

Fertilizer Compatibility

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And
Beyond

NPK's & Micros

- Concentration – Chemistry Constraints
 - Can't put 6 gallons in a 5 gallon bucket!
 - Certain elements need help to stay in solution
 - Sequestration
 - Chelation
- Compatibility – Choose Wisely

Nitrogen – Common Forms

- Ammonia
- UAN
- Urea
- Controlled release
 - Urea-formaldehyde
 - Isobutylidene diurea
 - Urea Triazone

Phosphorus – Common Forms

- Ammonium phosphate
- Potassium phosphate

Plant Food Madness

- The market is becoming more diverse with blends
 - 30/70 ortho/poly—typical high polyphosphate
 - 50/50 ortho/poly
 - 60/40 ortho/poly
 - 70/30 ortho/poly
 - 80/20 ortho/poly
 - 100/0 ortho/poly—typical all orthophosphate
 - We're no longer “purists”

Blends are the growth area.
K source can be KCl or KOH.

Potassium – Common Forms

- Potassium chloride, KCl
- Potassium hydroxide
- Potassium thiosulfate, KTS[®]
- K-Row 23[®] 0-0-23-8S.
- Less Common
 - Carbonates
 - Acetates

Sulfur

- Ammonium thiosulfate, ATS
- Potassium thiosulfate, KTS[®]
- K-Row 23[®] 0-0-23-8S
- Ammonium sulfate

Micronutrients: Common Fluid Sources

- Zinc: Chelates, ammoniated zinc complexes, sulfate, nitrate, chloride
- Manganese: Chelates, sulfate,
- Copper: Chelates, sulfate, chloride
- Iron: Chelates, sulfate
- Boron: Boric acid, MEA, Solubor®

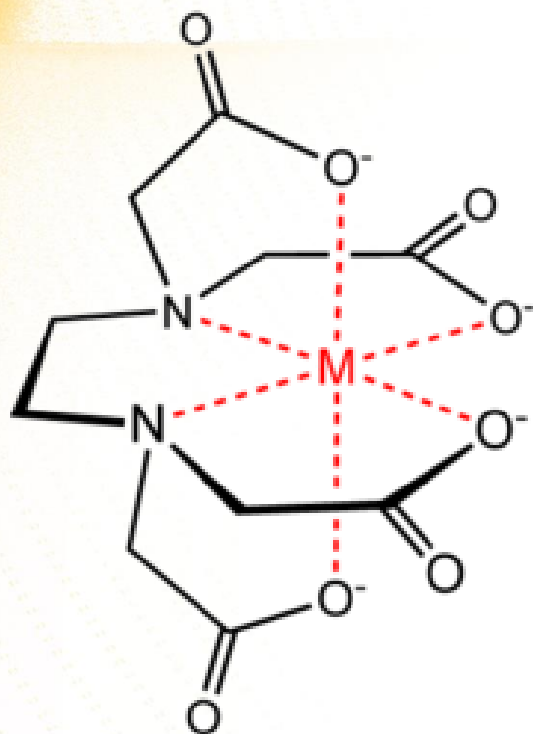
Chelates and micronutrients

Chelating Agent	Micronutrients			
	Copper	Iron	Manganese	Zinc
EDTA	X	X	X	X
HEEDTA	X	X	X	X
NTA		X		X
DTPA		X		
EDDHA		X		
Glucoheptonate		X		X

Storage & Transportation Issues

- Transports may need to be thoroughly cleaned before loading (chart follows)
- Chelates - plastic, lined, or fiberglass tanks
 - EDTA has an order of chelation (see slide)
 - Chelated Cu displaced by Fe, Cu metal plates on mild steel surface

Affinity Chart for EDTA



- Iron (Ferric)
- Mercury
- Copper
- Aluminum
- Nickel
- Lead
- Cobalt
- Iron (Ferrous)
- Zinc
- Cadmium
- Manganese
- Magnesium
- Calcium

Last product in trailer

Product to be loaded	> 50% Polys	20% - 50% Polys	100% Ortho	X-0-X	Aqua Ammonia	Urea Solution	UAN/AN	Ammonium Sulfate	ATS/KTS	K Carbonate	Urea Triazone	Water	Ammoniated Zinc Complex	Citrate, EDTA 10% Zn (10XL)	Chelate 9 Zn	Chelate Mn 6	10% B MEA	4.5 % Fe EDTA	7.5% Cu EDTA
Greater than 50% Polys																		Color	Color
20% - 50% Polys																		Color	Color
100% Ortho																		Color	Color
X-0-X zero Phosphates																			
Aqua Ammonia														Color				Color	Color
Urea Solution																		Color	Color
UAN/AN														Color				Color	Color
Ammonium Sulfate solution																		Color	Color
ATS/KTS																		Color	Color
K Carbonate																		Color	Color
Urea Triazone																		Color	Color
Water														Color					
Ammoniated Zinc Complex														Color		Color		Color	Color
Citrate, EDTA 10% Zn																Color		Color	Color
Chelate 9 Zn														Color		Color		Color	Color
Chelate Mn 6																		Color	Color
10% B MEA																			
4.5 % Fe EDTA																			Color
7.5% Cu EDTA																		Color	



And
Beyond

	Compatible
	Limited Compatibility
	Incompatible
Color	Might change final color

	> 50% Polys	20% - 50% Polys	100% Ortho	X-0-X	Aqua Ammonia	Urea Solution	UAN/AN	Ammonium Sulfate	ATS/KTS	K Carbonate	K Chloride	Urea Triazone	Water	Ammoniated Zinc Complex	Citrate, EDTA 10% Zn (10XL)	Chelate 9 Zn	Chelate Mn 6	10% B MEA	4.5 % Fe EDTA	7.5% Cu EDTA
Greater than 50% Polys																			Color	Color
20% - 50% Polys																			Color	Color
100% Ortho																			Color	Color
X-0-X zero Phosphate																			Color	Color
Aqua Ammonia															Color				Color	Color
Urea Solution															Color				Color	Color
UAN/AN															Color				Color	Color
Ammonium Sulfate solution															Color				Color	Color
ATS/KTS															Color				Color	Color
K Carbonate															Color				Color	Color
K Chloride															Color				Color	Color
Urea Triazone															Color				Color	Color
Water															Color		Color		Color	Color
Ammoniated Zinc Complex															Color		Color		Color	Color
Citrate, EDTA 10% Zn					Color	Color	Color	Color					Color	Color	Color	Color	Color		Color	Color
Chelate 9 Zn															Color		Color		Color	Color
Chelate Mn 6													Color		Color	Color			Color	Color
10% B MEA															Color				Color	Color
4.5 % Fe EDTA	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color		Color
7.5% Cu EDTA	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	

Blend physical properties

- Boron - Store above 50°
- Boron & Mn don't play well together
- Ammoniated zinc, Zn citrates & acetates don't mix well with low polyphosphates.
- Potassium precipitates nitrates & sulfates (within ranges)



Solutions for
AGRICULTURE

FluidFertilizer.com

	Anhydrous Ammonia	Aqua Ammonia	Urea Solution	Ammonium Nitrate Solution	UAN Solution	Ammonium Sulfate Solution	Ammonium Polyphosphate Solution	Ammonium Chloride Solution	Ammonium Thiosulfate	Potassium Thiosulfate	Calcium Thiosulfate	Magnesium Thiosulfate	Calcium-Ammonium Nitrate Solution	Calcium Nitrate Solution	Potassium Carbonate Solution
Anhydrous Ammonia ; 82-0-0															
Aqua Ammonia; 20-0-0	?														
Urea Solution; 23-0-0	?														
Ammonium Nitrate Solution; 20-0-0	?														
Urea Ammonium Nitrate Solution; UAN 28/32-0-0	?														
Ammonium Sulfate Solution; 8-0-0-9S	?	?													
Ammonium Polyphosphate Solution; 10-34-0	?	?													
Ammonium Chloride Solution; 6-0-0-16Cl	?														
Ammonium Thiosulfate Solution; ATS, 12-0-0-26S	?														
Potassium Thiosulfate Solution; KTS, 0-0-25-17S															
Calcium Thiosulfate; CaTS, 6%Ca 10%S															
Magnesium Thiosulfate; MgTS, 10%S 4%Mg															
Calcium-Ammonium Nitrate Solution; 17-0-0 8.8Ca															
Calcium Nitrate Solution; 8-0-0-11Ca															
Potassium Carbonate Solution; 0-0-32															
N-pHuric 28/27; 28-0-0-9S		?													
N-pHuric 15/49; 15-0-0-16S		?													
N-pHuric 10/55; 10-0-0-18S		?													
Water	?														
Nitric Acid	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phosphoric Acid (white)	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Phosphoric Acid (green)	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Sulfuric Acid	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Urea; 46-0-0															
Ammonium Nitrate; 34-0-0															
Calcium Nitrate; 15.5-0-0-19Ca															
Potassium Chloride; 0-0-62															
Potassium Nitrate; 13-0-46															
Magnesium Nitrate; 10-0-0-9Mg															
Monoammonium Phosphate (Technical, 12-61-0)															
Monopotassium Phosphate (0-52-34)															
PeKacid (0-60-20)															
N-pHuric 28/27															
N-pHuric 15/49															
N-pHuric 10/55															
Water															
Nitric Acid															
Phosphoric Acid (white)															
Phosphoric Acid (g)															
Sulfuric Acid															
Urea															
Ammonium Nitrate															
Calcium Nitrate															
Potassium Chloride															
Potassium Nitrate															
Magnesium Nitrate															
Technical Grade MAP															
Monopotassium Phosphate															
PeKacid															

Caution: This chart contains information based on the opinions of people in the fluid fertilizer industry. This information has been compiled as a general guide only. Neither the Fluid Fertilizer Foundation or contributors guarantee the accuracy of the information. Please refer to manufacturer/supplier product information and also perform a small jar compatibility test prior to final mixing.

- Compatible, results in generally acceptable mixture.
- Limited Compatibility, generally compatible within solubility limits.
- Very Limited Compatibility, generally unsuitable mixtures.
- Incompatible, unsuitable mixture and/or hazardous combination.
- ? Significant heat generated.

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Effect of Poly Content and N:P2O5 Ratio On Solubility

