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Natural Runoff Plot Study to determine effectiveness of organic amendments on Runoff and Erosion

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Literature Review

- Surface applied organic mulches and manure can significantly reduce both runoff and soil erosion (Adams, 1966; Meyer et al., 1972; Laflen et al., 1978; Vleeschauwer et al., 1978; Foster et al., 1985; Agassi et al., 1998; Muhktar, 2009).
- Dissipate raindrop impact, reduce crusting, increase roughness, lower shear forces, add organic matter, increase biological activity

Past Work at UGA

- Phase 1: Simulator Pan Study looking at erodibility
- Phase 2: Pot study looking at grass growth
- Phase 3: Treatments with most potential field tested with natural rainfall and using berms.
- Concentrated Flow
- Numerous Demonstrations



Phase 1: Treatments (Risse et al. 2004)

| Name | Description/Primary Feedstocks | Reps |
|------------|--|------|
| PLC1 | Poultry Gold Compost/PL | 2 |
| PLC2 | Sargents Nutrients/PL | 2 |
| PLC3 | Gro-mor Organics/PL, Vegetable culls, yard waste | 1 |
| PL | Aged Poultry Litter/ Layer manure | 2 |
| MSC | Cobb Co. Compost/ MSW Compost, biosolids | 2 |
| BSC | Erthfood compost/Biosolids, peanuts hulls | 3 |
| FWC | Creative Earth/Food residuals, wood waste | 2 |
| YWC | UGACompost/Yard & wood waste, some manure | 3 |
| WMf | Woodtech Superfine Mulch/Fine wood mulch | 2 |
| WMm | Woodtech Medium hardwood mulch | 3 |
| <i>WM2</i> | Rockdale Co. Mulch/Course ground waste wood | 2 |
| Soil | Bare Soil Control/ screened | 3 |

Treatment selection based on availability in Georgia.

Experimental Setup



- Approx. 1m² pan
- 6 in deep, 2 in soil, 2 in of treatment
- plywood w/ holes, cheesecloth, soil, treatment
- Surface smoothed and leveled
- soil pre-wet before run





Methods

- Norton Rainfall Simulator
- Approx. 16 cm/hr
 (Over 6 in/hr)
- Measure RO, SL, nutrients
- Sampling strategy

Results: Comparative



Conclusions

All compost and mulch treatments tended to reduce solids loss indicating that they were effective as blankets. Composting was important as indicated by differences in poultry litter.

- Mulches and soil lost less nutrients than composts but further studies need to look at longer term and vegetation impacts.
- Treatments with lower respiration rates and nitrate-nitrogen concentrations tended to have less erosion and transport of solids.

Phase 2: Pot study

- 9 treatments from previous study
- 5 gal pots over Cecil Soil
- Ryegrass planted in surface
- No irrigation after 2 weeks



Figure 3. Dry biomass after three and six months.

Phase 3: Field Study (Faucette et al, 2007a and b)

- Conducted on 3' X 15' plots
- 10% slope
- Treatments applied followed by 1 hour of 4" rain
- Follow-up sampling at 3 months and 1 year.

Treatments in field study

- BS: Bare soil
- HS: Hydroseed w/ silt fence
- HM: Hydroseed w/ mulch berm
- BC: Biosolids w/ biosolids berm
- MS: MSW compost & mulch w/ berm
- PL: Poultry litter compost & mulch w/ berm
- YW: UGA yard waste compost w/ berm

Site





Runoff from Hydroseeded plot









Day 1 3 months 12 months

Erosion Data



Concentrated Flow Studies (Zhu et al., 2011)

- Compost does not respond like soil
- Shear stress not dominating factor





OBJECTIVES

- to quantify the runoff and erosion benefits of organic matter additions under long term conditions and natural rainfall
 - Simulated rainfall is "worst case"
 - How much post construction stormwater management is provided?
 - How long does carbon stay in the soil system under these conditions?

Plots at Hort Farm

- 5x15 ft plots
- 10% uniform slope
- Degraded Pacelot soil

Hort Farm Plot Treatments

- Controls: Bare Soil, Grass
- Surface Mulch
- Surface Compost
- Incorporated Compost
- Incorporated Char

• 3 reps of each



- Total Volume of Runoff
- Subsampled for Total Solids Concentration
- Soil sampled annually for carbon by layer







- Analysis for period of June 1, 2010 to May 1, 2010.
- 38 rain events (0.6 to 11.3 cm, 85% of rain)





Conclusions

- Natural runoff plots established
- Initial results indicate that all treatments produced less runoff than bare soil. Surface Compost
 Mulch<Grass<Inc. Compost<Inc. Char
- Similar results for Solids loss although more variability (esp. with smaller storms) Mulch<Grass<Surface Compost<Inc. Char<Inc. Compost
- Higher biomass initially on control grass.
- Looking forward to additional long term analysis and collection of soil carbon data.

Questions??

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