Fluid Fertilizer Foundation

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THE FLUID JOURNAL

The Fluid Journal is published by the Fluid Fertilizer Foundation. Click on the magazine below to see our current issue.

Why Fluids?

Dale Leikam

2014 Fluid Fertilizer Marketing and Technology Workshop

Tuesday, December 9, 2014

12:30	Welcome and Announcements	
12:40	Fluid Fertilizer Agronomic Opportunities - Why Fluids?	
1:20	Regulatory Update (Renee Pinel, Western Plant Health Association)	
2:00	Break	
	Session A	**Session B**
2:20	Fertilizer Plant Site Security Audits (Mike Wollner, United Suppliers)	Lime vs. Gypsum vs. Calcium for the West (Rob Mikkelson, IPNI)
3:10	Plant Operation Issues and Maintenance (Scott Etner, Big W Sales)	Crop Management With Marginal Water Quality (Blake Sanden, UC Ext.)
4:00	Storage Tank Maintenance, Issues (Chris Brooks, Heartland Tank)	Interpretation of Water Test Results (Carl Bruice, Wilbur Ellis)
6:00	**Reception**	

Wednesday, December 10, 2014

8:00	West Coast/Global Fertilizer Outlook and Trends; 2012 and Beyond (Wayne Welter, Simplot)	
8:40	Energizing America: Facts for Addressing Energy Policy (Rayola Dougher, American Petroleum Institute)	
	Session A	***Session B***
9:30	Formulation and Compatibilitiy Issues (Allen Haynes, Simplot)	Getting To the Root Of Nutrient Availability (Scott Murrell, IPNI)
10:20	UAN Composition Variability & Other Issues (Mike Orr, SPC Consulting)	Appropriate Soil Test Methods/Interpretations (Bob Miller, Colorado State)
11:10	Plant Operations & Formulation Roundtable: Questions and Discussion (Rex Hopkins, Mike Orr, Participants & Others)	Ortho-Low Poly Products, Production & Characteristics (Del Butler, Simplot)
12:00	Wrap-Up, Thank You, Have a safe trip home!!	

What Are The Top 10 Advantages Of Fluid Fertilizers ?

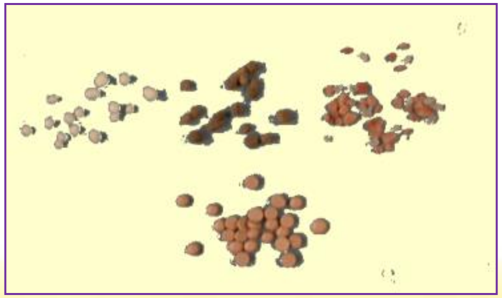
There Are So Many!

Some Benefit Everyone

For others, the relative advantage depends on the specific situation involved.

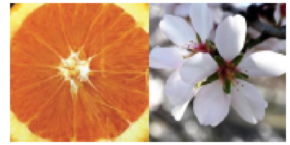


vs.



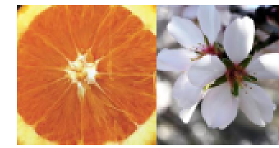

Tom Gerecke
2011 Workshop

Solutions and Opportunities with Fluid Fertilizer



- Improve fertigation injection times, timings
- Lower application costs from fertigation
- Many Liquid CRF materials for soil and foliar
- At high yield levels, placement, timing critical
- Fluids fit the 4 Rs best
  - Right Material
  - Right Rate
  - Right Place
  - Right Time

Solutions and Opportunities with Fluid Fertilizer



- Uniformity of application, especially micronutrients
- Soil pH up or down changes with depth, faster
- Uniform blends
- all in 1/ balanced applications
- Better efficiency with no till – even trees and vines
- Dilute-able for crop safety
- No dissolution for fertigation or sprays
- More, varied opportunities for additive inclusion
- Co-application with crop protection chemicals
- Liquids have most rapid foliar uptake

Actagro Plant Nutrients

Fluid Fertilizer Foundation

What Are Your Top Benefits ?

1. Fertilizer Placement
   a) Starter Applications
   b) Subsurface Band (knife)
   c) Surface Band (dribble)
2. Homogeneous Blends/Droplets
3. Split Applications
4. Foliar Applications
5. Nutrient Use Efficiency
6. Uniform Applications (including micronutrients)
7. Handling Convenience
8. Combining With Weed Control
9. Fertigation
10. Environmental Benefits
11. Precision Ag/Variable Rate Prescription Application
12. Etc., Etc., Etc.

Why Fluids?

5. Logistics

- Handling Convenience
- Product Safety
- Equipment Requirements
- Logistics Of Storage & Application

Temperature of Ammonia	Vapor Pressure
60°F	93 psi
100°F	197 psi

Fluid Fertilizer Foundation

Logistics

- **Handling Convenience & Cost**
  - Much easier and cost effective to equip for handling & applying fluid fertilizers (University researchers!)
- **Product Safety**
  - Desiccant properties & high pressure for ammonia
- **Numerous Fluid Equipment Options**
  - Many equipment options for fluid vs. dry
- **Transfer/Storage/Application Logistics**
  - Pumping vs. auger/belt transfer
  - Nurse tanks & plant storage requirements
  - Hose inspection/replacement
  - Caking, 'fines' development during handling

Why Fluids?

4. Precision - Right Rate

- Application Uniformity & Accuracy
- Homogeneous, No Segregation, Continuous Bands
- Calibration
- Variable Prescription Applications

Fluid Fertilizer Foundation

Why Fluids?

4. Precision - Right Rate

- Application Uniformity & Accuracy
- Homogeneous, No Segregation, Continuous Bands
- Calibration
- Variable Prescription Applications

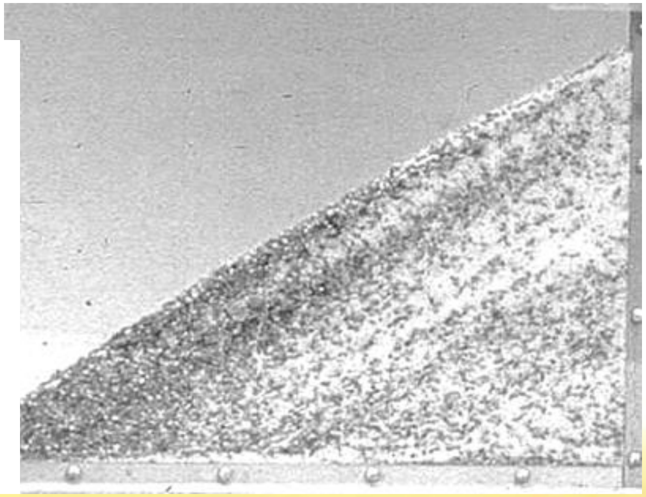
Uniform Distribution Of Nutrients With Fluid Fertilizers Is Unmatched

- *Uniform across the field*
- *Uniform across application swath*
- *Uniform within a continuous band*

Precision: No Segregation

Once blended, solid fertilizers immediately begin the process of unblending

- **Coning** – Occurs as blended materials are dropped, forming a conical pile in storage and application equipment – Larger particles roll to the edge of the pile
- **Vibration** – Vibration segregation occurs as the tendering equipment and applicator travel to or across the field – Size, weight.
- **Ballistic** – Ballistic segregation occurs during application. Larger particles weigh more and travel farther than smaller particles – 2X difference in diameter = 8X difference in weight.



Right Rate: Distribution Uniformity

ALABAMA

Optimizing Nutrient Stewardship Using Broadcast Fertilizer Application Methods

By John Fulton, Timothy McDonald, C. Wesley Wood, Oladiran Fasina and Simerjeet Virk

Visual illustration of the resulting distribution from an individual pan test using Blend 1 (17-17-17). Note that the DAP particles (larger in diameter) were applied further out than the KCl (pink particles) and ammonium nitrate (white particles). While not clearly visible, the center three tubes contain the highest percentage of dust particles, which were mainly ammonium nitrate.

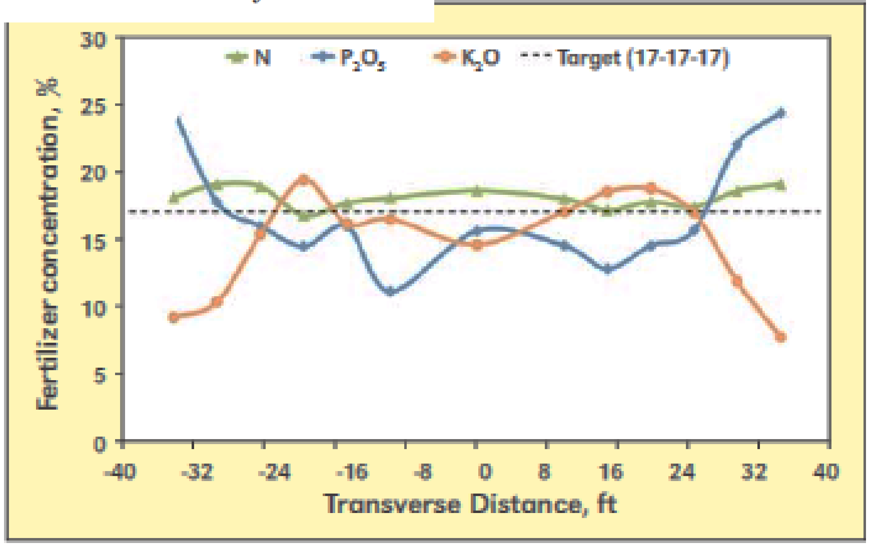
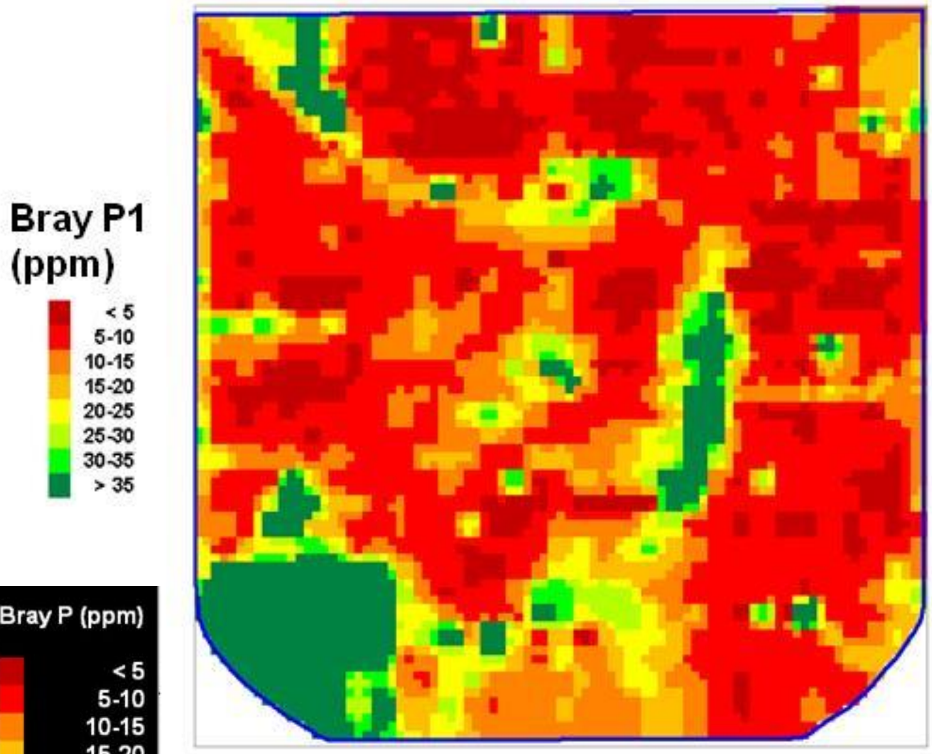


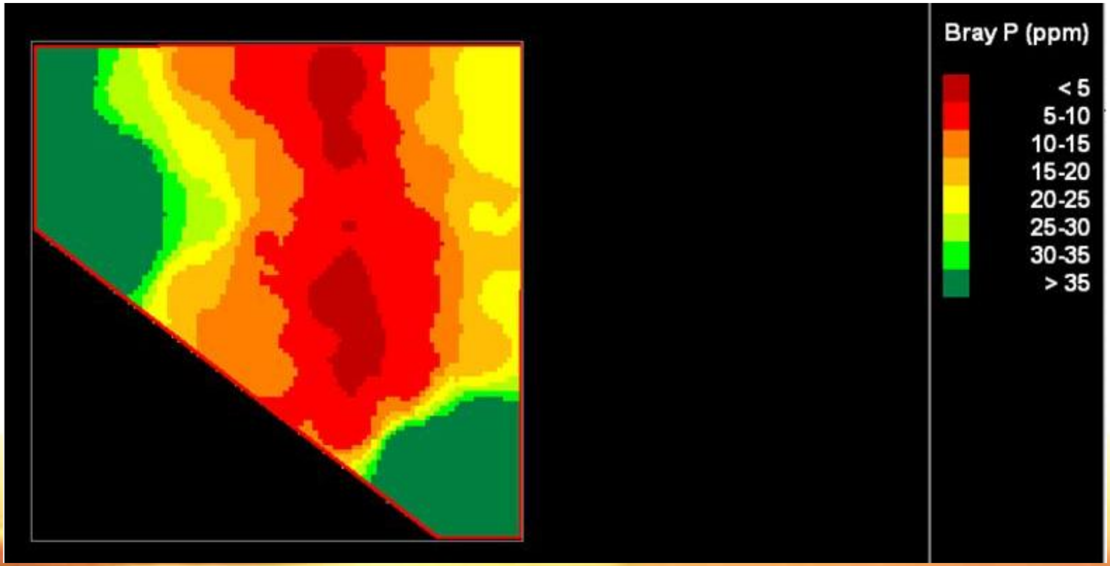
Figure 1. Example nutrient concentration across the spread width for Blend 1 (17-17-17) with a spreader setup at a 70 ft. spread width. Reported data are the mean of three pan tests.

Better Crops
2013, No. 3, pg. 15-17

Right Rate:

Variable Prescription Applications





Precision: Band Uniformity

by Drs. B. Eghball and D.H. Sander

Does Variable Distribution Affect Liquid P-Use Efficiency?

Florida scientist offers tips on how to use starters, plus describes the many benefits that accrue from their use. He focuses on corn.

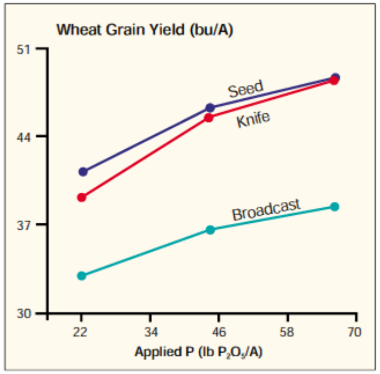


Figure 6. Effect of method of P application on wheat grain yield, Sander, et al.

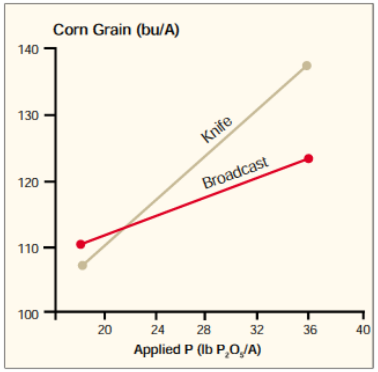


Figure 7. Effect of method of P application on corn grain yield, Raun, et al.

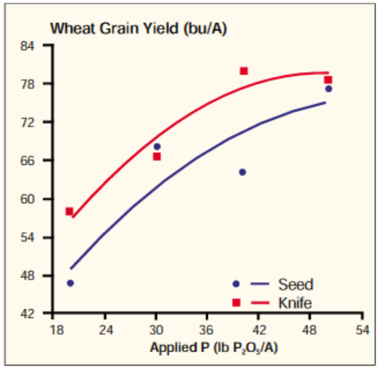


Figure 8. Effect of method of P application on wheat grain yield, Leikam, et al.

"Mixing of 10-34-0 with UAN may improve P-use efficiency both through improved P distribution and through ammonium-N effects on P uptake and P fixation."

Drs. Eghball and Sander
University of California

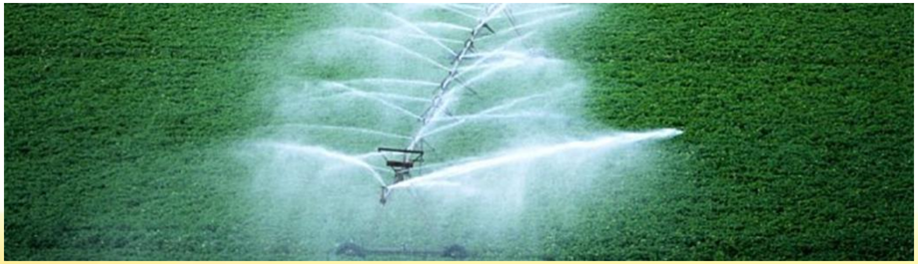
"…… we suggest that plant roots may follow a continuous band with only one root contact. However, with discontinuous bands, where fertilizer is placed in droplets or as dry particles too far apart to interact with each other, a new root contact may be needed for each droplet or particle."

Fluid Journal
Winter 2001

3. Flexibility

- **Versatility**
  - A wide variety of best-fit functions/competencies
  - Ability to do many things very well
  - Ability to fit many and varied situations

- **Adaptability**
  - Respond to changing environment (eg. weather)
  - Easily adjust to changing conditions (e.g. reduced-till)



Versatility

Versatile - Only nutrient sources adaptable to ALL methods & placements

- Broadcast
- Subsurface, surface, dribble and starter banding
- Drip, sprinkler and flood irrigation
- Only option for in-season foliar application

Versatile - Fits conventional, conservation, reduced, no-till systems and long-term permanent crops

Versatile - Ideally suited for pre-plant, planting time and in-season application

Versatility

Dr. Gyles Randall

Managing Nitrogen With Five-dollar Gas

Escalating natural gas prices with little possibility of low-cost nitrogen returning, strongly encourages growers to fine-tune management practices or jeopardize profits.

What form of N fertilizers is favored for split applications?

"Seven-year average corn grain yields were lowest with fall N without N-Serve, intermediate and equal for fall N + N-Serve and spring preplant N, and highest for split N treatment ...... Apparent N recovery and economic return in decreasing order: split N > Spring > Fall + N-Serve > Fall N.

These results clearly show yield, profitability and N efficiency advantages for the split N treatment."

Fluid Journal 2004

Fluid Fertilizer Foundation

Adaptability

Adaptable - Uniquely suited to changing soil/environmental conditions

Adaptable - Provides flexibility for simultaneous precision operations & applications

- Tillage and planting equipment
- Irrigation/fertigation systems
- With other crop nutrients & micronutrients
- With many pesticides
- With many fertilizer additives

Adaptability

Drs. Thomas A. Doerge and T. L. Thompson

Trickle Irrigation: One Answer To Site-Specific Nutrient Management

Practice is combined with tissue nitrate testing used to avoid N deficiencies as well as unneeded N inputs.

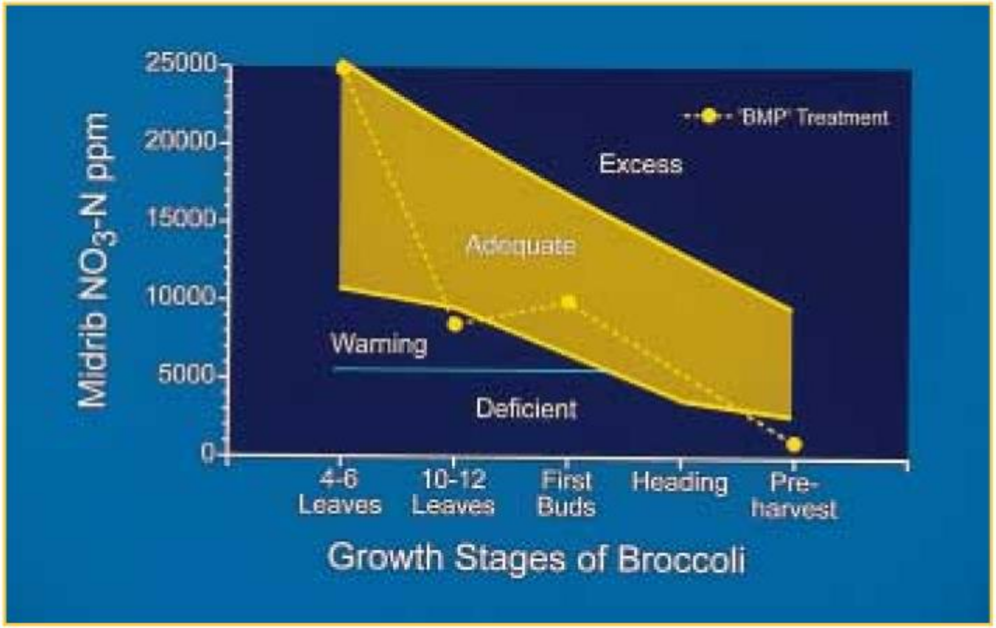


Figure 3. Interpretation of seasonal petiole nitrate levels in the BMP nitrogen treatment for broccoli, Doerge, et al., University of Arizona, 1994-95.

"Trickle irrigation in combination with feedback from in-season nitrogen (N) tissue tests offers almost unlimited flexibility in developing site-specific nutrient management plans."

Tom A. Doerge & T. L. Thompson
University of Arizona

Versatility & Adaptability

Fluid JOURNAL
Official Journal of the Fluid Fertilizer Foundation
Late Spring 2009
Vol. 17, No. 3, Issue #65

Dr. Derrick Oosterhuis

Timely Foliar Applications Rectify Nutrient Deficiencies

Applications should be made either early morning or late afternoon for maximum efficiency.

"Foliar fertilization is a viable means of applying certain fertilizers that can supplement traditional soil methods. *It can be used to improve the efficiency of a nutrient urgently required by the plant to produce maximum growth, yield, and fiber quality*. In this way, foliar fertilization supplements soil applications for a more efficient supply of nutrients to the developing cotton plant for optimum yields and fiber quality. In general, foliar applications should be made early morning or late evening for maximum efficiency, and no foliar applications should be made to water-stressed plants."

Fluid Journal 2009

Why Fluids?

2. Agronomics

- **Nutrient Use Efficiency**
- **Soil Chemistry**
- **Uniquely Suited To 4R Stewardship**

Agronomics: Efficiency

Drs. J. L. Havlin, A. J. Schlegel and G. M. Pierzynski

Fluid Journal 1993

Improved yields improve environment

Tests made on grain sorghum and winter wheat to determine optimum recovery and minimize N leaching.

Table 2. Fertilizer management effect on ANR and soil N content after harvest.

Rate (lbs/A) N	Rate (lbs/A) P_2O_5	Placement Method	Grain Sorgum ANR* %	Grain Sorgum Soil N* lbs/A	Winter Wheat ANR* %	Winter Wheat Soil N* lbs/A
0	0		-	41	-	25
40	0	Broadcast	22	70	31	44
40	20	"	36	59	44	40
40	40	"	[illegible]	52	[illegible]	36
80	0	"	[illegible]	86	[illegible]	57
80	20	"	30	66	32	50
80	40	"	34	64	33	48
40	0	Knife	37	61	46	41
40	20	"	[illegible]	50	[illegible]	39
40	40	"	[illegible]	48	[illegible]	33
80	0	"	31	76	35	49
80	20	"	36	58	50	43
80	40	"	38	57	49	40
40	0	Dribble	35	64	43	45
40	20	"	[illegible]	48	[illegible]	41
40	40	"	[illegible]	50	[illegible]	35
80	0	"	29	79	42	54
80	20	"	34	55	51	41
80	40	"	37	51	50	40

Broadcast: 31.8% (Grain Sorgum) / 36.7% (Winter Wheat)

Knife: 42.5% (Grain Sorgum) / 54.0% (Winter Wheat)

Dribble: 41.2% (Grain Sorgum) / 50.2% (Winter Wheat)

*ANR = apparent N recovery; Soil N = inorganic N content, 0 to 4-foot depth

Agronomics: Efficiency

by Dr. Raun Lohry

Liquid Starter Makes Conservation-till Work

Research shows liquid starters continue to excel under intensive management

“The most spectacular response from any plant food applied with starter is the tremendous increase in fertilizer efficiency gained by banding zinc in starter. In Nebraska tests, one-tenth of a pound of zinc increased yields by 37 bushels per acre! Researchers said, “With placement below and to the side of the seed only small amounts of zinc were needed to produce maximum yields.”

FJ Spring 1993 & FJ 1994 Fall

Table 5. Effect of starter applied zinc on corn grain yield over two years.

lb Zinc/A	Yield bu/A	Increase
0	82	
0.1	119	37
0.3	127	45
1.0	135	53

Effective Zinc Management

An infinitesimal amount of this mighty nutrient goes a long way in helping to product yield gains

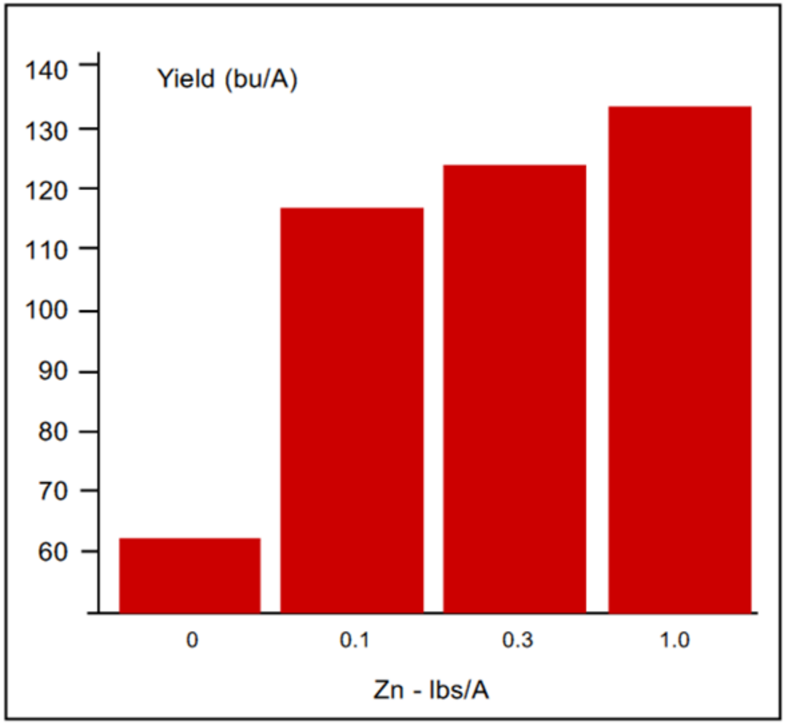


Figure 3. Effect on corn yield when banding zinc near seed, University of Nebraska.

Agronomics: Efficiency

Dr. Richard H. Fox and William P. Piekielek

Fluids Shine in Ammonia Volatilization Comparisons

Tests in no-till corn fields in central Pennsylvania compare UAN with urea.

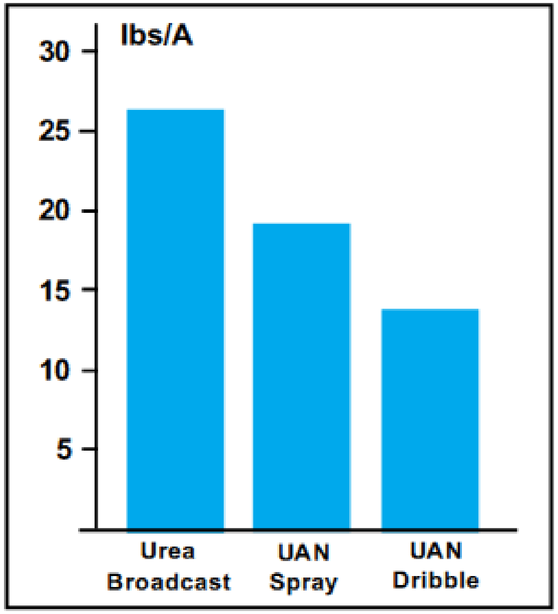


Figure 2. Total ammonia loss over 16-day period using different sources/methods, elinimating two outlier plots, Fox and Piekielek, Penn State, 1993.

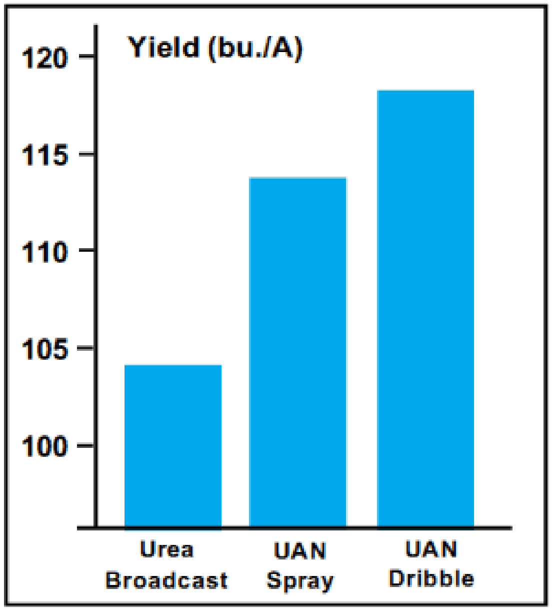


Figure 3. Corn Yields at early dent stage as function of N fertilizer source and method of application, Fox and Piekielek, Penn State, 1993.

"Fields had been in no-till for at least two years. .... Nitrogen fertilizer was applied at the rate of 120 lbs/A on May 12 when corn plants were one to two inches tall. Soil surface covered with crop residue when treatments were applied ranged from 60 to 80 percent." ❑

Fluid Fertilizer Foundation

Agronomics: Soil Chemistry

by Dr. R.E. Holloway, Dr. I. Bertrand, Mrs. A.J. Frischke, Mrs. D.M. Brace, and Dr. M.J. McLaughlin

Fluids Outdual Granular In Australian Wheat Trials

Fluid sources of P, N, and Zn performed markedly better than granular fertilizers in terms of promoting dry matter, P uptake, and grain yield

Fluid Journal Winter 2002

" Shoot dry weight increased 27 percent by adding 9 lbs/A of fluid N, versus no response to granular application. Similarly, the application of 9 lbs/A of fluid N increased P uptake in shoots by 29 percent, Mn uptake by 31 percent, and N uptake by 30 percent. No differences were recorded with granular applications."

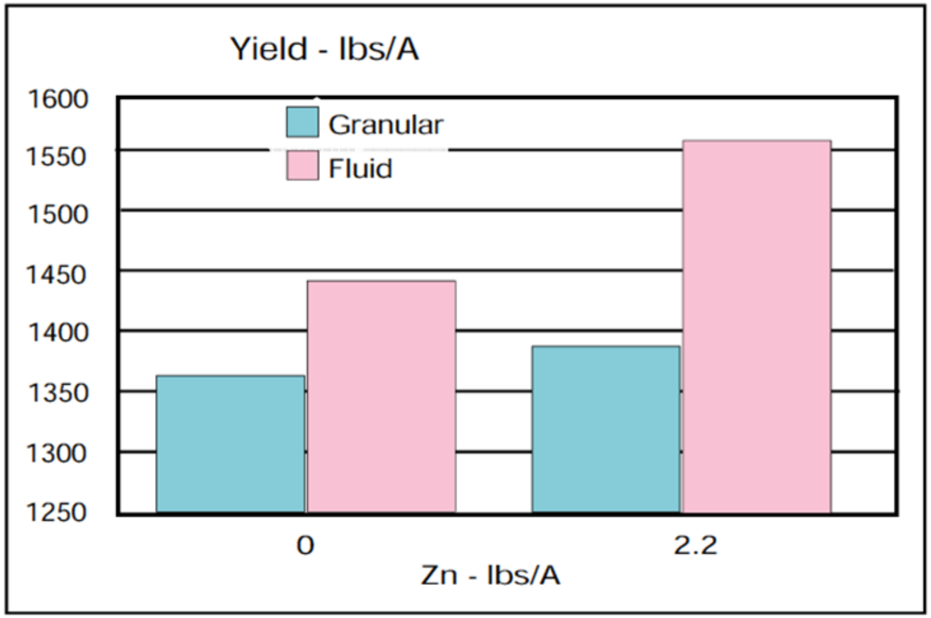


Figure 4. Effect of fertilizer source and application of Zn on grain yield of Frame wheat, Emerald Rise, 2000.

Agronomics: Soil Chemistry

DR. B. HOLLOWAY, D. BRACE, DR. I. RICHTER, DR. M. MCLAUGHLIN, G. HETTIARACHCHI, DR. R. ARMSTRONG

Micronutrient Availability Improved With Fluids

"The results support our conclusion in the 2005 issue of the Fluid Forum Proceedings, which shows that the best practice for cereal production on the highly calcareous soils of South Australia should involve the use of NP fluid fertilizers containing micronutrients--principally Zn, Mn, and Cu, although Cu was not used in these experiments."

Fluid Journal 2006

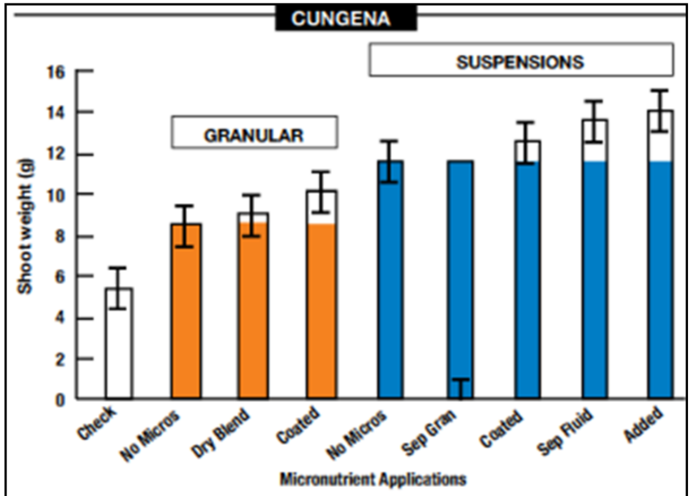


Figure 1. Response of Yitpi wheat shoot growth at early tillering. Color bars show response in shoot growth to granular and suspension fertilizer, with micronutrient response added as the clear top portion of the bar. Cungena, 2005.

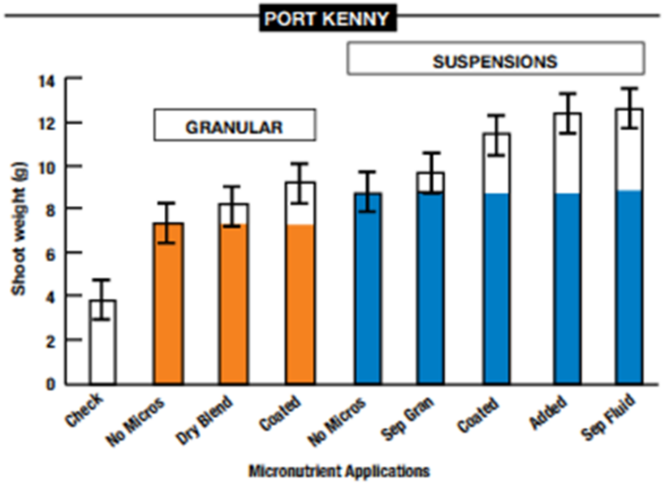
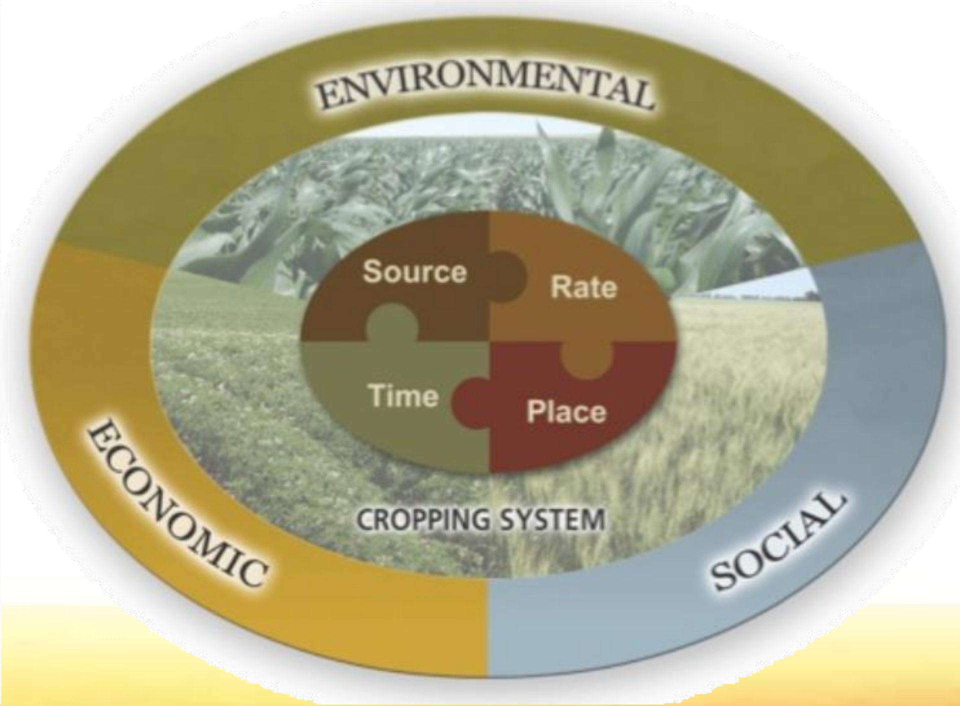


Figure 2. Response of Yitpi wheat shoot growth at early tillering. Color bars show response in shoot growth to granular and suspension fertilizer, with micronutrient response added as the clear top portion of the bar. Port Kenny, 2005.

Agronomics: 4R Stewardship

"Right source at the right rate, right time, and right place"



Agronomics: 4R Right Rate

The Right Rate: Uniform Distribution Of Nutrients With Fluid Fertilizers Is Unmatched

- Uniform across application swath
- Uniform across the field
- Uniform within a continuous band

Fluid Fertilizer Foundation

Agronomics: 4R Timing & Placement

DR. M. ALLEY, M. MARTZ, AND DR. W. THOMASON

Timing of N and P Crucial In Achieving High Corn Yields

"Data from these trials clearly indicate that relatively **high rates of N are needed in starter band fertilizers, and that P applications can be determined by soil testing. Our recommendations for corn are to apply 50 lbs/A of N in a 2 x 2 starter band in conjunction with needed P up to a rate of 50 lbs/A of P2O5 in the starter band. This rate of P covers the vast majority of soils used for corn production in the mid-Atlantic region. "**

Fluid Journal
2007

Agronomics: 4R Timing & Placement

T.L. Wesley, Drs. R.E. Lamond, V.L. Martin, S.R. Duncan

Applied N At R3 Stage Bumps Soybean Yields

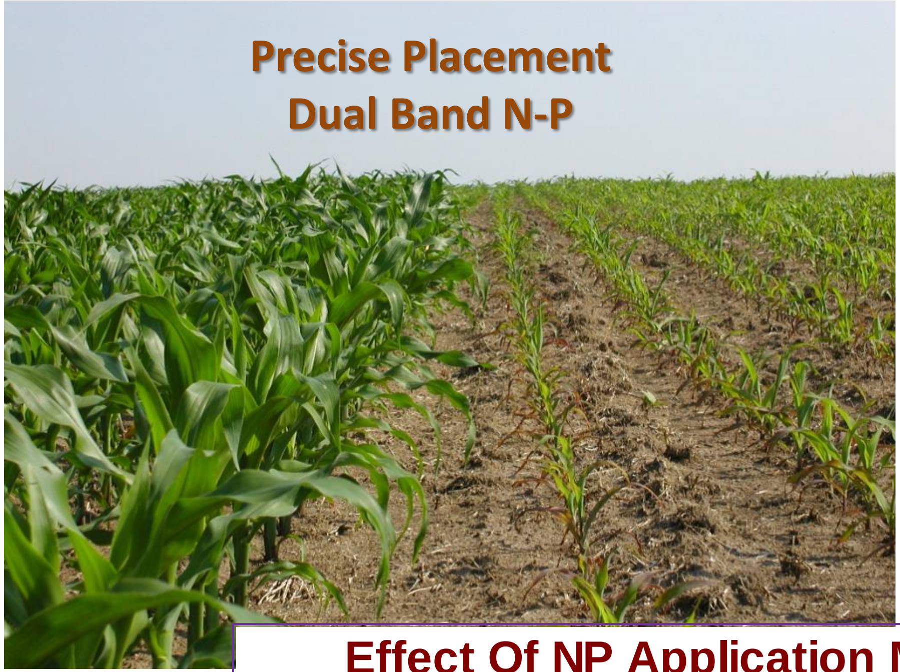
Nitrogen applications at R3 growth stage produce 11.8 percent average yield increase in two-year Kansas study.

"Results from a two-year study at four irrigated sites in Kansas show that late-season application of N to soybeans at the R3 growth stage will increase soybean yields."

Fluid Journal
Spring 1999

Fluid Fertilizer Foundation

Agronomics: Precise Placement



Effect Of NP Application Method On Wheat Yield

Application Method		Wheat Grain Yield (1979)		
		Harper	Dickinson	Osage
N	P	(bu/a)	(bu/a)	(bu/a)
Knife	Knife	47.9	64.0	62.90
Knife	B'cast	44.8	52.9	56.40
B'cast	Knife	46.8	56.4	59.10
B'cast	B'cast	44.8	53.4	52.90
	LSD (0.05)	NS	6.8	NS
No P Check Yield		43.8	47.3	57.10

Kansas

Fluid Fertilizer Foundation

1. Value

- Logistics, Flexibility, Precision and Agronomics …………………
- Profitability & Stewardship

Value vs. Low Cost

Top 5

Why Fluids

1. Value
- Performance, Profitability & Stewardship

2. Agronomics
- Uniquely Suited To 4R Stewardship
- Nutrient Use Efficiency
- Soil Chemistry

3. Flexibility
- Adaptability
- Versatility

4. Precision - Right Rate
- Application Uniformity & Accuracy
- Homogeneous, No Segregation, Continuous Bands
- Calibration
- Variable Prescription Applications

5. Logistics
- Special equipment not required
- Product transfer/storage logistics
- Equipment complexity, versatility & cost

Why Fluids?

Dale Leikam

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THE FLUID JOURNAL

The Fluid Journal is published by the Fluid Fertilizer Foundation. Click on the magazine below to see our current issue.

EVENTS

Fluid Technology Roundup
Ameristar Casino & Hotel
Council Bluffs, IA
December 10-11, 2013
Letter • Program • Registration

Fluid Forum
Talking Stick Casino
Scottsdale, AZ,

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Irrigation	Canola	GPS	1998
Point Injection	Cherries	High Yields	1999
Sidedressing	Chilis	Insects	2000
Split	Citrus	Liquid vs Dry	2001
Starter	Corn	Manure	2002
Surface Banding	Cotton	MSP	2003
Variable Rate	Edible Beans	Plant Populations	2004
Tillage	Forage	Residue	2005
No-Till	Grain	Roots	2006
Reduced Tillage	Grapefruit	Row Width	2007
Ridge-Till	Melons	Sensors	2008
Strip-Till	Onions	Soil	2009
Zone	Pasture	Turf	2010
Micronutrients	Peanuts	Water	2011
Boron	Pears	**Major Nutrients**	2012
Calcium	Pistachios	Nitrogen	
Chloride	Potatoes	Phosphorus	
Copper	Rice	Potassium	
Iron	Sorghum	Sulfur	
Magnesium	Soybeans	**Enhancers**	
Manganese	Sugar Beets	N-Inhibitors	
Molybdenum	Vegetables	Polymers	
Zinc	Wheat		
		Fertilizer Products	
		Soil Test/Soil Chemistry	


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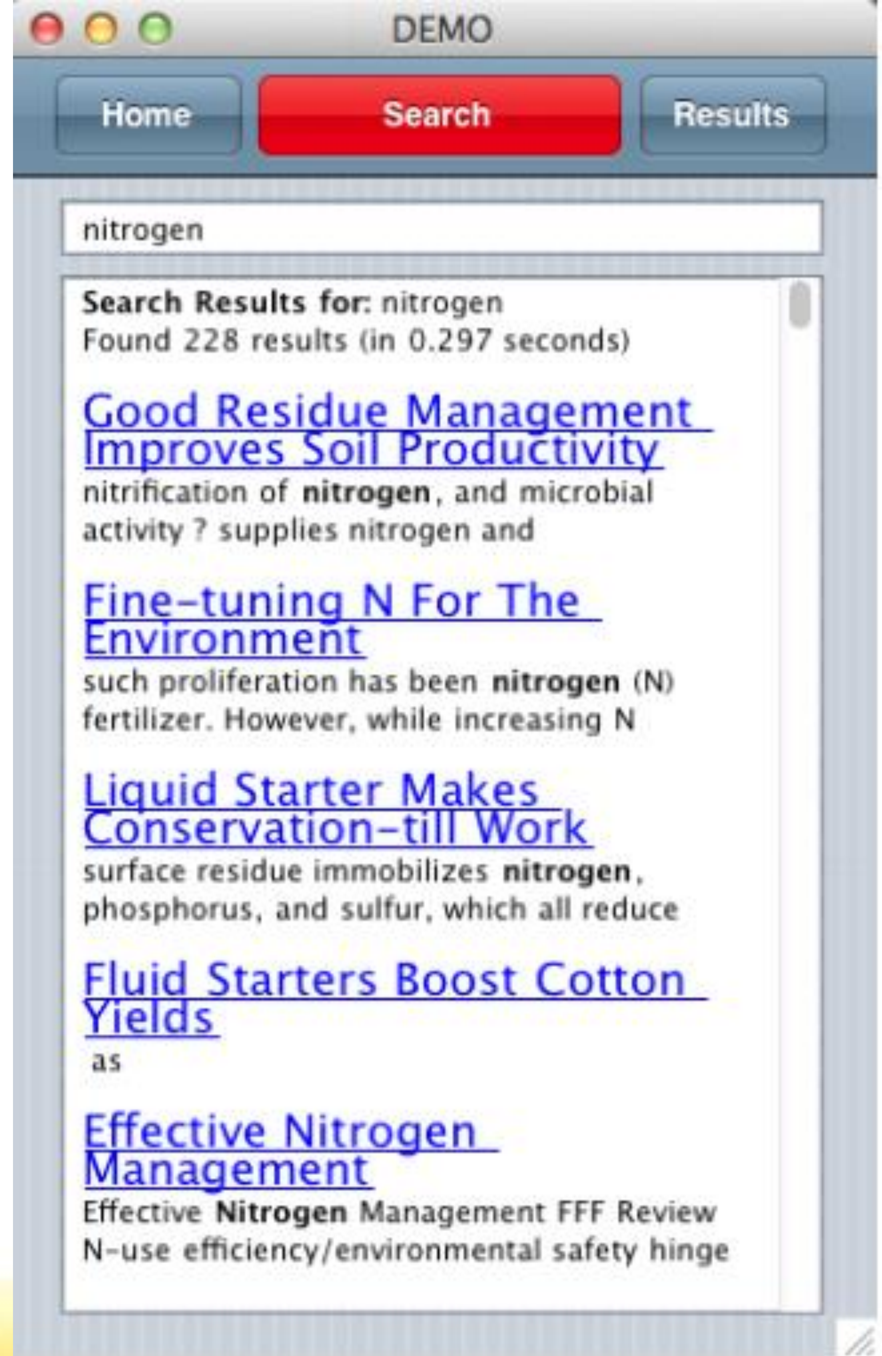
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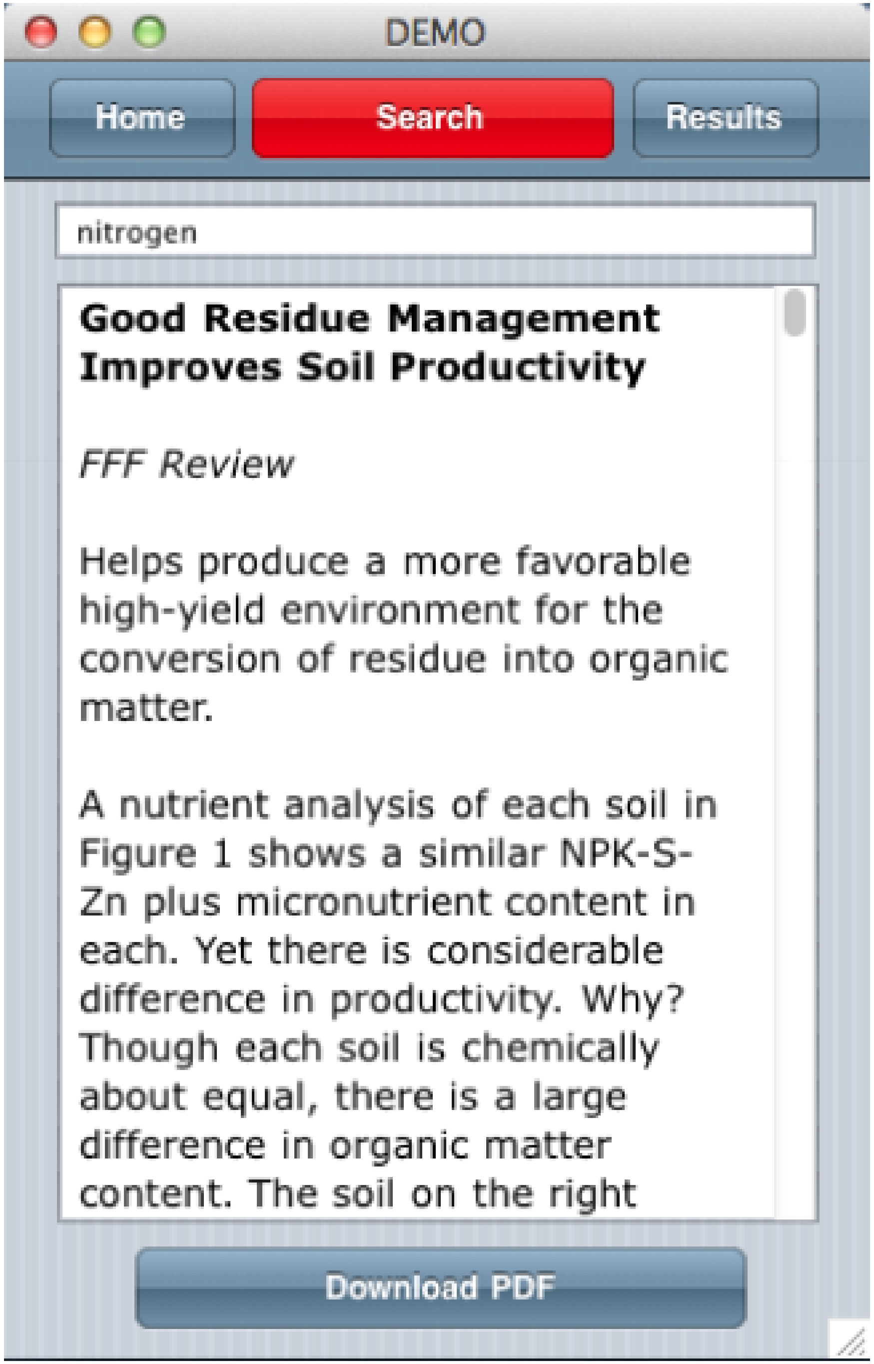
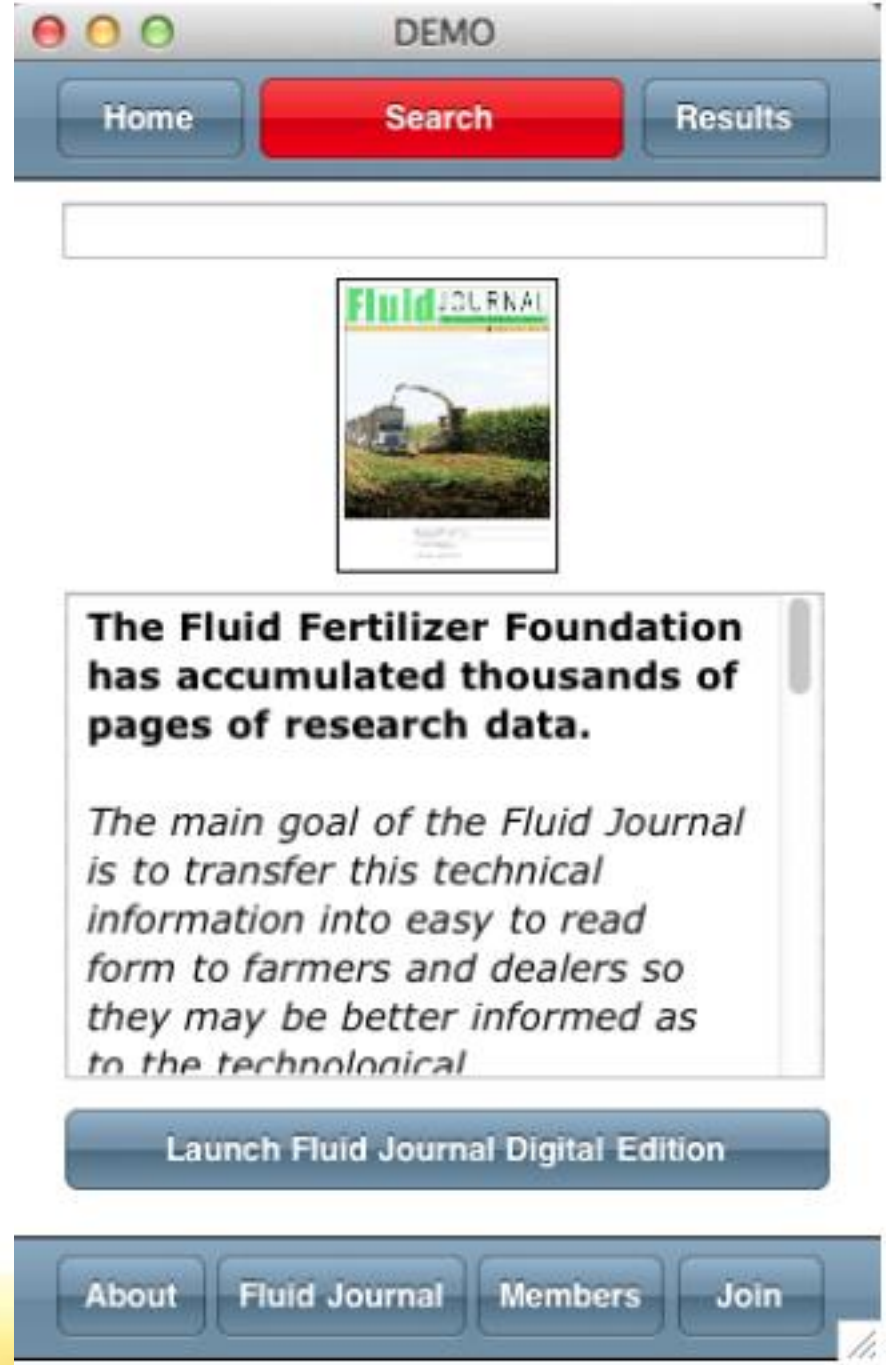
Good Residue Management Improves Soil Productivity
nitrification of nitrogen, and microbial activity ? supplies nitrogen and
Fine-tuning N For The Environment
such proliferation has been nitrogen (N) fertilizer. However, while increasing N
Liquid Starter Makes Conservation-till Work
surface residue immobilizes nitrogen, phosphorus, and sulfur, which all reduce
Fluid Starters Boost Cotton Yields
as
Effective Nitrogen Management
Effective Nitrogen Management FFF Review N-use efficiency/environmental safety hinge





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Fluid Fertilizer Foundation Research Summary

UNDERSTANDING INFLUENCE OF P PLACEMENT UNDER FIELD CONDITIONS

Knowledge of the dominant solid P species present in the soil following application of P fertilizers, and linking that to potential P availability, would help understand how to manage P in efficiently reduced-till systems. The objective of this research was to understand the infl uence of placement (broadcast vs. deep-banded P), fertilizer source (granular vs. liquid P), and time on reaction products of P under field conditions.

Summary Points

- Resin extractable P was greater for liquid P-treated soils when compared to the granular P-treated soils.
- Resin extractable P was lower for broadcast treatments as compared to deep-band treatments for both the time periods.
- Over a six-month period, reaction products of broadcast-granular, broadcast -liquid and deep-banded -granular fertilizers formed less soluble compounds while deep-banded liquid P remained mainly as adsorbed P forms.

Data

Treatment	Al- Phosphates	Ca-Phosphates	Fe(III) Phosphate	Fe(II) Phosphate	Adsorbed P
Urea Broadcast (Control)	60.4	-	-	39.6	-
Gr. MAP Broadcast	46.3	-	-	-	53.6
Liquid MAP Broadcast	-	100	-	-	-
Urea Deep band (Control)	-	53.0	-	47.0	-
Gr. MAP Deep band	-	51.6	-	-	48.4
Liquid MAP Deep band	-	19.8	-	-	80.3

Table 1. Percentage of P species in the fertilized soil section (0-1" for broadcase and 3-4" for deep-band). Determined with XANES spectra (six months after application.

Conclusions

It appears that when liquid MAP is deep-placed in no-till soil systems, more P remains in resin extractable P forms for six months after fertilizer application. In contrast, broadcasted P, either in granular or in liquid form, tended to transform into less extractable P forms after five-week or six-month time periods. Formation of Fe-, Al-, and/or Ca-P solid species, with different solubility, may have been the reason for the observed differences in extractability or potential availability of P between broadcast and deep-placed granular and liquid MAP evaluated in this study.

Research Credits

Dr. Hettiarachchi is an Assistant Professor, Dr. Mengel is a Professor, and Mr. Khatiwada is a graduate Research Assistant in the Departmentof Agronomy at Kansas State University.

Full paper is available from the Fluid Journal archives:

http://www.fluidjournalonline.com/?iid=58030

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Fluid Fertilizer Foundation Research Summary

STILL IMPORTANT: STARTERS ON HIGH P SOILS

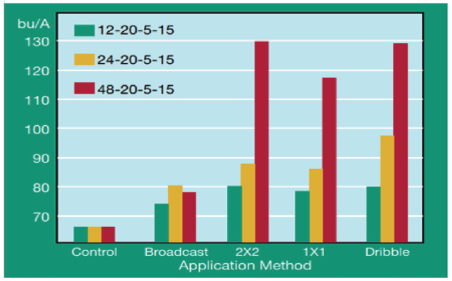
Continuing studies on corn response to starters on high P soils on the Delmarva Peninsula indicate that some starter P is important for highest yields even when soil test P levels are high. Eliminating P in starters because of high P index values puts growers at a disadvantage through lower yields, particularly in high residue systems, and likely has negative implications for N use efficiency.

Summary Points

- Some starter P is important for highest yields even when soil test P levels are high.
- Studies have consistently shown that broadcast starter have been inferior to 2 x 2 bands or surface bands beside the row.
- Complete high N starters that also include K, S, and Zn have proven to be better than N-alone starters.

Data

Table 1. The effect of starter formulation on corn yields



Conclusions

Our starter N rate comparisons support the importance of adequate N close to the emerging plant in the first crucial days after planting. Broadcast N is not the same and, like high P soil tests under high residue, cold soil conditions do not provide high enough N (or P) concentrations in the young plants' root zone to overcome soil environmental restrictions to nutrient uptake. Numerous studies have also emphasized the importance of readily available NPKS and Zn close to the developing root system to meet the demands of young plant roots. Nutrient adsorption per unit of root length is extremely high in early growth stages.

Research Credits

Ron Mulford

Ron Mulford is Agronomist (retired), University of Maryland, Lower Eastern Shore Research and Education Center.

Full paper is available from the Fluid Journal archives:

http://www.fluidfertilizer.com/PastArt/pdf/59P12-13.pdf

Fluid Fertilizer Foundation Research Summary

FOLIAR K APPLICATIONS SAFE WITH GLYPHOSATE

The incidence of K deficiency has increased in recent years due to 1) reduced K availability under drought conditions, 2) soil compaction, 3) reduced applications of K for soybeans due to low commodity prices, 4) higher corn grain yields, and 5) increased soybean acreage in rotation with corn, increasing K fertilizer requirements.

Summary Points

- Foliar K applications can be mixed with glyphosate with minimal crop injury.
- Foliar K applications can be mixed with glyphosate with minimal reduction in weed control.
- However, performance is influenced by K source.

Data

Table 1. The effect of fertilizer additive on grain yield applied alone as a weed-free treatment and tank mixed with glyphosphate, Novelty, 2004 and 2005.

Fertilizer additive	Rate K_2O lbs/A	Yield 2004		Yield 2005	
		Weed-free	Glyphosate tank mixture	Weed-free	Glyphosate tank mixture
		bu/A			
Non-treated		9.6		15.9	
Weed-free		66.3		47.6	
NIS			68.1		42.5
NIS + DAS			69.9		40.9
3-18-18	2.4	66.7	67.1	47.5	41.5
3-18-18	9.6	70.4	66.8	46.5	40.1
3-18-18	19.2	66.8	68.9	46.7	38.5
0-0-25-17-KTS	2.4	68.6	65.1	48.1	39.1
0-0-25-17-KTS	9.6	68.2	65.1	48.7	35.1
0-0-25-17-KTS	19.2	66.6	66.0	47.5	36.6
5-0-20-13	2.4	67.7	66.4	47.2	40.5
5-0-20-13	9.6	70.2	66.6	46.9	40.7
5-0-20-13	19.2	65.1	67.3	46.8	36.9
0-0-62	2.4	70.3	67.1	46.3	41.2
0-0-62	9.6	67.5	67.7	47.5	40.3
0-0-62	19.2	69.4	64.1	49.4	38.9
LSD		4.9		4.7	

Conclusions

Soybean injury resulting from foliar applications of up to 19.2 lbs/A of K2O from several K fertilizer sources (i.e., KCl, KTS, and 3-18-18) was generally less than 10 percent. Potassium fertilizer sources tank-mixed with glyphosate, such as 3-18-18, 5-0-20-13 (KTS + urea-triazone) and KCl controlled more than 90% of weeds and produced grain yields similar to herbicide applications with ammonium sulfate, while providing additional K to the soybean plant in a single-pass weed management in north Missouri. However, two-pass weed management in southern Missouri provided excellent weed control for all additives and grain yields were similar or greater than glyphosate plus ammonium sulfate. The results of the study indicate that foliar K applications can be mixed with glyphosate with minimal crop injury and reduction in weed control, depending on product selection and application rate.

Research Credits

Drs. K. Nelson, assistant professor, P. Motavalli, associate professor, M. Nathan, assistant professor and D. Dunn, Delta Center Soil Test Lab supervisor, are with the University of Missouri College of Agriculture, Food, and Natural Resources.

Full paper is available from the Fluid Journal archives:
http://www.fluidfertilizer.com/PastArt/pdf/56P14-16.pdf

Fluid Fertilizer Foundation Research Summary

SPECIFIC GRAVITY AND PH EFFECTS ON UAN BLENDING

In the past, UAN composition was fairly uniform and unanticipated blending issues were relatively infrequent. That has changed, however, and variations from load-to-load and supplier-to-supplier are more common. And variations in pH and specific gravity (density) can wreak havoc on your UAN blending processes. Reasons for the variations in UAN composition vary, but it is prudent to be aware of what you are dealing with so that you can produce a viable end.

Summary Points

- There are often variations in pH and specific gravity of UAN by the time the product reaches the dealer - which can affect compatibility
- There may be a relatively broad range of urea to ammonium nitrate ratios in making UAN solution depending upon the specific producer and the time of year which may affect compatibility .
- The overall solubility of UAN and APP when directly blended together (no additional water) – especially during times of the year when product and air temperatures are cold - affects

Photo 1. UAN (32-0-0) & APP Compatibility Issue, spring 2012.

Conclusions

It is recommended two tests should be used to determine potential formulation issues with UAN, especially in late-winter to early-spring when product temperatures may be very cold. The first is the use of a hydrometer to check specific gravity (estimates N content) and the second is testing the pH with a properly calibrated pH meter. This important information allows the user to be aware of composition variations in advance so that adjustment can be made when co-mingling with other products.

While some variability in the specific formulation of UAN has been around since the initial development of the UAN industry, the increased reliance on imported product has exacerbated this variability and subsequent compatibility issues. It seems to occur more often with unseasoned personnel or when not enough volume is in the storage tanks to minimize ratio variations and/or free ammonia and product is shipped out immediately. In the past, some manufacturers of UAN have had UAN summer blends and UAN winter blends, seasonally altering the ratios of urea to ammonium nitrate. Take time to familiarize yourself with the product you are receiving.

Research Credits

Michael Orr is President of Specialty Process Consulting, LLC in Pocatello, ID. Dr. Leikam is President of the Fluid Fertilizer Foundation in Manhattan, KS.

Full paper is available from the Fluid Journal archives:
http://www.fluidjournal.org/all2013/W13-A3.pdf

Solutions and Opportunities with Fluid Fertilizer

- Fluid Fertilizers are the most versatile materials in the market. The most progressive, farmers still in business I know have liquid fertilizers in 1 or more fertilization steps in their crop programs. This varies from alfalfa and corn to high value row crops to trees and vines to very high value flowers and bulbs. Seldom do farms add more dry fertilizers as they become more intensively managed. With ever increasing need for efficiency and efficacy, liquids are your number 1 choice.

Actagro Plant Nutrients

Fluid
Fertilizer
Foundation

Agronomics: 4R Timing & Placement

by Dr. Stanley A. Barber

Timing And Placement One Key to High Yields

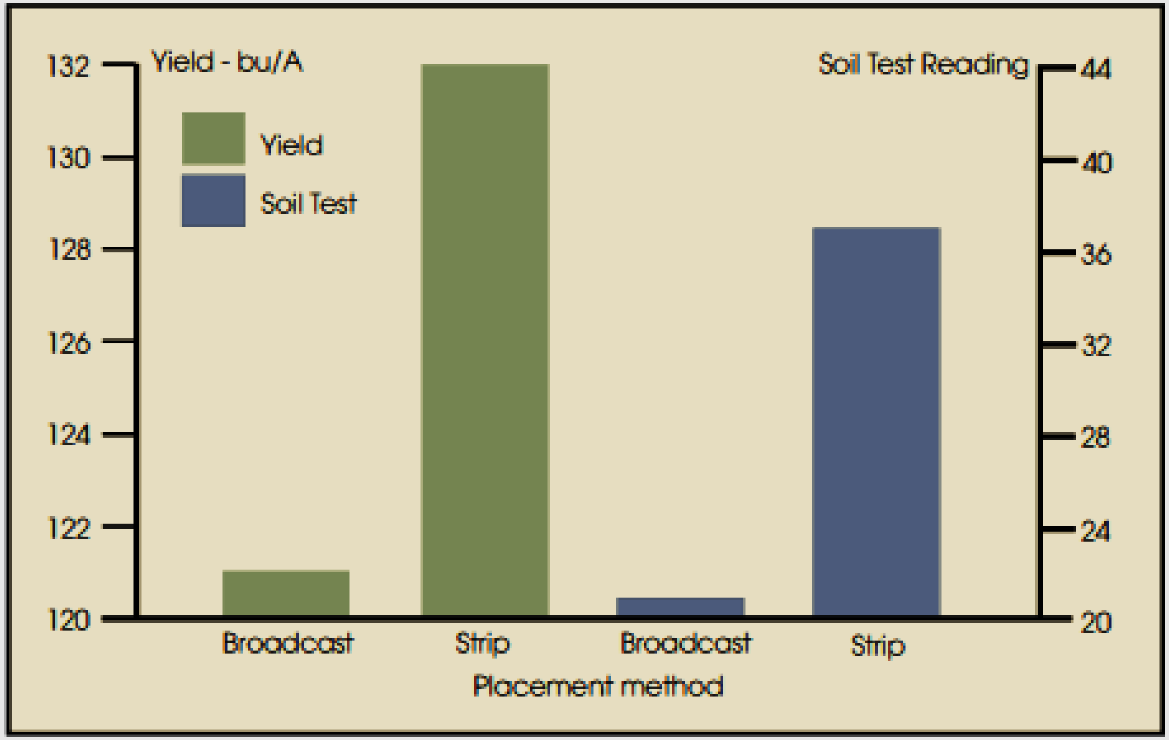


Figure 3. Average corn yields in a five-year comparison study of strip versus broadcast, Barber, Purdue University.

"Using an intermediate degree of mixing, accomplished via strip treatments, has proven the more efficient placement. Fertilizer reaches a greater proportion of the root system and is not tied up as much by the soil as occurs with broadcast applications. The use of strip treatments, versus the extremes of banding and broadcasting, is definitely worth considering in the pursuit of getting greater yield responses from applied fluids." ……….

Dr. Stan Barber

DR. GEORGE REHM, DR. JOHN LAMB, AND MARK BREDEHOEFT

A Look At Seed-safe Applications Of Fluids

Fluid Journal, Winter, 2007
Rehm, Lamb & Bredehoeft

Table 2. Corn yield as affected by fluid material, rate and placement in soils with two contrasting soil textures, 2005

		Texture, Placement, Rate											
		Silty clay loam						Loamy find sand					
		with seed		top of seed		below seed		with seed		top of seed		below seed	
	Material	high	low	high	low	high	low	high	low	high	low	high	low
		Check 208.7 bu/a						Check 185.5 bu/a					
5 & 10 gpa	10-34-0	211.6	203.6	213.8	208.9	213.6	209.6	154.9	176.8	170.5	190.6	151.7	199.3
5 & 10 gpa	4-10-10	204.7	196.9	210.3	208.4	203.0	210.3	192.8	203.7	188.4	208.7	201.3	190.9
3.4 & 6.8 gpa	3-18-18	201.0	212.2	215.3	209.3	211.0	206.7	189.3	207.8	205.7	203.5	201.1	204.4

Control (no fluid fertilizer) = 208.7 and 185.5 bu/A for silty clay loam and loamy fine sand sites, respectively.

"Grower interest in use of banded fluid fertilizer at planting is increasing. This renewed interest is due, in part, to frequent observations that banded fertilizer increases crop growth and subsequent yield. ……….. there are now several inexpensive attachments that can be added to planters to place fertilizer in a band near the seed at the time of planting."

Precision: Uniform Application

Once blended, solid fertilizers immediately begin the process of unblending!

Particle size is also the dominant characteristic affecting swath uniformity as well