

Water

Relation to Plants

Properties of Water Associated Uses of Water	
Polar Solvent	Dissolves soil minerals, sugar, amino acids, widest range of any liquid!
Hydraulic Fluid	Does not compress, so turgor pressure supports plant tissue, permits flow of material in xylem (transpiration) and phloem (translocation)
Reactive	Reactant: $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{O}_2 + \text{CH}_2\text{O}$ PSN Product: $\text{CH}_2\text{O} + \text{O}_2 \rightarrow \text{H}_2\text{O} + \text{CO}_2$ Resp
High Specific Heat	Heat Buffer: 1 Calorie = 1 Liter 1°C
High Heat of Fusion	Water liquid->gas removes energy from surface Evaporative cooling

Sources of Water

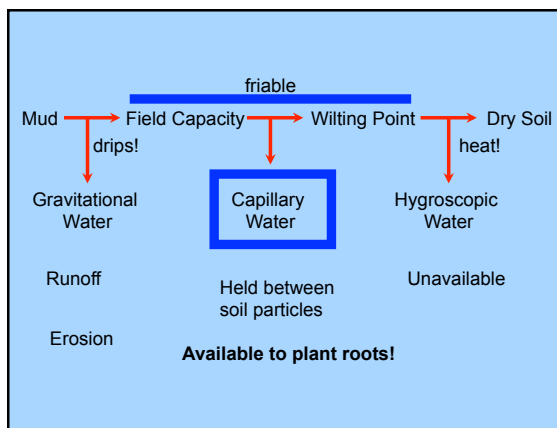
Precipitation: Fog, Mist, Rain, Snow, Sleet, Hail

Runoff: Brook, Creek, Stream, River

Water Table: Puddle, Pond, Lake
(Ocean not freshwater)

Soil Water: Most useful for plants

Aquifers: porous rock, wells, artesian wells, springs



Irrigation Methods

Sprinkler: Wastes more than 50% of water used
Water drops on leaves: dead spots
Humidity leads to fungal diseases
Kills "eggs" (zygotes!) of many "bugs"
May apply fertilizer/insecticide at same time

Surface: Less wasteful, no water spots, yes fertilizer
Not pesticide unless "systemic"
Furrow irrigation (trenches between rows of field)
Flood irrigation (un-level field, one furrow at high end)

Trickle: Even less wasteful, method in our greenhouse
Computer programming for even more even conditions

Wick: Capillary mat with ebb-flow pumping of fertilizer and water...plants take only what is needed.

Natural: 4 inches of rain needed per month.
Watch the news, read USA today, surf Wunderground.com.
Irrigate only when needed...IF needed...MOST CONSERVATIVE!

How Much? How Often?

Many people kill their plants with kindness (8 glasses per day)

Keeping soil friable:
Between Field Capacity and Wilting Point

1. Water to field capacity
2. Allow to sit in sun for many days (week) until wilting

You don't need a Green Thumb!

Dirty Finger Method: Put Finger in Soil

- If finger is wet, cold, dirty: NOT YET!
- If finger is dry, warm, clean: OK to Irrigate

When should I irrigate?

- ~~Mid-day?~~ Remember the water spots, magnifying lenses?
- ~~Evening?~~ Soil warm from afternoon, add water = fungi
- Morning? Soil cool for less evaporation waste
Spots evaporate from leaves before sun gets high

Other Pointers:

- Preserve water in soil with mulch
- Proper spacing of plants avoids soil heating and evaporation
- Water less often but more deeply to encourage deeper rooting
- Lighten waterlogging clay soils with sand or perlite!

Plant Factors Affecting Water Needs

	More	Less
It is a seedling		<input checked="" type="checkbox"/>
It is growing rapidly	<input checked="" type="checkbox"/>	
It is reproducing (flowers and fruits)	<input checked="" type="checkbox"/>	
It is dormant		<input checked="" type="checkbox"/>
It has succulent leaves		<input checked="" type="checkbox"/>
It has waxy leaves		<input checked="" type="checkbox"/>
It has hairy leaves		<input checked="" type="checkbox"/>
It has thin, fine, dissected leaves	<input checked="" type="checkbox"/>	
It has deep roots		<input checked="" type="checkbox"/>

Environmental Factors Affecting Water Needs

	More	Less
It is in a clay soil		<input checked="" type="checkbox"/>
It is in a sandy soil	<input checked="" type="checkbox"/>	
The temperature is hot	<input checked="" type="checkbox"/>	
The wind is blowing	<input checked="" type="checkbox"/>	
The humidity is high		<input checked="" type="checkbox"/>
The sun is bright (no clouds)	<input checked="" type="checkbox"/>	

Symptoms of Overwatering Symptoms of Underwatering

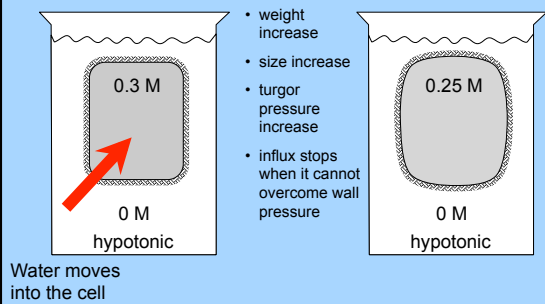
- | | |
|----------------------------|----------------------------------|
| Organs swell, crack open | Growth Inhibition (Dwarfing) |
| Fungi thrive (Damp-off) | Leaves with brown tips and edges |
| Yellowing of leaves | Blueing of leaves |
| Root Death by Asphyxiation | Abscission of leaves |
| Wilting | Wilting |

Notice that the shared symptom is WILTING!

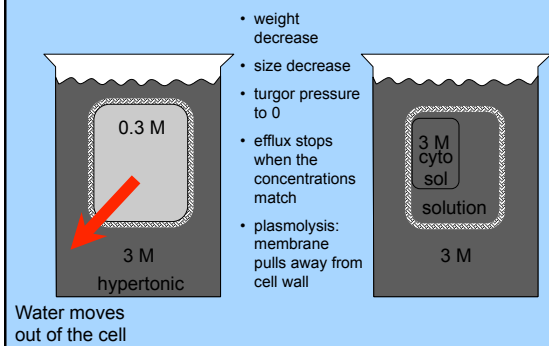
This leads to much overwatering!

These symptoms are easily explained by understanding OSMOSIS!

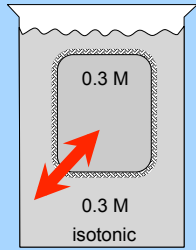
Osmosis: the passive movement of water from a place that is purer water to a place that is more polluted



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- no weight change
- no size change
- no turgor pressure change

Water moves into and out of the cell at same rate!