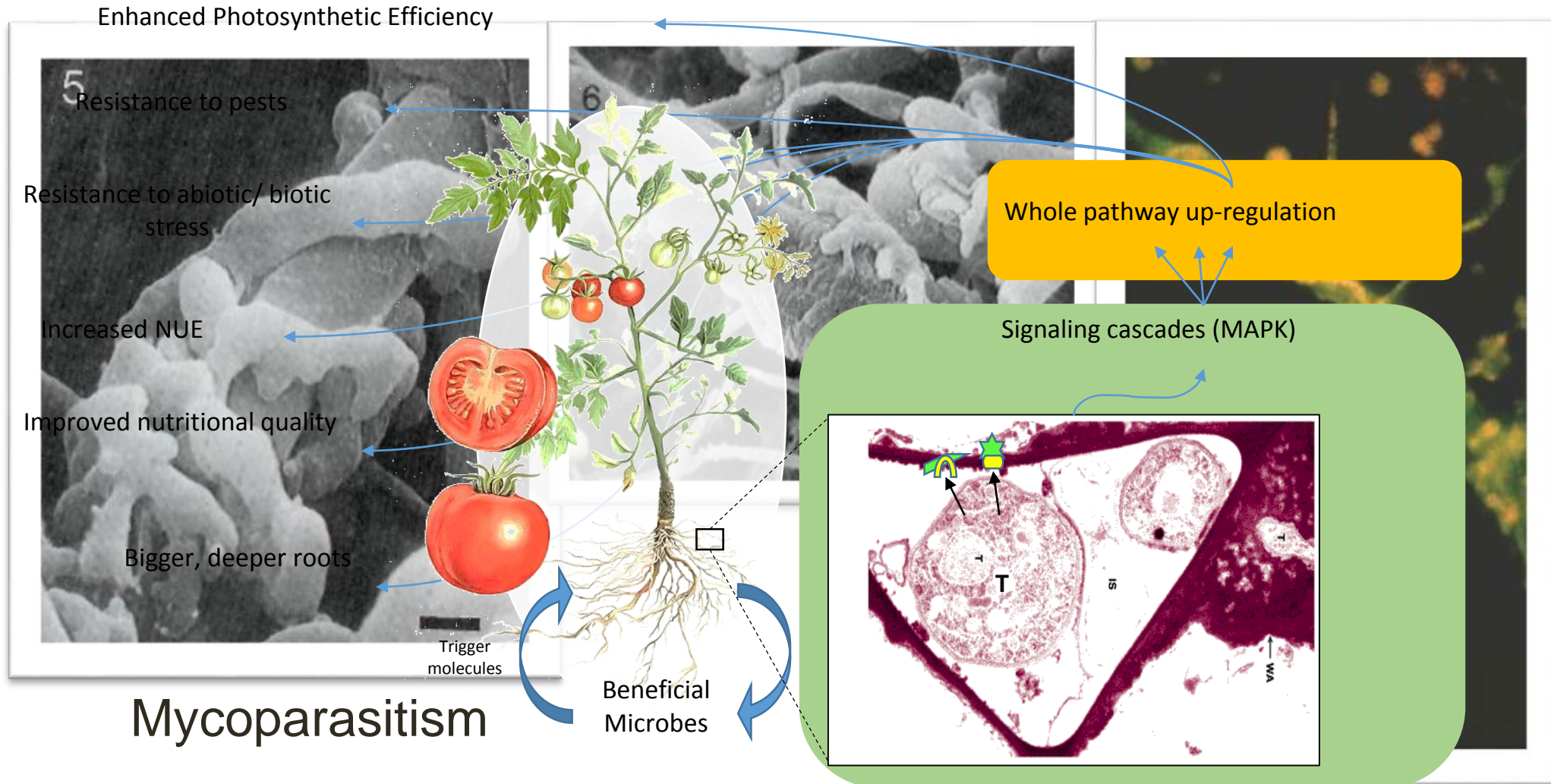


ABM DEVELOPS STRAINS WITH SUPERIOR GENETICS

- Focused Microbial Diversity[™]
 - ~2.3x10¹³ cfu/ac of native *Trichoderma* strains; even more *Bacillus*
 - Most of these have either no effect or a negative effect on crop performance
 - ABM has selected from the very best strains = best genetics
 - ABM's strains don't out-compete the native strains, they **out-perform** them.
- Analogy (corn):
 - Does it make sense to plant 800,000 seeds/ac of a poor variety to achieve the performance of 80,000 seeds/ac of an excellent variety?
 - Just as with corn or soybean variety selection, the genetics of the biological is critical.
- iGET[™]



MODELS: BENEFICIAL MICROBE × PLANT INTERACTIONS



iGET™ TECHNOLOGIES

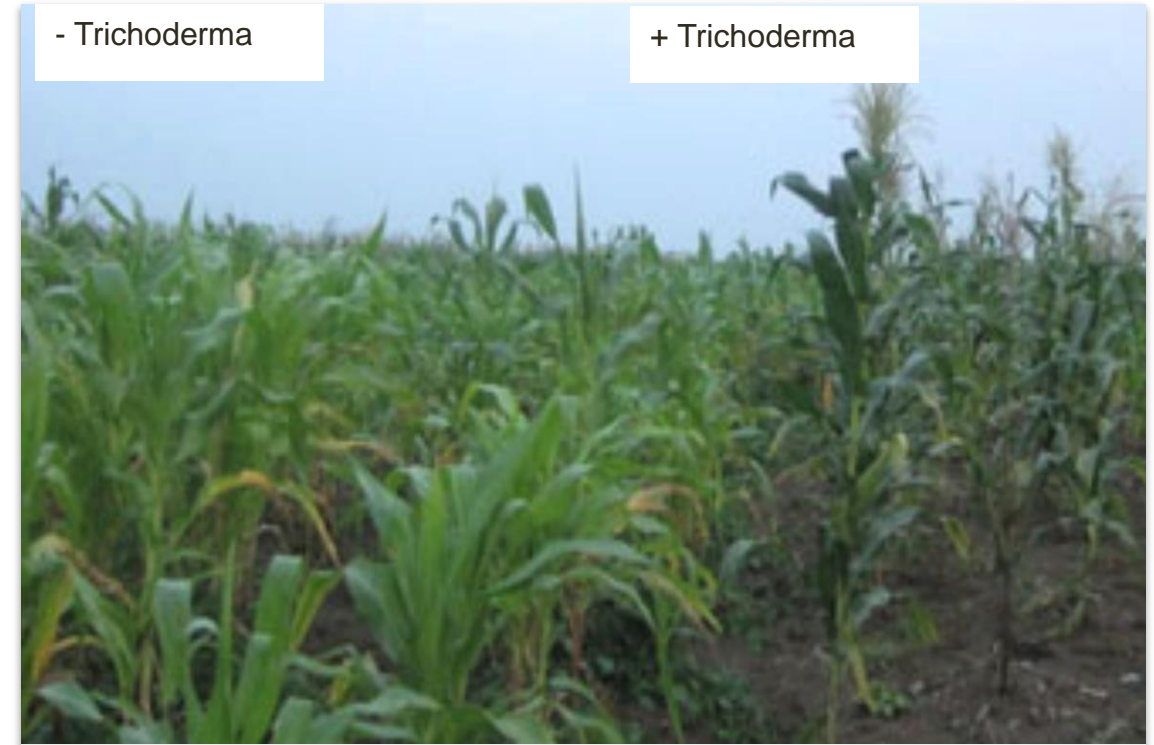
(INDUCED GENE EXPRESSION TRIGGERS)

- The basis of the beneficial effects of our *Trichoderma* and *Bacillus* products is iGET.
 - Strains colonize roots → systemically upregulate/coordinate entire biochemical pathways
 - Plants work better and harder with iGET.
- ABM leverages strain diversity to get synergistic beneficial effects.
 - Focused Microbial Diversity™
 - Different strains induce different iGET responses
 - It is essential to link the effects of the microbial genes with their effects in plants



STRESSES ALLEVIATED:

- Water deficit
- Salt
- Polluted soil
- Cold wet soils
- Poor quality seeds
- Plant pathogen attack
- Temperature (at least for seed germination)

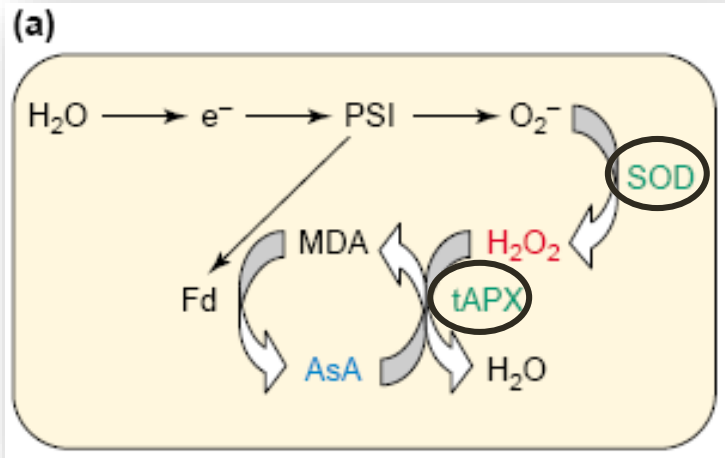


Maize with no added Nitrogen, DR Congo

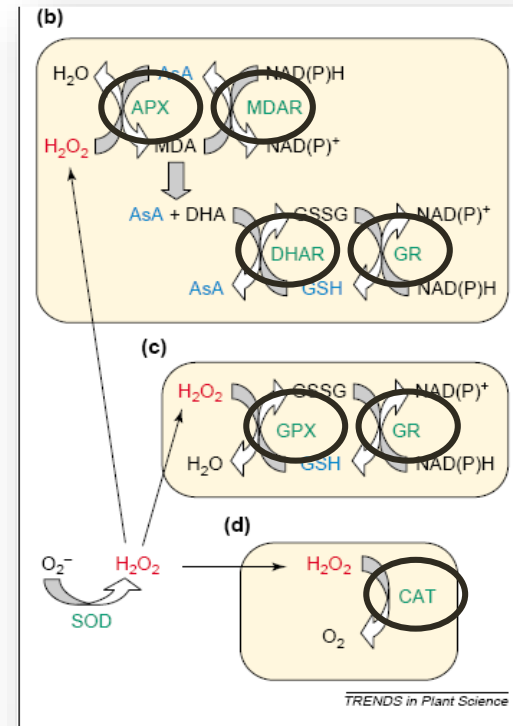
THE PATHWAYS OF REDOX CYCLING

- genes and proteins are known
- *Trichoderma* upregulates all of these

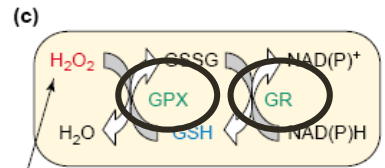
Water-Water Cycle (chloroplasts)



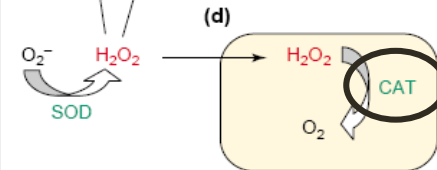
Glutathione-ascorbate cycle



GPX cycle



Catalase



TRENDS in Plant Science



FIELD EFFECTS

- 2012 drought (IL)
- Entire field received standard chemical treatment
- Stand to the right: seeds also treated w/ *Trichoderma*



SYSTEMIC RESISTANCE TO ANTHRACNOSE IN CORN



Trichoderma present only on the roots,

Leaves inoculated with *Colletotrichum graminicola*

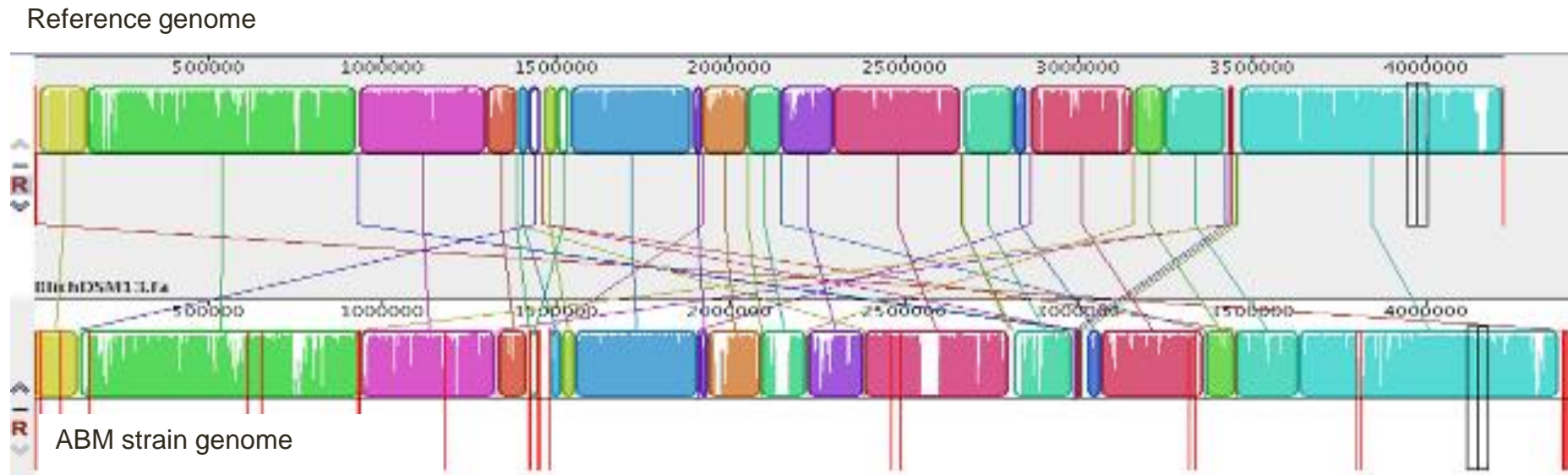
Considerably less disease on plants grown from *Trichoderma*-treated seeds than without



Harman, G. E., et al. (2004). *Phytopathology* 94: 147-153.

FOCUSED MICROBIAL DIVERSITY™

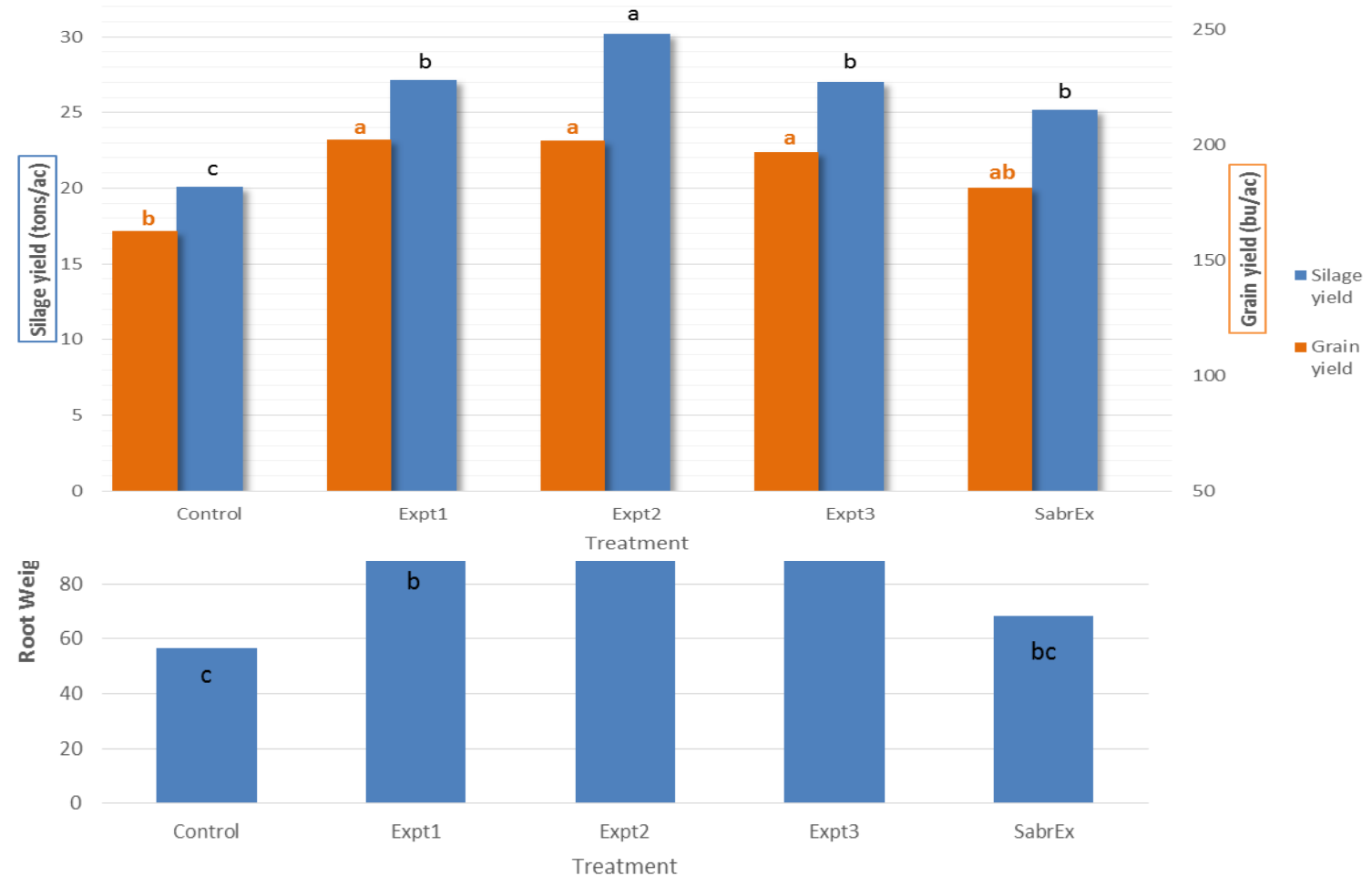
- Root colonization by elite *Trichoderma* or *Bacillus* strains results in beneficial agronomic effects.
- Most strains found naturally in the soil do not provide superior plant benefits.
- Therefore, different genes in the microbes' genomes must account for the different plant responses.
- This strategy leverages microbial genetic diversity from selected, i.e. focused, strains to positively effect beneficial agronomic traits.



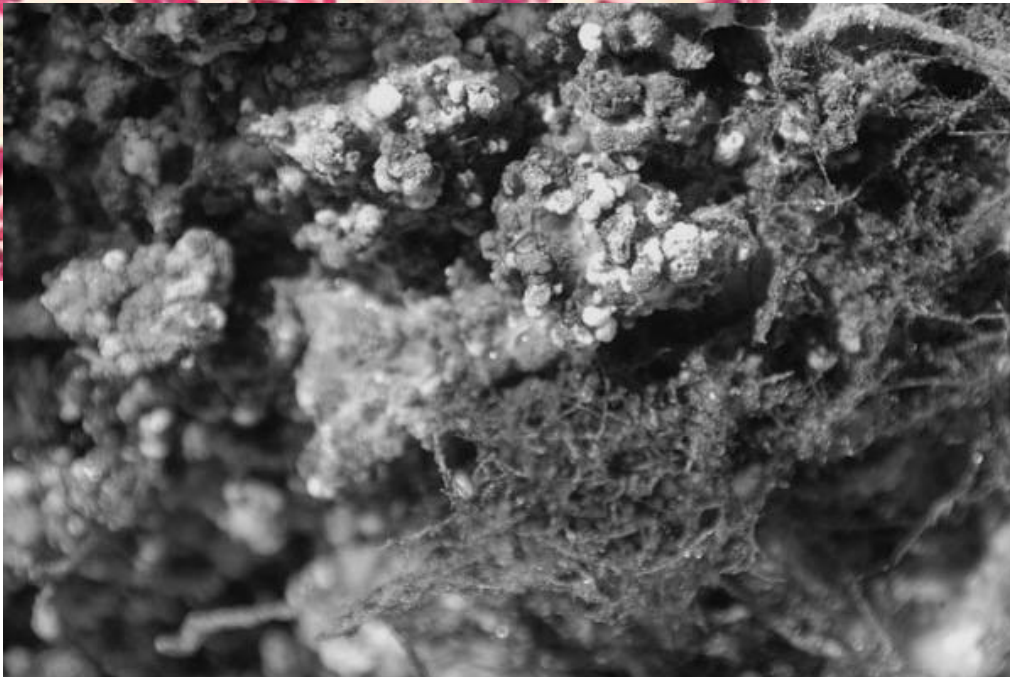
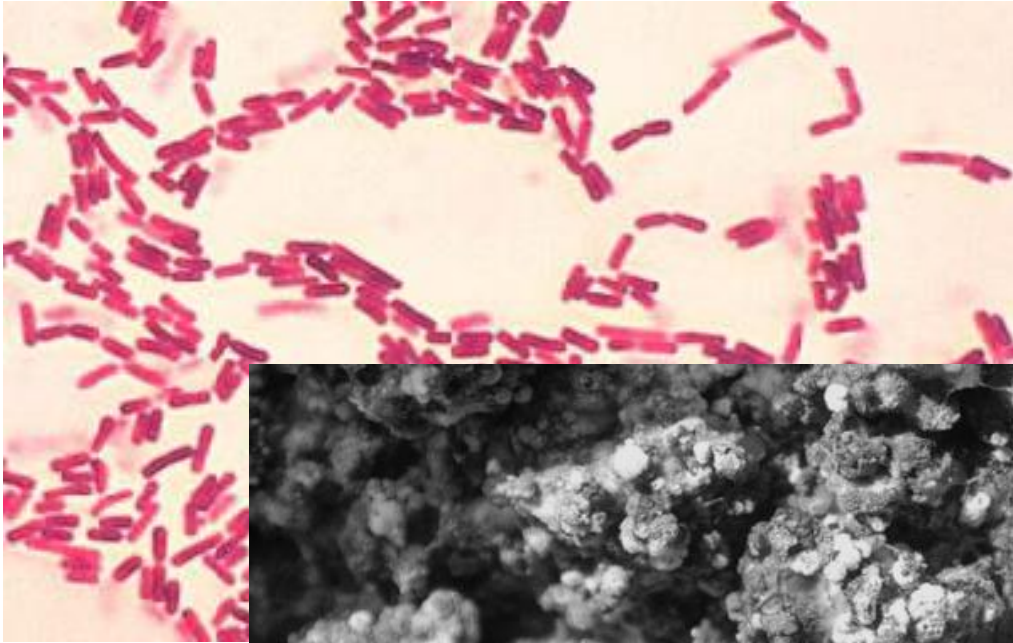
PRODUCTS IN THE R&D PIPELINE

- 2014 field trial data: Corn
- Both silage and grain yields significantly higher than control and SabrEx.
- **Root growth: the best new treatments are more than double the control**

2014 Phelps, NY R&D Corn Field Trials



INNER BEAUTY FORGES LONG LASTING RELATIONSHIPS



- Strains with **Rhizosphere competence** and **Endophytic competence** provide season long effects. ABM strains have both
- ABM strains out-perform the natural inoculum so there is no need to out-compete.
- Superior genetics finely tuned to work synergistically with plant genetics
- Focused Microbial Diversity™ to take advantage of the best microbial genetics.

