

THE ROLE OF FOLIAR NUTRITION IN PRODUCING QUALITY OLIVES

Talk held at the SA Olive AGM function held in Nov 2005 at Cascade Manor, Waterfall Park by Heather Raymond BSc (Agric) from Phosyn SA (Pty) Ltd

There is a lot of debate around the value of foliar feeding. What follows is a discussion outlining the reasons why a foliar feed would be applied and more importantly, guidelines as to the optimum time for applications. There is enough evidence (trials and commercial) which show that there is value to foliar feeding, provided a foliar feed is applied for the correct reasons and most importantly at the correct time.

Some information is given with regards to the role of the nutrients in the plant, aimed at helping the grower decide the optimum time of application when conditions arise where foliar feeding would be the better option for supplying the plant's nutrients.

Why foliar feed?

Although trees should theoretically be able to take up all their required nutrients from the soil, several factors can limit nutrient availability to the crop. These factors include:

- Soil pH: High pH limits availability of micro nutrient and phosphate
- Soil temperature e.g. lowering the temperature from 21 to 13 °C reduce phosphate availability in soil by almost 70%
- Soil type: Sandy soil leach nutrients e.g. boron, whilst high organic matter soils lock up e.g. copper
- Crop sensitivity: Certain crops have higher demand for certain nutrients
- Root damage: Mechanical, disease, herbicide etc
- Nutrient interactions - e.g. high N levels limit B uptake, high P levels limit Cu, Mn and Zn uptake
- Growth rates of crop where growth outstrips plant's capacity to supply.

In many cases, adding the nutrient to the soil will only result in further lockup. Supplementing with a carefully planned foliar program at key stages can have a marked positive effect on fruit yield and quality. Foliar feeding is thus used to either correct a deficiency (usually for micro nutrients since plant's demands are sufficiently small that foliar feeding can satisfy these demands) or supplement a macro or secondary nutrient requirement at a key stage when certain factors limit the nutrient availability in the crop.

When to foliar feed?

Understanding the role of each nutrient can assist in determining when the key stages of application are. To follow is a brief summary of some of the key functions of plant nutrients.

Macro nutrients

- *Nitrogen* is a basic building block of amino groups which are fundamental building blocks of proteins and enzymes. N is the most important nutrient determining yield and quality. Too little results in pale trees, small yellow leaves, heavy defoliation, fewer fruit set and hence low yield. Too much nitrogen results in lush growth and poor fruit set.

- *Phosphate* plays a vital role as an energy source in the plant. It is vital for optimum flower and fruit formation. In olives it plays an important role in oil formation. A deficiency can result in poor fruit set and growth and poor root growth. Deficiencies tend to occur in high pH and or sandy soils and in low soil temperatures.
- *Potassium* is needed for sugars/starch translocation, protein synthesis, cell division, roots and other plant parts), and regulates water balance in the plant. Potassium increases the oil content of fruits. A deficiency seriously affects yields although the fruit appears normal. Symptoms of a deficiency include light green leaves with tip burn predominantly on older leaves and dead areas appear in the tree.

Secondary nutrients

- *Calcium* moves into the plant with water to the sink areas (fruit/leaves and roots) and hence uptake depends on calcium availability and the tree root condition. Calcium uptake into fruit is high early in the season after which the fruit concentration decreases throughout the season. Calcium plays major role in cell wall structure and in cementing cells together and is usually regarded as the element with the highest effect on fruit quality and shelf life. Calcium deficiency results in cell wall collapse and when linked to a boron deficiency can result in soft nose fruit rot.
- *Magnesium* plays a vital role in chlorophyll formation, ensuring good leaf quality and hence optimum photosynthesis. It is thus required throughout the vegetative and fruiting periods.
- *Sulphur*, like nitrogen, is a component of amino acids, the building blocks to proteins in the plant. Sulphur is known to play major role in oil quality in other oil producing crops including canola. Sulphur deficiency tends to affect leaf growth, tree growth and fruit yield and quality.

Micronutrients

Six of the 12 essential nutrients are micronutrients, so called because they are required in small amounts. A deficiency in one or more micronutrient can be as detrimental to the crop as a macro nutrient deficiency. The most important micro nutrients in olive production are:

- *Boron*: Of all nutrients, boron's function in the plant is the least understood, yet the deficiency symptoms are best known. Boron has an affect on cell wall structure and also has a major effect on cell elongation (pollen tube) and root growth. New growth will be short and branched, with limb dieback and rough bark. Leaves may be small with some tip dieback. The direct effect on yield and quality results from poor fruit set and hence lower yields and boron deficiency have also been linked to soft nose. Trial data has shown that boron applied pre flowering increases flowering and fruit set. Boron deficiencies tend to occur in sandy soils, soils with high nitrogen levels and high pH soils.
- *Zinc*: It has been labelled as the most wide spread and damaging micronutrient deficiency. Even in the early stages of a deficiency, there is a reduction in yield

and fruit quality. Symptoms include lighter young leaves and fruit tends to mature earlier. There is a positive significant correlation between fruits zinc content and oil percentage in olives. Zinc deficiencies tend to occur in high pH soils, where heavy liming has been applied and or in high phosphate soils.

- *Copper*: A deficiency tends to affect the fruit more than vegetative growth, and a deficiency causes delayed flowering and maturation and weakened cell wall. Deficiencies tend to occur in sands, high pH soils, and soils with high organic matter contents. Due to standard copper fungicide sprays, copper deficiency is unlikely. In fact, it is important to stick strictly to recommended copper rates as too much can affect fruit quality, cause rancidity in the fruit and down grade fruit as a result of contamination.

The other micro nutrients including iron, manganese and molybdenum, are not expected to be problematic. However, as for all nutrients, it is advisable to do regular leaf and soil sampling and apply nutrients where necessary.

So when do you apply foliar feeds?

Each growth stage has a period of peak demand for one or more nutrients. Often the crop is simply unable to extract its full requirement from the soil and hence foliar applications of these nutrients can improve fruit yield and or quality. The key nutrients most likely to affect fruit quality are boron (B), calcium (Ca), magnesium (Mg), phosphate (P), zinc (Zn) and potassium (K). Optimum timings are summarized below.

- *Bud development* : Applying zinc and boron at this stage optimizes bud development and fruit set and hence yield .
- *Flowering and fruit set* : Phosphate and calcium are vitally important at this stage as phosphate supplied the energy to allow rapid cell division and calcium is required in laying down cell walls and cementing the walls together, thereby improving fruit quality and shelf life
- *Fruit enlargement*: During this periods, leaf quality is important so nutrients such as magnesium, manganese and iron are important to ensure optimum chlorophyll and hence carbohydrate synthesis in the leaf. Potassium is important for the transport of the carbohydrates to the fruit. This has an affect on fruit size and oils.
- *Post harvest*: Boron has been found to be mobilized in fruit trees 5 weeks prior to bud development and post harvest foliar applications accounted for 80% of boron in new spring buds. Zinc applied as a post harvest application lifted bud levels in spring, improving bud development and survival. Nitrogen post-harvest can improve bud development and bud strength in the following spring.

Summary:

To get the optimum from foliar sprays, identify the requirement through either leaf/soil analysis, visual symptoms, crop sensitivity and or local knowledge. Ensure that sufficient nutrient is applied at the correct time for the correct reasons, acknowledging that foliar feeding macro nutrients is generally supplemental to soil applications, whilst foliar feeding micro nutrients is an effective and easy methods of correcting deficiencies. Used correctly, foliar feeding can be an important tool in improving crop yield and quality.