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Biofertilizer Economics and Environmental Impacts

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What Is Biofertilizer?

- In this context, biofertilizers are bio-based nitrogen products that meet maturity and stability standards as measured by the US Composting Council's laboratory testing methods known as the TMECC, Testing Methods for Compost and Composting.

- They may be biological or from synthetic nitrogen or a combination of the two.

Some Problems with the Word "Composting"

- In the public mind, "composting" means any and all forms of decomposition
- **Best Management Practices** for composting means controlled mixing, forced aeration, temperature control and biofiltration
- We regularly hear, "compost is a soil conditioner, not a fertilizer."

Testing Methods

- TMECC
- Testing Methods for Evaluation of Compost and Composting
- Over Twenty Laboratory Procedures
- Peer Reviewed USDA Sponsored
- April -2000
- Over 50 Testing Facilities Use TMECC

Unstabilized or Immature Nitrogen

- Soil provides treatment to stability
- Seasonal (Fall) Land Application
- Soluble N leaches = Water Pollution
- Phytotoxicity to seeds and new growth
- Odors Nitrogen lost as Ammonia
- Vectors - Flies

S-Biofertilizer Manufacturing

- S-Nitrogen Not the Same as Total Nitrogen
- Not Losing Nitrogen to Air or Leachate
- Rethinking Biofiltration from Odor Treatment to “Nitrogen Recovery”
- Rethinking Carbon Inputs
- Available Carbon – Available Nitrogen
- Capital & Operating Cost - Market Driven

High Carbon Compost Disadvantages

- Carbon borrows N from Soil
- High tonnages per acre
- Unstable manure or compost is just as polluting as synthetic nitrogen
- Inconsistent quality and structure
- Pathogens, weeds and vectors

Waste Processing "Disposal Mentality"

- Minimize Transportation
- Low Capital Cost & Operating Cost
- "Acceptable" 50% Nitrogen Loss
- "Acceptable" Odor Events & Leachate Run-off
- "Acceptable" Fugitive Methane and VOC Production
- No Biofiltration
- High Carbon Content
- Low Compost Value – Soil Amendment
- Disposal Fee Driven Economics
- Multiple and Inconsistent Feedstocks
- Less than 1% Nitrogen

Turfgrass and Horticulture

- Turfgrass Fertilizer Sales $16 Billion per year, half residential, half commercial
- Nitrogen loading rate at 80 lbs. per acre
- Commercial Planter Mixes $8 Billion per year – Sphagnum Peat, NW America Bark and slow release nitrogen
- $150 to $400 per ton – 10X Compost Price

Agricultural Nitrogen

- Was around $17 Billion per year 2020
- Now closer to $30 Billion

- Urea – 46% N – increased from $240 per ton in 2020 to $740 per ton per day

- The net nitrogen market – Ag, Turf and Horticulture in the US is around $40 Billion

Biostabilization of Nitrogen

- Bio-based nitrogen is not stable
- Chemical N can be used for S-biostabilization
- Market claims for S-biofertilizers based on **net** Agronomic Loading Rates, not total N
- USDA Organic standards do not require N-pollution prevention or biostabilization
- If synthetic N is biostabilized, it is no longer identified as its source

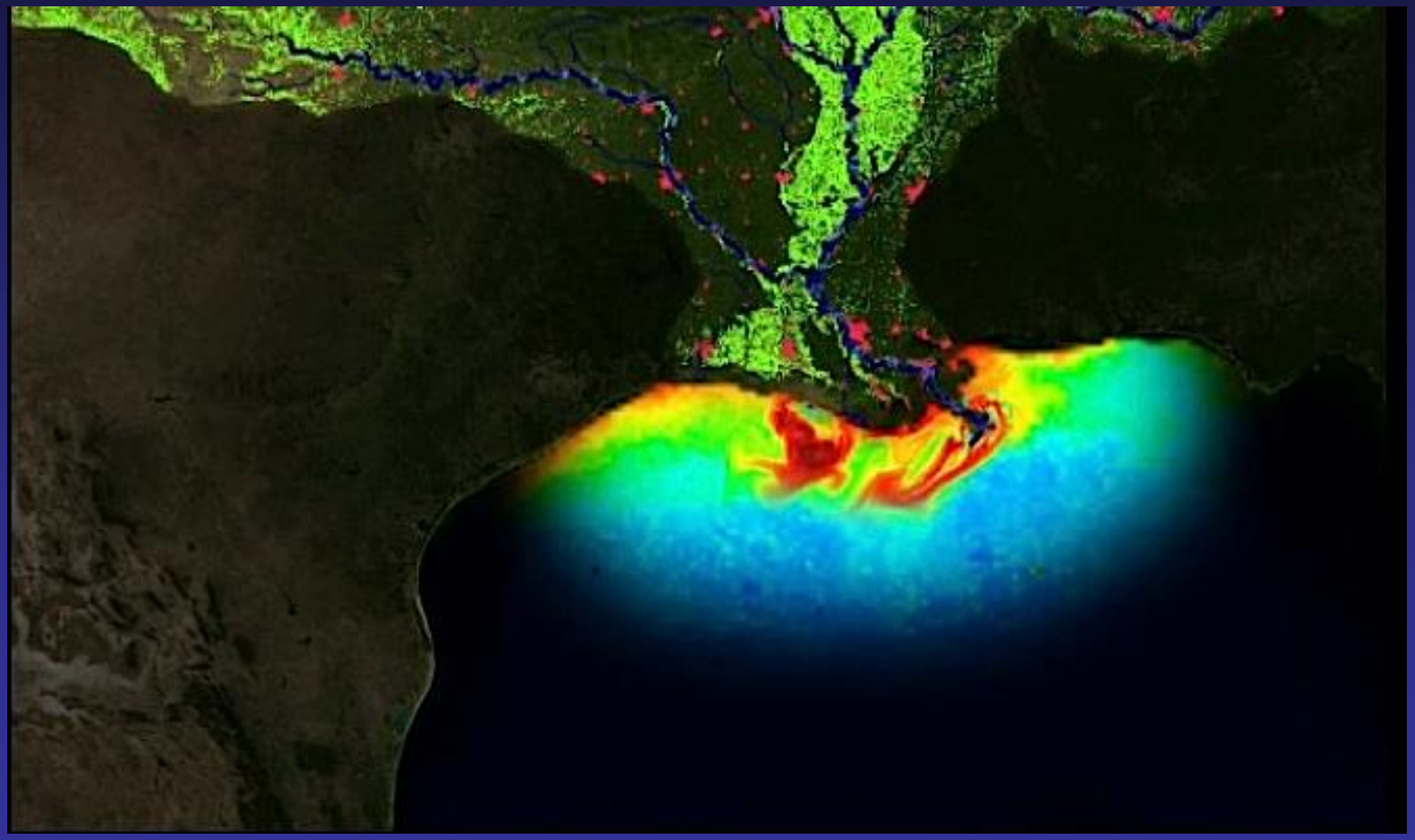
Agronomic Loading Rates

- Nitrogen demand per acre presumes 63% loss of Nitrogen to Ammonia and Leachate
- Typically 37% remains to sustain plants
- If a crop needs 100 lbs. of N per acre, the actual demand is 37 lbs. **stabilized**
- 63 lbs. per acre are lost as ammonia to the air and nitrates to ground and surface water

Biological Overloading

- If corn needs 160 lbs. of N per acre to achieve 60 lbs. net, farmers apply 200 lbs. per acre
- 90% of the overloaded N is lost to ammonia or nitrates, adding 36 lbs. lost to the already expected 100 lbs. lost
- Overloading N leads to **Phytotoxicity**

The Gulf of Mexico Dead Zone



Biological Overloading into Water Systems

- When nutrients such as nitrogen, phosphorous and organic matter enter a waterway, they are consumed by aquatic plants, resulting in increased quantities of lake weeds and algae. This can lead to decreased oxygen levels called "**eutrophication**".

- If the process becomes extreme, then oxygen in the water can be depleted, leading to **hypoxia**, or a "dead zone" with fish kills

Phytotoxicity from Unstabilized Nitrogen

- Spotting on Leaves

Dog Urine on Lawns

S-Biofertilizer
Key Maturity Indicators

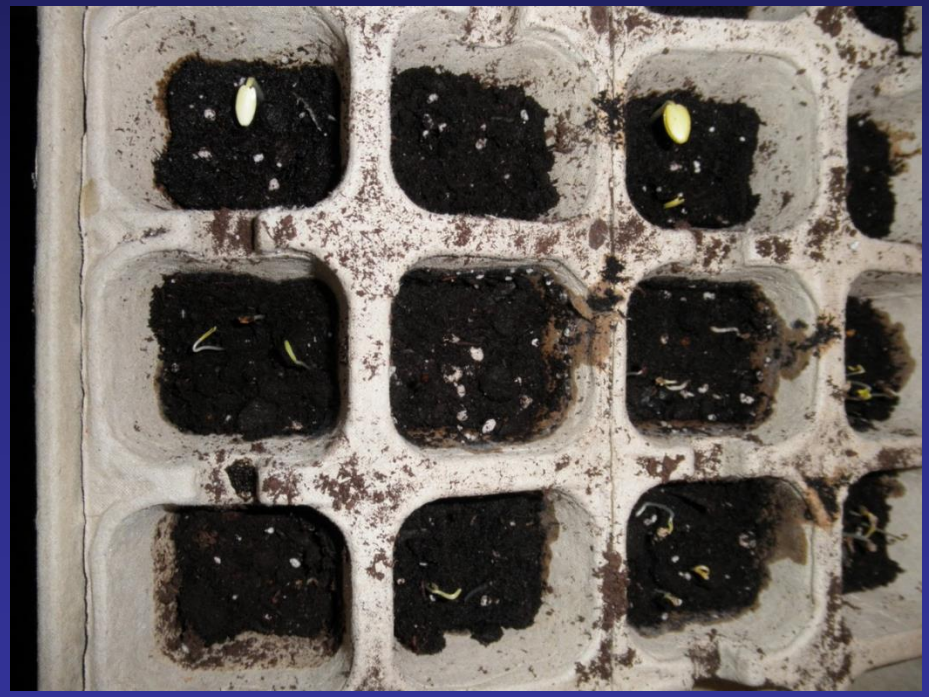
- 100% Cucumber seed germination
- Low C/N Ratio 5/1 to 10/1
- Low BAC – Under 10
- Low O2 Respiration
- Low NH3 off-gassing

Cucumber Seed Germination Test

- 100% Germination = Fully Mature

50% Half Stable

0% -Unstable



Forest Land Restoration

- Leaving slash following tree harvesting creates unnatural habitat and a fire risk
- Wood at 200 to 400 to 1 Carbon Nitrogen Ratio borrows scarce nitrogen
- Adding nitrogen to slash results in leachate runoff into pristine watersheds
- S-Biofertilizer is a method of conditioning wood byproducts into a non-polluting form

NaturTech Containerized In-Vessel Composting or Fermentation System

Compost as Lawn Fertilizer
1 yd^3 per 1200 Ft^3 = ¼”

Bioponics - Vertical Farming, Compost Socks and Green Roofs

- Support Generative Agriculture
- Teach Carbon & Nitrogen Cycling in 4th Grade
- Advocate renewable nutrient management
- Convert municipal composting sites into S-Biofertilizer Centers
- “Be pro-active regarding climate change
- “We have always done it this way”
- There is no “grandfather clause”
- Water, air and soil quality issues have changed
- The Organics Industry has to change as well