THE MACADAMIA INDUSTRY

IN NEW ZEALAND

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ABSTRACT

The New Zealand macadamia industry has been characterised by many small plantings, lifestyle blocks up to 1500 trees and two commercial plantations with more than 10000 trees. Completed research programmes have been few, mainly because government funding in horticulture has been channelled to the needs of the major crops such as kiwifruit. Changes in political policy affected funding for minor horticultural crops and spasmodic cuts in finance severely hindered long-term research projects. Because of its small size the macadamia industry had limited funds available from members but some research programmes have been completed including pest control, tree nutrition, basal stain and future research needs. A private consultant, Ian Gordon has carried out variety trials on a local selection. Several selections have been planted in different locations and have proven to be useful in pollination of Beaumont, the main variety planted in New Zealand.

Within the limits, set by climatic factors, the suitable growing areas are north of a line from New Plymouth to Gisborne. Both of those areas are marginal for commercial planting but sites on the sheltered north facing positions could grow satisfactory yields.

Yields per tree, generally have been below commercial requirements. Bad site selection, over sheltering, wrong variety choices for cross-pollination success, inadequate care with orchard management practices, especially with tree nutrition and pest control, and a general lack in professional planning have contributed to the present situation. There are exceptions, of course, with some orchards and processing plants equalling international standards.

Historical factors have left the local industry in a situation where growth and development have slowed. The reliance on one main variety, Beaumont, and the sale and/or closure of the three commercial enterprises in the decade of the twentieth century severely curtailed growth. This exposed the need for research projects in the search for

new varieties suitable for the cooler New Zealand climate and studies to promote better cross-pollination and final nut set results.

In addition the industry must raise quality standards to meet overseas competition. This country is not self-sufficient in the production of macadamia products and often the local product is much inferior to those imported. There is one processing plant in New Zealand which has quality standards the equal of the overseas competition and there is another one which is modern with high quality machinery but is not working to capacity due to a lack of available nut in shell (NIS). However there are a number of other processors who do not reach the required standards and their products lower the image of the nut as a high value food item. Local packaging is often below international standards and the New Zealand Macadamia Society could raise these issues with its members in an effort to improve sales and marketing results.

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Several people, not necessarily members of the Society, have been extraordinarily helpful in my study. Ian Gordon has had probably the longest continuous service to the New Zealand macadamia industry. He has let me tap into his knowledge and experience and supported my work all the way. Thank you Ian.

Vanessa Hayes has supported the study, giving ready access to research information on her plant variety trials at Torere. Her enthusiasm for the development of our macadamia industry and her energy pursuing excellence sets high standards which will be necessary if New Zealand is to match overseas benchmarks.

Vince and Diane Kerr were always supportive of this study and were able to provide historical and technical information and photos. Although both have cut practical involvement with macadamias their long association from the 1970's has been valuable and noteworthy.

Ian McConachie from Gympie, Queensland, was a major source of information and inspiration. Ian has had a long and successful life in the Australian macadamia industry and has recently commenced a working retirement to write a world history of macadamias. Via email, fax, letter and phone Ian has offered details of the Australian and world macadamia industry from the discovery in Queensland to present trends. He proved a generous host and a knowledgeable contributor.

Henry Bell is recognized as a new variety plant breeder in Australia of major importance. Since leaving his native Otago, some fifty years ago, Henry has run his Queensland property with great invention. His knowledge and success was important to my study and on many orchards and nurseries in New Zealand the results of his plant breeding have been crucial to the progress of the local breeding research.

I wish to thank the staff of the research stations at Te Puke, Mt Albert and Kerikeri for their help. At Kerikeri, Ted Dawson and Annette Richardson provided important research papers and comment and made available access to files and papers. At Mt Albert, Rick Edwards and his staff in the library were always generous with their time answering queries and location of information.

A number of pioneers in the New Zealand industry were approached and interviews recorded. These included early nurserymen, Co-op members and growers who made early plantings from the 1970's from Tauranga, Katikati and to the Bay of Islands.

Finally I wish to acknowledge the support of my wife Nola in completing the study. Without her love, patience and interpreting skills, through three changes of home and numerous computer glitches, this story would not have been accomplished.

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GLOSSARY

NIS	Nut in shell ie the outer husk has been removed.
% Moisture Content (M.C) NIS	A mature NIS taken from a tree, is approximately 1/3 shell, 1/3 kernel 1/3 moisture. The processor pays the grower a price based on the weight of NIS at 10% M.C. Example – a grower sends 1000Kg NIS to processor. The processor makes the following calculation to find M.C.

$$\% \text{ MC NIS} = \frac{\text{wet wt} - \text{corrected dry wt}}{\text{wet wt}} \times 100$$

NB corrected dry wt @ 1.5% is dry wt x 0.985

$$\therefore \ \%\text{MC NIS} = \frac{1000\text{Kg} - (850\text{Kg} \times 0.985)}{1000} \times 100$$

$$= \frac{1000 - 837}{1000} \times 100$$

$$= \frac{163}{1000} - 100$$

$$= 16.3\%$$

% Kernel (Crackout)	= The weight of the kernel as a percentage of the total weight of NIS

$$= \frac{\text{Kernel weight}}{\text{Total weight of NIS}} \times 100$$

Example = Processor receives 1000Kg of NIS. After drying to 1.5% MC the total kernel is weighed.

$$= \frac{\text{kernel weight}}{\text{total weight NIS}} \times 100$$

$$= \frac{350\text{Kg}}{1000\text{Kg}} \times 100$$

$$= \frac{350}{10}$$

= 35% crackout

No. 1 kernels are those which contain 72 + % of oil. A common test to find No 1 kernel is to place all kernels in the sample in tap water (ambient heat). The kernels that float are No 1.

$$\% \text{ No 1 kernel} = \frac{\text{weight of floaters}}{\text{total wt. kernel}} \times 100$$
$$= \frac{30 \text{ kg}}{35 \text{ kg}} \times 100$$
$$= \frac{30 \times 100}{35}$$
$$= 85.7\% \text{ No 1 kernel}$$

The term "usable kernel" may be defined as kernel which has been visually examined and been sorted as sound kernel. Sound kernel includes fully developed kernel and is free of defects such as insect damage, mould, decay, immaturity, discoloration, basal stain or rancidity and which are suitable for roasting, sale as raw kernel or use in confection sales.

$$\% \text{ Recovery (usable kernel)} = \frac{\% \text{ kernel}}{100} \times \% \text{ No 1 kernel}$$
$$= \frac{35 \text{ (crackout)}}{100} \times 85.7$$
$$= \frac{7}{20} \times 85.7$$
$$= 29.9\% \text{ Recovery}$$

Nut Maturity - Moisture content (at least 25%) and the percentage of No 1 kernels (contain more than 72% oil) are the best indicators of nut maturity. In Australia mature nuts drop over a period of 1-3 months. In New Zealand varieties do not drop generally and the grower picks random samples from the orchard from, late June, and checks if the inside of the husk has turned brown. If still white or cream picking is delayed until husks are brown. Then the trees are strip picked.

(int.) - *M. integrifolia*

(tet.) - *M. tetraphylla* - The only macademia species which produce edible nuts.

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CHAPTER ONE : INTRODUCTION

1.01 The Macadamia Industry in New Zealand

New Zealand, because of its geographical situation and relatively new immigration patterns, has imported a wide variety of crop plants for local cultivation. Maori migrations brought vegetable such as the yam and kumara from the Pacific regions and from early nineteenth century new settlers introduced vegetable and fruit plants as food sources (King 2003). Missionaries, for example, planted grapes and other crops, in the Bay of Islands in the 1830's (Pickmere 1994).

A diversity of sub-tropical and exotic horticultural fruit crops was introduced into New Zealand during the twentieth century. Some have had only limited commercial success, but others, such as kiwifruit, avocados, blueberries, olives and macadamias have adapted to local conditions. These, and others, continue to produce profitable crops for domestic and export markets (Ferguson and Bollard 1990).

The New Zealand macadamia industry grew from three commercial decisions made in the late 1970's and early 1980's. New Zealand's largest planting of macadamias commenced in Okaihau in 1978. Another large enterprise developed at South Head, near Helensville, where extensive site development preceded a planting of some 10000 mixed varieties from 1981. The third venture began when a meeting in Rawene in 1982 decided to form a co-operative of interested growers based in Whangarei.

Prior to these developments individual plantings of macadamias had occurred as far south as Dunedin (Gordon 2002) and Nelson and from as early as the 1870's. Climate was a key factor in obtaining a profitable yield from trees in New Zealand and most experimental plantings were made from the Bay of Plenty northward. A number of lifestyle plantings in the 1970's formed the basis for the setting up of the New Zealand

Macadamia Nut Growers Co-operative. Government researchers and semi-tropical and exotic nurserymen indicated that the Beaumont variety was superior to all others under New Zealand conditions. This led to the situation that over 90% of all macadamia trees planted in the country until 2000 were Beaumont.

Australian and Hawaiian plantations rarely chose Beaumont as the nut from this variety had to be hand picked (it does not drop to the ground naturally when mature) which brings a heavy harvesting cost. In addition the kernel is sweeter than most Australian and Hawaiian varieties which made it unpopular with processors as the Beaumont kernel burns when roasted. This meant that the Beaumont kernel had to be separated from the other varieties – another expense. Although some New Zealand processors (Garden 2002, Ward 2002) did not find the Beaumont kernel a problem in processing and continued to grow the variety, basically Beaumont did not suit the large plantations over 5000 trees.

By 2000 the local macadamia industry had failed to make significant progress. All three commercial ventures had failed to achieve profitable yields from their orchard bases and the businesses were sold to new owners or ceased trading. Crop yields per tree were disappointing, compared to overseas results, and many growers were disillusioned. Some turned to growing alternative crops or sold off their land.

Features of the New Zealand macadamia industry by 2000 included:

- An industry that was relatively small, scattered and lacking in co-ordination by a central authority.
- The Nut Growers Co-operative ranged from a total of 114 members in 1987 to 47 by 1996.

  The New Zealand Macadamia Society had reached a total of 76 members by 2005. Both the above associations attracted similar types of members – lifestyle and small scale growers with less than 1500 trees.
- In 2002 the size of the local industry, using statistics provided by the New Zealand Macadamia Society, was modest. (Table 1)

hand fertilise trees and to keep grass and weeds from smothering trees, paths and drains. Good research was available from the NZ Macadamia Growers Co-operative's regular news letters and from researchers at the Kerikeri Research Station and other agricultural agencies (Richards & Dawson 1993, Kerr News Bulletin 1986).

- ❖ The quality of processing plants ranged from excellent to unacceptable. Considering the small scale of the local industry there were too many processors – twelve (NZMS Newsletter No 39). There is an urgent need to rationalise the processing industry by reducing the number of factories and reaching the ISO production standards by those remaining. The macadamia nut is considered to be a luxury product and the local quality must reflect that image.

The following study reflects the present stage of the local macadamia industry development. It will begin with botanical classification and description of genus *Macadamia*, its discovery in Australia and its distribution. This will be followed by signs of commercial success on world markets particularly in Australia, Hawaii and South Africa. Chapter two will deal with research methods and materials. The following three chapters will follow the history of macadamias in New Zealand, the industry today and possible future directions to achieve growth.

The year 2000 appeared to be an appropriate time to commence a study of the New Zealand macadamia industry. My wife and I had recently sold our 2.2 hectare macadamia orchard because of ill-health and my mobility was severely restricted. In addition I was disturbed to hear that all records and traces of the life work of an important macadamia pioneer had been destroyed and lost forever.

Earlier, in my career as a teacher, I had gained a MA degree at Victoria University and a Dip Bus at Massey University. This academic background and ten year experience in converting a citrus orchard in Kerikeri to a macadamia plantation seemed to be sufficient preparation to start my research.

My wife and I had happily enjoyed eating macadamia nuts for many years and the chance to take early retirement and make a radical life change was too attractive to miss. We bought the citrus orchard complete with rich volcanic soil, irrigation, good aspect and shelter, a house, shed and tractor. The citrus trees were mature navel oranges, mandarins and tangelos planted in rows four metres apart.

We read local literature from government sources and private nurseries and took a trip to Queensland to learn about varieties, growing and processing in a wide range of conditions. Later we made another trip to Queensland concentrating on processing machinery and methods. Both trips were planned with the help of the secretary of the Australian Macadamia Society.

We planted 400 macadamia trees on our orchard. We chose Beaumont as the main crop and Elimbah and Renown as pollinators. We removed a citrus tree every four metres in every second row making the spacing of the macadamias four metres in the row and eight metres between the rows. Leaving most of the citrus in the ground had two advantages. The mature trees provided excellent shelter for the new macadamias and citrus could be removed as the macadamias grew. In addition, citrus provided an income before macadamias became commercial. The last citrus were removed in the tenth year.

We imported processing machinery from Australia in the third year when our trees started to produce increasing yields. In addition we bought nuts from other growers and had no problem in selling our products to supermarkets and health and gourmet food outlets. At that stage we had chocolate and carob bars made for us in Auckland containing nut pieces plus cherry and raisin. In addition we had macadamia spread made in Auckland. Our major sales were made of fresh nuts to supermarkets and health shops. We made marketing trips to Singapore, the USA and London and while our products were up to an acceptable quality standard we could not produce enough to satisfy market needs.

After two or three years of processing we required a larger and more efficient method of drying the NIS to 1.5% moisture. We purchased a container and had a dehumidifier unit fitted. The container was added to our factory and dried 6-8 tonnes of NIS in less than two weeks and maintained the nuts until they were needed for processing.

1.02 Botanical Classification and Description

The genus *Macadamia* belongs to the :

family: *Proteaceae*

sub-family: *Grevilleoideae*

tribe: *Macadamieae*

There are seven Australian species which fall into the following intrageneric groups:

1 *M. integrifolia, M. tetraphylla, M. ternifolia, M. jansenii*

2 *M. claudieana*

3 *M. whelanii, M. grandis.*

Note: *M. hildebrandii* is only found on Sulawesi, Indonesia, and is closely related to *M. claudieana* (George 1998).

Only the species *M. integrifolia,* and *M. tetraphylla* produce edible nuts (Peace 2001).

1.03 Proteaceae Family

The early history of the *Proteaceae* family in Australia shows that it emanated from a common moist forest flora approximately 100 million years ago. Pollen records indicate that the Macadamia species evolved in the late Cretaceous period about 60 million years ago (Dettmann and Jarzen 1998).

In New Zealand only two species of *Proteaceae* still exist. They are *Knightia excelsa* and *Toronia toru.* Pollen from many *Proteaceae* genera has been found in New Zealand including pollen from the Macadamia tribe (Pole 1998).

1.04 Discovery in Australia

"Four thousand years ago, in the Old World, many important food plants were being cultivated by man, including wheat, rice, barley, onions, tea, apples, olives and almonds. Before the time of Christ, corn, the sweet potato, cacao and kidney beans were under cultivation in the New World. The macadamia is a rarity – a "new"crop which was domesticated for the first time in 1858 in Australia. It is the only native Australian plant ever developed as a commercial food crop" (Rosengarten 1984).

The macadamia, an evergreen tree, is a native of the coastal rain forests of southeast Queensland and northern New South Wales, Australia. Some species produce nuts, which were an important source of food for the aboriginal tribes, but there is no evidence that the trees were cultivated. The aboriginal name for the nut is "Jindilli" in Queensland and further south in New South Wales it is call "Kindal Kindal". Some aborigines in tropical Queensland ate the bitter nuts from the *M. whelanii*, perhaps after extensive leaching (Gross and Weston 1992).

A German explorer, Fredrich Leichhardt, collected the first nut specimens on 18 September 1843. According to Leichhardt's diary the nuts were collected in the

Bunya Bunya Brush near Dulabi, Queensland. The nuts collected were *M. ternifolia* and therefore were inedible and the nuts and foliage were held in the Melbourne Herbarium for some years.

There has been some confusion, among scientists, about the location of the area where the nuts were found. Some suggest that Leichhardt climbed Mt Bauple, on 18 September 1843, which is 150 km north of the Bunya Bunya Brush and that *M. ternifolia* does not occur there. Evidence indicates that Leichhardt climbed Mt Bauple on 31 July and then carried on to an area where the specimens were collected (Gross and Weston 1992).

1.05 Taxonomic History

The taxonomic history of the macadamia species has been highlighted by reclassification changes. The first formal descriptions of macadamias came from Baron Ferdinand von Mueller in 1857. Mueller named a collection of two branches of macadamias he and Walter Hill found in the forests on the Pine River of Moreton Bay, as *M. ternifolia* in honour of his friend John Macadam, MD, who was at that time Secretary of the Philosophical Institute of Victoria. New Zealand could have had an early introduction to macadamias as Dr Macadam sailed from Australia to New Zealand in 1865. However, it was a very rough voyage and Dr Macadam broke some ribs, developed pleurisy and died at sea at the age of thirty-eight (Rosengarten 1984).

Later, in 1867, Mueller received further samples from Hill including edible fruit. Mueller described the fruit, and the tree which grew them, but he did not give a new name to the species. This was unfortunate as the original name, *M. ternifolia,* described a species which produced bitter inedible fruit. For the next hundred years Australian scientists found that it was difficult to classify the new samples accurately.

Two Australian scientists, Maiden and Betche, proposed in 1897 that the 1867 samples were a different species because of the edible fruit and differing leaf shape. Maiden and Betche classified the new samples as *M. integrifolia* (Gross and Weston 1992).

Current thinking accepts the taxonomy as follows with acknowledged classifying scientists shown in brackets:

- *M. integrifolia* - (Maiden and Betche 1897) - the main commercial species in Australia and Hawaii. It is a native of southeast Queensland and the nut is edible.
- *M. tetraphylla* – (Johnson 1954) – the nut is edible but with a sweeter flavour as it contains 50% more sugar. It is a native of southeast Queensland and northern New South Wales.
- *M. ternifolia,* - (Mueller 1857) has a small inedible nut with a bitter kernel caused by *cyanogenetic glycosides.* It is a native of southeast Queensland.
- *M. jansenii* – (Gross and Weston 1992) - is similar to *ternifolia* but the nuts are a little larger and inedible. It is a native of Miriam Vale in South Queensland just north of Maryborough.
- *M. claudieana* – (Gross and Hyland) – has soft shelled nuts which are edible, not bitter – found only in the Iron Ranges, far north Queensland.
- *M. whelanii* (Batley 1901) and *M. grandis* (Gross and Hyland) – both have inedible nuts with *grandis* bearing soft-shelled fruit. These species are found in State Forest Reserve 755, in the vicinity of the Barong Logging Area, north Queensland.
- *M. hildebrandii* - (Steenis 1952) - is found on the island of Sulawesi (Celebes) Indonesia and is closely related to *claudieana.*

Note: All species produce nuts with hard shells except *grandis* and *claudieana* which have soft shelled nuts (Gross and Weston 1992).

1.06 Morphological Features

The five major morphological characteristics of the four southern species –*M. jansenii, M. ternifolia, M. integrifolia* and *M. tetraphylla* are outlined in Table 2.

Table 2: Morphological features of the four southern species

Species	Leaves per whorl	Colour of new leaves	Petiole	Leaf margin spininess	Mature leaf shape
Jansenii	3	green	present	none	Short to medium length : width ratio > 4 Wider near the Middle
ternifolia	3	bright red	present	medium	Short Length : width ratio > 4 Wider near the middle.
integrifolia (int.)	3	green or bronze tipped	present	none to medium	Medium Length : width ratio > 4 Wider near the middle
tetraphylla (tet.)	4 or 4/5	deep red	absent	high	Long Length : width ratio > 4 Wider near the middle

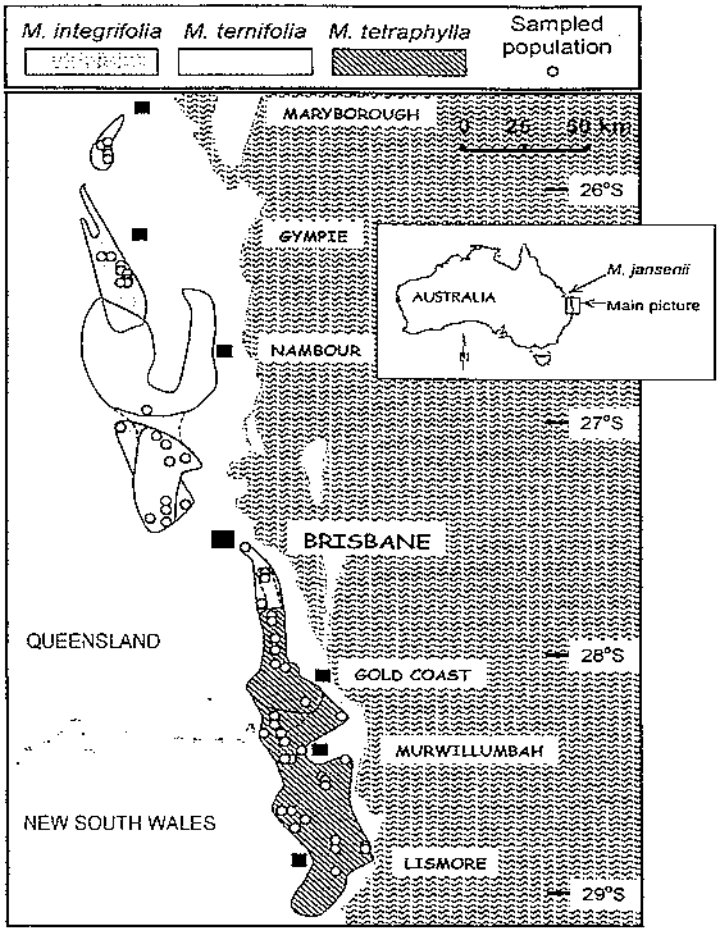
(Peace 2001).

1.07 Species Distribution

The four southern species are restricted to a narrow coastal strip of southern Queensland and northern New South Wales approximately 500 km long and usually less than 50 km wide. The northernmost species is *M. jansenii* known in only one small population

isolated by more than 180 km from the other species. Natural populations of *M. integrifolia* are found in several separate regions in southeast Queensland, from the Mt Bauple region approximately 20 km south of Maryborough to just into the Gold Coast hinterland. *M. ternifolia* occurs in the Pine Rivers district and the Blackall and Conondale Ranges, possibly one continuous region. Natural hybrids of *M. integrifolia* and *M. ternifolia* occur in populations where their ranges overlap – throughout most of the Pine Rivers district and probably also in the Imbil area. The southernmost species, *M. tetraphylla,* occurs naturally from the southern part of the Gold Coast hinterland in Queensland to south of Lismore in New South Wales. Macadamias in the Gold Coast hinterland are almost entirely natural hybrids of *M. integrifolia* and *M. tetraphylla* (Figure 1) (Peace 2001).

Figure 1: Species distributions and natural hybrid zones of the four species of the southern clade of macadamia



(Peace 2001).

The only known successful cross between *M. integrifolia* and *M. ternifolia*, is HAES791. This hybrid is able to produce edible nuts and was probably a natural cross rather than an intentional action. It is possible that *M. ternifolia* and *M. jansenii* could be used in plant breeding to give characteristics such as heat resistance but the bitter flavoured nuts of these varieties would have to be overcome to make the hybrid fruit edible (McConachie 2004).

One variety which may be useful in future macadamia breeding programmes, especially in warm northern areas of Queensland, is *M. claudieana*. It has a large fruit which is easily separated from its thin shell and the kernel is not bitter (Gross and Weston 1992).

1.08 Commercial Origins

Despite the Australian origins, the first development of macadamias as a commercial crop took place in Hawaii. In 1881 some *M. ternifolia* seed were taken to Hawaii from Australia and planted. Soon after, it was realised that there had been a mistake and that this species was undesirable for orchard cultivation. The trees were cut down to stop the spread of this unwanted species (Gross and Weston 1992). The following year William Purvis imported *M. tetraphylla* seed from the north Gympie area Queensland and planted them on the island of Hawaii. One of the original trees planted by Purvis was still producing nuts in 1983. In 1918 Mr Walter Naquim, who was the manager of a sugar company on the island, planted 18,000 macadamia seedlings sourced from the original Purvis trees. This large planting was a part of a reforestation project and the yield grew steadily. The wife of the sugar company manager experimented with the nuts in a number of ways to extend the income from the orchard. Mrs Naquim produced the first marketable added–value macadamia products, chocolate–coated macadamias (Rosengarten, 1984).

The first commercial macadamia orchard in Australia was established about 1888, when Charles Staff planted 250 *M. tetraphylla* seedlings near Lismore, New South Wales (Rosengarten, 1984). Developments in Australia followed more slowly until the

1960's—1970's when prospects for large scale planting and profitable local and export markets appeared.

1.09 Macadamia Production Figures

Macadamias make up barely 1% of the total world tree nut production (Table 3). This is partly due to the relatively recent appearance on nut production tables. Production costs for macadamias are higher than most other nuts because of the need for harvesting (using mechanical means), de-husking, drying, processing and packaging kernel.

Table 3: World nut production

Nuts	Kernel tonnes
Macadamia	25,000
Pecans	110,000
Pistachios	200,000
Cashews	250,000
Hazelnuts	330,000
Walnuts	370,000
Almonds	650,000
Total	**1935,000**

(Hargreaves 2004)

New Zealand prodution was too small (35,438kg) to be included in world macadamia production figures of nut-in-shell and kernel for 2003. Seven countries are listed (Table 4). Hawaii was the leading nut producer until the late 1990's but the sale of Hawaiian macadamia plantations for real estate and the increased planting in Australia meant that they produced the greatest volume in 2003.

Table 4: World macadamia production – NIS and kernel (2003)

Country/Region	NIS Tonnes	Kernel Tonnes
South Africa	12,500	3,400
Kenya	8,800	1,000
Malawi	4,000	1,000
Zimbabwe	900	120
Central America	17,000	3,100
Hawaii	22,000	5,500
Australia	30,000	9,100
Total	**95,200**	**23,220**

(Hargreaves 2004)

Note Factors that determine the weight of usable kernel include:

- The weight of moisture lost when drying down from 10% (the international standard for processors buying from growers) to 1.5% (the international standard when nuts are processed).
- The weight of kernel which cannot be used because of blemish which makes the kernel of no commercial value.

Australian production steadily increased from 1987 to 2004 due to new plantings, availability of new varieties and better on-farm management. Prices to growers varied from a high $3.95 (1988) to a low $1.60 (1991). These fluctuations (Table 5) reflect local supply quantity and quality variations and international economic conditions and these swings are common in the world food market places.

Table 5: Australian NIS production and prices

YEAR	NIS PRODUCTION	NIS PRICES - $/KG @ 10pc MC
1987	4,400	3.10
1988	5,200	3.95
1989	6,800	3.65
1990	12,000	2.50
1991	10,000	1.60
1992	13,000	2.03
1993	14,500	2.75
1994	19,700	2.80
1995	17,500	3.00
1996	20,500	3.05
1997	25,400	2.70
1998	26,500	2.45
1999	33,000	2.25
2000	29,500	2.12
2001	34,800	2.45
2002	30,200	2.75
2003	29,700	3.20
2004 forecast	37,000	3.10

(Hargreaves 2004)

Macadamia Production Figures

Hawaii was the first place to build a commercial macadamia industry. The figures (Table 6) are for Dry Nut In Shell (10% moisture) and they show the steady increase until year 2000. Available figures for the Hawaiian industry commenced in 1947. There was a steady increase in yields to reach a peak in 1995 – 2000. The sale of macadamia plantations and difficult weather conditions have combined to reduce production figures in the years since 2000.

Table 6: Actual & projected production (based on per tree yields) for Hawaii

YEAR	Projected Total Prod'n DIS tons	Actual Total Prod'n DIS tons
1947		286
1948		308
1949		318
1950		308
1951		342
1952	34	386
1953	81	438
1954	202	440
1955	424	422
1956	602	410
1957	838	466
1958	1141	603
1959	1485	831
1960	1844	953
1961	2263	1165
1962	2665	1701
1963	2967	2351
1964	3224	2723
1965	3484	3465
1966	3720	3866
1967	3941	3953
1968	4185	3613
1969	4311	4734
1970	4487	4558
1971	4692	5995
1972	4939	6554
1973	5325	5947
1974	5837	5499
1975	6463	7425
1976	7069	8260
1977	7693	8614
1978	8365	8927
1979	9103	9517
1980	9884	12093
1981	10567	15146
1982	11416	15132
1983	11885	16656
1984	12274	16520
1985	12617	17101
1986	13031	19051
1987	13482	19958
1988	14073	19369
1989	14854	20369
1990	15484	22907
1991	16461	22680
1992	17456	22453
1993	18794	21773
1994	20314	22000
1995	21572	23814
1996	23059	23134
1997	24324	25628
1998	25517	26309
1999	26491	26082
2000	27348	25628
2001	28070	22680
2002	28311	25300
2003	28509	23500

(Lee 2004)

Production Figures for South Africa, Australia and Hawaii

Australia, Hawaii (USA) and South Africa are the three major macadamia producing countries in the world. Data for areas planted and production in 2003 for these countries indicate that yields were 1.25, 1.58 and 3.14 tonnes per hectare for South Africa, Australia and Hawaii respectively These figures suggest that either planting densities were more intensive planting in Hawaii with 22,000 tonnes produced from 7,000 hectares or that the trees in Hawaii carry heavier crops than trees in the other sites

Table 7: Planted area (2003) and production NIS (2003) in South Africa, Australia and Hawaii.

Country	Planted Area (2003)	Production (2003)
South Africa	10,000 ha	12,500 tonnes
Australia	19,000 ha	30,000 tonnes
Hawaii	7,000 ha	22,000 tonnes

(Lee 2004)

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