The Liquid Fertilizer Advantage

Fertilizer Distribution

- Liquid applicators are able to deliver the same rate of fertilizer from the first to the last foot of each pass
- Due to differences in granular fertilizer shape and mass, spinner disc spreaders can not uniformly distribute dry granular fertilizers
- Corn yield losses of 3% on average have been reported in University studies comparing uniformly and non-uniformly distributed P & K fertilizer (Virk et al., 2013)

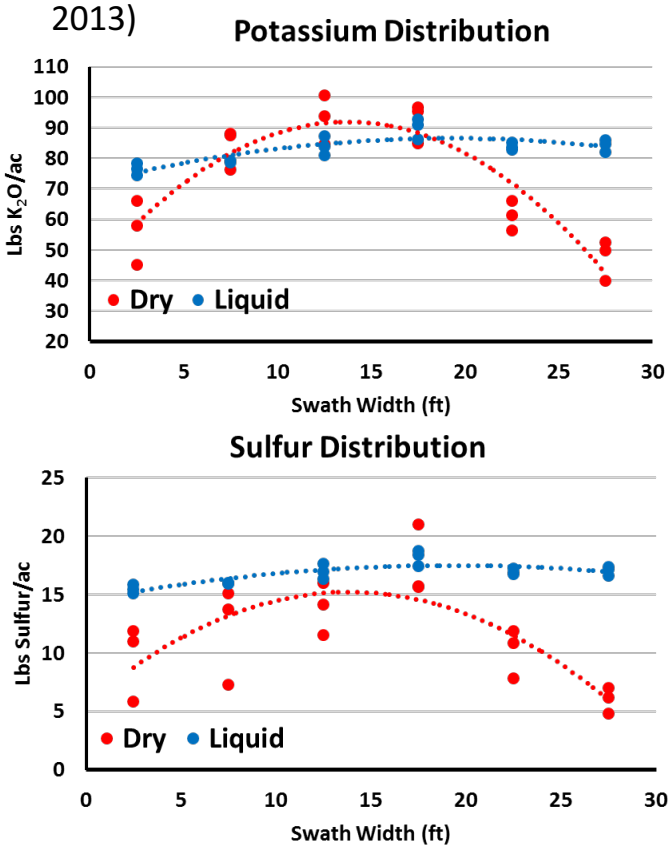

Fig 1 & 2 Distribution of potassium and sulfur fertilizer sources applied with a dry spinner disc spreader or a liquid fertilizer applicator across a 30 ft swath width.

Maintaining Fertilizer Blends

- Granular sources of dry fertilizer often have different sizes and shapes – denser smaller granules shift toward the bottom of the transport vehicle or the fertilizer spreader, while larger less dense granules stay toward the top
- Fluid sources of fertilizer however –
  - Dissolve in solution
  - Are held in suspension by clay
  - Agitated to keep in suspension
- The failure to maintain fertilizer blends causes some fertilizer sources to be spread at higher or lower rates than intended – reducing fertilizer efficiency & yield potentials

Table 1. Avg variability (standard deviation) of 5 samples from a blended liquid and dry fertilizer.

	Liquid	Dry	Liquid	Dry
Sample #	K_2O Blend %		Zinc Blend %	
1	7.55	28.4	0.056	1.4
2	7.54	31.5	0.059	3.4
3	7.43	30.8	0.056	0.8
4	7.62	28.3	0.057	2.2
5	7.51	33	0.055	1.1
Avg Variability	0.07	2.03	0.002	1.04

Sifting During Transportation

Before Transportation

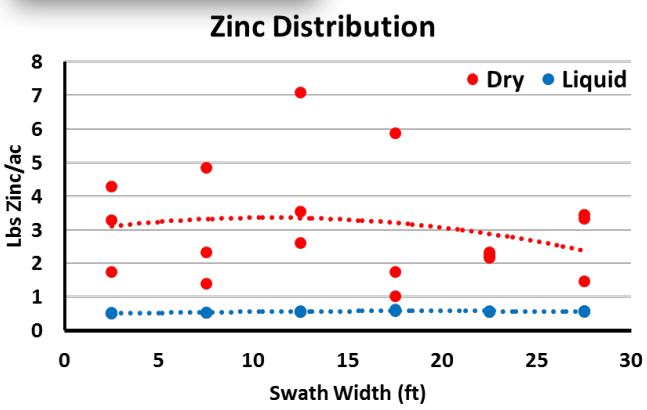

Fig 3 Distribution of zinc fertilizer sources applied with a dry spinner spreader or a liquid fertilizer applicator across a 30 ft swath width.

Reducing Phosphorus Soil Tie Up – Banding

- Phosphorus fertilizers are highly reactive with other mineral components of the soil
- At low pH's (> 5.5) phosphorus fertilizers are tied up with iron and aluminum oxides, causing plant available phosphorus to decrease
- At high pH's (< 7) phosphorus fertilizers transforms to calcium phosphates, which are not plant available forms of phosphorus

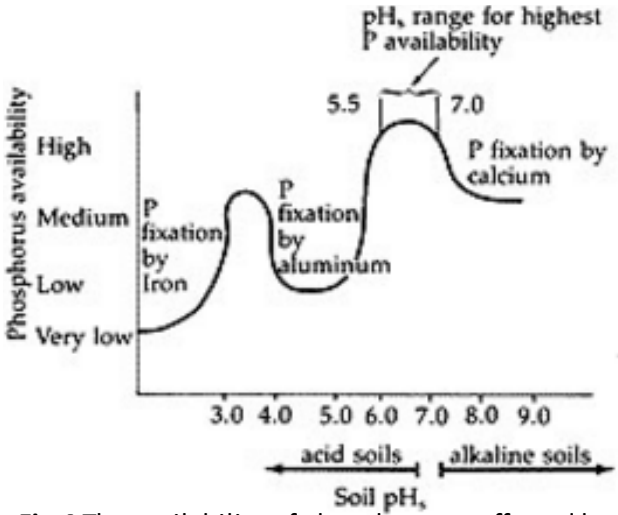

Fig 4 The availability of phosphorus as effected by soil pH. Figure appears in University of Missouri extension publication G9180.

- Banding phosphorus reduces fertilizer surface area - thus reducing the amount fixed by the soil
  - Banding reduces fixation of fertilizer phosphorus
  - Making more phosphorus fertilizer available for plant uptake

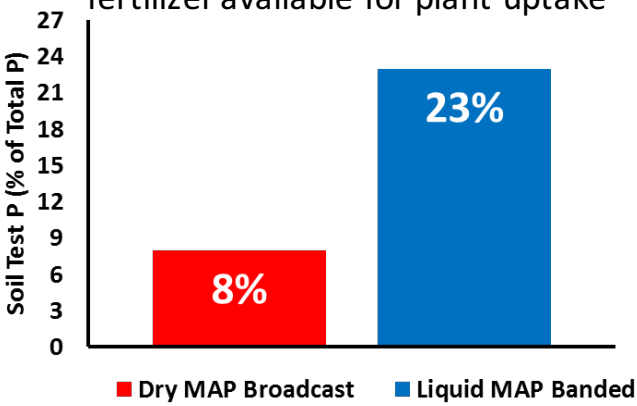

Fig 5 Soil test phosphorus (resin –extractable P) as a % of total soil phosphorus. Adapted from Khatiwada et al., 2012.

Summing Up The Liquid Advantage

- Liquid fertilizers allow for accurate in-field placement
  - Via a precise fertilizer distribution from the first to the last foot of each pass
  - By maintaining the integrity of the fertilizer blend
- Liquid fertilizers can easily be "dribble banded" on top the soil surface, coulter banded just below the soil surface, or deep banded with strip-till machines
  - Banding reduces phosphorus from being fixed into calcium, iron, and aluminum phosphates
  - Reducing phosphorus fixation into unavailable plant forms results in greater plant phosphorus uptake
- Due to accurate in-field placement and reduced phosphorus fertilizer tie up, it is common for Liqui-Grow's P & K fertilizer program to yield 3 to 8 bu/ac more at fertilizer responsive sites when compared to similar dry fertilizer programs

Table 2 Liquid and Dry fertilizers were applied at the same rates each year. Plots were randomized and replicated each year 3 or 4 times.

5 Year Avg Yield Liquid vs Dry Fall P & K			
Fert Source	**Yield (bu/ac)**	**Fert Cost (per/ac)**	**Net Return (per/ac)**
Dry	199.2	52.6	
Liquid	204.5	55.1	+16.05

References

Virk, S.S., D. K. Mullenix, A. Sharda, J. B. Hall, C. W. Wood, O. O. Fasina, T. P. McDonald, G. L. Pate, and J. P. Fulton. 2013. Case study: Distribution uniformity of a blended fertlizer applied using a variable rate spinner disc spreader. Applied Eng. In Ag. 29:5 1-9

Khatiwada, R., G. M. Hettiarachchi, D. B. Mengel, and M. Fei. 2012. Speciation of Phosphorus in a Fertilized, Reduced-Till Soil System: In-Field Treatment Incubation Study. Soil Sci. Soc. Am. J. 76:2006-2018