

# Hazelnuts

Basil Baldwin

## Introduction

Although hazelnuts (*Corylus avellana*) were introduced into Australia over 100 years ago, to date they have been grown only on a relatively small scale. Current annual production is estimated to be approximately 15 t of in-shell nuts. However, there appears to be an opportunity for considerable expansion of the local industry, as more than 1500 t of nuts and kernels, valued at more than \$7m are imported into Australia every year.

It is considered that the establishment of a local industry could complement overseas production through the provision of fresh, locally grown nuts that could be stored, at a relatively low cost, in-shell, and cracked as required to supply fresh kernels for local processors and consumers. Major users of hazelnuts in Europe are also interested in obtaining nuts from Australia, provided the nuts are of appropriate quality and are available in sufficient quantities.

In addition to the freshness of the Australian product for local users, it has the potential to capitalise on a 'clean and green' image, as few of the major pests

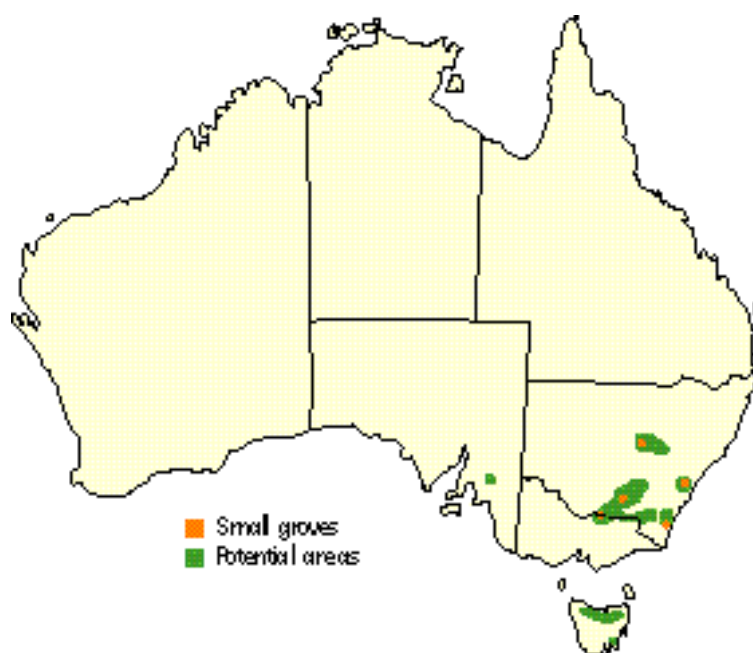
and diseases of hazelnuts have been introduced into Australia. In order to capitalise on these market opportunities, there needs to be research to evaluate appropriate varieties and develop efficient production systems. Growers must develop an industry infrastructure of mechanised harvesting, handling, storage, cracking and grading of nuts, orderly marketing and strategic alliances with major buyers.

## Markets and marketing issues

Hazelnuts are marketed as two products: nuts in-shell and kernels. Nuts in-shell, marketed

mainly for home or table consumption, account for less than 10% of the total market. Most hazelnuts are cracked and sold as kernels, which can be eaten fresh, but the vast majority are either blanched or roasted then used in confectionery products such as cakes, biscuits and chocolates.

The major centre of hazelnut production in the world is in northern Turkey, on the Black Sea coast. There are other important production areas in Italy, Spain and Oregon, USA. The nuts produced by the Turkish and European growers are commonly stored on-farm and then sold during the year to operators of cracking plants. The



cracked kernels are size-graded and placed in plastic vacuum packs which are kept in cool storage to prevent rancidity. The volume and value of imported nuts and kernels in recent years, are given in Table 1. The quantity of imported kernels has generally risen since 1990, as has the average price. Although the unit value is the price paid in the country of origin, importers have a greater cost than this, as they also incur shipping, storage and handling costs.

Many variations are possible in the market chain from production to processing and consumption (Fig. 1).

To date, one of the major constraints to the development of the local industry has been the lack of knowledge on the performance and appropriate management of the introduced varieties that might be grown to achieve the identified opportunities of import substitution.

## Production requirements

Hazelnut production is favoured by a climate with a cool winter and mild summer, such as is found in the coastal and upland areas of southern Australia.

Hazelnut trees have a poor tolerance to heat, wind and moisture stress. The tree is deciduous and, when dormant, can tolerate temperatures as low as  $-15^{\circ}\text{C}$ . However, at the time of pollination, the pollen and stigmas will tolerate temperatures no lower than  $-5^{\circ}\text{C}$ . This is not generally considered to be a problem in Australia.

The main northern hemisphere production areas have a Mediterranean-type climate and are in the latitude range  $37^{\circ}$  to  $47^{\circ}$ . The climate of locations in Australia, where small hazelnut groves have been successfully established, compares favourably with major northern hemisphere production areas (Table 2).

The growth of hazelnut trees is favoured by well drained, fertile soils with a pH range of 5.5–7.5. Good supplies of irrigation water in the summer months are considered to be essential, especially during the

Table 1. Quantities, values and sources of hazelnut imports into Australia, 1990–91 to 1995–96.

	90-91	91-92	92-93	93-94	94-95	95-96
Hazelnuts in — shell (t)						
Italy	26	14	5	—	—	14
Turkey	7	—	—	25	16	47
USA	52	84	119	96	75	51
Total	85	98	124	121	91	112
Total value (\$A'000)	217	157	197	279	269	347
Unit value (\$A/kg)	255	160	159	231	296	310
Shelled hazelnuts — kernels (t)						
Italy	107	92	71	114	299	49
Turkey	894	973	1041	794	1061	1372
USA	254	317	331	438	420	408
Total	1255	1382	1443	1346	1780	1829
Total value (\$A'000)	4900	5423	5398	7097	9097	8283
Unit value (\$A/kg)	390	392	3.74	527	5.11	4.53

Source: Australian Bureau of Statistics

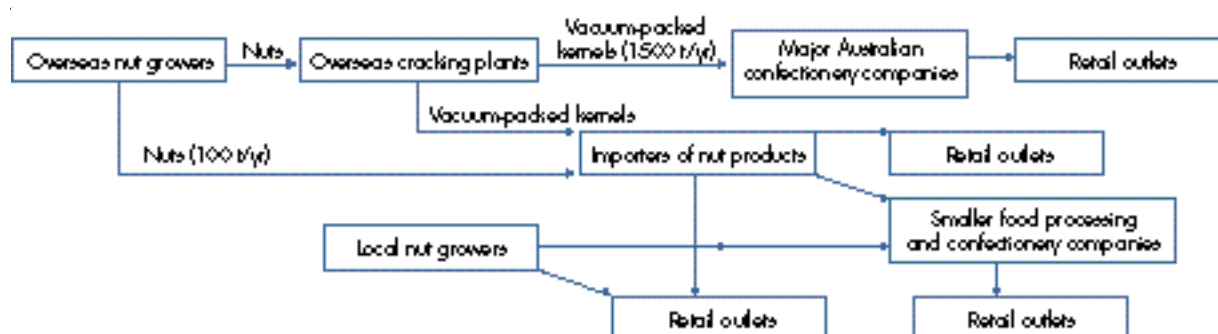


Figure 1. Principal components of the market chain from overseas nut production to processing organisations and retail outlets.

establishment phase of the grove and during dry seasons. Although the major production areas overseas generally have a high incidence of winter rainfall with relatively dry summers, irrigation does not appear to be a common practice in those centres. However, as evaporation rates in Australia are usually higher and rainfall is more erratic, irrigation facilities are generally recommended. Dry weather during the harvest period is advantageous.

Hazelnut trees do not tolerate strong winds and therefore the selection of sheltered sites or the planting of wind breaks before establishing the grove is very important.

Flat or gently sloping sites are preferred to facilitate operations within the grove, particularly mechanical harvesting.

### Varieties

Selecting the most appropriate hazelnut varieties for planting is a very important decision. There are two main aspects that have to be considered: the productivity of the tree and the marketability of the nuts. Ideally, the varieties planted should be both productive and of a type for which there is a market demand.

Although a wide range of varieties can be sold in-shell, there is a customer preference for nuts that are large with a clean, shiny

appearance and even size.

Varieties that meet these requirements include 'Wanliss Pride' from Australia and 'Ennis' from the USA (Table 3). 'Wanliss Pride' is a sweet-tasting nut when harvested and stored under appropriate conditions. It is, however, prone to rancidity when insufficient care has been taken to thoroughly dry the nuts at harvest time. A large proportion of the imported in-shell nuts are of the variety 'Oregon Barcelona', which has relatively large, attractive nuts. However, this variety is slowly being superseded by 'Ennis', which has an even larger nut.

Those growers who plan to sell into the kernel market need to

Table 2. Climatic data from major hazelnut production areas overseas compared with Australian localities where hazelnut groves have been successfully established.

Climatic data	Location						
	Overseas			Australia			
	Samsun, Northern Turkey	Nola Campania, Italy	Corvallis, Oregon, USA	Healesville, Vic	Myrtleford, Vic	Orange, NSW	Deloraine, Tas
Latitude	41 °N	41 °N	45 °N	38 °S	37 °S	34 °S	41 °S
Mean annual rainfall (mm)	739	1014	1084	1020	903	901	1087
Hottest month							
Mean max ( °C)	26	30	27	27	28	25	23
Mean min ( °C)	18	18	11	12	12	12	10
Mean rain (mm)	38	29	14	61	45	109	45
Rain days	4	4	3	7	5	9	8
Coldest month							
Mean max ( °C)	10	12	7	12	14	9	11
Mean min ( °C)	3	5	1	4	1	0	1
Mean rain (mm)	74	111	173	87	106	87	126
Rain days	10	11	19	16	14	14	17
Harvest month							
Mean rain (mm)	61	79	38	64	60	50	73
Rain days	6	5	6	8	6	7	10

Source: Climatic Averages, Australia 1988, Bureau of Meteorology, AGPS, The World Weather Guide by Pearce and Smith, 1990

talk to buyers or potential buyers to ascertain whether any particular characteristics of kernel size, shape, texture, taste and blanching or roasting flavour are being sought. Some processors have very specific requirements for their products.

### About the author



Basil Baldwin BSc(Hons), GradDipEd, MAGSci, is a Senior Lecturer at the Orange Agricultural College, University of Sydney (see Key contacts for address). His experience in agronomy includes developmental work with 'new' crops to Australia. Current research includes an evaluation of hazelnut varieties.

Hazelnut kernels are covered with a skin or pellicle, which varies in thickness and appearance between varieties. The pellicle can be readily removed from some varieties by a process known as blanching, which involves heating kernels for 10–15 minutes at 135°C, followed by brushing off the loose pellicle to leave a clean white kernel. Varieties that blanch well include 'Tonda di Giffoni', 'Willamette' and the

Australian selection, 'Tokolyi/Brownfield Cosford'. Roasting involves heating for a longer period. The flavour and crunchiness of kernels are increased by roasting. Although some varieties do not blanch well, they are highly prized for their flavour. 'Tonda Romana' is such a variety.

Most of the early hazelnut introductions into Australia were as nuts. As the species is cross-pollinated, these nuts were not true to varietal type. Local selections have been made from these early introductions, some of which have been found to be useful, e.g. 'Wanliss Pride', 'Tokolyi (or Brownfield) Cosford' and 'Tonollo'.

During the last 10 years, many individual growers and propagators have imported varieties from the USA and Europe, but extensive evaluations of these have not yet been made.

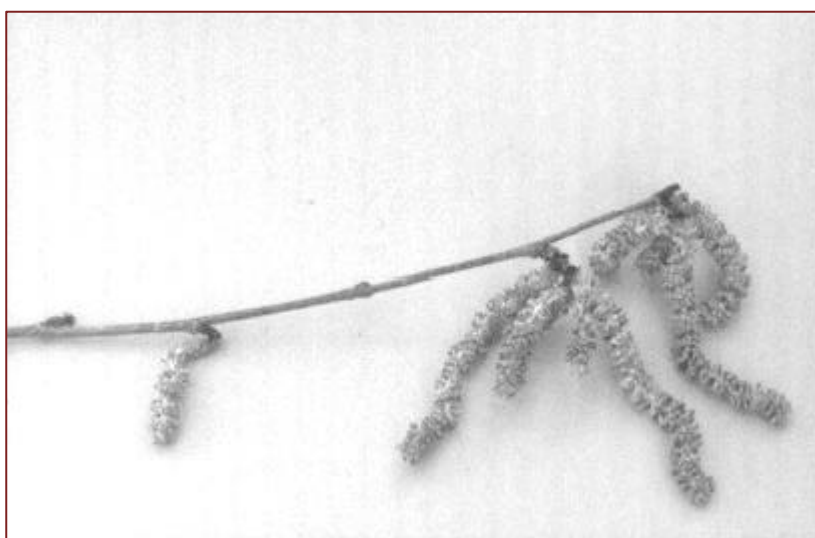
Summaries of the characteristics of Australian and promising overseas varieties are given in Table 3.

### Cultural practices

It is important to select a sheltered planting site, as hazelnut trees are very sensitive to wind damage, particularly in the establishment years. It is advisable to plant shelter belts around a proposed site two or three years ahead of planting the grove.

It is generally advisable to apply lime one year before planting to sites which are acid, to bring the soil pH up to about 6.5. Ripping the planting rows in the autumn of the planting year is beneficial on soils that are prone to compaction. Rotary hoeing or cultivating the planting row will loosen soil and provide an environment that favours root growth.

Groves are commonly planted at a density of 300–600 trees/ha, with a spacing of 5–6 m between the rows and 4–6 m between trees within the rows. The more vigorous varieties are planted at the wider spacing. It is essential to keep plantings free of weeds and highly advisable to mulch around the base of young trees to promote moisture retention and



Pollen that is shed from the elongated catkins is blown through hazelnut groves to cross-pollinate the receptive female flowers.

lower the soil temperatures in summer. It is very important that young trees receive adequate water. Supplementary irrigation may be required if rainfall is insufficient.

### Key statistics

Imports of hazelnut kernels  
1995-96

Total quantity	1829 t
Purchase cost at source	\$8.3m
Unit value at source	\$4.53/kg (kernel)

Hazelnut varieties produce suckers to varying degrees. These suckers produce very vigorous growth and must be removed two or three times each year, in order to avoid restricting the growth of the productive part of the tree. Suckers are removed either by hand or by chemical spraying.

Hazelnut trees are cross-pollinated. The male catkins, formed during late summer and autumn, elongate in winter and shed pollen which is carried on the wind to the small female flowers. When receptive, these female flowers appear as small buds with reddish filaments (stigmas) at their tips. Both

catkins and female flowers are borne on the same plant, but hazelnuts are not self-fertile. Although pollination occurs in the winter, fertilisation does not take place until early summer when the seed (kernel) develops within the shell. The mature nuts ripen in late summer and, in the American and western European varieties, fall from their husks to the ground. (The Turkish varieties do not fall free from the husk and are harvested by hand before drying and threshing.)

For pollination to be effective, the two varieties involved must be genetically compatible and their periods of pollen shed and

Table 3. Characteristics of some important overseas and Australian hazelnut varieties.

Variety	Country of origin	Growth habit	Av nut wt (g)	Characteristics of nuts and their uses	Principal pollinators
Barcelona	USA	Upright, vigorous	36	Moderate blanching, principally in-shell	Butler and Halls Giant
Butler	USA	Upright	36	In-shell market and pollinator	Barcelona, Ennis and Hall's Giant
Cassina	Spain	Moderate vigour,	19	Little pellicle, poor blanching	Hall's Giant
Ennis	USA	Erect, vigorous	4.3	Large nut for in-shell market	Hall's Giant and Butler
Hall's Giant or Merville de Bollwiller	Germany	Upright, few suckers	36	Large nut, principally a late pollinator for many varieties	Ennis and Cassina
Tonda di Giffoni	Central & Southern Italy	Moderate vigour	31	Excellent blanching, used in confectionery	TGDL and Willamette
Tonda Gentile delle Lange (TGDL)	Italy	Vigorous, moderately erect	26	Excellent blanching, excellent confectionery variety	Tonda di Giffoni
Tonda Romana	Central Italy	Upright spreading	30	Poor blanching, but little pellicle, good quality for confectionery use	Barcelona, TGDL and Tonda di Giffoni
Willamette	USA	Moderate vigour	28	Excellent kernel variety, very productive in USA	Tonda di Giffoni and Hall's Giant
Australian selections					
Tokoly/Brownfield Cosford	Aus	Vigorous, spreading, upright	31	Kernel blanches well, very crunchy	Uncertain
Tonolio	Aus	Mod vigour	3.4	Sweet kernel, blanches well	Uncertain
Wanliss Pride	Aus	Low vigour, bushy		Large nut, sweet kernel for in-shell market	Uncertain

stigmatic receptivity synchronous. The genetic compatibility of overseas varieties is known and can be used by growers to select appropriate varieties for effective pollination. The variety 'Ennis', for example, which is grown for its high yield of large nuts, is pollinated by the varieties 'Butler' and 'Halls Giant'. 'Butler' sheds its pollen earlier than 'Halls Giant'. These two varieties more than adequately cover the period when the female flowers of 'Ennis' are receptive. Both 'Butler' and 'Halls Giant' produce many catkins and copious quantities of pollen.

The selection of appropriate pollinators is a critical aspect of hazelnut production. A ratio of one pollinator tree to nine main crop trees is generally recommended to ensure sufficient pollen is spread through the grove.

### Pests and diseases

Hazelnut producers overseas have to contend with many pests and diseases but, thanks to strict quarantine regulations, most of these have so far been excluded from Australia. Nevertheless, hazelnut blight (*Xanthomonas corylina*), an important bacterial disease of hazelnuts world-wide, does occur in Australia. It was first detected in Victoria in 1980. Blight affects young trees mainly, causing dieback of new shoots and reddish brown lesions (1–3 mm diam.) on the leaves. The husks of infected nuts also have reddish-brown lesions on them and some staining or discoloration of the nuts themselves can occur. The disease is favoured by wet weather in spring and seems to be more

prevalent at sites where trees are exposed to strong winds. The rubbing of leaves under windy conditions causes damage to the leaf surface, which allows bacteria to enter and blight to develop.

### Key messages

- E Hazelnuts are a cool climate crop.
- E Hazelnuts valued at more than \$7m are imported annually into Australia.
- E Current Australian production of hazelnuts is virtually negligible.
- E Hazelnuts have great potential as an Australian crop, but more research is required.
- E Long term potential exists for export to northern hemisphere countries.

The principal method of blight control is through the application of protective copper-based sprays such as copper oxychloride.

Aphids are often found on the undersides of hazelnut leaves. These small, greenish insects suck out the sap of the plant and can affect development when aphid populations are high. Sooty mould fungus develops on the honeydew excreted by the aphids, causing an unsightly black discoloration of the leaves, nuts and wood.

Foxes can be a major pest at harvest time, as they pick up the ripe nuts from the ground and crack them in their powerful jaws. Sulphur-crested cockatoos have also caused major problems in some Australian groves.

### Harvest handling and postharvest treatment

In most commercial varieties, nuts fall freely to the ground, with their husks remaining on the tree. In small groves, nuts are often picked up by hand,



Hazelnut kernels are covered with a skin or pellicle. In some varieties it can be removed by blanching.

but as this is a relatively slow process, mechanised or partly mechanised systems are usually employed. There are three types of mechanical harvesters—sweep and pick-up, vacuum, and fingerwheel harvesters. The sweep and pick-up method is fast, but expensive and dusty. Vacuum harvesters are of intermediate price, but are relatively slow and noisy. In large overseas groves, sweeping machines are used to windrow nuts which are picked up by a vacuum sweeper. Some vacuum harvesters have hand-held hoses that operators use to suck up the fallen nuts. Fingerwheel harvesters are relatively cheap and have considerable potential, particularly for smaller groves. The fingers flick the nuts up into a collecting basket.

It is important to have a level, smooth and firm soil surface in the grove at harvest.

Nuts that are dirty should be washed. All nuts should be dried to a moisture content of 5%, as soon as possible after harvest. Nuts at this moisture content will keep satisfactorily for 12 months.

Nuts for the in-shell market should be size graded. The five size grades used in the USA are recommended for Australian grown nuts:

Small	less than 13 mm
Medium	13–18 mm
Large	18–19.5 mm
Very large	19.5–22 mm
Giant	over 22 mm

The maximum moisture tolerance is 5%, as is the maximum tolerance for blanks (empty shells).

For the kernel market, nuts are cracked and size graded. Kernels produced by the major exporting countries are subject to stringent quality specifications. There is a zero tolerance of rancid and mouldy nuts and foreign material.

### Economics of production

The main costs incurred in establishing a hazelnut grove are land preparation, purchase of young plants and installation of an irrigation system. Typical establishment costs are:

	\$/ha
Lime application 5 t/ha @ \$60/t	300
Land preparation, fertilisers and weed control	250
400 trees @ \$12/tree	4800
Micro sprinkler irrigation system <sup>a</sup>	2000
Total	7350

<sup>a</sup> Assumes water supply to the site

Little production occurs before the fifth year, with nut yields rising steadily over the next five years. Assuming a nut yield of 1 t/ha/year after the fifth year, the following annual gross margin could be anticipated:

Income	\$/ha	\$/ha
Hazelnuts (in-shell) 1 t/ha <sup>b</sup> @ \$3/kg		3000
Variable production costs		
Fertilisers	200	
Sucker removal (3 times/year)	150	
Mowing (5 times/year @ \$20)	100	
Weed control	50	
Irrigation (application costs)	100	
Harvesting (machine assisted)	200	
Total costs		800
Gross margin (\$/ha)		2200

<sup>b</sup> Commercial yields of 2 t/ha have been achieved with the variety 'Ennis' in Oregon, USA.



Hazelnut trees produce suckers which need to be removed. In nurseries, suckers are used for varietal propagation.

## Key contacts

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## Key references

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Allen, A (1986). Growing Nuts in Australia. Night Owl Publishers

Snare, L.N. (1993). Hazelnut Production. NSW Agriculture, Agfact H3.1.49

*Australian Nutgrower* (quarterly publication), Journal of the Australian Nut Industry Council, ed. J. Wilkinson