

Phosphorus and sulfur placement strategies for improving groundnut production in coarse textured soils of the CDZ

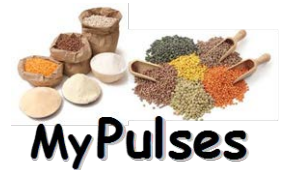
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Background

Availability of nutrients in the soil surface may be affected by changing rainfall patterns

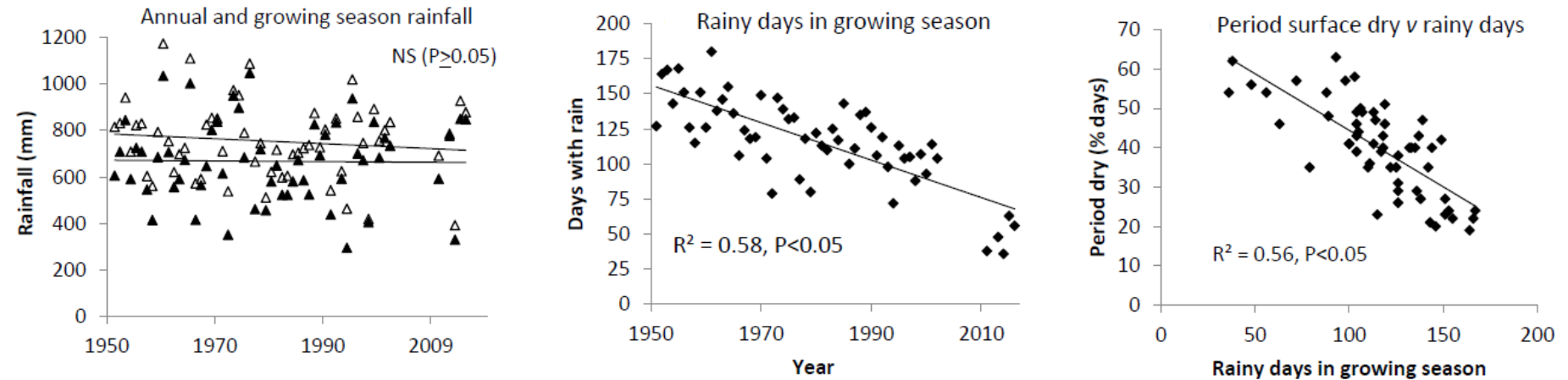


Figure 1. Changes in rainfall patterns in the CDZ (Cornish et al. unpub.)

Trial design

Surface and deep placed phosphorus (0, 20 and 40 kg P/ha) and gypsum (0 and 50 kg S/ha)



Trial management

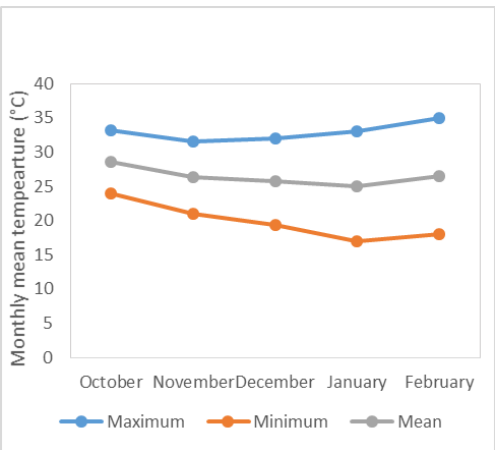
Sown in November, harvested 110 days later

Biomass cuts 40 DAS and at harvest with tissue analysis to capture uptake

Soil analysis pre and post-trial to depth to capture nutrient movement

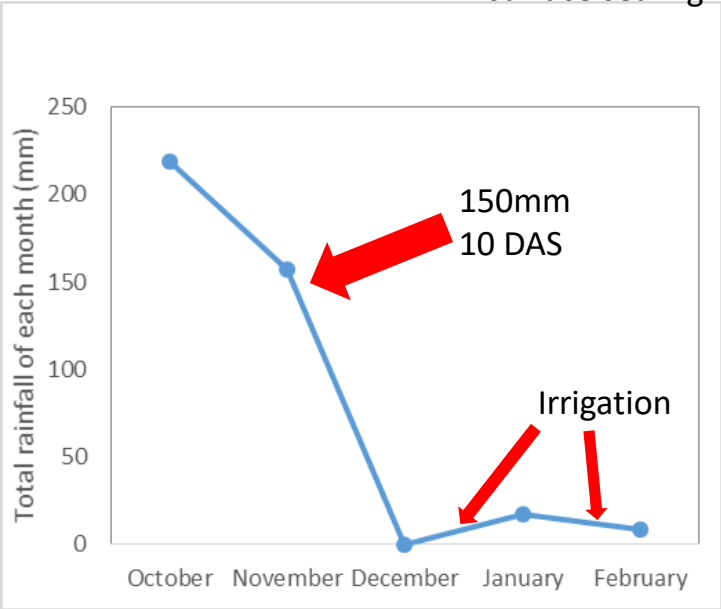


Climatic constraints



Temperatures good for
groundnut production

Trial flooded due to heavy
rain 10DAS – resultant
surface sealing



Phosphorus and sulfur status

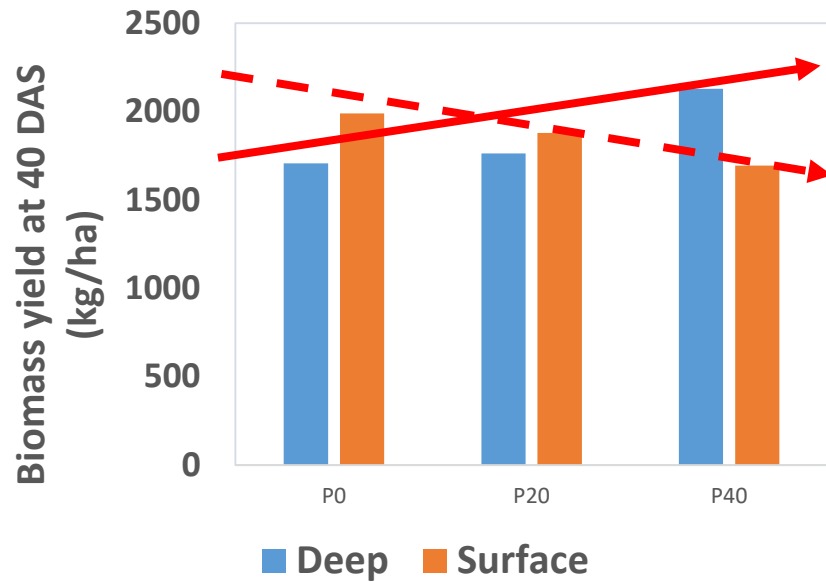
Initial soil chemical properties of the trial site to 180cm depth

Soil depth (cm)	pH	Soil textural class	Soil organic matter (%)	Available N (mg/kg)	Olsen P (mg/kg)	Available K (cmol/kg)	Sulfate S (mg/kg)
0-10	6.5	Sandy loam	1.2	42	11	0.23	4
10-30	6.8	Sandy loam	1.4	49	7	0.16	4
30-60	7.1	Sandy loam	1.1	37	1	0.13	4
60-90	7.3	Loamy sand	0.5	27	3	0.14	3
90-120	7.5	Loamy sand	0.4	22	1	0.13	4
120-150	7.7	Loamy sand	0.6	17	1	0.10	4
150-180	7.6	Loamy sand	0.7	21	2	0.14	5



Biomass yield responses

No S effect on yield; significant interaction of P by placement



Effect of P application and placement depth on biomass yield of groundnut 40DAS in a sandy soil



Biomass yield responses

No S, P or placement effect on final yield

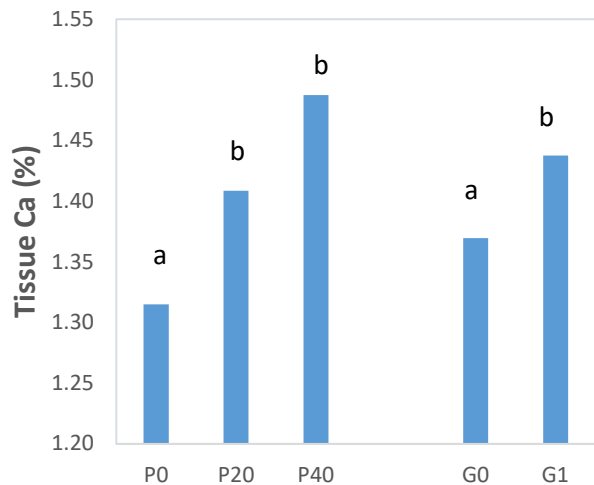
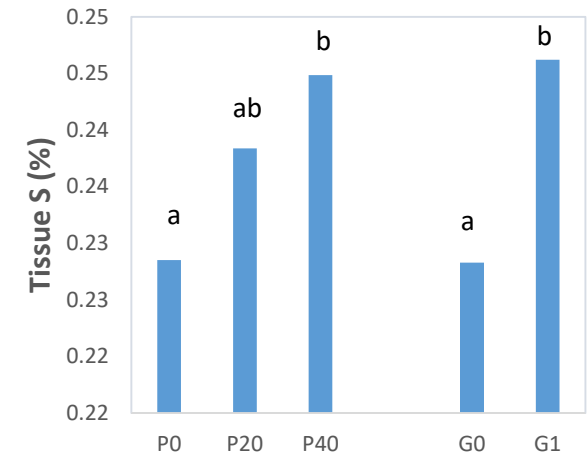
Yields at <50% of benchmark yields



Effect of gypsum on biomass yield, pod and seed yield and harvest index of groundnut grown in sandy soil

Gypsum rates	Biomass yield at harvest (t/ha)		Pod yield (t/ha)		Seed yield (t/ha)		Harvest index	
	Deep	Surface	Deep	Surface	Deep	Surface	Deep	Surface
G0	1.96	1.93	1.05	1.09	0.61	0.65	0.35	0.36
G1	2.04	2.10	1.08	1.12	0.67	0.66	0.35	0.35
Experimental mean yield	2.01		1.09		0.65		0.35	

Tissue S and Ca responses 40 DAS



Tissue P% also increased 5-8% with application of P ($P<0.05$)



Tissue P, S and Ca concentration as affected by fertiliser application at two depths and critical concentrations for growth

Tissue analysis	P (%)			S (%)		Ca (%)	
	P0	P20	P40	G0	G1	G0	G1
Average	0.35	0.33	0.34	0.25	0.26	1.47	1.52
Standard Deviation	0.02	0.03	0.01	0.01	0.01	0.12	0.07
Sufficiency range *	0.25-0.50			0.20-0.35		1.25-2.00	

Tissue S and Ca concentration as affected by fertiliser application at two depths

Soil P and S status post trial

Olsen P (mg/kg) post-harvest as affected by P placement, rate and soil depth

P rate	P0		P20		P40	
Depth	Surface	Deep	Surface	Deep	Surface	Deep
0-10 cm	6.7	5.3	9.5	8.8	11.5	11.5
10-30 cm	4.8	5.1	8.2	9.0	11.5	11.5
Average	5.5 ^a		8.9 ^b		11.5 ^c	

Available S (mg/kg) post-harvest as affected by S placement, rate and soil depth

S rate	G0		G50	
Depth	Surface	Deep	Surface	Deep
0-10 cm	0.1	1.8	3.8	3.5
10-30 cm	0.5	2.4	3.6	3.3
Average	1.2 ^a		3.5 ^b	



Conclusions and reflections

- Site selection on a low-lying, and ultimately fertile soil precluded the hypothesis being fully tested
- Careful establishment was rewarded with increased P, S and Ca uptake and soil values reflecting nutrient addition despite flooding
- Repeating the experiment on a low P and S site, not susceptible to flooding is warranted as climate change and mechanisation will both change fertiliser management strategies

Thanks

(Kyei zu tin bade)

Questions?



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