Lychee Production Soars in China

Production of lychee (also known as litchi) in China has risen almost ten fold in the last decade to 1.5 million tonnes and is poised to climb as high as 2.5 millions tonnes in the next few years. The result has been a market disaster as prices have plummeted. As a result the Chinese government has banned the planting of any more lychee trees and banks have ceased lending money to farmers. Once a tree reaches full size it can continue producing for centuries; a few lychee trees in western Guandong Province claimed to be 1,200 years old are still bearing. Lychees are hard to export because they spoil quickly although there has been some export to the United States and other overseas markets by air or by sea in refrigerated shipping containers. Some lychees are canned but the demand for the processed product is negligible despite its refreshing taste. The lychee, long a symbol of China has been losing its appeal there. For example, a canned lychee-flavored drink sold across the nation for many years has been losing market share to more fashionable drinks such as Coca Cola. Despite the overproduction in China, lychee trials and plantings are underway in a large part of the subtropical world. Lychee *(Litchi chinensis)* is a sapindaceous fruit and is closely elated to longan *(Dimocarpus longan)* and the tropical rambutan *(Nephelium lappaceum)*.

The Australian Ginger Industry

Mike Smith

THE PLANT

Ginger (*Zingiber officinale* Rosc.) is a perennial rhizomatous herb, the underground rhizome of which is the source of an important spice. It belongs to Zingiberaceae, which is a distinct family of aromatic tropical plants that yield spices, dyes, perfumes and medicines. Other well-known members of this family include turmeric and cardamom, while a number of ornamental species are cultivated for their showy flowers. The main distinguishing features of the genus *Zingiber* are the long curved anther appendages embracing the style, the 3-lobed lip, of which the side lobes are staminodes and the relatively large bracts, each with a single flower and a non-tubular bracteole. *Z. officinale* is a slender plant; 30-100 cm tall, with a robust branched rhizome borne horizontally near the surface of the soil and bearing leafy shoots close together.

Z. officinale is unknown in the wild state although it is considered to have originated in Southeast Asia. It has been cultivated in India and China since ancient times, usually as an annual. Ginger forms an essential ingredient in many Asian dishes and traditional medicines where distinction is made between fresh and dried rhizome. The aromatic oils provide a distinctive odour and pleasant sweet-lemony aroma. The most common, zingiberene, is claimed to be helpful for digestion and flatulence. The oleoresins account for the pungency, which provides most of the medicinal value of ginger. Most common are the gingerols, which are largely responsible for the anti-inflammatory, antinauseant and antioxidant effects. There are also components of the spice with antiviral activity and zingibain is a powerful protein-digesting enzyme.

WORLD PRODUCTION

Ginger has been used as a spice and medicine in India and China since ancient times, was known to the Greeks and Romans, and generally throughout Europe by the tenth century. Ginger was probably among the first vegetatively cultivated plants. Today it can be found in most tropical countries. India, China, Thailand, Australia, Fiji, Jamaica, Brazil and Nigeria are well-known producers. Ginger production, exports and imports of the top 5 countries as compared to Australia are shown in Table 1.

Most of the world trade in ginger is as a dried spice, however fresh rhizomes are also traded. Australia is major world supplier of high quality sugar-coated and preserved ginger. It is estimated that although confectionery ginger constitutes less than 3% of the world trade (by volume), it is important as a value-added product and earns a much higher rate of return compared to the fresh or dried rhizomes. Other significant processors and exporters of confectionery ginger products include China, Fiji and Thailand.

THE AUSTRALIAN INDUSTRY

Although ginger has been grown in India and China since ancient times, the Australian pioneering farmers established a viable industry only last century. The ginger grown commercially in Australia is dominated by one species, *Zingiber officinale*, and one cultivar,

Fresh rhizomes of 'Queensland' ginger. Rhizomes, both fresh and dried, are the source of an important spice and medicine.

Table 1. Production, exports and imports of the top 5 countries as compared to Australia.

Production		Exports		Imports	
Country	**(tonnes)**	**Country**	**(tonnes)**	**Country**	**(tonnes)**
India	275,000	China	200,378	Japan	97,740
China	258,263	Thailand	26,908	USA	21,115
Indonesia	151,000	India	8,531	India	17,693
Nigeria	110,000	Indonesia	7,470	Korea	15,077
Nepal	90,000	Brazil	5,844	Malaysia	13,613
Australia	10,000	Australia	3,000	Australia	800
World	**1,034,928**	**World**	**274,823**	**World**	**254,099**

FAOSTAT (2004)

'Queensland'. The Australian ginger industry is mechanised, standardised and centralised with approximately half sold on the fresh market and the other half processed. Approximately 40% of the world's supply of confectionery ginger is processed and sold by one company, Buderim Ginger Limited on Queensland's Sunshine Coast, just over an hour north of Brisbane.

Today, the Australian ginger industry is valued at more than US$40 million focused very much on exports and the production of superior quality ginger products. Although there are records of ginger growing in far north Queensland as early as the 1870s, the origins of the present industry are much closer to the state capital, Brisbane. It is believed the first ginger came to the Buderim plateau from China in 1916 when a Brisbane merchant brought back some rhizome-pieces in his pocket and gave them to his close friend Arthur Burnett, who was a Buderim farmer. At that time almost all of the ginger used in Australia was imported from China and was used as a dried, ground spice in biscuits, cakes and for making ginger beer.

Arthur Burnett distributed it to other growers in the district, and further experimentation in local kitchens led to development of other uses for the rhizome. Beryl Crosby and others discovered that by boiling and reboiling the ginger, and adding a lot of sugar and storing in airtight jars, a very satisfying sweet could be made. So in fact it was these women who were the true pioneers of the crystallised ginger we enjoy and know today as 'Buderim ginger' and which is sold around the world.

The original local ginger growers marketed their crop through Brisbane merchants but it was not until imports of ginger from China were disrupted during World War II that a co-operative was formed and the first processing facility built in the centre of Buderim Township to supply the Australian market. The factory developed the standard of its processing and finished product to the extent that in 1968 the Buderim Ginger Co-operative won an Australian export award. The Co-operative is now a public company and Buderim Ginger Limited continues to show leadership and has won other awards in export, marketing and

Ginger at the second late harvest and after the tops have died and been removed. Rhizomes are mechanically dug and deposited on the surface and then placed in bins by hand for transport to the packing shed or factory.

Table 2. Ginger yield at various harvest times.

Harvest	Time (SE Queensland)	Yield (tonnes/ha)
Early	Late February-Early March	12-50 (average 30)
1st Late	April	20-50 (average 35)
2nd Late	Mid June-Early August	38-75 (average 45)

A field of ginger approximately 5 months from planting and nearing early harvest. Maximum yields are obtained in well-drained friable soils using high inputs of good quality water, fertiliser and organic matter.

Ginger is sorted for quality and graded to size in the factory prior to the production of superior quality confectionery products.

tourism. Due to space constraints in the original factory, a modern factory was built in 1980 in Yandina and expanded into a major tourist complex in 1985. Another processor, Havenglaze Pty Ltd, commenced operations in Caboolture, Queensland, in 2001.

Table 3. Recent ginger industry funded research projects.

2000-2003	New value added opportunities for natural herapeutic products in the ginger industry	DPI&F, Horticulture Australia Ltd (HAL)
1992-2002	Rhizome and fibre development in early harvest ginger	DPI&F, University of Queensland
1998-2001	Overcoming seed quality problems in the ginger industry	Biological Crop Protection Pty Ltd, HAL
1994-2001	Developing tetraploid ginger varieties	DPI&F, HAL

A new tetraploid ginger variety was developed by DPI&F staff using colchicine applied to in vitro shoot cultures and was released to the industry as 'Buderim Gold'. The tetraploid was found to produce a rhizome with significantly larger rhizome sections as compared to the diploid industry standard, 'Queensland'. Larger rhizome sections mean greater recovery of premium sized confectionery ginger in the factory from the early harvest crop.

Around 25 growers currently constitute the Australian industry with approximately 150 hectares under cultivation in southeast Queensland (centred 26° 25'S). Ginger production in Australia is a capital and labour-intensive industry and maximum yields are obtained in well-drained friable coastal soils using high inputs of good quality water, fertiliser and organic matter. A high capital outlay is incurred in irrigation, specialised planting and harvesting equipment, and planting materials. Planting of 60 gram seed-pieces occurs from late August through to mid October in raised beds with approximately 7-10 tonnes being required to plant a hectare. Careful attention to irrigation is essential to prevent sunburn of newly developed shoots and to prevent water stress, as both will reduce the final yield. The majority of the crop is harvested in February/March, another portion in April/May and the balance in June/July onwards (Table 2).

By February, ginger farms are covered with a dense mass of vegetation to a height of about 1 m while under the ground the young rhizomes have developed into large clumps of odd-shaped "hands". Regular crop surveys monitor the growth in each patch, and samples are sent to the processor for hand grading to determine the relative extent of fibre development. It is important at early harvest to maximise the recovery of tender rhizome (42-35% fibre-free) that is used for confectionery ginger. By May, the plants have reached about 85% of their ultimate size and the content of oils and oleoresins are at their highest point in the growing cycle. These rhizomes are dried and sent to specialist processors for use in flavourings, essences and fragrances. The final harvest commences in June, by which time the plants are fully-grown with the green tops starting to die off. Most rhizomes from the late harvest are retained and treated for next season's crop and the balance are dried for the international spice trade.

Depending on the processor's sales forecasts for the next year's trading, quotas are issued to the growers for the three harvests. Growers plant according to processor needs and extra ginger can be planted for the fresh market. This arrangement ensures that production and marketing are conducted in an orderly fashion and Australian ginger growers are highly organised and efficient.

The success of the Australian ginger industry has been underpinned by sound research and work carried out by staff from the Department of Primary Industries and Fisheries, Queensland (DPI&F), the University of Queensland, the Queensland University of Technology and the Commonwealth Scientific and Industrial Organisation (CSIRO) (Table 3). It was Geoff Shrapnel of the Ginger Growers'

Co-operative Association who realised that specific research, not trial and error methods, was essential to the development of the industry. In instigating a research levy on growers in 1963, he pointed out that State and Federal Governments were prepared to help industries that were prepared to help themselves. The main aims for research have been to increase yield; to contain or reduce production costs; to produce a quality, processed product that can compete on the overseas markets and to make processing more efficient. To accomplish the strategy of improving profitability of the ginger industry, research embraces field trials to increase production through improved planting, nutrition and irrigation practices; controlling pests and diseases; genetic improvement and selection of superior cultivars; farm mechanisation and the effects of factory mechanisation and computerisation on ginger processing. Today the Australian ginger industry has some of the most efficient producers and processors in the world.

Further Reading

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Biodiversity of Tropical African Vegetables

Gerard Grubben and Leo Oyen

Tropical Africa is a vast area extending from Mauritania and Sudan in the North to Namibia and Madagascar in the South, encompassing 45 countries and 2 overseas territories with a population of about 625 million. In this area over 800 plant species are consumed as vegetable. Many of the circa 140 cultivated vegetable species and almost all of the wild ones are indigenous in tropical Africa; several of the major cultivated species, e.g. tomato, onion, capsicum pepper, kale, carrot and cucumber are exotics and were introduced in historical or colonial times. They are gradually becoming traditional, which results in numerous landraces. Although less important in quantities consumed than the major cultivated species, wild vegetables play an important role in rural communities; they are often collected while weeding fields or from fallow land. Some wild vegetables, however, are more important and are even traded internationally.

At present, this vast biodiversity is eroding because of increasing popularity of high yielding cultivars replacing landraces in e.g. tomato, pepper, onion and African eggplant (Fig. 1). The vast R&D efforts focused on these western vegetables make it difficult for better adapted but lower yielding traditional ones to compete. This process will accelerate since some Western seed companies have started breeding locally important vegetables, including a few indigenous ones. Loss of biodiversity of wild vegetables is caused by deforestation and degradation of the natural vegetation. Moreover, several wild vegetables are becoming overexploited and urgently need research to accelerate domestication. For other wild vegetables, the popularity is decreasing because harvesting is time consuming, making them more expensive than cultivated ones. Other reasons for disappearance of wild species are the dwindling knowledge of wild

Figure 1. Biodiversity in a single field of *Solanum aethiopicum* - African eggplant in Côte d'Ivoire.