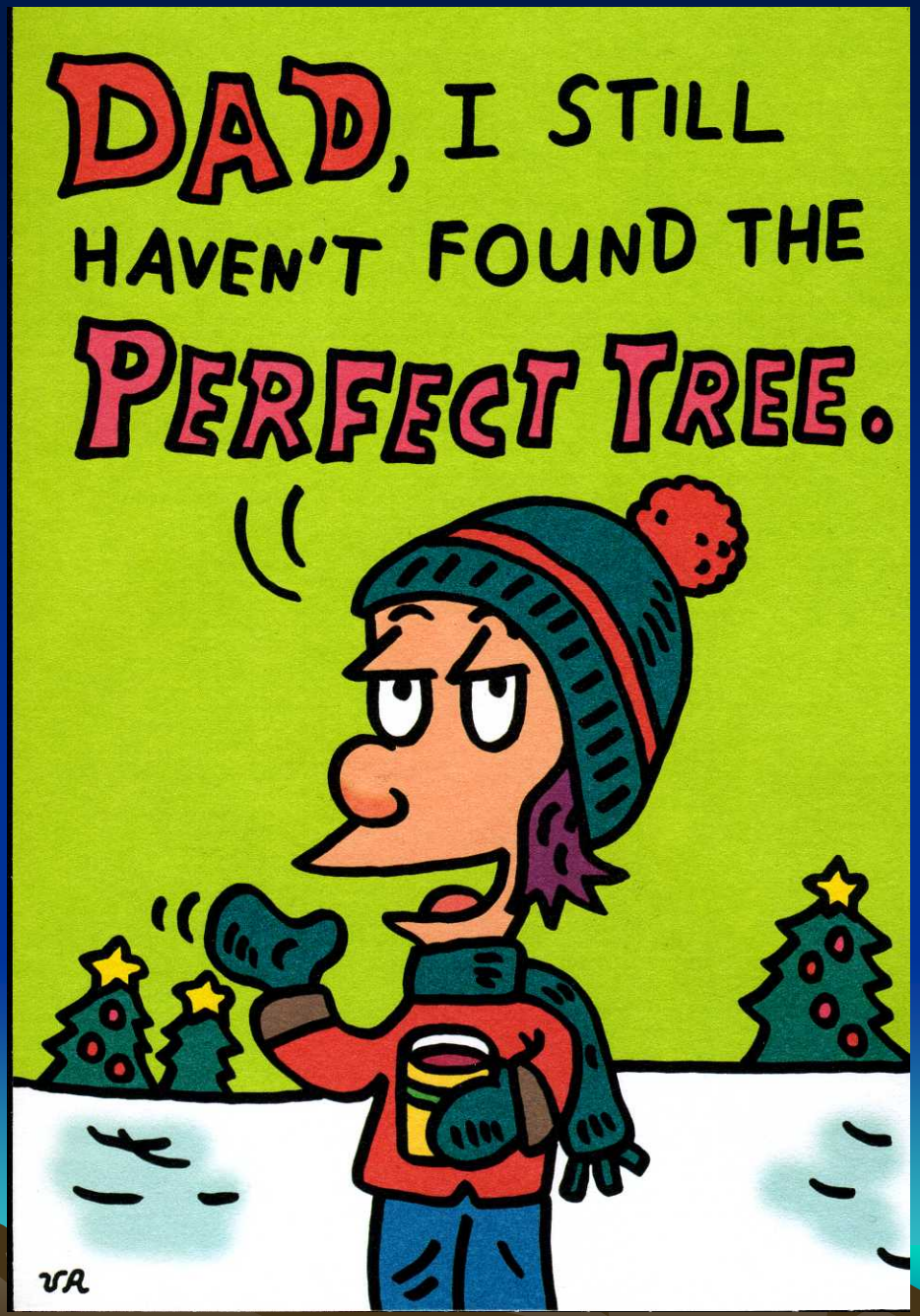

SOIL/TISSUE/WATER
ANALYSES
FOR
SPECIFICATIONS
OF
SOIL PREPARATION
WALLACE LABORATORIES


DAD, I STILL HAVEN'T FOUND THE PERFECT TREE.
VA

Dec 2007

YOU KNOW, THE ONE THAT GROWS MONEY.

MERRY CHRISTMAS

EARTH: The Stuff of Life

BY FIRMAN E. BEAR

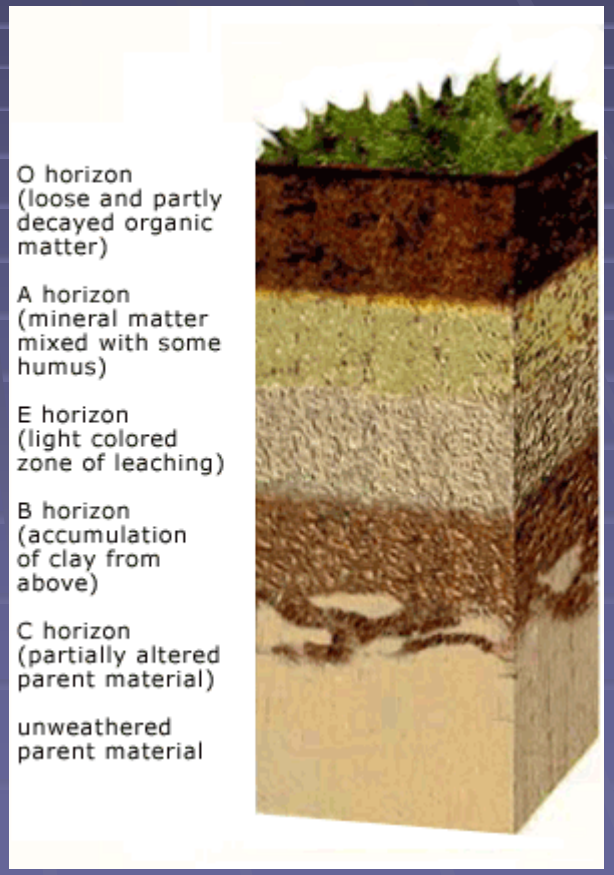
Second Edition, Revised

BY H. WAYNE PRITCHARD AND WALLACE E. AKIN

Soil Formation

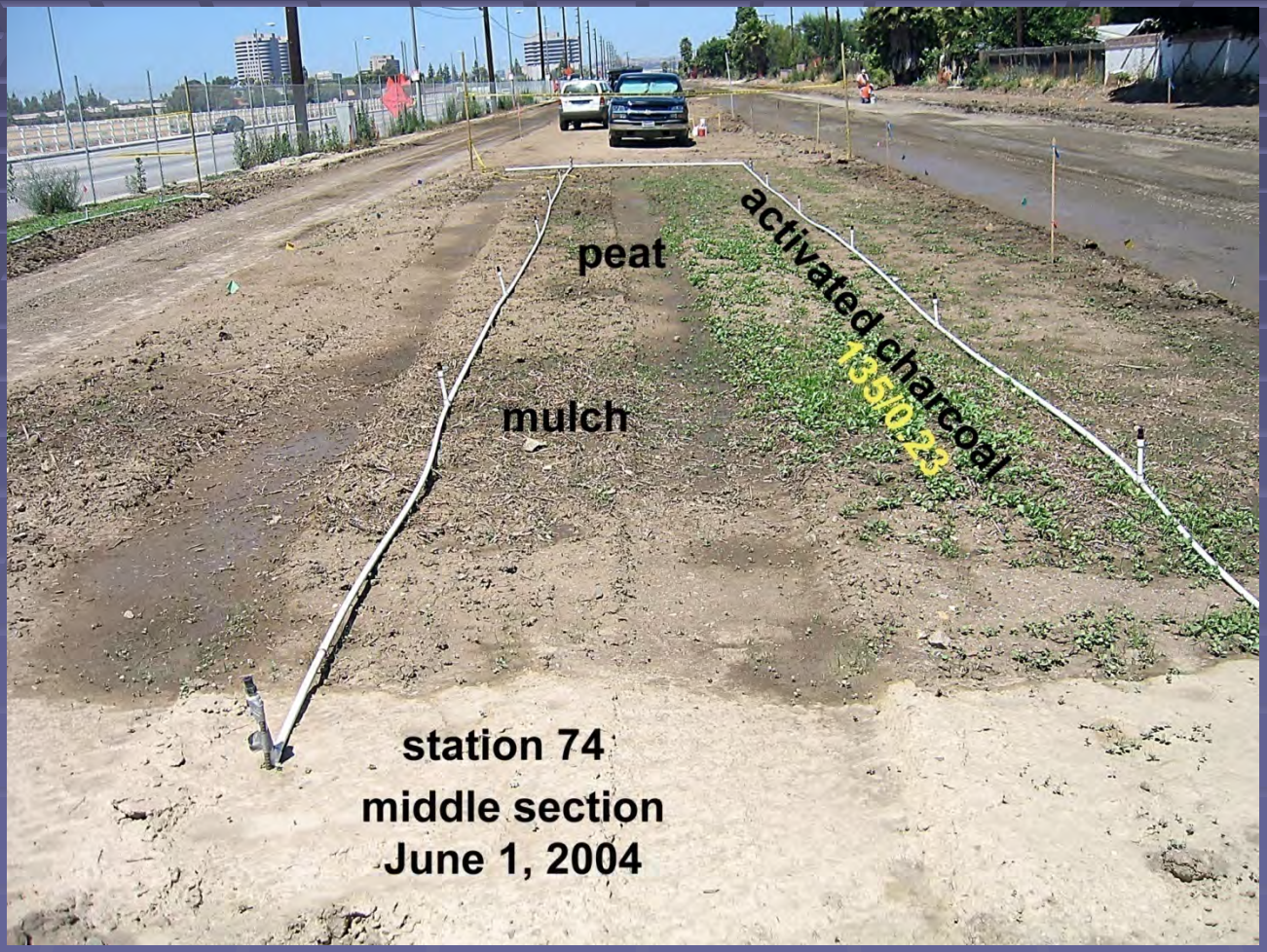
- Factors of Soil Formation
  not renewable in
  our generation

- Soil Horizons




Ken Smith on the Rails
in Santa Fe

MTA 2004: Before



MTA 2007 After


RECYCLABLE
MATERIAL
ONLY

C:N - Composting

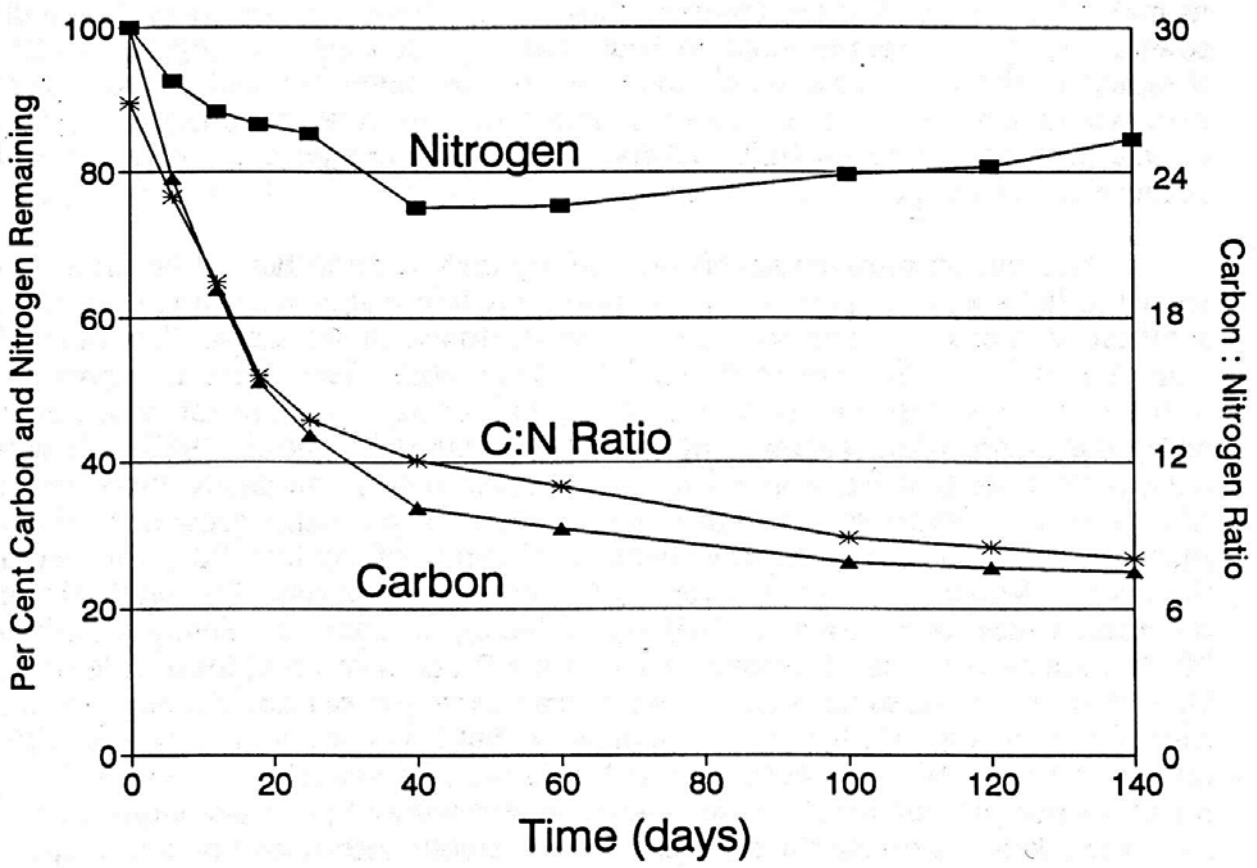
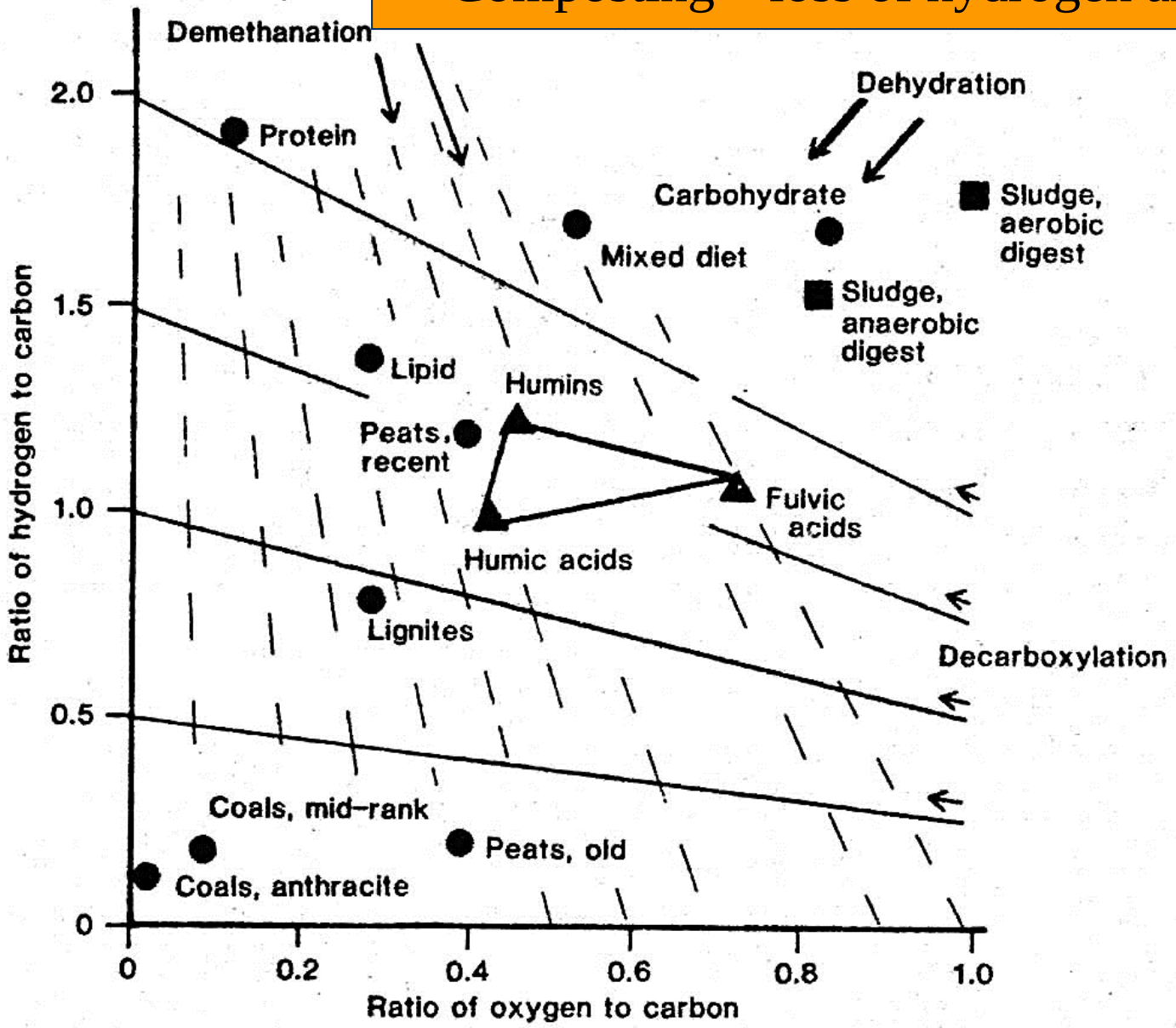
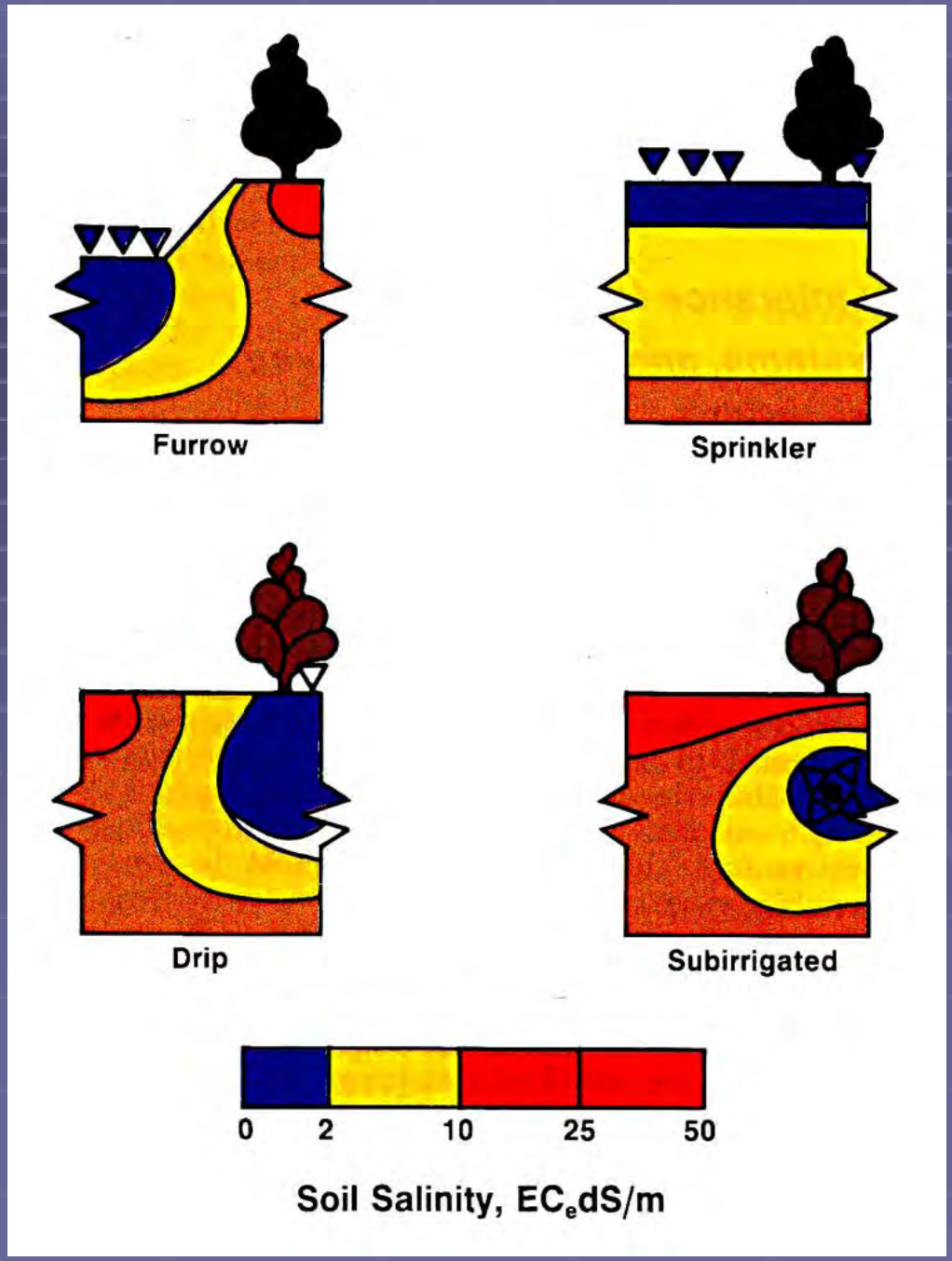


Figure 2: Some parameters of the composting process (adapted from Inbar et al., 1993). The graph involves the decomposition and synthesis phases only. In this experiment the nitrogen concentrations increased during "synthesis".

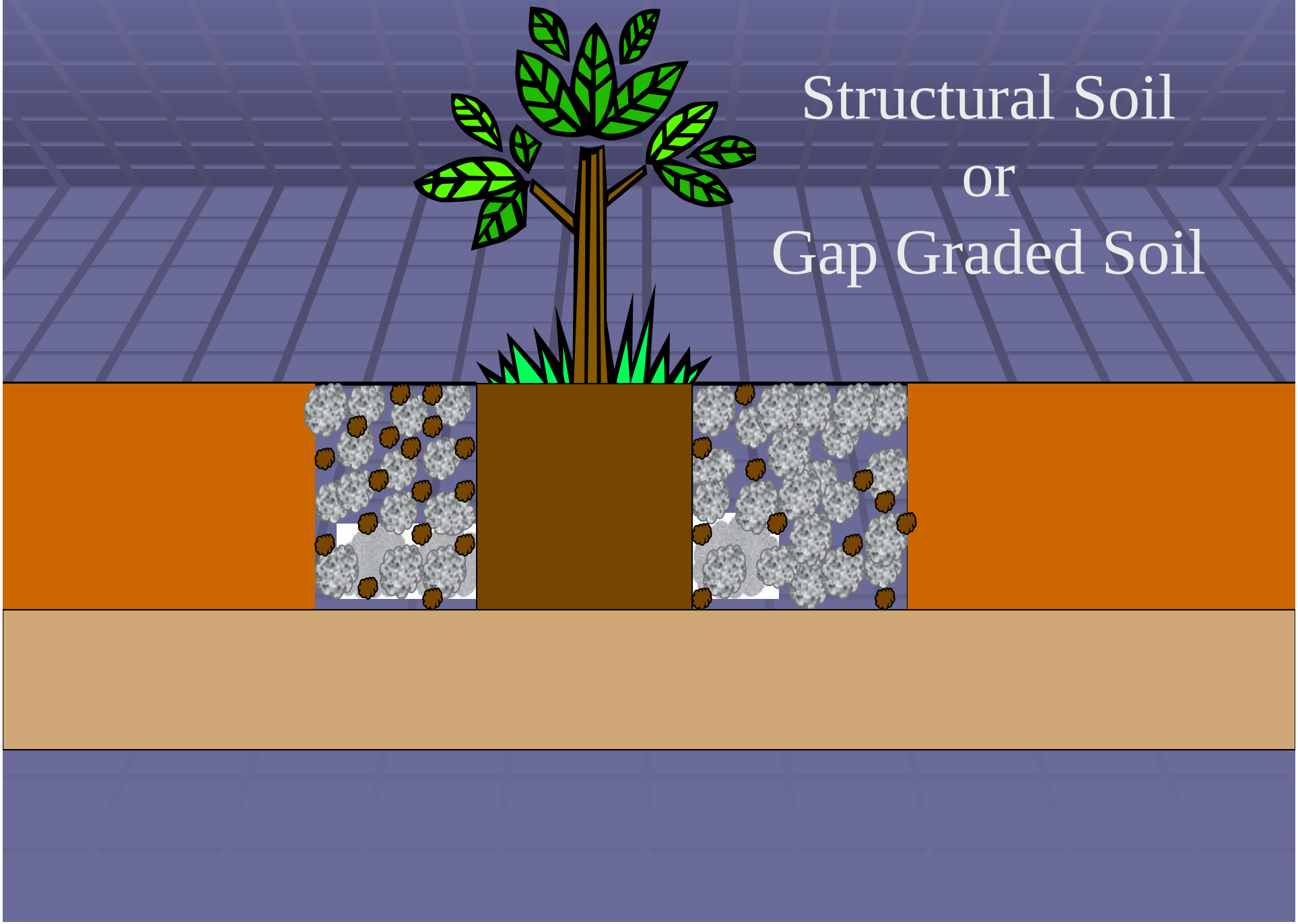
Composting – loss of hydrogen and oxygen



Methods of Irrigation - Surface or subsurface



Structural Soil
or
Gap Graded Soil




PERSHING SQUARE

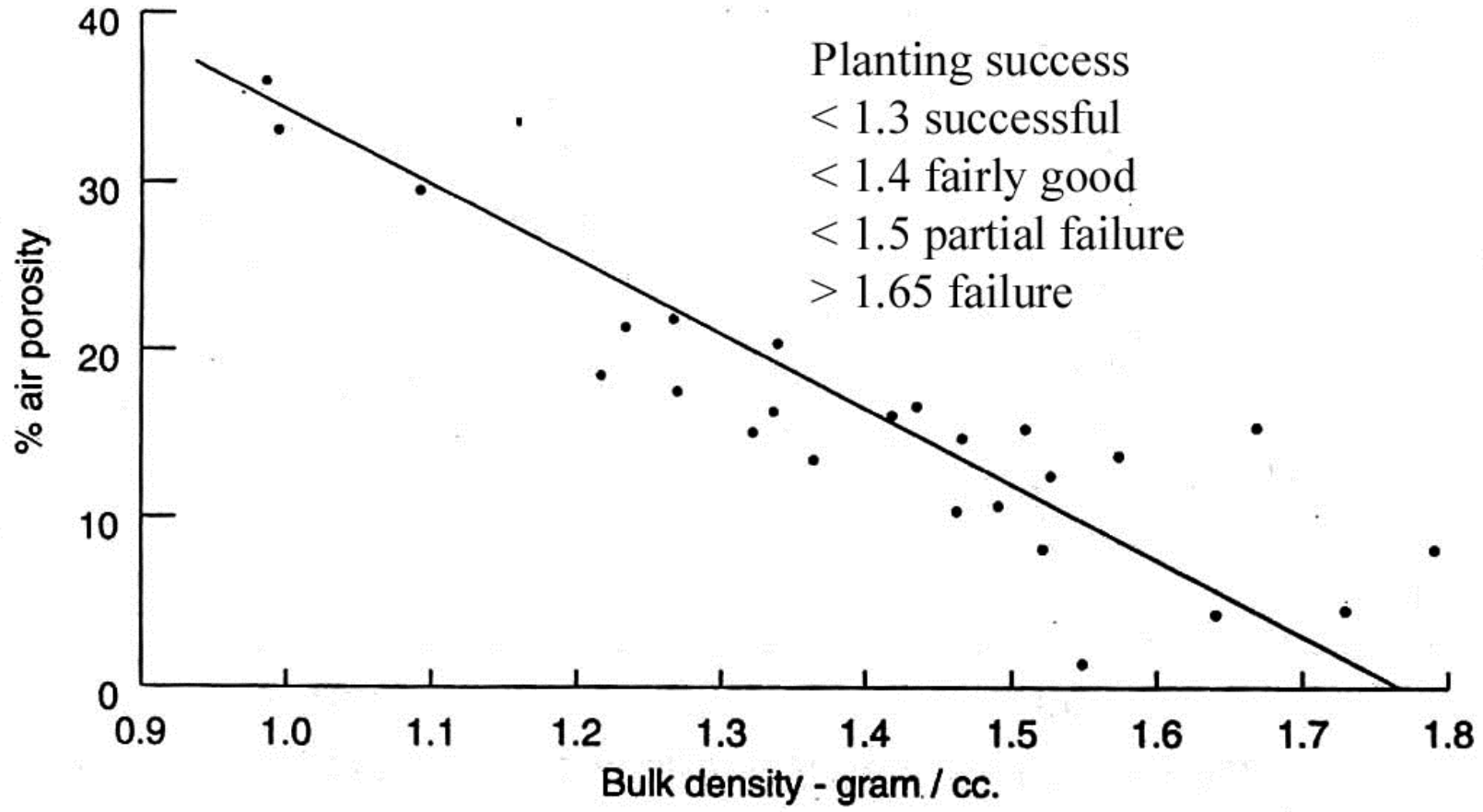
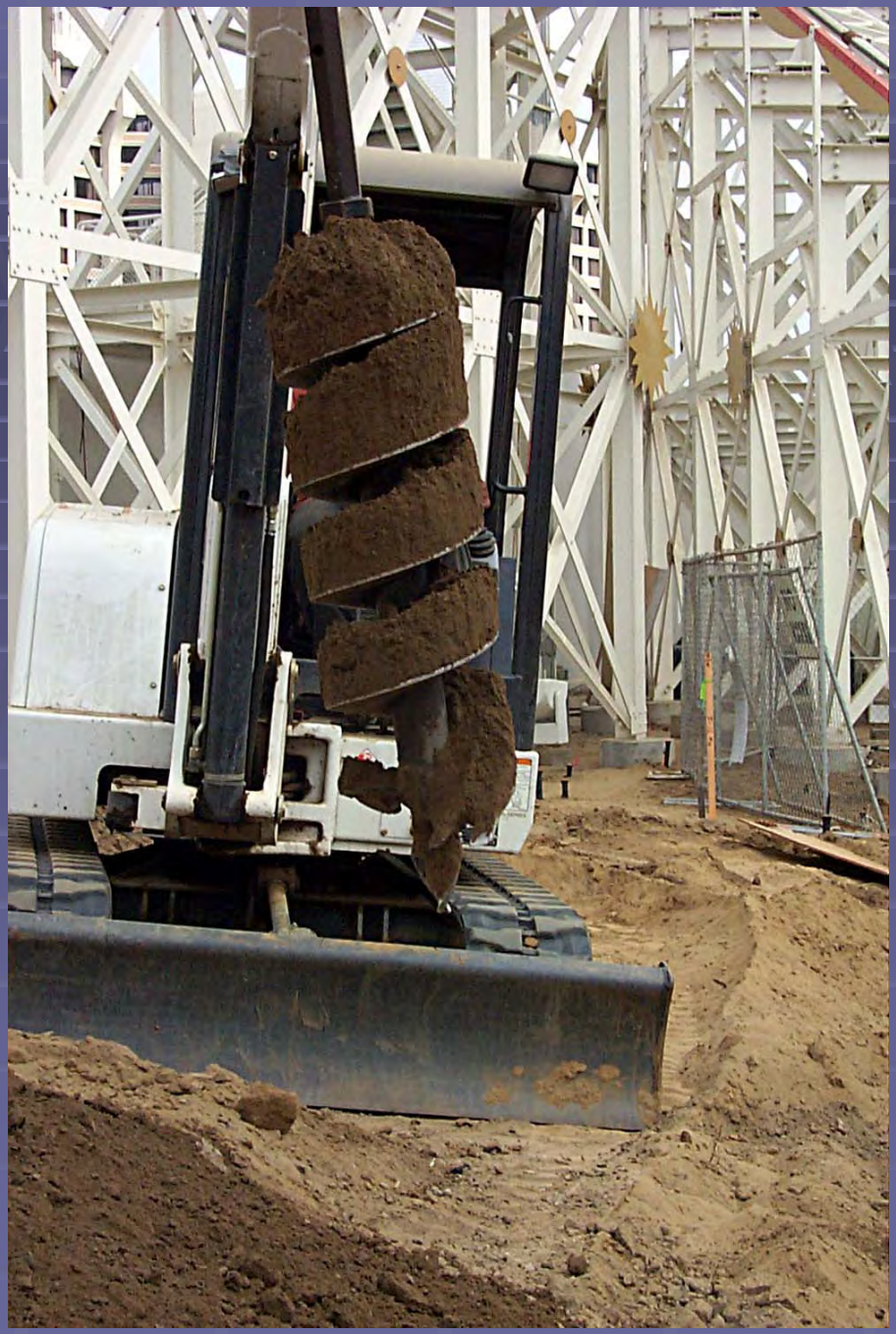


Fig 1. Relationship between air porosity and bulk density. (from Sudds and Browning 1941)


#6 2814



Land Degradation

- Mass grading
- Over excavation and recompaction to competent soil
- Change in use of land
- Salinization
- Desertification
- Deforestation
- Erosion – lack of topsoil
- Acidification
- Nutrient depletion
- Removal of plant organic matter/lack of replenishment
- Incorrect fertilization

Land Degradation

- Saline soils – 25% worldwide
- Extremely acidic soils – 33% mostly in tropics
- Degraded farmland – 38%

  Lack of topsoil, fertility and soil organic matter mainly due to erosion
- Urban soils – older areas/newer areas

Rooting in crack, not in soil

Sequestration of carbon in soil

Global soil carbon is about three times atmospheric pool

Increase concentration and content of soil carbon to lower atmospheric carbon

Soil Science Society of America, volume 74, pages 1775-85
Maillard, Paré and Munson

“Blade scarification had the greatest effect on soil organic carbon stock and stability”
(removal of plant litter and decomposed organic matter)

Organic Soil Amendment and Tillage Affect Soil Quality and Plant Performance in Simulated Residential Landscape

HortScience, volume 45, page 1522, 2010

Shawna Loper, Amy L. Shober, Christine Wiese, Geoffrey C. Denny, Craig D. Stanley and Edward F. Gilman

Urban Soils

- When land is urbanized, natural ecosystems are replaced by roads, homes, and commercial structures often resulting in significant disturbance to soils.
- Studies have shown that urban soils often lack natural soil horizons,
- can have alkaline pH,
- and contain low amounts of soil organic matter
- and nutrients (particularly nitrogen and phosphorus).

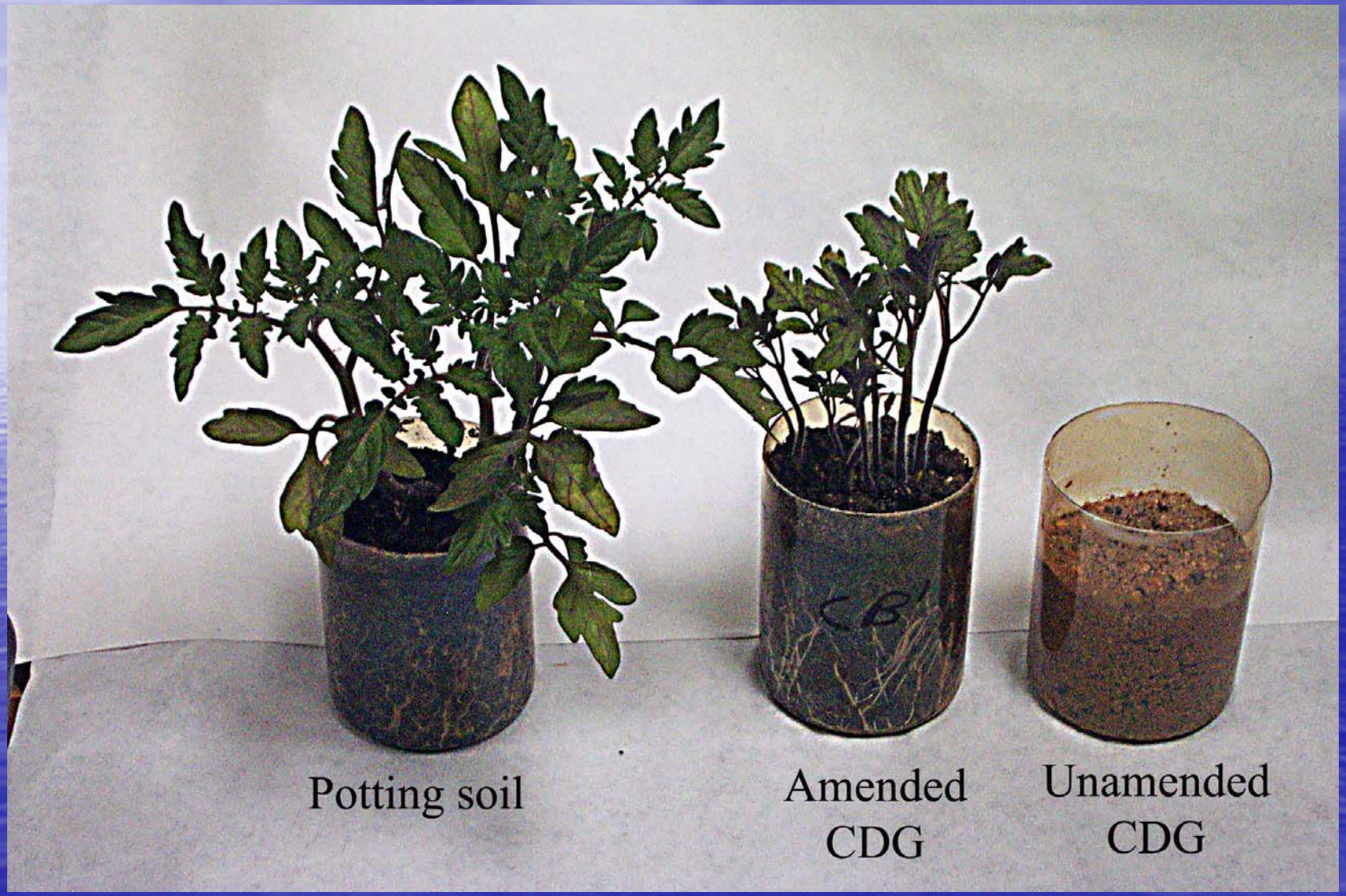
C


A
8
8
Chek Lap Kok
赤鱲角
Airport Rd
北大嶼山公路
N Lantau Hig
Discovery Bay
愉景灣
Discovery Bay
愉景灣
Tung Chung Bay
東涌灣
Tung Chung
東涌
Lantau North (extension) Country Park
北大嶼山郊野公園(擴建部份)
Tong Fuk Miu Wan
塘福廟灣
Lantau North Country Park
北大嶼郊野公園
Lantau Island
大嶼山
Silver Mine Bay
Mui Wo


More...
Map
Hong Kong Disneyland Resort
Hong Kong Disneyland
香港迪士尼樂園

Real World Sustainability: Hong Kong

Hong Kong Soil



LAW OF THE MAXIMUM

Growth of plants is proportional to the sum of all growth factors

HORTICULTURAL REVIEWS

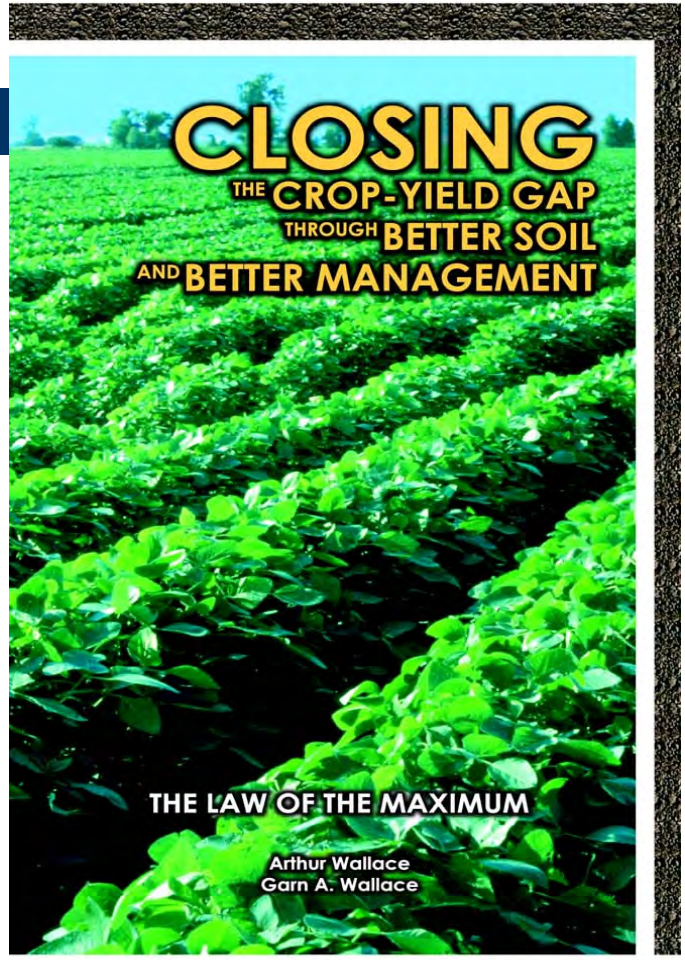
VOLUME 15

10

Limiting Factors, High Yields, and Law of the Maximum

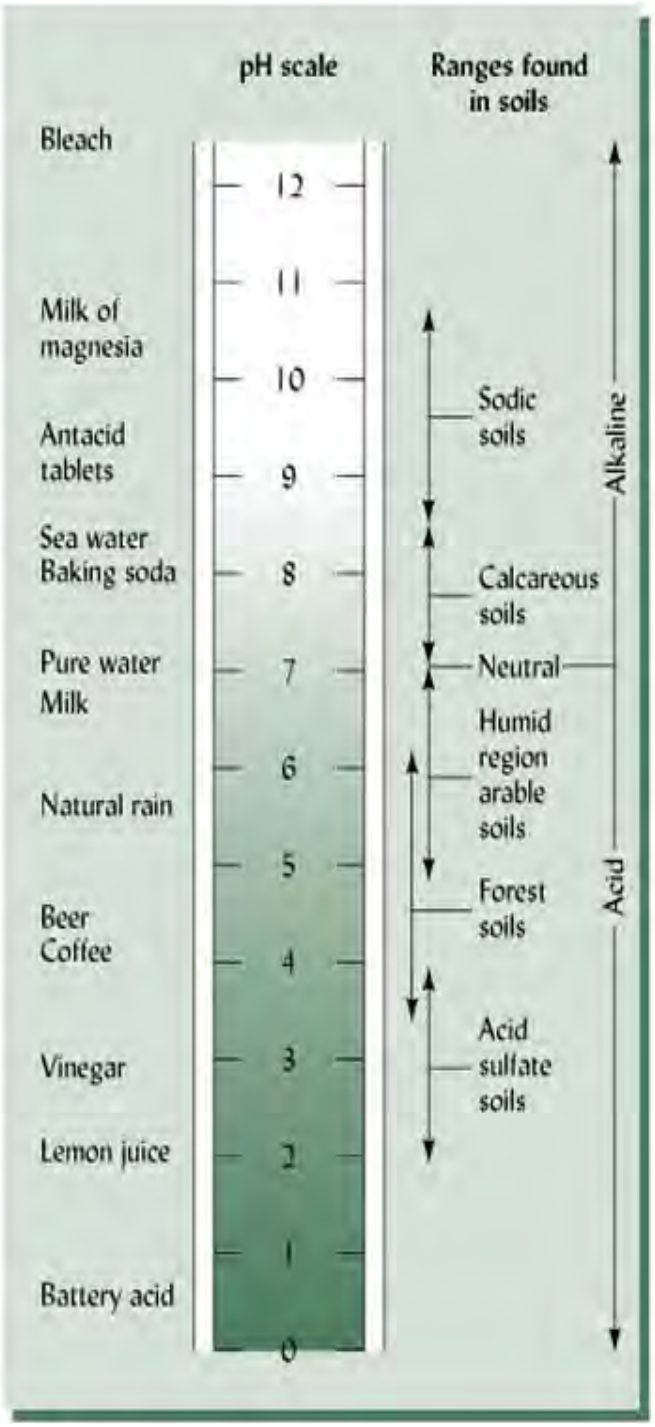
Arthur Wallace
Laboratory of Biomedical and Environmental Sciences, University of California, Los Angeles, Los Angeles, CA 90024-1786, Wallace Laboratories, El Segundo, CA 90245.

Garn A. Wallace
Wallace Laboratories, El Segundo, CA 90245.

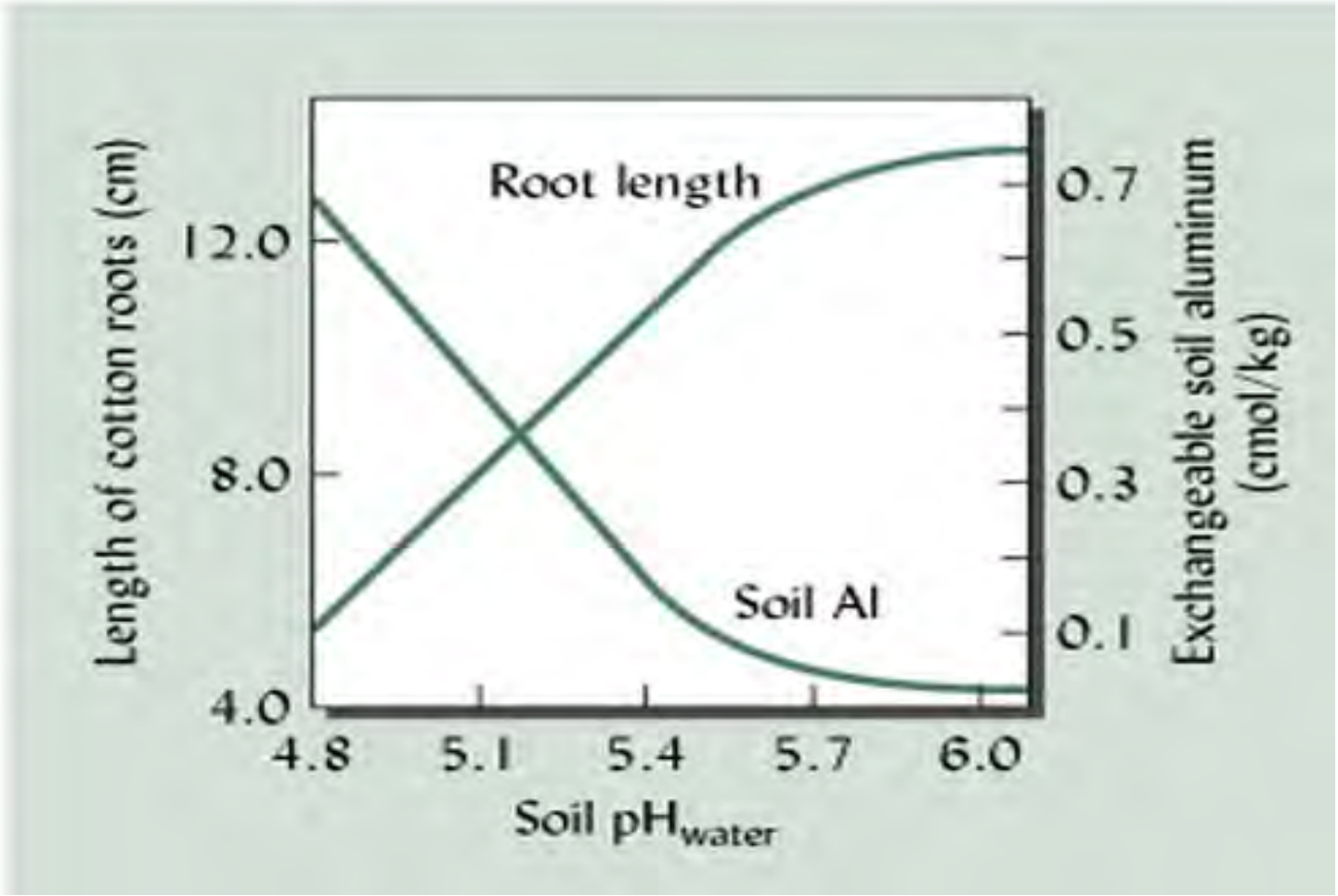


pH

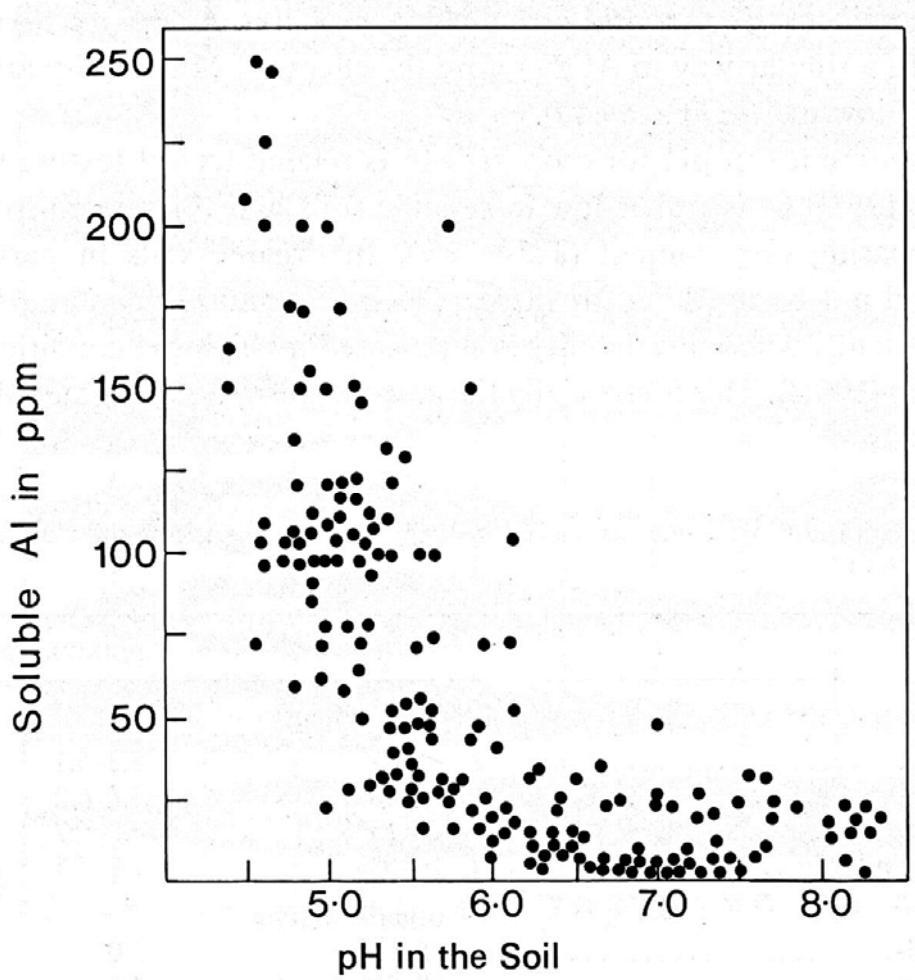
- What produces acidity?
- Effect of pH extremes on plants
- How to correct pH imbalances
- Optimal pH is not a rigid number


pH scale
Ranges found in soils
Bleach
Milk of magnesia
Antacid tablets
Sea water
Baking soda
Pure water
Milk
Natural rain
Beer
Coffee
Vinegar
Lemon juice
Battery acid
12
11
10
9
8
7
6
5
4
3
2
1
0
Sodic soils
Calcareous soils
Neutral
Humid region arable soils
Forest soils
Acid sulfate soils
Alkaline
Acid

pH effect on cotton growth



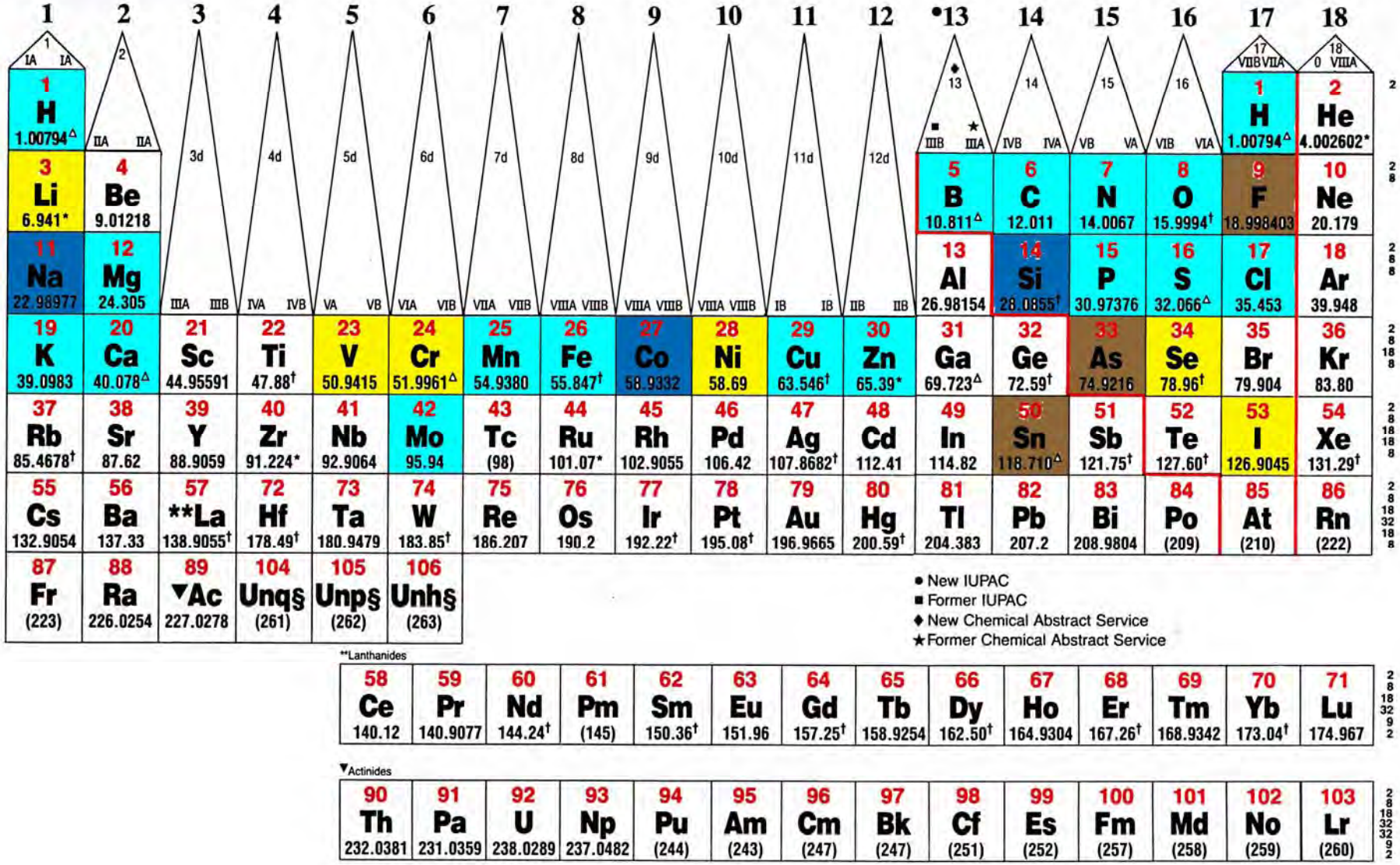
Aluminum



Optimum pH by soil type

Table 2.9 Optimum pH values measured in KCl extracts for various soil classes (SCHACHTSCHABEL [1963])

Soil class		optimum pH range
	Clay content	
Sand	< 5%	5.3–5.7
Sand	5–10%	5.8–6.2
sandy loams	10–15%	6.3–6.7
silty loams and clay	> 15%	7.0–7.5
	organic matter	
humic sands	5–10%	5.0
humic sands	10–20%	4.8–5.0
peats	> 20%	3.8–4.0


1 IA IA
2 IIA IIA
3 IIIA IIIB 3d
4 IVA IVB 4d
5 VA VB 5d
6 VIA VIB 6d
7 VIIA VIIB 7d
8 VIIIA VIIIB 8d
9 VIIIA VIIIB 9d
10 VIIIA VIIIB 10d
11 IB IB 11d
12 IIB IIB 12d
•13 ♦13 ■ IIIB ★ IIIA
14 IVB IVA
15 VB VA
16 VIB VIA
17 VIIB VIIA
18 0 VIIIA
1 H 1.00794△
2 He 4.002602*
3 Li 6.941*
4 Be 9.01218
5 B 10.811△
6 C 12.011
7 N 14.0067
8 O 15.9994†
9 F 18.998403
10 Ne 20.179
11 Na 22.98977
12 Mg 24.305
13 Al 26.98154
14 Si 28.0855†
15 P 30.97376
16 S 32.066△
17 Cl 35.453
18 Ar 39.948
19 K 39.0983
20 Ca 40.078△
21 Sc 44.95591
22 Ti 47.88†
23 V 50.9415
24 Cr 51.9961△
25 Mn 54.9380
26 Fe 55.847†
27 Co 58.9332
28 Ni 58.69
29 Cu 63.546†
30 Zn 65.39*
31 Ga 69.723△
32 Ge 72.59†
33 As 74.9216
34 Se 78.96†
35 Br 79.904
36 Kr 83.80
37 Rb 85.4678†
38 Sr 87.62
39 Y 88.9059
40 Zr 91.224*
41 Nb 92.9064
42 Mo 95.94
43 Tc (98)
44 Ru 101.07*
45 Rh 102.9055
46 Pd 106.42
47 Ag 107.8682†
48 Cd 112.41
49 In 114.82
50 Sn 118.710△
51 Sb 121.75†
52 Te 127.60†
53 I 126.9045
54 Xe 131.29†
55 Cs 132.9054
56 Ba 137.33
57 **La 138.9055†
72 Hf 178.49†
73 Ta 180.9479
74 W 183.85†
75 Re 186.207
76 Os 190.2
77 Ir 192.22†
78 Pt 195.08†
79 Au 196.9665
80 Hg 200.59†
81 Tl 204.383
82 Pb 207.2
83 Bi 208.9804
84 Po (209)
85 At (210)
86 Rn (222)
87 Fr (223)
88 Ra 226.0254
89 ▼Ac 227.0278
104 Unq§ (261)
105 Unp§ (262)
106 Unh§ (263)
2 2 8 2 8 8 2 8 18 8 2 8 18 18 8 2 8 18 32 18 8
• New IUPAC
■ Former IUPAC
♦ New Chemical Abstract Service
★ Former Chemical Abstract Service
**Lanthanides
58 Ce 140.12
59 Pr 140.9077
60 Nd 144.24†
61 Pm (145)
62 Sm 150.36†
63 Eu 151.96
64 Gd 157.25†
65 Tb 158.9254
66 Dy 162.50†
67 Ho 164.9304
68 Er 167.26†
69 Tm 168.9342
70 Yb 173.04†
71 Lu 174.967
2 8 18 32 9 2
▼Actinides
90 Th 232.0381
91 Pa 231.0359
92 U 238.0289
93 Np 237.0482
94 Pu (244)
95 Am (243)
96 Cm (247)
97 Bk (247)
98 Cf (251)
99 Es (252)
100 Fm (257)
101 Md (258)
102 No (259)
103 Lr (260)
2 8 18 32 32 9 2

Effects of Excessive Salinity

Wilting – absence of water uptake

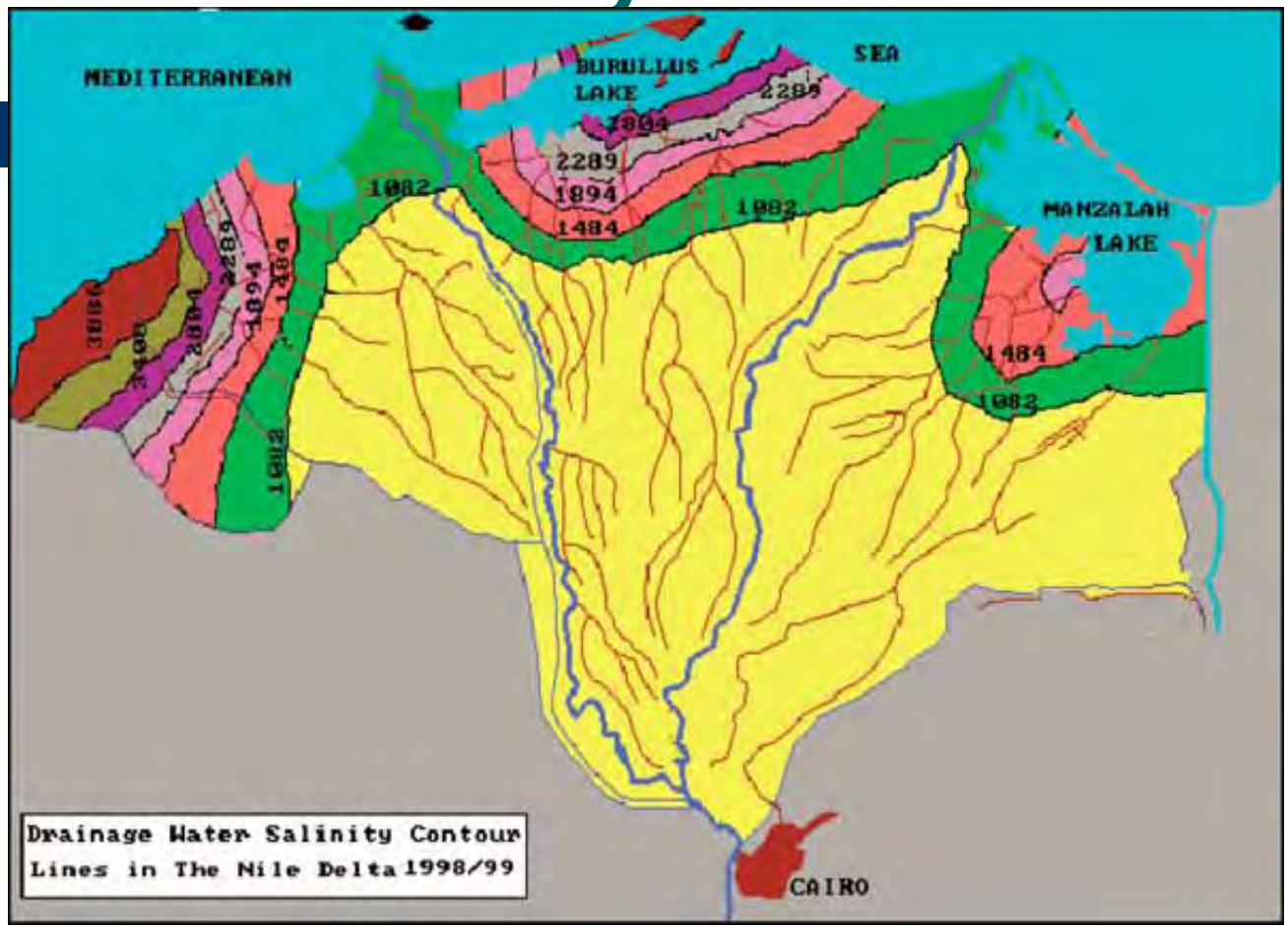
Scorching – salt accumulation in foliage

Defoliation

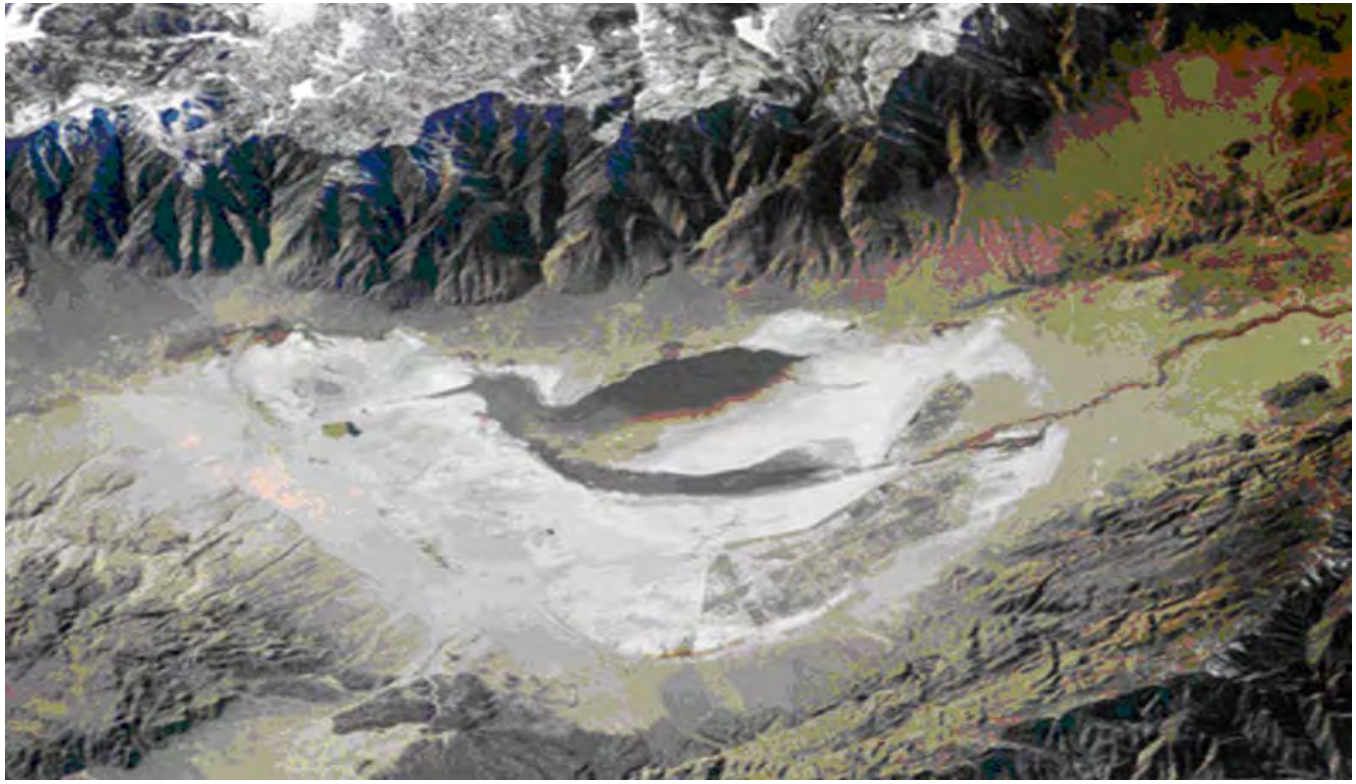
Death

Nile Delta

Nile Delta salinity



Owens Valley



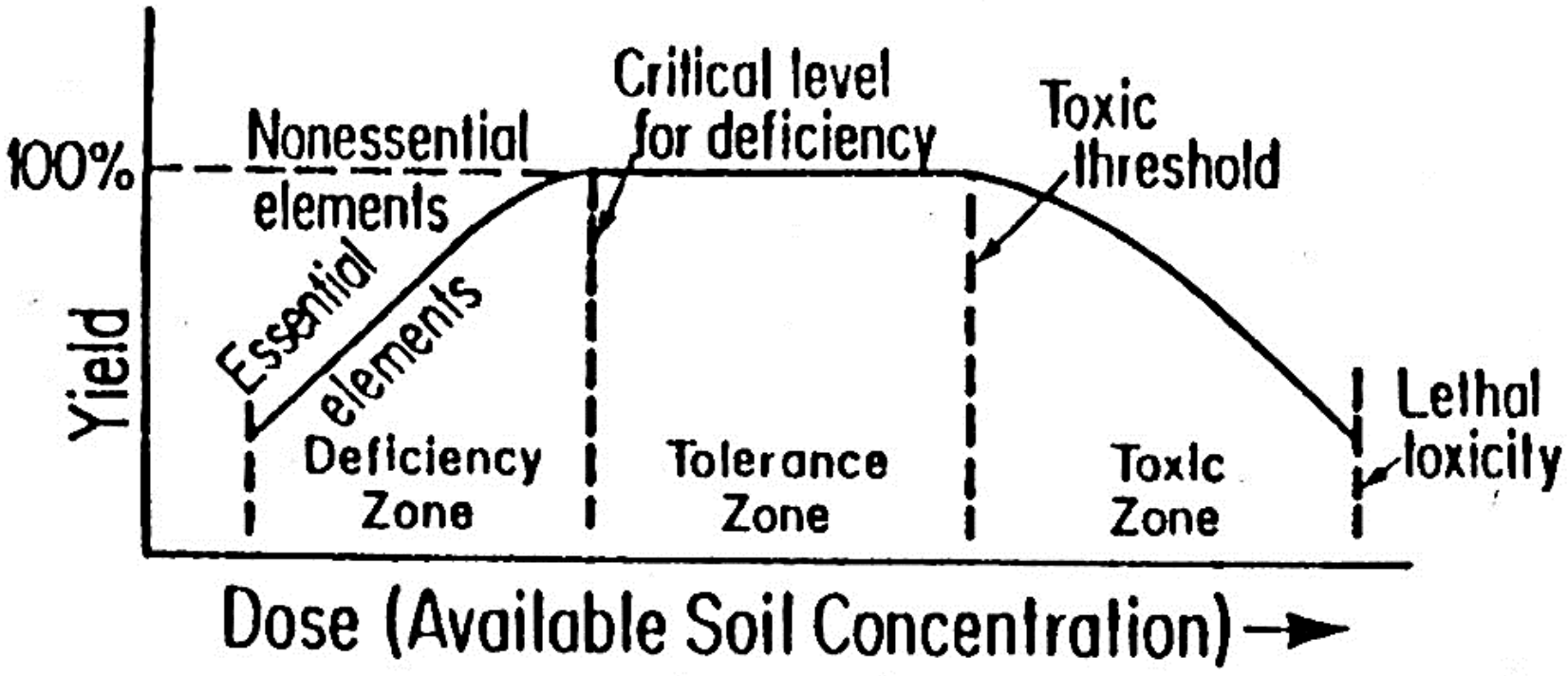
Owens Valley Salt Flat: Before

Owens Soil Properties

Salinity – 120 millimho/cm
boron – 60 parts per million
pH – 10.5
arsenic
lithium
high nitrate nitrogen

Leached Owens Playa

Dose

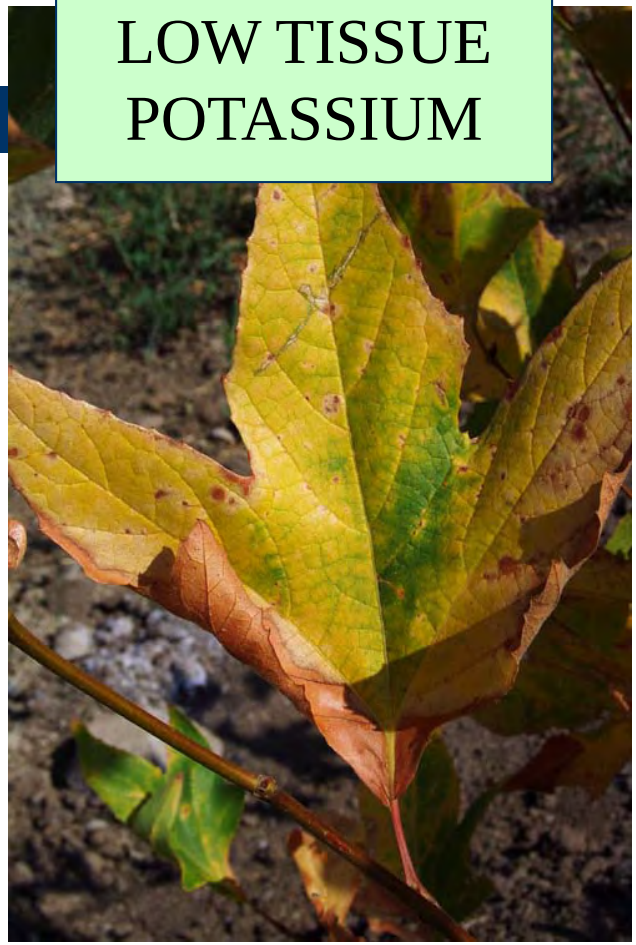

100%
Yield
Nonessential elements
Essential elements
Critical level for deficiency
Toxic threshold
Lethal toxicity
Deficiency Zone
Tolerance Zone
Toxic Zone
Dose (Available Soil Concentration)

Soils at Work

Soils at Work

HIGH SOIL MAGNESIUM

LOW TISSUE POTASSIUM



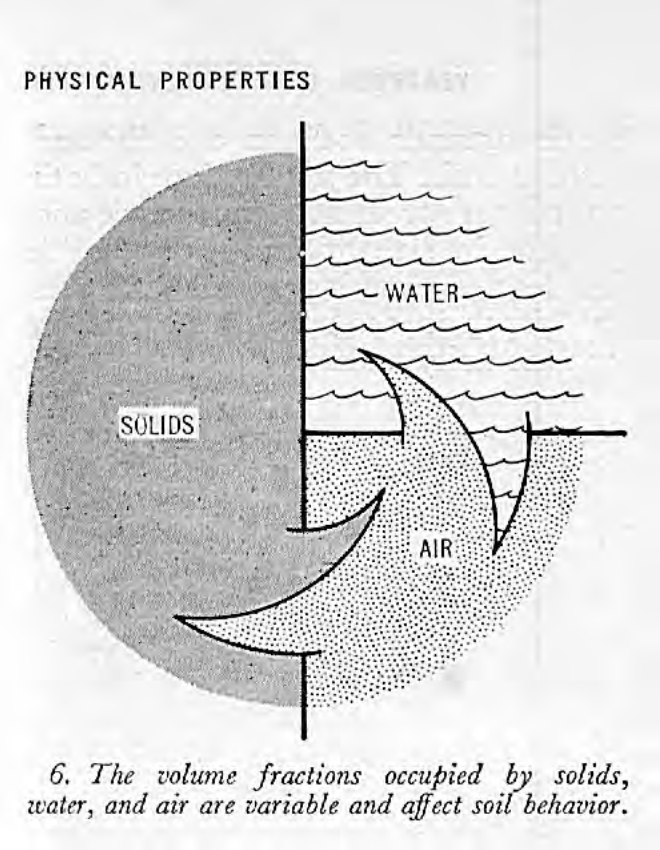
Absence of Toxicity minerals

- Arsenic
- Lead
- Excessive levels of:
  - Zinc
  - Copper
  - Nickel
  - Molybdenum – air conditioning anti-corrosion inhibitor
  - Cobalt, Chromium, Vanadium, Barium
- Hydrocarbons

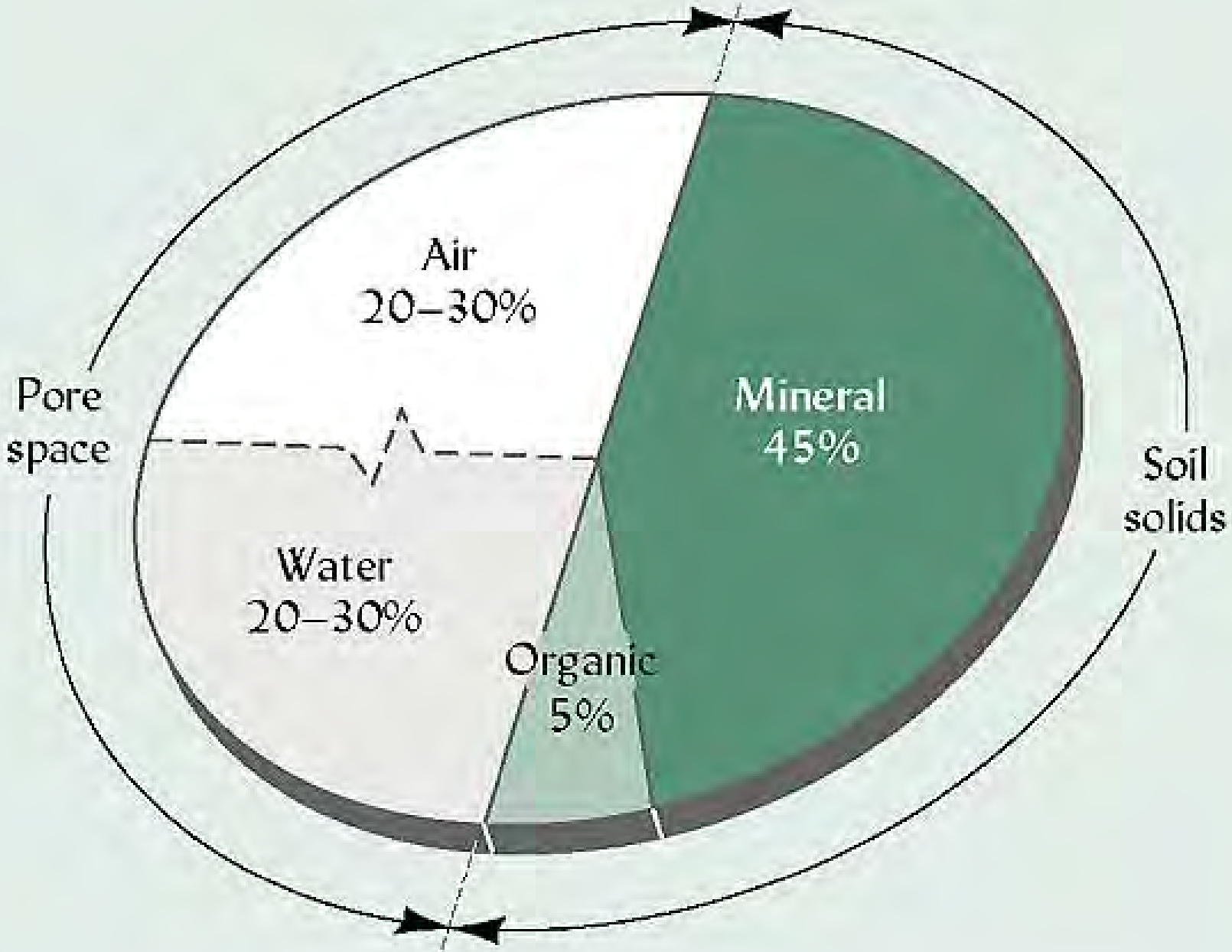
Sources of pollutants

- Tire dust
- Brake dust
- Galvanized steel – railroad track
- Weathered exterior paints
- Copper Chromium Arsenate treated wood
- Fertilizers – over use of incorrect products
- Amendments – salinity, metals and decomposable matter
- Soil sterilants
- Mined minerals
- Natural minerals – pyrites
- Change in land use – limed treated, concrete debris
- Filled sites – buried organic matter and rubble
- Inversion of soil profiles – coastal areas & arid areas

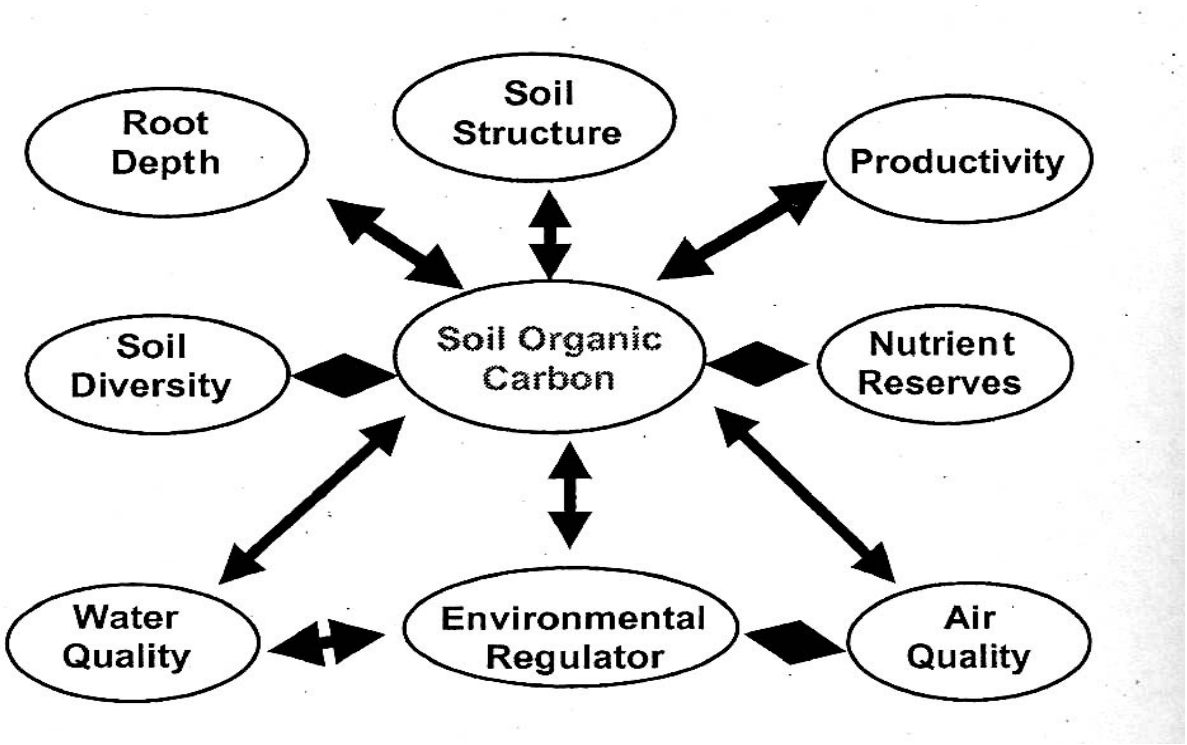
Soil porosity/texture/compaction



6. The volume fractions occupied by solids, water, and air are variable and affect soil behavior.


Air
20–30%
Pore
space
Mineral
45%
Soil
solids
Water
20–30%
Organic
5%

Benefits of Soil Organic Matter



Functions of organic matter

- Binder to soil particles
- Enhances soil porosity
- Enhances tilth
- Supplies nutrients
- Increases plant growth
- Decreases evaporative water loss

Soil Conditioning:
Importance of Water Stable Aggregates

Water Stable Aggregates Non-Stable Aggregates

one week

two week

Water Stable Aggregates Non-Stable Aggregates

four weeks

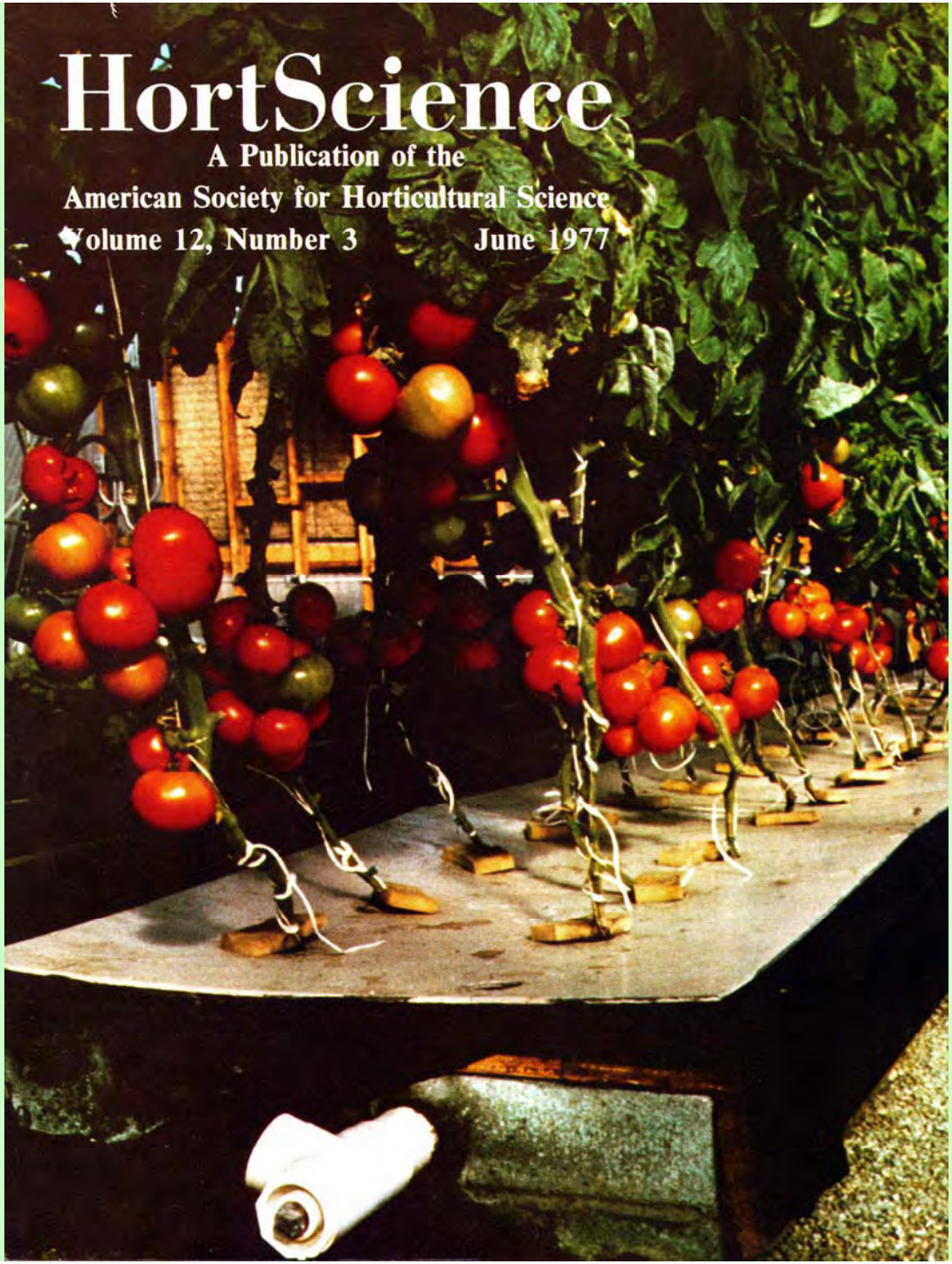
Fertile Island

- Old plant growth in enriched soil from accumulation of abscised leaves, sloughed roots, and droppings of animals.
- Moderate organic matter and high fertility
- Plants grow in clumps where soil is suitable

Fertile Islands form clumps

Transplanting of Native Shrubs on Disturbed Land in the Mojave Desert

- Abstract: Restoration of native shrubs on disturbed land is a very slow natural process in the Mojave desert; However, the time required can be shortened markedly with managed transplanting and husbandry procedures…….**and by supplying nutrient supplements**.
- Romney, Wallace & Hunter, Symposium on Shrub Ecophysiology and Biotechnology, 1989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American Society for Horticultural Science
Volume 12, Number 3 June 1977

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