

**Are you growing your
flowers in dirt or soil?**

**Why helping the soil achieve its
optimum health is important!**

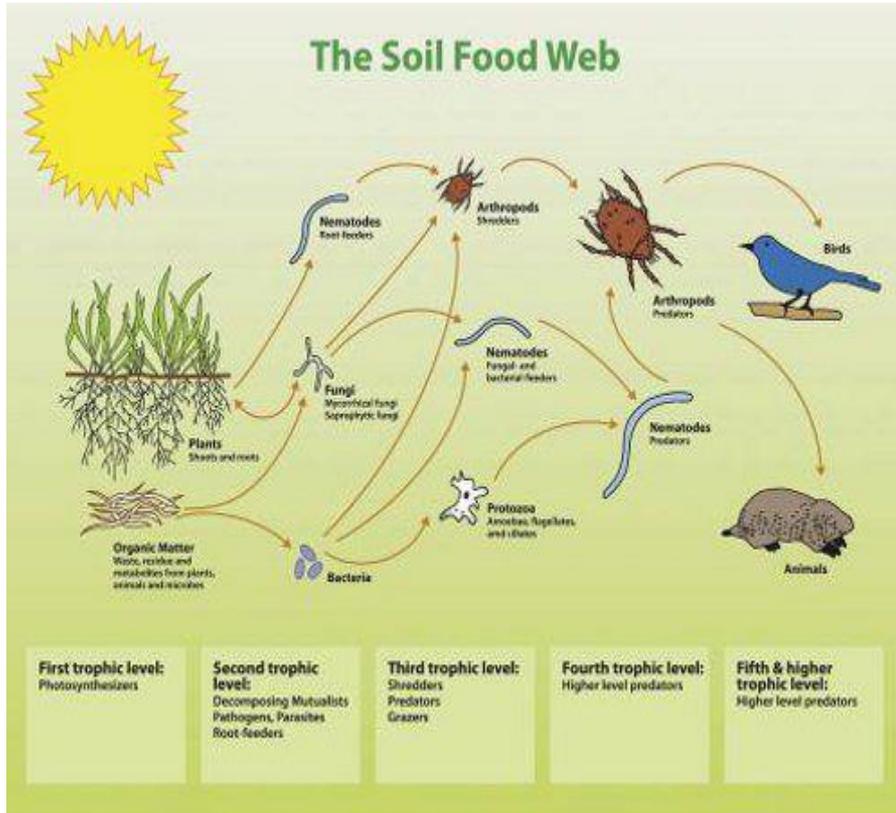
Bare Mtn's story on how and why we are adopting a no-till, biointensive approach to flower farming.

What's the Difference Between Soil & Dirt?

Soil contains a vibrant web of life residing in a well aggregated structure that supplies a balance of air, water, minerals & nutrients that supports it.

Dirt is lifeless, has no structure, and is basically the remnants of weathered rock, clay and silt. It cannot support plant life well without Man supplied nutrients. When dry and disturbed it will erode into the wind, when wet it will easily erode away into the water.....

The Soil food web: The Basics



Biology of the soil supports multiple levels of increasingly complex life.

This balance when supported or left to its own is self sustaining.

Plants are dependent not only on light and warmth of the Sun but also greatly on the microbes & fungi of the soil.

Microbes & fungi are dependent upon plants for nutrients too.

Healthy microbes & fungi contribute to soil aggregation/structure, chelating available minerals from soil for plants. Provide a food source for higher levels in the web.

Healthy Soil Overview

Soil Organic Matter (SOM) is approx 57-60% carbon by weight.

Carbon is one of the key building blocks sustaining microbes & fungi in the soil

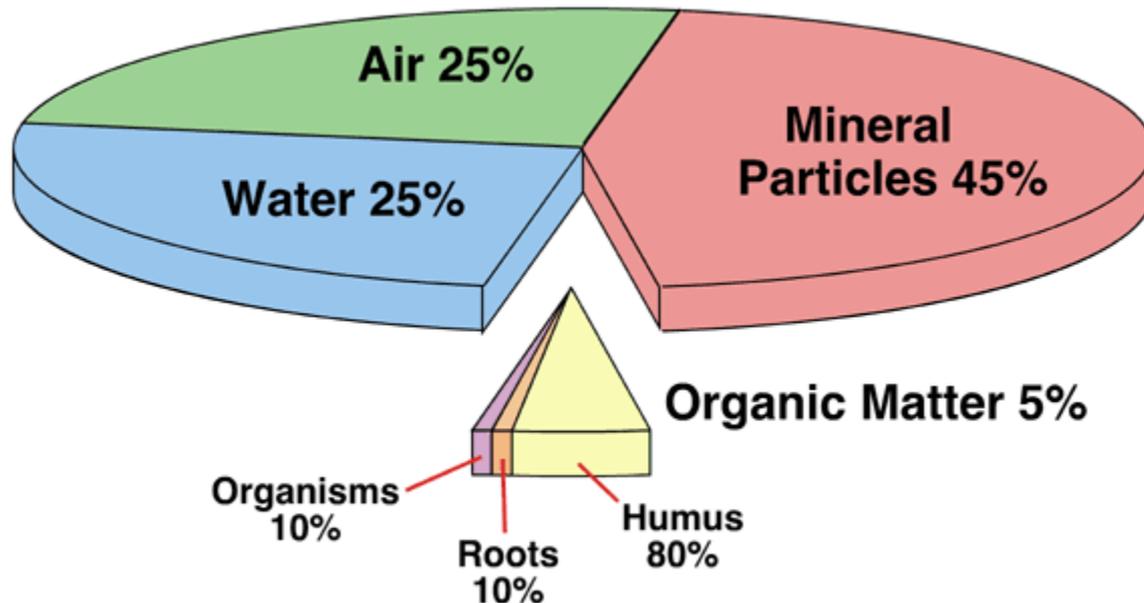
The key that makes soil alive is the soil foodweb that inhabits it.

Historically US agricultural soils had 6-10% SOM (USDA)

Agricultural soils today have 1-3% SOM (USDA)

Avg in fertile valleys of Calif is 1-1.5%!

Our Farms SOM by 2009 averaged 1-2%



Source: PhysicalGeography.net

Other Special Plant & Soil Foodweb Relationships

Upto 10-15% of the sugars that plants produce in photosynthesis are exuded from their roots into the surrounding soil.

Beneficial microbes and fungi feed on these sugars in exchange they provide plants with minerals, moisture and provide soil aggregation and protection from other damaging microbes or fungi that can cause disease.

Strong health of Microbes & fungi provide the food for other levels of the soil food web

In addition to root exudates decaying plant materials or compost also add organic soil carbon

Inorganic and organic carbon provide basic building blocks for plants, microbes and fungi.

Soil carbon helps retain minerals and other nutrients from leaching.

High soil carbon helps retain soil moisture and provides the ability to absorb more rainfall reducing erosion by providing a habitat for soil microbes which build soil aggregates.

Our History

Originally purchased the property in 1988 with no intentions other than raising a few animals and having a nice place “In the country”.

Started the Flower Farm in 2003 as a partnership to sell flowers in the Corvallis Farmers market.

Partnership ended in 2004 and we began selling flowers as Bare Mtn Farm

Used conventional methods, tractor tillage, rototiller, bed formers, fertilizers, pesticides and herbicides from 2004 to 2008

Went cold turkey away from all chemicals in 2009 due to our own health issues.

Began transitioning away from mechanical tillage in 2010

Totally stopped all mechanical tillage on all areas of the Farm by end of 2013.

Took us several years to develop skills and the tools necessary to regenerate our soils.

Our Farm's Situation

Our farm has 3 different soil types.

A northeast aspect

Slopes gently to a level field.

Each of our soil types is a clay-silt loam topsoil not much deeper than 1-2' with either a silt-sand subsoil or a heavy clay subsoil.

Soils were farmed for grass seed conventionally for 10-15 years.

Organic material content was low 1-2% on average. PH was 4.5-5 mineral availability was negatively impacted.

Farm has areas of slow or poor drainage due to soil compaction.

Approx 15,000 sq ft in field cultivation, 3300 sq ft under high tunnels.

What we did wrong!

Use of conventional tillage increased hardpans in all our growing areas.

Tillage although immediately made good looking seedbeds destroyed soil aggregates.

By destroying aggregates surface areas in the soil were increased which stoked microbiology to consume organic material quickly.

Tillage destroyed our community of soil fungi

Net effect was ever declining plant yields and plant health.

Doubled down on stupid! We severely disrupted the soil food web...

Our Philosophy Now

Disturb the soil as little as possible,

Keep a diversity of living plants in the ground as often as possible.

Keep the soil covered and protected as often as possible.

Use no mechanical tillage equipment

Increase the soil carbon (SOM)

Tilling the soil is the equivalent of an earthquake, hurricane, tornado, and forest fire occurring simultaneously to the world of soil organisms. Simply stated, tillage is bad for the soil.

Source: USDA:NRCs Farming in the 21st Century A practical approach to improve Soil Health Nov 2011

1 Tsp of 1% SOM in tilled soil contains tens of yards of fungi mycelium.

1 Tsp of 6% SOM in untilled soil contains tens of miles of fungi mycelium.

How we began a path to regeneration

Voraciously began consuming all literature of methods relating to no tillage

Looked for successful examples of farms scaled similarly for best practices

Began trying different techniques from cover cropping to occultation.

Studied concepts of soil remineralization

Realized that there is no one practice that fits all circumstances.

Context is a very important concept!

The tools we needed to use were very dependent on the conditions on the ground.

We realized that our farm contained unique areas that at different times of the year had different needs.

It's important to use the appropriate technology at the appropriate time.

Constant even moisture levels in the first 2-3 inches is key to keeping the biology evenly active.

Occultation: what is it? Is it really witchcraft?

Occultation is a practice organic veggie farmers here and in Europe have used for years.

The process is a form of mechanically keeping light from reaching the soil and trapping moisture near the soil surface to aid the soil biology to consume sheet mulched plant residue.

Typical process is 3-5 weeks depending on soil temperature.

We use geotextile weaved fabric or poly weaved sheeting such as silage tarp.



Cover Crops How Do They Fit In?



Use a diversity of crops in rotations. E.g. winter covers of hairy vetch, cereal rye, with clover. Summer covers of sub clover, and buckwheat.

Integrate growing covers with cash crops. We undersow sunflowers with subclover.

Covers can help retain moisture and moderate soil temps.

Mostly used in the field, limited use in our tunnels.

How we establish winter cover crops



Planting starts in late September. We have used both broadcast seeding, Earthway Seeder and seed balls.

Successful establishment is greatly dependent upon seed to ground contact, moisture levels. Try to seed just before first good Fall rains.

Winter covers are slow to establish and can allow some weeds to establish.

Modifying next year by adding buckwheat, oats, and barley to rye/vetch mix. These all winter kill and creates a smother crop allowing rye/vetch to establish well in Spring.

How to take out a winter cover



When mature vetch/rye is 5-6' tall. Use either feet or dragging a heavy chain over bed crimps cover down. Do this at pollination stage (Late May) and 95% dies.

This leaves a surface mulch allelopathic to weeds for several weeks. After 7-10 days We plant transplants directly in ground through the mulch.

Benefits: Retains moisture well, lowering irrigation needs. Moderates soil temp. Little to no weed pressure.

How we plant through the straw mulch



Use taller transplants like sunflower, marigolds, Ammi, strawflower etc.

The Pottiputki system works well as it punches through to the soil placing transplant in contact with the soil.

75mm size is for 2" blocks, 1.5" blocks use the 55mm.

We then apply 2 strips of T-Tape on a 2.5' wide bed. Emitters are every 8"

Benefits of the crimped mulch.



- A. You don't have to haul & spread straw mulch or lay down plastic sheeting!
- B. Slow sheet mulching process decays over course of Season providing even moisture retention, moderated soil temps, good weed suppression & habitat for beneficials.
- C. Can be planted into for multiple successions.
- D. Reduces or eliminates need for plastic or geotextile based weed suppression.
- E. Easy cleanup in Fall 1.) remove drip tapes, 2.) cut remaining residue with scythe, 3.) apply cover crop seed, layer minerals & compost.

Option 2: on removing a winter cover: Occultation



Tarp at the end of March when winter cover crop has come out of dormancy & grown some. 6-10 inches of green growth.

Leave tarp on for about 4 weeks. When it's removed apply compost and the bed is ready to be planted.

When the tarp is removed 80-90% of biomass material underneath will be gone.

The bed will be better suited for smaller flower transplants or direct seeding.

After 4 weeks of Occultation: Prep for Planting



- Most biomass has rotted
- Non rotted materials can be raked to edge of bed leaving smooth bed to transplant into.
- Total bed prep time : A little over 1hr
 - Remove & wrap tarp 15 min
 - Rake & smooth 100' bed 30 min
 - Reset drip lines 20 min

Planting using the Bio Intensive Process



Most plants are spaced equidistant apart at 6 or 9”.

Plants are placed on a diagonal or hex pattern.

Tight spacing quickly fills open bed space and in many cases creates a dense canopy choking weed growth.

Using hex pattern can yield 15-20% more plants in same Sq ft.

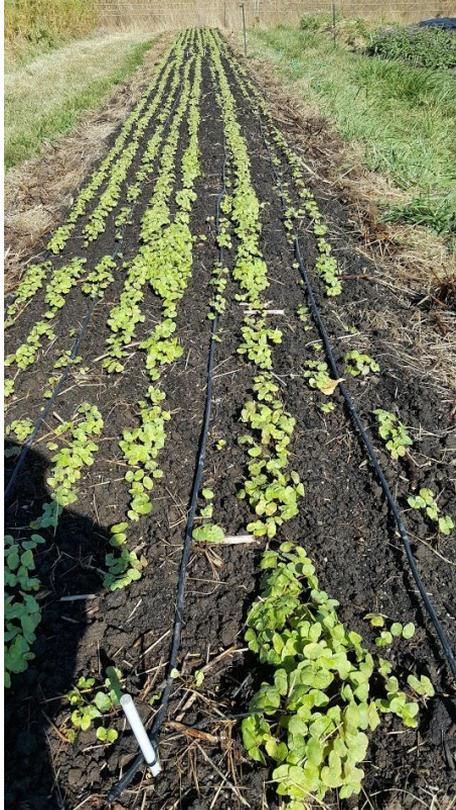
Benefits of better soil health



Higher soil fertility & friable depth allows tighter spacing while maintaining plant health.

A higher plant density of 15-20% more plants in many cases translates into 50-60% more flowering stems per square foot as compared to a standard square pattern.

Cropping Out Process



Remaining crop not harvested was scythed.
Refuse laid on top of bed. Roots & soil
part of plants remain undisturbed.

Applied cottonseed meal, basalt rock powder
and 1" compost on top.

Thoroughly wetted bed with sprinkler, 4-6 hrs.

Double Tarped the bed for 4 weeks.

Removed tarps 85-90% rotted, raked any
larger unrotted left on top of bed to beds
edge.

Used 2 ganged Earthway Seeders to put in
buckwheat cover. (This pic is at 10 days
after sowing)

Hoop Houses are a Unique Space



In our unheated tunnels control of the moisture, ventilation and to a lesser degree temps is with the operator.

Soils without natural rainfall and weathering can get a buildup of excess minerals or salts.

Higher soil temps over the season stokes soil biology and can consume more SOM.

Expensive real estate, need to crop year round, with quick rotations limited or no cover crops used.

Basic Management Techniques.



Annual soil tests.

Use Bio Intensive soil management processes.

Double dug each bed once. Use spading fork or broadfork to crack soil after each rotation.

Limited use of occultation, surface crop residue is removed & composted, roots are left in soil.

All minerals fertilizers, and compost are top dressed and thoroughly wetted in.

Plant directly into top dressings using hex pattern for high yield.

How To Manage Weeds in Tunnels



Use stale seedbed technique if weed seed bank is high.

Never turning the soil after initial double dig.

Use forks to crack soil not turn it. Rake smooth.

Leave most roots in soil.

Apply all minerals/meals/compost on top let “Ground Peeps” & moisture move materials deeper.

Plant intense so plants develop dense canopy.

Use collinear hoe to weeds between plants early at cotyledon stage if necessary before canopy covers over.

Roebuck Farm: New Plymouth/Taranaki New Zealand



Photo courtesy Roebuck Farm

When Roebuck Farm was started topsoil was very thin and he had a compacted Mountain Ash/Silt subsoil.

Used only a broadfork with ~18" tines for occasional deep cultivation and a modified deep spading fork between crop rotations

After 12 years of no till soil depth is over 20" and so friable Jodi can reach into the soil to his elbow or better with little effort.

He has developed a successful Veggie/Market Garden with intense cropping on now highly fertile soil, No Mechanical tillage.

Neversink Farm; Claryville NY.



Photo Courtesy: Neversink Farm

Conner Crickmore farms 1.5 acres using no tractors, no rototillers.

Uses permanent beds, Broadfork and spading forks, rakes and a Johnny's tilther for final seedbed prep.

Uses compost, minerals as required. Utilizes tight crop rotations.

With hoophouses, produces year round with revenues approx. \$350K

Employs ~5 people

Singing Frogs Farm; Sebastopol, Ca.



Founded in 2007 Diversified 8 acre veggie Farm quadrupled soil organic matter in 6 years. From 2.4% to 8-11%

Soil tilth has improved so much that they have reduced weekly water usage by 90%. Soil stores more moisture than surrounding farms.

Produces over \$100,000 veggies per growing acre.

Summary Of Benefits:

Higher fertility allows increased plants per sq ft of bed space. More flowers per sqft!

Better water management allows for lower irrigation needs.

Using soil biology to remove plant residues saves work.

More nutrient dense balanced plants yield reduced pest & disease pressures.

Biointensive planting with low soil disturbance reduces weed pressures avoiding need for plastic mulches or excessive cultivation.

Additional Resources:

The Intelligent Gardener -Steve Solomon

Bountiful Gardens - John Jeavons

Teaming with Microbes - Jeff Lowenfels

Teaming with Fungi - Jeff Lowenfels

Gaia's Garden Toby Hemenway

Podcasts: Permaculture Voices, Farmer to Farmer

Elaine Ingham, Patrice Gros, Gabe Brown, Charles Dowding & many more.

Bare Mtn Farm Youtube Channel or Baremtnfarm.com