UNIVERSITY OF MISSOURI
Extension

CAPE GIRARDEAU COUNTY

684 West Jackson Trail
P.O. Box 408
Jackson, MO 63755
PHONE: 573-243-3581
FAX: 573-243-1606
E-MAIL: Capeco@missouri.edu
WEB: http://extension .missouri.edu

Fertilizer Math

University of Missouri Extension does NOT endorse any one product. Always check with supplier and/or the label.

General Terms:

Buildup Period – MU standard is 8 years. Soil test report recommendations contain: seasonal crop need to reach yield goal (Removal Rate) + critical phosphorus and potassium soil levels (Buildup).

6-inch acre furrow slice – The default soil test recommendations are based on a 6" core sample depth. Therefore, it is important to be consistent in sampling depth in order to obtain best results.

Parts Per Million (PPM) - The 6" acre furrow slice represents 2 million pounds of soil per acre. Some labs will convert lab analysis levels of phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), zinc (Zn), sulfur (S), boron (B) from PPM to pounds (lbs) per acre while some do not.

PPM Conversions:

6" sample: PPM x 2 = lbs/A *lbs/ton = PPM x 0.002* *12" sample: PPM x 4 = lbs/A*

pH – This is a measurement of active hydrogen (H) ions in the soil. The level of H in the soil determines its acidity when below 7.0 (neutral) or alkalinity when above 7.0. The letter p indicates that hydrogen is a log scale of 10. Soil movement on the pH scale of 1.0 unit is 10 times more/less acidic. Ex: pH 4.0 is 100 times more acidic than pH 6.0. MU labs measure a salt pH while some commercial labs will measure a water pH. These measurements are both of hydrogen however the water pH will be 0.5 units higher. So a pH water of 6.0 would measure pH 5.5 in salt.

Refer to MU Guide 9102: http://extension.missouri.edu/p/G9102

Buffer pH – index value used to determine nuetralizable acidity (N.A.) Calculation: N.A. = 7.0 – buffer pH

Effective Nuetralizing Material (ENM) – standard measurement of limestone to reduce acidity. All ag lime in MO is analyzed for purity and fineness of grind which determines ENM. Check with your limestone dealer for the guaranteed analysis ENM per ton of their lime. Refer to MU Guide 9102: http://extension.missouri.edu/p/G9102

Organic Matter (OM) – Percentage of humus in a 6" acre furrow slice. It takes 10 lbs of organic material to make 1 pound organic matter. Mineralization of each 1% OM will provide approxmately 20 lbs N, 5 lbs P2O5, 2 lbs Sulfur per year

Nitrogen (N): Plant available nitrogen is in the form of nitrate (NO3). The other measurable form of nitrogen that readily coverts to nitrate is ammonium (NH4). N is needed for complete plant growth (root and shoot). Nitrogen recommendations are based on crop need and are given in actual (available) units. Nitrogen fertilizer sources contain a percentage of actual N per pound of fertilizer material.

Common N sources:

Urea	46% N	Urea-Ammonium Nitrate (UAN) solution	28% or 32% N
Ammonium sulfate	21% N	Anhydrous ammonia	82%
Ammonium nitrate	34% N	Diammonium phosphate (DAP)	18%

**UAN is an 11 pound/gallon liquid product*

Phosphorus (P): Plant available phosphorus is in the form of phosphate (P2O5). P is needed for root development and energy (ATP). Bray I and Mehlich III soil analysis gives the plant available phosphorus on a soil test. Phosphate recommendations based on soil test levels + crop need (buildup + removal). Phosphorus fertilizer sources contain a percentage of P2O5 per pound of material. Conversion Equation: P = P2O5 X 0.44

Common P sources:

Diammonium phosphate (DAP) 46% P2O5; Triple Super Phosphate 46% P2O5 (Other sources available)

Potassium (K): Plant available potassium is in the form of (K2O). K is needed for plant health. K2O recommendations based on soil test levels + crop need (buildup + removal). Potassium fertilizer sources contain a percentage of K2O per pound of material. Conversion Equation: K = K2O X 0.83

Common K sources:

Potash 60% K2O (Other sources available)

Sulfur (S): Plant available sulfur is in the form of sulfate (SO4). S is needed for N use in plants. Sulfur recommendations based on Organic Matter (O.M.) and CEC of soil.

Common S sources:

Ammonium sulfate 24% Calcium sulfate (gypsum) 15% Ammonium thiosulfate solution 26%
Elemental sulfur 90% (Elemental sulfur must be applied in time to convert to sulfate before crop need)

Mixed Fertilizers: Your major nutrients are generally abbreviated on a fertilizer package as N-P-K which is a percent per pound of product in bag. Many fertilizers come with a source of 2 or 3 of the major nutrients N, P, K and some come with micronutrients. When your soil test recommendations are given based on your yield goal and soil levels of P and K, fertilizer dealers can blend the amounts of N, P, K + micros to deliver a complete fertilizer per acre.

Common Pre-Blend Fertilizer Sources:

DAP 18-46-0; Ammonium Sulfate 21-0-0-24 (24% sulfate-sulfur)

Removal rates of common crops.

Crop	P Removal (lbs P2O5/unit)	K Removal (lbs K2O/unit)	P Removed Per Crop (lbs)	K Removed Per Crop (lbs)
Corn (150 bu)	**0.45**	**0.30**	**68**	**45**
Corn Silage (20 ton)	**3.6**	**9**	**72**	**180**
Soybeans (60 bu)	**0.84**	**1.44**	**50**	**86**
Wheat (70bu)	**0.60**	**0.30**	**42**	**21**
Alfalfa Hay (5 ton)	**10**	**45**	**50**	**225**
Cool Season Hay (3 ton)	**9**	**34**	**27**	**102**
Cool / Clover (3 ton)	**8**	**38**	**20**	**95**
Bermudagrass (4 ton)	**9**	**34**	**36**	**136**
Native Warm Season Grasses (3.5 ton)	**2**	**15**	**7**	**53**

Math Example:

If a soil test recommendation for 3 ton/A of fescue hay comes back: 120 lb N : 90 lbs P2O5 : 75 lbs K2O

Your fertilizer sources needed to meet this recommendation can vary based on nitrogen source. Recommendations will be rounded to nearest whole number:

First: determine P2O5 need:

90 lbs P2O5 / 0.46 = **195 lbs of DAP (18-46-0)**;

195 lbs DAP x 0.18 = 35 lbs N

Second: determine N need and subtract N credit from DAP (if this is the source)

120 lb N – 35 lbs N = 85 lbs N from N fertilizer source (ammonium nitrate for this example)

85 lbs N / 0.34 = **250 lbs Ammonium Nitrate (34-0-0)**

Third: determine K2O needed from Potash (0-0-60) source:

75 lbs K2O / 0.6 = **125 lbs of Potash (0-0-60)**

There are some fertilizer calculators online that can quickly calculate total amount of fertilizer need for your field.

Texas A&M: http://soiltesting.tamu.edu/calc2/AgNcalc.htm

University of Georgia: http://aesl.ces.uga.edu/soil/fertcalc/