Understanding Roots

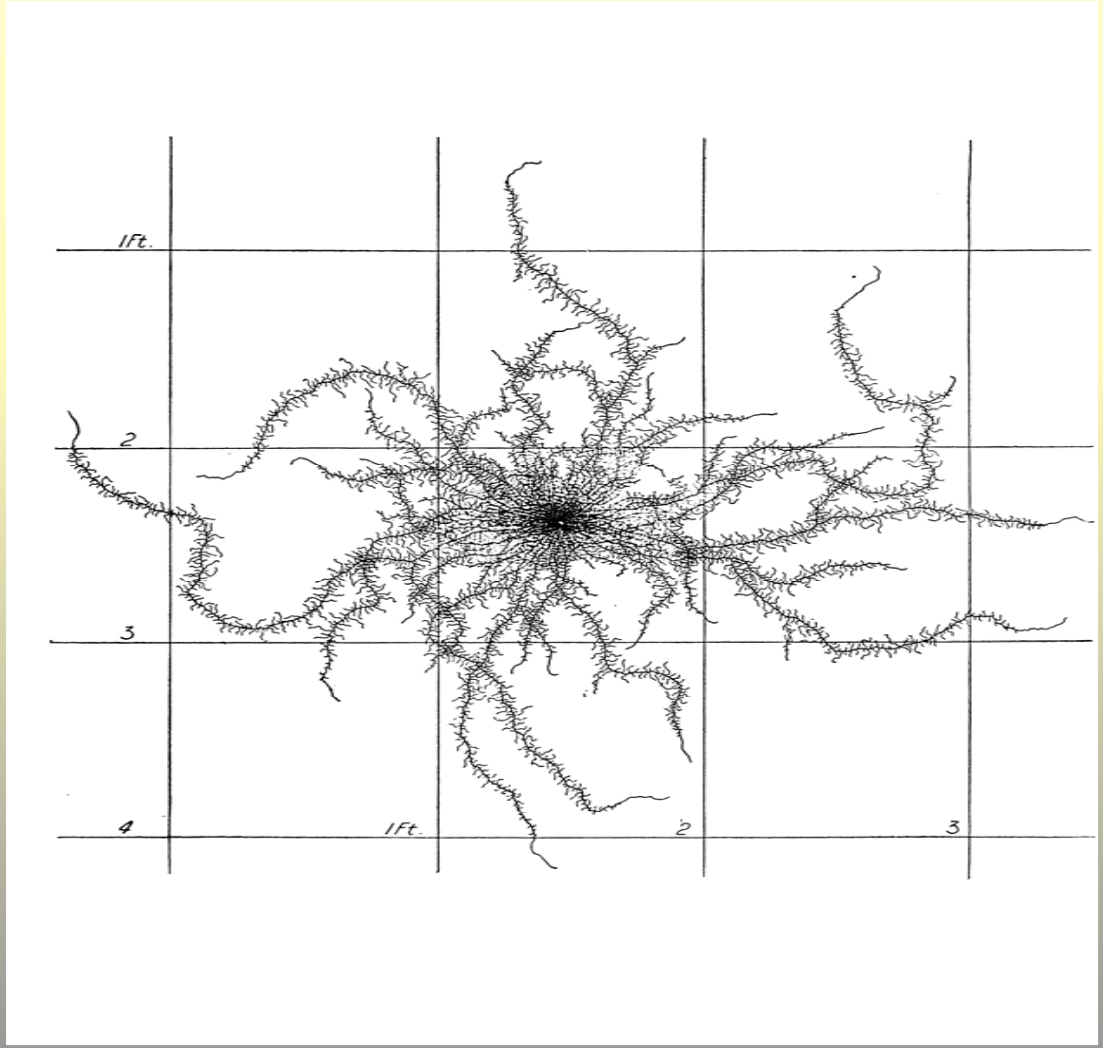
Discover How to Make Your Garden Flourish

Robert Kourik, Metamorphic Press,
634 Scotland Dr., Santa Rosa, CA,
95409

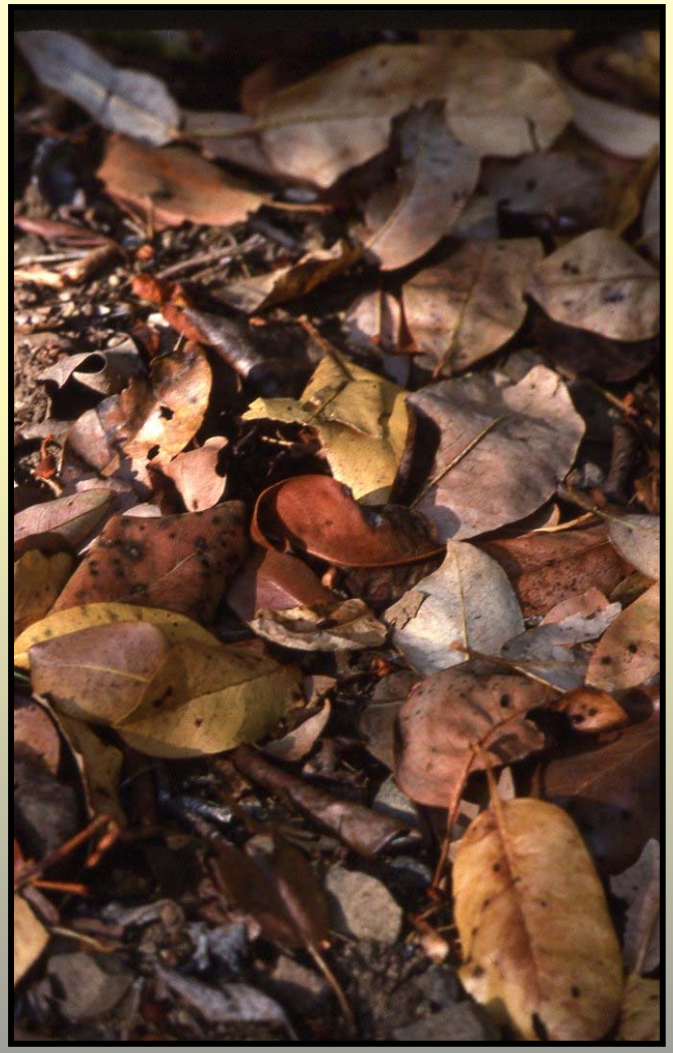
www.robertkourik.com

rkourik @sonic.net

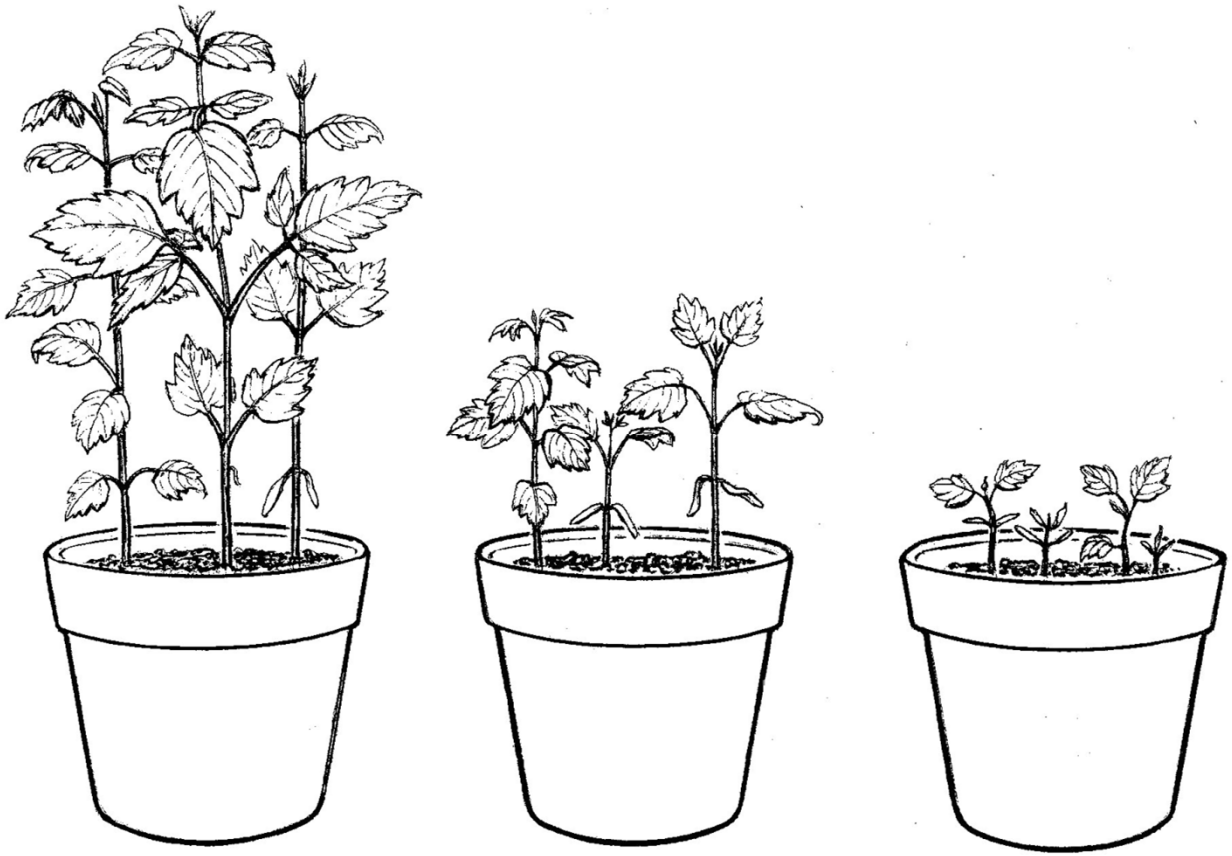
Kidney Bean, top 6 inches of root zone from above.



It all begins with the duff above the soil.



Then the first layers of humus and soil.



10-year-old Horseradish

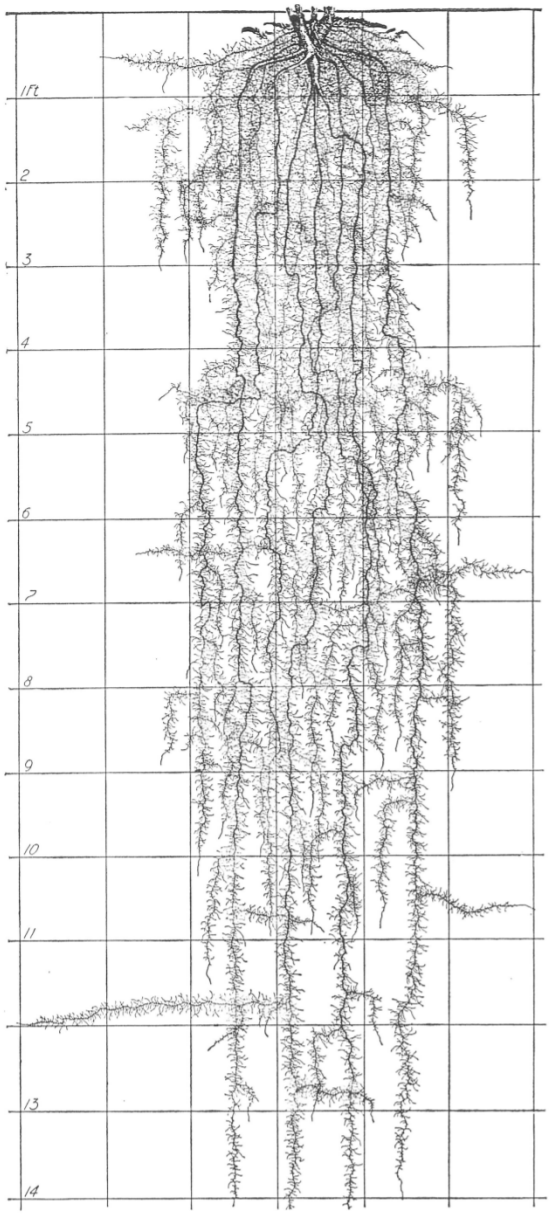


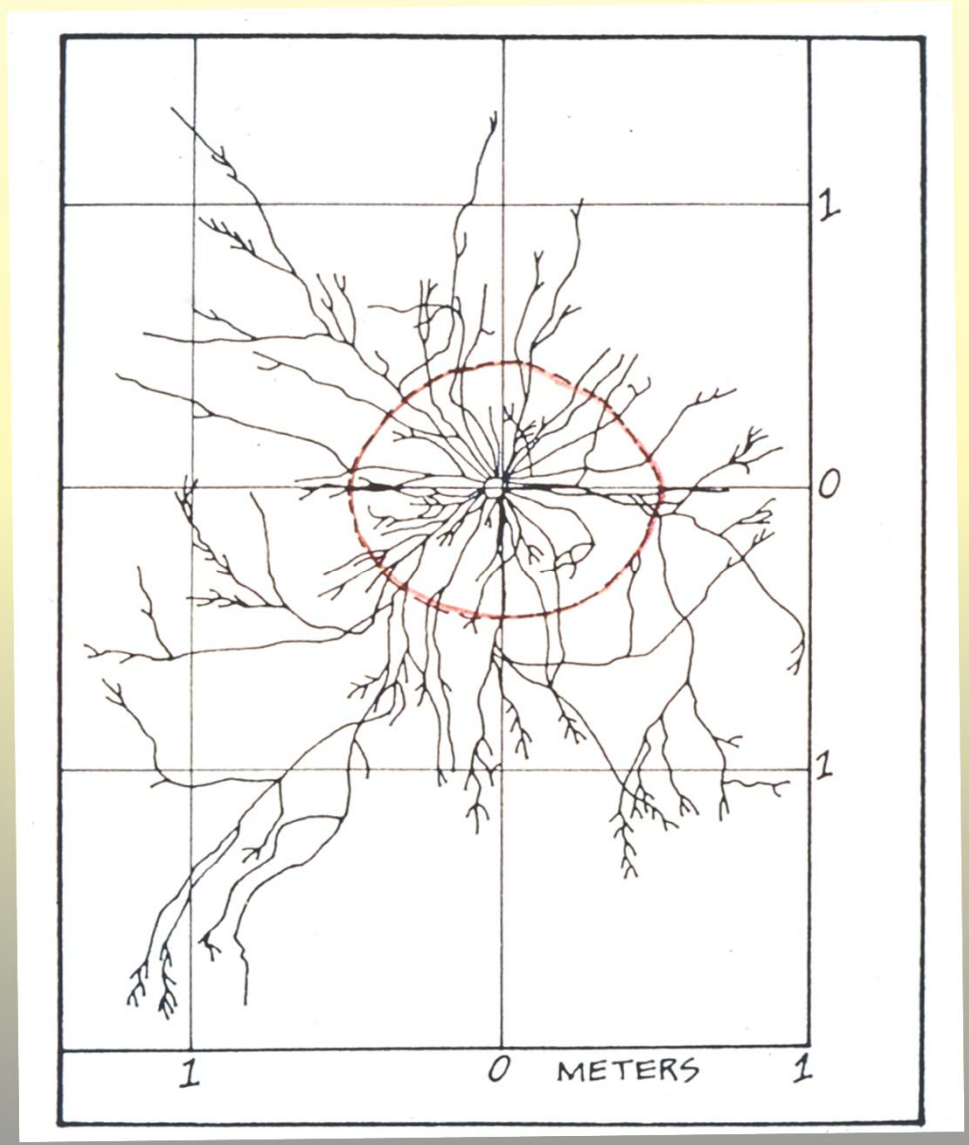
FIG. 45.—Mature root system of a 10-year-old plant of horse-radish.

Myth versus Reality

Roots grow well beyond the dripline

- 1.5-3Xs the canopy
- Some 5Xs, or more
- Feed at or beyond the dripline
- Trees less able to tolerate stress beyond the dripline
- Protect trees and vegetables beyond their dripline

Apple tree with roots far beyond the dripline.



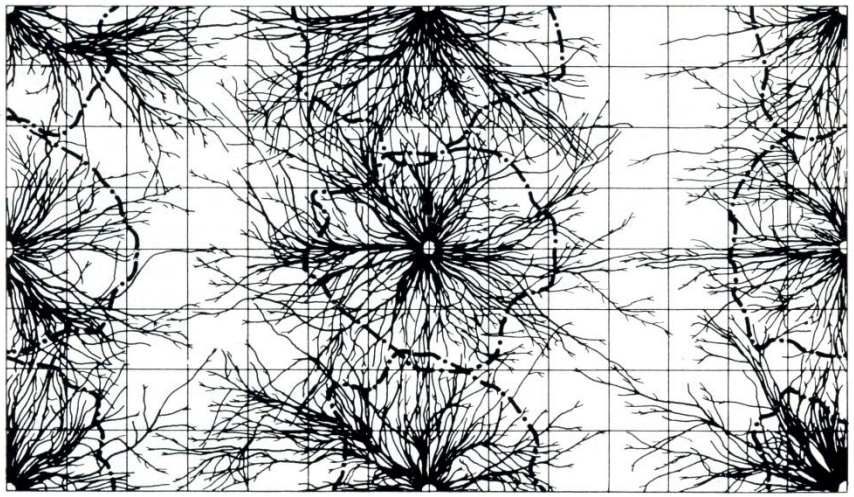


Fig. 37. Five-year-old spindle bush type Jonathan apple trees on M4 stock planted in sandy soil at a spacing of 7×4 m the root system occupied 29.1 m². (The sides of the squares are 1 m)

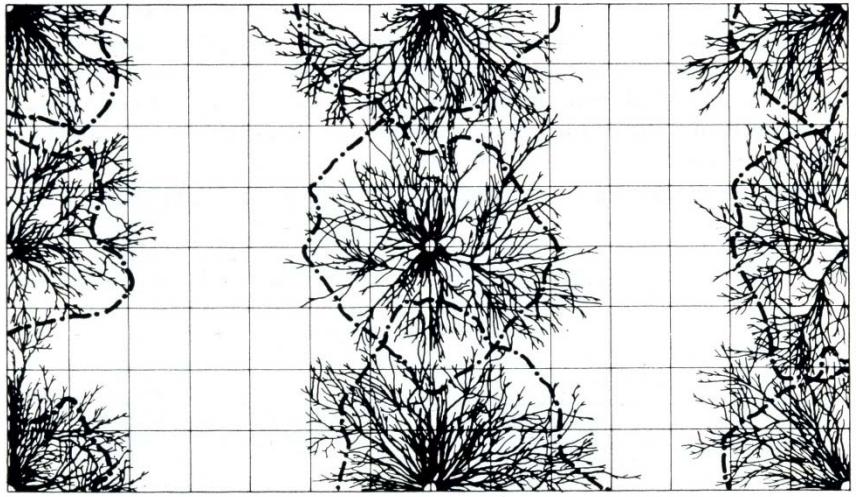
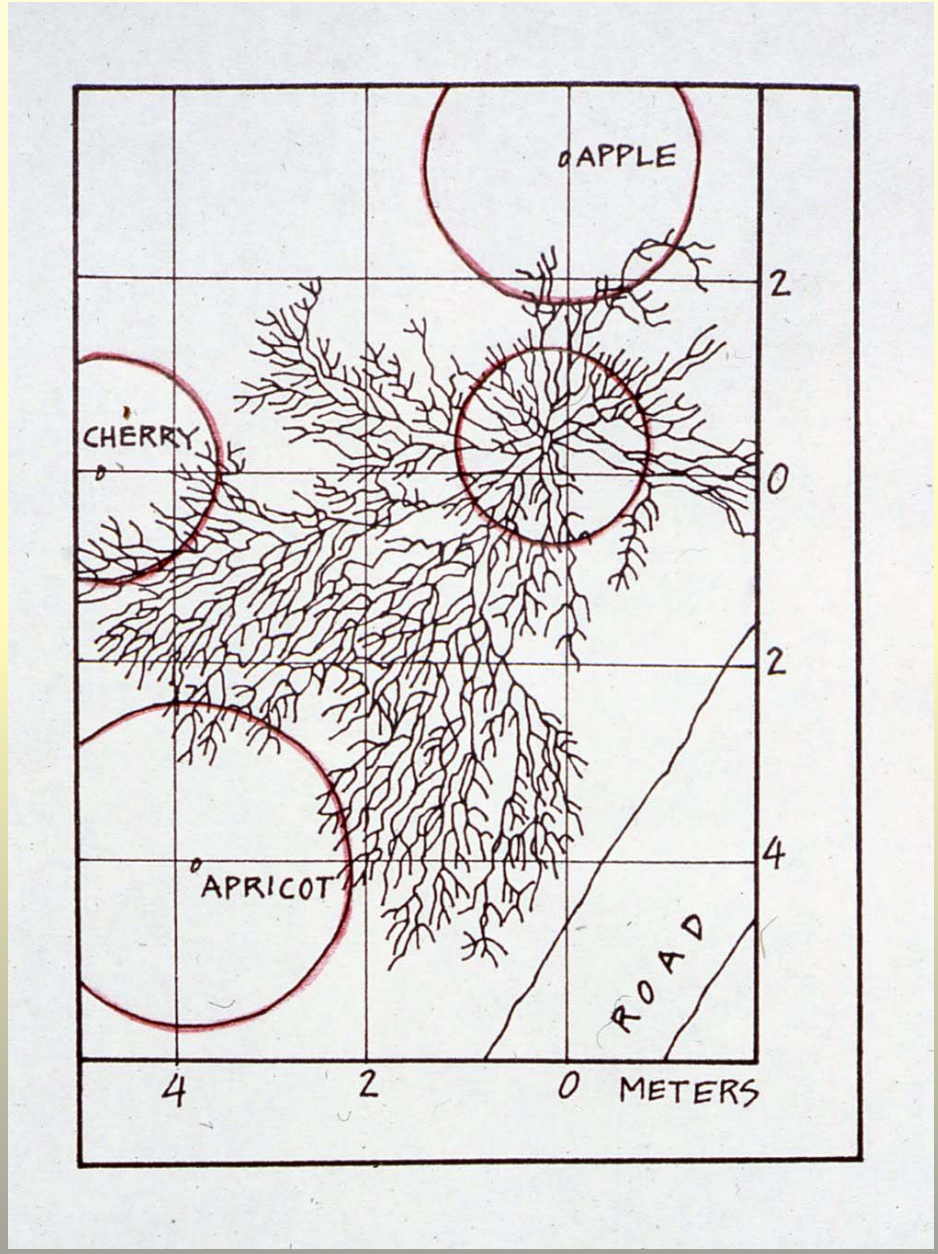
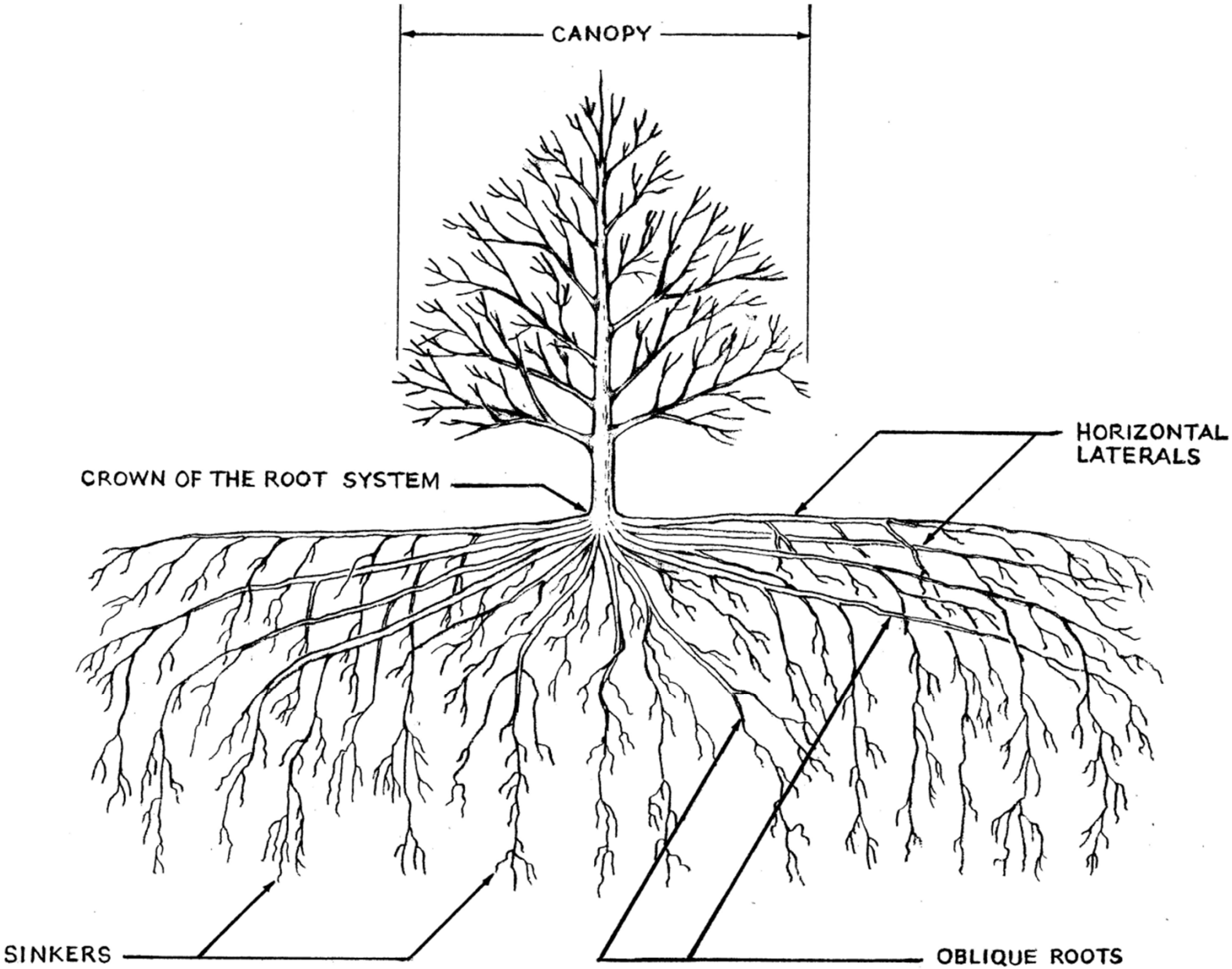


Fig. 38. Five-year-old spindle bush type Jonathan apple trees on M4 stock planted in loam at a spacing of 7×4 m. The root system only occupied 18.2 m². (The sides of the squares are 1 m)

Roots Grow Well
Beyond the Dripline,
(in red circles)
and away from
compaction.




CANOPY
HORIZONTAL LATERALS
CROWN OF THE ROOT SYSTEM
SINKERS
OBLIQUE ROOTS

Soil horizons

Most plants don't send many roots into clay subsoil. Main roots are only as deep as the topsoil. Even in deep topsoil, most of a tree's feeding roots are found in the top 12-36 inches.

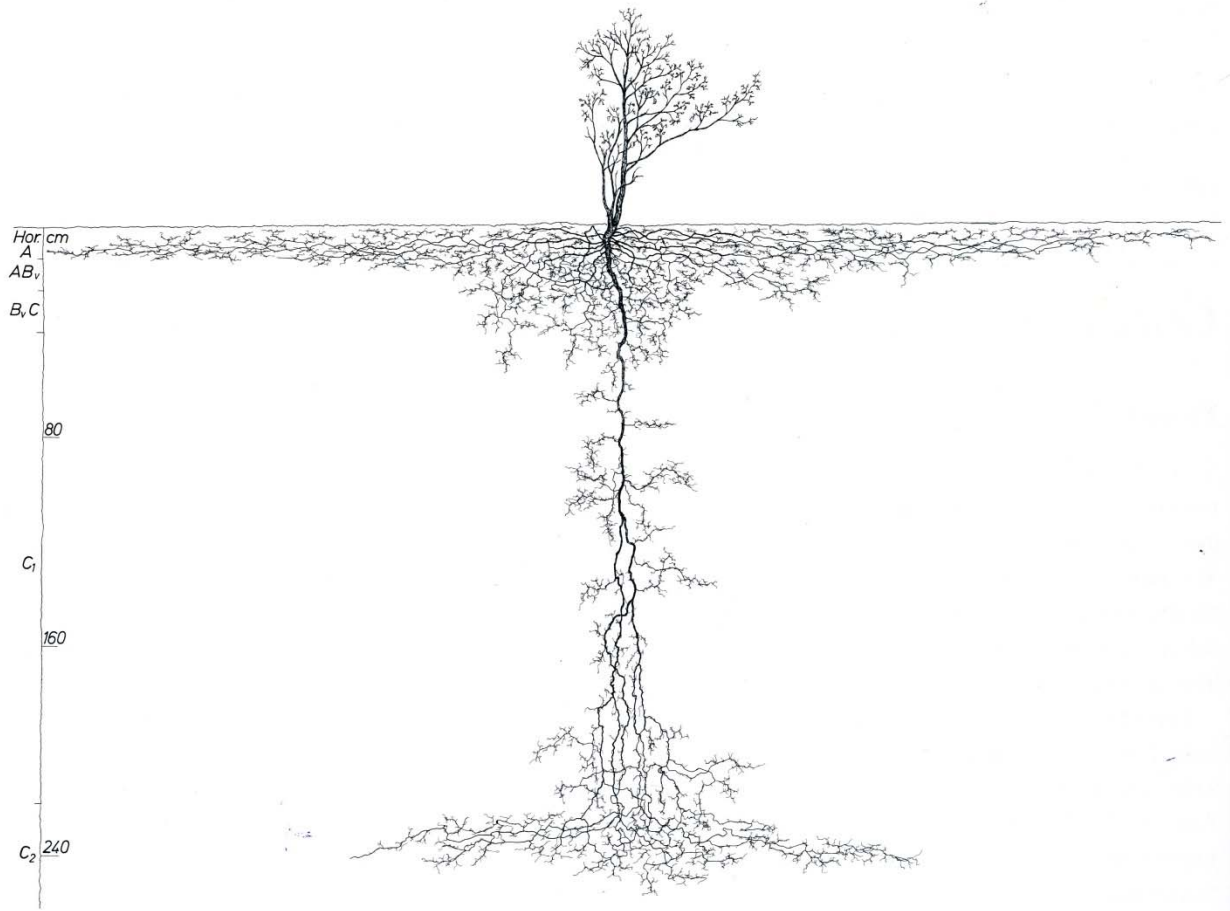


Abb. 111: Stiel-Eiche, *Quercus robur*, H–T–S = 82–253–445 cm, bei Grafenstein, Kärnten, Oberkante eines Südhanges mit einzelnen naturverjüngten Eichen, 460 m NN. Lockersediment-Braunerde über Niederterrasse. Bodenprofil Hor.: A 0–12 cm humoser, lehmiger Sand, feinkrümelig, locker, schwach steinig, stark durchwurzelt, AB_v 12–24 cm schwach humoser l S, steinig, locker, stark durchwurzelt, B_vC 24–40 cm l S, sehr steinig, locker, stark durchwurzelt, C_1 40–220 cm sandiger Schotter und Kies, sehr locker, Durchwurzelung abnehmend, C_2 Sand, Kies und Schotter, sehr locker, grundfrisch, Durchwurzelung gestaucht endend.

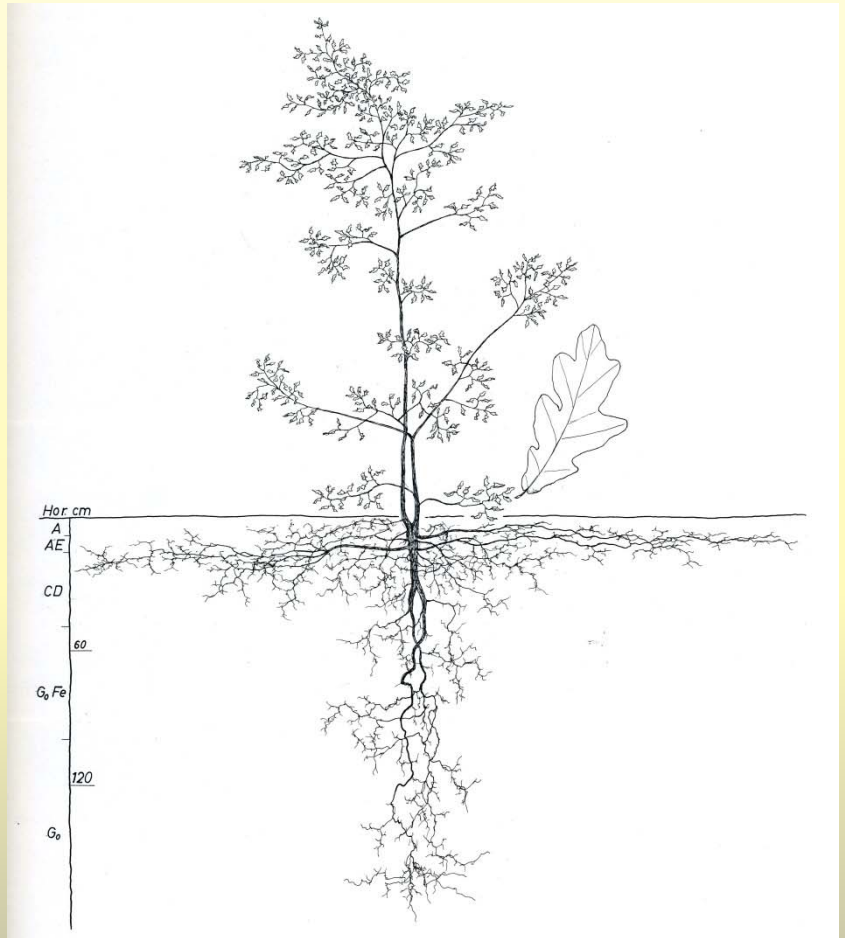


Abb. 117: Stiel-Eiche, *Quercus robur*, H–T–S = 222–173–324 cm, March-Au bei Drösing, Niederösterreich, Flußniederung, 158 m NN. Großer Wald-Kahlschlag mit einzelnen Stiel-Eichen, in der Krautschicht vorwiegend *Calamagrostis epigeios*. Vergleyter Semipodsol auf saurer Sandflur. Bodenprofil (Beschreibung nach Prof. Solar, verkürzt) Hor.: A 0–9 cm Graswurzelfilz, dunkel braungrauer Sand, stark humos, puffiger Moder, undeutlich krümelig, AE 9–17 cm undeutlich gebleichter Krumenuntersaum, brauner Sand, humos gefleckt, strukturlos, CD 17–50 cm Sand-Feinkies-Lage, $G_{o\ rel}$ Fe 50–70/100 cm trockengefallene Oberpartie des G_o-Hor. Wurzelstock-Ortstein-Horizont, Sand, Eisenhumus-Ortstein, verkittet, G_o temporär grundwasserführender Unterboden, Sand, rostfleckig, Durchwurzelung auslaufend, Grundwasserstand zur Zeit der Untersuchung 120 cm tief.

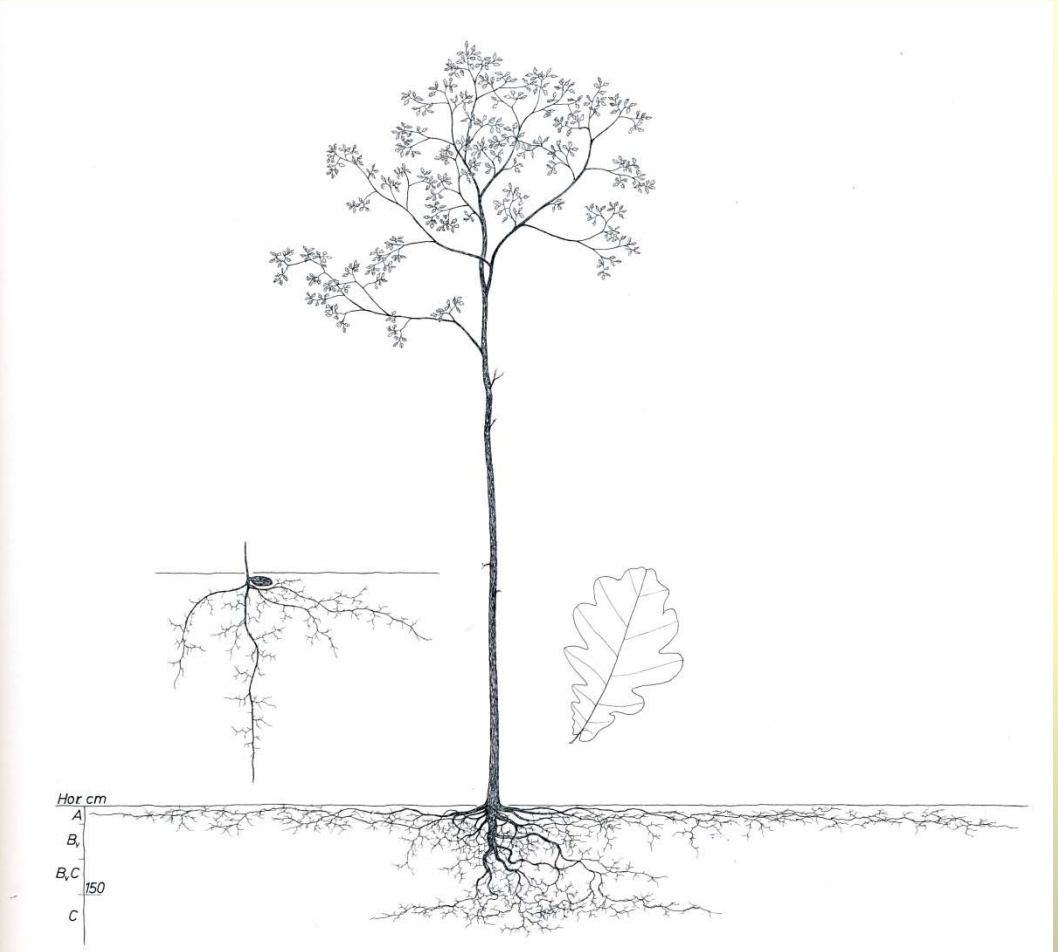


Abb. 113: Stiel-Eiche, *Quercus robur*, H–T–S = 1.290–222–1.569 cm, Umgebung Klagenfurt, eben, 450 m NN. Eichen-Hainbuchen-Wald mit *Pinus sylvestris*, im Unterwuchs vorwiegend *Rubus caesius* und *R. idaeus*. Lockersediment-Braunerde über Niederterrasse. Bodenprofil Hor.: A_1 0–8 cm Modermull, stark humoser, sandiger Lehm, sehr locker, schwach steinig, stark durchwurzelt, A_2 8–30 cm stark humoser s L, krümelig, locker, steinig, stark durchwurzelt, unterer Bereich der flachstreichenden Wurzeletage, B_v 30–90 cm lehmiger Sand, stark kiesig, schotterig, locker, mäßig stark durchwurzelt, Wurzeln vorwiegend abwärts gerichtet, B_vC 90–150 cm lehmiger Sand mit Kies und Schotter, sehr locker, schwach durchwurzelt, C Grobsand, Kies und Schotter, grundfrisch, Durchwurzelung gestaucht endend.

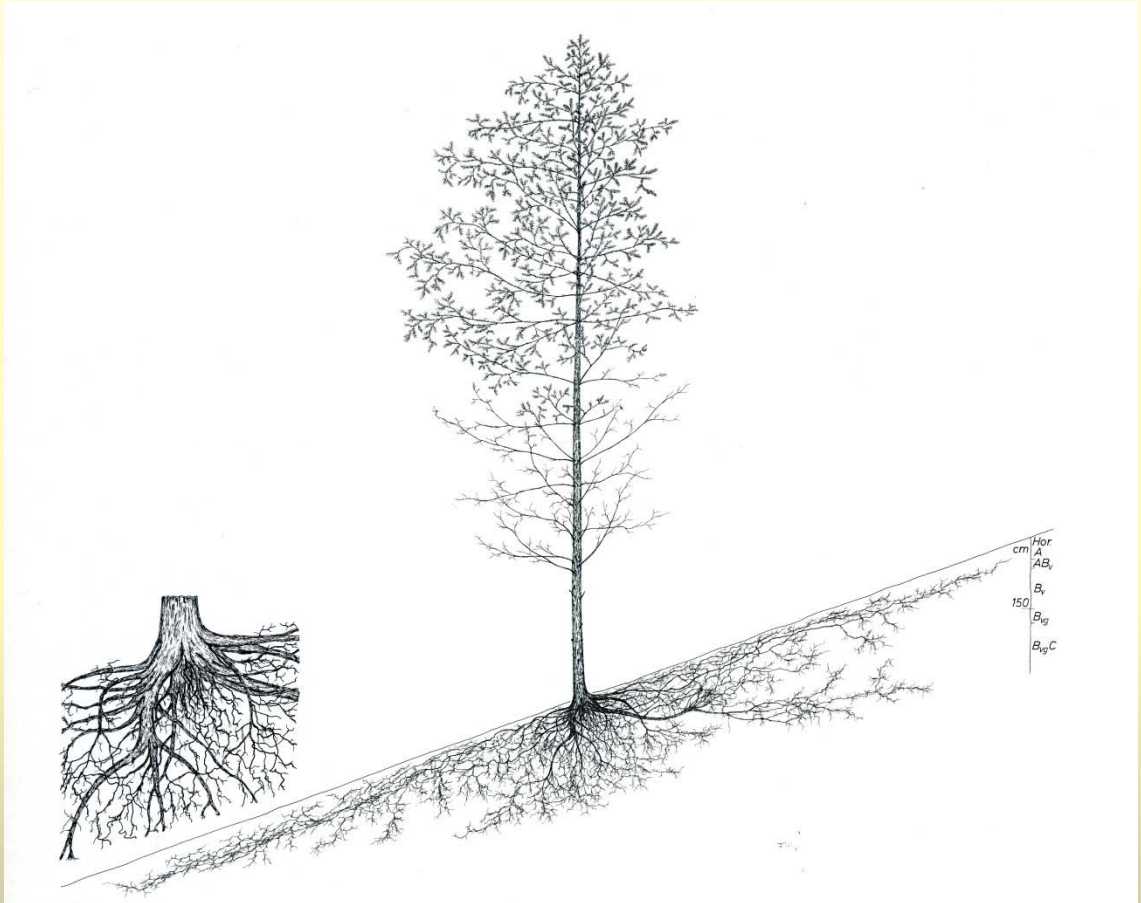


Abb. 51: Douglasie, *Pseudotsuga menziesii*, H–T–S = 1.395–240–2.025 cm, bei Treffen, Kärnten, Nordhang, 640 m NN. Buchen-Fichten-Wald mit eingefor steter Douglasie, in der Strauchschicht vorwiegend *Sambucus racemosa,* in der Krautschicht vorwiegend *Atropa belladonna* und *Salvia glutinosa.* Tiefgründige Braunerde, Bodenprofil Hor.: O 5–0 cm Streuauflage, Grobmoder, A_1 0–21 cm stark humoser, lehmiger Sand, Modermull, dunkelbraun (10YR 3/2), sehr locker, pH 4,8, sehr stark durchwurzelt, A_2 21–45 cm Mull, humoser l S, dunkelbraun (10YR 3/3), sehr locker, sehr gut durchwurzelt, AB_v 45–65 cm schwach humoser l S, braun (10YR 4/3), locker, schwach steinig, gut durchwurzelt, B_v 65–150 cm sandiger Schluff, mehlig, gelblichbraun (10YR 4/4), mäßig dicht, schwach steinig, pH 5,6, gut durchwurzelt, B_{vg} 150–180 cm feinsandiger Schluff, rostfleckig, sehr hangsickerfeucht, steinig, B_{vg} C schluffiger Sand, rostfleckig, stark durchsetzt mit Feinschutt aus Silikatschiefer, pH 6,3.

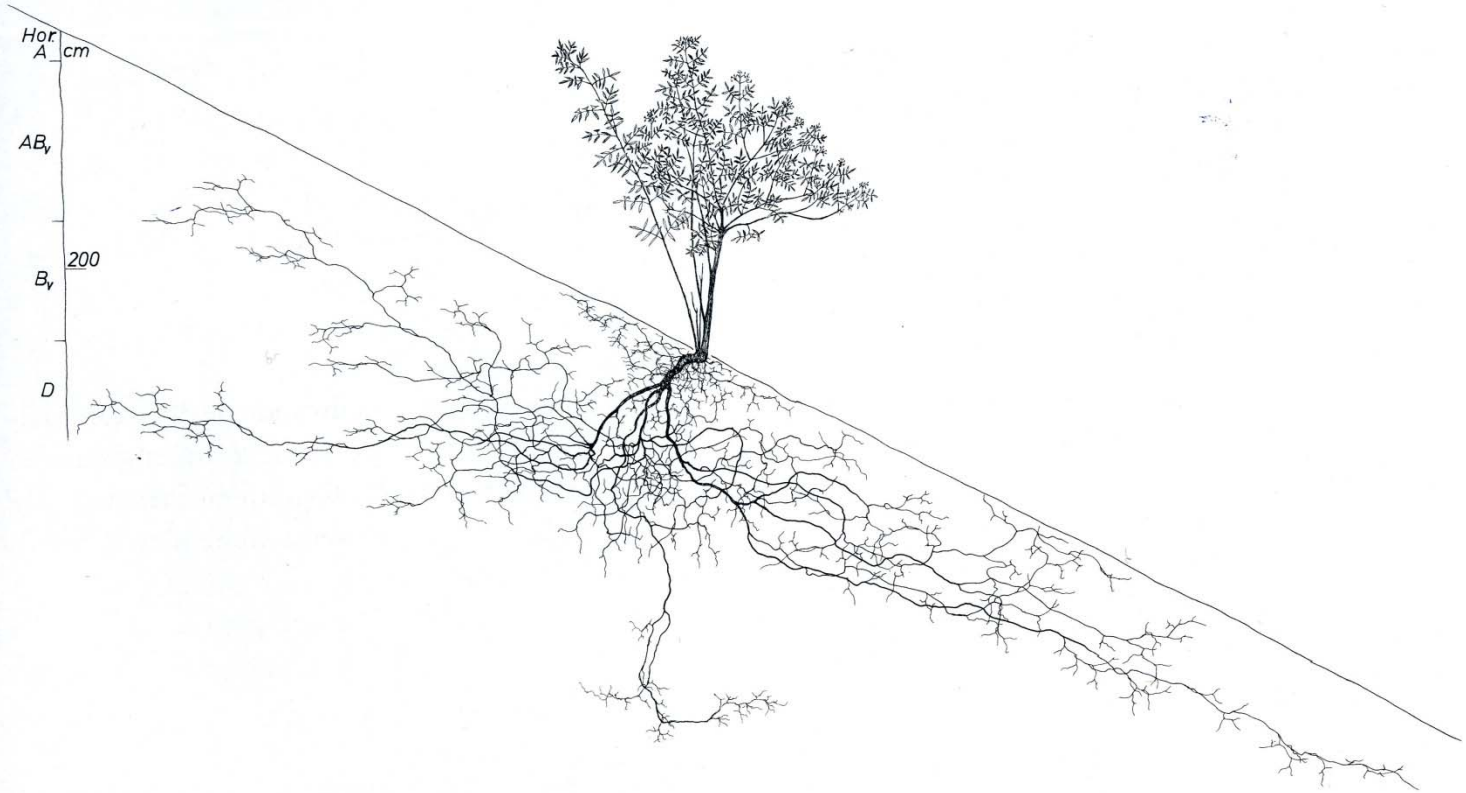


Abb. 182: Schwarzer Holunder, *Sambucus nigra*, H–T–S = 270–300–1.180 cm, Treffen bei Villach, Südhang, 515 m NN. Gebüsch mit *Salix alba, Alnus incana, Fraxinus excelsior* und *Sambucus nigra*. Lockersediment-Braunerde über Niederterrasse, Bodenprofil Hor.: A 0–25 cm humoser, lehmiger Sand, feinkrümelig, locker, schwach steinig, pH 6,9, mäßig stark durchwurzelt, AB$_v$ 25–160 cm schwach humoser l S, schwach durchsetzt mit Kies und Schotter, mäßig stark durchwurzelt, B$_v$ 160–260 cm l S, stärker kiesig-schotterig, mäßig stark durchwurzelt, D grauer, griffiger Sand, grundfrisch, pH 7,1, Durchwurzelung auslaufend.

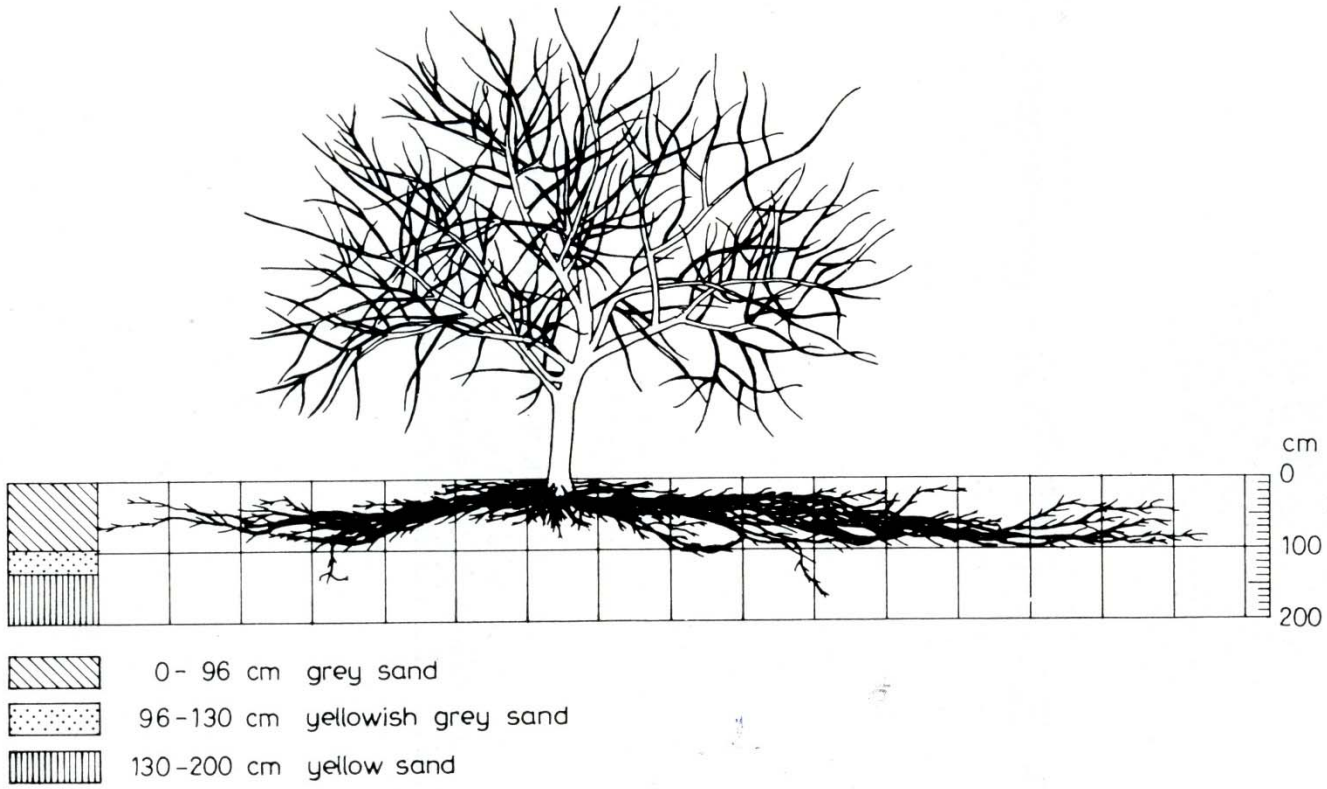


Fig. 113. The mass (76.02 per cent) of the root system of a 23-year-old apricot tree standing in drift sand on wild apricot stock was located in the 30–80 cm soil horizon. (The sides of the squares are 1 m)

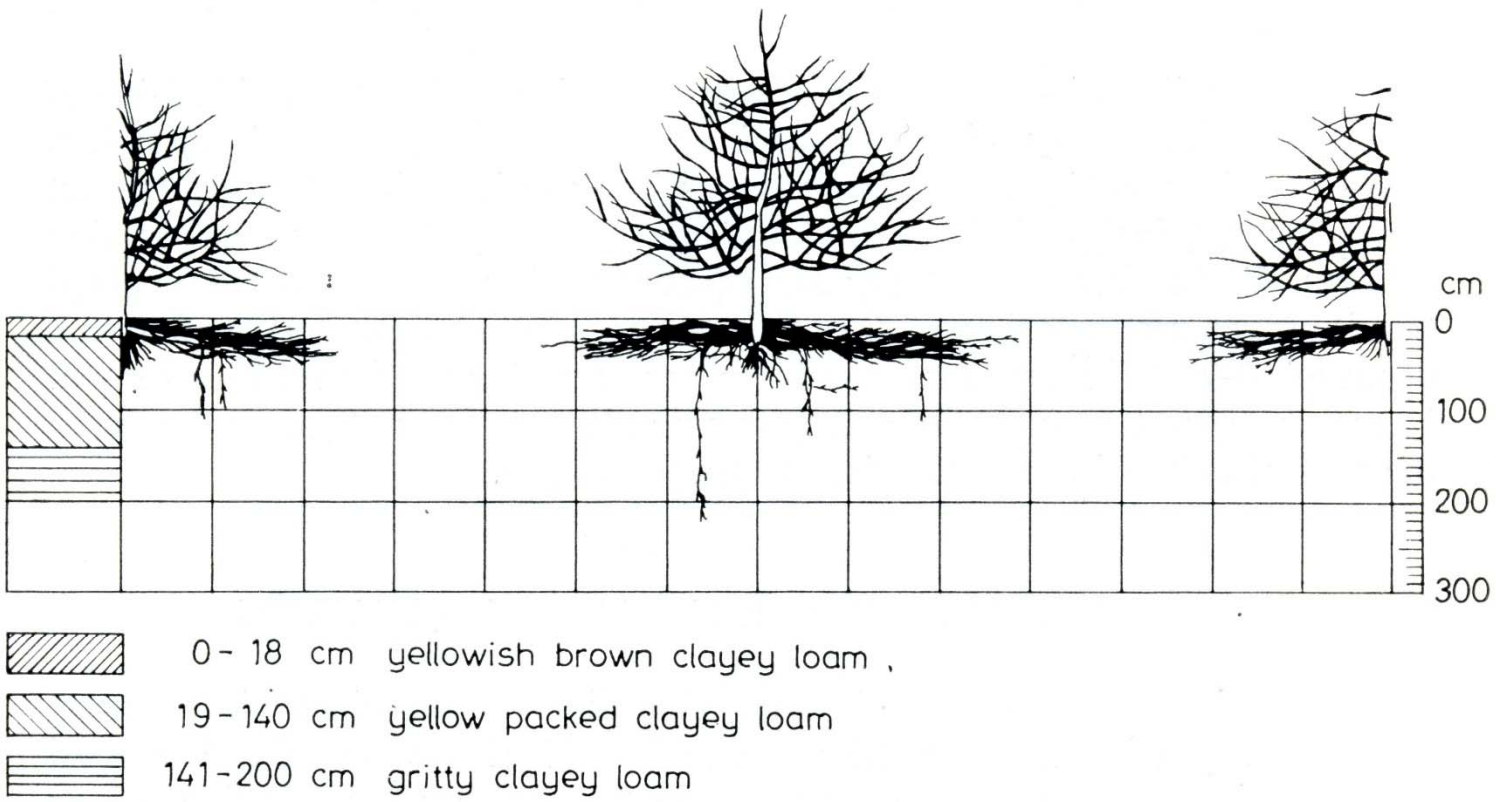
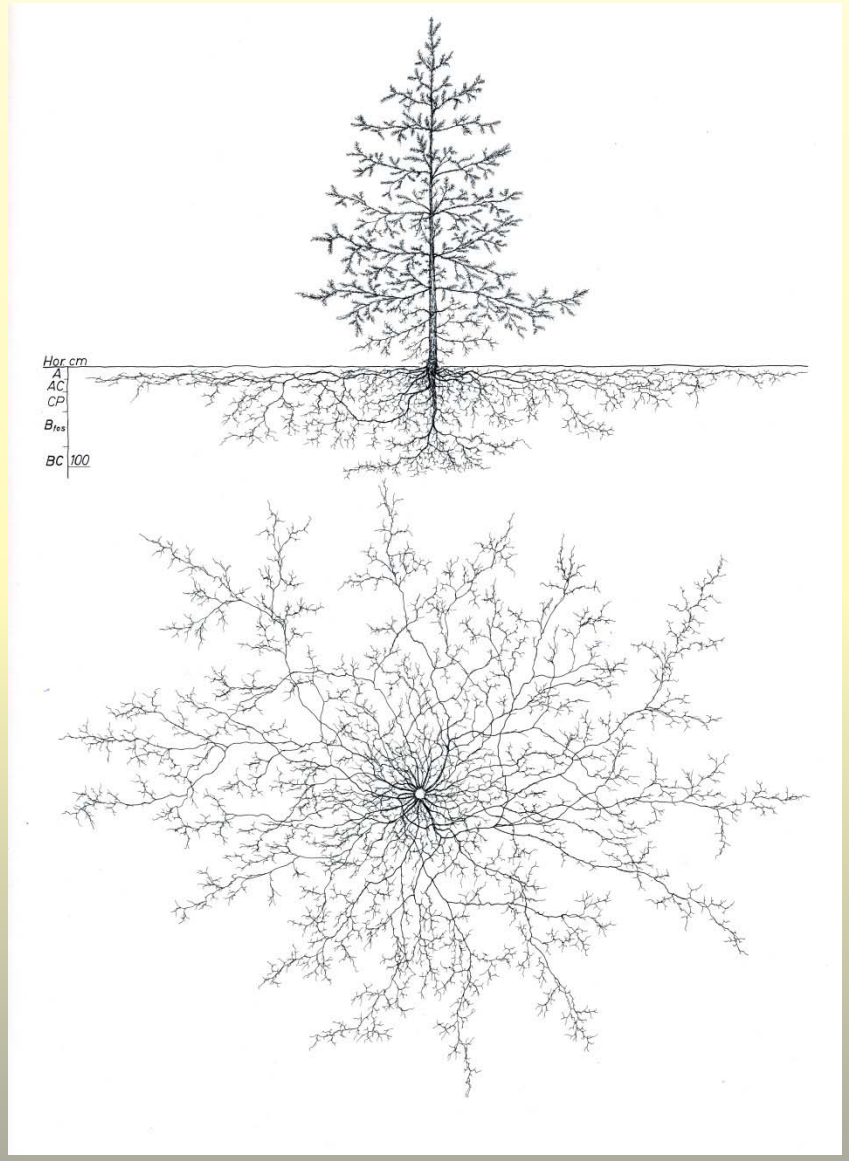


Fig. 44. Of the root system of 5-year-old spindle bush type Jonathan apple trees standing in loam on M4 stock 31.8 per cent was located in the upper 20 cm soil layer. (The sides of the squares are 1 m)


Hor cm
A
AC
CP
Bfes
BC
100

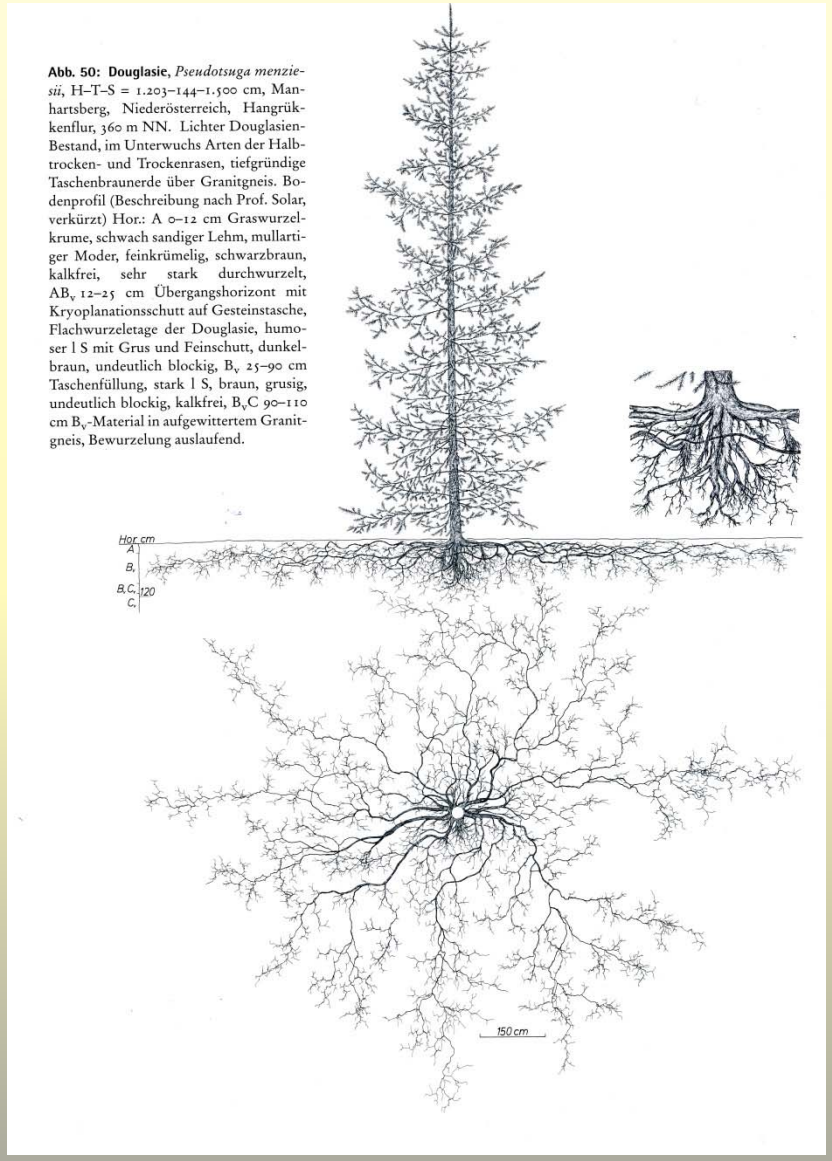


Abb. 50: Douglasie, *Pseudotsuga menziesii*, H–T–S = 1.203–144–1.500 cm, Manhartsberg, Niederösterreich, Hangrükkenflur, 360 m NN. Lichter Douglasien-Bestand, im Unterwuchs Arten der Halbtrocken- und Trockenrasen, tiefgründige Taschenbraunerde über Granitgneis. Bodenprofil (Beschreibung nach Prof. Solar, verkürzt) Hor.: A 0–12 cm Graswurzelkrume, schwach sandiger Lehm, mullartiger Moder, feinkrümelig, schwarzbraun, kalkfrei, sehr stark durchwurzelt, AB_v 12–25 cm Übergangshorizont mit Kryoplanationsschutt auf Gesteinstasche, Flachwurzeletage der Douglasie, humoser l S mit Grus und Feinschutt, dunkelbraun, undeutlich blockig, B_v 25–90 cm Taschenfüllung, stark l S, braun, grusig, undeutlich blockig, kalkfrei, B_vC 90–110 cm B_v-Material in aufgewittertem Granitgneis, Bewurzelung auslaufend.

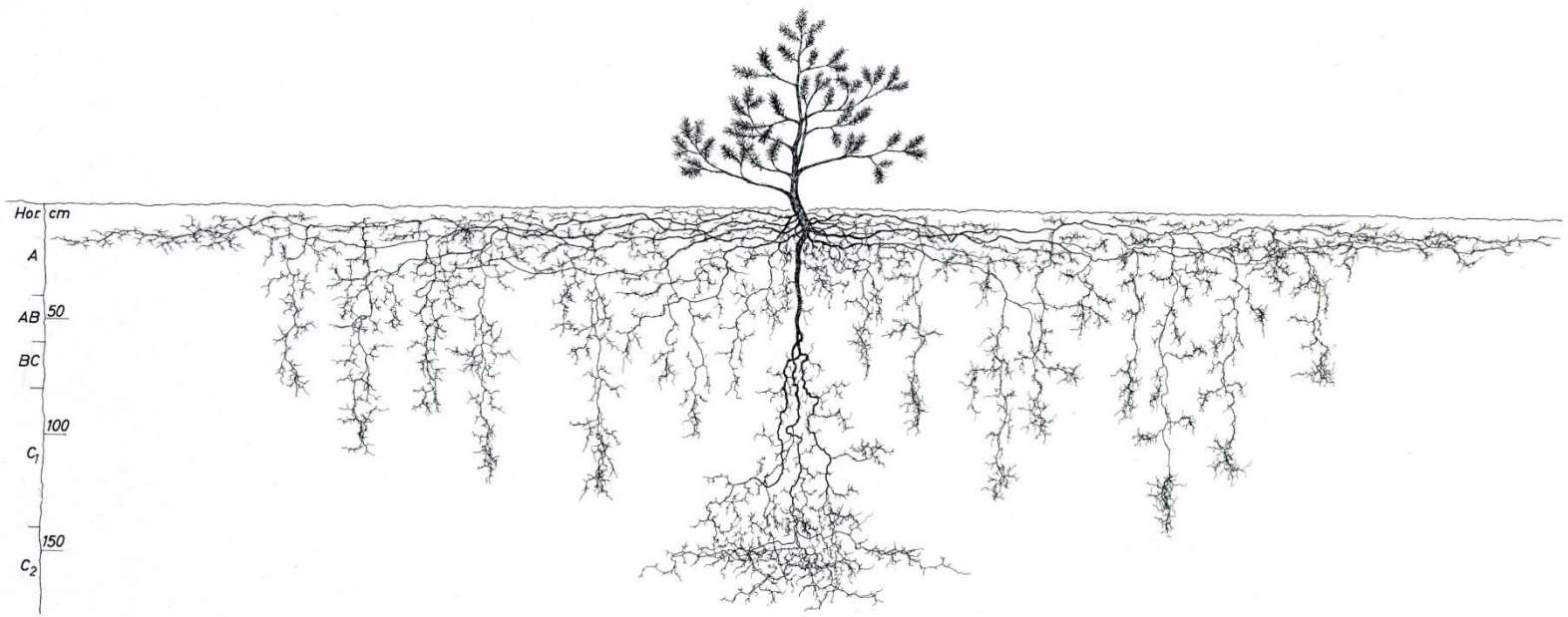
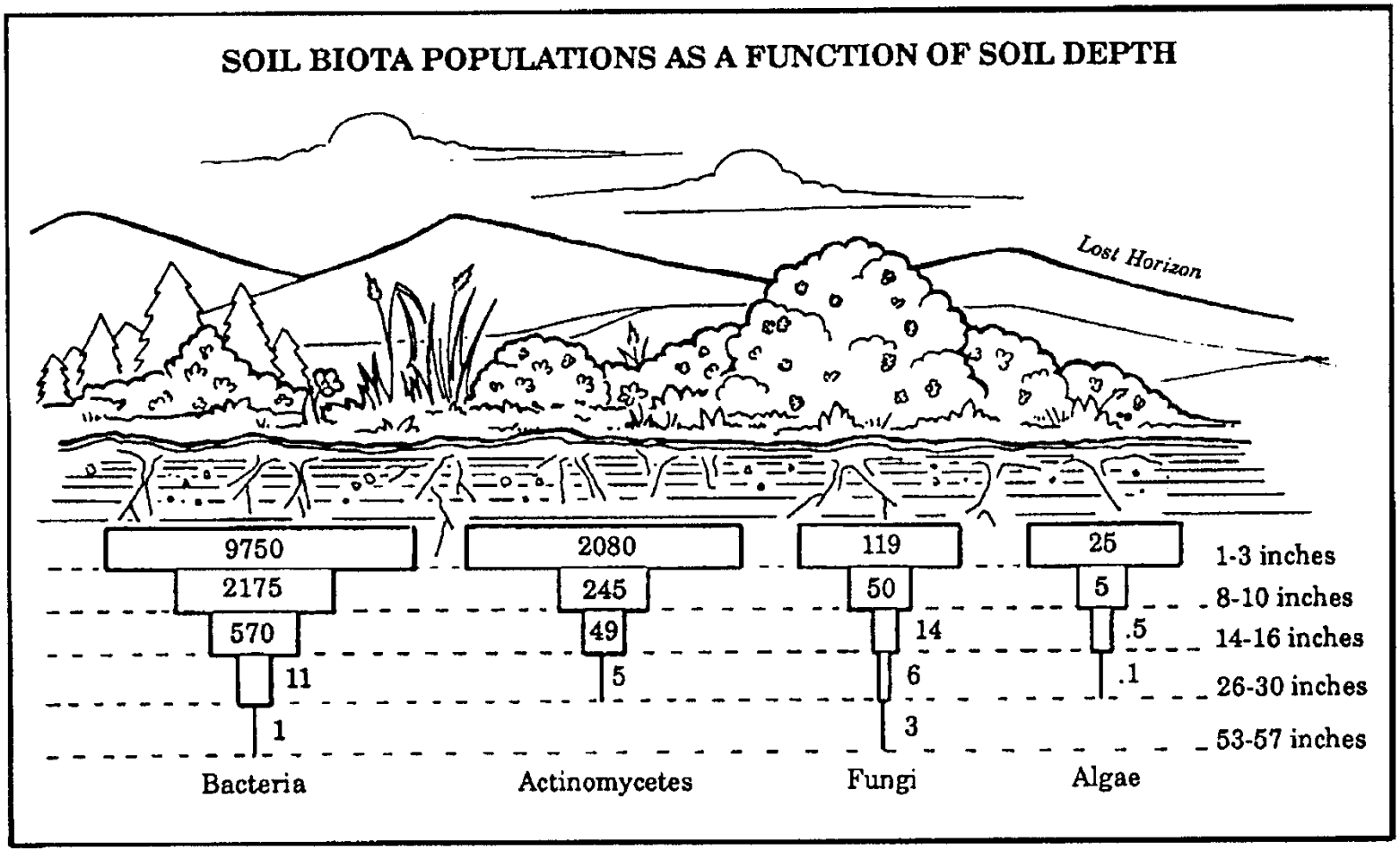
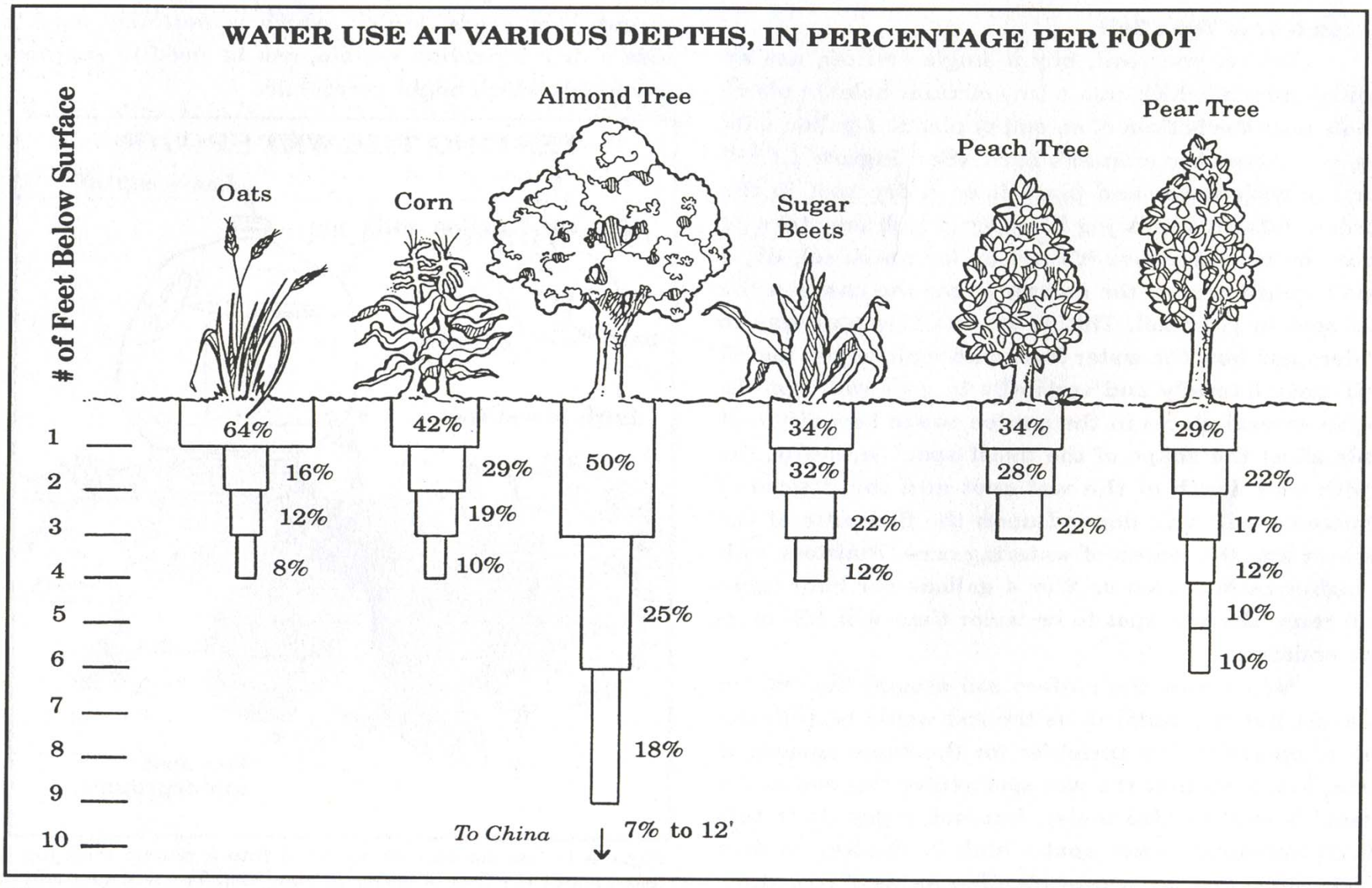


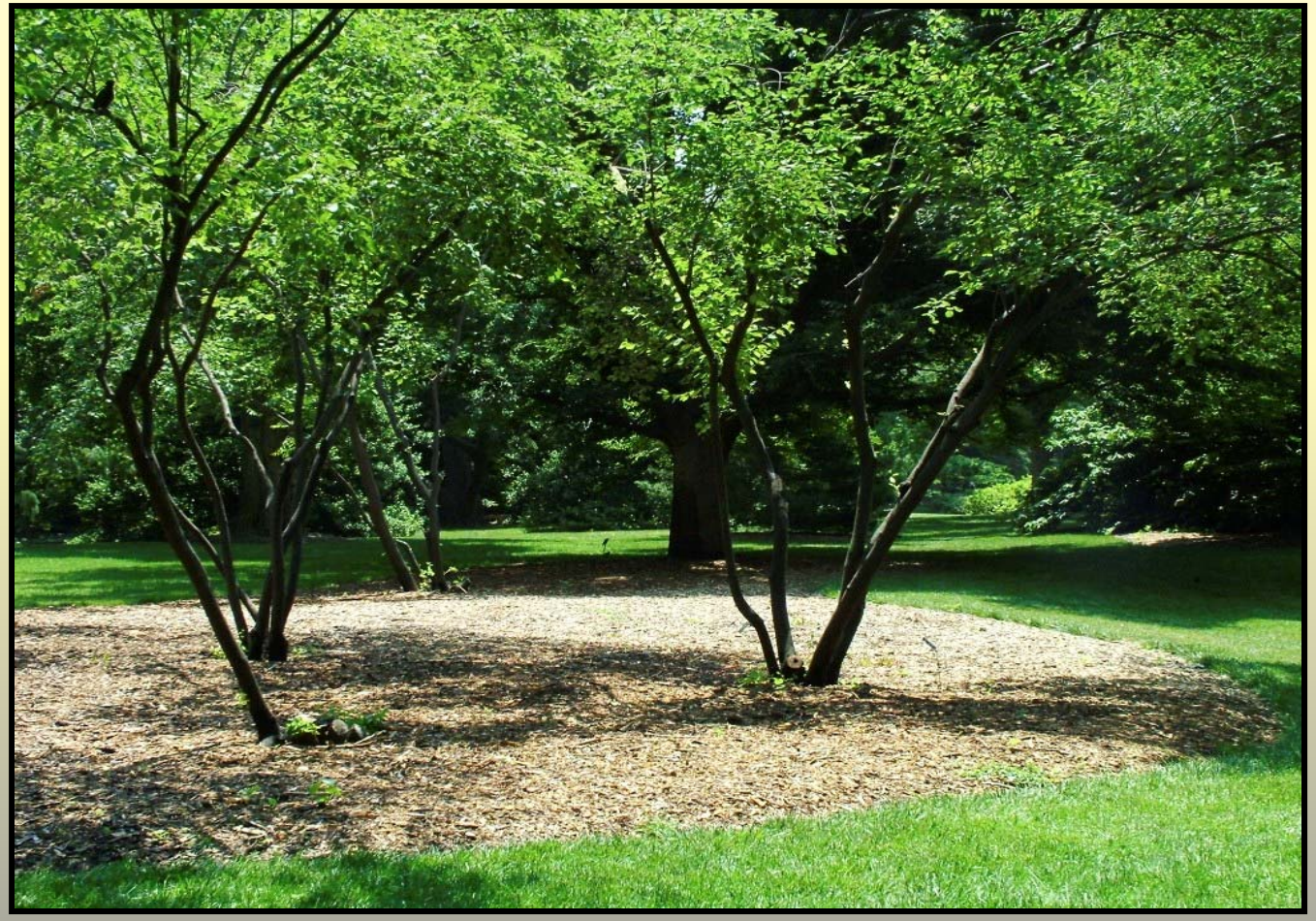
Abb. 31: Wald-Kiefer, *Pinus sylvestris* subsp. *sylvestris*, H–T–S = 87–174–653 cm, östlich Klagenfurt, Südhang, 465 m NN. Kiefern-Naturverjüngung. Lockersediment-Braunerde über Niederterrasse, Bodenprofil Hor.: O 3–0 cm Streuauflage, A_1 0–15 cm feinmoderreicher, lehmiger Sand, locker, stark durchwurzelt, A_2 15–40 cm humoser l S, locker, schwach steinig, stark durchwurzelt, AB_v 40–60 cm schwach humoser l S, stark steinig, locker, mäßig stark durchwurzelt, B_vC 60–80 cm schwach lehmiger S, sehr steinig, locker, schwach durchwurzelt, C_1 80–140 cm Sand und Schotter, sehr locker, schwach durchwurzelt, C_2 lehmiger Schluff, dicht, feuchter, stärker durchwurzelt, Bewurzelung rasch auslaufend.


SOIL BIOTA POPULATIONS AS A FUNCTION OF SOIL DEPTH
Lost Horizon
9750
2175
570
11
1
2080
245
49
5
119
50
14
6
3
25
5
.5
.1
1-3 inches
8-10 inches
14-16 inches
26-30 inches
53-57 inches
Bacteria
Actinomycetes
Fungi
Algae


WATER USE AT VARIOUS DEPTHS, IN PERCENTAGE PER FOOT
# of Feet Below Surface
1
2
3
4
5
6
7
8
9
10
Oats
64%
16%
12%
8%
Corn
42%
29%
19%
10%
Almond Tree
50%
25%
18%
To China
7% to 12'
Sugar Beets
34%
32%
22%
12%
Peach Tree
34%
28%
22%
Pear Tree
29%
22%
17%
12%
10%
10%

End the battle of death-mulched trunks!

Mulch to dripline or beyond, not just near trunk

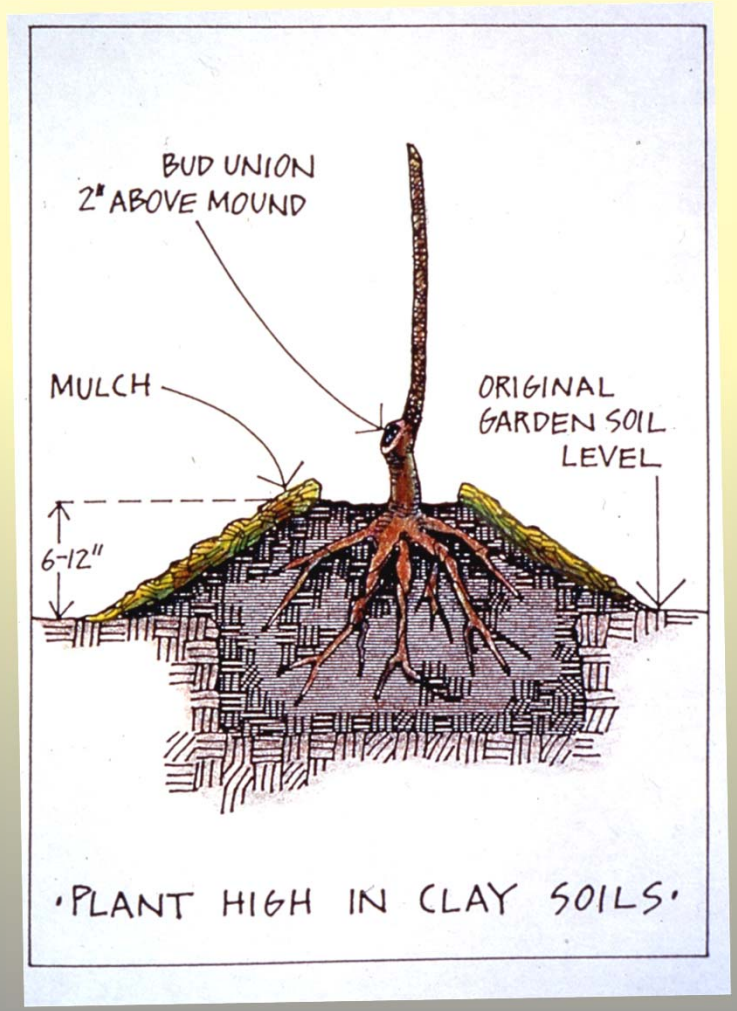


Some choices for mulching trees

Fruit trees with continuous mulch. Azaleas mulched to the dripline.

Or, in a lawn with plenty of drainage and on a mound.

Plant on a mound in any soil, but especially clay soils.

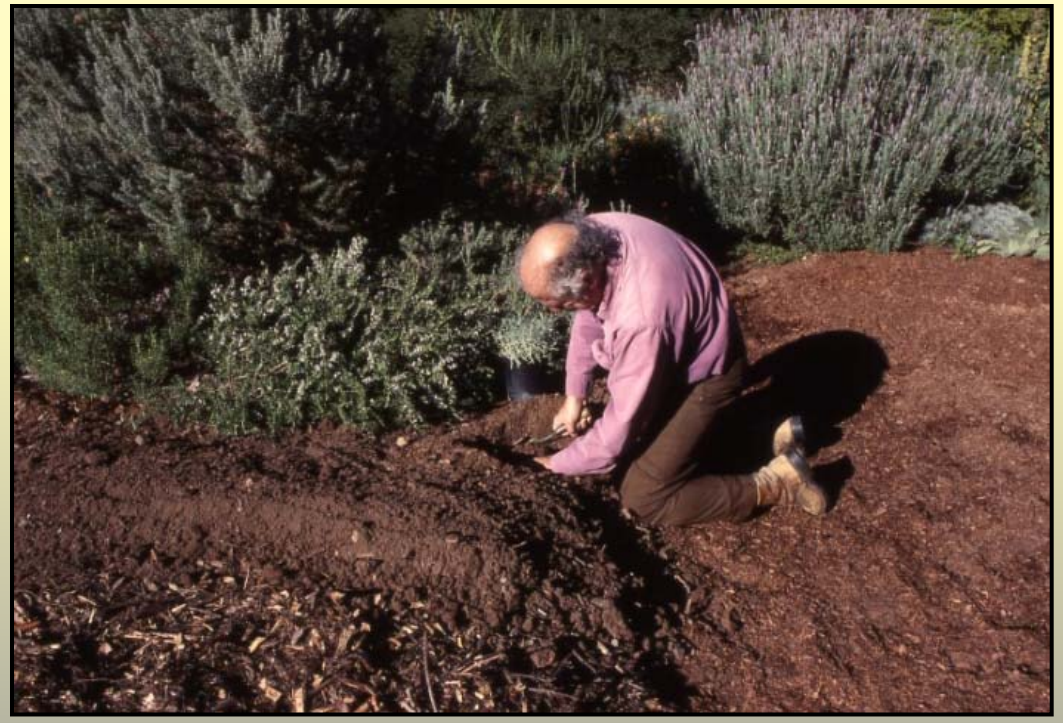


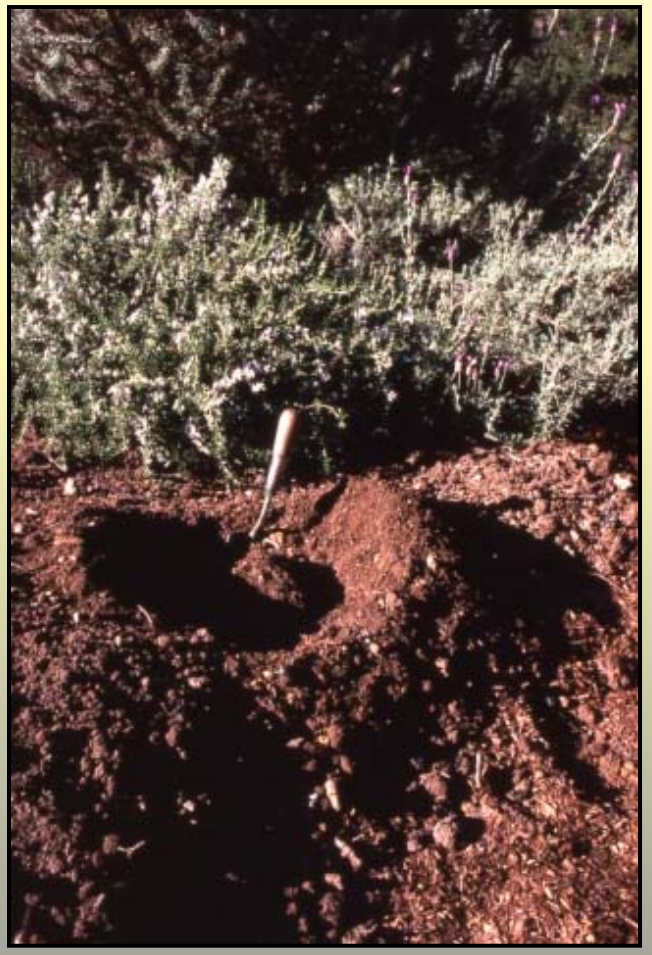
Planted on a mound,
not mulched too high.

- **Plant high on a mound, will settle 20-50%**
- **Cover with newspaper (or old garden B&W catalogs!)**
- **Cover with attractive mulch**
- **Use only B & W newspaper, not color inserts on slick paper**

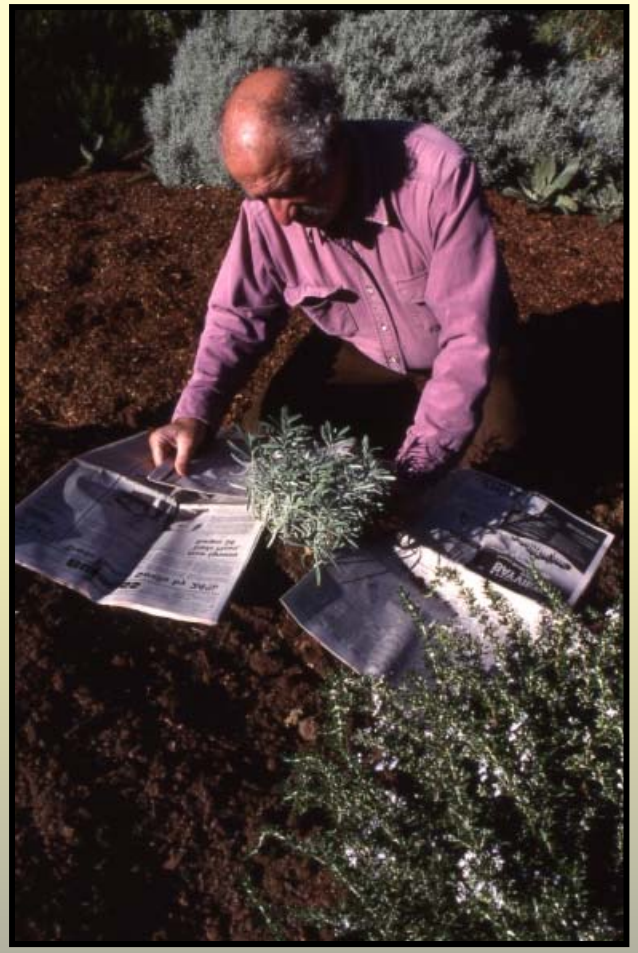
(Shameless product placement.)

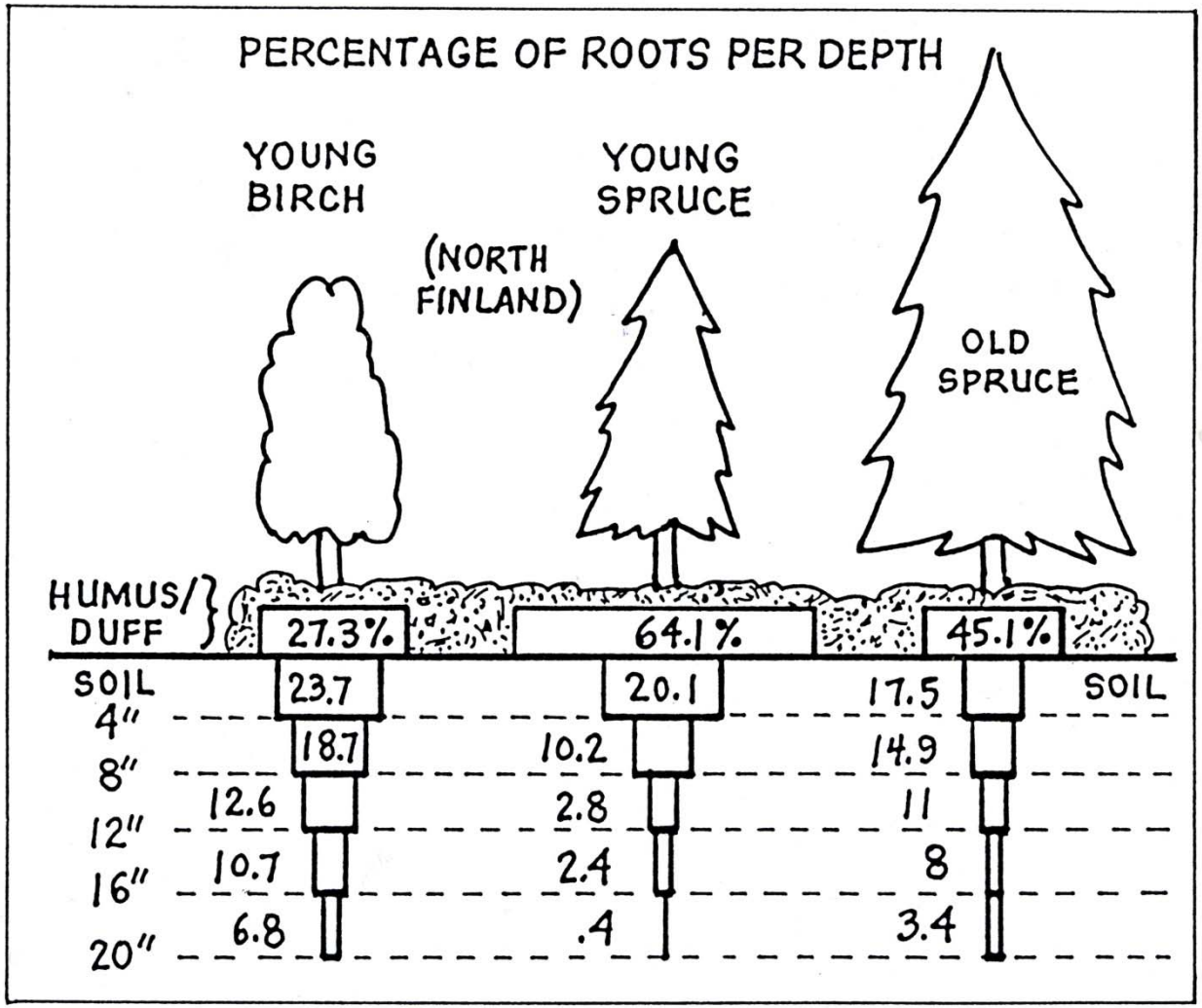
Step-by-step planting on a mound (Part 1)



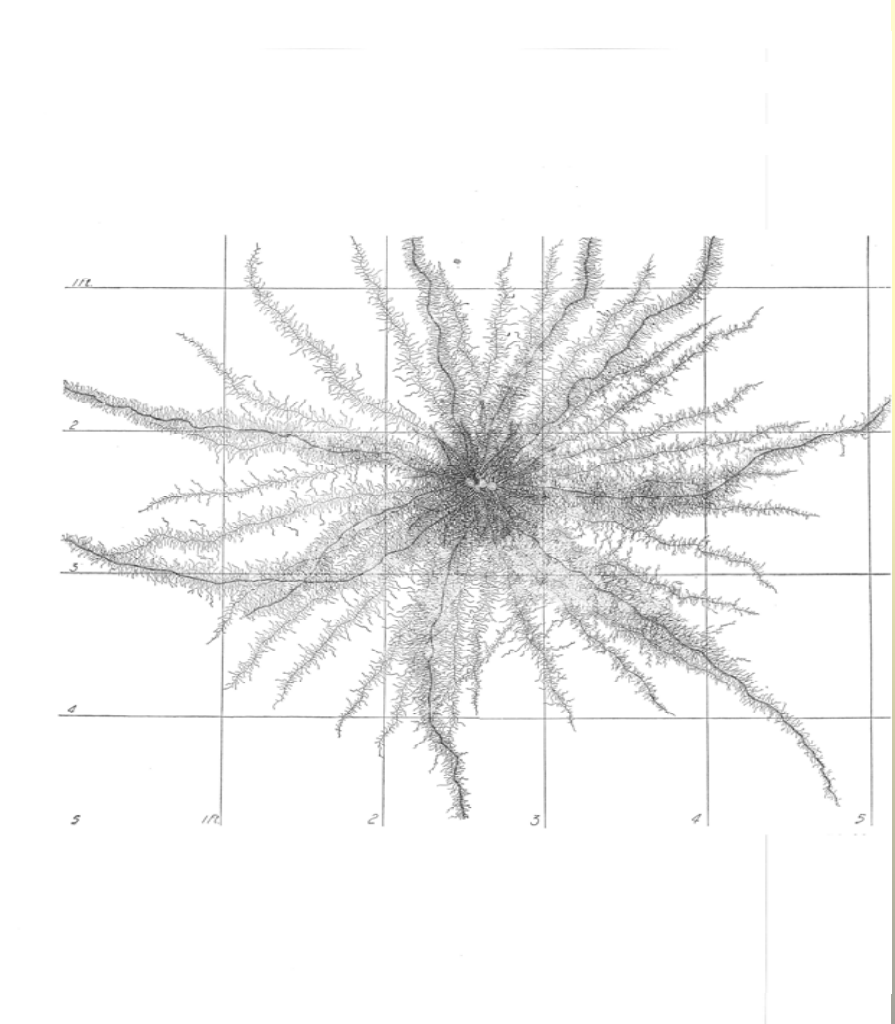


Step-by-step planting on a mound (Part 2)



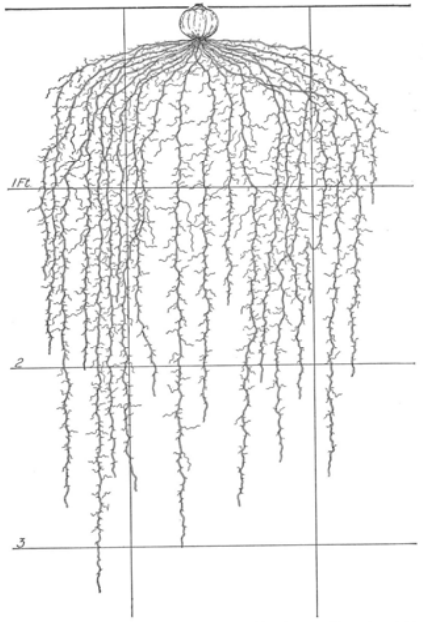

PERCENTAGE OF ROOTS PER DEPTH
YOUNG BIRCH
YOUNG SPRUCE
(NORTH FINLAND)
OLD SPRUCE
HUMUS/ DUFF
27.3%
64.1%
45.1%
SOIL
23.7
20.1
17.5
SOIL
4"
18.7
10.2
14.9
8"
12.6
2.8
11
12"
10.7
2.4
8
16"
6.8
.4
3.4
20"

Many vegetables have roots wider than foliage.

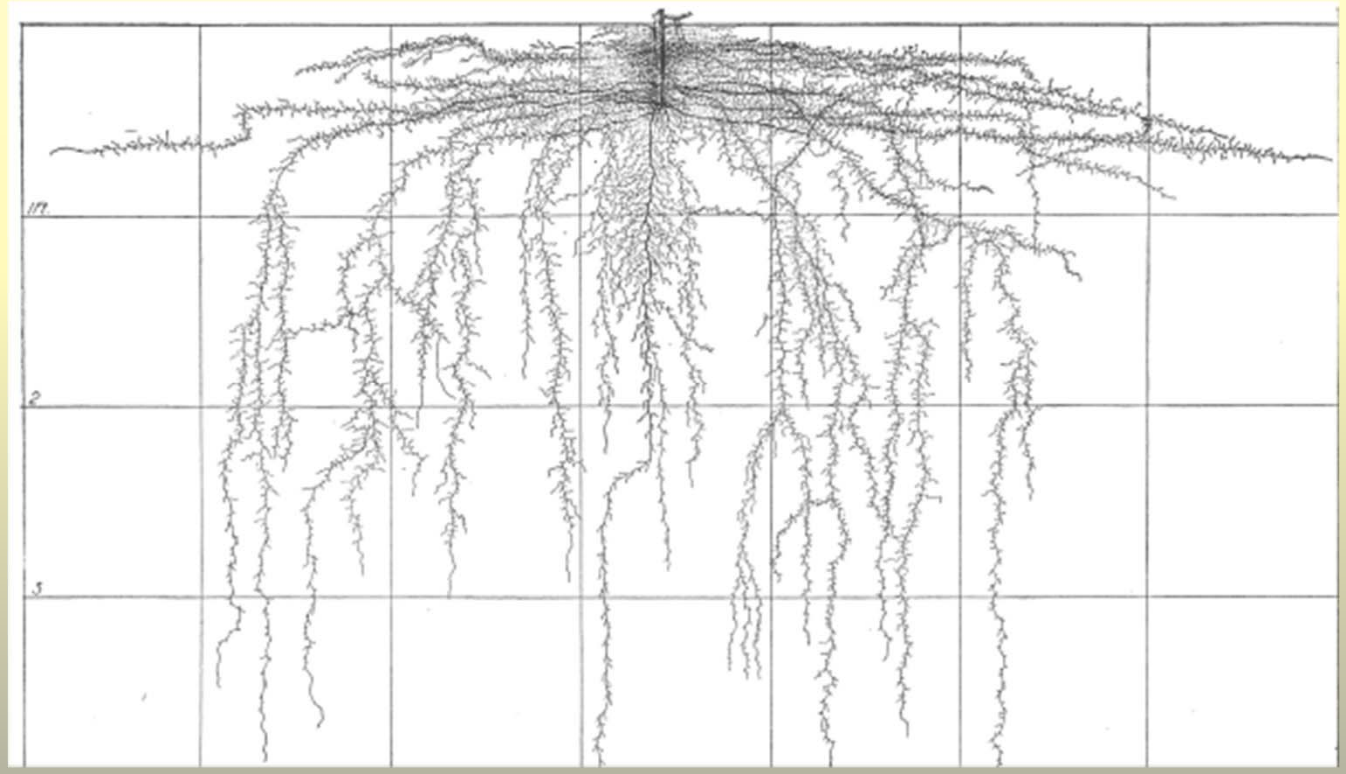


Corn plant seen from above (the top 6” of the root system) extends 2-3 feet beyond the corn’s stems.

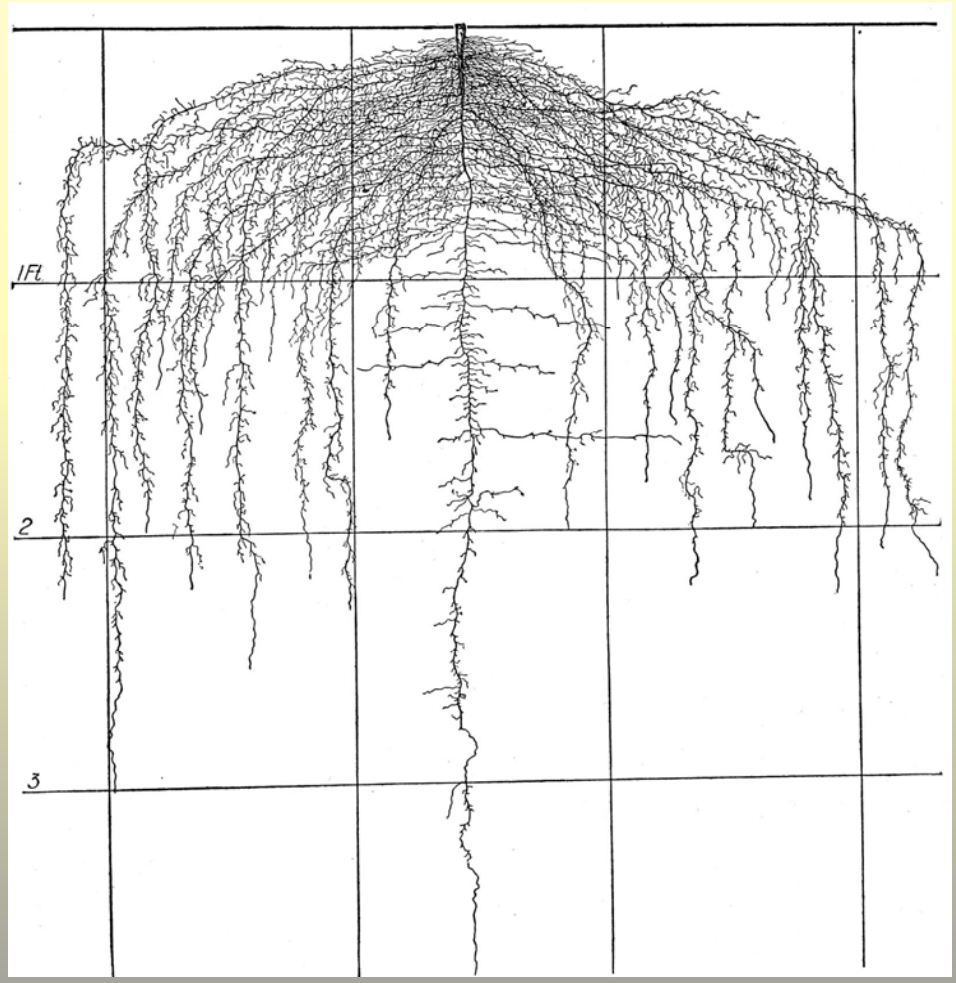
Onion



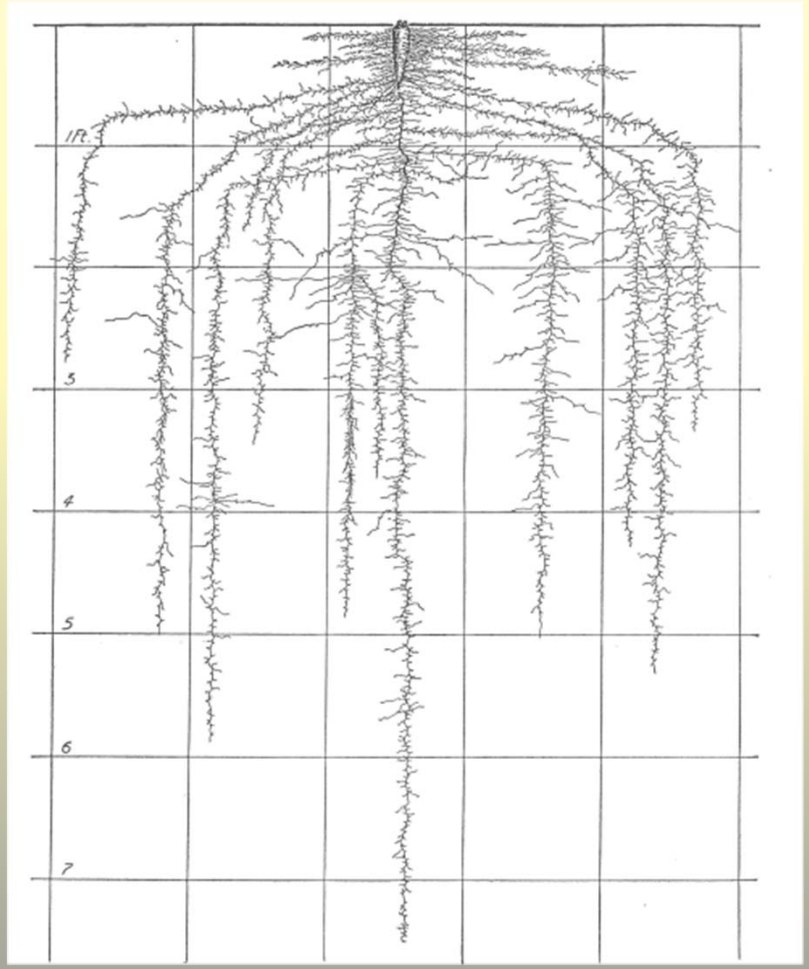
Tomato

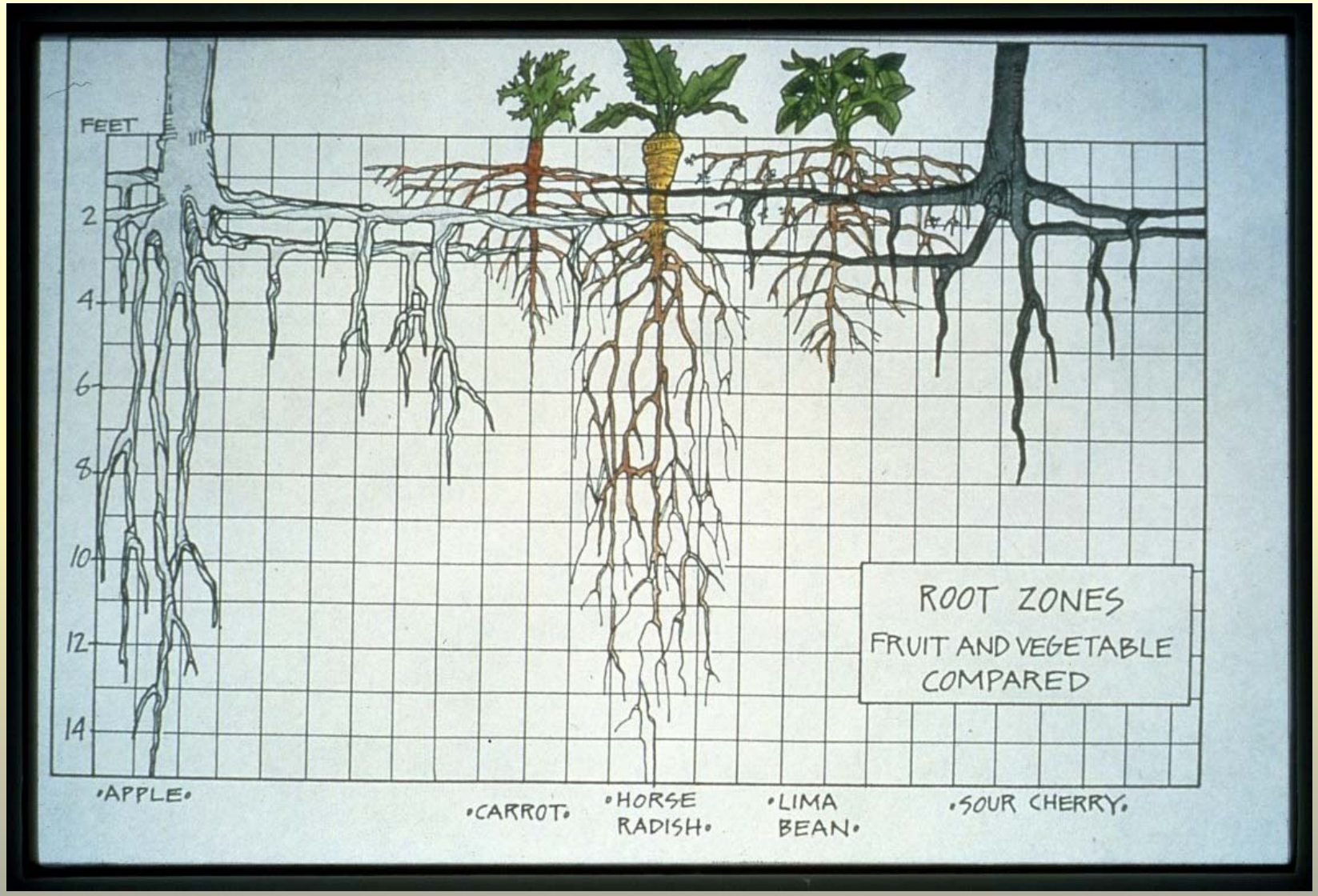


Lettuce

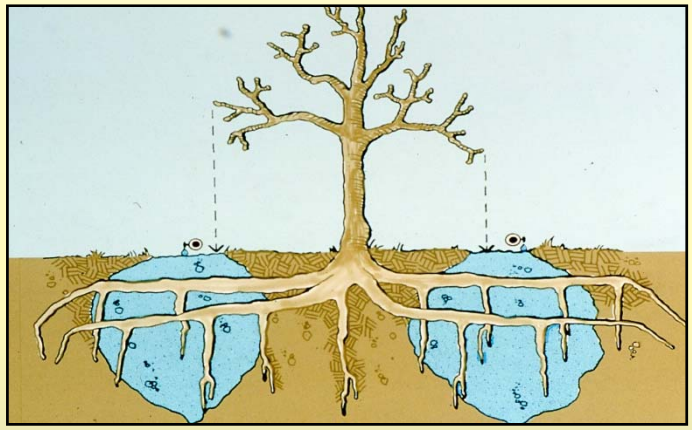


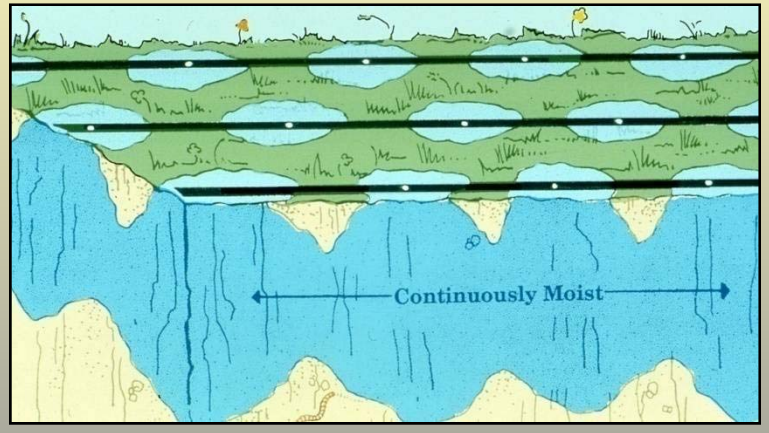
Carrot

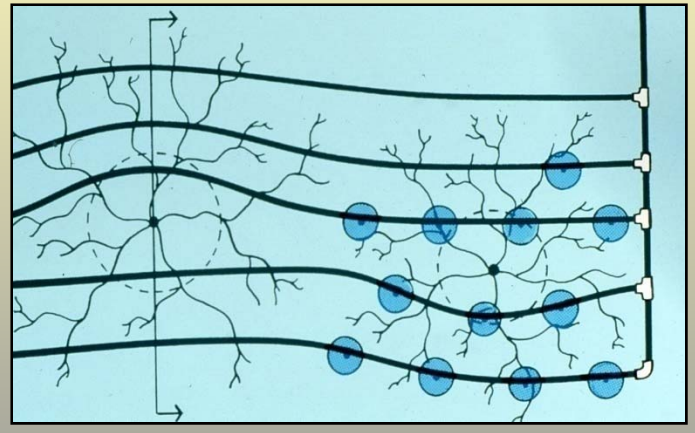



FEET
2
4
6
8
10
12
14
ROOT ZONES
FRUIT AND VEGETABLE
COMPARED
•APPLE•
•CARROT•
•HORSE
RADISH•
•LIMA
BEAN•
•SOUR CHERRY•

Drip irrigation for healthier root zones.







Plant *Between* the Wet Spots

Ruth Stout - the great champion no-till gardening

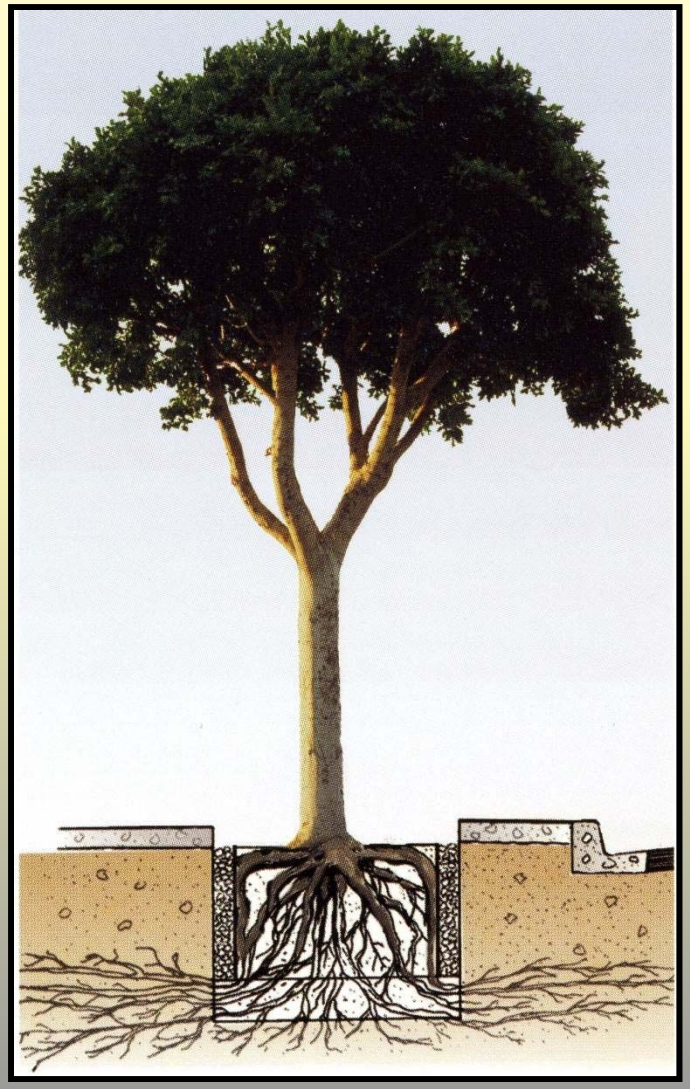
- Deep mulch
- No cultivation
- Esalen Inst.

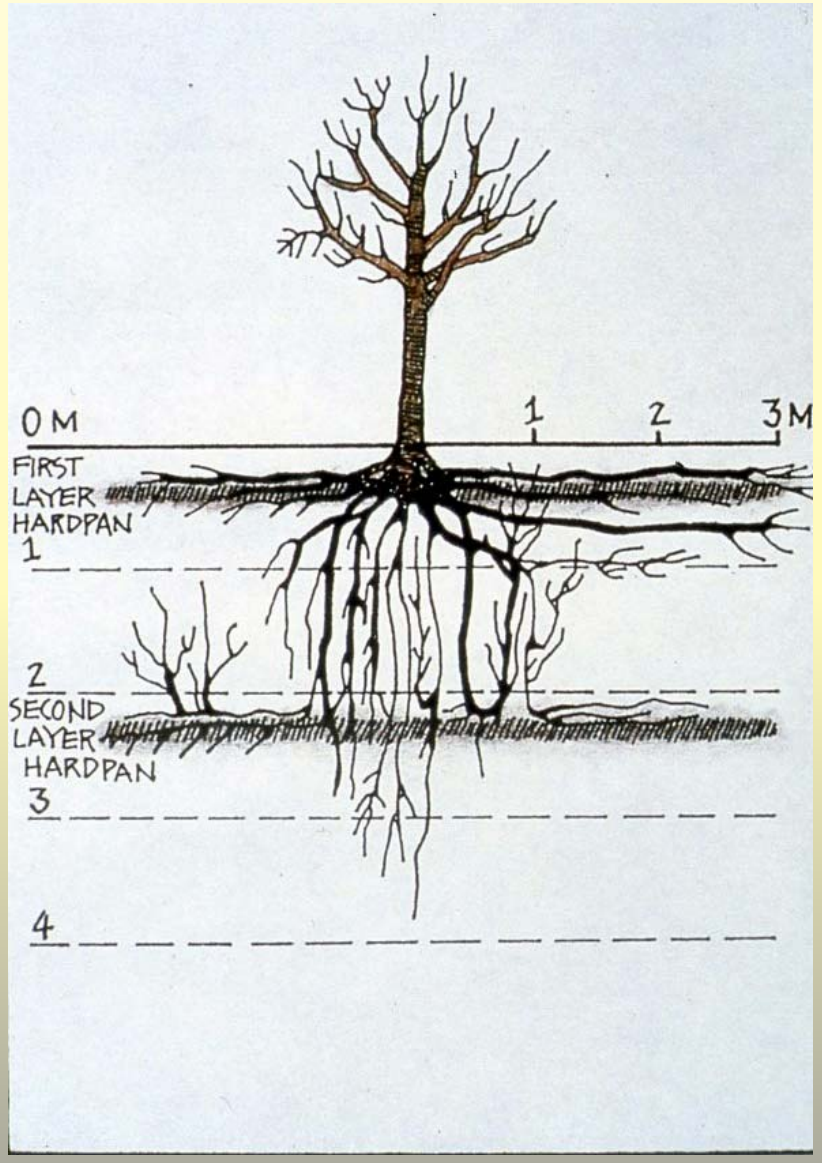

Vote Suck
Blood is not the drink for camps
Bay Area
Dispelling bar fights
BUSHES
Press Report

Quandary of trees near hardscape.

- **Heaving of hardscape by tree roots is a big problem**
- **Sidewalk ground down to reduce liability of tripping**
- **Root barriers supposed to solve problem, but often fail**

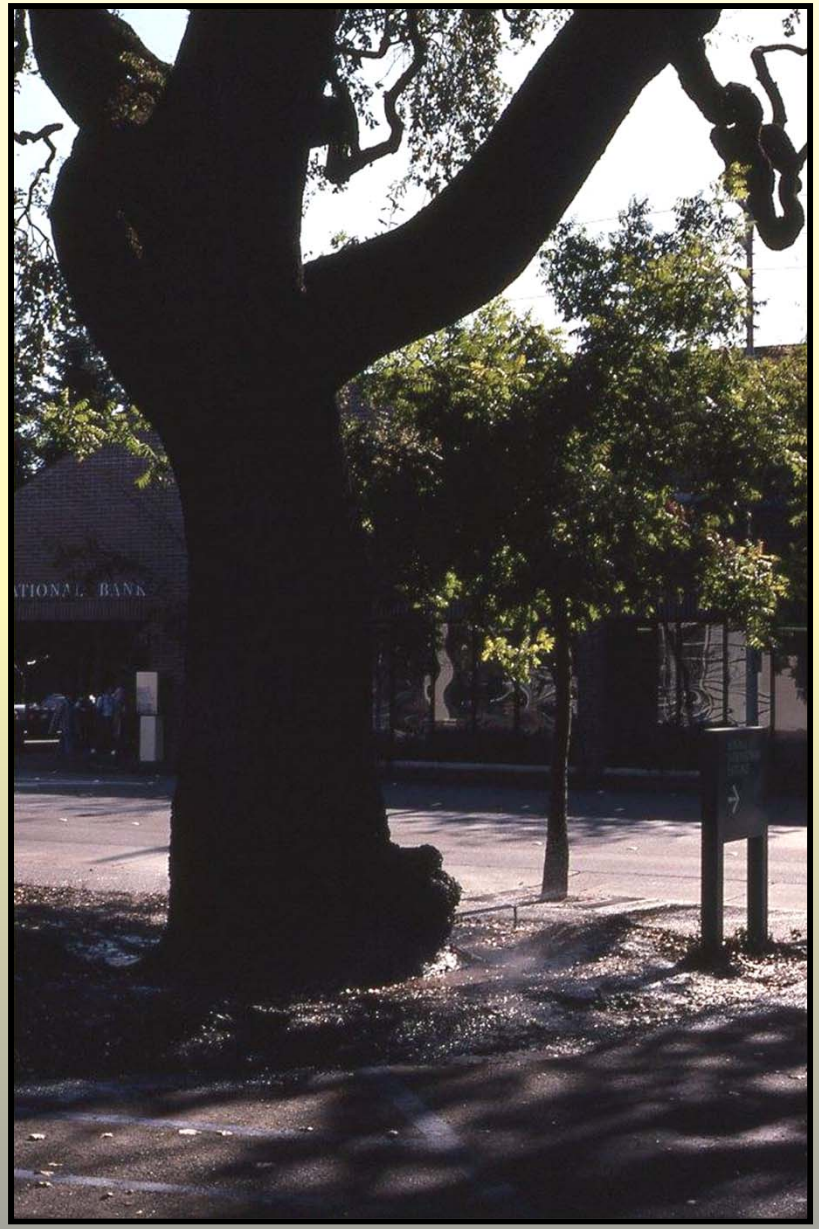
Ideal concept of root barriers.




0 M
1
2
3M
FIRST
LAYER
HARDPAN
1
2
SECOND
LAYER
HARDPAN
3
4

Realities of root barriers.

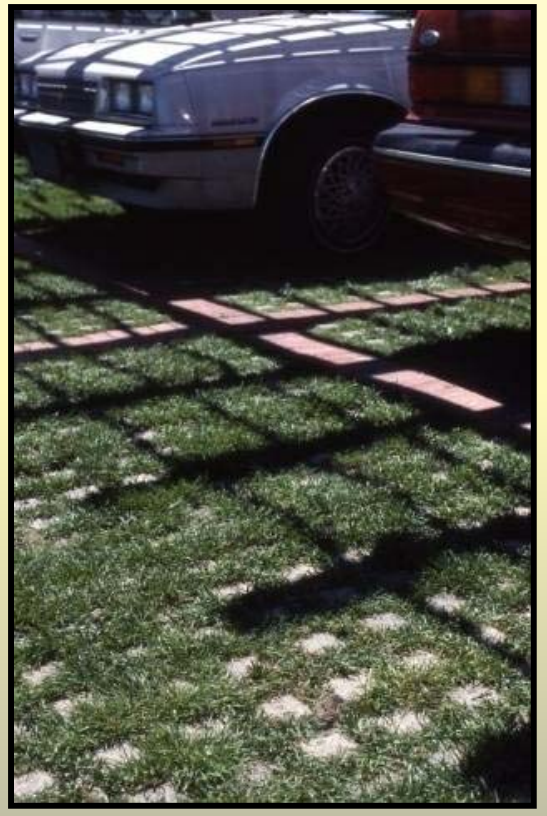
Roots are ambitious enough to grow right over the root barrier in pursuit of aerobic surface soil.


ATIONAL BANK

Promote good drainage and “breathing.”

Permeable Landscapes

- Air
- Water absorption
- Less compaction
- Healthier roots
- Lower runoff

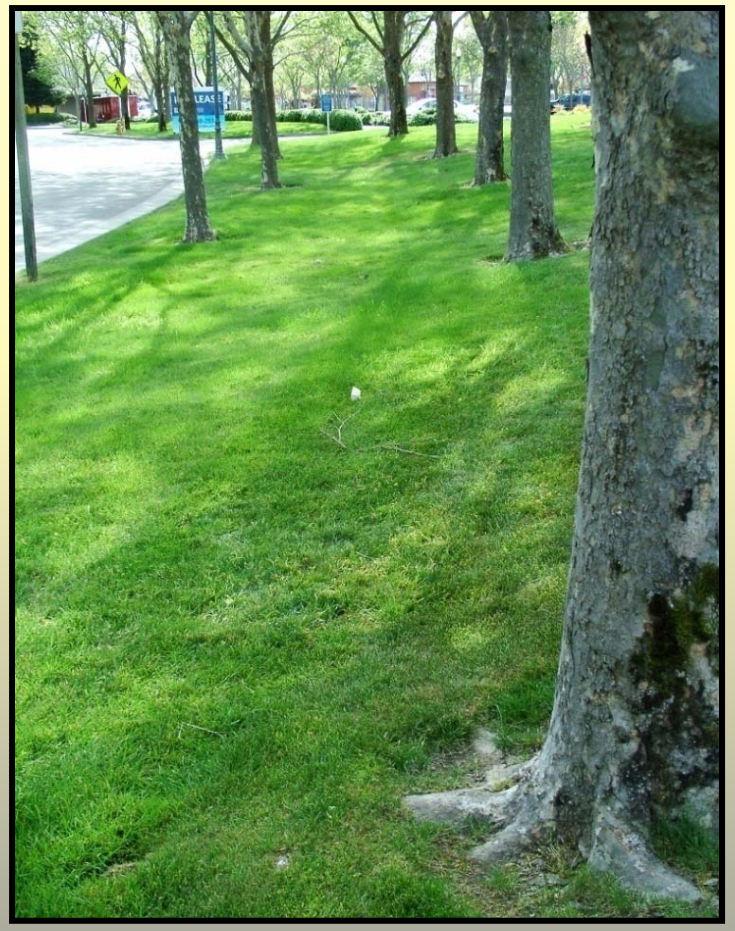


Room to move.

Give the poor roots space to grow!

Chico, CA best list for spacing of trees.

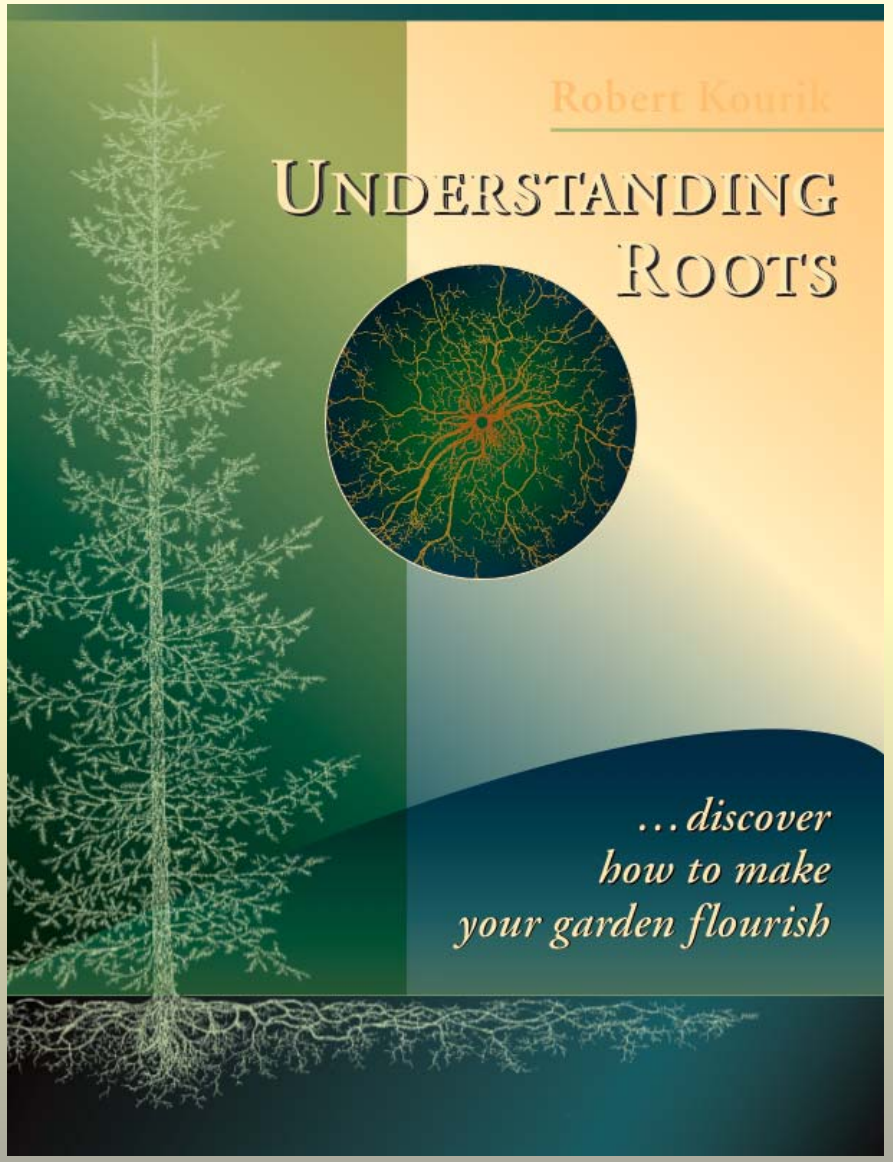
- **CA Sycamore 'Yardwood ‘ 70´h X 50´w. Optimal spacing 35´-40´**
- **The minimum planter width at least 7 feet.**
- **Best along riparian habitats or where roots can spread at least in one direction.**



Available now at:

robertkourik.com

$20 (list $24.95)



Troubles with wire gopher baskets.

- **Tube-grown trees are air-pruned by the “egress” at the bottom of each tube.**
- **Causes more laterals for less transplant shock and faster growth.**
- **The top-to-root ratio about equal to six- and seven-inch tube seedlings.**
- **The smaller the top foliage, the better.**

Very windy location!

- **“Nurse” shrubs shelter young coastal cypress**
- **After four years, 12” trees are 10+ feet and require no staking**
- **The more a tree is buffeted by the wind, the bigger its trunk and the healthier its roots**

Robert Kourik rkourik@sonic.net
www.robertkourik.com