The Healthy Garden

- **I will introduce you to ideas such as:**
  - **Soil**
  - **Soil health**
  - **Making a new garden**
  - **Planting**
  - **Composting**
  - **Inter planting crops vs monocrops**
  - **Beneficial insects**
  - **Harvesting**
  - **Clean up**
  - **Mulching**
  - **Pests and diseases**

Soil is a Living Organism
Don't Touch it!
Do Feed It

- Feed and water soil NOT plants
- Chemical fertilizers feed plants but harm soil
- Increase microbe diversity & density by suppling food (OM), warmth and water
- Macrobes – earthworms, insects & other small animals: tunnel are soil renovators
- 1 cm3 of healthy soil has > 9 million living organisms (see appendix for breakdown of organisms)
- **O.M.**
  - is food for all your macrobes and microbes
  - allows water to enter the soil and is a reservoir
  - holds 90% of its weight and 4x its volume in water
    - shares water with plants

Regenerative Soil Care

Regenerative is holistic & sustainable = restores nutrients

- **Don't touch!** - Minimal tilling/cultivating
- **Leave roots in the soil**
  - reduces soil erosion
  - food for plants
  - micro and macro organisms
  - loosens soil
  - increases water infiltration
  - improves gas exchange
- Increase plant biodiversity to increase nutrient, water, micro and macro biodiversity
- Reduce erosion by planting cover crops, mulching with compost, leaving plant stalks up to catch the snow and stop the wind
- Crop rotation
- **Produce is better quality and is more nutritious**

Soil Health

Keep your hands out of soil!

Feed and water soil never plants

Mulch: is a layer of anything that is not your soil on top of the bed.

- Preferred mulch is organic matter on top of the soil. Compost is best.
- Use compost as mulch to: feed soil, moderate T*, improve water retention/absorption

Results:

- Happy micro and macro organisms
- Reduces stress and diseases
- Improves water & nutrient uptake

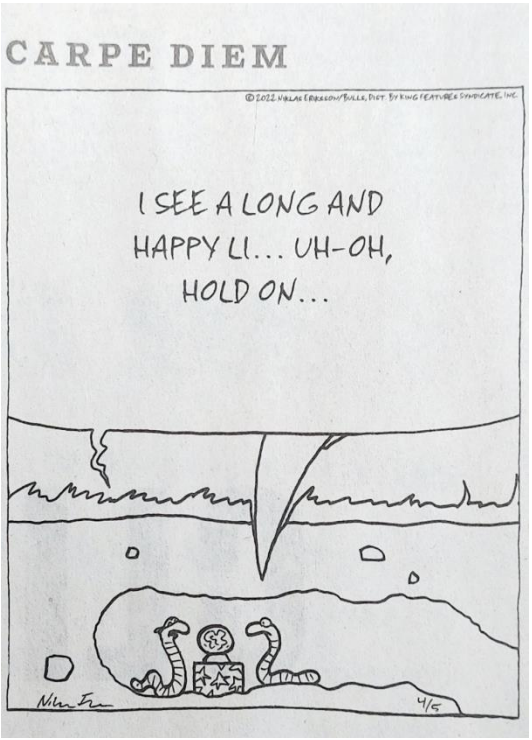
Soil is not Dirt

- It is a living organism.
- Don’t buy bagged top soil/black earth because it is not alive, it doesn’t help your garden soil to be healthier.
- Triple mix has organic matter in it so it is ok.
- Or better yet: add O.M. (Organic Matter) such as compost, mushroom compost, coffee grounds, egg shells and /or manure. Manure must be not fresh to be weed free and not burn the plants (uric acid).

- **Healthy soil** can have as many as 9 million living organisms / 1 cu cm. They thrive if they have the same conditions that we need: warmth, air, plenty of food (organic matter) and water.

Fungal hyphae in soil, feed plants nutrients, release minerals and improve soil structure by clumping it together.

Earthworms are not native to N. America but benefit disturbed soils (not native forests). They are Nature's rototillers! They pull mulch into the soil in a few weeks and the channels stay open until late winter.



Earthworm castings are their poop

The castings are nutritionally formulated for the best possible availability for plants. The worms transport materials to and from the surface to a

few feet into the soil. The channels are stable for the whole growing season allowing rain, water and air in. They are also covered by polysaccharides which host large and diverse populations of Micro and macro organisms.

Squash Bee egg chamber

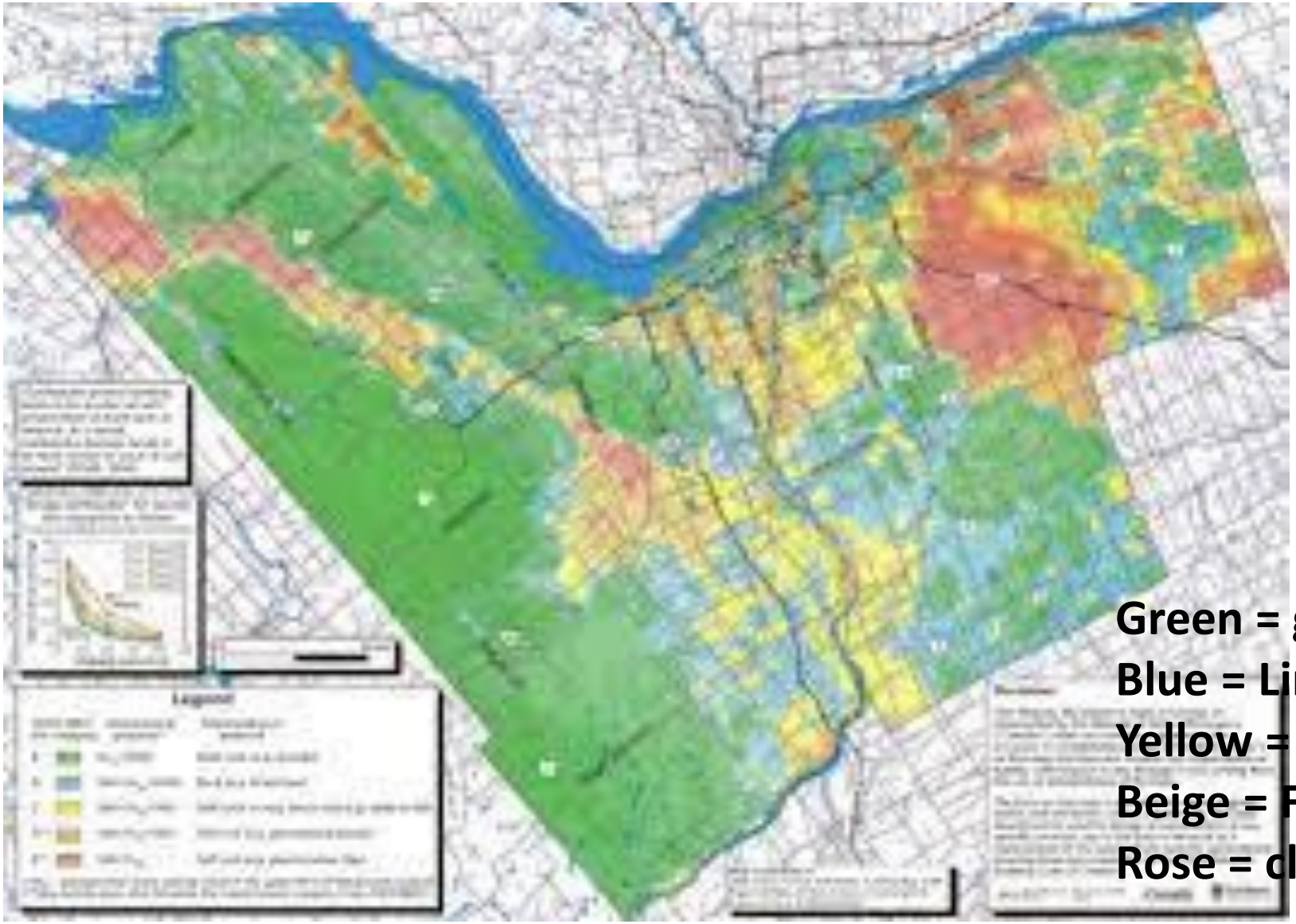
Tilling destroys all soil insect homes including squash bee egg chambers and the underground fungal mycelium.

Whereas earthworms protect soil flora and fauna.

Texture: refers to the % of

sand silt and clay in soil

Soil Map



Green = granite
Blue = Limestone
Yellow = large till
Beige = Fine Till
Rose = clay soil

Structure

Describes how Sand, Silt and Clay aggregate together. In nature, soil structure is often stable through the seasons and crumb like.

O.M. is the solution for all soil problems.

O.M. is the source of nutrients and a reservoir for water.

No chemical/synthetic fertilizers needed nor wanted.

They kill the living soil (organisms).

Making a New Garden

- Make new beds in the fall and add OM to amend the soil
- Let winter create a stable crumb structure
- OM improves all soil textures and structures
- Plant in the spring but disturb the soil as little as possible
- **Cultivation harms:**
  - Soil organism and soil structure
- **Follow the instructions on slide 34 For garden clean up**

Methods

Getting rid of grass/groundcover

1. choose a shape and mark it out using a garden hose or spray paint, etc.
2. Kill grass using:
    1. Clear plastic to solarize (kill diseases and plants)
    2. Black plastic to kill plants, remove before planting.
    3. Cardboard to kill plants. Put compost or soil on the cardboard to hold it in place. We don't want to disturb the soil so plant through the cardboard which will brake down during the growing seson

    Don't disturb soil

    Plant in spring

How to plant the garden in the Spring

- dig a hole just big enough for the roots
- stir in a little bone meal and compost at the bottom of the hole to stimulate root growth and stress tolerance
- spread out the roots when you place the plant into the hole
- fill the hole with water
- add soil back into the hole
- water again
- make a well for watering
- water the soil not the plant

Timing

- Cool crop seeds and bedding plants go into the soil in early May when the soil is still cool to your touch.
- Warm season seeds and bedding plants need soil that is warm to the touch down 3 inches. Put your fingers all the way into the soil to feel the temperature.
- Plant your garden from early May to late May.

Caution

- Use organic crop residues, or end products in your garden, don't introduce harmful pesticides into your soil.
- Any products that have been part of conventional agricultural systems such as manure, straw or mushroom compost will have significant levels of pesticide residues which will adversely affect the biology of your soil.

Composting
A home owners guide

Nature creates compost without your help

These instructions are for a backyard 1m x1m composter

- Let the rain in.
- Sprinkle soil on as you add garden waste.
- Once a month put a little soil onto the pile
- **Leave it alone!**
- Worms will come into the compost from the soil below.
- Microbes come from the soil / compost and rainfall.
- Worms and composting microbes need food, water and warmth.
- Winter cold slows down composting so use the compost from the fall cleanup to mulch in June.
- Use the compost from summer plant scraps in October as mulch.

Don’t worry, be happy composting happens

- In the compost pile layer soft & tough plants alternatively (i.e. squash & tomato).
- Don’t add diseased plants (i.e. tobacco mosaic virus on tomatoes, or Aster yellows).
- Don’t add weed seeds or hard to kill weed roots.
- Top with soil or compost.
- **Leave it alone!**

NOTE: A homeowners 1m x1m compost bin or pile will be a static composter populated mostly by bacteria. An aerobic compost pile has the addition of woody cellulose material and careful turning to let fungi thrive. The municipal composting is thermophilic and reaches 70*C.

Barrhaven Food Bank Composters
April after added garden debris into the composter

Debra Dynes F B Composter
Spring after planting squash, it was filled with garden debris last fall

Interplanting mimics nature

Interplanting creates self supporting plant diversity vs creating a plant desert.

Monocropping is an example of a plant desert.

The 3 Sisters: refers to the Americas Indigenous peoples practice of planting Corn, Bean and squash in the same hole because the help each other.

MONOCROPS ARE UNNATURAL

PALM OIL PLANTATION

Interplanting

In these beds we have a tomato plant, zucchini, kale, carrots, beets, turnips, and beans. The beds are 8’ x 5’

Onions and
hot peppers

The 3 sisters

Tomatoes
and beans

Interplanting

- Think of your whole garden as a personal ecosysyem, consider planting vegetables/herbs and flowers together.
- Kale (esp purple leaf looks dramatic in a flower border). Tabasco hot peppers are very eye catching in the front of a border.
- Herbs in the garden i.e. thyme and rosemary by the front walk or patio add a lovely scent and love the heat.

Interplanting

- Initially: Alternate root crops with above ground crops i.e. onions and lettuce, carrots and spinach, tomatoes and potatoes. No large spaces of one plant type.
- Consecutively: as you harvest one crop i.e. radishes plant another i.e beets/turnips/beans (not rutabagas)

Layering plants in a bed

Plant short root crops with above ground crops to increase productivity and diversity

Using tall plants to protect

Corn on the south and west side help protect tender plants from harsh sun (heat) and wind. The 3 sisters method protects the smaller plants.

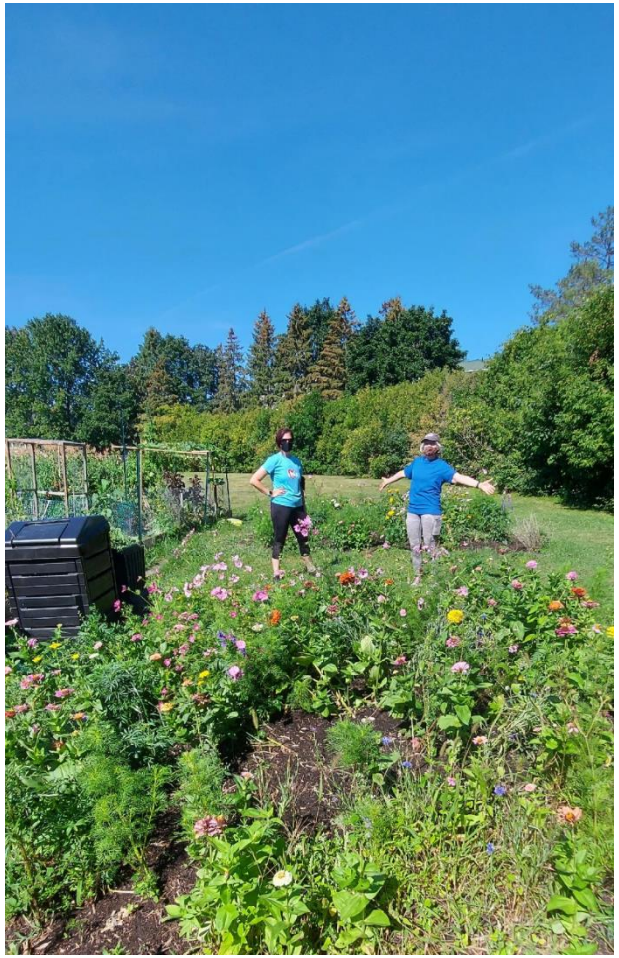
Interplanting Benefits

- increases productivity
- shades tender plants
- increases soil biodiversity which improves soil
- confuses pests
- reduces disease transmission

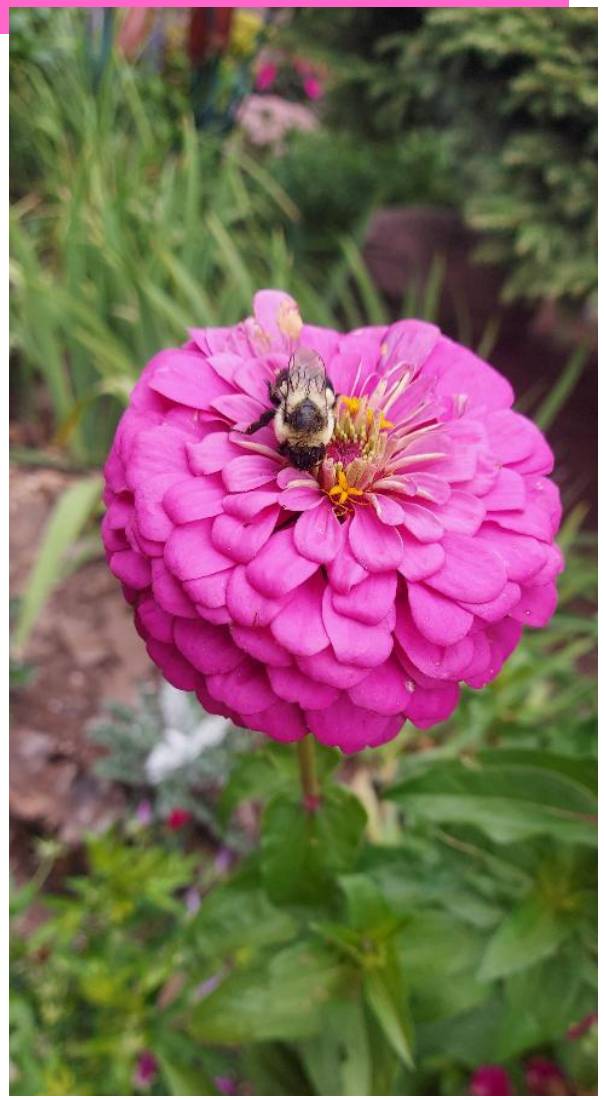
Crop Rotation

Never plant the same thing in the same place – it will increase diseases and reduce nutrients available to plants making the garden less productive. Each species of plants selectively uptakes nutrients in different quantities, i.e. Brassicas take up more calcium from the soil than zucchini.

Pollinator Gardens are a must have!

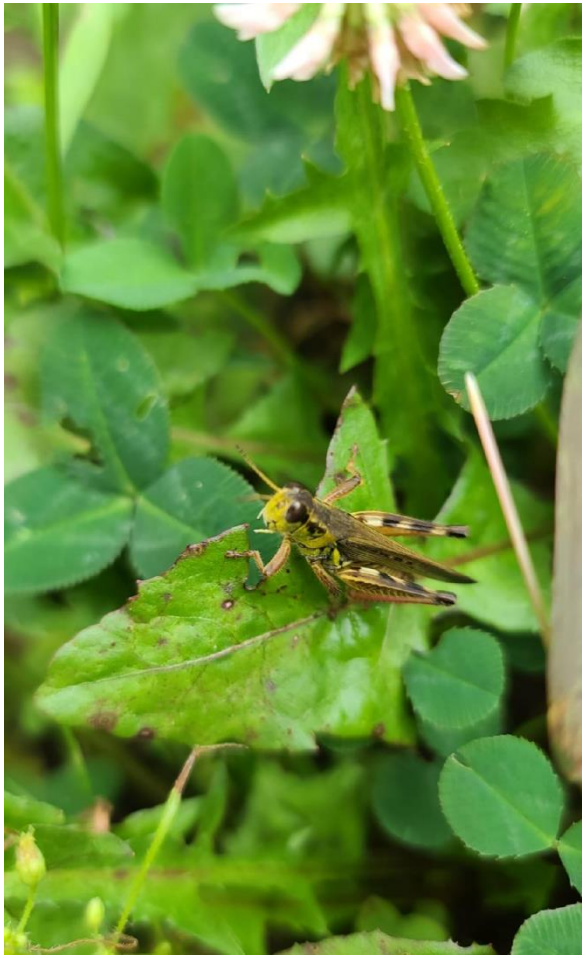


It will be an untidy space with a riot of flowers , mostly native, blooming at different times. Locate it in quiet place
Cut down the weeds or remove invasive roots early in the smmer. Clean up the garden carefully in late spring.



Pests

Identify the pest. Then manage it using a soap solution, isopropyl alcohol, diatomatious earth.
Please refer to the document on the BGClub web page “Common Garden Pests”



Diseases

- **Fungi/moulds**: treat prophylactically with milk or baking soda, and mulch with good quality compost. Using compost to mulch reduces disease transmission.

Bacteria and Viruses can't be treated

Remove affected plants from your property

- TMV (tobacco mosaic virus) on tomatoes
- Aster yellows on many plant species

TMV on Tomato, do not smoke cigarettes if you grow tomatoes.

Aster yellows is insect transmitted and affects many plant families. Remove the affected plants

Cabbage and lettuce

Helping your Beneficial Insects

- **You need to:**
- Create habitats that mimic nature in each micro ecosystem in the garden i.e. shade, sun, wet, dry etc. This includes shallow pans with stepping stones for the insects to drink water fro
- Make homes for native insects.
- Clean up less.
- Don’t turn the soil.
- No synthetic fertilizers or pesticides in or near the soil.

If you build a habitat they will come

Harvesting and clean up in the 21st Century

Know when to harvest your crops

- many root crops (parsnips, etc) and Brassicas (Brussel sprouts, etc) taste better after a frost.

Methods

- Cut the plants 4 -6 " above the soil
- Leave roots in soil (don't disturb soil)
- Broadcast a green crop such as winter Rye Grass seed

The roots will:

- create channels for water and air to enter and be stored in the soil
- Reduces wind erosion

Tree leaves can be left on the garden esp. to protect Garlic from squirrels.

Appendices

- Refer to the following documents posted on the Barrhaven Garden Club web page for more details
  - **The Healthy Vegetable garden 2022**
  - **Common Garden Pests and strategies to manage them 2022**
  - **Fall Garden Cleanup 2022**
- Below is other information

Soil Is Not Dirt!

Terms that describe best practices for soil health

- **Regenerative** (is a polyculture system) restores soil health by following systems in nature
- https://www.soilfoodweb.com/ Dr. Elaine Ingham. A group of soil scientists educating the public on the latest research for soil health
- https://kisstheground.com/ Also a great movie about soil on Netflix
- **Permaculture** (is a polyculture system)
  - is sustainable growing modelling thriving natural ecosystems
- **Organic**: no GMO, sewage sludge, chemical fertilizers or pesticides but can apply pesticides (such as copper sulphate, which is a fungicide)
- **Soil food web:** diverse populations that interact with each other and the sand, silt and clay.
- **Conventional growing has been practiced for only 100 years**
  - uses mechanical tilling, chemical fertilizers, pesticides etc. It started in the early 1900's. It damages soil biodiversity & health, fertility, and structure leading to compacted poor soil. Increases atmospheric CO_2.

Breakdown of organisms in 1cu cm of living soil

Microbial Diversity	*Average numbers*
Bacteria	9,00,00,000
Actinomycetes	40,00,000
Fungi	2,00,000
Algae	30,000
Protozoa	5000
Nematodes	30
Earthworms	< 1

https://www.researchgate.net/figure/The-average-number-of-organisms-in-1-cubic-centimetre-of-agricultural-soil-25_tbl1_291345421/download

Fungi is your Friend

Fungi communicate:

- https://www.theguardian.com/science/2022/apr/06/fungi-electrical-impulses-human-language-study?CMP=Share_AndroidApp_Other

The Secret Life of Fungi: Ten fascinating facts

- https://www.bbc.com/news/science-environment-45486844

Fantastic Fungi, Official Film Trailer | Moving Art by Louie Schwartzberg

- https://www.youtube.com/watch?v=bxABOiay6oA
- https://www.netflix.com/ca/title/81183477

The Nature of Things “The evolutionary story of how fungi shaped all terrestrial life — including us”

- https://www.youtube.com/watch?v=9xKeJyvnuWs

The Nature of Things “Smarty Plants”

- https://www.youtube.com/watch?v=iUWEBQu6uqg

What Trees Talk About: A revealing look at the secret life of trees

- https://www.youtube.com/watch?v=_LFvL_iYVaY

Harvesting and clean up in the 20th Century

Remove the vegetable plants as soon as they have been harvested to reduce insect and disease problems. Pick up the leaves and plant debris also.
Compost them if they are disease free

Technique

- Start at one end of the row and walk backwards. Do not step on the newly turned soil.
- To dig the soil, put the shovel all the way into the soil at an angle that is perpendicular to the soil (the handle will be forward in front of you)
- Invert the soil by lifting the shovel, and then rotate it so that the soil drops inward from the edges of the bed, turning the clump upside down. Put the surface soil down into the whole first and let the bottom be on top.
- Leave the soil in this loose clumping form; allow nature to break it down into bread crumb sized aggregates.

Timing:

Flip the soil when it is warm because the earthworms move down during the day as the sun warms up the soil.

Flip the soil as soon as you harvest to improve soil health.

Advantages: loose clumps improve water and air in soil

Disease/Pests: the diseases spores and pest insect eggs that may have been present are now buried 15cm (6”).

The reduced gas exchange will cause many insect eggs to die.

Disadvantages the soil structure and the fungal hyphae have been broken reducing the health of the soil

Walk backwards when digging

Large clumps allows better water movement into the soil (infiltration), through the soil (percolation) and air movement (gas exchange)

Info on soils in Barrhaven

The Soils of the Regional Municipality of Ottawa-Carleton (Excluding the Ottawa Urban Fringe) - Volume 1 and 2

- https://sis.agr.gc.ca/cansis/publications/surveys/on/on58/index.html
- Go to pages 45 and 55 to learn more about your own soil

Barrhaven Soil Map