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https://doi.org/10.29321/MAJ.10.A04206

Chelates in Agriculture — Sequestrenes and Versenols of Commerce

(A Review)

by

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It has been recently discovered that iron chlorosis in fr and garden crops could be completely cured by the use of cer complex organic iron compounds known as "iron chelates". metallic elements in this complex form are referred to technicall being "chelated", or "sequestered" to denote the manner in wl

the iron is combined with the organic fractions. 'Chelate' is a term derived from a Greek word meaning 'a claw'. These compounds combine with the metal in such a manner that the metal no longer exhibits the typical properties of the free compounds of the element (Bould, 1955, Allerton, 1955)

There are various causes attributed to chlorosis in plants and of these lime-induced iron chlorosis is the most common. Certain plants growing on a naturally calcareous soil are susceptible to chlorosis. In such cases, the soil and plant factors are such that iron is not in a form that can be utilized by the plant. Chlorotic leaves do not necessarily contain low amounts of iron, but, owing to adverse conditions within the plant cells, the iron is not available for chlorophyll formation. It is inactive and immobile. There exists an improper micronutrient balance. (Pierce and Alexander Hall, 1955.)

It is generally recognised that lime-induced chlorosis is difficult to cure. The use of inorganic salts of iron, either as leaf sprays or soil dressings has met with only partial success, for, although some intake and absorption of iron occurs, it is rapidly made unavailable. Even the radio-iron added to the soils was fixed in the soil to such a degree as to make it unavailable to the plants. (Holmes and Brown, 1955).

The use of iron chelates in this connection has aroused considerable interest. Some of the chelating agents in use are:

	Name	*Abbreviation*
1.	Diethyl-ethylene-triamine-penta-acetic Acid	DTPA
2.	Ethylene-diamine-tetra-acetic Acid	EDTA
3.	Hydroxy-ethyl-ethylene-diamine-triacetic Acid	HEEDTA
4.	Cyclohexane–1, 2–Diamino-tetra-acetic Acid	CDTA
5.	An Aromatic Amine (name not known)	138

For convenience these compounds are referred to by their abbreviations. If iron is combined with these compounds they are referred to as 'Chelated' e. g., Fe–EDTA, Fe–DTPA, etc; Otherwise they are just referred as 'Chelates' e. g. EDTA., DTPA, etc. These compounds dissolve freely to form pale-coloured solutions. The chemical characteristics of these compounds are not uniform nor is their behaviour in soils and on all crops the same. Some are stable in acid conditions, some others in alkaline conditions, some get fixed in the soil to a greater degree and so on. The use

of chelates with or without iron is both common. Leaf sprays have not proved successful. When used as soil dressings, the chelates have yielded good results. Even in minute quantities the chelates have a good effect and within a few weeks after application the full green colour of the leaves returned even in the most chlorotic leaves, (Wallace et. al. 1955, Bould June 1955, Cooper 1955, Holmes and Brown, 1955). With time the effectiveness of the chelate decreased, and hence for this reason and also to prevent it from getting fixed up in the clay, the chelate is applied just when chlorotic symptoms become manifest. (Holmes and Brown, 1955).

The mechanism of the behaviour of chelates is not well understood at present. The chelates when applied, even without Fe, have been able to activate iron in the soil and make it available to the plant. There is also evidence that the chelate molecule enters the plant and releases the immobile iron. The iron chelate also enters the plant and immediately the iron gets released for plant use. Some chelated iron compounds are found effective in decreasing the absorption and translocation of manganese and copper in the plant, while increasing the availability of iron, and thus restore the micro-element balance. (Wallace et al. 1955, Holmes and Brown, 1955)

There are possibilities of chelating these organic compounds with other microelements and extending their use to cure respective microelement deficiencies. In fact, attempts have already begun to prepare manganese chelates. Thus the use of chelates has great possibilities and is likely to play a very significant part in the treatment of micro-element deficiencies.

The chelated compounds are put on the market by various trade names like "Sequestrenes" "Versenols" etc. by different companies.

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