Potential of soil phosphorus saturation index for evaluating crop yield and leaching risks

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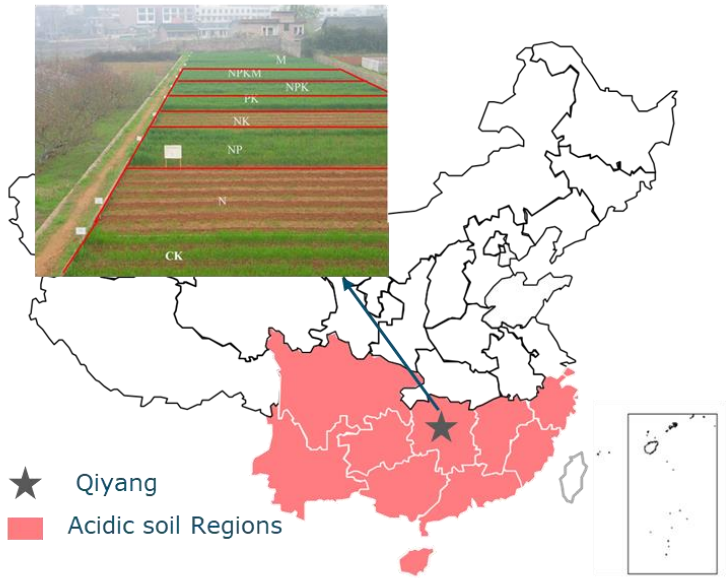
Research objectives of long-term P addition experiments

Objectives:

1. Assess impact of long-term fertilization on total, reactive (Oxalate P, Olsen P) and soluble P ($CaCl_2$ P).
2. Evaluate how crop yield and environmental risks respond to legacy P.
3. Evaluate if P saturation index (PSI) is a good risk indicator to crop yield (agronomic impacts) and leaching (environmental impacts).

(NB: PSI = ratio P oxalate /(Al + Fe) oxalate, used as environmental P indicator. Currently there are different agronomic P indicators)

Set-up of the experiments at Qiyang experimental station



Basic Information

Experimental Period	1990-2017
Cropping system	Winter Wheat-Summer Maize
Rainfall (mm)	**1407**
Soil Type	Acidic Soil

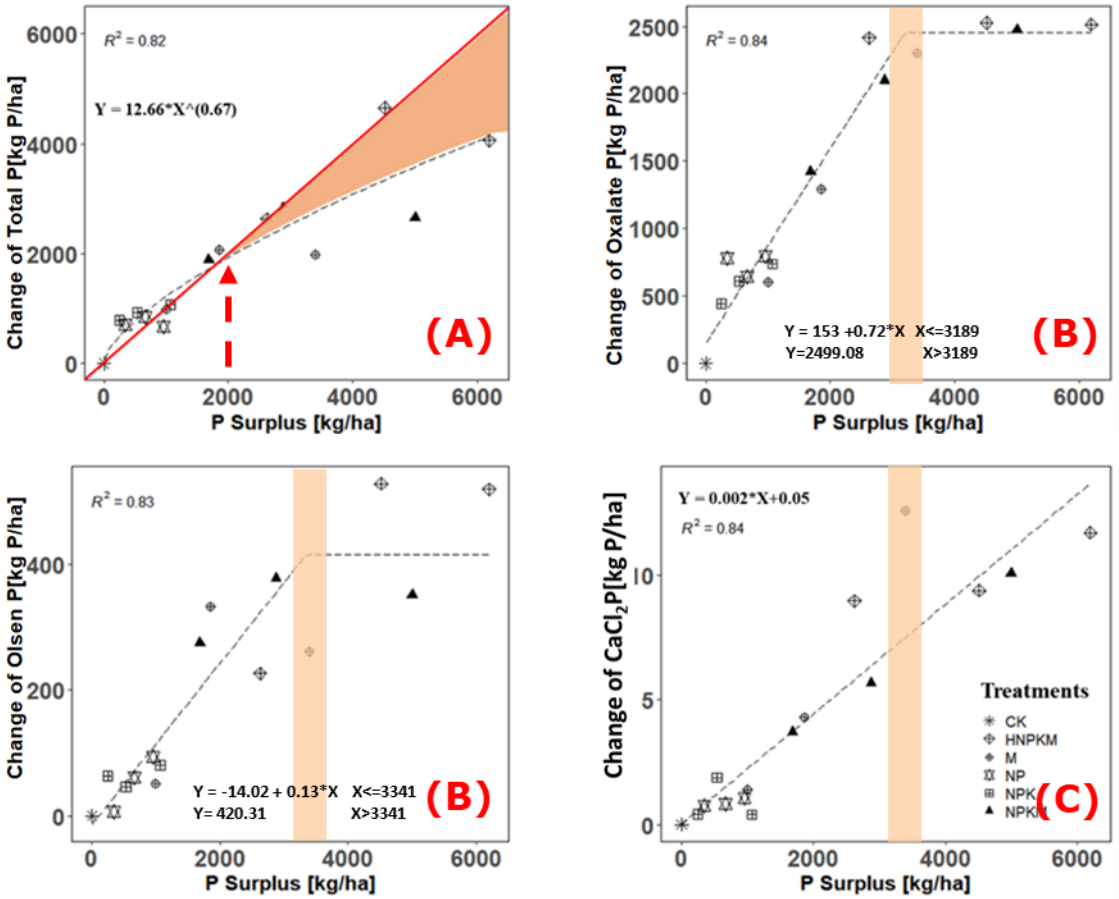
Initial Soil Properties

Clay content (%)	61
soil pH(1:2.5)	5.7
SOC (g/kg)	**6.7**
Olsen P (mg/kg)	**13.9**
Total P (mg/kg)	**450**
PSI	**0.03**

Mean annual P input under different fertilization

Treatments	Total P input (kg P/ha/yr)
CK	**0**
NP	**52**
NPK	**52**
NPKM	**215**
1.5NPKM	**320**
M	**227**

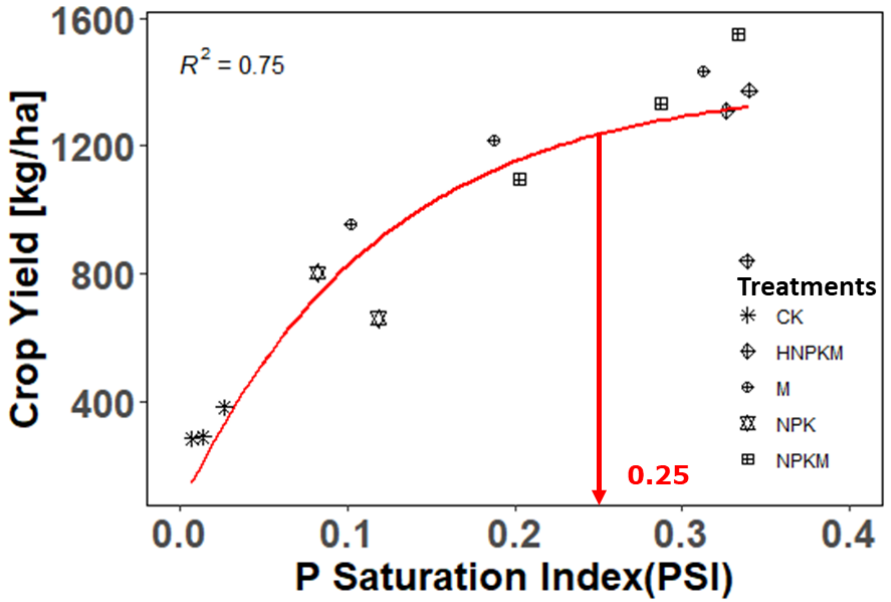
Impacts of P surplus on different soil P indicators



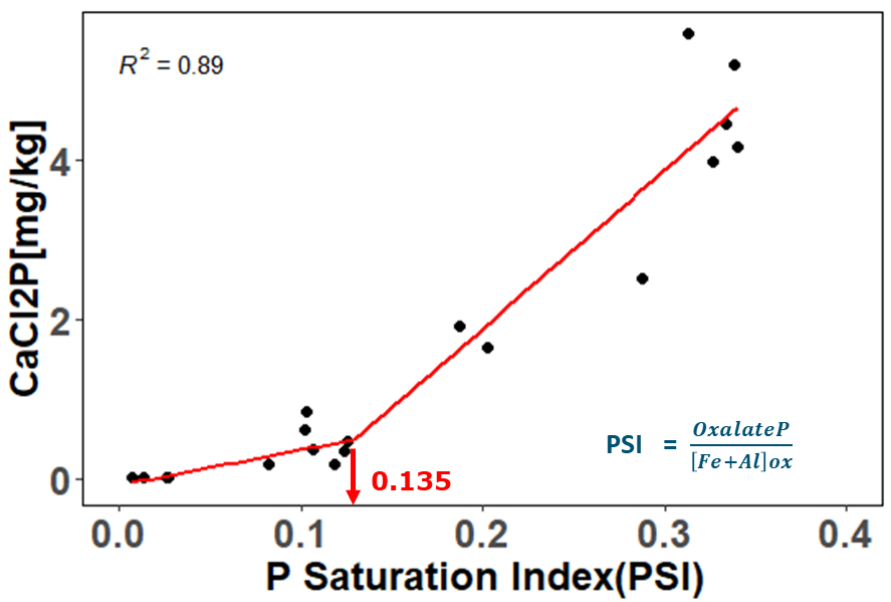
- When P surplus was near 2000 kg P/ha, added P did not fully accumulate and was lost by leaching (see A)
- When P surplus was near 3200 kg P/ha, reactive P pools (Oxalate P< Olsen P) were saturated (see B)
- The soluble P ($CaCl_2$ P) increase continuously with P surplus (see C)

PSI is a good indicator for risks to crop yield and leaching

Crop yields vary with PSI and are limited below a target level near 0.25



Leaching risk ($CaCl_2$ P) was strongly enhanced above a critical PSI near 0.135



PSI can well evaluate the impact of soil P on both crop yield and leaching risks, but challenge is to enhance crop yields at lower PSI by improved management

Thank you !