

RELAÇÕES HÍDRICAS NAS PLANTAS

5 DE MARÇO DE 2018

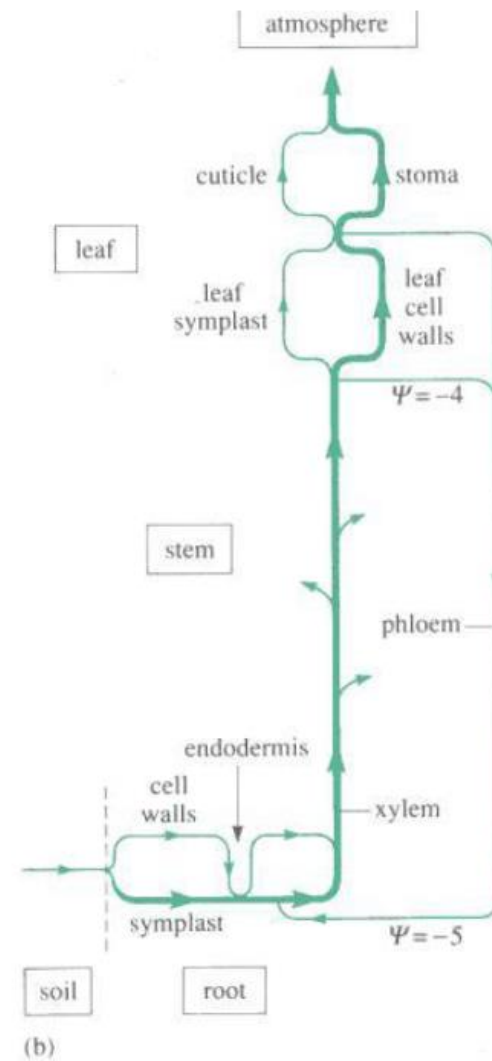
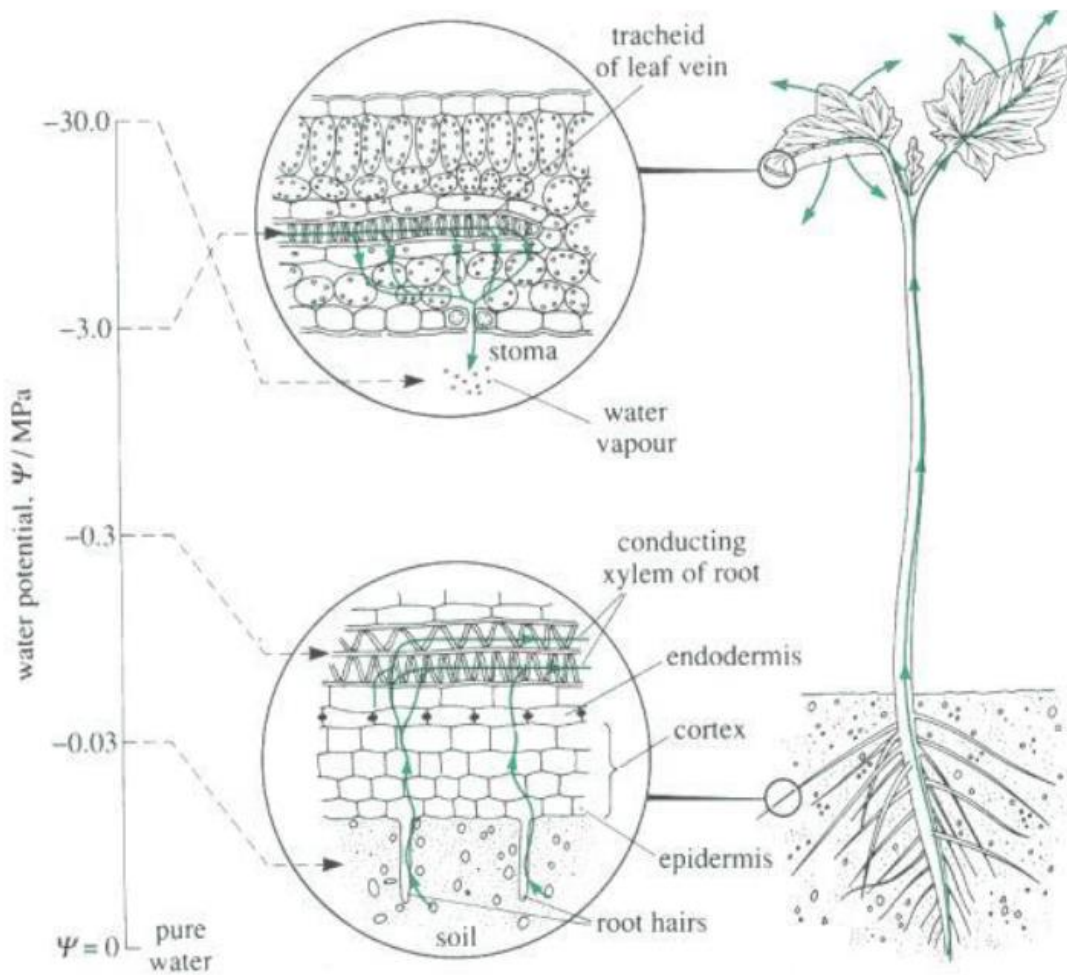
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Sumário da Aula Anterior:

Os potenciais hídrico, osmótico e de pressão no contexto da célula vegetal. Previsão de movimentos celulares de água. Turgescência e plasmólise. Movimentos transmembranares de água e aquaporinas. Métodos de determinação do potencial hídrico e seus componentes: Shardakov, psicrometria, bomba de Scholander, sonda de pressão e osmometria crioscópica.

Programa Para a Aula de Hoje:

Granulometria do solo. A tomada de nutrientes: influência do pH da solução do solo. A função das estruturas radiculares na absorção da água: o papel dos pêlos radiculares. O transporte lateral de água na raiz: da epiderme até aos vasos condutores. O papel da endoderme e da banda de Caspari. Transporte apoplástico, simplástico e transcelular. Métodos de medição do estado hídrico do solo: gravimétrico; pela textura e aparência; com bomba de neutrões; tensiométrico; e pela resistência eléctrica. Características e constituição do xilema: traqueídeos e traqueias ou elementos dos vasos.



Soil-Plant-Atmosphere continuum

Por exemplo, o solo correspondente ao ponto “S” na figura seguinte é formado por 15% de areia, 50% de silte e 35% de argila. Foi classificado como “argila”.

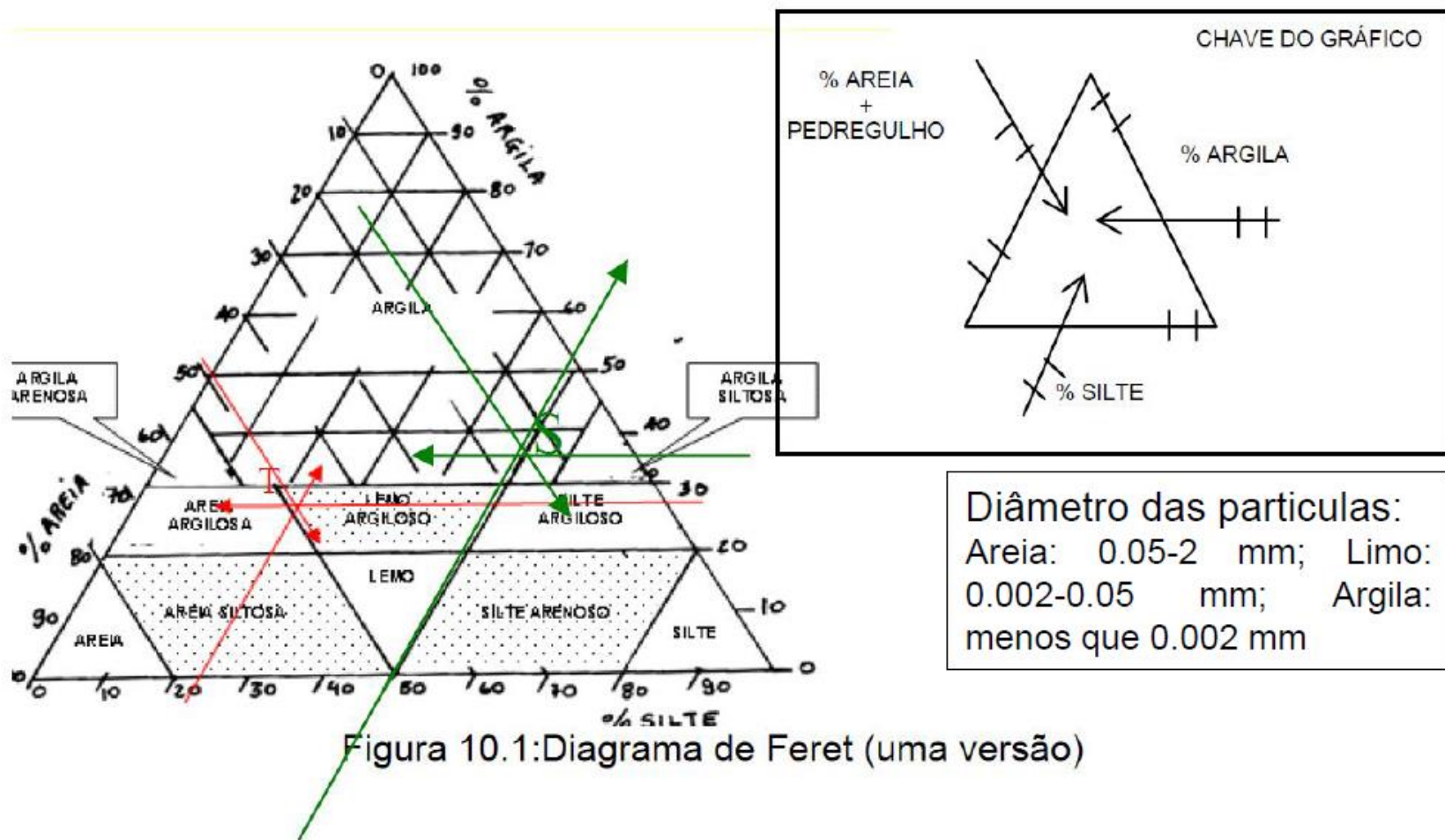


Figura 10.1: Diagrama de Feret (uma versão)

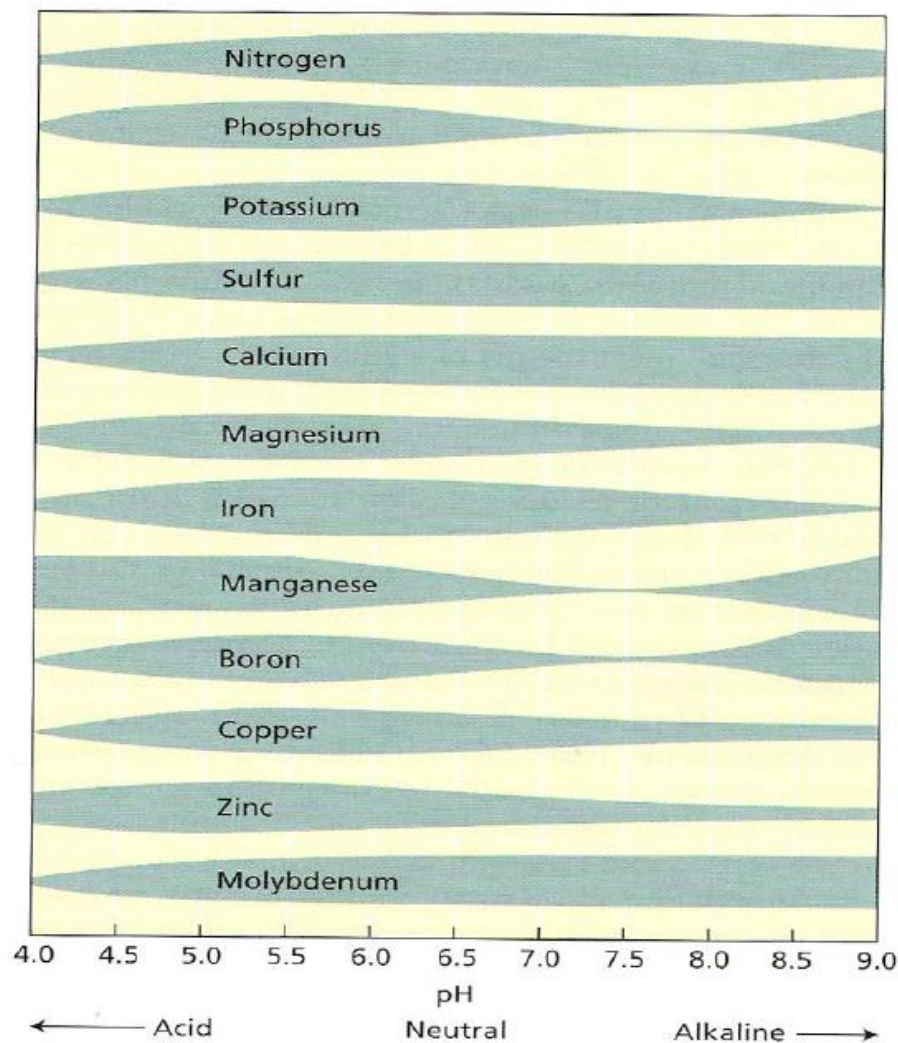


FIGURE 5.4 Influence of soil pH on the availability of nutrient elements in organic soils. The width of the shaded areas indicates the degree of nutrient availability to the plant root. All of these nutrients are available in the pH range of 5.5 to 6.5. (After Lucas and Davis 1961.)

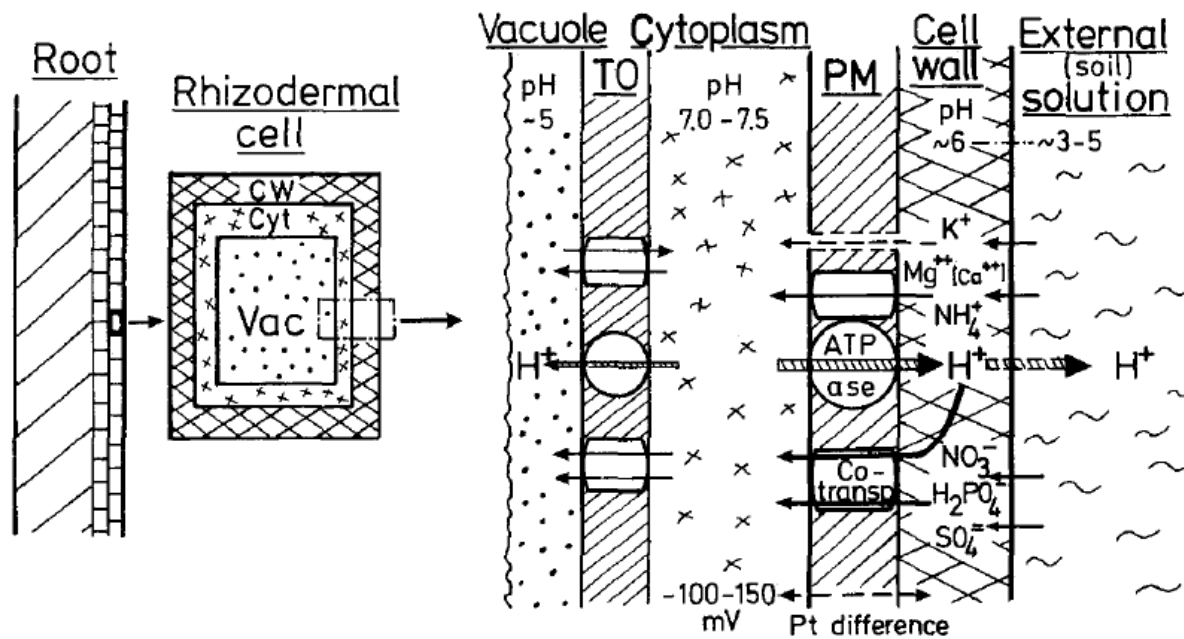
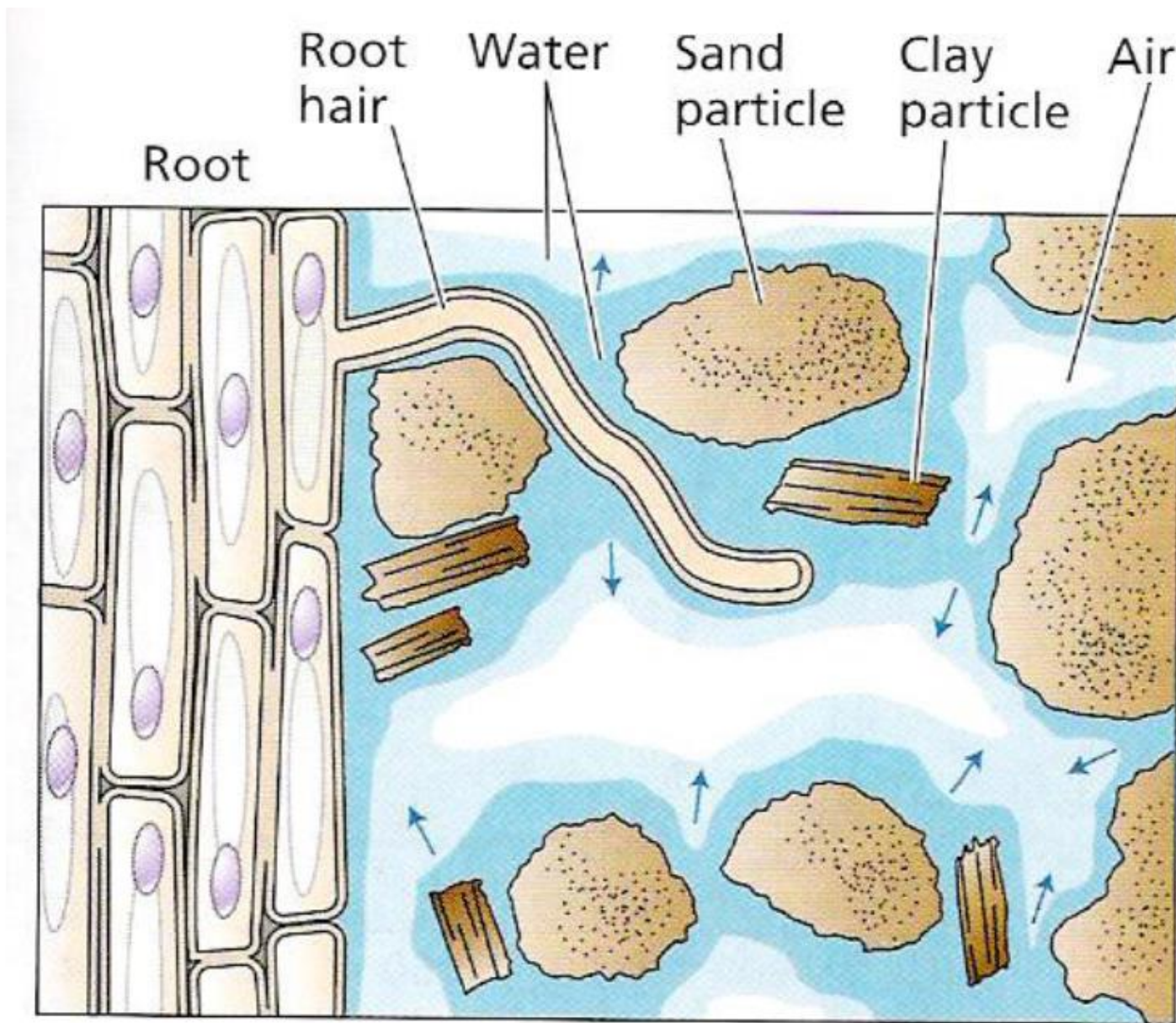


Fig. 1. Model showing the localization and functioning of electrogenic H⁺ pumps in rhizodermal cells and coupled ion transport. To = tonoplast; PM = plasma membrane (Marschner, 1990).

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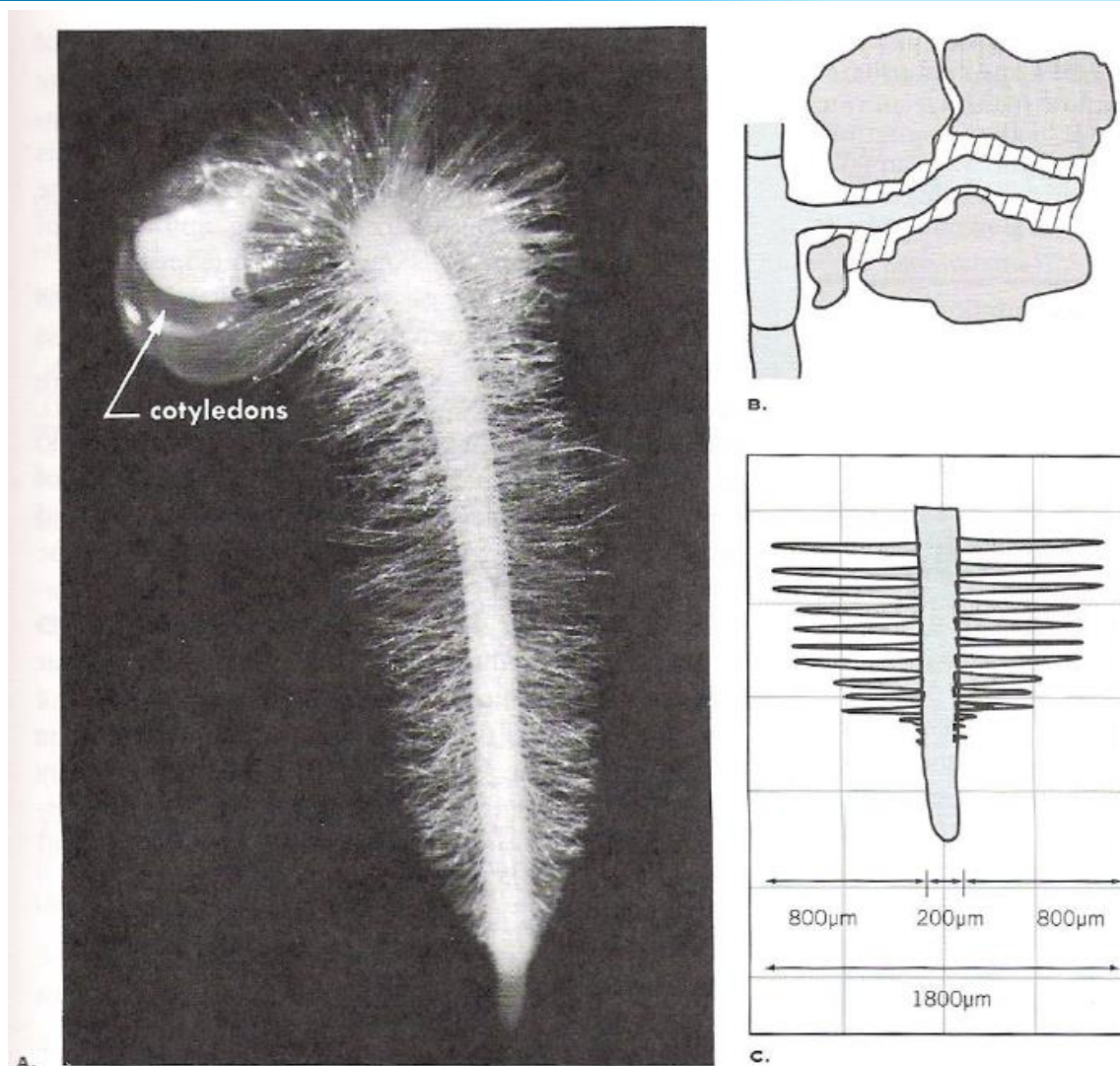
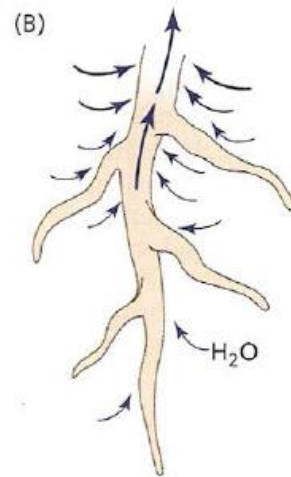
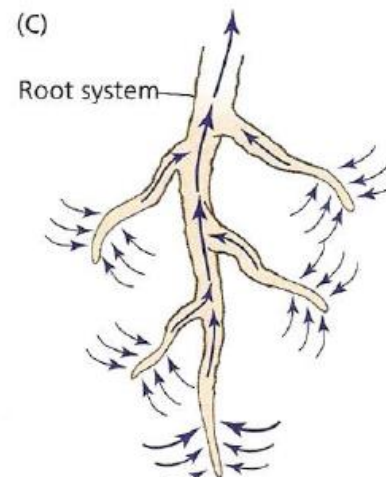


FIGURE 3.17 Root hairs and water uptake. (A) Root hairs on radish (*Raphanus sativus*). (B) Root hairs enhance water uptake by their ability to penetrate water-containing capillary spaces between soil particles. (C) Root hairs increase by several times the volume of soil that can be extracted of water by a root. (A from T. E. Weier et al. *Botany*. 6th edition. 1982. New York, Wiley. Fig. 9.7A. Used by permission of the authors.)



Entire surface equally permeable



Only zone near root tip is permeable

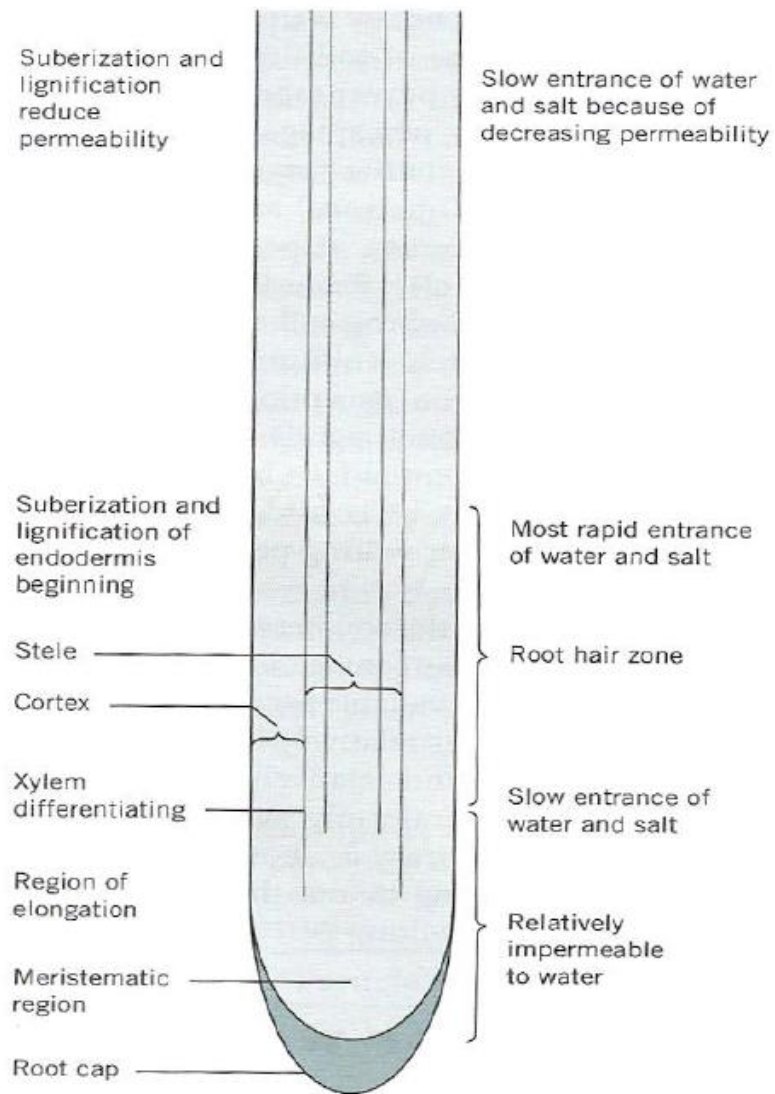
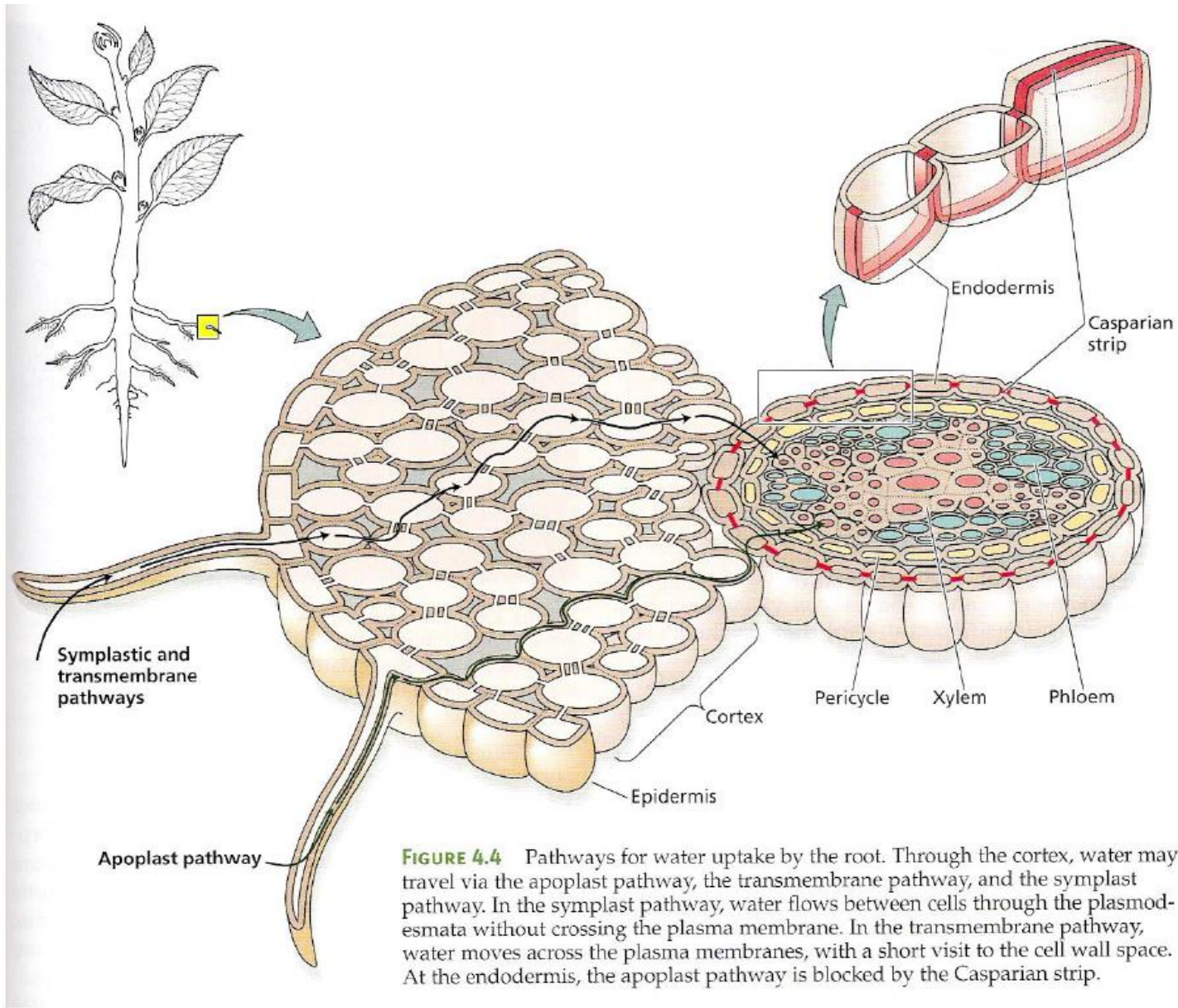


FIGURE 3.16 Diagrammatic illustration of the relationship between differentiation of root tissues and water uptake.



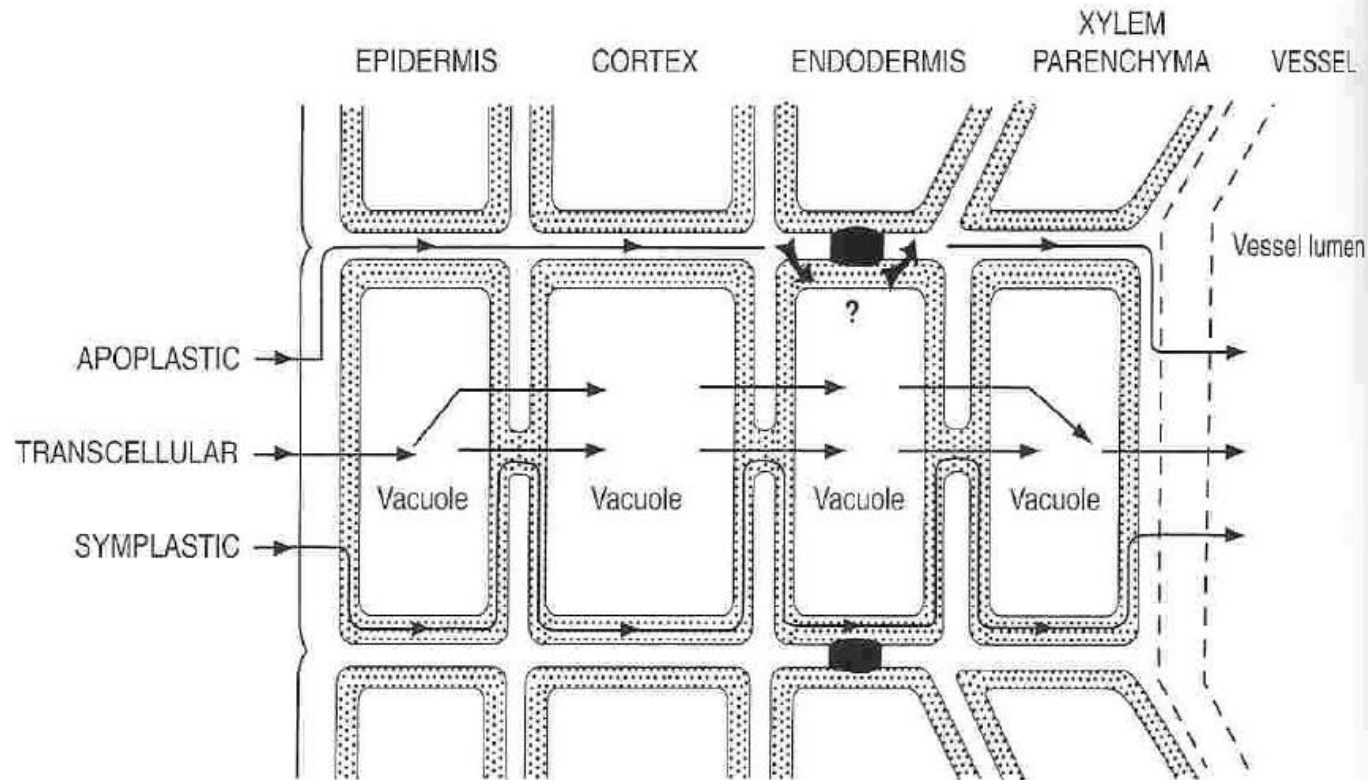


Fig. 3.8 Diagram of the postulated apoplastic, symplastic and transcellular routes of water movement through the root to the xylem. The arrowed lines represent the pathway of water; the symplast (cytoplasm and plasmodesmata) is stippled; the apoplast is white and the Casparian strips of the endodermal wall are shown in black. The xylem vessel wall and lumen are both parts of the apoplast, but their outlines are shown with dashed lines. For simplicity, all but one cortical cell layer and the pericycle (a parenchymatous layer inside the endodermis) are omitted. The transcellular route is shown in two variations: in the strictest sense it crosses every plasma membrane and tonoplast (upper arrows) but could also combine passage through membranes with passage through plasmodesmata (lower arrows). It is not certain to what extent the water in the apoplastic route has to bypass the Casparian strips as indicated by the curved arrows: see text for discussion.

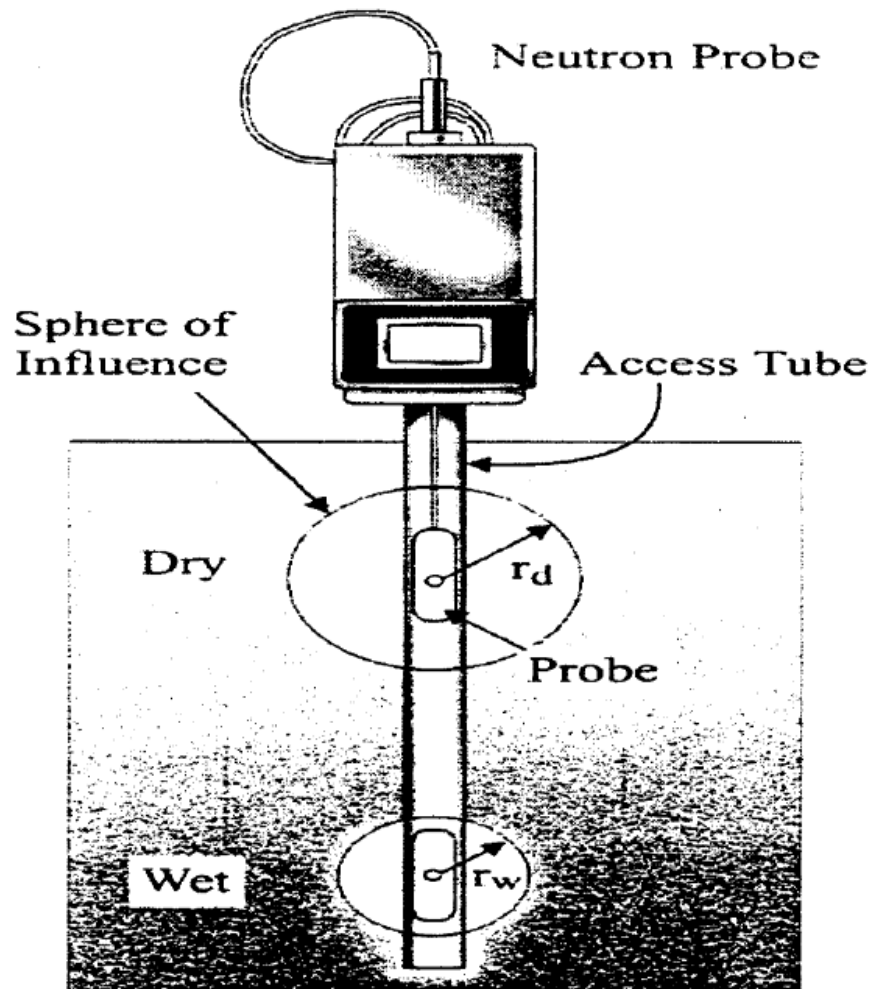
Soil Water Measurement

- Gravimetric
 - Measures mass water content (θ_m)
 - Take field samples → weigh → oven dry → weigh
 - Advantages: accurate; Multiple locations
 - Disadvantages: labor; Time delay
- Feel and appearance
 - Take field samples and feel them by hand
 - Advantages: low cost; Multiple locations
 - Disadvantages: experience required; Not highly accurate

Soil Water Measurement

- Neutron scattering (attenuation)
 - Measures volumetric water content (O_v)
 - Attenuation of high-energy neutrons by hydrogen nucleus
 - Advantages:
 - samples a relatively large soil sphere
 - repeatedly sample same site and several depths
 - accurate
 - Disadvantages:
 - high cost instrument
 - radioactive licensing and safety
 - not reliable for shallow measurements near the soil surface

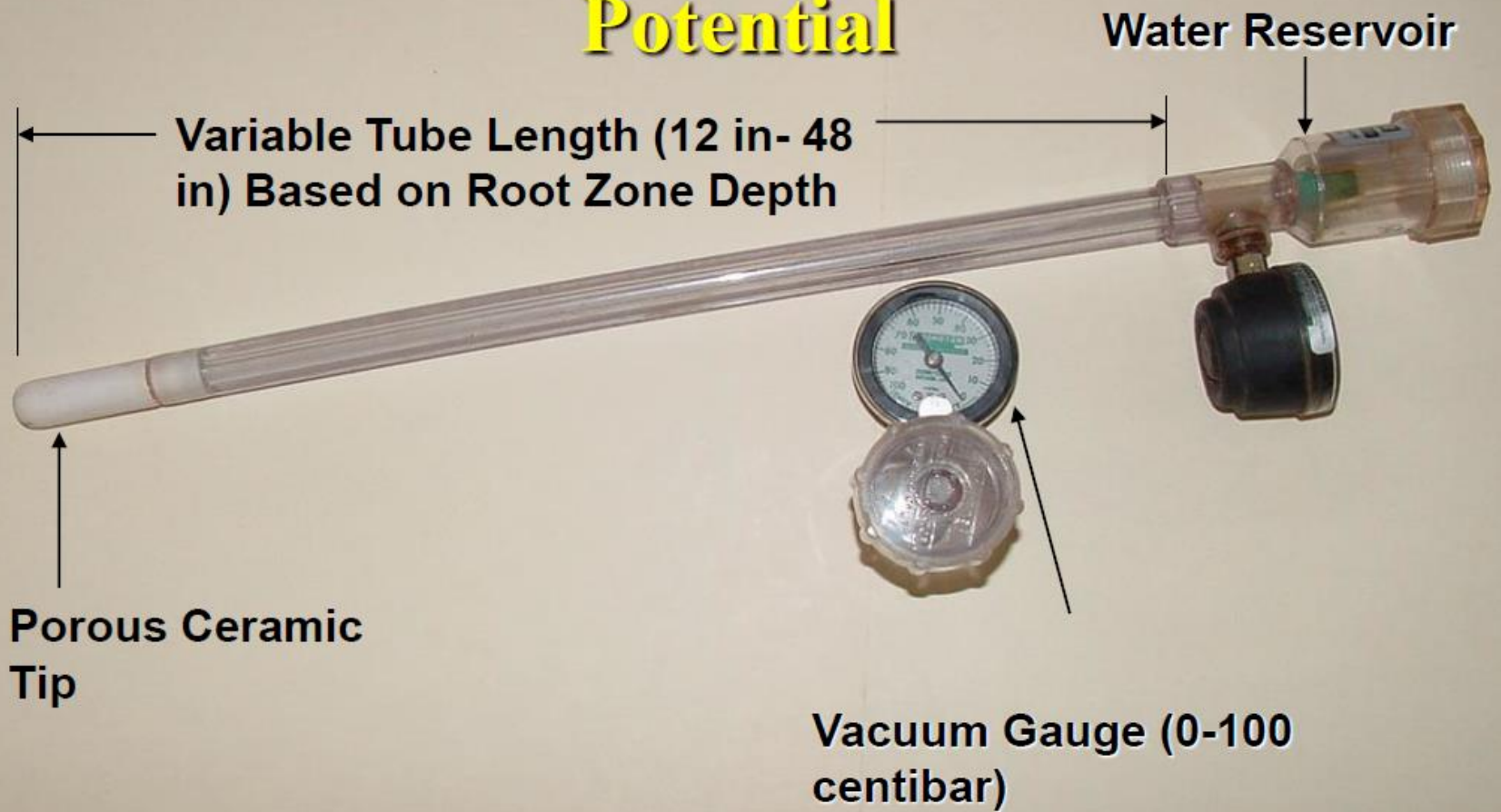
Soil Water Measurement Neutron Attenuation



Soil Water Measurement

- Tensiometers
 - Measure soil water potential (tension)
 - Practical operating range is about 0 to 0.75 bar of tension (this can be a limitation on medium- and fine-textured soils)

Tensiometer for Measuring Soil Water Potential



Porous Ceramic Tip

Vacuum Gauge (0-100 centibar)

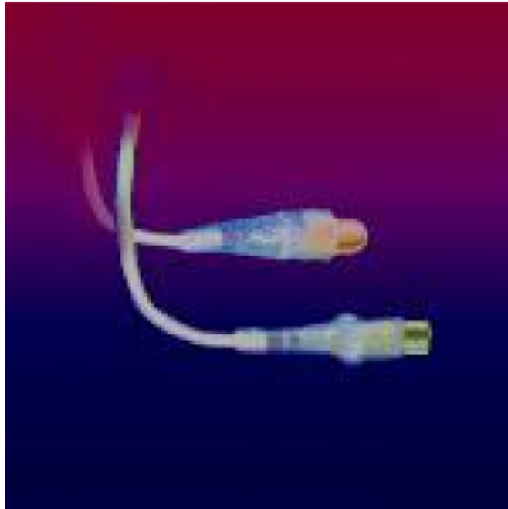
Soil Water Measurement

- Electrical resistance blocks
 - Measure soil water potential (tension)
 - Tend to work better at higher tensions (lower water contents)

Electrical Resistance Blocks & Meters



PSICROMETRIA DE SOLOS



Checklist de Conhecimentos e Competências a Adquirir:

- Compreender o processo de absorção radicular de água, a relação entre esta e a tomada de nutrientes e o papel que o pH do solo desempenha.
- Compreender a relação entre estrutura e função da raiz na absorção de água.
- Compreender a deslocação de água no interior da raiz e perceber o papel da banda de Caspari; Compreender os conceitos de transporte simplástico, transporte apoplástico e transporte transmembranar ou transcelular.
- Conhecer os princípios de funcionamento, as vantagens e limitações dos vários métodos de determinação do estado hídrico do solo abordados.

Sumário:

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Nuclear

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Complementar

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(capítulo 3, pp. 58-64)