Defining Tillage by Measures of Soil Health

Jim Martindale

An Inductive Reasoning Approach to making Tillage (which includes doing no tillage) Decisions

Current Approach?

TECHNOLOGY DEFINING ITSELF: WHAT IT LOOKS LIKE, HOW IT HANDLES WATER (OR APPEARS TO), WHERE CROP RESIDUES ARE LOCATED, WHAT SIZE IS CROP RESIDUE, SOIL BULK DENSITY CHANGES, ETC., ETC.

A SURGICAL APPROACH TO TILLAGE ?

Avoiding Collateral Damage

CT Scans
X-Ray
Fiber Optics

Laser (non-invasive) surgery……..
We Wouldn't define Surgery by the Size or Shape of the Scar, would we?

Genesis Chapter 2

4 These are the generations of the heavens and of the earth when they were created, in the day that the LORD God made the earth and the heavens,

5 And every plant of the field before it was in the earth, and every herb of the field before it grew: for the LORD God had not caused it to rain upon the earth, and there was not a man to till the ground.

6 But there went up a mist from the earth, and watered the whole face of the ground.

7 And the LORD God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul.

Key Elements for All Life on Earth

H_20

AIR

King James Version

In the six hundredth year of Noah's life, in the second month, the seventeenth day of the month, the same day were all the fountains of the great deep broken up, and the windows of heaven were opened.

Genesis 8:21

"And the LORD smelled a sweet savour; and the LORD said in his heart, I will not again curse the ground any more for man's sake; for the imagination of man's heart *is* evil from his youth; neither will I again smite any more every thing living, as I have done."

King James Version (KJV)

ISAIAH 28

22 Now therefore, do not be mockers,
Lest your bonds be made strong;
For I have heard from the Lord GOD of hosts,
A destruction determined even upon the whole earth.
23 Give ear and hear my voice,
Listen and hear my speech.
24 Does the plowman keep plowing all day to sow?
Does he keep turning his soil and breaking the clods?

But the black cummin is beaten out with a stick,
And the cummin with a rod.
28 Bread *flour* must be ground;
Therefore he does not thresh it forever,
Break *it with* his cartwheel,
Or crush it *with* his horsemen.
29 This also comes from the LORD of hosts,
Who is wonderful in counsel *and* excellent in guidance.

So in summary:

1700 years to the Flood Event and it began to rain and snow; seasons came upon the planet

By 600 BC or 1700 years after the Flood, God sends a messenger to inform Israel that their method of stewarding soil through tillage (which included violation of the Sabbath rest of the Land by this time) could destroy the planet.

Here today at about another 2600 years down the road, we are still searching for answers to the "Tillage Question".

To coin a phrase from Shakespeare: "To till or not to till." But is that really the question?

GENESIS 3

PRONOUNCING THE SENTENCE

23 Therefore the LORD God sent him forth from the garden of Eden, to till the ground from whence he was taken.

THE PREAMBLE TO SENTENCING

17 And unto Adam he said, Because thou hast hearkened unto the voice of thy wife, and hast eaten of the tree, of which I commanded thee, saying, Thou shalt not eat of it: cursed *is* the ground for thy sake; in sorrow shalt thou eat *of* it all the days of thy life;

18 Thorns also and thistles shall it bring forth to thee; and thou shalt eat the herb of the field;

19 In the sweat of thy face shalt thou eat bread, till thou return unto the ground; for out of it wast thou taken: for dust thou *art*, and unto dust shalt thou return.

Medical Analogy:

Morphology= The science of construction and kind of organisms without reference to function.

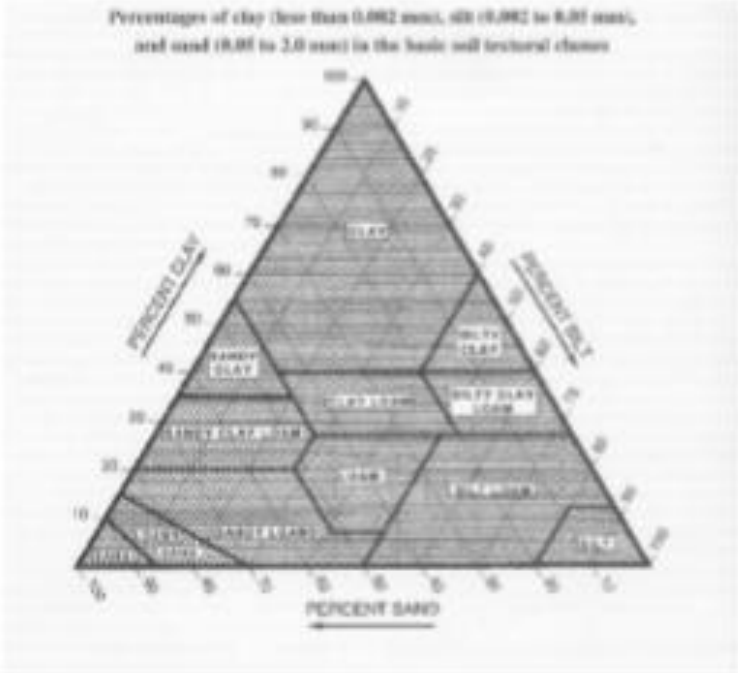
Soil Morphology: Focusing on Texture and Structure which leads inevitably to potential Biological composition and hence ultimately to function.

Soil Morphology - Texture

- Texture – proportions of sand, silt, and clay
  - organic matter does not affect soil texture – but it does affect structure [next section]

- Measured on the < 2 mm fraction - the "fine earth fraction"
  - Sand 2.0 mm – 53 µm
  - Silt 53 µm – 2 µm
  - Clay < 2 µm

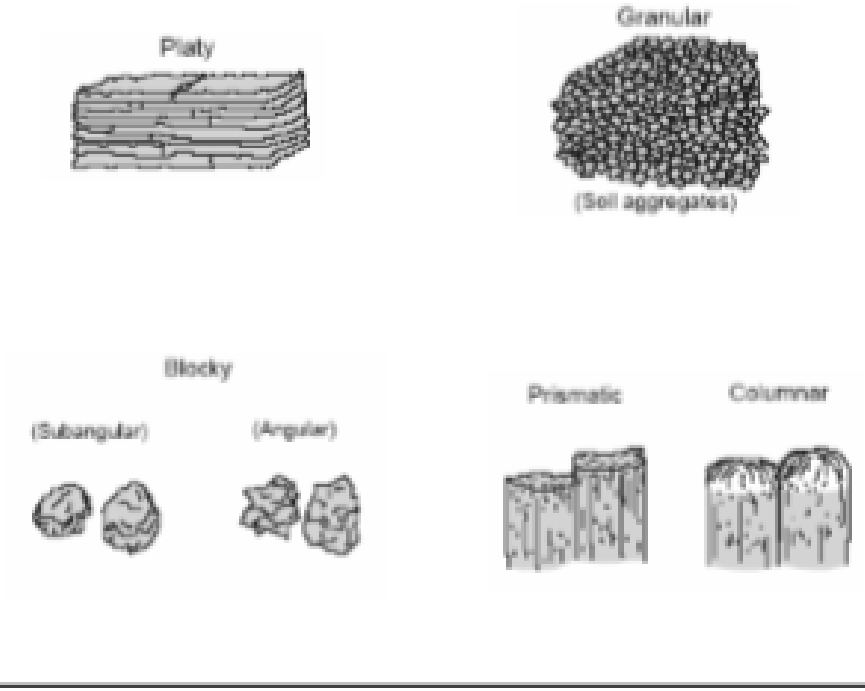
Soil Morphology - Texture



Soil Morphology - Structure

- Structure
  - Aggregation or physical organization of soil sand, silt, and clay particles into larger structures
  - Structures have repeatable planes of weakness between individual aggregates
    - Planes of weakness persist through time – at least one wetting and drying cycle
  - Naturally occurring structures are called “peds” – chunks left after plowing are called “clods”

Soil Morphology - Structure

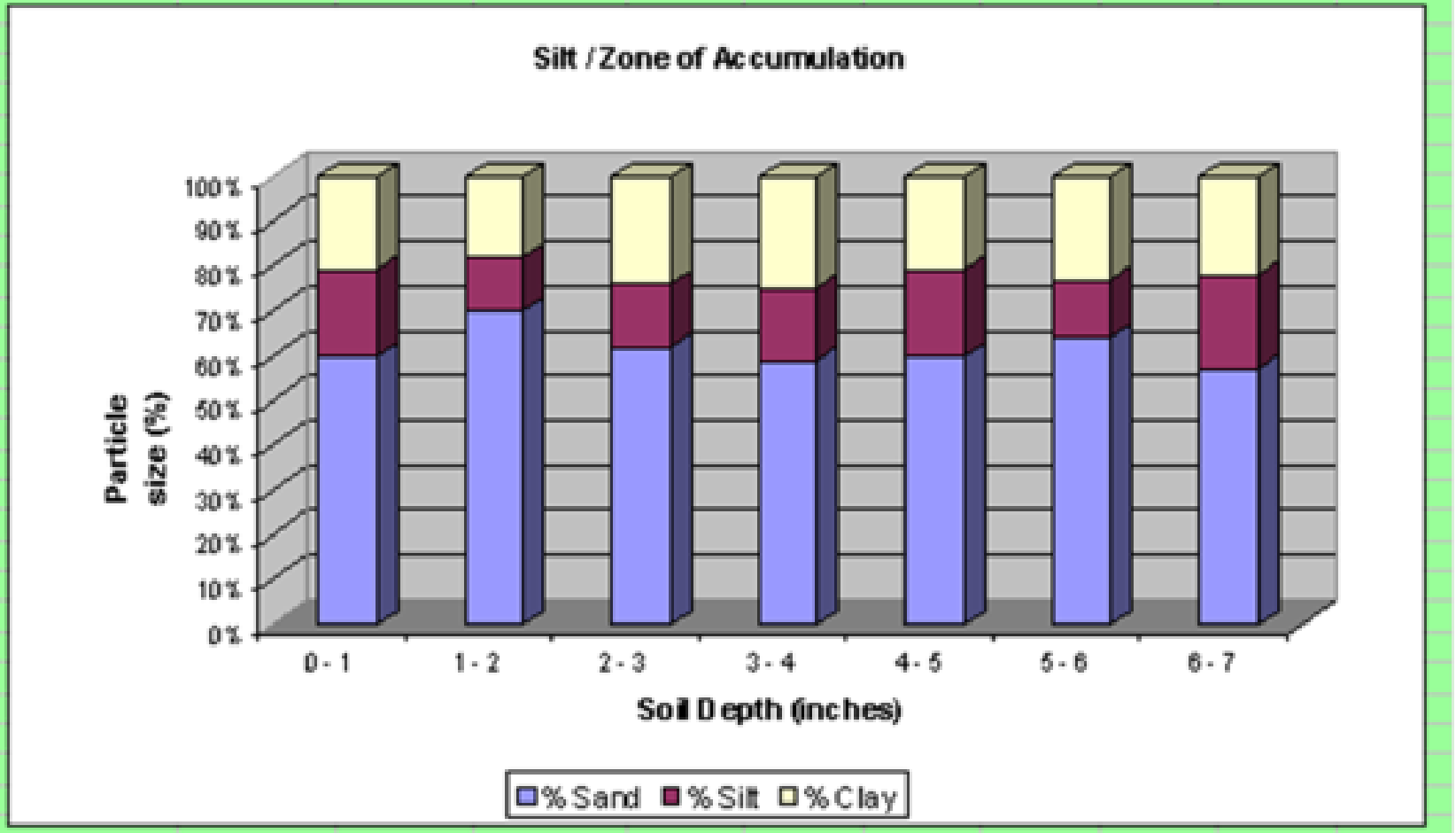


Mechanical Analysis of Soil

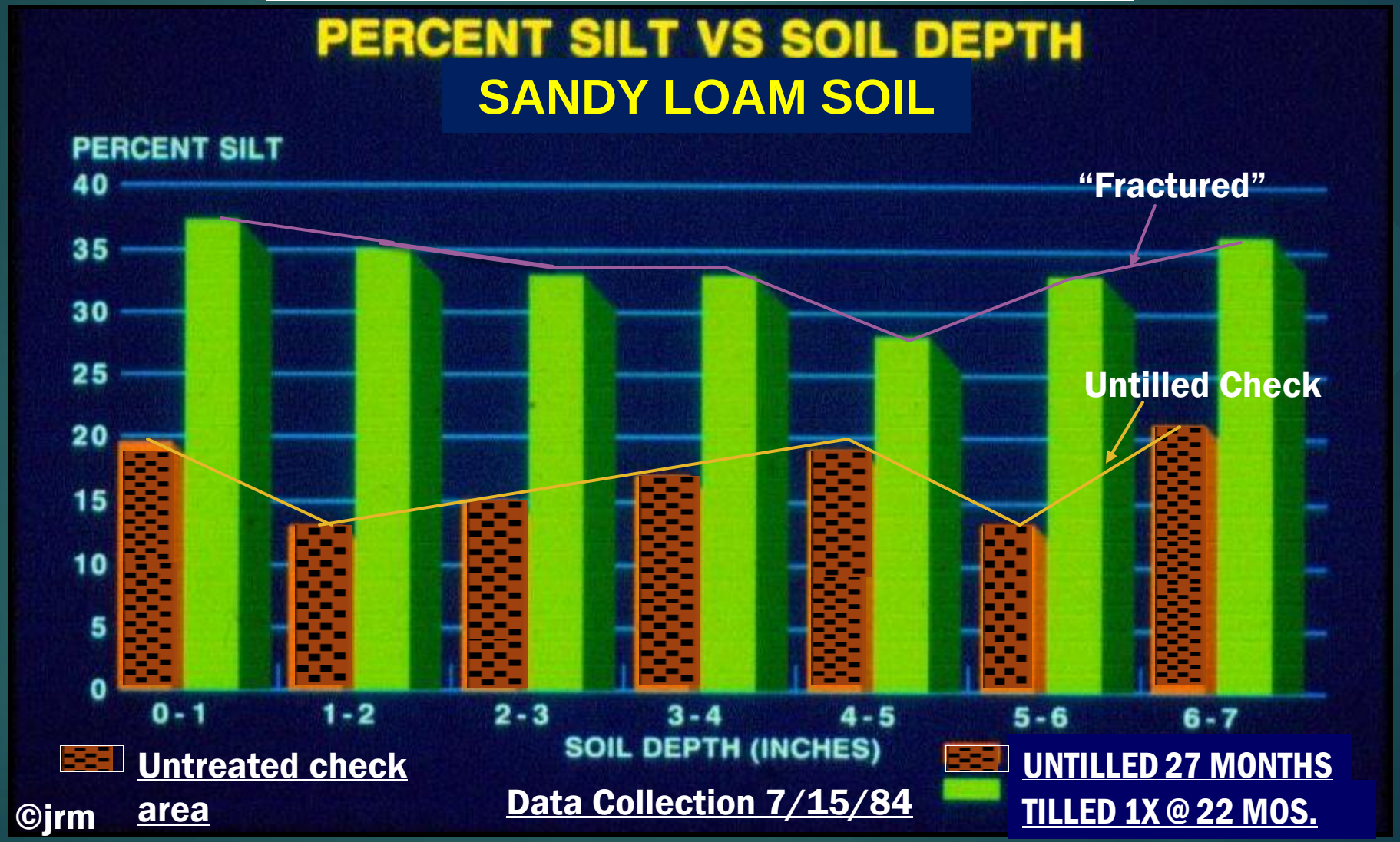
- The percentage distribution of those parts determines soil structure.
- Mechanical analysis is the determination of the size range of particles present in a soil, expressed as a percentage of the total dry weight.
- There are two methods generally used to find the particle-size distribution of soil:
  - (1) ***sieve analysis*** - for particle sizes larger than 0.075 mm in diameter, and
  - (2) ***hydrometer analysis*** - for particle sizes smaller than 0.075 mm in diameter.

TURNING A MEASUREMENT OF SOMETHING THAT IS "STATIC" INTO SOMETHING WHICH DEPICTS A PHENOMENON WHICH IS "DYNAMIC"

Soil Depth (inches)	% Sand	% Silt	% Clay
0 - 1	60	19	21
1 - 2	70	12	18
2 - 3	62	14	24
3 - 4	59	16	25
4 - 5	60	19	21
5 - 6	64	13	23
6 - 7	57	21	22



FIVE MONTHS PLUS SPRINGTIME RAINFALL OF 8 INCHES CHANGED THINGS

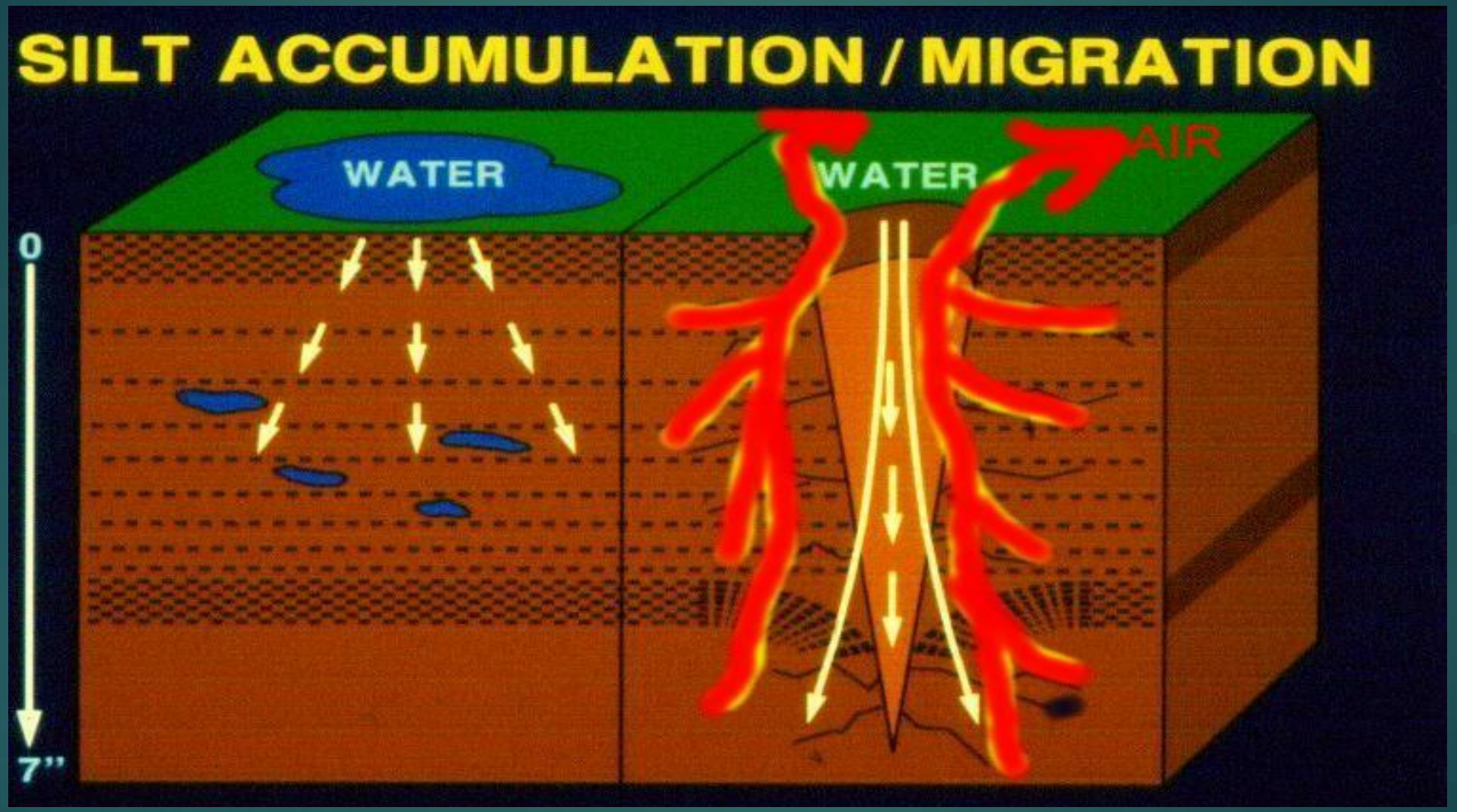


February 13, 1983 at 3:00 PM

Evidence that the **target was "HIT".**

READ "THE REST OF THE STORY" AT WWW.SOILCURSEBUSTER.COM

Time to Redefine TILLAGE ?...



???? MIGRATION/ACCUMULATION/RESTORATION

Streambed Formation Processes Applied to Vertical Water Movement

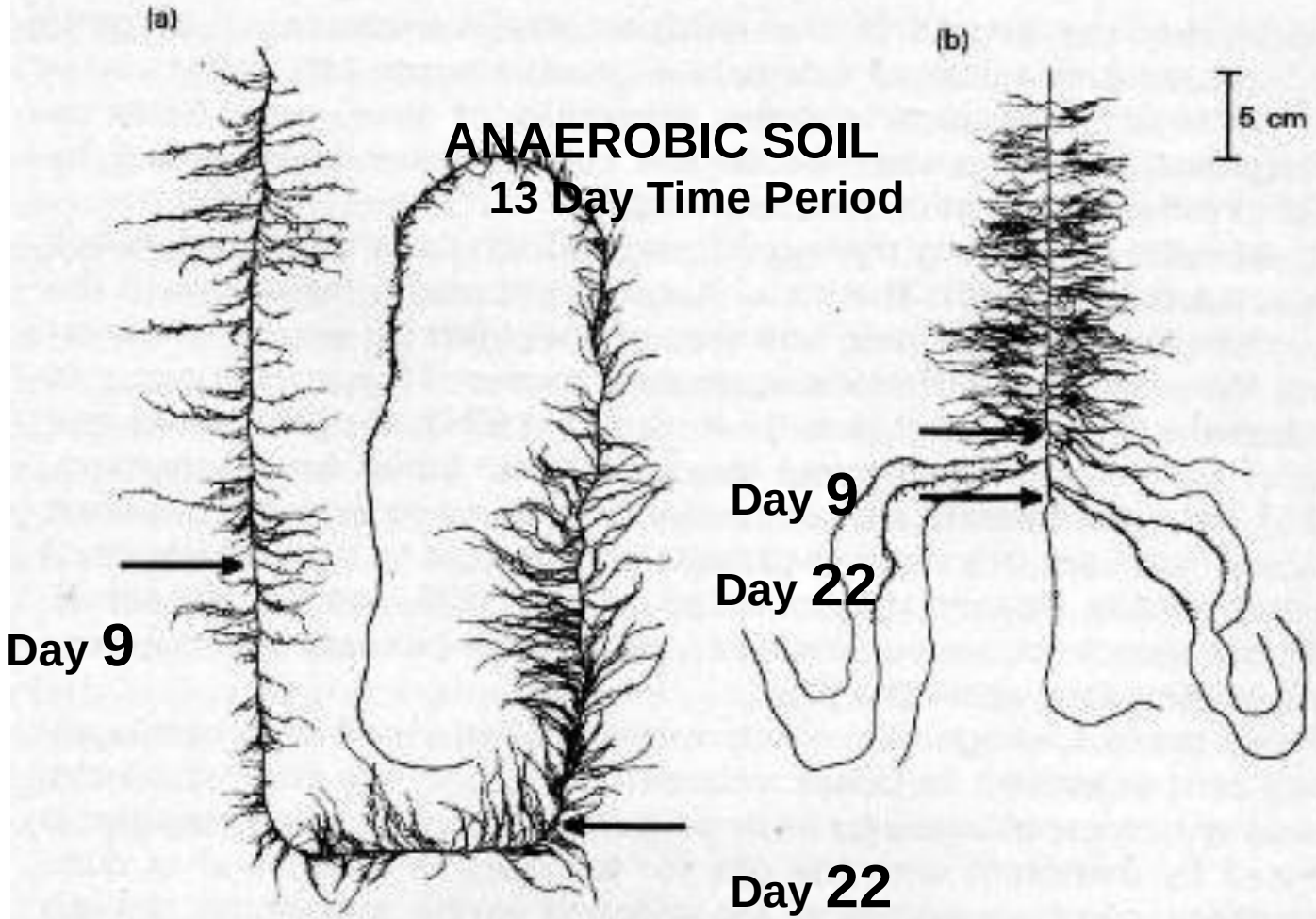


FIG. 9.5 Seminal axes of 35-day-old seedling of barley (Horedum vulgare) *grown in solution culture.* (a) *Control.* (b) *The root system was exposed to 10 ppm ethylene in air for thirteen days (9–22 days after germination), and then transferred to an ethylene-free environment for thirteen days before sampling. The arrows indicate the position of the apex at the beginning and end of treatment with ethylene (Crossett and Campbell, 1975).*

Taken from Plant Root Systems by R. Scott Russell, McGraw Hill (UK) 1977

Putting a different "Light" on things

- The 72 hours clock
- Expansion phase
- Ear Embryo row count
- Establishment phase
- Pollination
- New root development ceases

TAKE NOTE OF THE ROOT SYSTEM COLOR


TAKE NOTE OF THE ROOT SYSTEM COLOR

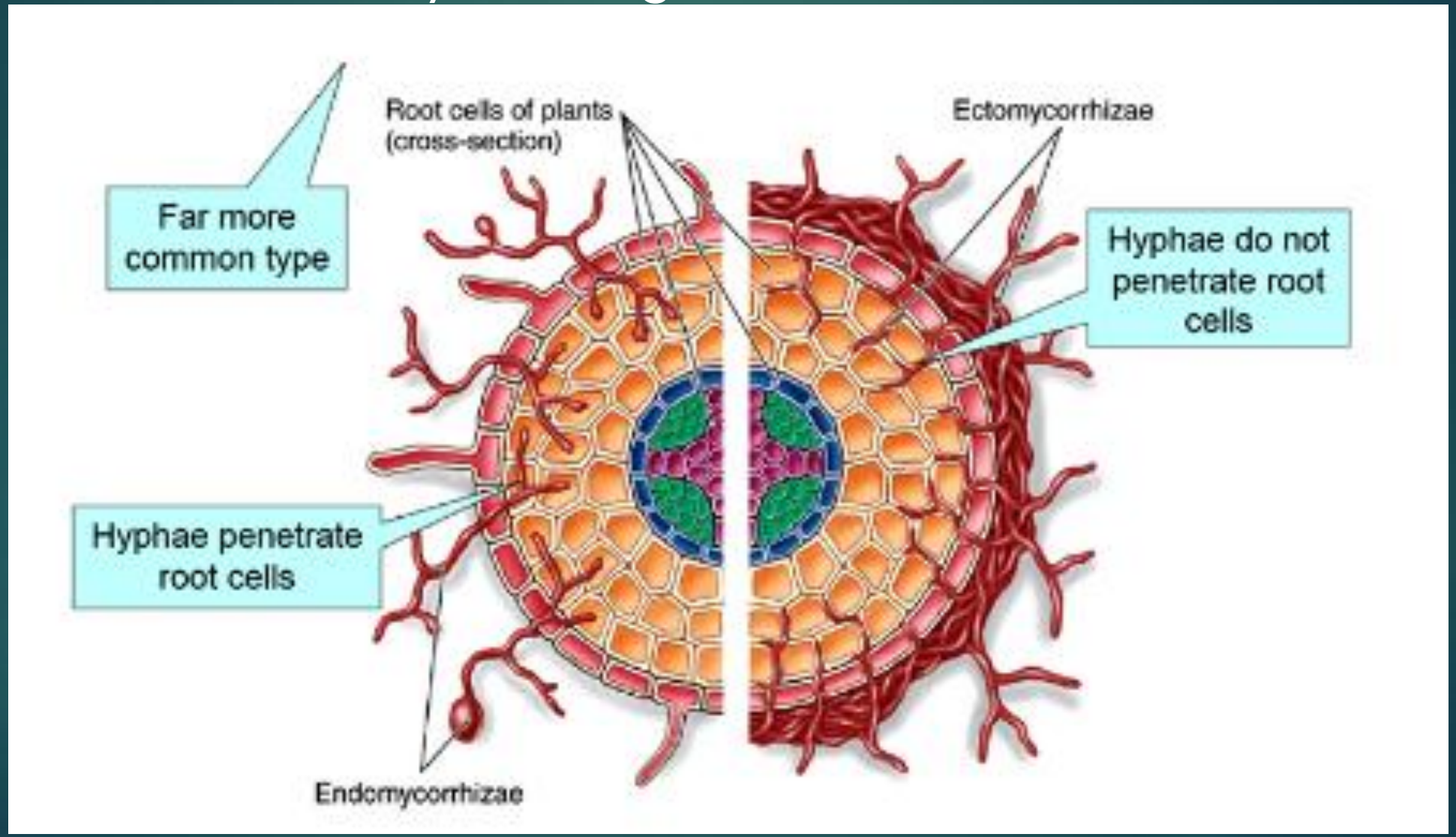
25 years of Organic Crop Production

Corn roots all done at 5 inches in depth after several hesitations

Traditional tillage and cultivation practices

Sandy Loam at 2%SOM and headed south

How much of, what type of, and where does this activity take place with a poorly formed root system and an environment which does not efficiently exchange air and water?



Definition of a Biofilm

- Biofilms are communities of microorganisms in a matrix that joins them together and to living or inert substrates
- Biofilms are surface-attached communities of bacteria, encased in an extracellular matrix of secreted proteins, carbohydrates, and/or DNA, that assume phenotypes distinct from those of planktonic cells

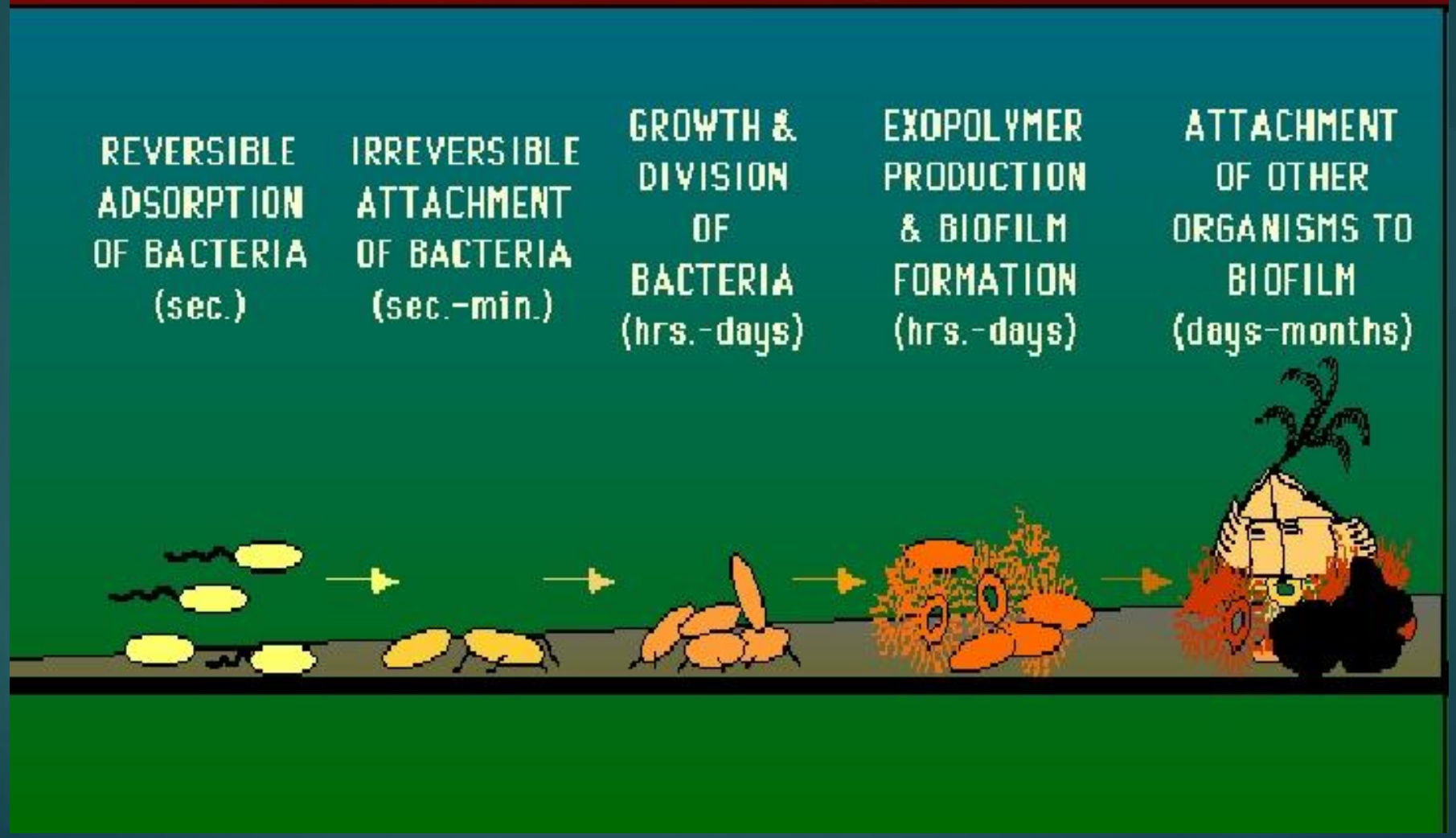
- Biofilms are likely to represent a natural scenario for bacterial communication.

(Davey and O'Toole, 2000)

- A microbial biofilm is considered a community that meets the following four basic criteria:

1. Must possess the abilities to self-organize (**Autopoiesis**)
2. Resist environmental perturbations (**Homeostasis**)
3. Must be more effective in association than in isolation (**Synergy**)
4. Respond to environmental changes as a unit rather than single individuals (**Communality**).

Steps in Biofilm formation



Biofilm Formation and Bac. Subtilus Colonization- ANTAGONIST

concentrations at which it does not kill. We speculate that the ability of *P. protegens* to produce DAPG and therefore inhibit biofilm formation and sporulation in *B. subtilis* might be relevant in their shared natural habitat of the plant root. Biofilm formation is required for *B. subtilis* to colonize plant roots (**42**, **43**). DAPG could confer a competitive advantage to *P. protegens* during root colonization in two ways: both by directly inhibiting *B. subtilis* growth in the areas closest to *P. protegens* (where the concentrations of DAPG are highest) and by preventing biofilm formation (and therefore colonization [**42**]) of *B. subtilis* in the regions beyond those areas (as the concentration of DAPG falls to subinhibitory levels further from *P. protegens*).

Acetic Acid Acts as a Volatile Signal To Stimulate Bacterial Biofilm Formation

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Caroline S. Harwood, Editor

+ Author Affiliations

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Y.C. and K.G. contributed equally to the work.

ABSTRACT

Volatiles are small air-transmittable chemicals with diverse biological activities. In this study, we showed that volatiles produced by the bacterium *Bacillus subtilis* had a profound effect on biofilm formation of neighboring *B. subtilis* cells that grew in proximity but were physically separated. We further demonstrated that one such volatile, acetic acid, is particularly potent in stimulating biofilm formation.

WHY IS THIS IMPORTANT?

1.) Properly designed large, deep root systems represent potentially large communities of colonizing microbes.

2.) An environment which triggers establishment of a bio-film on root systems represents a welcome mat and a porch light left on.

3.) If the beneficials move in first, there is no room left for the pathogens.

4.) The end products of "aerobic/anaerobic decomposition" need to present the community with the correct raw materials for the colonization to take place.

5.) Crop residues need to contain fats and oils.

Format: Abstract ▾ Send to ▾

Mycotoxin Res. 2015 Aug;31(3):137-43. doi: 10.1007/s12550-015-0224-8. Epub 2015 May 10.

Endophytic bacteria from wheat grain as biocontrol agents of Fusarium graminearum and deoxynivalenol production in wheat.

Pan D[1], Mionetto A, Tiscornia S, Bettucci L.

⊕ Author information

Abstract

In Uruguay, Fusarium graminearum is the most common species that infects wheat and is responsible for Fusarium head blight (FHB) and contamination of grain with deoxynivalenol (DON). The aim of this work was to select bacterial endophytes isolated from wheat grain to evaluate their antagonistic ability against F. graminearum and DON production in vitro and under field conditions. Four strains identified as Bacillus megaterium (BM1) and Bacillus subtilis (BS43, BSM0 y BSM2) significantly reduced fungal growth and spore germination of F. graminearum. This antagonist activity remained unchanged after the bacterial cultures were heat treated. Under field conditions, treatments with antagonist BM1 was the most effective, reducing the FHB incidence and severity by 93 and 54 %, respectively, and the production of DON by 89.3 %.

PACIFIC SALMON SOURCE = 71.0% VFA's

	%As is	% DM	% of VFA's
Lactic Acid, %	.01	.11	0.16
Acetic Acid, %	3.09	28.79	40.55
Lactic/Acetic Ratio		.00	
Propionic Acid, %	1.14	10.63	15.00
Butyric Acid, %	2.94	27.35	38.50
Iso-Butyric Acid, %	.44	4.13	5.82
Total Acids, %		71.01	

FRESHWATER CARP SOURCE = 13.77% VFA's

Lactic Acid, %	.15	1.50	10.8
Acetic Acid, %	.72	6.96	51.0
Lactic/Acetic Ratio		.22	
Propionic Acid, %	.13	1.27	9.2
Butyric Acid, %	.39	3.77	27.3
Iso-Butyric Acid, %	.03	.27	1.9
Total Acids, %		13.77	

Dairy One Testing Ithaca, NY

Soil Production of Acetic Acid

AEROBICALLY AND ANAEROBICALLY BY

ACETOBACTERIUM

Practicing **Strictly** Non-Invasive, Targeted Tillage since 1984.

Soils 45% clay, 45% silt & <5% sand

Golden Harvest Nat'l Silage Corn Competition 2015- Finished 3rd with 30 T./Ac.

Eliminated 3 gpa 9-18-9 Seed-safe fertilizer for first time since 1985.

Applied 50#/ac. 46-0-0 in 2X2 band 120#N-from manure.

Assessing Tillage Success- Gross observations

1.) Plant Health
- Yield and Nutrient Content
- Diseases present

2.) Soil Loss Through Erosion and Poor Percolation
- Wind & Water transport
- Water accumulations in sloughs
- Sodium deposits

3.) Weed Pressure
- Species

4.) Insect Diversity and Density
- Crop Residue Disappearance
- Counting Earthworms and Demographics
- Presence of insects pests

5.) Root Development
- Size and Shape

One of the best diagnostic tools available….

Keep one in the back of the pick-up at all times.

What is so important about a deeper root system?

1.) provides pathway for sugars and exudates to deeper soil strata

2.) promotes deeper mycorrhizal colonization

3.) organizes soil aggregates to create stability or resistance to compaction forces

4.) creates more deeper macropores for improved water percolation

The roots system development tells you where the water and air are exchanging.

See why no-tillers are turning Strip-tilling?

Virtually no root development beyond the edge of the strip-tilled zone.

How much carbon can be added to soil for microbial growth in this configuration?

What is this

John Deere

Ripper shank

telling us ?

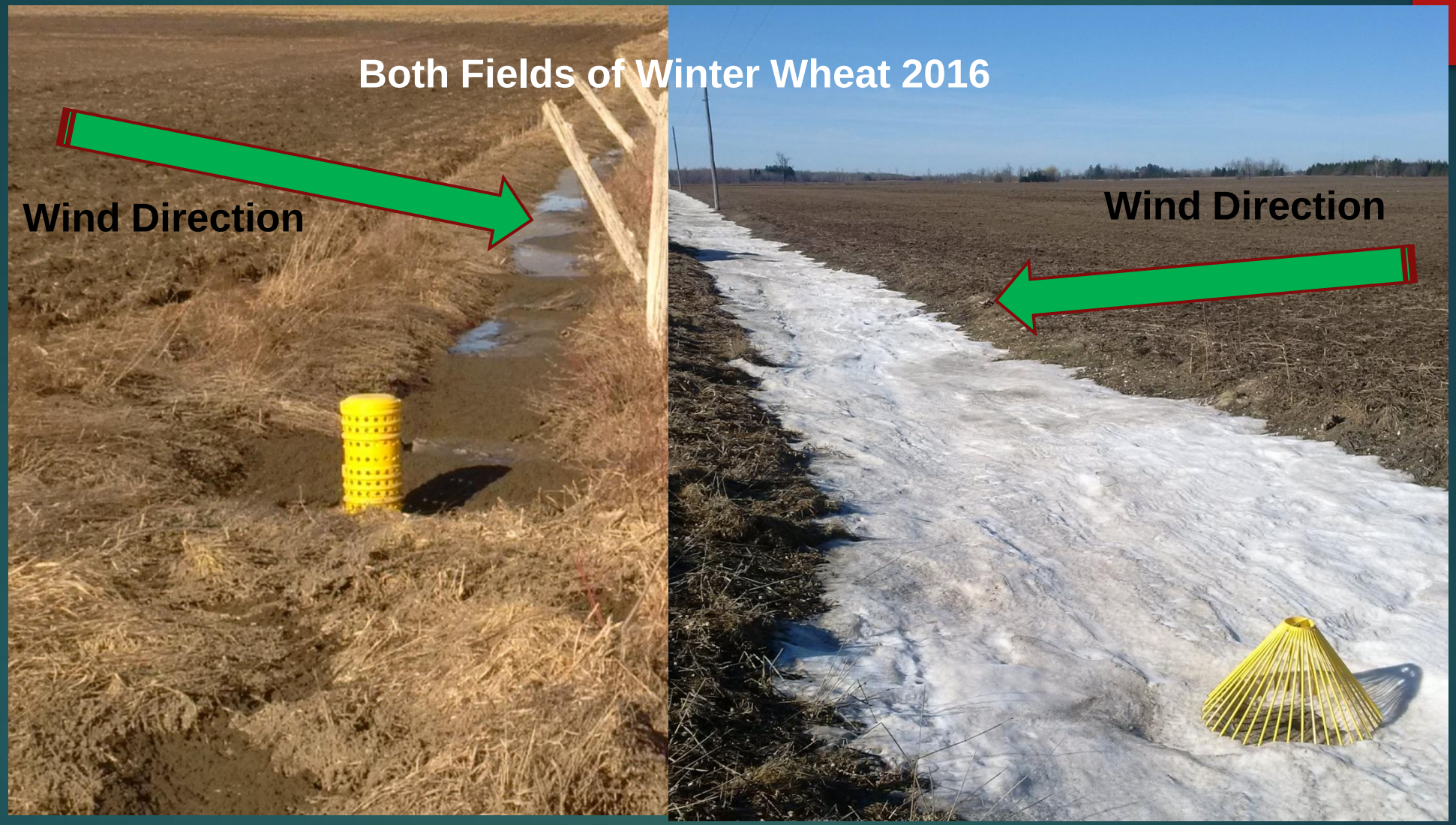
Sometimes wear patterns on equipment give us clear indications of what is being achieved.

7" to 10" is where the most wear is normally observed on deep-tillage shanks.

This wear pattern is exactly the reverse after 10 years of Targeted Non-invasive Tillage Root Development.

Getting to the bank before it closes!!! NO DETOURS ALLOWED.

Which Ditch Line is Yours?



Fall Chisel Plowed

Multi species cover, field cultivated, Fall Manure Injected, chisel plowed tracks, then CurseBusted

Photos Courtesy of Carl Brubacher

Other "Tools" for Assessing Impact of Tillage (or lack thereof)

1.) Soil Health Batteries
- PFLA- Ward Labs
- Haney Test
- Cornell Soil Health
- Solvita CO_2 Burst

2.) Plant Health
- Plant Sap Testing- Crop Health Labs/Nova Crop Control-OH
- Serology Testing for pathogens in plant sap and tissues

3.) Soil Testing
- Profiles such as 0-2" or 0-3" depths
- Tracking NO_3 and NH_4 Nitrogen 0-7", 7-14" and 14-21"

Sign Up Now for Microbial Analysis for Growers

Visit Dr. Mary Lucero

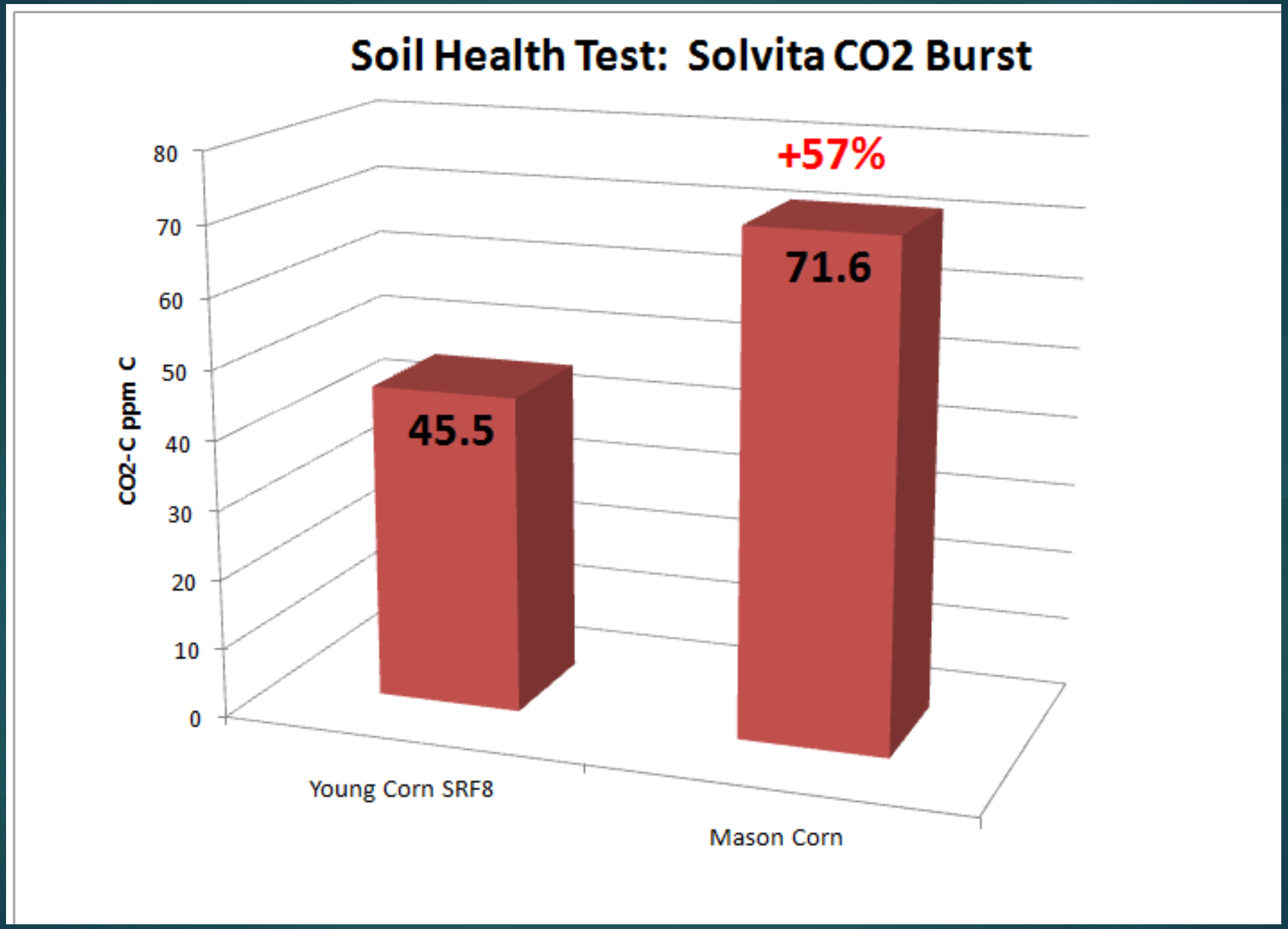
www.endofite.com

Set up your own lab and get personalized training on how to measure Microbial Density and Diversity.

“Soil Health” is a Modern Term

-refers to **soil** quality, is defined as the “continued capacity of **soil** to function as a vital living ecosystem that sustains plants, animals, and humans”.

-NRCS website


Soil Health Test: Solvita CO2 Burst
+57%
71.6
45.5
CO2-C ppm C
80
70
60
50
40
30
20
10
0
Young Corn SRF8
Mason Corn

Cornell Soil Health Audit 2006- Mason Farm Jefferson Co. NYS

		5 yr. Old Alfalfa		Following 2nd yr Corn	
BIOLOGICAL	Organic Matter (%)	4.1	6.0	3.7	5.0
	Active Carbon (ppm)	633	3.0	812	8.0
	Potentially Mineralizable Nitrogen (µgN/ gdwsoil/week)	10.5	6.0	18.0	10.0
	Root Health Rating (1-9)	2.5	9.0	3.5	8.0
CHEMICAL	pH (see CNAL Report)	6.2	9.0	6.7	10.0
	Extractable Phosphorus (see CNAL Report)	4.0	5.0	15.0	10.0
	Extractable Potassium (see CNAL Report)	138	10.0	133	10.0

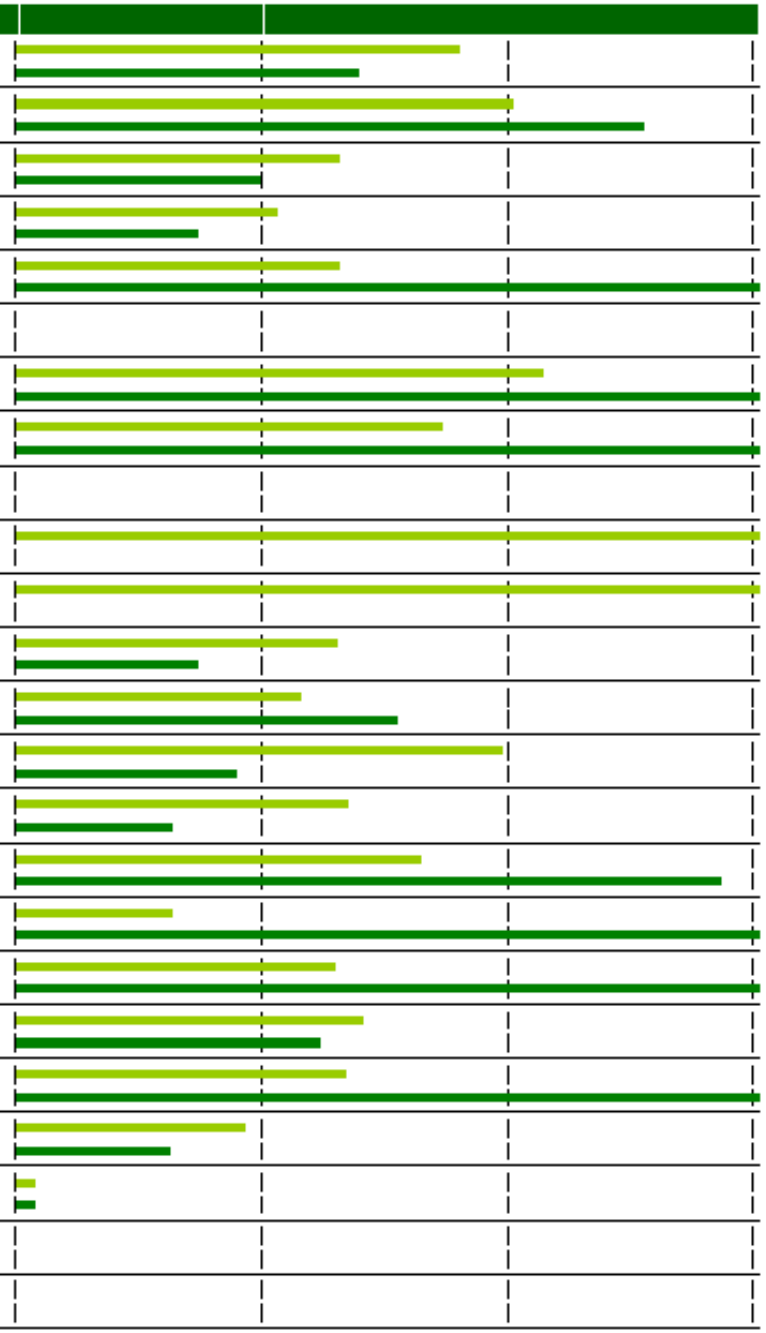
138% Increase

172% Increase

Removal amt. in 48 T/A. silage exceeded # applied over 2 yrs.

Only Potash applied from 20 tons of manure over 2 yrs. in 7 year rotation
NO POTASH APPLIED TO ALFALFA

Mineral		Current level	Optimum	
Total Sugars	%	1,3	0,5 - 1,5	1
	%	0,9		2
pH		6,6	6,2 - 6,6	1
		6,8		2
EC	mS/cm	9,6	8,9 - 11,1	1
	mS/cm	8,8		2
K - Potassium	ppm	3982	3915 - 5085	1
	ppm	2916		2
Ca - Calcium	ppm	1615	1278 - 2322	1
	ppm	3519		2
K / Ca		2,47		1
		0,83		2
Mg - Magnesium	ppm	922	600 - 900	1
	ppm	1370		2
Na - Sodium	ppm	5	2 - 6	1
	ppm	8		2
NH4 - Ammonium	ppm	258		1
	ppm	247		2
NO3 - Nitrate	ppm	71	<20 - 45	1
	ppm	<20		2
N in Nitrate	ppm	16	<5 - 10	1
	ppm	<5		2
N - Total Nitrogen	ppm	1699	1530 - 2070	1
	ppm	1138		2
Cl - Chloride	ppm	97	84 - 166	1
	ppm	129		2
S - Sulfur	ppm	246	152 - 248	1
	ppm	135		2
P - Phosphorus	ppm	242	165 - 385	1
	ppm	106		2
Si - Silica	ppm	29,6	22,4 - 33,6	1
	ppm	38,5		2
Fe - Iron	ppm	1,47	2,34 - 4,65	1
	ppm	5,97		2
Mn - Manganese	ppm	7,56	5,40 - 12,60	1
	ppm	19,37		2
Zn - Zinc	ppm	6,47	4,20 - 9,80	1
	ppm	5,53		2
B - Boron	ppm	3,58	2,68 - 5,32	1
	ppm	7,70		2
Cu - Copper	ppm	0,93	1,00 - 3,00	1
	ppm	0,62		2
Mo - Molybdenum	ppm	<0,05	0,15 - 0,45	1
	ppm	<0,05		2
Al - Aluminium	ppm	0,74		1
	ppm	5,92		2
Co - Cobalt	ppm	<0,10		1
	ppm	<0,10		2



Consult your advisor for appropriate fertilizer recommendations.

201.20170720

Soil Tests presented no indications of potential Iron or Copper deficiencies Burke Co. ND

Under the influence of high rates of Manganese supplementation and long-term (multi-year) ANAEROBIC No-Till SOIL conditions, Iron deficiency was triggered.

Burke County, ND

Fus. Gram. Strain cultured from infected HRSW, Durum and Malting Barley

Then grown in presence of six-strain combination of known Chitinase enzyme producers.

Chitinase dissolves Fus. Gram. Cell walls.

Waging pre-emptive war using natural predators in a soil eco-system that is breathing well.

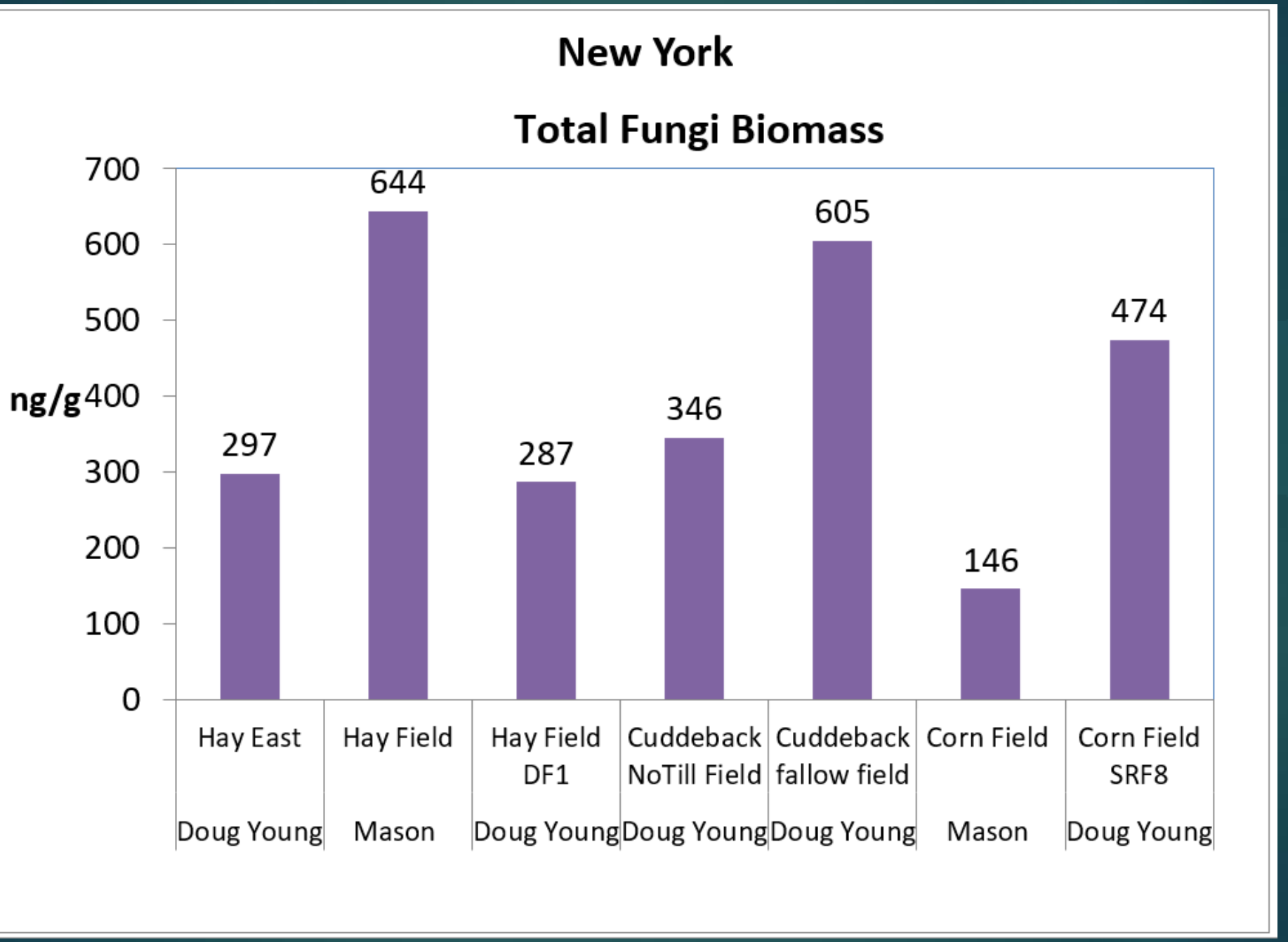
Comparing 30 year plus histories: Conventional tillage vs. Non-Invasive Targeted Tillage
Class I (Spruce Haven) vs. Class IV (Mason)Soils

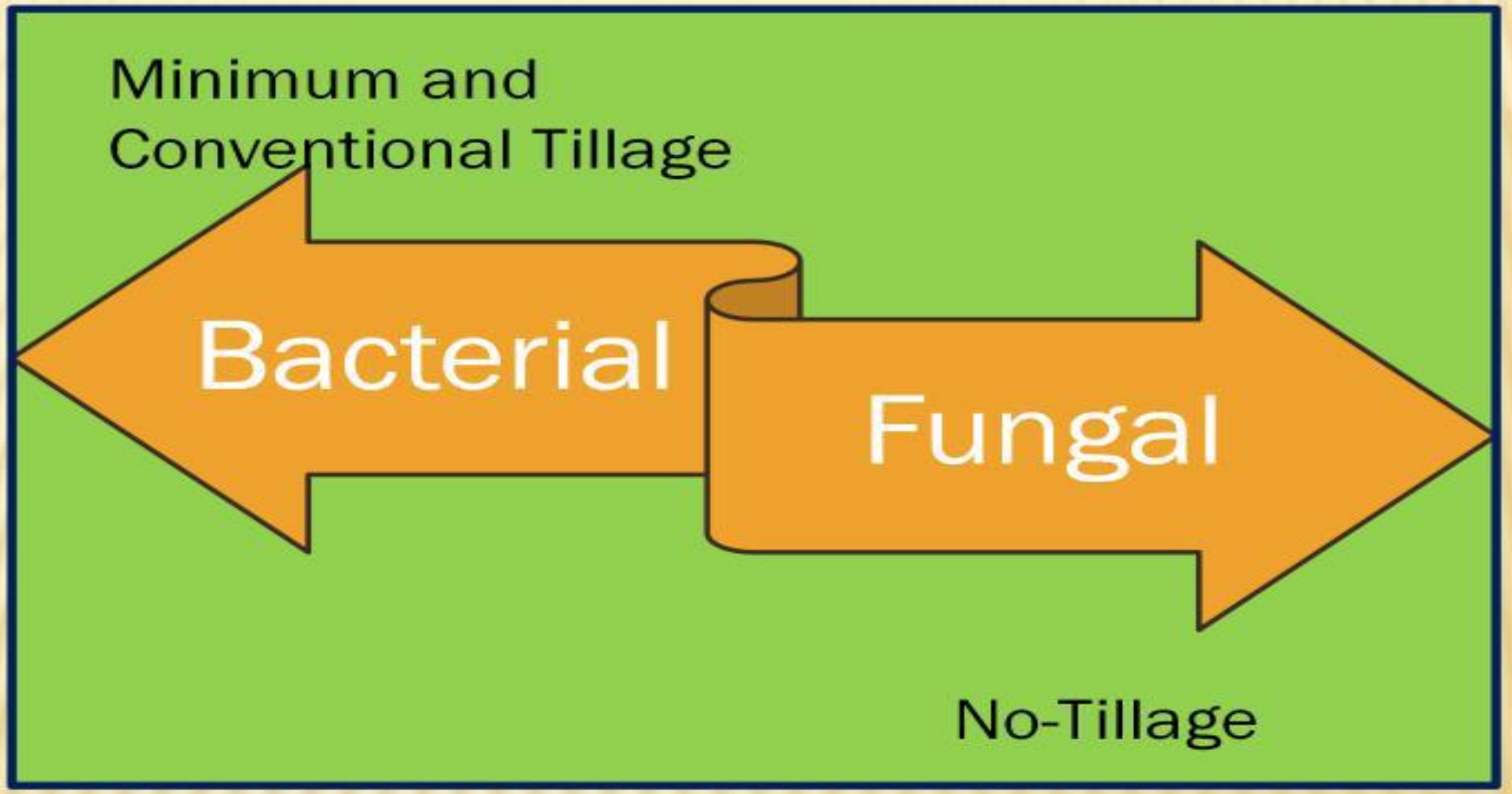
10/5/2015 Sampled

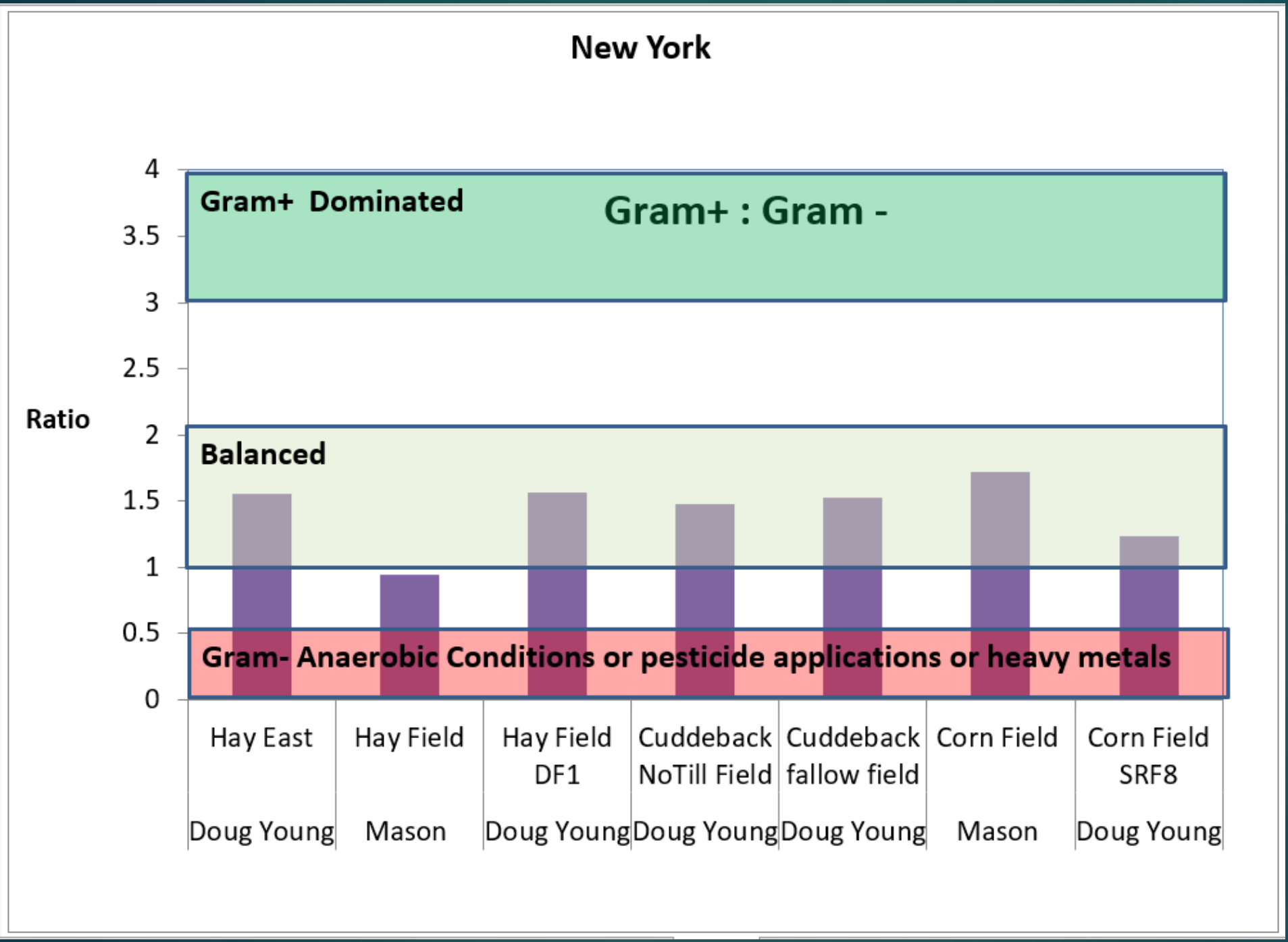
Spruce Haven Farm Soil Health Testing Summary

Ward Laboratories, Kearney, Nebraska

	Excellent	Very Good	Good	Above Average	Average			
Description	PLFA gn/g	Diversity Index	Fungi: Bacteria Ratio	Predator: Prey	Organic Matter % LOI	Soil Health	Solvita CO2 Burst ppm C	Total Organic Carbon ppm C
Spruce Haven Corn Silage	4797	1.503	0.1625	0.0189	3.1	9.09	45.5	45.5
Mason Corn Silage	2979.17	1.662	0.2316	0.029	1.3	13.96	71.6	249
Cuddeback Fallow	4772	1.602	0.2331	0.0337				
Mason Alfalfa Hay	5970	1.605	0.246	0.0302				


New York
Total Fungi Biomass
ng/g
700
600
500
400
300
200
100
0
297
644
287
346
605
146
474
Hay East
Doug Young
Hay Field
Mason
Hay Field DF1
Doug Young
Cuddeback NoTill Field
Doug Young
Cuddeback fallow field
Doug Young
Corn Field
Mason
Corn Field SRF8
Doug Young


Minimum and
Conventional Tillage
Bacterial
Fungal
No-Tillage



Sampling Date October 5th…….

Anaerobic Soil Conditions Increase resulting from Silt Density Layer development during the growing season?

SRF8 Conventional tillage vs. Mason Corn

Hay Field- Mason Tilled once per year in the Fall…needs more??

Merrick Farms Anecdotal:

- Corn/Soybean Rotation
- Started Surface Application with Targeted tillage in 2001
- No Irrigation
- Annual Ryegrass and Cereal Rye covercroping was sporadic following corn
- Manure Strip-till unit by Deitrich

Merrick Farms October Strip-Till Applied Swine Manure

Field Number	Sample Depth (in.)	Total PPM N	Total PPM NO3-N	#/ac.	Total N 0-14" #/ac.	Total N 0-21" #/ac.	% of NO3-N	% of TOTAL N
Surface applied 3000 gpa Oct 2012								
OBS	0-7	39.23	33.67	92			68	56
OBS	7-14	18.17	10.66	42	134		21	26
OBS	14-21	13.03	5.4	30		164	11	19
Strip-Applied 3000 gpa at 3 in. deep Nov. 2014						150 314		
OBS-in row	0-7	37.89	32.33	88			45	39
OBS-in row	7-14	28.97	18.68	68	156		26	30
OBS-in row	14-21	30.29	20.72	71		227	29	31

PAL Tested May 25th, 2015

Black Prairie Farms: Anecdotal

Corn-Soybean rotation

Pivot Irrigated

No Covercrops

Surface applied Manures following Soybean harvest

Fluted coulter outfitted toolbar on applicator

PSNT samples taken June 1st

CurseBuster tillage in fall before manures applied for two corn crop years prior to these tests

Black Prairie Farms- Goshen, IN- Lester Graber -- 24 years Continous Zero-Till _PSNT

Fields Number	depth in.	Total PPM N	Total PPM NO3-N	#/ac.	Total N 0-14 #/ac.	Total N 0-21 #/ac.	% of NO3-N	% of TOTAL N
LS 33	0-7	50.72	46.39	118			44	43
	7-14	41.84	36.15	98	216		35	36
	14-21	24.64	21.72	57		273	21	21
Home 20	0-7	21.6	19.12	50			31	29
	7-14	22.9	18.29	53	104		30	31
	14-21	28.82	23.37	67		171	38	39
Home 55	0-7	38.42	34.49	90			44	41
	7-14	32.3	26.29	75	165		34	35
	14-21	21.98	16.88	51		216	22	24
Home 140-S	0-7	63.21	52.08	147			49	47
	7-14	35.58	28.76	83	231		27	26
	14-21	35.67	26.03	83		314	24	27
Home 90 N Dairy	0-7	151.62	140.11	354			47	46
	7-14	90.59	82.38	211	565		28	28
	14-21	84.13	74.24	196		761	25	26
Home 90N Duck	0-7	182.27	167.03	425			39	37
	7-14	155.16	136.7	362	787		32	31
	14-21	159.08	126.94	371		1159	29	32
Home 90 SW	0-7	124.08	107.68	290			52	50
	7-14	74.68	60.34	174	464		29	30
	14-21	49.94	38.2	117		580	19	20

Lower TEC Soils

Dairy= More Carbon + Stablized Duck=less C and no Stabilizer

Hi-er TEC Soils

“One option is a DMI toolbar with a straight coulter and Dietrich shanks that allow for belowground incorporation. He runs a Genesis Tillage aerator that creates pockets on the soil surface for manure to settle and absorb into the ground.” By Darrell Bruggink posted on January 1, 2010 | Posted in Nutrient Management…Lessiter Pub.

Symptomatic of the disinformation published over the last 20+ years.

1.) The manure is already under the soil surface
2.) This aerator does not leave an open “pocket” unlike the Shattertine from Aerway
3.) The manure will diffuse (away from the concentration in the strip) through fracture lines
4.) The two machines control the flushing effect of strip-tilling (Merrick experience)

7000 gpa = <0.25" rainfall

Concentrated in 30 inch bands that are 6 inches deep

Producing methane and evolving Hydrogen Sulfide gas for many hours

Manure has a head start for ground water contamination at the bottom of the trench

Kewanee County, WI
50% of rural wells are contaminated from dairy manure

7000 gpa = < 0.25" Rainfall

Methane production and H_2S gassing gone in 20 minutes or less

Walk on dry soil in less than an hour after application.

All of the cereal rye stubble still covering the soil surface

AND, most importantly,

Rye roots still intact where they grew, supplying sunstrates for decomposing microbes being fired up with regular daily gas exchange

Building Soil Health (resulting in healthier everything else)

1.) Soils must infiltrate water and percolate it as well. Infiltration is only as great as percolation. Rain simulators miss this.

2.) Behavior of water, from the surface to the water table, determines soil gas exchange.

3.) Gas exchange is the KEY to microbiome respiration efficiency and growth.

4.) Every component in soil food web is ultimately responsible for creating a healthy nutrient dense plant.

5.) Plants are the generators of virtually all carbon resources needed for microbiome growth and reproduction.

6.) Root systems are the conduits between the sun's energy and the microbiome of the plant and soil which are a reflection of each other.

In Psalm 127, Solomon says, “Unless the Lord builds the house, those who build it labor in vain.”

Adding a Room to your House !!!
Does it require you to tear down the house?

Can we satisfy God's Command to till without tearing down the House to which we are adding more space?

www.soilcursebuster.com

Thank You for your kind attention and may the God of Heaven Bless you all in the days ahead.