Soil Health Session 7

Using Restored Soil to Produce Amazing Produce (Growing in Great Soil)

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(Growing in Great Soil)

OUTLINE

1) Starting a Garden (Why & Where before How)

2) Soil Enriching & Bed Prep
   Working & Tilling,

3) Sowing, Planting, Crop rotation,
   Common Crops
   Feeding & Weeding
   Pest & Disease Control
   Harvest & Use, and Quality control

A little Land can Produce A Lot

Farmers of Forty Centuries: (early 1900's before WW1)

- Chinese farmer on just 1 & 2/3 acres, supporting 10 person family and animals and making a living.
- Compared to an American 40 acre farm, regarded to be too small for one family, would support 240 people plus animals.

- One Japanese farmer fed his family and made a living from just one tenth of an acre, 400m2!
- Modern Market gardeners with power equipment brag about being able to make a living on ¼ acre, 1000m2

I’ve been growing all our own greens, fresh kitchen herbs and some vegetables on just 25m2 of garden bed space for over 7 years.

Inspired Introduction:

“CULTIVATE”

In the cultivation of the soil the thoughtful worker will find that treasures little dreamed of are opening up before him. No one can succeed in agriculture or gardening without attention to the laws involved. The special needs of every variety of plant must be studied. Different varieties require different soil and cultivation, and compliance with the laws governing each is the condition of success.

The attention required in transplanting, that not even a root fibre shall be crowded or misplaced, the care of the young plants, the pruning and watering, the shielding from frost at night and sun by day, keeping out weeds, disease, and insect pests, the training and arranging, not only teach important lessons concerning the development of character, but the work itself is a means of development.

In cultivating carefulness, patience, attention to detail, obedience to law, it imparts a most essential training. The constant contact with the mystery of life and the loveliness of nature, as well as the tenderness called forth in ministering to these beautiful objects of God's creation, tends to quicken the mind and refine and elevate the character. {AH 142.3}

EGW led by example: she planted trees at Avondale to prove they could grow well, always kept a vegetable and herb garden, and her husband James ran a berry farm when he ‘retired’.

Starting the Garden:

(why and where before how)

Proverbs 24:27 **First get your fields ready, next plant your crops, and then build your house**.(ERV)

- **Where: -** *General Principles:* - Choose best soil and site available, Choose a site with good aspect (exposure to sunlight for a good portion of the day – ideally 8-10 daylight hours), Keep away from tree root zones, Form beds where they are easy to work/accessible and allow for other important functions in that space (mowing, clothesline, sheds).
- Small Suburban blocks: Not much space, often obvious where to grow (edging beds on fencelines, vines on fences, biggest open space, using spaces like warm sunny walls for Mediterranean herbs or tropicals.)
- Larger Blocks/Acreage: Permaculture (access, water, structures, growing zones: 1)Grow herbs/veg closer to kitchen/house, 2)perennials and fruit trees further out, 3)pasture/fields and wild food forest/nature reserve)

Starting the Garden:

(why and where before how)

- ***Permanent Beds:*** Invest in permanent beds where soil is corrected, built up and returns on the investment!
- Keep annual vegetable rotation beds separate from perennials, carbon/weed-tea crops(comfrey, nettle), fruit trees.
- - Have space for Compost heaps, worm farm bathtub/box, seedlings nursery etc
- **Bed sizes:** Production market gardens worked by hand use 75cm wide beds that can easily be worked from both sides without unhealthy bending, with 45cm paths to allow wheelbarrow etc access. = 1.2m bed+path
- Make beds any size that fits into the growing area and ideally can be accessed/worked without standing on and compacting the bed. Raised beds for children, disabled, elderly can be useful.

Tilling / Working the ground

1) Correct soil Structure, test soil and correct base saturation: (Calcium to flocculate hard soils, Magnesium to hold together loose soil) and balance minerals.

2) Aerate the soil, bring in oxygen and aerobic life.

Loosen soil as deeply as possible with garden fork.

Break up clods with fork or shovel or hoe. *Watering also helps soften and suck air into soil pores.*

3) 'Bio Tilling": top dress soil with organic matter (compost, mulch), thoroughly moisten, cover with tarp or thick mulch or keep moist. Worms and microbes will dig and aerate creating pores and incorporating organic matter and worm castings. Usually 3 months in warmer climates.

Soil Enrichment / Bed Prep:

- Feed the soil organisms: Compost, Mulch breakdown, 'Green mulch/manure – cover crop of legumes/grain such as vetch & rye, mung beans, alfalfa – grow to good size and dig in while young and fresh.
- Slow release minerals: (Rock Dust) Cheap source of minerals, crushed basalt rock, called crusher dust (blue/green stone) at landscape supplies.

- "Building organic matter, re-mineralising the soil, deep tillage (bringing in air-not inverting) and planting a living mulch are basic steps to creating a living soil" (Stephen Meyer, Grow Your Health)
- "Whenever possible, keep the soil covered. This helps to conserve moisture and stimulates the microbial life in the soil. An organic mulch such as straw or leaves, will supress weeds and build organic matter."(Ibid)

- Can use a tarp/black plastic to cover and bio-till garden area not being used for a period of time.
- This is the easiest natural weed control. Often used by market gardeners after bed prep and before sowing to kill off weed seeds.

Sowing & Planting

Sowing:

- After loosening the soil deeper with a garden fork, break up clods on the surface with a hoe or rake, rake off anything large on the surface.
- Many seeds will come up in roughly loosened soil, but for the best seed bed try to get a fine ‘tilth’ (loose, fluffy layer) in the top inches to give seeds the best chance to germinate and take root.
- Seeds: Use reputable commercial companies that supply consistently germinating seed. Seed saving is easy, stake up flowering plants, allow to dry completely when seed is formed and store dry.
- Plan ahead! Sowing to harvest can be from 6 weeks to many months, check packet.
- Sowing: Make a drill (small furrow) with a hoe, spade or trowel in the fine tilth, spread the seeds carefully and evenly into the furrow and lightly cover over. Water in thoroughly. Keep moist till germination.

Sowing & Planting

Planting:

- Buy seedlings or raise them yourself in seedling trays or flats in the shade or nursery.
- *Raising Seedlings:* Buy seedling mix or make your own with screened compost and sand or fine screened soil. Sow 2-3 seeds for each plant into trays/flats. Keep moist and warm (but not too humid) and shaded.
- Ideally space seedlings so they touch each other by the time they are ¾ grown, this shades out weeds.
- Mark out spacings or use a spacing ruler. Small beds can easily be done by eye.
- Make a hole in the prepared bed with hand or trowel, gently tease seedling out of tray, loosen root ball a little if tightly bound, drop into hole and firm into place (just like tucking in bed!)
- Water well, weed tea or seaweed solution can be helpful for new root growth and microbe activity.
- Keep water up to seedlings until established, then water regularly.
- *Do I need to water?* Finger test: if you poke your finger in the soil and its moist/wet: NO, if dry: YES.

Crop Rotation

Crop Rotation:

- Changing the location of crops of plant families from year to year can stop most soil borne diseases and pests by breaking their breading cycle. Especially important for the 3 most disease prone plant families:

- Brassicas (Cabbage family),
- Cucurbits (pumpkins/melons/cucumber) and
- Nightshade (Tomatoes/Potatoes).

- Commercially this is done on a 3-7 year rotation, but in small gardens just rotate as possible.

Sabbath Year: - It's always good to have parts of the garden rest for a season or year at times.

"But during the seventh year, you will let the land rest. This will be a special time of rest to honor the LORD. You must not plant seed in your field or trim your vineyards." Leviticus 25:4 (ERV)

Common Crops: (Vegetables)

Greens:

- Easiest to grow, fast-often just 4-6 weeks sowing to harvest, cut and come again, large part of Gods original diet for man, low demand on the soil, nutrient dense – low calories, nutritious and medicinal.
- Suggestions: Kitchen herbs in rock garden/herb spiral (Rosemary, Sage, Oregano, Thyme).
- Rocket, salad-Radishes, Lettuce, Garlic Chives, Shallots, Parsley, Coriander, Silverbeet/Spinach, Ceylon Spinach(climbing), Island Spinach (Ibika), Asian Greens (BokChoy/PakChoy/Chinese Cabbage), Bush Beans.
- Self-Seeding/Sowing Herbs: (low maintenance in a low turnover area)
- Wilds: Dandelion, Purslane, Chickweed, Plantain, Stinging Nettle, Thistles, Lambsqaurters, Mallow (either between veggies, or in a wilder area, can cultivate an outer zone for wild food growing/harvesting)
- Common: Rocket, Lettuce, Dill, Fennel, Garlic Chives, Basil, Asian Greens, Cherry Tomatoes etc
- Cruciferous: (Cabbage, Kale, Broccoli) Heavier feeding greens. Anti-cancer, gut health. Take up more space and maybe only one harvest, Kale/Dinosaur Kale can be constant picking. Winter crop to avoid pests.

Tomatoes:

- Cherry's the easiest, productive, pest/disease resistant. Can stake, wire cage, or trellis.
- For large fruited types try to find VFN resistant tomatoes resist verticillium, fusarium and nematodes.
- Regular tomatoes are also stung by fruit fly in the tropics (traps/population control, or netting).
- Susceptible to fungal and bacterial diseases, keep plants dry, water roots not on leaves.
- Bush varieties (terminating), trellising varieties (non-terminating, keep growing up)
- Pruning? – leave wild, or snap off suckers(side shoots from stems) to get vertical growth/fruit set.

Climbers/Vines: (using vertical space)

- Climbing Beans: summer/mild winter, constant picking, single season, snake beans (.5m long)
- Cucumbers: Can be very productive, one large plant supply entire family for a month. Susceptible to powdery mildew, keep dry.
- Tropical climbers:

- Choko (like a vegetable pear, versatile, very productive)
- Loofah (zucchini-like veg that becomes a sponge when large) Snake Gourd (grows to 1m long)

- Passionfruit: large vine, can fill 10m of trellis/fence-line. Can cover pergola/patio. Heavy feeder. 4-5yr life, replace every 2-3 years for continuous fruit. Productive, vit c rich. Fruit ripe when drops off vine.

Pumpkins, Melons, Sweet Potatoes:

- Need a larger open space.
- Loosen soil and feed for wide root zone.
- Mulching can help to keep ground moist and fruit dry.
- Pumpkins like potassium(ashes),
- Melons like silica(sand). Heavy feeders.
- May need to hand pollinate if not many bees around. Harvest tips to eat, especially when pruning back overgrowth.

Feeding & Weeding

Fertilising:

- Avoid overusing harsh NPK fertilisers, high nitrogen fertilisers can attract pest such as aphids and put excess nitrates into produce which is unhealthy. Chicken manure is popular and can be good if you need Phosphorous and Nitrogen, but bad if your Phosphorous is high and often causes high (P) when over-applied.
- Organic gardeners who have a healthy soil which has been properly amended will gain Nitrogen from carbon cycling, microbial life and nitrogen fixing legumes.

- Weed/Comfrey teas: Rot down weeds or mineral rich plants such as comfrey/nettle in a bucket/drum, allow to sit for 1-2 weeks and thin down 10 to 1 to apply as liquid fertiliser. Note: this is a good self-sufficient fertiliser source but no guarantee of specifically meeting any particular crops needs.

Feeding & Weeding

Fertilising:

- Balanced Organic fertilisers with trace elements can be bought in large bags in pellet form and broadcast over beds before sowing/planting. (Check analysis)

NOTE: Fertilise and feed those crops that need it (leafy/fruiting), not those that don't

(root crops e.g. carrots, and legumes). It's good to alternate heavy feeders with light in the bed succession.

ALSO: Tailor your fertilising to your specific crop and soil needs. Check labels and NPK amounts.

Fertilser

“Too much of certain fertilisers can cause as many problems as low fertility. Aphids are often attracted to crops that are given too much nitrogen. Fresh manure, especially chicken manure, can encourage the insects to attack some crops. A friend of mine grew side by side beds of zucchini squash. The one fertilised with chicken manure was attacked by cucumber beetles, while the one that had been fed by composted horse manure and seaweed was left untouched. Fresh manure is best composted or used in crops such as corn that love nitrogen and are not prone to pests. Studies have shown that too many nitrates or free amino acids that have not been built into proteins signal the insects to devour the nutritionally imbalanced plants before the unsuspecting humans eat it” Stephen Meyer

Feeding:

- - Each Plant/plant family has individual fertilising needs. Check seed/seedlings packet, books, guides.
- - Generally, feed 2-3 times: during first growth, maturing and fruiting.

<u>HOW:</u>

1) Feed soil before planting (minerals, compost, fertiliser)

2) Liquid feed seedlings/growing plants (weed tea/seaweed/fish), side dress heavy feeders during maturing or flowering/fruiting with compost and or fertiliser.

- *Grow Fertiliser crops:* Comfrey Leaves(permanent spot, moist, not too hot in summer), Nettle, Weeds.

3) Mulching: protects soil life and slowly breaks down to feed plants.

Weeding (Cultivating):

- TOOLS: Hands, / Hand weeding prongs / forks.
- Hoes: (chipping and breaking up, cutting off at root level) Dutch/Asian(solid chipping blade)

  - Market garden quality: Collinear (flat blade), Stirrup (rounded thin blade rips through)
- Forks & Rakes (Break up and separate)
- Stay on top of weeds, don't allow to get out of control (1years seeding = 7 years weeding)
- *Natural Herbicides:* Salt (careful), Boron(Borax- found in cleaning aisle) – dissolve in watering can. Caustic Soda (strong alkali that burns weeds) – carefully dissolve in water, read safety labels. Vinegar(acid).

Pests & Diseases:

Pest & Disease Control*(Natural):*

Plants fed by healthy soil are less frequently attacked by pests and diseases. This may take several seasons to be achieved.

PEST CONTROL: Basics: balance fertility/minerals, build organic matter, aerate, crop rotation, sanitation (clean and dry, sunlight), encourage beneficial insects (biodiversity).

- Plant resistant varieties of susceptible crops
- Physical control (floating row cover nets)
- *Natural/ Botanical Insecticides:*

White Oil (Horticultural Oil): 1 cup dishwashing detergent, 2 cups vegetable oil, shake in jar until white, this is concentrate. Use one tablespoon in a litre of water in a garden sprayer. Don't apply over 30°C as may burn plants. Controls sucking and chewing insects such as aphids, scale, mealy bug and citrus leaf miner. Suffocates insects by blocking breathing holes. Needs to be sprayed on both sides of leaves and stems. Non-toxic, but kills all bugs good and bad.

Pyrethrum: from pyrethrum daisy, kills a wide range of insects.

Neem Oil: - natural plant oil, kills insects, used as spray.

(B.t.) Bacillus thuringiensis: is a bacteria that destroys larvae digestive tracts. Controls cabbage worms, tomato hornworms, and other insect larvae. Powder form.

Diatomaceous Earth: cuts up the soft bodied bugs.

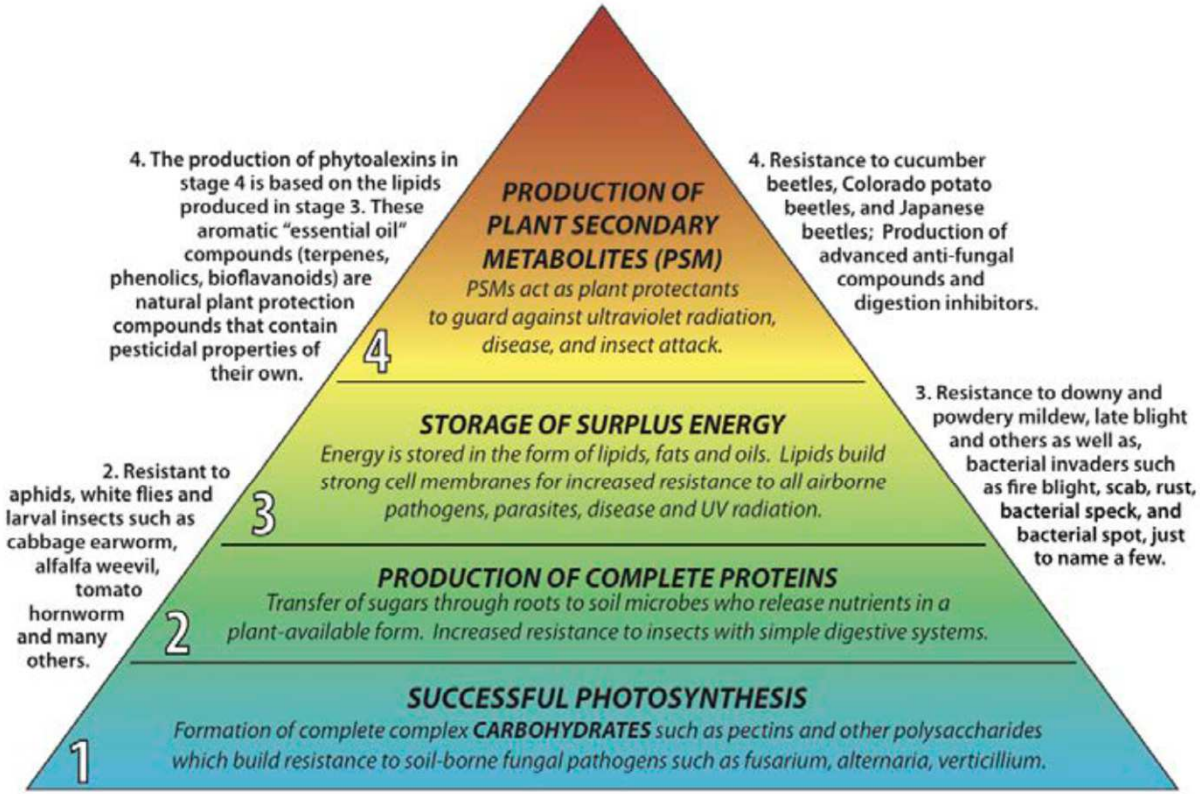
Check your local Gardening store / Bunnings for a range of these natural sprays/products.

DISEASE CONTROL: Fungi, Bacteria, Viruses

- - Crop rotation, remove affected plant material, disease resistant varieties, certified seed.
- - Fungus: garlic spray, milk powder in watering can on leaves, copper fungicides (have a level of toxicity)
- - Sunlight banishes much disease.

Optimal Nutrition Enables Advanced Function in Plants

As soils and crops transition toward biological farming practices, they pass through stages of increasingly better health. The progression toward better health restores the natural and biological abilities of the plant and soil system. Innate characteristics and advanced functions are enabled such as immunity to soil and airborne pathogens, resistance to insects, production of lipids which strengthen cell membranes for tastier, more storable fruit, and more.



If we wish to produce "food as medicine" this is where the medicine is.

Harvest and Use:

- Harvest and pick regularly it stimulates production!
- Utilise what's there (beet and radish leaves, pumpkin & sweet potato tips)
- Plan successive sowings and plantings in season.

Healthy plants

A healthy plant is characterised by good size, deep green leaves and good all round development. The plant should look vigorous and healthy at all stages of its development, with evenly coloured green leaves (unless a variegated or patterned variety), strong, sturdy stems, normal sized flowers and fruits in normal abundance.

Brix Meter *(Refractometer): - for measuring nutrient levels*

- Measures sugar content of vegetable/fruit liquids and thus the minerals. (Gods design is that minerals are bound to sugars in whole foods to buffer and facilitate their metabolism in the body)
- Only about $25 on ebay. Get one for general produce with a ATC(automatic temperature control), most have this.

- Online guides:

Refractive Index of Crop Juices -- Calibrated In % Sucrose Or ºBrix

	Poor	Average	Good	Excellent
FRUITS				
Apples	6	10	14	18
Avocados	4	6	8	10
Bananas	8	10	12	14
Blueberries	8	12	14	18
Cantaloupe	8	12	14	16
Casaba	8	10	12	14
Cherries	6	8	14	16
Coconut	8	10	12	14
Grapes	8	12	16	20
Grapefruit	6	10	14	18
Honeydew	8	10	12	14
Kumquat	4	6	8	10
Lemons	4	6	8	12
Limes	4	6	10	12
Mangos	4	6	10	14
Oranges	6	10	16	20
Papayas	6	10	18	22
Peaches	6	10	14	18
Pears	6	10	12	14
Pineapple	12	14	20	22
Raisins	60	70	75	80
Raspberries	6	8	12	14
Strawberries	6	8	12	14
Tomatoes	4	6	8	12
Watermelons	8	12	14	16
GRASSES				
Alfalfa	4	8	16	22
Grains	6	10	14	18
Sorghum	6	10	22	30

	Poor	Average	Good	Excellent
VEGETABLES				
Asparagus	2	4	6	8
Beets	6	8	10	12
Bell Peppers	4	6	8	12
Broccoli	6	8	10	12
Cabbage	6	8	10	12
Carrots	4	6	12	18
Cauliflower	4	6	8	10
Celery	4	6	10	12
Corn Stalks	4	8	14	20
Corn (Young)	6	10	18	24
Cow Peas	4	6	10	12
Cucumbers	4	6	8	12
Endives	4	6	8	10
English Peas	8	10	12	14
Escarole	4	6	8	10
Field Peas	4	6	10	12
Garlic, Cured	28	32	36	40
Green Beans	4	6	8	10
Hot Peppers	4	6	8	10
Kale	8	10	12	16
Kohlrabi	6	8	10	12
Lettuce	4	6	8	10
Onions	4	6	8	10
Parsley	4	6	8	10
Peanuts	4	6	8	10
Potatoes	3	5	7	8
Potatoes, Sweet	6	8	10	14
Romaine	4	6	8	10
Rutabagas	4	6	10	12
Squash	6	8	12	14
Sweet Corn	6	10	18	24
Turnips	4	6	8	10

Within a given species of plant, the crop with the higher refractive index will have a higher sugar content, higher mineral content, higher protein content and a greater specific gravity or density. This adds up to a sweeter tasting, more minerally nutritious food with lower nitrate and water content, lower freezing point, and better storage attributes.

www.aglabs.com
www.highbrixgardens.com

This chart was originally developed by Dr. Carey Reams

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The Quest for Nutrient Foods

Grocery Store Beans

Garden Beans

In response to critics of the Brix=Quality concept, at HighBrixGardens, we analyzed fresh green beans from our garden and compared them to fresh green beans purchased from a local market.

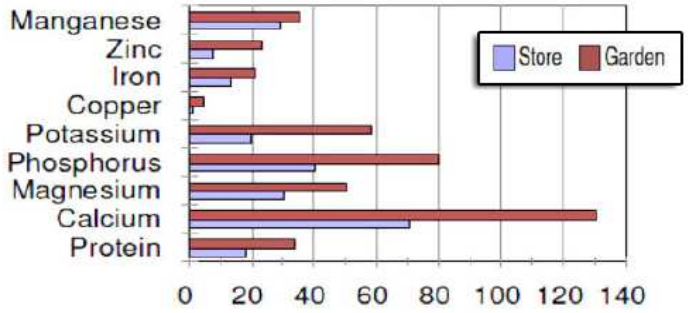
Brix	Dry Matter	pH	Taste
4.2	8.1%	5.5	garbage

Brix	Dry Matter	pH	Taste
6.1	16.6%	6.4	decent

Interestingly, the garden beans were planted in early autumn. Growing conditions were not ideal and we barely got the beans harvested before the plants froze out. The units in the chart below vary, but they are per 100 grams of bean. Notice that the garden beans are consistently higher

Nutritional Quality - Comparison of Store vs Garden Beans

For the complete results and analysis of the green beans see: http://www.highbrixgardens.com/nutrient-dense-foods.html



http://www.highbrixgarden
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A BIOLOGICAL APPROACH TO AGRICULTURE

“Unless people become natural people
There can be neither natural farming
nor natural food”

Masanobu Fukuoka

For the Lord has given comfort to Zion: he has made glad all her broken walls;

making her waste places like Eden, and changing her dry land into the garden of the Lord;

joy and delight will be there, praise and the sound of melody. Isaiah 51:3

The thief comes only to steal and kill and destroy. I came that they may have **life** and have it **in abundance.**

John 10:10