Economics of Almond Production in Southern Australia

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In the course of the preparation of this work special acknowledgement is given to the almond growers who supported the project with detailed financial information. The contributors are however to remain confidential.

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Comparative Analysis of Almond Growing in Southern Australia

1 BACKGROUND

Discussion in the Almond Board of Australia highlighted the need for an update of the 1999 publication "*Comparative Analysis of the Almond Industry*". The book was funded by PIRSA and provided a full financial analysis of almond orchard development and production. The publication also provided relative performance indices, comparisons and benchmarks. The book was popular with growers and potential investors and the 300 printed copies ran out within 4 years. There have been a number of significant changes within the industry in the past 8 years and the analysis is out-of-date. The industry has signalled that it would like to correct this with a revised version. This is a benchmarking document against which growers can strive for continuous improvement.

This project provides a method of analysis for individual business performance. The outcomes have been the development of a tool to analyse current business performance in almonds, develop a series of important financial indices, develop a group of financial benchmarks for comparison of almond businesses and indicate best practice standards for the industry in Australia. This system of analysis can assist an individual manager's understanding of their business, measure critical factors (and risks) in a development proposal, and act as a catalyst to improve the industry's competitiveness in the international scene as Australian production continues to grow.

2 ACKNOWLEDGMENTS

Funding: Horticulture Australia Limited and Primary Industries and Resources South Australia funded the project.

Co-operators: This project has been conducted in association with the Almond Board of Australia. Special thanks to the growers who assisted in the preparation of this report.

Phillip Taylor, Manager, Industry Strategy and Structure, PIRSA provided support and comment on the analysis.

3 EXECUTIVE SUMMARY

The project analysed the financial performance of a range of South Australian almond properties, established comparative information and developed benchmarks for economic performance. In all, six properties were analysed.

The project has provided:-

- detailed information to project participants, to assist them to identify business strengths and weaknesses
- feedback to industry on the key management issues that affect business performance
- a detailed report on major economic factors influencing the viability of the Australian Almond Industry
- a model allowing development proposals to be assessed against industry benchmarks (see Technology Transfer Web Site reference).

Using a whole farm approach to examine each business the data was analysed to produce several performance indices. They are categorised into:

1. Total business performance
2. Resource sustainability
3. Cost analysis

The primary finding of this project has been the critical financial indicators in almond production and their effect on profitability (Table 1). These performance benchmarks indicate a level at which most well managed properties should be able to operate. In some indicators an individual property may be able to do substantially better, while in others they will be more difficult to reach. Analysis of performance indicators should be assessed as a group of indicators, rather than each one in isolation.

Table 1: Primary financial performance indicators

Performance indicator	Performance benchmark
Best average 3-yr yields	Consistently above 3.2t/ha.
Years to mature return (2.45t/ha)	Mature yield in the sixth year
Years to first return (0.25t/ha)	First yield in the third year
Gross margin	>$10 000 /ha.
Cash costs/kg of kernel	<$2.01/kg
Cost of machinery depreciation	Less than 100 hectares <$ 450/ha. Greater than 100 hectares<$150/ha.
Labour costs per hectare	<$2200/ha.
Irrigation power costs	<$50/ML pumped

3.1 FINANCIAL ANALYSIS AND DEVELOPMENTAL PROPOSALS

The updated *Almond Economic Analysis Tool* can indicate the profitability, sensitivity and risk of a project and produce the performance indicators above. This economic model has been used to evaluate several successful new almond developments over the past seven years and is available to investors and producers on a consultancy basis. A disc copy will be available at the 2007 Almond Seminars and from the Australian Almond Board website for use by almond growers in Australia.

3.2 KEY ISSUES INFLUENCING PROFITABILITY

3.2.1 Yield

Increasing yield is already an integral part of the current research and development plan for industry projects. Improving yield can clearly benefit industry profitability. This study has reinforced the importance of yield as the primary driver of profit that is under the producer's control. Properties that have achieved well above the benchmark yield have larger gross margins, better cumulative cash flow and better internal rates of return. The model has been applied to the Optimisation trail at Berri SA to further demonstrate the important relationship between yield, fertiliser and irrigation.

- Pest and disease controls used by all properties were very similar and it appears that yield differences cannot be attributed to issues of disease or pest incursions. The level of pest and disease was low with no serious pest and disease problems were encountered. Only the control of *Prune Rust* varied with some control used in wetter years, later in the season.

  The cost of the control was between $200-$300 per hectare including application costs representing about 3% of total cash costs. Pest and disease control, while important is not a high cost item.

- Growers who have achieved the benchmark or better levels of production are characterised by using larger quantities of water on a per hectare basis. Some growers used pulse irrigation. Irrigation scheduling with a quantitative monitoring systems are common for these growers. This includes tensiometer or capacitance probes. In any development the process of soil surveys, professional irrigation design and scheduling is vital to the success of the project.

  Water pumping costs are a significant proportion of cash costs for almonds. Good irrigation design and accurate scheduling to the soil type are important in keeping this cost under control.

- No evidence was gathered on the standards used for nutrition management in the project, but tissue analysis with particular attention to nitrogen, potassium and zinc was widely used. Fertilisers are a significant cost and they need to be applied according to plant needs to maximise yield and lift the cost–benefit for fertiliser inputs. Over the past 10 years significant improvements have occurred in the management of nutrition of almonds.

3.2.2 Machinery ownership costs

Machinery ownership strategies vary widely. Large properties that own a complete set of harvesting equipment (a major cost in machinery), and work it efficiently can keep their machinery costs well within the benchmark of an annual depreciation of less than $150/ha. The economies of scale are clearly evident in larger property sizes. Properties of over 100 hectares can significantly reduce machinery ownership costs also afford to own and operate equipment within a single business although their replacement and maintenance programs need to be managed carefully to ensure costs do not become excessive.

Properties of around 40 hectares were able to efficiently operate a set of harvest machinery, but the ownership costs per hectare are higher at around $450/ha.

Smaller properties need to employ a range of strategies to reduce both machinery ownership and operating costs. These could include second hand ownership, syndication, and contracting of some work.

3.2.3 Water use

Almonds are a high water use crop in comparison with other horticultural perennial crops with average annual water use across the surveyed properties at 14.7Ml/ha. If it is to compete with other crops for resources such as water, then improved water use efficiency will assist in maintaining the development of this industry.

3.3 KEY RECOMMENDATIONS

The study identified a series of issues that industry may wish to pursue in future project work. These issues offer opportunities to improve the international competitiveness of the Australian Almond Industry. They are:

- Yield
  - Irrigation practice
  - Nutrition
- Machinery ownership costs
- Water use

The study has illustrated the need for growers to protect their yield in terms of irrigation practice, nutrition management and pest and disease control with yield (and price) being the primary determinants of profit.

Continued focus on factors identified in the 1999 study is also relevant in particular early returns and time to mature crops in the 6th leaf.

4 INTRODUCTION

Managing an almond growing business requires skills in management, production and economic arenas. The industry has seen substantial growth in the last 10 years with significant development in large-scale orchards.

This project compares the profitability of almond growing properties based on information provided by growers and using some pre-determined input costs and returns to reduce variability. The project delivers a series of benchmarks that can be;

- used as industry benchmarks,
- a model to enable growers to evaluate their own performance against the benchmarks and other years and
- a tool to determine the impact of changes on their annual profitability.

Successful almond production depends on more than profitability alone, with cash flows, sensitivity and risks associated with profits needing consideration. Ignoring any of these factors can lead to potential financial difficulties. Lending institutions also require profitability, cash flow risk and security to be evaluated. The model also enables the assessment of longer-term cash flow and the output is suited for bank development applications. This study did not investigate tax implications or finance considerations of any case studies or the typical example provided.

Establishing financial benchmarks for enterprise performance forms the basis for directing our efforts to maximise profit, set priorities in production, identify issues for industry viability and assist in forming research and development priorities in the future. Note that the analysis is an economic one and does not aim to deliver a management program for almond production, hence no indication of timing of operations is provided.

5 PROJECT AIMS

The project aims to analyse the financial performance of a range of Australian almond properties and establish comparative information to develop benchmarks for economic performance. Six properties were analysed as case studies.

The project aimed to provide:-

- detailed information to project participants to assist them to identify business strengths and weaknesses,
- feedback to industry on the key management issues that affect business performance,
- a detailed report on major economic factors influencing the viability of the Australian almond industry,
- a model allowing property performance, development proposals and “what if” scenarios to be assessed against industry benchmarks (see website).

This model will:-

- enable comparative analysis of almond properties
- identify key factors that influence individual business performance
- deliver performance indices and benchmarks that measure financial performance
- enable evaluation and comparison of future almond developments in Australia.

6 METHODOLOGY

6.1 DATA GATHERED

A complex computer based model was developed to evaluate the financial performance of properties. The model has been extensively modified since 1999 and has greater capabilities. The model used the inputs and outputs of the business, attached current values to the costs of these inputs and outputs then produced a series of gross margins, development budgets, sensitivity analyses and performance indices. The performance indices from the case study properties revealed a benchmark for the most important financial and physical indices and revealed best performance for these indices. A workshop also sought feedback to verify the importance of these benchmarks to producers.

This analysis and evaluation was undertaken for six properties selected from expressions of interest from growers of varying size located in the Riverland of South Australia. Information generated in the analysis was used to identify key industry economic issues.

6.1.1 Inputs

The inputs include land, water, working capital to purchase chemicals, fuel, machinery and labour. These inputs have been valued at current prices (less some discounts for larger purchases) as it is important in the comparative analysis that the cost/price differentials are highlighted on the basis of property size. The cost based analysis indicates where major costs are incurred in the production of almonds.

6.1.2 Outputs

In the analysis the value of the almond product has been set at a standard value per kilogram. No market analysis has been undertaken in this study. It has simply established the range of prices achieved for an average almond crop (all varieties) and assumed a reasonable long-term price of $5.70/kg. This figure can be varied easily to include price fluctuations over the life of an orchard for individual property analysis. Average yields over a 3-year period as presented by managers and owners from the case studies have been used. The comparison properties were analysed using an average of the last three years of production.

6.2 INFORMATION PRODUCED

6.2.1 Gross Margins

Gross margins are a well-accepted method of enterprise analysis. The method used analyses all cash costs of production. This includes chemicals, labour and machinery operating costs. It is important to note that the overheads of a property are not included in this method of analysis and hence returns can look attractive without reference to a development budget or level of investment. Interest and depreciation are not included in the gross margin.

6.2.2 Whole Farm Analysis

The whole farm analysis enables a picture of all the costs in the business over a number of years to be analysed. The development aspects were not compared in the study but the analysis model allows operators or potential investors to apply their own information. Importantly the scale of a business is reflected in this part of the analysis. Machinery cost data forms an important part of this section. The option to include interest payments is also available to growers.

Additional information on depreciation of plant, fixed assets and overheads results in an annual margin, providing a more accurate picture of profitability by including both cash and non-cash costs.

6.2.3 Development Budgets

The long-term development costs are vital to the success of a project and allow the development to be viewed from a long-term cash flow basis and gives the basis for negotiation for borrowed funds. Interest costs for borrowed funds are not part of the study, but the model allows for their inclusion. The model builds up a development budget that can be altered by growers to suit their specific financial circumstances. The profitability analysis (including non-cash costs) is provided only in graphical form.

6.2.4 Sensitivity Analysis

Sensitivity analysis reviews the project on an annual basis with a series of scenarios that focus on the most sensitive factors of price and yield. Many other factors can be analysed in this way using the economic model. Base lines are included to show overhead cash costs and interest. It is possible for users of the model to copy information from the model for use in their own spreadsheets.

The sensitivity analysis evaluated the impact of price variability and yield on the gross margin. The sensitivity analysis results in a cash break-even price established for a product from a particular property. As it is based on the gross margin, this price needs to be adjusted for overhead costs, interest payments made and for any depreciation of machinery to give total product break-even price. These fixed costs are included as separate graph lines on the sensitivity analysis.

6.2.5 Performance Indices

The final item allows analysis of the selected properties using performance indices to compare performance of properties. As a result of information gained in the study the most critical financial indices that is those that had the greatest impact on profits were used in the final benchmarks.

These basic concepts allow analysis of data that is usually readily available from growers and represents accepted standards in economic analysis.

7 WHAT IF ANALYSIS

The development of a financial computer analysis model has enabled the effect of changes in major inputs and outputs to be determined and their effect on the project assessed. Different scenarios for factors like first yield, mature yield, machinery investment or crop failure can be tested to give an outcome for strategy development against these various scenarios. In this year's model partial budgeting is possible with changes inputs and the impact on yield to be inserted and their impact on profitability being readily available. This approach is an important risk management tool.

8 KEY PERFORMANCE INDICES FOR ALMONDS

Using a whole farm approach to examine each business the data was analysed to produce several performance indices. They are categorised into:

1. Total business performance
2. Resource sustainability
3. Cost analysis

The three important components of profit can be divided broadly into yield, price and costs. The performance indices focus on aspects of each of these components.

8.1 TOTAL BUSINESS PERFORMANCE

The performance indices used include:

8.1.1 Best average 3-yr yield

Climatic risk can be significant in almond production. Frost, poor weather at pollination, windfall, hail and high humidity can all substantially increase the risk in primary production. The use of a running average for three years gives a clearer long-term view of yields that are possible in the industry.

8.1.2 Cost of production per kg kernel

The cost of production includes all annual cash costs, overheads, machinery depreciation costs and labour. When the yield is brought into the equation, an indicator that is independent of price and property size is the result. This figure provides a picture of the factors under the financial control of a

particular property and should be a central piece of data in any financial analysis. Being independent of price and property size, the figure can be used to compare and contrast different production systems and different regions.

8.1.3 Cumulative cash flow

Cumulative cash flow is critical to the success of almond investment. It will determine, in part, the viability of the project from a lender's point of view and is therefore an important consideration. Almonds, being a permanent crop can result in substantial peak debt, hence calculating cumulative cash flow and determining peak debt is important. Cumulative cash flow provides an indication of the year in which peak debt will occur. This information is available from the model but was not required in the qualitative financial analysis as detailed in the contract brief.

The number of years to a positive cumulative balance is the point at which the project has paid for itself not including interest repayments. An interest component can be added in the overhead costs to assess the effect of interest on the payback period.

8.1.4 Years to positive annual cash flow

In the early years of a project, the point at which annual income is greater than annual cash costs indicates the point at which debt can start to be reduced. These potential early returns can be a valuable aspect of the profitability of a particular crop. For example almonds could reach this point at year five or six, but delays will have impacts on profitability.

The actual cash spent in the project will influence the prospects for a development project. A clear distinction needs to made between cash costs (that influence the project cash flow) and non-cash costs such as depreciation and some labour that will influence the profitability of a project.

8.1.5 Gross margin

Gross margin provides a simple tool to easily assess enterprise performance between years, crops or similarly equipped properties without the need for complex financial analysis. Gross margin is a traditional measure of a particular crop's price for the product by the gross yields per hectare less cash costs. For example labour, chemicals, fuel, irrigation pumping costs and freight are included in the analysis. No allowance is made for overheads such as machinery depreciation, accountancy or development costs.

8.2 RESOURCE SUSTAINABILITY

Irrigation benchmarks are becoming increasingly important to horticulture as water becomes limiting and more expensive. Almonds are high water users and hence this benchmark may has an important effect on the initial project cost of water and affect the decision to invest in almonds.

8.2.1 Yield per ML

Yield per mega litre is calculated from information provided. Using yield allow comparison between properties and between years. The Gross income per mega-litre can be useful if determining a value on the limiting resource – water. Yield data has been multiplied by an assumed price of $5.70 /kg divided by the annual water use. This result can then be compared to other industries for their efficient use of an increasingly limiting resource. As water prices have reached up to $2.50/Kl for permanent allocations for private diversion in South Australia the capital value of water has equalled or exceeded the value of land on a per hectare basis. As water allocations become more expensive the capital invested in a project will also increase making an assessment based on water as a limiting resource, rather than land a valid indicator.

8.3 COST ANALYSIS

The profit margin of an enterprise is of primary importance, but its components of yield by price and costs requires a more detailed analysis if we are to improve margins. Many growers place a strong emphasis on reducing costs. Costs are divided into various categories reflecting their nature and effect on profit. The cost categories are fixed asset depreciation, machinery depreciation, labour, annual overheads and variable costs.

The whole farm analysis shows the overhead, machinery and fixed asset depreciation with variable (cash) costs illustrated in the gross margin.

8.3.1 Fixed asset depreciation

Infrastructure costs such as housing, sheds, irrigation systems and trees have been estimated based on current replacement cost and expected life. Each property has been assumed to have only one house, the actual shedding on the property has been valued, an estimate made of the value of the irrigation system, trees costed using current cost to comprise the total fixed assets of the property.

8.3.2 Machinery depreciation and capitalisation

Almond properties are highly mechanised and therefore have high unit costs for machinery in comparison to other horticultural industries.

Grower's valuation on equipment life and replacement costs has been used. The development budget included in each property analysis has used actual cash costs for purchase in the year it occurred and used a salvage value at the end of the useful life of the equipment. An annual straight-line depreciation value for each piece of equipment has been calculated where required for the comparative analysis.

The annual depreciation on a per hectare basis has been calculated and is used as the primary indicator of machinery investment. Analyses of total and average values of machinery investment were not consistent between properties and were rejected as useful indicators. Machinery investment strategies need to be developed that both reduce the total machinery cost

including fuel, repairs, maintenance and minimise the depreciation cost in any year.

8.3.3 Labour costs

Labour costs on a per hectare basis are a measure of the use of this resource. Owner operator labour has been valued at a standard value with an allowance for management. The labour use of each operation has been calculated and summed, then the resulting labour cost verified with the property's actual wages cost for the year to ensure integrity of these figures.

8.3.4 Annual overheads

Annual overhead costs are incurred to maintain the property infrastructure. The costs include accountancy, bank charges, rates, registration and insurances, fuel and power costs not attributed on a per hectare basis. The total costs vary with the size of the property, but annual overheads per hectare are not particularly sensitive on a per hectare basis. Repairs and maintenance have been divided, allocating costs to specific machinery where possible and the remainder allocated as actual overheads.

8.3.5 Gross margin cash costs

Gross margin cash costs are those that are allocated on a per hectare basis and contained in the gross margin. Only cash costs are included in this category.

The use of a simple pie diagram to assess variable cash costs incurred on an annual per hectare basis was used to draw out the major cash costs of almond production. This chart focuses on which items may have the greatest potential for cost savings.

8.4 OTHER INDICATORS

8.4.1 Sensitivity

Other important indicators of the whole farm performance are the effect of sensitivity of the business to price and yield changes within the unique cost structure of the property. It provides an important break-even point for the production of almonds and is provided as a graph.

9 RESULTS OF THE STUDY

9.1 PERFORMANCE COMPARISONS (BUSINESS INDICATORS)

The study chose a series of properties from different regions and management systems for analysis. These businesses ranged in size from 20 to 500 hectares. This study has no statistical validity, but represents what can be achieved and establishes benchmarks for key financial indicators. No single property sets all the benchmarks in any region, but rather tends to perform well in a few of them. The items selected as key financial benchmarks are: -

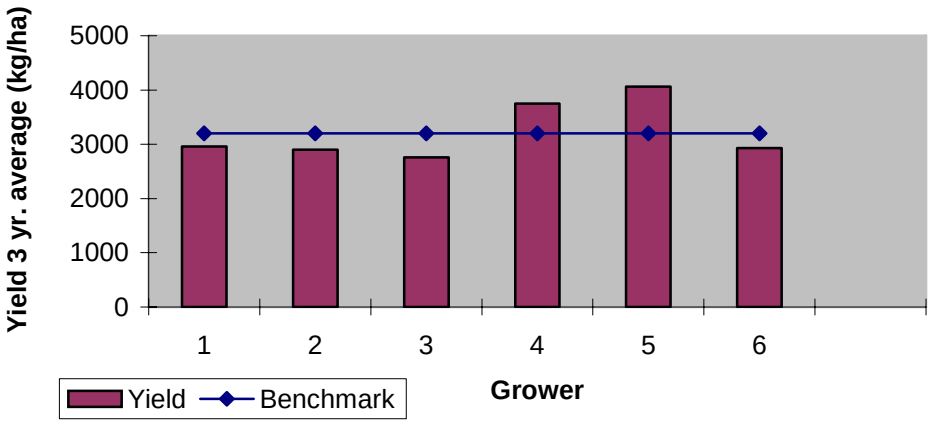
9.1.1 Total business performance

Best average 3-yr yield

The best consistent production figures in Australia have been up to 3.2 t/ha and this stands as a target yield for many best practice growers. This compares with the Australian average of 1.47t/ha (AAGA Strategic Plan 1996) and 10 years later the 2007 Australian average has risen to 2.97t/ha for mature trees (Haslett J. 2007). Growers who have attained this level of production have good soils and irrigation systems, are usually frost-free and have a high level of management skill. This level of production is based on a three-year average. With higher level of production, some alternate bearing is evident and yields of over 4t/ha were achieved by many properties in the 2007 harvest.

All the case study properties achieved close to the benchmark yield using a three-year average as illustrated in Graph 1.

Graph 1: Yields



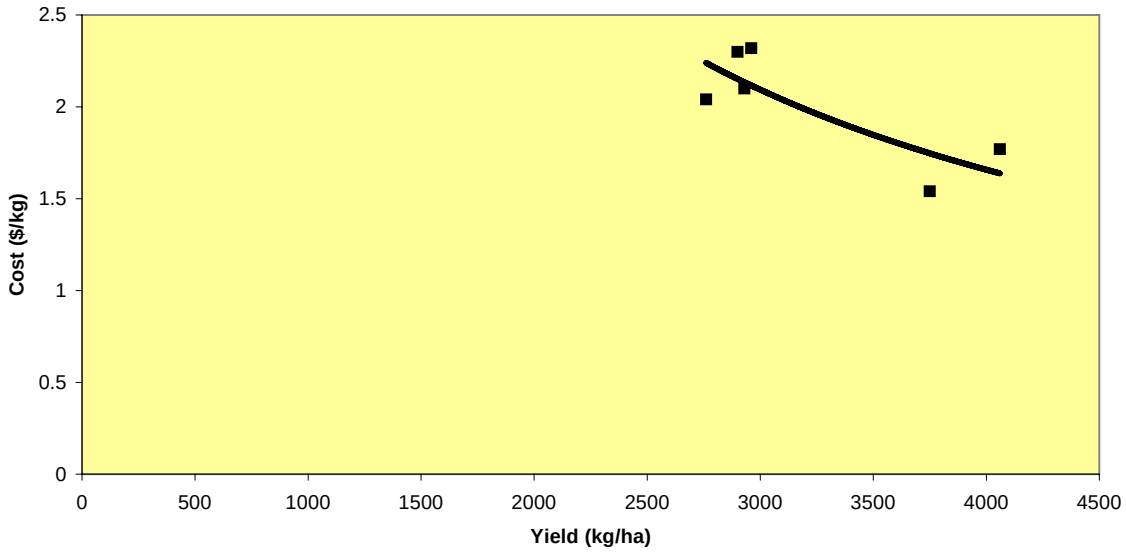
Yield is the primary driver for profitability and in conjunction with price is the most sensitive indicator of financial performance as expected. The case studies indicate that properties that have achieved well above the benchmark

yield have excellent gross margins, better cumulative cash flow and better internal rates of return. The properties that have the highest yields also have low costs per kilogram hectare, but there is no consistency in their costs per hectare. Properties in the middle size property ranges achieved the best average yields.

Cost of production per kg kernel

The cost of production per kilogram gives an indication of the level of cost efficiency of production against output. While yield is of primary importance any opportunity to reduce costs without diminishing yield will improve the margin. The range in cash costs/kg for the case studies was $1.54 to $2.30. The indicator varies widely with the variation being a function of yield per hectare and not costs per hectare. Cash costs per hectare actually increase as property size increases. Properties across the size range have obtained yields that are in the upper end of the production range enabling costs to be dispersed over the higher level of production resulting in lower costs per kilogram as shown by the trend line in Graph 2 below.

Graph 2: Yield versus cost per kilogram



Gross margin

Gross margins per hectare vary widely across the study. They are based on cash costs and do not include any overhead costs. This figure then allows the comparison of properties largely independent of their size. The range of gross margins per hectare varied between $15,875 and $9,793.

The typical gross margin (see website) is at least $10,000/ha. With many properties achieving greater than this level of margin, it is difficult to separate the properties further on the basis of hectare-based analysis. Each of the Riverland properties has yields above the benchmark yield of 3.2 t/ha in single years. Properties that have used higher input strategies (and higher cash cost) for their size or region have been able to attain up to 0.4t/ha additional

yield. As suggested previously, strategies that increase yield or insure yield against risk should be of the highest priority.

Gross margins are useful to compare enterprises within a business or between businesses where the parameters used are the same. Comparison between the case study properties also needs consideration of other factors such as property size, machinery depreciation and overheads. Use of gross margins alone can be misleading, particularly between properties of differing levels of capital investment.

It is important to qualify the importance of larger property size at this point. Properties of greater than 100 hectares clearly have substantially lower costs on a per hectare basis for machinery depreciation and overhead costs. Reduced costs of machinery per hectare with improved efficiency show large differences and lower overhead costs per hectare. Labour efficiencies were not substantially different across the range of property size. Labour costs are around $2200 per hectare for most properties.

The gross margin cash costs are not much different between properties regardless of size ranging from $5640 to $7184 with larger properties just above the average of $6385.

In conclusion where practices adopted can improve yield or substantially reduce the risk of crop loss they should be considered on a cost per kg of benefit basis rather than a more traditional per hectare basis. The cost of fertiliser (12-29%) or irrigation (8-13%) has significant potential to improve yield and are the first two items that should be reviewed. The potential for crop losses in high disease risk years is outweighed by the added cost of improved disease programs in low disease years (where they may not be needed) demonstrating the reducing of risk.

The yield differences between the properties are due to a range of effects and the specific causes of this yield difference are not within the scope of this project. The three main factors affecting yield identified as important by growers were irrigation management, nutrition and pest and disease control,.

By international standards the comparative yield of 3.2 t/ha is well above Californian yields and is achievable in the Riverland/Sunraysia. Higher yields are possible in situations where best practice operations are used with good management.

9.1.2 Resource sustainability

Gross income per ML

This indicator provides a simple comparison of the value of a product related to its water use.

Gross income per mega-litre provides a measure of the water use efficiency against other crops. Studies done in citrus and wine grapes (Skewes, Meissner 1997) provide the source of this comparison.

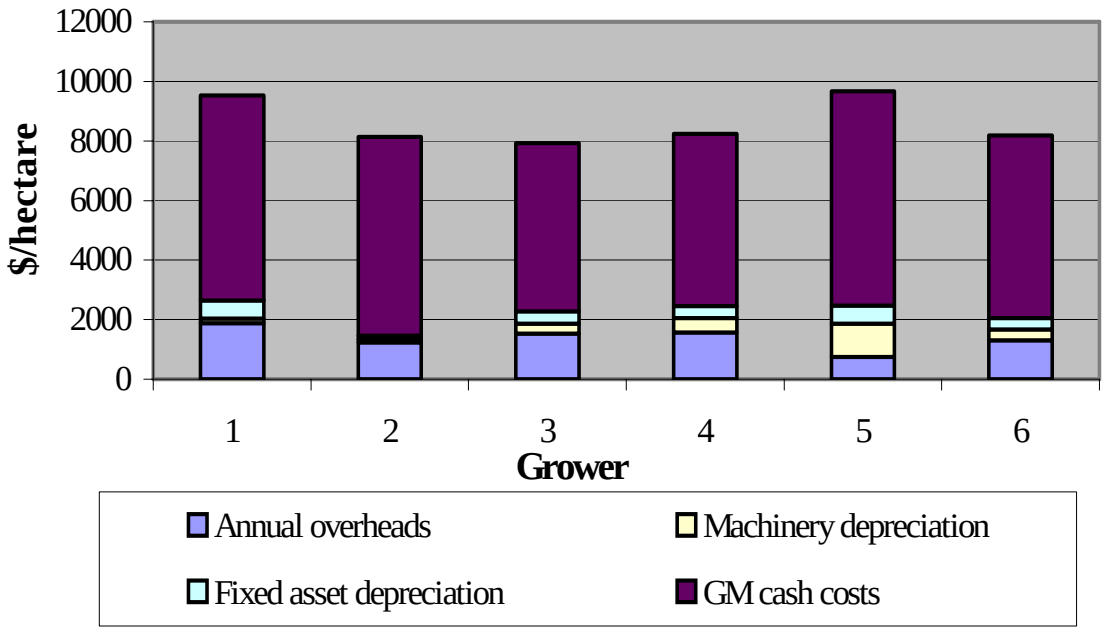
The gross return per mega-litre for almond properties ranged from $1014 to $1542 at a price of $5.70 /kg kernel. A more stable indicator is the yield per ML and a range of 200 to 270 kg/ML is a benchmark range of almond yields per mega-litre.
Almonds are a relatively high water use crop resulting in higher capital costs for water allocations on a per hectare basis. No attempt has been made to quantify the yield against water value to the variable prices of permanent water.

9.1.3 Cost analysis

Total costs

When all categories of costs including annual overheads, machinery, fixed asset depreciation and labour are included the range varies from $7922 to $9666 /ha in a mature orchard. The range contains variations in property size, regions and management strategies. The total costs are expressed in $/ha by category for six properties in Graph 5.

Graph 5: Total and break down of costs per hectare



The breakdown of costs graph (Graph 5) is presented for each major category and is composed of gross margin cash costs, fixed asset depreciation, machinery depreciation and annual overhead costs separated. Variable cash costs form the largest portion of total costs and hence attract the most attention for further analysis.

Fixed asset depreciation

Fixed asset depreciation is based on a 25-year life for the irrigation equipment, sheds, and trees. This results in 4% straight-line depreciation for these assets. There is a clear advantage for larger properties in this indicator.

The range of fixed assets depreciation was from $372 to $619/ha. The study did allocate only one house per property, which may give the larger properties some advantage, but clearly there are advantages in the use of shedding and the lower per hectare cost for irrigation systems.

Machinery depreciation/capitalisation

Machinery ownership (capitalisation) costs are high in comparison to other horticultural industries. In the study, properties that spread the costs of machinery ownership over many hectares achieved the lowest machinery costs. For example one tree shaker may have been used over 200 hectares while on other properties the shaker may have only been used on 30 hectares substantially reducing the depreciation and capitalisation costs on the larger property.

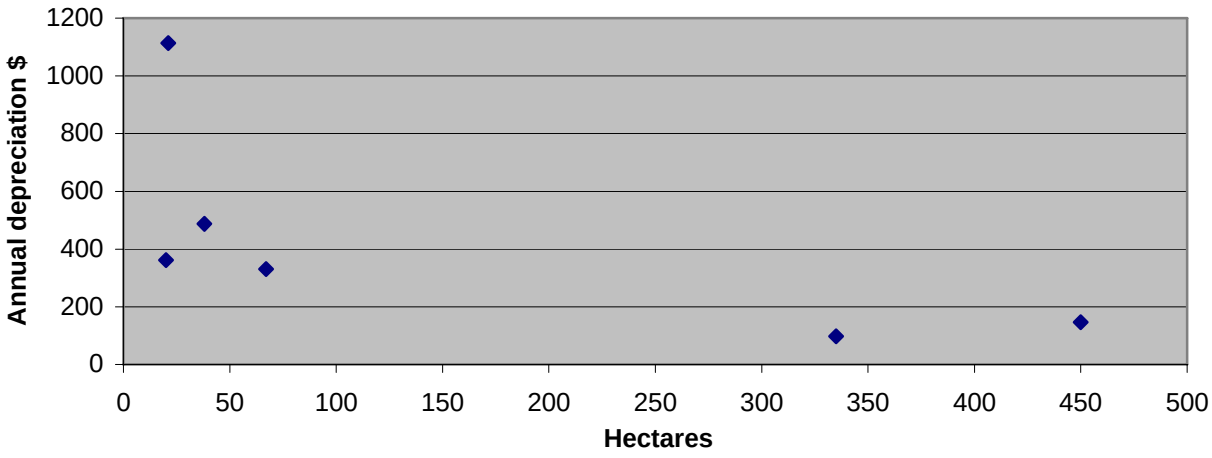
Larger properties have been able to reduce machinery capitalisation and achieved the lowest depreciation values of $100-$150/ha. The use of machinery over many hectares reduces the depreciation per hectare (or per kilogram), and marginally improves operating costs.

Properties of 40 hectares do not obtain the same advantages in the spread of ownership costs especially with harvest machinery that are possible on large properties but do obtain efficiencies in the efficient operation of that machinery. At the 40ha. size, harvest efficiencies are optimised, with the machinery being fully owned by the property but capital ownership costs are large. The benchmark is $400 /ha for machinery depreciation.

Machinery ownership options are more limited on smaller properties. Properties of 20 to 40 hectares may still own their own harvest equipment, however it would be unlikely to be new. Properties of less than 20 hectares must consider other forms of machinery ownership like syndication or use contract harvesting, but no properties of this size were included in the study.

Depreciation is used in a profitability analysis, and is shown in the machinery schedules. The benchmark value for depreciation is $150/ha/year for properties greater than 100 hectares for fully developed properties. Where properties are less than 40 hectares the depreciation benchmark is $450/ha/year fully developed. This is illustrated in Graph 6.

Graph 6: Machinery depreciation by property size



Labour costs

The labour costs benchmark does not vary much by property size. There is only a small difference in labour costs per hectare across the group showing labour costs of $2200 /ha. Labour represents a substantial proportion of annual costs, between 21% and 42% of total cash costs. It therefore represents an important item for efficient use and focus on cost reduction. As a rule of thumb one labour unit can operate 15-20 hectares of almonds as mature crop.
A management component has been attached to the labour component of each property at the value of the higher salary and benefits paid to the manager. The total labour cost for all labour on each property was also checked against the labour used from the grower's estimation of operations to ensure this was not under or over-estimated.

Annual overheads

Overheads are a small proportion (10-20%) of costs and include rates, accountancy, some repairs and maintenance, registration and office costs. Property size does improve the cost of annual overheads on a per hectare basis.

The division of these annual overheads are placed into administration (accountancy, bank fees), rates and taxes (council and water rates, registration), insurances, power, repairs and maintenance and other.

Other indicators

Sensitivity

The sensitivity graphs (Graph 7) based on the typical gross margins on *Almond Economic Analysis Tool* on the website using a range of almond prices/kg for given yields. The lines indicate the risk or break-even points for the business for a given yield. Using the benchmark yield of 3.2t/ha the break-even price of $2.37 for total cash costs derived from the typical example on the *Almond Economic Analysis Tool* . This is based on meeting most of the benchmarks.

The total cost to produce almonds including depreciation but not interest on borrowings is $2.71 in the typical example (See *Almond Economic Analysis Tool*) at the Australian benchmark yield of 3.2 t/ha inclusive of all cash and non-cash costs. Smaller properties, lower yields different machinery use and labour efficiency will increase this figure for most properties. This figure is the total cost per kilogram for almond production at a given yield. If almond prices were to drop to the $2.71/kg level then the return to capital would be 0% for this example.

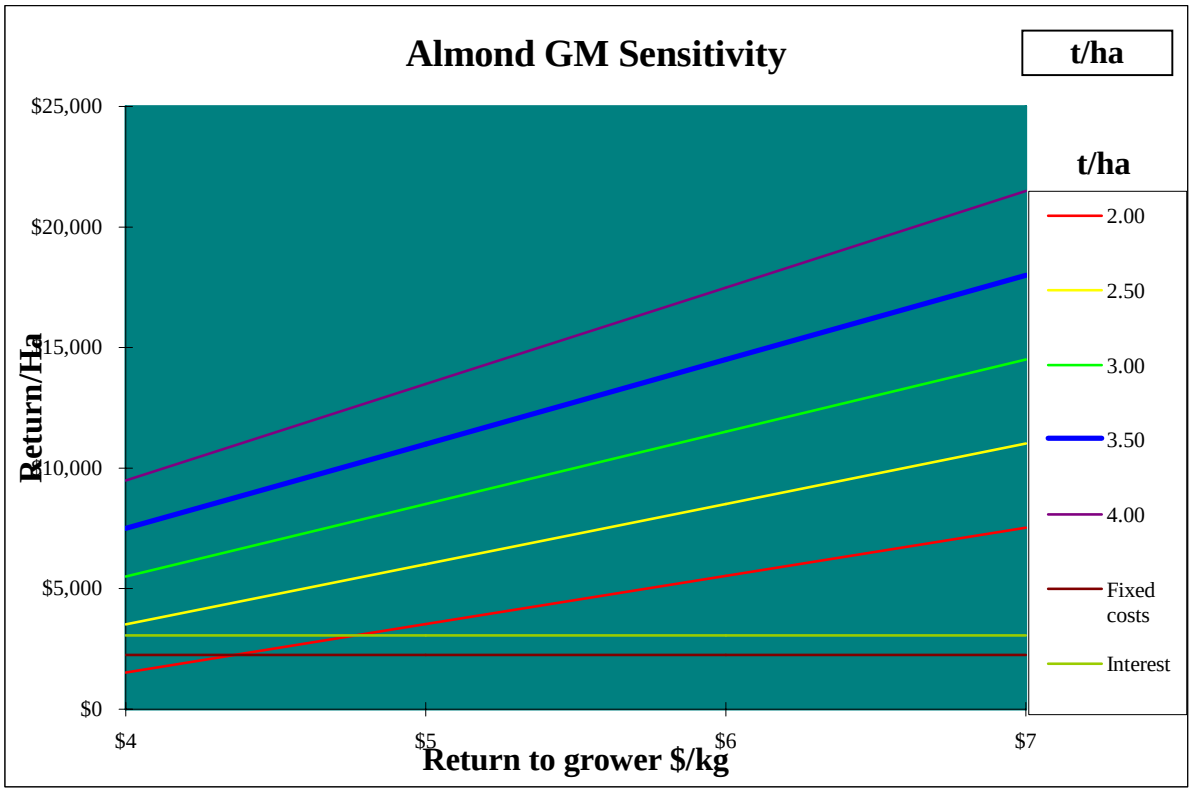
Interest will add $0.25 /kg per $10,000 borrowed per hectare at 8%. In other words if $400,000 were borrowed on a 40-hectare property at the benchmark yield of 3.2 t/ha the interest cost of this money (8%) will be $32,000 or $0.25/kg.

Graph 7

Gross margin sensitivity table
$/ha

		Yield t/Ha.					
		2.00	**2.50**	**3.00**	**3.50**	**4.00**	**Fixed costs**
	$4	$1,528	$3,518	$5,508	$7,498	$9,488	$2,256
Price	**$5**	$3,528	$6,018	$8,508	$10,998	$13,488	$2,256
$/kilogram	**$6**	$5,528	$8,518	$11,508	$14,498	$17,488	$2,256
	$7	$7,528	$11,018	$14,508	$17,998	$21,488	$2,256

Fixed costs include depreciation on fixed assets, trees and machinery and annual overhead costs.



A comparison of international competitiveness will be affected by our current and constantly changing exchange rate. While the A$ is at A$0.80:US$1.00 we will be less competitive, however a change to an exchange rate of say A$0.70:US$1.00 substantially improve our competitive advantage internationally. The external factors (out of producer control) can have a marked effect and the important ones include product price, exchange rate (affecting both machinery imports and international prices) and interest rates.

Gross Margin proportion of cash costs

The proportion of cash costs in Graph 8 indicates the typical costs in almond production. In order to reduce costs the effectiveness or efficiency of a particular input must be viewed in relation to its total cost. For example unallocated labour costs are the largest proportion of cash costs at 35% and may have good potential for improved efficiencies. On the other hand disease

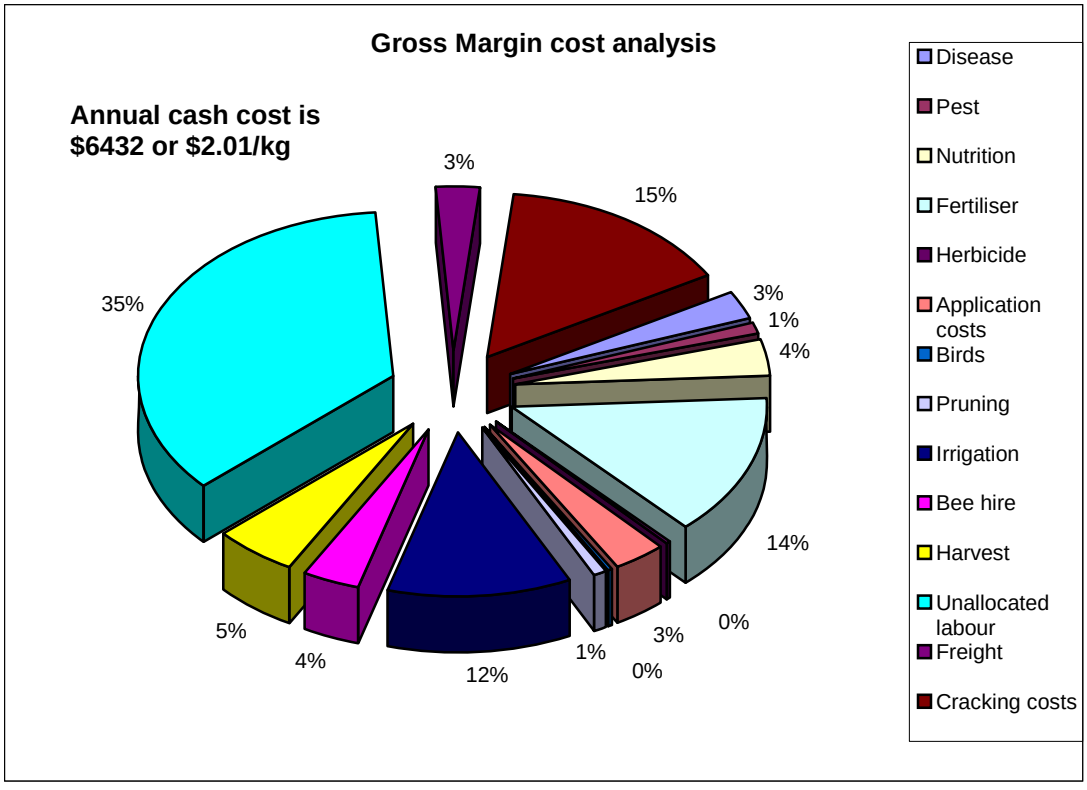
control costs are only 2.7% of cash costs so the cost savings here are not high especially when considering the potential yield loss due to poor control. The major proportions of cash costs are labour(35%), cracking costs(15%), irrigation power(12%), harvest costs(5%) and fertiliser costs(13%).

Note that machinery is already established as a primary cost item and is not discussed in this section as machinery depreciation is a non-cash cost.

Gross margin proportion of cost by category

Gross margin cost analysis

Proportional costs	$	%
Disease	$172	2.7%
Pest	$79	1.2%
Nutrition	$237	3.7%
Fertiliser	$881	13.7%
Herbicide	$32	0.5%
Application costs	$202	3.1%
Birds	$15	0.2%
Pruning	$59	0.9%
Irrigation	$750	11.7%
Bee hire	$240	3.7%
Harvest	$337	5.2%
Unallocated labour	$2,276	35.4%
Freight	$192	3.0%
Cracking costs	$960	14.9%
	$6,432	



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Economic Assessment of the "Optimisation Trial"

10.1 AIM

Provide economic assessment of CT trial results to guide the identification of superior technologies that may enhance productivity and cost efficiency.

10.2 METHOD

The Almond Economic Model has been used to assess data provided by the Almond Board of Australia on the "Optimisation Trial". Three treatments have been selected for analysis.

Table 1: Treatments for Economic Analysis

Treatment	Description	Detail
T1	Low Fertiliser Standard Water	240N 400K 18 ML
T2	Standard Fertiliser Standard Water	320N 600K 18 ML
T6	Standard Fertiliser Low Water	320N 600K 12 ML

The study uses data provided over a three-year period and averages the yield data over the period to reduce the impact of biennial bearing and season impacts. T1 and T2 showed no significant difference between yield and consequently the same yield has been used for these treatments. The yields of Non-Pariel and Carmel have been used as they represent the controlled yield data from the trial. The third variety Ne-Plus is excluded.

The inputs used are from the spray diaries, fertiliser records and management records for the trial. A set of standard costs has been used for inputs to avoid any variation of input prices.

The *Almond Economic Analysis Tool* has been used to analyse the data. The tool develops a Gross Margin on a per hectare basis for all variable costs. While the tool is capable of delivering a more complete property analysis these features are not used as the fixed costs such as overheads, depreciation and development costs will not be different between treatments. Machinery prices have been obtained from the benchmarking model developed as part of the Almond Economic Analysis.

It should also be noted that the data and gross margins do not represent a commercial almond orchard costs of production so comparisons are not valid. The trial has sought to ensure that yields are not limited by some inputs such as disease control or foliar nutrition. The relationship between the treatments is the important issue.

10.3 DISCUSSION

While yield differences may not be evident between T1 and T2 input costs vary significantly between these treatments. T6 with low water use also has a different cost structure. Consequently the Gross Margin differences are significant between treatments and care is needed in their interpretation.

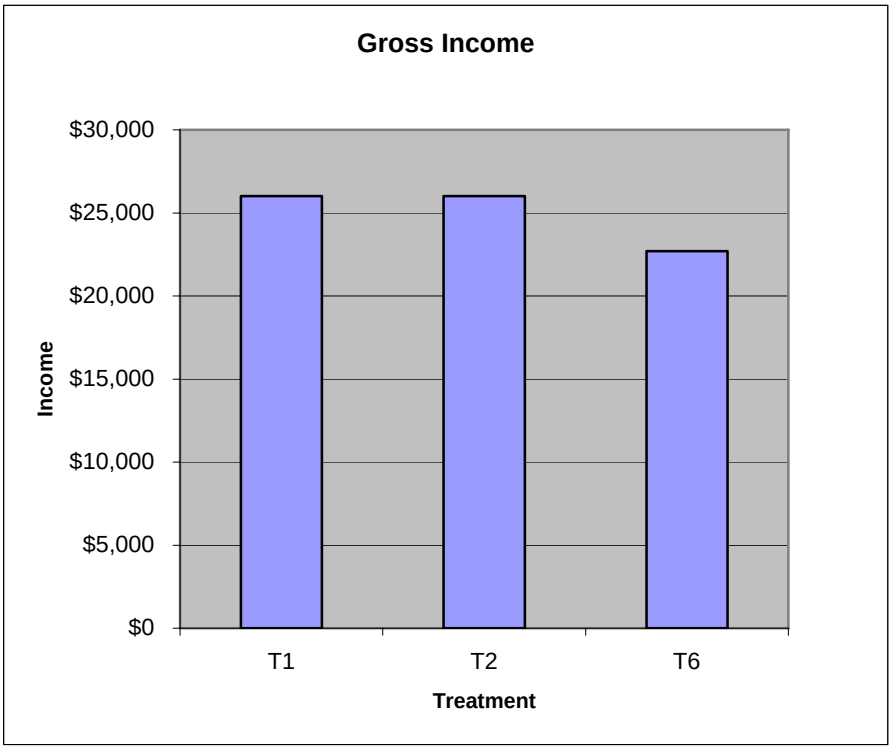
Table 2: Gross Margin and Yield

Treatment	Yield	Gross Income	Gross Margin	GM % of T1
T1	4.58	$26,009	$11,003	100%
T2	4.58	$26,009	$10,586	96%
T6	3.99	$22,689	$7,812	71%

10.3.1 Income

TI and T2 have the same yield hence no difference in total income. T6 delivered a reduced yield due to the lower water regime applied.

Graph 1: Income by Treatment

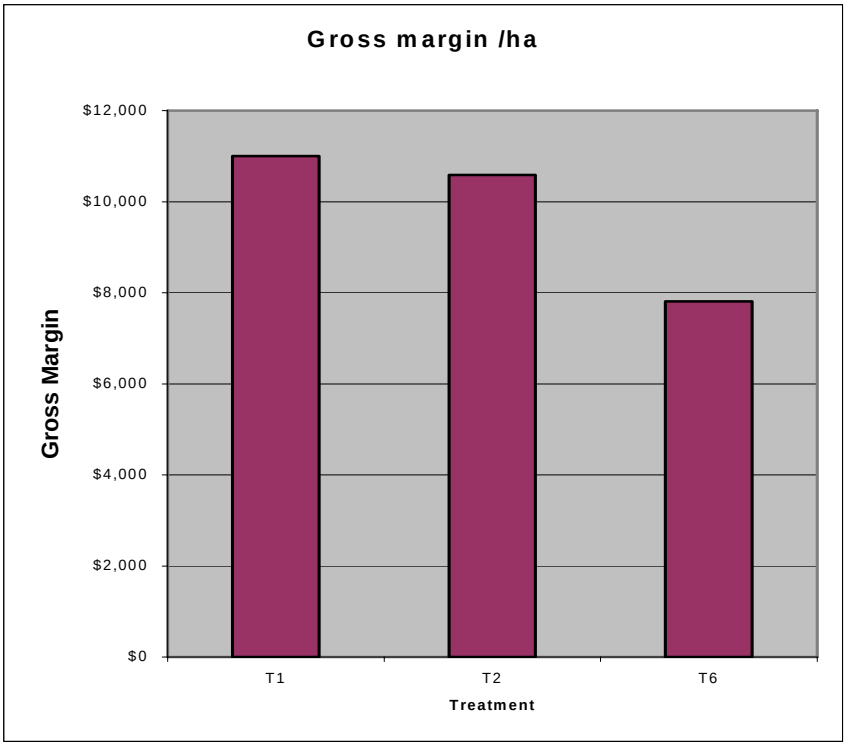


10.3.2 Gross Margin

When variable costs of production are taken in to account the Gross Margin gives a better picture of profitability on a per treatment basis. While T1 and T2 have the same yield and therefore the same income, the higher fertiliser inputs in T2 result in a lower Gross Margin for that treatment.

T6 has a lower yield primarily due to the lower irrigation applied. Fertiliser treatment is the same as T2. The lower irrigation amount saves only a marginal amount in pumping costs, but has a significant penalty in yield loss.
The value of water under the Gross Margin is considered to be a capital cost indicating a flaw in this method of analysis. This is reviewed later in the discussion.

Graph 2 Gross Margin/ha by treatment



10.3.3 Inputs

A comprehensive program of disease and insect control is used in the trial to ensure that no adverse impacts occur. All treatments received the same treatment and while it may be more that a commercial orchard would receive, there has been no yield loss from disease or insect incursions.

Table 3 Input Costs by Treatment

Treatment	Description	Total Costs	Disease Control	Pest Control	Foliar Nutrients	Fertiliser
T1	Low Fertiliser Standard Water	$15,006	$ 507	$ 85	$ 1294	$ 1372
T2	Standard Fertiliser Standard Water	$15,423	$ 507	$ 85	$ 1294	$ 1788
T6	Standard Fertiliser Low Water	$14,876	$ 507	$ 85	$ 1294	$ 1788

The nutrition applied has been non-limiting to ensure all possible nutrient needs are met. This has resulted in up to 19 applications of foliar nutrients. Eleven of these sprays were combined with disease control sprays and the remainder were foliar nutrients alone. In the trial treatments foliar nutrition and fertilisers applied through the irrigation system are significant costs. Notably, the trial costs run at around $15000 per hectare while the benchmarking costs are only $6400. This is the effect of non-limiting inputs used in a research trial. The benchmarking study (Part 1 of this project) supports the view that increased nutrition delivers increased yield. The issue is determining the point of diminishing marginal returns.

10.3.4 Water

In all trial treatments analysed increasing irrigation applications resulted in increased yield. It is vital to understand that Gross Margins are normally done on a per hectare basis and in fact the most limiting resource in the last few years has become water, not land. Performance indicia used in the Almond Economic Study show the margins on both a GM/ML and yield / ML basis. This paper is commissioned on the basis of per ha resource use.

Table 4 Water Costs by treatment

Treatment	Description	Detail
T1	Low Fertiliser Standard Water	$900 pump costs
T2	Standard Fertiliser Standard Water	$900 pump costs
T6	Standard Fertiliser Low Water	$564 pump costs

If we are to reach a valid conclusion on water use for the different treatments, then water use needs to have an annual value in addition to the cash cost of pumping that water. Current water trade prices on the temporary market are inflated due to a continuing drought. If water was valued at the current interest rate of the permanent trade price of water we will see some equity appear when the water is valued.

An annual cost of water can be established by taking a permanent price of water and multiplying it by an annual rate of interest. If the current trade price of water is $2300 and interest rate 0.082% then and annual price of water is $189/ML. This is then multiplied by the number of ML/ha. The cost of water resource then becomes $3395 for T1 and T2 and $2112 for T6. When this is added to the Gross Margin calculation the results are somewhat different.

Graph 3: Gross Margin at Water price of $189

Table 5 Gross margin using annual water value

Treatment	GM with annual water value	% of T1 @ $189	% of T1 @ $278
T1	$ 7601	100	100
T2	$ 7184	95	90
T6	$ 5680	75	85

If a range of water prices are used and graphed then the effect and point of diminishing returns becomes apparent. The impact of higher annual prices of water results in no difference between GM for different treatments.
It is possible to use the benchmarking tool with your set of figures to determine the viability of water purchase for different water values.

10.4 CONCLUSIONS

The economic analysis of the optimisation trial supports the view that optimising nutrition with maximum water application while maintaining control of disease maximises profits. The T1 and T2 treatments did not show differences in yield due to fertiliser applications using low fertiliser applications at 240N and 400K . Water application rates made a significant difference to yield and when an annual value is applied to yield there is still a profitable outcome from a GM perspective.

Growers can apply the principles of optimisation to their own situation and determine the value of increased nutrition or water application using the *Almond Economic Analysis Tool*.

10.5 APPENDICIES

GROSS MARGIN **Enterprise Name:** **CT TRIAL T1 All varieties**

Region : Location Irrigation : Drip

Enterprise Unit : CT TRIAL T1 All varieties Year 1998

Date : 10-Apr-07

							$/ha
GROSS RETURN							
production		4.58	t/ha @	$5,700	/t	$26,100	
grower levy				$20.00	/t	$92	
TOTAL GROSS RETURN							**$26,009**
PRODUCTION COSTS							
DISEASE PROGRAM	No. applications	Rate		Price			
Kocide	3	4	kg/ha.	$ 7.80	/kg	$94	
Rovral	1	2	l/ha.	$ 30.00	/l	$60	
Bravo	2	3.2	kg/ha.	$ 18.00	/kg	$115	
Rovral	1	1	l/ha.	$ 30.00	/l	$30	
Tilt	2	0.95	l/ha.	$ 38.40	/l	$73	
Application Costs	8	passes		$16.90	$/ha	$135	$507
PEST PROGRAM							
Winter Oil	1	60	l/ha.	$ 1.14	/l	$68	
Application costs	1	pass		$16.90	$/ha	$17	$85
NUTRIENT PROGRAM							
Urea(LoBi)	11	11.636	kg/ha.	$0.92	/kg	$118	
Urea	4	90	kg/ha.	$0.49	/kg	$176	
NZn	16	3.8	l/ha.	$6.11	/l	$372	
Potassium Nitrate	19	22.789	kg/ha.	$0.83	/kg	$359	
Boric acid	2	0.2	kg/ha.	$8.15	/kg	$3	
Solubor	2	3.7	kg/ha.	$2.62	/kg	$19	
Trace L	2	5	l/ha. /ha.	$6.05	/l	$61	
Application costs	11	passes		$16.90	$/ha	$186	$1,294
FERTILIZER PROGRAM							
Potassium Nitrate	9	43.5	kg/ha.	$0.83	/kg	$325	
Urea	7	42.5	kg/ha.	$0.49	/kg	$146	
Potassium Chloride (Muriate of l	11	44.6	l/ha.	$0.76	/l	$373	
Ammonium Nitrate	2	36.5	kg/ha.	$0.44	/kg	$32	
Librel FE	10	1.1	kg/ha.	$23.00	/kg	$253	
MAP	2	115	kg/ha.	$1.05	/kg	$243	
Application costs	pass			$16.90	$/ha		$1,372
HERBICIDES							
Roundup 360	3	3	l/ha.	$4.60	/l	$14	
Sprayseed	1	3	l/ha.	$8.90	/l	$9	
Roundup 360	2	3	l/ha.	$4.60	/l	$9	
Application costs	6	passes		$11.89	$/ha	$71	$103
BIRD CONTROL						$15	$15
PRUNING							
- Hand		245	trees	$8.00	/tree	$1,960	$1,960
IRRIGATION							
power		18000	Kl/ha	$0.05	c/Kl p	$900	$900
POLLINATION							
Hive hire		8	hives/ha	$40.00	/hive	$320	$320
MECHANICAL HARVESTING		$386.95	$/ha			$387	$387
UNALLOCATED LABOUR		257	hours	$25.00	/hour	$6,414	$6,414
FREIGHT TO CRACKER				$0.06	/t	$275	$275
CRACKING COSTS				0.3	/kg	$1,374	$1,374
TOTAL PRODUCTION COSTS						$15,006	**$15,006**
GROSS MARGIN ($/ha)						$11,003	**$11,003**

GROSS MARGIN — Enterprise Name: CT TRIAL T2 All varieties

Region : Location — Irrigation : Drip
Enterprise Unit : CT TRIAL T2 All varieties — Year 1998
Date : 10-Apr-07

							$/ha
GROSS RETURN							
production		4.55	t/ha @	$5,700	/t	$25,918	
grower levy				$20.00	/t	$91	
TOTAL GROSS RETURN							**$25,827**
PRODUCTION COSTS							
DISEASE PROGRAM	No. applications	Rate		Price			
Kocide	3	4	kg/ha.	$ 7.80	/kg	$94	
Rovral	1	2	l/ha.	$ 30.00	/l	$60	
Bravo	2	3.2	kg/ha.	$ 18.00	/kg	$115	
Rovral	1	1	l/ha.	$ 30.00	/l	$30	
Tilt	2	0.95	l/ha.	$ 38.40	/l	$73	
Application Costs	8 passes			$16.90	$/ha	$135	$507
PEST PROGRAM							
Winter Oil	1	60	l/ha.	$ 1.14	/l	$68	
Application costs	1 pass			$16.90	$/ha	$17	$85
NUTRIENT PROGRAM							
Urea(LoBi)	11	11.636	kg/ha.	$0.92	/kg	$118	
Urea	4	90	kg/ha.	$0.49	/kg	$176	
NZn	16	3.8	l/ha.	$6.11	/l	$372	
Potassium Nitrate	19	22.789	kg/ha.	$0.83	/kg	$359	
Boric acid	2	0.2	kg/ha.	$8.15	/kg	$3	
Solubor	2	3.7	kg/ha.	$2.62	/kg	$19	
Trace L	2	5	l/ha.	$6.05	/l	$61	
Application costs	11 passes			$16.90	$/ha	$186	$1,294
FERTILIZER PROGRAM							
Potassium Nitrate	14	43.5	kg/ha.	$0.83	/kg	$505	
Urea	8	42.7	kg/ha.	$0.49	/kg	$167	
Potassium Chloride (Muriate of l	16	45	l/ha.	$0.76	/l	$547	
Ammonium Nitrate	4	41	kg/ha.	$0.44	/kg	$73	
Librel FE	10	1.1	kg/ha.	$23.00	/kg	$253	
MAP	2	115	kg/ha.	$1.05	/kg	$243	
Application costs	pass			$16.90	$/ha		$1,788
HERBICIDES							
Roundup 360	3	3	l/ha.	$4.60	/l	$14	
Sprayseed	1	3	l/ha.	$8.90	/l	$9	
Roundup 360	2	3	l/ha.	$4.60	/l	$9	
Application costs	6 passes			$11.89	$/ha	$71	$103
BIRD CONTROL						$15	$15
PRUNING							
- Hand		245	hours	$8.00	/hr	$1,960	$1,960
IRRIGATION							
water (leased)		18000	/Kl	Water (Temp	/Kl		
power		18000	Kl/ha	$0.05	c/Kl p	$900	$900
POLLINATION							
Hive hire		8	hives/ha	$40.00	/hive	$320	$320
MECHANICAL HARVESTING		$386.95	$/ha			$387	$387
UNALLOCATED LABOUR		257	hours	$25.00	/hour	$6,414	$6,414
FREIGHT TO CRACKER				$0.06	/t	$273	$273
CRACKING COSTS				0.3	/kg	$1,364	$1,364
TOTAL PRODUCTION COSTS						$15,411	**$15,411**
GROSS MARGIN ($/ha)						$10,416	**$10,416**

GROSS MARGIN — Enterprise Name: CT TRIAL T6 All varieties

Region : Location — Irrigation : Drip
Enterprise Unit : CT TRIAL T6 All varieties — Year 1998
Date : 10-Apr-07

							$/ha
GROSS RETURN							
production		3.99	t/ha @	$5,700	/t	$22,769	
grower levy				$20.00	/t	$80	
TOTAL GROSS RETURN							**$22,689**
PRODUCTION COSTS							
DISEASE PROGRAM	No. applications	Rate		Price			
Kocide	3	4	kg/ha.	$ 7.80	/kg	$94	
Rovral	1	2	l/ha.	$ 30.00	/l	$60	
Bravo	2	3.2	kg/ha.	$ 18.00	/kg	$115	
Rovral	1	1	l/ha.	$ 30.00	/l	$30	
Tilt	2	0.95	l/ha.	$ 38.40	/l	$73	
Application Costs	8	passes		$16.90	$/ha	$135	$507
PEST PROGRAM							
Winter Oil	1	60	l/ha.	$ 1.14	/l	$68	
Application costs	1	pass		$16.90	$/ha	$17	$85
NUTRIENT PROGRAM							
Urea(LoBi)	11	11.636	kg/ha.	$0.92	/kg	$118	
Urea	4	90	kg/ha.	$0.49	/kg	$176	
NZn	16	3.8	l/ha.	$6.11	/l	$372	
Potassium Nitrate	19	22.789	kg/ha.	$0.83	/kg	$359	
Boric acid	2	0.2	kg/ha.	$8.15	/kg	$3	
Solubor	2	3.7	kg/ha.	$2.62	/kg	$19	
Trace L	2	5	l/ha.	$6.05	/l	$61	
Application costs	11	passes		$16.90	$/ha	$186	$1,294
FERTILIZER PROGRAM							
Potassium Nitrate	14	43.5	kg/ha.	$0.83	/kg	$505	
Urea	8	42.7	kg/ha.	$0.49	/kg	$167	
Potassium Chloride (Muriate of l	16	45	l/ha.	$0.76	/l	$547	
Ammonium Nitrate	4	41	kg/ha.	$0.44	/kg	$73	
Librel FE	10	1.1	kg/ha.	$23.00	/kg	$253	
MAP	2	115	kg/ha.	$1.05	/kg	$243	
Application costs		pass		$16.90	$/ha		$1,788
HERBICIDES							
Roundup 360	3	3	l/ha.	$4.60	/l	$14	
Sprayseed	1	3	l/ha.	$8.90	/l	$9	
Roundup 360	2	3	l/ha.	$4.60	/l	$9	
Application costs	6	passes		$11.89	$/ha	$71	$103
BIRD CONTROL						$15	$15
PRUNING							
- Hand		245	hours	$8.00	/hr	$1,960	$1,960
IRRIGATION							
power		11280	Kl/ha	$0.05	c/Kl p	$564	$564
POLLINATION							
Hive hire		8	hives/ha	$40.00	/hive	$320	$320
MECHANICAL HARVESTING		$386.95	$/ha			$387	$387
UNALLOCATED LABOUR		257	hours	$25.00	/hour	$6,414	$6,414
FREIGHT TO CRACKER				$0.06	/t	$240	$240
CRACKING COSTS				0.3	/kg	$1,198	$1,198
TOTAL PRODUCTION COSTS						$14,876	**$14,876**
GROSS MARGIN ($/ha)						$7,812	**$7,812**

Technology Transfer

The final report was presented to the Annual Almond industry Seminar held in Mildura on November 1st 2007. The following presentation was given to the conference in 3 parts;

Presentation of the Bencharking Study
Presentation of the Economic Analysis of the Optimisation Trial
A workshop on the operation of the model.

The *Almond Economic Analysis Tool* is available for almond industry levy payers on the industry section at http//:australian almonds.com.au using your login and password.

The *Almond Economic Analysis Tool* benchmark outputs are attached in the following pages followed by a short selection of the presentation slides demonstrates the model potential.

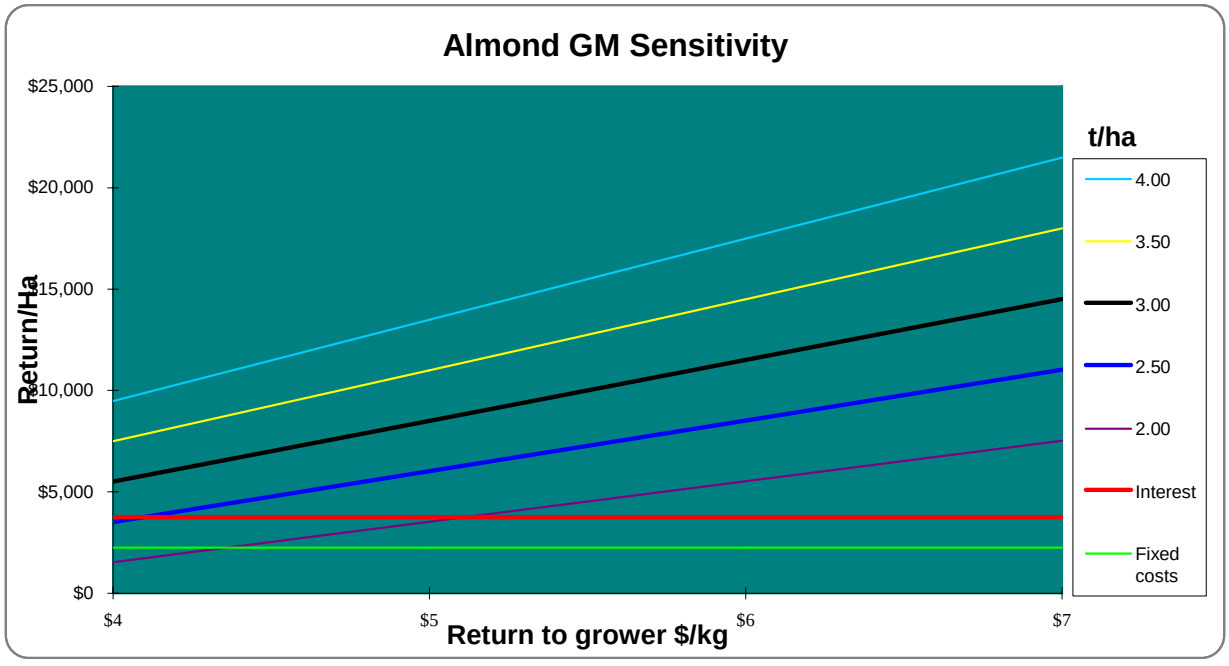
GROSS MARGIN	Enterprise Name:		Benchmark			
Region : Location		Irrigation : Drip				
Enterprise Unit : Benchmark		Year : 1998				
		Date : 10-Apr-07				
						$/ha
GROSS RETURN						
production	3.20	t/ha @	$5,700	/t	$18,240	
grower levy			$20.00	/t	$64	
TOTAL GROSS RETURN						**$18,176**
PRODUCTION COSTS						
DISEASE PROGRAM					$272	
PEST PROGRAM					$94	
NUTRIENT PROGRAM					$251	
FERTILIZER PROGRAM					$895	
HERBICIDES					$92	
BIRD CONTROL					$15	
PRUNING						
- Machine	0				$0	
- Hand	3	hours	$19.50	/hr	$59	
IRRIGATION						
water (leased)	15000	/Kl	Water (Ten	/Kl	$0	
power	15000	Kl/ha	$0.05	c/Kl pumped	$750	
POLLINATION						
Hive hire	6	hives/ha	$40.00	/hive	$240	
MECHANICAL HARVESTING	$336.86	$/ha			$337	
UNALLOCATED LABOUR	117	hours	$19.50	/hour	$2,276	
FREIGHT TO CRACKER			$0.06	/t	$192	
CRACKING COSTS			0.3	/kg	$960	
TOTAL PRODUCTION COSTS					$8,034	**$6,432**
GROSS MARGIN ($/ha)					$10,142	**$11,744**

PRODUCTION COSTS DETAIL								
DISEASE PROGRAM	**applications**		**Rate**		**Price**			
Kocide	1		2	kg/ha.	$8	/kg	$16	
Mancozeb	1		2	kg/ha.	$7	/kg	$14	
Mancozeb	3		4	kg/ha.	$7	/kg	$89	
Rovral	1		1	l/ha.	$30	/l	$30	
Tilt	1		0.64	l/ha.	$38	/l	$25	
							$0	
							$0	
							$0	
Application Costs	7	passes		0	$14	$/ha	$99	**$272**
PEST PROGRAM	**applications**		**Rate**		**Price**			**$94**
Winter Oil	1		70	l/ha.	$1	/l	$79	
							$0	
							$0	
							$0	
Application costs	1	pass		0	$14	$/ha	$14	**$94**
NUTRIENT PROGRAM	**applications**		**Rate**		**Price**			**$251**
Urea(LoBi)	2		6	kg/ha.	$1	/kg	$11	
Potassium Nitrate	5		6.25	kg/ha.	$1	/kg	$26	
Zinc Nitrate	5		5.5	l/ha.	$6	/l	$168	
Mantrac	2		1	kg/ha.	$16	/kg	$32	
				/ha.			$0	
				/ha.			$0	
				/ha.			$0	
				/ha.			$0	
Application costs	1	pass		0	$14	$/ha	$14	**$251**
FERTILIZER PROGRAM	**applications**		**Rate**		**Price**			**$895**
Urea	22		24	kg/ha.	$0	/kg	$259	
Potassium Nitrate	11		25	kg/ha.	$1	/kg	$228	
Phosphoric Acid	8		10	l/ha.	$2	/l	$145	
Potassium Chloride (Muriate of	7		12	kg/ha.	$1	/kg	$64	
MAP	5		10	kg/ha.	$1	/kg	$53	
Single Super	1		250	kg/ha.	$0	/kg	$64	
Ammonium Nitrate	5		10	kg/ha.	$0	/kg	$22	
Librel FE	2		1	kg/ha.	$23	/kg	$46	
	0		0				$0	
	0		0				$0	
Application costs	1	pass		0	$14	$/ha	$14	**$895**
HERBICIDES	**applications**		**Rate**		**Price**			**$92**
Roundup 360	3		3	l/ha.	$5	/l	$14	
	0		0				$0	
Sprayseed	1		3	l/ha.	$9	/l	$9	
Roundup 360	2		3	l/ha.	$5	/l	$9	
Application costs	6	passes		0	$10	$/ha	$60	**$92**

Gross margin sensitivity table $/ha

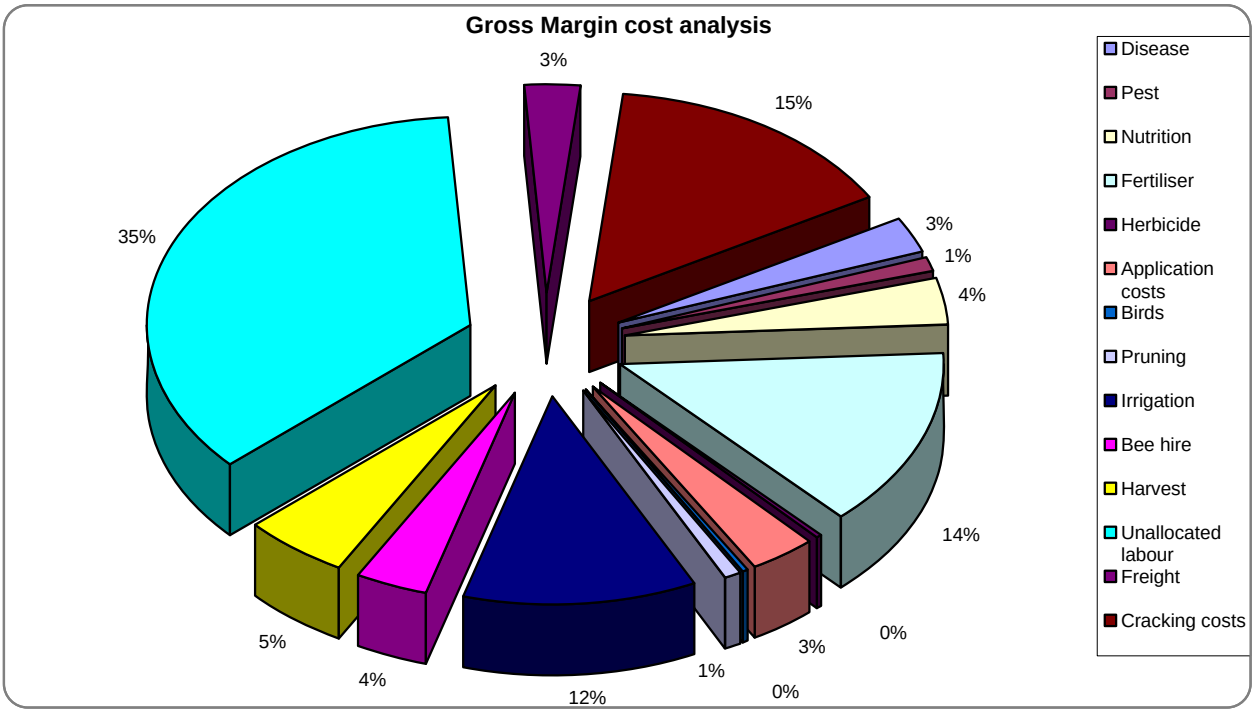
		Yield t/Ha.					
		2.00	2.50	3.00	3.50	4.00	Fixed costs
	$4	$1,528	$3,518	$5,508	$7,498	$9,488	$2,256
Price	$5	$3,528	$6,018	$8,508	$10,998	$13,488	$2,256
$/kilogram	$6	$5,528	$8,518	$11,508	$14,498	$17,488	$2,256
	$7	$7,528	$11,018	$14,508	$17,998	$21,488	$2,256

Fixed costs include depreciation on fixed assets, trees and machinery and annual overhead costs.



Gross margin cost analysis

Cost Category	$	%
Disease	$172	2.7%
Pest	$79	1.2%
Nutrition	$237	3.7%
Fertiliser	$881	13.7%
Herbicide	$32	0.5%
Application costs	$202	3.1%
Birds	$15	0.2%
Pruning	$59	0.9%
Irrigation	$750	11.7%
Bee hire	$240	3.7%
Harvest	$337	5.2%
Unallocated labc	$2,276	35.4%
Freight	$192	3.0%
Cracking costs	$960	14.9%
	$6,432	



Benchmark

Breakeven points	**/kg**			
Total Margin/kg		$	2.97	/kg
Gross Margin per kg kernel		$	3.67	/kg
Cost of production / kg		$	2.01	/kg
Overheads Costs/kg		$	0.36	/kg
Fixed AssetDepreciation/kg		$	0.15	/kg
Machinery Depreciation/kg		$	0.19	/kg
Total Costs/kg		$	2.71	/kg

Grower Comments

Gross margin	**/ha**		
Gross income		$18,176	
Gross margin /ha		$11,744	/ha
Cost of production / ha	$	6,431.52	/ha
Overheads Costs/ha	$	1,150.00	/ha
Fixed AssetDepreciation/ha	$	487.44	/ha
Machinery Depreciation/ha	$	618.75	/ha
Total Costs/ha	$	8,687.71	/ha
Total Margin/ha		$9,488	/ha

Benchmark					**Grower Comments**
Water use efficiency	**/ML**				
Yield/ML			213	kg/Ml water	
Cost of Production /ML		$	428.77	/ML water	
Overheads Costs/ML		$	76.67	/ML water	
Fixed AssetDepreciation/ML		$	32.50	/ML water	
Machinery Depreciation/ML		$	41.25	/ML water	
Total Costs/ML		$	579.18	/ML water	
GM/ML			$783	/ML water	
Gross Income/ML			$1,216	/Ml water	
Physical Indicies					
Property Size			40	ha	
Last 3 years average all crop	Yield 5		2.47	t/ha	
	Yield 6		2.96	t/ha	
	Yield 7		3.20	t/ha	
	3 Year average		2.88	t/ha	
Irrigation applied			15000	Kl/ha	
Labour/ha			$2,276	/ha	

HAL
Know-how for Horticulture™

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ALMOND BOARD OF AUSTRALIA

Almond Economic Analysis 2007

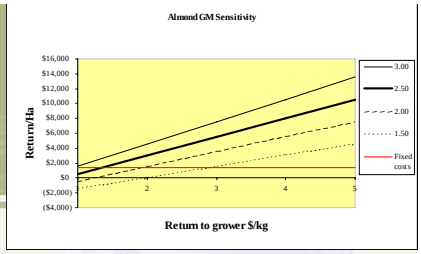
Annual Conference
Model release

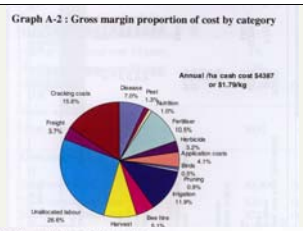
David Pocock

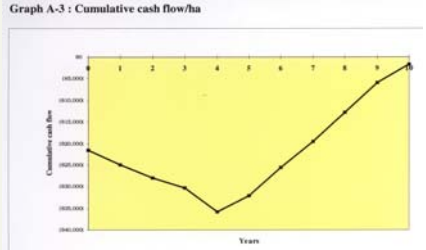
RURAL SOLUTIONS SA

Background

- 1998 Comparative Analysis
- Funding HAL and PIRSA
- A qualitative approach
- Primary Outputs
  - Gross Margin
  - Cash Flow
  - Development Budget
  - Sensitivity Analysis







Outputs

- 1. Revised publication "Comparative Analysis of Almond production in Southern Australia" to include updated input costs, enterprise sizes and cost curves.
- 2. Economic evaluation (Gross Margin) of the CT trial to enable identification of superior technologies for commercial application (best treatment)
- 3. A CD for use by growers and investors to analyse opportunities and their own economic performance

Performance Indices

- 3yr Average Yield
- Cost of production /kg kernel
- Cumulative Cash Flow
- Year's to positive cash flow
- IRR over 10 years
- Gross Margin
- Yield per ML

The Almond Economic Analysis

- Several properties used in a qualitative study to develop benchmarks for industry
- Limited Beta testing on the disc
- Resulting in 2 versions
  - A basic version to deliver a GM on a patch – Cash only
  - An advanced version delivering a profitability approach that includes depreciation and multi year analysis of a property.

The Almond Economic Analysis

- Several properties used in a qualitative study to develop benchmarks for industry
- Limited Beta testing on the disc
- Resulting in 2 versions
  - A basic version to deliver a GM on a patch – Cash only
  - An advanced version delivering a profitability approach that includes depreciation and multi year analysis of a property.

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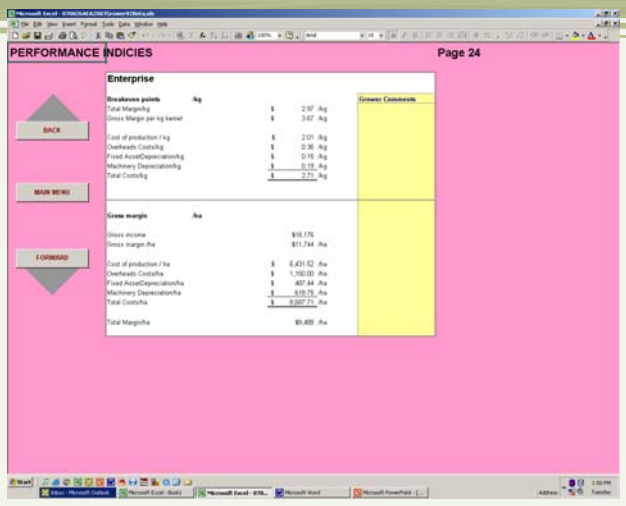
Performance Indices

Table 1: Primary financial performance indicators

Performance indicator	Performance benchmark
Best average 3-yr yields	Consistently above 3.2t/ha.
Years to mature return (2.45t/ha)	Mature yield in the sixth year
Years to first return (0.25t/ha)	First yield in the third year
Gross margin	>$10 000 /ha
Cash costs/kg of kernel	<$2.01/kg
Cost of machinery depreciation	Less than 100 hectares <$ 450/ha Greater than 100 hectares <$ 150/ha
Labour costs per hectare	<$2200/ha
Irrigation power costs	<$50/Ml pumped

The Benchmarks

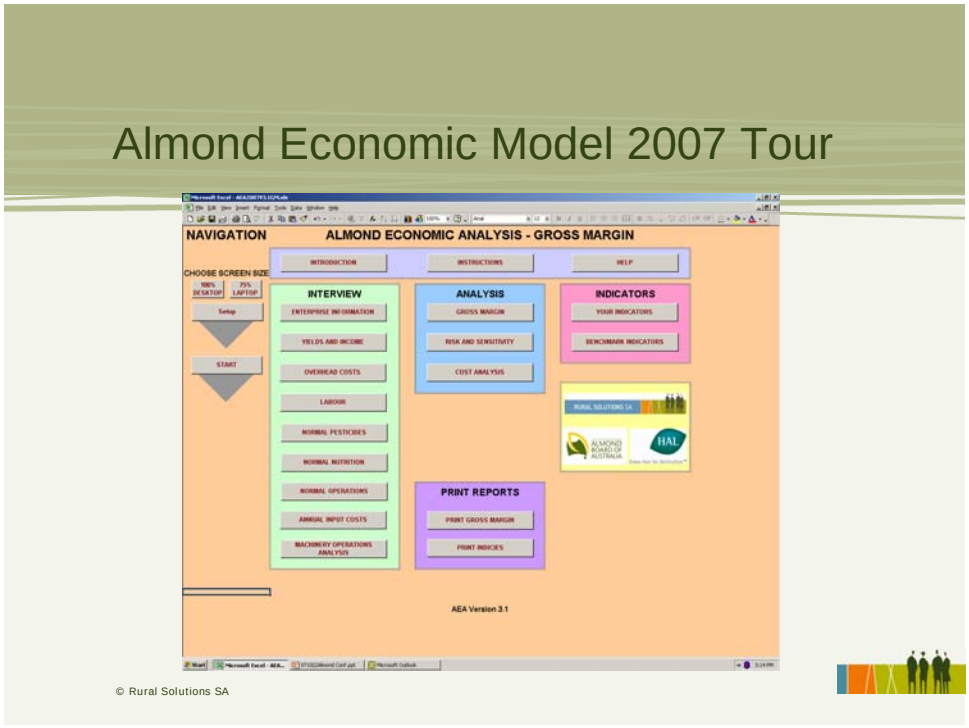


Availability

- On the net at **www.australianalmonds.com.au**
- Login under your registration
- Readily updated

Capability

- Emailable
- Excel 2003 and Excel 2007
- Windows XP and Vista
- Multi patch
- Cash (Gross Margin)
- Or profitability (Development proposal)


Almond Economic Model 2007 Tour
NAVIGATION
ALMOND ECONOMIC ANALYSIS - GROSS MARGIN
INTRODUCTION
INSTRUCTIONS
HELP
CHOOSE SCREEN SIZE
100% DESKTOP
75% LAPTOP
Setup
START
INTERVIEW
ENTERPRISE INFORMATION
YIELDS AND INCOME
OVERHEAD COSTS
LABOUR
NORMAL PESTICIDES
NORMAL NUTRITION
NORMAL OPERATIONS
ANNUAL INPUT COSTS
MACHINERY OPERATIONS ANALYSIS
ANALYSIS
GROSS MARGIN
RISK AND SENSITIVITY
COST ANALYSIS
INDICATORS
YOUR INDICATORS
BENCHMARK INDICATORS
PRINT REPORTS
PRINT GROSS MARGIN
PRINT INDICES
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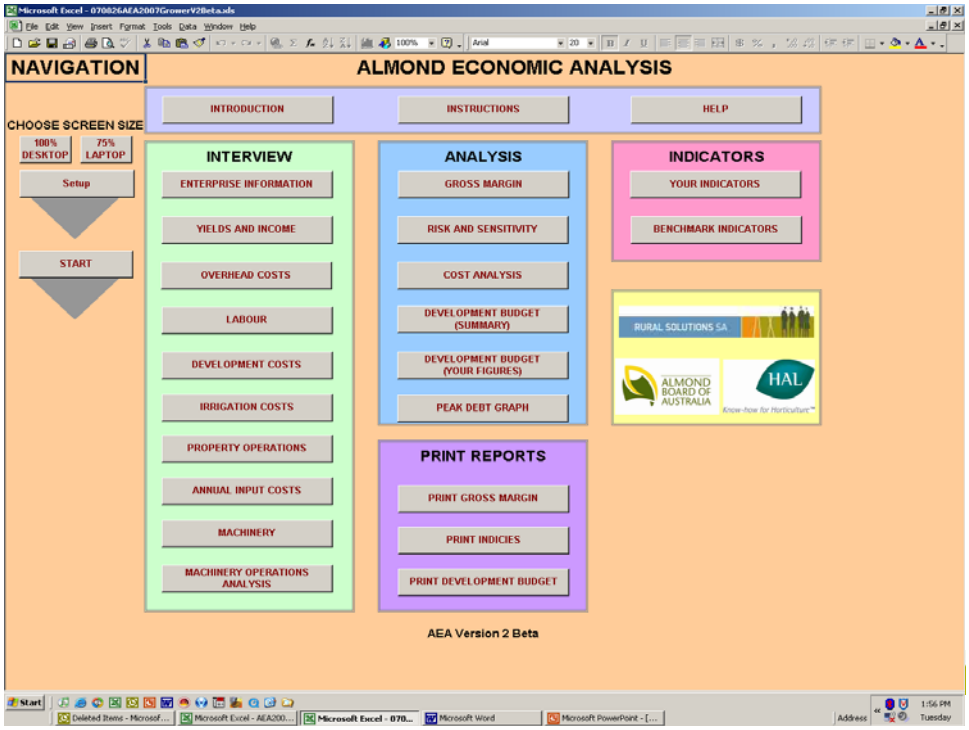
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DEVELOPMENT BUDGET (SUMMARY)
DEVELOPMENT BUDGET (YOUR FIGURES)
PEAK DEBT GRAPH
INDICATORS
YOUR INDICATORS
BENCHMARK INDICATORS
PRINT REPORTS
PRINT GROSS MARGIN
PRINT INDICIES
PRINT DEVELOPMENT BUDGET
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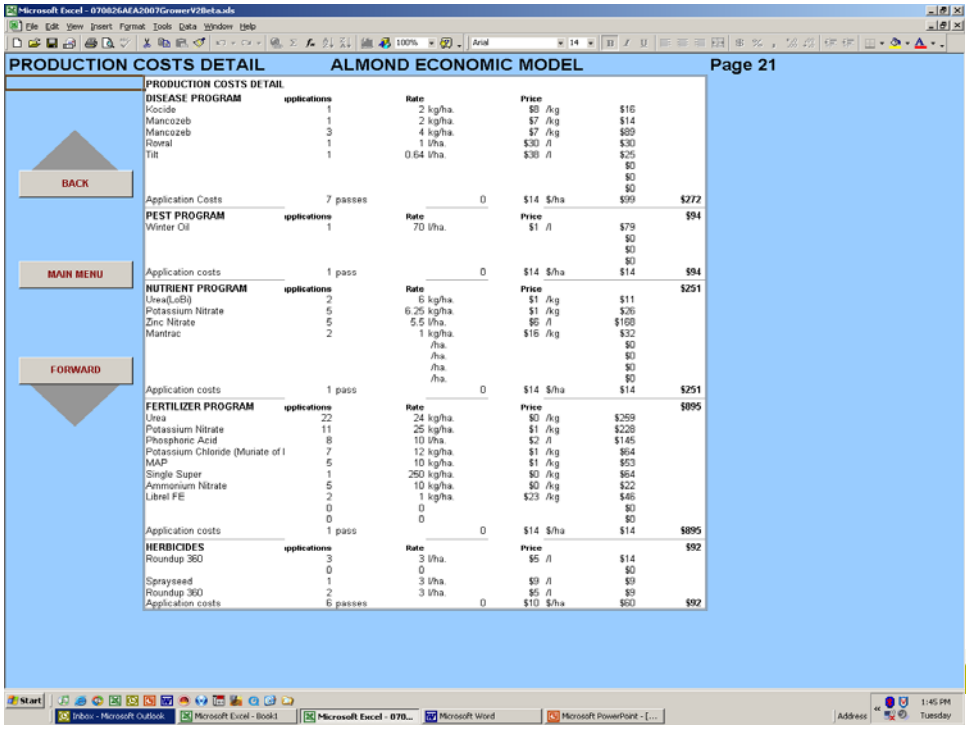


PRODUCTION COSTS DETAIL — ALMOND ECONOMIC MODEL — Page 21

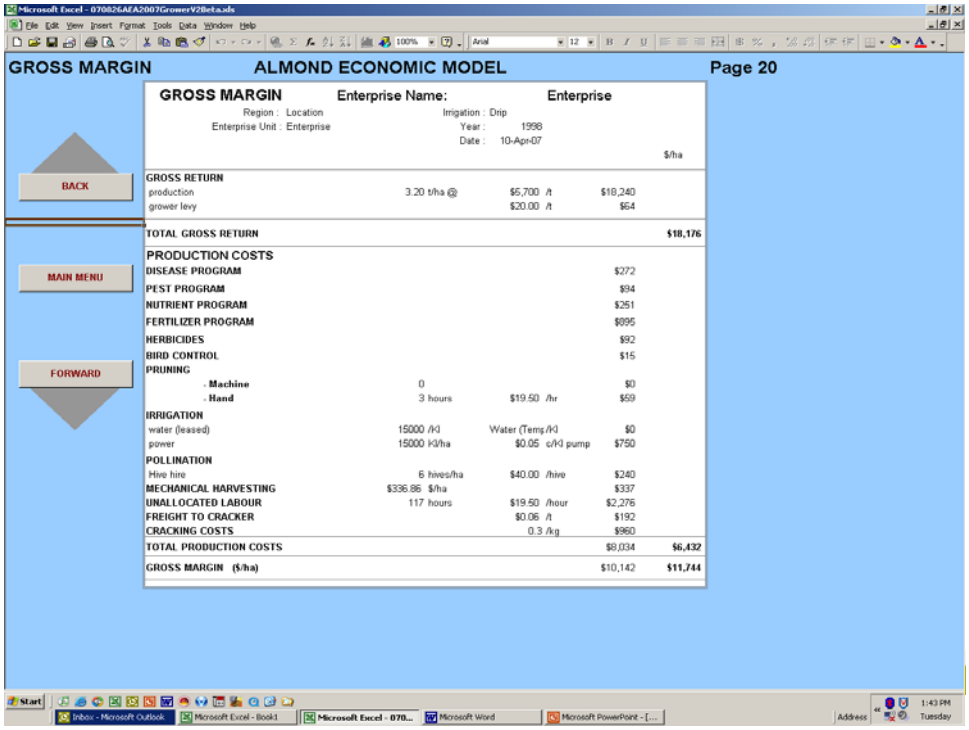
BACK

MAIN MENU

FORWARD

PRODUCTION COSTS DETAIL

DISEASE PROGRAM	applications		Rate		Price		
Kocide	1		2 kg/ha.		$8 /kg	$16	
Mancozeb	1		2 kg/ha.		$7 /kg	$14	
Mancozeb	3		4 kg/ha.		$7 /kg	$89	
Rovral	1		1 l/ha.		$30 /l	$30	
Tilt	1		0.64 l/ha.		$38 /l	$25	
						$0	
						$0	
						$0	
Application Costs	7 passes			0	$14 $/ha	$99	$272
PEST PROGRAM	**applications**		**Rate**		**Price**		**$94**
Winter Oil	1		70 l/ha.		$1 /l	$79	
						$0	
						$0	
						$0	
Application costs	1 pass			0	$14 $/ha	$14	$94
NUTRIENT PROGRAM	**applications**		**Rate**		**Price**		**$251**
Urea(Lo89)	2		6 kg/ha.		$1 /kg	$11	
Potassium Nitrate	5		6.25 kg/ha.		$1 /kg	$26	
Zinc Nitrate	5		5.5 l/ha.		$6 /l	$168	
Mantrac	2		1 kg/ha.		$16 /kg	$32	
			/ha.			$0	
			/ha.			$0	
			/ha.			$0	
			/ha.			$0	
Application costs	1 pass			0	$14 $/ha	$14	$251
FERTILIZER PROGRAM	**applications**		**Rate**		**Price**		**$895**
Urea	22		24 kg/ha.		$0 /kg	$259	
Potassium Nitrate	11		25 kg/ha.		$1 /kg	$228	
Phosphoric Acid	8		10 l/ha.		$2 /l	$145	
Potassium Chloride (Muriate of I	7		12 kg/ha.		$1 /kg	$64	
MAP	5		10 kg/ha.		$1 /kg	$53	
Single Super	1		250 kg/ha.		$0 /kg	$64	
Ammonium Nitrate	5		10 kg/ha.		$0 /kg	$22	
Librel FE	2		1 kg/ha.		$23 /kg	$46	
	0		0			$0	
	0		0			$0	
Application costs	1 pass			0	$14 $/ha	$14	$895
HERBICIDES	**applications**		**Rate**		**Price**		**$92**
Roundup 360	3		3 l/ha.		$5 /l	$14	
	0		0			$0	
Sprayseed	1		3 l/ha.		$9 /l	$9	
Roundup 360	2		3 l/ha.		$5 /l	$9	
Application costs	6 passes			0	$10 $/ha	$60	$92



GROSS MARGIN — ALMOND ECONOMIC MODEL — Page 20

BACK

MAIN MENU

FORWARD

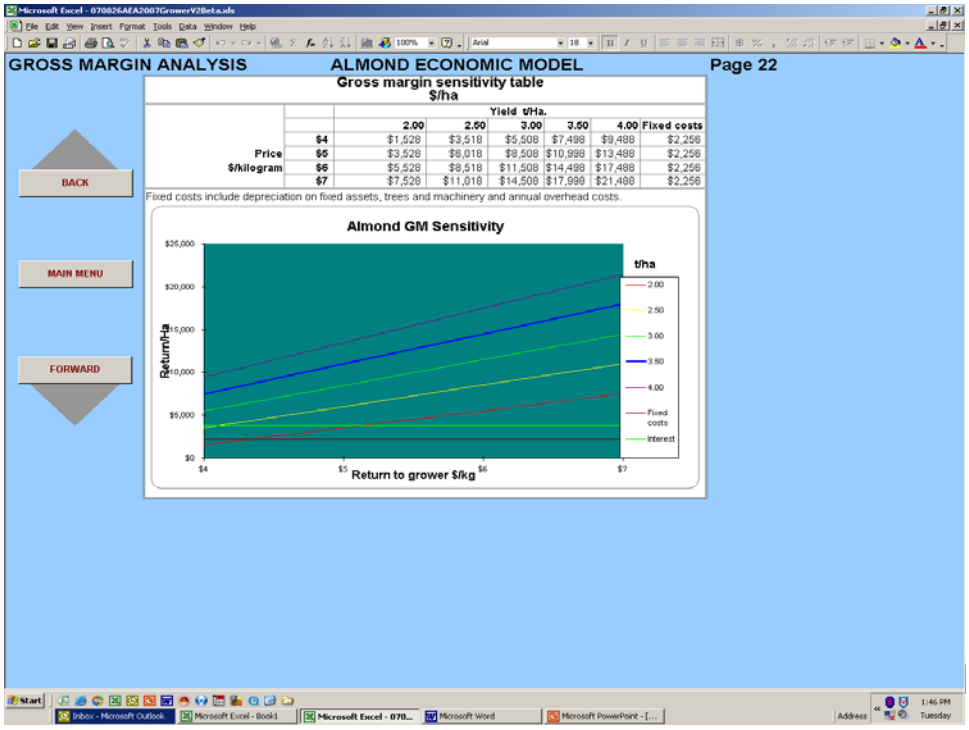
GROSS MARGIN Enterprise Name: Enterprise

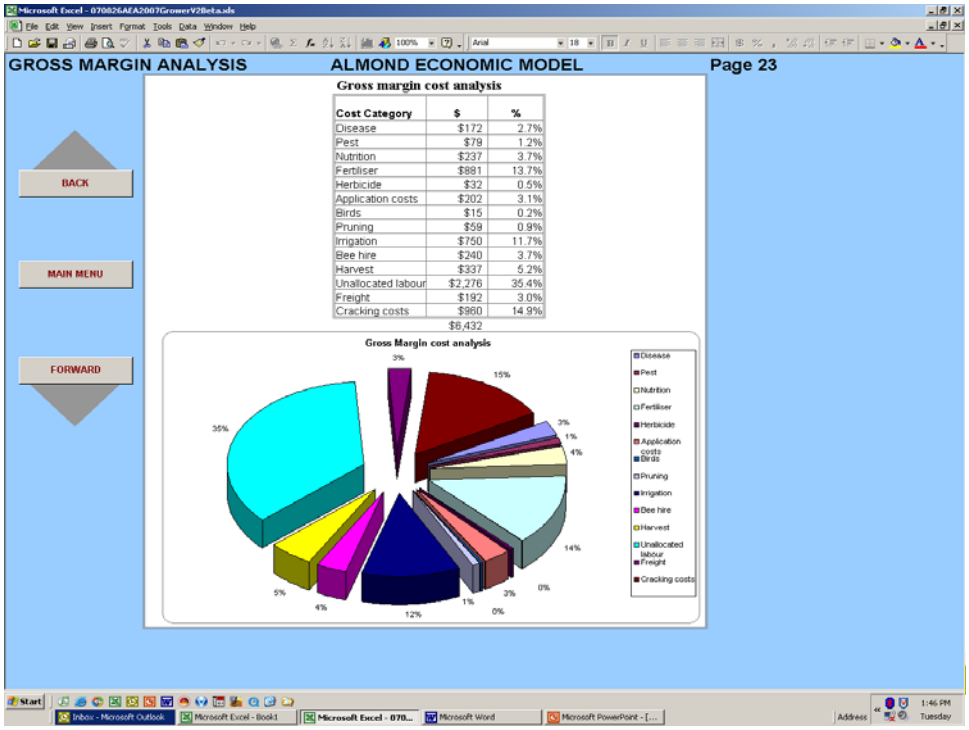
Region : Location — Irrigation : Drip

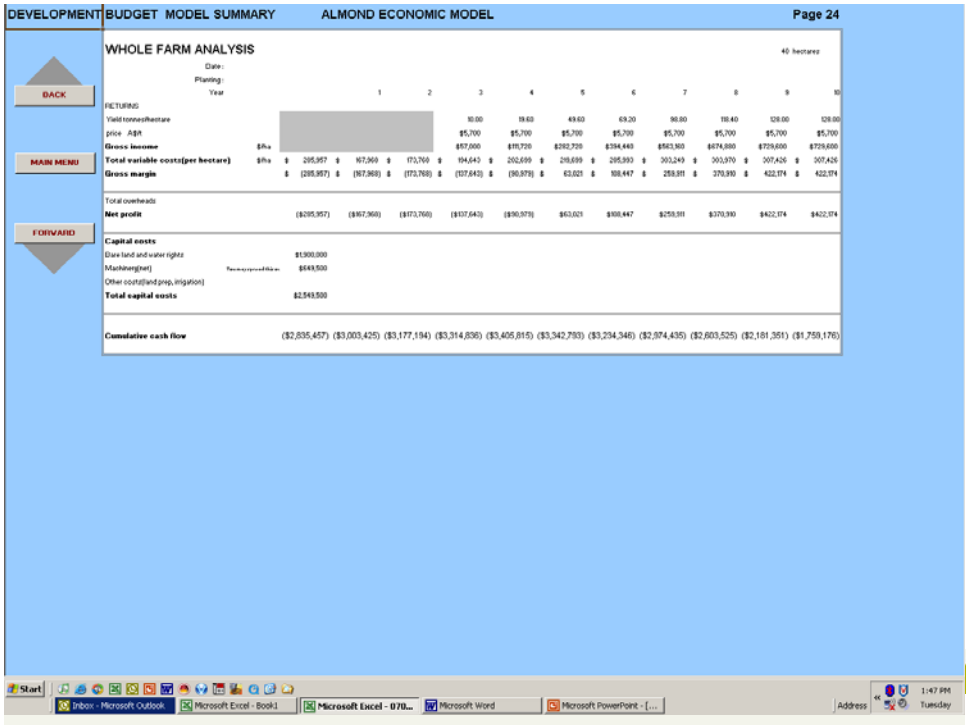
Enterprise Unit : Enterprise — Year : 1998

Date : 10-Apr-07

				$/ha
GROSS RETURN				
production	3.20 t/ha @	$5,700 /t	$18,240	
grower levy		$20.00 /t	$64	
TOTAL GROSS RETURN				**$18,176**
PRODUCTION COSTS				
DISEASE PROGRAM			$272	
PEST PROGRAM			$94	
NUTRIENT PROGRAM			$251	
FERTILIZER PROGRAM			$895	
HERBICIDES			$92	
BIRD CONTROL			$15	
PRUNING				
- Machine	0		$0	
- Hand	3 hours	$19.50 /hr	$59	
IRRIGATION				
water (leased)	15000 /kl	Water (Tems./kl)	$0	
power	15000 kl/ha	$0.05 c/kl pump	$750	
POLLINATION				
Hive hire	6 hives/ha	$40.00 /hive	$240	
MECHANICAL HARVESTING	$336.86 $/ha		$337	
UNALLOCATED LABOUR	117 hours	$19.50 /hour	$2,276	
FREIGHT TO CRACKER		$0.06 /t	$192	
CRACKING COSTS		0.3 /kg	$960	
TOTAL PRODUCTION COSTS			$8,034	**$6,432**
GROSS MARGIN ($/ha)			$10,142	**$11,744**


GROSS MARGIN ANALYSIS
ALMOND ECONOMIC MODEL
Page 22
BACK
MAIN MENU
FORWARD
Gross margin sensitivity table
$/ha
Yield t/Ha.
2.00 2.50 3.00 3.50 4.00 Fixed costs
Price $/kilogram
$4 $1,528 $3,518 $5,508 $7,498 $9,488 $2,256
$5 $3,528 $6,018 $8,508 $10,998 $13,488 $2,256
$6 $5,528 $8,518 $11,508 $14,498 $17,488 $2,256
$7 $7,526 $11,018 $14,508 $17,998 $21,486 $2,256
Fixed costs include depreciation on fixed assets, trees and machinery and annual overhead costs.
Almond GM Sensitivity
Return/Ha
Return to grower $/kg
t/ha
2.00
2.50
3.00
3.50
4.00
Fixed costs
Interest


GROSS MARGIN ANALYSIS
ALMOND ECONOMIC MODEL
Page 23
BACK
MAIN MENU
FORWARD
Gross margin cost analysis
Cost Category $ %
Disease $172 2.7%
Pest $79 1.2%
Nutrition $237 3.7%
Fertiliser $881 13.7%
Herbicide $32 0.5%
Application costs $202 3.1%
Birds $15 0.2%
Pruning $59 0.9%
Irrigation $750 11.7%
Bee hire $240 3.7%
Harvest $337 5.2%
Unallocated labour $2,276 35.4%
Freight $192 3.0%
Cracking costs $960 14.9%
$6,432
Gross Margin cost analysis

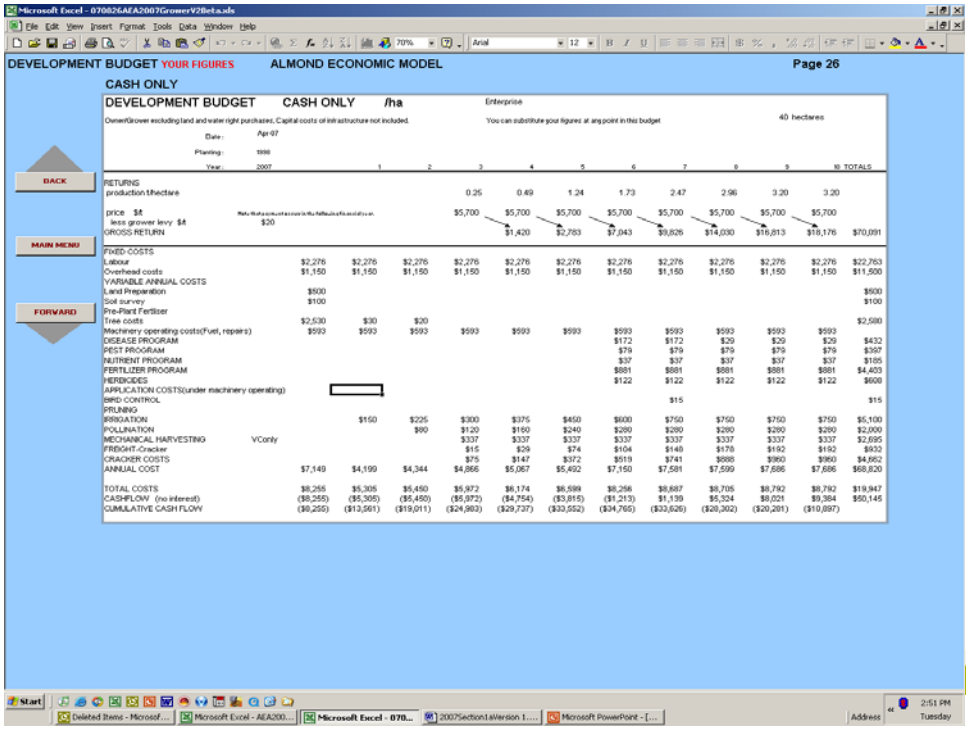


DEVELOPMENT BUDGET MODEL SUMMARY — ALMOND ECONOMIC MODEL — Page 24

BACK | MAIN MENU | FORWARD

WHOLE FARM ANALYSIS — 40 hectares

Year		1	2	3	4	5	6	7	8	9	10
RETURNS											
Yield tonnes/hectare				10.00	19.60	49.60	69.20	98.80	118.40	128.00	128.00
price A$/t				$5,700	$5,700	$5,700	$5,700	$5,700	$5,700	$5,700	$5,700
Gross income	$/ha			$57,000	$111,720	$282,720	$394,440	$563,160	$674,880	$729,600	$729,600
Total variable costs(per hectare)	$/ha	$ 295,957	$ 167,360	$ 172,760	$ 194,643	$ 202,699	$ 219,699	$ 295,993	$ 303,249	$ 307,970	$ 307,426
Gross margin		$ (295,957)	$ (167,360)	$ (172,760)	$ (137,643)	$ (90,979)	$ 63,021	$ 108,447	$ 259,311	$ 370,930	$ 422,174
Total overheads											
Net profit		($295,957)	($167,360)	($172,760)	($137,643)	($90,979)	$63,021	$108,447	$259,311	$370,930	$422,174
Capital costs											
Bare land and water rights		$1,900,000									
Machinery(net)		$649,500									
Other costs(land prep, irrigation)											
Total capital costs		$2,549,500									
Cumulative cash flow		($2,835,457)	($3,003,425)	($3,177,184)	($3,314,826)	($3,405,805)	($3,342,783)	($3,234,336)	($2,974,435)	($2,603,525)	($2,181,351)	($1,759,176)



DEVELOPMENT BUDGET YOUR FIGURES — ALMOND ECONOMIC MODEL — Page 26

CASH ONLY

BACK | MAIN MENU | FORWARD

DEVELOPMENT BUDGET CASH ONLY /ha — Enterprise — 40 hectares

Owner/Grower excluding land and water right purchases, Capital costs of infrastructure not included. — You can substitute your figures at any point in this budget

Date: Apr-07 | Planting: 1998 | Year: 2007

		1	2	3	4	5	6	7	8	9	10	TOTALS
RETURNS												
production t/hectare				0.25	0.49	1.24	1.73	2.47	2.96	3.20	3.20	
price $/t				$5,700	$5,700	$5,700	$5,700	$5,700	$5,700	$5,700	$5,700	
less grower levy $/t	$20				$1,420	$2,783	$7,043	$9,826	$14,030	$16,813	$18,176	$70,091
GROSS RETURN												
FIXED COSTS												
Labour		$2,276	$2,276	$2,276	$2,276	$2,276	$2,276	$2,276	$2,276	$2,276	$2,276	$22,763
Overhead costs		$1,150	$1,150	$1,150	$1,150	$1,150	$1,150	$1,150	$1,150	$1,150	$1,150	$11,500
VARIABLE ANNUAL COSTS												
Land Preparation		$500										$500
Soil survey		$100										$100
Pre-Plant Fertiliser												
Tree costs		$2,530	$30	$20								$2,580
Machinery operating costs(Fuel, repairs)		$593	$593	$593	$593	$593	$593	$593	$593	$593	$593	
DISEASE PROGRAM							$172	$172	$29	$29	$29	$432
PEST PROGRAM							$79	$79	$79	$79	$79	$397
NUTRIENT PROGRAM							$37	$37	$37	$37	$37	$185
FERTILIZER PROGRAM							$881	$881	$881	$881	$881	$4,403
HERBICIDES							$122	$122	$122	$122	$122	$608
APPLICATION COSTS(under machinery operating)												
BIRD CONTROL								$15				$15
PRUNING												
IRRIGATION			$150	$225	$300	$375	$450	$600	$750	$750	$750	$5,100
POLLINATION				$80	$120	$160	$240	$280	$280	$280	$280	$2,000
MECHANICAL HARVESTING	V.Conly				$337	$337	$337	$337	$337	$337	$337	$2,695
FREIGHT-Cracker					$15	$29	$74	$104	$148	$178	$192	$192	$932
CRACKER COSTS					$75	$147	$372	$519	$741	$888	$960	$960	$4,662
ANNUAL COST		$7,149	$4,199	$4,344	$4,866	$5,067	$5,492	$7,150	$7,581	$7,599	$7,686	$7,686	$68,820
TOTAL COSTS		$8,255	$5,305	$5,450	$5,972	$6,174	$6,599	$8,256	$8,687	$8,705	$8,792	$8,792	$19,947
CASHFLOW (no interest)		($8,255)	($5,305)	($5,450)	($5,972)	($4,754)	($3,815)	($1,213)	$1,139	$5,324	$8,021	$9,384	$50,145
CUMULATIVE CASH FLOW		($8,255)	($13,561)	($19,011)	($24,983)	($29,737)	($33,552)	($34,765)	($33,626)	($28,302)	($20,281)	($10,897)	

Key Issues influencing profitability

- **Yield**
- **Pest and disease control** 3% of cash costs
- **Irrigation Practice** Method and Amount
- **Nutrition** >300N and 400K
- **Machinery ownership**

The Almond Economic Analysis

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