

A biocontrol fungus that colonizes roots consistently

From concept to organic product Thomas Björkman

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What came before the SARE project

The widespread fungal genus *Trichoderma* contains certain strains that can reduce root disease on crops. To make them more useful in farming, many groups have tried to breed strains that suppress root diseases even better. A limiting factor has been finding strains that also compete and grow well enough that there is enough on crop roots to be effective.

My colleague, Gary Harman, selected a competitive and disease-suppressive strain in culture. It also worked in the greenhouse, but it was not clear that it would be successful in the tough and competitive environment of the soil. This project was designed to find out.

We also wanted to know how much this new strain improved growth and yield, particularly in the newlypopular but weak *shrunken2* type of sweet corn.

We showed that T-22 colonizes roots in the field...

What the SARE project accomplished

- at a much higher level that wild *Trichoderma* strains.
- when it is still too cold for wild strains to do so.
- even on sandy soils that typically don't support high fungal populations.
- even on organic farms with a robust and stable soil microflora.

In addition, many sweet corn farmers got experience applying the inoculum on their own farms.

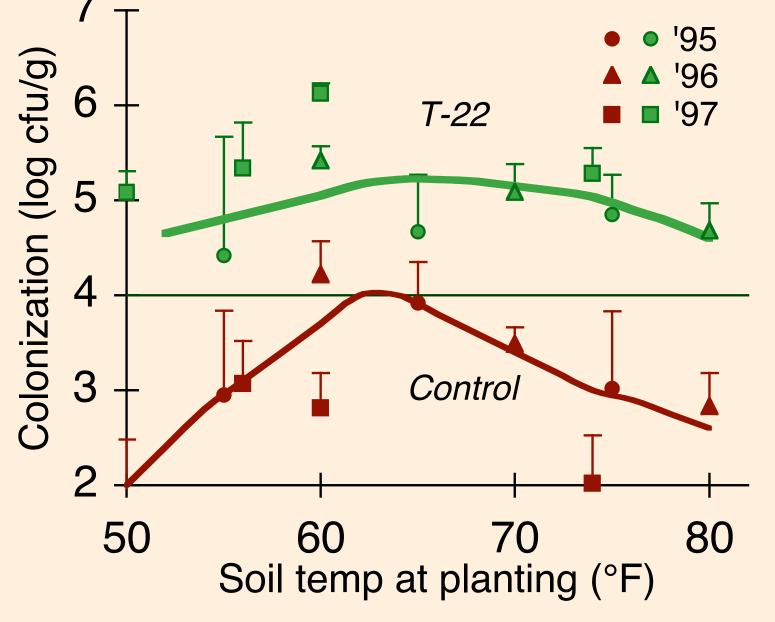
Biocontrol fungi selected for growing well on roots the lab are shown here to be excellent root colonizers in the field. That allows strain T-22 of the fungus *Trichoderma harzianum* to be present to protect roots from disease and to enhance growth. This fungus is now an OMRI-approved commercial product that is nationally distributed.

What happened after the SARE project

- Our work provided incentive for several companies to do largescale field trials. They have presented data on hundreds of onfarm trials since then.
- T-22 was OMRI approved for organic use in 1998.
- The strain is grown and made into a commercial product by a local company, BioWorks. It is distributed nationally by BioWorks for greenhouse uses and by Advanced Biological Materials for field uses. Many greenhouse and garden supply catalogs sell it.
- T-22 is used in the production of vegetable transplants, including big operations like Speedling.
- T-22 is used by some corn, wheat and soybean farmers with demand growing about 10% per year.
- Organic farmers are not using much at all.
- The greatest adoption of T-22 has been for ornamental greenhouse and nursery crops. Considerable demand was created by big national retailers wanting to carry "green" ornamentals and bedding plants.

T-22 colonizes roots well, and is not sensitive to seasonal variation. T-22 populations (green) were higher than wild *Trichoderma* (red) and less variable. The low temperature limit for *Trichoderma* growth in vitro is 10 to 15°C. The decline in wild strains in warmer soil is likely to be due to greater competition from other soil organisms.

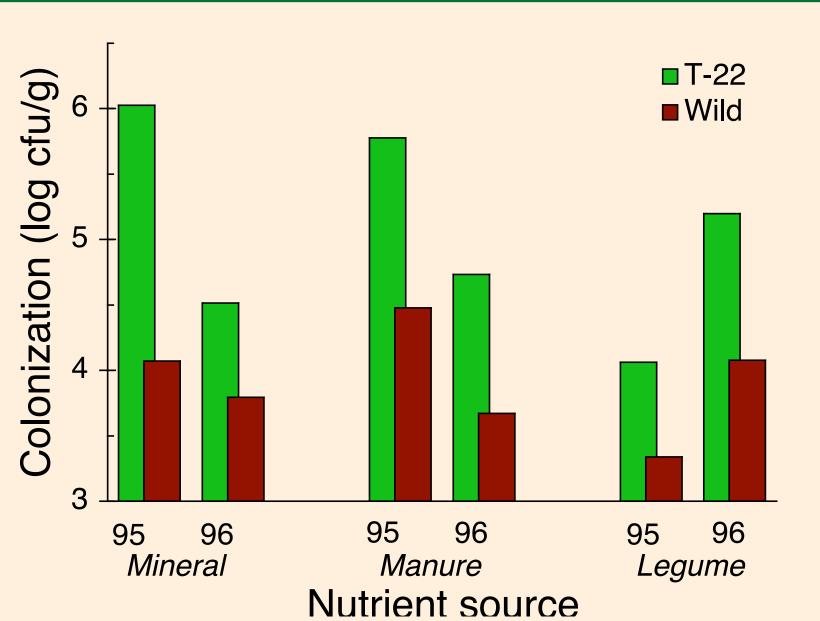
This result shows that the improved strain can be used at all spring planting dates.



Amount of *Trichoderma* on corn roots one month after planting. The minimum effective population is 10⁴ cfu/g (line).

Microbial competition on organic farms doesn't keep T-22 down. The soil microflora was altered by using 3 different management systems for 16 years (the Rodale Farming Systems Trial). The two systems with high organic matter input (Manure and Legume) support a substantially different microflora, but it was not more difficult for T-22 to invade this microbial community.

This result shows that T-22 will work on organic farms.

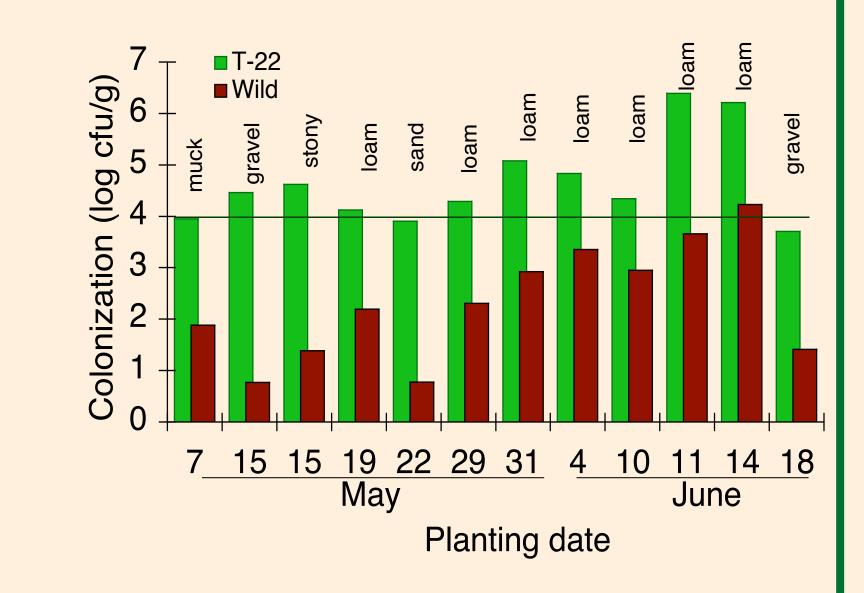


Growth of Trichoderma on corn roots in soils collected from the three regimes in the Rodale Farming Systems Trial.

T-22 grows well even on soils that fungi usually dislike. Colonization was measured on commercial sweet corn fields with various soil types. The welldrained sand, stone or gravel soils supported lower populations of wild *Trichoderma*, but had sufficient populations of T-22.

The wild strains did worst in early plantings into cold soil, but T-22 did well.

This result shows that the improved strain can be used on any soil.

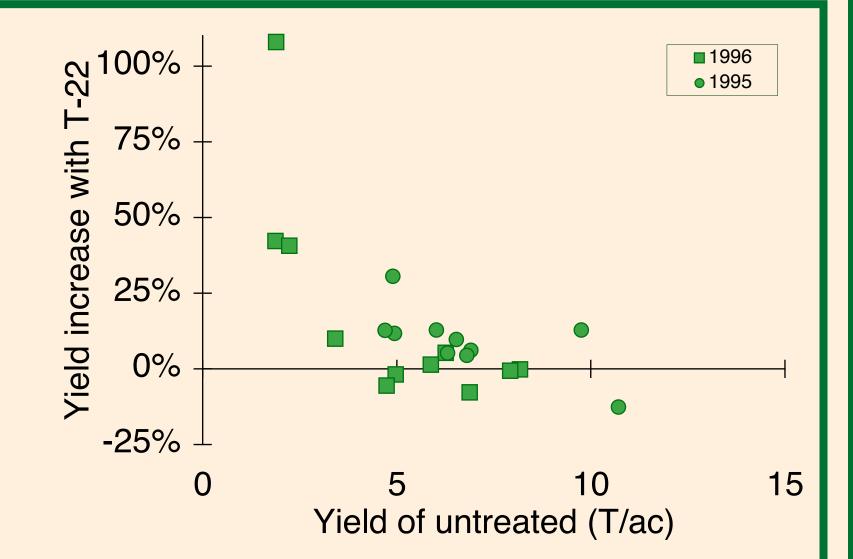


Amount of *Trichoderma* on corn roots one month after planting on various commercial farms in New York.

T-22 maintains yield if growing conditions get bad. In trials on commercial sweet-corn, yield was greater

in T-22-treated plots in those sites where yield was reduced. All the sites had high yield potential, so those with low yielding controls just had a challenging year.

This result shows that T-22 can help yield if there is a stress that better root function can overcome.



Acknowledgements

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