Key Elements of Nutrition for Fruit Size

Floral Initiation – Flowering – Initial Set (June-October)

- Apply 40-50% of annual nitrogen in 2 split applications at bud swell;
- Use a 1% urea spray when soil temperatures are low;
- Apply 50% (fertigation) or 100% (banding) of annual phosphorous before and during bloom;
- Apply 30-40% of annual potassium;
- Apply N-P-K mixes between September and November;
- Zinc is critical, apply foliar sprays as required;
- After fruit set apply magnesium and manganese foliar sprays as required;
- Adding low biuret urea (0.5%) to micronutrient sprays of zinc and manganese helps uptake.

Stage I Fruit Growth (November-December)

- Apply 25% of annual nitrogen in November after fruit set and at the end of the vegetative growth flush;
- Calcium nitrate is preferable to ammonium nitrate and urea as these forms of nitrogen compete with the uptake of calcium;
- If fertigating apply the remaining phosphorous (50%) at monthly intervals from October onwards;
- Ensure adequate supply of calcium to reduce albedo breakdown;
- Apply 30-50% annual potassium after fruit reach 10mm in size;
- Apply foliar micronutrient sprays of magnesium, manganese and zinc as needed;
- Overseas experience shows foliar sprays of potassium phosphite or MAP and potassium nitrate in November have improved fruit size.

Stage II Fruit Growth (January-April)

- Nitrogen is important, apply 25% of annual requirement (adjust for crop load) throughout this period; High levels of nitrogen delay maturity;
- Ensure adequate nitrogen levels for carbohydrate reserves for next seasons flower initiation in winter;
- Potassium is also important, apply 30% of annual requirement after final fruit drop stage in January-February;
- Maintain good nitrogen: potassium ratios (2≈1).

Tree Nutrition for Improving Fruit Size

Introduction

Nutrition in citrus has become a key management practice for growers to achieve maximum fruit size in their orchards.

In relation to fruit size there are major and minor nutrients which all play important roles and interact with each other. Some are obviously more important in relation to fruit size than others, but at the same time they may also play an important role in relation to fruit quality e.g. calcium and its role in reducing albedo breakdown.

At the core of all good fertilizer and nutrition programs should be regular leaf analysis and good record keeping which can be used to monitor changes.

Citrus require optimum nutrition at each growth stage to promote better fruit size and tree health.

Following is a summary of the major growth stages that are related to fruit size and the nutritional requirement of trees. This is based on information provided by Tienie du Preez during his visit to South Australia in September 2001.

Floral Initiation, Flowering & Initial Fruit Set (June- October)

Nitrogen

The first application of nitrogen should be applied at budswell and should be up to 40-50% of the total nitrogen applied for the year. Apply in two split applications 14-21 days apart especially on sandy soils. Also apply a 1% urea spray especially when soil temperatures are low (less than13^{o}C). Urea should not be ground applied at this time of the year due to its slow conversion time to ammonium. N:P:K mixes are best applied between September and November.

Phosphorous

Phosphorous is important at this time and should be applied just before and during the bloom period. If you are banding the phosphorous to the soil apply 100% of the annual requirement now. If you are using fertigation apply 50% at this time and the remainder at monthly intervals.

Zinc

Zinc at this stage is also very important. Zinc sulphate is the preferred form. Zinc can be added to all foliar sprays 3-4 times per season. The recommended rate is 100-150gm/100litres. Low zinc levels or trees deficient in zinc will develop poor growth, have small leaves, lower crop yields and develop small fruit. Apply the first spray at about 1/3 – 1/2 leaf expansion and then as needed during fruit development. Always add 0.5% low biuret urea to all these foliar sprays.

Magnesium and Manganese

If needed magnesium and manganese can be applied to the developing spring flush or after fruit set. When applying these foliar sprays always add 0.5% low biuret urea, as this aids in the uptake of zinc and manganese.

Stage I Fruit Growth (November-December)

Nitrogen, Phosphorous and Potassium

Do not over stimulate trees during this period, because any growth flush will compete with the fruitlets and will result in poor fruit set. Just enough nutrients are needed to maintain biological activity.

It is preferable to apply nitrogen (25%) at the end of the vegetative growth flush in November, especially if trees are well fed with nitrogen in previous stages. The rest of the nitrogen can be

applied in January. The ideal source of nitrogen at this time is calcium nitrate, however other forms can be used.

Potassium (30%) can be applied after fruit set (10mm size). The rest of the potassium should be applied in December and at the end of January when it is necessary for cell enlargement.

Calcium
In this period calcium is important to reduce albedo breakdown. Nitrogen applications should be kept to a minimum as it competes with the uptake of calcium especially the ammonium nitrate and urea forms (which need to be converted to ammonium).

Other
Magnesium, nitrogen, phosphorous and potassium all compete with the uptake of calcium and therefore their applications should be closely related to leaf analysis and should not be over supplied in the cell division stage.

Weak trees or those showing yellowing should receive a foliar application of low biuret urea, zinc and manganese sulphate.

Iron chelates may be needed especially in calcareous and high pH soils or in very wet conditions.

Stage II Fruit Growth (January – April)

Potassium
Potassium should be applied during January & February after the final fruit drop stage. However too much or too little potassium will inhibit calcium uptake therefore increasing the likelihood of albedo breakdown. Aim for leaf levels of 1.0-%-1.5%. The higher the nitrogen levels are, the higher the potassium levels should be, to ensure that good N: K (2≈1) ratios are achieved. Potassium sprays should occur in December, January, and February (3% potassium nitrate depending on historical leaf-K levels). Potassium is especially important from February onwards.

Nitrogen
Aim to provide 25% of the annual nitrogen requirements. If you are broadcasting apply as a single dose in January. If you are using fertigation apply at monthly intervals from January through to April. It is important to be careful at this stage for those varieties which you wish to harvest early, as high nitrogen levels will delay maturity. Applications should always be based on leaf analysis and leaf colour.

Other
Research from California shows that foliar sprays of potassium phosphite in November and January significantly improved fruit size even at optimum phosphorous and potassium leaf levels. South African growers use foliar sprays of MAP (0.5%) and potassium nitrate (3-4%) in November and January to provide phosphorous and potassium when demand is high.

Other Information

Previous leaf nutrient standards for citrus are now considered too low to achieve the best fruit size. Growers should therefore aim for the following leaf nutrient levels:

Nitrogen 2.4-2.8%	Phosphorous 0.14-0.18	Potassium 1.0-1.5%
Magnesium 0.3-0.7%	Zinc 30-100ppm	Manganese 25-100ppm
Boron 50-150ppm	Iron 60-120ppm	Copper 6-15ppm

Sodium and chloride inhibit fruit size and interfere with overall tree health and nutrient balance. Leaf sodium levels should be less than 0.16% and chloride levels below 0.3%. Nutrient ratios for Nitrogen : Potassium of 2 ≈ 1 and Nitrogen : Phosphorous of 20-15 ≈ 1