

Improving water and nutrient retention capacity of the pine bark substrate using amendments

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Issues with container nursery production

Overhead irrigation is inefficient:
result in runoff losses which further
poses environmental issues

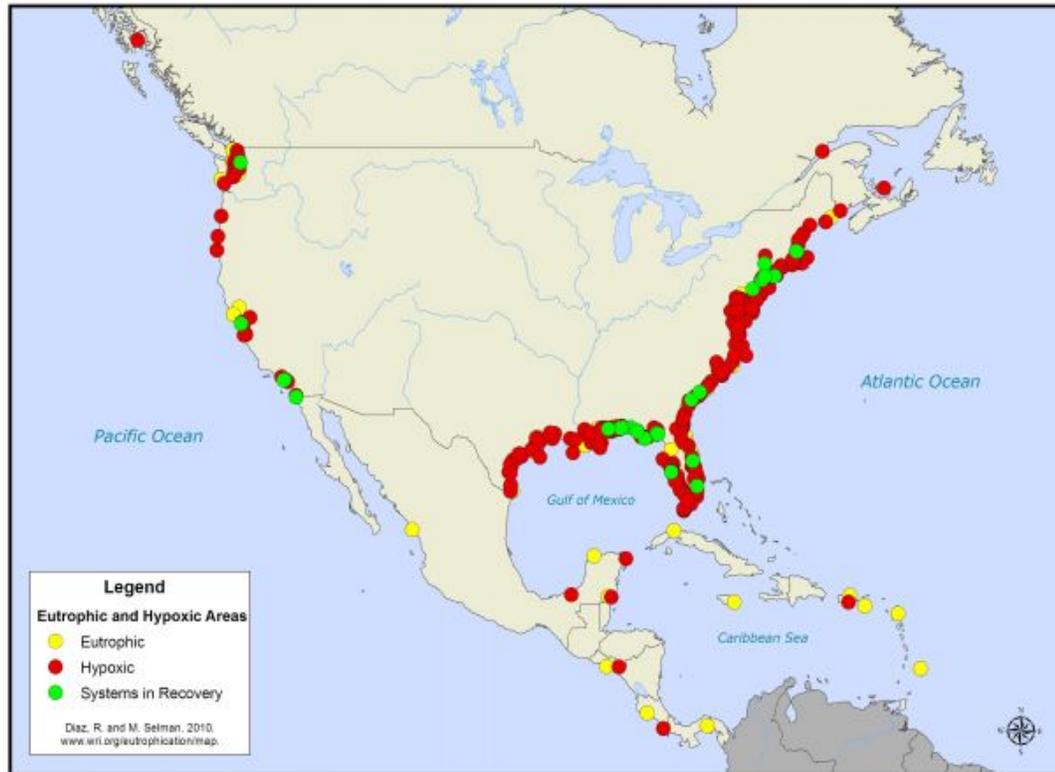


Spray stakes can minimize application
losses, however water and nutrients
can be lost in leaching from containers

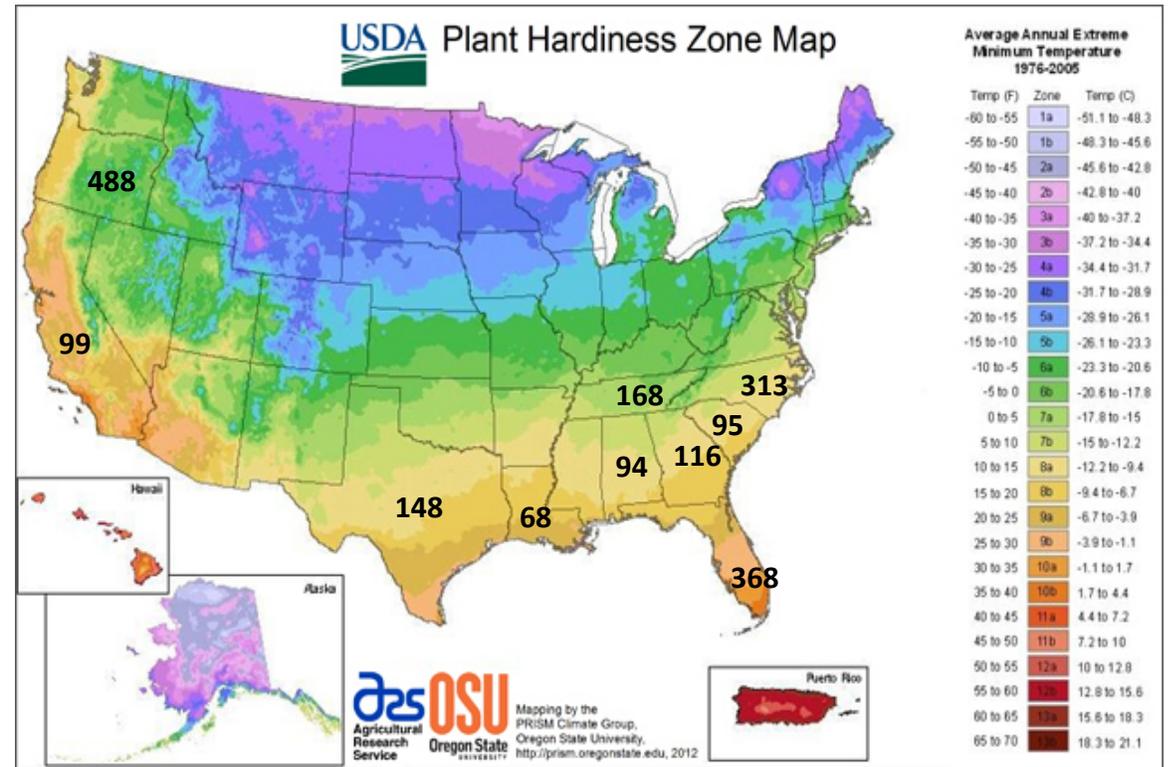


US ornamental nursery industry is highly vulnerable for restrictions and penalties that can be imposed by EPA

Eutrophic and Hypoxic Coastal Areas of North America and the Caribbean



Top 10 US states for ornamental nurseries



Why anions are easily leached from pine bark filled containers?

- CEC >>> AEC in pine bark media
- The cations adsorbed on the surfaces repel anions making them mobile in the soil solution and susceptible to leaching losses
- As more water leaches out of containers, more anions are leached
- Pine bark is coarse, thus retains less water making anions more susceptible for leaching

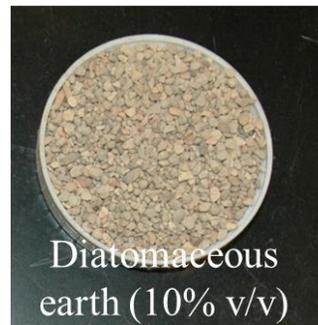


Amendments to pine bark media

- Calcined clay and diatomaceous earth can be potentially used as amendments to pine bark media
- Diatomaceous earth is a soft, crumbly, porous sedimentary deposit formed from the fossil remains of diatoms whereas calcined clay is produced by heating kaolin to high temperatures
- They both possess higher moisture retention capacity, thus may further increase anion retention in pine bark media
- Objective of the current study was to study the effect of adding calcined clay and diatomaceous earth to pine bark substrate on water and anion retention capacities

Experimental Methods

- Design: randomized complete block
- Treatments:
 1. pine bark (8 parts) + sand (1 part)
 2. pine bark (8 parts) + sand (1 part) + calcined clay (10% v/v)
 3. pine bark (8 parts) + sand (1 part) + diatomaceous earth (10% v/v)
- Replications: 6
- Analyses: regression and ANOVA



Measurements conducted during the study

- Media in containers was wetted with a given volume of plain water and allowed to equilibrate; media was wetted several times until leaching was observed; after each wetting, samples were taken for hygrometer to measure water potential and then dried in an oven to measure gravimetric water content
- Media was brought to container capacity with fertilizer water; later media was sequentially irrigated with a given volume of plain water several times; each time after leaching stopped, media EC and nitrate concentration in the leachate were measured



WP4 hygrometer for substrate water potential measurements

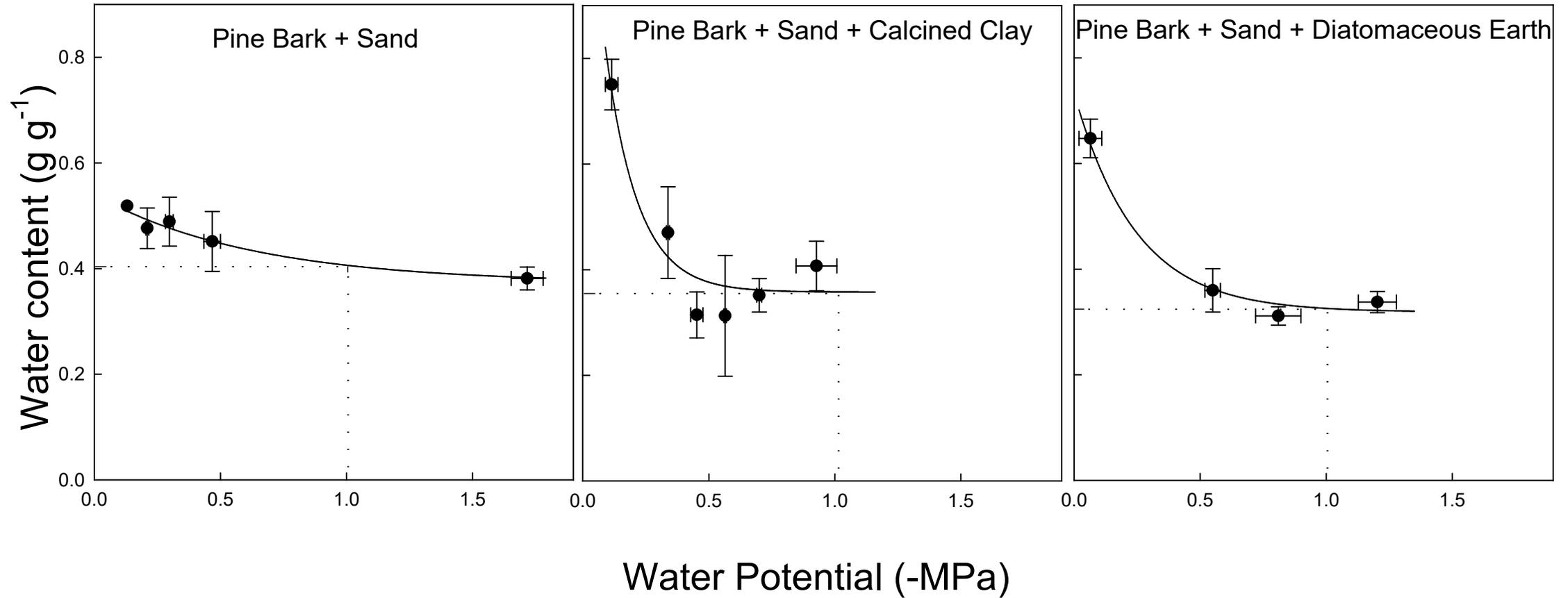


Spectrophotometer for leachate nitrate measurements

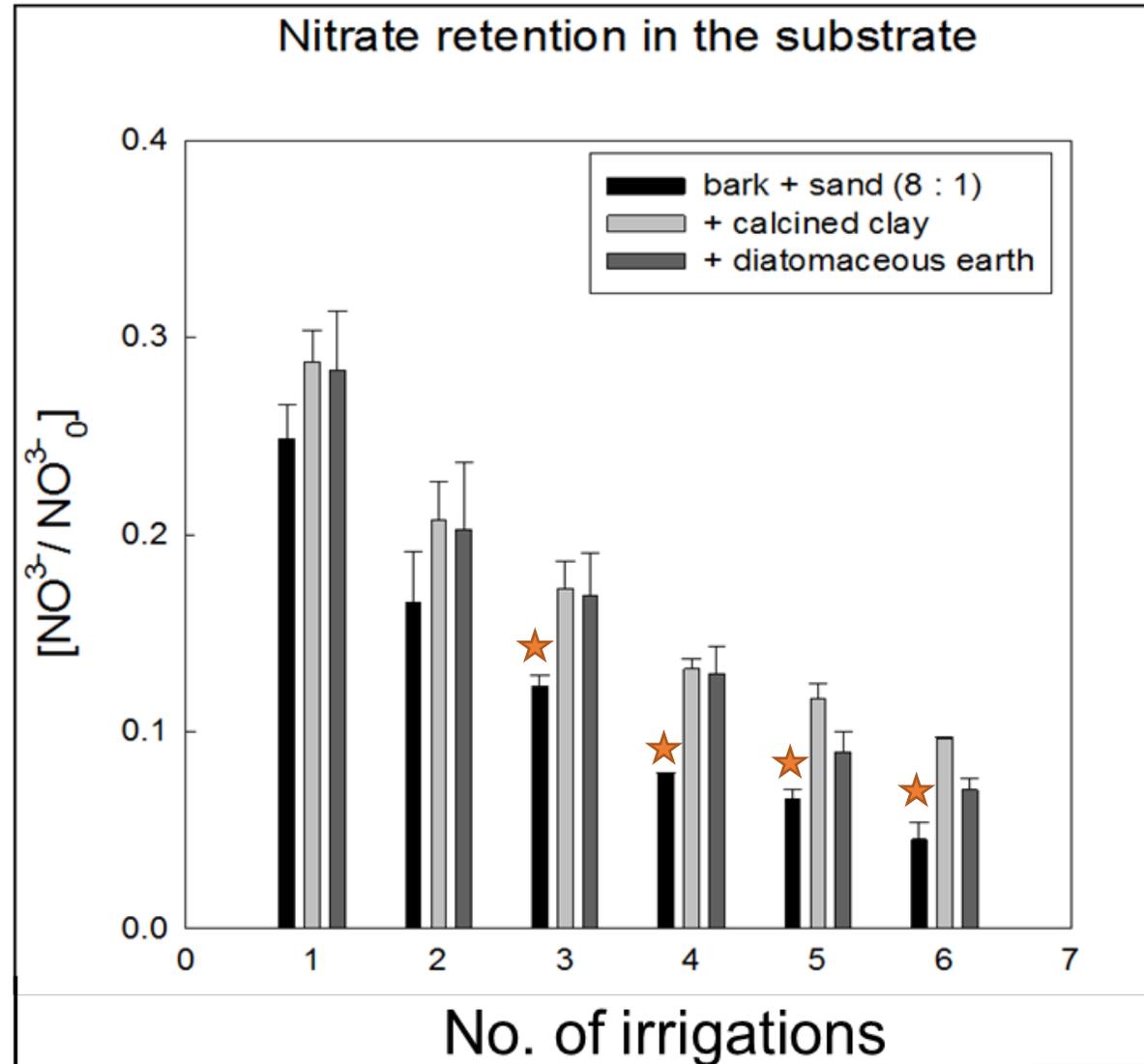


Digital EC probe for substrate electrical conductivity measurements

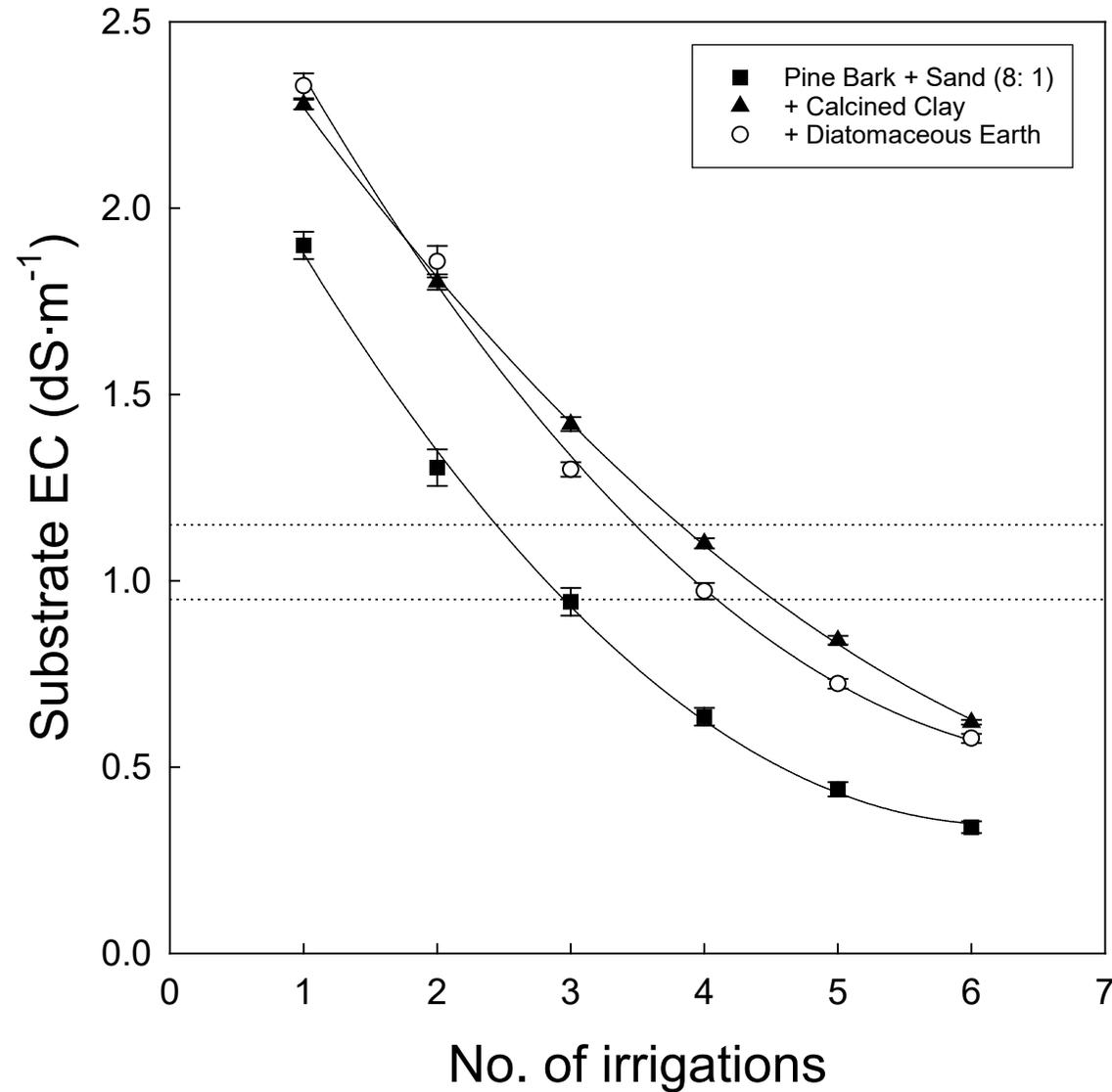
Both amendments increased container capacity and plant available water in the pine bark substrate



Both amendments increased nitrate retention in the bark substrate during sequential irrigations



Both amendments increased electrical conductivity of the pine bark substrate during sequential irrigations



Conclusions

- Amendments like calcined clay and diatomaceous earth can increase moisture retention thus reducing anion leaching from containers filled with pine bark media
- Calcined clay appears to be a better amendment than diatomaceous earth