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Evaluating the fertiliser application options for crops grown in re-engineered acidic duplex soil in WA

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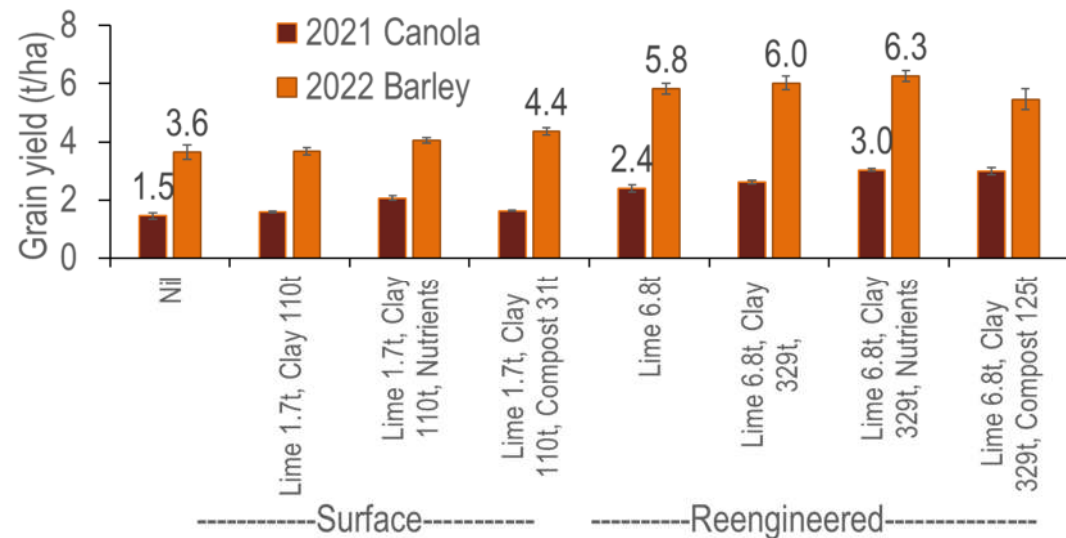


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Introduction

- Soil re-engineering by excavation and deep incorporation of lime, clay and nutrients showed the potential to double the grain yield (Azam et al 2024).
- The benefit of loosening and incorporation of lime and clay might last long, but the nutrients need to be applied often.

Q: Can topdressing of nutrients generate the same yield as deep placement once a soil is re-engineered?



Azam et. al., 2022

Reconstructed soil column studies of re-engineering duplex profile with sub-soil acidity, compaction & poor nutrition

Low bulk density (1.5 g/cm^3)

Low soil strength (1 MPa)

Four ameliorants

1. Nil ameliorant
2. Clay (5 % clay 0-40 cm+ 5.8 ton/ha Gypsum 0-80 cm)
3. Lime (12 ton/ha 0-80 cm)
4. Clay + Lime

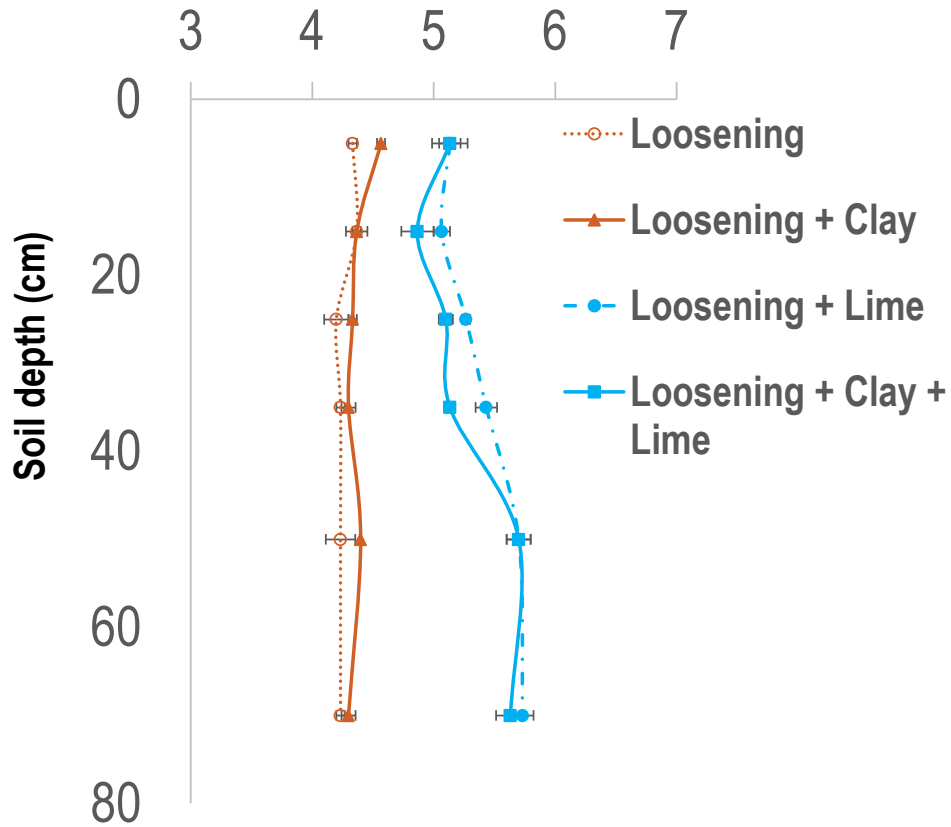
Three fertiliser rates (kg/ha)

- F1. Topdressing at low rate (N:P:K 28.5:11.5:19.5)
- F2. Topdressing at high rate (N:P:K 57:23:39)
- F3. Deep incorporating at re-engineering rate (N:P:K 228:92:156)

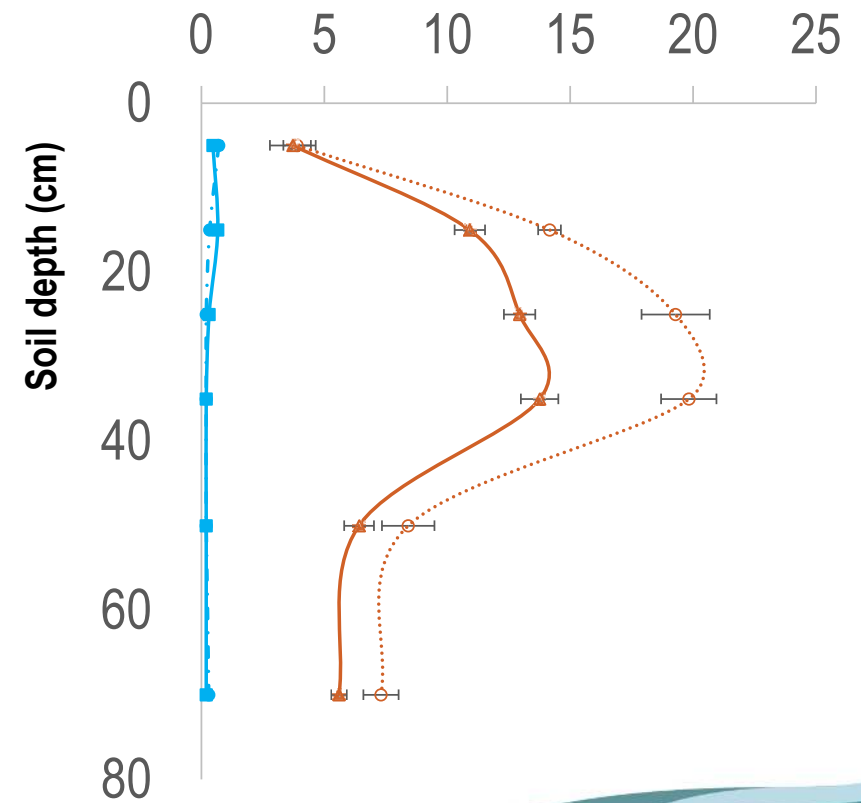


Deep incorporation of lime increased soil pH above the target level and eliminated extractable aluminium concentration (EAC) well below the toxic level.

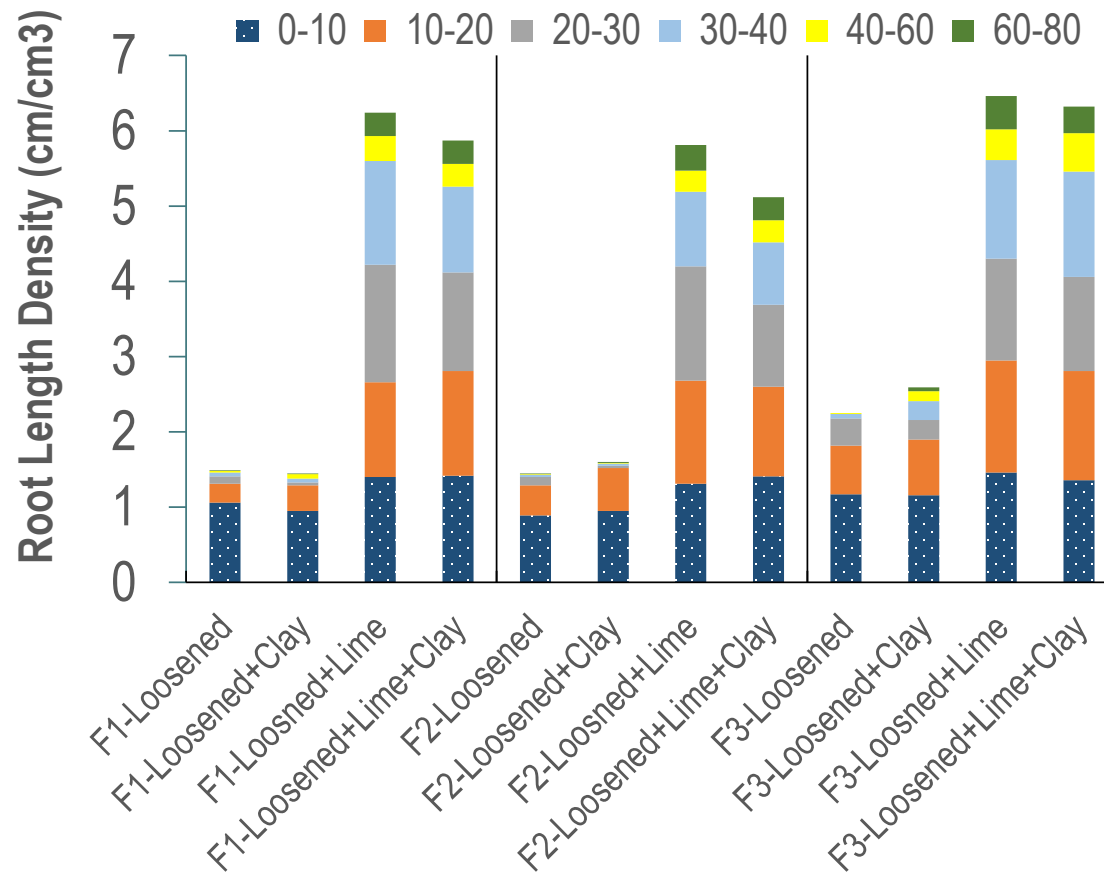
Soil pH (CaCl₂)



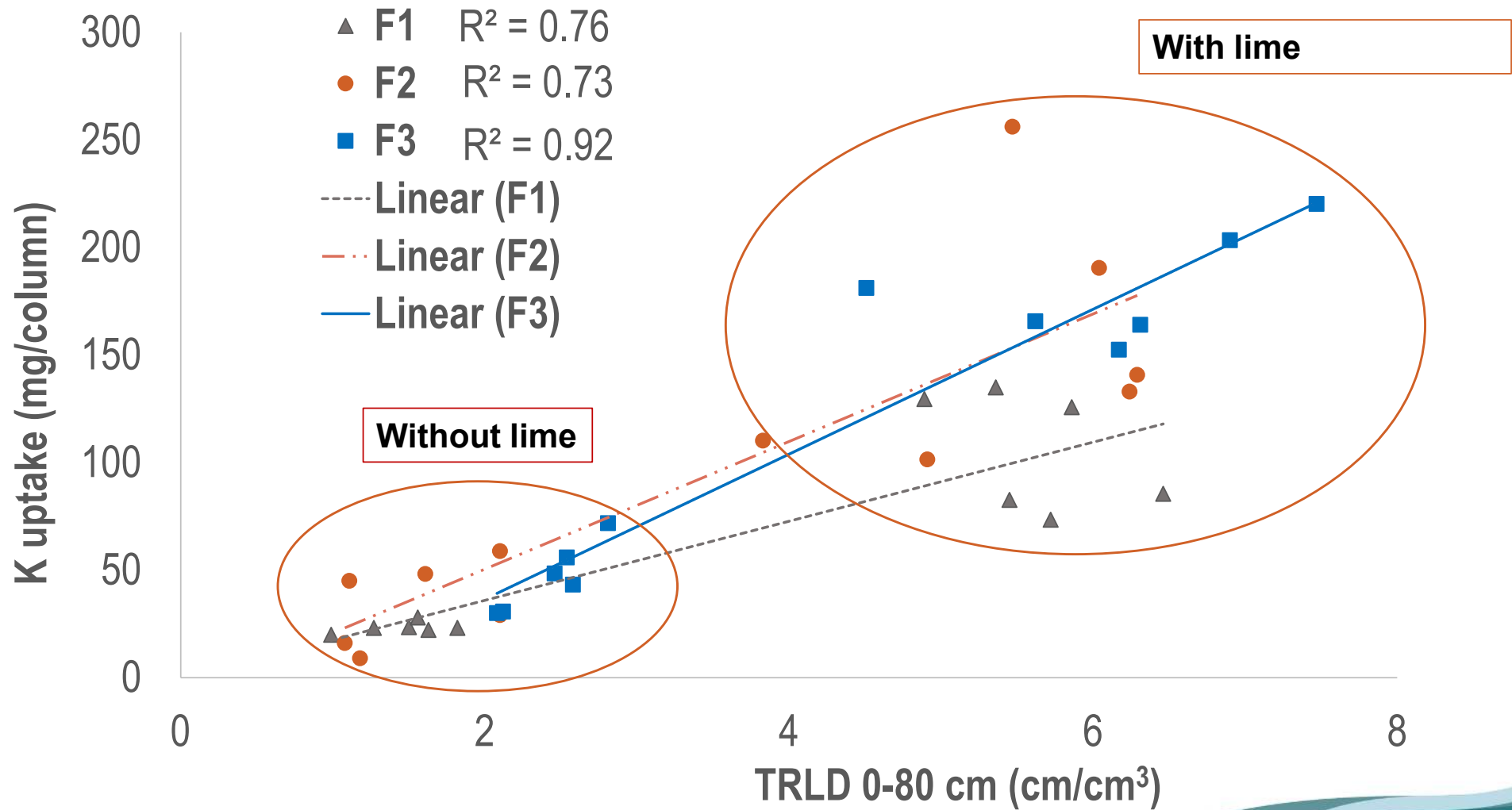
Soil EAC (CaCl₂) (mg/kg)



Treatment effects (fertiliser, ameliorant) on root length density at anthesis (Z 59)



Relations between root length density and nutrient uptake



Aboveground biomass and the number of ears per column as influenced by fertiliser treatment

	Fertiliser treatment			l.s.d. ($P=0.05$)
	F1	F2	F3	
Aboveground biomass per column (g)	5.39 a	8.02 b	9.63 b	1.67
Number of ears per column	6.67 a	9.0 b	10.42 b	1.69

Means followed by the same letter for a given data row are not significantly different

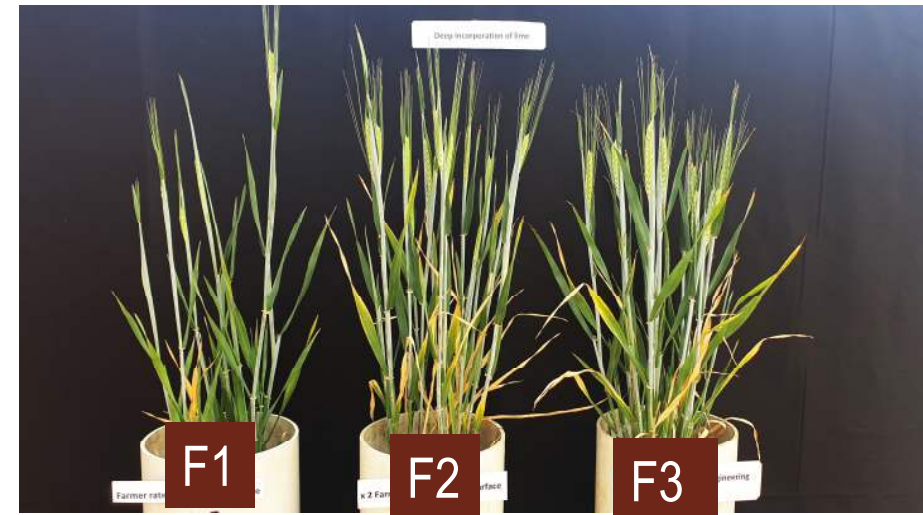
Aboveground biomass and the number of ears per column as influenced by ameliorant treatment

	Ameliorant treatment				l.s.d. ($P=0.05$)
	Loosening	Loosening + Clay	Loosening + Lime	Loosening + Lime + Clay	
Aboveground biomass per column (g)	3.46 a	4.32 a	11.16 b	11.78 b	1.91
Number of ears per column	5.44 a	5.89 a	11.56 b	11.89 b	1.95

Means followed by the same letter for a given data row are not significantly different

Conclusions

- Lime incorporation was the main factor in improving root growth, shoot biomass and ear count
- A higher rate of topdressed fertiliser could be as efficient as deep incorporation of a very high fertiliser rate once soil constraints were re-engineered





Thank you

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- **DPIRD-WA**
- **Grain Research and Development Cooperation**
- **Soil Science and Crop Nutrition Team DPIRD**

Important disclaimer

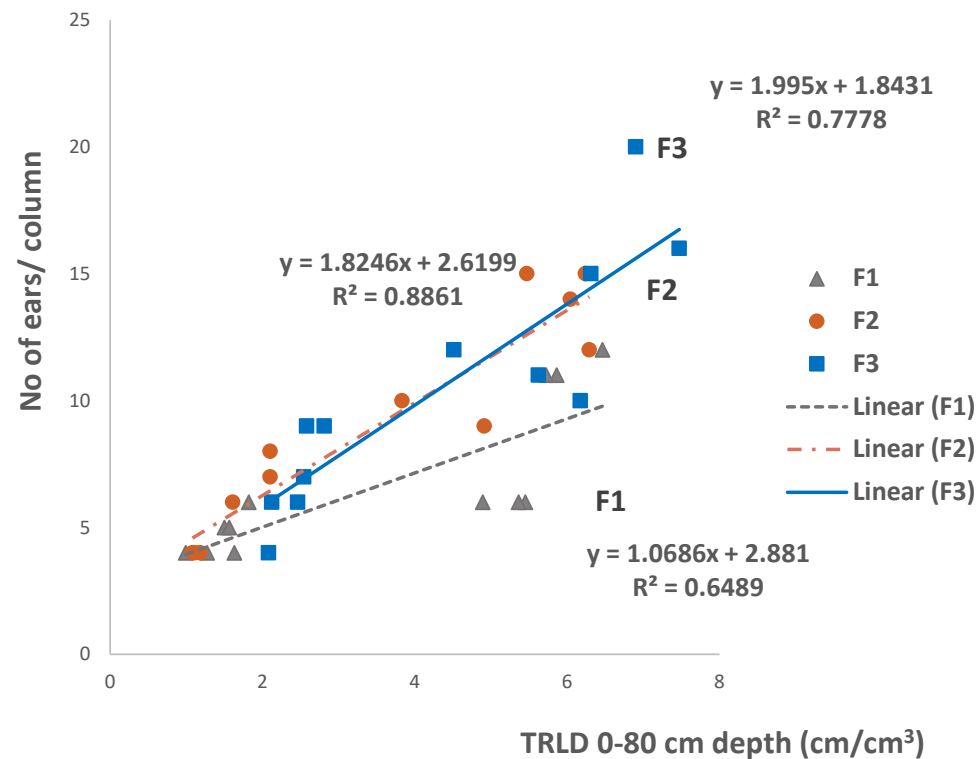
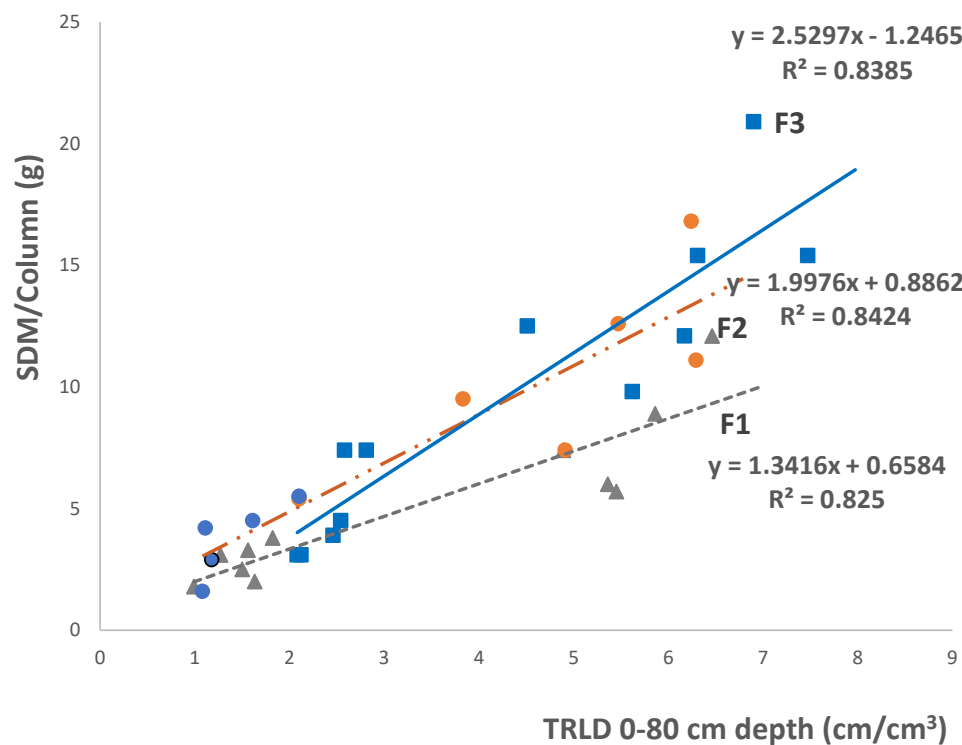
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No nitrogen fertiliser applied



Relations between aerial traits (yield insights) and underground trait (Z-59)



Relations between root length density and nutrient uptake

