16 INTERACTIONS BETWEEN ELEMENTS

In citriculture the most known interactions are those between N and P and also K and Mg.

In general when the level of N increases, the level of P will decrease and vice versa although the opposite is much less obvious.

When the concentration of potassium in the leaves is increased by means of soil application or foliar sprays, the concentration of Mg will decrease significantly. The opposite interaction is also strong especially if the water contains a fair amount of Mg. Therefore it is very important not to increase K without watching the level of Mg. The increasing K status can reduce the Mg status to such an extent that fruit size will also suffer. It is also very common that the Mg status does decrease when K is applied, especially by means of foliar sprays (Table 25).

Table 25. The influence of foliar applied potassium nitrate on the magnesium status of the leaves

	N%	P%	K%	Ca%	Mg%	S%
Before KNO_3 was applied	2,45	0,15	**0,65**	5,08	**0,32**	0,37
After KNO_3 was applied	2,50	0,16	**1,22**	4,74	**0,21**	0,36

The other important interaction is between NH_4^+ and K, especially in nutrient solutions. The absorption of K will be severely reduced when the concentration of NH_4^+ is slightly too high. On the other hand NO_3^- will enhance the concentration of K in the plants. NH_4^+ also suppresses the absorption of NO_3^-.

Citrus leaves deficient in K will accumulate up to 2,5 times more ammonium than leaves receiving ample K. This gives rise to the increase production of argenine, proline en putresine resulting in stress and a decreased number of flowers and fruit set.

It the P status in the soil or in the plant is too high it will suppress the absorption of Cu and Zn and can induce deficiencies (Martin & Van Gundy, 1963). When the concentration of P in the fertigation solution of sweet peppers is not decreased at the end of the season, Zn deficiency develops.

Zn and Fe will also influence each other negatively when one is in excess present. The high concentration of Fe reported in some leaf analyses will not interfere with Zn because that Fe is insoluble. It is the active iron that interferes with the metabolism of Zn.

Other possible interactions are given in Table 26.

Table 26. Mutual interactions of the nutrient elements.

Absorption of .....will	reduce the absorption of .... (Suppression/antagonism)	increase the absorption of… (Stimulates/synergism)
NH_4^+	Mg, Ca, K, NO_3 en Mo	Mn, $H_2PO_4^-$, SO_4^{--} en Cl^-
NO_3^-	Fe and Zn	K, Ca, Mg and Mo
$H_2PO_4^-$ of HPO_4^{--}	Cu and Zn	Mo
K^+	Ca and Mg	Mn and Fe
Ca^{++}	NH_4^+-N	Mn and B
Mg^{++}	Ca, K en S	?
Fe^{++}	Cu and Zn	?
Zn^{++}	Cu	?
Cu^{++}	Zn and Mo	?
Mn^{++}	Zn and Mo	?
MoO_4^{--}	Fe	N

Plaaskem (011-397 4640) published the "Mulder's Chart" that lists a number of unusual interactions between the elements as well as the influence of some other factors on the supply of nutrients to the plant. Some interesting ones are as follows.

- A low pH in the soil will reduce the absorption or supply P, K, Ca, S, Mg, Zn, Cu and Mo.
- Cold and wet soils will reduce the absorption or supply of NO_3-N, P, K, Ca, Mg, Fe, Zn and B.
- High clay content in the soil will reduce the absorption or supply of P, K, Ca, Mg, S, Fe, Zn and Mn.

Poor aeration or poor drainage will reduce the absorption or supply of NO_3-N, K en Fe.