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IMPROVING P USE EFFICIENCY WITH POLYMER TECHNOLOGY

Larry MURPHY
Murphy-Agro, USA

International Fertilizer Industry Association

NEW AG INTERNATIONAL

IMPROVING P USE EFFICIENCY WITH POLYMER TECHNOLOGY

L.S. Murphy, Murphy Agro
J.L. Sanders, SFP
W.B. Gordon, Kansas State Univ.
T.A. Tindall, J.R. Simplot

The Problem

Phosphate becomes tied-up, or fixed

On low pH soils
- **Aluminum**
- **Iron**

On high pH soils
- **Calcium**
- **Magnesium**

AVAIL

POLYMER CHEMISTRY FOR INCREASING PHOSPHORUS USE EFFICIENCY AND PROFITS

SPECIALTY FERTILIZER PRODUCTS--SFP

WHAT IS AVAIL?

- One of a patented family of dicarboxylic copolymers.
- Can be used as a coating on granular phosphates (2 liters/ton) or mixed into liquid phosphate fertilizers (0.5 liters/100 liters)

AVAIL CHARACTERISTICS

- An extremely high effective charge density – approximately 1800 milliequivalents /100 gms.
- Polymeric structure very specific to sequestering multivalent cations.
- Functionality over wide range of soil pH
- Water soluble
- Biodegradable --- 10-12 months

MODE OF ACTION?

- Polymer sequesters antagonistic cations in **soil solution** around P fertilizer granule or in fluid band. DOES NOT CHANGE THE ENTIRE SOIL MASS!
- P remains unfixed and available for plant uptake.
- Results in highly concentrated zones of available P for the plants (***microenvironments***).

WHAT HAS RESEARCH SHOWN?

University and government agency research has produced typical yield gains of 10–15%.

A high percentage of P-responsive studies have recorded AVAIL benefits. Perfect record? Of course not!

RESPONSES ARE NOT CONFINED TO SPECIFIC CROPS.

A SOIL CHEMISTRY EFFECT.

INITIAL GREENHOUSE STUDY

Dr. Ray Lamond
Kansas State University

- Acidic (pH 4.7), high P soil
- Polymer coated on MAP
- P banded beside seed
- Essentially doubled corn dry matter

INITIAL AVAIL EVALUATION
Maize - Greenhouse

Material	Dry Wt.	P Conc.	P Uptake
	grams	%	mgm
Control	5.18	0.827	43.2
P1X	8.90	0.996	88.7
P2X	9.55	1.043	99.6
$LSD_{.05}$	2.47	0.177	31.8

Lamond, Kansas State Univ.

Soil pH=4.7; Soil test P=74 ppm Bray-1. 20 kg P banded on basis of 76 cm row.

WHEAT RESPONSE TO ENHANCED P AVAILABILITY—FIRST FIELD STUDY
Kansas

Treatment Applied	Grain Yield t/ha
Control	2.15
MAP	2.28
MAP + Avail	2.69
$LSD_{.10}$	0.47

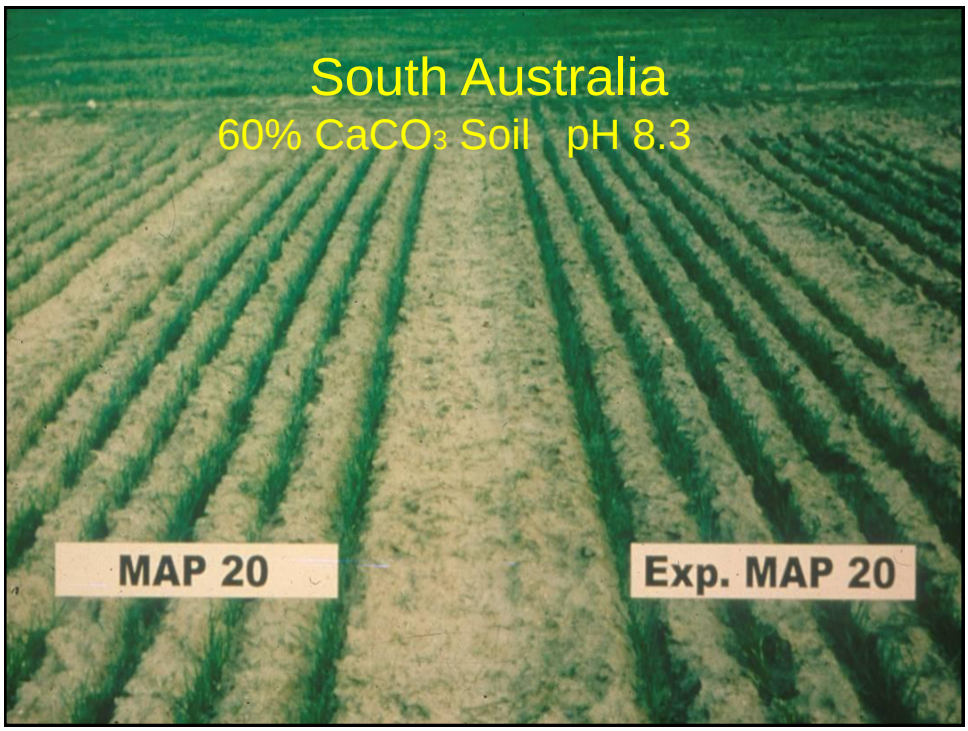
Murphy Agro – Kansas State Univ.

22 kg P/ha banded at planting. Soil pH 4.7

POLYMER AND P APPLICATION METHOD EFFECTS ON WHEAT Arkansas

Treatment	Yield t/ha
Control	3.14
MAP banded	3.68
MAP + polymer, banded	5.17
MAP broadcast	3.91
MAP + polymer, broadcast	4.41
MAP + seed, broadcast	3.70
Map + polymer + seed, broadcast	4.59
LSD (0.10)	0.46

33lkg P/ha. Soil P test low. Soil pH=7.6. University of Arkansas



ENHANCING P AVAILABILITY FOR WHEAT
South Australia

Treatments kg P/ha	Grain Yield kg/ha	Total Dry Matter kg/ha	Heads/meter^2
MAP 4	1689	5913	254
MAP 4 + polymer	1879	7140	299
MAP 10	1944	7024	274
MAP 10 + polymer	1955	8184	312
MAP 20	2081	7681	290
MAP 20 + polymer	2241	7894	309
$LSD_{.10}$	132	1186	49

P banded at seeding.
Soil 60% $CaCO_3$.

South Australia Research and Development Institute
Dr. Bob Holloway.

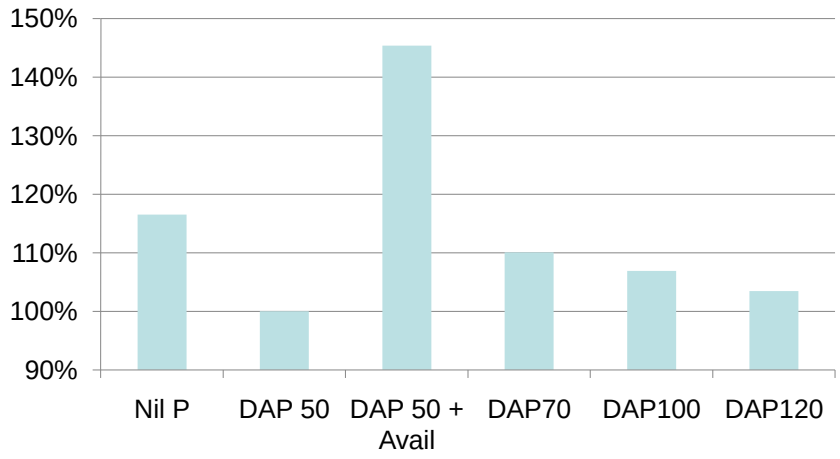
AVAIL EFFECTS ON WHEAT P RESPONSE
South Australia -- 2009

Kg P/ha	Yield, kg/ha
0	2948 cd
50 DAP	2910 d
50 DAP + Avail	3684 a
70 DAP	3158 bcd
100 DAP	3241 b
120 DAP	3276 b

Axe — P≤ 0.001

Craig Davis, A.W. Vater Co. — LSD 284.7

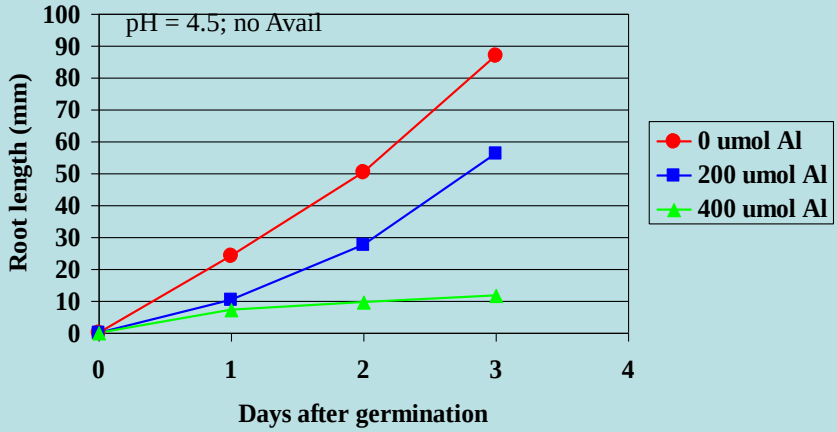
INCREASED NET RETURN OVER DAP 50
Kadina, South Australia -- 2009



AVAIL EFFECTS ON ALUMINUM TOXICITY TO WHEAT SEEDLINGS—ACIDIC SOILS

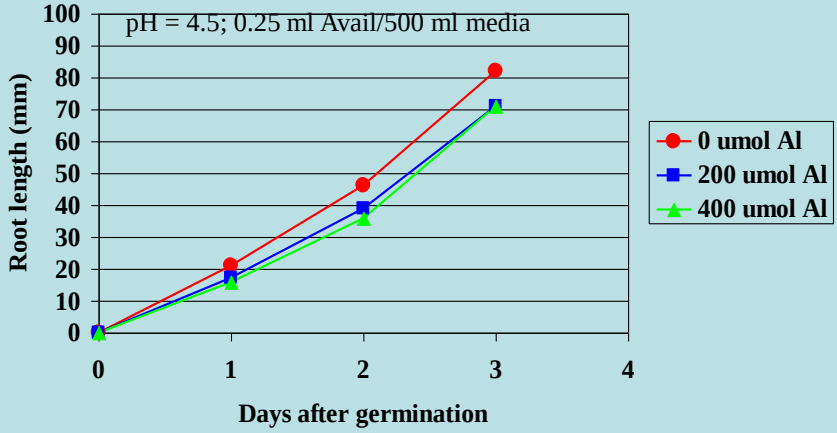
Dr. Rich Koenig, Washington State Univ.

ALUMINUM EFFECTS ON WHEAT GROWTH
Low pH

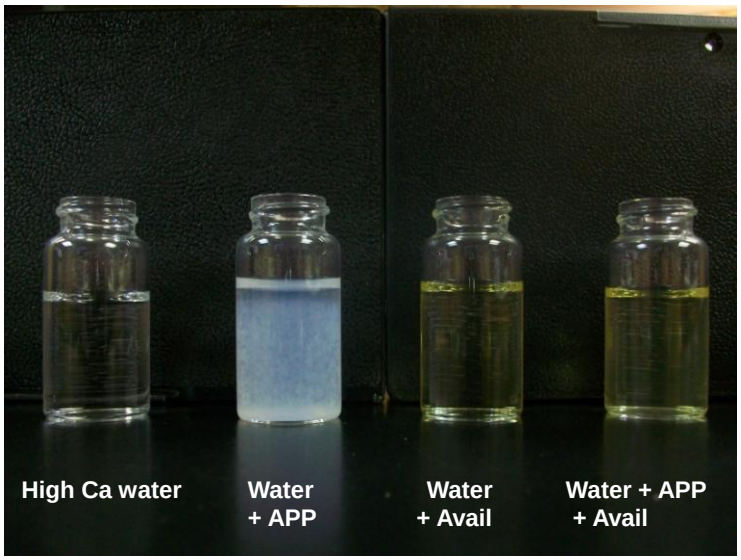


Rich Koenig, WSU

ALUMINUM EFFECTS ON WHEAT IN PRESENCE OF AVAIL POLYMER
Low pH



Rich Koenig, WSU

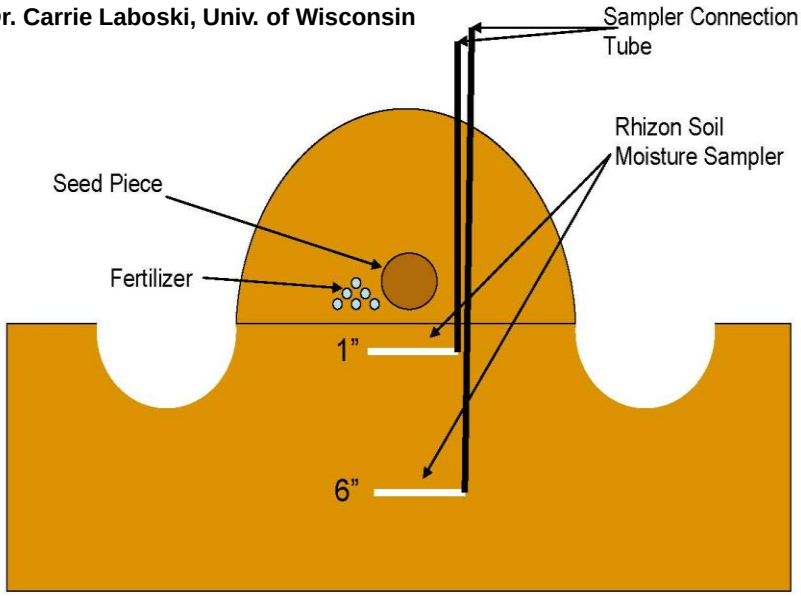


Hard water	Hard water + 10-34-0 (one drop) pH = 6.8	Hard water + AVAIL [AVAIL] = 0.5% v/v	Hard water + 10-34-0 +AVAIL pH = 6.8

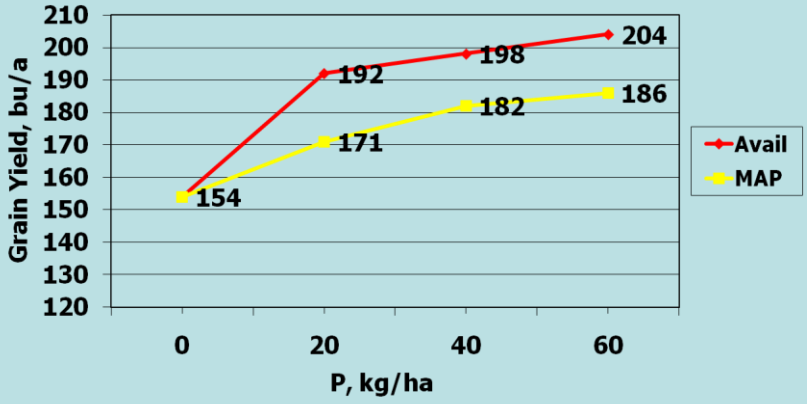
Dr. Eric Ellison
J.R. Simplot

SAMPLING SOIL SOLUTION FOR P MOBILITY

Dr. Carrie Laboski, Univ. of Wisconsin



Avail Effects on Corn Grain Yield 2001-2003 Kansas



pH 6.8; Soil test P= 40 ppm Bray-1

Gordon, KSU

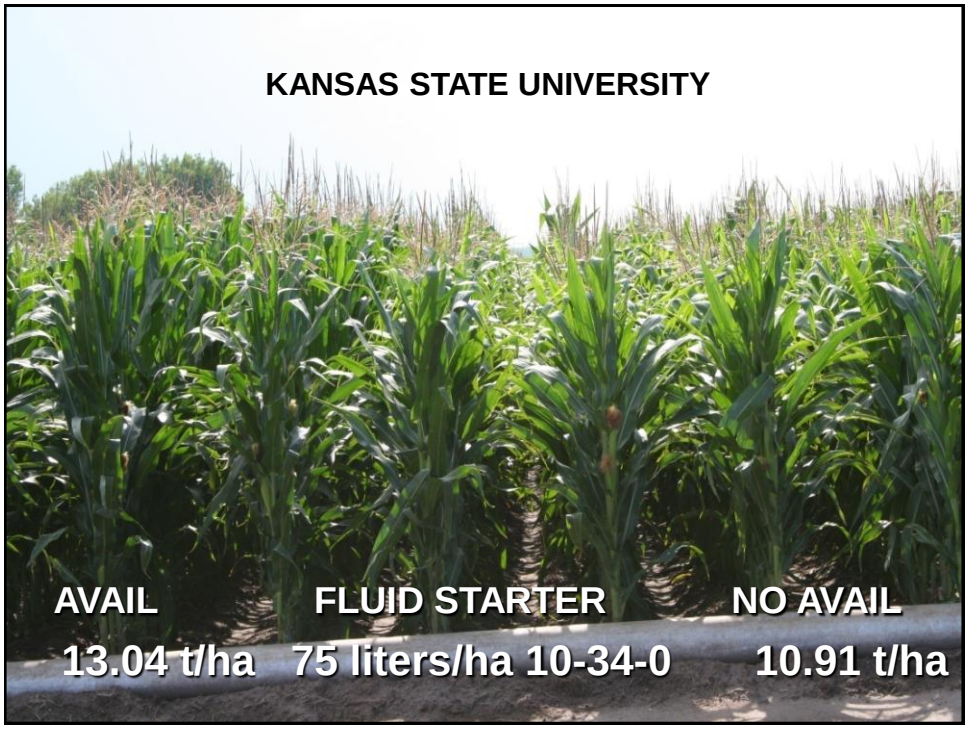
Avail / DAP – Maize *

University of Minnesota
Waseca, Mn.
Contributor: Dr. Gyles Randall
Southern Research and Outreach Center
Preplant Broadcast Application
Soil pH: 7.3

	kg. P/ha	T/ha	Gross Income Per hectare @ $137.55/T	Avail Benefit Per Hectare
GSP – 18-46-0	56	11.67	$1605.20	
18-46-0 + Avail (+ $10.07/ha)	56	12.41	$1706.99	**+ $101.79 Grower ROI 9:1**

*Mean of 3 year study at 56 kg/ha rate: '02-04

UNIVERSITY OF MINNESOTA



AVAIL IN MAIZE STARTER

Kentucky

Treatments	Moisture %	Yield t/ha
9-10-3 fluid pop-up 28 L/ha	15.5	11.3
9-10-3 + Avail	14.2	12.6

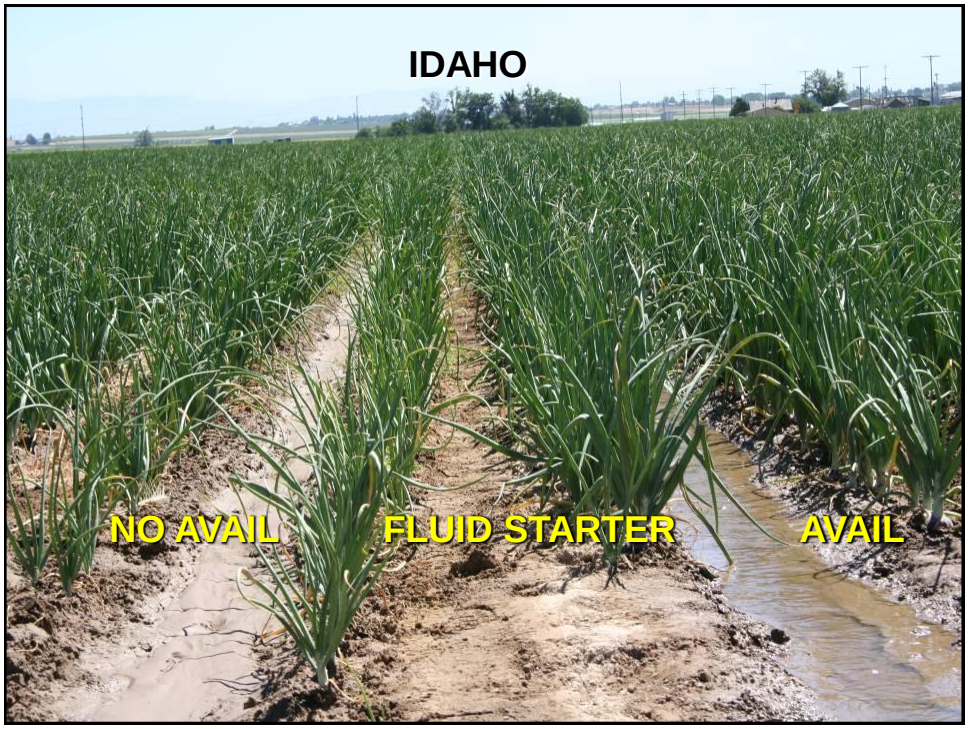
Southern States

Hybrid: BoJac 7527

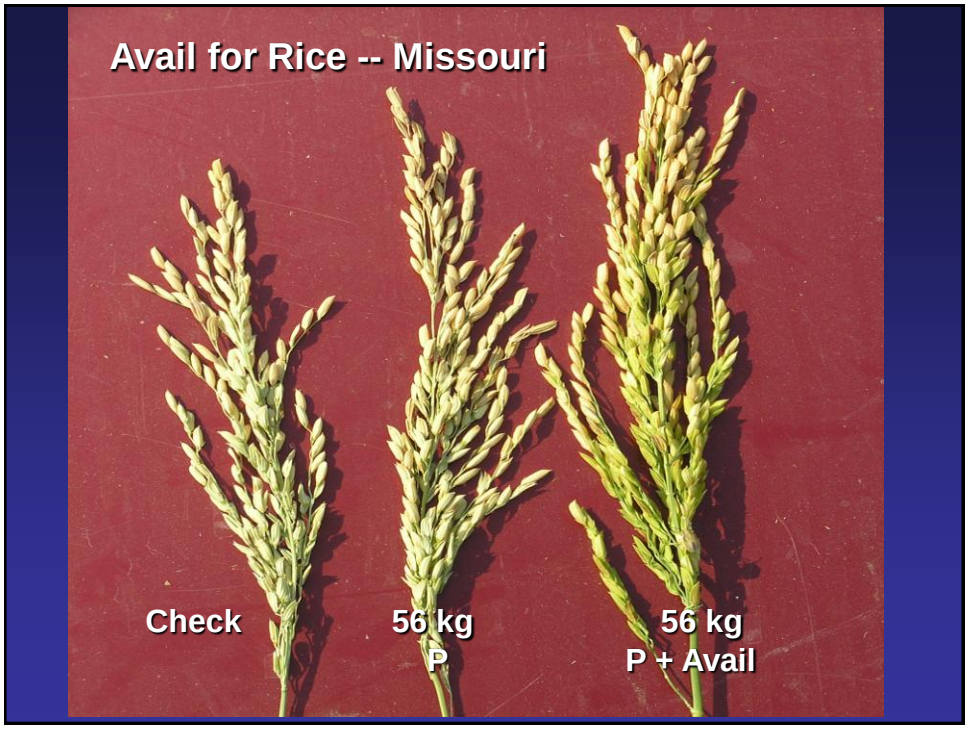

SOUTH AUSTRALIA -- 2009
AVAIL
NO AVAIL
Dr. Bob Holloway

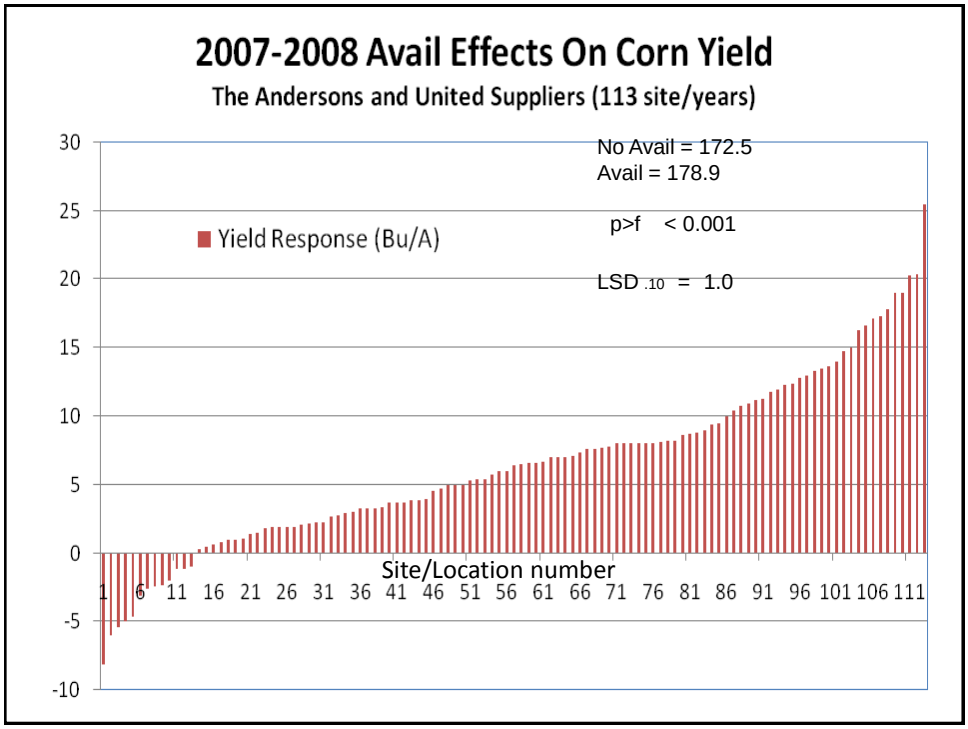

ARGENTINA
MAP + AVAIL
MAP
Dr. :Ricardo Melgar, INTA


NO P
MAP
MAP + AVAIL
Dr. Bryan Hopkins
Univ. of Idaho
CK
MAP
SFP


IDAHO
NO AVAIL
FLUID STARTER
AVAIL

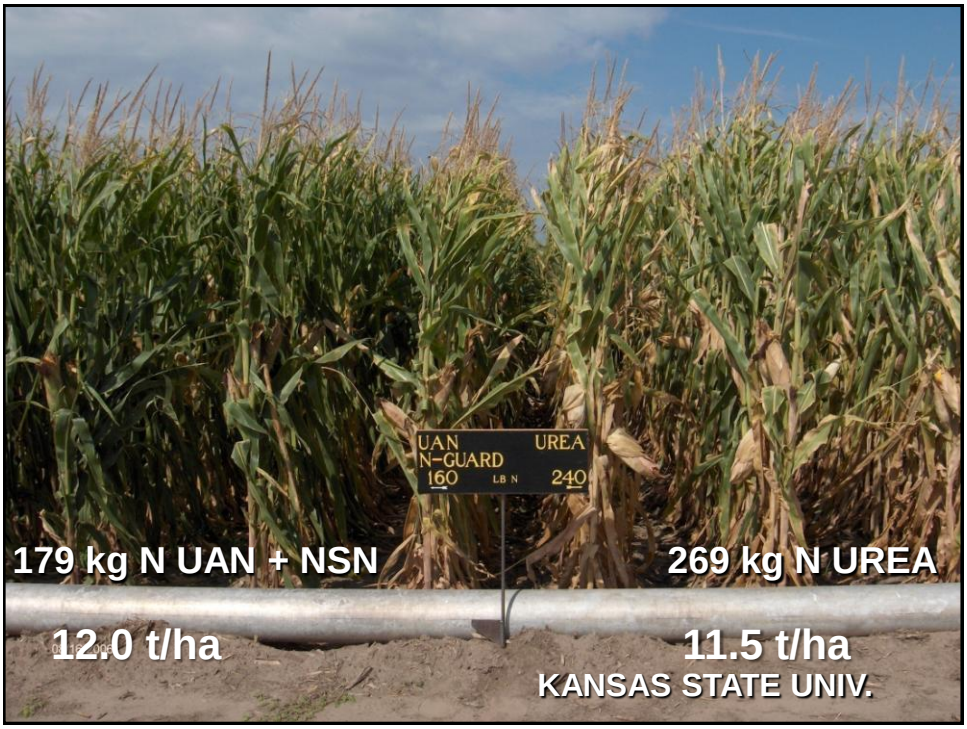

IDAHO -- 2006
NO AVAIL
10-34-0 STARTER
AVAIL SD
31.8 t/ha
Jumbos
45.0 t/ha
60.8 t/ha
Total
69.5 t/ha
Jumbos at $264/tonne = $3646/ha increased return


Avail for Rice -- Missouri
Check
56 kg
P
56 kg
P + Avail



NUTRISPHERE-N

Improving N Use Efficiency and Profits



N RATES AND N-GUARD
No-Till Corn, Kansas--2006

N Rates	Urea		UAN	
kg/ha	NSN	None	NSN	None
0		8.65 t/ha		
90	10.41	9.53	10.66	9.85
180	11.79	10.60	12.04	10.47
270	12.36	11.79	12.29	11.35

All N broadcast — Gordon, KSU

Soil pH: 7.0

STACKING POLYMER TECHNOLOGY

No-Till Maize – Kansas

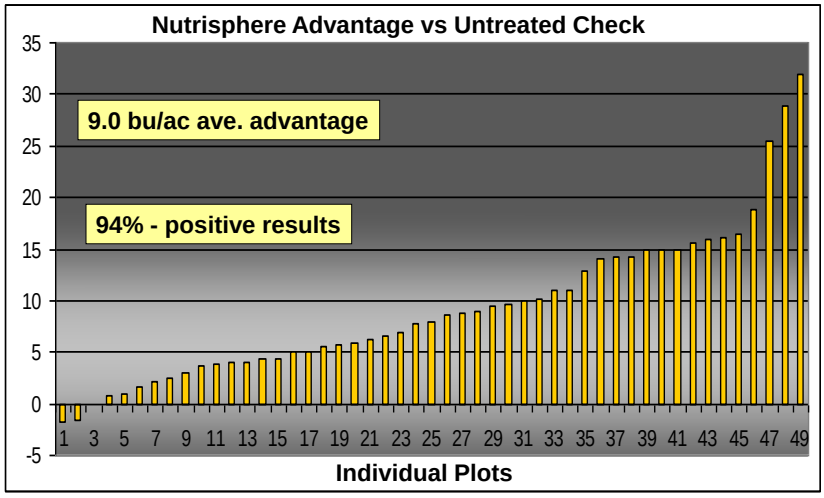
Treatments	Yield t/ha
No N, no P	9.34 f
160 N + 30 P	14.30 e
160 N + 30 P + Avail	15.11 d
160 N + Nutrisphere-N + 30 P	15.74 b
160 N + N-N + 30 P + Avail	16.24 a

17+34+0 starter 5 x 5 cm Gordon, KSU

UAN broadcast after planting

Nutrisphere Performance Summary

Corn Side by Side Comparisons
2007-2009



United Suppliers, Eldora, IA