

Getting Your Ground Ready for Growing And Being a Biological Grower

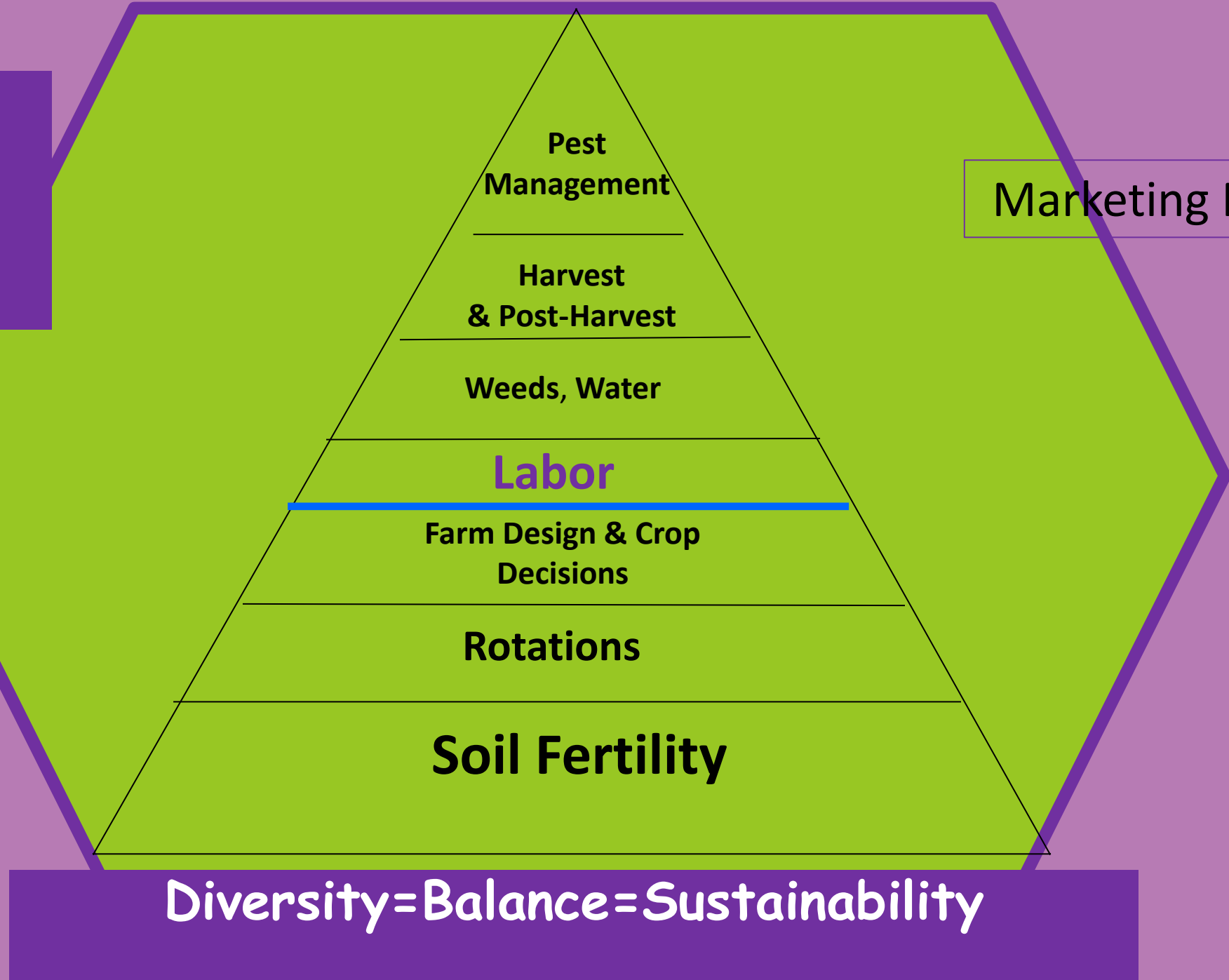
Ellen Polishuk



Flower photos by Barbara Lamborne of
Greenstone Field in Virginia

Farm Systems
Hierarchy of
Importance

Marketing Plan



Alex Hitt, Peregrine Farms, 2012

Time versus Money

Each can substitute for the other in many situations

But you can't have NEITHER 😊

What money can buy:

- Expertise/Advice
- Fertility:
 - Compost
 - Phosphorus
 - Trace mineral
 - Inoculants
 - Biological Stimulants
- Equipment and Infrastructure

What Time can buy:

- Experience on your land
- Experience on others land – working or visiting
- Fertility, at least partially:
 - cover crops and green manures
 - Getting weeds under control



What Makes a Farm Successful?

Production Prowess
Marketing and Business Prowess
People Skills

Healthy Soil is the Basis of Excellent Production



Three-Legged Stool of Healthy Soils



- Physical: Soil components, Aggregation, CEC, OM
- Chemical: pH, Nutrient Content/Balance, OM
- Biological: Soil Food Web, OM

Soil Chemistry

Why Do We Care?



- Yield
- Crop Quality
 - * stem length
 - * vase life

Soil Physics

Why Do We Care?

- Aggregation = air/water ratio = Happy roots = Yield
- Work less, Wear less



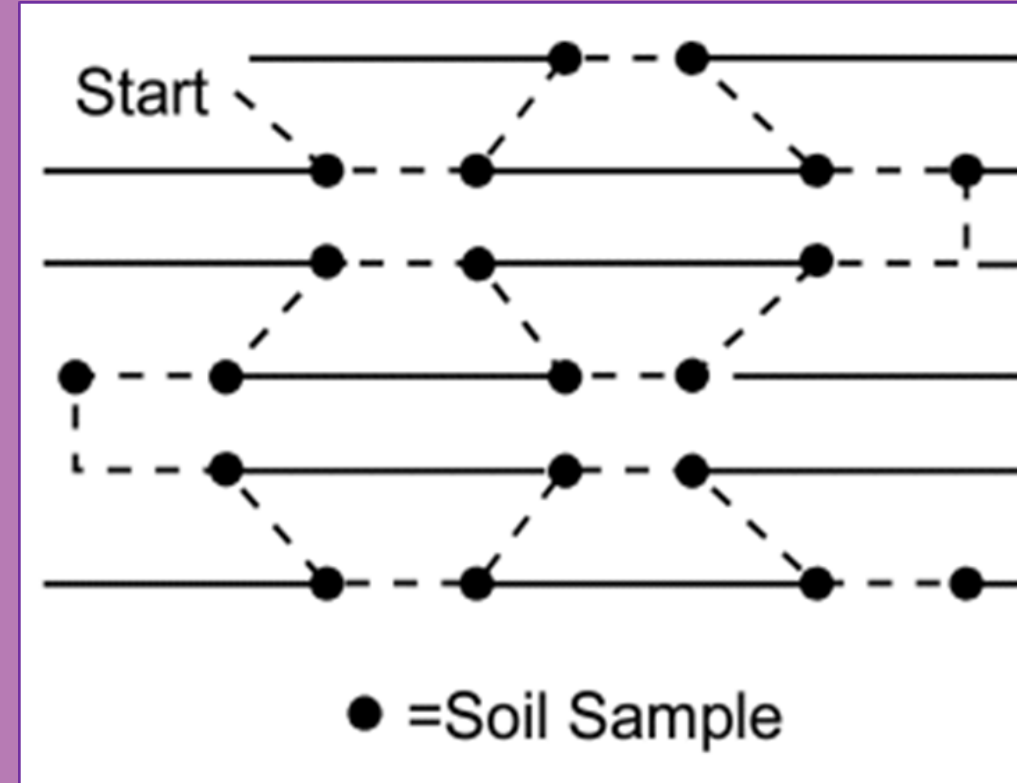
- Storing and cycling nutrients = **Feeding your plants**
- Creating stable soil aggregates so you have tilth = **Growing is Easy**
- Biodiversity to keep plants healthy = **Pest Control**

Rule #1

Soil Test and Apply What's Missing



Soil Testing





SOIL ANALYSIS

Client :	Grower :	Report No: 21-025-1014
		Cust No: 27042
		Date Printed: 01/29/2021
		Date Received : 01/25/2021
		PO:
		Page : 1 of 5

Lab No: 46681

Field:

Sample ID: Field CF

Test	Method	Results	SOIL TEST RATINGS					Calculated Cation Exchange Capacity
			Very Low	Low	Medium	Optimum	Very High	
Soil pH	1:1	6.2						3.6 meq/100g
Buffer pH	SMP	6.89						%Saturation
Phosphorus (P)	M3	6 ppm						%sat meq
Potassium (K)	M3	23 ppm						K 1.6 0.1
Calcium (Ca)	M3	497 ppm						Ca 69.0 2.5
Magnesium (Mg)	M3	69 ppm						Mg 16.0 0.6
Sulfur (S)	M3	6 ppm						H 11.1 0.4
Boron (B)	M3	0.1 ppm						Na 1.6 0.1
Copper (Cu)	M3	0.5 ppm						
Iron (Fe)	M3	68 ppm						K/Mg Ratio: 0.10
Manganese (Mn)	M3	51 ppm						Ca/Mg Ratio: 4.31
Zinc (Zn)	M3	2.0 ppm						
Sodium (Na)	M3	13 ppm						
Soluble Salts								
Organic Matter	LOI	2.2% ENR 88						
Nitrate Nitrogen								

SOIL FERTILITY GUIDELINES

Crop : Annual Flowers

Yield Goal : 1

Optimum

Rec Units:

LB/1000 SF

(lbs)	LIME	(tons)	N	P ₂ O ₅	K ₂ O	Mg	S	B	Cu	Mn	Zn	Fe
20			3.0	3.0	3.0	0	0.20	0.02	0.10	0	0	
Crop :			Rec Units:									

Comments :

What you need to learn from the soil test?

- CEC
- OM
- pH
- Nutrient Levels
- Nutrient Balance

Apply What's Missing = Major Soil Corrections



Get the pH correct with Lime



Annual Crop Fertilizer

- What nutrients are leaving the farm?
- And how will you replace them?
 - Mineral fertilizer
 - Cover crops and green manures
 - Compost or Manure
 - Liquid Fertilizer



How to Choose Products?

Bio-friendliness, bio-availability

Price, including trucking

Ease of use/spreading

Speed of release –

- Length of crop season
- CEC

Other concerns: smell, storability

Role of Liquids in Fertility? Foliars and Fertigation



Upsides:

- quick acting
- Specific, targeted
- No soil disturbance needed
- Can go under landscape cloth

Downsides:

- Expense
- Time
- Temperament



What the soil test does not tell you

- Whether those nutrients are plant available?
- Biology – who's there to help feed the plant?
- Physics –
 - is the soil soft and crumbly so that roots can grow and reach the nutrients?
 - can the microbes breathe?

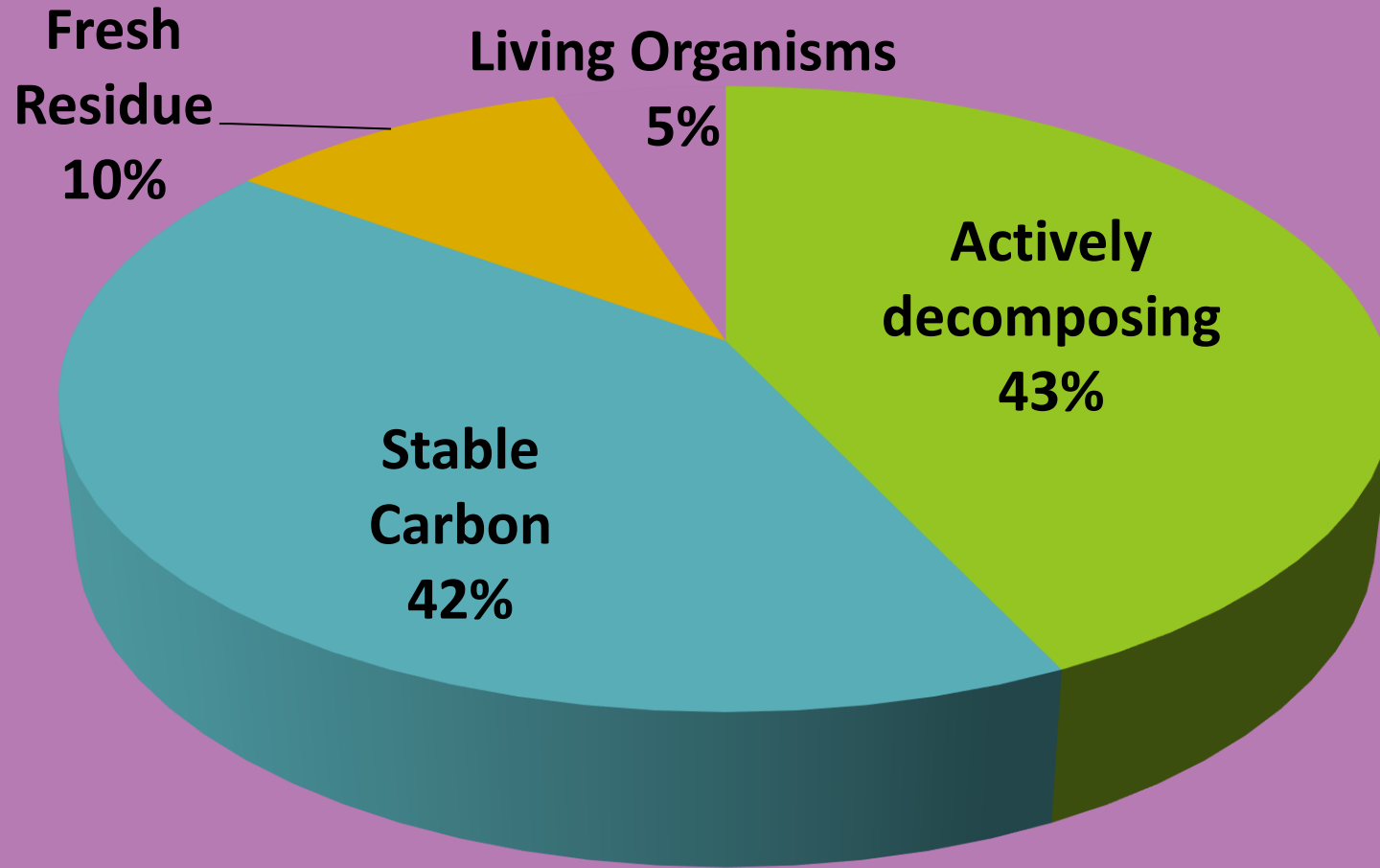


**Soils Lesson
what's up with
organic matter?**

Organic Matter = Carbon



Organic Matter Composition



Organic Matter = the living, the dead, and the very dead

Roles of each kind of OM

The Living = soil biology,

- what keeps our plants fed, protected and healthy
- creates soil aggregation

The Dead = critter food

- Nutrient Cycling

The Very Dead = Stable Carbon

- most of the ‘magical’ properties of Organic Matter
- Detoxification, buffering, water holding capacity, nutrient holding capacity

Why Raise Organic Matter?

- ↑ water holding capacity
- ↑ soil aggregation (tilth)
- ↑ drainage
- ↓ erosion
- ↑ CEC — just a little bit
- ↑ nutrient levels



CHEMICAL SOIL

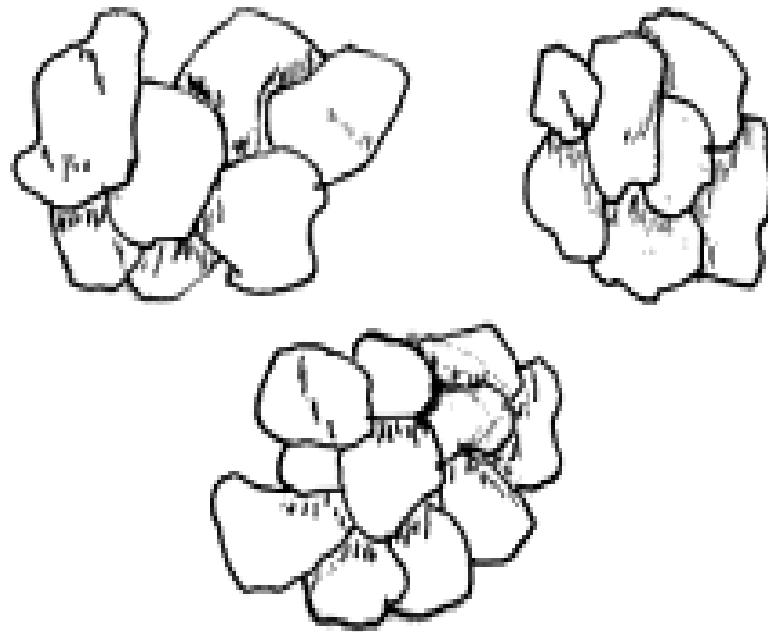


ORGANIC SOIL





Single grains –
No organized structure



Grains formed into aggregates –
Good organized structure

**Soil
aggregation:
this is how tilth
is obtained**

Compacted Clod

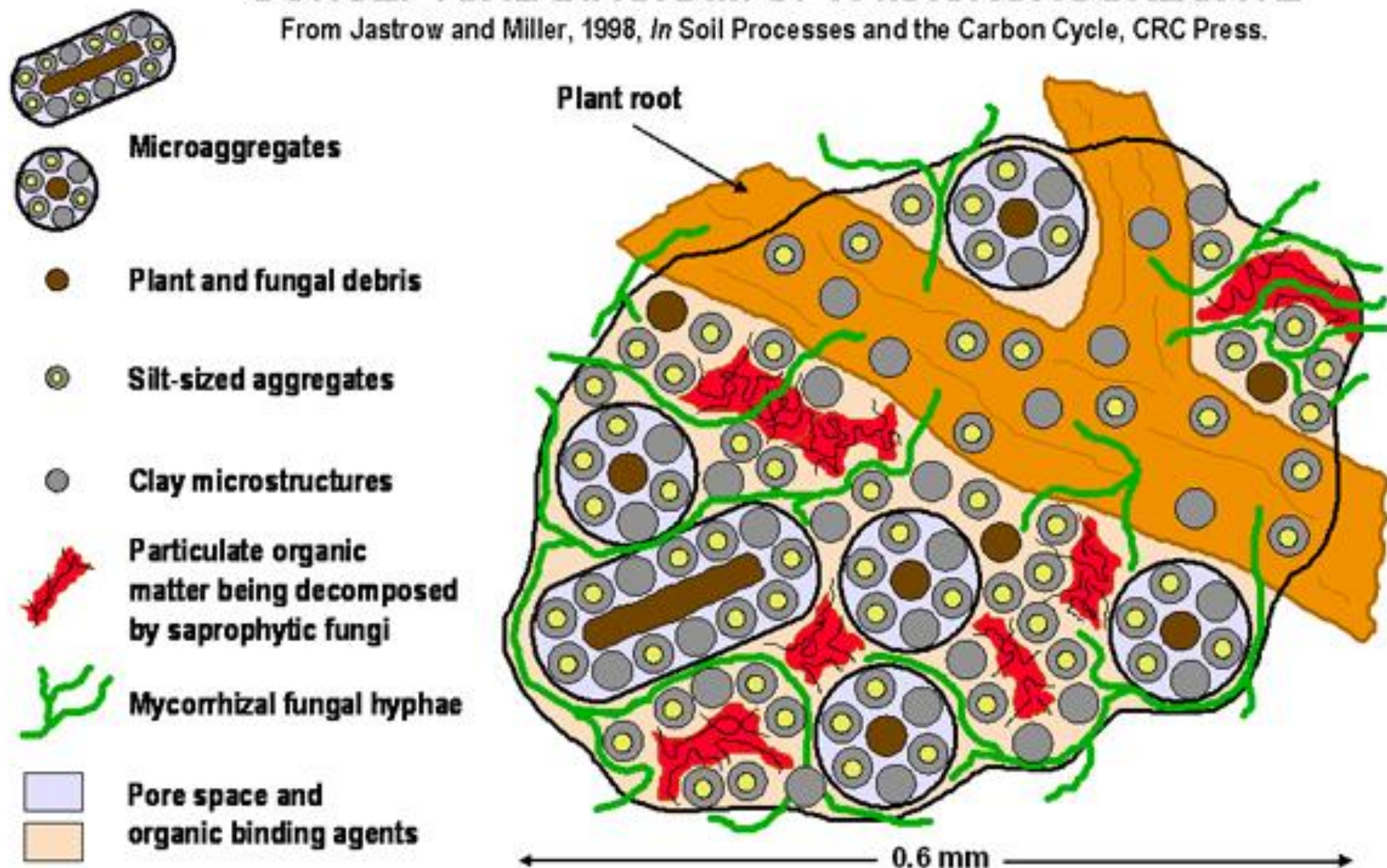


Nicely Aggregated Soil



CONCEPTUAL DIAGRAM OF A MACROAGGREGATE

From Jastrow and Miller, 1998, *In Soil Processes and the Carbon Cycle*, CRC Press.



Micro Aggregate

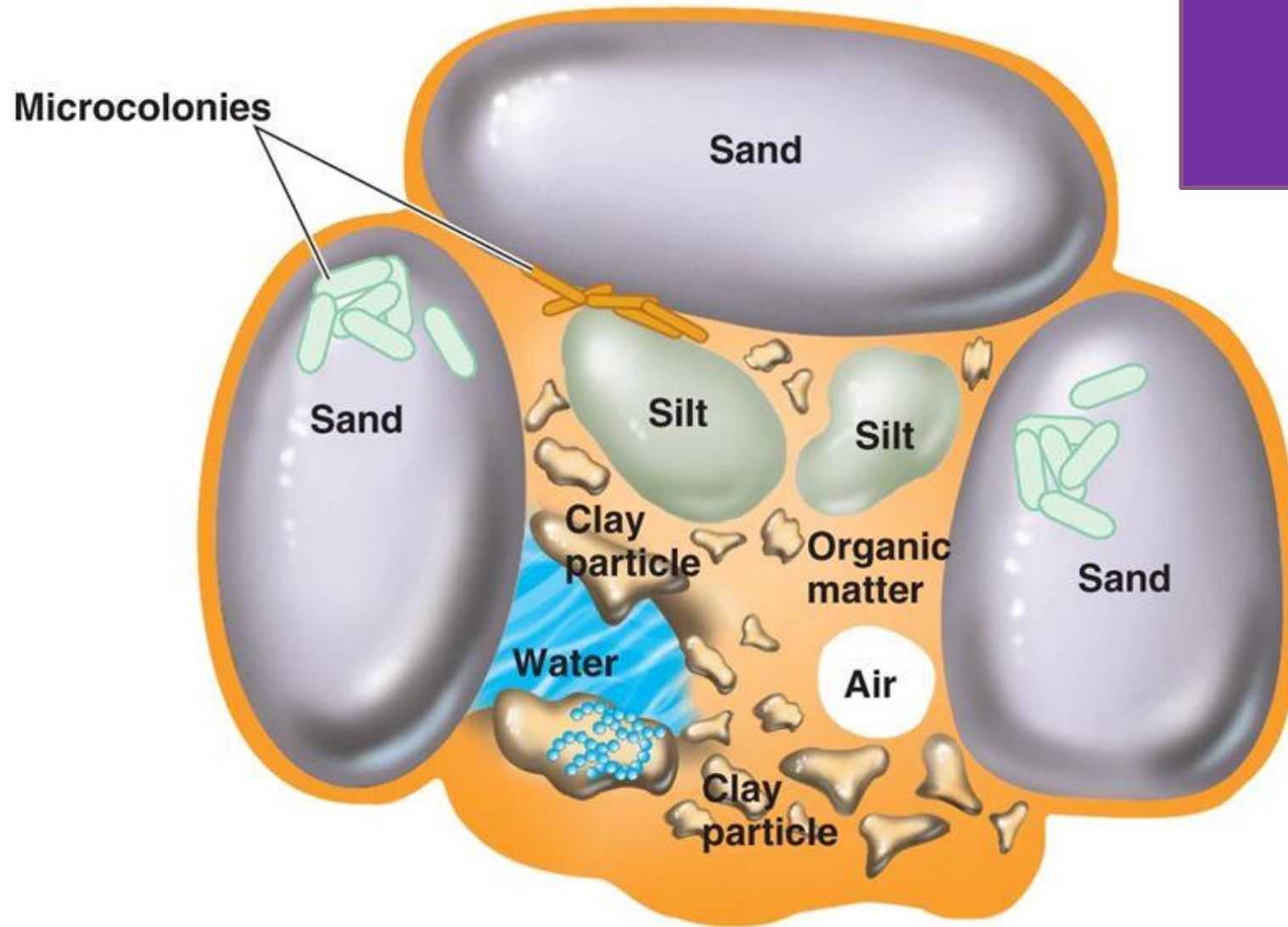


Figure 23.11



**Back to the
RULES**



Tillage!

What's all the fuss about?

Rule #2
Tillage with Care

What is tillage anyway? Any Soil Disturbance





Why Do We Till?

- Aeration
- Organic matter/Amendment Incorporation
- Fine Seedbed Prep for small seeded crops
- Weed Control
- Residue Management

Possible/Probable Negative Impacts of Tillage

- ↓ soil OM (loss of soil carbon)
- ↓ soil aggregation – tillage can pulverize soil and ruin aggregates
- ↑ Erosion potential
- If these are not mitigated then overall decrease in soil health ensues:
 - ↓ pore space = ↓ oxygen = ↑ in compaction
 - ↓ nutrient holding capacity
 - ↓ water holding capacity (droughty)
 - ↓ drainage (ponding)

Use Your Judgement

- Never** work wet ground
- Use lightest equipment you can
- Efficiency = as few trips across the field as possible

Do Right By Your Soil

- Provide lots of OM
- Grow cover crops and green manures

Pro Biology

- Avoid poisons
- Use biologically friendly amendments

How Do We
Mitigate
those effects?

Alternatives to Tillage

Goal	Alternative
Aeration	Very High OM so soil is already aerated, NO compaction Excellent cover cropping
OM/amendment Incorporation	Topdress only, liquids Broadfork Only
Fine Seedbed Prep for small seeded crops	Use lightest fastest touch, avoid blenderizing = Tilther, rake, etc No-till into thick layer of good compost
Weed Control	Mulches (living, plastic, hay/straw), Flaming, Prevention
Residue Management	Tarping (occultation)



Living with Residue: 'bare' ground planting



I LOVE Spaders:
One pass and ready to GO



No/low till planting at Singing Frogs Farm, CA



The background of the slide is a close-up photograph of tulip bulbs and flowers. On the left, there are several red tulip bulbs, some with green leaves. On the right, there are white tulip flowers in various stages of bloom. The overall image is a collage of these floral elements.

Rules #3 and #4
Keep the Soil Covered
Continually Add Organic Matter

Plant cover crops religiously
Grow green manures
Use organic mulches
Spread compost and/or manure

Cover Crops

- **Goals**
 - Erosion prevention
 - Nutrient Cycling
 - Nitrogen Addition (N)
- **Timing** = fall plant, over winter
- **My choices:**
 - Wheat, rye, barley
 - Crimson clover, vetch
 - Tillage Radish

Green Manures/Soil Building Crops

- **Goals**
 - Soil building
 - Nutrient Addition (N)
- **Timing** = main season!
- **My choices:**
 - Sorghum sudan, millet
 - Cowpeas, soybean, sunhemp
 - Buckwheat
 - Oats/field peas (spring only)



← Fall planted Rye and
Vetch Cover Crop

Spring planted Oats and
Peas Green manure ↓



Crimson Clover Cover Crop





Summer Green Manure

Sudex and Cowpeas

How to Plant Cover Crops and Green Manures



Grain Drill



Belly Seeder

Spin Spreader



A red International Harvester 84 tractor is shown from a side-rear perspective, working in a field of tall, green grass. The tractor has a large, treaded rear tire and a smaller front tire. A yellow flail mower attachment is visible at the rear. The grass is being cut and is piled up behind the tractor. In the background, there is a line of trees under a blue sky with some clouds. The text "INTERNATIONAL 84" is visible on the side of the tractor.

FLAIL MOWER
Before
incorporation
or tarping

What is the role of compost?



Physics,
Chemistry,
and
Biology

The background of the slide is a photograph of a field. On the left and center, there are dense green plants with large, heart-shaped leaves, likely a vegetable crop like squash or pumpkin. To the right of these plants is a distinct border made of dry, yellowish-brown straw or mulch. The lighting is bright, suggesting a sunny day.

Maintain Soil Cover

The soil should be covered by
crops,
crop residue,
or mulch

As much as possible

Quick summer green manure of buckwheat

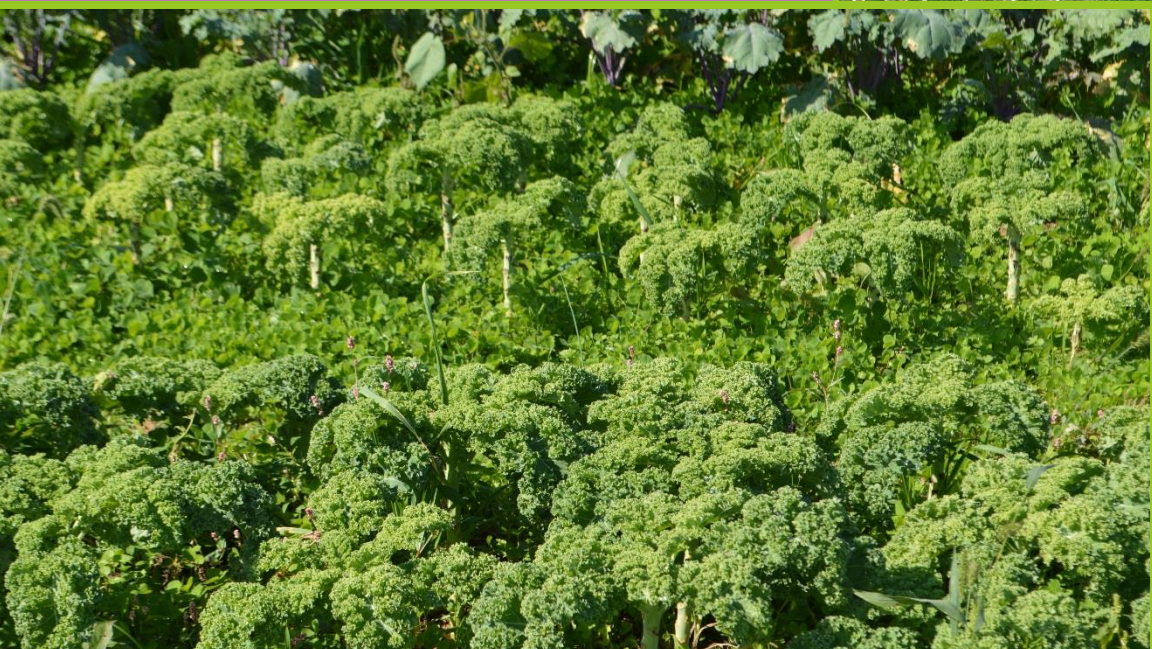


Post Flail Mowing

I Love Mulch



Clover over-seeded into Fall Brassicas



Rule #5
Rotate crops



The Many Goals of Crop Rotation

Disease/Insect Prevention
Weed Management
Feeding the Microbes

A photograph of a red tractor driving through a green field. To the left of the tractor, there are rows of tilled soil covered with black plastic mulch. The background shows a line of trees and a clear sky. A purple rectangular box with white text is overlaid on the right side of the image.

5 rules for maintaining soil health

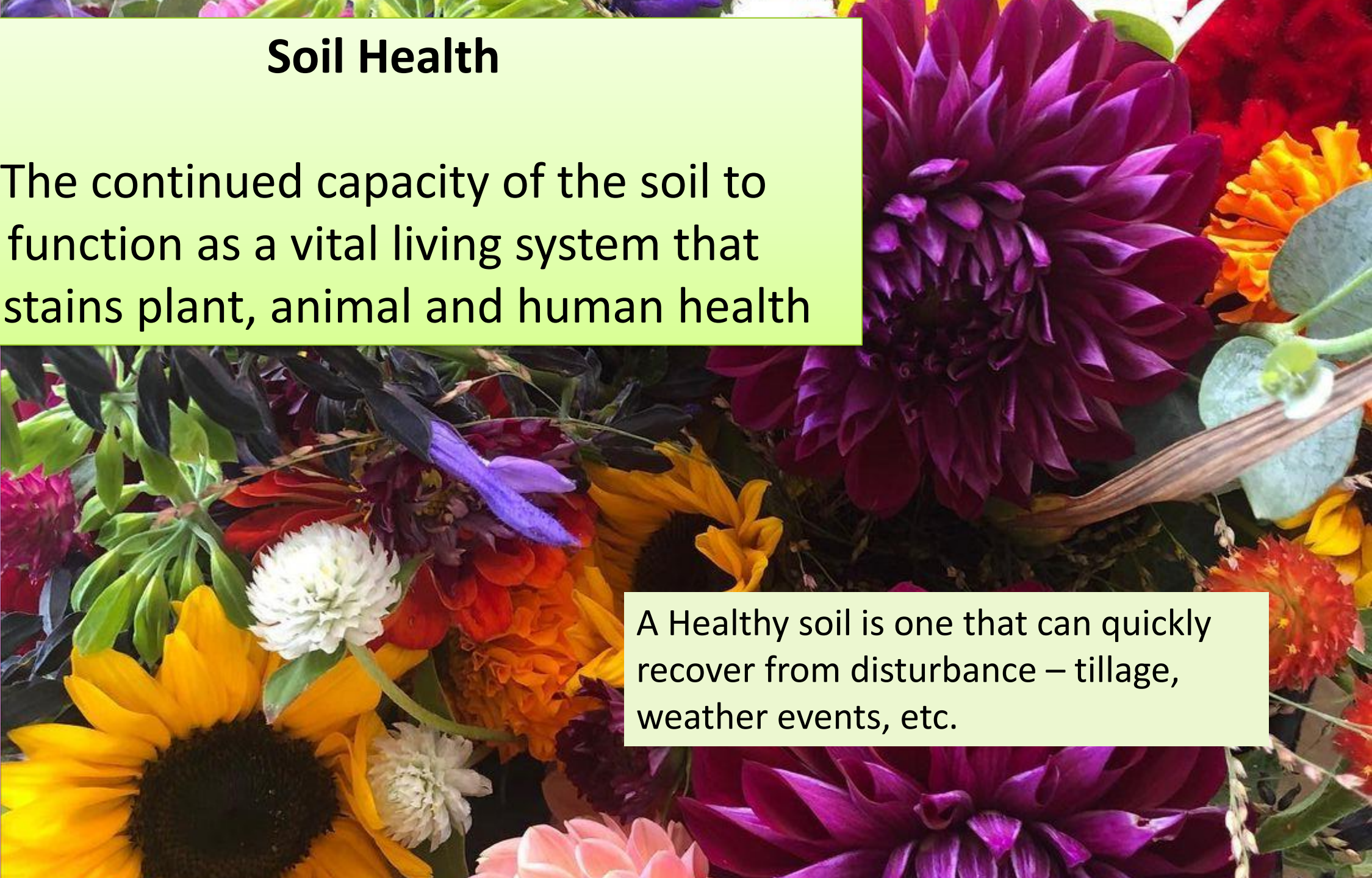
1. Test and balance soil nutrients, add what's missing
2. Till thoughtfully and gently
3. Keep adding Organic Matter
4. Keep the soil covered as much as possible
5. Rotate crops

How long does it take to “heal” land?



Soil Health

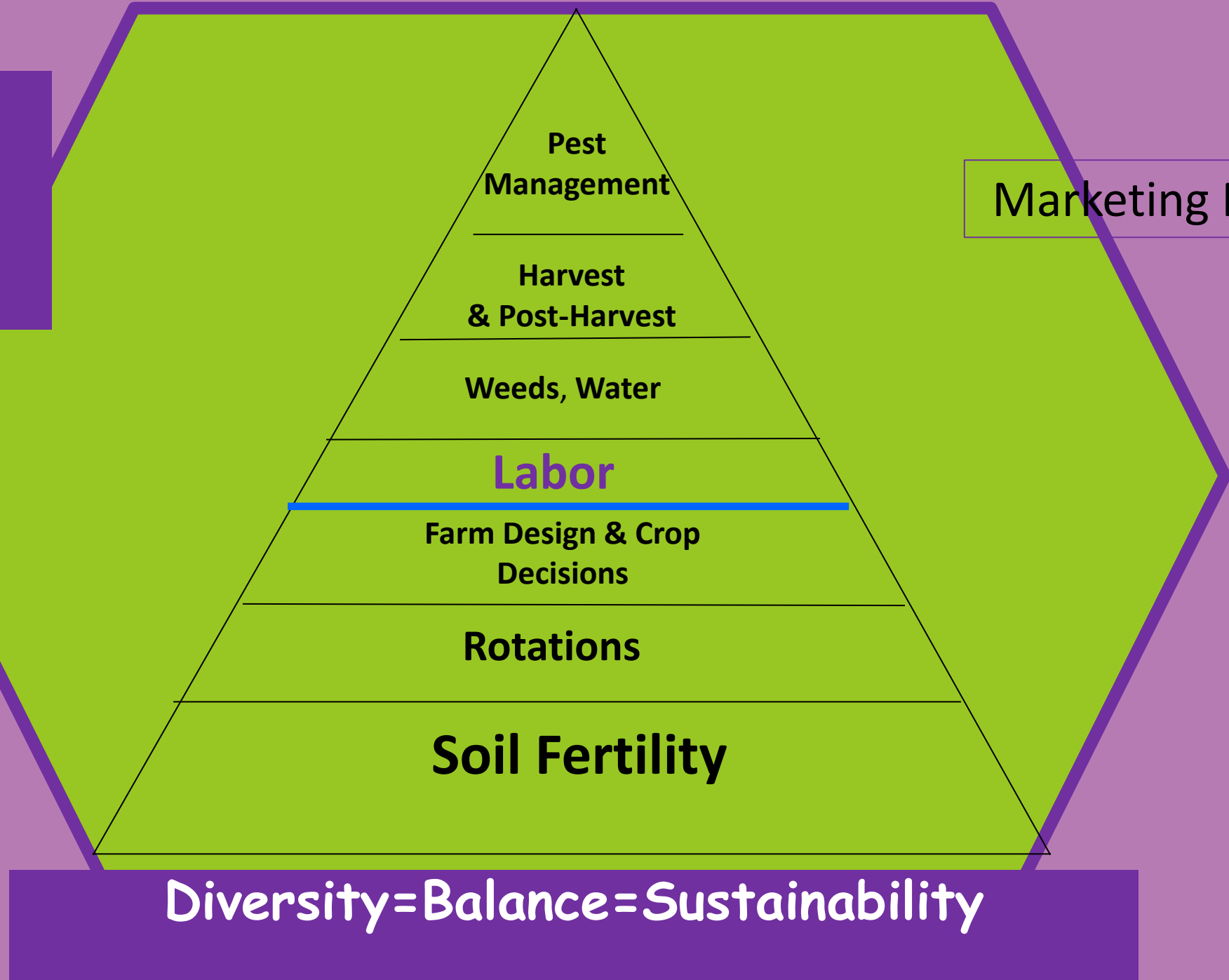
The continued capacity of the soil to function as a vital living system that sustains plant, animal and human health

A vibrant bouquet of flowers, including purple dahlias, yellow sunflowers, orange and red chrysanthemums, and a white pom-pom flower, set against a purple background.

A Healthy soil is one that can quickly recover from disturbance – tillage, weather events, etc.

Farm Systems
Hierarchy of
Importance

Marketing Plan



Alex Hitt, Peregrine Farms, 2012

THANK YOU



STAY IN TOUCH WITH ME



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Greenstone Field in Virginia