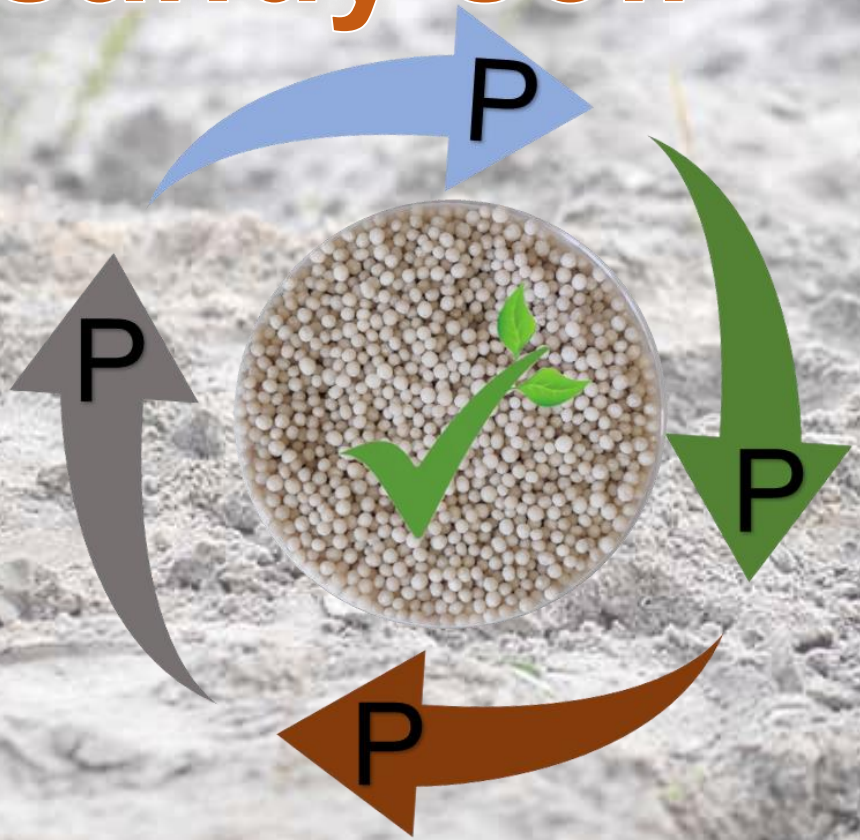
The use of wastewater-recovered struvite as a phosphorus fertiliser in sandy soil



THE UNIVERSITY OF WESTERN AUSTRALIA

SANDY SOILS GLOBAL CONFERENCE
PERTH | AUSTRALIA | JULY 2025

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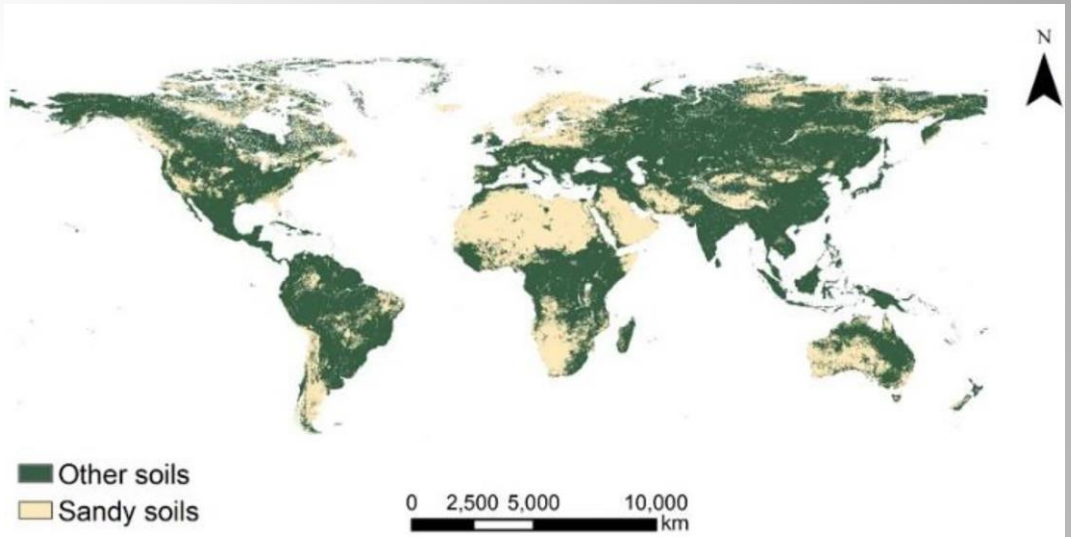
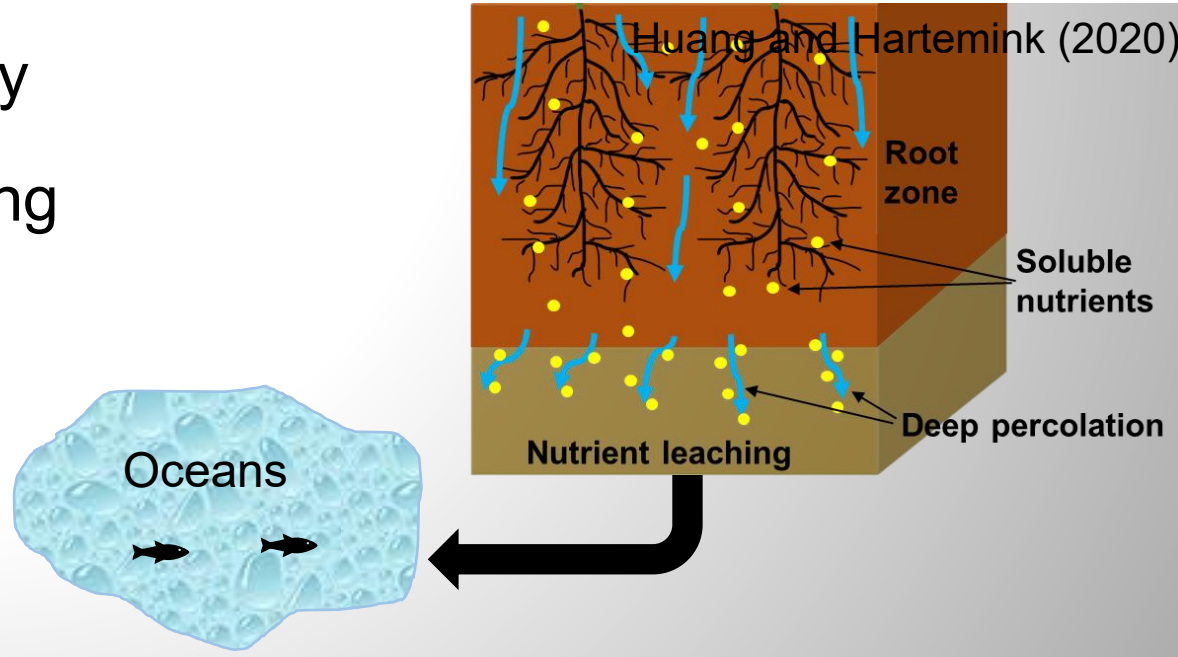
Introduction

Sandy soils

- Widely distributed across the world
- More than 50% sand and less than 20% clay content
- Low water- and nutrient-holding capacity
- Susceptible to nutrient (P and N) leaching
- Increase in use of inorganic fertilisers
- Conventional inorganic fertilisers are highly soluble



Huang and Hartemink (2020)

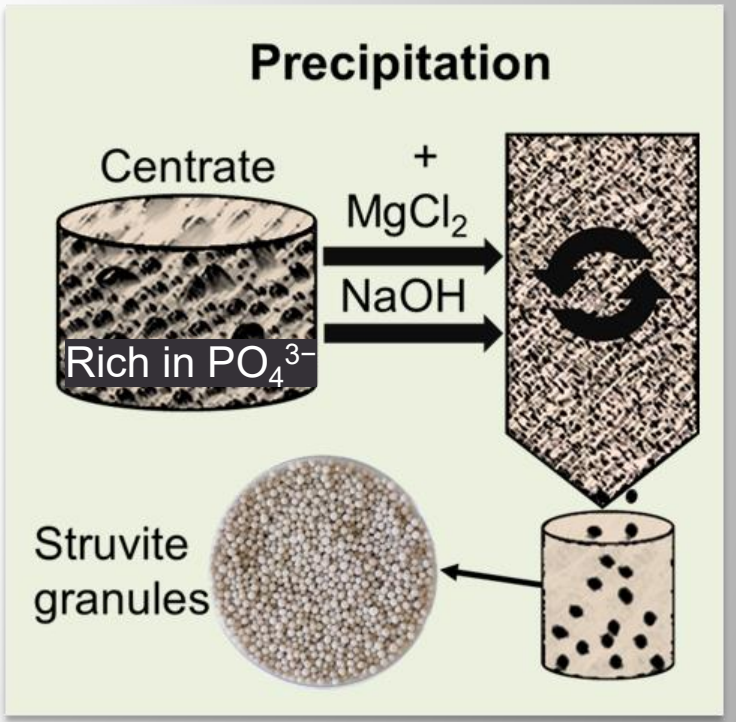


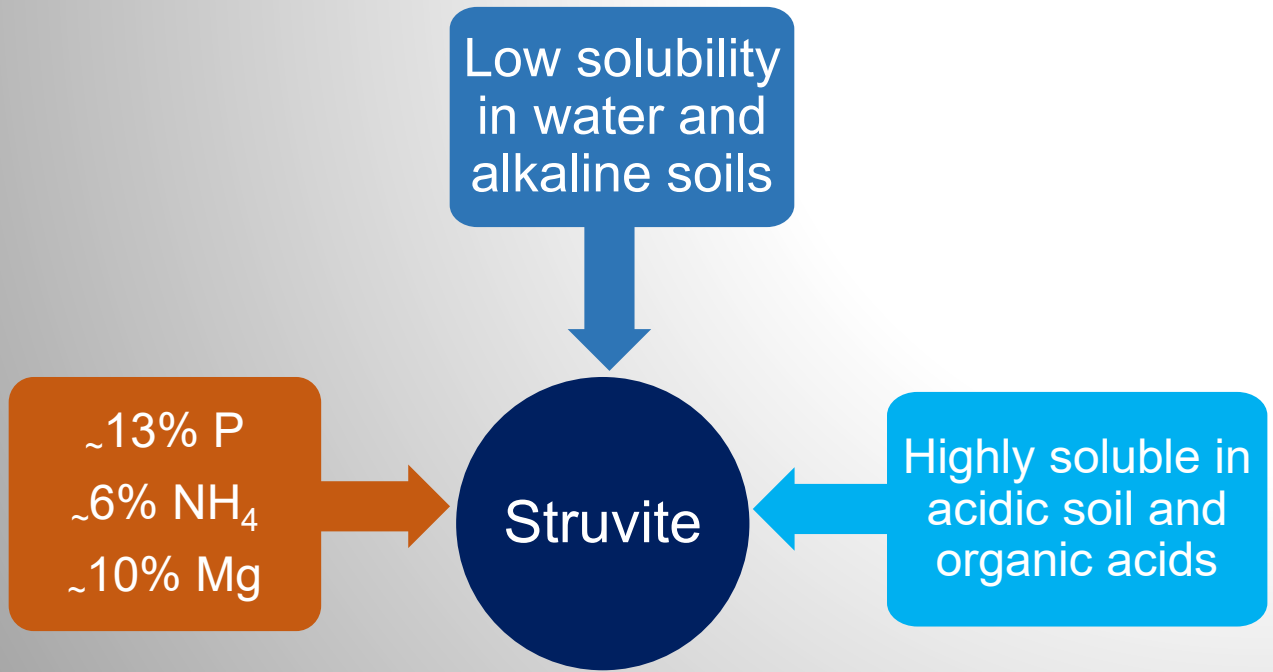
Acharya et al (2023)

Introduction

Struvite

- A salt builds up in treatment plant pipes
- Derived from recycling of wastewater
- Gaining attention as an alternative P source



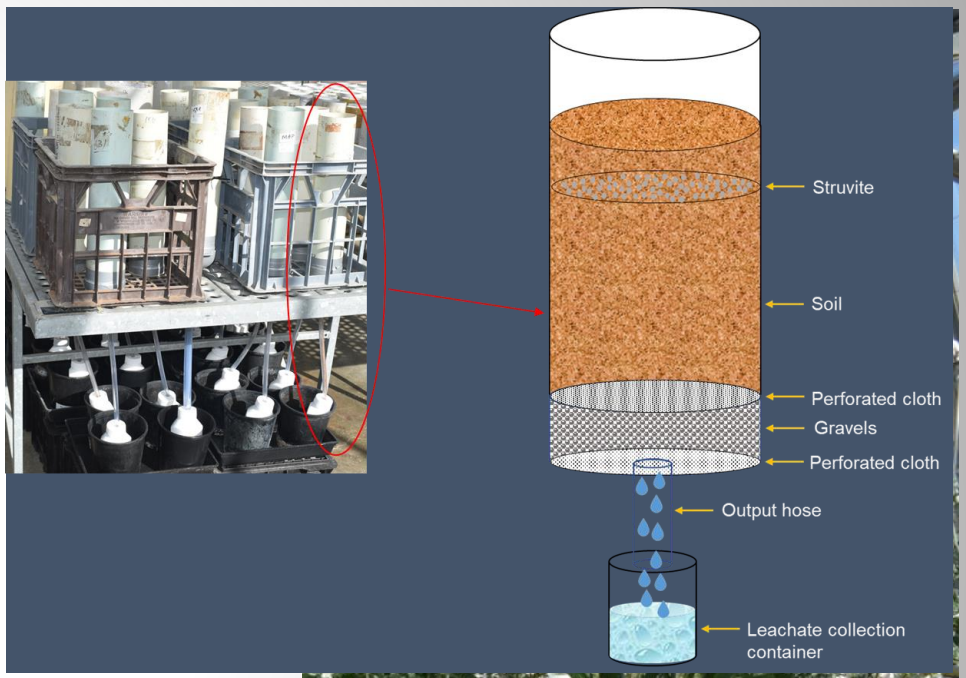


Latifian et al (2012)

Methods

Experiments

- Evaluate the P leaching from struvite
- Assess the plant growth response to struvite



Methods

Soil type (loamy sand)

- Acidic (pH 5.0)
- 97% sand, 1.5 clay and 1.5% silt

Species

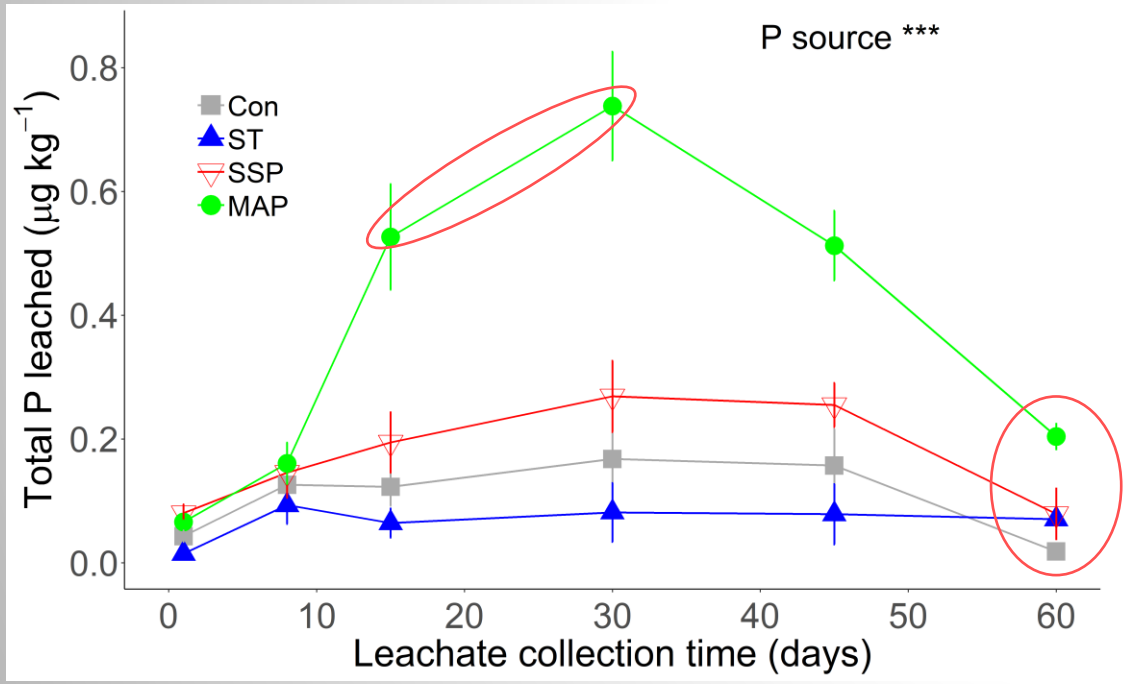
- Chickpea (high root-exuded carboxylate)
- Wheat (low root-exuded carboxylate)

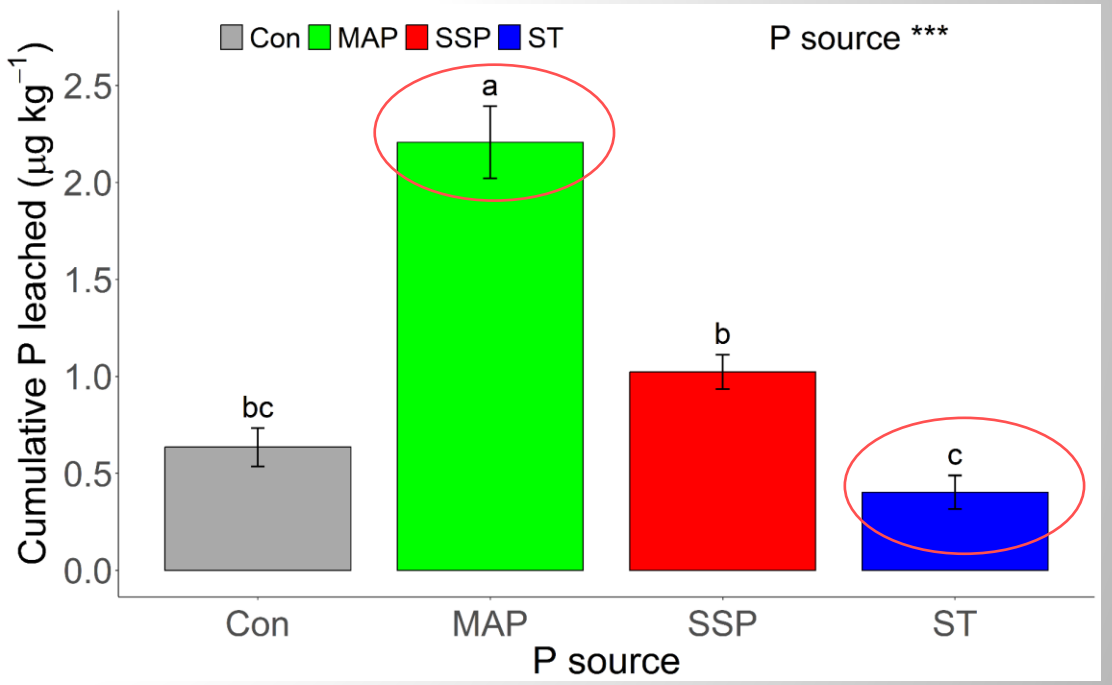
Phosphorus (P) sources (90 µg P g^{-1} dry soil)

- Struvite (ST)
- Mono-ammonium phosphate (MAP)
- Single superphosphate (SSP)
- Control (Con, No-P)

Results

Leaching exp

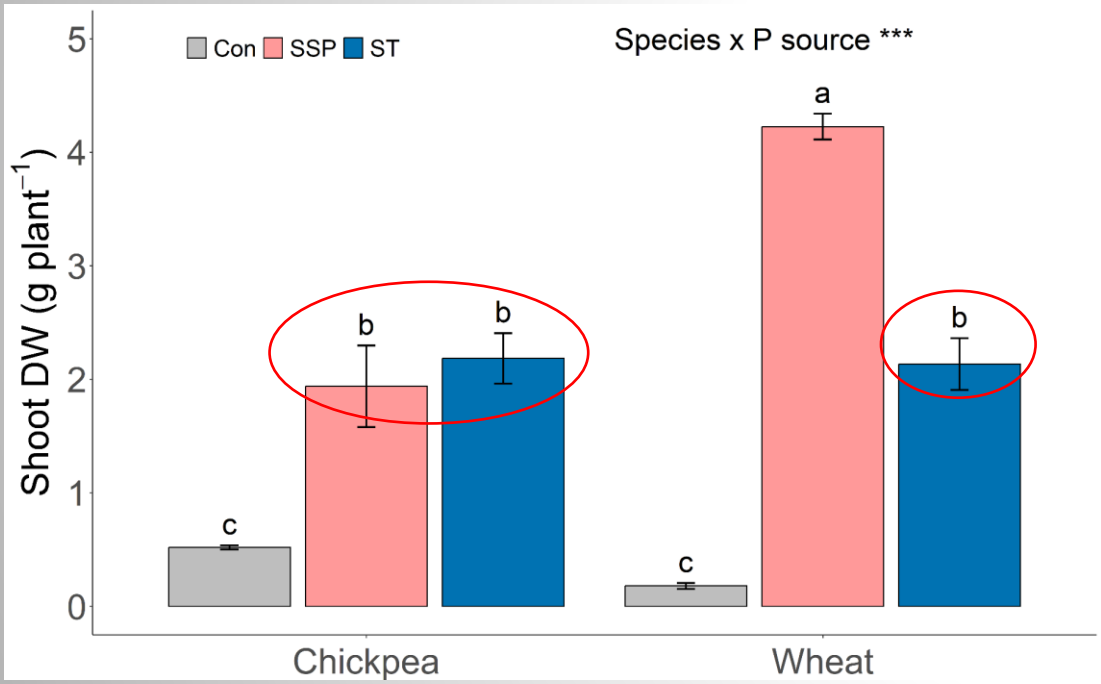




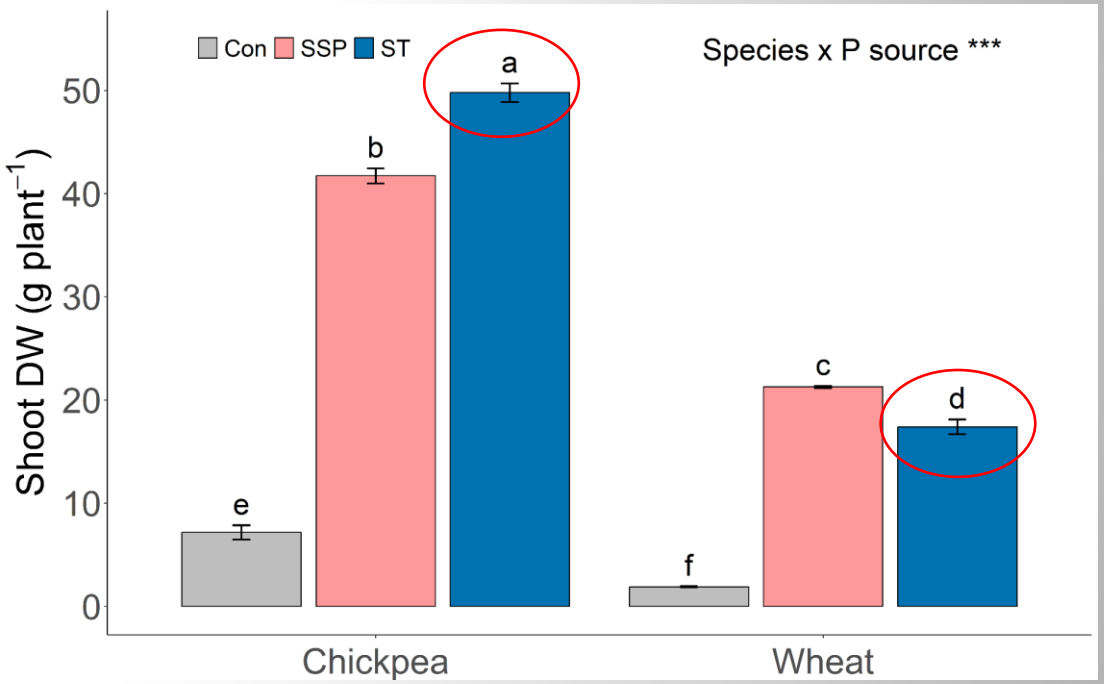
Results

Plant growth exp

Early growth (8 weeks after sowing)



Physiological maturity

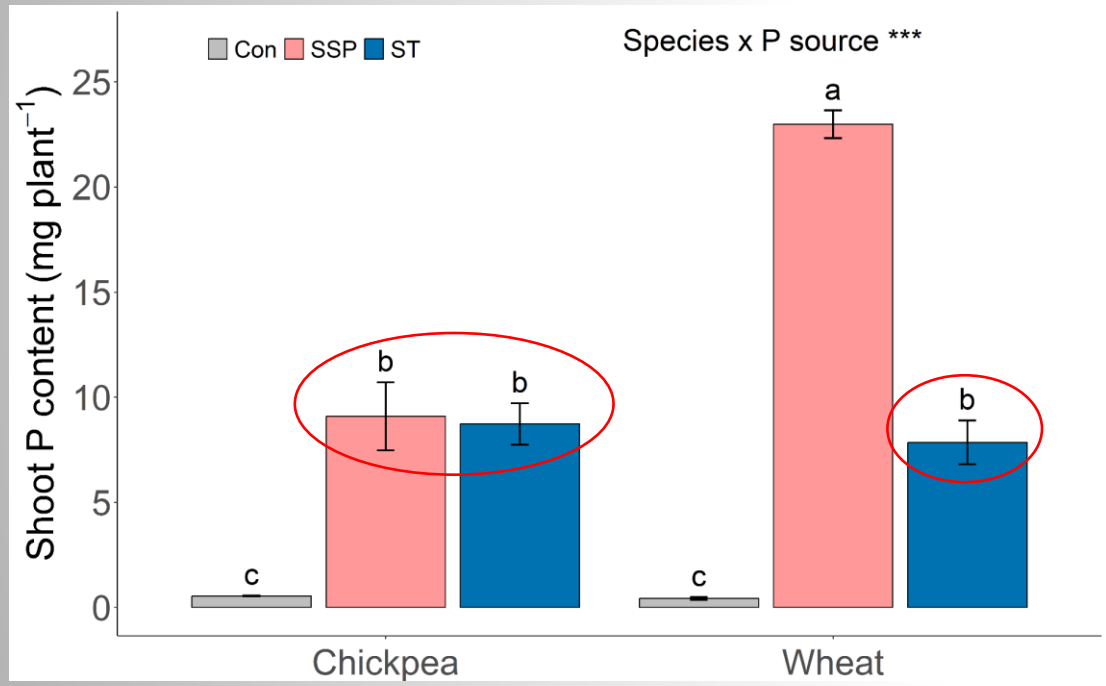


Shoot Dry weight (DW)

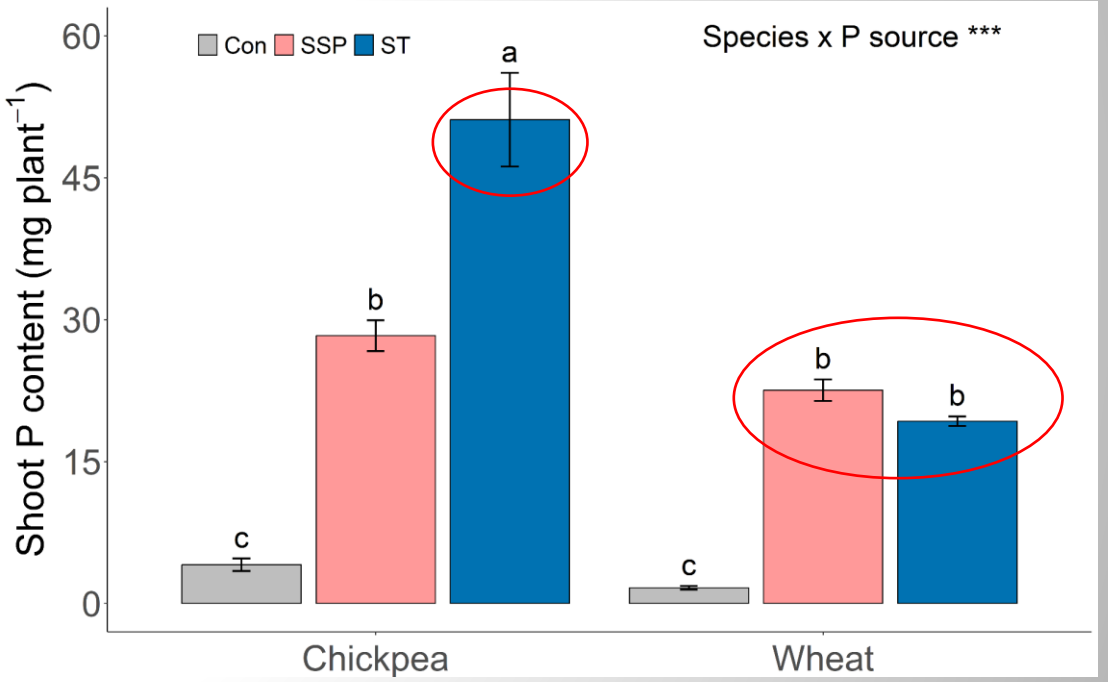
Results

Plant growth exp

Early growth (8 weeks after sowing)



Physiological maturity



Shoot phosphorus content

Results

Plant growth exp

Early growth (8 weeks after sowing)

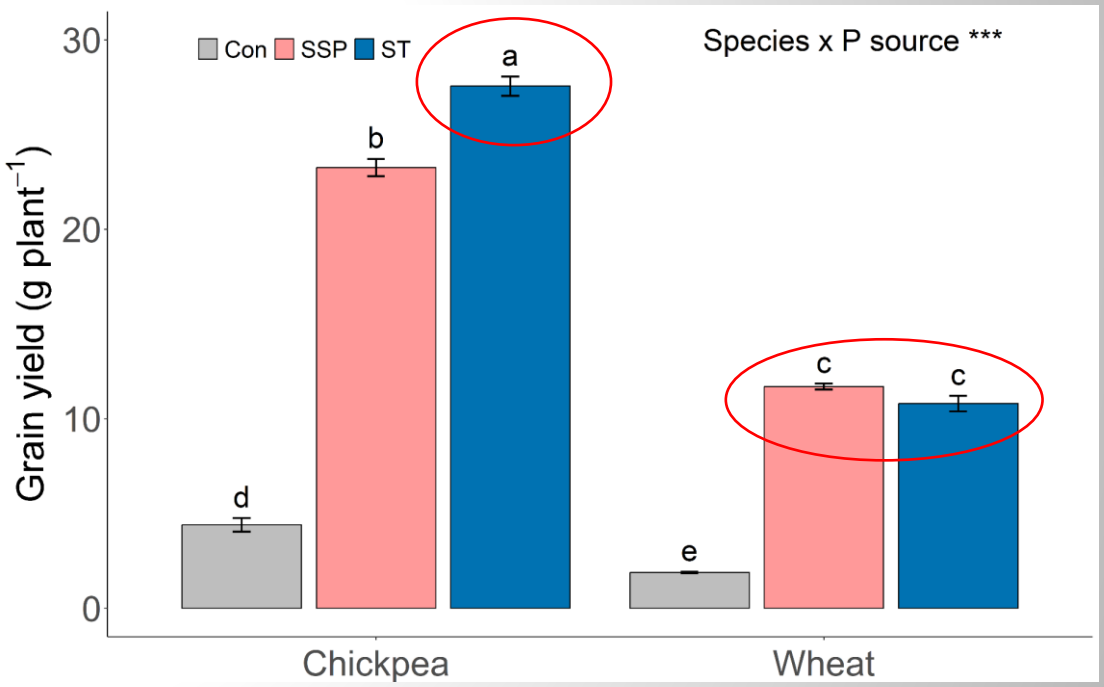
Root exuded carboxylates (organic acids)

Results

Plant growth exp

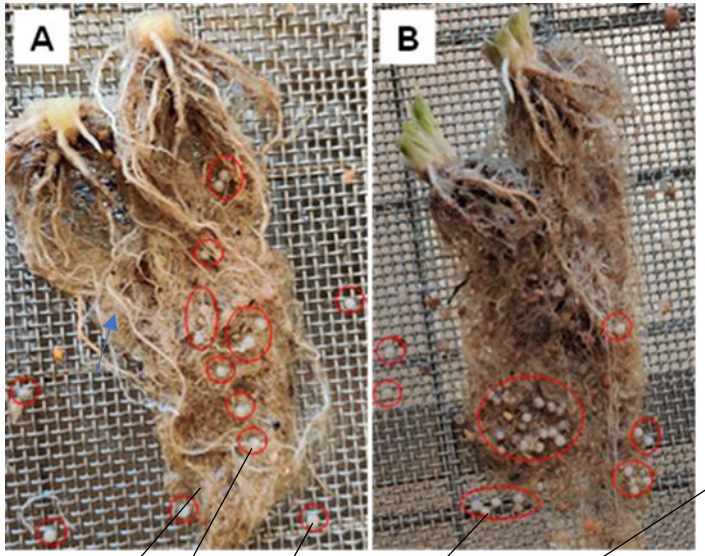
Agronomic P-use efficiency

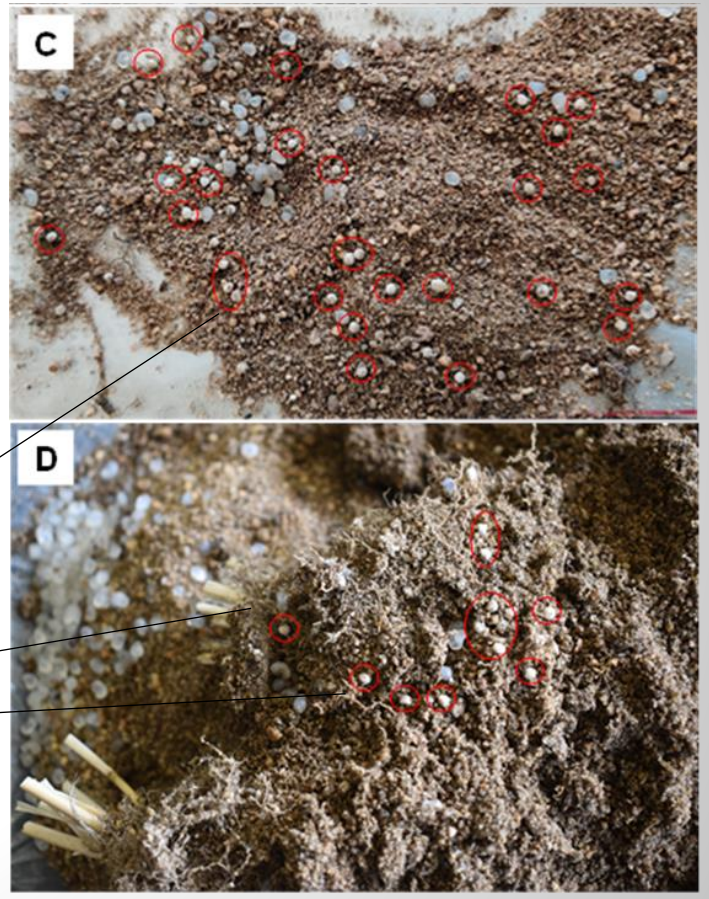
Grain yield



Results

Plant growth exp





Undissolved struvite granules even after six months

Significant residual value for following crop

Conclusions

Under struvite fertilisation

- Lower P leaching than soluble fertilisers in sandy soils.
- Chickpea exuded more carboxylates.
- Chickpea had higher grain yield than wheat.
- A significant residual value for subsequent crops.

Take home message

In sandy soils, struvite can be a promising sustainable alternative P fertiliser, offering both agronomic and environmental benefits.

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Thanks

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