WHERE DO FLUIDS FIT IN A DRY-AMMONIA PROGRAM?

Larry Murphy
Murphy Agro
FFF IS EMPHASIZING....

- Good nutrition
- Higher yields
- Maintenance of soil test levels
- Lower production costs/bushel, ton, pound
- Higher profitability
FFF WORKS CLOSELY TO COORDINATE INDUSTRY SUPPORT OF APPLIED RESEARCH
WE DON’T HAVE ALL THE ANSWERS:

- Research is continuing
- We have to work with what we know
SOME FACTORS TO CONSIDER

• How fluids, drys and anhydrous fit together
• Idea here is not to replace heavy rates of P and K but to look at how systems complement each other
• Recognize push toward reduced tillage
• Growth of fluid starters in reduced tillage
• Emphasis on efficiency
• Split N applications
LET’S ALSO THINK ABOUT...

• Nutritional interaction with genetics, important in evaluation of new practices
• New or improved chemistry for fertilizer use efficiency
• New tools, re-evaluating methods of application, nutrient timing
• Revisiting starter formulations
• Value of uniformity in a band
• Nutrient interactions
• Nutrient uptake patterns
LET’S ALSO THINK ABOUT...

• Environmental pressure---N, P, others?
• Common sense! Environmental and agronomic benefits go hand in hand.
• N and P losses cost money! We have the tools and we are using them! Can never stop losses completely but we can continue to fine tune nutrient supply systems.
FLUIDS AND NITROGEN MANAGEMENT

FLEXIBILITY

• High N starters
• Fertigation – Split N...genetic requirement for late season N; environmental benefits?
• Dribble as tool to manage N availability, control N losses via volatilization
N-Rate and Method of Application Effects on Corn Grain Yield -- Kansas

![Graph showing the relationship between N-rate and corn grain yield for different application methods in Kansas. The graph plots yield in bushels per acre (bu/a) against N-rate in pounds per acre (lb/a). Different methods include Band, Broadcast, Broad+N-N, and Broad+Agrotain+. The UAN mark indicates the universal application network.]
GENETICS AND N RESPONSES
# Genetics Affect Corn Response to N and N Efficiency Products

<table>
<thead>
<tr>
<th></th>
<th>DKC 64-69</th>
<th>Pioneer 1745HR</th>
<th>Stine VT3PRO</th>
<th>Triumph 7514S</th>
</tr>
</thead>
<tbody>
<tr>
<td>UTC (0 N/A)</td>
<td>77</td>
<td>62</td>
<td>55</td>
<td>58</td>
</tr>
<tr>
<td>Urea 184 N/A</td>
<td>177</td>
<td>158</td>
<td>146</td>
<td>142</td>
</tr>
<tr>
<td>Urea + Agrotain 184 N/A</td>
<td>180</td>
<td>171</td>
<td>151</td>
<td>150</td>
</tr>
<tr>
<td>Urea + N-N 184 N/A</td>
<td>182</td>
<td>170</td>
<td>160</td>
<td>162</td>
</tr>
</tbody>
</table>

Location, Jackson Co. Arkansas
Dr. Ronnie Helms, G&H Associates
LATE SEASON N RESPONSES

• Genetic demands for ammonium N greater with high yield hybrids
• A benefit of fertigation?
• Energy storage benefits, less energy for nitrate-N reduction
• Nitrification suppression
THE IMPORTANCE OF MAINTAINING ADEQUATE SOIL P AND K
SUBSOIL K DEPLETION
The need for supplemental potassium is not always predictable by soil test.
MANY FACTORS INFLUENCE CROP RESPONSES TO STARTERS BESIDES SOIL TEST VALUES

Large amounts of residues
Cold soils
Compaction
Genetics
Effects of Low Soil Temperature on K Uptake

- Slows diffusion of K to the root
- Restrict root growth and activity
- Reduce plant nutrient uptake

![Graph showing K uptake over days after planting at 60°F and 90°F temperatures.](image)
Uptake Affected by Interactions with Other Cations
IF THESE CONDITIONS EXIST, STARTER K CAN BENEFIT THE CROP
WHAT ABOUT K IN STARTERS FOR REDUCED TILLAGE?

• Current wisdom—don’t need K on high K soils
• How wise is the wisdom?
• STRESS...STRESS...STRESS in early season
• Low temperature stress; compaction stress; maybe excessive soil moisture stress
• Soluble K can help overcome this stress
• Include some K in starter for reduced tillage NO MATTER WHAT THE SOIL TEST LEVEL IS!
## STARTER FERTILIZER EFFECTS ON RIDGE-TILLED CORN
(Soil Test K=420 ppm)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>V-6 Dry Weight</th>
<th>V-6 K</th>
<th>Days from Emergence</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0-0-0</td>
<td>210</td>
<td>6.2</td>
<td>79</td>
<td>162</td>
</tr>
<tr>
<td>15-30-5</td>
<td>382</td>
<td>10.9</td>
<td>71</td>
<td>185</td>
</tr>
<tr>
<td>30-15-5</td>
<td>355</td>
<td>15.2</td>
<td>71</td>
<td>173</td>
</tr>
<tr>
<td>30-30-0</td>
<td>395</td>
<td>11.2</td>
<td>71</td>
<td>184</td>
</tr>
<tr>
<td>30-30-5</td>
<td>460</td>
<td>15.2</td>
<td>67</td>
<td>195</td>
</tr>
<tr>
<td>LSD(0.05)</td>
<td>28</td>
<td>1.5</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

Dr. Barney Gordon, Kansas State
10-34-0 ALONE DOESN’T DO THE TRICK

- NPKSZn formulations—Branded complete options
- May not need a lot of K
- Can’t get in a lot of K with high N formulations
- 5-10 lb K\textsubscript{2}O/A may be enough in starter
WE ALL KNOW THIS:

THE AVAILABILITY AND UPTAKE OF ONE NUTRIENT AFFECTS USE EFFICIENCY OF OTHERS
Potassium and N Use Efficiency

![Graph showing the relationship between application rate and corn grain yield with different potassium (K₂O) application levels (0 lbs, 96 lbs, 144 lbs per acre).](image)

- **Y-axis**: Corn grain yield (bu/ac)
- **X-axis**: Application rate (lbs N/ac)

**Legend**:
- Green dots: 0 lbs K₂O/ac
- Orange dots: 96 lbs K₂O/ac
- Blue dots: 144 lbs K₂O/ac

Dr. Jay Johnson, Ohio State Univ.
LATE SEASON FLUID K
Fertigation, high clearance sidedress?
Bob Miller – CSU
Reduced tillage – New emphasis on starters
Higher Soil Bulk Density Can Lead to Diminished P Uptake by Corn

<table>
<thead>
<tr>
<th>Soil Texture</th>
<th>Bulk Density g/cm³</th>
<th>P in Shoots %</th>
<th>P Uptake mg/pot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loamy sand</td>
<td>1.30</td>
<td>0.59</td>
<td>63.7</td>
</tr>
<tr>
<td></td>
<td>1.60</td>
<td>0.44</td>
<td>47.5</td>
</tr>
<tr>
<td></td>
<td>1.90</td>
<td>0.33</td>
<td>12.2</td>
</tr>
<tr>
<td>Silt loam</td>
<td>1.10</td>
<td>0.41</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1.35</td>
<td>0.35</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>1.60</td>
<td>0.28</td>
<td>--</td>
</tr>
<tr>
<td>Silty clay</td>
<td>1.10</td>
<td>0.55</td>
<td>78.1</td>
</tr>
<tr>
<td></td>
<td>1.35</td>
<td>0.41</td>
<td>48.4</td>
</tr>
<tr>
<td>Guelph (Canada)</td>
<td>1.50</td>
<td>0.34</td>
<td>29.6</td>
</tr>
</tbody>
</table>
Effects of Soil Temperature

When soil temperature was reduced from 70 to 58 degrees Fahrenheit:

- Corn root growth decreased 5-fold
- P uptake by corn roots decreased 4-fold

(Mackay and Barber, 1984 Purdue)
IN HIGH RESIDUE SYSTEMS, USE OF STARTER SHOULD BE A MANAGEMENT DECISION, UP FRONT, REGARDLESS OF SOIL TEST VALUES
MICROENVIRONMENTAL CONDITIONS HAVE SUBSTANTIAL EFFECTS ON NUTRIENT AVAILABILITY
MODIFICATION OF MICROENVIRONMENTS CAN ENHANCE NUTRIENT USE EFFICIENCY
Phosphate Fertilizer Enhancer
AMMONIUM FORM $\text{NH}_4^+$
THE MICROENVIRONMENT OF N-P BANDS
N Stimulation of P Absorption by Plants

- Decrease in the rhizosphere pH and increased solubility of soil phosphates.
- Increased root length.
- Increased physiological capacity of the root to adsorb P. N treatment of corn roots resulted in higher P uptake than a 10-fold increase in P concentration.

(Kamprath, 1987)
HIGH N STARTERS
THE IMPORTANCE OF ADEQUATE AVAILABLE N CLOSE TO THE PLANT IN THE FIRST 30 DAYS OF GROWTH
### High N Starter Effects on Corn
(bu/A) 3-year Avg (Kansas)

<table>
<thead>
<tr>
<th>Starter</th>
<th>In-furrow</th>
<th>2x2</th>
<th>Dribble</th>
<th>Row Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-15-5</td>
<td>172</td>
<td>194</td>
<td>190</td>
<td>179</td>
</tr>
<tr>
<td>15-15-5</td>
<td>177</td>
<td>197</td>
<td>198</td>
<td>180</td>
</tr>
<tr>
<td>30-15-5</td>
<td>174</td>
<td>216</td>
<td>212</td>
<td>192</td>
</tr>
<tr>
<td>45-15-5</td>
<td>171</td>
<td>215</td>
<td>213</td>
<td>195</td>
</tr>
<tr>
<td>60-15-5</td>
<td>163</td>
<td>214</td>
<td>213</td>
<td>201</td>
</tr>
<tr>
<td>Average</td>
<td><strong>171</strong></td>
<td><strong>207</strong></td>
<td><strong>205</strong></td>
<td><strong>189</strong></td>
</tr>
</tbody>
</table>

Dr. Barney Gordon, Kansas State
HIGHER STARTER N --A LOGISTICAL PROBLEM BUT ALSO BIG REWARDS!

★ WILL EARLY BROADCAST
UREA OR FERTIGATED UAN
DO THE SAME THING?
NOT CLOSE TO THE ROW!
HIGH CONCENTRATIONS OF AMMONIUM N MAY INCREASE SOIL P MOVEMENT
FLUID BAND

P CONCENTRATIONS

J. Kovar, USDA-ARS
There is a starter formulation better than 10-34-0
FERTILIZING HIGH YIELD BEANS
WHAT ABOUT SUPPLEMENTAL NITROGEN?
N FOR HIGH YIELD
SOYBEANS
Ammonium-N
Irrigation
Fertigation
SOYBEANS LIKE AMMONIUM N

• Nitrate-N seems to be harder on nodulation

• Remember that S is essential for N fixation by Rhizobia
Effect of Late-Season N on Soybean Yield

- Johnson Co.
- Shawnee Co.
- Reno Co.
- Stafford Co.

Yield bu/a

Each location averaged over two sites
LATE-SEASON SUPPLEMENTAL N FERTILIZATION

- Positive yield responses more consistent, particularly in high-yield environments
- Responses obtained with 20-50 lb N/ac
- Responses often economic
- Easier to do with fertigation
WHAT ABOUT FLUID STARTERS FOR BEANS?
STARTERS?

Never have done that!
Does it work?
What to watch for?
HIGH SENSITIVITY TO SOLUBLE SALTS

Be Careful!
Precision Placement of Fluids
Pop-Up Can Be a Problem
2x2 Placement Safer
<table>
<thead>
<tr>
<th>Treatments</th>
<th>Year 1 Yield</th>
<th>Year 2 Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>lb P₂O₅/A</td>
<td>bu/A</td>
<td>bu/A</td>
</tr>
<tr>
<td>Control</td>
<td>52d</td>
<td>32d</td>
</tr>
<tr>
<td>30 MAP</td>
<td>62c</td>
<td>41c</td>
</tr>
<tr>
<td>30 MAP + Avail</td>
<td>70b</td>
<td>57a</td>
</tr>
<tr>
<td>60 MAP</td>
<td>62c</td>
<td>47b</td>
</tr>
<tr>
<td>60 MAP + Avail</td>
<td>73a</td>
<td>58a</td>
</tr>
</tbody>
</table>

Duncan’s multiple range test, 5%. Gordon, Kansas State Univ.
Effect of Residual K on Soybean Yield

L. F. Welch (Illinois)
SULFUR: ESSENTIAL FOR N FIXATION IN LEGUMES
DON’T FORGET MICRONUTRIENTS FOR HIGH YIELD BEANS !!
SOYBEAN RESPONSE TO ZINC CAN BE HIGHLY PROFITABLE

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Yield</th>
<th>Leaf Composition</th>
<th>Net Return from Zn</th>
</tr>
</thead>
<tbody>
<tr>
<td>lb Zn/A</td>
<td>bu/A</td>
<td>%P</td>
<td>ppm Zn</td>
</tr>
<tr>
<td>0</td>
<td>30</td>
<td>0.260</td>
<td>17.9</td>
</tr>
<tr>
<td>2</td>
<td>46</td>
<td>0.165</td>
<td>24.9</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>0.177</td>
<td>28.9</td>
</tr>
</tbody>
</table>

Beans $11/bu; Zn $2.00/lb. Zn soil test: Low
Zn broadcast preplant Pawnee Co., KS
GLYPHOSATE RESISTANT BEANS
Mn Response in Glyphosate Resistant Soybeans---Kansas

![Graph showing Mn response in Glyphosate Resistant Soybeans in Kansas. The x-axis represents Mn-rate in lb/a, and the y-axis represents Yield in bu/a. Two lines are plotted: one for KS 4202 and another for KS 4202RR. The graph indicates a positive correlation between Mn-rate and Yield for KS 4202RR, whereas KS 4202 shows a steady decline in Yield as Mn-rate increases.]
## Fluid Starter Manganese Effects on Soybean Yield

<table>
<thead>
<tr>
<th>Stage of Growth</th>
<th>Yield, bu/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated check</td>
<td>66</td>
</tr>
<tr>
<td>Starter (.3 lb)</td>
<td>66</td>
</tr>
<tr>
<td>Starter (.6 lb)</td>
<td>70</td>
</tr>
<tr>
<td>Starter (.3 lb) + V4</td>
<td>74</td>
</tr>
<tr>
<td>V4</td>
<td>66</td>
</tr>
<tr>
<td>V4+V8</td>
<td>72</td>
</tr>
<tr>
<td>V4+V8+R2</td>
<td>74</td>
</tr>
<tr>
<td>LSD (0.05)</td>
<td>3</td>
</tr>
</tbody>
</table>

Gly+Mn (sequestered Mn)
### FOLIAR Mn FOR GLYPHOSATE RESISTANT BEANS

<table>
<thead>
<tr>
<th>Stage of Growth</th>
<th>Yield (bu/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>62</td>
</tr>
<tr>
<td>V-4</td>
<td>68</td>
</tr>
<tr>
<td>V-4 + V-8</td>
<td>72</td>
</tr>
<tr>
<td>V-4 + V-8 + R-2</td>
<td>80</td>
</tr>
<tr>
<td><strong>LSD .05</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

0.3 lb Mn as Mn polymer/appln
IN CLOSING:

• Lots of opportunities for profitable use of fluids in dry-ammonia programs
  Precision and flexibility are big pluses for fluids
• Precision placement of starters
• Manipulation of starter formulations
• Micronutrients in starters of foliars
• Fertigation, split N
• And the list goes on........