



Ohio DM Reuse To GO or To GROW

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Partners and Participants



Lake Erie
Commission



BLUF...Bench-scale Outputs & Recipes



APPLICATION	FINDING
Brownfield Cap / Cover	When compacted meets CERCLA landfill cover and exceeds 1.00E-05 cm/s hydraulic conductivity.
General site fill	When compacted has suitable strength for beneath asphalt parking lots.
Engineered fill	With 3% cement added has suitable strength for single story building foundation soil.
	With 7% cement added has suitable strength for multi-story building and general purpose roadways foundation soil.
	With 10% cement added has suitable strength for interstate roadway foundation soil.
Turf grass	Blend site soil with 30 to 70% dewatered sediments for sod or seeding with fescue.
Mechanical blending	Three passes with rear-tine tiller resulted in a uniform blend of sand, compost, and dewatered sediment initially laid in layers.

APPLICATION	FINDING
Ecological restoration	Blend site soil with 50 to 100% dewatered sediments for seeding with restoration seed mix.
Agricultural—Corn	Blend site soil with 10% dewatered sediments for corn. Amending typical farm soil with dredged material produced crop with increased biomass, increased yield (additional ears), and shorter time to reproductive stage. Growing corn in 100% dredged material reduced germination, height, survival, & no ears.
Agricultural—Soybean	Blend site soil with 20% dewatered sediments for soybeans. Amending typical farm soil with dredged material produced crop with increased biomass and tallest average height.
Amendment—Compost	Blending with 5% compost tended to increase plant growth.
Amendment—Acidifier	Incorporating acidifier tended to reduce seed germination and plant growth.

Findings are laboratory study based—consult Engineer-of-Record, Agronomist, Agricultural Extension Office or other pertinent professional to tailor findings to specific application and individual site conditions.

BLUF...Field Demonstration

Dredged Material as a Fertilizer Equivalent

- Balanced phosphorus across fields using thin-application of Toledo Harbor dredged material
- Maintained Certified Organic Field status
- Equivalent yields
- Lessons
 - Receiving field selection obstructed by pre-existing excess fertilizing
 - Weed seed & compaction concerns
 - Ag equipment ↔ Civil equipment
 - Seasonal application (frozen ground)



Advancing with Academia



Megan Rua – Wright State University

- Ecological Restoration (Journal)
 - The use of dredged sediments as a soil amendment for improving plant responses in prairie restorations ¹
- Agroecosystems, Geosciences & Environment (Journal) – *pending*
 - Evaluating corn, tall fescue, and canola growth on sediments dredged from the Lorain Harbor ¹
- Sustainable Agriculture and Environment (Journal)
 - Dredged sediments contain potentially beneficial microorganisms for agricultural and little harmful cyanobacteria
- Grants
 - Investigating the feasibility of Black River dredged sediment blends as farm soil amendment [2021] ¹
 - Investigating the feasibility of Black River dredged sediment blends for ecological restoration [2022] ¹

Angelica Vazquez-Ortega – Bowling Green State University

- Environmental Quality (Journal)
 - Assessing the Effects of Lake-Dredged Sediments on Soil Health: Agricultural and Environmental Implications on Northwestern Ohio
- Grants
 - Assessing dissolved reactive phosphorus sequestration onto farm soils amended with Lake Erie dredged sediments: implications on hydrological budgets and HAB occurrences [2022]
 - Strategic positioning plan for lake sediments as a specialty crop amendment [2022]
 - Beneficially using dredged material as farm amendment to improve soil health and crop yield: a farm demonstration project [2022] ¹
 - Investigating the feasibility of Black River dredged sediment blends as farm soil amendment [2021] ¹
 - Dynamics of microbial communities in agricultural soil amended with dredged material [2018]
 - Dredged material blended with organic rich soils to amend farm soils [2018]
 - Dredged material benefits for crop production [2018]

¹ C. Platt, Co-Investigator

Residual Solids Evaluation (RSE)



What

- Practical Reuse Applications Focus
- Built upon studies-by-others yet customizing to Black River local market
- Plant survival & growth
 - Partnered with Universities – BGSU & WSU
 - Mirror and expand other port's dredged material reuse in agricultural crop production
 - Corn, soybean
 - Expand into agriculture-related markets: sod, fescue, restoration mix
- Engineered Fill
 - Methods in general conformance with ASTM



Engineered Fill

So what? What does it all mean?



Untreated dredged material (as-is)



3% cement additive

7% cement additive



10% cement additive

Final acceptance of soil for use on any type of project is at the discretion of the project Engineer of Record

RSE – Greenhouse Studies



Consumable Soil reuse – sod, turf, fescue, restoration seed mix trials



Agricultural crop reuse – Corn, soybean trials

University Studies Overview



BGSU

- Investigators
 - Dr. Angelica Vazquez-Ortega
 - Margaret Rettig (undergrad research)
- DM & FS ratios
- Compost amendment
- pH adjustment / soil acidifier
- Corn, soybean, sod grass
- Germination & Growth
- Aboveground & below ground Biomass – three test species

WSU

- Investigators
 - Dr. Megan Rua
 - Maureen Roddy (undergrad research)
- DM & FS ratios
- Plant-based soil prep (canola)
- Corn, fescue, restoration mix
- Germination & Growth
- Aboveground & below ground Biomass
- Corn lifecycle (ears)
- Restoration mix diversity

BGSU Top Take-Aways



- DM improved growth in both corn and soybeans
- Treatments with compost tended to perform better...ones with acidifier tended to be less successful.
- DM did not hinder sod grass growth

- 10 DM : 85 FS : 5 Compost
 - best for corn...tallest and greatest above & below ground biomass
- 20 DM : 75 FS : 5 Compost
 - Best for soybeans...highest average height and greatest above & below ground biomass
- 70, 50, & 30 DM are similar for sod survival, growth, biomass

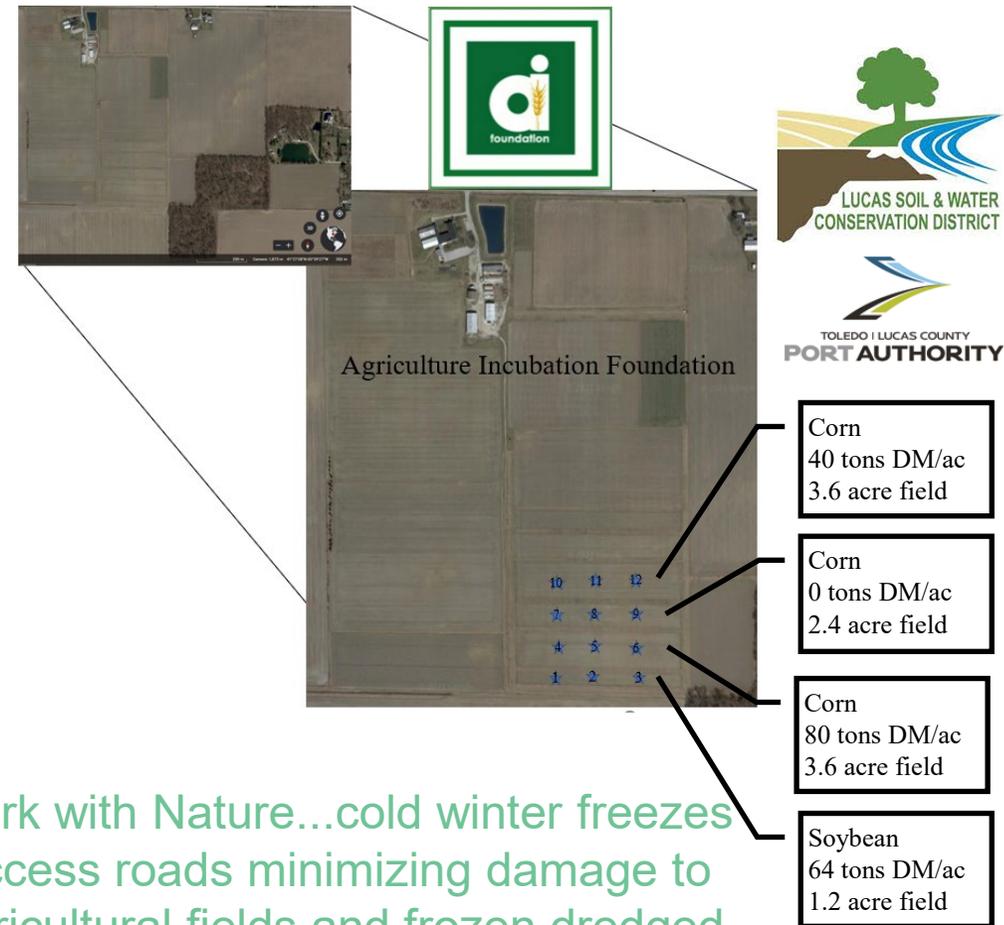
WSU Top Take-Aways



- Corn grown on DM+FS produced additional ears suggesting higher yield (than commercial hybrids)
- Corn grown on Lorain DM+FS reached reproductive stages **faster than** Toledo fresh or weathered DM + FS.
- 100% DM was not suitable for corn (reduced germination, height, survival, & no ears)
- 50 DM : 50 FS yields greatest diversity for restoration purposes, yet 70 & 100% yielded high diversity suggesting these ratios are suitable for restoration applications with limited or no blending
- 30 DM : 70 FS ideal for canola
- 70, 50, & 30 DM are similar for fescue

Farm Demonstration – 10 acres

- Mechanically dredged, hydraulically offloaded and gravity dewatered fine-grained organic-laden sediments from **Toledo Harbor / Maumee River** were used.
 - ~80 ppm of Phosphorus (Mehlich 3 method)
- **500 tons** of dewatered dredged material were excavated, transported, and applied to three fields at different rates with a fourth field as a control.
 - Target: 40 ppm of Phosphorus (Mehlich 3 method) after tilling
- Terragator 2505 with Tebbe Box mechanically broadcast thin layer of dredged material at:
 - Corn: 40 tons DM/ac - ¼ inch
 - Corn: 80 tons DM/ac – ½ inch
 - Soybean: 64 tons DM/ac – ½ inch
- Licensing and permitting conditions complicated securing participants



Work with Nature...cold winter freezes access roads minimizing damage to agricultural fields and frozen dredged material eases excavation and transportation...reduces cost!

...Future Opportunities

- Soil has commercial value and is consumed inducing recurring supply needs
 - Opportunity for BUDM market
- Topsoil as a consumable product
 - Greenhouse Growers
 - Sod farmers
 - Ecological restoration
- Topsoil as a commodity-dirt brokers
 - [Find or Get Rid of Fill Dirt for Free – DirtGeo](#)
 - [Joe Dirt - about-us \(444dirt.com\)](#)
 - [Fill Dirt | Dirt Removal | Dirt Delivery | Dirt Broker | Dirt Hauling | Dirt Cheap Cincinnati Ohio](#)
- Two perceived waste streams (fine-grained dredged material and manufactured sand) can make a marketable, beneficial reuse product comparable in price to imported natural soil





Discussion

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