Kootenay & Boundary Farm Advisors

Regenerating Soil Health with Nicole Masters — Greenwood, Sept. 26 & 27, 2019

Event Summary

The Hays of Waikikahei Ranch hosted Nicole Masters of Integrity Soils and 20 participants for a two-day workshop on soil health and regenerative agriculture. Key takeaways included:

- **The Five M's:**
  - **Mindset** — #1, get "regenerative", from victim to agent, from killing to thinking.
  - **Management** — #2, the "worst first" triage nurse: Air then Water then Food.
  - **Microbes & Minerals** — #3, feed microbes to balance the system, but if a critical mineral is required, "kickstart" the system with an amendment.
  - **OM** — Organic **Matter**: increase deep, stable carbon through root exudates for fungi. (The plants are "ordering pizza" and buying it with carbon currency.)
- **Balanced soil biology increases yields:**
  - Resistance to soil erosion and increased soil building
  - Better water retention, nutrient availability
  - Fewer weeds, better disease resistance
  - Better decomposition of woody/peaty debris
  - Buffer soils to pH 7 from as high as pH 9 (alkaline) and as low as pH 5 (acid)
  - Extremely compact, rock-like hardpans break up quickly and permanently
  - "Plant nutrition is driven by biological functions."
- **Ways to observe soil health:**
  - Compare under fence lines (undisturbed) versus in the field.
  - Diversity of desirable plants.
  - Worms per shovel.
  - Crumbly "chocolate cake" soil. No plates of compact soil, no bad smells. Fast decomposition.
  - Check soil colour and texture when moist, roll into balls and snakes for "handfeel" tests.
  - Microbes + gravity smooth out soil.
  - No "urine patches" if there is sufficient nitrogen, mostly from free-living N-fixers.
  - N-fixing nodules on roots are reddish. Not active if white: need inoculant OR add seaweed for micronutrients (molybdenum, cobalt) OR fertilizer (e.g. urea) was added.
  - Grass roots with "Rastafarian" (dreadlock structure), not going sideways on hardpans.
  - Rippled leaves = low boron
- **Weeds as indicators and healers:**
  - Weeds help address soil problems: de-compaction, detoxify, mineral balancing, add organic matter, increase microbes, cover bare soil.
  - Use soil amendments to accelerate the improvements weeds make slowly on their own.
  - Annual weeds indicate low levels of fungi.
  - Non-mycorrhizal plants use powerful acids instead of fungal helpers: Amaranths (Lambs Quarters, Pigweed), Brassicas, Rushes, Sedges

- **More fungi:**
    - More fungi = bigger aggregates, more mineral miners, more water produced, better infiltration, better forage quality, fewer weeds.
    - Bacterial soils have smaller, dustier aggregates, more prone to erosion and compaction, surface crusts and mosses, "primitive" weeds like oxeye daisy, tansy, chervil, ...
    - Fungi like complex (brown) foods: brown hay, leaves, straw, woodchips, fish hydrolysate
    - Bacteria like simple (green) foods: manure, grass, milk, urine, molasses, fish emulsion
    - Excessive nitrogen decreases fungi and increases weeds, disease, insects, and frost.
    - Deepest soil and healthiest pasture grasses at 1:1 or 2:1 fungi:bacteria. Proper grazing management pushes systems to this balance.
- **Microbial indicators and healers:**
    - Reduce frost damage at -2°C to -4°C with *Pseudomonas fluorescens* to attack the ice-nucleating *Pseudomonas syringae. P. fluorescens* is common in worm castings.
- **Refractometer (Brix meter) + garlic press:**
    - Use it every day to compare weeds with legumes/grasses/crops.
    - Turn it sideways to see a sharper line.
    - Varies with sun, temperature, etc. Brix highest at midday. Dehydrated and diseased plants have higher Brix because defenses are activated.
        - Brix < 3 with a sharp line = nitrates in soil, a deadly pasture
        - Brix 3 to 6 = plants are barely scraping by
        - Brix > 12 with a blurry/fuzzy line = great health
        - Brix > 18 = superb, humming, ...
        - Brix same all day = Boron deficiency. Add chicken manure.
- **Water Infiltration Test:**
    - 6"-long 4"-pipe, pound 3" into ground. Add 1" of water in a single shot while starting a timer. Stop the timer when more than half of the surface soil glistens. Less than 12 min.
- **Soil and Foliar Tests:**
    - Tissue tests tell us the deficiencies a plant is actually experiencing. Use soil samples to determine application rates of amendments identified by foliar tests. "Nobody ever got paid for a perfect soil test."
    - Compare foliar samples of weeds and desirable plants from the same field. If weeds have significantly different values than desirable plants, there may be a deficiency or excess of that nutrient.
    - Test water: If hard (>150ppm) needs to be softened.
- **Vortex Slurries**
    - Flow-through vortex tank loaded with "anything". Applied 2-3 gallons/acre through a coarse 3/16" to ¼" spray nozzle.
- **Blaster Extactors**
    - Air blast and water to bottom of drum mostly filled by a perforated container of vermicast or compost. Flow-through run until output is no longer chocolate brown.
    - Apply with a fine sprayer immediately or after brief storage.
    - Midwest Biosystems: http://aeromasterequipment.com/tea-extractor.php

- **Weed "Marmite":**
    - Collect weeds (e.g. thistle) in a bucket/barrel and compress under weight for 6 months to ferment. Dilute the "marmite" with water and apply to weedy areas as a tonic with trace nutrients and anti-weed diseases and chemicals.
    - 5 to 20 lbs of fresh weed mass per acre, harvested when lush green or in flower.
- **Great soil helpers:**
    - Use additives as "catalysts" to transition soils.
    - **Vermicast** (worm castings): To "switch on" the soil life and detoxify chemical residues.
        - Dry vermicast: 30 lbs/acre when drilling seed to protect growing plants, best as a seed coating; OR 400 lbs/acre broadcast for a multi-year response.
        - Liquid vermicast extract: 2 gal/acre (sprayed); OR mixed at 1 gal per ton of seed as a coating; OR dripped at 0.5 gal/acre while drilling seed.
        - Dip transplants in liquid extract before planting.
        - Add worm extract to glyphosate to reduce application rate by half.
        - Make a worm farm: Commercial vermicast is usually bacterial, better to make your own. Cover in the winter with hay (1-2') and/or geotextile/tarp.
    - **Humic acid (humate), fulvic acid, and fish hydrolosate**: Fungal foods that help "wake up" soils and turn on "quorum sensing". Note: fish hydrolosate, NOT fish emulsion.
    - **Molasses**: Bacterial food. Fall is a good time to add humates and sugars.
    - **Kelp**: 1 lb/acre to stimulate rooting.
    - **AMF** (arbuscular mycorrhizal fungi), **Azobacter, Frankia, Aspergillus, ...**
    - **Redman salts** (or seawater): 5-10 lbs/acre and as a livestock lick.
    - **Calcium & Magnesium**: Add in balance, use dolomite if Mg levels are low.
    - **Cover crops:** Smartmix cover crop calculator: https://smartmix.greencoverseed.com/
    - **Slurries and extracts:** Applied after disturbances or in spring: "Rip and Drip," "Seed and Feed."
        - Slurries can use "anything": seed, compost, seaweed, lime, white wood chips (poplar, birch, maple, alder, willow, etc.; NOT conifers, oaks, aromatic woods).
        - 25 gal/acre compost extract along with vermicast treatments.
        - Versus actively aerated compost tea: "no messing around getting things right."
    - **Actively aerated compost tea:** Bubble water vigorously for 2-3 days with a basket of compost, leaf duff, fish hydrolosate, seaweed, humic acid, molasses, ...
    - **Milk:** Sometimes antibiotic milk is dumped. Milk powder cheap if contaminated.
        - Story: Nightshade in sheep pasture had fuzzy Brix 18, grasses had sharp Brix 3. Sprayed milk (sugars, fats) at 4-5 gal/acre (encouraging lactobacillus). Brix values reversed within an hour, effect lasted 3 weeks. (Long-term fix here was calcium.
    - **Coca-cola**: Phosphoric acid plus sugars, a good fertilizing combo. Light foliar feed helps switch plants from vegetative to fruiting and ripening.

Nicole Master's website and book: https://www.integritysoils.co.nz