DIVISION OF AGRICULTURE
RESEARCH & EXTENSION
University of Arkansas System

Agriculture and Natural Resources

FSA2222

Understanding Fertilizer Nutrient Content and Guaranteed Analysis

Bronc Finch
Assistant Professor -
Soil Fertility

Brian Haller
White County
Staff Chair

Trent Roberts
Professor -
Soil Fertility

Understanding fertilizers and their nutrient content is important for properly budgeting for fertilizer applications. High prices and many alternatives to traditional synthetic fertilizers can feel overwhelming. The simplicity of fertilizer labels can be overshadowed by the vast array of information available through the internet and other sources. This article offers insight on fertilizer labels, guaranteed analysis and how to compare available products to meet needs in the field.

Information such as soil analysis, available products and cost are required to make reliable fertilizer rate recommendations. This article focuses on providing the information you need to use available resources to ensure you receive the most effective and efficient product.

What Information is on Fertilizer Labels?

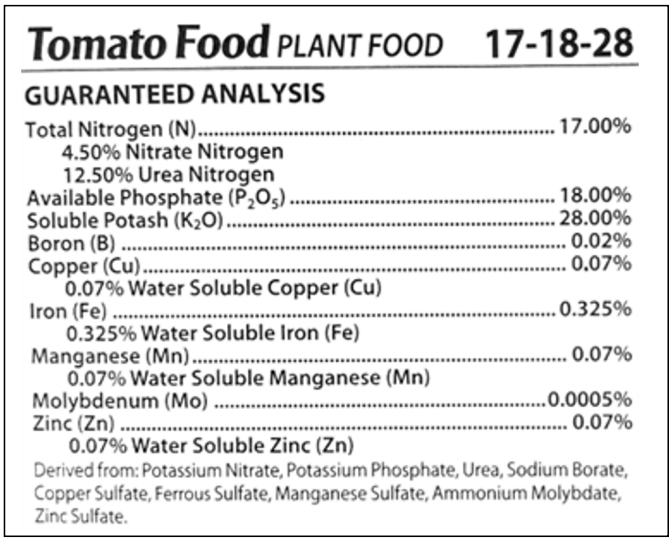
Fertilizer labels have a volume of information that can become confusing to even the most experienced applicators. The most important aspects of fertilizer labels are the guaranteed analysis and application requirements. Other important information may also be present, such as personal protective equipment requirements and environmental and health concerns. These shouldn't be overlooked. But for the scope of fertilizer calculations, the guaranteed analysis will be the primary information needed.

Guaranteed Analysis

Most fertilizers will have analysis represented as three sets of numbers separated by a dash that represents the percentage of nitrogen (N), phosphorus (P) as P_2O_5 and potassium (K) as K_2O, in that order. Occasionally additional nutrients may be presented and followed with a letter, such as ammonium sulfate 21-0-0-24(S). The "S" refers to sulfur. Not all nutrients, however, may be presented in the product nomenclature. Because of this, the guaranteed analysis table should be referenced to accurately determine the nutrient content of a fertilizer product (Figure 1).

Arkansas Is Our Campus

Visit our website at:
http://www.uaex.uada.edu



Tomato Food PLANT FOOD **17-18-28**

GUARANTEED ANALYSIS

Total Nitrogen (N) 17.00%
4.50% Nitrate Nitrogen
12.50% Urea Nitrogen
Available Phosphate (P_2O_5) 18.00%
Soluble Potash (K_2O) 28.00%
Boron (B) 0.02%
Copper (Cu) 0.07%
0.07% Water Soluble Copper (Cu)
Iron (Fe) 0.325%
0.325% Water Soluble Iron (Fe)
Manganese (Mn) 0.07%
0.07% Water Soluble Manganese (Mn)
Molybdenum (Mo) 0.0005%
Zinc (Zn) 0.07%
0.07% Water Soluble Zinc (Zn)
Derived from: Potassium Nitrate, Potassium Phosphate, Urea, Sodium Borate, Copper Sulfate, Ferrous Sulfate, Manganese Sulfate, Ammonium Molybdate, Zinc Sulfate.

Figure 1. Example fertilizer guaranteed analysis label.

As a reminder, the guaranteed analysis is the minimum concentration of nutrients contained in each product. The various forms of nutrients that may be present can also be found on the label, such as N, comprised of nitrate and urea-nitrogen, in Figure 1. Information on the various forms helps to understand the product makeup, but the total nutrient content percentage will be used for calculations. Formulation or chemical makeup is oftentimes more important for micronutrients, as the chemical composition can impact solubility and ultimately, plant availability. For the example provided in Figure 1, the guaranteed analysis is 17 percent N, 18 percent P_2O_5, and 28 percent K_2O.

Forms of Fertilizers

Granular Fertilizers

Granular fertilizers are among the most commonly available fertilizers for a broad range of applications. Fertilizers are made into small granules containing nutrients and fillers that can be broadcast on the soil surface or banded below the soil. Common granular fertilizers and guaranteed analyses can be found in Table 1.

When calculating the nutrients available in granular fertilizers, you should multiply the weight of the product by the whole number percentage of the nutrient concentration and divide that by 100. For example,

One ton (2.000 lb) of Diammonium Phosphate (DAP) has a guaranteed analysis of 18-46-0, meaning that 18 percent of that 2,000 lb. is N and 46 percent is P as P_2O_5. The following equations show the calculation of the amount of nutrients in a ton of DAP.

Nitrogen: 2000 (lb product) × 18 (percent of N) ÷ 100 = 360 lbs N

Phosphorus (P_2O_5): 2000 (lb product) × 46 (percent of P_2O_5) ÷ 100 = 920 lb P_2O_5

Table 1. Percent nutrient concentrations of common granular fertilizer products found in Arkansas by guaranteed analysis.

	N	P_2O_5	K_2O	S	Cl	B	Zn
	---------- % ----------						
Nitrogen							
Ammonium sulfate (AMS)	21	-	-	24	-	-	-
Ammonium nitrate (AN)	34	-	-	-	-	-	-
Urea	46	-	-	-	-	-	-
Phosphorus							
Monoammonium Phosphate (MAP)	11	52	-	1	-	-	-
Diammonium Phosphate (DAP)	18	46	-	-	-	-	-
Triple Superphosphate (TSP)	-	46	-	<1	-	-	-
Micro-Essentials SZ (MESZ)	12	40	-	10	-	-	1
Micro-Essentials S10(MES-10)	12	40	-	10	-	-	-
Potassium							
Muriate of Potash (MOP)	-	-	60	-	47	-	-
Potassium sulfate (K_2SO_4)	-	-	52	18	-	-	-
Aspire	-	-	58	-	-	0.5	-

The guaranteed analysis is the percentage of nutrients in 100 percent of the product, so an easier way to think of it is in 100 lbs. of DAP (18-46-0), there is 18 lbs. N and 46 lbs. P_2O_5. A ton of DAP would have 20 times that amount of nutrients.

This method can be used for all nutrients in granular fertilizers as well as for other dry fertilizer sources such as litter, manure or composts on an "as is basis."

Fluid Fertilizers

Fluid fertilizers are among the most commonly available fertilizers for an increased range of applications. Fluid fertilizers are often blends of nutrients in a liquid form, along with an inert liquid (typically water) at a specific concentration. Each form of fluid fertilizer will have a specific density (weight per volume), often expressed as pounds per gallon, that is used in fertilizer calculations for application rates. Common fluid fertilizers, densities and guaranteed analyses can be found in Table 2.

Table 2. Percent nutrient concentration and density (lb/gal) for common fluid fertilizers used in Arkansas.

Fluid Fertilizers	Density†	N	P_2O_5	K_2O	S
	lb/gal	---------- % ----------			
Urea-ammonium nitrate (UAN)	10.96‡	28	-	-	-
	11.06‡	32	-	-	-
Ammonium polyphosphate (APP)	11.68‡	10	34	-	-
	12.00‡	11	37	-	-
Ammonium Thiosulfate (ATS)	11.10	12	-	-	26
Potassium Thiosulfate (KTS)	12.20	-	-	25	17

†Density reported at 68°F, Density subject to change by environmental factors.
‡Nutrient concentration influences product density.

Fertilizer density is used to balance the units of fertilizer and nutrients it contains. To do so the density of the product is multiplied by the guaranteed analysis for each nutrient to determine the density of the nutrient in the fertilizer. For example,

Ammonium Polyphosphate (APP) weighs 11.68 lbs./gal, with a guaranteed analysis of 10-34-0, meaning 10 percent of that 11.6 lb is N and 34 percent is P_2O_5. The calculation for each nutrient is:

Nitrogen: 11.68 (lb/gal) (APP) × 10 (percent of N) ÷ 100 = 1.17 lbs N per gallon of APP

Phosphorus (P_2O_5): 11.68 (lb/gal) (APP) × 34 (percent of P_2O_5) ÷ 100 = 3.97 lb P as P_2O_5 per gallon of APP

Therefore, for each gallon of APP applied, you are applying 1.17 lbs. N and 3.97 lbs. P_2O_5. When calculating the amount of liquid product needed for an application, the amount of nutrient applied per gallon is required, therefore this previous step is vitally important for calculating the product need.

Summary

Fertilizer labels can be confusing, but by using the information outlined in this fact sheet, the concentration of nutrients can be calculated to provide a better understanding of the product of interest. The information presented here is not meant to deter or enforce the use of any one fertilizer type/source, but solely to help producers better understand what is being used. This information should be used in conjunction with soil tests, nutrient removal and other recommendations for guiding fertilization programs and maintaining proper nutrient stewardship. For more information on fertilizer calculations, soil testing, or nutrient recommendations please contact your local University of Arkansas System Division of Agriculture Cooperative Extension Service or visit https://www.uaex.uada.edu/.

BRONC FINCH is an assistant professor of soil fertility with the University of Arkansas System Division of Agriculture Cooperative Extension, Little Rock. **BRIAN HALLER** is the staff chair of White County with the University of Arkansas System Division of Agriculture Cooperative Extension and **TRENT ROBERTS** a professor of soil fertility with the University of Arkansas at Fayetteville.