

Understanding the mode of action of phosphite in avocado

Lara-Simone Pretorius, Imsu Nokdy, Elizabeth Dann (UQ)
Marc Goetz, Harley Smith (CSIRO Agriculture & Food)

e.dann@uq.edu.au

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Phosphite (phosphonate) is widely used to manage Phytophthora root rot in avocado



“Where the “heck” is all that phosphonate going?”

- Monitoring phosphite residues in fruit in 2018-2019 showed that phosphite, (PO_3), translocates to fruit
- Reports from growers that multiple sprays (and injections) still not increasing root levels
- Further testing showed PO_3 in many plant tissues not directly sprayed with phosphonate e.g. flowers, leaf flush and stems, immature/mature fruit flesh and seed, seedlings
- Suggested translocation, storage and re-translocation (potentially with the carbohydrate cycle)



Mature fruit pulp 135-200 ppm
Seed 560 ppm

Field trial at Ravensbourne

August 2020



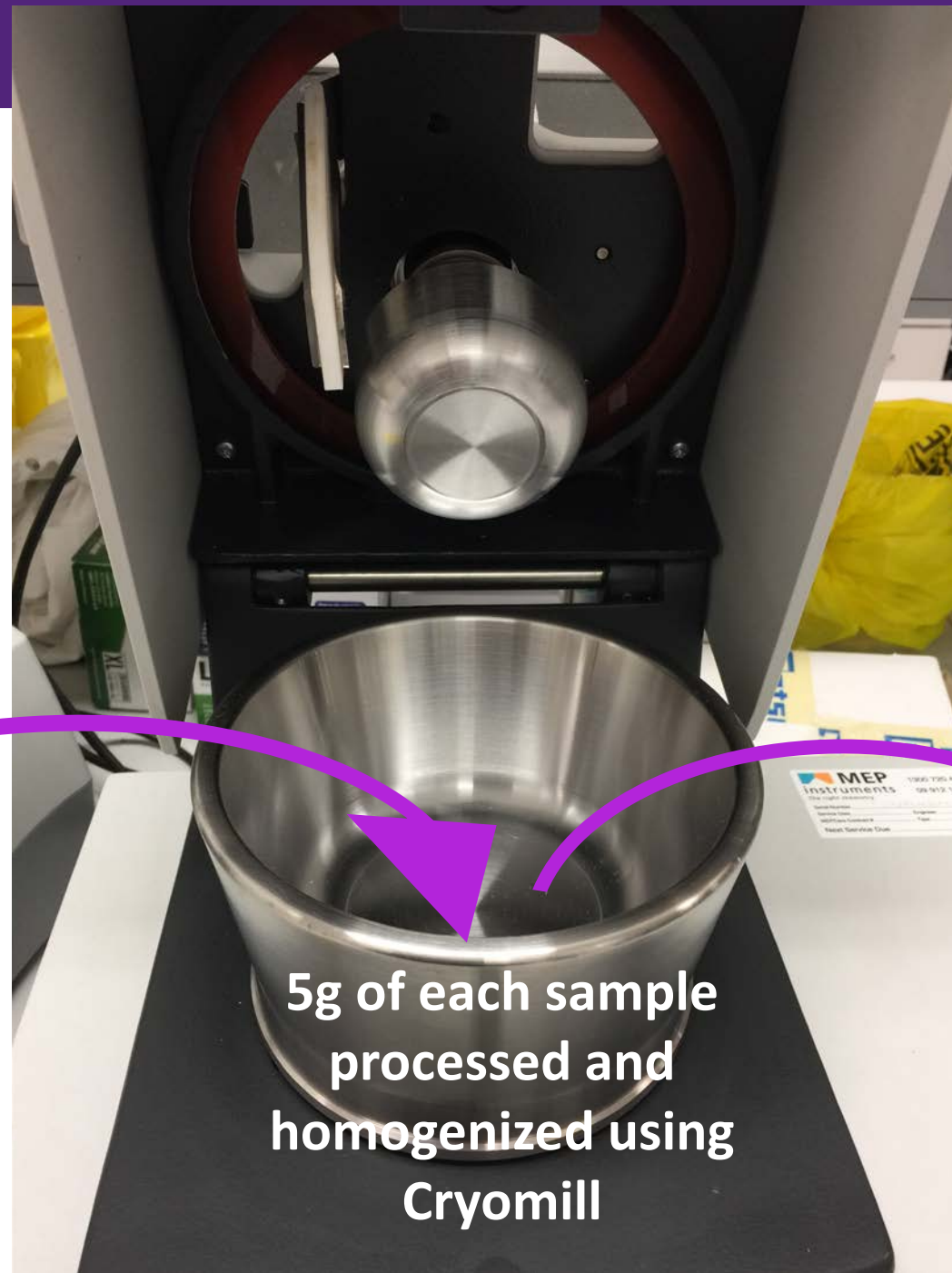
March 2023

What is the relationship between phosphite and carbohydrate ?

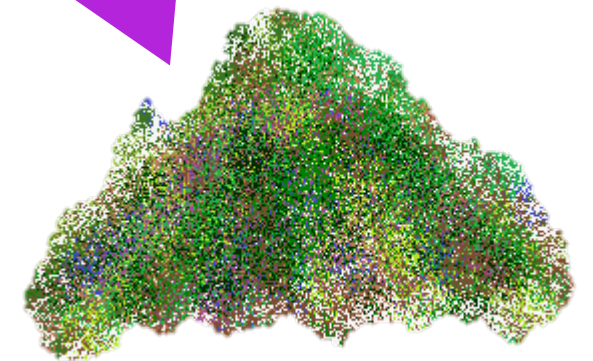
- Treatments in field trial at Ravensbourne, mature trees
 - Nil (unsprayed)
 - Phos (potassium phosphonate sprayed at both root flushes)
- Sampling at different time points 2021–2022
- Sampling different tissues
 - thick roots (5mm), feeder roots, shoots/stems, leaves, flowers, mature and immature fruit and seed
- Measured total starch (colorimetric assay) and soluble sugars glucose, fructose, sucrose, mannoheptulose, perseitol (HPLC)
- Phosphite measured
- Nutrient analyses (selected samples)



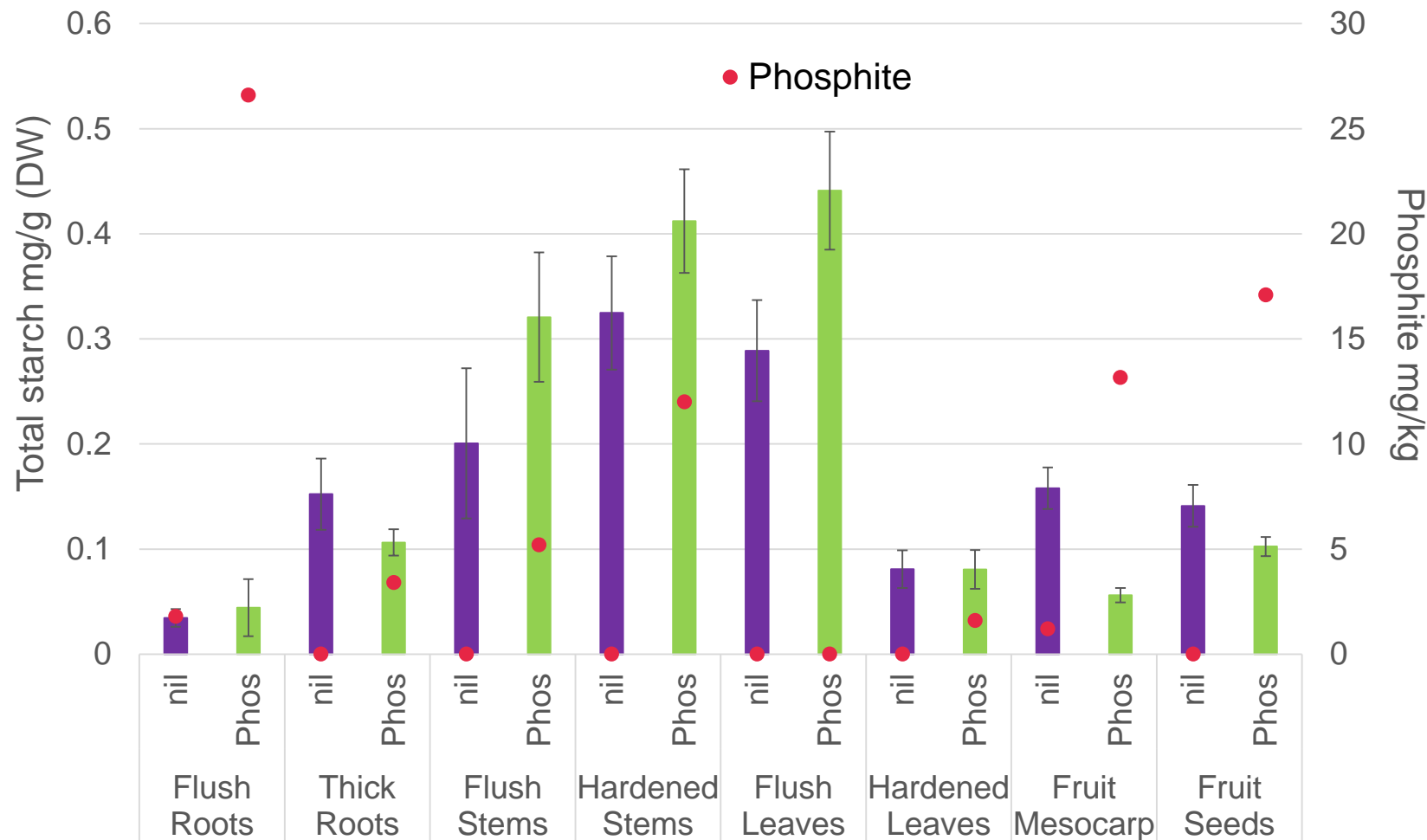
Methods



5g of each sample processed and homogenized using Cryomill

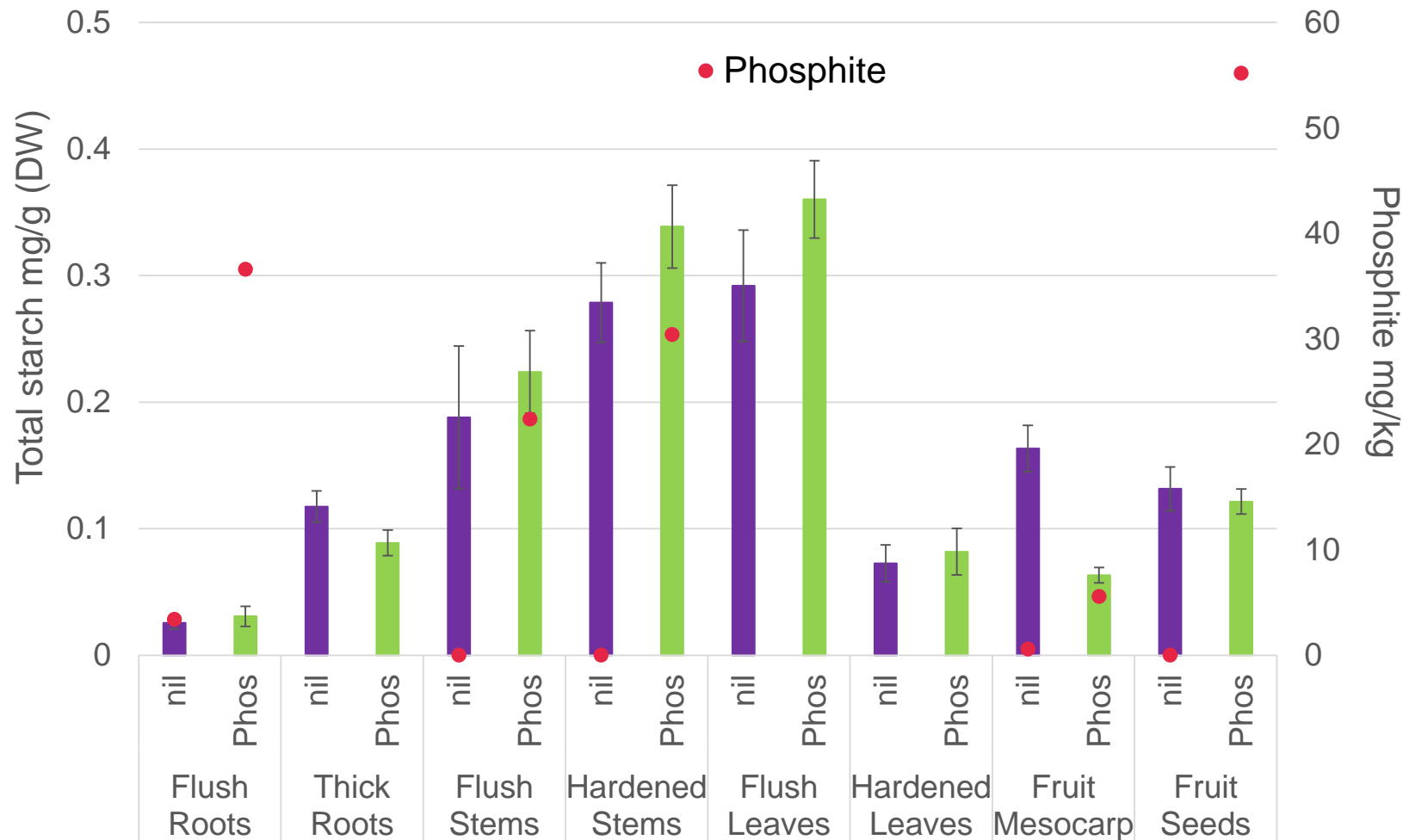


Starch results - samples collected 16 April 2021



- Stems and leaves have higher total starch
- Stems and flush leaves of sprayed trees have higher starch than unsprayed
- Thick roots, immature fruit flesh and seed of sprayed trees have lower starch than unsprayed
- Feeder roots, stems, immature flesh and seed accumulate high PO_3
- *Statistics pending*

Starch results - samples collected 13 April 2022

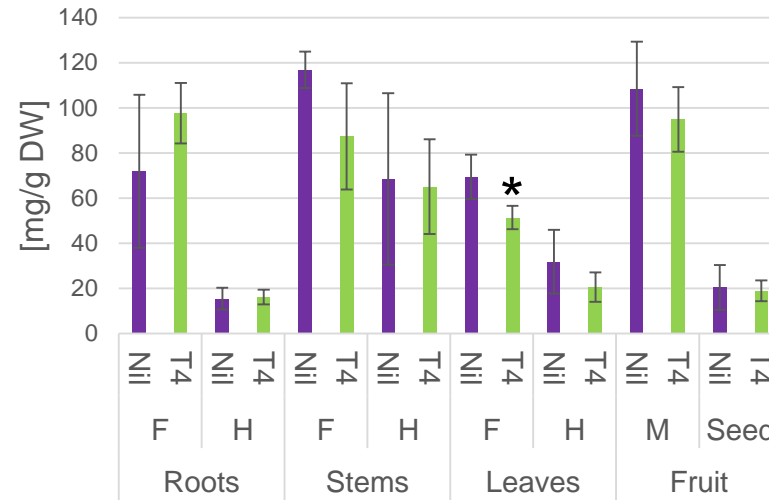


- Stems and leaves have higher total starch
- Stems and flush leaves of sprayed trees have higher starch than unsprayed (but not significant)
- Thick roots, immature fruit flesh and seed of sprayed trees have lower starch than unsprayed
- Feeder roots, stems and seed accumulate high PO_3
- *Statistics pending*

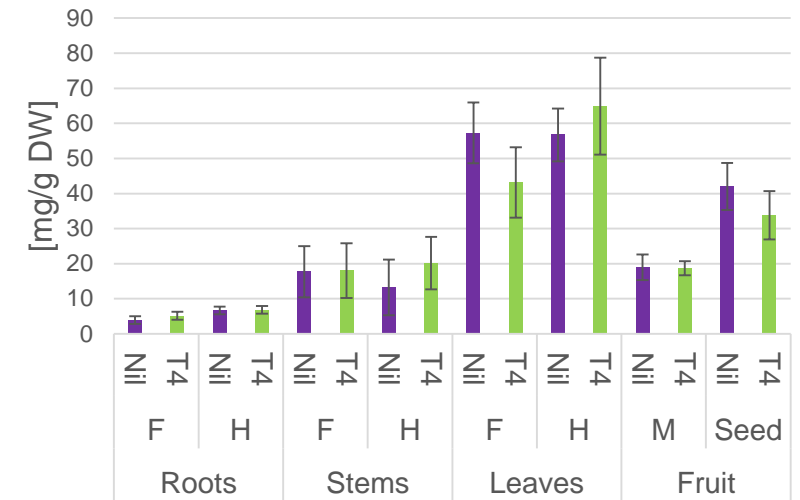
Soluble sugars – samples collected 16 April 2021

F=Flush
H=Hardened
M=Mesocarp

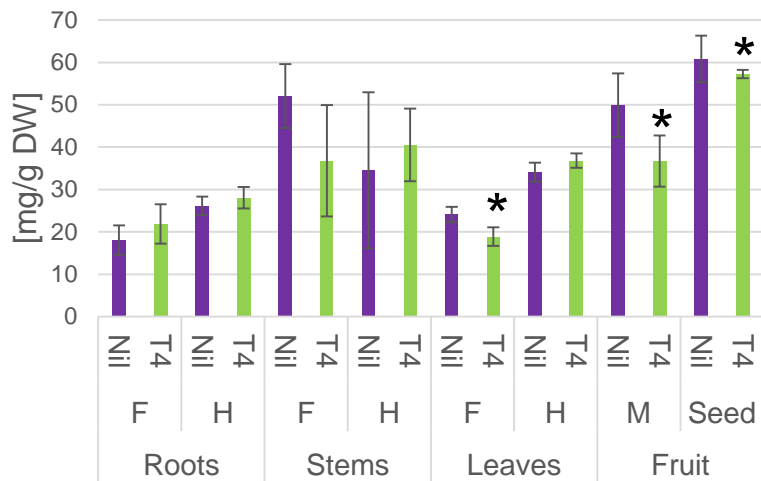
Mannoheptulose



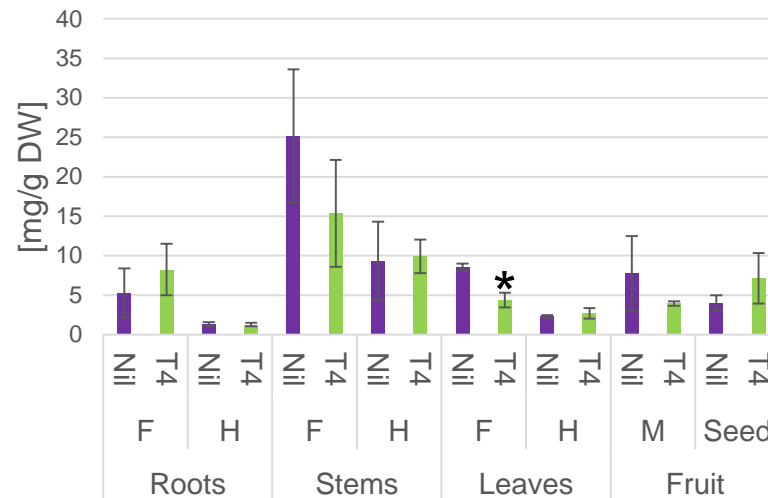
Sucrose



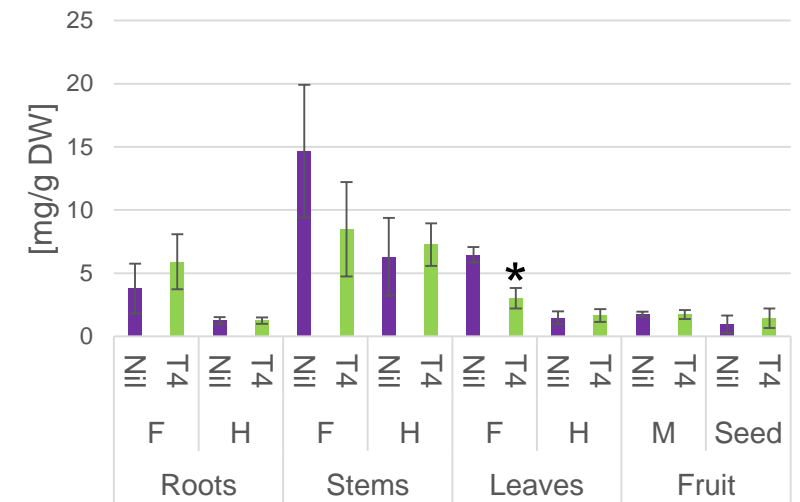
Perseitol



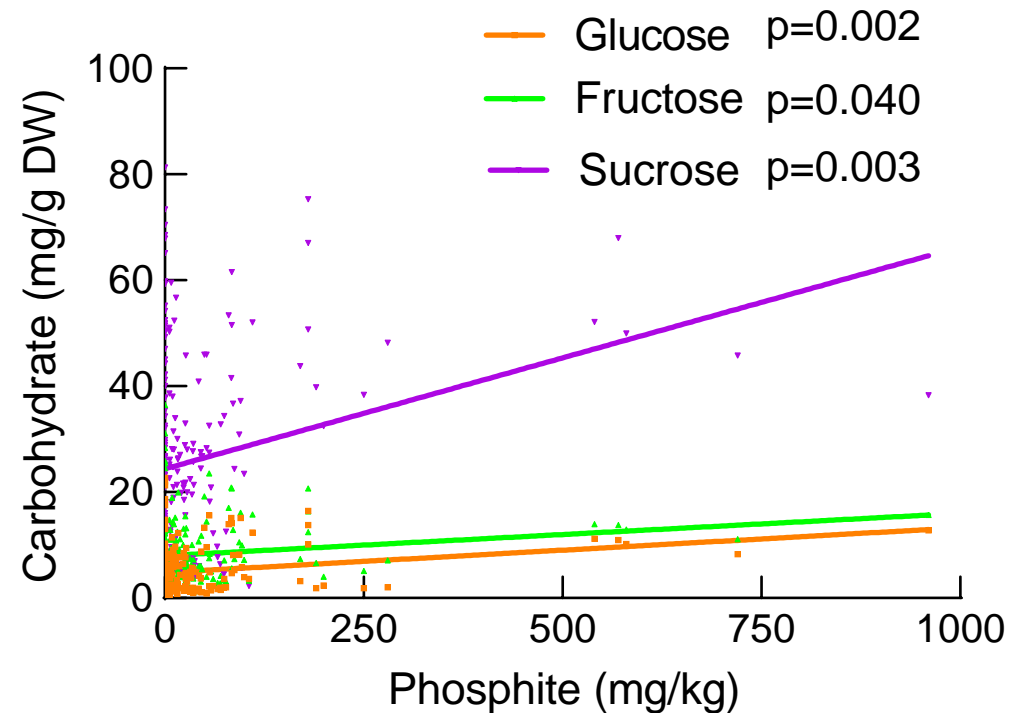
Fructose



Glucose

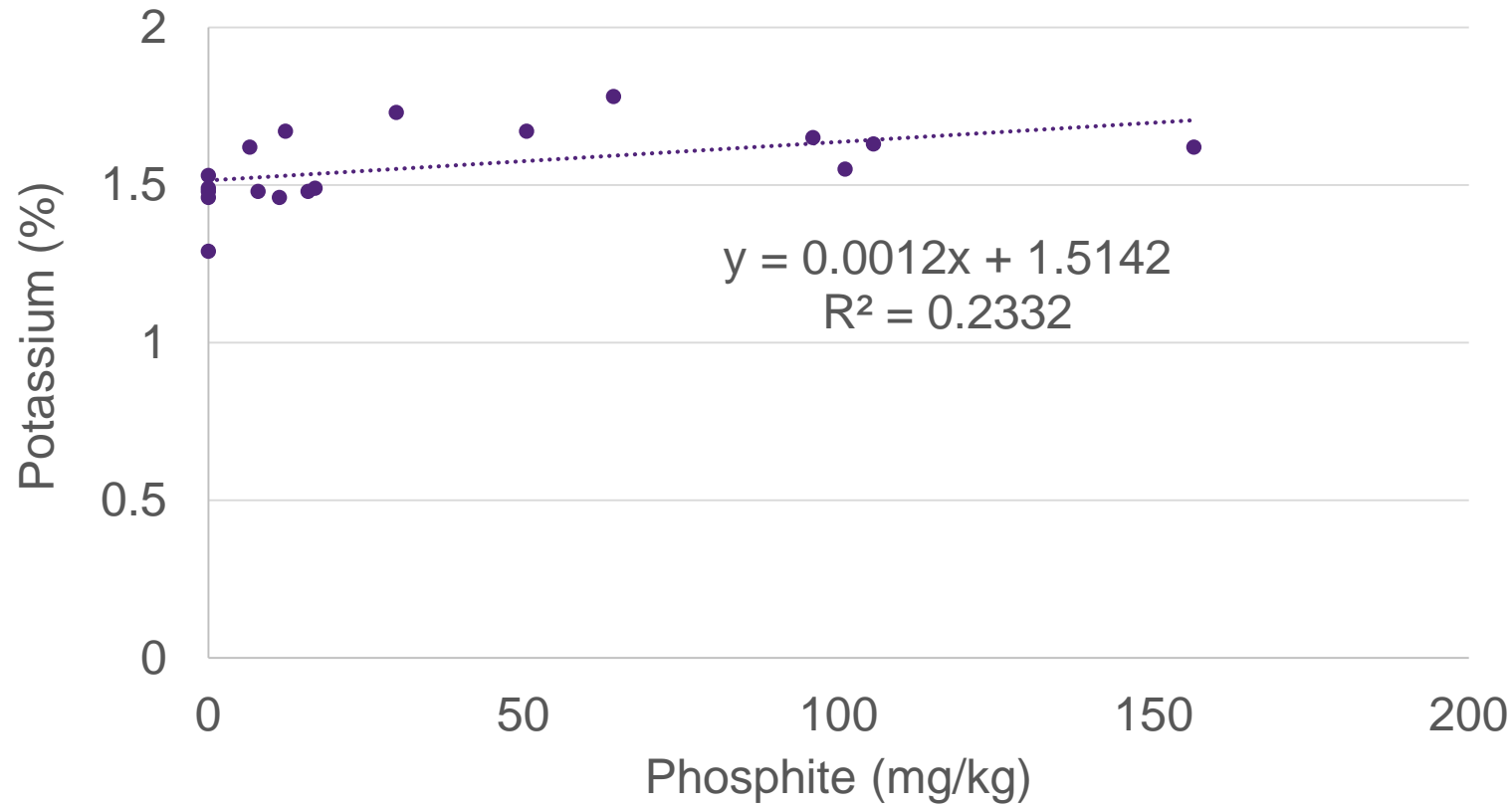


Phosphite correlates with glucose, fructose and sucrose



- Across all sampling times and tissue types (n=215 pairs)
- Not significant for starch, perseitol or mannoheptulose

Phosphite correlates with potassium in fruit pulp



- $p=0.042$ (n=18 pairs)

Conclusions

- Some effects of phosphite with carbohydrate in some tissues at some sampling times
 - Not consistent, probably depends on factors e.g. spray timing, crop load, weather?
- Overall, highly significant correlations between phosphite conc. and simple sugars
- Potassium accumulation in fruit pulp likely from potassium phosphonate sprays
- More detailed data analyses underway

Acknowledgements

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