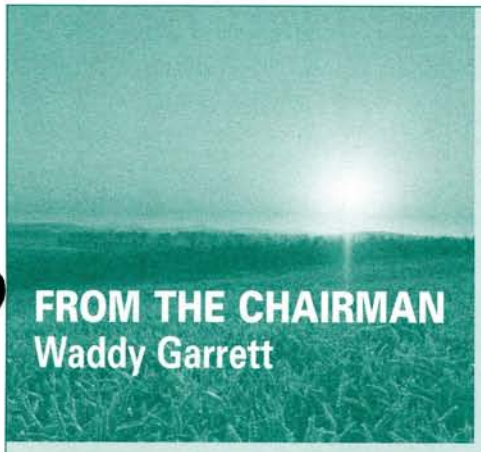
Fluid Digest

Spring/Summer
1997
Volume 3

Inside



FROM THE CHAIRMAN
Waddy Garrett

This year, 1997, is our 15th Anniversary of the Foundation. It was established 1982 with the goal of increasing the market share of fluid fertilizer. Most members agree that this goal is being achieved. Our Research & Development Committee criteria; is that research projects should be novel and innovative. The intent is to identify market opportunities where fluid fertilizer excels in both agronomic and economic performance. The results are clearly evident. Fluid fertilizers are being used in nearly every US experiment station. They are the preferred form of farm fertilizer for band placement, starter, sidedress and fertigation. They hold a strong position in nearly all of the US major fertilizer markets, and are experiencing growth in several international markets. In summary,. FFF has paid a very good return on investment to its contributors. Thank you for being a member.

The Fluid Fertilizer Foundation annual Symposium was held in Scottsdale, AZ on February 23-25, 1997. We had an all time record attendance which exceeded 200. New board officers were elected: G. Waddy Garrett, Alliance Agronomics, Inc., Chairman; Michael Buffington, Tessenderlo-Kerley, Secretary/Treasurer; David Delaney PCS Sales, Ex-Officio. Research reports presented at the Forum are published in the Fluid Forum Proceedings Book. The 1997 edition has 202 pages of information. Often overlooked is the fact that FFF research project leaders are well known scientists. They publish their work in scientific journals, present papers at scientific meetings, author popular articles and provide fertility management information for extension bulletins. They are continually giving scientific credibility to the products and programs that the Foundation members sell.

Published by the
Fluid Fertilizer Foundation
11701 Borman Drive, Ste. 110
St. Louis, MO 63146
(314) 567-7955
(314) 567-6808 (fax)

FFF Major Development in Fluid Fertilizer.

The Fluid Fertilizer Foundation (FFF) has been a major factor in the development of the fluid fertilizer placement market. The word placement usually means that fertilizer is applied in a concentrated band. There are many different placements being used with great success by fluid dealers in the United States and other countries. Placements include preplant bands applied on the soil surface or injected into the soil. Injected bands are common practice for bed planted and ridge till crops. FFF supported research projects show that placement is a "Best Management Practice" for many crop production systems.

The subject of this issue of Fluid Digest is the widely recommended starter fertilizer placement. Starter fertilizer is normally placed in a band within a distance of l to 3 inches from seed at planting. In some cases a small amount of fertilizer is being placed in direct contact with corn, wheat and grain sorghum seed. The FFF has funded a long list of starter research studies since the Foundation was established in l982. One of the early ones, conducted by Dr. Joe Touchton, Auburn University, has had a big impact on the market for starter fertilizer and the volume of fluid fertilizers in demand by that market.

Dr. Touchton worked with cotton, grain sorghum, corn, soybeans and peanuts. His work showed that for cotton, grain, sorghum and corn there is a strong interaction between tillage and yield response to starter fertilizer. Without starter fertilizer, conventional tillage crops produced a higher yield than no-tillage crops. With starter fertilizer, no-tillage crop yield was equal to or greater than conventional tillage crop yield (Table l and 2).

The importance of high nitrogen (25 to 30 lb/acre) in a starter application was also evident in the data from Dr. Touchton's research. The importance of nitrogen versus phosphorus varied from year to year and site to site but it was evident that the nitrogen application rate should be at least equal to phosphorus. In one study on corn, the highest grain yield in l984 was produced with N-P starter. The following year, l985, nitrogen alone increased grain yield by 28 bu/acre and there was no additional response to phosphorus and potassium (Table 3).

The studies at Auburn University were conclusive enough to cause the researcher to publish a table with suggested rates of starter fertilizers for grain crops (Table 4). Note that the suggested rate of nitrogen per acre is 30-40 lb/acre and phosphorus is suggested for soils with a high P soil test level.

A number of other states now have data that relates well to the results of the studies in Alabama. Several of those states recommend a N-P starter fertilizer for conservation tillage grain crop production systems. The suggested rate of nitrogen is 25 to 30 lb/acre. As starter fertilizer research moved North, potassium became more important as a starter nutrient. One recent study by University of Illinois researchers showed that at some sites in some years, potassium can be the yield increasing nutrient in a starter band. A full report on the University of Illinois starter research study is published in the l995 edition of the Proceedings for the North Central Extension-Industry Soil Fertility Conference, pages 54 through 80. For l994, in the 2x2 banded N-P-K starter component of the study, potassium was the key nutrient at two of four sites. At the Gridley site the 0-0-20 treatment increased grain yield by 18 bu/acre. At Oblong the 0-0-20 treatment increased yield by 14 bu/acre (Table 5).

The FFF continues to support starter research. In the l997 Fluid Forum Proceeding there are reports on six starter fertilizer research projects in various stages of progress. One with some very interesting results is being conducted by Doctors Pierzynski and Gordon at Kansas State University.

Kansas State currently recommends the use of starter fertilizer that supplies a 30 lb/acre rate of N and P_2O_5 in a 2x2 placement for conservation tillage, corn and grain sorghum. This recommendation is based on the results of several earlier studies. The current project is designed to study varietal response of corn and grain sorghum to starter fertilizer. The study compares four popular varieties each of corn and grain sorghum. The production system for corn is ridge-tilled, furrow-irrigated. Grain sorghum is no-tillage, dryland (rain fed). In the l997 report, two corn hybrids, Pioneer 3563 and Dekalb 646 did not show a yield response to any starter treatment. Starter fertilizer containing N and P increased the grain yield of Pioneer 3346 and Dekalk 591

Table 1

Grain Sorghum Yields as Affected by Tillage, Starter Fertilizer and Sidedress N.

Sidedress Nitrogen	Tillage and Starter Fertilizer: None Yes[1]	None No	Conventional Yes	Conventional No
lb/acre	bu/acre			
0	50	39	55	44
40	72	62	73	71
80	85	72	83	81
120	92	76	88	81

[1] 'Yes' indicates 120 lb/acre of 20-34-0 starter fertilizer and 'no' indicates no starter fertilizer.

Table 2

Seed cotton yields (on a soil that does not generally require in-row subsoiling for top yields) as affected by tillage, in-row subsoiling, and starter fertilizer (l00 lb/acre of 22-20-3).

Starter Fertilizer[1]	Till SS	Till NS	No-Till SS	No-Till NS
	Seed Cotton lb/acre			
No	1700	1790	1780	1840
Yes	2500	2280	2920	2230

[1]Starter Fertilizer was applied 2 x 2 for the non subsoiled treatment (NS) and deep in the subsoil channel for the subsoiled treatment (SS).

Table 3

Contrasting effect among years of ingredients in starter fertilizer on corn grown on a soil high in residual P and K.

Starter Fertilizer	Years 1984	1985
	bu/acre	
None	109	150
N	128	178
N-P	141	176
N-P-K	138	176

Table 4

Suggested rate of starter fertilizers for grain crops grown on soils with varying residual P and K levels.

Soil Test Level	Ingredient N	P_2O_5	K_2O
	lb/acre		
Hi P - Hi K	30-40	10-20	0
Med P - Hi K	30-40	20-40	0
Hi P - Med K	30-40	10-20	10-20

by 54 and 50 bu/acre respectively. The addition of sulfur to the starter fertilizer mix resulted in an additional 18 bu/acre yield increase for Pioneer 3346 (a total of 72 bu/acre over no starter) and an additional 14 bu/acre increase for Dekalb 591 (a total of 64 bu/acre over no starter) (Table 6).

Two of four grain sorghum varieties did not respond to starter fertilizer in the Kansas State study. They were Pioneer 8699 and Northrup King KS 735. Starter Fertilizer containing N-P increased the grain yield of Dekalb 40Y by 22 bu/acre and Dekalk 48 by 25 bu/acre. There was no response to the addition of K_20, S or Zn to the starter mix (Table 7).

Many researchers that study starter fertilizers use fluid fertilizers almost exclusively. There is a very good reason why:

1. Fluid Fertilizers require a minimum amount of time and labor for application.
2. Fluid Fertilizers make homogenous mixes that can be applied accurately and uniformly in a band as well as broadcast.
3. Fluid Fertilizers can be prescription mixed to meet site specific and crop specific nutrient requirements.
4. Fluid Fertilizers contain nutrient forms that are readily available to seedling plant roots.

For those who have some questions about placing starter fertilizer in direct contact with seed there are two recent pieces of information that may be helpful. One titled, "Seed Placed Fertilizer" was published on page 56 of the 1995 Edition of the North Central Extension-Industry Soil Fertility Conference Proceedings. The other titled, "Placement With Affect Success of Starter Fertilizers" is published in Vol. No. 97-7, May 2, 1997 edition of the University of Nebraska Cooperative Extension Newsletter; CROPWATCH.

Table 5

Effect of 2x2 banded starter fertilizer on corn grain yield. 1994

Starter			Locations			
N	P_2O_5	K_2O	Aston	Gridley	Pana	Oblong
lb/acre			bu/acre			
0	0	0	177 D[1]	128 C	136 C	136 BC
25	0	0	189 AB	139 ABC	152 A	129 C
0	30	0	185 BC	132 BC	134 C	130 C
25	30	0	191 A	142 AB	151 AB	136 BC
0	0	20	178 D	146 A	132 C	150 A
25	0	20	189 AB	146 A	137 C	141 B
0	30	20	181 CD	138 ABC	143 ABC	136 BC
25	30	20	189 AB	146 A	141 BC	150 A

[1]Average values followed by the same letter in the row or column are not significantly different (based on LSD at 0∝=0.10)

Table 6

Starter fertilizer combinations effects on grain yield of corn hybrids. Scandia KS

Hybrid	Starter Fertilizer Combination					Yield
	lb/acre					bu/acre
	N	P_2O_3	K_20	S	Zn	
Pioneer 3563	0	0	0	0	0	221
	30	30	0	0	0	223
	30	30	20	0	0	222
	30	30	0	10	0	220
	30	30	0	0	1	220
	30	30	20	10	1	221
	0	0	0	0	0	153
Pioneer 3346	30	30	0	0	0	207
	30	30	20	0	0	207
	30	30	0	10	0	225
	30	30	0	0	1	209
	30	30	20	10	1	228
	0	0	0	0	0	165
Dekalb 591	30	30	0	0	0	215
	30	30	20	0	0	213
	30	30	0	10	0	229
	30	30	0	0	1	215
	30	30	20	10	1	229
Dekalb 646	0	0	0	0	0	201
	30	30	0	0	0	204
	30	30	20	0	0	203
	30	30	0	10	0	205
	30	30	0	0	1	207
	30	30	20	10	1	202
LSD(0-05)						9

Table 7

Starter fertilizer combinations effects on grain yield of grain sorghum hybrids. Belleville, KS

Hybrid	Starter Fertilizer Combination lb/acre					Yield bu/acre
	N	P_2O_5	K_2O	S	Zn	
Pioneer 8699	0	0	0	0	0	130
	30	30	0	0	0	128
	30	30	20	0	0	127
	30	30	0	10	0	130
	30	30	0	0	1	128
	30	30	20	1	1	127
	0	0	0	0	0	126
Northrup King KS 735	30	30	0	0	0	127
	30	30	20	0	0	125
	30	30	0	10	0	125
	30	30	30	0	1	124
	30	30	0	10	1	126
Dekalb 40Y	0	0	0	0	0	111
	30	30	0	0	0	133
	30	30	20	0	0	133
	30	30	0	10	0	131
	30	30	0	0	1	133
	30	30	20	10	1	134
Dekalb 48	0	0	0	0	0	117
	30	30	0	0	0	142
	30	30	20	0	0	144
	30	30	0	10	0	140
	30	30	0	0	1	140
	30	30	30	0	1	140
LSD(0-05)						9

Seed Placed Fertilizer

Applying fertilizers in a 2x2 band requires equipping planters with an extra coulter, and may slow planting speeds. These drawbacks, plus the availability of 'low-salt' fertilizers, have resurfaced an interest in seed-placed (pop-up) fertilizers for no-till. It is recommended that no more than 10-15 lbs/A of $N+K_2O$ be applied with the seed because of the risk of salt injury (Fixen and Lohry, 1993; Randall and Hoeft, 1988). It is unclear whether seed-placed fertilizers might provide a yield benefit in Illinois no-till corn.

Mordtvedt (1976) cited desirable properties of seed-placed fertilizers; high water solubility, low salt index, high analysis (especially P), and absence of NH_3-liberating products (urea and DAP). Ammonium nitrate and potassium chloride are considered to be undesirable seed-placed fertilizers because of their high salt content. Fluid ammonium polyphosphates (such as 10-34-0) supply N without the hazard of NH_3 toxicity (Mordtvedt, 1976). Baweja and Bates (1971) and Waters (1972) reported that liquid fertilizers are less toxic to corn seedlings than dry fertilizers applied at rates providing the same total quantities of plant nutrients because the water contained in liquid fertilizers dilutes the salts. However, the amount of water in the fertilizer is small compared to the amount of water in the soil, so these liquid sources probably also benefited from low salt contents.

Placement will affect success of starter fertilizers...

- Placement of starter fertilizers with milo can be important to whether they help or hurt a struggling seedling.

- Starter fertilizers can be placed with milo or corn seed if the fertilizer's salt index is less than 6 lbs per acre. The salt index is calculated from the formulation of the starter fertilizer and the rate at which it is applied.

- Start with the gallons of starter fertilizer you intend to apply. Let's use seven (7) gallons per acre for an example.

- Multiply the gallons by the weight of the fertilizer you have chosen to apply. If 7-21-7 is chosen, it weighs 11 pounds per gallon. In this case the application will be 7 gallons per acre x 11 lbs per gallon which equals 77 pounds of fertilizer.

- The salt index is the added contribution of nitrogen (N), potassium (K) and sulfur (S) in the fertilizer. In this case we would have .07 x 77 or 5.4 lbs of nitrogen and .07 x 77 or 5.4 lbs of potassium. The total is 10.8 lbs per acre of total salt index. This is far above the recommended level of less than 6 lbs of salt per acre. Salt injury to the seedlings would be expected under some conditions.

- Fertilizer formulations vary in analysis. Some formulations may have a lower salt index and may be safer in some situations.

- When starter is not placed with the seed, increased rates can be used. Placement selection can depend on the volume of fertilizer, planter set-up, tillage practices and type of fertilizer. The one critical area to consider is the probability of the roots growing through the band in a timely fashion. Bands placed at least two inches deep in the soil and within five inches of the row should usually meet the need for root penetration. (Paul Hay, Extension Educator Gage County).