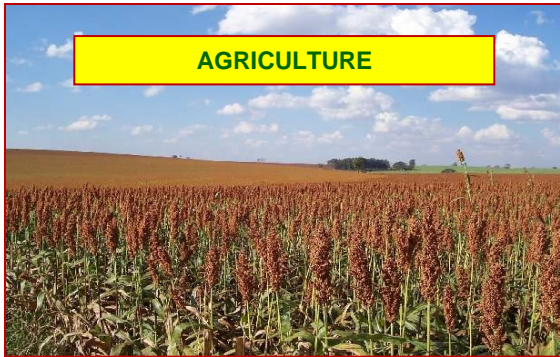


FERTILIZER LATINO AMERICANO 2013  
TECHNICAL INNOVATION AND NICHE PRODUCTS  
- JAN 20 – 22, Hilton SP Morumbi, BRAZIL -

# INNOVATIONS IN FERTILIZER AND FERTILIZER MANAGEMENT

Dr. Luís Ignácio Prochnow  
IPNI Brazil Program Director

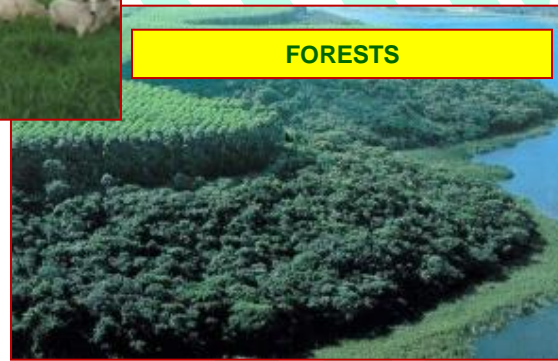
AGRICULTURE



LIVESTOCK



FORESTS



IPNI INTERNATIONAL PLANT NUTRITION INSTITUTE



# INTERNATIONAL PLANT NUTRITION INSTITUTE (IPNI)

✓ Not-for-profit organization dedicated to research and education for the responsible management of plant nutrients for the benefit of the human family.

“We train the trainers and influence the influencers”

Dr. Terry Roberts - President IPNI

## INNOVATIONS IN FERTILIZER AND FERTILIZER MANAGEMENT

### QUESTIONS TO ADDRESS

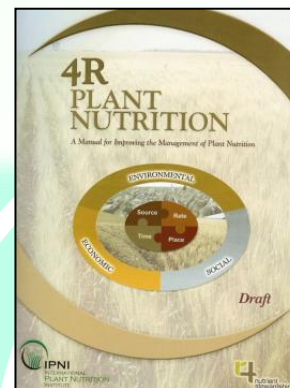
- ✓ Are there innovations in fertilizer management? Are such innovations feasible at farm level?
- ✓ Are there innovations in fertilizer management? [WWW.IPNI.ORG.BR](http://WWW.IPNI.ORG.BR) them?
- ✓ Is the industry in general taking advantage or opportunities created by research?
- ✓ Is the industry leading forefront research in terms of new fertilizers?





# INNOVATIONS ON FERTILIZER MANAGEMENT

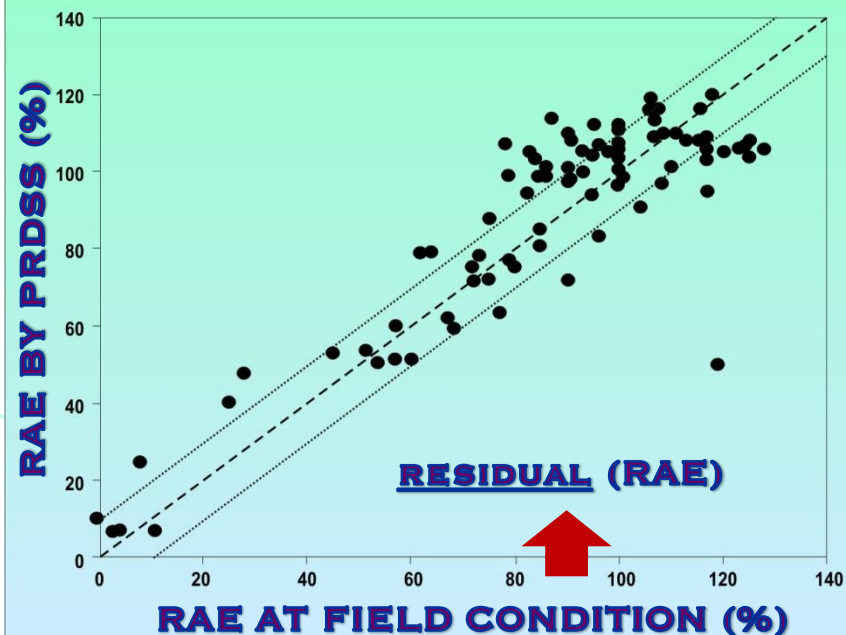
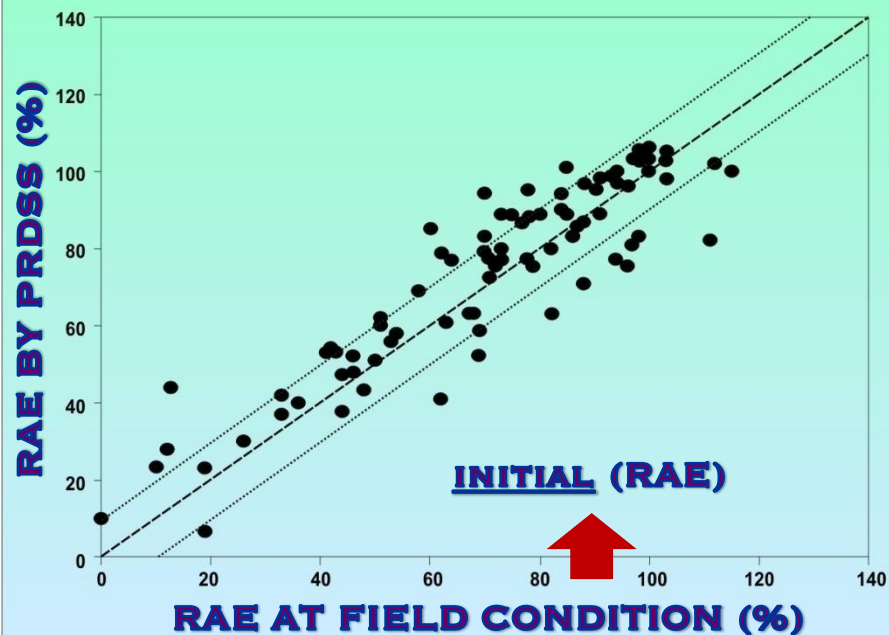
- ✓ Good field applied research aiming better nutrient use efficiency.
- ✓ Many good tools available to farmers for better nutrient use efficiency (publications, modeling, local research data, etc).
- ✓ Several joint initiatives across the globe for FBMPs.
- ✓ Great effort from industry on efficient use of nutrients aiming adequate agronomy, environment and social aspects (4R Nutrient Stewardship Program).
- ✓ We need to intensify good extension work.



APPLICATION OF THE RIGHT NUTRIENT SOURCE  
AT THE RIGHT RATE, TIME, AND PLACE



# PHOSPHATE ROCK DECISSION SUPPORT SYSTEM (PRDSS)



[HTTP://WWW-ISWAM.IAEA.ORG/DAPR/SRV/EN/HOME](http://www-iswam.iaea.org/dapr/srv/en/home)

# INNOVATIONS IN FERTILIZER

## New Released Products

- ✓ Fertilizers with lower potential for N losses to the environment (e.g., urea with NBPT).
- ✓ Fertilizers specific to certain agronomic conditions (e.g., urea supergranule for flooded rice).
- ✓ More adequate nutrient composition to different soils and crops (e.g., inclusion of micronutrients).
- ✓ More efficient form of delivering nutrients (e.g., fluid fertilizers containing P for calcareous soils).



# FROM PROBLEM TO SOLUTION THROUGH SCIENCE

## CHAPTER EIGHT

### RECENT DEVELOPMENTS OF FERTILIZER PRODUCTION AND USE TO IMPROVE NUTRIENT EFFICIENCY AND MINIMIZE ENVIRONMENTAL IMPACTS

S. H. Chien,<sup>\*1</sup> L. I. Prochnow,<sup>†</sup> and H. Cantarella<sup>‡</sup>

#### Contents

1. Introduction	268
2. Improving the Efficiency of Nitrogen Fertilizers	269
2.1. Controlled-release coated urea products	270
2.2. Slow-release urea-aldehyde polymer products	272
2.3. Urea supergranules for deep placement	273
2.4. Reducing nitrate leaching/denitrification by nitrification inhibitors	275
2.5. Reducing ammonia volatilization by urease inhibitors	275
2.6. Reducing ammonia volatilization and nitrate leaching/denitrification by combining urease and nitrification inhibitors	283
2.7. Use of ammonium sulfate to enhance N efficiency of urea	286
3. Improving the Efficiency of Conventional Phosphorus Fertilizers	288
3.1. Coated water-soluble phosphorus fertilizers	288
3.2. Urea supergranules containing phosphorus and potassium nutrients	290
3.3. Fluid versus granular water-soluble phosphorus fertilizers	291
4. Use of Nonconventional Phosphorus Fertilizers	293
4.1. Phosphate rock for direct application	293
4.2. Mixture of phosphate rock and water-soluble P	296
4.3. Calcined nonapatite phosphate rock for direct application	297
4.4. Agronomic effectiveness of nonconventional acidulated phosphate fertilizers	300
5. New Granular Nitrogen and Phosphorus Fertilizers Containing Sulfur Nutrient	306

\* Formerly with International Fertilizer Development Center (IFDC), Muscle Shoals, Alabama, USA

† International Plant Nutrition Institute (IPNI), Piracicaba, SP, Brazil

‡ Instituto Agronômico, Campinas, SP, Brazil

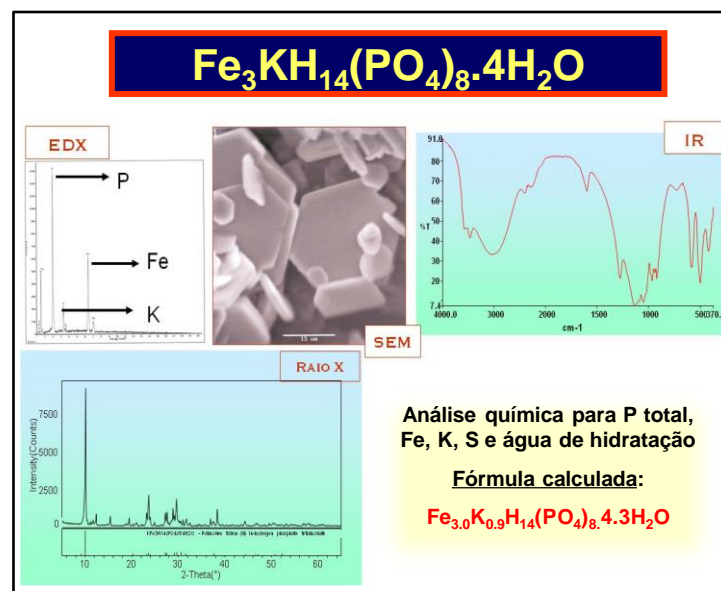
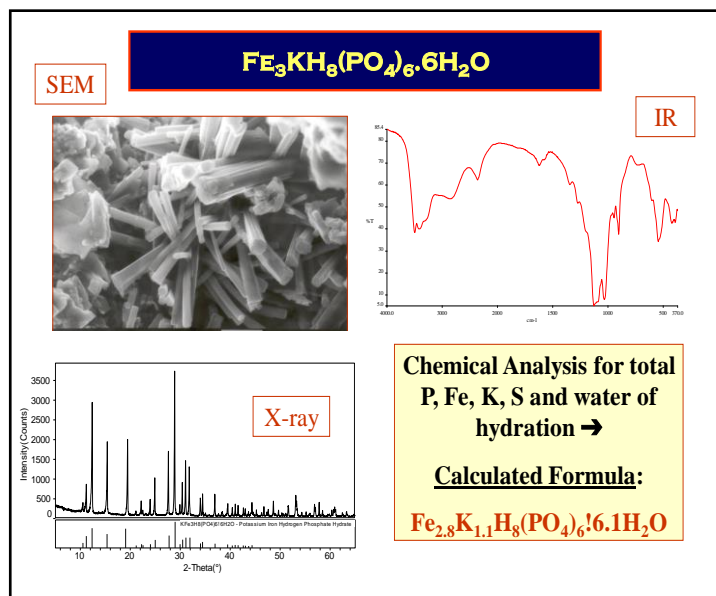
‡ Corresponding author: 1905 Beechwood Circle, Florence, Alabama, USA; email: nchien@comcast.net

## EXAMPLE

- ✓ Premium Grade PR is decreasing worldwide.
- ✓ Tendency for lower water soluble P in final fertilizers.
- ✓ Is it really necessary for totally acidulated P sources to always have high water solubility?



# Synthesis, characterization and agronomic evaluation of iron phosphate impurities in superphosphates



✓ **RESEARCH HAS SHOWED NOT TO BE NECESSARY TO ALWAYS HAVE HIGH WATER-SOLUBILITY IN FULLY ACIDULATED PHOSPHATE FERTILIZERS. DATA OBTAINED SUGGEST THAT THE WSP REQUIREMENT SHOULD BE RELATED TO THE SOIL SYSTEM, THE CROP AND THE CHEMICAL COMPOSITION OF THE FERTILIZER.**

# SCIENCE LOOKING FOR FERTILIZERS WITH LOWER POTENTIAL TO IMPACT THE ENVIRONMENT



Cummulative P Losses

Soils	P Sources		
	Control	PR	TSP
<i>Losses of Dissolved Reactive P (kg ha<sup>-1</sup>)</i>			
Alvira	0,28	0,52	32,2
Berks	0,18	0,39	14,5
Watson	0,23	0,43	16,2
Média*	0,23 c	0,45 b	20,9 a
<i>Total P Losses (kg ha<sup>-1</sup>)</i>			
Alvira	0,35	0,83	33,2
Berks	0,30	0,68	15,5
Watson	0,31	0,72	19,6
Média*	0,32 c	0,74 b	22,7 a

Source: Shigaki et al. (2007).

## Improving P fertiliser use efficiency (PUE)

- ✓ Placement/moisture interactions
- ✓ Alteration of chemistry in the fertilised zone
- ✓ Accurate diagnosis of P deficiency
- ✓ Modifying cultivars to improve PUE

Source: Courtesy of Mike McLaughlin.



## Modifying cultivars to improve PUE



Source: Hocking et al. 1997.

## “New” chelates to improve TE effectiveness

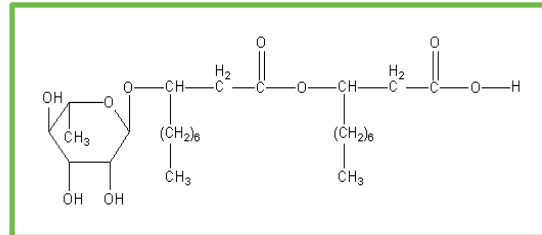
### Improving TE fertilizer efficiency for P fertilizers

#### New trace element fertilizers

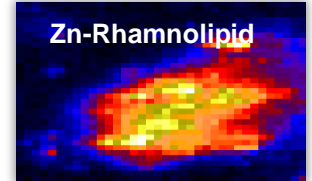
- ✓ Physically protect TE from phosphate
- ✓ Chemically protect TE from phosphate
- ✓ Change granule chemistry
  - ✓ Fluid fertilizers

#### Rhamnolipid (RH)

Produced by bacteria, can diffuse easily across plant root membranes



#### Zn-Rhamnolipid



#### Response of wheat to additions of rhamnolipid



0 0.75 2 4 6

Rhamnolipid (mg/kg). All pots 2ppm Zn

# INNOVATIONS ON FERTILIZER (NEW SOURCES)

- ✓ **Some good options already in the market (e.g., NBPT use to suppress N volatilization from urea).**
- ✓ **Some fertilizer companies working on new possibilities.**
- ✓ **Many good opportunities in literature that could translate into new products. Need for final field research.**
- ✓ **Advanced techniques applied in fertilizer research.**
- ✓ **Good opportunity to adapt plants to soil (genetic studies).**
- ✓ **Be careful with “snake oils”. Only agronomic expertise can provide the necessary and adequate direction to follow.**



# INNOVATIONS IN FERTILIZER AND FERTILIZER MANAGEMENT

## SHORT ANSWERS TO SOME QUESTIONS

- ✓ Are there innovations in fertilizer management? **Yes.**
- ✓ Are such innovations feasible at farm level? **Many are. Crop consultants are essential.**
- ✓ Are there innovations in fertilizer? **No recent real breakthroughs to be applied in large scale but some interesting possibilities.**
- ✓ If so, what are them? **Products leading to lower N losses, So, etc.**
- ✓ Is the industry in general taking advantage of opportunities created by research? **In general more could be done.**
- ✓ Is the industry leading forefront research in terms of new fertilizers? **More can be done. Creating experties in terms of forefront research is not an easy task. It is necessary to strongly invest in forming experts in fertilizer development.**



**SUCCESS TO ALL,  
MOST ESPECIALLY TO THOSE RELATED TO PRODUCING  
FOOD,  
AND THANKS MUCH FOR YOUR ATTENTION!**



**Website:**  
<http://www.ipni.org.br>

**Telephone/fax:**  
55 (19) 3433-3254

