Feeding Macadamias - Australia's number one native-food crop
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BREAKOUT BOX

(From the Australian Macadamia Society)

Macadamia nuts are the only Australian native-food crop that has seen significant commercial development for local and export markets. More than 850 growers across three states (Queensland, NSW and WA) and expanding, produce around 40,000 tonnes per year, with 70% of production exported as kernel to more than 40 countries. The main growing region stretches along 1,000 kilometres of Australia's east coast – from the mid north coast of New South Wales up to Mackay in Queensland.

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UNDERSTANDING macadamia trees' specialised root system and annual cropping cycle are the keys to meeting their year-round nutrient and soil-condition requirements.

A strong root system provides the foundation for long-term, high-value nut production and resilience to adverse conditions, so deserves close management attention.

Just south of Brisbane and based centrally in the main hub of macadamia growing in southeast Queensland-northern NSW, Barmac has become an important local provider of custom-blended nutrients and organic soil-health products for individual macadamia growers – calculated and mixed on the basis of soil and leaf analyses, agronomist's advice and crop-stage requirements.

The company custom-blends both granular and soluble liquid fertilisers for macadamia and other growers.

Barmac technical support and product development officer Chris Poletto said that with more than 20 years' experience in blending, the company was responding to growers' increasingly sophisticated approach to soil nutrients, condition and health.

"Smart growers want to fertilise their crop more intelligently than has been past practice. Standard 'off-the-shelf' products are not quite hitting their quality and production expectations.

"Growers seeking nutrient blends to match their individual soil and leaf analysis results are driving increased demand for customised fertiliser blends, including slow-release fertilisers to better match crop demand over several months. Growers are also wishing to incorporate organic matter and soil-conditioning granules in their fertiliser applications to improve soil properties, plant health, and crop yield and quality.

"In response we use a product containing carbon, silica, and specialised microbiology in as many blends as we can – to provide high carbon and microbes, blending organic matter and biological input with traditional, individual nutrients. We also use a guano product as an organic base for macadamia mixes and custom blends – a slow-release source of phosphorous and calcium, which macadamias seem to enjoy."

Specialised, adapted root system

Mr Poletto said that in their natural habitat in the lower layers of Queensland and NSW coastal subtropical forest, macadamia's shallow feeder-root system was designed to constantly forage for nutrients in the top few centimetres of soil and decomposing leaf litter on the forest floor – an environment high in carbon and organic matter.

"The best results in a commercial environment are achieved by mimicking these natural forest-floor conditions – mulch to preserve soil moisture, protect surface roots and minimise weeds; good levels of carbon and organic matter to promote fine root growth and specialised proteoid roots; and well-aerated, well-drained soil at planting to encourage strong structural roots to hold the tree up, and to access water and nutrients from deeper in the soil profile."

Members of the Proteacea family, macadamias have developed the ability to grow proteoid roots – intense clusters of tightly-knit small rootlets which play an important part in nutrient absorption, especially uptake of phosphorous. Proteoid roots are indicative of a healthy macadamia root system.

"You only need to scratch the surface to find feeder roots and proteoid roots extending near the surface of the soil, sometimes just below the leaf litter – hence the importance of the orchard floor having friable, organic-rich topsoil out to the canopy drip lines.

"The aim of a fertiliser and soil-conditioning program is to build and keep the tree and root systems healthy, plus replace the nutrients removed each year by the crop.

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Annual crop cycle

A typical yearly cycle for Australian macadamias: Planting in autumn. Then 4 year's growth before crop bearing. Flower buds initiated around May. Plant energy (carbohydrates) accumulated and stored through winter. August- September flowers open, with only small proportion (about 1-2%) setting nuts by early October. Stored plant energy is depleted by the spring vegetative flush. 5-8 weeks after flowering, there is a natural drop of small nuts as the tree adjusts its crop load (late October-early November) Nuts grow in fresh weight through spring-early summer. Once at full size, shells begin to harden December to early January. Once the shell has hardened off, oil accumulation begins (late December through January) lasting about 2 months. Plant energy accumulated and stored through late summer-early autumn is depleted in early- mid autumn by autumn vegetative flush, plus nut filling and maturing. Mature nuts begin to fall – from mid-February to late March depending on the region, and continue to come down over next 6 months. Peak nut drop around late May-June. Flowers initiated for the next crop around May.

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Mr Poletto said macadamias were not heavy feeders, preferring to be provided with small amounts of nutrients often.

"The aim of a fertiliser program is to build and keep a healthy tree and root system and to replace the nutrients removed each year by the nut crop. Vegetative-growth and nut-growth stages tend to deplete nutrients, particularly nitrogen (N), phosphorous (P), and potassium (K).

"Fertiliser inputs are driven by the tree stage of life and cropping cycle rather than the calendar."

He said that at least three months before planting, growers were advised to apply lime, dolomite, gypsum , phosphorous, calcium (Ca) and zinc (Zn) according to soil analysis and local recommendations.

"Closer to planting they would apply more soluble fertilisers such as nitrogen and potassium to avoid their loss through leaching."

Young trees

He said the aim of fertilising and soil conditioning at this stage was to build strong heathy trees and set them up for a long, productive life.

"If recommended planting preparations have been followed, fertiliser is unlikely to be required for the first few months until new growth has hardened.

"Young trees respond better to frequent small feeds than a single large dose, so with soil analysis as the guide, apply small amounts of fertiliser every 8 weeks or so in the growing season (September to May). Fertigation is ideal if irrigation is available. Keep solid fertiliser 20cm away from the trunk and spread evenly to 30cm past edge of canopy.

"Young trees tend to have a high requirement for nitrogen and phosphorous, and a low requirement for potassium until bearing. If pH is above 5, no lime or dolomite is required."

Nut-bearing trees

He said the aim of fertilising and soil conditioning at this stage was to achieve maximum production of quality nuts; to keep vegetative and reproductive growth in balance; and to maintain a healthy root system.

"Annually monitor soil and leaf levels and base your fertiliser program on that.

"Soil analysis gives you a snapshot of the presence and quantity of nutrients in the soil; monitors soil pH, organic matter and the balance of the cation elements calcium, magnesium, potassium, sodium, aluminium; and monitors soluble phosphorous and trace elements.

"Leaf analysis gives an insight into the uptake of plant-available soil nutrients. A nutrient deficiency in the tree at this stage (shown via leaf analysis) is impacting on the current crop, could limit this season's yield, and requires urgent action.

"The ideal time to sample is after harvesting and before flowering (Sept-November) when nutrient levels are most stable.

"Fertiliser rates are calculated to bring nutrient levels back into the optimum range by customising the fertiliser mix to the real needs of your crop, plus allowance for nutrient removal by the crop and the nitrogen requirement for tree vigour."

Typical crop drain on nutrients

For an idea of the crop drain on nutrients, he said an average NIS (nut-in-shell) yield of 3.5 tonnes per hectare would remove about 63kg nitrogen, 3.5kg phosphorous, 70kg potassium, 17.5kg sulphur, 35kg calcium, and 5.25 kg magnesium per hectare per year.

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Some fertiliser tips:

In typical, well-managed macadamia orchards nitrogen, potassium and boron are likely to be the only nutrients requiring addition each year. Split nitrogen fertiliser requirements into as many applications as possible through the year, with an extra application after heavy rain. Apply most of the required potassium in several applications through spring, with the rest spread through the year. Apply fertilisers of low solubility (such as phosphorous, gypsum, zinc sulphate) before summer rains to help incorporation. Root-growth flushes follow a similar pattern to vegetative growth flushes, so make sure there is sufficient available phosphorus to stimulate root growth at these important times. Apply fertilisers of low solubility (such as phosphorous, gypsum, zinc sulphate) before summer rains to help incorporation. Root-growth flushes follow a similar pattern to vegetative growth flushes, so make sure there is sufficient available phosphorus to stimulate root growth at these important times. Apply boron and (if required) zinc foliar fertilisers (boron in spring, zinc in summer). Boron is especially important around flowering and nut filling. Trials have found 4 x monthly sprayings from flowering increased NIS yield, the proportion of first-grade kernels and kernel weight. If boron levels are low in leaf analysis, apply up to four foliar sprays September to March and soil dressings during autumn (Mar-May).

If zinc is low in leaf and soil, the response depends on soil type. On red kraznozems, zinc uptake is restricted so apply via foliar spray to the summer growth flush. If deficiency is severe reapply to winter/spring growth flush and developing nuts. On other soil types apply under canopy in broad 30cm band under drip line just before summer wet. Calcium and magnesium may require adjustment every 3 years. Organic carbon (OC) needs to be continually maintained above 2% with regular addition of Organic Matter. Other nutrients usually require little or no adjustment for longer periods.

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