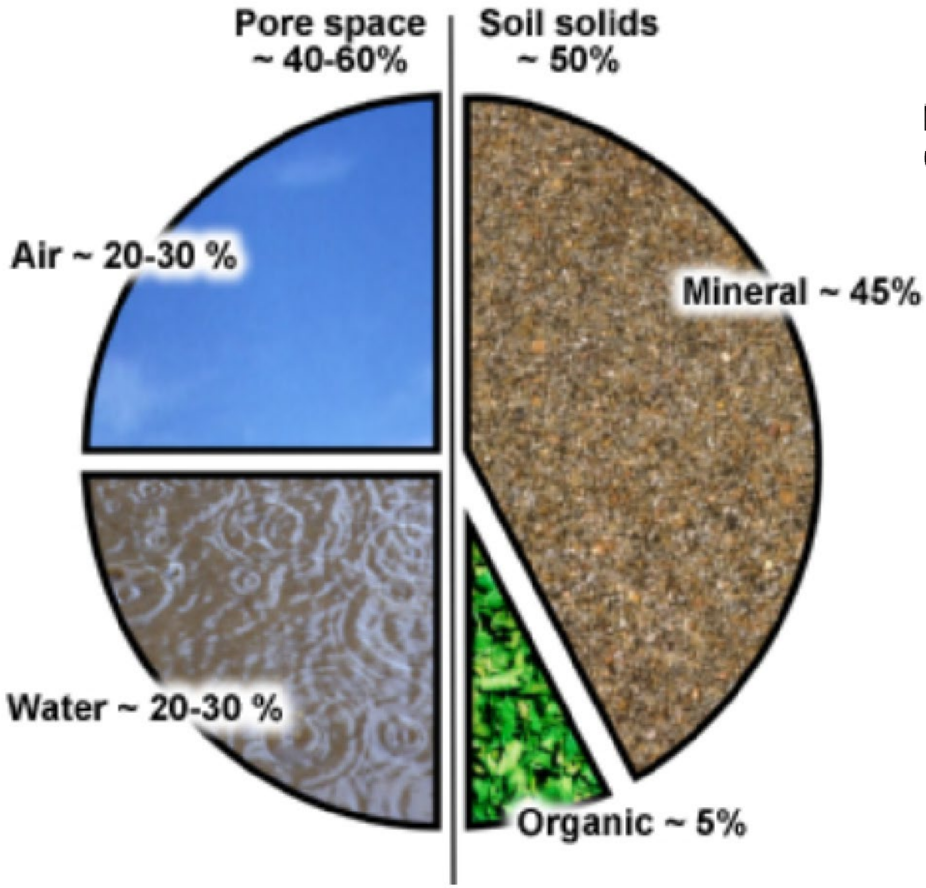
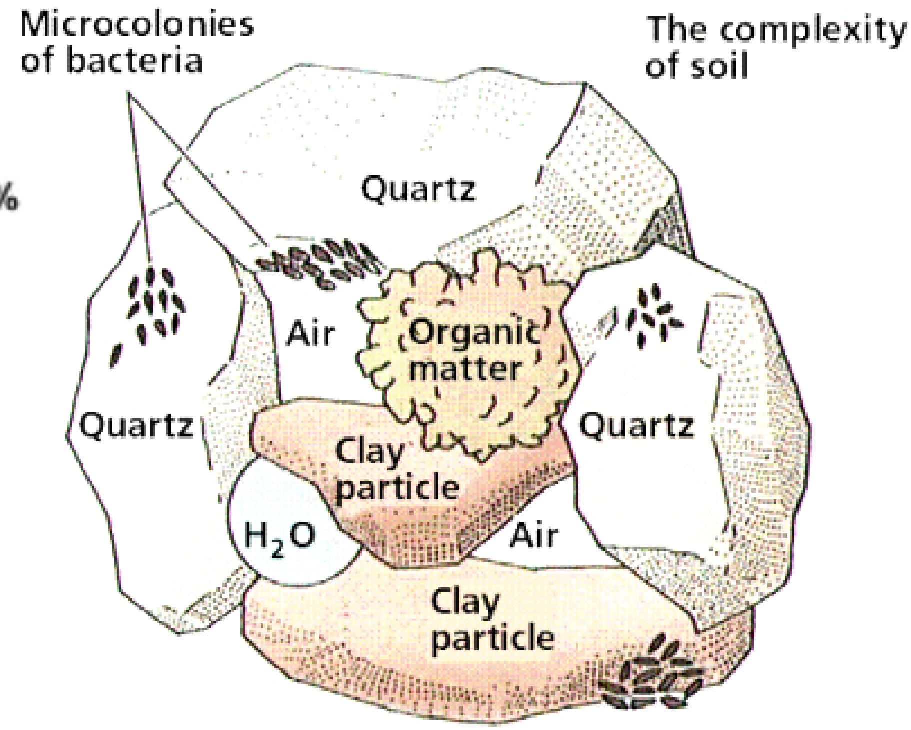
MARION COUNTY

SOIL AND WATER

CONSERVATION DISTRICT

Clean Water Indiana



North Carolina Coop Extension

Each 1 % of Organic Matter contains

10,000 lbs. of Carbon

1000 lbs. of Nitrogen

100 lbs. of Phosphorous

100 lbs. of Sulfur

.3" – 1" of H_2O

By **increasing the water absorption** of all of the cropland in the Mississippi River Basin by just **one-half inch** (through improved soil health), that water retention would be the equivalent of **the amount of water that flows over Niagara Falls in 83 days**!!!

Color – Texture – Taste – Vitamin Content – Disease Resistance – Pest Resistance – Fruiting Size – Reproduction – Drought Resistance – Cold and Heat Resistance – Etc.

Soil Health

Minimize Soil Disturbance

Maximize Soil Cover

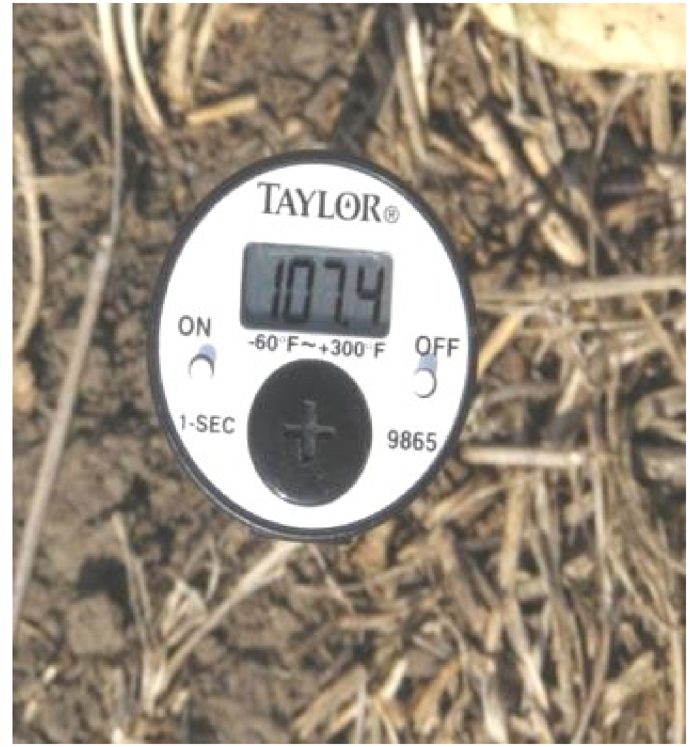
Maximize Continuous Living Roots

Maximize Plant and Biological Diversity

MINIMIZE DISTURBANCE


MAXIMIZE SOIL COVER


The
amboo
SMALL
ardener



TEMP	OUTCOME
70 degrees	100% of moisture is used for plant growth
95 degrees	15% of moisture is used for growth and 85% is lost through evaporation and transpiration
130 degrees	100% of moisture is lost
140 degrees	Soil biota die
Source: USDA SCS	

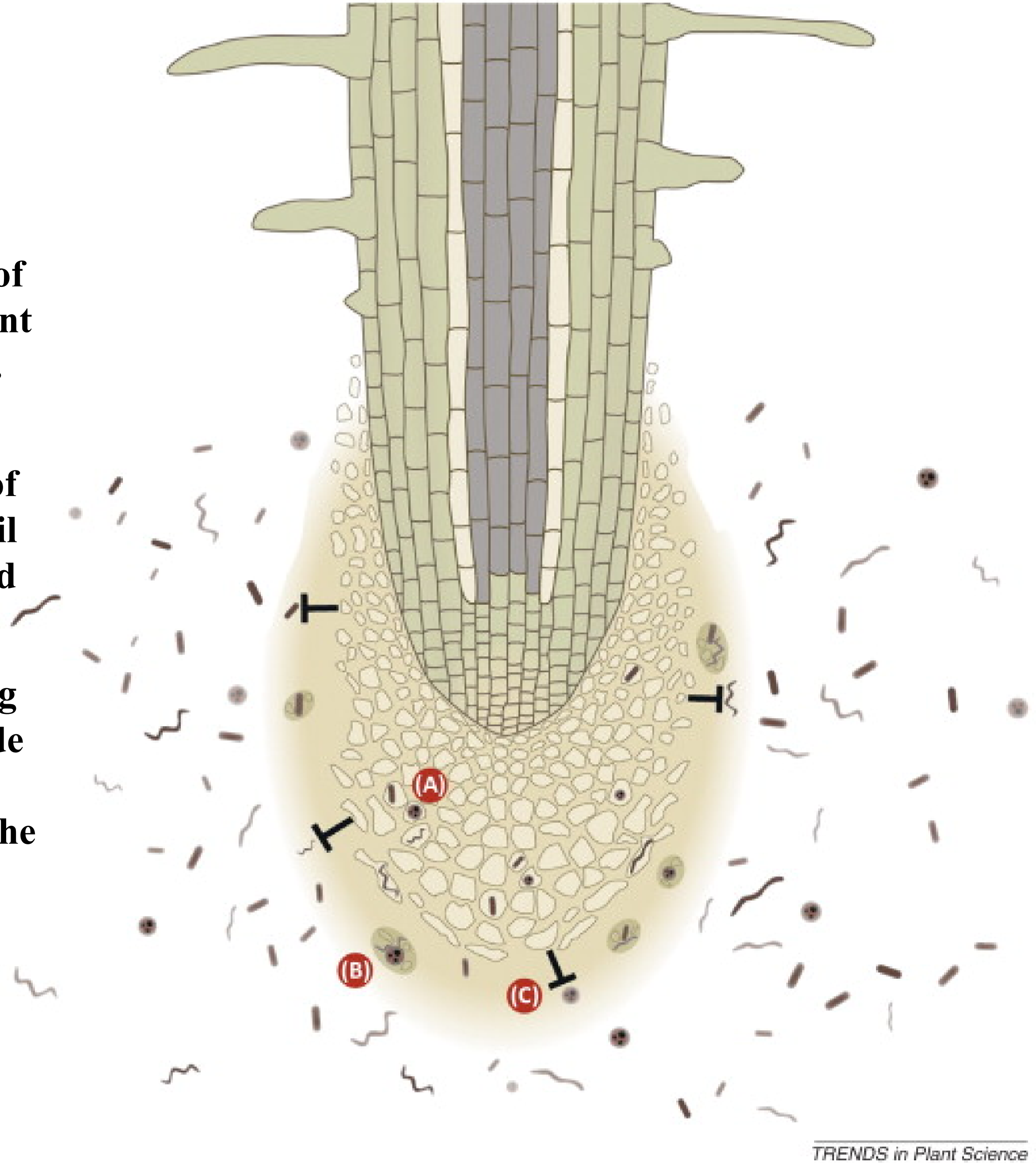

MAXIMIZE LIVING ROOTS


Photo credit: Dan Perkins

Thousands of different plant exudates…

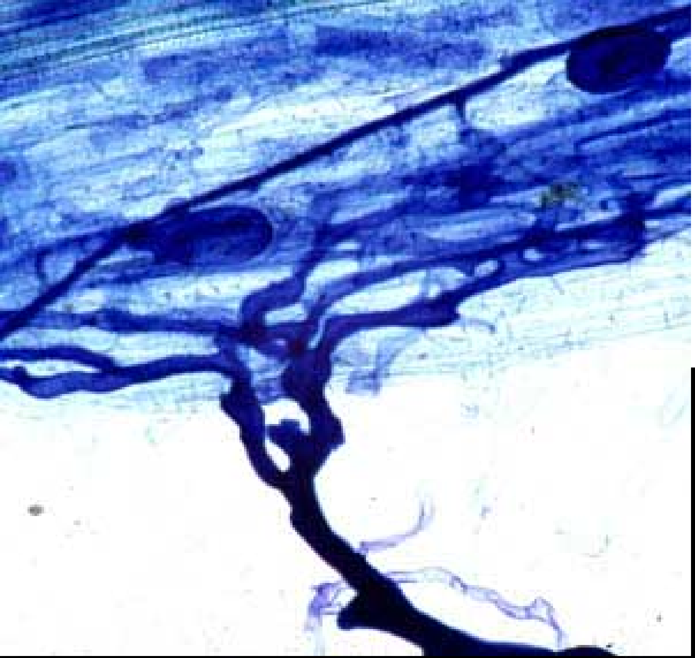
attract thousands of different soil bacteria and fungi…

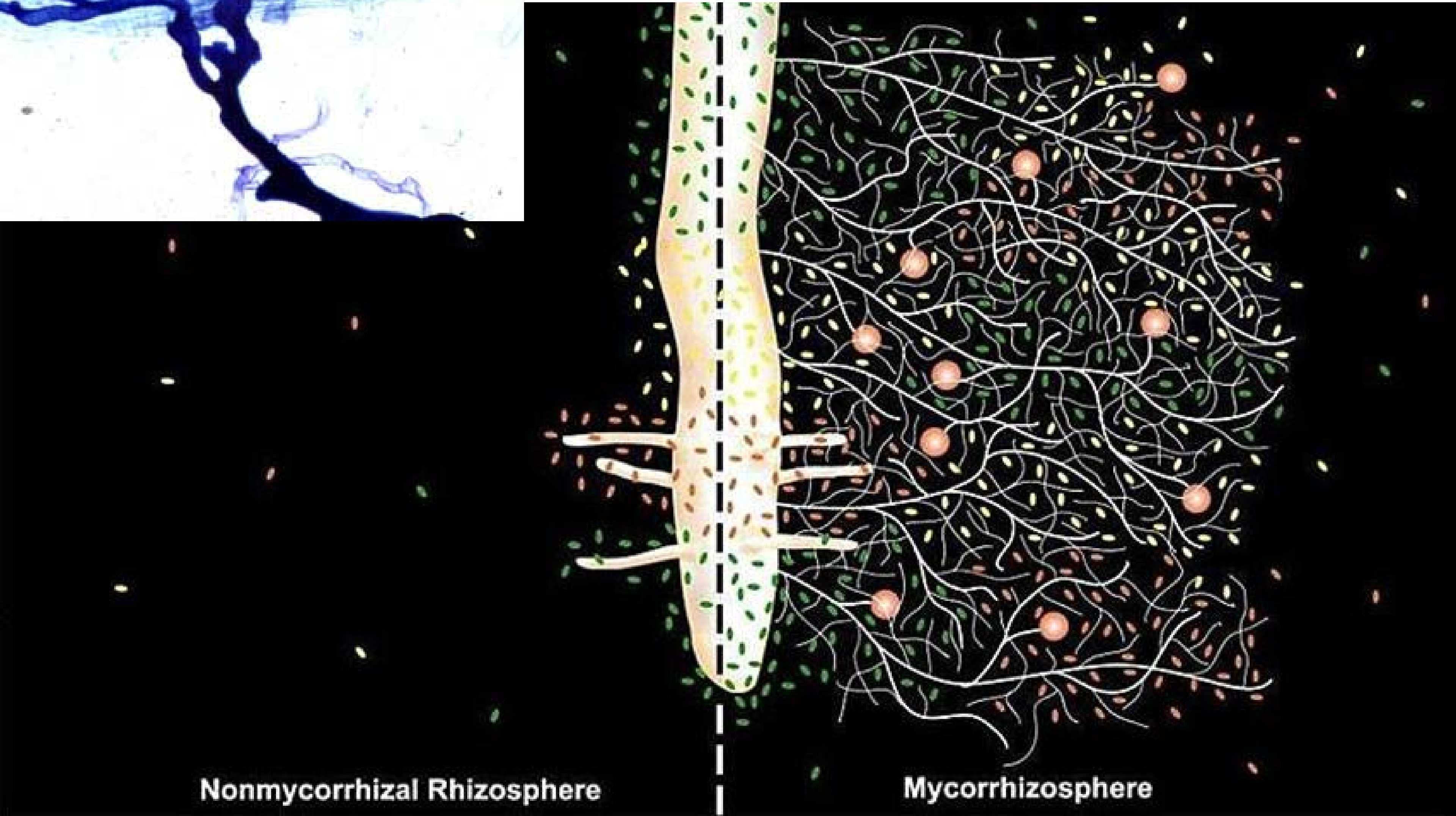
which bring the multitude of trace minerals to the plant.



Mycorrhizal Fungi

Soil aggregation, water, nutrients, improved N-fixation, resistance to fungal disease, parasitic nematodes, drought, salinity, and aluminum toxicity





MAXIMIZE PLANT & BIOLOGICAL DIVERSITY

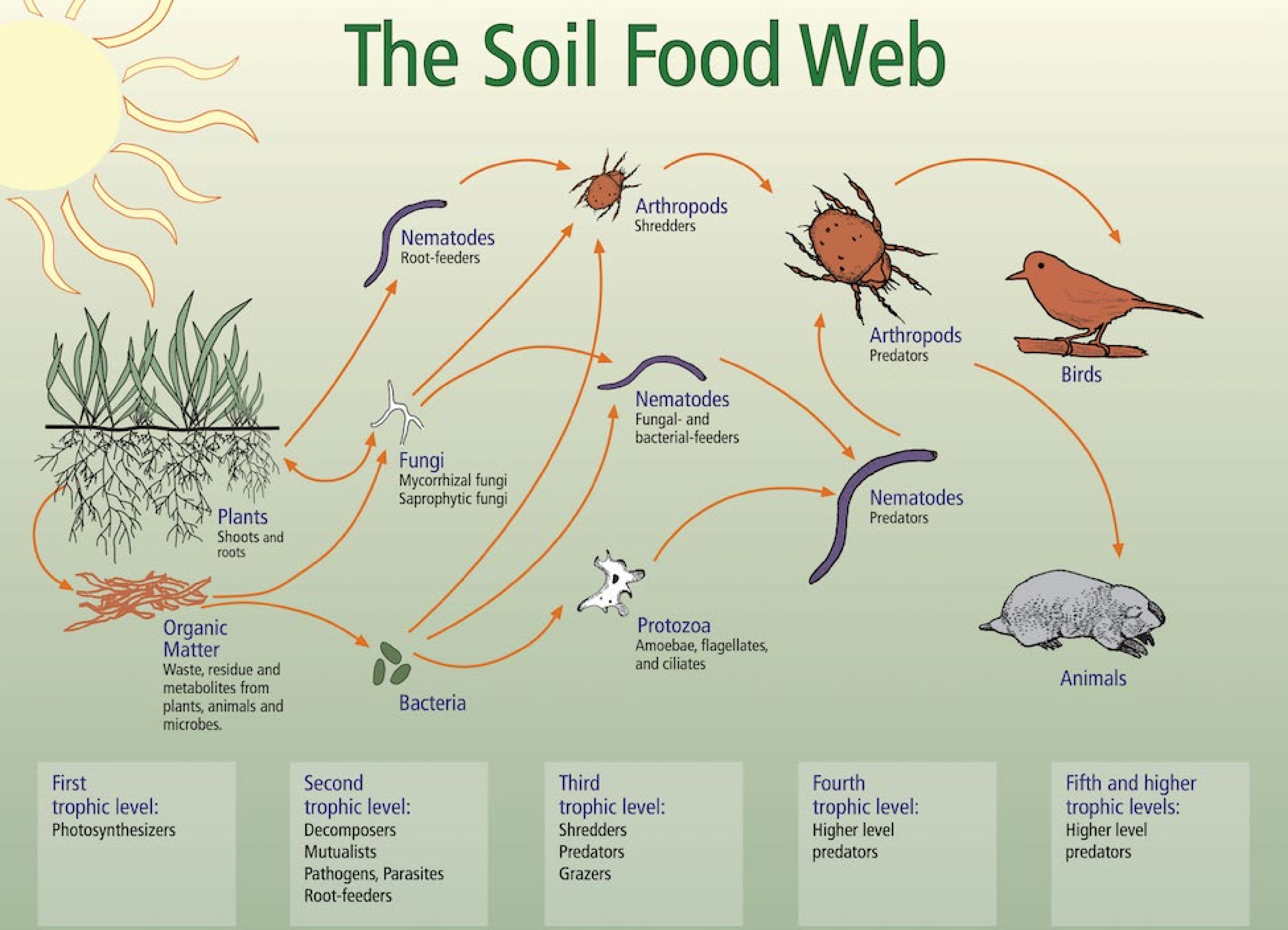
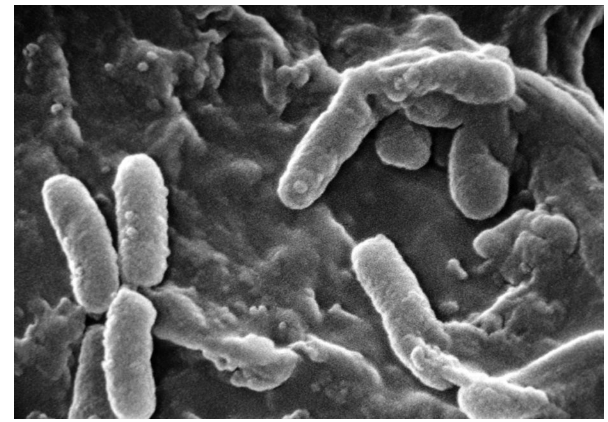


Image courtesy of National Resource Conservation Service (NRCS).

Bacteria



- Contribute to soil stability
- Decompose pesticides
- Feed on organic matter that is easy to breakdown
- Store and cycle nitrogen

Fungi

- Store and release nitrogen
- Form mutualistic relationships with plants
- Feed on hard to decompose organic matter

Nematodes and Protazoa

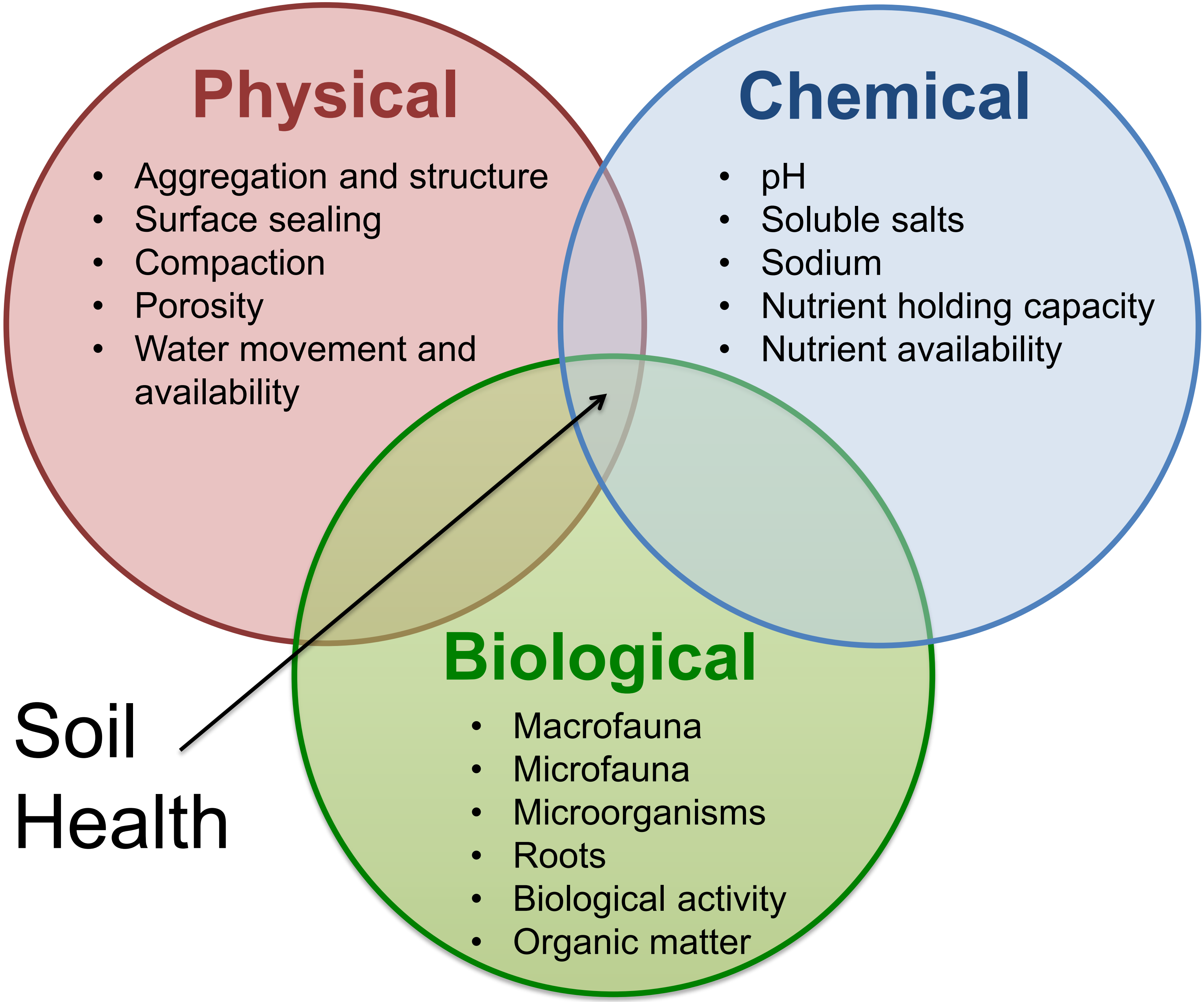
- Contribute to soil stability
- Important part of the nitrogen cycle
- Help keep the bacterial population in balance

Microarthropods

- Shred and decompose organic matter

Earthworms

- Good for nutrient cycling and stability functions
- Burrowing through lubricated tunnels forces air in and out of soil
- Earthworm casts contain 11% of the humus and 7X the nitrogen, 11X the phosphorus, and 9X the potash than surrounding soil


Physical
Aggregation and structure
Surface sealing
Compaction
Porosity
Water movement and availability
Chemical
pH
Soluble salts
Sodium
Nutrient holding capacity
Nutrient availability
Biological
Macrofauna
Microfauna
Microorganisms
Roots
Biological activity
Organic matter
Soil Health

Soil Testing
& Nutrient Management

DEFINITION

- Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

PURPOSE

- To budget, supply, and conserve nutrients for plant production.
- To minimize agricultural pollution of surface and groundwater resources.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To maintain or improve the physical, chemical, and biological condition of soil.

GOAL
Develop a nutrient budget for nitrogen, phosphorus, and potassium that considers all potential sources of nutrients including, but not limited to, green manures, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.

MARION COUNTY
SOIL AND WATER
CONSERVATION DISTRICT


5m
16FEET

Sample ID: EC8 Lab Number: 75812

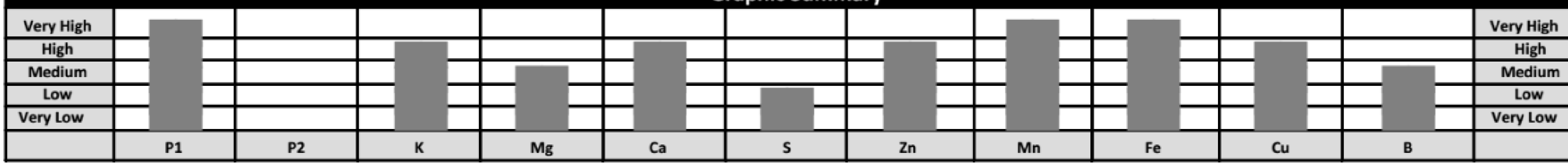
SOIL TEST REPORT

Soil Test Results

Organic Matter %	Phosphorus: Bray-1 Equiv ppm	Phosphorus: Bray P2 ppm	Potassium K ppm	Magnesium Mg ppm	Calcium Ca ppm	Sodium Na ppm	pH: Soil pH	pH: Buffer pH	CEC meq/100g	Cation Saturation: % K	Cation Saturation: % Mg	Cation Saturation: % Ca	Cation Saturation: % H	Cation Saturation: % Na
3.2	133		198	180	1750		7.4		10.8	4.7	13.9	81.3		

Sulfur S ppm	Zinc Zn ppm	Manganese Mn ppm	Iron Fe ppm	Copper Cu ppm	Boron B ppm	Soluble Salts (1:2) mmho/cm	Nitrate NO_3-N ppm	Ammonium NH_4-N ppm	Bicarbonate-P P ppm	Chloride Cl ppm		Aluminum Al-M3 ppm
7	5.1	64	98	1.8	1.1							

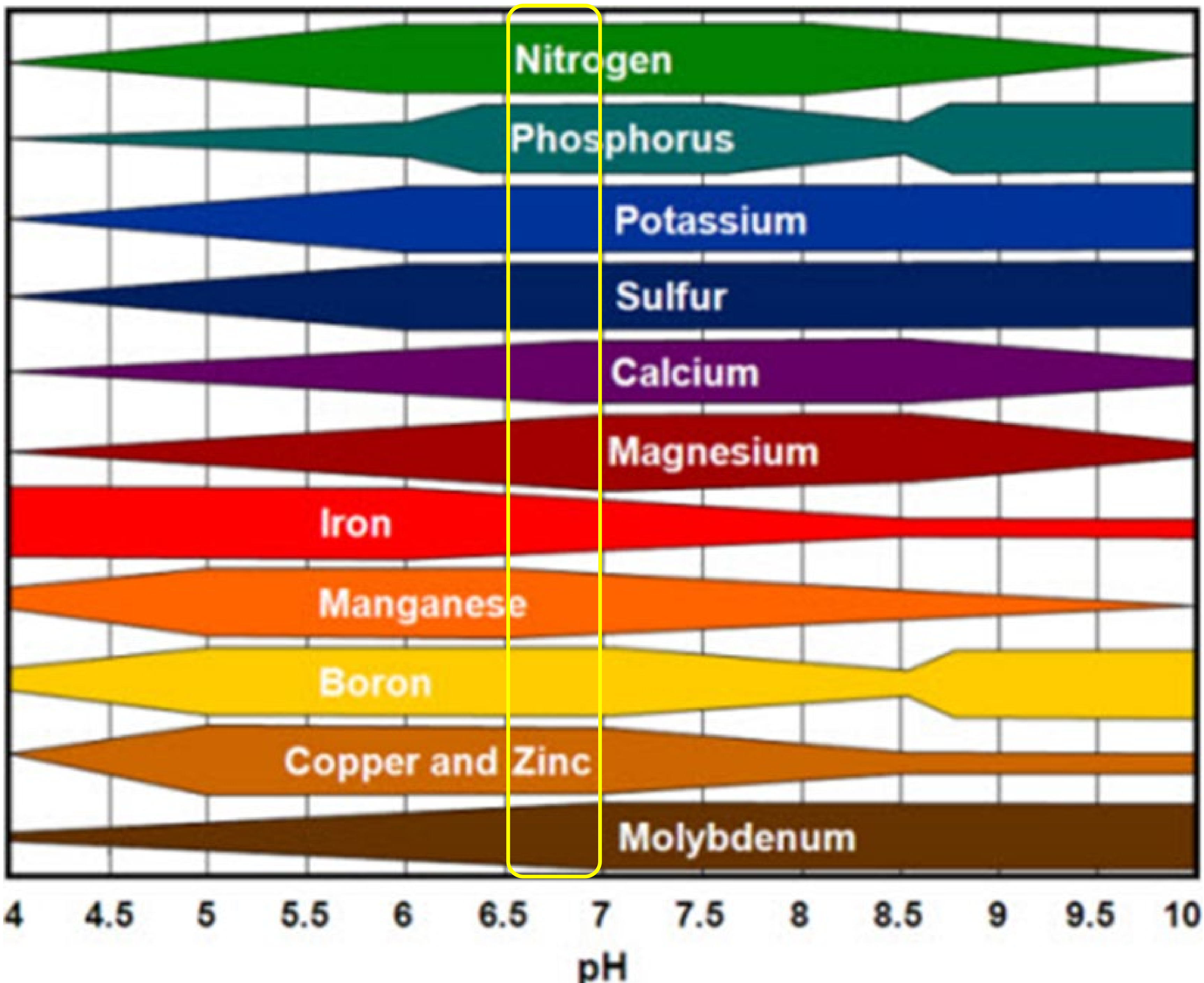
Graphic Summary



Soil Fertility Recommendations

Intended Crop	Yield Goal	Previous Crop	Lime Tons/A	Nitrogen N lb/A	Phosphate P_2O_5 lb/A	Potash K_2O lb/A	Magnesium Mg lb/A	Sulfur S lb/A	Zinc Zn lb/A	Manganese Mn lb/A	Iron Fe lb/A	Copper Cu lb/A	Boron B lb/A
Market Garden		Market Garden	0.0	145	0	100	0	26	3.0	0	0	0	1.0

Sample EC8: MARKET GARDEN- The soil pH is high (alkaline soil) and may affect the growth and production of some garden plants. Apply and till in 10 pounds of sulfur per 1,000 square feet in the fall on a yearly basis until the soil pH is 7.0 or less.


Nitrogen
Phosphorus
Potassium
Sulfur
Calcium
Magnesium
Iron
Manganese
Boron
Copper and Zinc
Molybdenum
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
pH

Element	Common Available Form	Source
Needed in large amounts		
Carbon	CO_2	atmosphere
Oxygen	O_2, H_2O	atmosphere and soil pores
Hydrogen	H_2O	water in soil pores
Nitrogen	NO_3^-, NH_4^+	soil
Phosphorus	$H_2PO_4^-$, HPO_4^{-2}	soil
Potassium	K^+	soil
Calcium	Ca^{+2}	soil
Magnesium	Mg^{+2}	soil
Sulfur	SO_4^{-2}	soil
Needed in small amounts		
Iron	Fe^{+2}, Fe^{+3}	soil
Manganese	Mn^{+2}	soil
Copper	Cu^+, Cu^{+2}	soil
Zinc	Zn^{+2}	soil
Boron	H_3BO_3	soil
Molybdenum	MoO_4^{-2}	soil
Chlorine	Cl^-	soil
Cobalt	Co^{+2}	soil
Nickel	Ni^{+2}	soil

Table 4. Nutrient analysis (percent by weight) of common organic fertilizer materials (Gaskell et al., 2007)

Material	Nitrogen (% N)	Phosphorus (% P_2O_5)	Potassium (% K_2O)
Chilean nitrate	16	0	0
Blood meal	12	0	0
Feather meal	12	0	0
Fish meal/powder	10-11	6	2
Seabird & bat guano	9-12	3-8	1-2
Meat and bone meal	8	5	1
Soybean meal	7	2	1
Processed liquid fish residues*	4	2	2
Alfalfa meal	4	1	1
Pelleted chicken manure	2-4	1.5	1.5
Bone meal	2	15	0
Kelp	<1	0	4
Soft rock phosphate	0	15-30**	0
Potassium-magnesium sulfate	0	0	22
Cocoa shells	1	1	3
Cottonseed meal	6	2	2
Granite dust	0	0	5
Hoof & horn meal	11	2	0
Seaweed, ground	1	0.2	2
Muriate of potash (KCl)	0	0	60

* Note: all analyses are % by weight, as specified in state fertilizer laws. For liquids, product density (weight per gallon) should be used to calculate nutrient application rate: (g/ac)*(lb nutrient/g)=(lb nutrient/ac)

* *Soft rock phosphate provides only 1-3% of its P in acid soils, and little or no P in soils with pH over 7.

Table 1. Nitrogen requirement of vegetable crops based on seasonal nitrogen uptake

Low Total N Need <120 lb/acre	Medium Total N Need <120-200 lb/acre	High Total N Need >200 lb/acre
Baby greens	Carrot	Broccoli
Beans	Corn, Sweet	Cabbage
Cucumbers	Garlic	Cauliflower
Radish	Lettuce	Celery
Spinach	Melons	Potato
Squashes	Onion	
	Peppers	
	Tomatoes	

— *Gaskell et al. 2006, Soil Fertility Management for Organic Crops*

Crop	Yield range per acre	Soil organic matter content (%)			
		< 2.0	2.0–9.9	10.0–20.0	> 20.0
		lb N/a to apply[a]			
Alfalfa, seeding	1.0–2.5 ton	30	0	0	0
Alfalfa, established	2.6–9.5 ton	0	0	0	0
Apple, establishment[b]	—	2	2	2	2
Asparagus	2,000–4,000 lb	80	60	40	20
Barley[c]	25–100 bu	70	50	30	15
Bean, dry (kidney, navy)	10–40 cwt	40	30	20	10
Bean, lima	2,000–5,000 lb	60	40	20	10
Bean, snap	1.5–6.5 ton	60	40	20	0
Beet, table	5–20 ton	120	100	80	30
Blueberry, establishment[d]	—	30	30	30	30
Brassica, forage	2–3 ton	120	100	80	40
Broccoli	4–6 ton	100	80	60	25
Brussels sprouts	4–6 ton	100	80	60	25

Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin

Table 7.4 continued. Phosphorus (P) and potassium (K) fertilizer application rate guidelines.

Crop name	Yield goal (per acre)	P_2O_5 rate guidelines					K_2O rate guidelines					
		VL	L	O	H	EH	VL	L	O	H	VH	EH
		----------lb P_2O_5/a to apply[a]----------					----------lb K_2O/a to apply[b]----------					
Buckwheat	1,200–2,000 lb	60	50	20	10	0	65	50	20	10	5	0
Cabbage	8–12 ton	95	70	15	10	0	170	140	70	35	20	0
	12.1–20 ton	105	80	25	15	0	215	185	115	60	30	0
	20.1–30 ton	120	95	40	20	0	280	250	180	90	45	0
Canola	30–50 bu	85	75	45	25	0	125	110	80	40	20	0
Carrot	20–30 ton	125	100	45	25	0	340	310	240	120	60	0
Cauliflower	6–8 ton	100	75	20	10	0	150	120	50	25	15	0
Celery	25–35 ton	180	155	100	50	0	400	370	300	150	75	0

Nutrient Application Guidelines for Field, Vegetable, and Fruit Crops in Wisconsin

Table 4. Nutrient analysis (percent by weight) of common organic fertilizer materials (Gaskell et al., 2007)

Material	Nitrogen (% N)	Phosphorus (% P_2O_5)	Potassium (% K_2O)
Chilean nitrate	16	0	0
Blood meal	12	0	0
Feather meal	12	0	0
Fish meal/powder	10-11	6	2
Seabird & bat guano	9-12	3-8	1-2
Meat and bone meal	8	5	1
Soybean meal	7	2	1
Processed liquid fish residues*	4	2	2
Alfalfa meal	4	1	1
Pelleted chicken manure	2-4	1.5	1.5
Bone meal	2	15	0
Kelp	<1	0	4
Soft rock phosphate	0	15-30**	0
Potassium-magnesium sulfate	0	0	22
Cocoa shells	1	1	3
Cottonseed meal	6	2	2
Granite dust	0	0	5
Hoof & horn meal	11	2	0
Seaweed, ground	1	0.2	2
Muriate of potash (KCl)	0	0	60

* Note: all analyses are % by weight, as specified in state fertilizer laws. For liquids, product density (weight per gallon) should be used to calculate nutrient application rate: (g/ac)*(lb nutrient/g)=(lb nutrient/ac)

* *Soft rock phosphate provides only 1-3% of its P in acid soils, and little or no P in soils with pH over 7.

Pounds/Acre	55
Square Feet	100
Ounces/Area	2.02

	Goal	Actual	Amount	Bloodmeal	Feathermeal	Kelp Meal	Alfalfa Meal	Elemental Sulfur	Gypsum
					18				
Nitrogen	2.00	2.16	N	13	12	1	2.5		
Phosphrous		0.00	P2O5			0.3	1		
Potassium		0.06	K20		0.35	2.5	1		
Sulfur		0.07	S		0.4	2		90	16
Calcium		0.11	Ca		0.6	2			21
Magnesium		0.00	Mg			0.7			
Sodium		0.00	Na						
Boron		0.00	B						
Iron		0.00	Fe						
Manganese		0.00	Mn						

Sample ID: C11
Lab Number: 91580

COMPOST ANALYSIS

Date Received: 4/14/2017
Date Reported: 4/18/2017

Analysis	Unit	Analysis Result	Dry Basis Result	Analysis Method
Moisture @ 70 C	%	41.62		TMECC 03.09-A
Solids	%	58.38		TMECC 03.09-A
Total Nitrogen (N)	%	0.48	0.83	TMECC 04.02-D
Phosphorus (P)	%	0.12	0.21	TMECC 04.03-A
Phosphate (P_2O_5)	%	0.28	0.48	TMECC 04.03-A
Potassium (K)	%	0.21	0.36	TMECC 04.04-A
Potash (K_2O)	%	0.25	0.43	TMECC 04.04-A
Sulfur (S)	%	0.08	0.13	TMECC 04.05-S
Magnesium (Mg)	%	0.74	1.26	TMECC 04.05-MG
Calcium (Ca)	%	3.75	6.43	TMECC 04.05-CA
Sodium (Na)	%	0.01	0.02	TMECC 04.05-NA
Iron (Fe)	%	0.99	1.70	TMECC 04.05-FE
Aluminum (Al)	%	0.71	1.21	TMECC 04.07-AL
Copper (Cu)	mg/kg	45	77	TMECC 04.05-CU
Manganese (Mn)	mg/kg	269	461	TMECC 04.05-MN

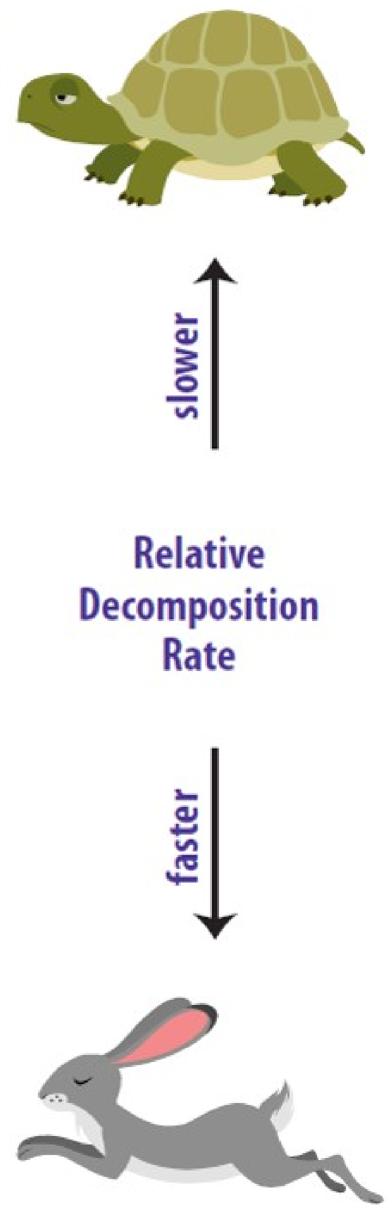
TMECC - Test Methods for the Examination of Composting and Compost (TMECC), The U.S. Composting Council.

Analysis	Unit	Analysis Result	Dry Basis Result	Analysis Method
Zinc (Zn)	mg/kg	209	358	TMECC 04.05-ZN
pH	-	7.7		TMECC 04.11-A
Soluble Salts	dS/m	0.23		TMECC 04.10-A
Ash @ 550 C	%	40.85	69.98	TMECC 03.02-B
Organic Matter (LOI @ 550 C)	%	17.53	30.02	TMECC 05.07-A
Total Organic Carbon (C)	%	8.76	15.01	TMECC 04.01-A
Carbon:Nitrogen Ratio (C:N)	-	18.1:1	18.1:1	TMECC 05.02-A

Compost	
Weight (lbs/cubic ft.)	40
Depth (inches)	1
Area (square ft.)	100
Cubic Feet	8.3
Total Weight (lbs)	333.3
% Nutrient	0.48
Nutrient Content (lbs)	1.6
Nutrient Content (oz)	25.6
Available in Year (%)	10.0
Nutrient Contribution (oz)	2.6

Table 1. Carbon to nitrogen ratios of crop residues and other organic materials

Material	C:N Ratio
rye straw	82:1
wheat straw	80:1
oat straw	70:1
corn stover	57:1
rye cover crop (anthesis)	37:1
pea straw	29:1
rye cover crop (vegetative)	26:1
mature alfalfa hay	25:1
Ideal Microbial Diet	**24:1**
rotted barnyard manure	20:1
legume hay	17:1
beef manure	17:1
young alfalfa hay	13:1
hairy vetch cover crop	11:1
soil microbes (average)	8:1



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