Leaching Fractions Achieved in South Delta Soils under Alfalfa Culture

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Why is salinity an important consideration in (Delta) agriculture?

Salt problems occur on approximately one-third of all irrigated land in the world.

- In general,
  - Parent material weathers to form salts.
  - Some soil amendments may contain salt.
  - Salts are carried in irrigation water.
  - Influenced by shallow, saline groundwater.
- In the Delta,
  - Many soils have low permeability and are difficult to leach.
  - Surface water used for irrigation, and quality may be degraded when it reaches the Delta.
  - Below sea level.

Effects of Salinity on Plant Growth

- Osmotic stress

  (*most common means by which salt impairs plant growth*)
- Specific ion toxicities
- Degraded soil conditions that limit plant water availability

Leaching is the Primary Management Strategy for Salinity

- Leaching must be practiced when soil salinity has the potential to impact yield.
- Leaching occurs when water is applied in excess of soil moisture depletion due to evapotranspiration (ET).
- Leaching may occur during the rainy season or whenever an irrigation event occurs.
- Leaching fraction (Lf) is the fraction of the total applied water that passes below the root zone.
- The purpose of this study was to gain knowledge of the current leaching fractions achieved in south Delta soils under alfalfa culture.

Research Project:

Leaching Fractions Achieved in South Delta Soils under Alfalfa Culture (2013-2015)

Site	Water Source	Soil Series
1	San Joaquin River	Merritt silty clay loam
2	Old River	Merritt silty clay loam
3	San Joaquin River	Merritt silty clay loam
4	Middle River	Merritt silty clay loam
5	Paradise Cut	Grangeville fine sandy loam
6	Grant Line Canal	Grangeville fine sandy loam
7	North Canal	Ryde clay loam

Results

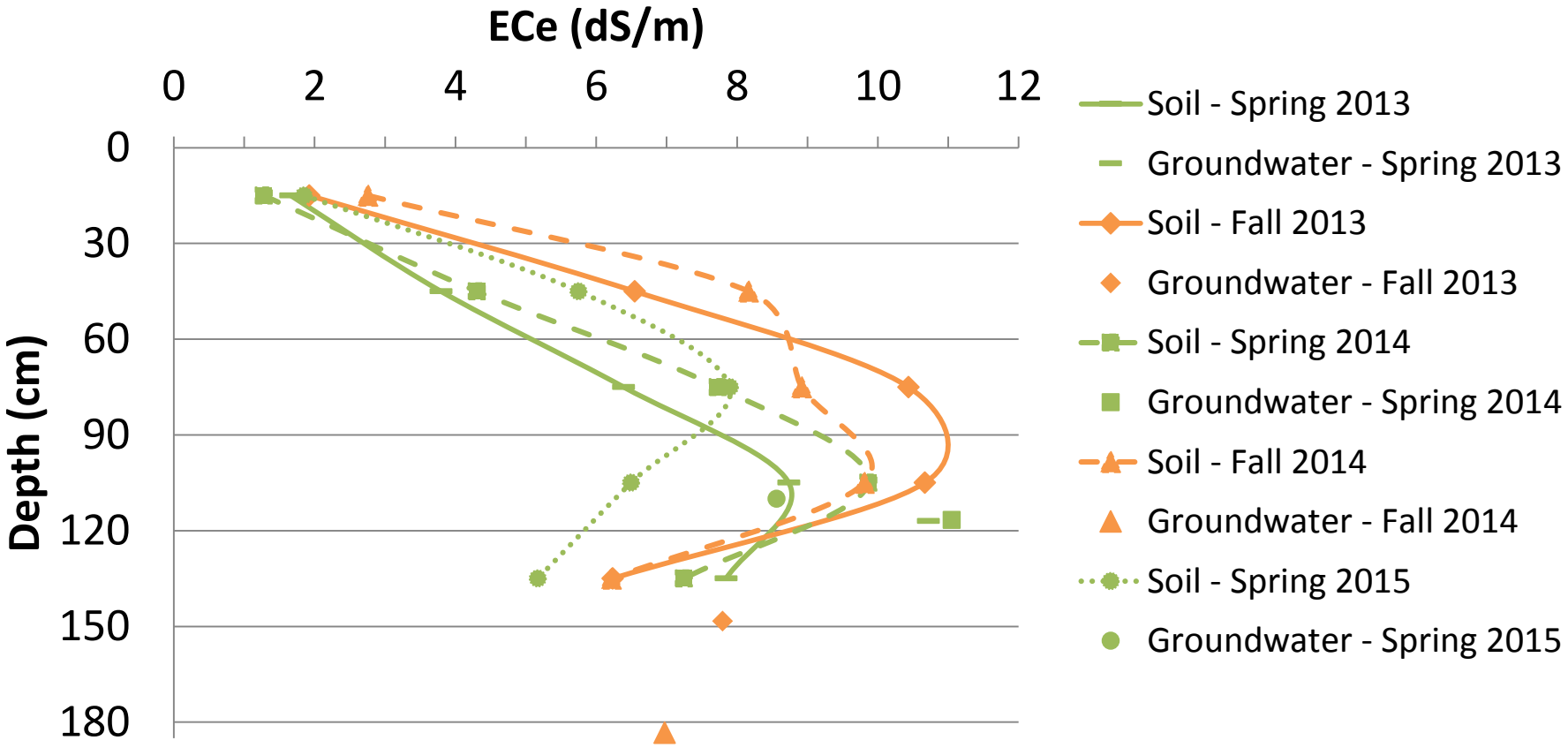
Site	2013 RZ Dep (cm)	2013 ECe† (dS/m)	2013 ECw* (dS/m)	2013 Lf (%)	2014 RZ Dep (cm)	2014 ECe† (dS/m)	2014 ECw* (dS/m)	2014 Lf (%)
1	100	11.2	0.54	3	120	9.8	0.54	3
2	150	14.1	0.74	3	130	9.8	0.88	5
3	140	1.4	0.57	21	140	1.2	0.40	18
4	150	9.5	0.47	3	120	10.7	0.57	2
5	130	3.6	1.78	25	130	4.1	1.93	26
6	120	8.1	0.85	6	130	9.8	0.87	5
7	140	3.1	0.36	7	150	3.8	0.49	8

†Salinity of the soil saturated paste at the base of the root zone.

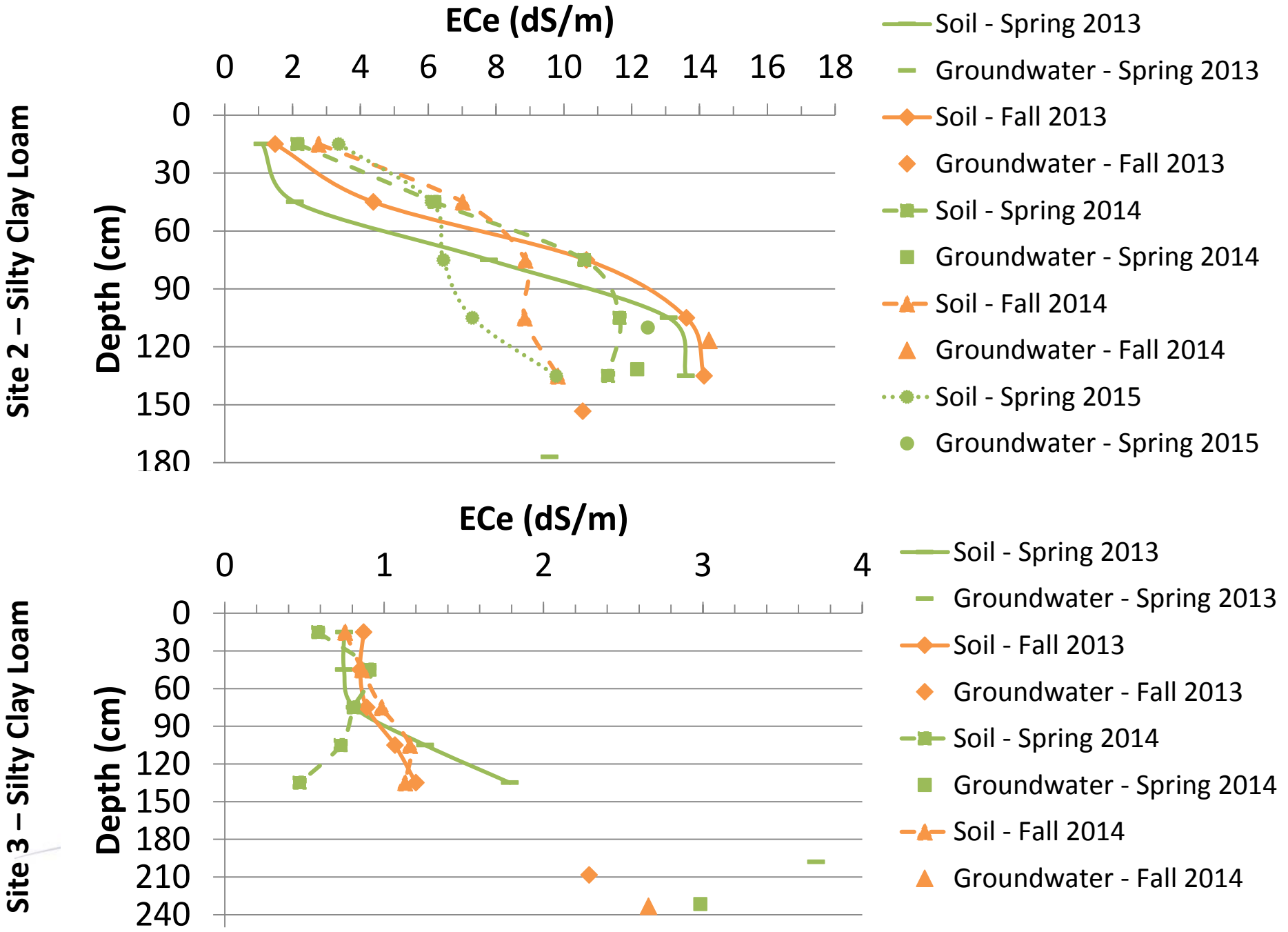
*Seasonal average applied water salinity.

Results

Soil Salinity – Site 1 – Silty Clay Loam

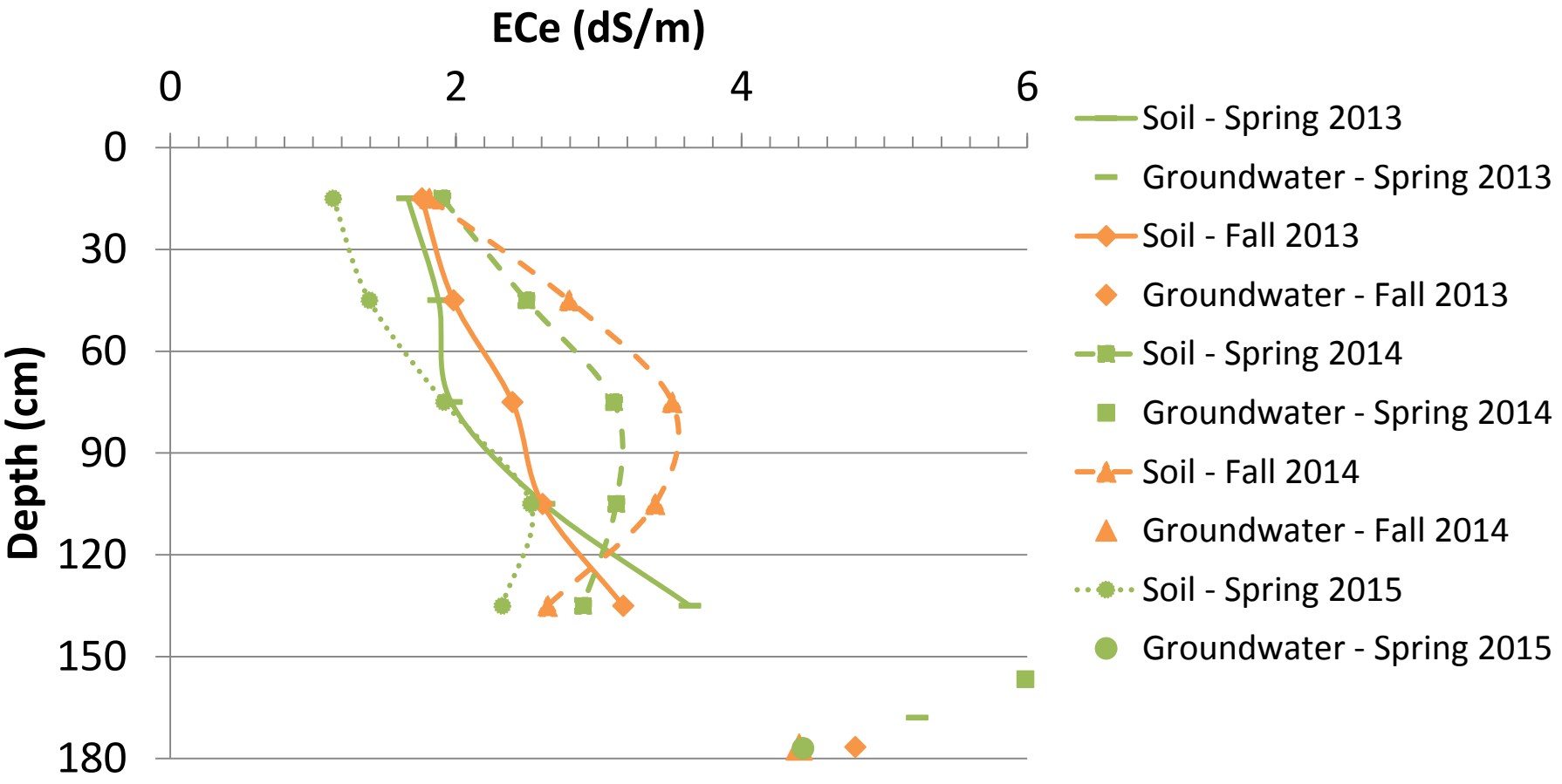


- Soil salinity increased from spring to fall in both 2013 and 2014.
- Shallow spring groundwater appeared to be impairing leaching .


Site 2 – Silty Clay Loam
ECe (dS/m)
0
2
4
6
8
10
12
14
16
18
Depth (cm)
0
30
60
90
120
150
180
Soil - Spring 2013
Groundwater - Spring 2013
Soil - Fall 2013
Groundwater - Fall 2013
Soil - Spring 2014
Groundwater - Spring 2014
Soil - Fall 2014
Groundwater - Fall 2014
Soil - Spring 2015
Groundwater - Spring 2015
Site 3 – Silty Clay Loam
ECe (dS/m)
0
1
2
3
4
Depth (cm)
0
30
60
90
120
150
180
210
240
Soil - Spring 2013
Groundwater - Spring 2013
Soil - Fall 2013
Groundwater - Fall 2013
Soil - Spring 2014
Groundwater - Spring 2014
Soil - Fall 2014
Groundwater - Fall 2014

Results

Soil Salinity – Site 5 – Fine Sandy Loam



- Highest seasonal applied water salinity, but lower root zone salinity compared to other sites. This soil was more easily leached than the clay loam soils.

Results

	2013		2014	
Site	Number of Cuttings	Annual Yield (tons/acre)	Number of Cuttings	Annual Yield (tons/acre)
1	6	8.2	6	5.6
2	6	11.9	6	9.3
3	6	8.3	7	4.4
4	6	8.1	6	5.4
5	5	9.8	5	9.2
6	6	10.4	6	8.2
7	6	8.4	6	7.8

Conclusions

- Salinity is a problem in the Delta because soils have low permeability, surface irrigation water may be degraded, saline groundwater is shallow, and elevation is below sea level.
- Under current water quality conditions, data illustrate that achieved leaching fractions are low and salts are building up in the soil to levels that have the potential to reduce crop yields.
- The Delta's unique growing conditions and best management practices put constraints on growers' ability to leach salts.
- Salinity will continue to impact Delta agriculture, especially under conditions of limited water supplies or higher surface water salinity.