Dialogues with Hugh: No3: Are Organics Best?

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The question, "Are organics best?' is irrelevant to a plant; they ignore the issue of an 'organic source' or a 'non-organic source' entirely. Therefore, the concept that "organics are best" is a complete fable when deciding what source of fertiliser is the best to supply to our orchids. Despite current trends in human affairs and beliefs, plants have no direct interest in chemically complex organic foods. They take up their mineral elements in non-organic forms.

In what forms do plants absorb the essential mineral elements?

Plants do not 'eat' solid food. All essential mineral elements are absorbed from a watery 'soup' as electrically charged elements or compounds called ions. Consider the case of potassium sulphate, which as a solid is a crystalline electrically neutral molecule. When potassium sulphate dissolves in water, it separates into two electrically charged ions:
(a) the positively charged potassium ion that contains 1 atom of potassium carrying a single negative electrical charge (i.e. K^+); and
(b) a negatively charged sulphate ion that contains 1 atom of sulphur surrounded by 4 atoms of oxygen, and carries a double negative electrical charge (i.e. SO_4^{2-}). Orchids and all plants can absorb potassium only as the potassium ion, K^+, and sulphur only as the sulphate ion, SO_4^{2-}.

The take home message here is that should a fertiliser supply any of the essential mineral elements as complex organic compounds such as urea or those found in natural fertilisers, the organic compounds must firstly be converted into simpler soluble chemicals that, when dissolved in water, provide the essential element in a form that plants can take up (Table 1).

Table 1. The forms in which the essential macro- and micro-nutrient mineral elements are absorbed by orchids[1].

Element	Chemical symbol	Ionic form that plants absorb
Nitrogen	N	NO_3^- and NH_4^+
Potassium	K	K^+
Calcium	Ca	Ca^{2+}
Magnesium	Mg	Mg^{2+}
Phosphorus	P	HPO_3^{2-} and $(H_2PO_4)^-$
Sulphur	S	SO_4^{2-}
Chlorine	Cl	Cl^-
Iron	Fe	Fe^{3+} and Fe^{2+}
Boron	B	$(H_2BO_3)^-$
Manganese	Mn	Mn^{2+}
Zinc	Zn	Zn^{2+}
Copper	Cu	Cu^+ and Cu^{2+}
Molybdenum	Mo	MoO_4^{2-} and $(Mo_3O_{11})^{4-}$

[1]Adapted from Table 5-13, Arditti, J. (1992).

Because plants take up their mineral elements only as ions dissolved in water (Table 1), non-organic sources such as potassium sulphate, Superphosphate™ (i.e. calcium phosphate), or calcium nitrate provide the essential mineral element in an immediately available form. On the other hand, when an essential element is supplied as part of complex organic compounds such as amino acids or protiens, that element is only available after the organic compounds have been converted into simple, soluble chemical salts that will dissolve in water and give the ions listed in Table 1. In this respect, organic sources can be considered as a time-delayed source of the essential mineral elements.

Other than the time-delay in availability of the essential mineral element, the remaining question is: "Are the bacteria present in the potting mix that will breakdown the organic compounds into the forms of the essential mineral elements that orchids can absorb?" In soils where there are many different types of micro-organisms, the correct bacteria are usually present, but a similar situation may not occur in many potting mixes. Potting mixes with a high proportion of vegetable material such as bark and peat are more likely to have the right bacteria than a mix that is made up mainly of inert materials such as Perlite™, gravel, and charcoal.

However, an advantage of organic sources is that they may contain bioactive substances that are not present in non-organic sources. Such bioactive substances may include vitamins, amino acids, enzymes, and plant growth regulators that may promote root growth or stimulate shoot growth.

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Reference:

Arditti, J. (1992). *Fundamentals of Orchid Biology* (Chapter 5: Physiology, p. 196-206), John Wylie & Sons, New York.