UNIVERSITY OF ILLINOIS EXTENSION

College of Agricultural, Consumer and Environmental Sciences

Using Compost to Reduce Irrigation Needs

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Outline of Presentation

- Overview of compost/water use study
- Use of irrigation cost software to estimate potential energy savings
- Discussion of compost/water use field study in Illinois

Soil Structure and Compost

- Compost binds clay minerals together, creating a granular or crumb soil structure.
- Improves water retention and infiltration

Water Infiltration and Retention

- In sandy soils, compost will increase water holding capacity by absorbing water.
- In high clay content soils, compost will improve aggregation, allowing water to move through soil faster.

Use of Paper Mill Residuals and Compost **(Foley and Cooperband)**

- Study examined short and intermediate term use of paper mill residuals and composted PMR in sandy soils in central Wisconsin
- Areas planted to potatoes in year one and snap beans in year two
- Applied at rates of based on N requirements- 22.4 dry Mg ha $^{-1}$ (10 tons/Ac.-low rate) to 44.8 dry Mg ha $^{-1}$ (20 tons/Ac.-high rate)

Published in Journal of Environmental Quality 31:2086-2095 (2002)

Soil Water Findings
(Foley and Cooperband)

- Following 2nd application of amendments, all amended plots increased Plant Available Water by 5 to 45 percent compared to the control.

- This would have potentially reduced the average amount of irrigation water needed by 10 to 90 percent.

What is the potential energy cost savings from reducing irrigation cycles?

Irrigation Energy Cost Comparison- Developed by Kansas State University

http://www.oznet.ksu.edu/irrigate/Software/icost.xls

Can input current energy costs along with information related to irrigation system

Inputs for energy costs in Central Illinois- 160 Acre system

IRRIGATION ENERGY COST COMPARISON

Compares energy costs of irrigation pumping with different fuels at various prices and levels of performance. % NPPPC is percent of Nebraska Pumping Plant Performance Criteria.

INPUT VALUES FOR WHITE BOXES OR ACCEPT CURRENT VALUES

160	Acres	Electric:	0.090	$/kWh	100	% NPPPC
1	Inch Application	Nat. Gas:	8.60	$/mcf	100	% NPPPC
100	Feet Lift	Diesel:	2.90	$/gal	100	% NPPPC
20	PSI Pressure	Propane:	1.60	$/gal	100	% NPPPC

ALL OUTPUT IS LISTED IN THIS RED BOX

		---------- Cost as percent of: ----------			
	Energy Cost ($)	Electric	Nat. Gas	Diesel	Propane
Electricity:	272.14	100	73	44	44
Natural Gas:	373.00	137	100	60	60
Diesel:	620.84	228	166	100	100
Propane:	621.43	228	167	100	100

0.885 whp-hr/kWh Electricity
61.7 whp-hr/mcf Natural Gas
12.5 whp-hr/gal Diesel
6.89 whp-hr/gal Propane

This program was originally developed by David Pacey and Freddie Lamm, Kansas State University

At current prices, a reduction of one irrigation cycle would reduce energy costs by $270 to $620 on a 160 acre system, depending on the energy source used

If 3 to 7 irrigation cycles can be eliminated during a growing season, this would reduce energy costs by approximately $800 to $4300 per year on a 160 acre system

Water Conserved

- Each irrigation cycle uses over 850,000 gallons of water.*
- Reducing 3 to 7 cycles per season would save 2.5 to 6 millions gallons of groundwater.

*Personal conversation, Mason County Soil and Water Conservation District Irrigation Technician

Field Study- Mason County Illinois

- Rates of 0, 10, and 20 tons/acre of compost
- Measure soil changes
- Measure soil moisture during growing season
- Three replications

Bio-Solids Analysis Report

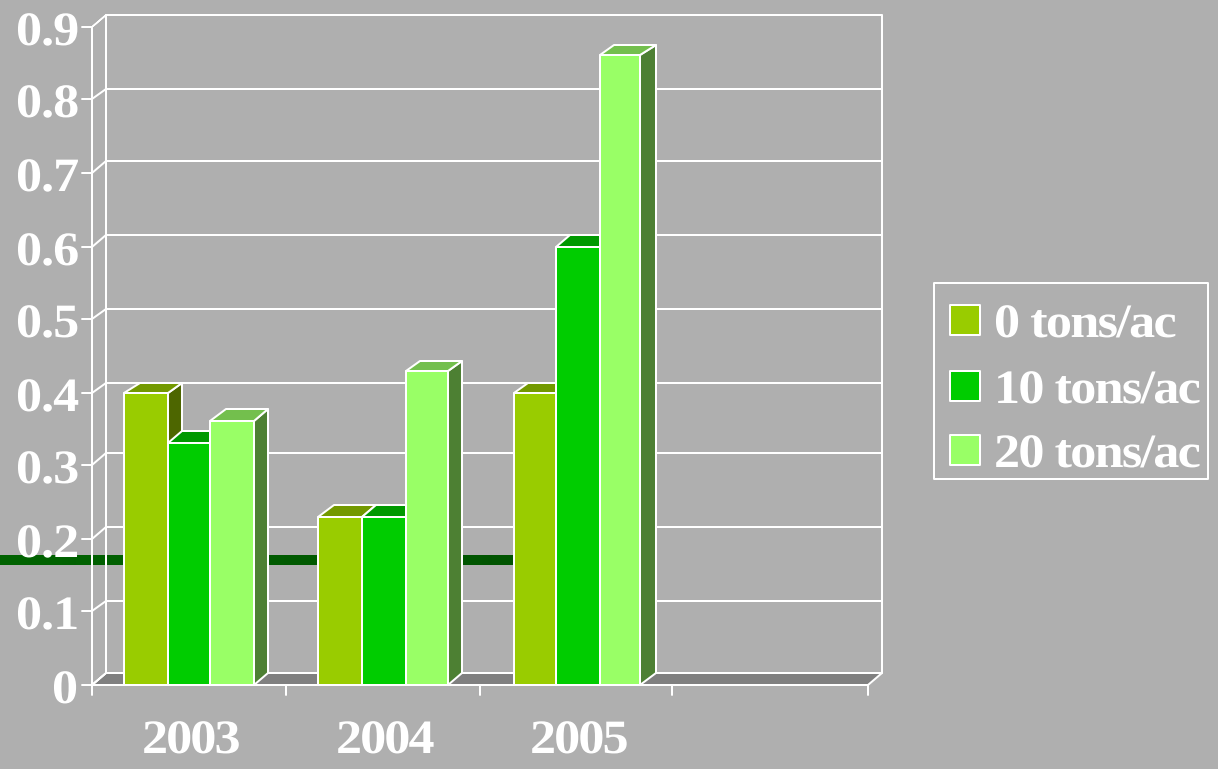
Parameters	Analysis as Received	Nutrients lbs/ton	Est. First Year Availability lbs/ton
Ammonium Nitrogen (N)	n.d. %	0.0	0
Organic Nitrogen (N)	0.63 %	12.6	4
Total Nitrogen (N)	0.63 %	12.5	4
Phosphorus (P_2O_5)	0.60 %	12.1	8
Potassium (K_2O)	0.54 %	10.8	10
Sulfur (S)	0.14 %	2.8	1
Calcium (Ca)	2.33 %	46.6	33
Magnesium (Mg)	0.70 %	14.1	10
Sodium (Na)	0.04 %	0.8	1
Copper (Cu)	25 ppm	0.05	0.04
Iron (Fe)	7604 ppm	15.21	10.65
Manganese (Mn)	429 ppm	0.86	0.60
Zinc (Zn)	140 ppm	0.28	0.20
Moisture	29.5 %		
Total Solids	70.5 %	1410.0	
Total Salts		84.8	
pH	7.8		

n.d. Non Detect

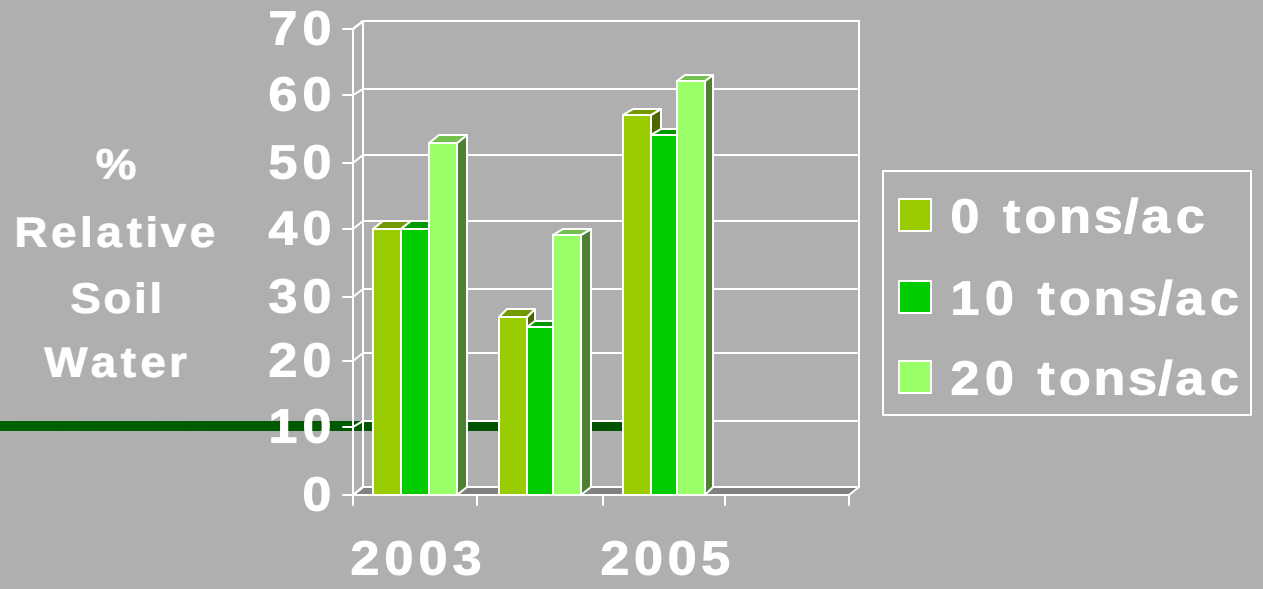
... application with incorporation. Nitrogen av

Average Organic Matter Contents for Plots

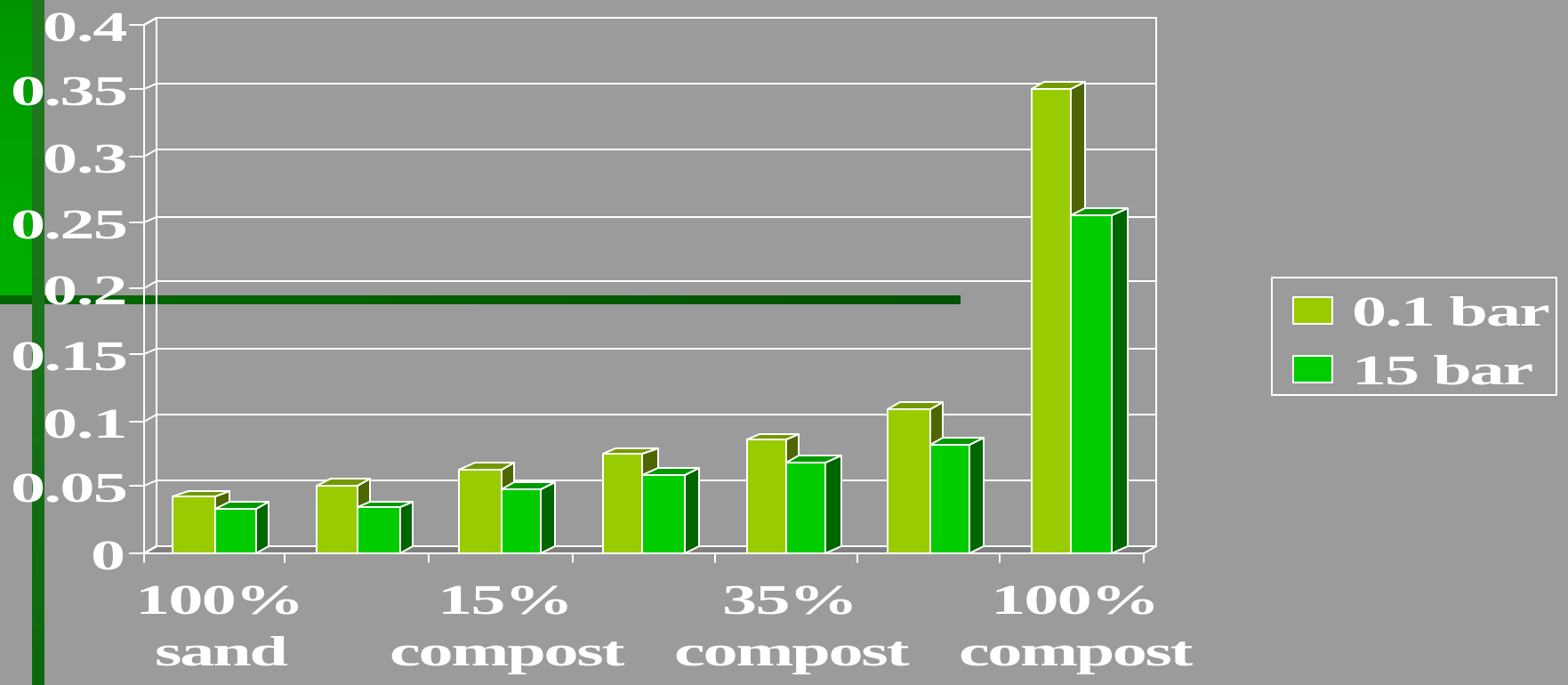
Soil sampled 11 months after application of compost



Relative Soil Water Content during Growing Season



Lab Study
Compost and Sand Mixtures



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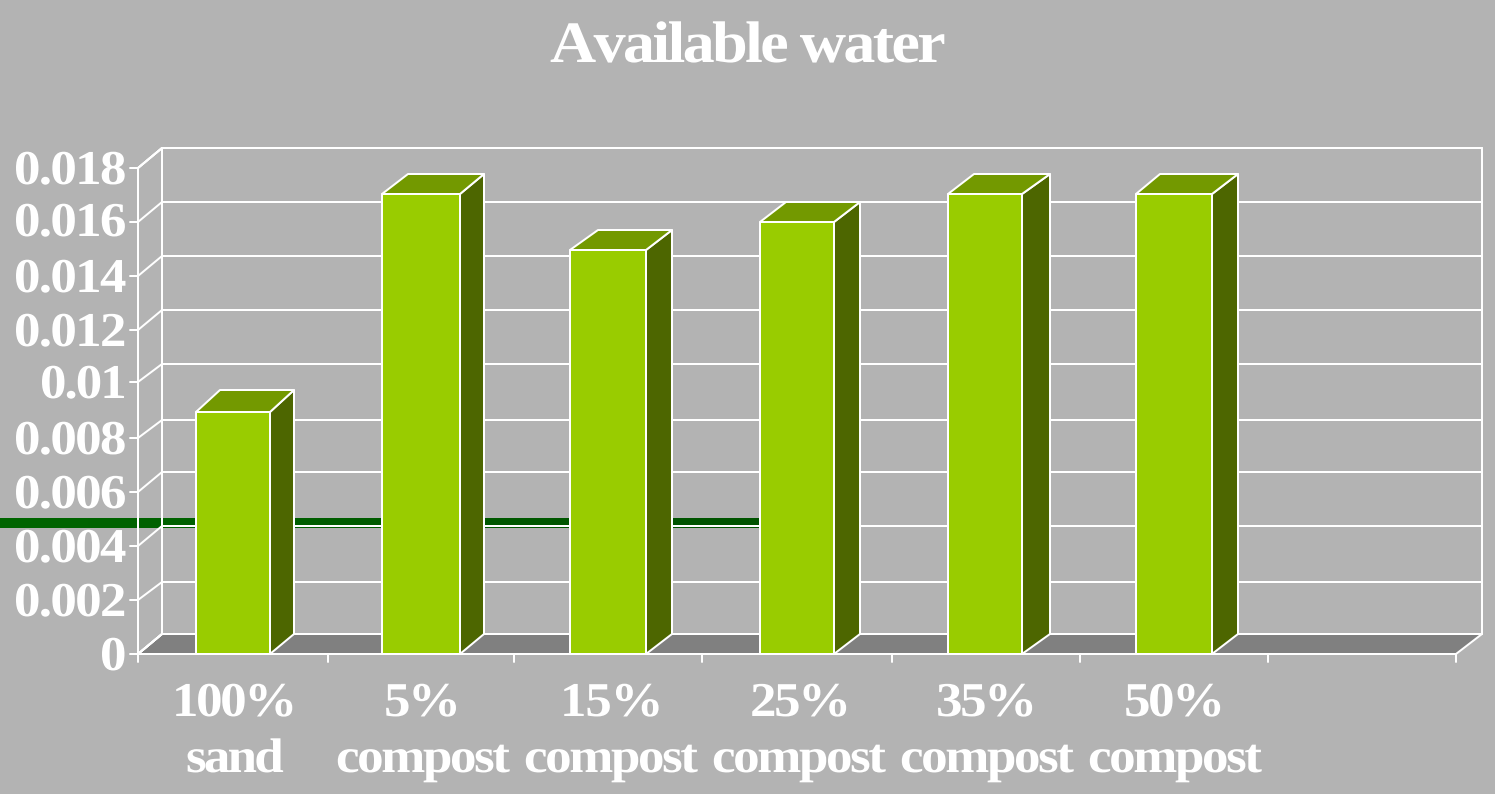

Lab Results Compost/Sand Mixture

- Appears any addition of compost will increase soil water retention
- Increase in plant available water may not be huge with increases in compost %

Future Field Studies

- Using various mixtures of compost and lake sediments
- Smaller texture soil particles may assist with aggregation and creation of smaller pore space in sandy soils?

Summary- Potential Benefits

- Use of compost may reduce irrigation needs, reducing energy usage/costs
- Reduction of groundwater usage
- Traditional benefits associated with compost amendments (soil tilth, etc.)