Evaluation of Almond Shell Mulch Application to Established Alfalfa Fields

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Delta Crops Grower Meeting

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Project Background:

- Can established alfalfa fields serve as a sink for almond shell by products without affecting stand productivity?
- Alfalfa—deep rooted legume, fixes nitrogen
- Established stands selected because of risk of N immobilization at soil surface where high-carbon shells applied.

Project Methods:

Control	Gypsum	Almond Shells	Control
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- Treatments applied to same plots for 2 years
- 3-year-old stand at project start

Project Methods:

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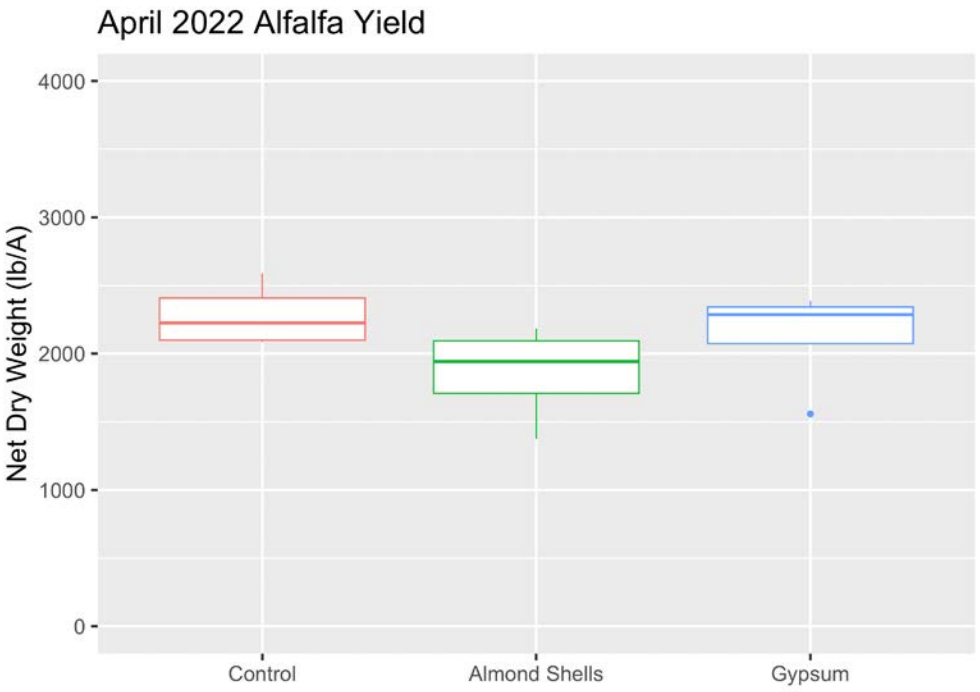
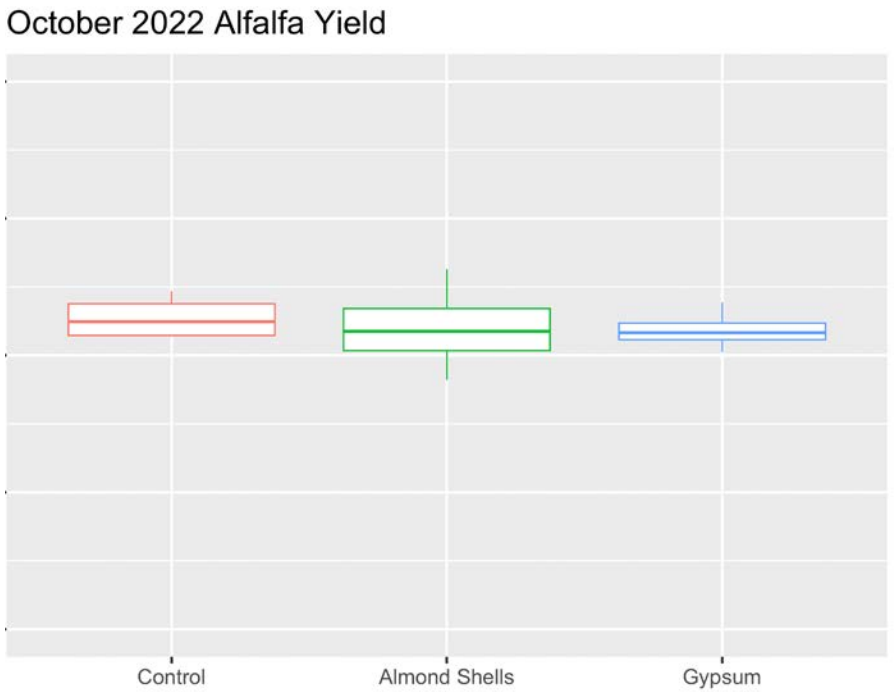
- Treatments applied to same plots for 2 years
- 3-year-old stand at project start
- Yr 1: treatments applied on October 6th
  - shells at 4-8 tons/ac, gypsum at 2 tons/ac
- Yr 2: treatments applied on November 19th
  - shells 12.5 tons/ac and gypsum 3.3-3.9 tons/ac

Yields trend lower with shells in spring possibly due to spring tie up of N for feeder roots. Slightly higher in October. Not statistically significant.





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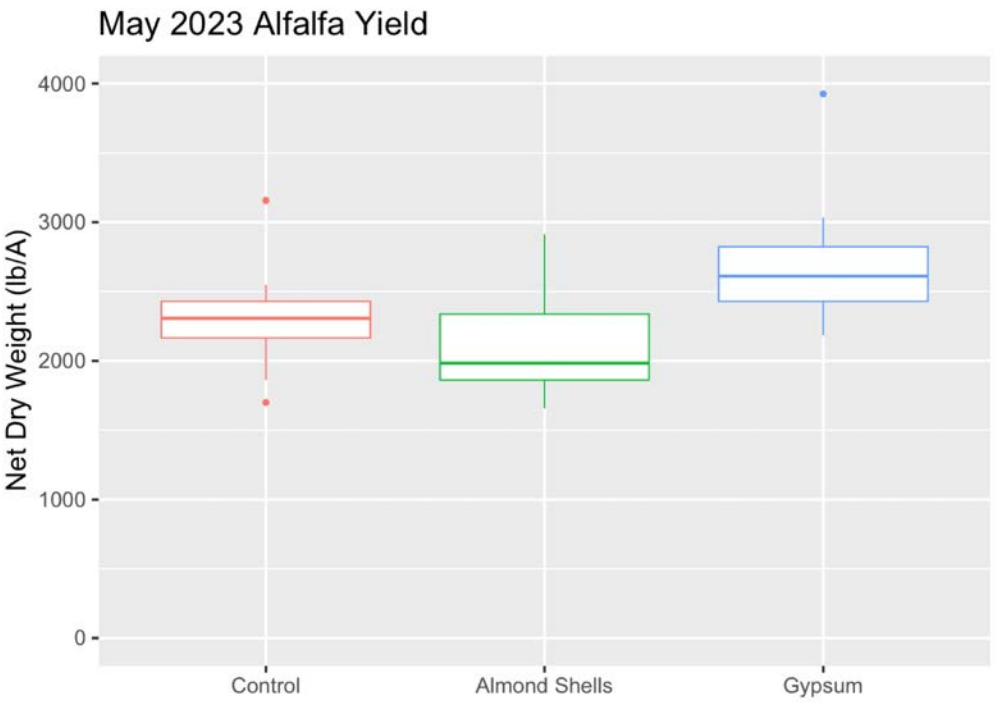
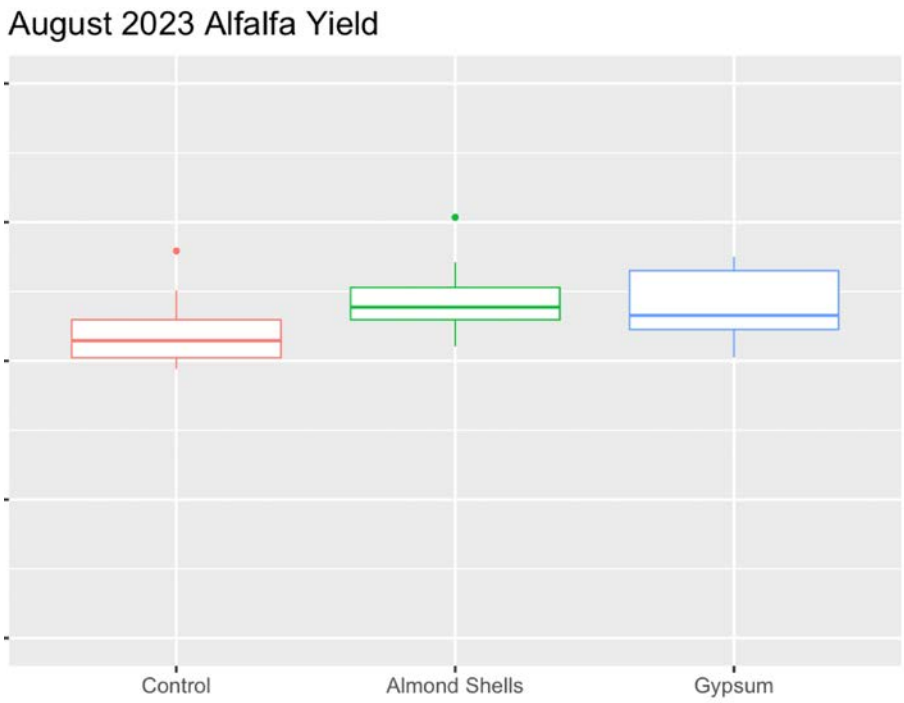
Similar yield trends in year 2. Yield with shells is slightly higher in the summer though no statistically significant differences for any cutting.





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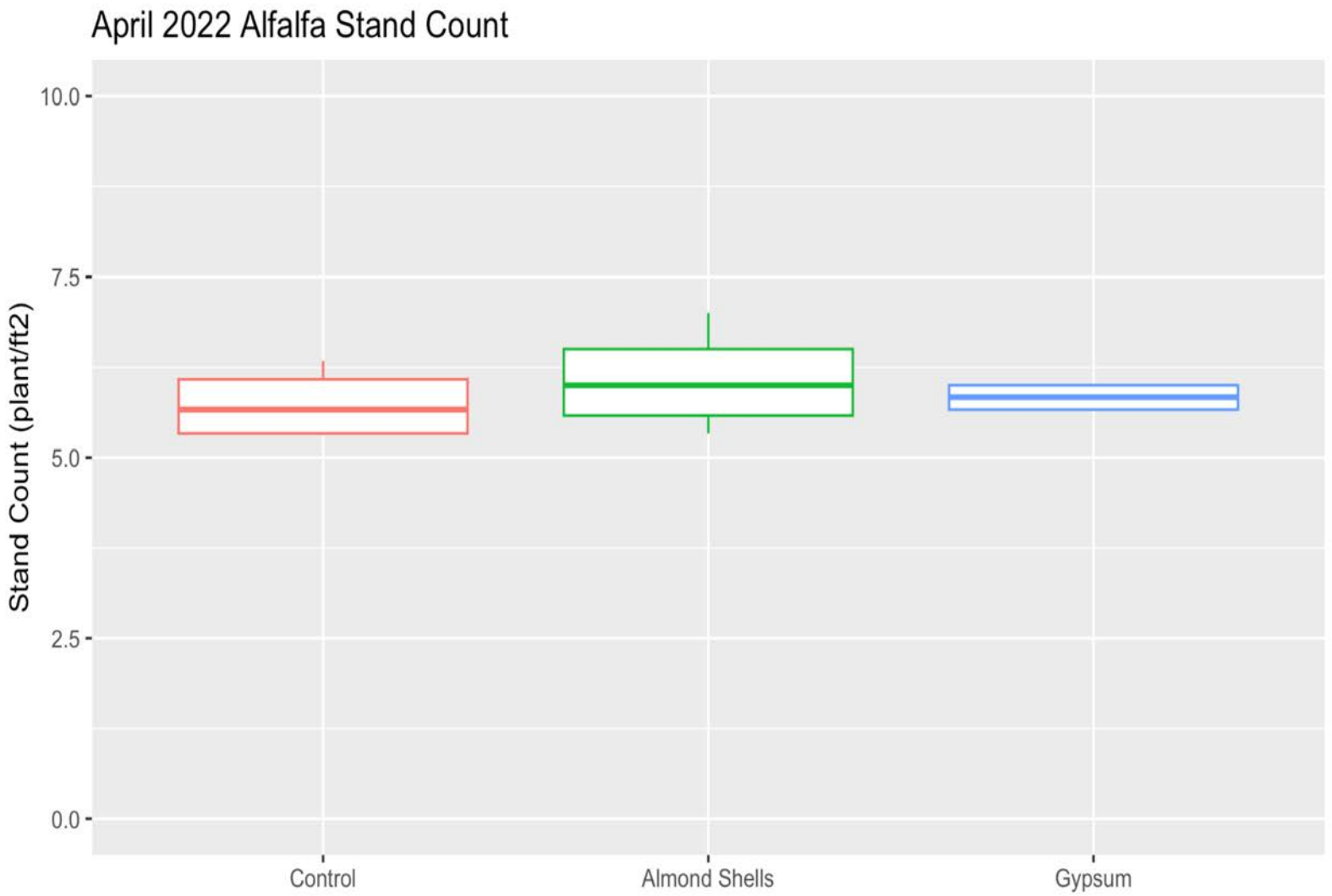
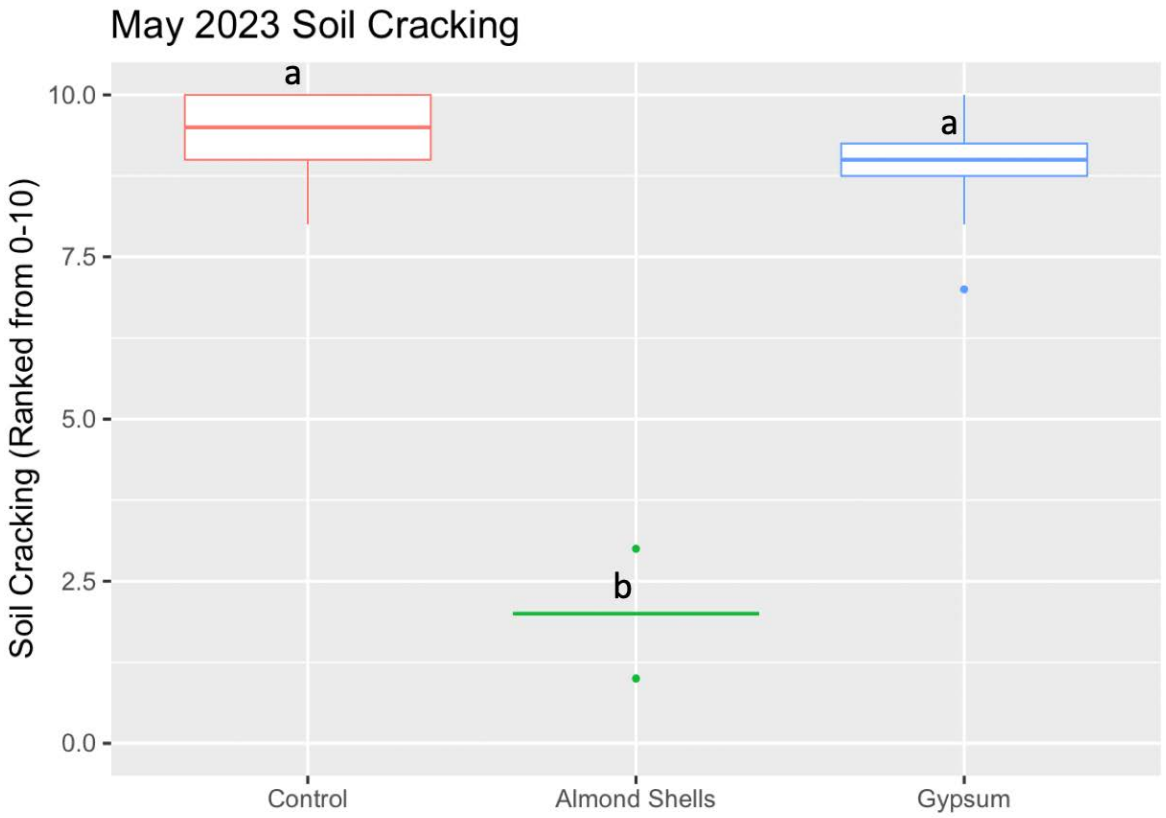
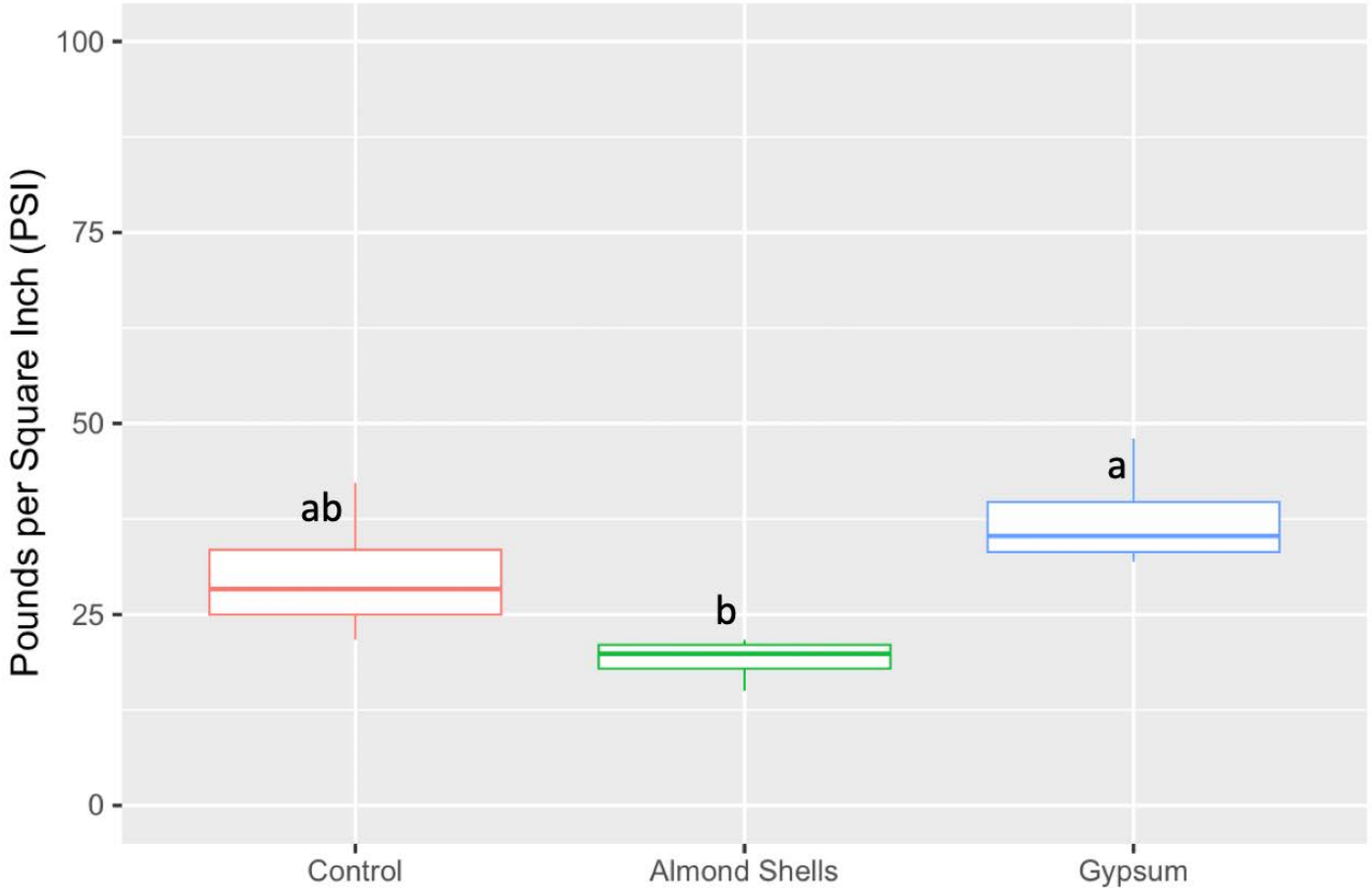
No differences in stand vigor or weed pressure



Soil cracking can tear plant roots and is a soil health indicator. Shells significantly reduced soil cracking on 4 measurement dates.



Soil compaction was reduced in the top 3” of soil after 2 years of almond shell application. Bulk density and aggregate stability were not changed.



Data collected in September 2023

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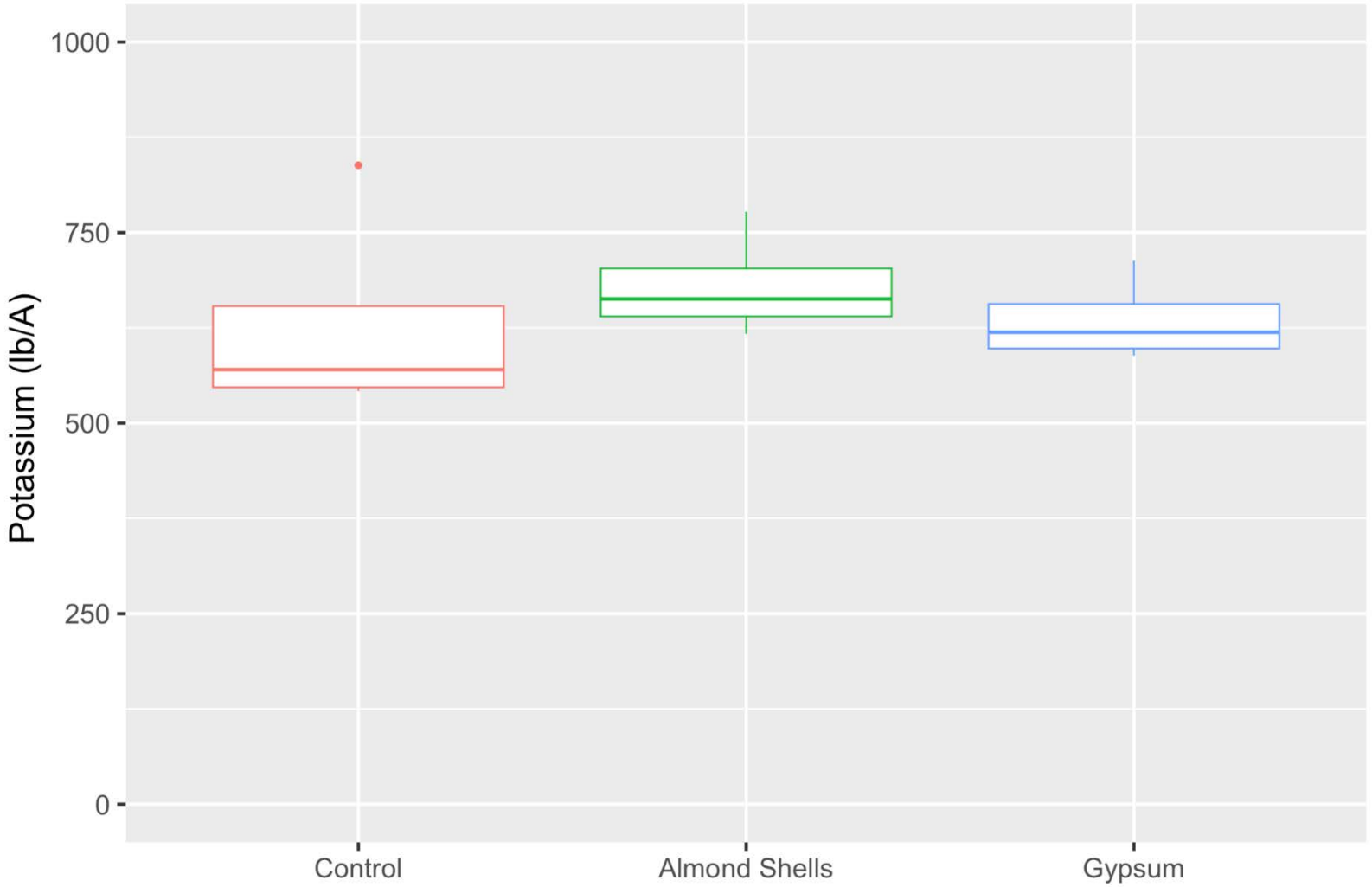
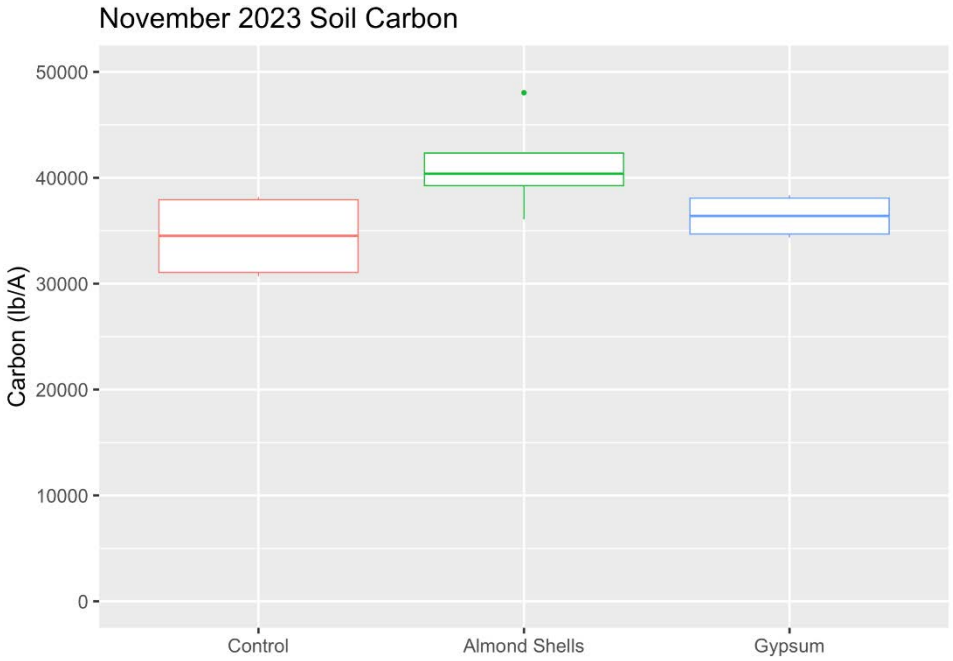
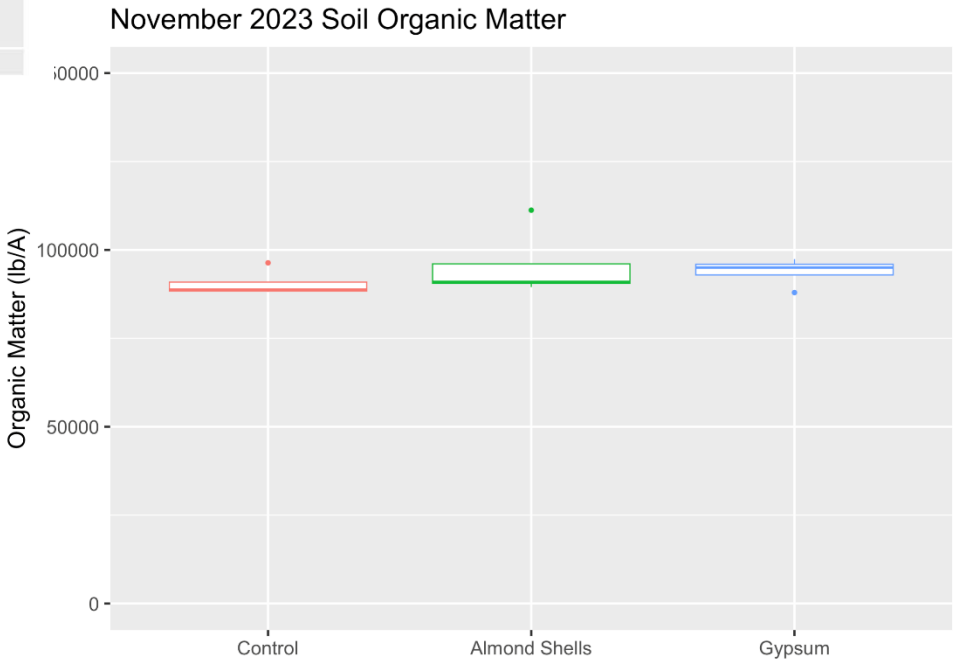
Almond shell byproducts have about 30 lbs K/ton, which can eventually leach into the root zone as shells decompose. More K with shells (top foot) but not statistically significant.



Data collected in November 2023

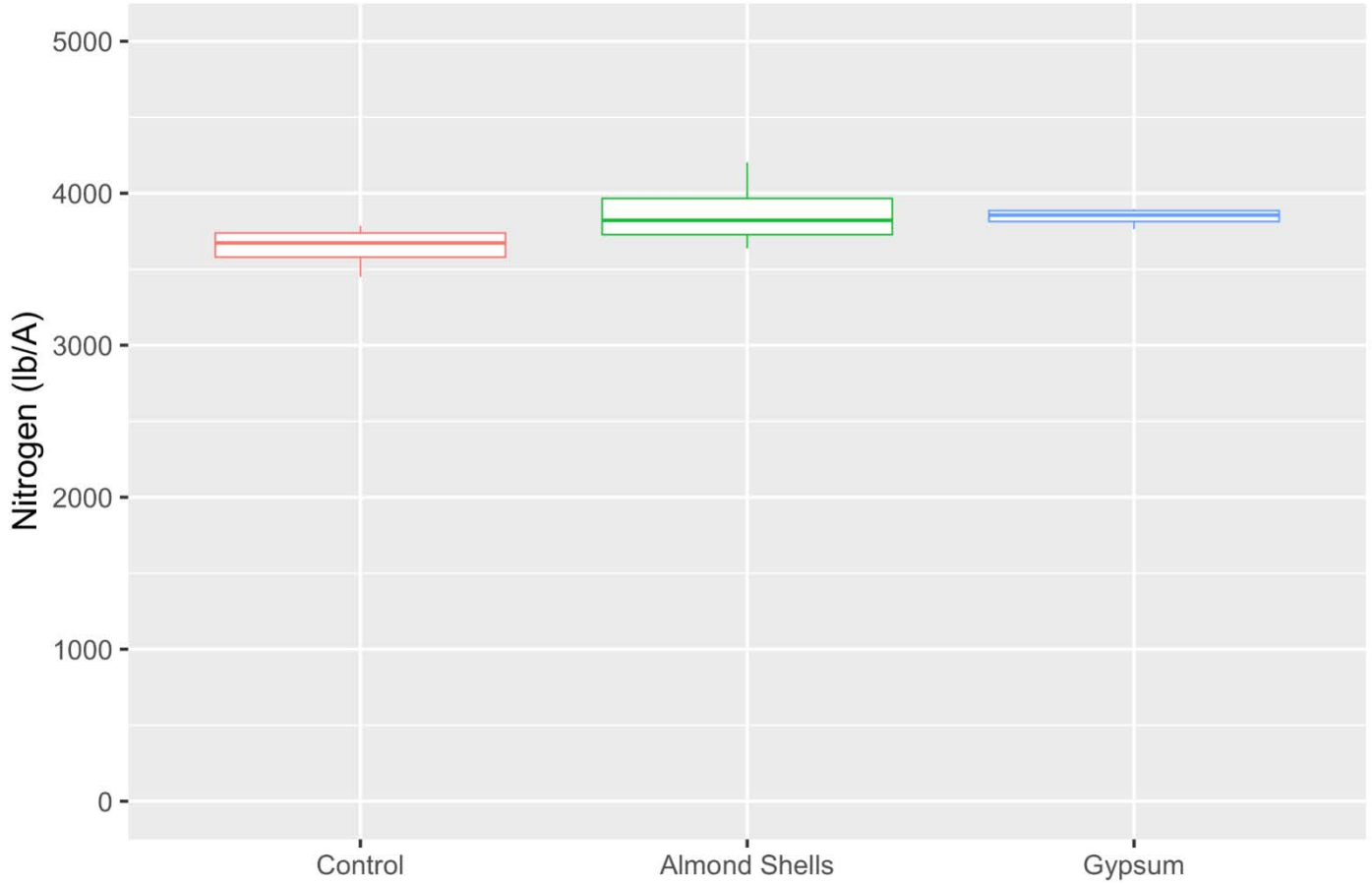
Soil carbon and organic matter were higher in almond shell plots, but differences were not statistically significant.





Data collected in November 2023

Other soil fertility measurements like cation exchange capacity (CEC), total N, magnesium, calcium, and pH were not affected by treated.



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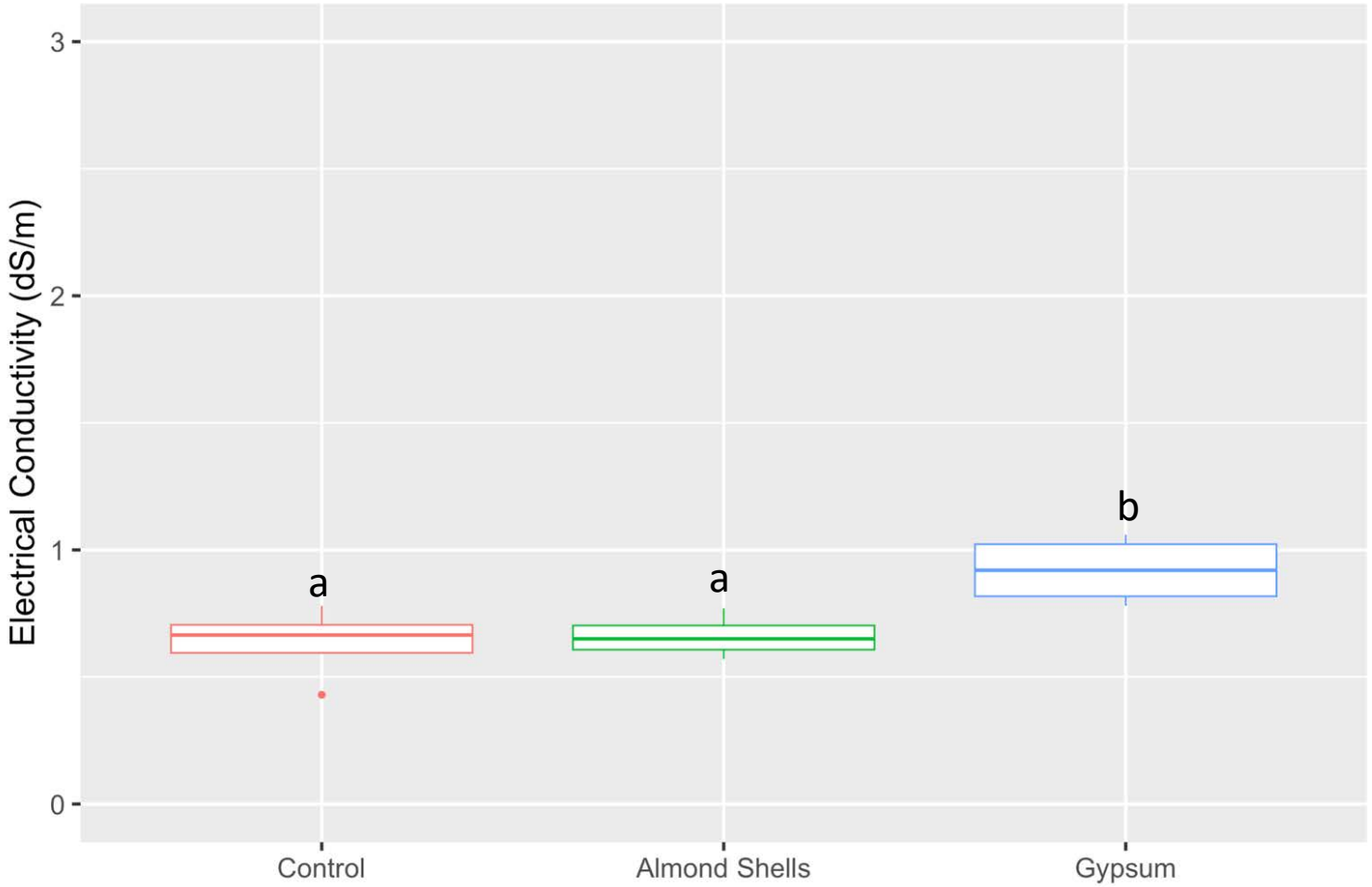
Gypsum is a highly soluble salt, and electrical conductivity (EC), which measures salinity was significantly higher with gypsum application than shells or control.



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Water infiltrated fastest with shells for all 4 inches (Dec 2023). Statistically significant for 4th inch only.

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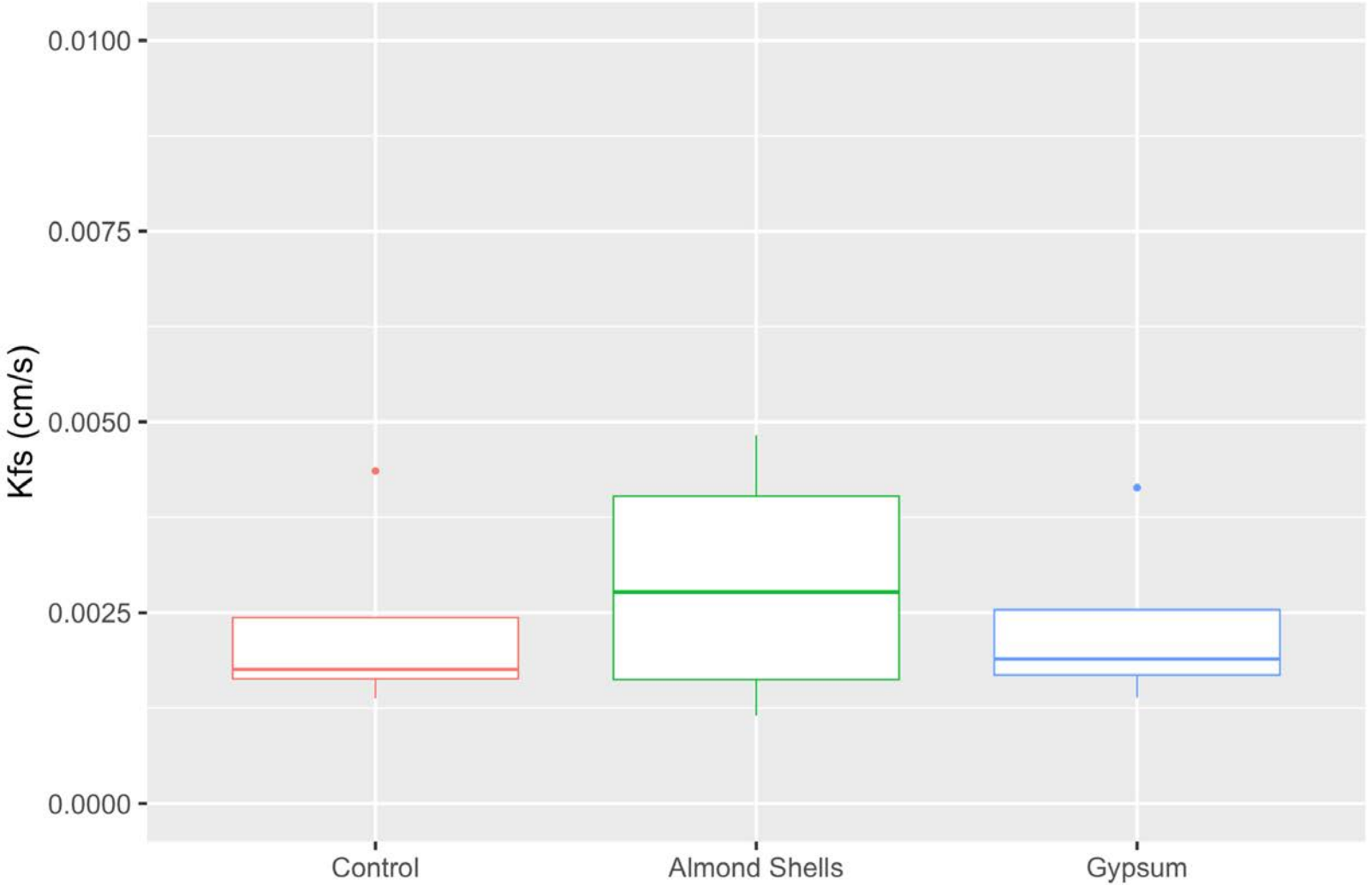
Saturated hydraulic conductivity – the rate the water moves into saturated soil – was fastest with almond shell plots. Not statistically significant.



Data collected December 2023

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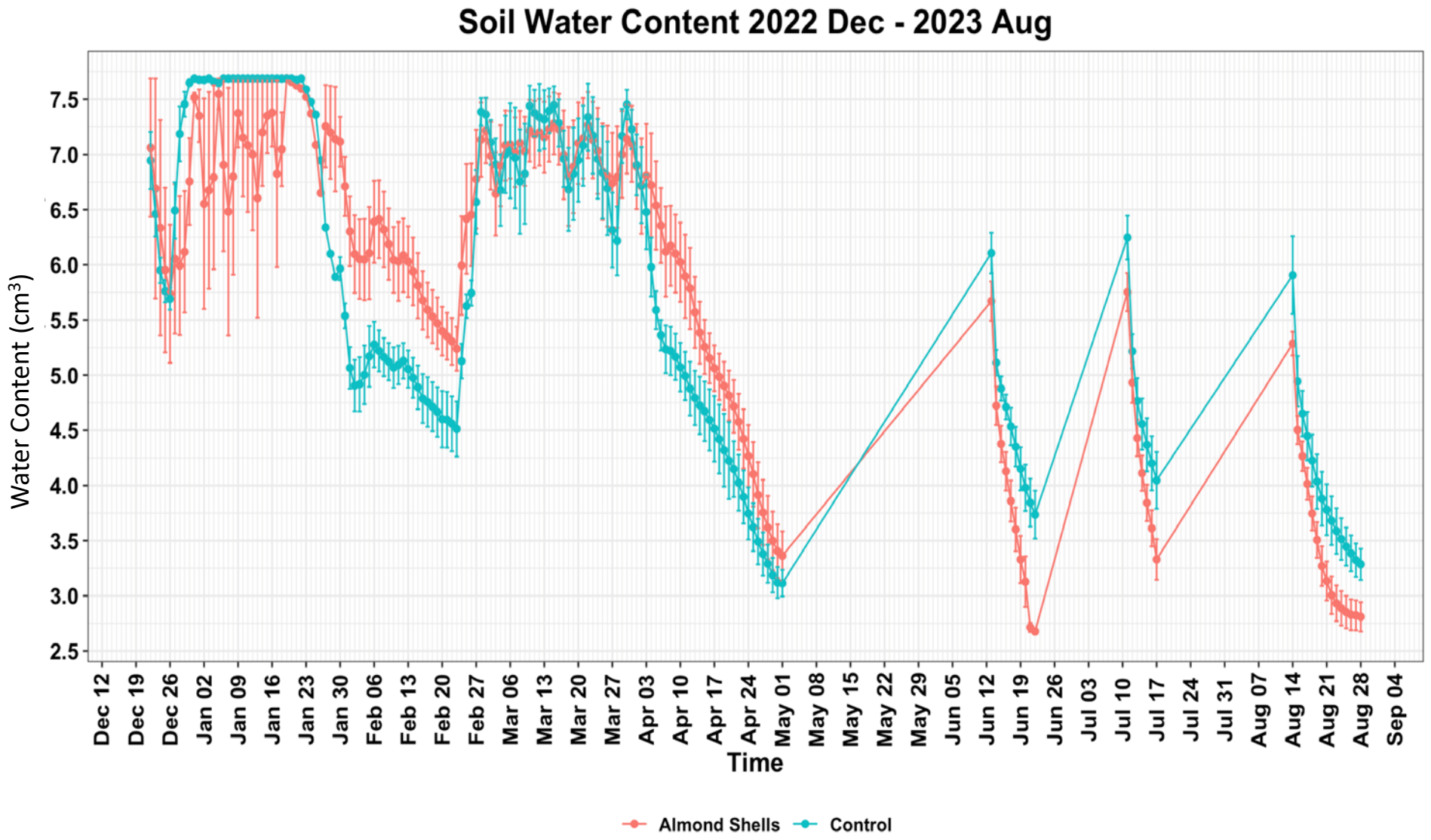
Water volume slightly higher in almond shell plots in winter. Slightly lower (0.5cm) in summer. Alfalfa yields proportional to available water and yields were slightly higher with shells.



Project Summary and Conclusions

- Shell application to established alfalfa does not appear to affect overall stand productivity.
- Soil health metrics such as soil cracking, compaction, and soil water properties were improved with almond shell application.
- This project was an initial evaluation and did not quantify the optimum application rate.

Project Summary and Conclusions

- Alfalfa may provide an opportunity to divert almond shells and shells are free (vs compost) but order early.
- Since shells are not incorporated, any N tie up would be slow, and only at soil surface.
- Shell incorporation prior to planting is not recommended due to N tie up. Do not apply shells to 1st year stands.

Application considerations

- Almond shells are bulky and very lightweight, which can be challenging to spread. Shells are a dry material (6.5% moisture). Transportation costs are not lost to water weight. More than one truckload/field may be needed for soil coverage.
- Freight ($10/ton within 50 miles) and spreading ($15/ton) costs are high. Costs may not be worth it given lack of measurable changes to soil fertility/yield.

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Thank you!
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