Life in the Soil

Elaine Ingham, B.A., M.S., Ph.D.

President, Soil Foodweb Inc.

soilfoodweb@aol.com

Elaine Ingham, B.A., M.S., Ph.D.

Soil Microbiologist

St. Olaf College, Double Major in Biology and Chemistry Master's, Texas A&M, Marine Microbiology

Ph.D., Colorado State University, Soil Microbiology Research Fellow, University of Georgia

Assistant, Associate Professor, Oregon State University (1986 – 2001)

Rodale Institute, Chief Scientist 2011 - 2013

President, Soil Foodweb Inc., 1996 – present New York, Australia, New Zealand, South Africa, Canada East and West, England,



A Healthy Food Web Will:

- Suppress Disease (competition, inhibition, consumption; no more pesticides!)
- Retain Nutrients (stop run-off, leaching)
- Nutrients Available at rates plants require (eliminate fertilizer) leading to flavor and nutrition for animals and humans
- Decompose Toxins
- Build Soil Structure –(reduce water use, increase water holding capacity, increase rooting depth)

Minerals in soil (Sparks 2003)

Element	Soils	s (mg/kg)	In the Earth's	In Sediments
	Median	Range	crust (mean)	(mean)
0	490,000	-	474,000	486,000
Si	330,000	250,000-410,000	277,000	245,000
ΑΙ	71,000	10,000-300,000	82,000	72,000
Fe	40,000	2,000-550,000	41,000	41,000
C (total)	20,000	7,000-500,000	480	29,400
Са	15,000	700-500,000	41,000	66,000
Mg	5,000	400-9,000	23,000	14,000
K	14,000	80-37,000	21,000	20,000
Na	5,000	150-25,000	23,000	5,700
Mn	1,000	20-10,000	950	770
Zn	90	1-900	75	95
Мо	1.2	0.1-40	1.5	2
Ni	50	2-750	80	52
Cu	30	2-250	50	33
Ν	2,000	200-5,000	25	470
Р	800	35-5,300	1,000	670
S (total)	700	30-1 600	260	2 200

Nutrient Pools in Soil



Without organisms to retain the soluble nutrients that a plant does not take up, or to change plant-not-available forms in plant-available forms, no new soluble nutrients will occur. Plants will suffer.

What biomass of each organism is needed so the plant gets the nutrients it needs?

Soil Chemistry: Nutrient Pools

- **Total Nutrients** not normally reported – Grind, complete digestion and combustion
- Exchangeable Nutrients (Melick 3, Ammonium Acetate 1N)
 - Strong extracting agents, but not ALL nutrients
- Soluble Nutrients
 - Extracts soil solution or water soluble nutrients
 - Available nutrients made available how?
- Plant Tissue Tests
 - Total chemical components..... Balanced?

Availability of Minerals Relative to pH



Without biology, you are stuck with pH as the sole arbiter of what is available to plant roots, as indicated to the left. But add organisms, and plant nutrition is no longer ruled by chemistry alone.

Soil vs Dirt: Clean water?



so no "cleaning" process

Who is in the soil?

Hi! I'm Alaimus! I'm from the town of Vegetable Roots!

I eat aerobic bacteria and don't like bad-tasting anaerobic bacteria at all. My job is to turn nutrients in bacteria into plant-available forms.





Bacteria, fungi, humus, aggregates: microscope view



BacteriaA few Fungi......BalancedMore Fungi...... Fungi

Bacteria:	10 µg	100 µg	500	600 µg	500 μg	700 µg
Fungi:	0 μg	10 µg	250	600 µg	800 μg	7000 µg

Forms of nutrients: Critical to understand

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NO₃.....NH₄ NO₃ and NH₄

Protozoa....B-f....F-f....Predatory....Microarthropods Nematodes

What does your plant need?







Lawns, trees, gardens or crops, the story is the same. Soil biology is being destroyed by human management. Roots are not going as deep as they should, and water, fertility and disease protection are lost.

Just because we see this all the time, does it mean this is how plants grow?

Peter M. Wild, Boston Tree Preservation

Josh Webber: Portmore Golf Course, North Devon, UK





- Hendrikus Schraven holding ryegrass planted July 15, 2002
- Harvested Nov 6, 2002 Mowed through the summer
- 70% Essential Soil, 30% Compost/organic fertilizer Compost tea once
- No weeds, no disease

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The root of the matter is infiltration Oxygen? Disease? Microbes?



Sod installed around new pond just after installation and one compost tea spray



6 weeks after sod was laid with compost tea below and on the sod. **Roots were less** than ¹/₂ inch, now 6 inches deep into the soil. No erosion, no weeds, no disease



Biological V's Conventional Approach to Soil Management

Compost Tea Test Trial Summer 2003

by Abron New Zealand Russell Snodgrass, SFI Advisor

Background

- Trial area consists of two plots fenced off from stock and the pasture harvested every 20-30 days using a mower
- Trial was carried out on a conventional dairy farm in the Bay of Plenty, New Zealand
- All testing is done by Hill Laboratories and the Soil Foodweb Institute NZ
- Trial overseen by Mark Macintosh of Agfirst Consultants
- Trial started 1 October 2003 Trial finished 24 February 2004

Treatment

• Compost Tea Plot

- Three applications of compost tea and foods at 150L/ha applied every 4 weeks starting in October 2003
- No fertiliser had been applied to the compost tea trial plot for the 12 months prior or throughout the trial

• Control Plot

- Conventionally fertilised with urea at an application rate of 75kg/ha every 6-8 weeks (450kg/ha per year)
- Phosphate Sulphur Magnesium applied at industry maintenance levels

Total Dry Matter Grown



Is it true that lower yields occur in Organic Agriculture? If you get the life in the soil correct, that is not true.

Average Clover % in Pasture Sward



Herbage Mineral Levels Improved



Biological Soil Test Results

Soil Foodweb test done 4 weeks after 3rd application - Dec 2003

Biomass Data	Control	Compost Tea
Active Bacteria (ug/g)	64.2	30.4
Total Bacteria (ug/g)	348	257
Active Fungi (ug/g)	0.5	144
Total Fungi (ug/g)	113	227
Fungi to Bacteria Ratio	0.32	0.88
Fungi Hyphal Diameter (um)	2.5	3
Protozoa (per gram)		
Flagellates	8395	58730
Amoebae	8395	5873
Ciliates	4046	1767
Mycorrhizal fungi root colonisation (%)	0	4

Nematodes

Numbers per gram fresh soil

Туре	Control	Compost Tea	Variance
Bacteria feeders	1.98	4.52	128%
Fungal feeders	0.99	1.58	60%
Fungal / Root feeders	1.09	0.24	-78%
Root feeders	0.99	0.12	- 87%
Predatory Nematodes	0	0	0

Key Results

- 11.78% increase in total dry matter grown over the control
- \$307/ha increased milk income from the extra dry matter grown
- Big increases in herbage mineral levels, resulting in reduced animal health costs; recovery from facial eczema
- 780% increase in clover content giving the soil access to more free nitrogen
- Huge reductions in root feeding nematodes, providing a better environment for increased clover growth
- Reduce costs by \$200,000 on a 300 acre farm in the first growing season

There is hope.....

- We can return the soil to health in a short time, and for little cost
- It will not cost billions, or even millions of dollars
- It will not take years
- Within one growing season, you can get the increased yields, decrease your costs and improve nutrition in the food you produce
- IF you get the biology right for your plant
- IF you get the WHOLE FOOD WEB back

Contact Information....

• Dr. Elaine Ingham, B.S., M.S., Ph.D.

- Soil Foodweb Inc. soilfoodweb@aol.com
 - -2864 NW Monterey Pl, Corvallis, Oregon

• Soil Life Consultants soillifeconsultants.com