DEPARTMENT OF
BIOSYSTEMS AND
AGRICULTURAL ENGINEERING

Utilizing Subsurface Drip Irrigation in Central US: Lessons Learned

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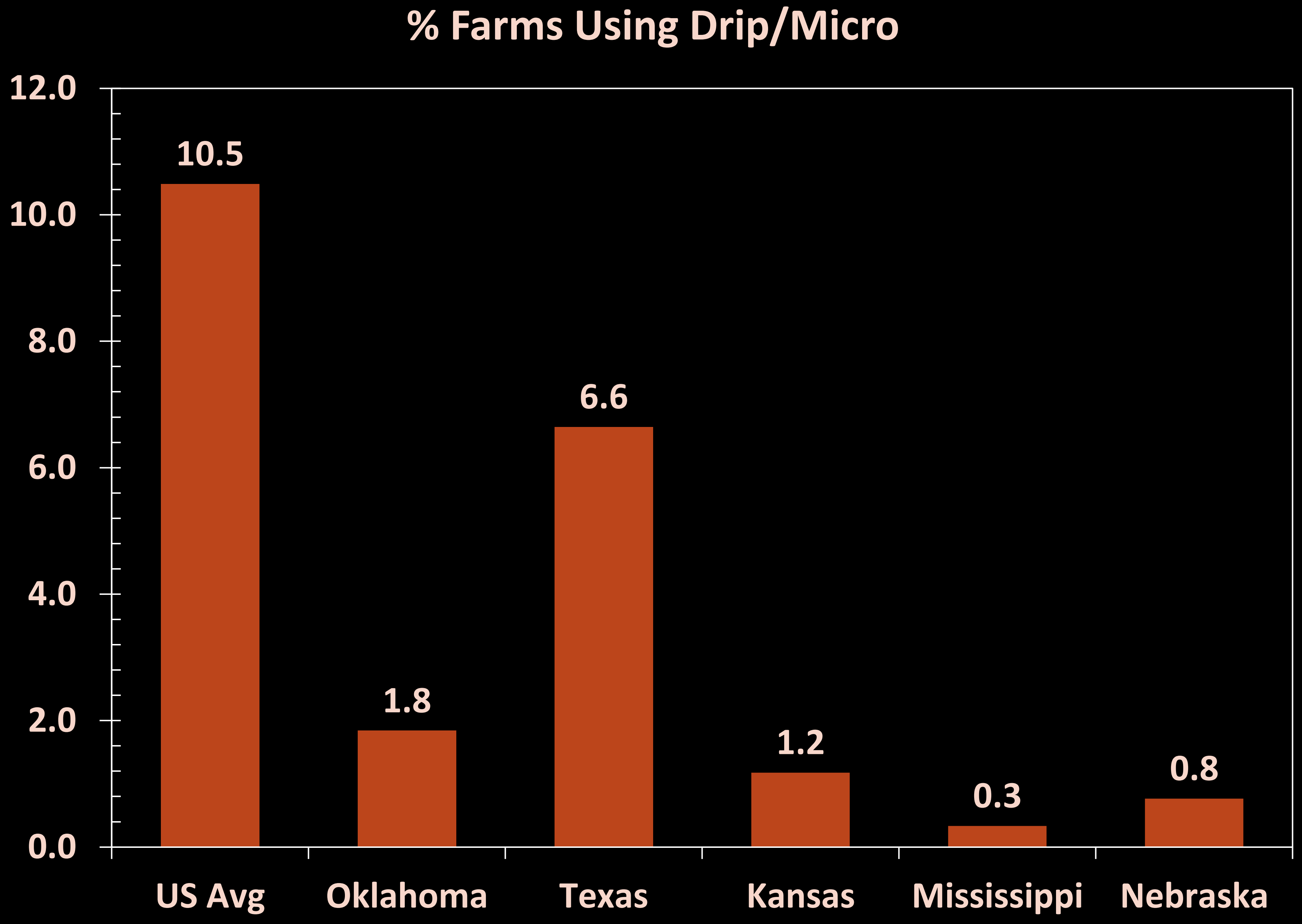
Outline

- Drip irrigation in central US
- Two examples from Oklahoma
- Salinity in SDI systems: ideas and suggestions
- Root intrusion in SDI systems: ideas and suggestions


% Farms Using Drip/Micro
12.0
10.0
8.0
6.0
4.0
2.0
0.0
10.5
1.8
6.6
1.2
0.3
0.8
US Avg
Oklahoma
Texas
Kansas
Mississippi
Nebraska

Greatest Barriers to SDI Adoption in central US

- System cost
- Germination and crop establishment
- Prevention of animal and insect damage to driplines

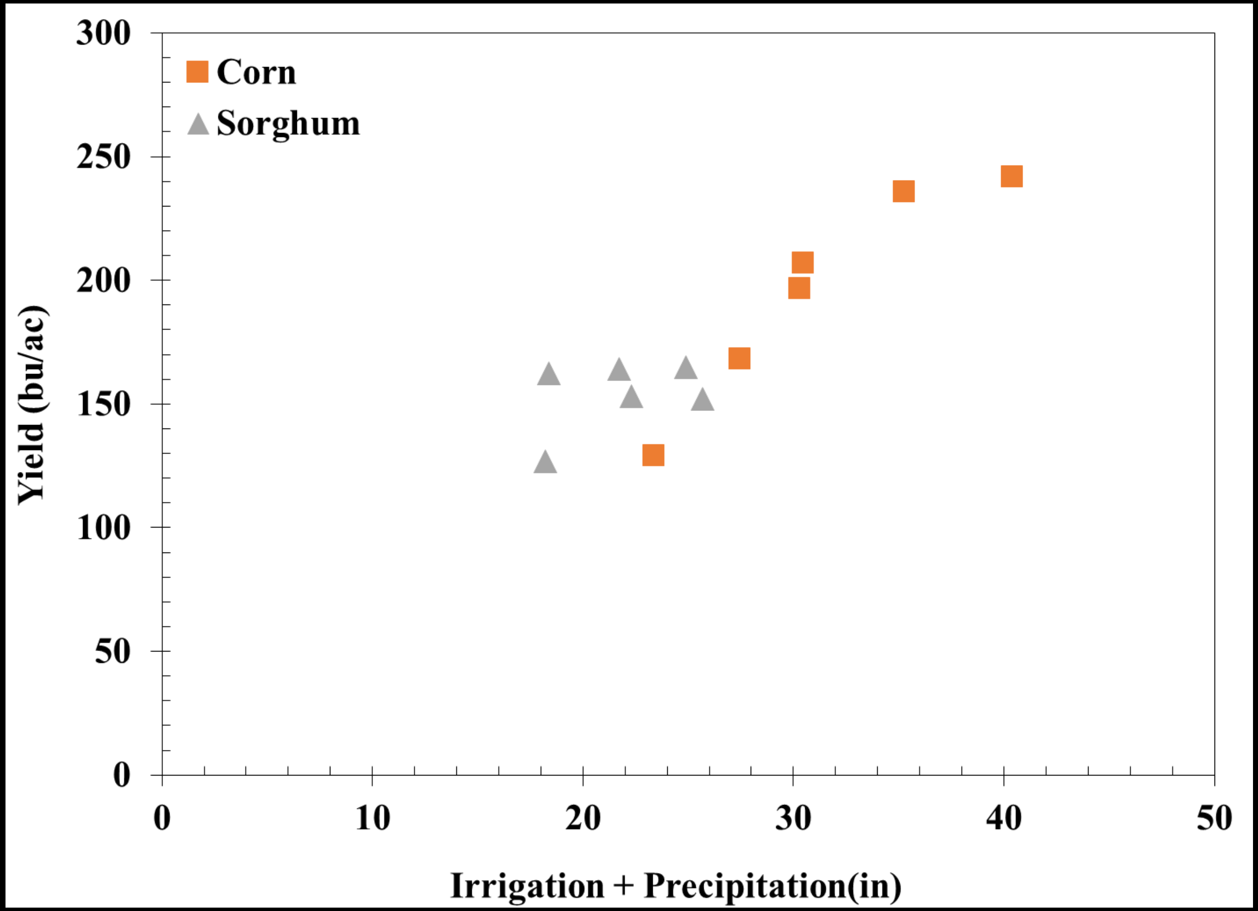
Example 1: Oklahoma Panhandle

Distance from drip lines


First Aid
Eldar
Shany


Results from Oklahoma Panhandle

- Corn and Sorghum yields were not influenced by offset treatments
- Decreasing irrigation amount resulted in yield loss



Example 2: Central Oklahoma

Effluent disposal

Effluent disposal

- Farm effluent collected at lagoons
- Pumped to SDI for hay production

Effluent disposal

- 5/8-inch diameter, 15-mil DripNet PC
- Tapes 16 inches (40 cm) deep, 30 inches (76 cm) spacing
- 0.26 gph emitters, 24 inches (60 cm) spacing


-Zone Solenoid Valves
-Manual Flush Valves w/ Air Vents
-Submain Air Vents
1
2
3
4
5
6
7
8
9
10
W McElroy Rd
N Sangre Rd
Image © 2009 DigitalGlobe
© 2009 Tele Atlas
©2007 Google™
36°07'39.74" N 97°06'03.21" W elev 879 ft
Streaming ||||||||| 100%
Eye alt 3540 ft

Station Valves for Zones #1 & #2

Flush Valves & Air Vents for Zones #1 & #2



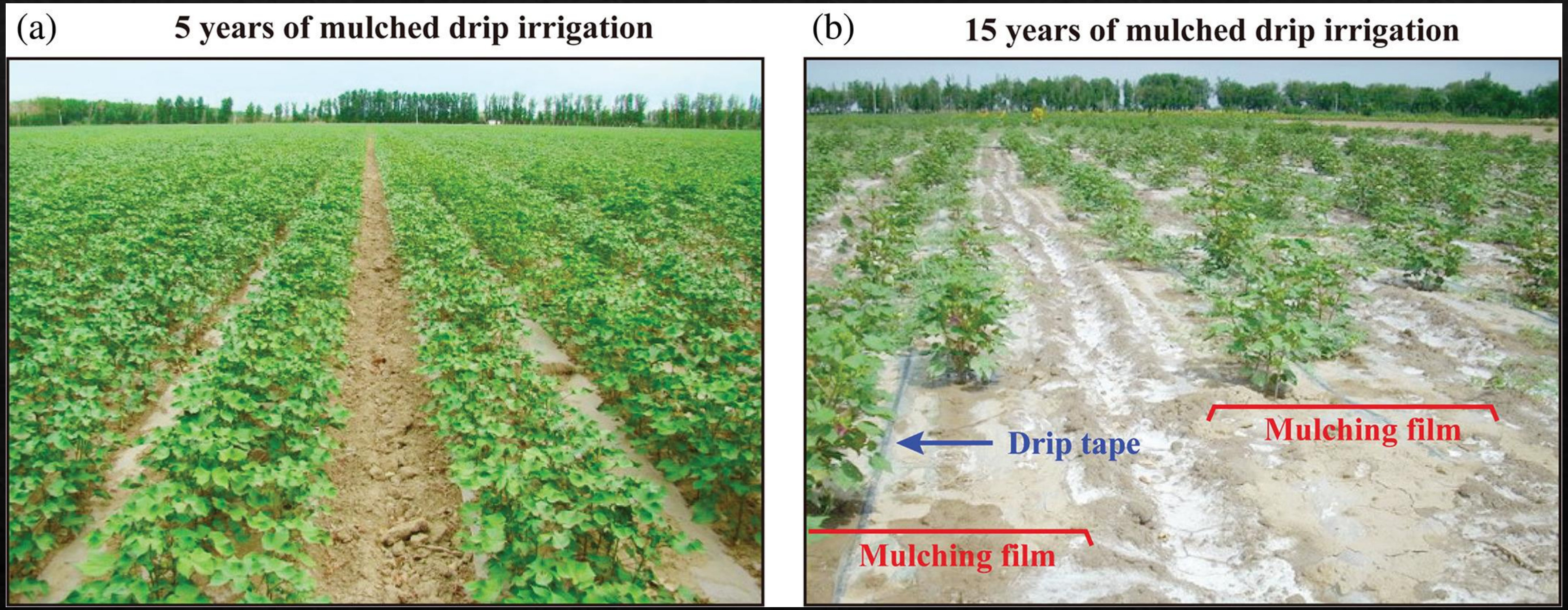
CAMELBAK
LASCO

Effluent disposal

- Zone 4:
  - q_{avg} = 0.27 gph; UC = 91%; DU = 83%

- Zone 7:
  - q_{avg} = 0.28 gph; UC = 96%; DU = 93%


Salinity



Source: Wang, Z., Fan, B., & Guo, L. (2019). Soil salinization after long-term mulched drip irrigation poses a potential risk to agricultural sustainability. European journal of soil science, 70(1), 20-24.

Some ideas and suggestions

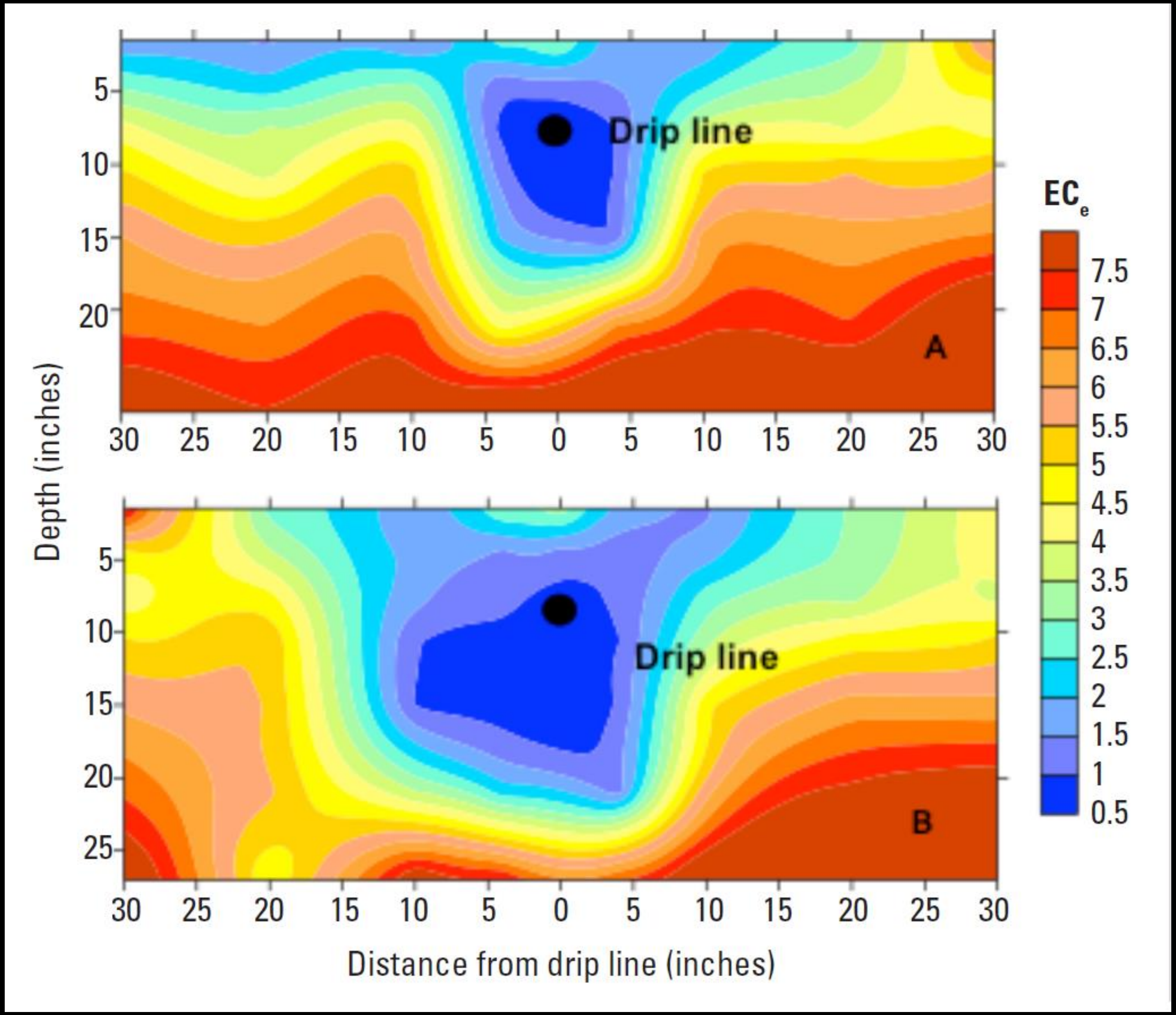
1. A review of previous studies found mixed results under saline conditions. Sometimes SDI performed better than sprinkler and furrow, sometimes worse.
2. In cases when SDI resulted in reduced salt impact compared to furrow, it was because less water was applied and water was pushed away from the root zone.
3. Salty fields can be irrigated during rains to further protect plants after emergence.
4. Machines that would remove the salty soil from the surface and plant down just a little bit could help (listing).
5. The placement of drip lines relative to crop row is important.

Some ideas and suggestions

6. Irrigation scheduling plays a major role. Not enough water prevents leaching from happening, too much water can cause more issues, especially under shallow groundwater conditions (or hard pans).
7. Leaching (reclamation & maintenance) can be used effectively to reduce salinity if appropriate water resources are available.
8. System design and maintenance are also critical. Proper maintenance (flushing, chlorination, and acid injection) can guarantee system performance.
9. History of each field, previous irrigation system should be considered. New drip next to old drip.
10. Salt tolerant varieties should be developed locally as a viable strategy.

Some ideas and suggestions

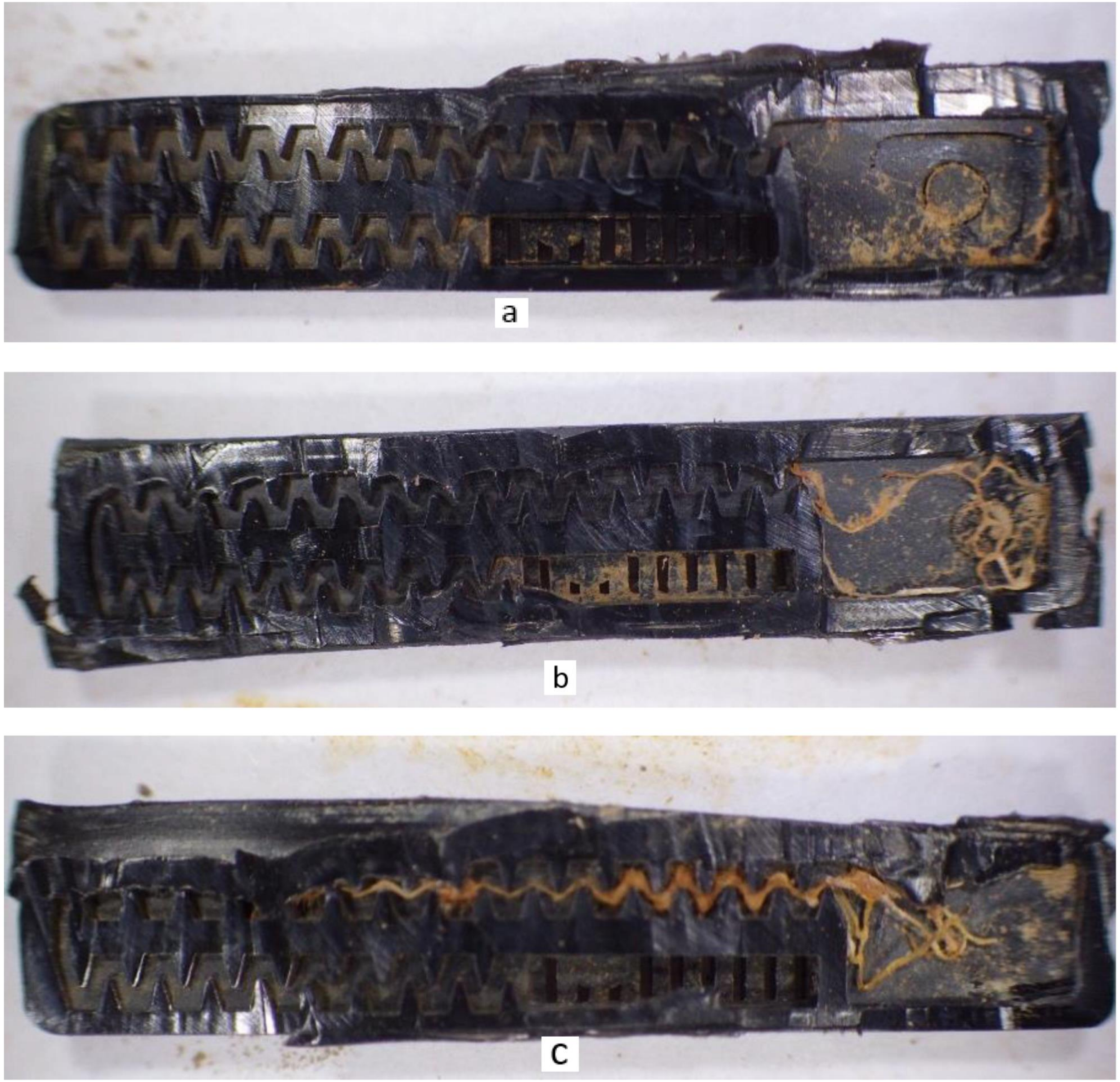
11. Soil texture and health impact the effectiveness of leaching and many other practices implemented, as well as general crop health.



A: 12 inches of applied water, B: 19 inches of applied water

Hanson, B., & May, D. (2011). Drip irrigation salinity management for row crops. UCANR Publications.

Root Intrusion



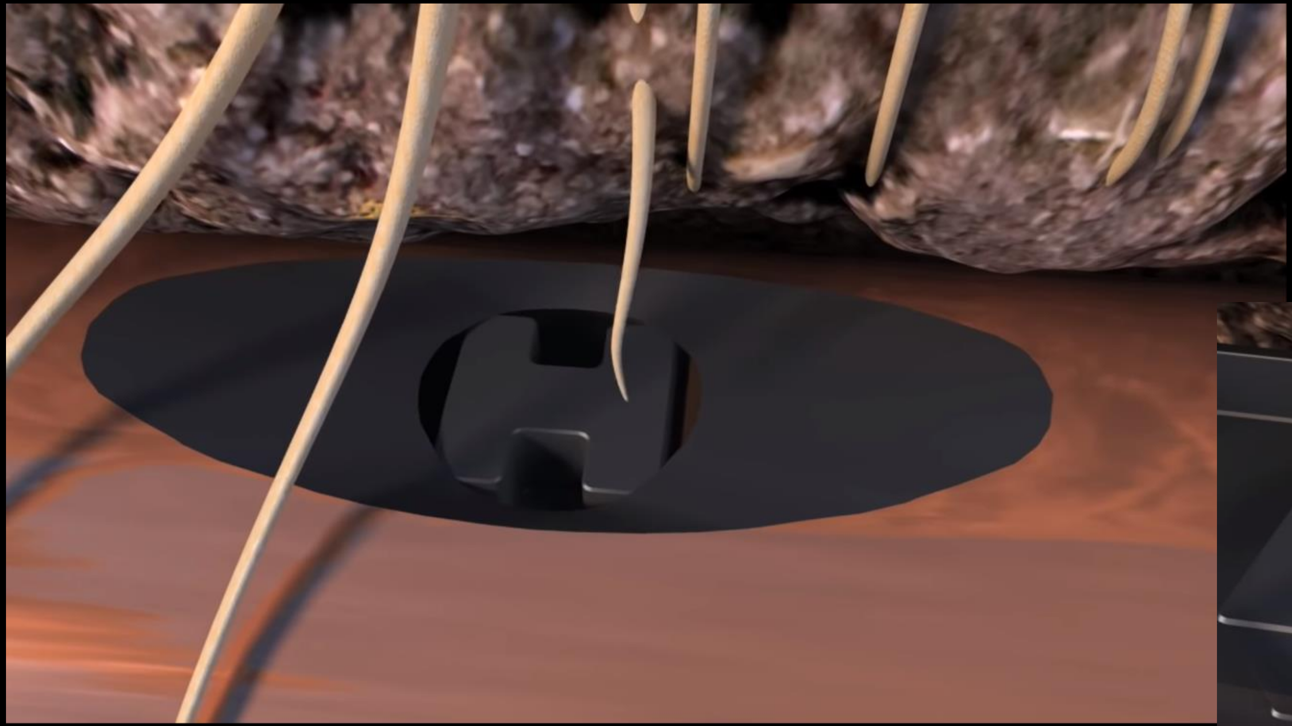
Source: Guo, S. (2019). Subsurface Drip Lateral Line Depths to Protect against Root Intrusion. Water, 11(11), 2285.

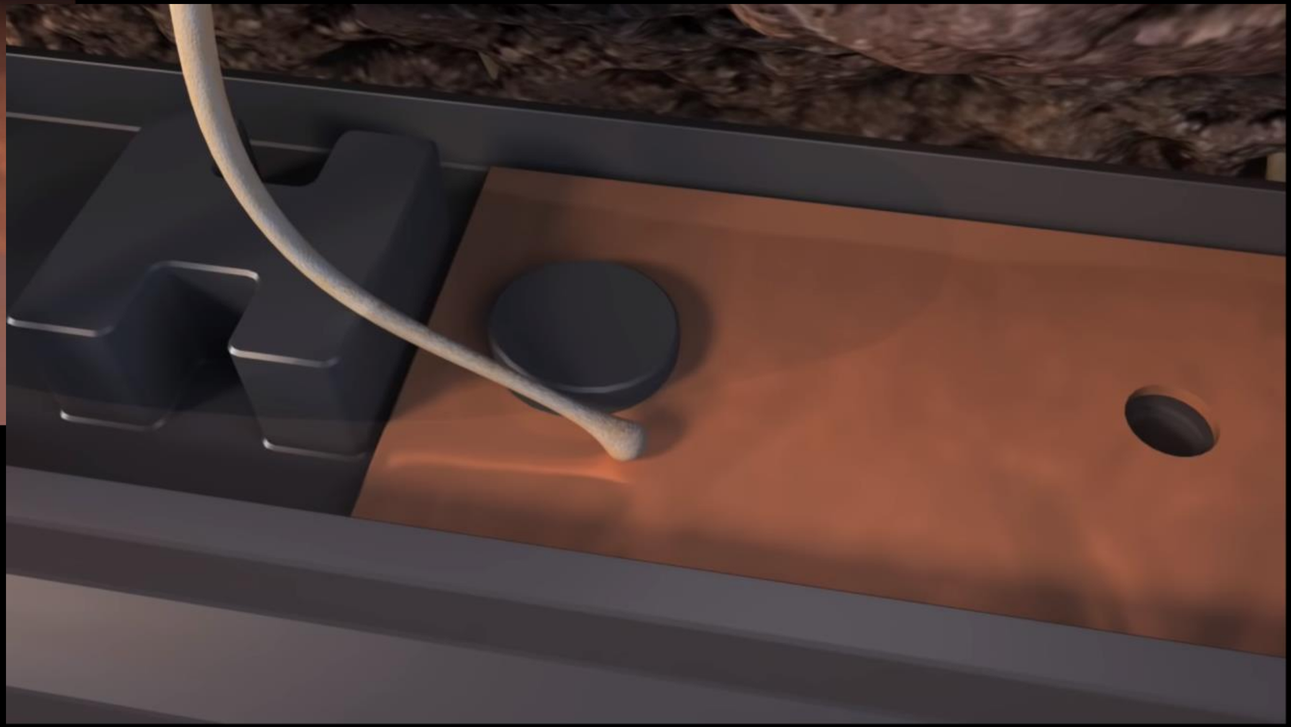
Industry solutions

- A few molecules of patented chemicals are constantly released

Industry solutions

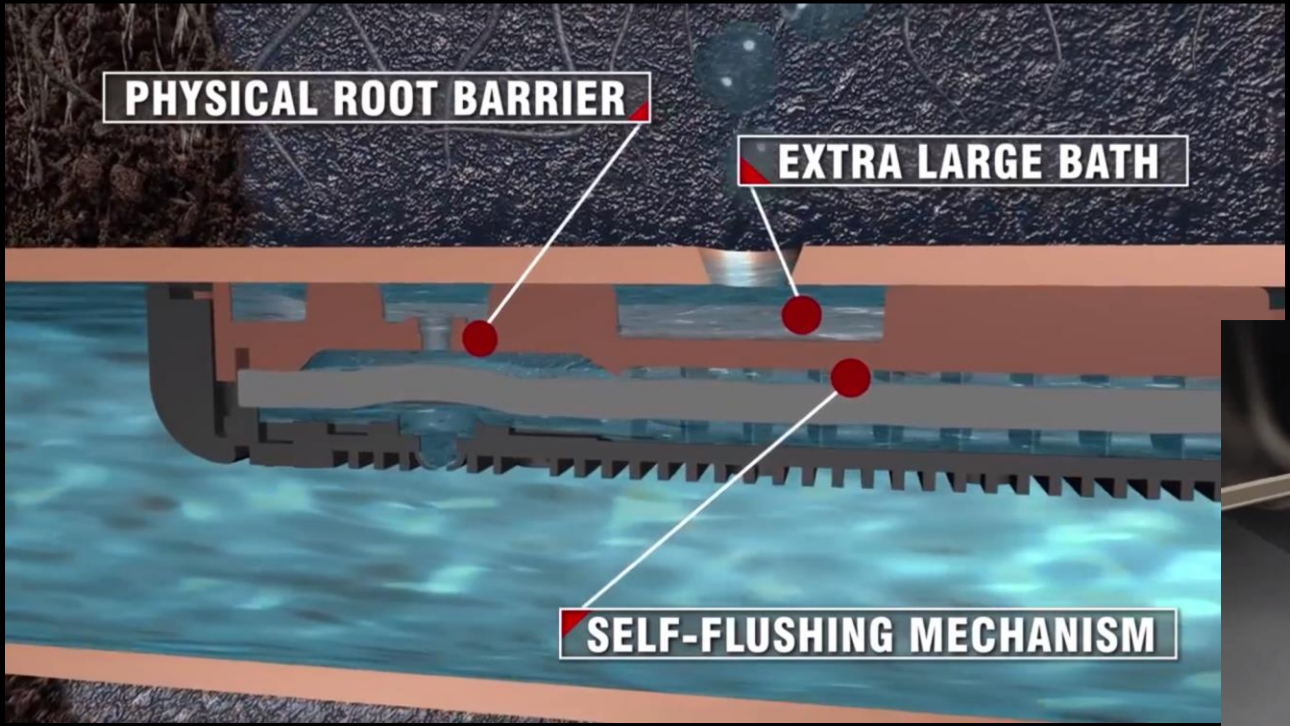
- Copper oxide (environmentally friendly)

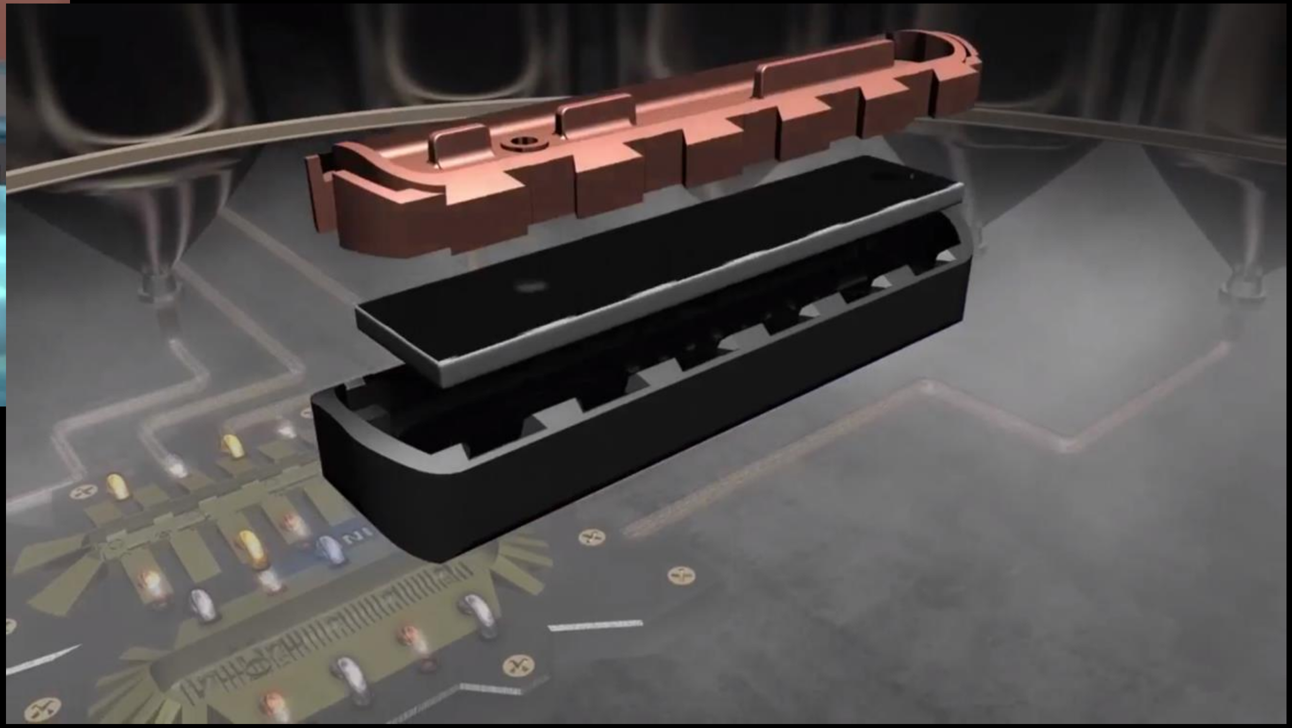




Industry solutions

- Physical barrier and copper oxide infusion





Some ideas and suggestions

1. In general, this issue is more challenging under limited water conditions
2. Keeping the soil around the emitter at high moisture levels can help.
3. With the same amount of water, increasing irrigation frequency (shorter interval) is suggested.
4. Lowering pH by injecting acid discourages root growth.
5. High dose of chlorine (100 to 400 ppm) can destroy roots in the drippers.
6. Injecting herbicides (metam sodium or trifluralin) kills roots too.
7. Seamless dripline may perform better if roots grow along the seam and into the dripper.

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