Microbial Products in Turfgrass

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Terms

- Fertilizer
- Biological pesticide (Biopesticide)
- Inoculant
- Rhizosphere
- Fungi
- Bacteria
- Rhizosphere

Fertilizer

- guaranteed analysis (%N-P_2O_5-K_2O)
- state tested, state laws apply
- if g.a. missing can only be sold as soil amendment or conditioner


LAWN & GARDEN
FERTILIZER
13-13-13
PLUS SULFUR
GUARANTEED ANALYSIS
Total Nitrogen (N) 13%
10.6% Ammoniacal Nitrogen
2.4% Urea Nitrogen
Available Phosphate (P_2O_5) 13%
Soluble Potash (K_2O) 4%
Sulfur (S) .....
4% Combined Sulfur (S)
Nutrients Sources: Urea, Ammonium Phosphate, Ammonium Sulfate, Muriate of Potash.
FOLLOW INSTRUCTIONS CAREFULLY
LAWN — GRASSES
1. Apply only when grass is dry.
2. For best results apply—early spring—June—early f
3. Apply 6 lbs. per 1000 sq. ft. of lawn at each applicat
4. Spread fertilizer evenly.
5. Water generously immediately following applicatior
FLOWERS — VEGETABLES
1. Apply annually in early spring.

COMPOST

Temperate, moisture controlled finished composted product.

- SINGLE SOURCE BEEF MANURE.
- ORDERLESS, SAFE TO USE ANYWHERE.
- COMPOSTED AEAROBICALLY, AND WEED SEEDS ARE DESTROYED.

Biological pesticides (Biopesticides)

- products that claim to directly control pests.
- regulated by the EPA.
- specific target, specific pesticidal claim.

September 18, 2009. *Lawn & Landscape*:

Econem Receives EPA Registration as First *Pasteuria* Product for Sting Nematode Control in Turf.

Pasteuria Bioscience has received EPA registration for Econem biologicial nematicide for cor s in turf.

Slide is not an endorsement or critique of this particular product. It is merely an example of an EPA registered biological product.

ORGANIC SOIL AMENDMENT

Turfgrass Stress Relief and Biostimulant with Beneficial Trichoderma Fungi

RELIEF FROM NEMATODE INFESTATION STRESS

Active Ingredients By Weight:

CYMOPERLO, BIOSTIMULANTS, HUMATES & TRICHODERMA.....	70%
Inert Ingredients.....	30%

Directions For Use:

Product can be sprayed by a tank sprayer or approved hose end sprayer. Irrigate with a minimum of 1/8" of water immediately following application. Product performs best when injected subsurface into the root zone.

Recommended Application Rates:

Four(4) to Six(6) Gallons per acre is recommended for fine turf. The Six(6) Gallon rate should be used for heavy infestation or severe turf stress and damage. A rate of 16 ounces per 1000 square feet should be used for home lawns and commercial properties. There are no limitations on reapplication.

Environmental Hazards:

There are no known environmental hazards associated with the use of this product.

Personal Hazards:

Poses no danger to humans or animals (see precautionary statements).

NOT a biopesticide.

Inoculants

- term often applied to a microbial product that claims to improve general turf health.
- often diverse mixtures of bacteria or fungi.

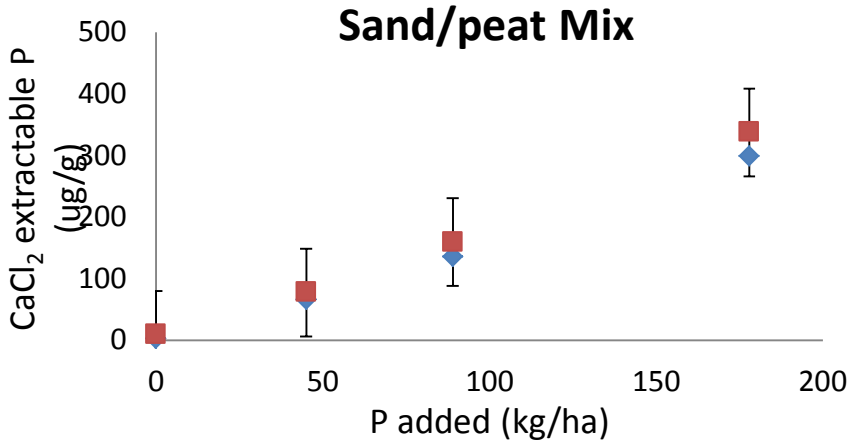
Active Ingredients by Weight: (This Product is Not A Plant Food)
Natural Sugars, Sugar Extract, Humecants, Trichoderma, Beneficial Microbes, Naturally Occurring Vitamins, Pantothenic Acid, Riboflavin, Fulvic Acid, Maganese, Iron and Ascophyllum, Yucca Schidigera, Nitrogen Fixing Bacteria and Phosphorus Solubilizing Bacteria: 70% Inert Ingredients: 30%

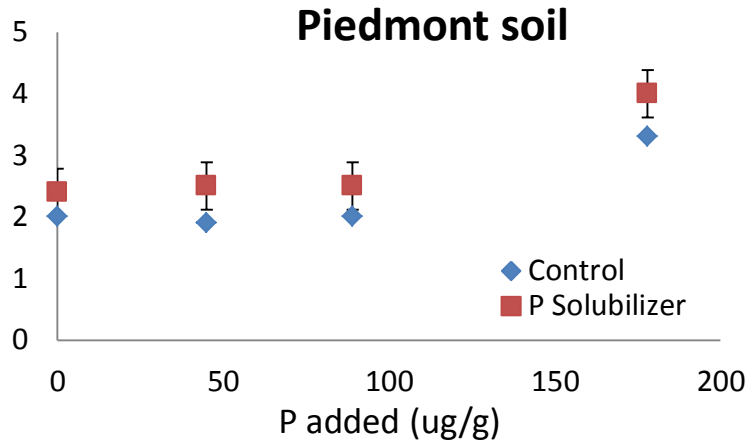
Directions For Use:

GUARANTEED ANALYSIS
0-0-3

Ingredients	% by Weight
Iron as Fe ..... (77% EDTA)	10%
Humates and Humic Acids	10%
Cold Water Kelp	8%
Natural Sugars (sucrose), Vitamins, (B-Complexes, K) Amino Acids and ..... Beneficial Bacteria	5%
Nitrogen Fixing Bacteria	App. 15 billion/lb.
Phosphorus Solubilizing Bacteria	App. 30 billion/lb.

3% Potassium (K_20) derived from Humate and Kelp





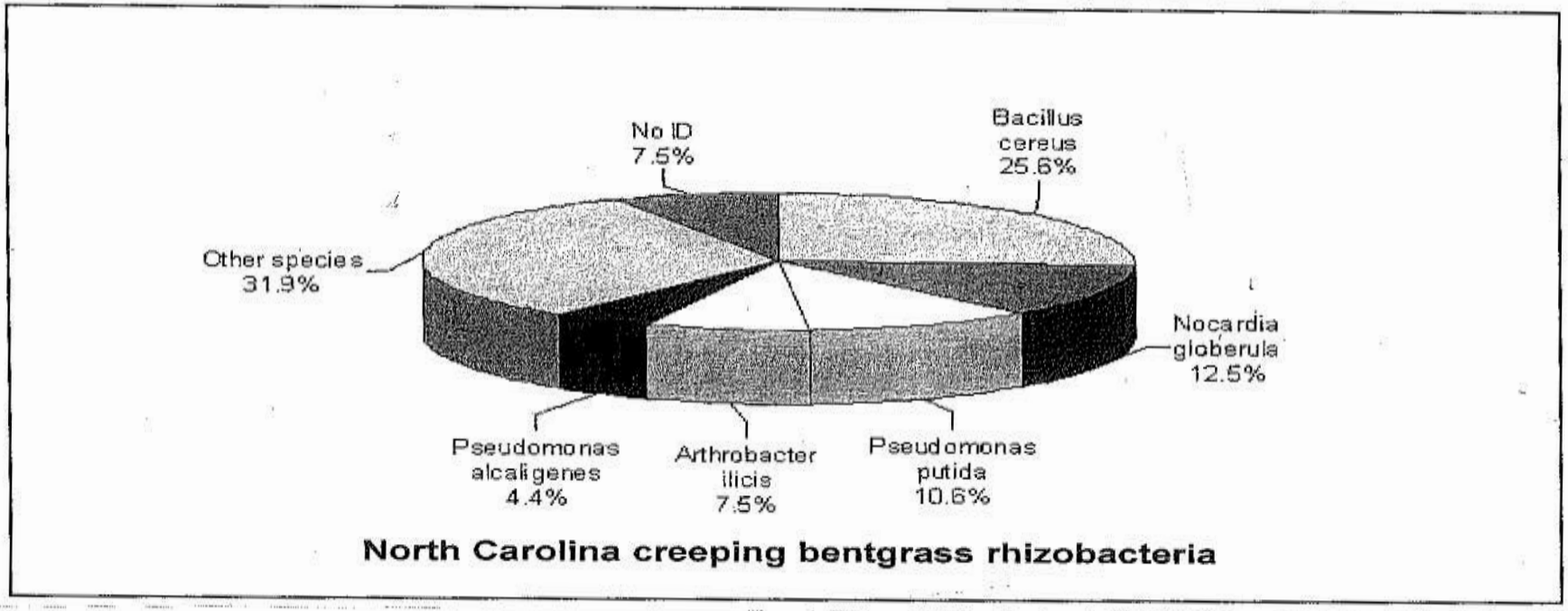
Effect of inclusion of a P solubilizing bacteria on extractable soil P.


2 34
USE BEFORE DATE STAMPED ABOVE
inoculant
INCREASES YIELDS
IMPROVES QUALITY
BUILDS UP SOIL FERTILITY
DIRECTIONS
Use no water for planter box application
SCATTER INOCULANT OVER TOP OF SEED IN HOPPER. MIX LIGHTLY INTO TOP INCH OF SEED. RUN STICK TO BOTTOM OF HOPPER SEVERAL TIMES. PLANT.
USE ONLY FOR SEEDS SPECIFIED ON FRONT PANEL.
DO NOT USE AFTER DATE AT TOP OF THIS PANEL.
GUARANTEE
Use UNICO INOCULANT according to directions BEFORE EXPIRATION DATE. UNICO Inoculant, when packed contains sufficient living bacteria to inoculate the kind and amount of seed stated on front panel. Under normal conditions it will form beneficial nodules on the roots of plant for which this inoculant is intended. However, due to the many factors beyond our control after UNICO Inoculant leaves the laboratory we will not in any way be responsible for the crop.

Symbiotic N Fixation
NOT in Turfgrass

Rhizosphere

- area around plant roots affected by plant metabolic activity.
- rhizobacteria - root-associated bacteria.
- PGPR - plant-growth-promoting rhizobacteria.



Elliott et al., 2004

Fungi

- simple organisms
- mycorrhizal fungi
- Fusarium
- Rhizoctonia
- Trichoderma

Evaluation of commercial arbuscular mycorrhizal inocula in a sand/peat medium. Corn (*Zea mays* L.)

Table 2 Effects of different application rates of commercial AMF inocula on percentage of root length colonized and frequency of AMF formation in plants of *Zea mays*

Inoculum #	Recommended rate		5× Recommended rate		10× Recommended rate	
	% Col.	Freq. (%)	% Col.	Freq. (%)	% Col.	Freq. (%)
1	None	None	None	None	None	None
2	None	None	None	None	None	None
3	6.1±3.0[a]	80	68.6±4.4	100	72.5±3.0	100
4	None	None	None	None	None	None
5	None	None	None	None	None	None
6	8.0±4.4	80	1.2±1.2	20	None	None
7	0.4±0.4	10	4.9±2.7	60	12.5±6.3	80
8	None	None	None	None	8.6±2.9	100
Dune 1	60.5±2.9	100	nt[b]	nt	nt	nt
Dune 2	73.7±1.2	100	nt	nt	nt	nt
Dune 3	46.4±3.0	100	nt	nt	nt	nt

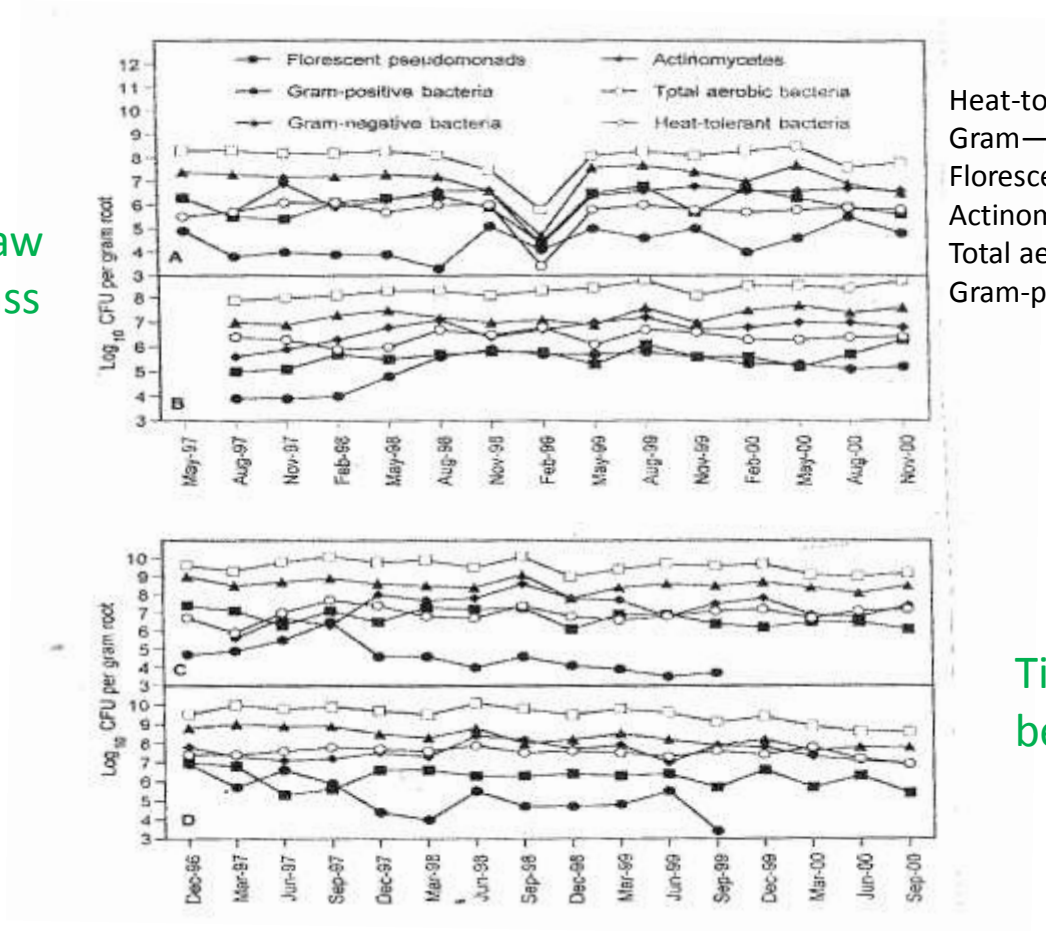
[a] Mean±SD
[b] Not tested

Tarbell and Koske, 2007

Bacteria

- more numerous in soil than all other organisms combined
- 1 soil sample may have 4,000 distinct bacterial species
- prokaryotic (no cell nucleus)
- *Anthrobacter, Bacillus, Pseudomonas* three common soil bacteria

Crenshaw bentgrass



Heat-tolerant bacteria
Gram—negative bacteria
Florescent pseudomonads
Actinomycetes
Total aerobic bacteria
Gram-positive bacteria

Tifdwarf bermudagrass

UpShot

- Lots of stuff already there.
- Issue is quantification and identification.
- How do we introduce microorganisms to our system and create positive effects?
- Not saying it can’t happen or won’t happen – identification and testing is the key.