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Common Fertilizers Used in Virginia: Secondary and Micronutrients

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Introduction

Secondary macronutrients are used in relatively large quantities by plants for optimal growth and are sulfur (S), calcium (Ca), and magnesium (Mg). Micronutrients on the other hand are needed in much smaller quantities than both primary and secondary macronutrients; however, micronutrients are still essential for plant growth. Often, soils in Virginia contain enough micronutrients and fertilizer amendments are not warranted. Micronutrients include iron (Fe), zinc (Zn), copper (Cu), manganese (Mn), boron (B), chloride (Cl), molybdenum (Mo), cobalt (Co), sodium (Na), silicon (Si), selenium (Se), nickel (Ni), and Vanadium (V) (Havlin et al, 1996). Soil pH plays a large role in soil availability of secondary and micronutrients; therefore, proper soil testing and lime amendments are necessary to ensure adequate nutrient solubility within the soil system. Visit the Virginia Tech Soil Testing Lab website for additional publications and resources regarding proper soil sampling techniques and recommendations at: https://www.soiltest.vt.edu/. This publication will outline some possible secondary macronutrient and micronutrient fertilizer sources. However, numerous formulations and blends are available from many different companies and dealers. Regardless of product or source used, read the product's label carefully and follow all recommendations for foliar and/or soil application.

Table 1. Common fertilizer sources used in Virginia for secondary macronutrient and micronutrient applications.

Fertilizer Material	**Chemical Formula**	**Nutrient Percent**	**Other Nutrients (%)**
Calcium sources		**% Ca**	
Calcitic lime	$CaCO_3$	31.7	
Calcium nitrate	$Ca(NO_3)_2$	21.0	15% N
Dolomitic lime	$CaCO_3 \cdot MgCO_3$	21.5	11.4% Mg
Gypsum	$CaSO_4 \cdot 2H_2O$	22.5	16.8% S
Hydrated lime	$Ca(OH)_2$	46.1	
Marl	$CaCO_3$	24.0	
Polyhalite	$K2SO4 \cdot MgSO4 \cdot 2CaSO4 \cdot 2H2O$	12.0	14% K_2O, 19% S, 4% Mg
Superphosphate, normal	$Ca(H_2PO_4)_2$	18-21	16-20% P_2O_5
Superphosphate, triple	$Ca(H_2PO_4)_2$	13-15	44-48% P_2O_5
Sulfur sources		**% S**	
Ammonium sulfate	$(NH_4)_2SO_4$	24	21% N
Ammonium thiosulfate	$(NH_4)_2S_2O_3$	26	12% N

Fertilizer Material	Chemical Formula	Nutrient Percent	Other Nutrients (%)
Gypsum	$CaSO_4 \cdot 2H_2O$	16.8	22.5% Ca
Polyhalite	K2SO4·MgSO4·2CaSO4· 2H2O	19	14% K_2O, 19% S, 4% Mg, 12% Ca
Potassium magnesium sulfate	$K_2SO_4 \cdot 2MgSO_4$	22.0	22% K_2O, 11% Mg
Potassium sulfate	K2SO4	17-20	48-54% K_2O
Potassium thiosulfate	$K_2S_2O_3$	17	25% K_2O
Sulfur, elemental	S	90-100	
Urea-sulfur	$CO(NH_2)_2$+S	10-20	36-40% N
Urea-ammonium nitrate, sulfur blend	Various	3-5	24-28% N
Zinc sulfate	$ZnSO_4 \cdot H_2O$	17.8	36.4% Zn
Magnesium sources		**% Mg**	
Dolomitic lime	$MgCO_3 \cdot CaCO_3$	11.4	21.5% Ca
Epsom salt	$MgSO_4 \cdot 7H_2O$	9.6	13% S
Magnesia	MgO	55.0	
Polyhalite	K2SO4·MgSO4·2CaSO4· 2H2O	4	14% K_2O, 19% S, 12% Ca
Potassium magnesium sulfate	$K_2SO_4 \cdot 2MgSO_4$	11.2	22% K_2O, 22% S
Boron Sources		**% B**	
Borax	$Na_2B_4O_7 \cdot 10H_2O$	11.3	
Sodium octaborate, Borate 65	$Na_2B_8O_{13} \cdot 4H_2O$	20-21	
Sodium pentaborate	$Na_2B_{10}O_{16} \cdot 10H_2O$	18	
Sodium tetraborate, Borate 46	$Na_2B_4O_7 \cdot 5H_2O$	14-15	
Boric acid	H_3BO_3	17.0	
Boron frits	Frit	2-11	
Solubor	$Na_2B_4O_7 \cdot 5H_2O$ + $Na_2B_{10}O_{16} \cdot 10H_2O$	20-21	
Molybdenum sources		**% Mo**	
Ammonium molybdate	$(NH_4)_6Mo_7O_{24} \cdot 2H_2O$	54	7% N
Molybdenum frits	Frit	1-30	
Molybdenum trioxide	MoO_3	66	
Sodium molybdate	$Na_2MoO_4 \cdot 2H_2O$	39	
Copper ammonium phosphate	$Cu(NH_4)PO_4 \cdot H_2O$	32	7.2% N, 36.5% P_2O_5
Copper chelates	NaCuHEDTA	9	

Fertilizer Material	Chemical Formula	Nutrient Percent	Other Nutrients (%)
Copper sources		**% Cu**	
Copper chelates	$Na_2CuEDTA$	13	
Copper frits	Frit	40-50	
Copper sulfate	$CuSO_4 \cdot 5H_2O$	25.5	12.8% S
Manganese sources		**% Mn**	
Manganese chelate	MnEDTA	12	
Manganese frits	Frit	10-35	
Manganese oxide	MnO	41-68	
Manganese sulfate	$MnSO_4 \cdot 4H_2O$	26-28	14.4% S
Zinc sources		**% Zn**	
Zinc carbonate	$ZnCO_3$	52	
Zinc chelates	NaZnHEDTA	9	
Zinc chelates	$Na_2ZnEDTA$	14	
Zinc oxide	ZnO	78	
Zinc phosphate	$Zn_3(PO_4)_2$	51	18.4% P_2O_5
Zinc sulfate	$ZnSO_4 \cdot H_2O$	35	17.9% S
Iron Sources		**% Fe**	
Iron ammonium phosphate	$Fe(NH_4)PO_4 \cdot H_2O$	29	7.5% N, 38% P_2O_5
Iron ammonium polyphosphate	$Fe(NH_4)HP_2O_7$	22	5.6% N, 57% P_2O_5
Iron chelates	NaFeEDTA	5-14	
Iron chelates	NaFeEDDHA	6	
Iron chelates	NaFeDTPA	10	
Iron frits	Frit	30-40	
Iron sulfate, Ferrous sulfate	$FeSO_4 \cdot 7H_2O$	19	11.5% S

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