



PEDAVER
THE TRANSFORMATIVE PRODUCER



Understanding Capillary Action How Water Moves in Soil and Roots Uptake

Restoring Natural Balances for Sustainable Nutritious Food



PQNK: Cultivating Sustainable Tomorrow Through Regenerative Agriculture

Understanding How Water Moves In Your Soil

Understanding How Water Moves in Your Soil:

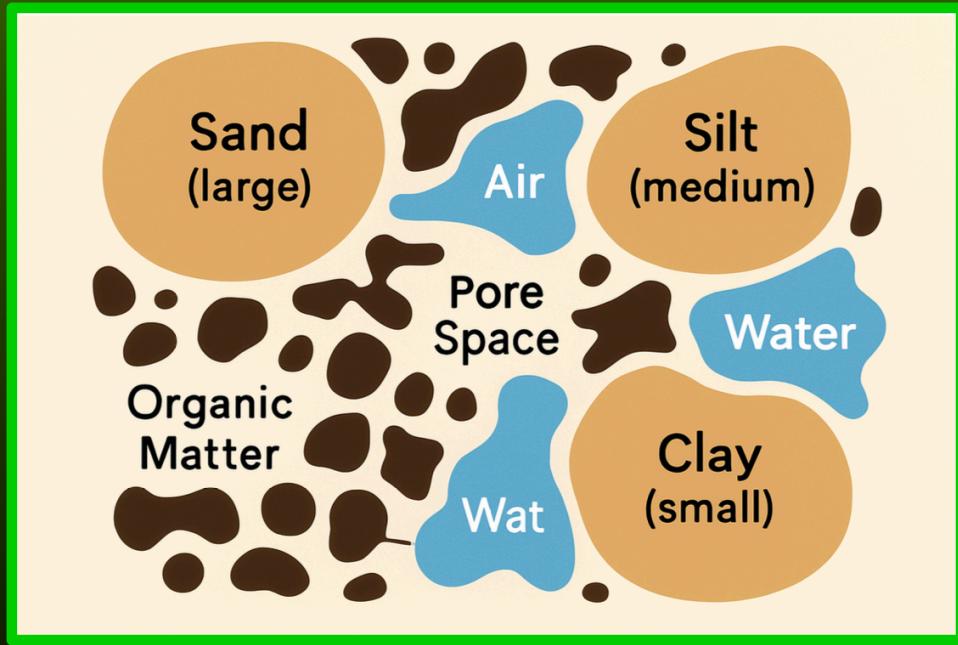
Hello everyone. Today we're talking about something called capillary action. It might sound technical, but it's happening in your soil every day and plays a huge role in how water behaves on your farm – affecting everything from irrigation to crop health. Understanding it can help you manage your soil and water more effectively.



A Quick Look Inside Your Soil

A Quick Look Inside Your Soil:

- **Solid Bits:** Sand, Silt, Clay particles + Organic Matter (the living and dead stuff)
- **Empty Spaces:** Pores (like tiny tunnels and gaps)
- **What Fills the Pores:** Water, Air and Soil-life

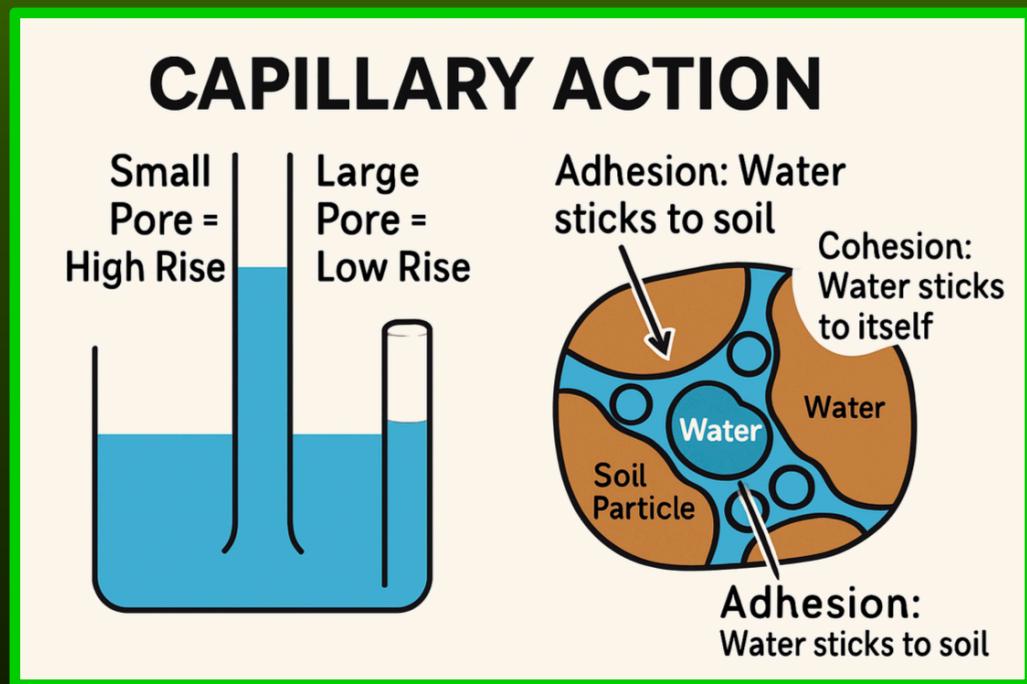


Before we dive into capillary action, let's quickly remember what soil is made of. It's not just dirt! It's a mix of solid particles – sand, silt, and clay – plus vital organic matter. Crucially, soil also has empty spaces called pores. These pores are the sites of action, where they hold the water and air your crops require, as well as the microbial activity.

How Water Moves Uphill (And Sideways!) In Soil

How Water Moves Uphill (and Sideways!) in Soil:

- **Water is Sticky:** It sticks to soil particles (Adhesion) and to itself (Cohesion).
- **Tiny Spaces Rule:** These sticky forces are strongest in small pore spaces.
- **Like a Sponge:** Water gets pulled into and through these tiny soil pores, even upwards against gravity!



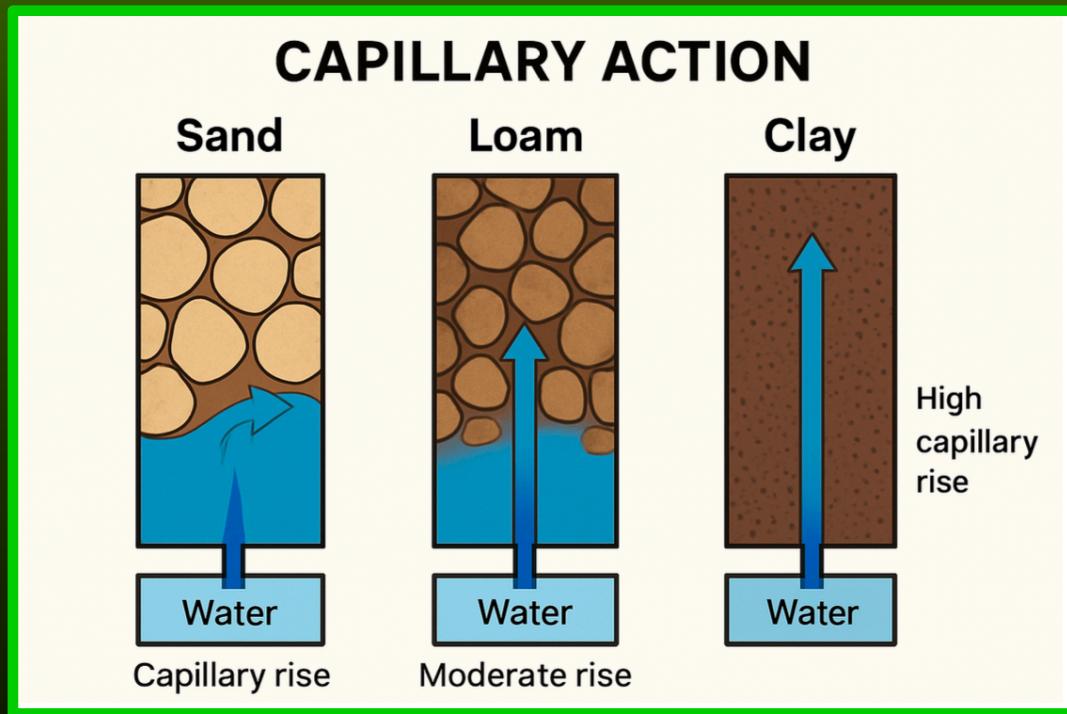
So, what is capillary action? Think of water as being sticky. It likes to stick to soil particles – that's called adhesion. It also likes to stick to itself – that's cohesion.

In the tiny pore spaces in your soil, these sticky forces work together like a magnet, pulling water into and through the soil. It's like how a sponge soaks up water. This force is strong enough to pull water sideways and even upwards, fighting against gravity!

How Soil Type Affects Water Movement

How Soil Type Affects Water Movement:

- **Sandy Soil:** Large pores: Water moves fast (drains quickly), but capillary rise is **LOW**.
- **Clay Soil:** Tiny pores: Water moves **SLOWLY**, but capillary rise is **HIGH**.
- **Loam/Silt Soil:** Good mix of pore sizes - Moderate water movement and **GOOD** capillary rise.



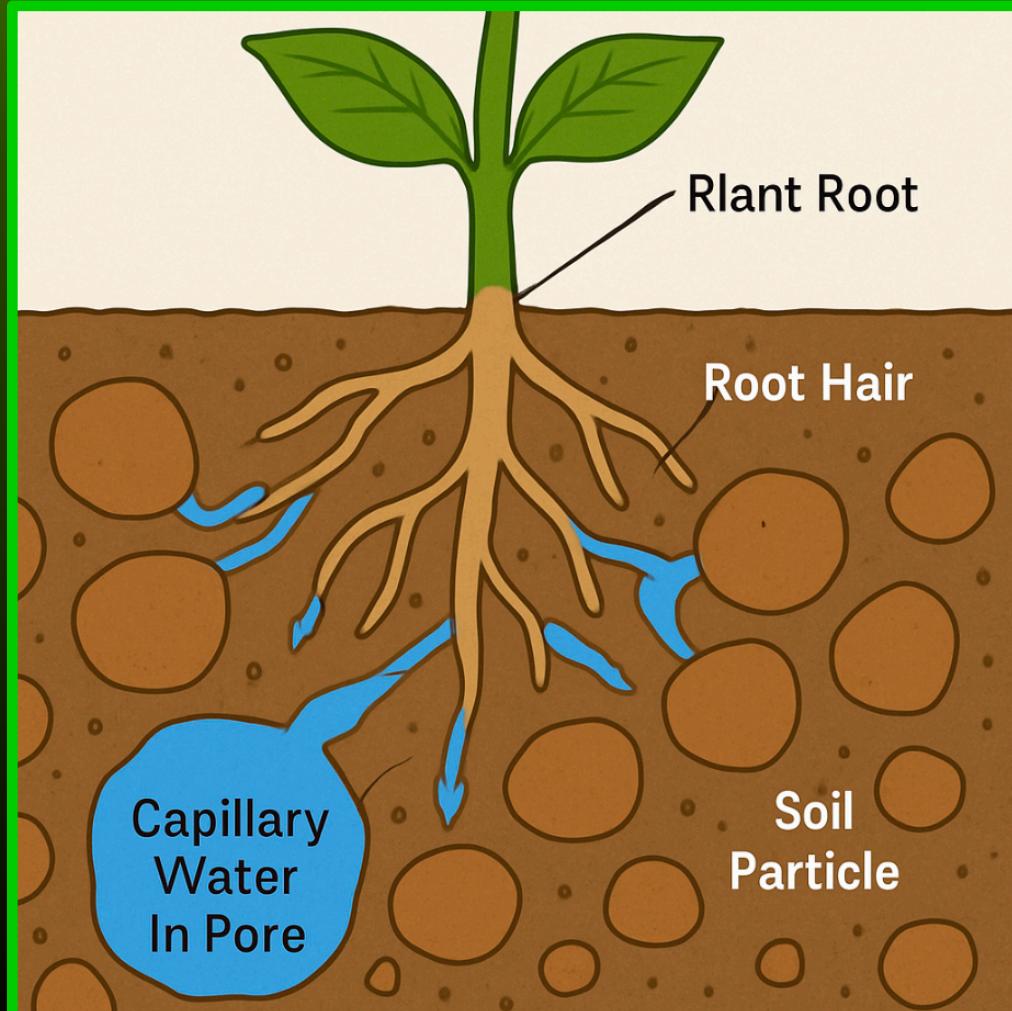
The type of soil you have makes a big difference. Sandy soils have big pores. Water moves through them quickly, which is good for drainage, but it doesn't rise very high through capillary action. Clay soils have tiny pores. Water moves slowly, but capillary action can pull water up much higher. Loam soils are often the sweet spot, with a mix of pore sizes for decent water movement and good capillary rise.

Feeding Your Crops Between Showers

Feeding Your Crops Between Showers:

- Capillary water is 'held' water available to plants.
- Roots pull this water from soil pores.
- Important source of water between rainfall or irrigation.
- Good capillary action helps crops survive dry spells.

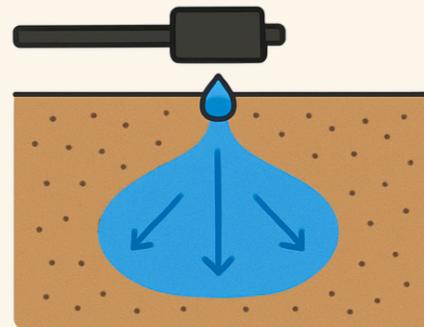
Why does this matter for your crops? The water held in those tiny capillary pores is a key source of moisture for your plants, especially between rains or irrigation cycles. Plant roots tap into this 'held' water. Good capillary action means water can move towards the roots as the plant uses it, helping your crops stay hydrated and survive dry periods.



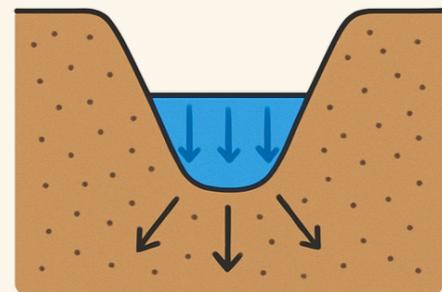
Spreading The Water Wealth

Spreading the Water Wealth:

- Capillarity helps distribute irrigation water.
- Moves water sideways and downwards from drip lines or furrows.
- Wets a larger soil volume, reaching more roots.
- Improves irrigation efficiency (less water needed).
- Helps avoid waterlogging right at the surface.



Drip Irrigation:
Water spreads
via capillarity



Furrow Irrigation:
Capillarity pulls
water sideways

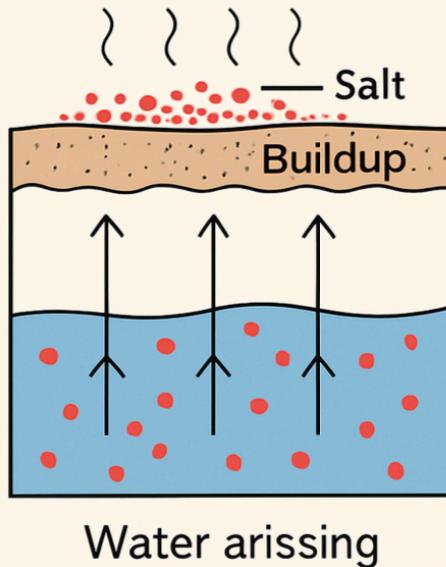
Capillary action is your friend when it comes to irrigation. When you apply water, whether through drip lines or furrows, capillarity helps pull that water sideways and downwards into the surrounding soil. This means you wet a larger volume of soil, reaching more roots, and making your irrigation more efficient. It also helps prevent water just pooling on the surface.

When Capillary Action Causes Problems

When Capillary Action Causes Problems:

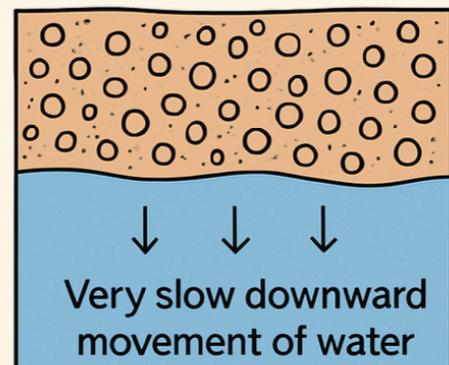
- Salt Buildup:** In dry climates, capillary rise can pull water *and dissolved salts* up to the surface. When water evaporates, salts are left behind, harming soil and crops.
- Poor Drainage:** In fine-textured soils (clays), strong capillary forces hold water tightly and slow downward movement, contributing to waterlogging or poor drainage if structure is poor.

SALT BUILDUP



POOR DRAINAGE IN FINE SOIL

Dense, clay soil



Strong capillary hold

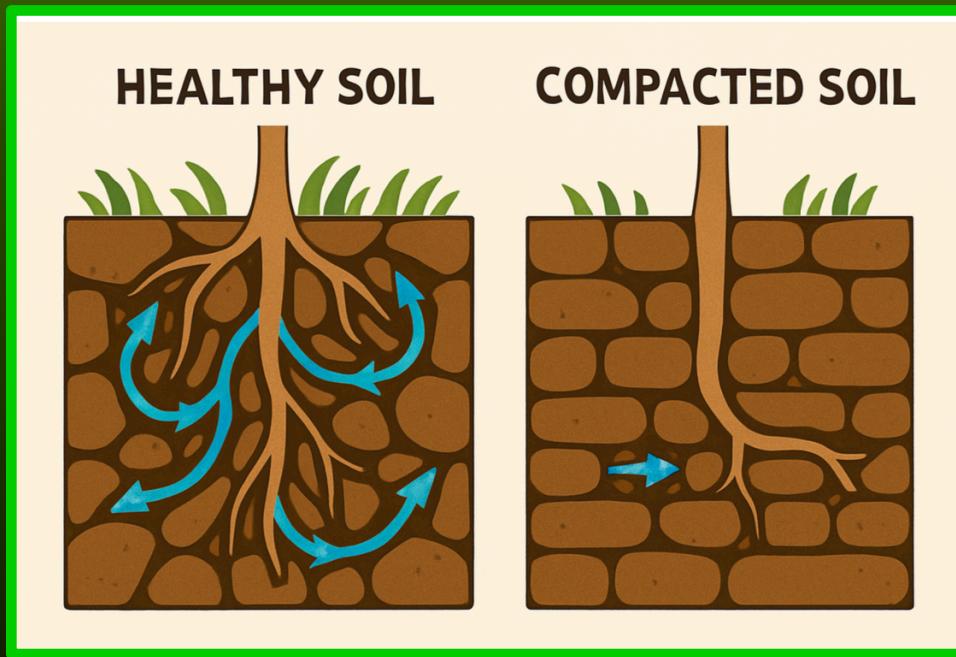
But capillary action isn't always helpful. In dry areas, strong capillary rise can pull water up from deeper soil layers. If that water contains dissolved salts, they get carried to the surface. When the water evaporates, the salts get left behind, building up over time and potentially damaging your crops. Also, in heavy clay soils, the same forces that pull water up can also hold onto it tightly, slowing down drainage.

Compaction: The Enemy Of Good Water Movement

Compaction: The Enemy of Good Water

Movement:

- Heavy machinery, wet conditions, and traffic squash soil pores.
- Compaction destroys the network of small capillary pores.
- Hinders water movement (up, down, sideways).
- Reduces water infiltration and increases runoff.
- Makes it harder for roots to grow and find water.



One of the biggest enemies of good capillary action is soil compaction. Driving heavy equipment, especially on wet soil, squeezes those vital pore spaces shut.

This destroys the network that water uses to move via capillarity. Water can't easily soak in, move up to roots, or drain away. Compaction basically creates a roadblock for water and roots.

PQNK: The Pristine Organic Farming System

Working WITH the Soil and Water in the PQNK way:

- **Improve Soil Structure:** Break the hardpan to leach salts, Make raised beds, Grow cover crops to open the soil pores for better infiltration and seepage, Use No-tillage planters– this will create better pore networks.
- **Smart Irrigation:** Water efficiently to meet crop needs without causing excessive upward movement of salts. Keep the soil covered with thick organic mulch to restrict capillaries for surfacing salts.
- **Control Traffic:** Minimize trips across the field, use furrows (controlled traffic farming) to limit compaction in the growing area.

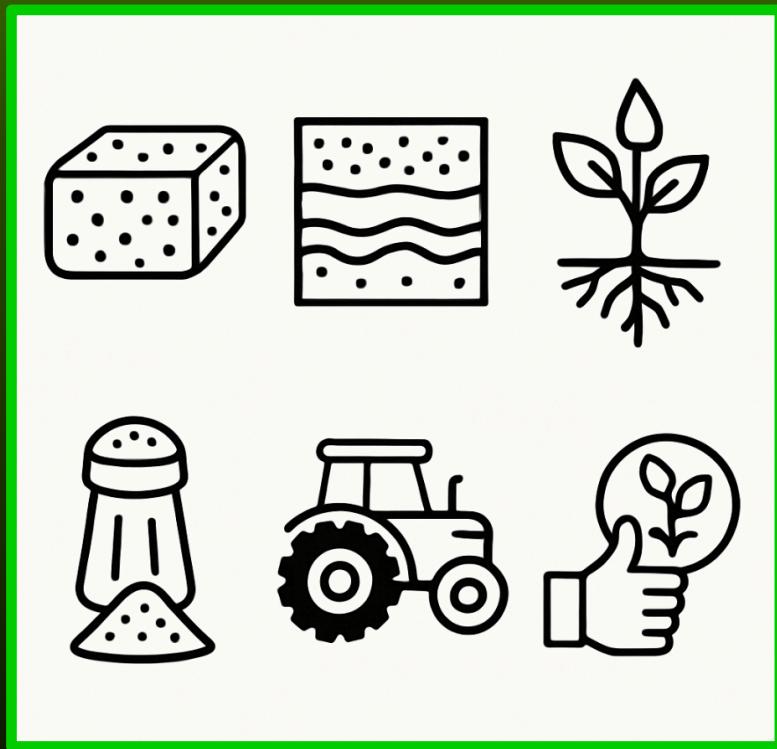


So, how can you manage capillary action to your advantage? Focus on building healthy soil. Grow organic matter, plant cover crops, leave the roots in soil (don't uproot), and no-till to create and maintain those crucial pore spaces. Irrigate smartly – give crops what they need, but avoid over-watering; maintain soil cover that brings up salts. And finally, manage your field traffic. Sticking to furrows can limit compaction to smaller areas, protecting the rest of your soil structure.

What To Remember?

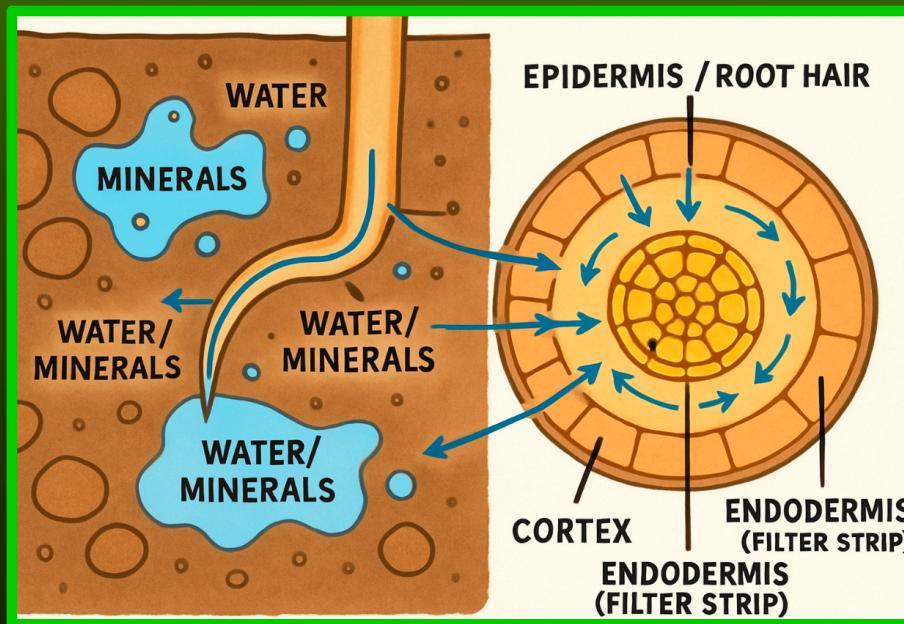
What to Remember:

- **Capillary action:** Water moving through small soil pores (like a sponge).
- **Soil Type is Key:** Affects how high and fast water moves.
- **It Impacts:** Crop water supply, restricted furrow irrigation, salt movement, infiltration.
- **Compaction:** Bad News for water movement.
- **Good Soil Management:** Working *with* capillary action.



Let's quickly recap the main points. Capillary action is how water moves through the tiny pores in your soil, driven by water's 'stickiness'. Your soil type – sand, silt, or clay – greatly influences this movement. It affects how your crops get water, how your irrigation spreads, potential salt issues, and infiltration. Compaction is a major problem that hinders this process. The key is good soil management – things like adding organic matter by no tillage and reducing compaction help you work *with* capillary action for a healthier, more productive farm.

How Roots Drink And Filter



Think of your plant roots like tiny straws, but much smarter! Here's how they drink up water and nutrients from the soil:

1. **Absorption:** It starts with the root hairs – those fuzzy little extensions on the roots. They reach out into the soil and soak up water along with dissolved minerals, like nitrogen, phosphorus, and potassium, that your plants need to grow.
2. **Moving Inwards:** This water and mineral mix then travels inwards through the main body of the root, called the cortex. It can seep between the cells or pass through them.
3. **The Gatekeeper (Filtering):** Before reaching the plant's main plumbing system, everything has to pass through a special layer called the endodermis. Think of this layer like a bouncer at a club door or a selective filter. It has a waxy strip (called the Casparyan strip) that blocks the easy path between cells. This forces the water and minerals to pass *through* the endodermal cells.