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Using Compost and Mulch to Control Runoff, Erosion, and Nutrient Losses

Dr. Mark Risse, Britt Faucette, Dr. Mark Nearing, Julia Gaskin, and Dr. Larry West

The University of Georgia, Biological and Agricultural Engineering and Crop and Soil Science Departments

The USDA-ARS National Soil Erosion Research Lab, West Lafayette, Indiana

Sediment from Soil Erosion

- Important Water Quality Issue
  - carries other pollutants
  - turbidity and aquatic health
  - sedimentation in reservoirs
- Sources include:
  - construction, NPDES permits
  - roads
  - agriculture

Typical Erosion Control?
ORGIA EROSION CONTROL CENTER
78-445-9065

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).
- Dissipate raindrop impact, reduce crusting, increase roughness, lower shear forces, add organic matter, increase biological activity
- Many reports on compost use, little science...

OBJECTIVES

- to develop a better understanding of the characteristics of composts and mulches as related to their use as erosion control blankets.
  - to test the effectiveness of various compost and mulch materials used as blankets in reducing sediment and nutrient losses
  - to correlate the physical and chemical properties of the materials to the measured losses.

Methods

- 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.
- Extension: Gotta have demos…

Phase 1:Treatments

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
WM2	Rockdale Co. Mulch/Course ground waste wood	2
Soil	Bare Soil Control/ screened	3

Treatment selection based on availability in Georgia.

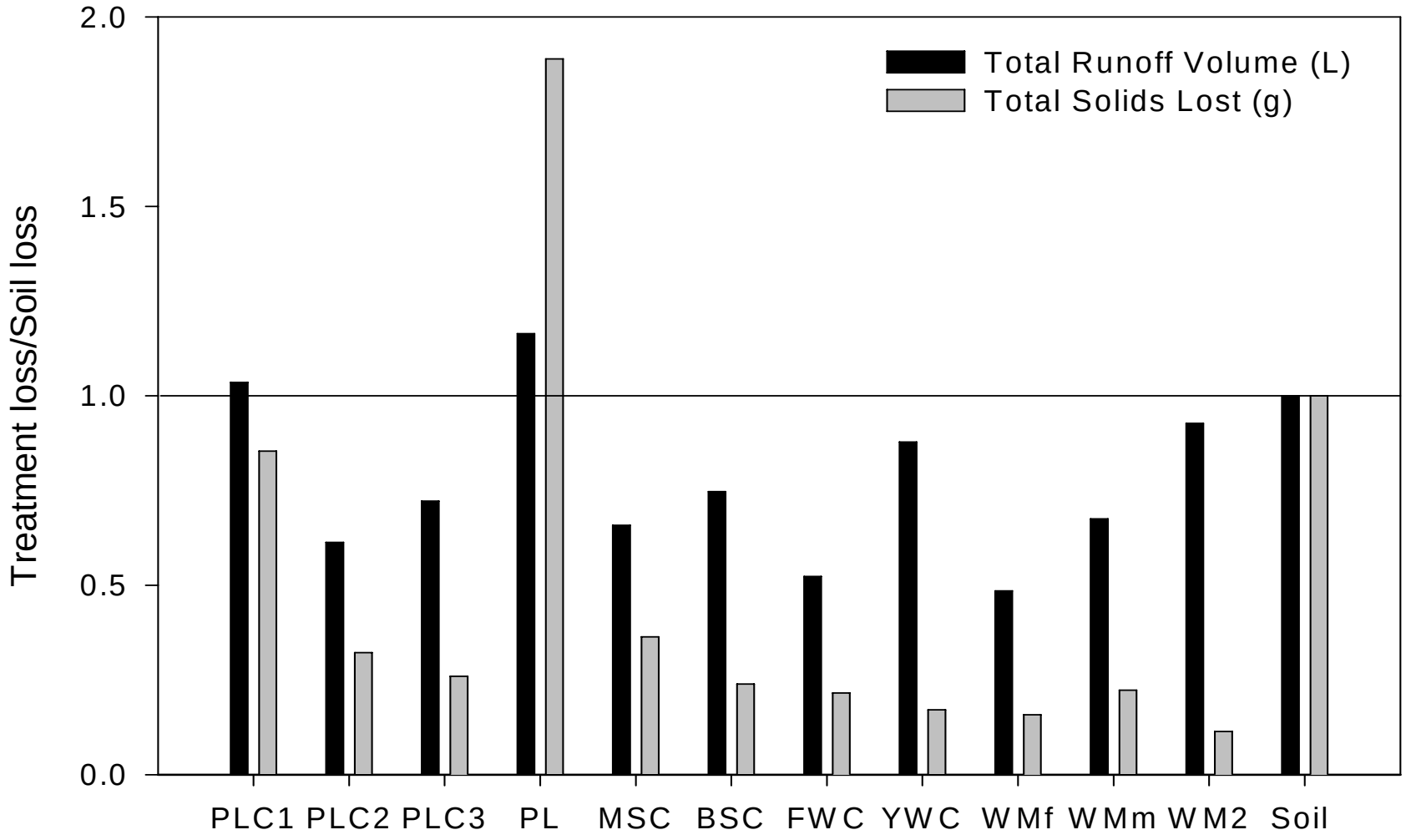
Experimental Setup

- Approx. $1m^2$ 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



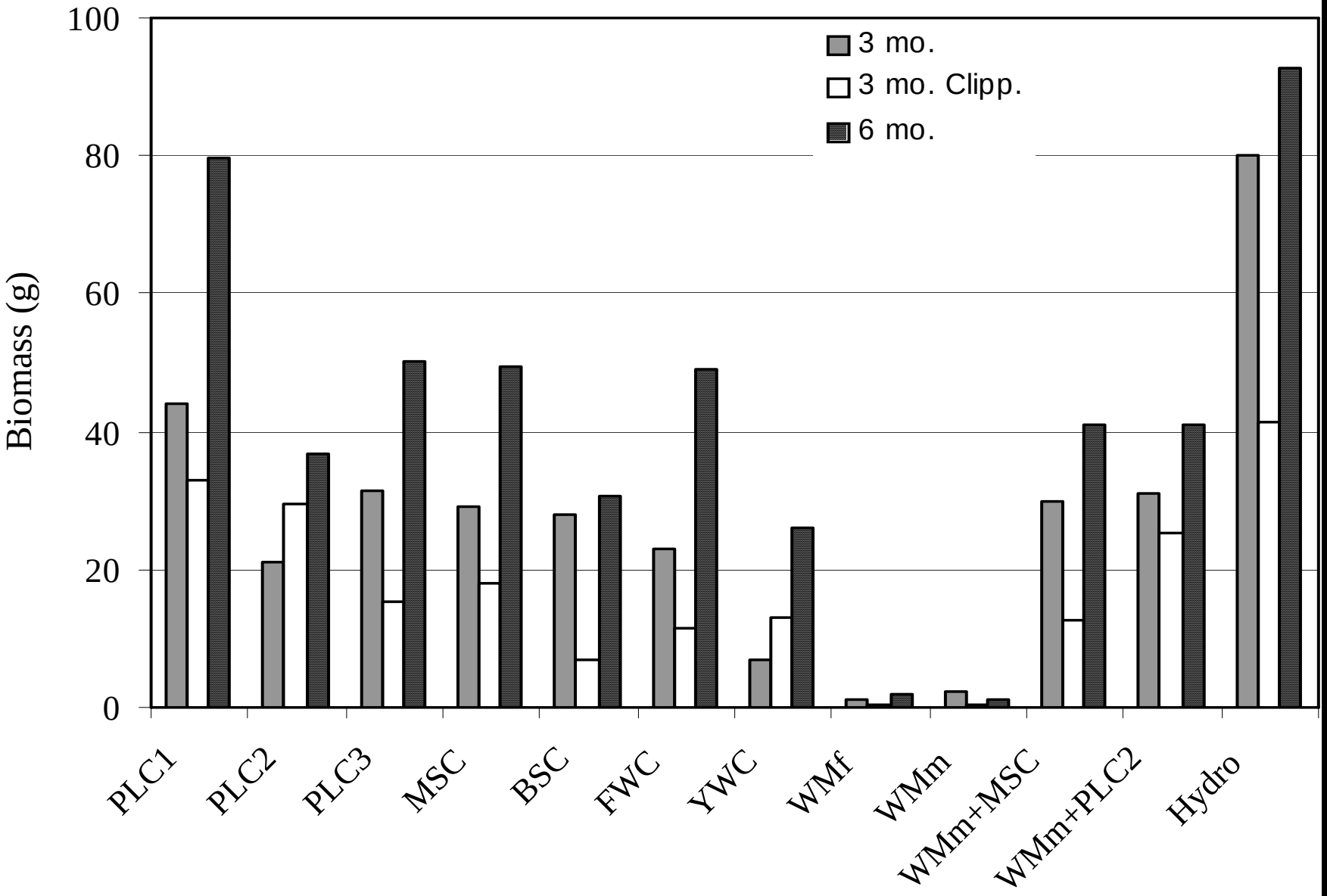
Conclusions

- 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

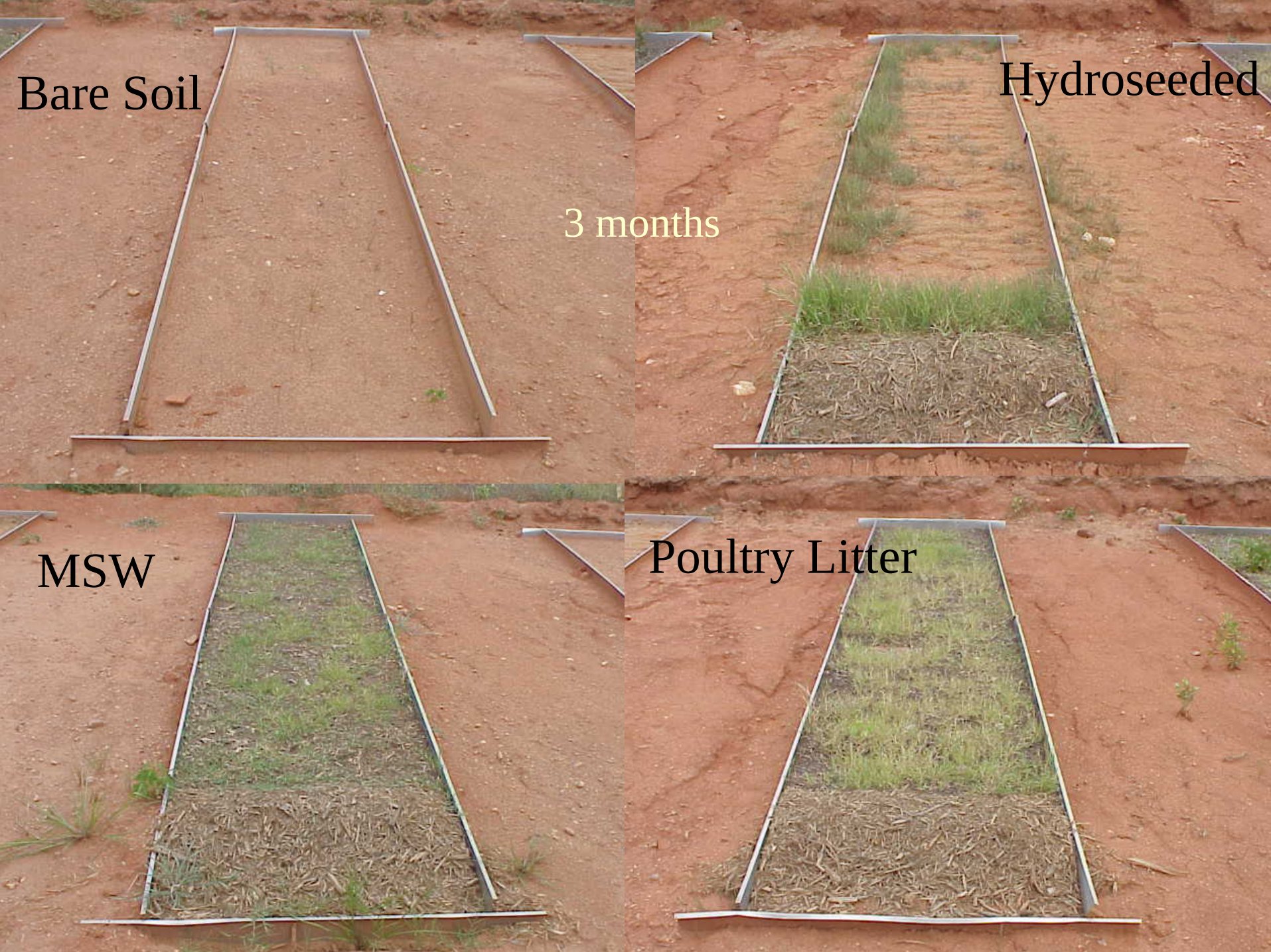
- Conducted on 3’X 15’ plots
- 10% slope
- Treatments applied followed by 1 hour of 4” rain
- Follow-up sampling at 3 months and 1 year.

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

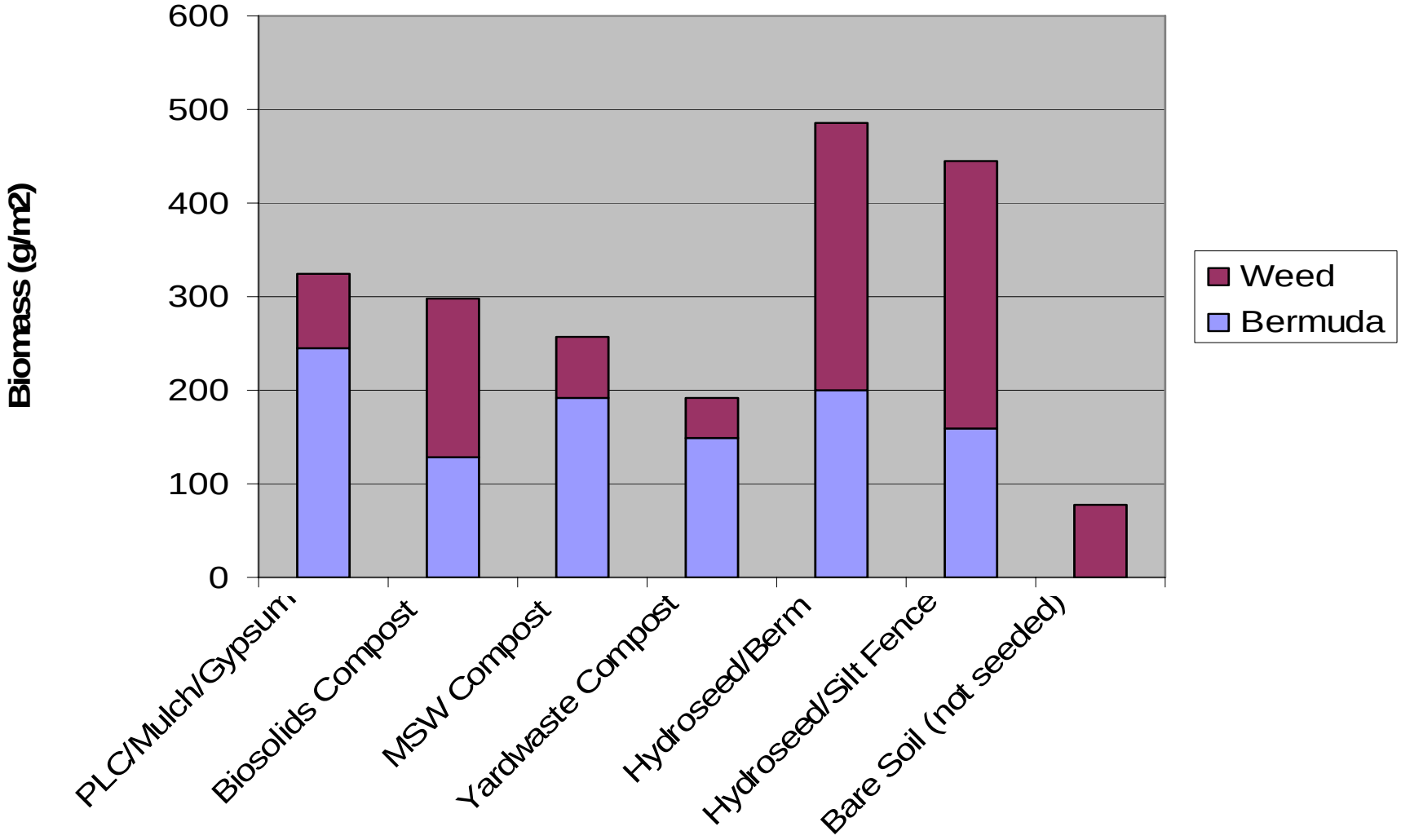

Bare Soil
Hydroseeded
3 months
MSW
Poultry Litter

Vegetation, % Cover

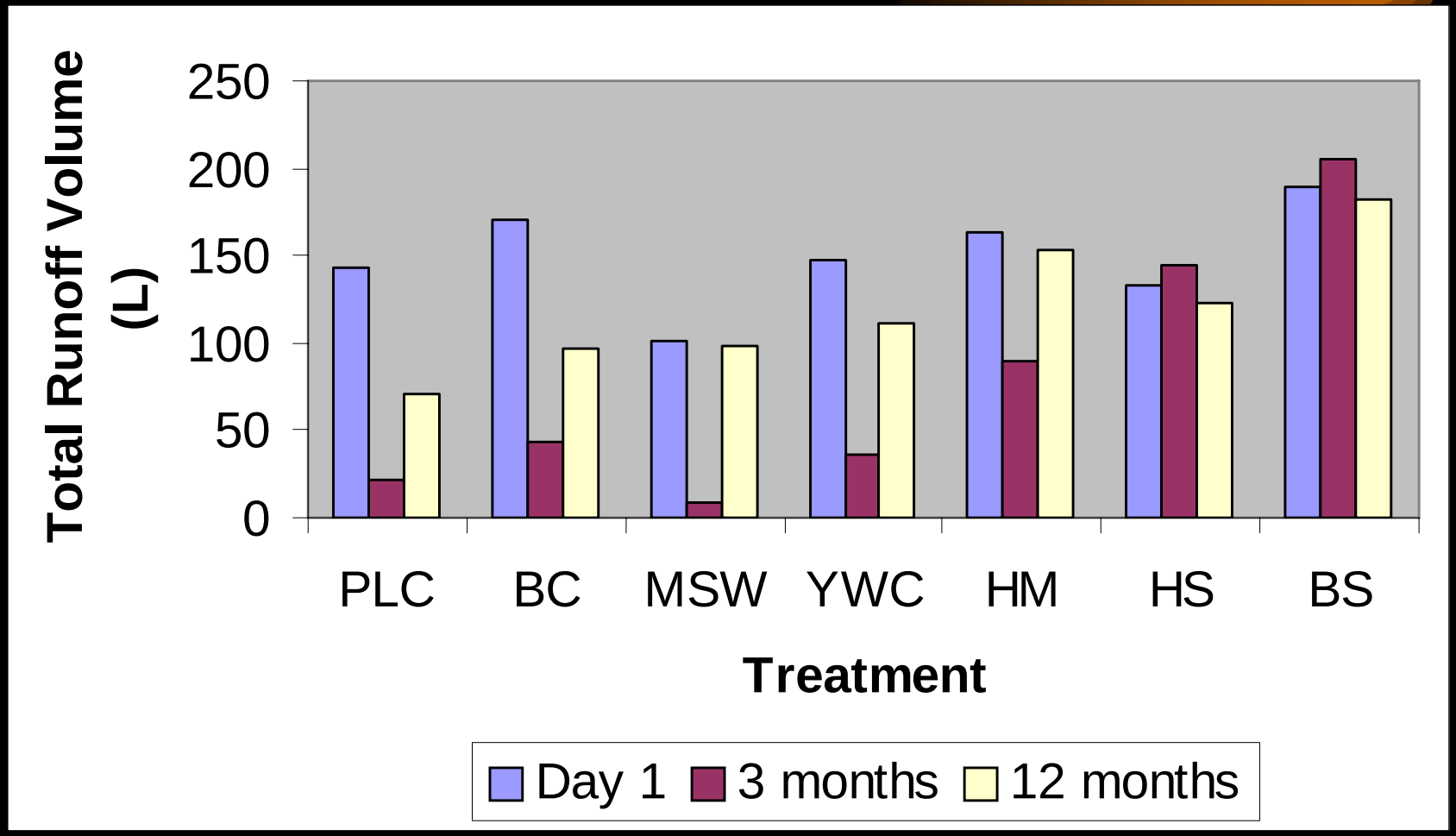
Treatment	3 months	12 months
PLC/Mulch/Gypsum	63.82a	72.93a
Biosolids Compost	56.81a	85.83a
MSW Compost/Mulch	58.54a	71.9a
Yardwaste Compost	62.16a	68.03a
Hydroseed/Mulch Berm	21.95b	86.23a
Hydroseed/Silt Fence	21.67b	80.53a
Bare Soil (not seeded)	17.15b	24.17b

12 month cover was correlated to N additions in treatment

Biomass growth at 12 months



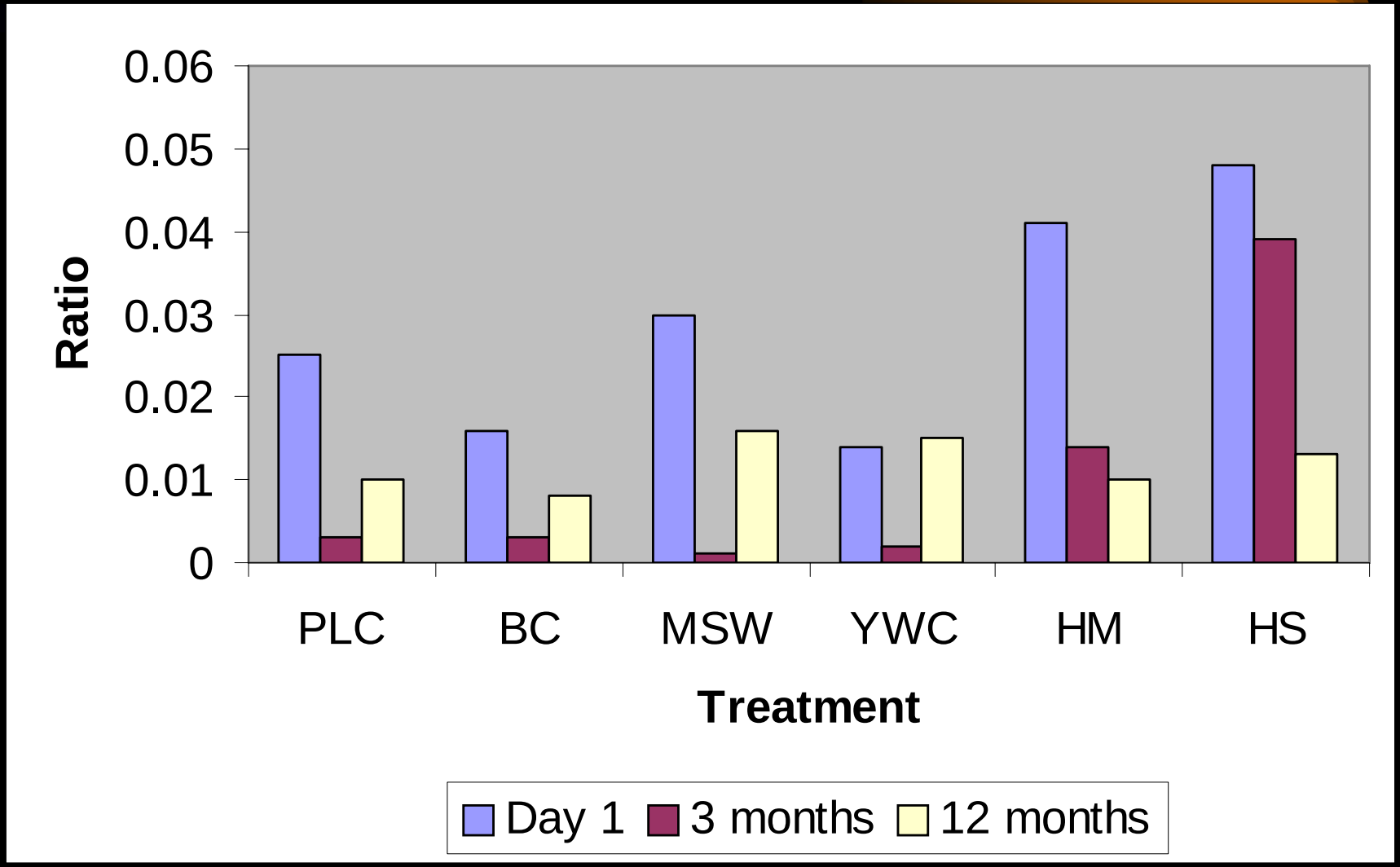
Runoff Data


Total Runoff Volume (L)
250
200
150
100
50
0
PLC
BC
MSW
YWC
HM
HS
BS
Treatment
Day 1
3 months
12 months

Results:Total Erosion (g/m^2)

Treatment	1 day	3 month	1 year
PLC/Mulch/Gypsum	158.9b	14.6b	10.8b
Biosolids Compost	105.8b	18.9b	8.8b
MSW Compost	191.9b	6.0b	17.8b
Yardwaste Compost	88.5b	13.7b	17.1b
Hydroseed/ Berm	265.1b	78.1b	10.9b
Hydroseed/Silt Fence	307.9b	219.6b	14.5b
Bare Soil (not seeded)	6428.1a	54642.1a	1109.7a

Erosion Data



Total N Load (mg/m^2)

Treatment	DAY ONE	THREE MONTHS	TWELVE MONTHS
PLC/Mulch/Gypsum	842 bcd	25 b	40 b
Biosolids Compost	4061 a	254 a	42 b
MSW Compost	8 e	23 b	47 b
Yardwaste Compost	450 cde	39 ab	34 b
Hydroseed/Berm	1391 b	90 ab	43 b
Hydroseed/SiltFence	1008 bc	188 ab	40 b
Bare Soil	76.7de	92 ab	103 a

Phosphorus: Initial Run

Treatment	Initial	3 Months	1 Year
PLC/Mulch/Gypsum	3.07 b	1.58 b	1.04 b
Biosolids Compost	4.12 b	6.30 a	1.96 a
MSW Compost	2.19 b	0.45 b	0.53 bc
Yardwaste Compost	2.15 b	1.61 b	0.48 c
Hydroseed/Berm	25.87 a	1.42 b	0.49 c
Hydroseed/SiltFence	22.40 a	1.64 b	0.70 bc
Bare Soil	0.02 b	0.49 b	0.64 bc

Conclusions

- Compost blankets maintained more vegetative biomass and cover early in the study. Treatments with more N supported more long term biomass.
- Compost blankets produced less runoff than hydroseeded plots or bare soil.
- Compost blankets and berms were at least as effective as silt fences and hydroseeding at controlling erosion. Trend toward improved performance.
- Nutrient loads were equivalent to or less than those from hyroseeded plots.

Phase III Demonstration Sites:

Compost use for erosion control

The University of Georgia

Wood-Tech MULCH

Cobb County Composting Facility

Georgia Composting Association

Erth Products

BOBO GRINDING

P2AD

U.S. Poultry & Egg Association

Animal Waste Management Center

Cobb County Demonstration Site
Original condition of the slope

Slope prepared by grading

2”
seeded
control
2”
unseeded
Hydro-
seed
1.5”
seeded
1.5”
mulch

Control after a 3” storm event

Hydroseeded after 3” rain event

6 months

Erosion mat *vs* Compost blanket

Beers
Construction &
Erth Products

Before
GA DOT &
Georgia Natural,
Poultry Gold,
Gromor Organics

After
4 months

Rayonier & DOT at 70% slope

Rayonier
Paper
Products &
GA DOT

Not a Cure-all

Cost of Application is impediment

Questions??

For more information, see www.agp2.org