Chapter 5
Working with the Soil Food Web

Lecture 24 – Application Methods
and The Biological Plan

What equipment is needed to make and apply BioComplete™ Soil Amendments?

1. Break up compaction
    - Speed establishment of food web organisms throughout the soil profile
    - Build structure in advance of the arrival of crop roots
    - Maintain aeration, drainage and water holding, growth of beneficial organisms and roots
    - Rent this equipment; not needed once organisms are established
    - Plan your start date, consider permanent ground cover / cover plants
2. Routine applications to the soil surface to maintain soil life
    - Solid or liquid applications, whatever is easiest
3. Applications to the foliage/fruit/seed
    - These applications become less necessary as soil life builds
    - If pesticide drift is a problem, grow wind barriers to protect crops
4. The Biological Plan

Application Methods - Tillage

Yeomans or Keyline Plow

- Wings on the bottom of the plow tines cause the soil to shatter, allowing air into the soil
- Injectors can be used to introduce the biology into the furrows and shattered soil
- The surface is left undisturbed and thus exudates maintained

Application Methods – Light Tillage

Harrow or Rake

- Break up shallow compaction, less weight to compact soil
- Apply BioComplete™ solids or liquids prior to harrowing or raking to facilitate movement into the soil
- Residues mixed in, but cover plants left intact

Application Methods - Tillage

Deep Ripper Plow

- Slices deep furrows in the soil, but does not shatter the compacted soil.
- Results in harm to soil biology with little benefit.

Application Methods - Tillage

Rotovator

- Soil is turned and mixed, resulting in massive damage to soil life.
- Compaction layer is formed at the depth the blades reach into the soil.
- Structure is lost and has to be rebuilt. Erosion and run-off enhanced

Application Methods - Soil Drench, Foliar Sprays

- Sprayers can be modified and used to apply biology
- Remove any 90 degree pipes
- Protect microorganisms when being applied – Impact Pressure must remain below the critical level of 80 – 100psi
- Cleaning is critical. Any biofilm left on the internal surfaces of the tank, hoses or other parts will result in anaerobic conditions and contamination

Application Methods - Soil Drench

Soil Drench: Small-Scale

- For small areas a Broad-fork can be used to break up compaction layers in the upper few inches of the soil.
- BioComplete™ Liquids can then be poured onto the disturbed areas to introduce the Biology using a watering-can
  or small sprayers.

Application Methods – At Planting

Small-Scale (Seed Drills); Large Scale (Seed Planters)

- Opens a furrow in the soil
- BioComplete™ Extract immediately drops to surface of furrow
- Seed then drops on that biologically enhanced soil
- Other powders or liquids could be applied if desired
- Furrows are then closed
- Must protect microorganisms when being applied. No 90 degree turns in pipes, impact pressure below the critical level of 80 - 100psi
- Any biofilm left on any internal surfaces will result in anaerobic conditions and contamination

Application Methods - Foliar

- From small scale watering cans, battery powered back-pack sprayers to skid sprayers and large scale field sprayers, beneficial organisms can be easily applied to soil and foliage
- Must protect microorganisms when being applied – Impact Pressure must remain below the critical level of 80 – 100psi
- Cleaning: Any biofilm left on the internal surfaces of the tank, hoses or other parts will result in anaerobic conditions and contamination

Large Scale Foliar Application

Application Methods – Soil Injection

Injection and Aeration

- Particularly useful around perennial plants, i.e., trees, vines and shrubs.
- Organisms can be injected in liquid form at regular intervals into the root zone.
- Aerators drill 3 - 8 inch core holes in the soil and can then spray BioComplete ™ Liquid preparations of organisms or foods into those holes.
- For greatest effect, biology should be introduced *below and through* the compaction layer.

The Biological Plan

1. Identify which Soil Food Web organisms are missing for the plants desired
2. Select an appropriate BioComplete™ Soil Amendment preparation containing high levels of the missing organisms
3. Decide on appropriate application methods to deliver organisms to the seed, soil and foliage to deal with compaction, fertility, pests/diseases and retention of nutrients
4. Consider options for protecting the soil surface to prevent compaction issues and to feed microorganisms year-round
5. Produce an action plan with dates for each application and monitoring event needed

The Biological Plan: Example Boston Lawn

1. Identify which Soil Food Web organisms are missing for the plants desired:

   - Soil Biology reports revealed only bacteria present in soils throughout the property. Use of inorganic fertilizers and pesticides most likely were the cause of this damage

   - Pests, diseases and lack of healthy growth for most plants except weeds suggest lack of beneficial biology in the soil

   - Food web is not balanced for anything except weeds

The Biological Plan: Example Boston Lawn

2. Select an appropriate BioComplete™ Soil Amendment preparation containing high levels of the missing organisms

   - Compost was **assumed** to be BioComplete™ Compost: **TEST!!!!!**

   - Biological assessment proved the compost was not BioComplete™ Compost

   - The hardest work that had to be done was to get BioComplete™ Soil Amendments to add the beneficial organisms back into the soil

The Biological Plan: Example Boston Lawn

3. Decide on appropriate application methods

TEST!!!!! After each application!!!!!

- BioComplete™ Soil Amendment applications in the fall or spring: Place on calendar, **test!**
- Deal with compaction if needed: calendar, **test!**
- Apply BioComplete™ Teas to aboveground foliage at start of plant growth (bud-swell on perennials, first leaf appearance in annuals)
- Apply BioComplete™ Liquids to foliage or to soil if any signs of poor fertility: calendar, **test!**
- Deal with pest or diseases at each stage of their life cycle: calendar, **test!**

Organisms After BioComplete™ Compost Addition

Organisms	Agricultural Field	Compost (1 ton/ac)	Two weeks later
Total bacteria (µg/g dry soil)	300	2000	800
# bacterial sp/g soil (DNA)	5,000	75,000	75,000
Total fungi (µg/g dry soil)	5	950	650
# fungal species /g soil (DNA)	500	25,000	25,000
Protozoa: F, A C	0, 0 1,450	12,000, 31,000 29	6,000, 17,000 67

The Biological Plan

4. Consider options for protecting the soil surface to prevent compaction issues and to feed microorganisms year-round

   - Mulch everything!
   - Trial understory plants to see which will perform as desired
   - Write the action plan on your calendar!

The Biological Plan: Example Boston Lawn

Diverse Landscape Management

Harrington's Organics; Boston Tree Preservation; SafeLawns

Monitoring

Date	F:B	P:N	Notes
Soil before starting: October	5: 300 Want: 300:300	0 : 4 Rf Want: 10,000 Prot	No difference b/t grass; flowers; veg: trees areas
Compost Autumn	250:300 plus humic acids (fungi)	Protozoa 20,000; No nematodes	Mulch under trees, shrubs. VAM spores
Soil March 15	150:400	F: 10,000 A: 5,000 C: none	Bf nemas only

Date	F:B	P:N	Notes
Compost for Tea, March (needed help)	225: 1050	F: 8,000 A: 1,000 C: none	Bf and Ff: 15/g
Compost tea, April	150: 900	No protozoa. No nemas	Fungal foods add protozoan infusion
Soil, April (2 wks later)	300:750	F: 10,000 A: 15,000 C: 25	Bf nemas only

Date	**F:B**	**P:N**	**Notes**
Compost for Tea, May	200: 2050	F: 10,000 A: 1,000 C: none	Bf and Ff: 15/g
Compost pre-treated with fungal foods	750:450	F: 15,000 A: 25,000 C: 25	No nemas detected (disturbance)
Compost tea, May	350: 550 Humic acids added	Protozoan infusion added.	No nemas.
Soil, May	550: 900	F: 30,000 A: 5,000 C: 25	Bf nemas

Date	**F:B**	**P:N**	**Notes**
Compost pre-treated with fungal foods	1050:500	F: 10,000 A: 5,000 C: 25	Bf nemas
Compost tea, June	500: 300 Humic acids trees, shrubs	F: 20,000 A: 15,000 C: 25	Bf nemas.
Soil June 15	450:450 grass 450:225 shrubs 700: 300 trees	F: 30,000 A: 25,000 C: 100	Bf, Ff and Pred

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