Hazelnuts
Orientation points in regenerative agriculture

Corporates transitions to regenerative, JBS, Mars, Nestlé, PepsiCo, Walmart, Danone, General Mills, McCain, Sodexo.

The primary objective of regenerative is to maximize photosynthesis to naturally enhance soil quality by sequestering carbon from the atmosphere, capturing nitrogen from the air and phosphorus from the soil.

Regenerative tests

- PLFA, Chemical signal to different groups of microbe, (Arbusculus fungus).
- Haney test, measures nitrogen availability and microbial respiration and activity.
- DNA test: Biology and pathogen analysis.
- Mineral Assey test: (mine test, total nutrient digestion).
- Croptix test: measures nutrition in leaves.
- MicroBiometer: measures ratio F/B and microbial biomass.
- Refractometer Brix reading for sugar and mineral.

Empirical Research Measurement Tools

Brix	EC	pH	Ca	K
Na	N	Microscope	Chlorophylle	

source internet - www.aquaportail.com

Microbiometer

MicroBiometer soil analysis chart

Microbial Biomass	Low	Fair	Good	Excellent
Agriculture soil	Less than 200	200 -400	400 - 600	600+
Container soil	Less than 500	500 -700	700 - 1200	1200+
Compost	Less than 500	500 - 700	700 - 1200	1200+
Compost Tea	Less than 20	20 - 30	30 - 60	60+
Compost Extract	Less than 30	40 - 40	40 - 80	80+

F=fungal B =Bacteria Microbial biomass carbon = ug C /g

Name	Produit	F	B	ug C /g
Premix	Compost	56%	44%	733
Neil wormcasting	Compost	47%	53%	706
Compost # 5 Larocque	Compost	5%	95%	95
Compost # 6 Larocque	Compost	32%	68%	288
Blueberry Hedge Yves Larocque	Soil	34%	66%	270
Blueberry Field # 18 Yves Larocque	Soil	25%	75%	247
Blueberry Field # 20 Yves Larocque	Soil	27%	73%	306

Quality Data Sheet Template

Project Name:_____ Type of crop:_____

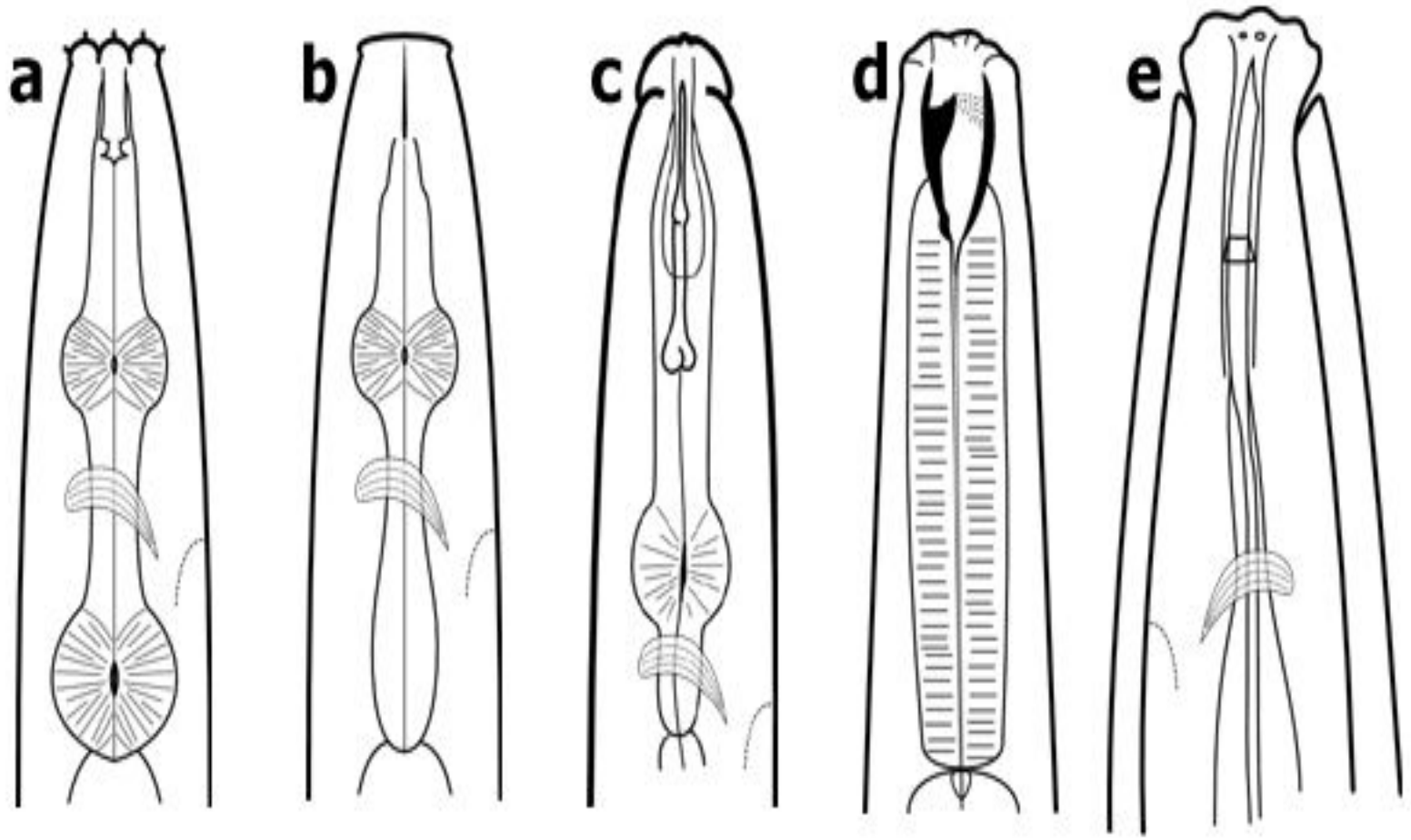
Date of sample :_____ Sample Number:_____

- F-B ratio depends on plant type

Bacteria	300-3000	Actinobacteria	1 - 4 (um/g)
Fungi	300-3000		Microgramme
Protozoa	- 50 000 total	Flagellates Amoebaes Ciliates	
Nematodes	200	Bacteria feeding	
Nematodes	20	Fungal feeding	

Nematodes

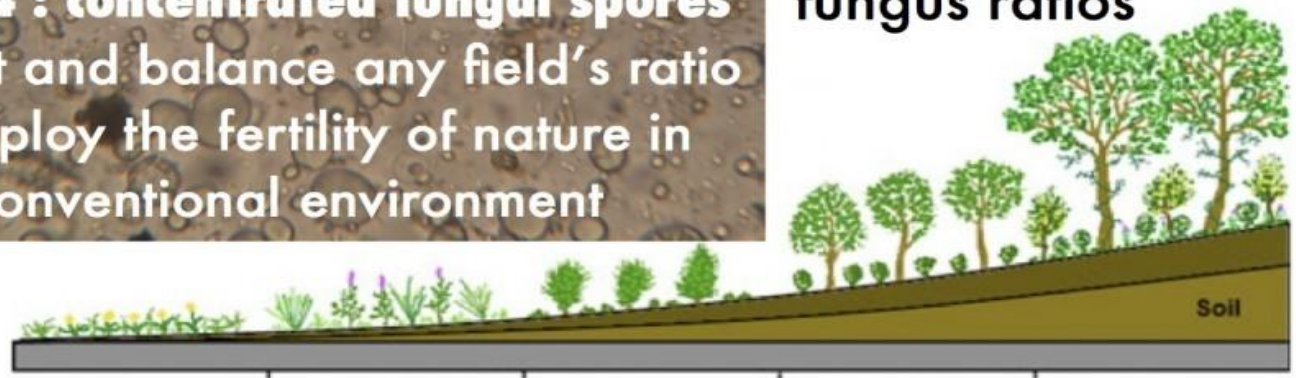
Bacteria Fungal Plant Predator Omnivore



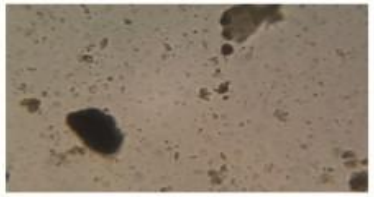
Proportion of Microbial Life

SCIENCE

plants thrive in ideal bacteria to fungus ratios



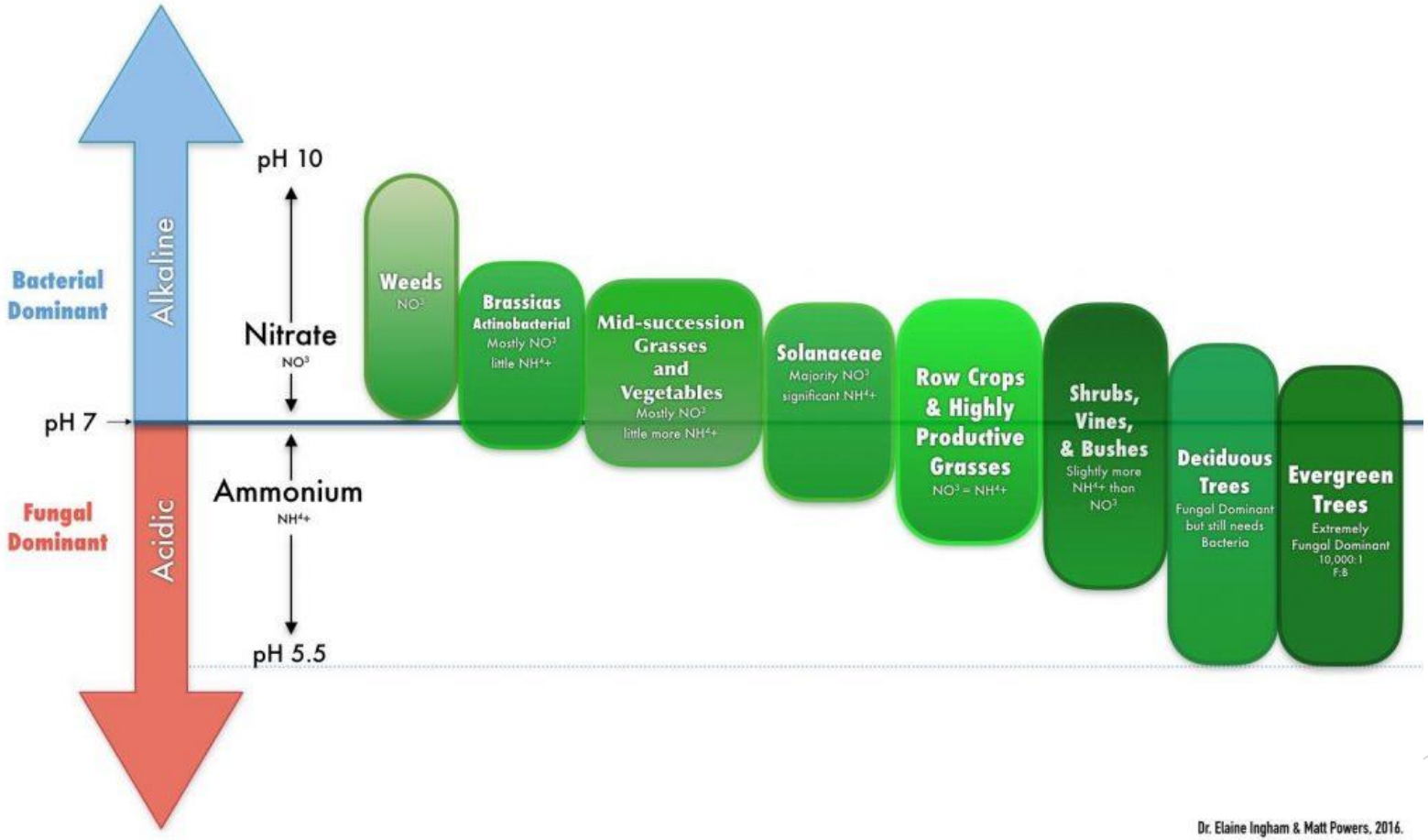
	Weeds	Pioneer Plants (Annual)	Perennial Plants and Grasses	Veggies	Trees	Climax Forest (Mature Forest)
Bacteria	10	100	500	600	500	700
Fungus	0	10	250	600	800	7,000



This is where we want to be

get closer now @ NaturalFarmingHawaii.net

Bacteria vs Fungus



Dr. Elaine Ingham & Matt Powers, 2016.

Compost tea and extraction tank

Photosynthesis

- CO_2 plus H_2O plus sun = ATP (sugar)
- Sugar carbon eventually forms fat, oils, phospholipids.
- As photosynthesis activity increases, the production of the amino acid arginine from exudate increases, the deeper the roots will be in the soil.

The activity of photosynthesis

- The activity level of photosynthesis is about 15% to 20%.
- The goal of Regenerative Agriculture: to increase the level of activity to 40% or 60% and above.
- This means that your fruit will be sweeter and healthier.
- Complete protein synthesis. This means that there is no nitrogen (ammonium or nitrate) left that is not converted into the complete protein (amino acid), so there is no food source for the insects.
- This increase in photosynthesis produces more than 1000 different kinds of sugar and amino acids, (Exudates and Biodiversity).

Carbone Sequestration

- The exudate carbon sequesters 5 to 30 times more carbon than through the decomposition of organic matter and is more stable.
- The necromass increases with the abundance of microbial life and its diversification, when it dies it gives back the carbon it has eaten from the exudate. (Dr. Christine Jones).

Brix level where insects loose interest in plant

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

At what Brix levels do various insects' loose interest in plants?

Aphid group 6 -8 Brix

Sucking insects 7 – 9 Brix

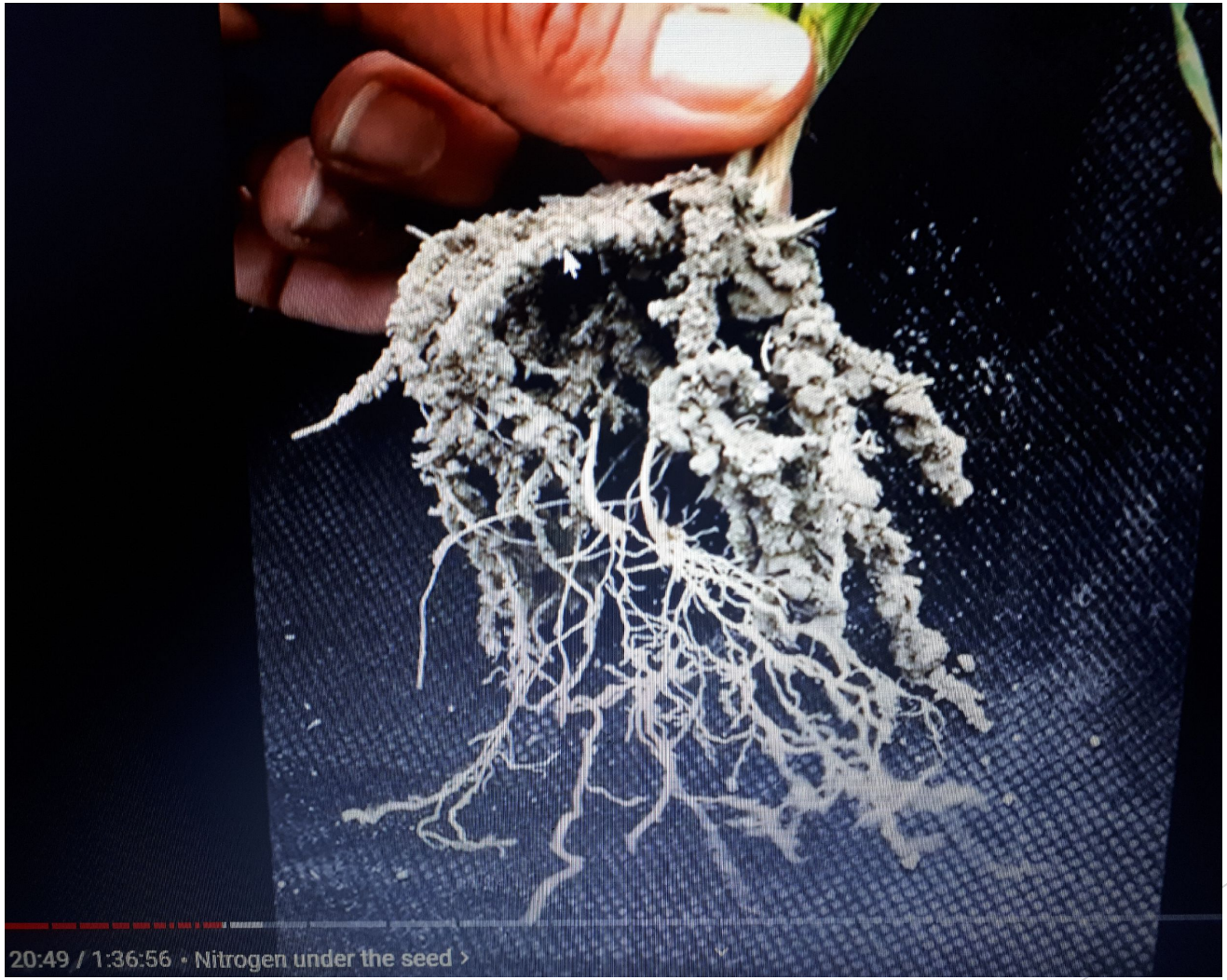
Chewing insects 9 – 11 Brix

Grasshopper group 10 – 12+

	Plant secondary metabolites increase Between 1 to 8.5 Brix	Water retention abilities increase Between 8.5 to 13	No insects No disease Higher than 13 brix

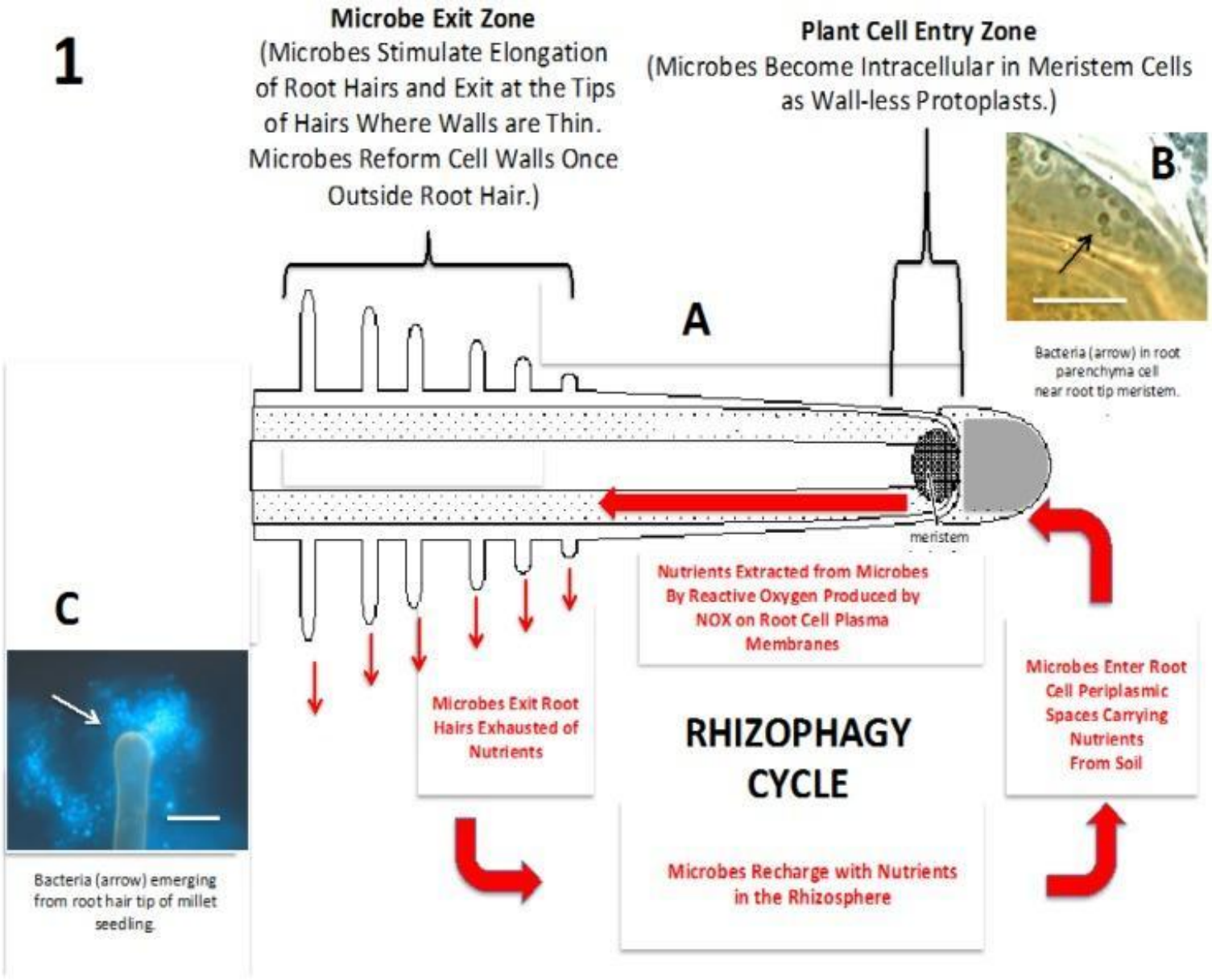
High Regenerative and Fine Roots Conventional Chemical

by Dr. Christine John



Rhizophagy cycle

- The rhizophage cycle is an oxidative process in the plant to extract nutrition from symbiotic microbes.
- The microbes produce ethylene and nitric oxide, which act as hormones that lengthen the cells of the root hairs.
- Endophytes have been found in 300,000 plant species.
- 40% of nitrogen and perhaps 70% to 80% of nutrient come from rhizophagy cycle.
- Dr. James F. White, Professor of Plant Biology. Rutgers University.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Microbe Exit Zone
(Microbes Stimulate Elongation of Root Hairs and Exit at the Tips of Hairs Where Walls are Thin. Microbes Reform Cell Walls Once Outside Root Hair.)
Plant Cell Entry Zone
(Microbes Become Intracellular in Meristem Cells as Wall-less Protoplasts.)
A
B
Bacteria (arrow) in root parenchyma cell near root tip meristem.
meristem
C
Bacteria (arrow) emerging from root hair tip of millet seedling.
Nutrients Extracted from Microbes By Reactive Oxygen Produced by NOX on Root Cell Plasma Membranes
Microbes Exit Root Hairs Exhausted of Nutrients
RHIZOPHAGY CYCLE
Microbes Enter Root Cell Periplasmic Spaces Carrying Nutrients From Soil
Microbes Recharge with Nutrients in the Rhizosphere

Order of activity of photosynthesis

- In order of importance:
- Light
- Temperature
- Water
- CO_2
- Manganese
- Iron
- From a soil in reduction form.

Manganese

- Manganese on the reduction form is the most important element for increasing photosynthesis because it divided the water molecule in the plant in H to OH and is called hydrolyzed water it works with iron, cobalt and copper.
- Iron, in the form of oxidation, remains in the plant tissues, while in the reduction phase, it is found in the sap and increases the activity of photosynthesis.

eH & pH

- pH = hydrogen proton.
- eH = hydrogen electron.

- In overly oxidized soil, the plant must provide too much energy for microbial life, which reduces the activity of photosynthesis.

Oxidized	versus	Reduced
Sandy soil	vs	Clay soil
Mn ++++	vs	Mn ++

The Biochemical Sequence of the Basis of Plant Nutrition by Hugh Lovel

- Preceded by sulfur.
- Boron provides pressure to the sap that activates Silica
- that carries all nutrients starting with Calcium
- that provides the glue that stick to Nitrogen
- Forming amino acids that allows DNA and the vision of cells and amino acids forming the protein especially chlorophyll which specifically affects trace elements and
- Magnesium that transfers energy to the
- Phosphorus and
- Carbon to form the sugars that go where the
- Potassium transport it.

The mobility of the elements in the plant

Immobile	Semi mobile	Mobile
Sulfur & Calcium	Sulfur	Nitrogen
Iron & Boron	Selenium	Phosphorus
Chlorine & Cobalt production	Iron	Potassium
Manganese & copper	Copper	Magnesium
Silica		Zinc
Barium & Cadmium		Molybdenum
Chrominium & Lithium		
Paladium & Vanadium		

Element Mobility Speed

Phloem fast elements	Phloem medium elements	Phloem slow elements
Potassium	Iron	Calcium
Magnesium	Zinc	Manganese
Phosphorus	Copper	
Sulfur	Boron	
Nitrogen	Molybdenum	
Sodium		
Chlorine		

Sap analysis by John Kempf

Element	Antidotes	Photosy-nthesis	Protein synthesis	Fruit Quality	Catalysis	Solution	Product
K	Mn			ДД	Mn	Mn	Holo K
Ca	B			ДД	B, Si	B, Si	Holo Cat Sea shield
Mg	N	ДД					Photo Mg Sea crop
Na	Ca						Sea crop Redmond Salt
NH^4	Carbohydrate						
NO_3	Mg, S, Mo						
Total N	Mg	ДД					Sea shield Urea
Cl	Ca, P						
S	N		ДД				Sea shield
P	Zn	ДД			Zn, Fe	Zn, Fe	Holo phos Sea shield
Si	...						Sea shield
Fe	P	ДД					Solute Rebound Iron
Mn	P	ДД					Solute/rebound Mn
Zn	P			ДД			Solute/rebound zinc
B	Ca		ДД				Solute/rebound Boron
Cu	P			ДД			Solute/rebound Copper
Mo	...		ДД				Solute/rebound Molybdenum

Boron Deficiency

A boron deficiency coats the permeability of the membrane. Boron deficiency reduces the retention of potassium, sucrose, phenol and amino acids.

Boron	Potassium	Sucrose	Phenol	Amino Acid
µm			µg g-1Fw	
0.01	630	900	79	163
0.20	390	440	72	122
1.0	52	70	17	33
20.0	18	20	13	2.3

A well-balanced soil includes

- **Calcium (Ca++) 60 to 80%**
- Magnesium (Mg++) 10 to 20%
- Potassium (K+) 2 to 5%
- Sodium (Na+) 1 to 4%
- Phosphorus (P-) = K in weight but in phosphate (P205) it must have twice as much as potassium (K20)
- Sulfur (s--) 50% of K and up to 300 PPM
- Iron (Fe+) 1/3 to ½ of K, minimum of 50 ppm
- Manganese (Mn+) 1/3 to ½ of Fe, minimum of 25 ppm
- Zinc (Zn+) 1/10 of P, 10 to 50 ppm
- Copper (Cu+) ½ of Zn, 5 to 25
- Boron (B+++ or B-) 1/1000 of Ca, 1 to 4 ppm
- Chlorine (Cl-)1 – 2 X Na, minimum of 25 ppm

Silicon concentration (ppm) in plant leaves

Rice	100,000	Winter squash	2,031
Wheat	40,000	Avocado	2,300
Mustard	30,000	Asparagus	2,400
Verbena	20,352	Clementine	2,500
Cannabis	20,000	Spinach	2,500
Cucumber	10,164	Strawberry	3,000
Corn	10,000	Apples	3,200
Sugarcane	7,300	Summer squash	3,497
Lettuce	7,000	Barley	3,600
Watermelon	6,340	Almonds	1,800
Mango	5,260	Summer grape	1,600
Sunflower	5,180	Walnuts	1,300
Pumpkin	4,591	Lavender	1,260
Apples	4,600	African Marigold	1,256
Grape	3,700	Pensy	1,107
Tomato	2,000	Bacopa	1,016

Huplaso Silicon product