COLORADO STATE UNIVERSITY EXTENSION

Lab and Field Evaluation of Biopolymer Sealants to Control Seepage from Earthen Irrigation Canals

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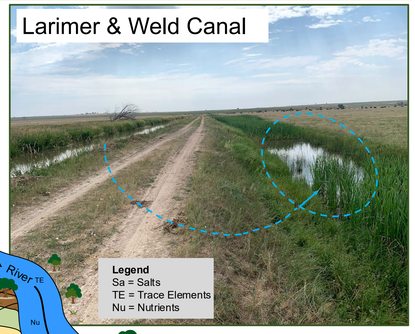
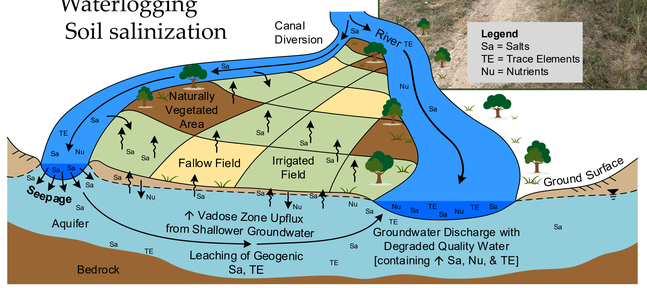
1 CANAL SEEPAGE

IMPACTS OF CANAL SEEPAGE

- Loss of intended water use
- Loss of water quantity (via evapotranspiration)
- Economic damages
- Agro-environmental Degradation
  - Waterlogging
  - Soil salinization





A conceptual schematic of water loss and negative environmental impacts from canal seepage

2 INTERNSHIP GOAL

Assist the agricultural community to boost the efficiency of irrigation water conveyance and to reduce adverse impacts of conveyance losses on crop productivity and the environment. This will be achieved through detailed evaluation of best practices in applying biopolymer sealants for canal seepage control.

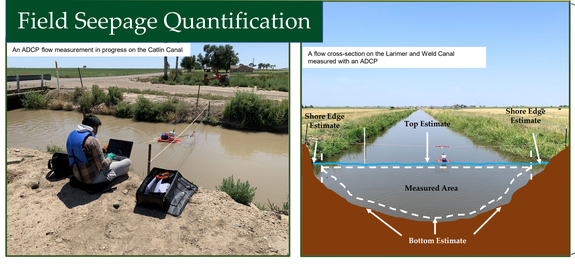
3 SUSTAINABLE AGRICULTURAL WATER MANAGEMENT

Permanent liners are costly and do not allow seepage when water is plentiful

Sealants cost significantly less and can be applied on an as-needed basis

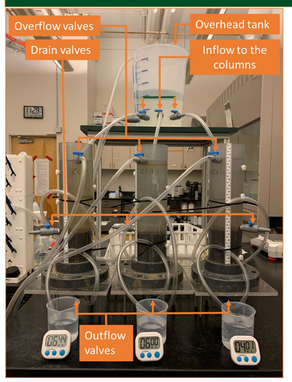
4 INTERNSHIP DEVELOPMENTS

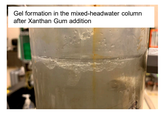
Field Seepage Quantification

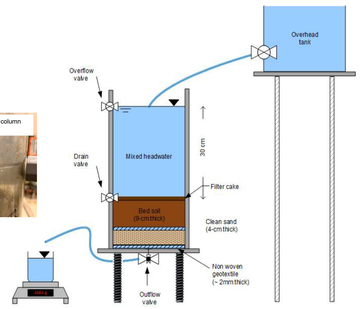


Conducting water balance on irrigation canals and using Acoustic Doppler Current Profiler (**ADCP**) devices for flow monitoring

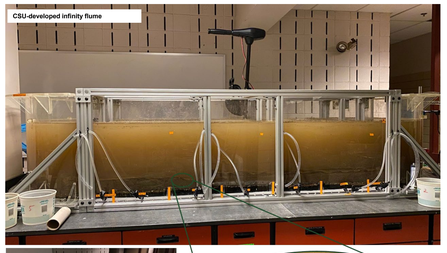
Lab Seepage Quantification

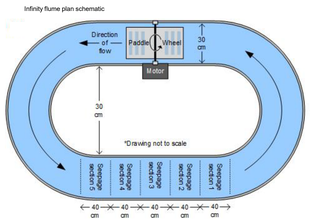


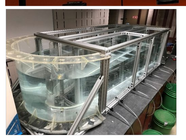


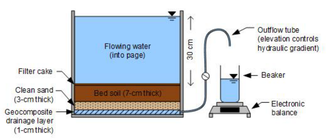


Mixed-Headwater Column Section View

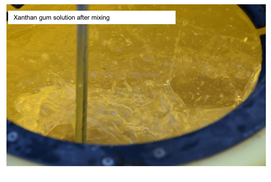






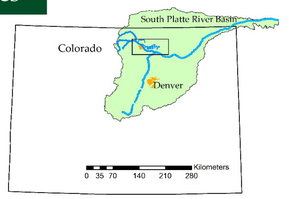


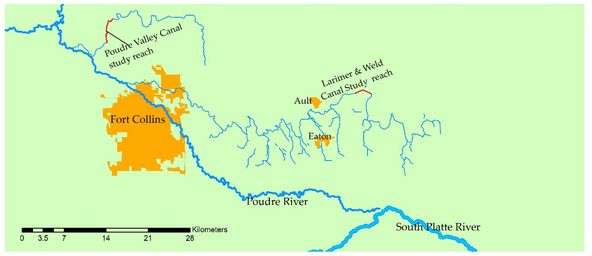
CSU field application of sealants



CSU polymer sealant studies

- Lab and field investigations
- Biopolymer sealants (Xanthan Gum)





5 FIELD RESULTS

Location	Year	Canal	Avg Pre-application seepage ($m^3/s/km$)	Polymer applied	Avg Post-application seepage ($m^3/s/km$)	Percent reduction in Seepage
Colorado, USA	2021	Larimer & Weld Canal	0.0654	Xanthan Gum (powder)	0.0191	71 (1 day)
Colorado, USA	2021	Poudre Valley Canal	0.0610	--	--	--
Colorado, USA	2022	Larimer & Weld Canal	0.075	Xanthan Gum (solution)	0.0247	67 (1 month)

6 SUMMARY OF FINDINGS

- Polymer sealants cost a fraction of the cost of traditional liners and can be easily applied during the periods of water stress to mitigate canal seepage loss
- Biopolymer sealants enhance environmental protection, exhibit encouraging seepage reduction rates and ensure a healthy and sustainable agricultural water cycle.
- The research conducted in 2021 and 2022 revealed that treating the canals with Xanthan Gum can reduce seepage by 67-71%. The results are summarized in the table under section 5.

7 NEXT STEPS

- Continuing laboratory column and flume test under a wider variety of conditions (varying soils, water sediment concentrations, polymer application rates, etc)
- Finding the easiest and most effective method of applying the polymer to the flowing canal
- Assessing economic costs and benefits

8 REFERENCE

Lund, A. R., Martin, C. A., Gates, T. K., Scalia IV, J., & Babar, M. M. (2021). Field evaluation of a polymer sealant for canal seepage reduction. *Agricultural Water Management*, *252*, 106898.