Financial Planning in the Macadamia Industry

Classroom resources

Year 10,11,12 Business Studies

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Acknowledgement
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Contents

Background ............................................................................................................................................. 5

Lesson sequence ..................................................................................................................................... 9

Task 1 Introduction to the Macadamia Industry .................................................................................. 10
  Part A - Farm visit.......................................................................................................................... 10
  Part B - Industry research ............................................................................................................. 10
  Student worksheet............................................................................................................................ 11

Task 2: Developing skills using Microsoft programs ........................................................................ 13
  Part A - Word processing ............................................................................................................. 13
  Part B - Spreadsheets ..................................................................................................................... 13
  Part C - Publishing ............................................................................................................................. 15

Task 3: Business Plan............................................................................................................................. 17
  The Farm ........................................................................................................................................... 17
  The Business Plan.............................................................................................................................. 17
  Company structure ........................................................................................................................... 18
  Fixed assets ....................................................................................................................................... 26
  Variables ............................................................................................................................................. 28
  Risks to the business ......................................................................................................................... 28
  Student worksheets .......................................................................................................................... 32

Task 4: Financial Planner for Macadamia ..................................................................................... 34
  The scenario......................................................................................................................................... 35
  The Financial Planner ..................................................................................................................... 35
  Production ......................................................................................................................................... 40
  Price .................................................................................................................................................. 42
  Annual costs ....................................................................................................................................... 43
Background

This sequence of lessons is designed to engage business studies students with real world scenarios in the macadamia industry. It was developed in conjunction with the Australian Macadamia Society and the Gateway Schools to Agribusiness, an initiative of the Queensland Government. This resource was trialled by the Gateway School, Kepnock State High School Bundaberg Queensland in 2013 with Year 10 Business Studies.

Gateway Schools to Agribusiness

The Gateway School project aims to help young people make a successful transition from school into further education and/or employment. The project also encourages partnerships between schools, vocational training (VET), universities and industry to provide career opportunities for young people.

The project provides opportunities for students and school communities to engage in the diverse range of careers across businesses based on primary industries. Students gain valuable experience in a horticultural industry while still at school, providing them with the tools and knowledge to make informed decisions about training and employment upon leaving school, and at the same time raising the profile of careers in the agribusiness sector.

The initiative was developed in response to skills shortages across agribusiness industries and the need to attract and retain a skilled workforce across the agribusiness sector for the future.

Australian macadamia industry

Australia is the world’s major producer of macadamia nuts, the only Australian native food crop that has seen significant commercial development for local and export markets. There are 850 growers, producing around 40,000 tonnes, with 70% of production exported as kernel to the world market.

The main growing region stretches around 1,000 kilometres along Australia’s east coast; from the mid north coast of New South Wales up to Mackay in Queensland and the industry annually generates more than $400 million providing economic benefit to local communities. The Australian macadamia industry is worth more than $200 million annually, with 70% of the crop exported to more than 40 countries.

The industry is expanding rapidly as planting and production increases with production forecasts of 39,000 tonnes in 2013.

The Curriculum

It is intended that the resource meets the requirements of the proposed Economics and Business Curriculum to be developed by the Australian Curriculum, Assessment and Reporting Authority.

The Shape of the Australian Curriculum: Economics and Business (December 2012) Australian Curriculum, Assessment and Reporting Authority states that:
“Students will participate in economic and business investigations and enterprise activities, and be provided with opportunities to develop personal and social skills such as leadership and initiative, developing and maintaining positive relationships, negotiating and resolving conflict and making informed and responsible decisions.”

Students should develop critical thinking as they learn to evaluate information and consider alternatives. Broad thinking prepares students for their lives beyond school. The agricultural industry encourages students to consider all aspects of rural industries, including agribusiness as career opportunities.

Increasingly, the curriculum should have a regional and global perspective, with opportunities to understand the complex interdependencies involved with the economics and business area. Students will participate in activities that are more sophisticated, develop economic and business reasoning and interpretation skills, acknowledge the complexities of contemporary life, and make connections to related everyday issues and events.

The ACARA report encourages teachers to have “students investigate an event or issue of interest related to economics and/or business to develop their knowledge and skills in analysis, synthesis and evaluation of economic and business information and data.”

Students will:

- Develop an understanding of an Australian rural industry in a business context
- Manipulate an industry-standard economic tool to develop business cases for investment
- Develop skills in Microsoft suite of programs including Word, Powerpoint, Excel and Publisher

The lesson plans are based on five sequential steps that build on a topic in a logical manner. These are Engage; Explore; Explain; Elaborate; and Evaluate: the 5Es.

This is an inquiry-orientated teaching and learning model where students use their prior knowledge and literacies to develop explanations for their hands-on experiences. Students have opportunities to represent and re-represent their developing understanding. They are engaged actively in the learning process.

__________________________

1 The Shape of the Australian Curriculum: Economics and Business (December 2012) Australian Curriculum, Assessment and Reporting Authority

2 An elaboration of the PrimaryConnections 5Es teaching and learning model Adapted from Bybee (1989) The Australian Academy of Science Primary Connections
The 5 Es

Engage  A lesson that mentally engages students with an activity or question. It captures their interest, provides an opportunity for them to express what they know about the concept or skill being developed, and helps them to make connections between what they know and new ideas.

Explore  Students carry out hands-on activities in which they can explore the concept or skill. They grapple with the problem or phenomenon and describe it in their own words. This phase allows students to acquire a common set of experiences that they can use to help each other make sense of the new concept or skill.

Explain  Only after students have explored the concept or skill does the teacher provide the concepts and terms used by the students to develop explanations for the phenomenon they have experienced. The significant aspect of this phase is that explanation follows experience.

Elaborate  This phase provides opportunities for students to apply what they have learned to new situations and so develop a deeper understanding of the concept or greater use of the skill. It is important for students to discuss and compare their ideas with each other during this phase.

Evaluate  The final phase provides an opportunity for students to review and reflect on their own learning and new understanding and skills. It is also when students provide evidence for changes to their understanding, beliefs and skills.  

Further support

Australian Macadamia Society will support teachers in organising visits to macadamia farms.

Contact Australian Macadamia Society

Suite 1, 113 Dawson Street
Lismore NSW 2480 AUSTRALIA
Telephone: 02 6622 4933
Email: office@macadamias.org

3 An elaboration of the PrimaryConnections 5Es teaching and learning model Adapted from Bybee (1989) The Australian Academy of Science Primary Connections
Website: www.macadamias.org
## Lesson sequence

<table>
<thead>
<tr>
<th>PHASE</th>
<th>LESSON</th>
<th>CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGAGE</td>
<td>Introduction to the macadamia industry</td>
<td>To capture students’ interest and find out what they think they know about rural industries</td>
</tr>
<tr>
<td></td>
<td>Industry research</td>
<td>To elicit students’ questions about farming business.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Develop research skills to provide a background about the macadamia industry</td>
</tr>
<tr>
<td></td>
<td>Farm visit</td>
<td>To provide real-life experiences of a farming operation</td>
</tr>
<tr>
<td>EXPLORE</td>
<td>Develop computer skills using Microsoft programs</td>
<td>Create a range of documents based on data from the macadamia industry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Industry brochure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chart of prices and production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Company letterhead</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Business card</td>
</tr>
<tr>
<td>EXPLAIN</td>
<td>Develop a business plan for a macadamia business</td>
<td>To extend students’ knowledge to design and write a business plan</td>
</tr>
<tr>
<td>ELABORATE</td>
<td>Use the Financial Planner for Macadamia to extend the concept of business planning and investment analysis</td>
<td>Role play an investor in the macadamia industry by using an industry-standard tool to examine scenarios for investment.</td>
</tr>
<tr>
<td>EVALUATE</td>
<td>To provide opportunities for students to represent what they know about the business operation of a rural business.</td>
<td>Folio of student work</td>
</tr>
</tbody>
</table>
Task 1 Introduction to the Macadamia Industry

Aim: To introduce students to the macadamia industry

Students will undertake research into the macadamia industry combined with a farm visit (if possible).

**Part A - Farm visit**

Contact Australian Macadamia Society to organise a farm visit.

Suite 1, 113 Dawson Street
Lismore NSW 2480
Telephone: 02 6622 4933
Email: office@macadamias.org
Website: [www.macadamias.org](http://www.macadamias.org)

If the student group is unable to visit a macadamia orchard, read Appendix 2 - A Visitor’s Guide to Hinkler Park Plantation. This will provide an overview of a typical orchard to give students a concept of the farming practices involved in growing macadamia nuts.

Complete Student worksheet – Part A

**Part B - Industry research**

Read Appendix 1 The Macadamia Story and Appendix 2 Visitor’s Guide to Hinkler Park Plantation.

Complete Student worksheet – Part B
Student worksheet

Part A Farm visit

1. Describe the farm you are visiting:
   - Location
   - Size
   - Number of trees
   - How many staff – permanent and temporary

2. How are the trees propagated?

3. Draw a calendar to show the main tasks carried out in the orchard each month.

4. How are the macadamia nuts harvested?

5. List the equipment (and the value) used on the farm

6. List all of the Workplace, Health and Safety equipment and signs that you see.

Part B Industry research

Read The Macadamia Story and complete the following questions. You may also find the following websites useful.

1. Frequently asked questions give a lot of background

2. About macadamias
   http://www.australian-macadamias.org/about-austrie-macadamias/about-macadamias?lang=en&r=1&Itemid=95

3. Industry information – resources and research
   http://www.australian-macadamias.org/resources-a-research?lang=en&r=1&Itemid=187

Questions

Where are macadamias grown in Australia (include a map in your answer)?

What is the size of the industry (area and production)?

What is the role of the Australian Macadamia Society?

Draw a diagram to illustrate the macadamia process from growing to marketing.
Name three countries that Australia exports macadamia nuts to.
In a paragraph, describe the health benefits of eating macadamia nuts.
Task 2: Developing skills using Microsoft programs

Aim: To introduce students to word processing skills using macadamia industry information.

Part A - Word processing

Use the following information to create a Word document that illustrates the process for growing and processing macadamias.

Processing macadamias
http://www.australian-macadamias.org/home/growing?lang=en&r=1&Itemid=10

Note: do not use the images and words on this website.

Your document should include:

- Title
- Flow chart of the process from the trees to packaging
- Diagrams or images of the processes. These may created or taken from research (sources must be acknowledged).
- Written descriptions of each step in the process

Part B - Spreadsheets

Use the following data to produce a chart of the Annual Production of Nut in Shell. You should graph both production and price. The chart should include:

1. Title
2. Axis labels
3. Background image that illustrates the purpose of the chart

Use the chart to answer these questions:

What is the best way to illustrate the data? Why?

If you change the Y axis for production (tonnes), what is the effect on the chart? How does this represent the data?

What is the production and price for June 1995?

Table 1 Macadamia production and prices

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Nut In Shell prices – $/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
<td>4400</td>
<td>3.10</td>
</tr>
<tr>
<td>1988</td>
<td>5200</td>
<td>3.95</td>
</tr>
<tr>
<td>1989</td>
<td>6800</td>
<td>3.65</td>
</tr>
<tr>
<td>1990</td>
<td>12000</td>
<td>2.50</td>
</tr>
<tr>
<td>1991</td>
<td>10000</td>
<td>1.60</td>
</tr>
<tr>
<td>1992</td>
<td>13000</td>
<td>2.03</td>
</tr>
<tr>
<td>1993</td>
<td>14500</td>
<td>2.75</td>
</tr>
<tr>
<td>1994</td>
<td>19700</td>
<td>2.80</td>
</tr>
<tr>
<td>1995</td>
<td>17500</td>
<td>3.00</td>
</tr>
<tr>
<td>1996</td>
<td>20500</td>
<td>3.05</td>
</tr>
<tr>
<td>1997</td>
<td>25400</td>
<td>2.70</td>
</tr>
<tr>
<td>1998</td>
<td>26500</td>
<td>2.45</td>
</tr>
<tr>
<td>1999</td>
<td>33000</td>
<td>2.25</td>
</tr>
<tr>
<td>2000</td>
<td>29500</td>
<td>2.12</td>
</tr>
<tr>
<td>2001</td>
<td>34800</td>
<td>2.45</td>
</tr>
<tr>
<td>2002</td>
<td>30200</td>
<td>2.75</td>
</tr>
<tr>
<td>2003</td>
<td>29700</td>
<td>3.20</td>
</tr>
<tr>
<td>2004</td>
<td>43700</td>
<td>3.45</td>
</tr>
<tr>
<td>2005</td>
<td>35500</td>
<td>3.60</td>
</tr>
<tr>
<td>2006</td>
<td>43900</td>
<td>2.60</td>
</tr>
<tr>
<td>2007</td>
<td>41800</td>
<td>1.50</td>
</tr>
<tr>
<td>2008</td>
<td>36000</td>
<td>1.65</td>
</tr>
<tr>
<td>2009</td>
<td>37500</td>
<td>1.90</td>
</tr>
<tr>
<td>2010</td>
<td>35500</td>
<td>2.65</td>
</tr>
<tr>
<td>2011</td>
<td>28500</td>
<td>3.10</td>
</tr>
<tr>
<td>2012</td>
<td>40000</td>
<td>3.20</td>
</tr>
</tbody>
</table>
Part C - Publishing

Create documents for a macadamia growing business using a publishing program such as Publisher:

- Company letterhead
- Business card

The documents should include a design that portrays:

- Business colour schema
- Company name
- Company logo
- Company vision
- Contact details

Examples are included.

Figure 1 Business card

![Business Card Image]
Task 3: Business Plan

Aim: To develop a Business Plan for a 20 hectare macadamia orchard.

The Farm

The scenario is based on a typical 20 hectare orchard (including equipment) purchased for $760,000. The farm must achieve a 3.5 tonne/hectare crop and receive $3/kg based on current prices at 33% kernel recovery.

For the 20 hectare orchard we have made assumptions that affect costs of production. The farm includes equipment worth $760,000; the farm will achieve a 3.5 tonne/hectare crop and you will receive $3/kg based on current prices at 33% kernel recovery.

The Business Plan

A business plan is a detailed study of the organisation’s activities, which highlights where the organisation has been, where it is now and where it wants to get to in the future, and enterprises an action program to achieve these results.

The business plan examines three aspects of the organisation in relation to time:

1. The organisation’s present position
2. Where the stakeholders want it to be within a three to five year time frame
3. How it will reach the position desired by the stakeholders

Confusion exists in using the term ‘business plan’. People refer to business plans associated with the establishment or acquisition of a new venture when they often mean feasibility studies. Others talk of business plans for the launch of new products or services, when they really mean product plans. Small business planning comprises the development of strategic plans, (long term and directional) from operational plans (medium term) and tactical plans (short term and specific). Business planning involves both of these areas.
Figure 3 The three major components of small business planning.

**Strategic planning:** is the managerial process of developing and maintaining a strategic fit between the enterprise and its changing environmental opportunities. It relies on developing clear objectives and goals and may include a growth strategy and product portfolio plans.

**Tactical plans:** investigate the costs and returns of the enterprise as well as identifying the enterprise’s current and required resources then planning on the best use of those resources.

**Operational plans:** complete the planned tasks and monitor the outcomes and adjust the plan accordingly.

Finally, this should be seen as a cycle that starts again by reviewing the enterprise’s goals.

**Company structure**

One of the more important decisions you must make when setting up your business is its legal structure. Your choice of structure can impact on your business financially and how your business is perceived. The structure can also limit your liabilities and protect your assets. An incorrect structure may also affect your business adversely.

Common business structures available in Australia include:

- sole proprietor/trader
- partnerships
- companies
- trusts
• associations
• corporations
• government owned enterprises
• profit or non-for profit legal structure.

The structure that is most appropriate for your business will depend on factors such as:

• size of your business
• number of people involved and their preferences
• type of business
• cost and difficulty of establishment
• taxation – achieving the maximum economic rewards
• financial – present and future
• superannuation
• management control and independence
• government interference – how much is acceptable to you
• need for additional skills
• risk/liability exposure to individuals
• your own personal preference (what works for you)
• family/cultural expectations
• ownership transfer
• confidentiality
• protection of stakeholders and assets.

Other guidelines that may be helpful in choosing a business structure include the following.

• Ensure the structure is one that you understand and you know what your role is.
• Choose flexibility as changes may incur tax liability later.
• Document agreements for partnerships and shareholders.
• Ensure establishment and ongoing costs are affordable.
- Consider your own personal circumstances.
- Ensure the administration of your business is under control.

The most common business structures for small business are furthered explained below.

**Sole proprietor/trader**

A sole trader is one who trades as an individual without the use of a company structure or partners. The sole trader is the sole owner of the business therefore has complete control over it and is responsible for the actions of the business. There are insignificant costs to establish — a business name costs $100 (currently) however there is no requirement to register a business name. The Australian Taxation Office (ATO) issues an ABN (Australian Business Number) and a sole trader is obliged to register for GST only when their earnings reach $50,000.

As a sole trader you can trade under your own name or register a business name. The business and the sole trader are still one and the same and therefore as a sole trader you a legally responsible for the business – you and your business are not two separate entities.

Administration of a business as a sole trader is simple and straightforward. An important point to note is that while the sole trader retains the profits from the business, the liabilities extend to privately owned assets.

**Partnership**

A partnership is similar to a number of sole traders joining together. A partnership is obliged to register a business name so that it can trade under that name. Although the partnership is treated as a ‘unit’ for accounting purposes, it is not treated that way by the law. Therefore all partners are jointly and individually liable for all debts and obligations under the partnership regardless of the partnership percentage. Partnerships do not offer legal protection.

**Company**

A company is formed when a group of individuals, or firms, combine as shareholders and incorporate under the provisions of the Corporations Act 2001 (Commonwealth). Companies can either be proprietary limited (Pty Ltd) or public companies. Proprietary limited companies cannot offer their shares to the public hence they are often called private companies. Public companies can offer shares to the public.

Private companies have a share capital. They can have less than fifty non-employee shareholders, who do not promote investments. Another difference between private companies and public
companies is that private companies have less financial and disclosure obligations. The private company is a separate legal entity, set apart from the individuals (shareholders) who own or operate it. The company can (on its own):

- invest in property
- enter into contracts
- lend and borrow money
- operate its own bank account
- sue and be sued
- be bought and sold

A company provides financial protection for those who own or operate it. The shareholders only risk their contribution to the company not their personal assets. The company’s separate identity is recognised for tax purposes.

A company is more complex than a sole trader structure and must have a written constitution that must:

- include a memorandum of association that states the company’s name, address, objectives, capital
- include articles of association that detail the company’s internal rules of operation

A company must also:

- be registered with the Australian Securities and Investments Commission (ASIC) and receive an ACN (Australian Company Number)
- include their ACN on all stationery
- be incorporated
Table 2: Comparison of the three main business structures

<table>
<thead>
<tr>
<th>Item or feature</th>
<th>Sole Trader</th>
<th>Partnership</th>
<th>Private Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment cost/other costs</td>
<td>Nil.</td>
<td>Business name and cost of partnership agreement approx $1000.</td>
<td>Reservation of name registration approx $500. Professional fees approx $500.</td>
</tr>
<tr>
<td></td>
<td>Business name $100-nil annual registration costs.</td>
<td>Time cost of partner meetings.</td>
<td>$500 for filing fees.</td>
</tr>
<tr>
<td>Ownership/Management</td>
<td>One individual. Owned personally/sole trader.</td>
<td>2-20 partners.</td>
<td>1-50 shareholders. No separate legal entity. Partners &amp; business are the same.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Property, assets and liabilities belong to partners/joint.</td>
<td>Property and assets belong to company, not the members/Board of Directors.</td>
</tr>
<tr>
<td>accounting and tax)</td>
<td></td>
<td></td>
<td>requirements.</td>
</tr>
<tr>
<td>Legal status</td>
<td>Owner and business are the same.</td>
<td>No separate legal entity. Partners &amp; business are the same.</td>
<td>Shareholders are legally separate from the business.</td>
</tr>
<tr>
<td>Personal asset protection</td>
<td>Nil.</td>
<td>Nil.</td>
<td>Yes, if no personal guarantees.</td>
</tr>
<tr>
<td>Tax</td>
<td>Business loss offsets possible. High marginal rates on income tax. 50%</td>
<td>Same as sole trader.</td>
<td>30% income tax rate.</td>
</tr>
<tr>
<td><strong>Income splitting</strong></td>
<td>Very limited opportunities.</td>
<td>Possible. Rules involved.</td>
<td>Flexibility in distribution as dividends, payments to employees.</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------------------------</td>
<td>---------------------------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Legal documentation requirements</strong></td>
<td>None, except registration of business name.</td>
<td>Partnership agreement and registration of business name.</td>
<td>ACN, Memorandum of Association, Articles of Association, Certificate of Incorporation, Company Seal, Company and business names and ACN on all stationery.</td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td>Easy to restructure.</td>
<td>Can be difficult due to competing interests of partners.</td>
<td>Good opportunities although changes may affect tax adversely.</td>
</tr>
<tr>
<td><strong>Continuity</strong></td>
<td>Business ends with death or bankruptcy of sole trader.</td>
<td>May continue after death of one partner if structured correctly otherwise will end.</td>
<td>Continues unless wound up by shareholders or directors.</td>
</tr>
<tr>
<td><strong>Superannuation</strong></td>
<td>Deductions limited.</td>
<td>Deductions limited.</td>
<td>Flexible options.</td>
</tr>
<tr>
<td><strong>Profit distribution</strong></td>
<td>Immediate.</td>
<td>As agreed.</td>
<td>From profits only and according to ownership shares and constitutional rights.</td>
</tr>
</tbody>
</table>
Fixed assets

Understanding the value of the enterprise’s fixed assets is an important element in determining the current position of the enterprise.

Land

A market value for land is established by considering similar land sales in similar location and condition. Recent local and regional sales of grazing or cultivated land (per hectare/acre) are the best indicators of current market value. Base your estimate of market value on the sale of similar properties in the same locality or one nearby. Take into account land use, water availability and improvements.

Buildings/improvements

Replacement value is the best valuation method for buildings and improvements. In other words consider how much it would cost to build a similar building.

Plant and machinery

Plant and machinery are valued using the current market value. That is the value they would return if they were sold in the current market. The book value or written-down value of machinery is the plant/machinery’s value that has reduced by (accumulated) depreciation. Depreciation is essentially a calculation for taxation purposes and hence the written-down value is only a book value and is not a true reflection of the asset value.
Table 3 Farm equipment (Note: the equipment on the farm is mostly 2 years old)

<table>
<thead>
<tr>
<th>Trees and equipment</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees – 312 trees/ha</td>
<td>Fertilising</td>
</tr>
<tr>
<td>Shed</td>
<td>Pest &amp; disease control</td>
</tr>
<tr>
<td>Slasher</td>
<td>Irrigation (water &amp; pumping) - fixed service charge, pumping, allocation &amp; consumption charges</td>
</tr>
<tr>
<td>Carryall for tractor</td>
<td>Fuel and oil for carting nuts</td>
</tr>
<tr>
<td>Blower mister</td>
<td>Fuel &amp; oil for slashing; side-pruning; spraying insecticides &amp; herbicides</td>
</tr>
<tr>
<td>Irrigation equipment</td>
<td>Mulching</td>
</tr>
<tr>
<td>Fertiliser spreader</td>
<td>Weed control</td>
</tr>
<tr>
<td>Irrigation water – channel water</td>
<td>Contract harvesting</td>
</tr>
<tr>
<td>Tractor</td>
<td>Freight to processor</td>
</tr>
<tr>
<td>Trailer</td>
<td>Hired labour</td>
</tr>
<tr>
<td>Boom spray</td>
<td></td>
</tr>
<tr>
<td>Vehicle - utility</td>
<td></td>
</tr>
<tr>
<td>Dehusker</td>
<td></td>
</tr>
<tr>
<td>Dryer</td>
<td></td>
</tr>
</tbody>
</table>
Variables

There is a range of variables that can have an impact on macadamia investment returns. These include:

1. Orchard purchase price OR establishment cost. This is the amount you are investing and the amount you expect to get a return on. Whether you buy cheaply or pay "too much" for your block will have a big impact on your % return.

2. Price received for nut-in-shell (NIS). Use an industry standard of $3.00/kg (for 33% kernel recovery net of levy). You also need to consider that prices vary a lot, so you need to consider a price range of between $2 and $4/kg.

3. Yield per hectare. This varies a lot across the industry and can dramatically affect the gross income and hence the % return on an individual farm. In the tables below, we have considered a range of 2.5-4.5 tonnes/hectare (1 - 1.8 tonnes/acre) which is a reasonable range in the industry.

4. Costs of production. This is a result of management skills and economies of scale and also varies markedly across the industry.

Risks to the business

Risks affect the business in diverse ways. Risk effects are usually apparent in direct outcomes by increasing costs. Some risks influence the business by affecting the public, public perception, the environment, or safety and health considerations. When analysing risk you need to look at the effect risks have on the business as a whole.

Risk assessment is the process of quantifying the risk in a business. Risk analysis has two aspects:

- The first determines the likelihood of a risk occurring (risk frequency); risks are classified along a continuum from very unlikely to very probable.
- The second judges the impact of the risk should it occur (consequence severity).
In analysing a risk you are deciding on the relationship between the likelihood of a risk occurring and the consequences of the risk you have identified. You then have to define the level of risk and what it means in terms of managing the risk.

Identify the risks that affect your business. These can be:

Physical: this could involve personal injuries, environmental and weather conditions and the physical assets of your business.

Financial: this could mean fraud, theft, membership fees, insurance costs, loss of funding etc.

Legal: this includes responsibilities imposed by federal, state or local governments

Ethical or moral: involving actual or potential harm to the reputation or beliefs of an individual or the business.

How do you identify the different types of hazards/risks?

- conduct an audit to evaluate the effectiveness of the workplace health and safety system
- conduct a workplace inspection
- review accident/incident investigation reports and insurance claims
- look at injury/illness records
- look at worker/customer complaints
- research risk management plans from similar businesses
- talk to stakeholders, clients and employees
- research any legislation that is applicable to the business and its risks
- research any policies and procedures that are applicable to the business and its risk management
- analyse scenarios.

Evaluating the risk

In this step you are deciding whether a risk is acceptable. Your evaluation will take into account the following:
• the importance of the activity you are risk managing and its outcomes
• the degree of control you have over the risk
• the potential and actual losses which may arise from the risk
• the benefits and opportunities presented by the risk.

An acceptable risk is not necessarily one that is insignificant. You may decide that a risk is acceptable because:
• the risk level is so low that it does not warrant spending time and money to manage it
• the risk level is low and the benefits presented by the risk outweigh the cost of managing it
• the opportunities presented by the risk are much greater than the threats.

The goal of risk analysis is not to eliminate all risk from the business. Rather, the goal is to recognise the significant risk challenges to the business and to initiate an appropriate management response to their management and mitigation.

List the risks for the business in the table; assign each risk a likelihood that it will occur and then rate the consequences of that risk occurring. The level of risk is calculated by multiplying the likelihood by the consequences.

Table 4 Risk assessment

<table>
<thead>
<tr>
<th>Risk</th>
<th>Likelihood (A)</th>
<th>Consequences (B)</th>
<th>Level of Risk (A x B)</th>
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Add more rows

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Consequences</th>
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<tbody>
<tr>
<td>remote 1</td>
<td>no impact 1</td>
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<tr>
<td>unlikely 2</td>
<td>minor 2</td>
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<tr>
<td>likely 3</td>
<td>moderate 3</td>
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<tr>
<td>highly likely 4</td>
<td>major 4</td>
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<td>----------------</td>
<td>--------</td>
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<tr>
<td>near certainty 5</td>
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</table>
**Student worksheets**

**Business plan**

<table>
<thead>
<tr>
<th>Business Idea</th>
<th>Products/services</th>
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<tr>
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<thead>
<tr>
<th>Vision</th>
<th>Business Goals</th>
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**SWOT analysis**

<table>
<thead>
<tr>
<th>Internal</th>
<th>External</th>
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<tbody>
<tr>
<td>Strengths</td>
<td>Opportunities (in the market)</td>
</tr>
<tr>
<td>Weaknesses</td>
<td>Threats (in the environment)</td>
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</tbody>
</table>
### Analysis of SWOT

<table>
<thead>
<tr>
<th>Strength + Opportunity (Advantage)</th>
<th>Weakness + Strength (Danger)</th>
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<tbody>
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<tr>
<td><strong>Other</strong></td>
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**Business objectives**

<table>
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<td>3.</td>
<td>4.</td>
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<td>5.</td>
<td>6.</td>
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</table>

**Operations plan**

<table>
<thead>
<tr>
<th>Where are we now?</th>
<th>Strategy</th>
<th>Actions</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>How will we get there?</td>
<td>What steps will we take?</td>
<td>Where do we want to be?</td>
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Task 4: Financial Planner for Macadamia

Aim: To develop business analysis skills utilising an industry financial planning tool.

Investors and growers need accurate financial information in order to make sound investment and management decisions. Financial and production data is needed for planning. The Financial Planner for Macadamia is a financial planning software tool for the Australian macadamia industry that lets an investor explore different farming scenarios before committing their finances.

Business students are able to use the Financial Planner for Macadamias in the same way as investors. They take on the role of an investor in the macadamia industry, using the financial planner, to investigate a scenario. It has capability for:

- Investment planning – allows planning for investment in a business
- Cash budgeting – performance indicators for an existing business, either a template or a created profile

Students can use the financial planner to evaluate the viability of a range of macadamia investment options and how they can be financed. The planner can be used to measure the financial impact of alternative farm business strategies such as expansion, tree replacement, capital investments and operational changes. Over the life of an analysis, the relative impact of factors such as price, yield and quality can also be measured.

Schools are able to obtain a free license to use the macadamia financial planner by contacting the Department of Agriculture, Fisheries & Forestry Queensland (DAFFQ) who developed the software. A free license to use will be issued to each school and the software supplied via disk. There is limited support for schools in using the software.

To access the Financial Planner for Macadamia, contact the Business Manager, jodie.campbell@daff.qld.gov.au

For queries about the financial planner, contact Shane Mulo, QDAFF shane.mulo@daff.qld.gov.au
The scenario

The scenario is based on purchasing a typical 20 hectare orchard (including equipment) for $760,000, achieving a 3.5 tonne/hectare crop and receiving $3/kg based on current prices at 33% kernel recovery.

Task 1 Determine the annual return from investing in the established orchard.

Task 2 Compare returns from Task 1 with the average return over 30 years of establishing an orchard on bare land.

There are several risks involved in macadamias as an investment which suggest you should aim for a higher return than if you were getting involved in something more secure like BHP shares. Some of these risks include the possibility of a cyclone or storm severely damaging trees in your orchard, a major price slump for NIS or a new pest or disease affecting yield.

Task 3 Compare the Return On investment on the established farm if a cyclone causes major destruction on your farm in Year 5. One third of the trees are blown out of the ground and the nut crop is reduced to 10% of that expected.

The Financial Planner

The Financial Planner for Macadamia provides an objective measurement of the viability of a range of macadamia farm business investment options.

This includes how and when particular expenditure will be made, comparison of one investment scenario versus another, the impact of debt and equity on an investment, and the likely impact of particular farm management strategies on cash flows and profitability.

The use of customisable profiles enables students to easily adapt data to suit their specific situation. The four different types of analysis include an investment appraisal, cash budget, profile comparison and sensitivity analysis. Within these analyses a range of key economic indicators are available to measure viability over the life of an investment as well as annual summaries for a range of economic criteria.
A profile is created by choosing a suitable template (there are 6-7 options) and customising data to suit.

The Financial Planner is a single user MS-Windows executable that is compatible with XP through to Windows 7/8. Support files for the program are stored under the “Public Documents” folder on the local PC.

As it is a standalone application, it is important that scenarios or “profiles” created or modified by students are backed up. The program contains a backup facility that can be used to backup all profiles into a single backup file. Profiles can also be exported to individual XML files which can be copied or moved as needed. Technical information and financial explanations are available in the Help section within the program.

The Financial Planner for Macadamia provides a range of analyses, including investment, cash budget, scenario comparison and sensitivity analysis. Each of these analyses provides annual financial summaries for up to thirty years. The analyses are underpinned by the industry profiles, each of which describes a unique farm business scenario. The Financial Planner can be used to analyse a range of macadamia industry scenarios and criteria, such as:

- the viability of investment in the macadamia industry;
- the profitability of existing or proposed management strategies over time;
- the relative impact of key criteria such as yield, price, costs, and kernel recovery on profitability; and
- annual cash flows, balances and finance requirements over the life of an investment

The cash budget includes cash on hand at the start and end of each year, tax payable, periodic capital and profit. It also provides a range of performance indicators including interest coverage ratio, farm operating surplus and debt to income ratio. Supporting data also includes annual debt, principal and interest, production and taxable income.

A sensitivity analysis is available to allow users to model variation in each of these criteria and compare their relative impact on profitability over time. Users can adjust threshold values for any two of these criteria across two different scenarios to compare outcomes in each case. This allows, for example, comparison of best and worst case scenarios, with results displayed against a control
scenario to determine the range of impact. Several performance measures can be charted including production, profit, cumulative cash flow, nut price and revenue, operating expenses and present value.

For detailed comparison of more complex farm business scenarios, there is a profile comparison analysis. This facility allows simultaneous comparison of up to ten individual profiles and includes ranking of these according to key performance indicators such as net present value and internal rate of return. A range of performance measures can also be charted annually, similar to that of the sensitivity analysis.

Each analysis can run for between three and thirty years, providing several performance measures on an annual basis as well as over the life of the analysis. Results are presented in tabular and graphical form and can be printed or exported for use in other programs.

Each profile contains all of the information required by the analyses, including tree planting details, production, prices, inflation, depreciation, taxation, costs, periodic expenditure and finance. A detailed list of information contained in each profile is shown in Table 5.

Table 5 Information contained in profiles

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis term</td>
<td>An analysis term can be set to between 3 and 30 years.</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>Annual costs are automatically indexed for inflation.</td>
</tr>
<tr>
<td>Depreciation method</td>
<td>For depreciation of capital items. Both straight line and reducing balance methods are supported.</td>
</tr>
<tr>
<td>Business model</td>
<td>Used for taxation purposes. Options include partnership, sole trader, company or custom taxation rate. Taxation can be excluded by selecting a custom taxation rate of zero.</td>
</tr>
<tr>
<td>Initial investment costs</td>
<td>Investment costs can be itemised with optional depreciation of each as required.</td>
</tr>
<tr>
<td>Initial and final values</td>
<td>Initial and final value of the asset at the beginning and end of the analysis term.</td>
</tr>
</tbody>
</table>
**Required rate of return**  
The rate of return that is required to make the investment project acceptable. This is used in conjunction with the discounted cash flow analysis, part of the investment module.

**Tree plantings**  
Includes tree counts, spacing, age, growth pattern, life span, optimum yield potential and kernel recovery. There is no limit on the number of plantings that can be defined in a profile.

**Nut prices**  
Includes both current and future price estimates. Future pricing is based on fully customisable price models.

**Industry levies**  
Based on a rate payable in cents per kilogram of kernel produced.

**Annual costs**  
Includes fixed and variable costs for both non-bearing and bearing trees and standard and custom cost categories. Variable costs can be expressed as dollars per hectare or dollars per tonne.

**Periodic expenditure**  
Includes both purchases and leases. Purchases include both cash and finance with full amortisation of finance and depreciation. Leases include support for recurring leases as well as payout, financing and depreciation of residuals.

**Finance**  
Includes both cash and borrowings with support for tax free owner contributions and withdrawals. Supports full amortisation of finance.

A set of yield response curves is also integrated into the planner, providing models of yield potential for each year of tree age. This is related to optimum mature yield to determine annual yield for trees that are not yet fully mature. Users can easily create their own curves to model the performance of their trees. Similarly, a set of nut price models is built into the planner, allowing users to choose a future price scenario that reflects what they believe will be future price trends. Users can easily create and customise their own price models if required. The relationship between each of the major components in the financial planner is shown in Figure 4.
Production

Production or yield is one of the key drivers of profitability. Yield is governed by a range of factors including the number of trees planted, tree age and rate of growth, planting density, nutrition, canopy management and kernel recovery. To accurately estimate both current and future production, the financial planner manages information about existing as well as proposed tree plantings.

Tree information is recorded in the plantings section within profiles. In this context, a planting is defined as a group of trees of uniform age, spacing, yield potential and kernel recovery. Users can create as many plantings as they need to accurately describe all of the trees on their farm. Planting details include tree counts, spacing, age at first harvest, expected mature yield and saleable kernel recovery (Figure 5).
Plantings can be active throughout an entire analysis term or have their life span limited to a specific range of years within that term. This enables users to create scenarios that include future tree plantings, tree removal or other orchard changes.

Each planting is linked to a yield curve that describes the proportion of expected mature yield that is available each year as trees age. Several yield curves based on typical yield potential for trees at different planting densities are included with the program. Users can either automatically assign one of these standard yield curves to their planting according to the closest matching planting density, or they can choose a specific yield curve themselves. Users also have the option of creating and customising their own yield curves (Figure 6). This can be useful for accommodating irregular yield patterns such as biennial bearing, steady yield decline in older or stressed trees, or high early yields in dense plantings.

For each year of an analysis, the planner examines all plantings to determine the total trees for that year, their ages and their yield potential based on tree age in conjunction with yield curves. This information is then used to estimate combined production across all plantings for that year. Saleable kernel recovery data from the profile is used to convert nut in shell to kernel estimates.
Figure 6 Creating or customising a yield curve.

**Price**

Future nut in shell price is perhaps the most challenging and variable factor to manage. The financial planner utilises a set of price models that reflect a range of future price scenarios, including both linear and non-linear growth patterns at various rates.

Users enter the current nut in shell price in the profile and also select an appropriate price model for estimating future prices. The current nut in shell price is used in the first year of the analysis to convert production to revenue. Price fluctuations relative to the current price are applied in all subsequent years of the analysis according to the shape of the selected price model (Figure 7).

Users can either choose one of the standard price models provided with the planner, or create their own custom price model, using a similar process to that of creating a yield curve.
Annual costs can be recorded for both bearing and non-bearing trees. These include total fixed costs as well as variable costs. Variable costs can be expressed either as dollars per hectare or dollars per tonne of nut in shell (bearing trees only). A range of typical cost categories is included and there is also provision for entering up to two custom fixed costs and four custom variable costs (Figure 8).

The financial planner uses planting information to distinguish between bearing and non-bearing trees on an annual basis within analyses. As non-bearing trees grow and begin to bear nuts, a gradual transition is required from non-bearing costs to bearing costs. The planner smoothly manages this transition based on tree age. Program parameters allow users to control the percentage of bearing costs to be applied when trees first begin to bear, as well as the number of years after first bearing at which full costs are applied.
Quality

Saleable or sound kernel recovery is specified for each planting created within a profile (Figure 8). Processors typically pay bonuses for kernel recoveries exceeding the industry average and users can set program preferences that specify the industry average sound kernel recovery (SKR) and unsound kernel recovery (UKR) as well as the bonus paid for each 1% that SKR exceeds the industry average (Figure 9).

For each year in an analysis, conversion of total tonnes of nut in shell to kernel incorporates both actual SKR and industry average UKR. The revenue calculation for each year also includes estimation of bonuses paid for exceeding industry average sound kernel recovery.
Figure 9 Program preferences showing kernel recovery options.

**Taxation**

Taxation can be applied within the financial planner via four different business models including sole trader, company, partnership and custom. Users choose one of these models within a profile.

For sole traders, taxation is calculated according to marginal taxation rates. These rates are built into the program and are updateable via the internet. Marginal tax rates are also used for partnerships, with each partner attracting a tax liability according to their proportion of ownership. This partnership information can be recorded within a profile.

For companies, a flat taxation applies and this can be customised via a program parameter. The custom option is also based on a flat taxation rate that is entered directly by users in the profile. Taxation can be eliminated from all analyses by selecting a custom taxation rate of zero. The planner also supports the optional deferral of tax assets in years where there is a net loss.

**Depreciation**

The financial planner supports depreciation of initial investment costs as well as periodic capital expenditure, including payout of residual values on termination of leases. Users can choose between
straight line and reducing balance methods of depreciation. Where straight line depreciation is specified, assets are assigned a life span in years, during which time their value is written down annually by a fixed proportion of their initial value. The reducing balance method allocates a fixed percentage of an asset’s written down value each year, based on a depreciation rate entered by the user. Both depreciation methods make the assumption that there is no residual value at the end of the asset’s useful life. Any amount not depreciated at the end of the analysis term is assumed to be recovered upon sale of the business. These amounts are displayed as residual capital within the financial planner.

Users can choose which assets they wish to depreciate and can also set either the lifespan or the depreciation rate for each asset depending on the depreciation method selected.

**Analyses**

Four analyses are available within the financial planner. These include investment, cash budget, profile comparison and sensitivity analyses.

**Investment analysis**

The investment analysis is useful for investors and others who wish to examine the viability of macadamia industry investment. It is also useful for existing industry members who wish to measure the financial viability of proposed changes to their business such as expansion, capitalisation and other management changes.

The investment analysis measures the profitability of a specific investment scenario over time and provides standard financial indicators such as Net Present Value and Internal Rate of Return. As such, it allows investors to compare the viability of macadamia production with other forms of investment. It also provides a summary of cash flows, periodic capital expenditure and the present values of net cash flows on a yearly basis. Results are available in both tabular and graphical format (Figure 10).
Figure 10 A discounted cash flow analysis

**Cash budget analysis**

The cash budget analysis allows existing growers to examine their annual cash balance. It is useful for measuring the impact of changes to existing farm operations and also for determining whether finance will be required and if so, in which years. Annual cash on hand is reported at both the start and end of each year of the analysis, with a breakdown of revenue, inflows, expenditure and withdrawals in between. This analysis also includes estimated tax payable, deferred tax assets and debt servicing costs, including principal and interest.

Performance indicators are presented for each year of the analysis, including operating expenses before and after tax, profit, interest coverage ratio, farm operating surplus and debt to income ratio. Results are available in both tabular (Figure 11) and graphical format.
Figure 11 A cash budget analysis

Profile comparison analysis

The profile comparison analysis compares and ranks the profitability of multiple profiles. To use this feature, users must first create two or more profiles, each of which can reflect a different business scenario. By creating individual profiles, users can model complex scenarios involving many dependent criteria. Once created, profiles can easily be cloned and modified to accommodate very specific management changes as required.

Up to ten profiles can be simultaneously compared and ranked according to their net present value or internal rate of return. Charts are also available comparing annual summaries for each of the profiles for a range of criteria including cumulative cash flow, net nut revenue, nut in shell price, operating expenses, present value, profit, production and tax payable (Figure 12).
Sensitivity analysis

The sensitivity analysis provides a ‘what if’ style tool allowing users to adjust key criteria within a single profile and measuring the impact on profitability over the life of an investment.

Up to two custom scenarios can be derived from a single profile, allowing users to model best and worst case outcomes. Each scenario is customised by adjusting threshold levels for criteria such as yield, kernel recovery, annual costs, and nut in shell price. The level of threshold adjustment available is dependent on the selected criterion. A separate analysis is conducted of the two custom scenarios as well as the original profile, which in this instance becomes the control scenario.

The investment viability of each scenario is presented in the form of net present value and internal rate of return.

A range of annual analysis criteria are also presented graphically for each scenario, including cumulative cash flow, net nut revenue, nut in shell price, operating expenses, present value, profit, production and tax payable (Figure 13).
Developers of the Financial Planner

The Financial Planner for the macadamia industry was developed by Shane Mulo, Geoff Slaughter and Paul O’Hare.

Shane Mulo is a Department of Agriculture, Fisheries & Forestry Queensland senior extension horticulturist specialising in farm management information systems.

Dr Geoff Slaughter is a senior lecturer in accounting at the University of Southern Queensland, specialising in environmental accounting. He has been involved in a number of projects involving the development of financial and economic models for sustainable and profitable management in the agribusiness sector over the last ten years.

Paul O’Hare is a Department of Agriculture, Fisheries & Forestry Queensland senior principal extension horticulturist with 28 years’ experience as a horticultural extension officer with special expertise in macadamias, facilitation of industry groups, technology transfer and project evaluation.
Appendix 1: The Macadamia Story

It is believed that long before Australia was mapped by European explorers, Aboriginal people would congregate on the eastern slopes of Australia’s Great Dividing Range to feed on the seed of two evergreen trees, one of which they called ‘Kindal Kindal’.

In the 1850’s these trees were noticed by a British botanist Walter Hill and by German botanist Ferdinand Von Meuller, who later became the Director of the Botanical Gardens of Brisbane, Australia. The two men were struck with the majestic beauty of the specimens found growing in the rain forests of Queensland.

The nature of the Australian macadamia industry is such that it requires a significant level of professional skill amongst growers, processors and marketers. The importance of the industry to the Australian economy in terms of its contribution to local employment and investment as well as domestic and export markets cannot be overstated.

The Australian macadamia industry is the largest producer of the only commercially viable native Australian product in the world. The combination of macadamias’ unique flavour, texture and heritage is a source of great pride amongst those involved in the industry.

Production of macadamia nuts, the only Australian native plant crop that has been developed commercially as a food, is centred in Northern New South Wales and South Eastern Queensland. These areas provide the rich soils and high annual rainfall needed to promote maximum growth.

Macadamia trees grow slowly to heights of 12 to 15 metres. They have shiny dark green leaves, and bear sprays of sweet-smelling flowers. Each spray produces from four to fifteen ‘nutlets’ which will eventually ripen into nuts.

The nuts themselves grow encased in a hard, woody shell, which is protected by a green-brown fibrous husk. The nuts fall to the ground between March and September each year and are harvested by pin wheel harvesters at regular intervals.

Growing macadamias
Flower initiation occurs mainly during May with cool weather and shortened days. Prolonged overcast weather in early autumn can bring about earlier initiation.

The flower cluster is a raceme with 200 or more perfect flowers. Flowers are pink on *M. tetraphylla* and creamy white on *M. integrifolia*. Each flower has four stamens and a pistil with an ovary which contains two ovules. The flowers are protandrous – male first – with pollen being released 1-2 days before the stigma – female part – becomes receptive.

Most flowers first open from the basal or top end of the inflorescence and may take up to a week for the distal ones to open.

Heavy flowering may cause excessive carbohydrate depletion. After flowering only one ovule is fertilised and only about 1% of flowers set fruit. At about 5-8 weeks after flowering considerable nut drop occurs when nuts are about pea size.

Shell hardening takes place in early December followed by rapid oil accumulation in late December and January. Sunlight and warmth during the oil formation period may account for better quality. Dry periods during the oil formation period increase kernel recovery and Grade 1 kernels while wet overcast conditions depress quality.

Nut development in macadamia from full flowering (anthesis) to kernel maturity takes about 30 weeks. Anthesis in the last week of September would be followed by an exponential increase in growth at 4-7 weeks (October/November), and shell hardening in 14-15 weeks (end of December) at which time cell division is complete and no further growth takes place. For the next three months (January to March) nuts mature by converting sugars and starches to oil. This is a very important process which determines the final quality of the nut.

**Environment**

Although macadamia originated in subtropical rainforest it can tolerate a wide range of moisture conditions. Macadamia has the potential to adapt to poor soils with the aid of proteoid roots – intense clusters of short lateral roots which greatly improve the plant’s ability to absorb nutrients.

**Soils**

Soil should be 1-2m deep and well drained with a pH of 6.0 in 1:5 water (or 5.0 in CaCl₂). Soils should be high in organic matter with organic carbon content above 4%.
Macadamias will grow on a wide range of well-drained soils. Although macadamias will grow on steep hillsides and rocky sites, these should be avoided for commercial operations as they make cultural and harvesting operations difficult and costly.

Tree stumps, large roots and surface rock should be removed but deep ripping is required only if there are hardpans or compaction layers.

Soil should be analysed and treated as necessary in the tree row after the grass has been killed with herbicide. Soil pH should be adjusted to 6.0 (1:5 water) or 5.0 (1:4 CaCl₂) and lime or dolomite, phosphorus, copper and zinc added as required about three months before planting. A green manure crop can be used to protect the cultivated soil from sunlight and erosion.

**Climate**

Areas selected must be frost free, for even light frosts may damage young trees. Temperature is the dominant climatic factor influencing growth and productivity. Optimum growth and photosynthesis occurs in the narrow range of 20-25°C. Long periods of high temperatures can cause yellowing in new growth. This is seen in hot locations on the North West side of trees, when temperatures exceed 38°C after midday. In cooler months the symptoms disappear. Close planting and under tree irrigation can help reduce temperatures at hot locations like Rockhampton in Queensland.

Mature macadamias can withstand short periods of frost to 6°C, but young trees could be severely affected by frost of 1-2°C. Wrapping trunks to a height of 45cm can protect trees from light frosts.

Most growing areas in NSW range from 100-200m altitude. During seasons with excessive cloud cover and frequent rain, reduced photosynthesis can increase shell thickness and decrease kernel recovery and Grade 1 kernels.

**Water – rainfall, irrigation**

Most genera of Proteaceae grow well in a climate where periods of wet and dry weather alternate. Research in NSW over 10 years showed that when annual rainfall ranged between 1,200-2,300mm, supplementary irrigation did not benefit producing trees. Increased irrigation rates decreased nut size and Grade 1 kernels but increased nut number without changing total yield.
Careful consideration needs to be given to the water requirements of macadamia in low rainfall areas – particularly if evaporation rates are high. Irrigation, with access to permanent water, is needed during protracted dry periods.

Macadamia is sensitive to saline water. Salt levels above 300ppm may cause scorching. Irrigation water should be tested, for salt levels can vary throughout the season and locality.

**Wind**

Macadamias do not have clearly defined tap roots and young trees are particularly sensitive to blow downs in strong winds. Areas which do not experience strong winds are ideal, and exposed land should be protected by windbreaks.

It is important to establish permanent windbreaks around exposed boundaries and along ridges. They should be established 1-3 years before planting the orchard. Australian native species such as casuarinas (Casuarina cunninghamiana) and tallowwood (Eucalyptus microcorys) can be used.

Deep ripping near the windbreaks reduces competition with macadamia trees. During plantation establishment, use barner grass (Pennisetum purpureum spp) between every third or fourth row. Barner grass requires management to reduce competition with macadamia.

The grass should not impede air drainage in frosty areas. It should be cut every second year to stop it invading the orchard rows and becoming a rat haven. It is often removed after 5-6 years. When cut, baled and left for a month, it provides excellent under tree mulch.

**Orchard layout**

Plantations should be designed to allow for safe mechanical cultural operations. Avoid steep slopes to minimise the risk of soil erosion. Establishment of grassed waterways and shallow drains above and within the orchard, to carry torrential rainfall, should be discussed with the Soil Conservation Service before planting.

Orchard design should favour long rows to maximise land use and efficient machinery operation. North-south row orientation to allow sunlight on both sides of trees, particularly in winter, is favoured if all other considerations have been satisfied. Tree rows can be gently mounded, leaving a shallow broad based drain. Inaccurate levelling can cause erosion or ponding.
Tree variety, soil conditions and topography will affect planting distance which can vary from 6m by 3m to 10m by 4m. Staggered planting within rows to form equilateral triangles is favoured by some but in the main, trees usually form hedgerows after 5-7 years and diagonal thinning is rarely practiced.

Trees planted at high densities come into production earlier. The penalty for high density plantings, for example 6m by 3m, is the higher initial cost of establishing an orchard. However, it reduces the time to reach a positive cash flow to offset the large investment required to establish macadamias.

It may be possible to delay tree thinning in a high density orchard by occasional trimming after harvest in winter. However, when production per hectare starts to decline, remove alternate rows to allow enough light to penetrate the canopy to maintain productivity. At this stage – 12 to 15 years – consider partially replacing existing varieties with new ones that are more precocious and produce higher quality nuts.

Field planting of grafted trees in the autumn avoids extreme temperature. One or two hand waterings are usually enough to establish the young trees. Their roots will have extended into the surrounding soil by the time temperatures increase in spring. If a spring planting is required a more comprehensive watering operation, or temporary irrigation system, will be required because of the likelihood of dry spells.

The young tree’s roots should be examined for any L-shaped, gooseneck or pot bound roots which must be pruned, otherwise the tree will not be able to withstand strong winds. A malformed root system will ultimately choke itself from an inadequate water and nutrient supply. Avoid advanced nursery trees with pot bound roots which will not move into the surrounding soil and establish a sound root system.

The planting hole should have rough sides and base so the roots can move out readily into the soil. About 50g of superphosphate can be mixed in soil at the bottom of the hole and 200g of composted fowl manure added to the soil around the roots.

The tree can be positioned with a 100 lean in the direction of prevailing wind with the dominant bud facing in that direction. Use 10-20L of water to consolidate the soil around the roots. Avoid staking trees as self-supporting trees develop stronger trunks.
A ring 1m in diameter can be covered with a coarse fibrous mulch 5-10cm thick to reduce moisture loss, suppress weed growth and prevent excessively high soil temperature in the surface root area.

Direct contact of mulch with the trunk should be avoided to reduce the risk of trunk canker. After the tree has established, the lower leaves can be removed to avoid contact with any herbicide spray drift.

Trees planted in spring will require white plastic paint to prevent sunburn. Loose wrapping of trunks can protect against frost, animals, herbicides and sunburn.

**Harvesting**

Preparation for conventional harvesting from the ground should begin in late summer with herbicides used to control grasses and weeds under the trees. Most nuts fall from the tree in late summer to early winter while still encased in the husk. The earliest falling nuts can be immature or insect damaged. It is desirable therefore to have an early harvest to remove any immature or last season’s nuts. Damaged or poor quality nuts can be floated off in water tanks.

Machine harvesting is more economical than manual harvesting where total orchard production exceeds 35 tonnes. The action of mechanical harvesters can damage soil and roots. During wet conditions the use of harvesters is restricted.

There is no alternative to manual harvesting on steep slopes and rocky ground. A challenge exists to develop a harvesting technique which is cost effective and causes little damage to the soil surface.

**Dehusking**

Most nuts that fall are still enclosed in husks which have to be removed mechanically. Dehusk nuts within 24 hours of harvest otherwise considerable quality reduction can occur due to heat build-up. If nuts cannot be dehusked immediately it is best to leave them unharvested.

Macadamias fall from the tree with a moisture content of about 20%. It is usual to reduce this to 10% or less before selling to processors. Small lots of nuts can be air dried on shallow wire racks under cover on the farm. Large quantities are dried with unheated forced air in silos.
Further drying at the factory uses heat over several days to reduce moisture to about 1.5%; ready for cracking. Growers are paid for percentage kernel recovery, quality and weight of nut-in-shell adjusted to 10% moisture. Deductions are made for immature, mouldy, insect damaged or germinated kernel. Nut-in-shell yield at 10% moisture is about 3-4 t/ha for wide spaced trees.

**Drying**

Careful drying is a critical step in macadamia processing to maximise shelf life and quality of the end product. At harvest the nuts have a moisture content of up to 30%. Drying can take up to three weeks and reduces the moisture content to around 1.5%. The kernel shrinks away from the inside of the shell and allows the shells to be cracked without damaging the kernel.

**Cracking**

Modern machines have been developed to crack the tough shell of the macadamia without damaging the precious kernel within. These machines have either a fixed blade and cutting blade, or a combination of rollers and a base plate to compress the shell.

**Marketing**

Currently, macadamias account for about 2-3% of the world tree nut market, leaving ample opportunity for expansion in existing markets and for developing new markets.

The industry in Australia is evolving and expanding rapidly as production increases. Australian exporters have developed major markets for bulk raw macadamia kernel in many different grades; value-added products and retail packs. In excess of 60% of the nut-in-shell produced in Australia is directly exported as kernel to the world market. The Australian market has expanded enormously in recent years with many new high quality value-added products available.
Appendix 2: A Macadamia Orchard

Visitors Guide to Hinkler Park Plantation

18/07/2011 v4.0

Introduction

Hinkler Park Plantation (HPP) was founded in Bundaberg in 1988 with the first macadamia trees planted in 1990.

The aim of the Company is to produce premium macadamia kernel in irrigated orchards maximising the use of machinery in as many operations as possible. Management procedures used by the Company have been formulated with a focus on long term sustainability utilising current soil practices and water resources.

HPP owns an orchard at Mt Bauple (30 km North of Gympie) and has expanded into the Childers area, but its largest holdings are located in Bundaberg. In total, HPP has over 2400 hectares of macadamia plantation with the number of trees now in excess of 680,000.

The Company employs up to 45 permanent staff and up to 16 seasonal workers. HPP currently produces in excess of 3000t of nut-in-shell (NIS) annually which will increase to potentially double in the next 10 years as younger farms mature and their full yield potential is realised.
Image 1 Aerial view of Oakwood orchard, Bundaberg

All HPP farms are irrigated and water sources include private dams, government water schemes (surface water) and underground (sub-artesian) supplies. HPP currently owns approximately 4000 ML + of surface allocation and 1823 ML of sub-artesian water allocation.

Image 2 60 ML irrigation dam, Ragni farm, Bundaberg
The following sections summarise the planting and production aspects of the Company.

**The Nursery**

The HPP nursery is located at Oakwood, North Bundaberg and is set up to hold 120,000 trees at any one time and aims to produce approximately 40,000 trees for field planting annually.

Seed nut from cultivar H2 is placed on a heated sand bed and covered with hessian and kept moist for approximately 10 days until germination occurs. The germinated seed nut is then transferred from the sand bed into 5 litre polyethylene bags which have been filled with a sand and pine bark potting mix.

The seed is planted approximately 50 mm deep and it may take up to 4 weeks for the cotyledons to emerge. The seedling is grown until the stem reaches a diameter of between 5 to 10 mm at which point it is grafted and placed under a 30% shade net which aids in the reduction of sunburn damage as new shoots develop.

Scion wood is sourced from the orchard and is cinctured (bark removed) 6-8 weeks prior to grafting to increase carbohydrate levels thereby maximising grafting success.

![Image 3 12 week old grafted seedlings under shaded area.](image)
Grafting success is evidenced by the emergence of shoots from the scion, which can take up to 8 weeks. Once the graft is 35 weeks of age, the tree is ready for field planting.

Trees in the nursery are watered via an overhead irrigation system and nutrients supplied by the application of a slow release fertiliser. Trace element foliar sprays are applied when deficiency symptoms are visually observed.

All trees in the nursery are sprayed with a fungicide, one application per week, to protect mainly against *Alternaria* sp., while insecticides are applied only when needed. Pests of nursery macadamias include Macadamia Felted Coccid, scales, thrips and grasshoppers.

**Land Preparation**

HPP carries out a full topographic survey so that the tree rows are set out in a manner which allows water to drain away as quickly as possible after a rainfall event. This is a critical aspect for two reasons: firstly, macadamias do not like standing in water for any length of time and will quickly die if this occurs. Secondly, fast drainage of water from the orchard surface allows for machinery to access the paddock after a rainfall event which is critical for continued machinery access, especially during the harvest period.

The land is ploughed 400 mm deep to turn in crop residues and any low areas are filled with soil using a scraper. The construction of waterways within a farm may be needed to aid in the complete removal of water from the orchard. The tree rows are then pegged out and the underground component of the irrigation system is installed. Once completed, the rows are mounded using a grader which aids in water drainage and maximises the amount of topsoil immediate to the tree roots.

Row width varies depending on the class of soil and cultivar but the predominant width is 8 metres. Due to most of the land having naturally low fertility and previously been utilised for sugar cane production, adequate levels of essential nutrients can be lacking.

Soil tests are carried out and results assessed to identify which nutrients are deficient and will need to be applied prior to planting Usually nitrogen, potassium, calcium, magnesium, copper, zinc and boron are the main elements usually affecting tree growth. Other micro-nutrients may be considered to a lesser extent.

Being an Australian native, Phosphorus levels are kept lower than in other vegetable crops, and may need adjusting.

Calcium and magnesium levels are adjusted by using lime, gypsum, magnesium oxide or dolomite – the combination being determined by the pH of the soil. These ameliorants are applied prior to ploughing to maximise incorporation while the other nutrients are applied just prior to planting and are banded on the tree row as a dry fertiliser blend.
The last process in land preparation is to sow grass seed in the inter row. HPP uses ‘Rhodes grass’ (*Chloris sp.*), as it establishes quickly, is relatively deep rooted and provides a bulk of organic matter which can be used as mulch around young trees.

**Planting**

Planting is achieved mechanically, with 5 people able to plant up to 2 000 trees daily. The planting machine is attached to a tractor and is operated hydraulically. A trailer carrying trees is connected to the planter which when empty, is swapped for a full one. The planting machine determines the tree spacing via a distance wheel which can be replaced to achieve accurate spacing. Spacing varies between 3 metres and 4.5 metres, depending on soil class and cultivar.

![Image of planting team in action](image)

**Image 4 Planting team in action**

The planter opens the ground, injects fertiliser into the hole, releases the trees, rolls out trickle tape, and closes the ground over the positioned tree as it moves along. The trees are then watered in for a number of hours once planting for the day is completed.
The Young Orchard

The next three years of the young orchard is mainly a cycle of herbicide spraying and slashing. Weeds are controlled using a 1 metre strip either side of the tree, and are sprayed using weed sensor technology and a covered boom set up with low drift nozzles.

HPP uses side delivery 2.5 metre wide slashers which are run either side of the tree row delivering cut grass around the tree creating a mulched bed. This allows for better soil water retention and controls weed, and provides an organic additional layer and environment for greater earthworm activity around the roots of the young tree, which benefits the overall health and growth potential of the orchard.
Intermittent pruning is carried out annually to remove low hanging branches which interfere with herbicide application and future mechanical harvesting. The majority of pruning is carried out mechanically with the remaining branches removed manually. The fertilising of the young trees is carried out by injecting soluble fertilisers into the trickle irrigation system and constitutes a basic NPK mix.

Pest population rates are seasonally monitored, and pest numbers are only sprayed when it is deemed essential, after preference has been given to releasing predator ‘Trygogramma’ wasps to control the population levels of nut borer, and ‘Cryptolaemus’ beetles to control the population levels of mealybug.

The Maturing Orchard

Once the trees become four years old, they will begin to bear fruit, require larger amounts of water and nutrients and the canopy will need managing to allow continued machinery access.

In the maturing orchard, the trickle irrigation system is replaced with a micro-sprinkler system. The laterals (above ground poly pipe) are hung in the trees to allow for harvesting and 100-130 litre/hour sprinklers are staked into the ground – one between two trees.

This fully automated computer controlled system will deliver a peak water supply of 500 litres/tree/week during the moisture critical oil accumulation phase. Nutrient requirements are determined by annual leaf and soil tests and by crop removal data.

Nutrients are applied and watered in via a computer controlled spreader. These spreaders are able to have their rate varied by the operator while on the move and independently for either side of application as they travel through each inter-row. This allows the operator to increase the ‘base’ rate for sections of poorly growing trees or for certain higher nutrient demanding cultivars which leads to a much more even orchard growth in terms of tree health and vigour.

Current research and development is investigating ways to ‘map’ nutrition areas using aerial images. It is hoped these images may then be programmed into the ‘controller’ to automate the release of fertiliser within each tree row.

A customised granular fertiliser mix that includes Nitrogen, Potassium, Phosphorus, Sulphur, Zinc and Boron is also applied and watered into the profile. Calcium and magnesium can be applied as, or in a combination of dolomite, lime, gypsum and magnesium oxide (depending on soil pH) while copper is taken up by the tree from the fungicidal coppers that are sprayed during the nut growth phase.

The important pests to monitor in mature orchards are predominantly flower pollination and nut-setting feeders. Macadamia Flower Caterpillar and Black Citrus Aphid can adversely affect flowers while Green Vegetable Bug and Fruit Spotting Bug can feed on young developing nuts causing them to abort from the tree.
Once the nut starts to mature, it can be damaged by Macadamia Nut Borer which can bore through the green husk and occasionally the shell - either way, causing the nut to fall prematurely. Insect monitoring is carried out internally by a trained team of employees, and threshold levels determine if predatory wasps are released or spraying is required.

Certain cultivars are also susceptible to the fungal nut disease, Macadamia Husk Spot, which requires three fungicide applications during the nut growth period to minimise the spread of the fungus and prevent the nuts falling prematurely.

Insecticide and fungicide application is achieved through the use of company-built and designed computer controlled sprayers that can travel through the orchard at up to 10 km/hr and are filled by a nurse tanker in the orchard, thereby maximising the amount of time that they are actually working. A team of two sprayers and one nurse tanker can cover 120 ha of orchard in 9 hours which would be the equivalent of four conventional air-blast sprayers.

![Image 7 High speed computer controlled insecticide sprayer](image)

Canopy management becomes an important issue at year 10-12 which is about the time when the trees may start crowding the inter row, depending on variety. The industry accepted procedure is to wait until the final harvest is complete and then the orchard is pruned mechanically.

The trees are skirted (to remove the bottom branches) and 1 or 2 vertical cuts are made on the side - essentially creating a hedgerow with a 2.5 metre gap for machinery and light access. The procedure is carried out every 2 to 4 years depending on the vegetative vigour of a particular orchard. A process of tree removal has also been undertaken on the oldest orchards to allow better light penetration and production of new fruiting wood on the remaining larger trees.
Weed management becomes less of an issue as the orchard ages as a lack of light under the trees prevents weed from growing. Any weed growth at the end of rows is controlled by spraying with a handgun from a quad bike.

**Harvesting**

The macadamia nut is mature by the end of February and some cultivars will begin to fall by March. Contrary to popular belief, the trees are not shaken as the nuts drop naturally, albeit at different time and durations (from between April and October).

Prior to harvesting, an operation commonly referred to as a pre-harvest clean up, is carried out. A tractor-mounted blower is used to blow leaves, sticks and old or immature nuts from under the trees which are then mulched up by a flail mower that is passed either side of the tree row. This allows the first harvest pass to pick up predominantly freshly dropped nut thereby maximising the quality of the product.

![Image 8 Mature orchard with four weeks of fallen nut on the ground ready for harvesting](image)

At HPP, no sweeper-type harvesters are used (which can cause large amounts of soil disturbance); only the pinwheel-type machines are used, which are gentle on the orchard floor thus minimising soil loss.

As the harvester travels up the row, it picks up the nuts in front of it in the finger wheels, while a fan on the head of the harvester blows the nuts that are between the trees over to the next row which will be subsequently picked.

The nuts are ejected from the finger wheels into augers and then travel through a dehusker where the majority of the husk is removed and dumped back onto the orchard floor. The husk is a rich
source of potassium, nitrogen and valuable organic matter which will decompose over the following months to re-incorporate and recycle back to the trees’ soil nutrient zones.

The nuts are augured into the rear 1.5t bin to the harvester, which when full, is then emptied into a 5t field bin. Constant communication between the Harvesting Team Supervisor and the truck drivers, allows the Tonne field bins to be placed on headlands adjacent to where they are harvesting.

Image 9 Mechanical harvester tipping product into field bin

The Field bins are collected by truck and taken to the receival pits at the ‘Sorting Sheds’ located at Oakwood and Moore Park.

The nuts travel by conveyor over an initial table where foreign matter is removed and then conveyed into buffer bins/silos that feed respective ‘Primary production lines’.

Each ‘Primary Line’ consists of a set of dehuskers (to remove any husk that may have passed through the harvesters) and a trommel that removes undersized nut less than 17 mm (industry standard stipulation). Once the nuts exit the trommel, they pass over a Primary Sorting Table where any defective nuts, pest damage or foreign objects, can be removed to waste, before passing into a ‘Water Sorting Tank’.

The water sorter is filled with chlorinated and filter pumped water, and is used early in the season to capture immature nuts to float off to waste. The mature nuts sink to subsequently be elevated into a storage silo to ‘dry down’ over the period of 7-10 days using fans to circulate ambient air through the silo bed depth.
Image 10 Secondary sorting of product in dehusking shed

After the nuts have been adequately ‘dried down’ they are passed over the secondary tables for re-sorting and another final inspection before being accumulated into a dispatch silo.

Nuts are loaded into B-double transporters and delivered to processing facilities in either Lismore or near Bundaberg at Winfield.

The processing facilities shell the nut, sort it into different styles (based on size), and grade the kernel (by colour consistency) into premium and commercial grades for sealing in foil lined, nitrogen flushed vacuum sealed bulk 10kg or 11.4kg bags, boxed and placed on pallets and stored in refrigerated cold rooms for wholesale distribution.

Disclaimer

The Visitors Guide is distributed to give a guest an overview of the operations carried out by Hinkler Park Plantation. This document should not be used as a ‘guide’ to growing macadamias as there are various methods available to growers to create similar outcomes and the way operations are carried out is often a reflection of the culture of the company and the resources that are available to it.
# Macadamia Management Calendar

This chart sets out the crop cycle and how management interacts with the cycle, but is not endorsed by Hinkler Park Plantation as a definitive cycle for annual cropping, as many other factors, such as weather, pest management, or nutrition management, can affect each period within this cycle.

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Page 69
Appendix 3: Useful Links


Industry information – resources and research
http://www.australian-macadamias.org/resources-a-research?lang=en&r=1&Itemid=187