

AVOCADOS – HOLY GUACAMOLE!



Avocados – Holy Guacomole! was a feature article in our ANZ [Agri Focus](#) March 2018 edition. Written by our rural economist, this report provides an overview of the industry and potential returns for growers and investors. There are both opportunities and advantages and issues and challenges in the avocado sector which this paper explores in more detail.

SUMMARY

Trendy, versatile and nutritious, per capita consumption of avocados is increasing and supply is struggling to keep up, with a long lead-in time until newly developed orchards bear fruit.

The industry has ambitious plans to lift total earnings from \$146m to the high-\$200m mark over the next five years. This is expected to be driven by large-scale greenfield developments and improving average yields. Currently, the fresh domestic (32%) and Australian market (56%) account for the lion's share of the crop. Both markets are expected to remain important, with higher returns than other markets and further lifts in consumption.

In time, more competition can be expected in the Australian market (local supply and other exporters gaining access) and there will be a need to find a home for increasing NZ supply. This means growing other promising Pacific Rim markets, such as Greater China, where market access has just been gained to the mainland. Consumption growth in the Pacific Rim is expected to be driven by the general lift in consumption of healthy foods and the expansion of Western foodservice, tourism and expat communities.

Grower returns from avocados are favourable with an industry average of \$27,300/ha in recent years and top growers achieving \$78,000/ha. We develop a commercially focused greenfield model that shows an at-maturity profit of \$43,500/ha. Positive cash flow is delivered in year five and establishment costs as well as financing costs can be repaid from cash flow in year eight. The internal rate of return (excluding the cost of land) is 24% if the steady state profit of \$43,500/ha in year 10 is held through to 20 years of age. This is well above the cost of capital when compared with a long-run interest rate assumption of 7%.

Like most primary sector investments, when the cost of land is included the internal rate of return drops significantly. Suitable bare land in the Bay of Plenty is \$125,000/ha or more due to competition with kiwifruit and urban expansion. In Northland the cost is closer to \$30,000/ha due to less competitive pressure from other land uses. If this is included and other assumptions applied to both regions, the internal rate of return drops to just 12% in the Bay of Plenty, but achieves a more respectable 19% in Northland.

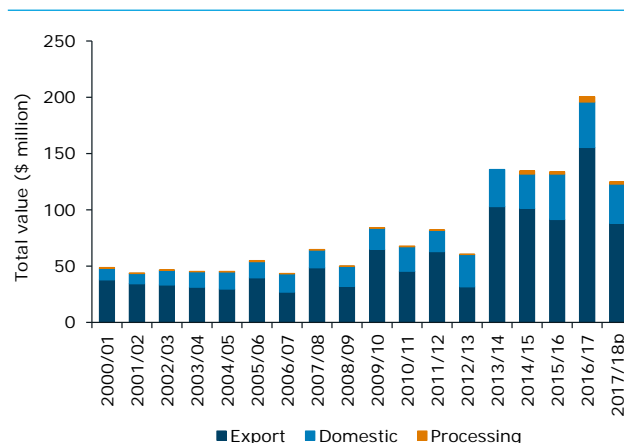
The economics of avocados appear to stack up well, but there are many practicalities to consider. Achieving consistent yields and maintaining tree health are challenging and require very good orchard management.

INTRODUCTION

Identifying the next 'big thing' that will bring about transformational change is a real challenge in today's fast-paced world. Constantly shifting consumer preferences with intense competitive pressure from multiple angles (both direct competitors and substitutes) means the goalposts are constantly shifting. However, identification of opportunity is just the first step. What follows is a lot of hard work across a number of business facets and regulation to realise the true potential of an opportunity.

In the avocado sector identification of new opportunities has occurred (ie. growing the Australian market and the opening up of the Chinese market) and now the hard work is underway to try to reach the sector's full potential and capture new opportunities. What follows is an overview of the sector and potential returns for growers/investors.

FIGURE 1: AVOCADO INDUSTRY EARNINGS



Source: ANZ, NZ Avocado

The avocado sector has ambitious plans to increase the value of the industry from \$146 million (five-year average) to the high-\$200 million mark over the next five years. This requires a near doubling in industry growth versus the circa 7% annual growth experienced on average since 2000/01. This is expected to be driven by both new, larger-scale greenfield developments and improving average yields across the sector. The irregular-bearing nature of avocados in New Zealand conditions is currently the sector's largest challenge to achieving a sustained higher growth rate. In terms of market split, exports currently account for around 74% of the sector's revenue, while 25% is from the NZ market and 2% is processed product.

Total avocado export earnings have grown around 11% per annum over the past 10 years. This makes it one of the fastest-growing primary sector exports, with more to come. While domestic consumption will continue to expand, most of the future growth in demand is expected to come from fresh or processed/package product being sold to the Australian, Chinese and broader Asian markets. Enabling this, New Zealand has just gained market access to China – alongside competitors Mexico, Peru and Chile.

At present Australia accounts for around 80% of export revenue with Japan (4%), Singapore (2%), Thailand (2%) and South Korea (2%) being the other major markets. In the short term Australia will remain critically important given very favourable returns versus other markets (see more below), but increased competition from both others gaining market access and more local Australian supply can be expected in the future. This means it's critically important to develop other markets to match expanding New Zealand supplies.

WHAT'S SO SPECIAL ABOUT AVOCADOS?

In short, avocados are trendy, versatile and have a nutritional profile that is suitable for a range of health foods and beauty products.

Consumption trends for many foods are increasingly been driven by fashion. There has been an explosion of food 'gurus' who provide often conflicting views on what constitutes a good diet. Often one food guru will advocate a diet low in fat, or carbohydrate, or protein and the very next will claim the exact opposite. The trendiness and changing perceptions of different foods will continue to be powerful drivers of long-term consumption trends.

The trendiness of avocados is helped by one of the strongest social media presences of all foods. Avocados' social media charm is driven by their 'smashed avocado on toast' popularity among urban millennials. Its 'instagrammable' appearance due to its unique shape, skin texture and vibrant green colour plays an important part too.

Avocados are versatile, and can be used fresh at all meals of the day, as an ingredient for many baked goods or cooked dishes, and as a flavour enhancement (ie. sauce). Avocado is often used fresh in salads, sandwiches, burritos, tacos, sushi, and burgers, or as an ingredient in dips, guacamole, sauces, soups, smoothies and as a substitute fat in baked goods or cooked dishes.

This versatility, combined with the avocado's trendiness has seen consumption grow rapidly in recent years (see more below).

Equally important to its long-term success is cementing the avocado's nutritional and health credentials, especially with Asian markets being eyed up. Looking through the hype of many trendy foods and conflicting beliefs of food gurus, we are seeing a deepening body of research into the exact nutritional make-up of different foods and their specific impact on human health throughout our life. While the results of individual scientific studies can often be as confusing as health gurus' advice, over time the accumulation of a wider body of research will no doubt provide better clarity of what is and isn't 'healthy'.

Early dietary studies focused on the broad constituents of proteins, fats or carbohydrates. Later studies began to examine the effects of specific components, such as

vitamins, minerals and dietary fibre. More recently, scientists have begun measuring phytochemicals (thought to prevent many chronic diseases) like flavonols and anthocyanins, and even more mysterious substances like free radicals.

Avocados, like butter, have benefited from the 'fat renaissance' – the belated recognition that fat is an essential part of the human diet and that decades of advice to avoid it was not leading to better health outcomes. There has also been much more research into different types of fat and their impacts on the human body. In short, saturated fat is now good (in moderation), while manufactured trans fats, even in small amounts, are bad.

Avocados are a unique fruit in that they are high in fat and fairly low in carbohydrates (specifically, sugar and starch). They are the only fruit that contains protein, carbohydrates and fat too. A ripe avocado is around 70-80% water, 10-20% fat, 8-9% carbohydrate, and 2% protein. The health qualities of both the types of fats and carbohydrates are high.

In the case of the fat in an avocado, around 70-75% is monounsaturated and 10-15% polyunsaturated, with the remainder being saturated and trans fats. The consumption of both monounsaturated and polyunsaturated fats have both long been viewed as part of a healthy diet to support metabolism, cell signalling, the health of various body tissues, immunity, hormone production, and the absorption of many nutrients (such as vitamins A, C and E). Fat suffered for decades from a misperception that cutting as much fat as possible from a diet was optimal for weight control and hence health.

Of the carbohydrates in avocados around 75-80% is dietary fibre. For most other fruits, sugars such as fructose and glucose usually account for more than 60% of the carbohydrate content. There are two types of fibre: soluble and insoluble. Soluble fibre can help reduce cholesterol re-absorption in the intestine, while insoluble fibre, such as that found in avocados, keeps bowel movements regular. Fibre may also play a part in weight management – eating fibre-rich meals can provide a fuller feeling more quickly, helping reduce the amount eaten.

Avocados are also nutrient dense, containing a number of vitamins and phytochemicals: potassium, magnesium, vitamin A, vitamin C, vitamin E, vitamin K1, folate, vitamin B1-6, niacin, copper, pantothenic acid, riboflavin, choline, lutein/zeaxanthin, phytosterols, and MUFA rich oil. Being nutrient rich means fewer calories can be consumed for the same or more nutrients (being vitamins and phytochemicals).

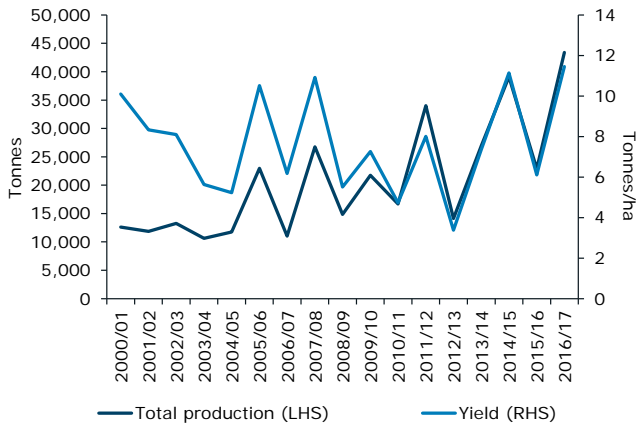
Other evidence-based research has also shown avocados' mix of vitamins, antioxidants and folate has a range of other health benefits including reducing tiredness and exhaustion; boosting immunity, brain and nervous system function; and helping development at all stages of life, but particularly for children and during pregnancy.

In summary, the excitement around avocados is being driven by not only its versatility, but also its many health benefits.

INDUSTRY PRODUCTION DYNAMICS

There are thought to be around 1,500 New Zealand avocado growers producing an average total of around 5.6 million trays of fruit each year (just over 1,000 growers are registered with NZ Avocado).

FIGURE 2: NEW ZEALAND PRODUCTION AND YIELDS



Source: ANZ, NZ Avocado

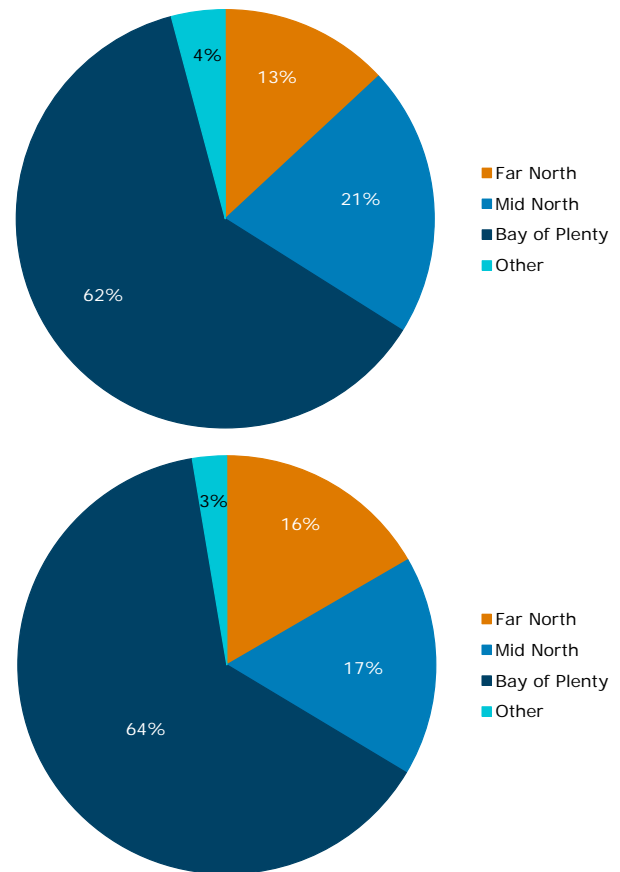
Of these growers many are hobby/lifestyle focused, particularly in the Bay of Plenty area. In fact, of the around 1,500 growers, 60% of their orchards are less than 2.5ha, accounting for 30% of the growing area. Larger, commercially-focused orchards greater than 10ha account for just 3% of orchards, but make up over 20% of the growing area.

There are currently around 3,800ha of avocados in New Zealand that on average produce around 11.5t/ha of fruit per year (2090 trays/ha). However, there is very irregular bearing, especially in the Bay of Plenty region, which causes large variations in year-to-year production (shown in figures 2 and 4).

Currently the Bay of Plenty accounts for 60% of the growing area and Northland 36%. Looking through the irregular bearing challenge for the Bay of Plenty, that region has accounted for 64% of production over the last five years. This has equated to an average yield of 7.9 t/ha (or 1,440 trays/ha), but the annual variation has ranged from 1.8 t/ha to 12.2 t/ha over this period. The biophysical conditions in the Far North see far more consistent and higher yields, having averaged nearly 9.7t/ha, with an annual variation of 8.4 t/ha to 11.3 t/ha over the last five years. For comparison commercially focused growers are achieving crop yields of 18.5 t/ha up to 25 t/ha.

A proportion of the current growing area is newly developed orchards that are yet to bear full crops. Full production tends to be reached between 8 to 10 years of age, but it steps up significantly after four years.

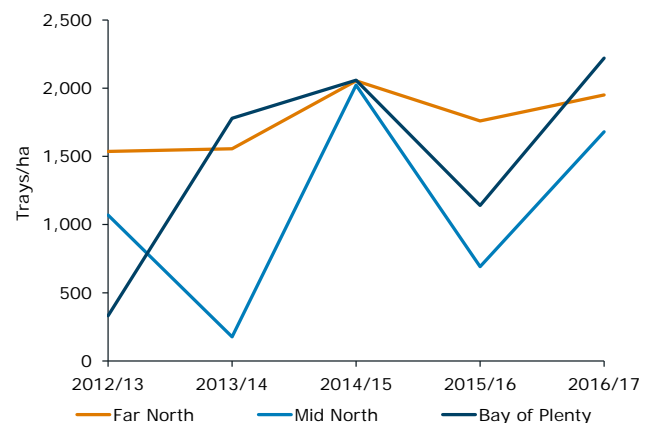
FIGURE 3: REGIONAL GROWING AREA AND PRODUCTION FOR AVOCADOS



Source: ANZ, NZ Avocado

New greenfields establishment is forecast at around 1,200ha over the next five years or so, depending heavily on the availability of trees. Combined with the ambition to push average yields toward 15 t/ha on a regular basis, this could see total annual production reach 13 million trays over the next 10 years (up from 5.6 million trays at present). The majority of new greenfields development is set to occur in the Northland region due to availability to land and favourable biophysical conditions. The Bay of Plenty region will also see some development, but finding suitable land and its cost are key barriers.

FIGURE 4: REGIONAL ORCHARD YIELDS



Source: ANZ, NZ Avocado

INDUSTRY STRUCTURE

The supply chain works by growers entering into a supply contract for a year with a local marketer or exporter. When the fruit is picked it is graded and packed at supporting pack houses. There are 22 pack houses in total, of which 14 are export-approved. Many of the pack houses are kiwifruit oriented and grade/pack avocados in the off-season. The fruit is then shipped to pre-ripening facilities either offshore or onshore.

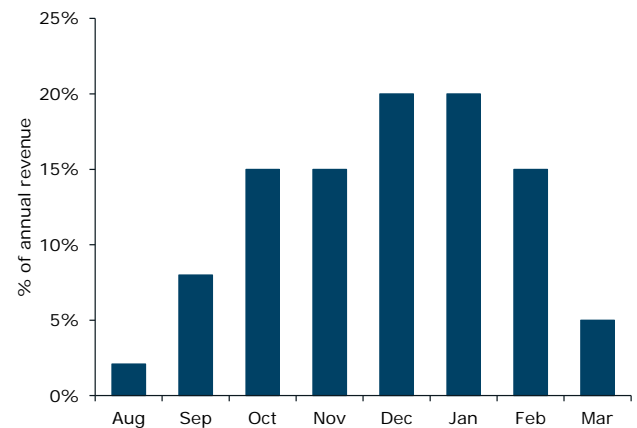
Locally, there are a number of marketers and suppliers that sell directly into both the retail and foodservice channels. Some growers sell product directly via own store or orchard gate sales, or local fruit/vege markets. Lower-graded product is sent for processing in New Zealand or Australia into oil or packaged food products. These are then sold either locally or exported into health stores or the food supply chain – typically through wholesalers, but in some cases directly too.

The marketplace is more concentrated for the exporters of fresh product. Avoco accounts for around 60-65% of export volumes. This is a joint venture between Tavo New Zealand and Primor Produce. The other two major players are Just Avocado (~15%), Seeka (~15%) and 8-10 smaller players that account for the remaining volume. For Avoco the main market is Australia, in which the majority of the crop is sold under direct retail programmes to the Coles and Woolworths supermarket chains. Surplus product is sold into wholesale markets in Australia, or retail programs into six countries in Asia. Product is sold and paid weekly/

fortnightly as per the retail programme entered into. Payment terms are usually monthly for wholesale or Asian retail programmes.

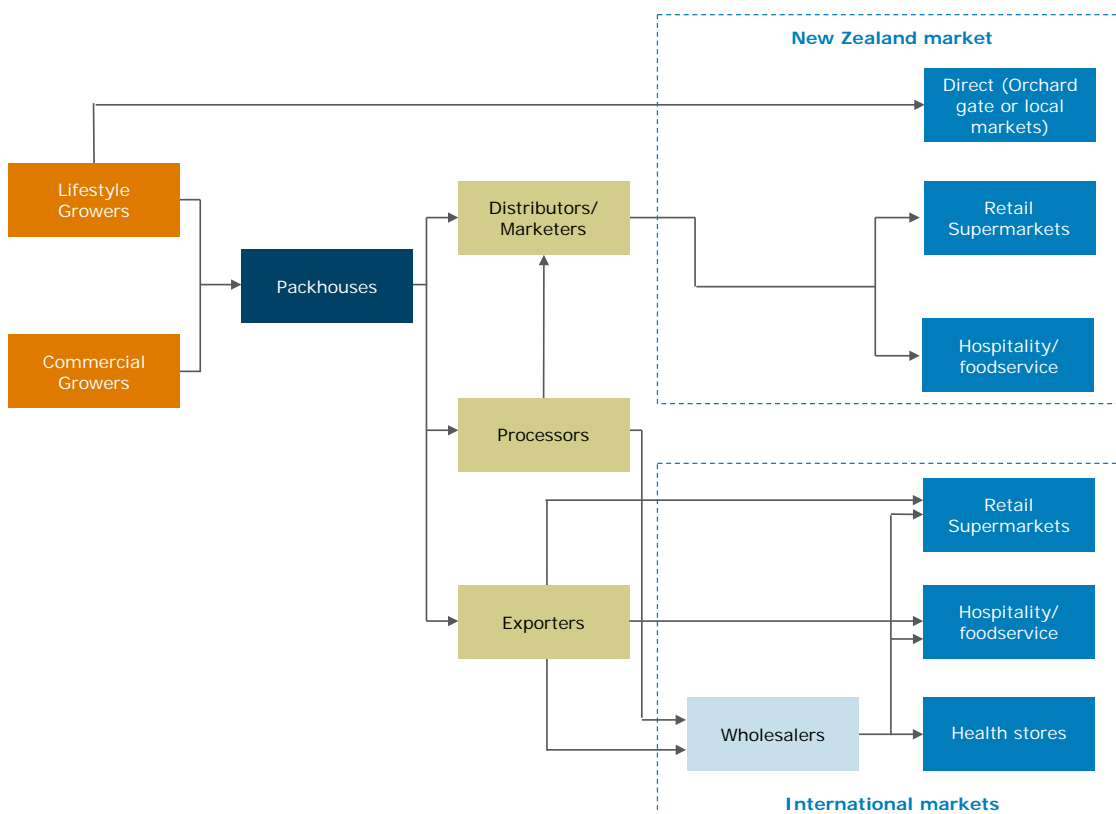
Avoco – the main exporter – pays growers 7-8 times throughout the year. An initial advance payment is made when fruit is picked and packed. Then regular payments are made over the season as fruit is sold. Approximately 5% of each sale is held back for the final wash up. The first trays are sold in August with the final trays sold in February/March. The average % of total revenue received by month is shown in figure 6.

FIGURE 6: GROWER PAYMENT PROFILE



Source: ANZ, Avoco

FIGURE 5: MARKET STRUCTURE FOR NEW ZEALAND AVOCADOS



Source: ANZ, NZ Avocado

The other support organisations for the industry include NZ Avocado, Horticulture NZ and service/product suppliers. New Zealand Avocado supports growers' interests through generic promotion of avocados, research and development programmes, general advocacy and information dissemination. All exporters must be registered with the NZ Horticulture Export Authority under NZ Avocado. Additional this means NZ Avocado implements quality standards, export grade standards, and rules and procedures that must be followed by growers, pack houses and exporters. This is important to maintain discipline around quality standards to protect NZ fruit's reputation and market access. These rules and procedures are documented in the Avocado Quality Manual and the Avocado Export Marketing Strategy. There are also consultants and service/product suppliers, such as Fruitfed, Farmlands and contract pickers that directly help growers with key inputs and crop harvest.

MARKETS

In recent years the fresh export market has accounted for 61% of total production and 74% of total sales revenue. The domestic fresh market has accounted for 28% of total production and 25% of total sales revenue, with the remainder being processed product.

As outlined avocados are trendy, versatile and have a nutritional profile that is suitable for a range of health foods and beauty products. We discuss each in turn.

Beauty products

In the natural beauty space several labels have incorporated avocado and its oils into their formulations. The poly- and mono-unsaturated fatty acids, as well as the long list of vitamins that the fruit possesses, give the avocado moisturising qualities. It is for this reason that avocados can be found in everything from under-eye cream and moisturisers to shampoo, promising rejuvenation and protection. The South Korean market in particular likes skin and hair products containing avocado.

Oil products

In order to make the most from reject and lower-quality fruit, oils and other value-add products have been created. A range of oil products exists, often infused with other flavours such as lime, balsamic, lemon, etc. Avocado oil has a high smoking point¹, making it perfect for cooking, as it can be fried, baked, stir-fried, deep-fried, seared, barbecued, roasted and sautéed. The avocado oil industry has averaged total sales of \$5.3m over the past two years. The success of the avocado oil market has meant that oil producers are now battling to source enough local avocados to produce their products. This has seen several companies set up operations offshore to source enough avocados to meet demand.

¹ Smoking point¹ is when the oil being used to cook begins to give off smoke. A higher smoking point means there are more cooking options available for that oil. It avoids giving the food being cooked a burnt taste when the cooking oil is heated past its smoke point. Natural fats also begin to break down at this point, releasing dangerous free radicals. Beneficial nutrients and phytochemicals found in many unrefined oils are also destroyed.

Packaged food products

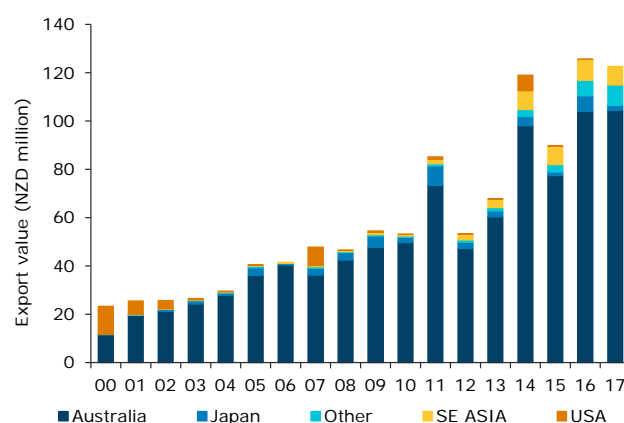
The flesh of the avocado is used in many value-add or packaged food products such as pre-mashed for convenience, butter alternatives, baby food and dressings. Keeping with the theme of waste reduction, in 2012 Avocado Oil NZ began work on producing powdered avocado using the leftover purée from the oil production process. The production of the powder, called Avopure, was taken from concept to commercialisation through collaboration with the government-funded Bioresource Processing Alliance and New Zealand Food Innovation Network's facilities. This value-add by-product is used in cosmetics, nutraceuticals and food products. It is exported to Australia, Japan, China and the United States.

The processed avocado space has seen a significant amount of growth in recent years. Prior to 2014, the revenue stream from processed products was minimal – averaging just under \$355,000 per annum from the 2004/05 to the 2013/14 season. While still only a small part of the total industry, revenue has grown strongly since 2014/15, with the latest season seeing \$4.52 million in sales of processed products.

New Zealand's fresh markets

The fresh domestic (32%) and Australian (56%) market have together accounted for around 89% of the total crop over the past five years. Both markets have seen strong per capita consumption gains in recent years. With total Australasian supply struggling to meet demand, especially in the latter part of the New Zealand season (February/March), this has seen wholesale and orchard gate returns jump. Indeed, Australian market returns have nearly doubled in recent years and have achieved prices nearly a third higher than the domestic and other export markets.

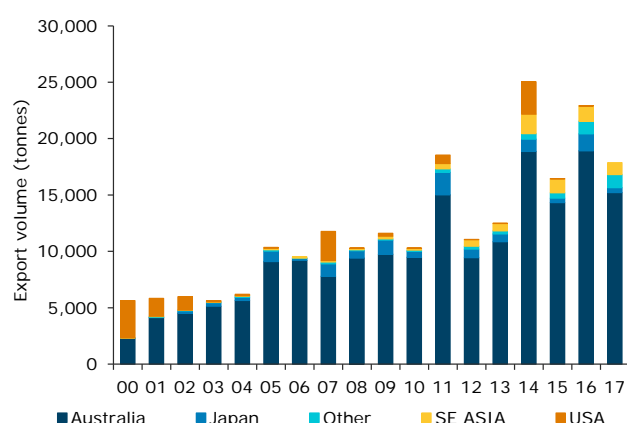
FIGURE 7: NEW ZEALAND EXPORT MARKETS BY VALUE



Source: ANZ, Statistics NZ

Other smaller export markets include Japan (4%), Singapore (2%), Thailand (2%), South Korea (2%), India, Malaysia and Taiwan. The US market has been used in the past to sell excess volumes from larger crops. This has been less the case in recent years with the Australasian market and prices performing so strongly.

FIGURE 8: NEW ZEALAND EXPORT MARKETS BY VOLUME

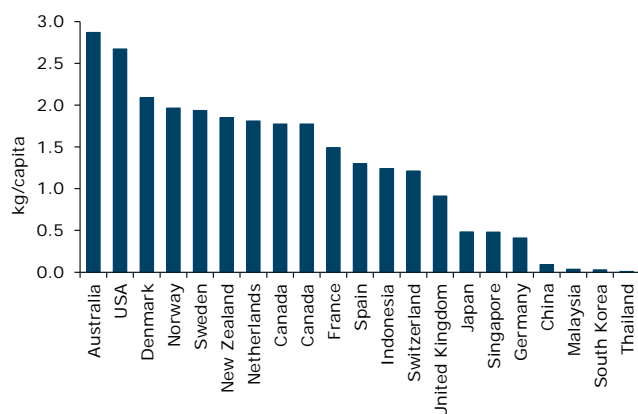


Source: ANZ, Statistics NZ

International marketplace

With expanding supplies, the maturing New Zealand market and heavy concentration risk to Australia, the search is on to develop other markets to grow long-term industry value. Market access, competitor pressure, freight costs, shelf life, consumer demand/preferences, supply chain robustness, retail/foodservice relationships and market returns are all important considerations in the search for new markets.

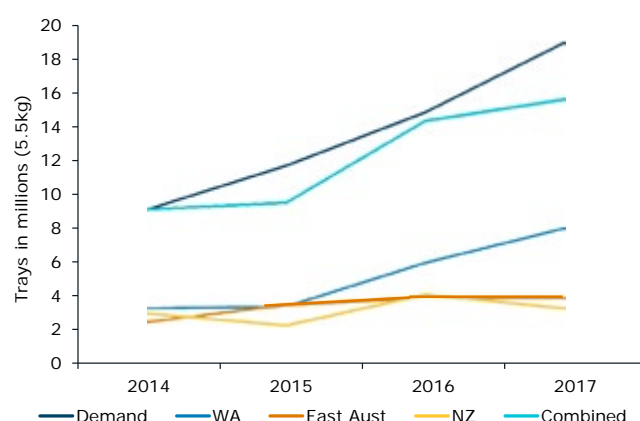
FIGURE 9: AVOCADO CONSUMPTION IN SELECTED COUNTRIES



Source: ANZ, FAO

Per capita consumption is highest in the larger-producing areas/countries in South America and select parts of Africa, at 3 to 7kg per annum. Outside of these areas, Australia has one of the highest per capita consumption of avocados. This demand has been growing in excess of 6% per annum over the past five years. Restrictive market access (phytosanitary and biosecurity requirements in particular) means the market is currently supplied solely by domestic and New Zealand sources. However, the potential signing of the CPTPP by Australia is likely to open access to Mexico and other competitors such as Peru and Chile in the future.

FIGURE 10: AUSTRALIAN MARKET AVOCADO SUPPLY/DEMAND GAP

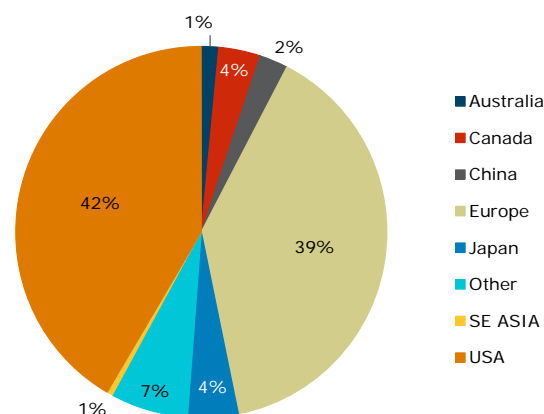


Source: ANZ, Avoco

At present the Australian market consumes around 15 million trays per annum. Of this, local supply accounts for around 12 million trays (78%) and New Zealand the remainder. Total hypothetical demand at 'reasonable' prices is estimated to be around 18.7 million trays – implying around a 20% supply deficit. Due to this supply deficit, Australian producers are looking to expand production with estimates of growth toward the 20 million tray mark over the next 10 years.

Other markets where existing consumption is high and growing quickly include North America and Northern European countries.

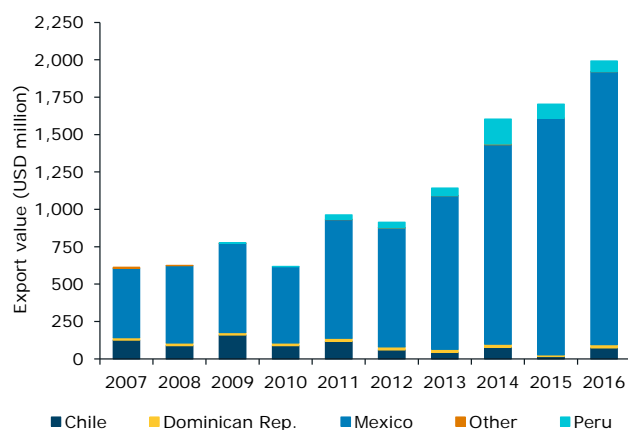
FIGURE 11: TOTAL WORLD IMPORTS BY REGION



Source: ANZ, Comtrade

These countries are also where existing domestic production is relatively low compared with consumption and which rely on imports to fill the gap. In fact the North American and European markets combined account for 85% of global import demand. Yet New Zealand sends little to no fruit to these markets.

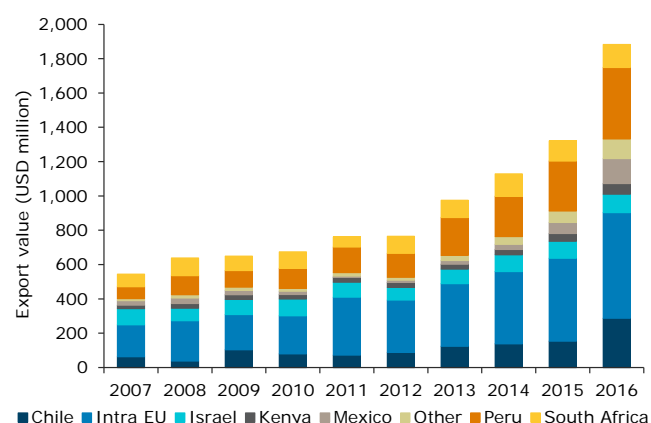
FIGURE 12: US AVOCADO IMPORTS BY COUNTRY



Source: ANZ, Comtrade

The reality is that the long shipping times and freight costs limit opportunities in European markets. In the future, improved dynamic controlled atmosphere technologies are expected to improve the reliability and shelf life of shipping avocados to European markets, potentially improving viability. In the case of the US, there is a large domestic production source in California, but this market is challenged by distance too, especially to the East Coast of the US. There is also fierce competitive pressure in both regions. In the case of the US, imports are dominated by Mexico (92%), while in Europe it's a mix of the likes of Mexico, Peru, Chile, Kenya, South Africa and Israel. New Zealand also faces tariffs in the US market that other competitors don't.

FIGURE 13: EUROPEAN AVOCADO IMPORTS BY COUNTRY



Source: ANZ, Comtrade

In terms of competitive pressures in the Pacific Rim where New Zealand's market diversification play is expected to be targeted, the North/South American competitors – particularly Mexico, Chile, Peru and Colombia – will provide the stiffest competition. These four producers account for around 70% of global exports and these have grown at 19% per annum over the past five years. Other exporter growth is running at only 10% over the same period. Market access remains restrictive in some Pacific Rim markets for these countries. However, they are also investing in expanding their growing area, improving food and biosecurity safety measures throughout the supply chain, and new orchard practices to boost both the production and quality of fruit.

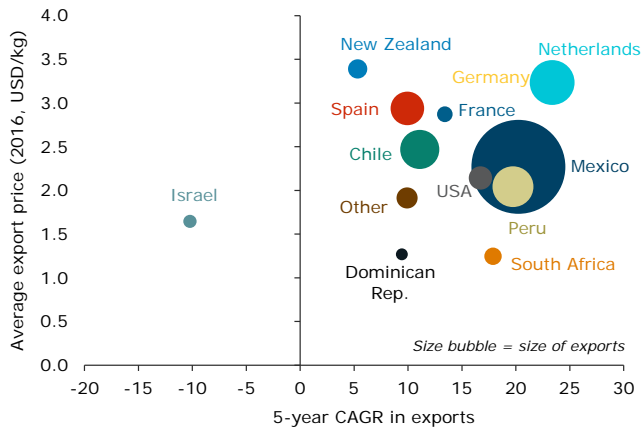
TABLE 1: GLOBAL AVOCADO PRODUCTION CALENDAR

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
South Africa												
Kenya												
Peru												
Brazil												
Argentina												
California												
Australia												
Mexico												
Chile												
Israel												
Spain												
New Zealand												
Columbia												
India												

Key: In season; Out of season; New Zealand's production season

Source: ANZ, Avoco

FIGURE 14: TOP 15 GLOBAL AVOCADO EXPORTERS

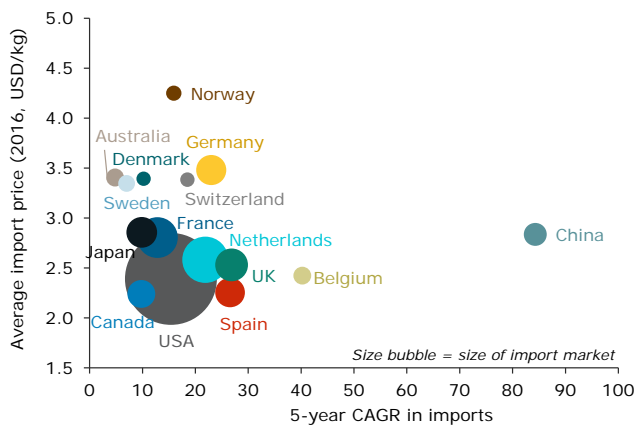


Source: ANZ, Comtrade

Interestingly, there isn't the classic Northern versus Southern split in terms of the production season for different countries. Peruvian competition will be more on the shoulders of the NZ season, but Mexico, Chile and Columbia all produce fruit during the same timeframe as our season.

More specifically, if you examine consumption growth, import trends and pricing, some of the most attractive markets are Switzerland, Sweden, Norway, Germany and Denmark. For now, the tyranny of distance (shelf life and freight costs) and lack of surplus product means these markets aren't realistic prospects.

FIGURE 15: TOP 15 GLOBAL AVOCADO IMPORTERS

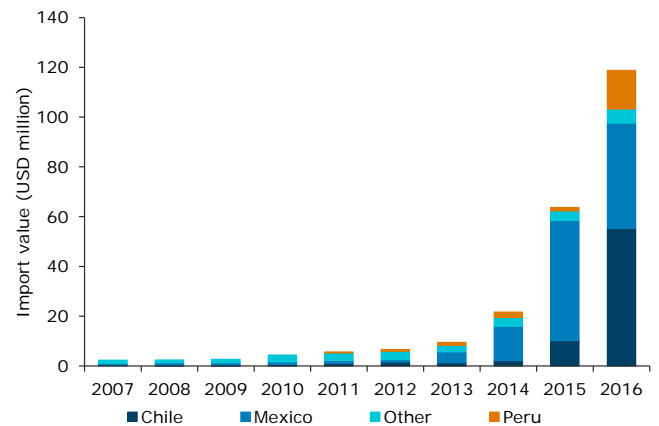


Source: ANZ, Comtrade

Rather, New Zealand exporters are looking to target the Greater China region and other existing Asian markets such as Japan, Singapore, South Korea, Thailand and Malaysia. China has long been viewed as a significant opportunity even though many Chinese palates are unfamiliar with the fruit, as underscored by current low per capita consumption (see figure 9). Consumption growth is expected to be driven by all the trends that are supporting the general growth of many food products, as well as avocados' health angle. As they say, food in the Chinese culture is viewed as 'health first and nutrition second'. This is the complete reverse of many Western markets, where it's the avocado's versatility that is an important driver of increasing consumption.

Unfortunately, the competition (Chile, Mexico and Peru) already have the hop on market access into China. Market access has recently been approved for New Zealand product, so some of the 2018 crop, starting in August, is expected to be destined for China. Relatively low volumes are likely initially and there will be extra marketing costs to establish and build a profile/brand. Initially the tug of war will be striking the right balance between needing to diversify from the Australasian market longer-term and the current shortage of supply in markets which offer very lucrative returns. It will require some exporter discipline to strike the right balance.

FIGURE 16: CHINESE AVOCADO IMPORTS



Source: ANZ, Comtrade

Each of the other Asian markets have their own quirks. Japan tends to like smaller fruit, after being established by the US, but this benefits Mexican fruit now. Singapore like the fruit for heart health; China to assist baby development (folate) and South Korea to promote smooth skin and silky hair. No doubt with more research these trends will continue to evolve and be incorporated into exporters' marketing activities, consumer education and packaging.

Expat communities and tourism are also drivers of increasing consumption in many Asian markets, such as Singapore and Thailand. Additionally, the growth in western food service restaurants (ie. Mexican, etc) across Asia is introducing the avocado in different forms to many new consumers too, which is driving consumption growth.

THE ECONOMICS AND PRACTICALITIES OF GROWING AVOCADOS

There are a number of things that need to be considered when completing a greenfield establishment for avocados, or investing in an existing orchard. We won't go into all the ins and outs on the selection, establishment and key orchard management functions here.²

Broadly, in terms of site selection some of the key considerations include:

1. Winter and flowering temperatures/light intensity – important for the fruit set and determining yields.
2. Physical soil attributes– requires a well-aerated, well-drained soil for healthy root growth and limiting root-rot pressure.
3. Aspect – best light conditions are north-east and north-facing orchards. Areas prone to waterlogging need to be avoided for root rot.
4. Chemical soil attributes – adequate nutrition – especially nitrogen, potassium, boron and zinc – are very important for sustained yields and sizing.
5. Water – irrigation is required for heavy crops in areas with low summer rainfall – 30-40% of Bay of Plenty orchards are estimated to have irrigation.
6. Wind – protection is required for possible tree and fruit damage in high-wind areas.

Once a suitable site has been selected orchard design can take place. Orchards are using either clonal rootstock with the Hass cultivar grafted on top, or seedling rootstock with Hass grafted on top. While Hass is the main variety used in New Zealand, as it's more suited to our cooler growing conditions, there are others, including GEM, Carmen and Reed. Trees are normally grown in a nursery for two years before being planted. The first substantial crop is produced around 4 to 5 years of age and full production is reached between 8 to 10 years of age.

There are a range of views on planting density, which seems to come down to personal preference. Recent developments seem to be favouring higher-density planting of 400 trees/ha (5 by 5 metre spacing) that are then thinned later on to avoid shading. Others prefer a planting density of 200 trees/ha (7 by 7 metre spacing) with less thinning at maturity and lower tree costs. We have constructed a budget below based on 400 trees per hectare of clonal rootstock.

² Detailed information is available through the likes of [NZ Avocado](#) for those who are interested.

INITIAL ESTABLISHMENT COSTS

Item	\$/tree	\$/ha
Trees	\$40-\$50	\$16,000-\$20,000
Planting Costs (labour & equipment)	\$15-\$18	\$6,000-\$7,000
Fertiliser	\$2.5-\$5.0	\$1,000-\$2,000
Mulch	\$7.30	\$2,900
Tree shelter	\$15	\$6,000
Orchard shelter	\$3.10	\$1,250
Total	\$83-\$98	\$33,150-\$39,150
Site specific costs		
Irrigation	\$13-\$20	\$5,000-\$8,000
Drainage	\$5-\$10	\$2,000-\$4,000
Contouring	\$13-\$25	\$5,000-\$10,000
Total	\$113-\$153	\$45,150-\$61,150

Source: ANZ

There is a wide range of other assumptions that are applied to derive these high-level estimates:

1. The price of trees varies depending on the rootstock. Germinated seedlings range from \$20-\$25/tree, whereas clonal rootstock is twice this price at \$40-\$50/tree. The range depends on region and specific royalties charged for the different types of clonal rootstock.
2. There is a range of planting costs associated with digging holes, planting, spreading fertiliser/mulch, constructing shelter around each tree, watering etc. All the preparation through to final planting is assumed to take around half an hour per tree, with a labour cost of \$20/hour (there are some assumed equipment costs too).
3. The fertiliser cost depends on soil testing results and what deficiencies for growing avocados might exist.
4. Mulch is required to lay around each tree to reduce the chance of root rot.
5. Shade and wind shelter is required for each tree and ideally for the entire orchard at around 1.5-2.0ha blocks.

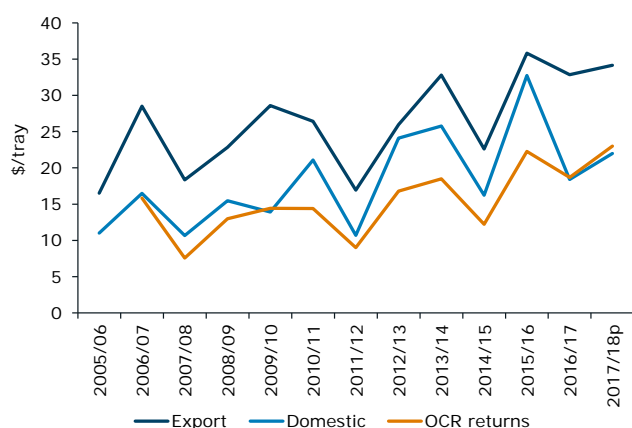
More site-specific costs include irrigation, drainage and contouring (ripping of clay pan/compacted soil, altering aspect etc). For irrigation, estimates vary from \$5,000 to \$8,000/canopy ha for the reticulation system, sprinklers and installation. Drainage ranges from \$2,000 to \$4,000/canopy ha. Contouring can have a wide range depending on the type of work completed so could range from nothing through to \$10,000/ha or more.

These and other equipment costs can bring a greenfield development of a commercial orchard toward the \$45,000 to \$60,000/ca ha mark. Of course it can be a lot lower if seedlings are used, labour costs are non-cash (ie. owner-operators' time) and there are limited site-specific costs, such as contouring and orchard shelter.

Like most horticultural crops, the revenue side tends to dictate underlying returns. There are thought to be around 11 different factors that influence yields (eg. pollination – reliant on bees as one can't artificially pollinate, temperatures during key growing phases, disease pressures, sunlight hours, soil type, nutrition, root health, canopy management, etc). The potential for one or several of these factors to combine and affect yields is very high.

New Zealand's biophysical conditions, combined with an irregular fruit-bearing tendency, often lead to large variations in year-to-year yields. A big part of the Avocado Primary Growth Partnership initiative is a goal to sustainably lift yields toward 15 t/ha and reduce their inconsistency. As mentioned earlier, there are many lifestyle-focused growers and some greenfield developments yet to reach maturity that reduce the average industry yield. Those establishing larger-scale, more intensive orchards are looking to achieve yields of 16 to 24 t/ha, or 3,000 to 4,400 trays/ha at maturity. We have assumed 18.5 t/ha, or 3,400 trays/ha at year 10 in our model.

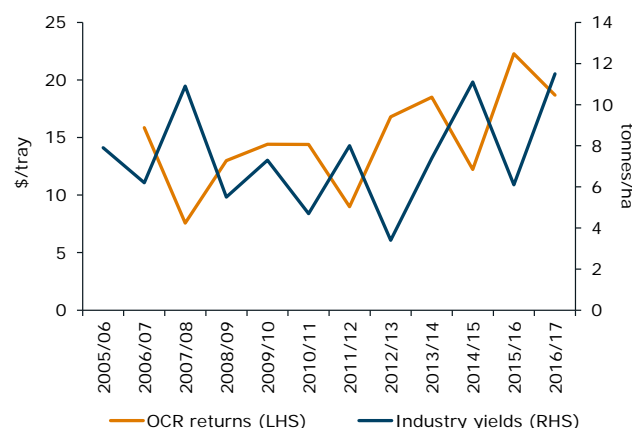
FIGURE 17: AVERAGE ORCHARD GATE RETURNS



Source: ANZ, NZ Avocado

Export market returns outperform the domestic market, so the grading and proportion of a crop sold into either the export (usually the highest-graded fruit) or domestic market influences the average orchard returns a grower receives. Gross export returns have averaged \$31.7/tray and the domestic market \$23/tray over the last five years. Gross returns per tray have increased in recent seasons, however, as strong Australian demand has lifted pricing (10%), which in turn has had a knock-on effect to pricing in other markets (5-8%). The weighted average return across all markets has been \$28.8/tray over the past five years. Post-harvest costs (grading, packaging, freight, marketing etc) have averaged \$9.9/tray over this period. This has delivered an average orchard-gate return of \$18.9/tray. This has varied from \$12 to \$22/tray over this period.

FIGURE 18: ORCHARD GATE RETURNS VERSUS INDUSTRY YIELDS



Source: ANZ, NZ Avocado

The more recent lift in marketplace returns has pushed orchard-gate returns into the low \$20/tray range over recent years. We have decided to use the five-year average of \$18.9/tray given the favourable demand backdrop – a more conservative estimate would be around \$15/tray, which can be covered by sensitivity analysis. Similar to kiwifruit, there is some revenue protection (smoothing) provided by the counter-cyclicity of prices and yield. That is, a large New Zealand crop (high yields) usually leads to lower orchard gate prices and vice versa.

The last piece of the puzzle is orchard costs, which cover labour, picking/harvesting, fertiliser, pruning/thinning, pollination, phytophthora control, mulch, irrigation, spraying and general maintenance. A big proportion of this is labour focused. Aside from the initial establishment costs listed above, ongoing operating costs start out low and increase as the trees grow and produce more fruit.

We have assumed operating costs around \$3,500 to \$5,500/ha in the initial establishment years. These then build to \$19,000-\$20,000/ha at maturity when picking costs are included. However, like many of the other assumptions there is a wide range of cost structures from \$10,000/ha up to the \$30,000/ha mark, depending on a range of assumptions/orchard setups. Our estimate is around the middle of this range.

MODELLED PER HECTARE RETURNS OVER THE FIRST 10 YEARS OF ESTABLISHING ORCHARD

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Orchard yield (kg)	-	-	500	3,083	7,194	10,278	14,389	14,800	15,417	18,500
Tray equivalents (TE)	-	-	91	561	1,308	1,869	2,616	2,691	2,803	3,364
Average \$ per tray			18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
Income	-	-	1,718	10,595	24,723	35,318	49,445	50,858	52,977	63,573
Less picking cost	-	-	67	492	1,340	2,038	3,132	3,579	4,101	5,592
Gross contribution	-	-	1,652	10,103	23,383	33,280	46,314	47,279	48,876	57,981
Establishment costs										
Plants and planting	26,000	-	-	-	-	-	-	-	-	-
Irrigation	6,500	-	-	-	-	-	-	-	-	-
Shelter belts	7,250	-	-	-	-	-	-	-	-	-
Other	10,000									
Total	49,750	-	-	-	-	-	-	-	-	-
General orchard costs										
Grass mowing	500	500	500	500	500	500	500	500	500	500
Weed spray	250	250	250	250	250	250	250	250	250	250
Shelter belt trim/mulch	-	-	-	-	200	200	200	200	200	200
Other general maintenance	100	100	100	100	100	100	100	100	100	100
Total orchard costs	850	850	850	850	1,050	1,050	1,050	1,050	1,050	1,050
Tree management costs										
Consultancy	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Monitoring	400	400	400	500	500	600	600	600	800	800
Sprays (inc foliar)	900	900	1,500	1,800	3,000	3,000	3,000	3,000	3,000	3,000
Fertiliser	1,500	500	500	1,500	2,000	2,000	2,200	2,200	2,200	2,200
Irrigation (excl depreciation, interest)	200	200	200	200	200	250	250	250	250	210
Pruning & thinning	-	-	1,000	1,250	1,500	1,750	5,000	1,750	5,000	1,750
Mulch	2,900	-	-	2,900	-	2,900	-	-	-	2,900
Phytophthora control	-	650	550	550	400	400	400	400	400	400
Pollination	-	-	300	600	900	900	1,200	1,200	1,200	1,200
Total tree mgmt. costs	6,900	3,650	5,450	10,300	9,500	12,800	13,650	10,400	13,850	13,460
Total expenditure	57,500	4,500	6,300	11,150	10,550	13,850	14,700	11,450	14,900	14,510
Net contribution/ cash flow	-57,500	-4,500	-4,648	-1,047	12,833	19,430	31,614	35,829	33,976	43,471
Plus opening balance	0	-61,525	-70,647	-80,566	-87,325	-79,707	-64,496	-35,184	646	34,622
	-57,500	-66,025	-75,295	-81,612	-74,492	-60,276	-32,882	646	34,622	78,093
Notional interest	-4,025	-4,622	-5,271	-5,713	-5,214	-4,219	-2,302	-	-	-
Closing cash balance	-61,525	-70,647	-80,566	-87,325	-79,707	-64,496	-35,184	646	34,622	78,093

Source: ANZ

The net result of all these assumptions is at maturity the trees deliver profit of \$43,500/ha. Positive cash flow is delivered in year five and establishment costs as well as financing costs (at an assumed 7% interest rate) can be repaid from cash flow in year eight. The internal rate of return (excluding the cost of land) is 24% if the steady-state profit of \$43,500/ha in year 10 is held through to 20 years of age. This is well above the cost of capital when compared with a long-run interest rate cost of 7%. As a comparison, the average return across the industry has been \$27,300/ha over the last four years. The top growers over the same period achieving higher yields have delivered \$78,000/ha.

Like most primary sector investments, when the cost of land is included the internal rate of return drops significantly. Suitable bare land in the Bay of Plenty is \$125,000/ha-plus due to the competition with kiwifruit and urban expansion. In Northland the cost is closer to \$30,000/ha due to less competitive pressure from other land uses. If this is included and other assumptions applied to both regions the internal rate of return drops to just 12% in the Bay of Plenty, but achieves a more respectable 19% in Northland.

No surprise then that the Northland region with more reliable yield outcomes and lower land cost is proving attractive from a greenfield development and returns perspective. However, labour and other services (ie. pack houses, pickers etc) in the Bay of Plenty are likely easier to source, and have potentially lower costs due to better economies of scale.

Sensitivity analysis

Looking at some sensitivity analysis of orchard gate returns and yields shows a variation of \$24,000 to \$56,000/ha at maturity around the mid-point of our applied assumptions. Returns drop off exponentially when yields fall below 12 t/ha and orchard gate returns are below \$18/tray.

SENSITIVITY ANALYSIS OF PER HECTARE RETURNS FOR ORCHARD GATE PRICES AND YIELDS

		OCR returns (\$/tray)				
		12	15	18	21	24
Yield (t/ha)	8	526	4,890	9,254	13,617	17,981
	10	4,285	9,740	15,195	20,649	26,104
	12	8,045	14,590	21,135	27,681	34,226
	14	11,804	19,440	27,076	34,713	42,349
	16	15,563	24,290	33,017	41,745	50,472
	18	19,322	29,140	38,958	48,776	58,595
	20	23,081	33,990	44,899	55,808	66,717
	22	26,840	38,840	50,840	62,840	74,840
	24	30,599	43,690	56,781	69,872	82,963

Source: ANZ

Looking at the same metrics but for internal rates of return shows results above 12% when achieving yields in excess of 13t/ha and orchard gate returns of at least \$15/tray. While this excludes the cost of land it is still well above the 7% cost of capital threshold and our personal preference of 10% for primary sector investments (ie. adjusting for appropriate risks etc).

SENSITIVITY ANALYSIS OF INTERNAL RATE OF RETURN FOR ORCHARD GATE PRICES AND YIELDS – EXCLUDES COST OF LAND

		OCR returns (\$/tray)				
		12	15	18	21	24
Yield (t/ha)	8	-18.60	-2.20	3.90	8.10	11.30
	10	-3.30	4.40	9.30	13.10	16.20
	12	2.50	8.90	13.40	17.00	20.10
	14	6.50	12.30	16.70	20.30	23.40
	16	9.70	15.30	19.60	23.20	26.40
	18	12.30	17.80	22.10	25.80	29.00
	20	14.60	20.10	24.40	28.10	31.40
	22	16.70	22.10	26.50	30.30	33.60
	24	18.60	24.00	28.50	32.30	35.70

Source: ANZ

All up, the economics of avocados looks to stack up well, but there are many practicalities to consider. Achieving consistent yields and maintaining tree health are considered challenging and require very good orchard management. The sector's further research into optimising tree decline management, understanding and validating new canopy management strategies, evaluating new cultivars and the development of best-practice guidelines will be very important in improving long-term outcomes.

There are a number of other sector challenges:

Biosecurity – there are a number of potential pest and pathogens that New Zealand currently doesn't have. The industry has signed an agreement with the Government that includes a comprehensive plan for mitigating key biosecurity risks and a response pathway for any incursions that occur.

Accessing skilled labour – like most horticultural crops, labour requirements vary throughout the season and the current tight labour market conditions are making it difficult to source appropriate skilled people. The seasonal nature of the work can also make it difficult to retain skilled employees even though avocados are somewhat counter-seasonal to New Zealand's big crops such as pipfruit, kiwifruit and viticulture. Minimum wage increases over coming years, employment law changes and tightening migration could also have some impact on the cost of certain orchard functions, such as fruit-picking or tree-pruning.

Disease and pest issues – there is a range of pest and disease issues that can attack the tree or fruit. These are usually controlled with spray/chemical applications and integrated management systems based around good nutrition, orchard hygiene, careful handling, post-harvest treatment and temperature control. Key pests include leafroller caterpillars, greenhouse thrips and six-spotted mite infestations. Key diseases are root rot caused by *Phytophthora cinnamomi* and ripe rot through the flesh or stem end caused by a range of pathogens and high rainfall during the growing season. *Phytophthora cinnamomi* is a soil fungus that rots actively growing avocado feeder roots. The fungus is now widely distributed in all main avocado production areas, limiting tree performance and yield.

Research and development investment – more needs to be invested across the entire supply chain to improve efficiencies, validate health benefits and develop new markets. On orchard, the main focus needs to be on improving the consistency of yields through integrated management practices. In the marketplace there is a need to further investigate the health benefits of avocados and work this into the sector's marketing and product marketing/branding. Elsewhere, if the Chinese market is to be cracked there will be a need to invest in educational marketing to teach households the nutritional benefits of avocados and how they are used in different meals, etc.

Supply chain efficiencies/improvement – some of the target markets for future growth are further away, raising freight cost and shelf-life challenges. To overcome this, further investment is required in new handling/storage technologies to extend shelf life once picked and to continue to meet restrict biosecurity importing requirements in new markets, such as China.

Accessing trees – there is a two year wait for avocado trees, such as the demand and nursery capacity at present.

MORE INFORMATION

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