PRACTICAL ACTION
Technology challenging poverty

GINGER PROCESSING

Introduction

Ginger is an upright tropical plant (*Zingiber officinale* Rosc.) that grows to about 1 metre tall. It originated in India and is now produced in tropical climates throughout the world; China, Taiwan, Nigeria, Jamaica, Mauritius and Australia are the major producers. The largest markets for ground ginger are the United Kingdom, Yemen, the USA, Middle East, Singapore and Malaysia. The edible parts of the plant are the rhizome (at the base of the stem) and the young tender stem.

Figure 1: Fresh ginger.
Photo: Practical Action / Neil Noble

Forms of ginger

Ginger is usually available in three different forms:

- Fresh (green) root ginger
- Preserved ginger in brine or syrup
- Dried ginger spice.

Fresh ginger is usually consumed in the area where it is produced, although it is possible to transport fresh roots internationally. Both mature and immature rhizomes are consumed as a fresh vegetable.

Preserved ginger is only made from immature rhizomes. Most preserved ginger is exported. Hong Kong, China and Australia are the major producers of preserved ginger and dominate the world market.

Making preserved ginger is not simple as it requires a great deal of care and attention to quality. Only the youngest most tender stems of ginger should be used. It is difficult to compete with the well established Chinese and Australian producers, therefore processors are advised against making this product.

Dried ginger spice is produced from the mature rhizome. As the rhizome matures the flavour and aroma become much stronger. Dried ginger is exported, usually in large pieces which are ground into a spice in the country of destination. Dried ginger can be ground and used directly as a spice and also for the extraction of ginger oil and ginger oleoresin.

This brief outlines the important steps that should be taken pre-harvest and post-harvest to produce dried ginger.

Cultivation of ginger

Ginger is a perennial plant but is usually grown as an annual for harvesting as a spice. It requires a warm and humid climate and a heavy rainfall of 150-300cm a year or plenty of irrigation. The plant can be cultivated from almost sea level to an altitude of 1500m above sea level. It thrives well in sandy or clay loam soil with good drainage and humus content. Ginger is

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best grown in partial shade and can be incorporated as an intercrop in coconut, coffee and orange plantations. Planting is done in April/May during the monsoon rains. Ginger is harvested by digging out the rhizomes when the tops have died down. The harvesting and processing of dried ginger varies in different countries.

Processing dried ginger

There are two important factors to consider when selecting ginger rhizomes for processing:

a) **Stage of maturity at harvest**. Ginger rhizomes can be harvested from about 5 months after planting. At this stage they are immature. The roots are tender with a mild flavour and are suitable for fresh consumption or for processing into preserved ginger. After 7 months the rhizomes will become less tender and the flavour will be too strong to use them fresh. They are then only useful for drying. Mature rhizomes for drying are harvested between 8 and 9 months of age when they have a high aroma and flavour. If they are harvested later than this the fibre content will be too high.

b) **Native properties of the type grown**. Gingers grown in different parts of the world can differ in their native properties such as flavour, aroma and colour and this affects their suitability for processing. This is most important when preparing dried ginger, which needs rhizomes with a strong flavour and aroma. Himachel, Maran, Mananthody and Kuruppampady are good varieties for the preparation of dried ginger. Size of rhizome is an important factor to consider when drying ginger – medium sized rhizomes are the most suitable for drying. Large rhizomes often have a high moisture content which causes problems with drying.

Making dried ginger

Dried ginger is available in a number of different forms – the rhizomes can be left whole or they may be split or sliced into smaller pieces to accelerate drying. Sometimes the rhizomes are killed by peeling or boiling them for 10 to 15 minutes, which causes the rhizomes to become blackened. They have to be whitened (bleached) by treating with lime or sulphurous acid. The only product which is acceptable for the UK market is cleanly peeled dried ginger.

The process for dried ginger:

- The fresh rhizome is harvested at between 8 to 9 months of age.
- The roots and leaves are removed and the rhizomes are washed.
- The rhizomes have to be 'killed' or inactivated. This is done by peeling, rough scraping or chopping the rhizome into slices (either lengthwise or across the rhizome). The skin should be peeled off using a wooden scraper made from bamboo to prevent staining the rhizome. Whole unpeeled rhizomes can be killed by boiling in water for 10 minutes.
- After peeling and washing, the rhizomes are soaked for 2-3 hours in clean water then soaked in a solution of 1.5-2.0% lime (calcium oxide) for 6 hours. This produces a lighter coloured (bleached) rhizome. After soaking, the rhizomes are drained.
- The rhizomes are dried. The traditional method is to lay the pieces on clean bamboo mats or on a concrete floor and sun-dry until a final moisture content of 10%. Drying may take anything from 7 to 14 days depending upon the weather conditions. During drying, the rhizomes lose between 60 and 70% in weight.
- In rainy conditions, a mechanical drier such as a tray drier should be used to accelerate the drying process. Sliced ginger pieces take only 5-6 hours to dry when a hot air drier is used. Whole peeled ginger rhizomes take about 16-18 hours to dry in a mechanical drier. It is important to monitor the air flow and temperature during drying. The drying temperature should not exceed 60°C as this causes the rhizome flesh to darken. See the Practical Action Technical Brief on drying for further information on the different types of drier available.
- After drying, the rhizomes are cleaned to remove any dirt, pieces of dried peel and insects. An air separator can be used for large quantities, but at the small scale it is probably not cost effective.
- The dried rhizomes should be packaged into air-tight, moisture proof packaging for storage or export.

Quality assurance of dried ginger

Quality of the dried ginger is assessed by the appearance of the final product (colour, lack of mould or aflatoxin) and the aroma and flavour.
These qualities are influenced by a combination of pre- and post-harvest factors:

- The most important factor is the cultivar of ginger used as this determines the flavour, aroma, pungency and levels of essential oil and fibre.
- The stage or maturity of the rhizome at harvest determines its suitability for end use. Rhizomes that are 8-9 months old produce the best quality dried ginger as they have a good combination of aroma and pungency and not too much fibre.
- After harvest the rhizomes should be handled with care to prevent injury. They should be washed immediately after harvest to ensure a pale colour. The wet rhizomes should not be allowed to lie in heaps for too long as they will begin to ferment.
- Care should be taken when removing the outer cork skin. It is essential to remove the skin to reduce the fibre content, but if the peeling is too thick, it may reduce the content of volatile oil which is contained near the surface of the rhizome.
- During drying the rhizomes should lose about 60-70% of their weight and achieve a final moisture content of 7-12%. Care should be taken to prevent the growth of mould during drying.
- The use of a mechanical drier produces a higher quality, cleaner product. The drying conditions can be carefully controlled and monitored and the time taken to dry is considerably reduced.
- After harvest, the cleaning, peeling and drying processes should be carried out as quickly as possible to prevent the growth of bacteria and mould and to prevent fermentation. If the drying process takes too long there is a risk of the ginger becoming infected by aflatoxin or other fungus.
- Dried ginger should be stored in a dry place to prevent the growth of mould. Storage for a long time results in the loss of flavour and pungency.

Grading

Quality specifications are imposed by the importing country and refer to the cleanliness specifications of the ginger rather than the quality. It is important to meet the minimum standards or the ginger will be rejected by the importers.

There are several forms of dried rhizome, which are described below:

Type	Description
Peeled, scraped, uncoated	Whole rhizome with the corky skin removed
Rough scraped	Whole rhizome with the skin partially removed
Unpeeled, coated	Whole rhizome with the skin intact
Black ginger	Whole rhizome scalded before being scraped and dried
Bleached	Whole rhizome treated with lime of diluted sulphuric acid
Splits and slices	Unpeeled rhizomes, split or sliced
Ratoons	Second growth rhizomes, small, dark and very fibrous

Grinding

Grinding can be a method of adding value to a product. However, it is not advisable to grind spices as they are more vulnerable to spoilage after grinding. The flavour and aroma compounds are not stable and will quickly disappear from ground products. The storage life of ground spices is much less than for the whole spices. It is very difficult for the consumer to judge the quality of a ground spice. It is also very easy for unscrupulous processors to contaminate the ground spice by adding other material. Therefore most consumers, from wholesalers to individual customers, prefer to buy whole spices.

Dried ginger is usually exported whole and ground in the country of import.

Packaging

Bulk rhizomes can be packed in jute sacks, wooden boxes or lined corrugated cardboard boxes for shipping. Dry slices or powder are packaged in multi-wall laminated bags. Some laminates are better than others due to film permeability. The packaging material should be impermeable to moisture and air. Sealing machines can be used to seal the bags. Attractive labels should be applied to the products. The label needs to contain all relevant product and legal information – the name of the product, brand name (if appropriate), details of the manufacturer (name and address), date of manufacture, expiry date, weight of the contents, added ingredients (if relevant) plus any other information that the country of origin and of import may require (a barcode, producer code and packer code are all extra information that is required in some countries to help trace the product back to its origin). See the Practical Action Technical Brief on labelling for further information on labelling requirements.

Storage

Dried rhizomes, slices and splits should be stored in a cool place (10-15°C). At higher temperatures (23-26°C) the flavour compounds start to deteriorate and ginger loses some of its taste and aroma. The storage room should be dry and away from the direct sunlight. During storage the rhizomes should be protected from attack by insects and other pests. Natural pesticides such as the leaves of *Glycosmis pentaphylla* or *Azadirachta indica* can be added to the rhizomes to prevent damage from the cigarette beetle (*Lasioderma serricome*).

The storage room should be clean, dry, cool and free from pests. Mosquito netting should be fitted on the windows to prevent pests and insects from entering the room. Strong smelling foods, detergents and paints should not be stored in the same room.

Ginger oil distillation

Ginger oil can be produced from fresh or dried rhizomes. Oil from the dried rhizomes will contain fewer of the low boiling point volatile compounds (the compounds that give ginger its flavour and aroma) as these will have evaporated during the drying process. The best ginger oil is obtained from whole rhizomes that are unpeeled.

Ginger oil is obtained using a process of steam distillation. The dried rhizomes are ground to a coarse powder and loaded into a still. Steam is passed through the powder, which extracts the volatile oil components. The steam is then condensed with cold water. As the steam condenses, the oils separate out of the steam water and can be collected. In India the material is re-distilled to get the maximum yield of oil. The yield of oil from dried ginger rhizomes is between 1.5 to 3.0%. The remaining rhizome powder contains about 50% starch and can be used for animal feed. It is sometimes dried and ground to make an inferior spice. For further information see the Practical Action Technical Brief on Essential oil distillation.

Equipment suppliers

This is a selective list of suppliers of equipment and does not imply endorsement by Practical Action.

This website includes lists of companies in India who supply food processing equipment.
http://www.niir.org/directory/tag/z,,1b_0_32/fruit+processing/index.html

Dryers

Acufil Machines
S. F. No. 120/2, Kalapatty Post Office
Coimbatore - 641 035
Tamil Nadu
India
Tel: +91 422 2666108/2669909
Fax: +91 422 2666255
Email: acufilmachines@yahoo.co.in
acufilmachines@hotmail.com

Website:
http://www.indiamart.com/acufilmachines/#products

Bombay Engineering Works
1 Navyug Industrial Estate
185 Tokersey Jivraj Road
Opposite Swan Mill, Sewree (W)
Mumbai 400015
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Fax: +91 22 24135828
E-mail: bomeng@vsnl.com
Website:http://www.bombayengg.com/contact.html

Premium Engineers Pvt Ltd
Plot No 2009, Phase IV, GIDC
Vatva, Ahmedabad 382445
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Tel: +91 79 25830836
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Rank and Company
A-p6/3, Wazirpur Industrial Estate
Delhi – 110 052
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URB industrial Infantas
Los Olivios
Lima
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Tel: +51 14 528 9731
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Packaging and labelling machines

Acufil Machines
India (See above)

Gardners Corporation
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New Delhi 110003, India
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Gurdeep Packaging Machines
Harichand Mill compound
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Ashoka Industries
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Website: http://www.mitchell-dryers.co.uk/

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Bowenpally
Secunderabad - 500011, Andhra Pradesh, India
Tel: +91 40 32504222
Fax: +91 40 27742638
Website: http://www.orbitequipments.com

Pharmaco Machines
Unit No. 4, S.No.25 A
Opp Savali Dhaba, Nr.Indo-Max
Nanded Phata, Off Sinhagad Rd.
Pune – 411041
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Rank and Company
India (see above)

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Website: http://www.iisr.org/package/index.php?spice=ginger&body=Overview

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Industrial Technology Institute (ITI)
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E-mail: info@iti.lk
Website: http://www.iti.lk

Food and Agriculture Organisation (FAO)

Further reading

Drying a selection of Practical Action Technical Briefs
Essential Oil Distillation Practical Action Technical Brief
Herbs and Spices a selection of Practical Action Technical Briefs
Labelling Food Products Practical Action Technical Brief
Drying UNIFEM Practical Action Publishing 1995
Try Drying It! Case Studies in the Dissemination of Tray Drying Technology, B Axtell,Practical Action Publishing 1991
Producing Solar Dried Fruit and Vegetables for Micro and Small scale Rural Enterprise Development, A Series of Practical Guides' written by the Natural Resources Institute.
Setting up a food drying business P Thuillier, Practical Action Publishing, 2002
Drying Food for Profit B Axtell, Practical Action Publishing, 2002
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