DOES AMENDING BIOLOGICALLY INERT COVERSOILS WITH COMPOST WORK?


BH/5


6

CLIMATE IS FRIGID

SEMIARID

12.5” MEAN ANNUAL PRECIP.

MOST IN MAY-JUNE

Coversoil initially is dirt.
Soil is distinguished by the organisms living in and on it.

Compost is intended to speed the conversion of dirt to soil.

PLANT NUTRITION – TWO APPROACHES

Exploit more soil volume (more roots, mycorrhiza, organic acids)
Make more nutrients available (fertilize, nutrient cycling, nitrogen fixation)

COMPOST AMENDMENT – THE DREAM OF NUTRIENT CYCLING

“Organic matter” refers to a heterogeneous collection of substrates that soil inhabitants use to capture energy and carbon for cell synthesis.

With molecules as different as hemicellulose, celluloses, proteins, pectins, starches, aromatic hydrocarbons, etc., the initial steps of decomposition differ, but

The final steps involve only a few simple sugars and organic acids. *There is a certain underlying unity in metabolic reaction.* Alexander

“Generally speaking, large organic polymers in the soil tend to be broken down by only a few specialized soil bacteria (or other microbes) whereas smaller organic molecules and sub-units of these polymers tend to provide a substrate for a much wider array of bacteria.” Killham

POSSIBLE BENEFITS OF COMPOST:

Soil Structure
Fertilizer Effect
Chelation….Plexing heavy metals?

BENEFITS OF COMPOST

>Water-holding capacity of coarse soils

>Aeration of “heavy soils”

Nutrient cycling

HOW MUCH COMPOST?

REALLY HOW MUCH OM?

1% IN UPPER SIX INCHES OR

1.5% IN UPPER FOUR INCHES

COMPOST DATA

Check for harmful properties

Maturity, C:N ratio

Is the producing site weedy?

Price per unit mass dry OM

RESULTS MAY VARY!

RECOMMEND COMPOST-COUNCIL-APPROVED LABORATORIES

2 COMPOSTS, 5 LABS

HOW MUCH VARIANCE?

Organic Matter (loss on ignition):

Compost A: 26 to 43%
Compost B: 50 to 98%

2 COMPOSTS, 5 LABS

Percent Moisture:

Compost A: 36 to 44%

Compost B: 55 to 62%

2 COMPOSTS, 5 LABS

Mineral N:

Compost A: 1,000 to 1,800 ppm nitrate and 0 to 2,900 ppm ammonium

Compost B: 260 to 780 ppm nitrate and 480 to 4,160 ppm ammonium

SPECING COMPOST IS HARD

COMPOST COSTS

2012 BIDS

$0.08 TO $0.14 PER POUND OM

$1,400 TO $2,500 PER ACRE PLUS INCORPORATION


264

Organic Matter Placement

COMPOST MUST BE BIOLIGICALLY ACTIVE TO CONTRIBUTE TO NUTRIENT CYCLING

CAN YOU ESTABLISH NUTRIENT CYCLING CONCURRENT WITH VASCULAR PLANTS?

OR DO THE VASCULAR PLANTS HAVE TO PRECEDE THE SOIL FOODWEB?

IS THE BULK SOIL THE WRONG PLACE TO FOCUS?

THE FOLLOWING REVEGETATION ALONG SILVER BOW CREEK WAS NINE YEARS OLD WHEN SAMPLED

STARTS WITH BIOLOGICIALLY INERT COVERSOIL (BORROW)


C2


C3


C4


C1


VC 2


VC4


UC3

AMOUNT OF PERENNIAL PLANT COVER DID NOT DIFFER SIGINIFICANTLY IN COMPOSTED AND UNCOMPOSTED REVEGETATION –

12 composted transects 70%

5 composted 64%

BUT NOT A PERFECT PAIRED COMPARISON

TREND IN PERENNIAL PLANT COVER WAS UP EVEN AS LEGUMES DECREASED

NO SIGN OF COLLAPSE OR IMMINENT COLLAPSE IN FIRST 7 YEARS, COMPOST OR NOT.

Soil Microbiology Comparison Based on Taxon Diversity of:

- Heterotrophic bacteria
- Fungi (mycorrhiza and others)
- Free nitrogen-fixers
- Actinomycetes
- Pseudomonads (bacteria)

INTERPRETATION

Summed Indices for Soils

- High Diversity >12.5
- Moderate Diversity 7-12.5
- Low Diversity <7

NOT SURE ACTUALLY INTERVAL

- NO UNITS. MAY BE MERELY ORDINAL
- "Although the scores may appear to be more precise than ranks, generally these scales do not meet the requirements of any higher level of measurement and may properly be viewed as ordinal."
- Rating plant performance or vigor falls into this category. If you combine measurements but lose units, it's a ranking.

SUMMED INDICES

COMPOSTED	UNCOMPOSTED
5.3	5.0

NO DIFFERENCE

REMEMBER LOW = <7

NEXT A COMPARISON IN TWO-YEAR-OLD REVEGETATION

ALSO SILVER BOW CREEK


CO 25
C 1


CO-25
C2


Sharpie
FINE POINT


CO 25
VC 1


CO 25
VC 2

SUMMED DIVERSITY INDEX

COMPOSTED	UNCOMPOSTED
4.5	4.4

AGAIN NO DIFFERENCE

TRY, TRY AGAIN

ONE YEAR OLD, JUST ONE SAMPLE EACH IN COMPOSTED AND UNCOMPOSTED

SUMMED DIVERSITY

COMPOSTED UNCOMPOSTED

4.1 4.6

DISAPPOINTING

NEXT, GOLDEN SUNLIGHT MINE

- MANURE-BASED COMPOST
- MORE DIFFICULT TO APPLY UNIFORMLY AND INCORPORATE COMPARED TO SILVER BOW CREEK


T4

GOLDEN SUNLIGHT COVERSOIL MICROBIAL DIVERSITY

SUMMED DIVERSITY OF 2-YEAR-OLD COMPOSTED SOILS

MEAN 4.4

REMEMBER <7 IS LOW

RANGE FROM 3 TO 4.9

SEEING NO POSITIVE EFFECT

UNABLE TO CONCLUDE

FROM VASCULAR PLANT PERFORMANCE OR MICROBIOLOGICAL ANALYSIS

THAT COMPOST CONFERS BENEFIT

NOT ENOUGH COMPOST!

ODD THAT COMPOST-PILE AREAS WOULD HAVE SCANT REVEG


T33


1•0
2•0
3•0
4•0
5•0
6•0
7•0
8•0
9•0


F31


T31


T31

In general, microorganisms require the same inorganic ions as higher plants, and they compete with the macroorganisms where the nutrient supply is suboptimal.(Alexander p.384)


10-YEAR-OLD BIG
SAGEBRUSH

COMPOST'S CONTRIBUTION TO ESTABLISHING NUTRIENT CYCLING IS FAR LESS THAN I HOPED

OTHER BENEFITS MADE MORE SENSE WHEN COMPOST COST $10/CY THAN $30/CY PLUS INCORPORATION COSTS

COMPOST MIGHT WORK BETTER IN A WAMER, MOISTER CLIMATE AND SOILS WITH MORE ORGANIC MATTER…..

MAYBE NUTRIENT CYCLING IS ADEQUATE WITH RATHER LOW MICROBIAL DIVERSITY.

MAYBE THE VASCULAR PLANTS MUST LEAD AND SOIL MICROORGANISMS FOLLOW

MAYBE THE MICROBIAL ACTIVITY THAT IS MOST IMPORTANT TO VASCULAR PLANTS IS CONFINED TO THE RHIZOSPHERE AND MYCORRHIZOSPHERE, NOT THE BULK SOIL.

In the rhizosphere, crop residues, manure, and chemical fertilizers have little effect on the microflora, compared to fallow or nonrhizospheric soils, where they have great effect.

In general, the character of the vegetation seems to have more effect than fertility.

“The 1% of the soil volume that typically comprises plant root systems, and the associated rhizosphere soil, is a zone of intense change and activity in which the major part of soil nutrient cycling occurs.” (Killham p. 79)