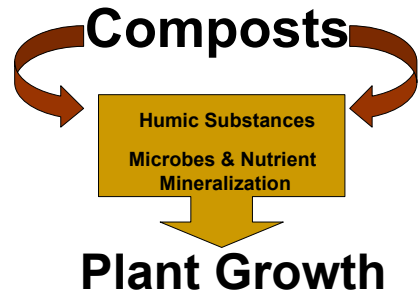


Effects of Organic Amendments on Soil Humic Substances Content and Physiological Properties of Field-Grown Maize

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Mechanism of Compost Activity



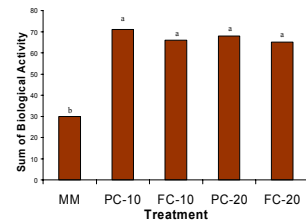
What are Humic Substances?

- C-based substances
- 'Active' fraction of organic matter
- Release nutrients during mineralization
- Possess hormone qualities



Vermicomposts Increase Microbial Activity

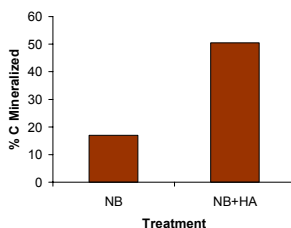
Microbial Activity Index in a Standard Commercial Potting Medium



Adapted from Atiyeh et al., 2000

Soil-Extracted Humic Substances Increase Microbial C Mineralization

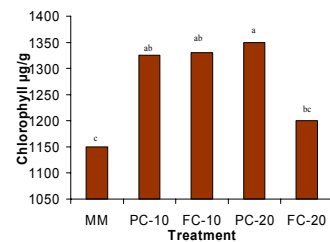
% Carbon Mineralization via Microbial Activity



Adapted from Filip et al., 1998

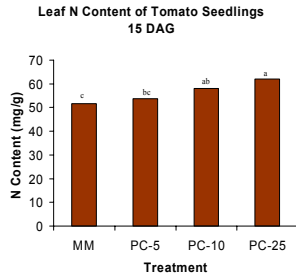
Vermicomposts Increase Leaf Chlorophyll Content

Leaf Chlorophyll Content of Marigold Leaves Seven Days After Germination



Adapted from Atiyeh et al. 2000

Vermicompost Increases Plant N Uptake



Adapted from Atiyeh et al., 2001

Summary

- Compost use can improve plant growth
- Plant growth stimulation may be due to the indirect action of humic substances on microbial activity

Summer Research at NPAREC in Orange, VA

Objectives

- Compare the effects of inorganic fertilizer, poultry litter, and two composts on soil humic substances content.
- Evaluate leaf health, yield, and seed quality of field-grown corn planted in these treatments.



2003-2004 Treatments

F	Annual recommended NPK fertilizer rate
ABSC	BS-Compost @ 100% agron N
AYWC	YW-Compost @ 100% agron N
PL	Poultry litter @ 100% agron N
LBSC	BS-Compost @ 30% agron N
LYWC	YW-Compost @ 30% agron N
Ctl	Control – No soil amendments or fertilizer

Amendment PAN and Application Rate

Trmt	2003		2004	
	PAN		Application rate	
	----g/kg----		----Mg/ha----	
PL	36.9	37.0	5.1	4.2
LYWC	1.89	3.09	21	14
AWYC	1.89	3.09	70	48
LBSC	5.81	6.22	6.3	6.2
ABSC	5.81	6.22	21	21



Soil and Leaf Sampling

- Soil samples were collected down to 15cm depth on June 4, 2004 for humic substance analysis
- Ear leaves were sampled 15 days after silking (DAS) for chlorophyll content, photochemical efficiency, and antioxidant activities
- Ears were harvested on Sept. 14, 2004 and sent to Iowa State Grain Quality Lab for kernel protein determination



Soil Humic Substances Content Summer 2004

Treatment	g Humified C/g soil
F	4.37 c
ABSC	5.24 b
AYWC	8.95 a
PL	4.51 bc
LBSC	4.97 bc
LYWC	5.01 bc
Ctrl	4.48 bc

Leaf Chlorophyll Content and Photochemical Efficiency 15 DAS

Treatment	Chyll	Fv/Fm
F	0.0136 a	0.786 a
ABSC	0.0140 a	0.783 a
AYWC	0.0138 a	0.785 a
PL	0.0135 a	0.769 ab
LBSC	0.0105 b	0.773 ab
LYWC	0.0115 b	0.771 ab
Ctrl	0.0072 c	0.751 b

Leaf Antioxidant Activity 15 DAS

Treatment	SOD	APX
F	106 c	7 b
ABSC	1312 bc	7 b
AYWC	1070 bc	7 b
PL	846 c	7 b
LBSC	1642 ab	12 ab
LYWC	1553 bc	8 b
Ctrl	2402 a	15 a

U activity/mg protein

Yield and Seed Protein Content

Treatment	Yield (bu/ac)	Protein (%)
F	211 a	7.4 b
ABSC	205 a	8.0 a
AYWC	217 a	7.4 b
PL	197 a	7.0 c
LBSC	146 b	6.2 d
LYWC	164 b	6.5 d
Ctrl	100 c	5.2 e

Conclusions

- Soil humic substances content increases with increasing C input
- Agronomic composts and poultry litter rates were adequate to supply crop N
- Leaf health, yield, and seed quality were influenced by available N, not soil humic substances content

References

- Atiyeh, R.M., C.A. Edwards, S. Subler, and J. Metzger. 2001. Pig manure vermicompost as a component of a horticultural bedding plant medium: Effects on physiochemical properties and plant growth. *Bioresoucre Tech.* 78:11-20.
- Atiyeh, R.M., S. Subler, C.A. Edwards, G. Bachman, J. Metzger, and W. Shuster. 2000. Effects of vermicompost and composts on plant growth in horticultural container media and soil. *Pedo Biologia.* 44:579-590.
- Filip, Z., W. Pecher, and J. Berthelin. 1999. Microbial utilization and transformation of humic acid extracted from different soils. *J. Plant Nutr. Soil Sci.* 162:212-222.