

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 ·MgCO ₃	21.5	11.4% Mg
Gypsum	CaSO ₄ ·2H ₂ O	22.5	16.8% S
Hydrated lime	Ca(OH) ₂	46.1	
Marl	CaCO ₃	24.0	
Polyhalite	K ₂ SO ₄ ·MgSO ₄ ·2CaSO ₄ · 2H ₂ O	12.0	14% K ₂ O, 19% S, 4% Mg
Superphosphate, normal	Ca(H ₂ PO ₄) ₂	18-21	16-20% P ₂ O ₅
Superphosphate, triple	Ca(H ₂ PO ₄) ₂	13-15	44-48% P ₂ O ₅
Sulfur sources		% S	
Ammonium sulfate	(NH ₄) ₂ SO ₄	24	21% N
Ammonium thiosulfate	(NH ₄) ₂ S ₂ O ₃	26	12% N

Fertilizer Material	Chemical Formula	Nutrient Percent	Other Nutrients (%)
Gypsum	CaSO ₄ ·2H ₂ O	16.8	22.5% Ca
Polyhalite	K ₂ SO ₄ ·MgSO ₄ ·2CaSO ₄ · 2H ₂ O	19	14% K ₂ O, 19% S, 4% Mg, 12% Ca
Potassium magnesium sulfate	K ₂ SO ₄ ·2MgSO ₄	22.0	22% K ₂ O, 11% Mg
Potassium sulfate	K ₂ SO ₄	17-20	48-54% K ₂ O
Potassium thiosulfate	K ₂ S ₂ O ₃	17	25% K ₂ O
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 ·H ₂ O	17.8	36.4% Zn
Magnesium sources		% Mg	
Dolomitic lime	MgCO ₃ ·CaCO ₃	11.4	21.5% Ca
Epsom salt	MgSO ₄ ·7H ₂ O	9.6	13% S
Magnesia	MgO	55.0	
Polyhalite	K ₂ SO ₄ ·MgSO ₄ ·2CaSO ₄ · 2H ₂ O	4	14% K ₂ O, 19% S, 12% Ca
Potassium magnesium sulfate	K ₂ SO ₄ ·2MgSO ₄	11.2	22% K ₂ O, 22% S
Boron Sources		% B	
Borax	Na ₂ B ₄ O ₇ ·10H ₂ O	11.3	
Sodium octaborate, Borate 65	Na ₂ B ₈ O ₁₃ ·4H ₂ O	20-21	
Sodium pentaborate	Na ₂ B ₁₀ O ₁₆ ·10H ₂ O	18	
Sodium tetraborate, Borate 46	Na ₂ B ₄ O ₇ ·5H ₂ O	14-15	
Boric acid	H ₃ BO ₃	17.0	
Boron frits	Frit	2-11	
Solubor	Na ₂ B ₄ O ₇ ·5H ₂ O + Na ₂ B ₁₀ O ₁₆ ·10H ₂ O	20-21	
Molybdenum sources		% Mo	
Ammonium molybdate	(NH ₄) ₆ Mo ₇ O ₂₄ ·2H ₂ O	54	7% N
Molybdenum frits	Frit	1-30	
Molybdenum trioxide	MoO ₃	66	
Sodium molybdate	Na ₂ MoO ₄ ·2H ₂ O	39	
Copper ammonium phosphate	Cu(NH ₄)PO ₄ ·H ₂ O	32	7.2% N, 36.5% P ₂ O ₅
Copper chelates	NaCuHEDTA	9	

Fertilizer Material	Chemical Formula	Nutrient Percent	Other Nutrients (%)
Copper sources		% Cu	
Copper chelates	Na ₂ CuEDTA	13	
Copper frits	Frit	40-50	
Copper sulfate	CuSO ₄ ·5H ₂ O	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 ·4H ₂ O	26-28	14.4% S
Zinc sources		% Zn	
Zinc carbonate	ZnCO ₃	52	
Zinc chelates	NaZnHEDTA	9	
Zinc chelates	Na ₂ ZnEDTA	14	
Zinc oxide	ZnO	78	
Zinc phosphate	Zn ₃ (PO ₄) ₂	51	18.4% P ₂ O ₅
Zinc sulfate	ZnSO ₄ ·H ₂ O	35	17.9% S
Iron Sources		% Fe	
Iron ammonium phosphate	Fe(NH ₄)PO ₄ ·H ₂ O	29	7.5% N, 38% P ₂ O ₅
Iron ammonium polyphosphate	Fe(NH ₄)HP ₂ O ₇	22	5.6% N, 57% P ₂ O 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 ·7H ₂ O	19	11.5% S

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