An Update on IFAS Development of Nutritional and Irrigation Guidelines for Profitable Bamboo Production in Florida

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Background information

1. A considerably high number of growers exploring alternatives to the citrus HLB endemic situation.

2. No existing best management practices (BMPs) on bamboo farming adapted to Florida.

3. The need to develop and establish recommendations on fertilizer use in bamboo based on Florida soils for quality production.

Objectives of first study

For Nitrogen (N) and Phosphorus (P)

1. Compare growth rates of young asper bamboo plants in response to four different N and P.
2. Evaluate culm diameter, leaf chlorophyll content, and culm production trends in young asper bamboo.
3. Determine the optimum rate of N and P for the best asper bamboo performance.

Experimental setup

- Experiment unit: 1 pot
- N study experiment units: 20 pots
- P study experiment units: 20 pots
- Repetitions in each study: 5
- Study duration: 5 Months
- Peat moss (80%) and perlite (20%)

N Study

P Study

Experimental setup

Treatment description

Phosphorus (P) study		Nitrogen (N) study	
Rate (Lb./ac P)	Repetitions	Rate (Lb./ac N)	Repetitions
0	5	0	5
20	5	100	5
40	5	200	5
80	5	300	5

Experimental setup

Supplementary fertilizers applied And Irrigation

To the N study

- Applied ¼ lbs./pot of 0-20-20
- Onetime application, quick release

To the P study

- Applied 3/8 lbs./pot of 26-0-11
- Onetime application, slow release

Automated drip irrigation

- 8 L/h drippers were used

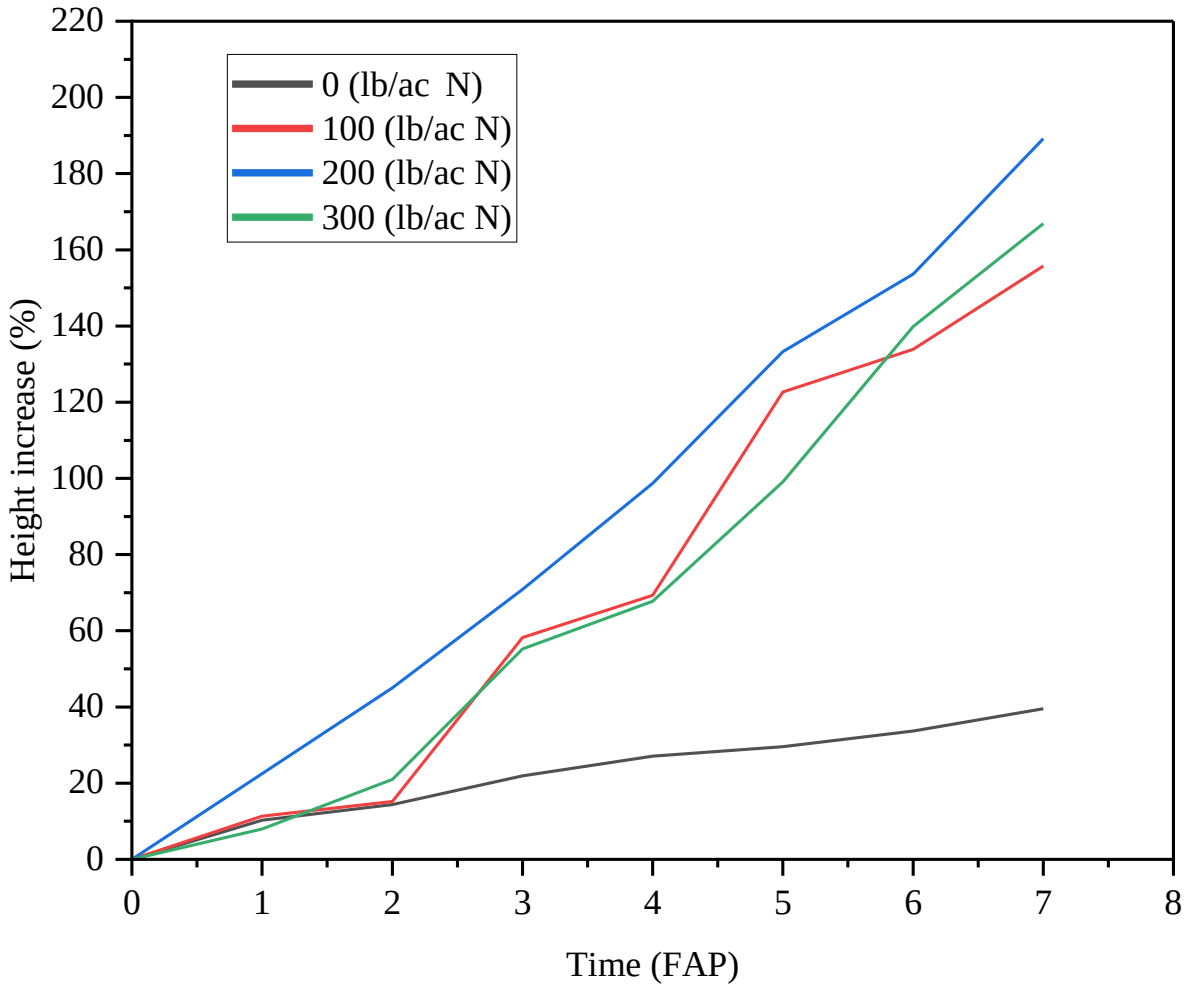
Variables

Measurements and periods

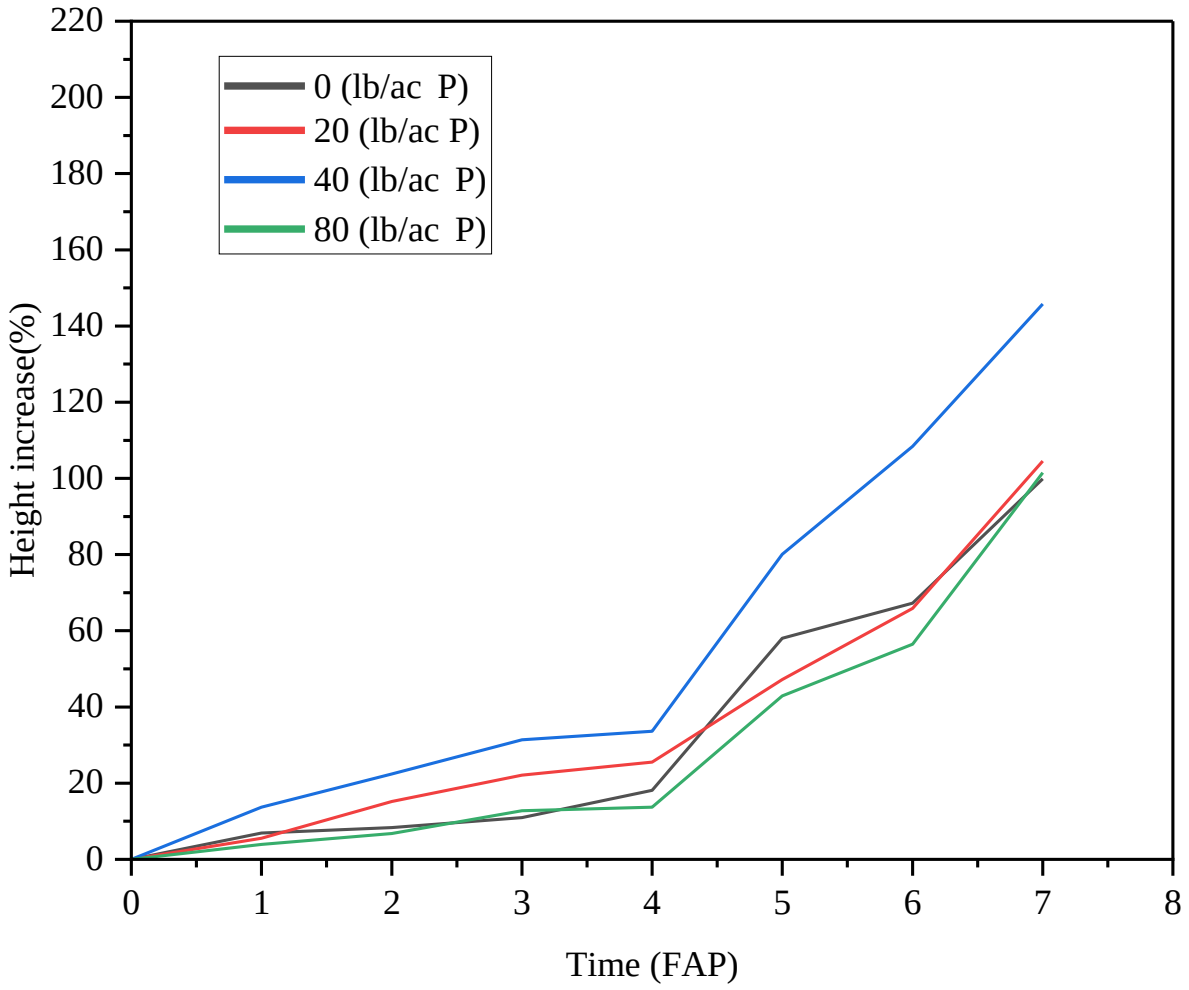
1. Average clump height, number of culms, and diameter were done biweekly.
2. One culm on each clump was identified and marked on a spot where the diameter was measured every time.
3. The number of culms per clump was counted before treatment application.
4. Tissue nutrient analysis and chlorophyll content were done monthly.
5. Total biomass was quantified at the end of the experiment.

Clump Height

N study



P Study



FAP=Fortnight After Planting

Differences in height, diameter & nutrient concentration

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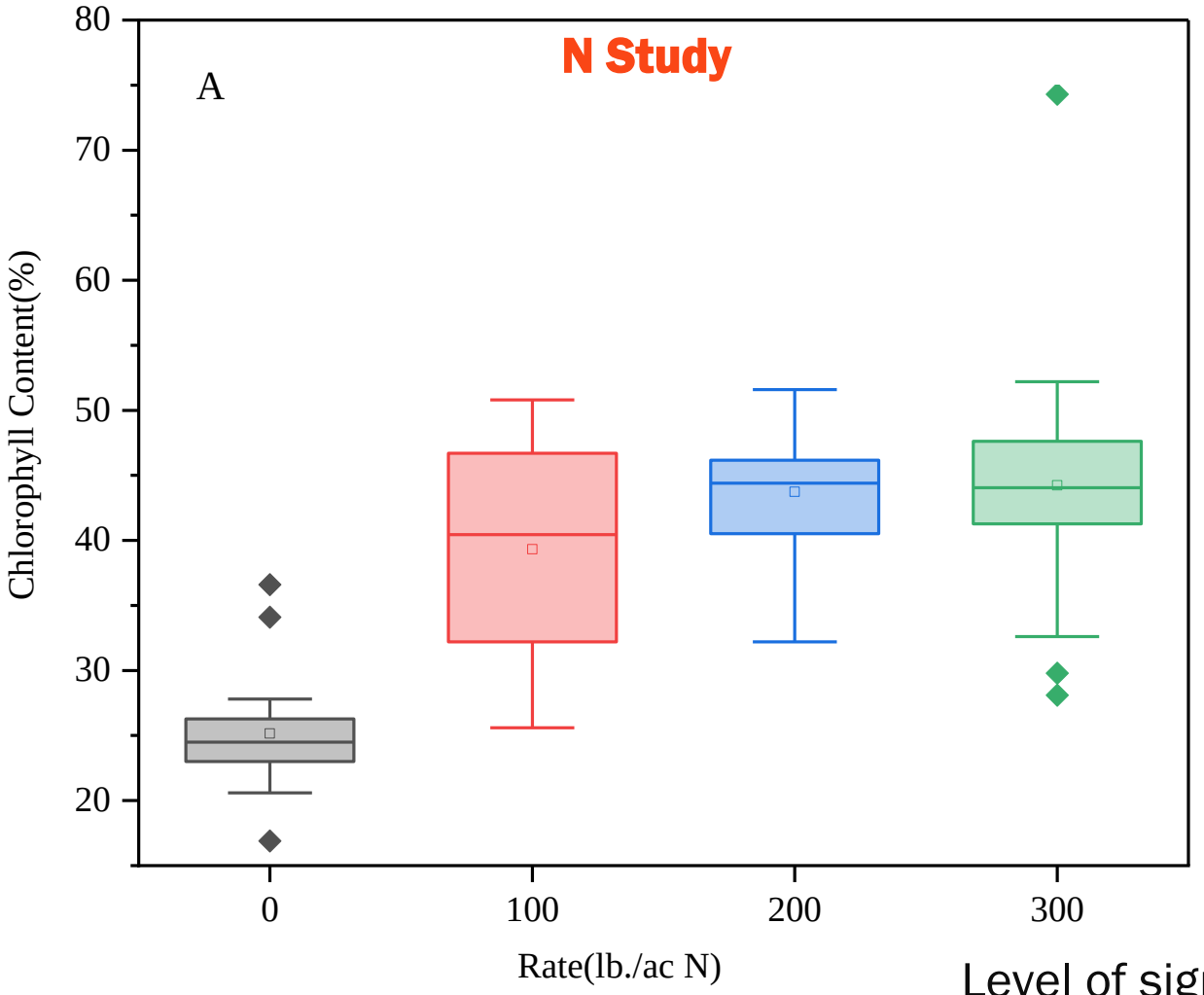
Nutrient	Rate	Clump Height	Culm diameter	Tissue Nutrient Concentration
	(lb./ac N)	(Inch)	(Inch)	N (%)
N	0	6.15 ± 0.73b	0.150 ± 0.0051b	2.16 ± 0.142b
	100	20.69 ± 2.82a	0.167 ± 0.0040ab	2.41 ± 0.150ab
	200	25.83 ± 3.21a	0.179 ± 0.00548a	2.72 ± 0.185ab
	300	20.88 ± 2.96a	0.164 ± 0.0046ab	2.81 ± 0.181a
	(lb./ac P)	(Inch)	(inch)	P (%)
P	0	10.56 ± 1.94a	0.190 ± 0.0073a	0.37 ± 0.078a
	20	12.49 ± 2.02a	0.173 ± 0.0050ab	0.36 ± 0.057a
	40	13.70 ± 2.20a	0.164 ± 0.0057b	0.33 ± 0.066a
	80	10.76 ± 1.99a	0.180 ± 0.0052ab	0.36 ± 0.069a

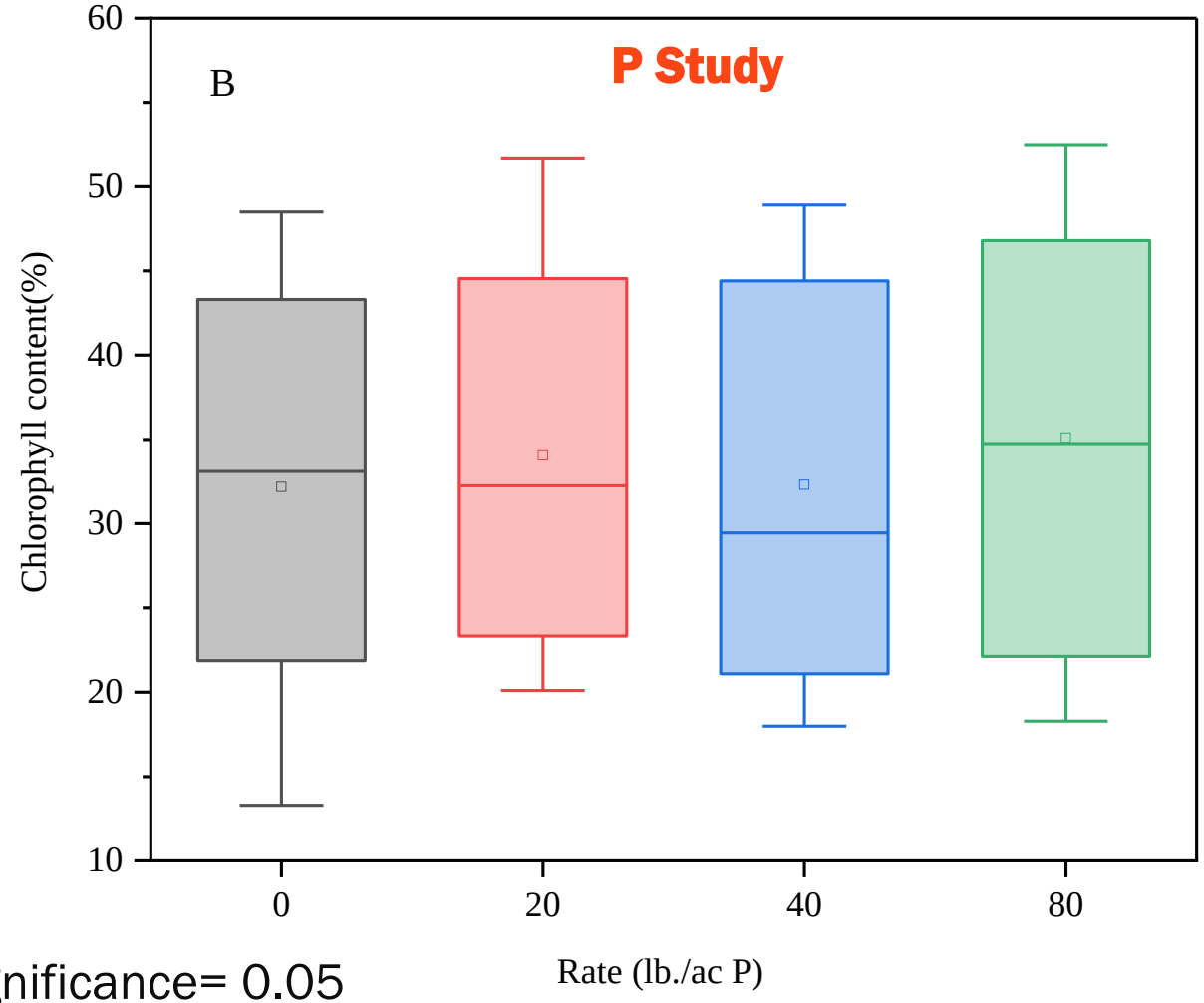
Level of significance= 0.05

Chlorophyll content

p=0.0001

p=0.848





Level of significance= 0.05

Culm production

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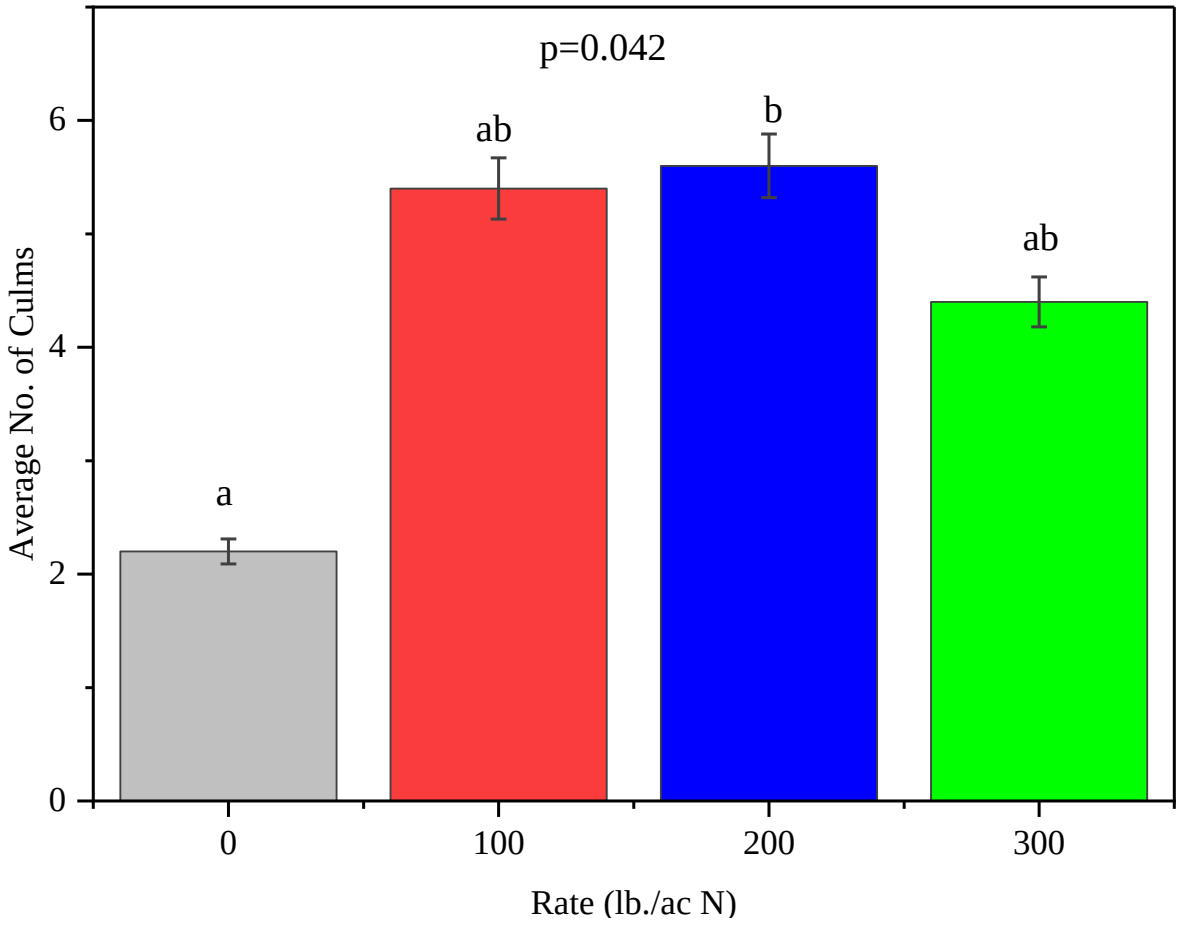
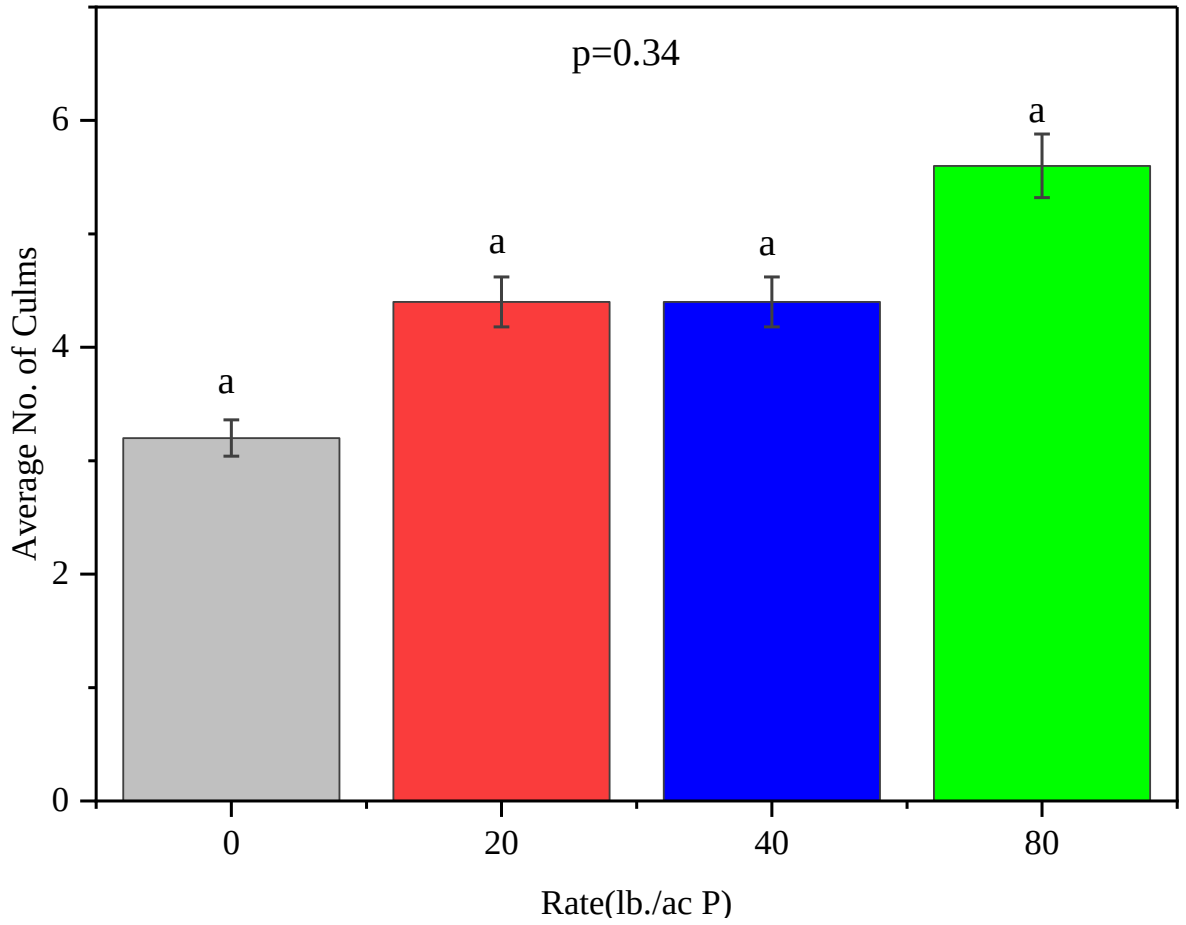
N Study



P Study



Level of significance= 0.05

Dry matter accumulation

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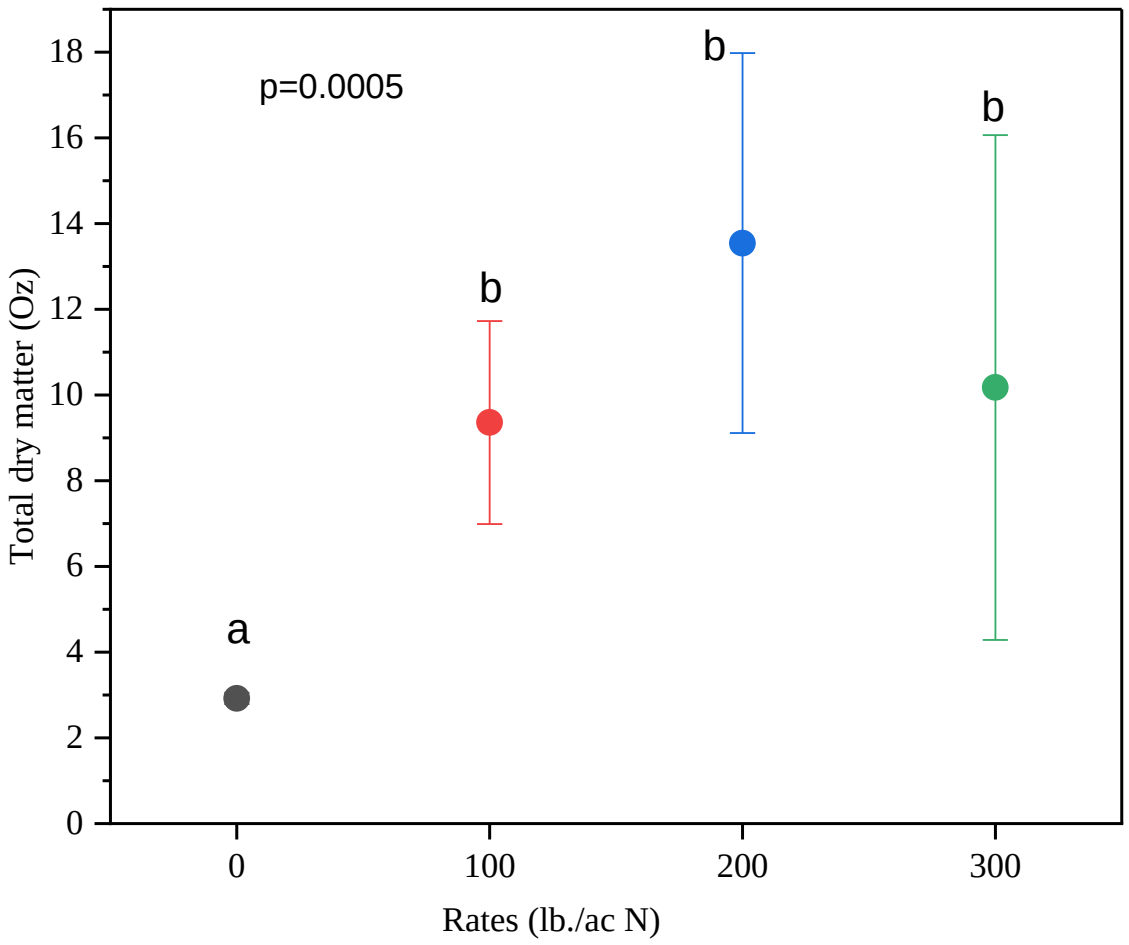
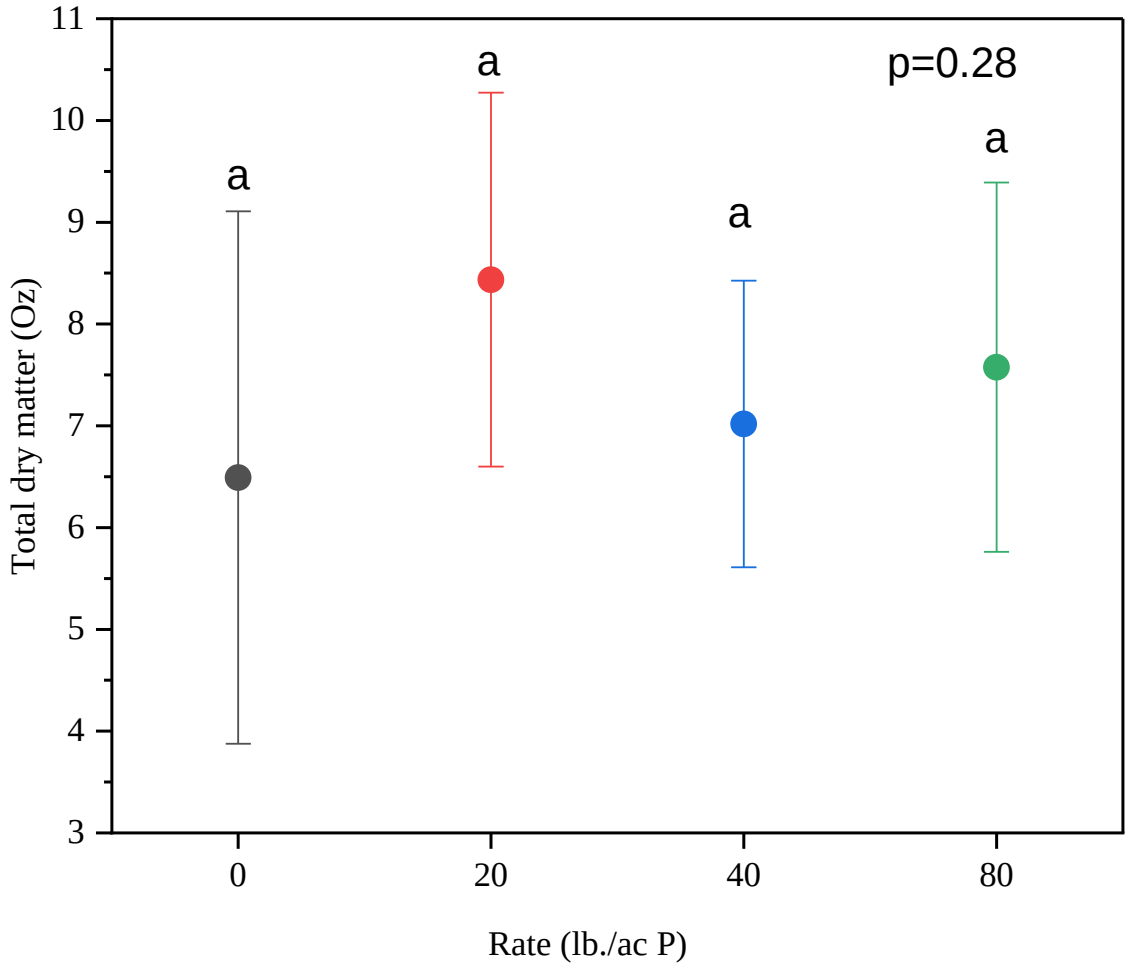
N Study



P Study



Level of significance= 0.05

Optimal N/P estimation

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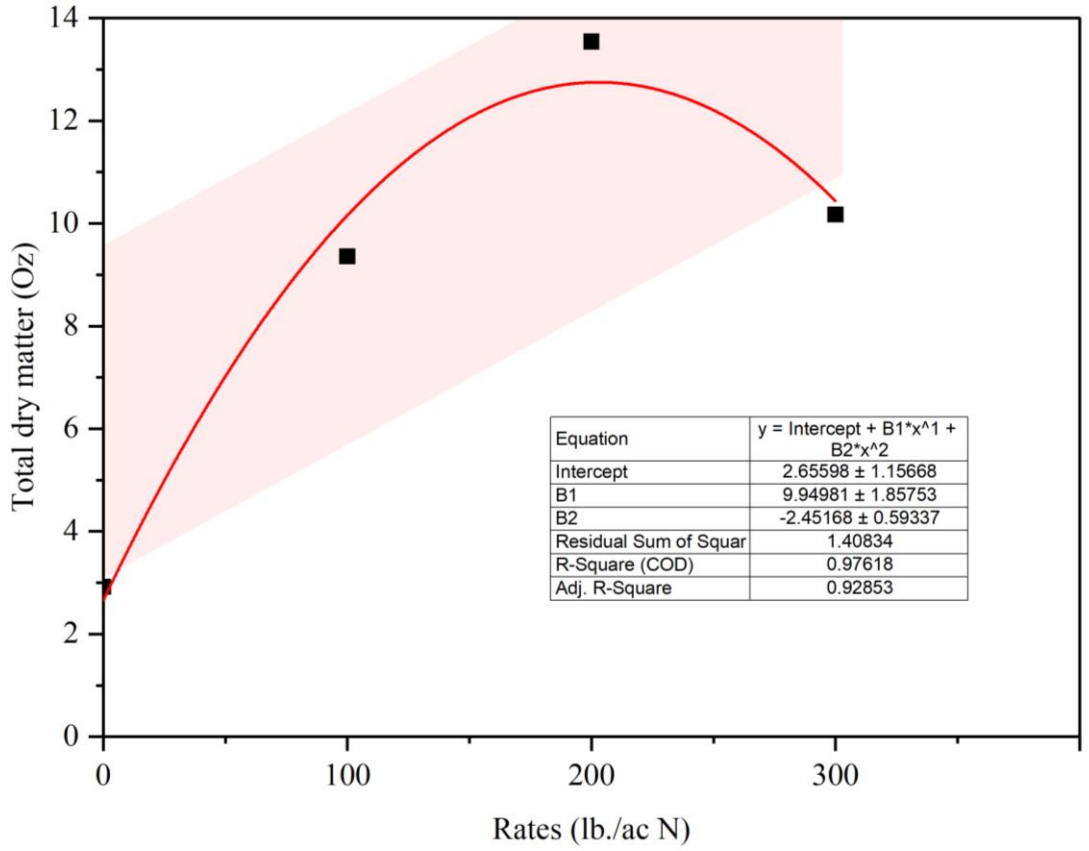
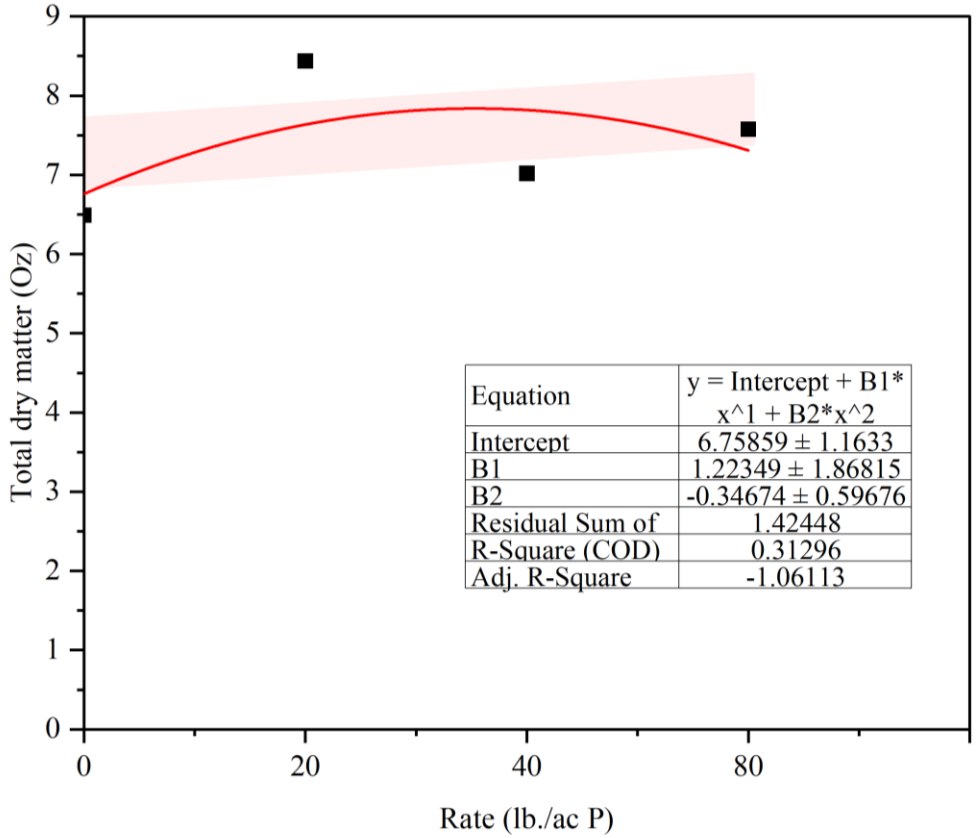
N Study

100 to 200 lbs N per acre per seem optimal!



P Study

20 lbs P per acre per seems optimal!



2nd level polynomial regression analysis

Conclusions

From the preliminary results we observed,

1. Higher rates of N, up to a certain amount, increased the growth rate, number of culms produced, and dry matter accumulation
2. Varying rates of P had no impact on clump height, number of culms, or dry matter accumulation.
3. From the preliminary results, 200 lbs./ac N treatment performed well in terms of height, number of culms, and dry matter accumulation.

Irrigation studies in Frostproof FL

Dr. Kadyampakeni (left), Kondwani Kamsikiri (middle) and Aaron Mejia-Bendeck (right) installing sensors

Future plans

Observations and plans,

1. We observed that newly emerged culms had a bigger diameter than the older ones, we need to understand how increasing rates of N/P affect the diameter of new culms.
2. We need to take the treatments in the field to understand N dynamics and bamboo response to develop the guidelines based on fully established bamboo plants.

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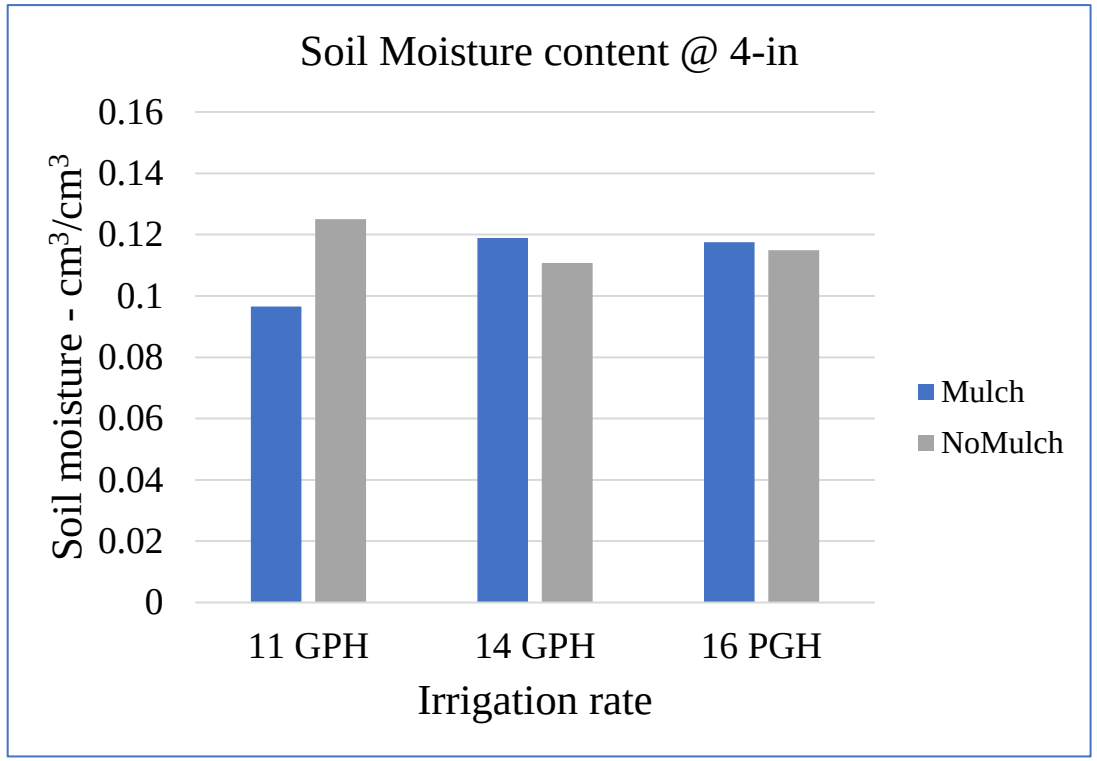
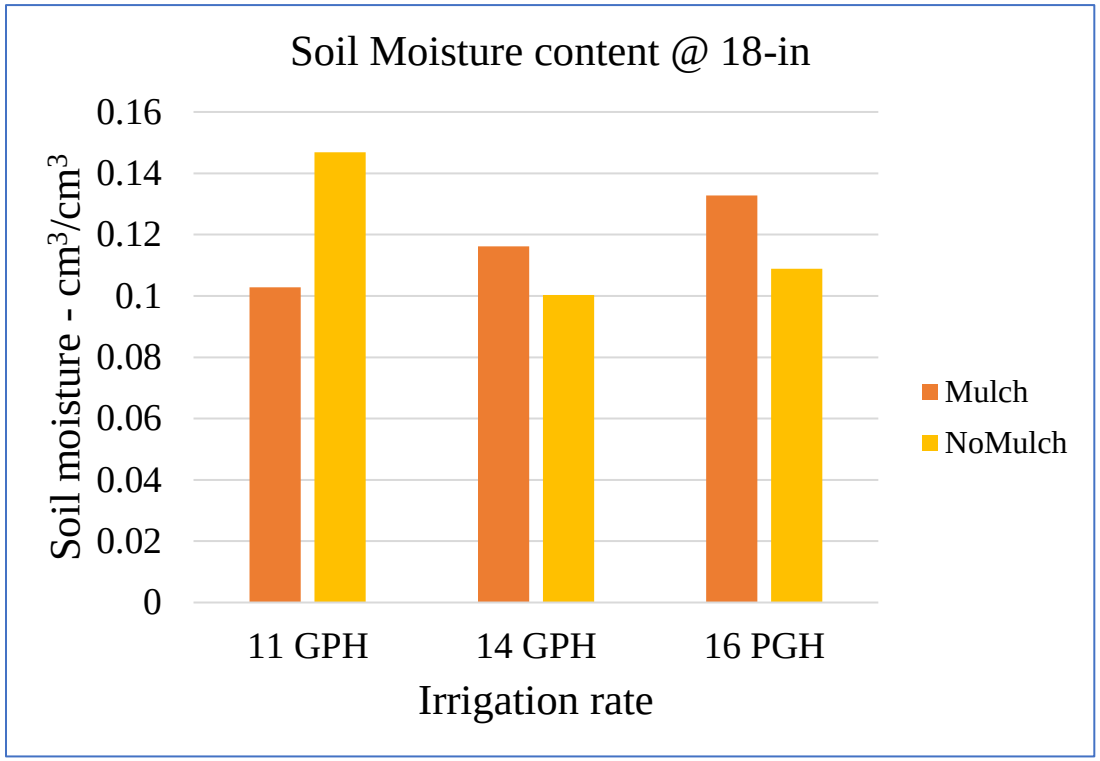
Average Soil moisture content in different depths for CL4

Soil moisture largely around field capacity or slightly above believe it should be between 0.10-0.12 cm^3 cm^{-3}

About 11 GPH is about meets the water needs at 4 and 18 inch depths

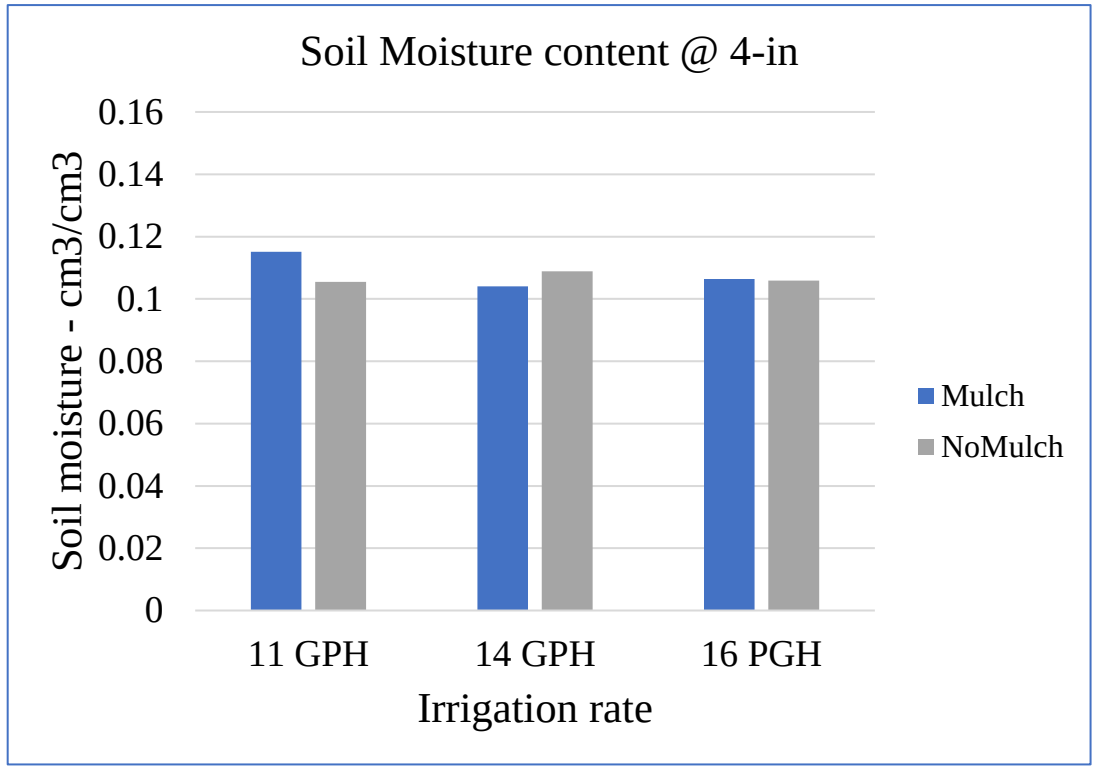


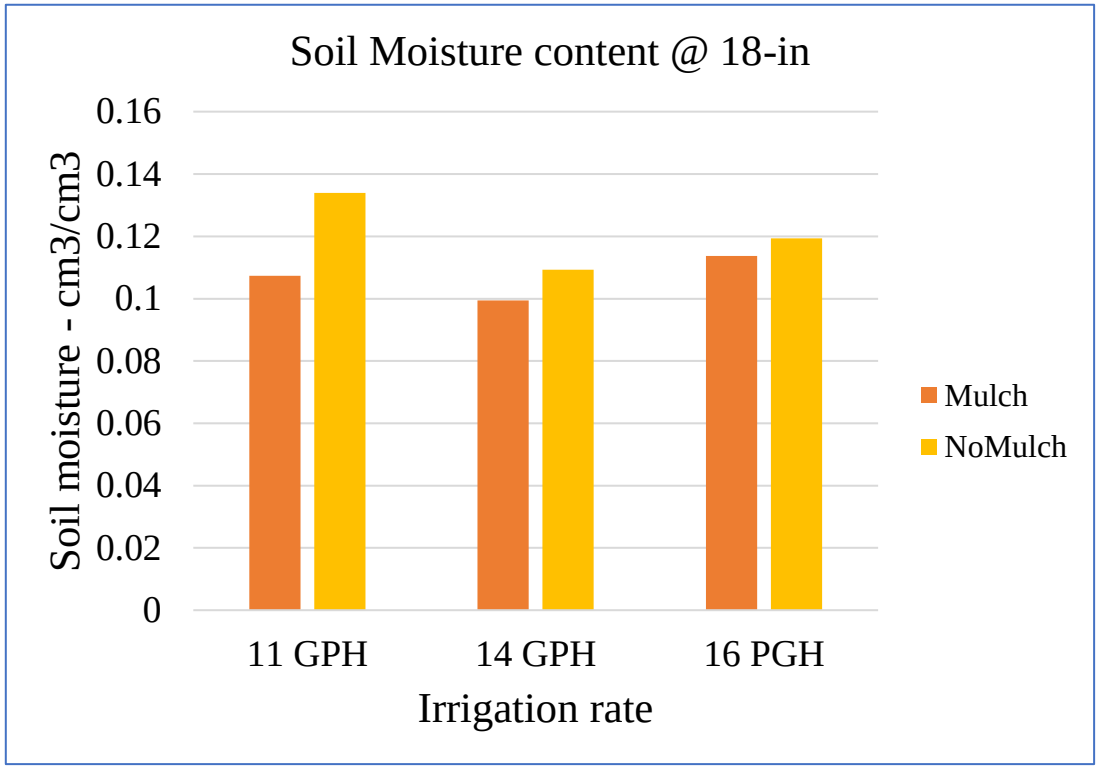


Average soil moisture content in different depths for CL6

The minimum soil moisture in the case of 11 GPH was 0.07 and 0.08 cm^3 cm^{-3} for 4- and 18-in depths, respectively.

The minimum soil moisture in the case of 16 GPH was 0.08 and 0.09 cm^3 cm^{-3} for 4- and 18-in, respectively.





Nitrogen study at Eden and Pioneer farms

- **Study setup and progress**

1. We are evaluating the N rates in two farms, Eden and Pioneer.
2. Experiments set up for both sites.
3. Soil and leaf sampling has been done already.

Rate (lbs./ac N)	Plots	No. of clumps/plot	Repetitions
0	4	5	4
25	4	5	4
50	4	5	4
100	4	5	4

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Our progress

- **Baseline soil analysis results for selected elements at Pioneer**

	Treatments			
Nutrients	0 lbs./ac	25 lbs./ac	50 lbs./ac	100 lbs./ac
P (lbs/a)	161	228.25	240	206.25
K (lbs/a)	35	37	51	44.25
pH	7.175	7.2	7.35	7.175
Nitrate N (lbs/ac)	1.35	2.455	6.495	6.265
Ammonium (lbs/ac)	3.715	3.41	3.02	3.675
Organic matter (%)	1.04	1.075	1.1025	1.155

Our progress

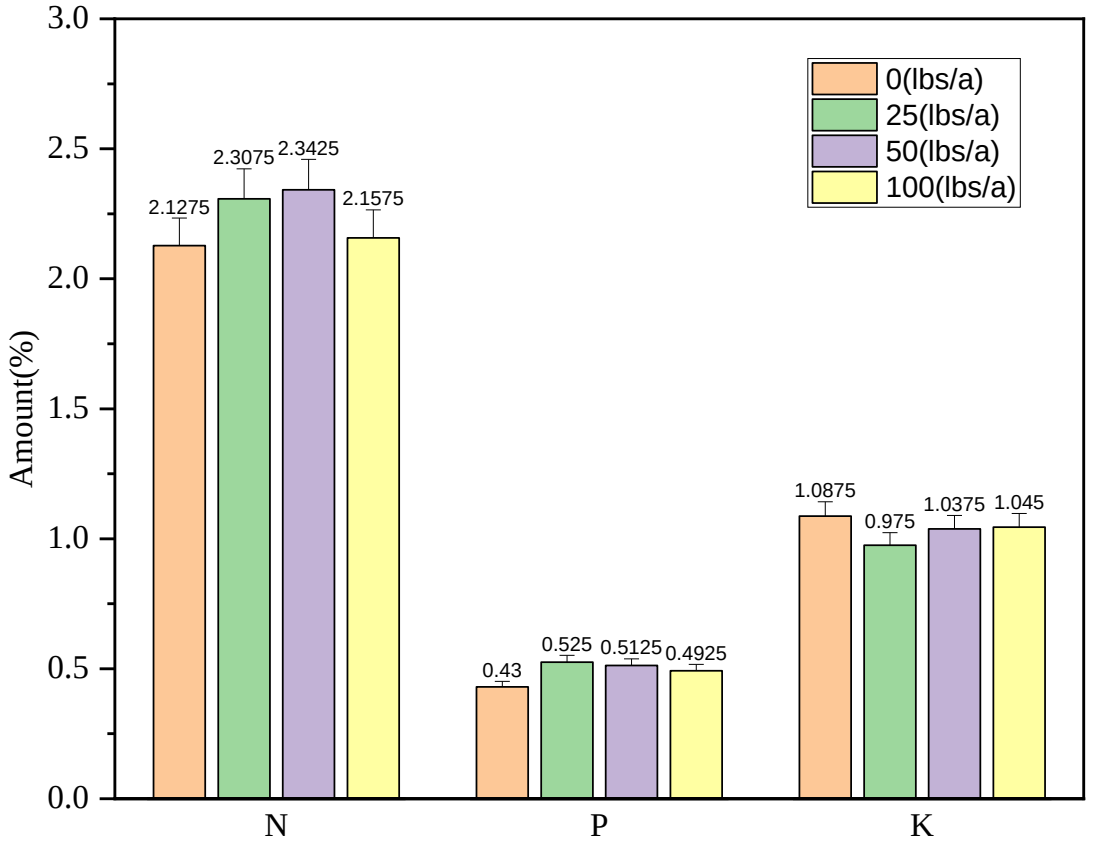
- **Baseline soil analysis results for selected elements at Eden**

	Treatments			
Nutrients	0 lbs./ac	25 lbs./ac	50 lbs./ac	100 lbs./ac
P (lbs/a)	71	52.75	63	76.5
K (lbs/a)	25.75	26.25	27	34
pH	7.05	7.075	7.325	7.1
Nitrate (lbs/ac)	0.75	0.53	0.535	0.7
Ammonium (lbs/ac)	4.935	3.555	3.135	5.46
Organic matter (%)	0.5225	0.4275	0.56	0.63

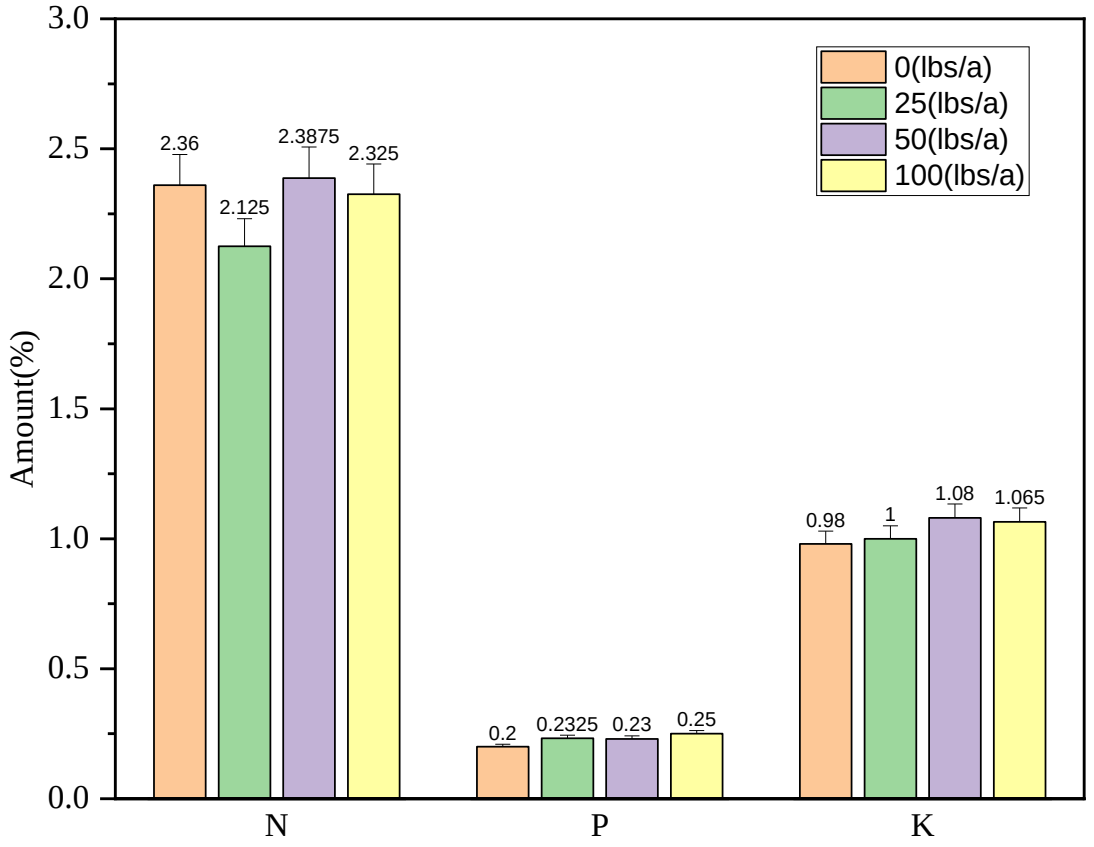
Our progress

- **Leaf sample analysis results for both sites**

Pioneer farm



Eden farm



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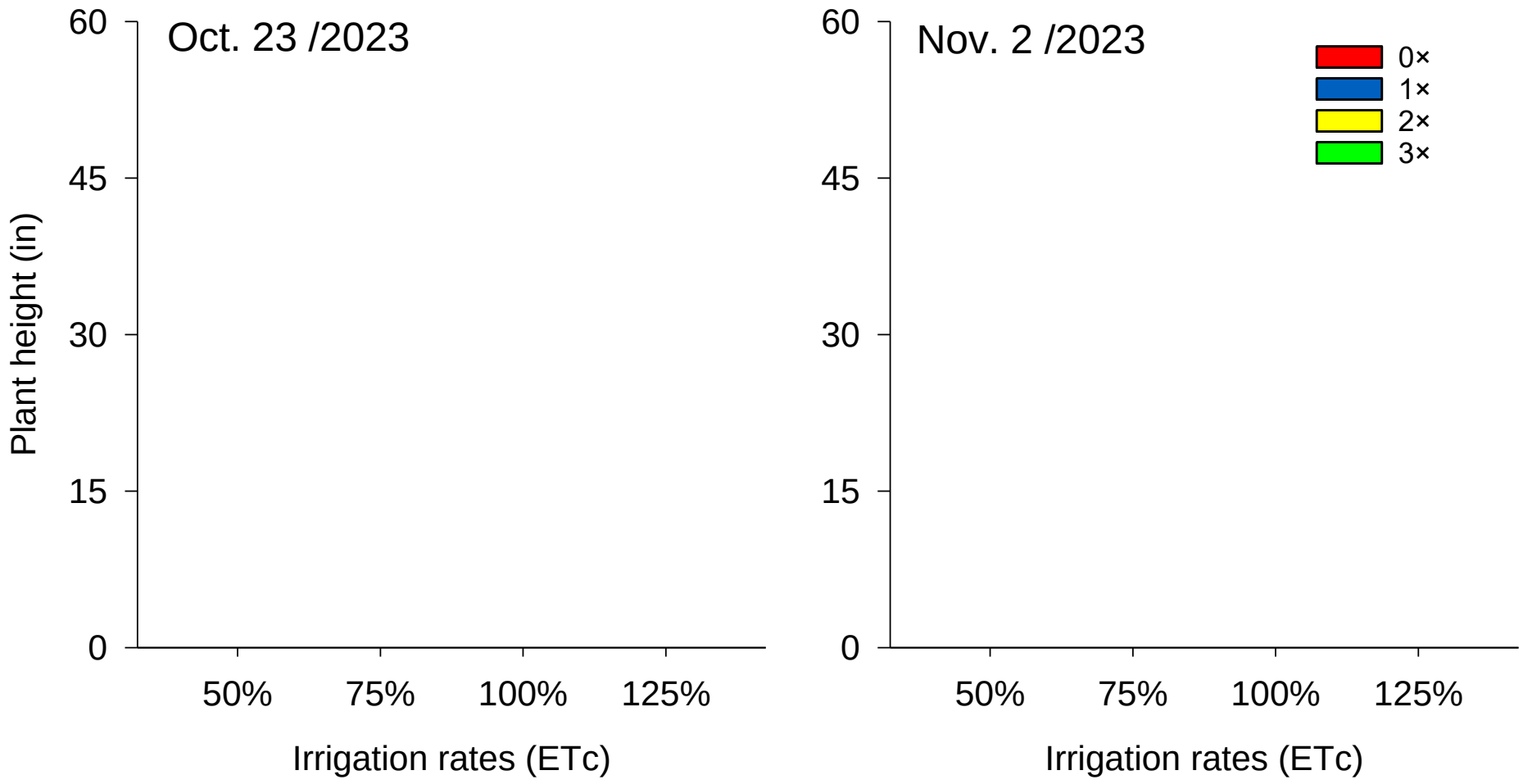
More variables to be evaluated per treatment at both sites

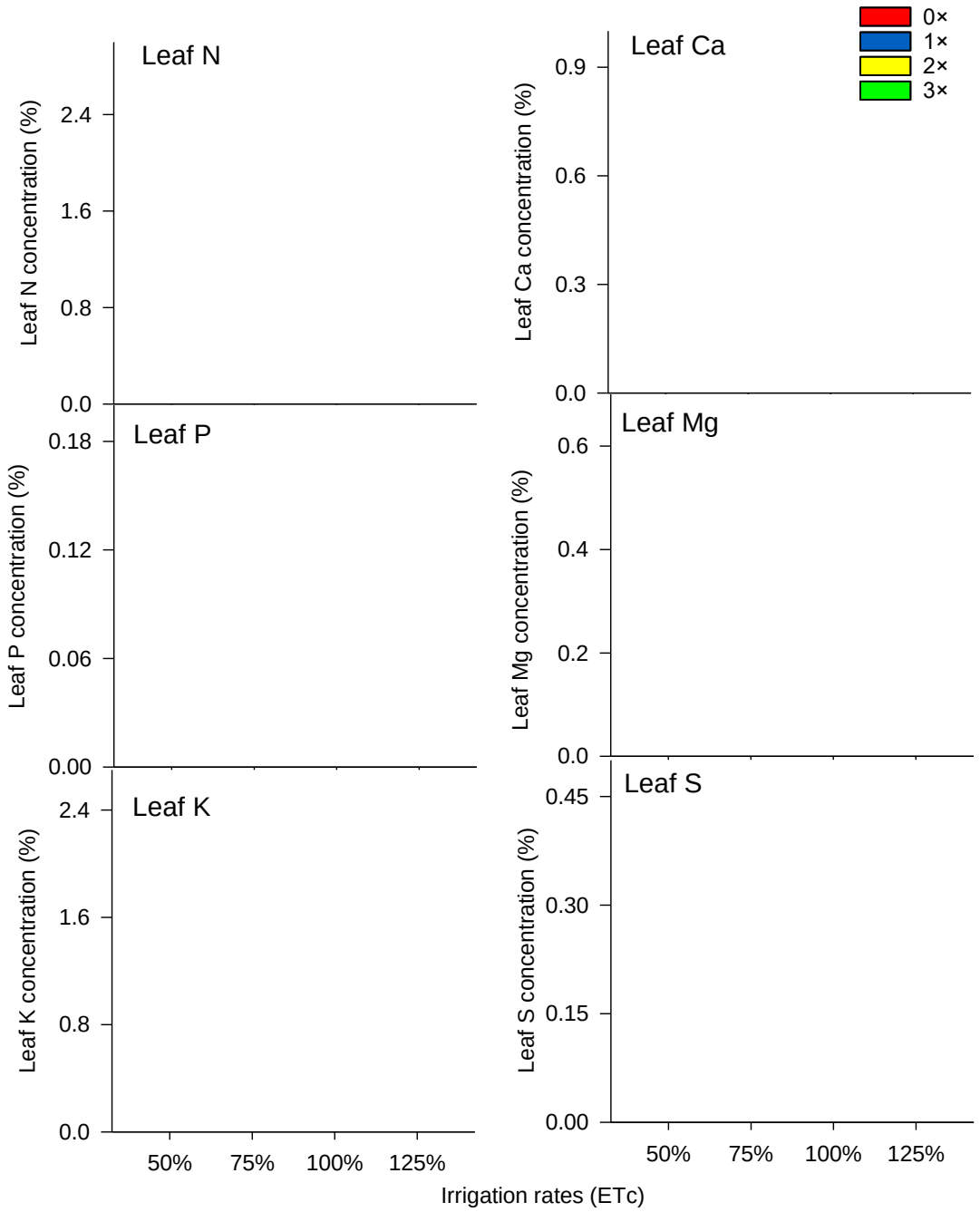
1. Clump height
2. Culm production
3. Diameter of new culms
4. Leaf Area Index (LAI) per clump and plot

- **Comparison of potassium fertilization and irrigation rates: Similar trends in 3-4 months**



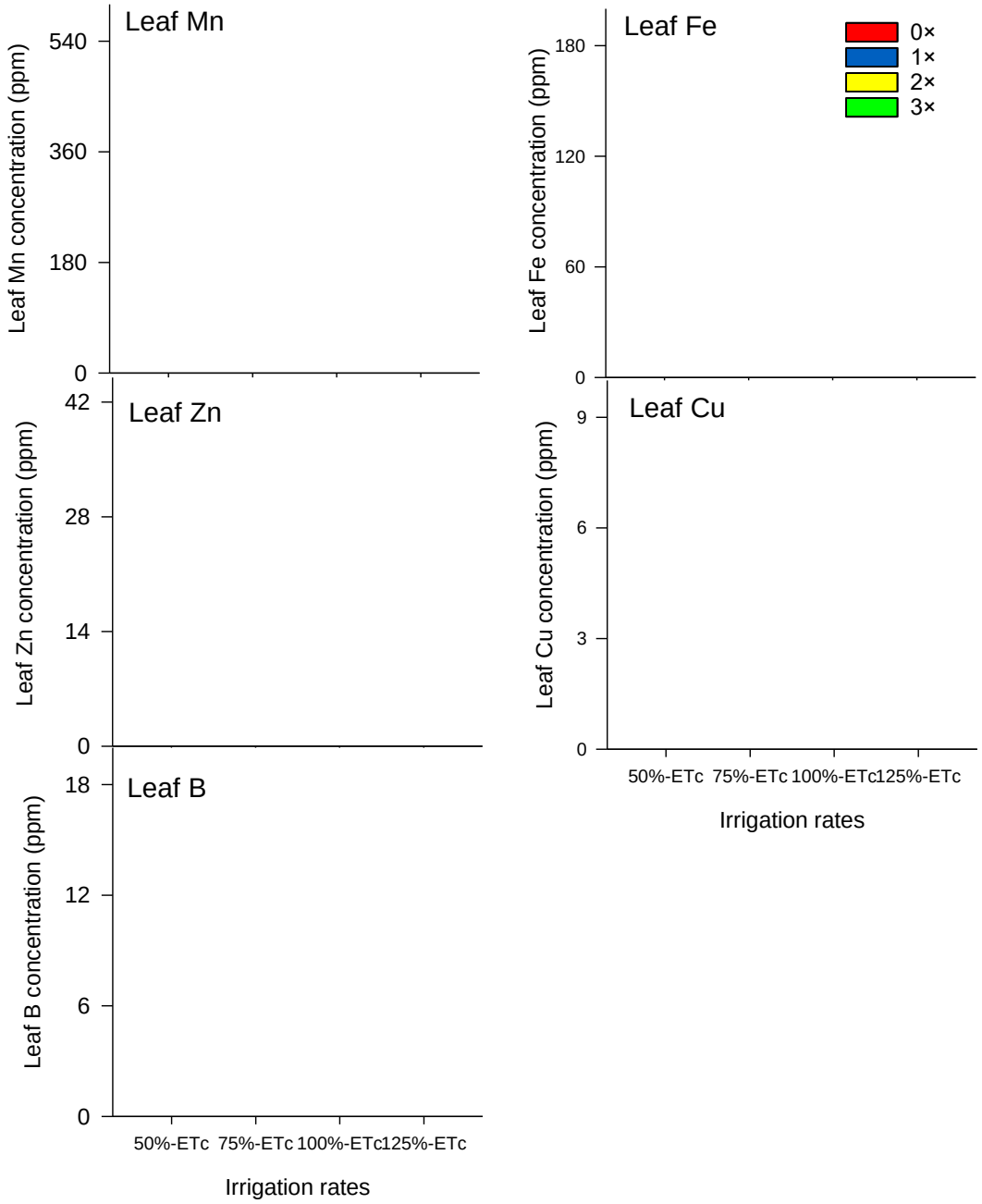
- Impact of irrigation and potassium rates on primary and secondary macronutrients

- **Since this is just the start, we find similar trends on N, Ca, P, Mg, K, S availability and uptake**



- **Impact of irrigation and potassium on micronutrient availability.**

- Largely comparable trends across potassium and irrigation rates.



Summary

- More work on N, P and K studies
- Irrigation thresholds to be determined over time (2 to 3 years)
- Nutrient thresholds to be finalized after both greenhouse and field studies (3-4 years)
- Right emitter sizes to be suggested and recommended to growers in 2024/2025.

Acknowledgements

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