

# Macadamia grower's handbook

Reprint – information current in 2004



## REPRINT INFORMATION – PLEASE READ!

For updated information please call 13 25 23 or visit the website [www.deedi.qld.gov.au](http://www.deedi.qld.gov.au)

This publication has been reprinted as a digital book without any changes to the content published in 2004. We advise readers to take particular note of the areas most likely to be out-of-date and so requiring further research:

- Chemical recommendations—check with an agronomist or Infopest [www.infopest.qld.gov.au](http://www.infopest.qld.gov.au)
- Financial information—costs and returns listed in this publication are out of date. Please contact an adviser or industry body to assist with identifying more current figures.
- Varieties—new varieties are likely to be available and some older varieties may no longer be recommended. Check with an agronomist, call the Business Information Centre on 13 25 23, visit our website [www.deedi.qld.gov.au](http://www.deedi.qld.gov.au) or contact the industry body.
- Contacts—many of the contact details may have changed and there could be several new contacts available. The industry organisation may be able to assist you to find the information or services you require.
- Organisation names—most government agencies referred to in this publication have had name changes. Contact the Business Information Centre on 13 25 23 or the industry organisation to find out the current name and contact details for these agencies.
- Additional information—many other sources of information are now available for each crop. Contact an agronomist, Business Information Centre on 13 25 23 or the industry organisation for other suggested reading.

Even with these limitations we believe this information kit provides important and valuable information for intending and existing growers.

**This publication was last revised in 2004. The information is not current and the accuracy of the information cannot be guaranteed by the State of Queensland.**

This information has been made available to assist users to identify issues involved in macadamia production. This information is not to be used or relied upon by users for any purpose which may expose the user or any other person to loss or damage. Users should conduct their own inquiries and rely on their own independent professional advice.

While every care has been taken in preparing this publication, the State of Queensland accepts no responsibility for decisions or actions taken as a result of any data, information, statement or advice, expressed or implied, contained in this publication.



Queensland Government



## *Before you* **START**

*If you have never grown macadamias before, you will find this section very useful. It is a checklist of the things you need to know before you start. It will help you make the right decisions about growing macadamias. The information here is brief and to the point. We provide more detail on important areas in other sections of the handbook. Symbols on the left of the page will help you make these links.*

### **A brief introduction to the macadamia industry**

Australia grows around 16,000 hectares of macadamias with about 60% in New South Wales and 40% in Queensland. The main production areas are the Lismore and Nambucca regions of New South Wales, and the Glasshouse Mountains, Gympie, Bundaberg and Atherton Tableland regions in Queensland. A small industry also exists in southwest Western Australia. Around 800 growers are involved in the Australian industry, with orchards ranging in size up to 600 hectares. The average orchard size is about 20 hectares.

The macadamia is the only Australian native plant to be commercially grown in a major way as a food crop and so is a unique Australian industry. The industry in Australia only developed to a significant extent after Hawaii developed a commercial macadamia industry following the tree's introduction there as a windbreak for sugarcane plantations. For many years, most of the Australian industry was based on varieties developed in Hawaii, with the varieties HAES 246 (Keauhou), HAES 344 (Kau), HAES 741 (Mauka) and HAES 660 (Keaau) making up most of the orchards. However, in recent years with the development of Australian varieties such as Hidden Valley A4 and Hidden Valley A16, most new orchards are now based on a mixture of Hawaiian and Australian varieties. Trees are grown from grafted or budded nursery stock.

Nuts are harvested off the ground using mechanical harvesters, and in some situations, by hand. Harvesting begins in March-April and is normally completed by September-October.

About 25% of the crop is exported as nut-in-shell (NIS). Almost all of the rest of the crop is processed in factories in southern Queensland and northern New South Wales with about 70% of the processed product being exported. The major markets are USA, Japan, China and Europe, particularly Germany. About 1% of production is sold as nut-in-shell on the Australian fresh nut market.

## **Know what you are getting into**

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Macadamia growing is appealing to new growers because the industry is perceived to have a more secure, assured and profitable future than many other tree crops. This is underpinned to some extent by the fact that macadamias are in demand on the world nut market, yet make up only about 2% of world tree nut production. This indicates significant potential scope for expansion. Other advantages include:

- As the industry continues to mature, production and marketing risks will be better understood.
- The industry has a strong industry peak body, the Australian Macadamia Society, including growers, processors, marketers and researchers, which operates a well-organised R&D and market promotion program.
- Through the efforts of the industry, the Australian product has developed a good reputation for quality and is well respected in the world market place.
- Mechanisation is available for most orchard operations. This reduces labour management concerns, particularly when compared with most other subtropical tree crops, which require hand harvesting and pruning.
- Compared to other horticultural crops, macadamias, if handled correctly, have a longer potential storage life.
- Packaging and marketing costs are substantially lower than for other horticultural crops.

However, be aware that success in macadamias is not as easy as many are led to believe. The following points summarise the main constraints:

- Like all tree nut crops, macadamias are a long term venture with production commencing only in about the fourth or fifth year and the trees not maturing until about 12 to 16 years after planting. Individual tree yields are also lower than for most other tree crops. This means you have a long wait for your first cash flow and an even longer wait for a positive return on your investment.
- Because macadamias are predominantly an export crop, the prices received by growers can vary significantly from year to year depending on market developments and Australia's exchange rate with its trading partners. This makes it difficult to predict prices and future returns.



See *The Farm you need* on page 6 for more information on orchard selection issues.

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#### NOTE

Do a thorough marketing and business plan. This will give you a more accurate picture of what you are getting into.

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- Macadamia trees have limited tolerance to frost, heat, wind, drought, fire and poor drainage. Therefore, selection of an orchard site has to be exacting with only a limited range of areas in Australia ideally suited to the crop. Finding farm blocks of a viable size within these limited areas can be difficult. Remember that blocks with steep and broken terrain will be substantially more expensive to bring into production and subsequently manage. Blocks in drier areas will also require irrigation.
- Macadamia trees require a high level of management for profitable yields and nut quality. They are susceptible to a wide range of pests and diseases, which require regular monitoring and application of control measures. Irrigation (where required), nutrition, harvesting and post-harvest handling also need careful management. This requires the ability to carefully plan and manage orchard operations. In addition, as prices are linked closely with nut quality, a commitment to quality and quality assurance is essential.
- As the impact of farming on the environment comes under increasing scrutiny, all orchard operations require careful management to minimise environmental risks. Particular issues include the noise from dehusking equipment in closely-settled areas, spray drift control, and soil erosion under trees from the combined effects of high rainfall, shade and mechanical harvesting.
- The establishment of a macadamia orchard requires a major capital investment. Although it may be argued that this is no greater in the initial stages than for most other tree crops, the payback period is longer and individual items of harvesting and postharvest equipment are much more expensive.

It is important before embarking on growing macadamias, to take time to research the subject thoroughly. Be cautious about extravagant claims of economic performance and do a thorough business plan.

## What you can expect to make

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### Yields

Yields vary with location, season, variety and level of management. Bearing commences in about the fourth or fifth year and reaches a peak at maturity in about the twelfth to fifteenth year. For a well-managed orchard with tree spacings of 8 m x 4 m (312 trees per ha), expected peak yields at maturity are approximately 3.5 to 4 tonnes of NIS per ha (12 to 13 kg per tree) at 10% m.c. Very well-managed orchards may do slightly better than this and conversely, poorly-managed orchards or those on poor sites may fail to reach these figures. An indication of yields for a well-managed orchard is shown in Table 1.

**Table 1.** Expected average yields (kg NIS at 10% m.c. based on 312 trees/ha)

| Year  | Yield per tree | Yield per hectare* |
|-------|----------------|--------------------|
| 1     | 0              | 0                  |
| 2     | 0              | 0                  |
| 3     | 0              | 0                  |
| 4     | 0              | 0                  |
| 5     | 1              | 300                |
| 6     | 2              | 600                |
| 7     | 4              | 1,200              |
| 8     | 6              | 1,800              |
| 9     | 9              | 2,400              |
| 10    | 10             | 3,000              |
| 11    | 11             | 3,200              |
| 12–15 | 12–13          | 3,500–4,000        |

\* Figures assume that trees are pruned to maintain machinery access and light and spray penetration. Note that in closer-spaced orchards, yields may reach the peak/ha figures earlier than indicated. However, yields may then decline without pruning and good management. With good management, yields/ha for mature trees are generally similar for all spacings.

**NOTE**

Price is often adjusted upwards for higher sound kernel recovery and often adjusted downwards for higher unsound kernel recovery.

**Prices**

Prices paid by processors vary from year to year depending on world market forces of supply and demand and Australia's exchange rate. From 1990 to 2003, prices for NIS with 33% sound kernel recovery, a maximum of 3.5% unsound kernel recovery, at 10% moisture content, varied from a low of around \$1.60/kg to a high of around \$3.20/kg. Approximate annual prices paid by major processors during this period are listed in Table 2.

**Table 2.** Approximate annual prices for NIS (33% sound kernel recovery, max of 3.5% unsound kernel recovery, at 10% moisture content)

| Year          | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Price (\$/kg) | 2.50 | 1.60 | 2.03 | 2.75 | 2.80 | 3.00 | 3.05 | 2.70 | 2.35 | 2.04 | 2.10 | 2.45 | 2.75 | 3.20 |

In developing a budget, it is suggested that a long-term average price of \$2.20 to \$2.60 be used.

**NOTE**

Production costs include only those costs actually associated with growing the crop. These do not include fixed or overhead costs (which add approximately \$1,500/ha for a typical 20 ha orchard), capital costs or interest repayments.

**Production costs**

Before trees start to bear, it costs approximately \$3,000 to \$3,500 per hectare per year to operate the orchard. This is based on an orchard of 312 trees per hectare, equating to a per tree cost of approximately \$10 to \$12. This includes costs involved in fertilising, irrigating (if required), mulching, pest, disease and weed control, tree training, machinery operating costs and labour. When harvesting commences, the additional costs of mechanical harvesting, dehusking, drying and storage are generally about \$1,000 to \$1,500 per hectare (assuming a yield at 12 to 15 years of 3,500 kg NIS per hectare). This makes the total annual production costs for a mature orchard about \$4,000 to \$5,000.

## Gross income

No significant income can be expected until the sixth year. Costs generally exceed income until about the eighth year. Accumulated costs generally exceed accumulated income until at least the eleventh year. At a NIS price of \$2.50/kg, marketed yield of 3,500 kg NIS/ha and production costs of \$4,500/ha, income from mature trees before fixed or overhead costs are subtracted, should be around \$4,000 to \$4,500/ha. This would make income from a mature orchard of 20 ha (before fixed or overhead cost are subtracted) about \$80,000 to \$90,000. However, remember that there can be considerable variation from these figures. Also note that taxation implications will affect the breakeven point.

## The capital you need

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Excluding the cost of land and a house, up to \$400,000 (irrigated) and \$300,000 (non-irrigated) is required to establish a 20-hectare macadamia orchard (approximately \$50 to \$60 per tree). This includes the cost of:

- trees, land preparation and tree establishment;
- a shed for storage, postharvest handling and drying;
- an irrigation system including a dam, piping and under-tree sprinklers (where required);
- a tractor (about 90 HP);
- a slasher;
- a trailer;
- a boom sprayer for herbicides;
- a 4WD utility.

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### NOTE

The approximate figure of \$120,000 is a guide only. It varies according to the equipment purchased.

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Once cropping commences in the fifth year, approximately a further \$120,000 is required for a harvester, dehusker, sorting, drying and storage equipment, and an airblast sprayer for insecticides and fungicides. An alternative to purchasing this equipment would be to use contract harvesting services (where available), a central harvesting and dehusking facility or a processor accepting nut-in-husk (where available). If using contract services, ensure that the service will be available at critical times.

## Taxation

As the costs of establishing an orchard are substantial, the ability to deduct allowable expenditure through taxation is important to most growers. The issue is complex and professional advice from an experienced horticultural accountant is recommended.



See *Taxation* on page 74 for a brief summary of taxation provisions.

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**WARNING**

If in doubt about the quality of the soil, seek advice from an experienced soils consultant.

**NOTE**

It may be possible to mound the tree rows to improve soil depth or drainage.

**NOTE**

Except in highly exposed sites, most new orchards are being established without windbreaks as the owners consider the disadvantages outweigh the advantages.

## The farm you need

### Soil

Macadamias grow on a wide range of free-draining soils but perform best on deep, well-drained soils, rich in organic matter. For successful commercial production, a minimum depth of 0.5 m of friable, well-drained soil is essential. A depth of 1 m is preferred, as this minimises the risk from trunk canker disease and tree decline. However, be aware that extremely well-drained soils may be a problem in drought years, if not irrigated. Avoid soils with heavy clay or rock bars within 1 m of the surface. Make a soil map to check variation in soil type and depth across the site. Also avoid soils containing small stones of a similar size to macadamia nuts near the surface. These may cause excessive wear on harvesting and dehusking machinery.

### Slope

Slopes of up to 15% are suitable provided the orchard is designed to minimise erosion. Steeper slopes present a major erosion risk and make it difficult to operate machinery safely, particularly when wet. Avoid these wherever possible.

### Wind protection

Protection from strong winds is desirable, either through natural forest surrounds or planted windbreaks. Macadamia trees are brittle and breakages occur easily, particularly during storms in highly exposed sites. Wind can also slow growth in young trees and may cause premature fall of young, immature nuts. Windbreaks can also double as buffer zones to reduce the risk of spray drift. However, competition for light, water and nutrients, future orchard management problems and the reduction in planted area need to be carefully considered. Windbreaks may also be relatively ineffective in some sloping sites.

The most susceptible period for damage is during the first four years after tree establishment. Once trees within the row start to grow together and form a continuous canopy, they are less prone to significant damage, and windbreaks are generally of little benefit except in highly exposed sites. In addition, if windbreaks are to be effective, they need to be in place at least one year and preferably two years before the orchard is planted. They also need to be positioned to provide adequate protection from the direction of the main prevailing winds.

Assess each site on the basis of the above information before planting windbreaks. Choose species carefully so they will have minimal impact on later macadamia tree growth and orchard operations such as harvesting.

### Climate

Leaves of mature macadamia trees have been known to withstand temperatures as low as  $-5^{\circ}\text{C}$  for short periods without damage. Low frost risk areas

are preferred for all macadamia orchards because young trees as well as the lower trunks and flowers of older trees are very susceptible to damage when temperatures fall below  $-1^{\circ}\text{C}$ . The trunks of young trees can be protected from frost damage by wrapping the lower trunks with insulating materials.

Avoid sites where temperatures regularly exceed  $35^{\circ}\text{C}$ . High temperatures reduce vegetative growth, increase premature nut drop, adversely affect nut growth and oil accumulation, and may cause leaf burn. Also avoid sites where winter maximum temperatures are regularly less than  $15^{\circ}\text{C}$ . Consult local climatic data, especially outside known major production areas.

Where possible, avoid locations prone to extended wet weather in August and September. This favours flower diseases such as blossom blight and makes pesticide application and harvesting more difficult.

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**NOTE**

Check with your local authority on noise regulations.

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**Location**

Because of the noise associated with dehusking equipment, and possible complaints about spraying operations, the number and proximity of neighbours' houses needs to be considered. When purchasing land, also consider the likelihood of future urban development which might impact on farming operations.

**Water supply**

Irrigation is recommended where annual rainfall is less than about 1200 mm or where it is unevenly distributed throughout the year. In other areas, irrigation may be useful, particularly during extended dry periods. Where it is used, calculate requirements on mature trees using up to five megalitres per hectare per year. A salt level of less than 1.2 dS/m (decisiemens per metre) is preferred. Note that all orchards require a water supply for spraying.

**Fire risk**

As macadamias are highly susceptible to fire damage, take the fire risk of surrounding bushland into account when purchasing land. This can be minimised by preventing the buildup of long grass in dry years.

**The machinery and equipment you need**

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Essential equipment to set up the orchard includes:

- an irrigation system including a dam, piping and under-tree sprinklers or trickle system (where annual rainfall is less than 1200 mm or where it is unevenly distributed throughout the year);
- a tractor large enough to operate spray and harvesting equipment (for example 90HP for a 20-hectare orchard);
- two sprayers—one for weed control (boom sprayer preferred for larger orchards); one for pests and diseases (for example, a handgun);
- safety equipment to use when spraying;
- storage shed for farm chemicals;



- slasher;
- 4WD utility;
- heavy duty trailer (preferably tipping);
- fertiliser spreader;
- workshop space and tools.

When nut production commences in the fifth year, the following equipment is also required, unless use is made of contracting services or central nut handling facilities:

- harvesting equipment;
- dehusker and sorting equipment;
- shed for storage, postharvest handling and drying;
- a silo or similar for drying and storing nuts;
- a tree sprayer (for example, airblast sprayer) for pest and disease control.

## **The labour you need**

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One person should be able to manage up to 30 hectares (non-irrigated) and 20 hectares (irrigated) of orchard trees for the first four or five years until trees begin to bear. This includes fertilising, irrigation, tree training, weed control, pest and disease control and slashing.

From then until about the eighth year, some casual labour may be required for harvesting, dehusking and sorting.

From the eighth year on, labour needs at harvesting increase dramatically making either the purchase of harvesting machinery or the use of contract harvesting services necessary. Note that smaller orchards are generally more labour intensive due to a reduced range of machinery.

## **Other considerations**

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Macadamias are susceptible to a range of pests and diseases and failure to apply appropriate control measures can lead to major losses of yield and quality. Spraying is therefore considered essential, particularly between October and March. Pest and disease monitoring is the best way to determine the regularity and timing of spraying. This requires willingness to either employ specialised crop protection consultants or learn these monitoring systems yourself.

Knowledge of marketing will assist in the negotiation of sales with processors. A commitment to quality management throughout your entire production and marketing system is essential if you wish to maximise returns.

The orchard must be run as a business with accurate record keeping and good financial management.