SOIL HEALTH RESPONSES TO RECLAIMED WATER IRRIGATION, AND NUTRIENT LEACHING FROM PINE BARK AMENDMENTS

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INTRODUCTION

- Reclaimed water (RW) is the future of agricultural irrigation.
- RW contains constituents of concern (CECs) such as salts, nutrients, heavy metals etc.
- Commercial blueberry production utilizes RW + Pine bark (PB)
- PB = leaching ≠ environmental safety

OBJECTIVES

- To quantify and compare nutrient leaching from native soil and pine bark amendments under RW irrigation in greenhouse-grown blueberries

HYPOTHESES

- RW leachates will have greater nutrient load (i.e., CECs) than ground water leachates
- PB substrates will have higher leachate volume and consequently, greater leachate nutrient load

MATERIALS AND METHODS

Treatments:

- Ground Water (GW)
- Recl. Water 1 (RW1)
- Recl. Water 2 (RW2)

Native soil (S)

Pine bark (P)

1:1 S_P

Design (Greenhouse):

- RCBD - 5 replicates
- Drip irrigation; Fertigation (20-20-20)
- Test plant: blueberries

Source: Sandoval et al. 2013

Leachate analysis:

- NO_3, PO_4 and NH_4 load (AA3 autoanalyzer)
- Leachate outflow volume

Data analysis in R:

- Log transformation
- Analysis of variance
- Tukey HSD test ($p \leq 0.05$)

Table 1. Property of water samples

Properties	GW	RW1	RW2
NH_4 (mg/l)	0.0595	0.077	0.05
NO_3 (mg/l)	0.666	3.525	3.225
PO_4 (mg/l)	0.6255	26.28	1.88
pH	8.28	7.865	8.2
ECw (ds/m)	0.437	0.731	0.8025
SAR	0.39	3.96	3.615

RESULTS AND DISCUSSION

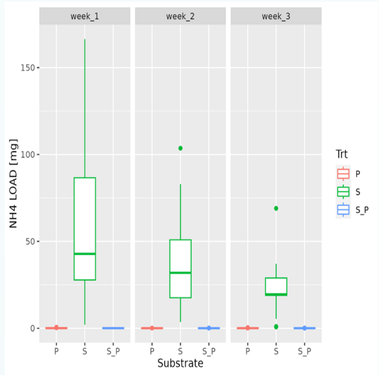

Fig. 1. Effect of substrate and time on NH_4 leaching

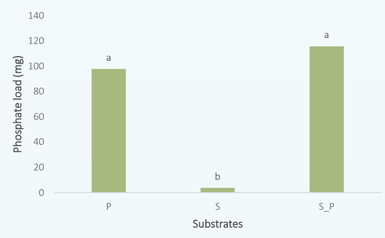

Fig. 2. Effect of substrate on PO_4 leaching

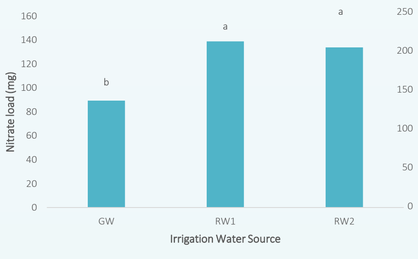

Fig. 3. Effect of water source on NO_3 leaching

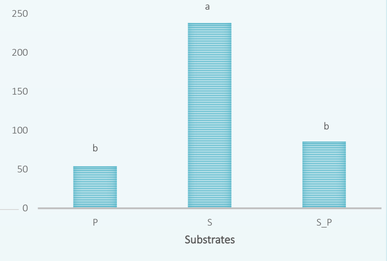

Fig. 4. Effect of substrate on NO_3 leaching

Ammonium leaching

- S > P = S_P: organic amendments improves cation retention
- The effect of substrate type on NH_4 leaching was affected by time
- By the end of week 3, the NH_4 load in the soil leachates had significantly decreased by 16.8%

Phosphate Leaching

- Only substrate type had significant impact on PO_4 load
- S < P = S_P: pine bark treatments have large pores

Nitrate Leaching

- Water source and substrate type had significant impact on NO_3 leaching
- GW < RW1 = RW2: high inherent [NO_3]
- S > P = S_P: pine bark treatments showed less NO_3 leaching

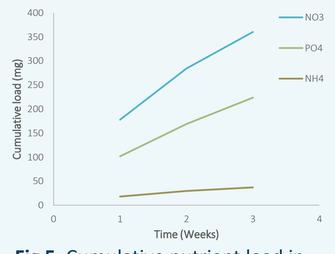

Fig 5. Cumulative nutrient load in leachates

CONCLUSION

- PB amendment triggered PO_4 leaching but favored NO_3 retention
- As hypothesized, PB had a 17.6% greater leachate volume ($p<0.05$) than native soil due to its large pores
- Load: $NO_3 > PO_4 > NH_4^+$ (Fig. 5)
- NO_3 load in GW ≠ RW therefore, source of water affects leachate quality
- CECs in RW contributed to the NO_3 load in the leachates

RECOMMENDATIONS

- For environmental safety, BMPs in pine bark management should be given greater attention and awareness
- We recommend that critical levels of CECs in RW should be standardized, and treatment protocols/processes should be tailored to achieve these critical levels on a national scale.

FUTURE WORK

- Continue to monitor nutrient loads in leachate samples over a year time frame
- Study how RW irrigation impacts C and N mineralization, and microbial community structure of treatments.

REFERENCES

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- Toor, G. S., & Lusk, M. (2011). Reclaimed water use in the landscape: constituents of concern in reclaimed water. *EDIS*, *2011*(2).