Trace Elements - Raw ingredients used to make natural fertilizers are inherently rich in trace nutrients. mother nature likes diversity in the materials she creates. Humans, on the other hand, like to purify everything. Unfortunately, in doing so we tend to overlook the importance of those *contaminants* we exclude.

Trace elements are essential for plants of any kind. However, the subtle difference between not enough and too much can easily injure or kill plant organisms. In most cases mineral soils provide ample amounts of trace elements to plants. When trace elements are deficient, it is often because of other factors, such as incorrect pH, soil atmosphere imbalances, nutrient imbalances, or inadequate weathering mechanisms in the soil. Mono-cropping can also deplete the soil of certain trace elements because of the plant variety's constant demand for a specific nutrient.

Commercial preparations of trace elements are usually in the form of mineral salts or synthetic chelates. Because plants are very sensitive to excess trace elements, applications of these materials should be in accordance with an accurate soil test. Natural fertilizers made from raw, unrefined, materials usually contain a variety of trace elements, which are released at a rate relative to the level of biological activity in the soil. Kelp meal or seaweed extract is also a good source of trace elements.

Plants use trace elements in very small quantities for the formation of enzymes and other organic components. Once combined with organic compounds they are called chelates. The more organic matter content in a soil, the richer it will be in chelates. Organic chelates are a major source of available micronutrients in the soil.

Natural sources of trace elements are both mineral and in the form of organic chelates. Most raw minerals (such as rock phosphate, greensand, granite dust and basalt) are rich in trace elements, but they are insoluble and rely on biological activity to make them available to plants. Organic sources include composts, manures and green manures, but the trace mineral content of these sources will vary, depending on how much of these elements were in the environment where the sources were originally produced.

When addressing trace element deficiencies, natural sources may not be appropriate to use. The diversity of elements in natural materials may be fine for maintaining a balanced level in the soil, but these materials do not have enough of any one element to address a specific deficiency. For this reason, most organic certification groups allow synthetic, inorganic sources of trace elements to be used on a restricted basis. The use of concentrated commercial preparations of trace elements is not allowed without justification from a soil test.

Some manufacturers produce synthetic chelates containing specific trace elements that are in a highly available form. Others produce salts or oxides that contain trace elements, also in an available form. Great care must be taken when using these products because there is an extremely fine line between not enough and toxic levels of trace elements.

Trace Element Containing Materials

Trace Element Source	Formula	Content %
Boron		
Borate 48	$Na_2B_4O_7 \cdot 10H_2O$	14-15
Foliarel	$Na_2B_8O_{13} \cdot 4H_2O$	21
Solubor	$Na_2B_4O_7 \cdot 10H_2O + Na_2B_{10}O_{16} \cdot 10H_2O$	20
Borax	$Na_2B_4O_7 \cdot 10H_2O$	11
Copper		
Copper sulfate (monohydrate)	$CuSO_4 \cdot H_2O$	35
Copper sulfate (pentahydrate)	$CuSO_4 \cdot 5H_2O$	25
Cupric oxide	CuO	75
Cuprous oxide	Cu_2O	89
Cupric ammonium phosphate	$Cu(NH_4)PO_4 \cdot H_2O$	32

Trace Element Source	Formula	Content %
Basic copper sulfates	$CuSO_4 \cdot 3Cu(OH)_2$	13-53
Cupric chloride	$CuCl_2$	17
Copper chelates	Na_2Cu-EDTA or NaCu-HEDTA	9-13
Iron		
Ferous ammonium phosphate	$Fe(NH_4)PO_4 \cdot H_2O$	29
Ferrous ammonium sulfate	$(NH_4)_2SO_4 \cdot FeSO_4 \cdot 6H_2O$	14
Ferrous sulfate	$FeSO_4 \cdot 7H_2O$	19-21
Ferric sulfate	$Fe(SO_4)_3 \cdot 4H_2O$	23
Iron chelates	NaFe-EDTA, HFDTA,EDDHA, DTPA	5-10
Manganese		
Manganese sulfate	$MnSO_4 \cdot 4H_2O$	26-28
Manganese oxide	MnO	41-68
Manganese chelate	Mn-EDTA	5-12
Molybdenum		
Ammonium molybdate	$(NH_4)_6Mo_7O_{24} \cdot 2H_2O$	54
Sodium molybdate	$Na_2MoO_4 \cdot 2H_2O$	39-41
Molybdenum trioxide	MoO_3	66
Zinc		
Zinc sulfate	$ZnSO_4 \cdot H_2O$	35
Zinc oxide	ZnO	78-80
Zinc chelates	NaZn-EDTA, TA, HEDTA	9-14

Source: Jones, B.J., Plant Nutrition Manual