SOILS: WHERE FOOD BEGINS

Omission plot technique for assessing the nutrient contribution towards productivity of rice-maize cropping system in calcareous soils in eastern India

SINGH Shiveshwar Pratap (Ph.D., Soil Science)
Dr. Rajendra Prasad Central Agricultural University, INDIA

Global Symposium on Soils for Nutrition | 26-29 July 2022

GLOBAL SOIL PARTNERSHIP

OUTLINE

- Background
- Methodology
- Results and Discussion
- Conclusions

Background

- More than 1/3rd of the world's cultivable soils are calcareous and occupy 70 per cent of the total geographic area of the country.
- Excess lime and high pH causes low solubility and high degree of nutrient fixation. Therefore, farmers tend to add extra amount of fertilizers which may result in an imbalanced nutrition.
- Thus, the aim of the present study was to evaluate the indigenous nutrient supplying capacity of calcareous soil using a nutrient omission plot technique under rice-maize cropping system.
- “**Omission Plots**” techniques: a particular essential nutrient is omitted from the fertilization schedule keeping the supply of other limiting nutrients in ample quantity.

Methodology: Location and treatment details

Total No. districts: 2
Total no. of villages: 6
Total no. of sites: 23 (22 at farmers field and 1 at University farm)

Site 1 | Site 2

Two sites fixed as permanent sites for 3 years

Site 3 | Site 4 | Site 5 → Three sites for 1^{st} year only

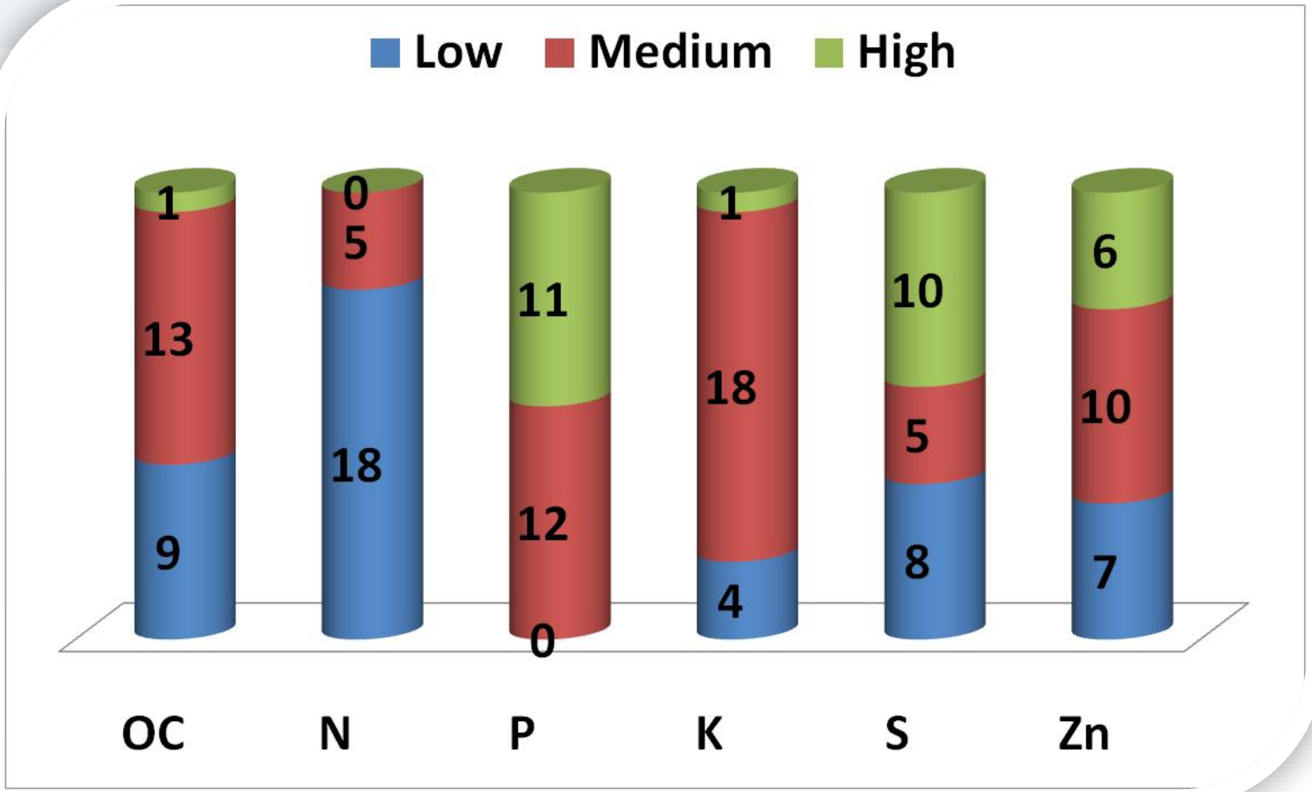
Site 6 | Site 7 | Site 8 → Three sites for 2^{nd} year only

Site 9 | Site 10 | Site 11 → Three sites for 3^{rd} year only

Treatments	Crop & Var.
*T_1: N+P+K+S+Zn	Rice:
*T_2: P+K+S+Zn (-N)	*Hybrid : Arize6444
*T_3: N+K+S+Zn (-P)	
*T_4: N+P+S+Zn (-K)	# Inbred: Rajshree
*T_5: N+P+K+Zn (-S)	
*T_6: N+P+K+S (-Zn)	Maize:
#T_7: Unfertilized	*Hybrid : DKC9081
#T_8: N+P+K+S+Zn	
*T_9: Unfertilized	# Inbred: Laxmi

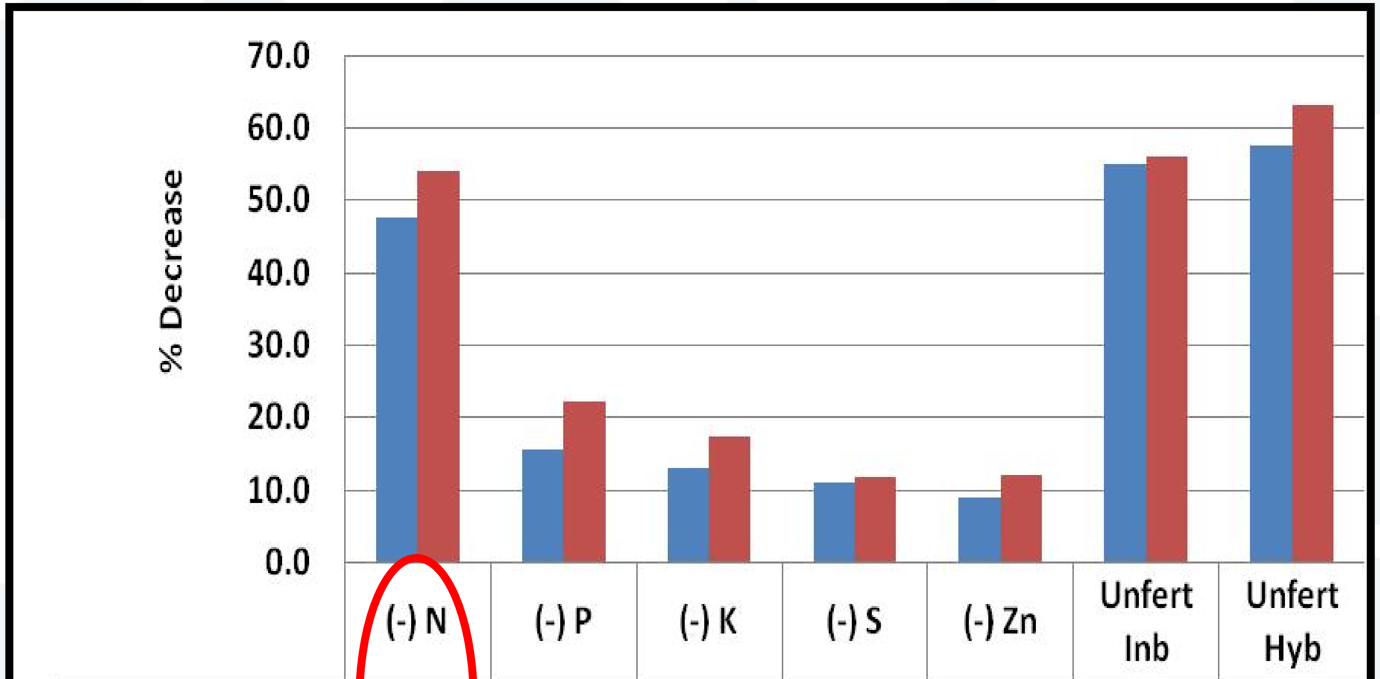
Status of initial soil (0-15 cm) of the selected 23 experimental sites

Parameter	Range	Mean & SD
pH (1:2)	7.43 – 8.28	7.88 ± 0.21
EC (1:2) dS/m	0.21 – 0.72	0.35 ± 0.12
OC (%)	0.33 – 0.80	0.56 ± 0.12
N (Kg/ha)	190.4 – 375.2	233.6 ± 40.70
P (Kg/ha)	12.4 – 56.6	25.3 ± 13.05
K (Kg/ha)	86.2 – 253.1	182.8 ± 50.57
S (mg/kg)	8.4 – 52.8	19.8 ± 11.22
Zn (mg/kg)	0.21 – 2.16	1.0 ± 0.59



Rating of the experimental sites in low, medium and high categories

Percent decrease in rice equivalent yield (Fig 1) and sustainable yield index (SYI) (Fig 2)



	(-) N	(-) P	(-) K	(-) S	(-) Zn	Unfert Inb	Unfert Hyb
New Sites	47.8	15.6	13.1	11.1	8.9	55.0	57.7
Permanent Sites	54.2	22.2	17.5	11.8	12.0	56.2	63.1

Fig 1

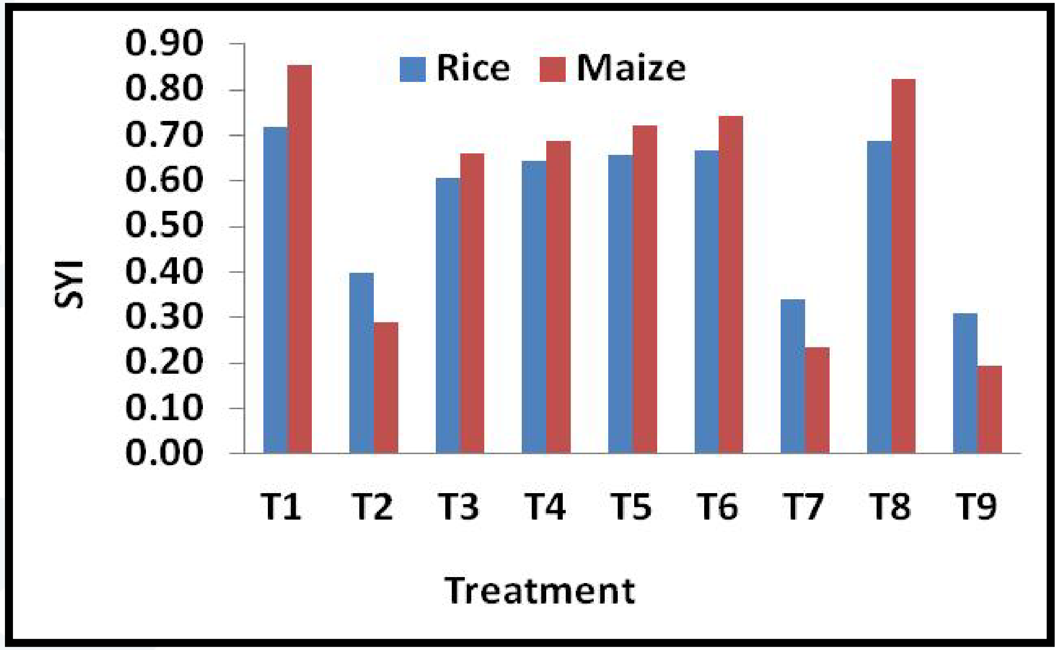
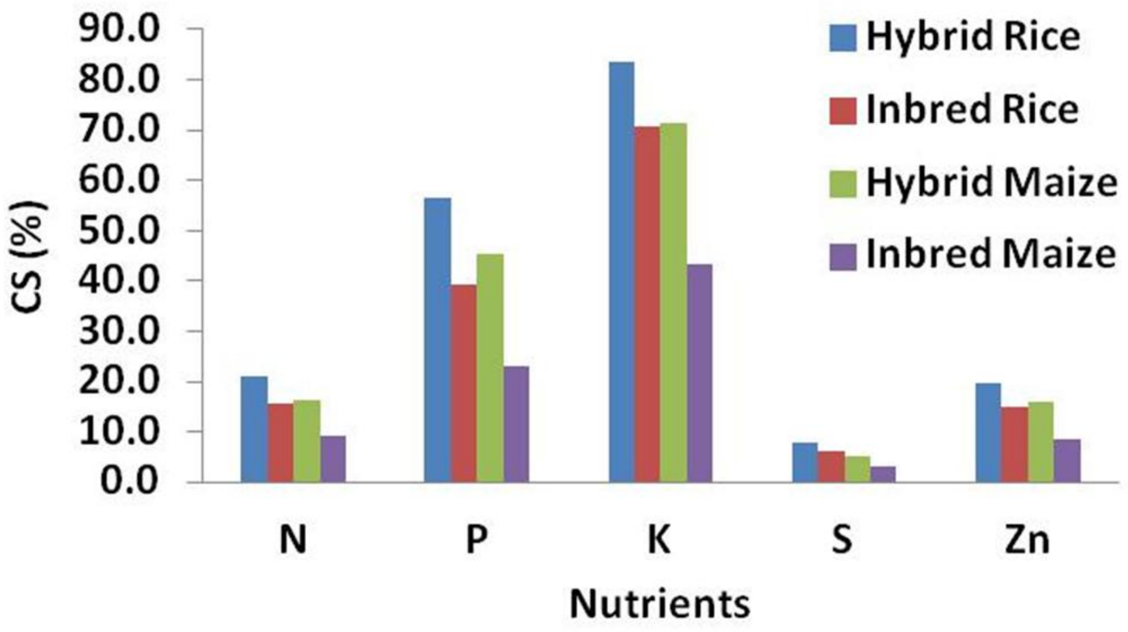


Fig 2

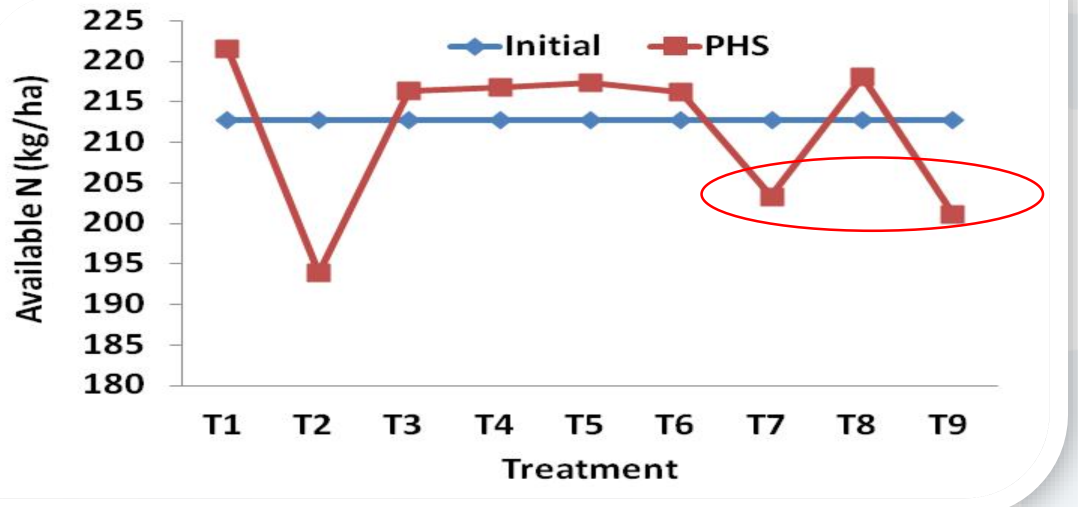
Nutrient Requirement (NR), Contribution from Soil (CS) and Contribution from Fertilizer (CF) under rice and maize

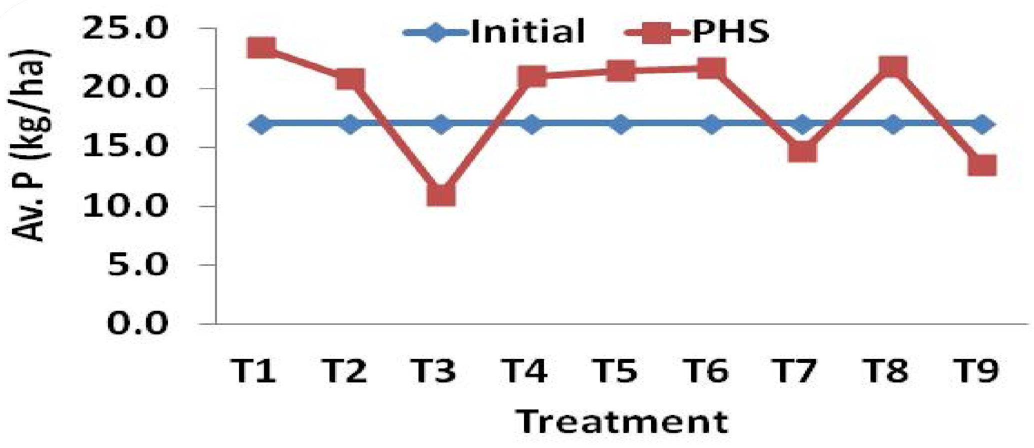
Nutrients	Hybrid Rice			Hybrid Maize		
	NR (kg/q)	CS (%)	CF (%)	NR (kg/q)	CS (%)	CF (%)
N	1.86	21.16	48.16	1.59	16.40	58.81
P	0.31	56.65	44.21	0.32	45.29	41.68
K	2.04	83.66	94.05	2.18	71.43	95.92
S	0.23	7.71	29.29	0.23	5.15	58.23
Zn	7.28	19.7	9.38	9.60	15.98	25.65

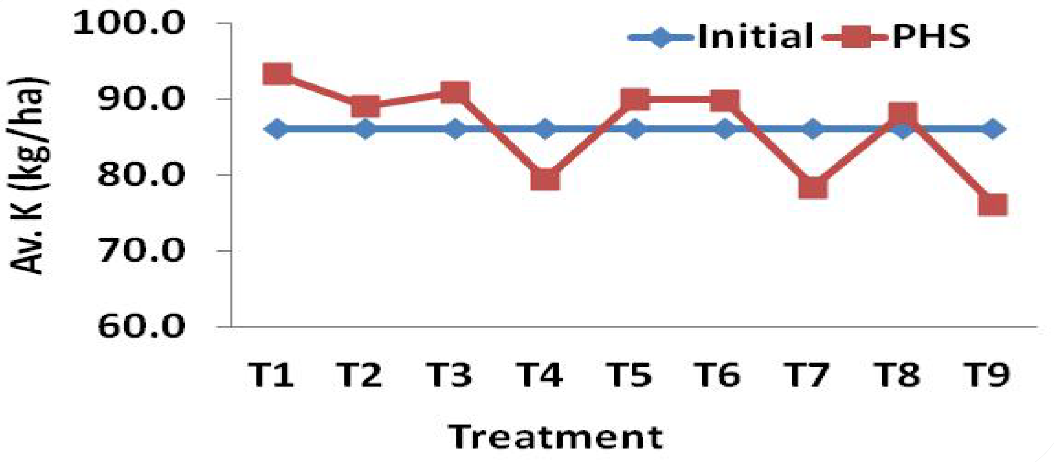
Nutrients	Inbred Rice			Inbred Maize		
	NR (kg/q)	CS (%)	CF (%)	NR (kg/q)	CS (%)	CF (%)
N	1.83	15.57	42.84	1.34	9.20	37.07
P	0.31	39.32	39.70	0.26	23.01	36.01
K	2.32	70.86	87.16	2.05	43.18	79.77
S	0.27	6.17	22.54	0.23	3.16	32.29
Zn	8.59	15.06	7.35	8.46	8.35	12.34

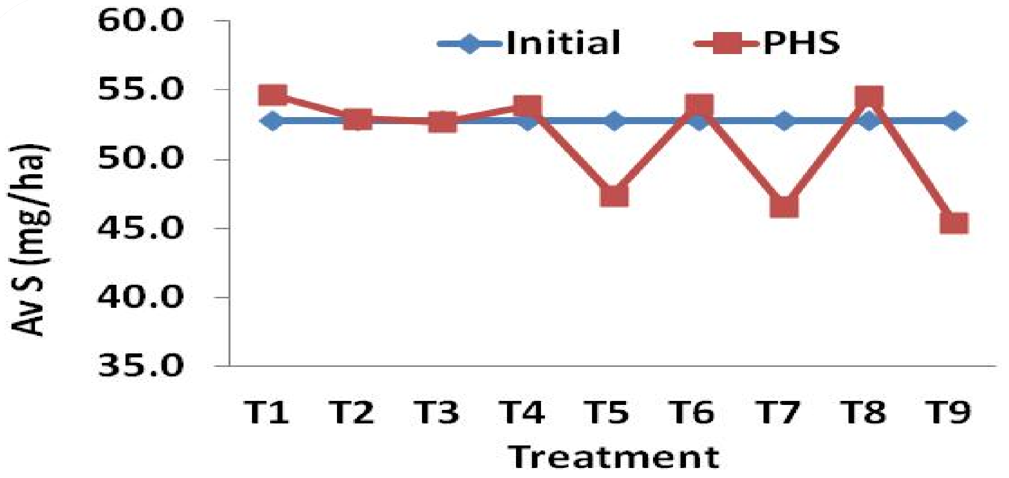


Status of available nutrients in post harvest soil









Conclusions

- Omission of the nutrients reduced the rice equivalent yield (REY) over ample fertilization, and in general, N (52.5%) was most limiting nutrient followed by P (19.8%), K (16.2%), S (11.4%) and Zn (10.9%).
- **Improved nutrient management through synchronization of indigenous nutrient supplying capacity with targeted crop yield could improve productivity, soil fertility, nutrient use efficiency and farm income.**
- However, further research is needed at different locations to determine and optimize the nutrient demands by the hybrid crops for getting sustainable yield and maintaining soil fertility.

Thank you !

Acknowledgements

The financial support of International Plant Nutrition Institute (IPNI)-South Asia Program and the technical and administrative support of Dr. Rajendra Prasad Central Agricultural University, India for conducting the project is thankfully acknowledged.