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גורל החנקן לאחר דישון של עץ תמר צעיר: שטיפה, פליטה, וקיבוע לתוך הרקמה

איליה גלפנד

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Date palms experiment: four levels of N application



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Effect of increasing nitrogen fertilization on soil nitrous oxide emissions and nitrate leaching in a young date palm (*Phoenix dactylifera* L., cv. Medjool) orchard

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Daniel's MS Thesis

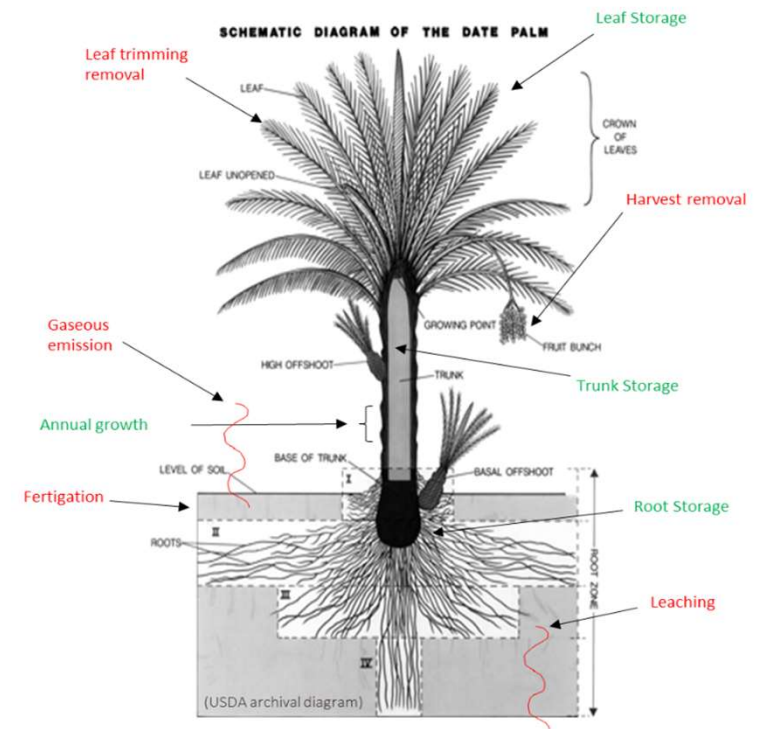


Objectives

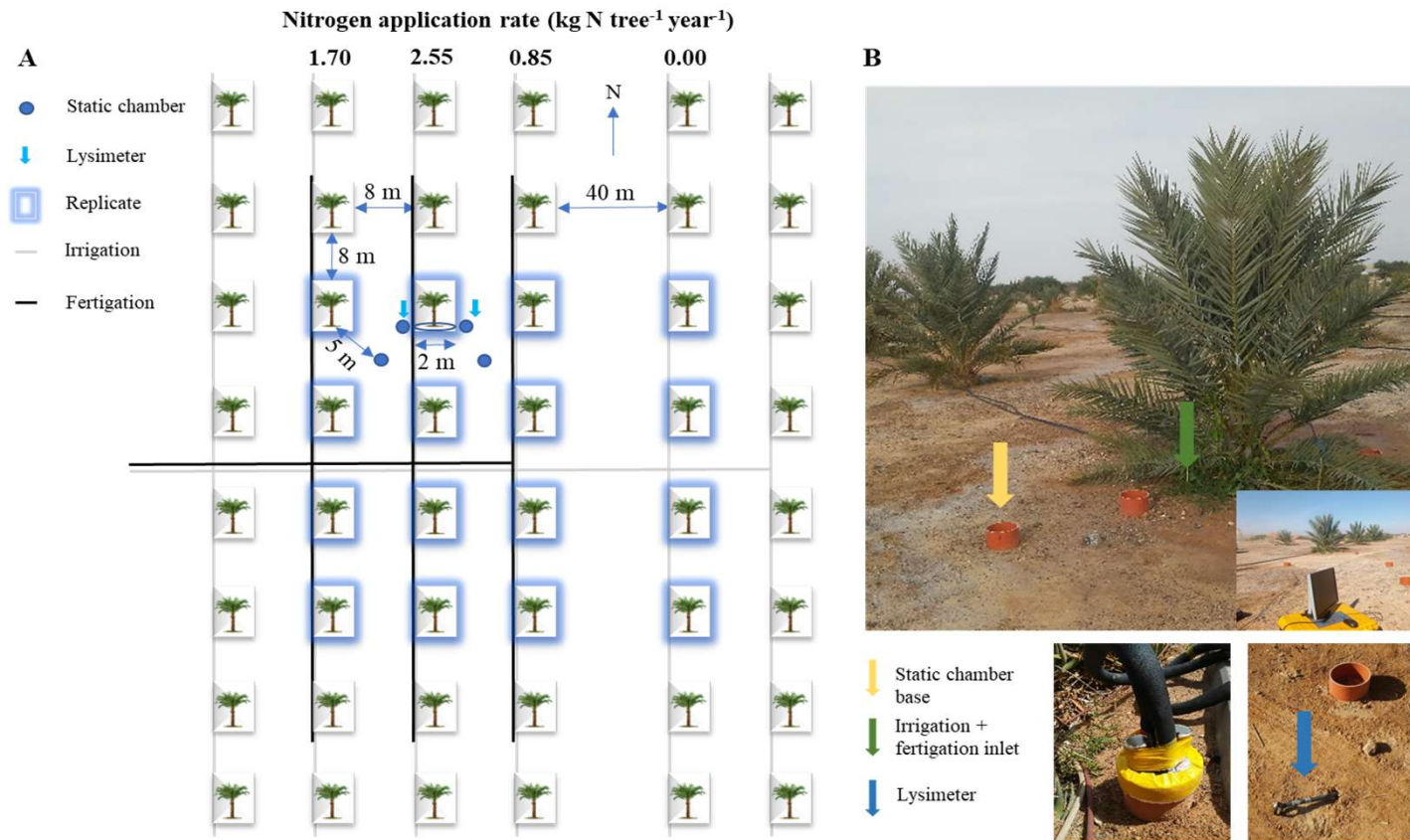
- Describe and quantify the N balance.
- Improve current N fertilization methods, with an attempt to minimize environmental impacts.

Hypothesis

- Exceeding N fertilizer application beyond the plant's uptake has no benefit to the crop's productivity and will result in substantial N loss in gaseous and soluble forms.



Experimental Design & Study Site

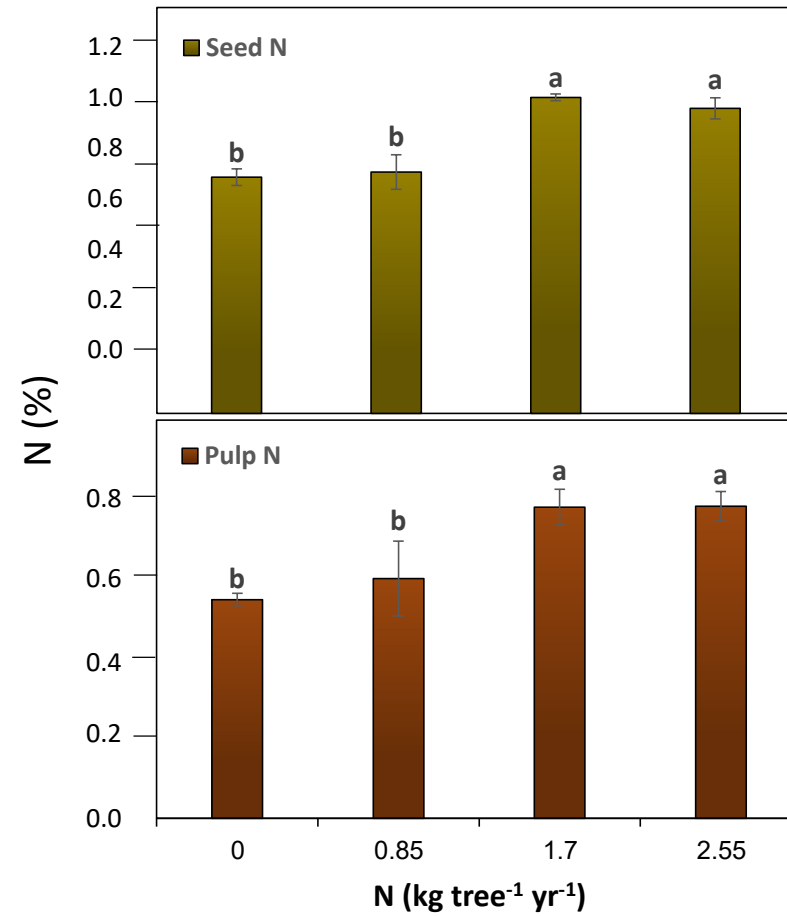
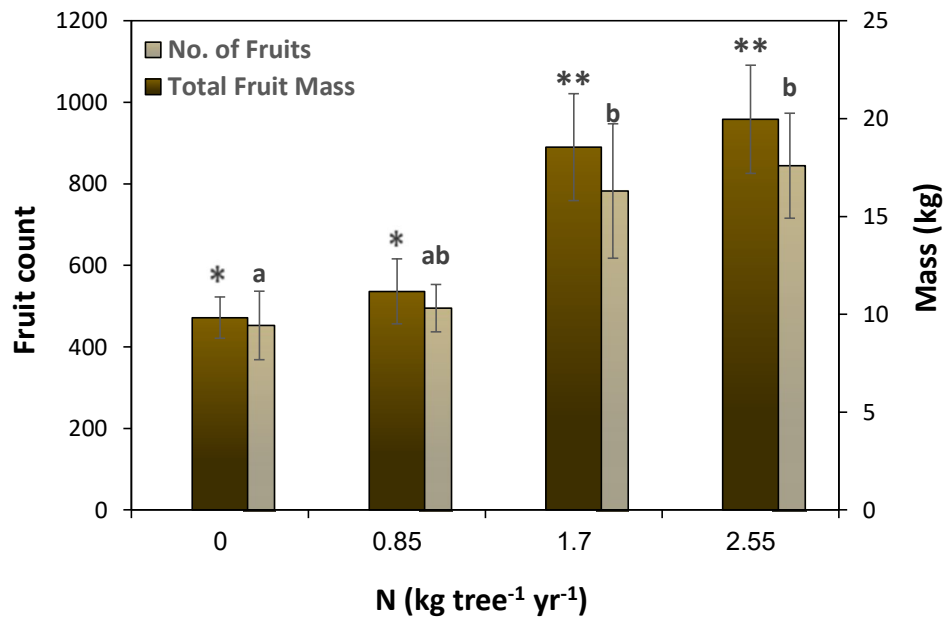


Clay	Silt	Sand	Organic C	Total N	CO_3^{2-}	Bulk Density	Porosity	pH
					%	kg L^{-1}		
5.5	31.5	63.0	0.32 ± 0.03	0.046 ± 0.009	58.1 ± 0.5	1.34 ± 0.21	0.5 ± 0.1	8.3

Fruit

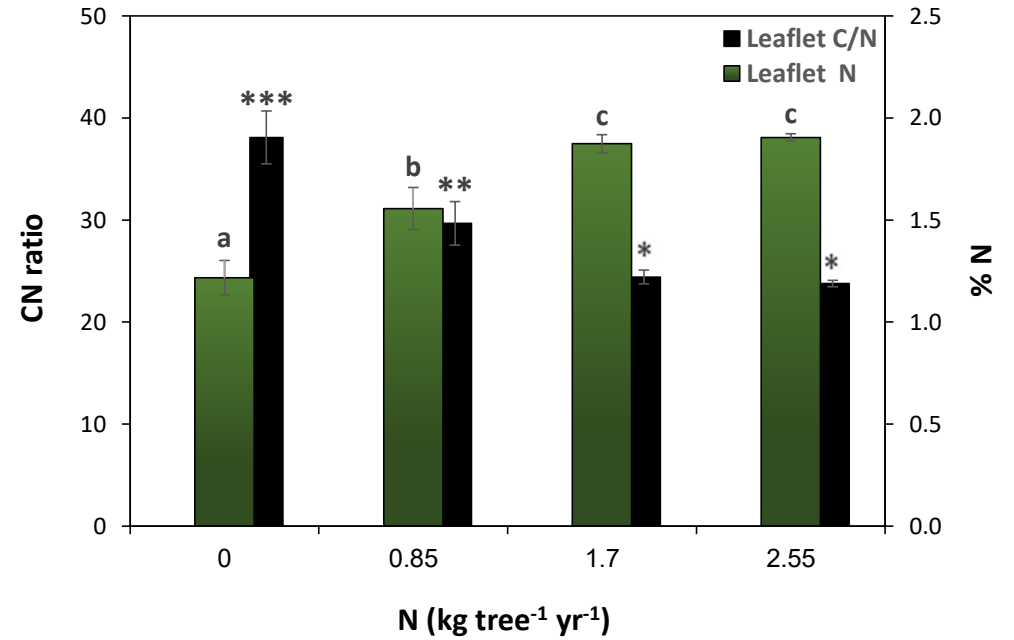
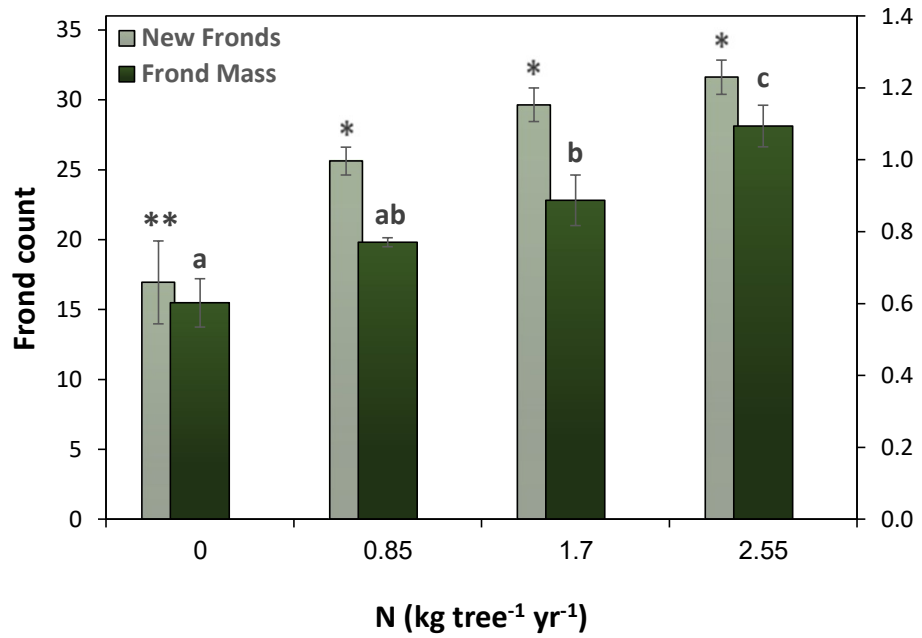


Fruit Yield & C N Analysis



*Average per tree.

Fronnd Growth & C N Analysis



*Average per tree.

Crop Performance – Summary

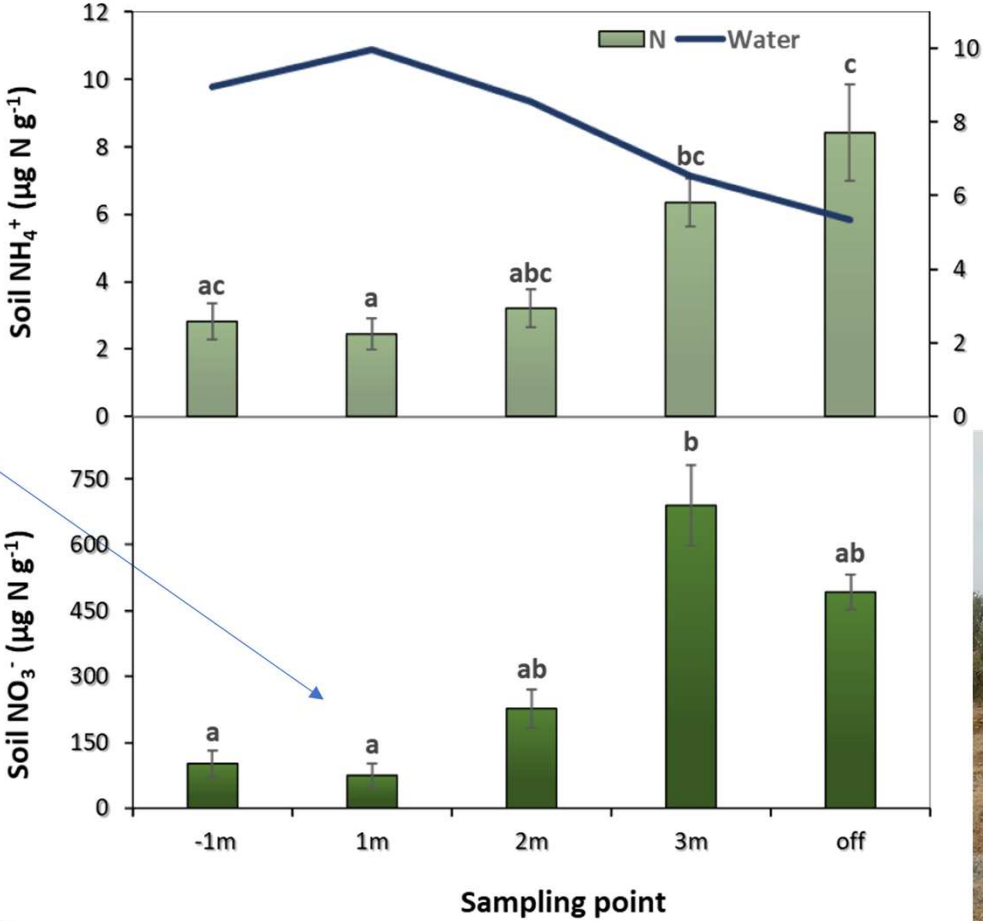
- Fruit yield and fruit N uptake responded to fertilization and increased from zero to 1.7 kg N without further increase
- Frond growth increased consistently with each increasing fertilization rate. Frond N uptake increased up to 1.7 kg N fertilization level. – Acceleration of vegetative growth.
- N use efficiency increased from 0.85 kg N to 1.7 kg N fertilization levels, and decreased from 1.7 kg N to 2.55 kg N.



Soil

Soil Inorganic N Pool Across a Wetting-Drying Gradient

Fertigation inlet

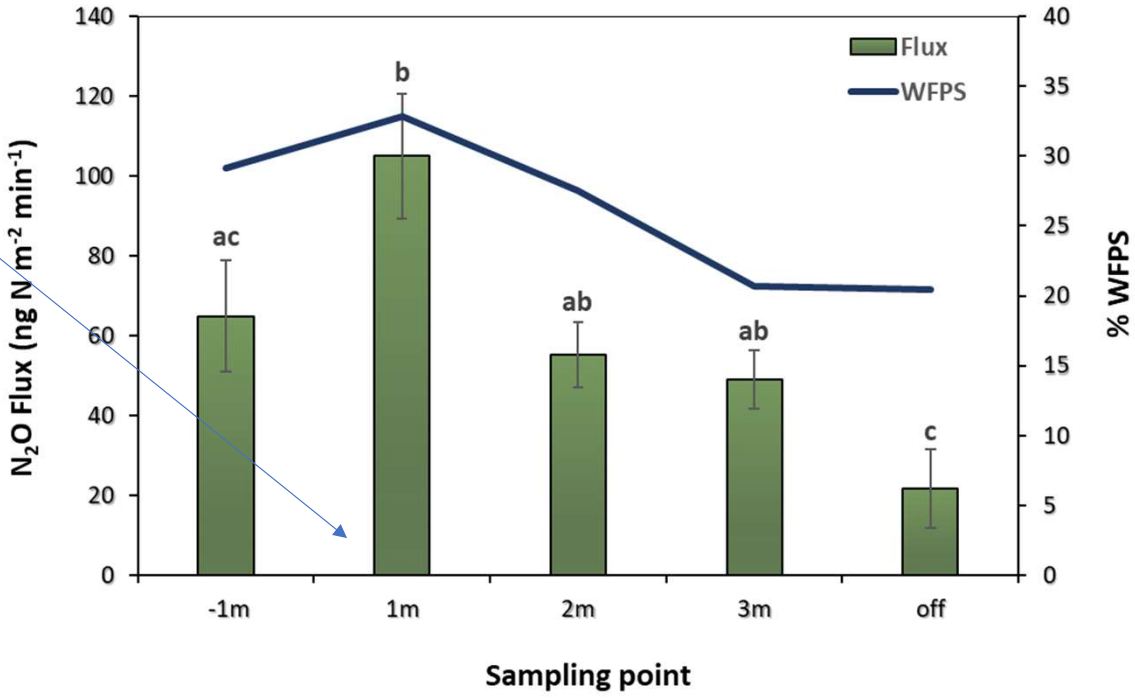


*Averaged for all fertilization levels, per tree.



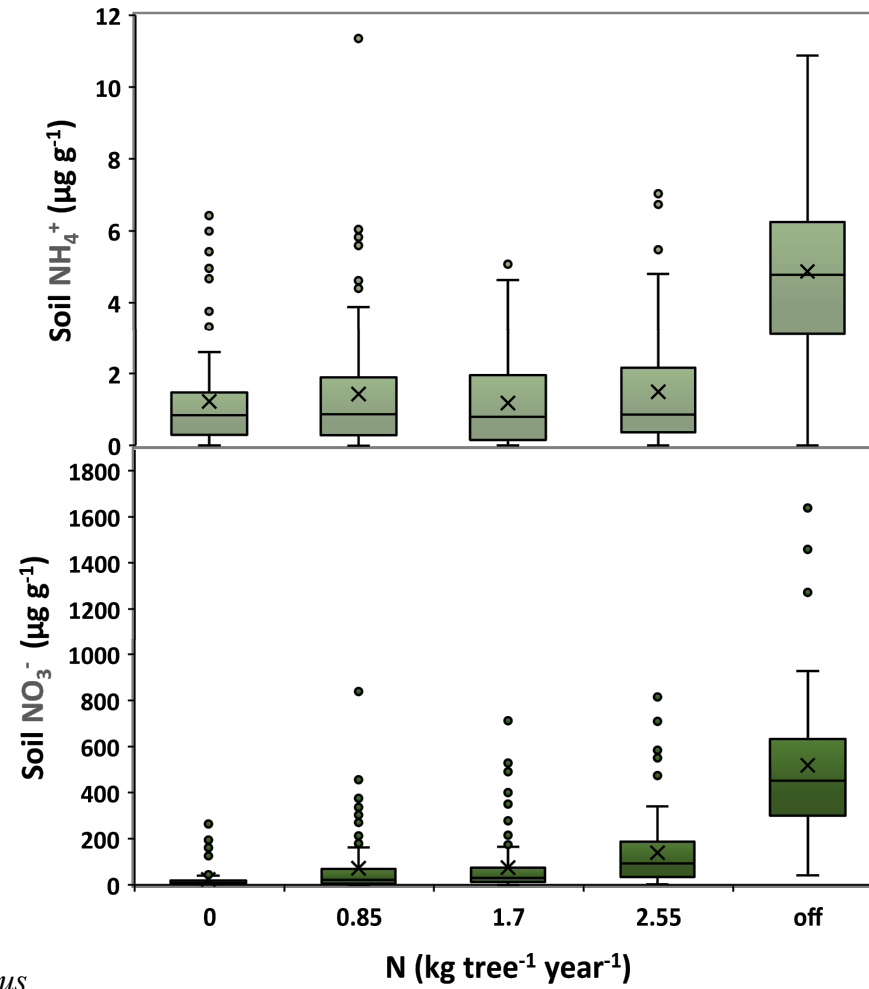
Soil N₂O Emissions Across a Wetting-Drying Gradient

Fertigation inlet



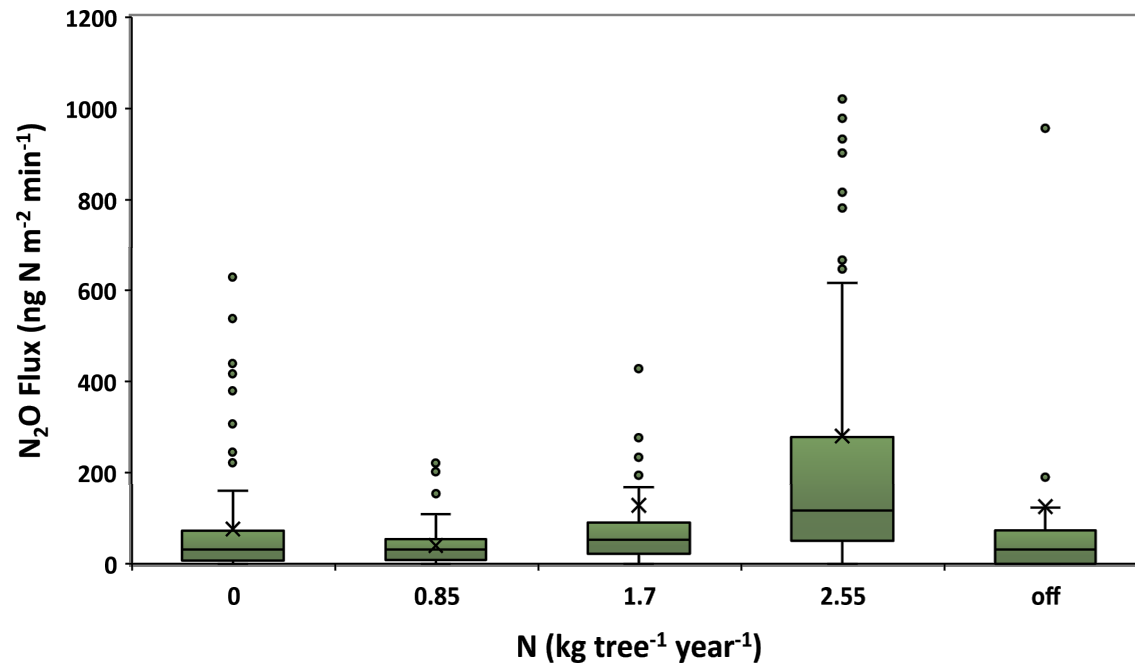
*Averaged for all fertilization levels, per tree.

Fertilization Effect on Soil Inorganic N pool



**Seasonal average per tree, within a 1 m radius around the tree and off-treatment.*

Fertilization Effect on Soil N₂O Emission Rate

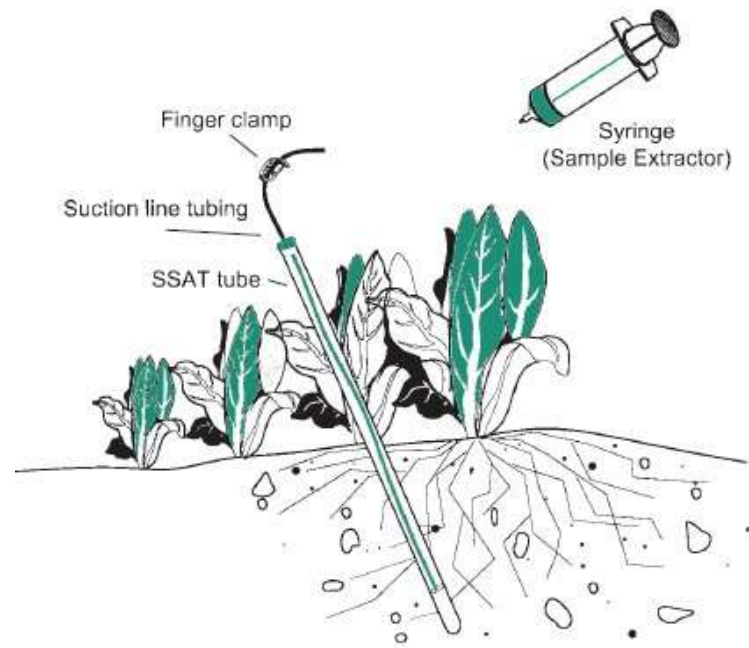


**Seasonal average per tree, within a 1 m radius around the tree and off-treatment.*

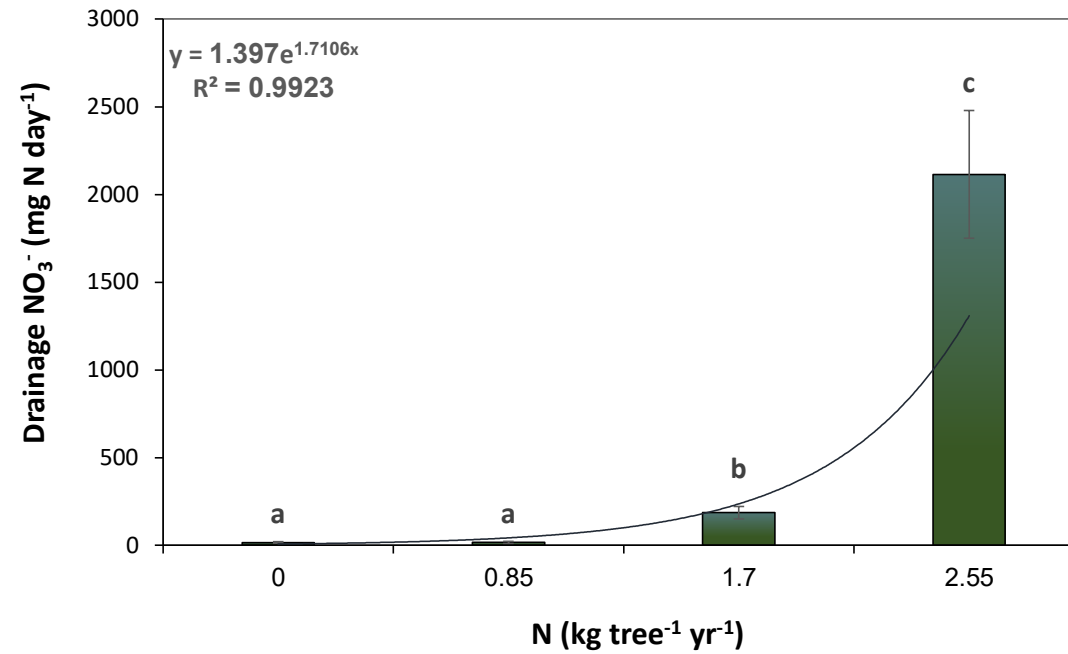
Soil N Dynamics – Summary

- Drier soils are, lower N₂O fluxes and higher inorganic N concentration in soil
- Both, soil N and N₂O were largely increasing with the increasing fertilization rate.

Groundwater

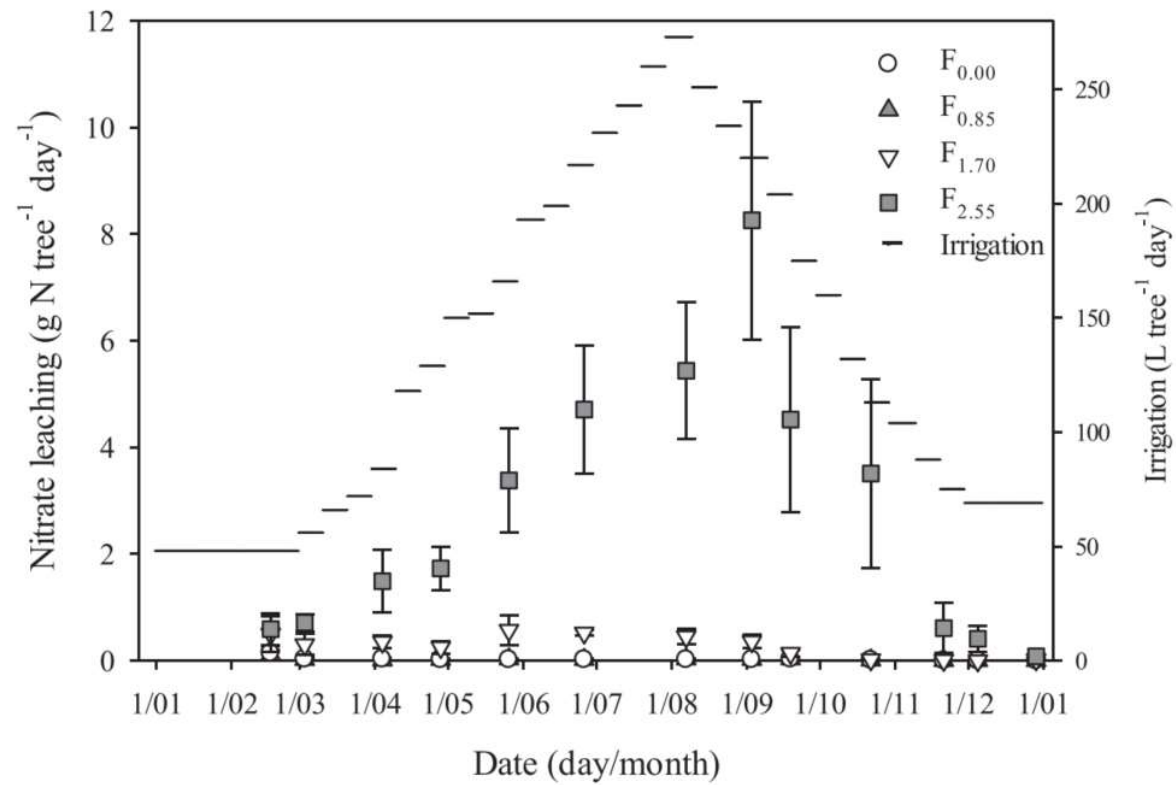


Fertilization Rates Effect on N Leaching



**Seasonal average per tree, measured at 0.5 m and 1 m distances.*

Annual Cycle of Daily N Leaching



*Average daily drainage per tree.

N Leaching – Summary

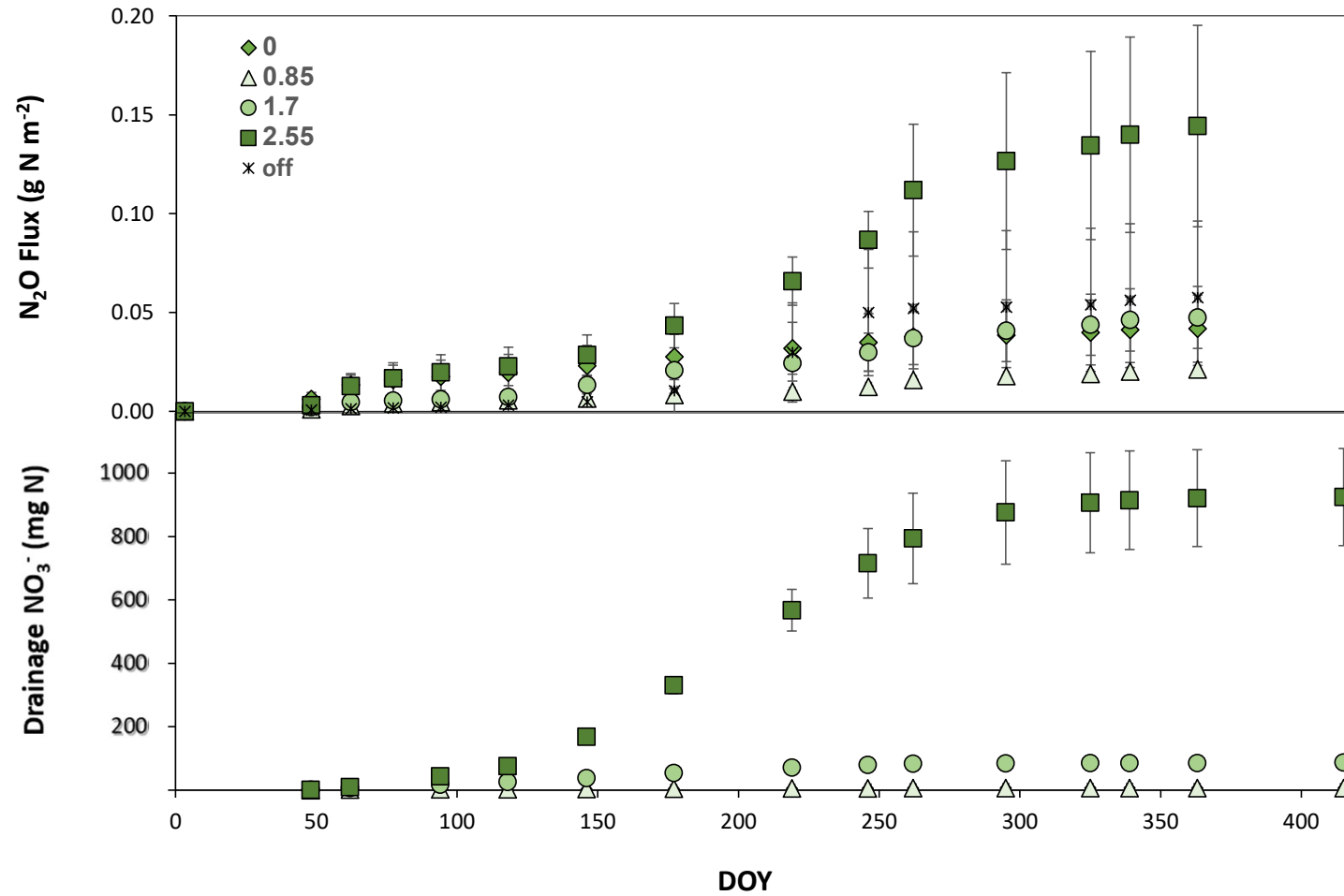
- N leaching followed an exponential increase with the increasing fertilization rate.
- N leaching was significantly increasing in the summer months, following the increase in irrigation.



N Budget

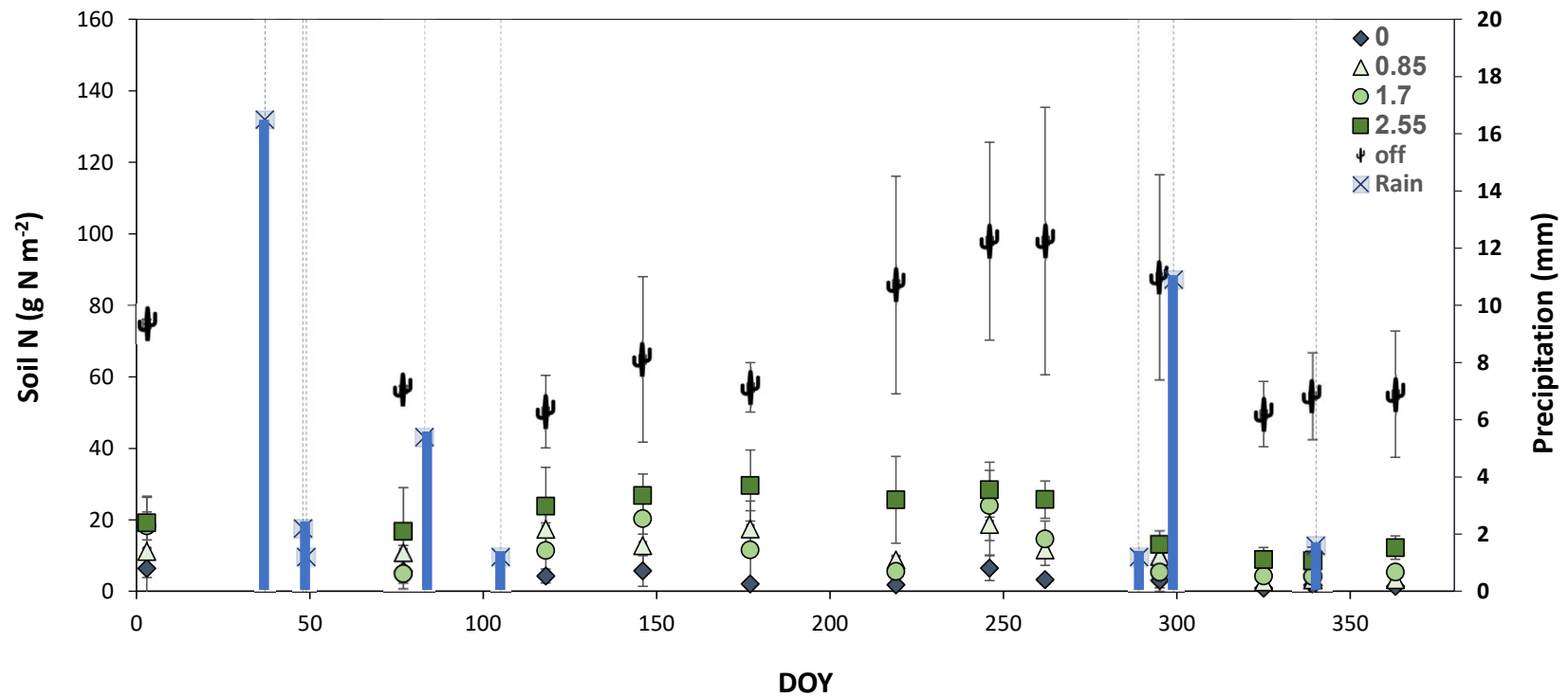


Cumulative Annual Gaseous & Groundwater N loss



**Estimated annual cumulative, within a 1 m radius.*

Annual cycle of soil inorganic N pool

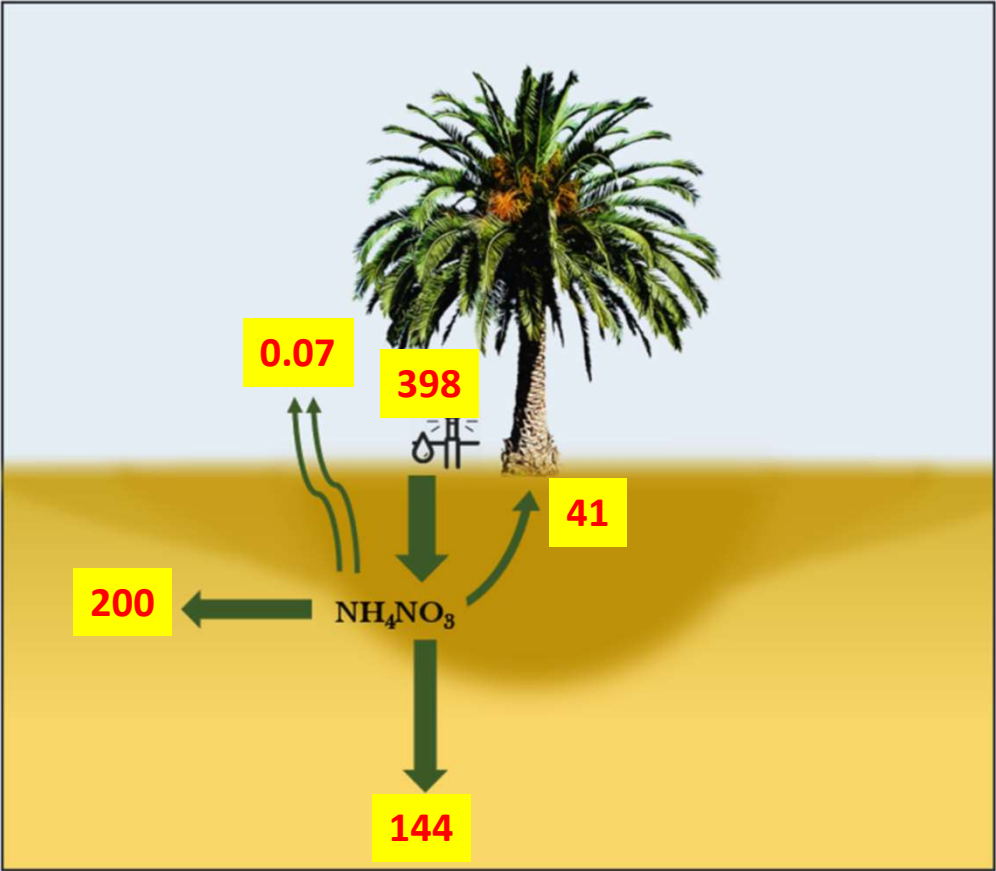


*Total soil inorganic N measured at 0.1 m depth, within a 1 m radius for fertilized trees, and off-treatment dry areas.

Annual N Budget

Application of
2.55 kg N tree⁻¹

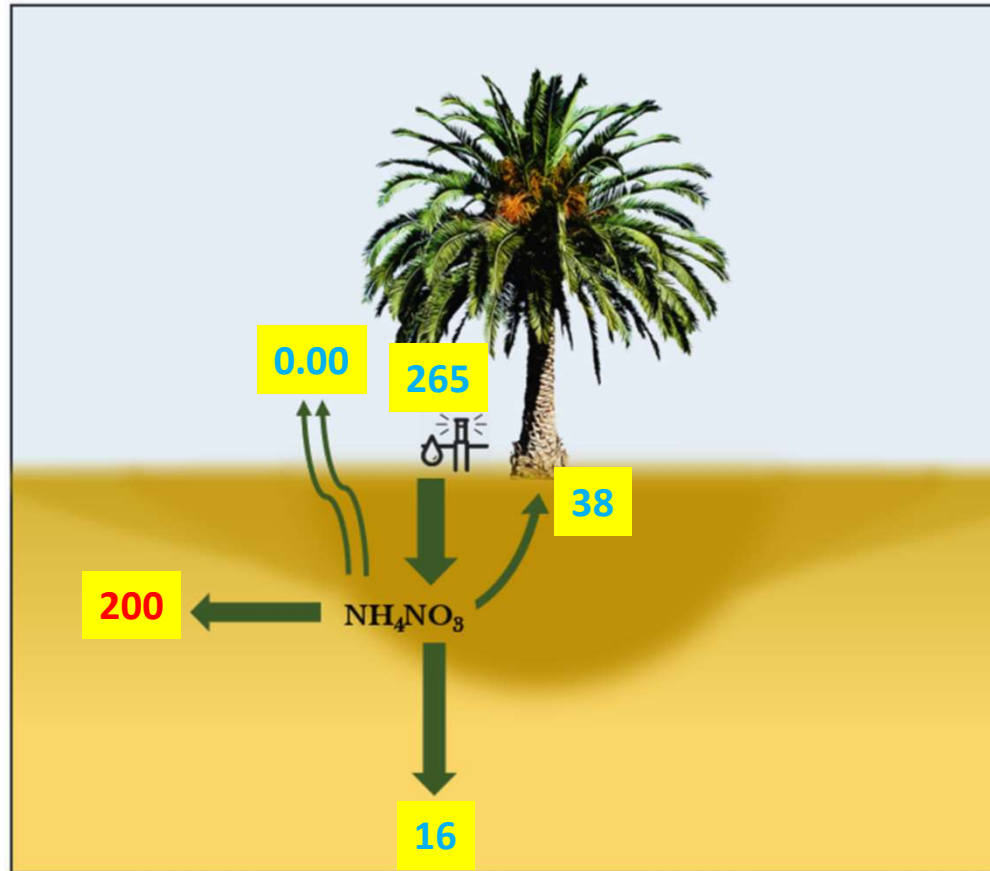
kg N ha⁻¹ year⁻¹



Annual N Budget

Application of
1.75 kg N tree⁻¹

kg N ha⁻¹ year⁻¹



Conclusions

- Excess fertilization, beyond $1.7 \text{ kg N tree}^{-1} \text{ yr}^{-1}$, significantly increased N loss through N_2O emissions and N leaching without positive effect on the yield (but increasing vegetative growth!).
- The dry soil around the tree (0-10 cm) proved to constitute a major outlet for excess N.
- N addition through fertigation seemed to be optimal for our young Medjool palm crop productivity at $1.7 \text{ kg N tree}^{-1} \text{ yr}^{-1}$.

