



Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

USDA-ARS Salinity Laboratory
Riverside, California

Agricultural Water Efficiency and Salinity Research Unit

Overcoming water quality and water scarcity constraints on
agriculture and human health



U.S. Salinity Laboratory Timeline

1928: Rubidoux Laboratory

Water quality impacts on irrigation, boron toxicity

1937: United States Regional Salinity Laboratory

Agriculture on saline and alkali soils

1948: United States Salinity Laboratory

Combined Regional and Rubidoux Laboratories

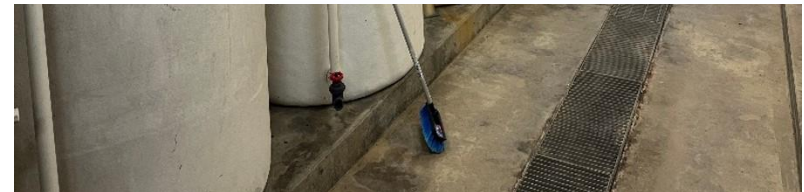
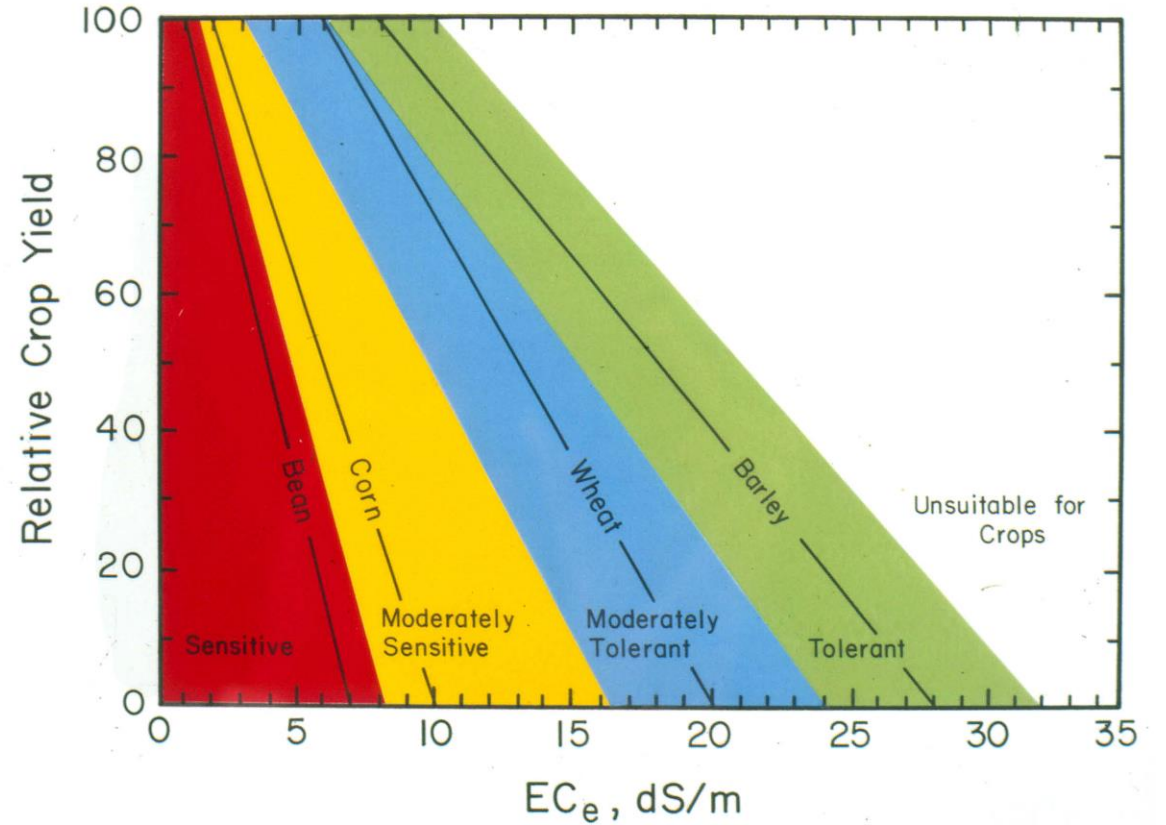
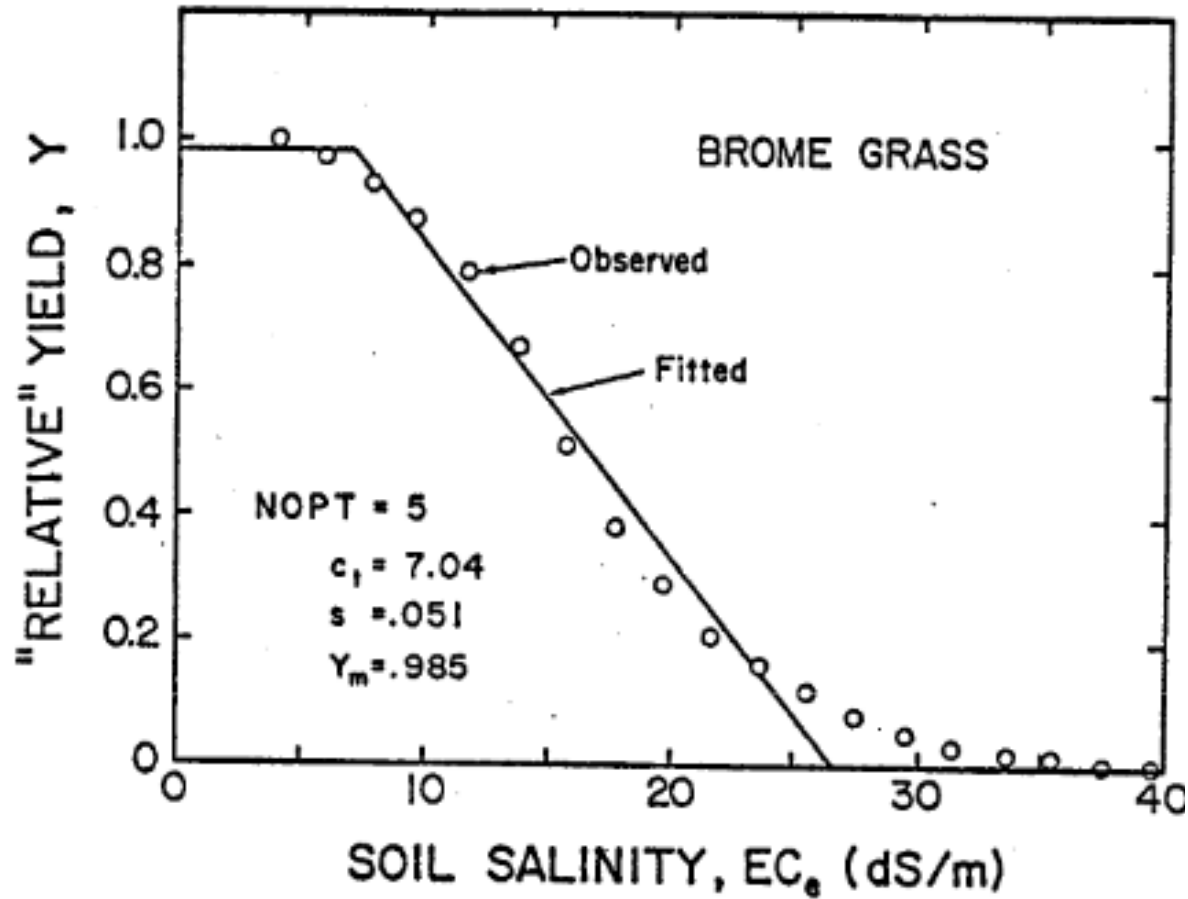
1954: Publication of Handbook 60

1995: Moved to current facility at U.C. Riverside

2000: Renamed George E. Brown, Jr., Salinity Laboratory



Plant Salt Tolerance

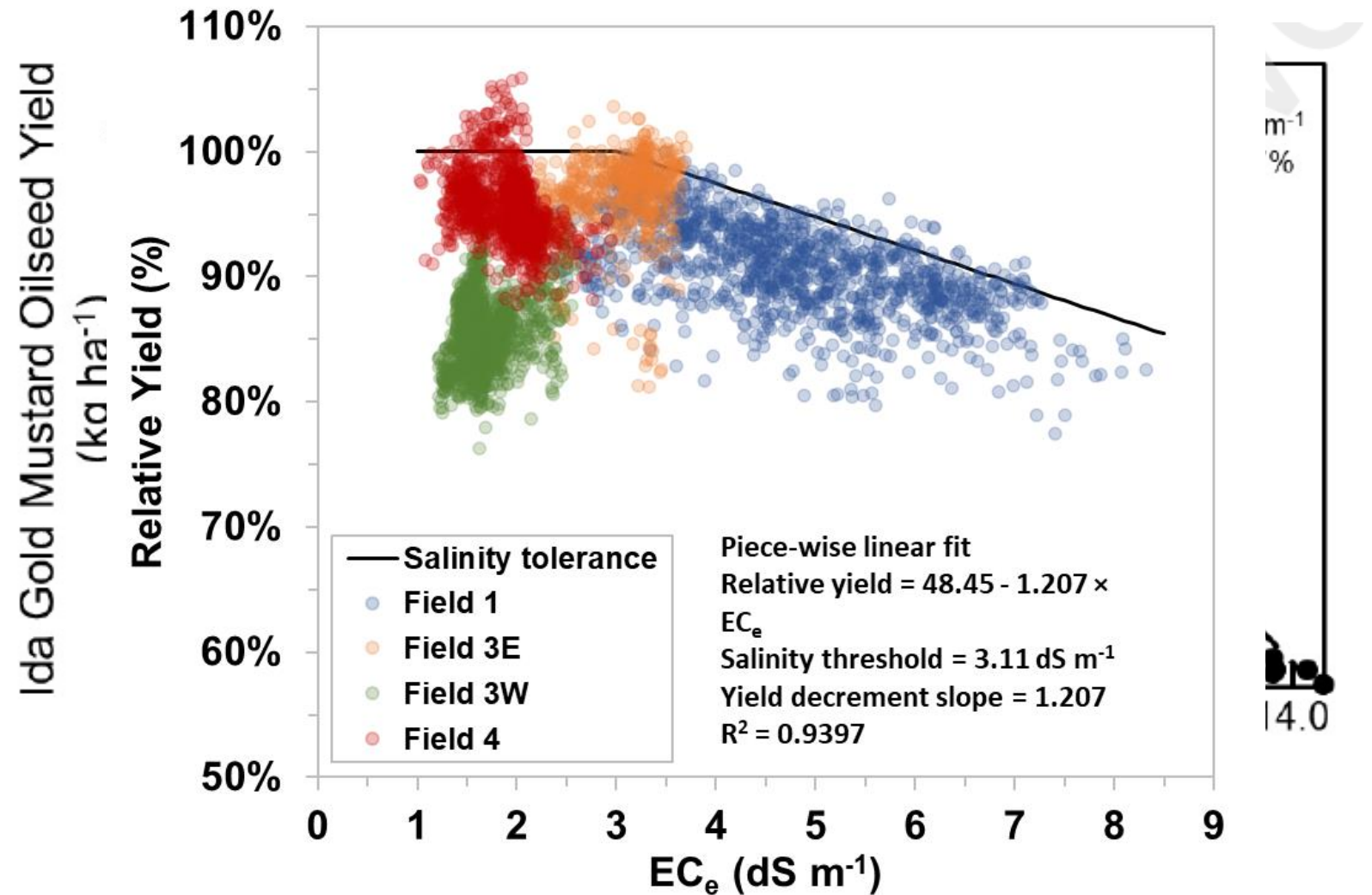
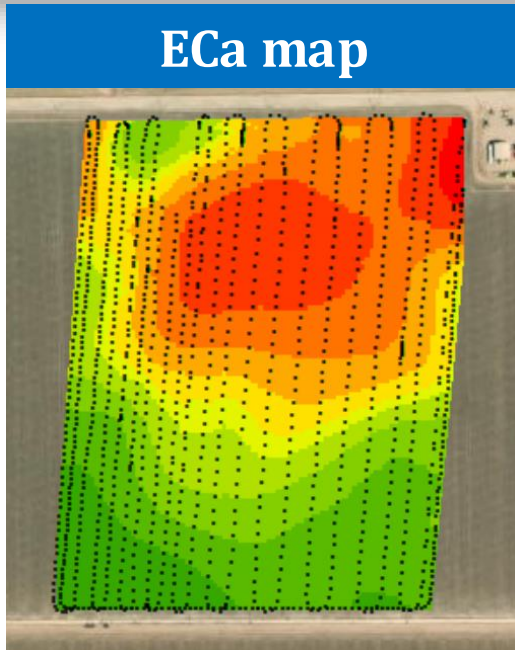


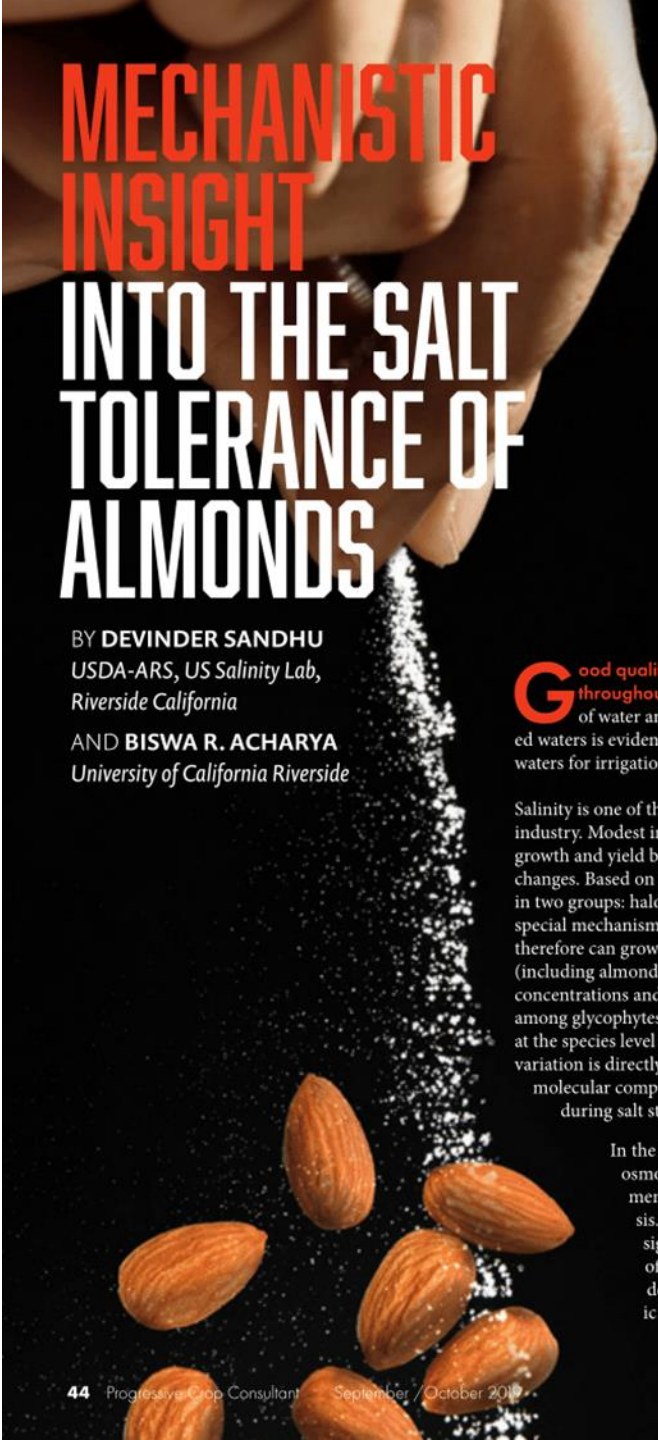
Alternative Approach for Plant Salt Tolerance Studies

ECa field survey



ECa map



A close-up photograph of a hand pouring a stream of white salt crystals over several almonds. The almonds are scattered on a dark surface, and the salt is falling from the hand, creating a dynamic visual of salt stress.

MECHANISTIC INSIGHT INTO THE SALT TOLERANCE OF ALMONDS

BY **DEVINDER SANDHU**
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AND **BISWA R. ACHARYA**
University of California Riverside

Good quality water is extremely important for agriculture throughout the world. However, due to reduced availability of water and increasing food demands, future use of degraded waters is evident. One of the major concerns of utilizing degraded waters for irrigation is their high salt concentration.

Salinity is one of the main abiotic stresses faced by the agriculture industry. Modest increase of soil salinity level impacts both plant growth and yield by causing several physiological and biochemical changes. Based on salt tolerance level plants are classified broadly in two groups: halophytes and glycophytes. The halophytes have special mechanisms to tolerate high concentrations of salts and therefore can grow in saline environments. The majority of plants (including almonds) are glycophytes and cannot tolerate high salt concentrations and so grow in soil containing low salts. However, among glycophytes, salt tolerance level varies tremendously not only at the species level but also at the variety level within a species. This variation is directly dependent on the functional status of various molecular components that play critical roles to protect the plant during salt stress.

In the initial stages of salinity exposure, a plant faces osmotic stress, resulting in ion imbalance in cells, membrane disintegration and reduced photosynthesis. In addition, osmotic stress in the root sends a signal throughout the plant causing reprogramming of physiological and molecular activities to initiate defense response against salinity stress. Slowly ionic stress develops, leading to accumulation of Na^+



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Salt Tolerant Alfalfa Grown With Seawater



Standard
variety

New salt-
tolerant line

CLIATH
3/0-01

Diagnosis and Improvement of

Saline and Alkali Soils

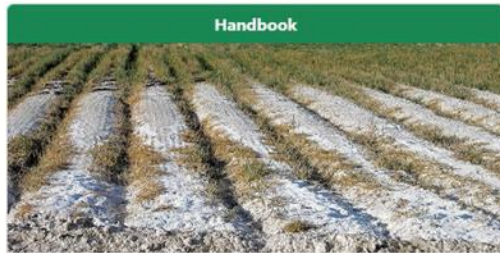
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United States Salinity Laboratory Staff

Agriculture Handbook No. 60
UNITED STATES DEPARTMENT OF AGRICULTURE

Welcome to Handbook 60++

Information and apps for the diagnosis and improvement of saline and sodic soils

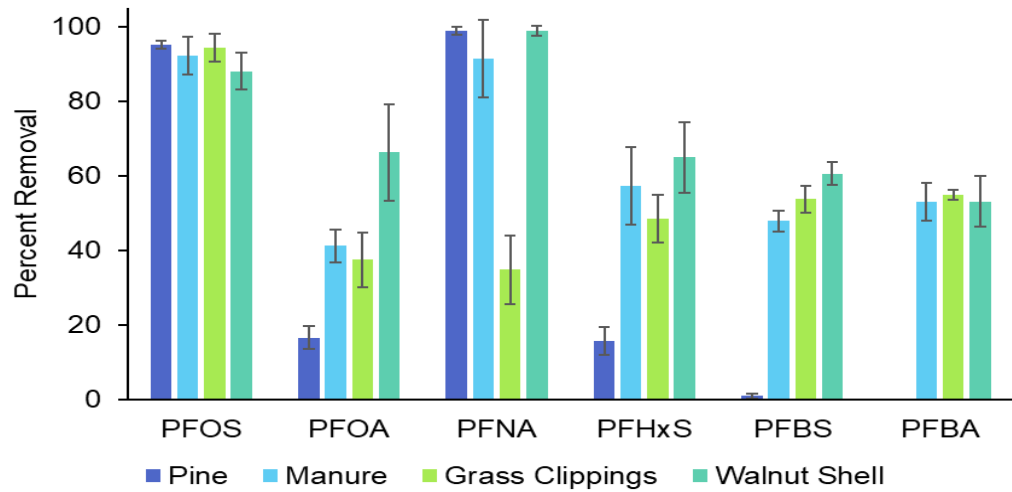


- [Origin and nature of saline and sodic soils](#)
- [Properties of saline and sodic soils](#)
- [Plant salt tolerance](#)
- [Management and improvement of saline and sodic soils](#)
- [Methods for soil characterization](#)
- [Sensor directed soil sampling](#)
- [Etc. etc.](#)



- Plant Salt Tolerance**
 - [SALTOL](#)
Tabulations of crop salt tolerance parameters
 - [SALFIT](#)
Analysis of salinity response curves
- Soil hydraulic properties**
 - [ROSETTA](#)
Predict soil hydraulic parameters
 - [REIC](#)
Analysis of soil hydraulic properties
 - [UNSODA](#)
Database of unsaturated soil hydraulic parameters
- Soil water quality**
 - [CXTFIT](#)
Breakthrough curve analysis
 - [XCHEM](#)
Saturation extract chemistry
 - [WATSUIT](#)
Simulated irrigation impacts on root zone salinity
- Field sampling design**
 - [SDSAMP](#)

PFAS & Biochar



Sustainable and Regenerative Agricultural Systems

