

13 BORON

13.1 Role in citrus production

Boron (B) is also fairly immobile in the plant and a continuous supply is required. Boron is involved in carbohydrate supply to the growing tips (meristem), lignifications of cell walls, nucleic acid synthesis and rate of respiration. Boron is therefore involved in reproduction, growth and maintenance of plant organs.

When reproduction, growth and maintenance are inhibited by a lack of B, production is drastically reduced.

Boron deficiency

Boron deficiencies are common and can effectively be corrected by foliar sprays, soil applications or fertigation. Soil applications have a longer residual effect than foliar sprays.

Symptom of a boron deficiency manifested firstly in the fruit. The fruit is smaller, skins are thin and very hard with gum pockets in the juice vesicles around the centre.

Leaf symptoms of a boron deficiency resemble that of mild cold damage. The veins especially on the underside of the leaf are cracked and corky.

Excess boron

Of all the micro-nutrients, B is the one that reaches toxic levels the easiest. Even where B deficiency prevails, uneven spreading of the boron source on the soil can cause an excessive concentration in the soil and leaves. When the boron supply increases that quickly the tree will drop its leaves. The root that were overdosed and the branch directly above it, will suffer alone or the most. The dropped leaves will be scorched but some will remain green with no symptoms.

Symptoms of a moderate but continuous excess of boron (Like when the soil or irrigation water contains high levels of B) start at the tip of older leaves. The tip turns yellow, then necrotic with mottles between the veins.

The effects of excess boron, especially if it is

a temporary condition, can be alleviated by the application of Ca. Lime or gypsum will then be the appropriate source.

13.2 Sources of boron

Of the six micro-nutrients required by plants, only B and molybdenum can successfully be corrected by foliar sprays and soil applications. Various sources of boron are available and the majority can be used in both application methods (Table 24).

Table 24. Sources of boron

Source	% B
Water soluble sodium borate	16 – 21
Boric acid	17
Borax	11
Calcium borate	5 - 14

Some sodium borates (Like Solubor^R and SprayborTM) are formulated for foliar sprays, but like boric acid can also be applied to the soil in a solution by means of an adapted herbicide spray.

Borax is used for soil applications. It contains 11% boron and only 50g per tree or 2,0kg per ha, must be applied. This small mass must be distributed evenly beneath the canopy. This and the potential toxic effect when the borate is not properly distributed, makes soil applications much less convenient.

Calcium borate contains 14%, B total and 1% water soluble B. It is much more convenient and safer to use. Applications of 150g per mature tree on sandy soils (10 -15% clay) and 250g on clayey soils (20 – 25% clay) are safe and much easier to distribute. This application is much more efficient on sandy than clayey soils.

Soil applications of borates last longer with a residual effect of up to five years. Foliar sprays have a residual effect of about 18 months. The soil applications are however, more risky. Even though the correct mass is applied, poor distribution can be risky.

Soluble sodium borates (like Solubor^R) are special formulations for foliar applications. Most borates are not compatible with oil or oil based formulations, arsenate or lime sulphur.

Initially a warning against applications of borates on the blossom was sound. However, borates are sprayed on mango trees to improve fruit set by supporting the growth of the pollen tube. Most citrus cultivars blossom so profoundly that borates can be applied on the blossom, if required. A reduction in the number of flowers, except perhaps on navels and Deltas can only be beneficent.

Borates will form an insoluble salt manganese borate, if combined at high rates in excess of 150g Solubor^R or 30g B per 100 litres water. Zinc sulphate will also form a precipitate with borates which renders the Zn ineffective. Manganese sulphate, zinc nitrate and soluble boron are compatible at rates of 80mg Zn, 500mg Mn and 300mg B per litre.

Boric acid is also soluble in water and the same precautions as for sodium borates apply.

13.3 Fertilisation with boron

Soil applications

Soil applications of borates are very effective on citrus. Either the powders or solutions can be applied by hand or mechanically. Ensure that the borate is properly distributed.

Fertigation with microjets

Fertigation with microjets is generally basically the same as hand or mechanical application and the same principles applies. However if the water is distributed poorly, so will the borate and poor distribution might cause toxicities.

Fertigation with drippers

Any water soluble product can be applied at low concentrations. Also beware of possible accumulation on the perimeter of the wetted zone.

13.4 Foliar sprays

Again any soluble borate can be applied as a foliar spray. The effective concentration is mentioned above (30g B per 100 litre water or 300mg B per litre). Adapt the dosage of other products to equal this.

Again, do not mix borates with oil or oil based compounds.