

Guidelines for Growing Hazelnuts in New Zealand

Bulletin 2: Hazelnut Varieties

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Selecting the right variety to suit the markets that a grower plans to supply is a critical factor for developing a profitable hazelnut orchard. Most markets have specific requirements in terms of nut or kernel size and kernel texture, shape, taste, and blanching and/or roasting ability. To profitably supply the chosen markets, growers also need varieties that are able to deliver high yields regularly from an early age.

Hazelnuts are sold into two main markets: kernel and in-shell. Nut quality requirements differ between these two markets.

In-shell Markets

The in-shell market uses nuts that:

- are large (>18 mm shell diameter) with attractive shells
- have very little or no fibre on the kernel
- have plump, crisp kernels when dried
- are not susceptible to the development of mould on the kernels



Fig. 1: In-shell nuts for sale, Oregon, USA.

Kernel Markets

Most hazelnuts are traded as kernels, to be used as raw nuts for snacking or further processed for use in confectionary, baked goods, nut butters or other processed products. Preferred kernel size is usually in the 11 to 15 mm range.

The kernel market is further divided into trade in unblanched and blanched kernels. Hazelnut kernels are covered with a brown skin, the pellicle, which varies in appearance and ease of removal. This blanching process usually involves lightly roasting kernels for 10 to 15 minutes at 135 °C to 150 °C and rubbing or brushing them.

The kernel market typically requires nuts that have:

- round nut shape with thin shells that are easy to crack
- round kernel with a strong hazel flavour
- thin pellicle with little or no fibre cover
- crisp texture when dried
- good storage ability to prolong shelf life

In addition, the blanched kernel market requires kernels that have a pellicle that is easily removed by heat.



Fig.2: Unblanched kernels (Whiteheart variety)



Fig. 3: Blanched kernels (Whiteheart variety)

Other factors

Other factors to consider when selecting varieties are:

- yield potential
- percent kernel
- level of defective nuts
- tree vigour and health

Varieties vary in their ability to crop heavily every year. International studies show that Barcelona has a high yield potential (i.e. crops heavily wherever there are suitable growing conditions) whereas Merveille de Bollwiller has a low yield potential. Barcelona and Whiteheart are known to have a strong tendency towards biennial bearing (i.e. they alternate between heavy crops and light crops) whereas Tonda di Giffoni tends to crop well every year.

Commercial varieties should have a high ratio of kernel weight to nut weight (percent kernel), to maximise the yield of saleable kernel per tonne of nuts harvested. This ratio is influenced by the thickness of the shell and the amount of kernel shrinkage during drying.

Most nut processing companies have limits on the level of defective nuts or kernels allowed. The varieties selected must be able to yield a crop that can meet those quality standards. Some varieties have a tendency to develop mould on the kernels or have thick corky fibre on the kernels. These problems increase if there is wet weather at harvest time. Unfortunately the list of varieties that develop mould contains some of the most productive varieties such as Tonda di Giffoni.

Nut quality problems, such as kernel shrivelling, increase in high yielding varieties with larger nuts (e.g. Barcelona and Ennis) when these are grown in less than ideal climatic conditions. These problems are less common in varieties with smaller nuts.

Round nuts are easier to crack and process successfully. Varieties with elongated nuts, such as Kentish Cob, are usually restricted to small niche markets.

Varieties will only reach their full potential yield if they are grown in well managed orchards and are suited to the local growing environment. Hazels are adapted to a moist temperate climate and they hate extremes of heat or cold. Later flowering varieties have greater chilling requirements and yields may be affected by a lack of winter chilling in warmer northern areas. Varieties that come into leaf early (e.g. Lansing, Tonda di Giffoni) may be damaged by severe spring frosts when grown in colder southern areas.

Many of the main hazelnut varieties grown commercially overseas were imported into New Zealand over 30 years ago. Evaluation of these varieties has shown that Barcelona, Tonda Romana, and Whiteheart have potential to produce commercial crops of hazelnuts with kernels that meet international quality standards. Ennis and Tonda di Giffoni have performed well in some orchards but more research is needed to solve problems with nut quality before these varieties can be recommended for widespread planting in commercial orchards.

Polliniser varieties are planted for pollen production, and nut quality and yield are secondary considerations. Most polliniser varieties used in New Zealand produce large nuts suited to the in-shell market. Many are cracked and used to produce hazelnut oil or hazelnut paste. Some varieties, such as Alexandra, have nuts that are difficult to crack and yield poor quality kernels.

Photographs accompanying the descriptions illustrate the main nut characteristics (size, shape, fibre and degree of blanching).

Commercial Varieties

Barcelona

An old cultivar widely distributed in Western Europe, probably originating in Spain, and the main cultivar grown in Oregon, USA for the last century. It is very vigorous, forming a large spreading tree. The husk, one third longer than the nut, opens and sheds the nut freely. Barcelona is very resistant to big bud mites. It is susceptible to bacterial blight and is often affected by “brown stain” which causes a large number of misshapen nuts. It flowers mid-season. Suitable pollinisers are Butler, Lansing, and Merveille de Bollwiller.

Barcelona is very productive, yielding a medium to large dark brown nut with a shell of medium thickness yielding 39-43% kernel by weight. The kernel often has some corky fibre attached but blanches moderately well with a good flavour.

Barcelona requires good orchard management and warm dry summers to produce good quality nuts.



Fig.4: Barcelona variety –
in-shell, unblanched kernel, blanched kernel

Ennis

Ennis was developed in Washington, USA, and was introduced into commercial production around 1940. It is probably a cross between Barcelona and Daviana. It was selected primarily for its large nut size and high yield capacity. It forms a vigorous tree with an open crown. Ennis is late coming into leaf. There are usually just one or two nuts per cluster. The husk tends to clasp the nut and many nuts fall in the husk. It is susceptible to bacterial blight and moderately susceptible to big bud mites. Pollen is shed mid-season, female flowering is mid to late. Many flowers are borne on the catkin peduncles (stalks). Suitable pollinisers are Merveille de Bollwiller (in cooler areas only), Alexandra, and Keen's Late.

Ennis is very productive with large attractive nuts yielding 43 – 46% kernel. The shell is pale, glossy, striped, and easily cracked. Kernels are usually free of fibre and do not blanch.

When grown in well managed orchards on high quality soils in areas with high sunshine hours, the kernels are generally plump; however shrivelled kernels and blank nuts (nuts with no kernels or small undeveloped kernels) are common when Ennis is grown in less than ideal environments.



Fig.5: Ennis variety –
in-shell, unblanched kernel, blanched kernel

Tonda di Giffoni

Tonda di Giffoni is an Italian variety of ancient origin, grown in the province of Salerno (near Naples). The tree is vigorous and semi-erect. It holds its leaves late into the autumn and the new leaves emerge very early (mid-August in the Bay of Plenty). The husk is slightly longer than the nut; many nuts fall in the husk.

Tonda di Giffoni is resistant to bacterial blight, and only slightly susceptible to big bud mites. Female flowering and pollen shed are mid-season. Suitable pollinisers are Barcelona, Butler, and Lansing.

Tonda di Giffoni is very precocious and productive. The medium-sized nuts are round, brown with a distinct stripe and very pronounced grooves on the sides yielding 44 - 47% kernel. The kernels are round, often grooved, and may have light fibre. They blanch very well.

Tonda di Giffoni has yielded well in most parts of New Zealand but has problems with high levels of mould in most orchards. It is sensitive to frosts in spring. It has relatively low chill requirements for catkins and vegetative buds and may be suited to areas with mild winters in the drier areas of New Zealand.



Fig.6: Tonda di Giffoni variety – in-shell, unblanched kernel, blanched kernel

Tonda Romana

Tonda Romana is an Italian variety of ancient origin, and is the main variety in the hazelnut orchards of Viterbo province (north of Rome). The tree is of moderate to low vigour, semi-erect in form, and has many suckers. The husk is slightly longer than the nut; most nuts fall free of the husk.

Tonda Romana is resistant to big bud mites but is rather susceptible to bacterial blight. Pollen shed and female flowering are mid-season. Suitable pollinisers are Lansing, Tonda di Giffoni, and Merveille de Bollwiller.

Tonda Romana has moderate to high yields. The nut is medium to small in size, round, with a dull light brown shell yielding 44-48% kernel. Kernels are round, usually free of fibre and do not blanch. Black tips can be a problem due to splitting along the shell suture



Fig.7: Tonda Romana variety – in-shell, unblanched kernel, blanched kernel

Whiteheart

Whiteheart is the main variety grown commercially in New Zealand. It is a New Zealand variety selected in the 1980s from a number of plantings of a variety sold as “Waterloo” by Duncan and Davies.

The tree has low vigour, an erect form, and suckers strongly. The husk is nearly twice as long as the nut and clasps the nut tightly. Many nuts fall in the husk. Clusters often have 3 to 8 nuts per cluster. Some clusters tend to hang in the trees into winter.

Whiteheart is susceptible to bacterial blight and big bud mites. Pollen is shed mid-season but female flowering is very late.

Whiteheart has moderate to high yields when grown in well-managed orchards. The medium-sized, round nut has a shiny brown, thin shell yielding 47 to 50% kernel. Kernels are round, free of fibre, and blanch very well.

Whiteheart is the main variety grown in commercial orchards in New Zealand because good nut quality can be achieved in all growing regions. Whiteheart is a low vigour variety and orchards need to be planted with closer tree spacing than is common with more vigorous varieties. Good orchard management is essential to achieve acceptable commercial yields.



Fig.8: Whiteheart variety – in-shell, unblanched kernel, blanched kernel

Varieties used as pollinisers

Alexandra

Alexandra is a New Zealand selection from Alexandra in Central Otago. It forms a large, vigorous, open, spreading tree with few suckers. The husk is about the same length as the nut and most nuts fall free of the husk.

It is moderately resistant to big bud mites and is susceptible to bacterial blight. It sheds pollen over a long period late in the winter. Female flowering and bud burst are very late.

If other late pollinisers are present, Alexandra has heavy yields of nuts. The nuts are flattened, blocky in shape, with a dull pale cream/brown colour drying to a dull grey/brown. Nuts have very thick shells, with small elongated kernels with a moderate to light fibre cover.

Alexandra is the main late polliniser used for late flowering cultivars such as Whiteheart and Ennis. It has large numbers of catkins, often in large “bunches” of more than 10 catkins.



Fig.9: Alexandra variety – in-shell, unblanched kernel, blanched kernel

Butler

Butler originated as a seedling in Oregon, USA and was introduced into cultivation in 1957. It appears to be a cross between Barcelona and Daviana. It is very vigorous with an erect tree form. The husk is slightly shorter than the nut and most nuts fall free of the husk. Nut drop occurs over a long period.

It is susceptible to bacterial blight and big bud mites. It drops pollen for a long period early in the season but the female flowers are late. Suitable pollinisers are Merveille de Bollwiller (in cooler regions), Alexandra, and Keen's Late.

Butler is very productive and has yielded well in most parts of New Zealand. Nuts have a high percent kernel (47 – 49%). The kernels do not blanch and are sometimes considered to have a bland flavour. Shrivelled kernels are common.



Fig.10: Butler variety – in-shell, unblanched kernel, blanched kernel

Keen's Late

Keen's Late is a New Zealand selection chosen for its late pollen production. It forms an erect tree of moderate vigour. The husk encloses the nut tightly and many nuts fall in the husk.

It is susceptible to bacterial blight and moderately susceptible to big bud mites. Pollen shed is very late, extending well into early September. Female flowers emerge before, or about the same time, as catkin extension. Suitable pollinisers are Merveille de Bollwiller and Alexandra.

Keen's Late crops well, yielding elongated nuts with 26 – 30% kernel. Kernels do not blanch.



Fig 11: Keen's Late variety – in-shell, unblanched kernel, blanched kernel

Kentish Cob

Also called Du Chilly or Longue d'Espagne, Kentish Cob originated as a seedling selection in Kent, England.

The tree is of relatively low vigour, semi-erect and productive. It is late coming into leaf. The husks extend beyond the nut, 50 to 60 % of the nuts fall free. It is moderately resistant to big bud mites and susceptible to bacterial blight. Pollen shed is late, making it a useful late polliniser. Female flowering is late. Suitable pollinisers are Merveille de Bollwiller and Alexandra.

The nuts are large, long, and flattened. The shell is thin (48% kernel) and the nuts are easily cracked. The kernels are long, free of fibre, sweet and do not blanch



Fig.12: Kentish Cob variety – in-shell, unblanched kernel, blanched kernel

Lansing

Lansing originated in Oregon, USA. The tree is semi-erect and vigorous. Leaves fall late but bud burst is early. Husks are the same length as the nut and most nuts fall free of the husk.

Lansing is resistant to bacterial blight and big bud mites. Pollen shed and female flowering are mid-season. Suitable pollinisers are Tonda di Giffoni and Merveille de Bollwiller.

Lansing is productive, with large attractive round nuts, brown with a distinct stripe. The shell is thin and easily cracked, yielding 44 – 50% kernel. The large round kernels are usually free of adhering fibre but are susceptible to mould and shrivelling.

Lansing is a very productive, healthy variety that is a valuable mid-season polliniser. The nut is a similar size to Ennis but darker brown and globular to oblate in shape rather than ovoid.



Fig.13: Lansing variety – in-shell, unblanched kernel, blanched kernel

Merveille de Bollwiller

Merveille de Bollwiller is called Hall's Giant in Australia and the USA. The tree is vigorous and spreading with dark green leaves. Merveille de Bollwiller is late coming into leaf. It has distinctive dark red to purple buds. Catkins have a purple blush. The husk is slightly longer than nut but most nuts fall free of the husk.

Merveille de Bollwiller is resistant to bacterial blight and big bud mites. Pollen is shed late, often for a short period. Female flowering is late. Suitable pollinisers are Alexandra and Keen's Late.

Merveille de Bollwiller has low yields of attractive medium to large nuts yielding 36 – 41% kernel. The shell is thick, brown and glossy. The kernel is round to oval, firm and free of fibre. It blanches well.



Fig.14: Merveille de Bolwiller variety – in-shell, unblanched kernel, blanched kernel

PRODUCTION CHARACTERISTICS OF FIVE HAZELNUT VARIETIES WITH POTENTIAL FOR COMMERCIAL PRODUCTION IN NEW ZEALAND

Variety	Potential Use	Kernel %	Advantages	Disadvantages
Barcelona	Kernel In-shell	39-43%	High yielding vigorous tree. Nut can be used for in-shell or roasted kernel markets. Not susceptible to big bud mite.	Susceptible to “brown-stain”. Heavy fibre on the kernel in damper climates.
Ennis	In-shell	43-46%	High yielding. Medium vigour tree. Very large, attractive nut.	Susceptible to bacterial blight. Requires ideal growing conditions to produce good quality nuts.
Tonda di Giffoni	Kernel	44-47%	Good kernel flavour. Kernels blanch well. High yielding vigorous tree.	Susceptible to mould on the kernels.
Tonda Romana	Kernel	44-48%	Excellent kernel flavour. Medium vigour growth habit. Not susceptible to big bud mite.	Kernels do not blanch. Susceptible to bacterial blight. Numerous suckers.
Whiteheart	Kernel	47-50%	Good kernel flavour. Kernels blanch well. Low vigour growth habit. Produces high quality nuts in most regions.	Numerous suckers. Many nuts retained in husk. Some nut clusters do not fall at harvest. Susceptible to big bud mite and bacterial blight.

Further information:

Only the main commercial varieties and their pollinisers are described in this bulletin. For detailed descriptions and illustrations of all varieties available in New Zealand, see www.hazelnut.org.nz.

Baldwin, B. 2010. Hazelnuts: Variety assessment for south-eastern Australia. RIRDC publ. No. 09/178. Available at <https://rirdc.infoservices.com.au/items/09-178>

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