# Grow Biointensive Farming and Gardening

## A Sustainable Agricultural System

Seasons of Sustainable Agriculture
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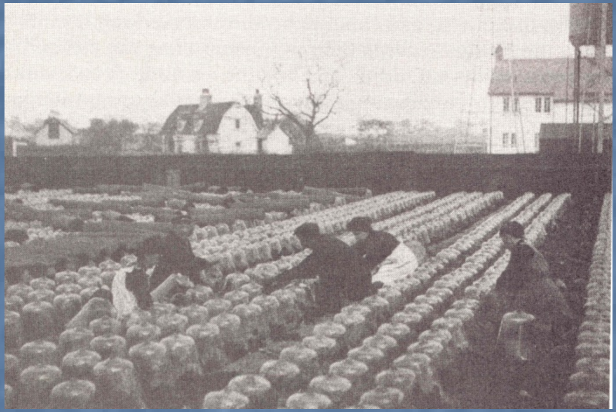
# Historical Perspective
## (Ancient)

- Chinese Agriculture - 4,000-6,000 years old
- Japanese Agriculture - 2,000-6,000 years old
- Greek Agriculture – 2,000 years old
- Bolivian, Peruvian, Mayan Agriculture – 1,000 years old

# Historical Perspective
(Resent)



- Monastary “preserves”
- French Intensive
- Bio-Dynamics (Steiner)
- Bio-Dynamic/French Intensive – Alan Chadwick at Santa Cruz
- Grow Biointensive – John Jeavons at Ecology Action, Willits CA.

# Current agricultural Problems

- More people to feed and less land
- 10 calories of Fossil fuel to produce
  1 calorie of food
- Declining water availability (40% of grain irrigated)
- Reduced genetic base; over 95% of seed varieties ever used have been lost
- Declining nutrient quality of food

# Advantages of Biointensive Agriculture

- Produce 2-6 times as much food in the same area
- Reduce the energy demands (almost eliminate fossil fuels)
- Use water 3-8 times more effectively
- Develop a local, diverse, and secure seed base
- Provide self contained closed loop fertility

# 8 Basic Components of Biointensive

- Deep soil preparation

  allows

- Close plant spacing

  and the practice of

- Companion planting

  using

- Open pollinated seeds

  fed by

- Compost

  obtained from

- Sustainable soil fertility

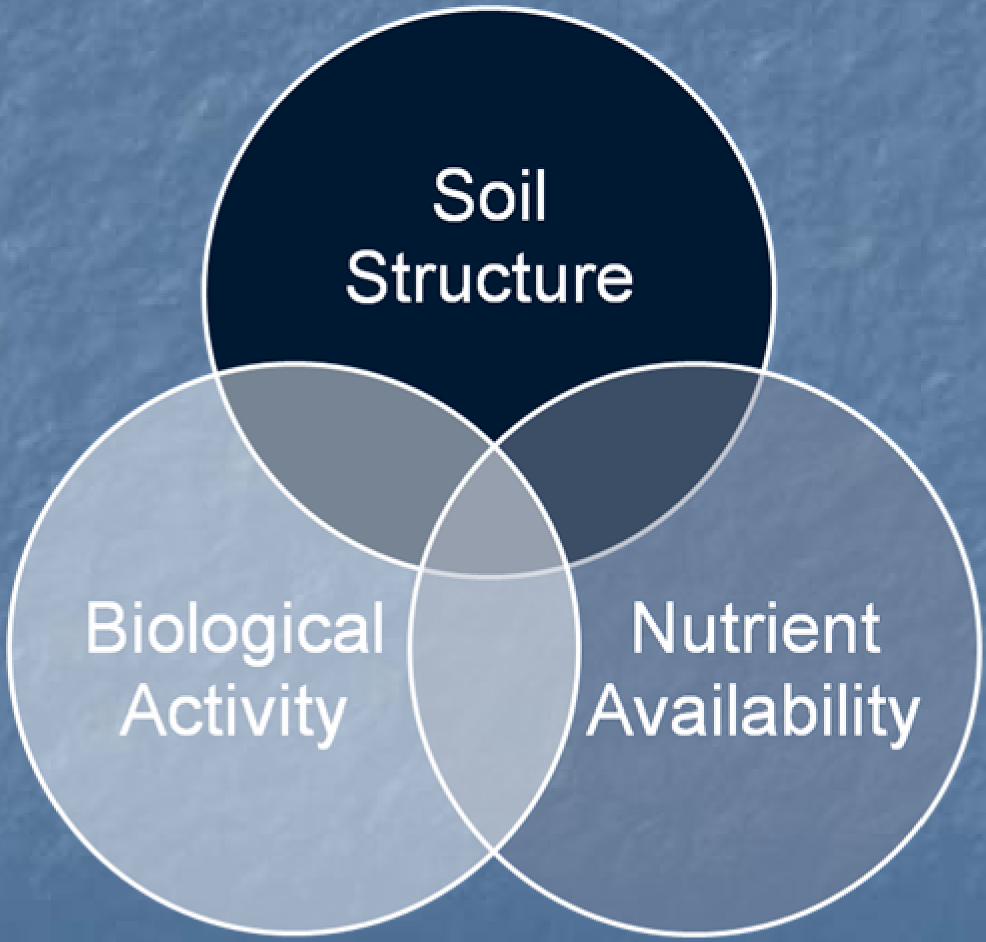
  which provides a

- Complete diet

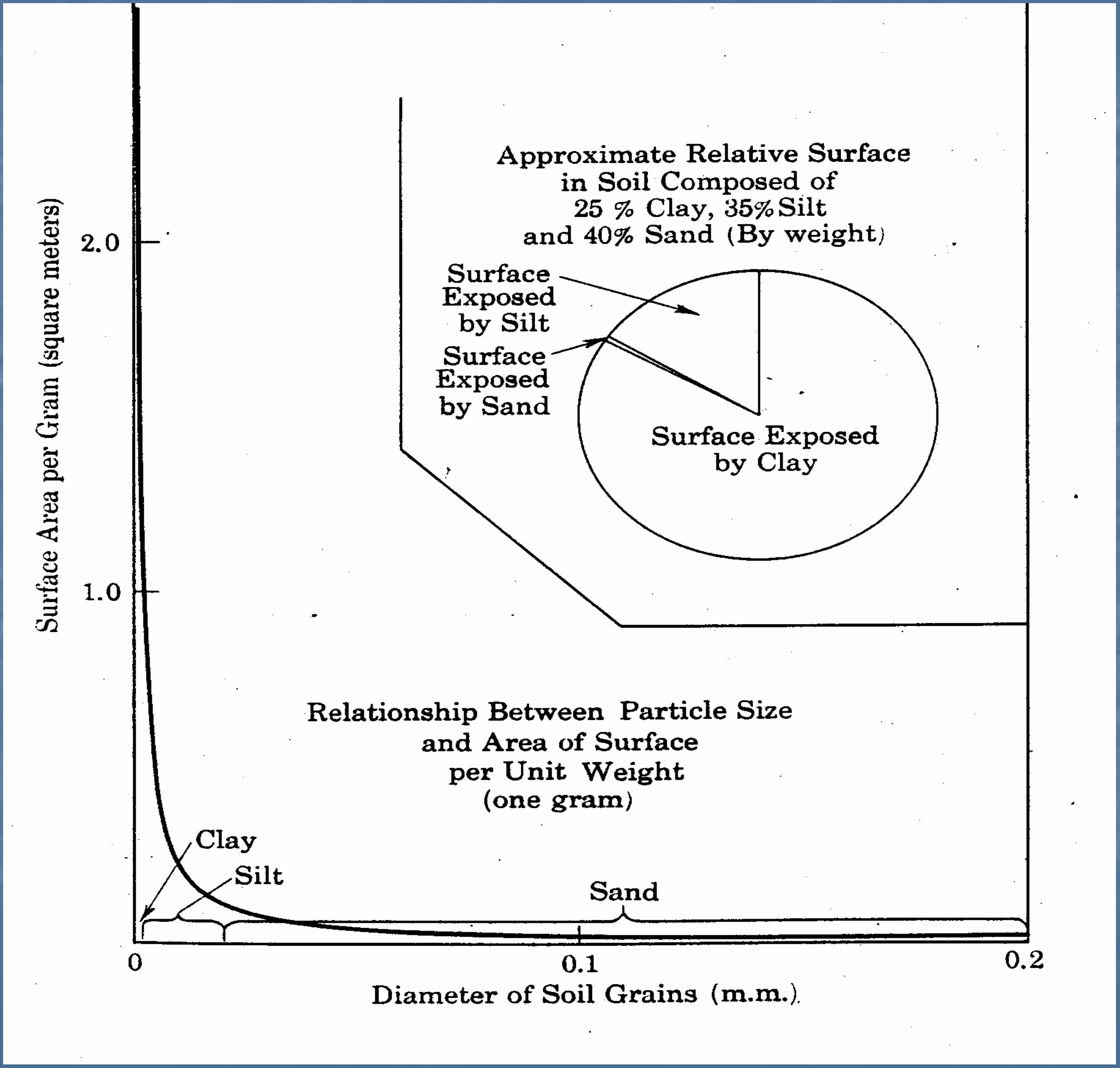
  within a

- Whole system

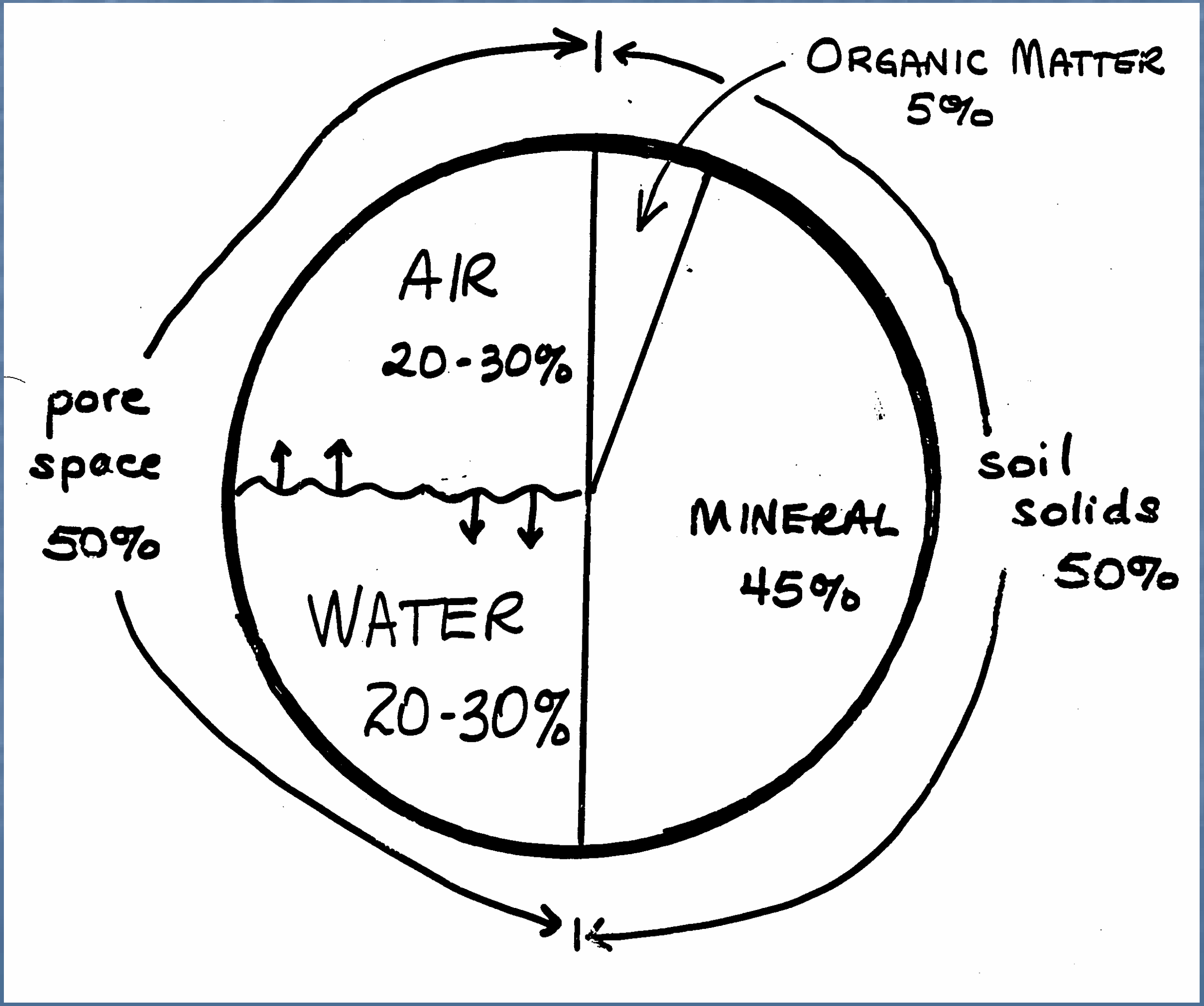
# A Healthy Soil



# Importance of Particle Size

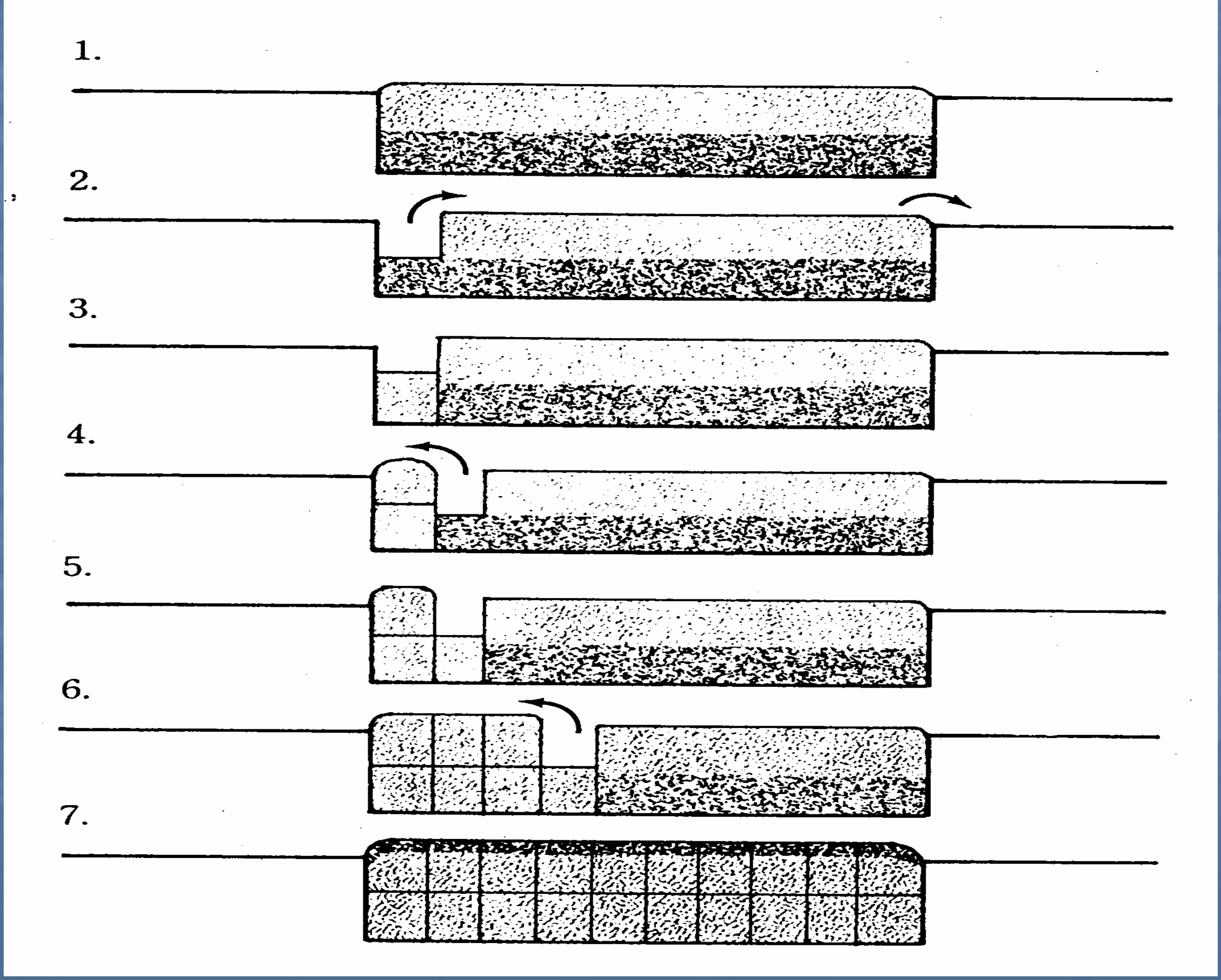


# Volume Composition of Soil



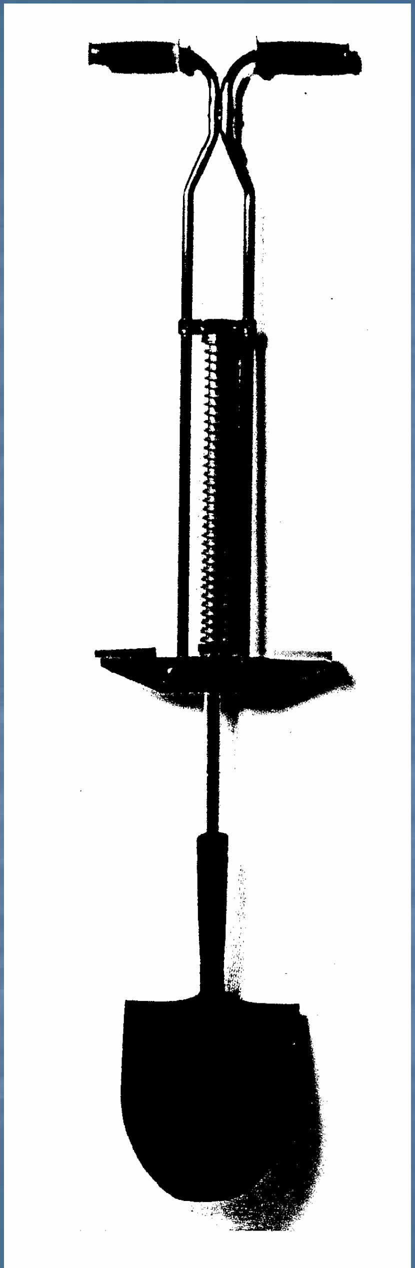
# Permanent Beds and Pathways

# Double Digging



# The U-bar

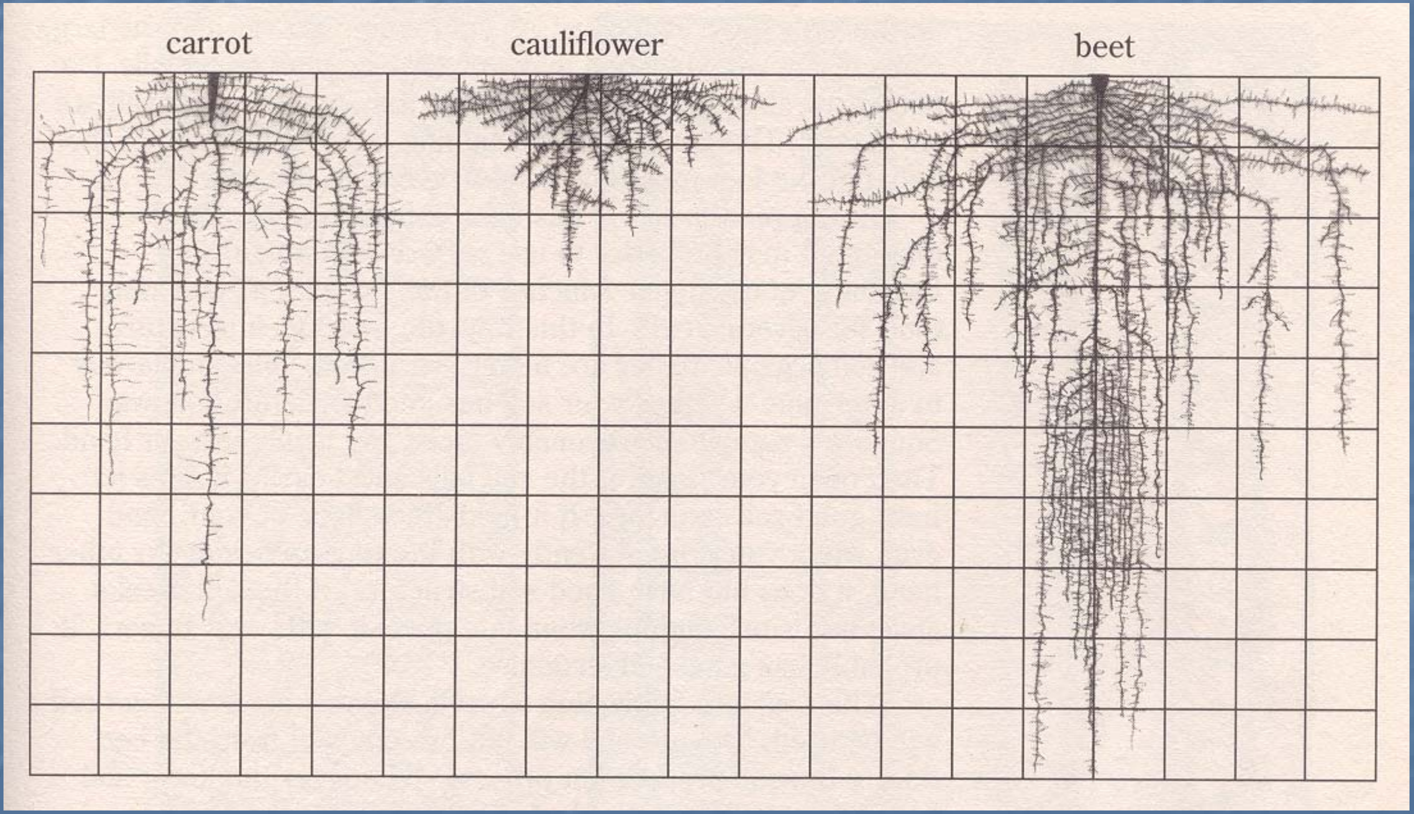
# Alternative tool for double digging



# Using Plants to loosen the soil

# Root Depth of Selected Vegetables

(from “How to Grow  More Vegetables”)



# One ounce of healthy soil has…

- Several billion bacteria (15,000 different kinds)
- 3 million yeast
- 1.4 million algae
- 1 million protozoa
- Macro vertebrates:
  (worms, mites, millipedes,
  centipedes and insects)

# Importance of Rhizosphere

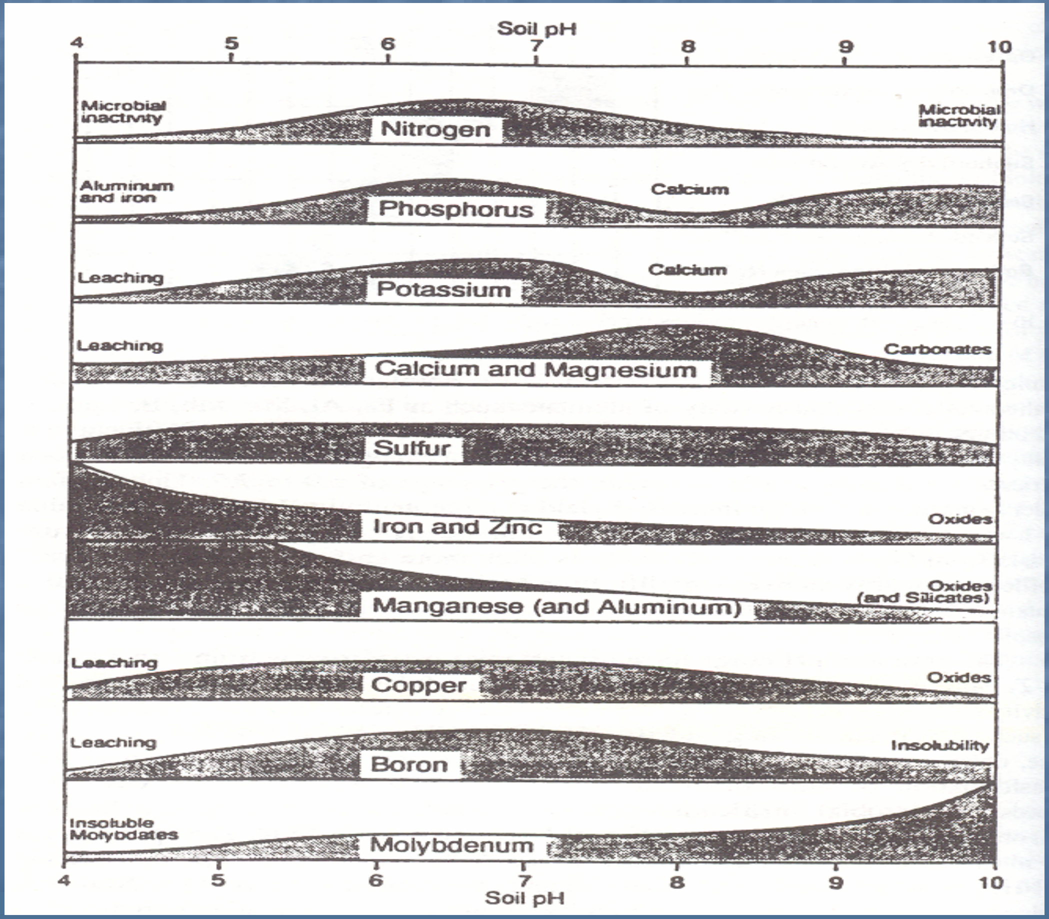
- 100 times the biological activity
- Buffers pH +/- 10 times (1 pH point)
- Solubilize nutrients from soil

# Nutrient Availability

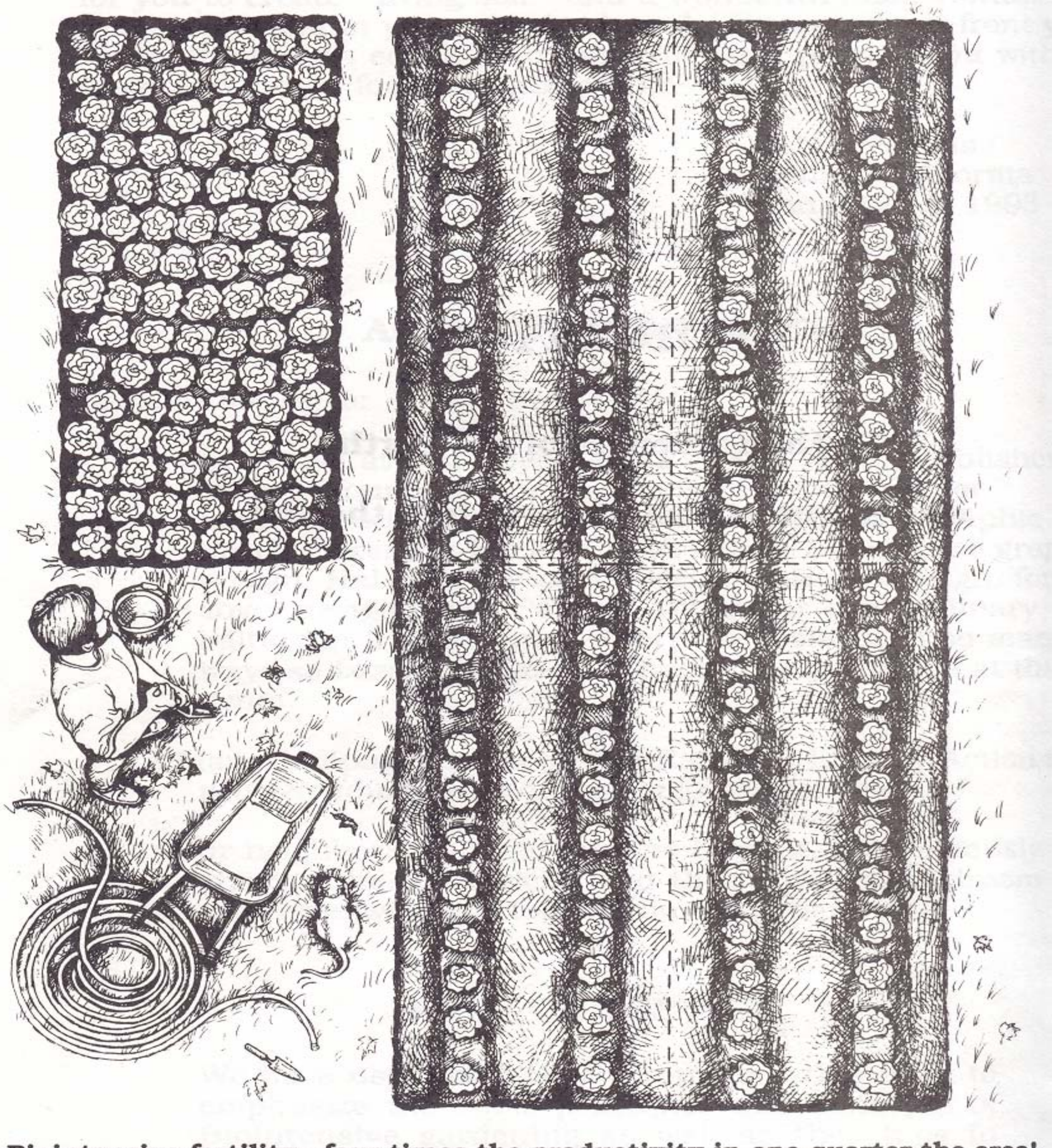
- Biological activity increases nutrients in several ways (pH and metabolic byproducts)
- Cation exchange capacity (CEC)
- Organic vs inorganic systems

  (Journal of nutrition)

# Soil pH and Nutrient Availability
(from "Methods for Assessing Soil Quality")



# Close Plant Spacings

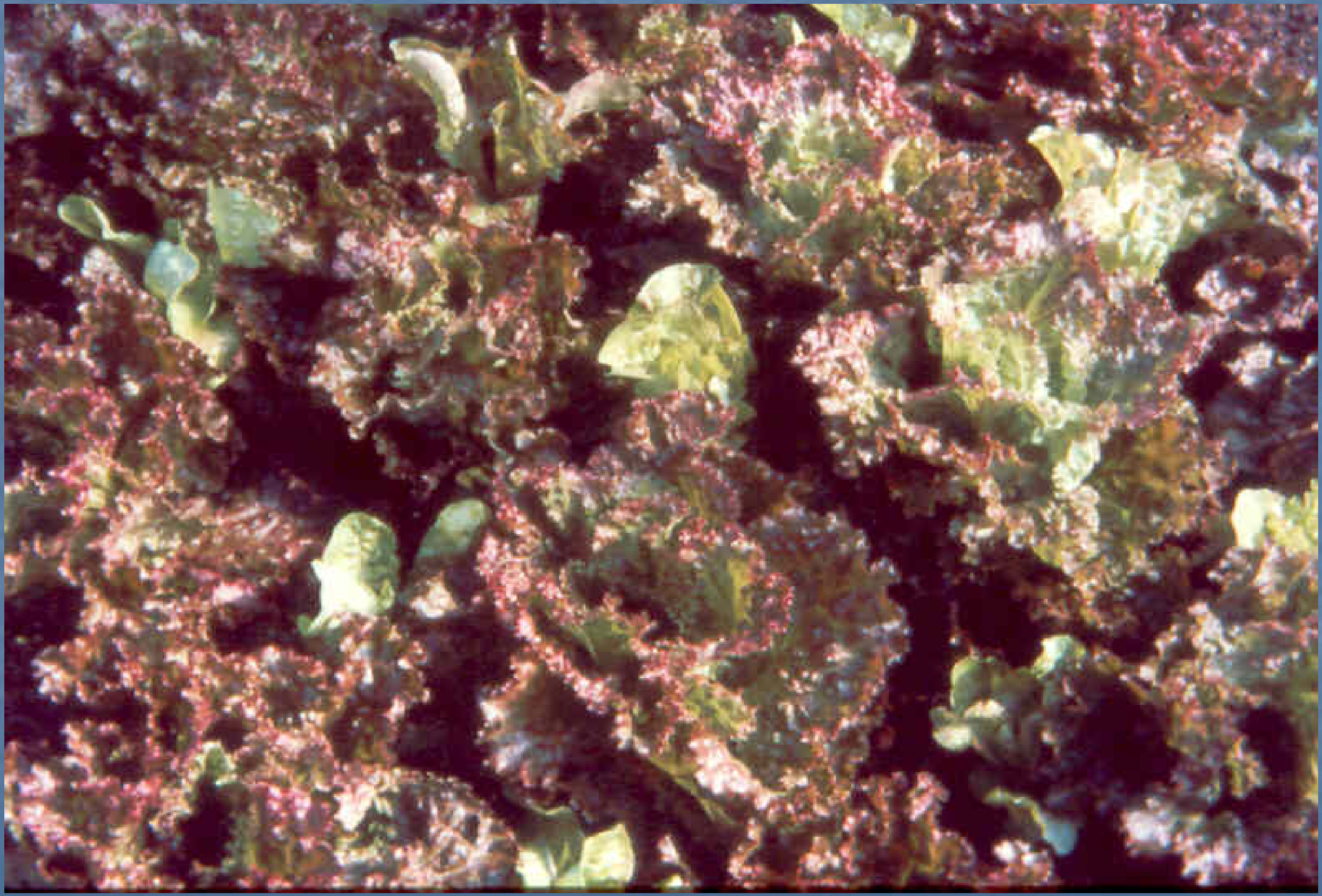


**Biointensive fertility—four times the productivity in one-quarter the area!**

(from "Lazy Bed Gardening" Jeavons and Cox)

# Interplanting

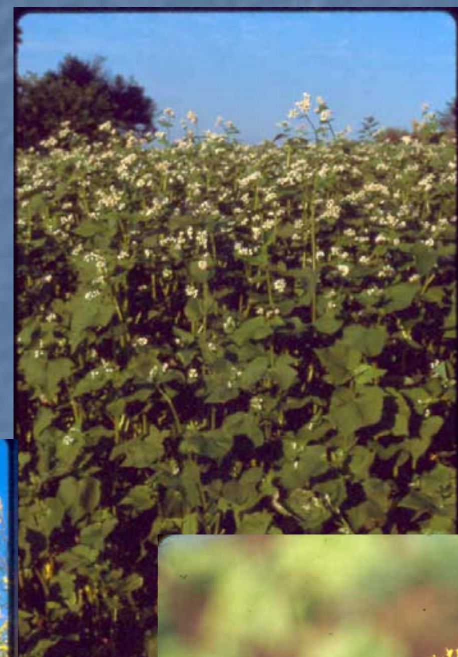
# 4 Square Planting

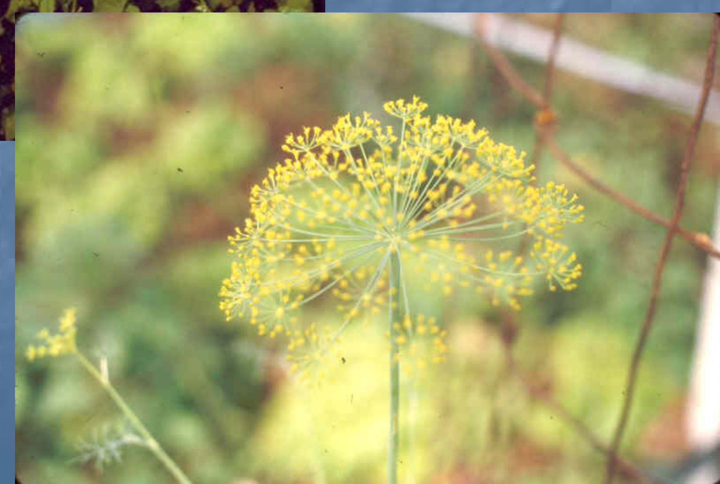


# Companion Planting

## Borage for pollination

# Insectary Crops



# Open Pollinated Seeds

# Velvet Roller Seed Cleaner

# Rubbing Board Seed Cleaner

# Compost for maximum return

- C:N ratio (45-60:1)
- Mesophylic pile temperature
- Add soil
- Use Structural carbon (waxes, cellulose, lignins)
- Correct moisture (55%)

# Compost Crops

- 1/3 of total area dedicated to carbon for soil
- Multiple duty crops
- Carbon examples: Corn, Jerusalem Artichokes, Grains, Sunflowers
- Nitrogen examples:  Fava beans, alfalfa, comfrey

# CARBON IN COMPOST AND GREEN MANURE (Revised)

Assumptions:
- 100 sq ft (= 1 bed) of each crop at **intermediate** Biointensive yields
- Initial C:N ratio of 30:1 (except for Green Manure Clover), using other nitrogenous or carbonaceous material in the compost pile, and optimal decomposition of combined materials
- Similar curing of Green Manure (with lower C:N ratio in soil, less cured carbon may be produced)

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| | TIME TO GROW CROP | YIELD / BED lb [kg] | % DRY MATTER | DRY MATTER lb [kg] | % CARBON | "BUILT" CARBON lb [kg] | CURING FACTOR | CURED CARBON lb [kg] |
| **CORN, Fodder for <u>Compost</u>** | 1 crop* (3-6 mo.) | 48.5 @ [22.0] dry | x 90.6% | = 43.9 [19.9] | x 52.3% | = 23.0 [10.4] | ÷ 2 | = 11.5 [5.2] {4.4 units} |
| **ALFALFA for <u>Compost</u>** | 6-month harvest from established plants | 275.6@ [125.0] green | x 26.3% | = 72.5 [32.9] | x 54.3% | = 39.4 [17.9] | ÷ 2 | = 19.7 [8.9] {7.6 units} |
| **CLOVER, Medium Red for <u>Compost</u>** | 6-month harvest from established plants | 162.5@ [73.7] green | x 27.5% | = 44.7 [20.3] | x 54.4% | = 24.3 [11.0] | ÷ 2 | = 12.2 [5.5] {4.7 units} |
| **ALFALFA or CLOVER, Med. Red, for <u>Green Manure</u>** | newly sown, ~4 months to first cutting; + ~1 month to decompose | 51.2 [23.2] green | x 18.7%** | = 9.6 [4.3] | x 54.4% | = 5.2 [2.3] | ÷ 2 | = 2.6# [1.2]# {1 unit} |

* If conditions are optimal, two crops of corn may be grown within 6 months, therefore doubling the carbon produced.

@ Enough corn for one compost pile; enough alfalfa for 2.4 compost piles; enough clover for 1.4 compost piles, assuming a "built" volume of 27 cu ft and equal volumes of dry and green materials.

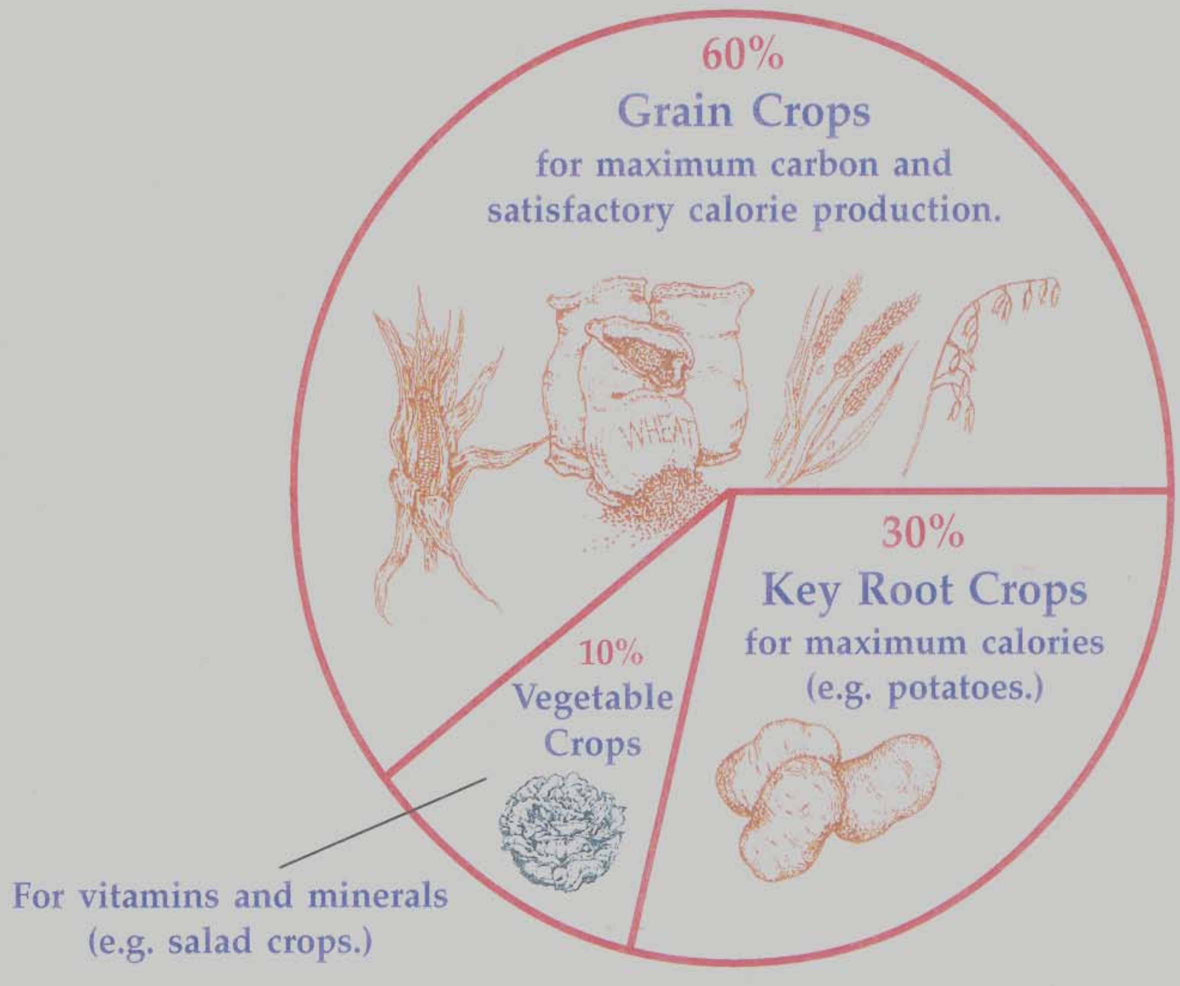
** Red Clover, before bloom, from Morrison's *Feeds and Feeding*. May be lower at point when used for Green Manure. Alfalfa may be somewhat higher.

# Probably less because of low C:N ratio.

# Complete Diet

- Calorie efficient
- Kitchen efficient
- Space efficient
- Carbon efficient
- Storage efficient

# *Crop Selection for Maximum Production of Calories*



# No Till

# Permaculture

- Use the natural properties of your land
  - Sun
  - Wind
  - Shade
  - Slope
- Add enhancements
  - Rain water collecting
  - Extend the season
  - Container gardening
  - Indoor gardening



# Energy Use in Chemical Agriculture

- 17% off US energy is used for Agriculture
- The Green Revolution increased the energy flow by an average of 50 times
- In 1990 we used 100 gal of oil to produce food on one acre
- Oil reserves will be insufficient to meet demand by 2020 (UN Development Programme)

# Energy Use in Organic Agriculture

- Uses less fossil fuel fertilizers (31% 0f chemical agriculture budget)
- Many studies have indicated that organic is only 58-90% as productive
- As a result, in some cases, organic actually uses more energy per yield than chemical agriculture.

# Agricultural Productivity

- Peppers; 11 times (1100%) the US Average
- Eggplant; 7 times the US Average
- Carrots; 7.4 times the US Average,

  487 lbs./bed (100 sq. ft.)
- Onions; 4.2 times the US Average, 380 lbs./bed
- Rye; 12 times the US Average
- Garlic; 3 times the US Average

# Plant to Invite Beneficial Insects

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