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Some Myths and Facts about the Use of Phosphorus in Agriculture

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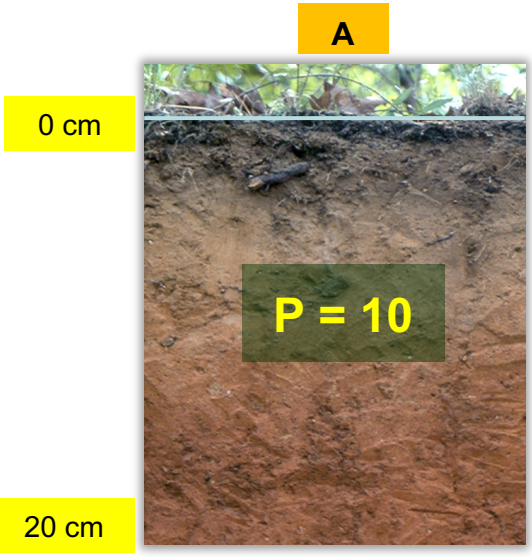
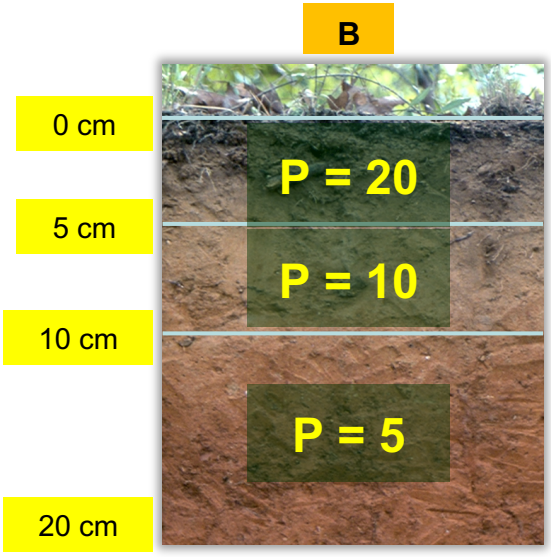
Motivation

- P is one of the key nutrients for plant nutrition.
- Fertilizing with P is generally seen as of low efficiency.
- Due to the complexity of P soil reactions and the variety of P source options many agronomic management technical issues are controversial.
- This presentation will discuss some of the main aspects related to the agronomic use of P in agriculture.
- Model adopted is of Q&A.

Question # 1: May we transfer the sufficiency levels of P obtained in conventional agriculture to no-till?





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Is availability of P in A the same as in B?

Considering calibration was developed for A = 0-20 cm how to interpretate results in B? Would we need to recalibrate for the new system?

Conclusion:

Not ideal. The ideal would be to calibrate the methodology again.

Question # 2: Are high contents of P in PR for direct application desirable?

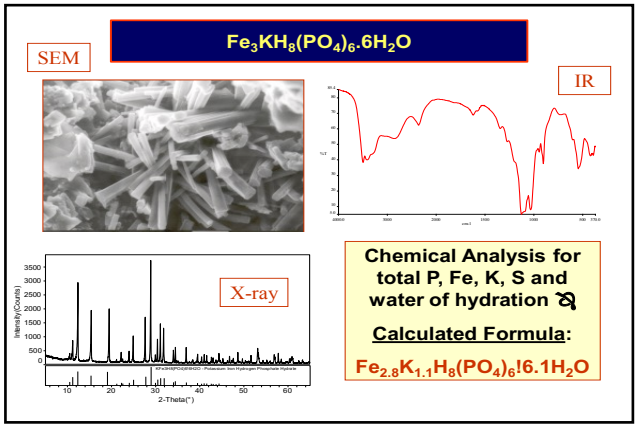
Types of PR Sources and Total P_2O_5 Content

PR Source	Total P_2O_5,%	PR Reactivity
Gafsa,Tunisia	29.0	High
El-Hasa, Jordan	32.0	Medium
Tennessee, USA	31.0	Low
Sukulu, Uganda	39.3	Very Low
Araxa, Brazil	36.1	Very Low
Ontario, Canada	37.8	Very Low
Phalaborwa, S. Africa	36-41	Very Low

PR sources with very high P_2O_5 content (> 35%) are *igneous* rock and very low in reactivity and agronomic effectiveness due to low CO_3/PO_4 substitution.

Conclusion:
Exactly the opposite.

Question # 3: Is it necessary to always have high water solubility in totally acidulated P fertilizers?



P Source	Dry-matter yield	P uptake
	Upland Rice	
MCP	100	100
SSP1	98	88
SSP2	96	93
SSP3	88	76
	Flooded Rice	
MCP	100	100
SSP1	97	91
SSP2	111	110
SSP3	102	85
MCP: Standard source of P		
RAE = (bi/bMCP)*100, *i* = other SSP		

Prochnow et al., 2008

Does not it sound funny?

The fertilizer industry spends energy and money to transform phosphate rock, which has very very low water solubility, in highly soluble P sources, like SSP, TSP, MAP, DAP, and then, because it is too soluble, many try to somehow protect it for lower water solubility

Isn't there a more logical possibility?

Conclusion:

Not really. Adequate research should define the requirement for P water solubility for different sources and agronomic conditions, which will optimize the use of P resources.

Question # 4:
Is P localized better than P broadcasted?

- Agronomically, depending on an interaction of factors, mainly soil P availability through the soil profile and climatic conditions:

(A) P in furrow > P broadcasted

(B) P in furrow = P broadcasted

(C) P in furrow < P broadcasted

Soil depth, cm	Management		
	A	B	C
	Soil P concentration, ppm*		
0 to 5	3	65	48
5 to 10	2	6	25
10 to 20	1	2	19
20 to 40	1	1	15
40 to 60	1	1	2

- We need to consider environment implications.

Conclusion:

Not necessarily. Local conditions, specially soil profile and climate, will define the most adequate form to place P in the soil. Environmental implications need to be considered.

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Question # 5: Can legacy P be used as to decrease the future needs of phosphate fertilizer in the tropics?

Agronomic practices in tropical regions that can recycle some legacy P into forms more available to plants:

(1) Management of soil acidity with lime and phosphogypsum applications.

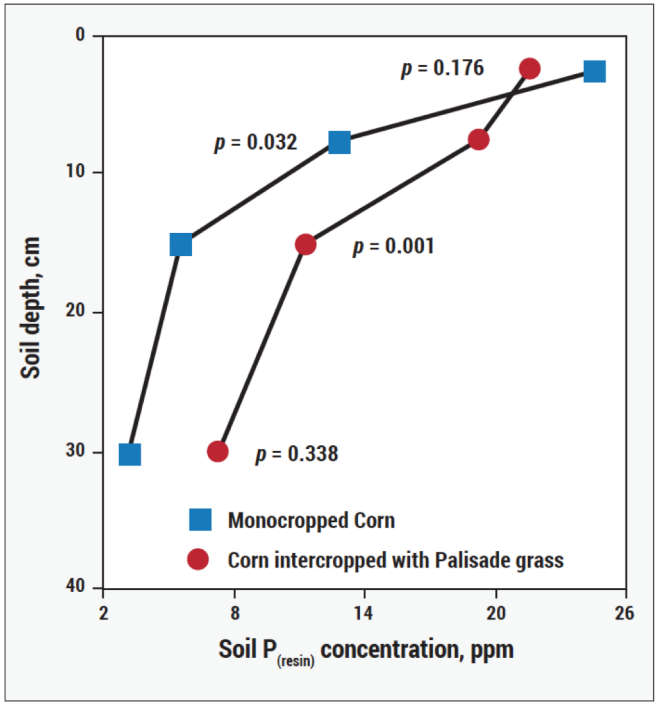
(2) Crop rotation.

(3) Development or selection of plant species or cultivars with higher efficiency in recovering P from the soil.

Conclusion:

No doubt. Techniques are available and others will be invented. This will not eliminate the need for P input in many circumstances.

Question # 6: Does integrating grass and grain crops increase P availability in the system?



Source:
Crusciol et al. 2015.

Conclusion:
Yes. Research should identify more adequate cropping systems for each region.

Question # 7:
Is P from fertilizers really less eficiente than N and K?

- P has very complex interactions with the soil system and much of what is applied can be converted to forms not readily available to plants, but stays in the soil system.
- N and K are lost from the soil system much easier than P.
- Not readily available forms of P can gradually become available depending on forms of P, length of time, cropping systems, management and strategies.

Conclusion:
Not necessarily. In the medium to long run P can even be more efficient than N and K.

Final Comments

- Sometimes it is not what it seems.
- Only science can provide the best alternatives.
- Be skeptical with miracles.
- Be careful in changing dogmas but don’t be afraid to change if science points out in that direction.

Thank You Very Much For Your Attention!

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