PASSION FRUIT JAM
SMALL-SCALE PRODUCTION

Introduction
Passion fruit (Passiflora edulis) is the edible fruit of a plant that is native to South America but which is widely grown in many tropical or sub-tropical areas. Other common names for passion fruit are Maracuya, Parcha (Spanish) and Maracuja (Portuguese). The passion fruit is round to oval, and either yellow or dark purple at maturity. It has a soft to firm, juicy interior filled with numerous seeds. The fruit can be grown to eat or for its juice, which has a strong exotic flavour and bright orange colour and is often added to other fruit juices to enhance the flavour.

The fruits vary in size, but on average there are 25-35 fruits per kg. The bigger fruits (heavier than 30g) are more suitable for food processing as they have a higher percentage of juice to rind. The juice has a pH between 2.6 and 3.0 and an unusually high starch content.

There are two important commercial varieties, purple passion fruit (Passiflora edulis), and yellow passion fruit (Passiflora edulis flavicarpa). The latter has larger fruits, more acidic juice and a less preferred flavour. The fruits are most suitable for processing when all greenness has disappeared and the outer skin has a smooth or slightly crinkled surface.

The fresh whole fruit can only be stored for a few days at ambient temperature before it deteriorates. If the storage temperature is reduced to 6.5°C, they can be stored for 3-4 weeks before any major deterioration. The pulp can be stored for long periods in bulk with 1000-1500ppm of sulphur dioxide or benzoic acid or a mixture of both, but there is a reduction in the quality of the flavour. During heat preservation the main problem to overcome is the loss of the extremely heat sensitive flavour, which is susceptible to quick oxidation.

The seeds are not suitable for stock feeding due to their very high crude fibre content. However, they can be refined and used in the manufacture of soap, paint, varnish and cooking oils.

The skin of passion fruit is a good source of pectin, and makes a good manure.

This technical brief should be read together with the brief on jams and marmalades, where there is an overview of the principles of jam making and a general introduction to quality assurance and control.

Recipe
Sugar 49%  
Fruit juice 20% (starting recipe  
Skin pulp 20% before boiling)  
Water 11%  
Sodium bicarbonate 0.015%
In most countries, preservative cannot be added to the jam. Only a residue of preservative is allowed in jam which has been made from fruit pulp which has been stored with chemical preservatives (100ppm sulphur dioxide or 500ppm benzoic acid). Sodium bicarbonate is not a preservative. It is added to adjust the pH of the jam if the juice is too acidic. Jams give a gel when there is the correct ratio of pectin to water and the pH is between 2.5-3.45pH. The optimum pH to give a good gel is pH 3.0. Therefore, sodium bicarbonate is generally added to passion fruit juice to decrease the acidity.

**Method**

Wash whole fruits in clean water and discard any bad fruits.

Cut fruits in half with a stainless steel knife and scoop out the pulp with a stainless steel spoon. Stainless steel equipment is preferred for fruit as it does not stain the flesh and does not react with the acidity of the juice. If stainless steel is not available, make sure the knives and spoons are not rusted. Use a plastic spoon to scoop out the flesh.

Extract the juice from the pulp by liquidising the pulp at a very low speed for about a minute. It is important to use a low speed to prevent the seeds from chipping. Chipped seeds appear as black specks in the jam. They are very difficult to remove and give the product a bad appearance. Tip the contents into a muslin cloth and squeeze out the juice leaving the seeds behind. This method will give a yield of raw juice from whole fruit of between 30 to 35%.

Measure the amount of juice extracted and use this to calculate how much skin pulp is required. Skin pulp is added to the jam as it contains natural pectin and so saves adding artificial pectin which is expensive.

To make skin pulp take the same quantity of skins, as skin pulp required. Boil the skins for approximately 30 minutes, until the flesh of the skin is soft and translucent. Then remove the skins from the water and scoop out the flesh from the outer cuticle. Liquidise this softened flesh with water (2 parts softened flesh to 1 part water) until it forms a smooth cream. Use the water in which the skins were boiled as this will contain pectin washed out during the boiling. Squeeze the mixture through a muslin cloth to remove hard pieces of pith.

Mix the raw juice with sodium bicarbonate (NaHCO₃) before boiling (if the NaHCO₃ is added during boiling the jam will bubble-up over the top of the saucepan). Add the sugar and water and heat gently at first to ensure the sugar has dissolved. Then boil rapidly to evaporate the water and continue until the jam thickens. Keep stirring during boiling to make sure the jam does not stick to the base of the pan. Jam should not be boiled for more than 12-15 minutes as this can give rise to caramel flavours, over sweetness and discolouration, apart from being a waste of energy. By reducing the amount of water in the starting recipe, the boiling time can be reduced.

**Boiling to reach the final sugar concentration**

The aim of boiling is to reduce the water content of the mixture and concentrate the fruit and sugar in as short a time as possible. The final Total Soluble Solids (TSS) content of a jam (also known as the “Degrees Brix” or “end-point of the jam”) should be 65 to 68% (the TSS is a measure of the amount of material that is soluble in water. It is expressed as a percentage -a product with 100% soluble solids, has no water and one with 0% soluble solids is all water).

The correct sugar content is critical for proper gel formation and for preservation of the jam or jelly. If the final TSS of jam is lower than 65-68% the shelf life will be reduced. The jam will have a runny consistency and bacteria and moulds will be able to grow in the product. If the TSS is higher than 68%, the jam will be very stiff and the sugar might start to form crystals in the jam.
The end-point of boiling is measured in different ways. The most accurate method is to use a refractometer to measure the total sugar concentration. Remove the pan from the heat during testing as the jam will continue to cook and may become over-cooked. It is always possible to cook the jam a little bit more, but once it is over-cooked (and too thick) it cannot be reversed.

Cool the sample before it is measured by smearing it on a cold dry plate or saucepan lid. All implements used to take the sample must be dry otherwise the reading will be reduced. It is important to stir the jam at all times during heating, otherwise it may burn at the bottom of the saucepan, causing off flavours and discoloration.

This method is not really suitable for home-use as a refractometer costs about US$ 150. It is only when making jam for sale that a refractometer is necessary, to ensure consistency between different batches of the jam. When making jam for home consumption, other methods can be used to determine the end point: these include the drop test, the skin wrinkle test, or the use of a jam thermometer to test the temperature (68% sugar corresponds to a jam temperature of 105°C).

When the jam starts to thicken, it is important to test for the end point at frequent intervals. Remember to remove the pan from the heat source while you test or it will continue to thicken and may burn.

**Filling into jars, cooling and labelling**

Wash and sterilise the glass jars and lids by placing in a pan of water and boiling for 10 minutes. Remove the jars from the water with a pair of tongs and stand upside down to drain. Do not dry with a towel as this could contaminate the jars. If glass jars are not available, use plastic jars. These cannot be sterilised with boiling water as they will melt. They should be thoroughly cleaned in warm soapy water and rinsed with a weak solution of sodium metabisulphite. Sterilising tablets (made of sodium metabisulphite) can be bought for this purpose.

Allow the jam to cool slightly (to about 80°C for glass jars and 60°C for plastic jars) and then pour it into clean, sterilised jars. The jars should still be warm to prevent them from cracking when the hot jam is poured in. If the jam is cooled too much it will be difficult to pour. Place the clean lids on top and fasten. Invert the jars to form a seal. The filled jars can be placed in water to cool down the jam so that it does not keep cooking in the jar. The water should not be too cold or the glass may crack. Also, the water level must be kept below the lid of the jar. The gel starts to form as the temperature of the jam reduces (about 55°C) and continues until it is cold. The jars should not be moved or shaken while they are cooling or the gel will not form and the jam will not set.

**Storage**

Jam that is hygienically prepared, boiled until it reaches the correct final total soluble solids (68%) and which is packaged in sterilised glass jars can be stored for up to a year so long as it is kept in a cool place away from direct sunlight. Jam that is packaged in plastic containers has a shorter shelf life – up to 4 months.

**Equipment list**

- Glass jars, Omnia lids and labels
- Omnia capper
- Cooking facilities, gas ring, electric ring, etc
- Stainless steel saucepan
- Thermometer in protective jacket
- Stainless steel cutting knife and spoon
- Wooden spoon for stirring
- Refractometer
- Cutting board
- Scales
- Liquidiser or mashing tool
Equipment suppliers
Note: This is a selective list of suppliers and does not imply endorsement by Practical Action

Cutting and slicing equipment
A range of manual and powered cutting and slicing machinery is available.

- Eastend Engineering Company
  173/1 Gopal Lal Thakur Road
  Calcutta 700 035
  India
  Tel: +91 33 2553 6397

- Narangs Corporation
  P-25 Connaught Place
  New Delhi 110001
  India
  Tel: +91 11 2336 3547
  Fax: +91 11 2374 6705

- Gardners Corporation
  158 Golf Links
  New Delhi 110003
  India
  Tel: +91 11 2334 4287/2336
  3640 Fax: +91 11 2371 7179

Juice filters, strainers and sieves
A range of filtering and straining equipment can be used. The simplest is the filter bag (or jelly bag) made of terylene or muslin cloth. More sophisticated are the filter presses and strainers which may be mechanised.

- Gauthier
  Parc Scientifique Agropolis
  34397 Montpellier
  Cedex 5
  France
  Tel: +33 4 67 61 11 56
  Fax: +33 4 67 54 73 90

- Alvan Blanch
  Chelworth
  Malmesbury
  Wiltshire
  SN16 9SG
  United Kingdom
  Tel: +44 (0) 666 577333
  Fax: +44 (0) 666 577339
  E-mail: info@alvanblanch.co.uk
  Website: http://www.alvanblanch.co.uk

- Lakeland Mail order kitchenware
  38 Alexandra Buildings
  Windermere
  LA23 1BQ
  United Kingdom
  Tel: +44 (0)15394 88100
  Website: www.lakeland.co.uk

Weighing machines
It is important to have accurate weighing machines. Quite often more than one machine is required - - a large one to weigh the fruit and a small one for weighing out the dry ingredients such as pectin and spices.

- Fisher Scientific
  Bishop Meadow Road
  Loughborough
  LE11 5RG
  UK
  Tel: +44 1509 231166
  Fax: +44 1509 231893
  Email: fisher@fisher.co.uk
  Web: www.fisher.co.uk
Alvan Blanch
UK (see above)

Lakeland
UK (see above)

Gardners Corporation
India (see above)

Essae-Teraoka Ltd
377/22 6th Cross Wilson Garden
Bangalore 560027
India
Tel: +91 80 2216185/2241165

Narangs Corporation
India (see above)

Juice extractors and pulpers
A variety of juice extractors and pulpers is available from a wide range of suppliers. They are available in different capacities and either manual or powered (either electric or diesel).

Kenwood Limited
New Lane
Havant
Hampshire
PO9 2NH
United Kingdom
Tel: +44 (0) 23 9247 6000
Fax: +44 (0) 23 9239 2400
Website: http://www.kenwood.co.uk

Alvan Blanch
UK (see above)

Lehman Hardware and Appliances Inc.
P.O. Box 41
Kidron
Ohio 44636
USA
Tel orders: +1 877 438 5346
Tel enquiries: +1 888 438 5346
E-mail: info@lehmans.com
Website: http://www.lehmans.com

Robot Coupe
12 Avenue Cal Leclerc
BP 134
71303 Montceau-les-Mines
France
Tel: +33 3 85 58 80 80

DISEG (Diseno Industrial y Servicios Generales)
Av Jose Carlos Mariategui 1256
Villa Maria del Triunfo
Lima
Peru
Tel: +51 14 283 1417

Servifabri SA
JR Alberto Aberd
No. 400 Urb Miguel Grau (ex Pinote)
San Martin de Porres
Lima
Peru
Tel: +51 14 481 1967

Bajaj Machine Private Limited
7/20, 7/27, Jai Lakshmi Industrial Estate, Side-IV
Sahibabad Industrial Area
Ghaziabad-201301
U.P
India
Tel: +91 120 22775119/22775137
Fax: +91 120 22775137
Website: www.indiamart.com/bajajmachine

Buhler (India) Pvt Ltd
13-D, K A I D B Industrial Area, Attibele
Bangalore
Karnataka 562107
India
Tel: +91 80-27820000
Fax: +91 80-7820001
Website: www.buhlergroup.com

Delhi Industries
4 Paharganj Lane,
New Delhi 110055
India
Tel: +91 11 2529720, 27525200,
27536888
Fax: +91 11 25791291
Boiling pans should be made of aluminium, enamelled metal or stainless steel. For larger quantities it is necessary to buy equipment which does not cause burning or sticking of the product to the bottom of the pan. Stainless steel steam jacketed kettles, which are double walled pans are suitable for boiling large quantities of jam and are available in a range of sizes (from 5 to 500 litres).
Passion fruit jam

Raylons Metal Works
Kondivita Lane
J. B. Nagar Post Office
Post Box No. 17426
Andheri (E) Andheri - Kurla Road,
Mumbai - 400 059
India
Tel: +91 22 26323288 / 6325932

Sri Rajalakshmi Commercial Kitchen Equipment
No.57, (old No. 30/1) Silver Jubilee Park Road
Bangalore - 560 002
India
Tel: +91 (0)812 2222 1054/223 9738
Fax: +91 (0)812 2222 2047

United Engineering (Eastern) Corporation
Shantiniketan Site No.2 & 3
(10th Floor) 8 Camac Street
Kolkata, West Bengal 700017
India
Tel: +91 33-22823914, 22820157
Fax: +91 33-22823742

Bottle filling and packaging equipment

H Erben Limited
Lady Lane
Hadleigh
Suffolk
IP7 6AS
United Kingdom
Tel: +44 (0)1473 823011
Fax: +44 (0)1473 828252
Website: http://www.erben.co.uk

Sussex and Berkshire Machinery Company PLC
Blacknest
Alton, Hants GU34 4PX
United Kingdom
Tel: + 44 (0)1420 22669
Fax: + 44 (0)1420 22687
E-mail: technical@sabplc.uk
Website: http://www.sabplc.co.uk/

T Giusti and Son Limited
Rixon Road, Finedon Road Industrial Estate
Wellingborough, Northamptonshire NN8 4BA
United Kingdom
Tel: + 44 (0)1933 229933
Fax: + 44 (0)1933 272363
Website: www.giusti.co.uk

Israel Newton Limited
Summerley Works
All Alone Road
Bradford
West Yorkshire BD10 8TT
United Kingdom
Tel: +44 (0)1274 612059
Fax:+44 (0)1274 612059

APV Baker Limited
Manor Drive
Paston Parkway
Peterborough
Cambridgeshire
PE4 7AP
United Kingdom
Tel: +44 (0)1733 283000

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: www.indiamart.com

Autopack Machines Pvt Ltd
101-C Poonam Cambers
A Wing, 1st Floor
Dr Annie Besant Road, Worli
Mumbai 400018
India
Tel: +91 22 2493 4406/2497
4800/2492 4806
Fax: +91 22 2496 4926
E-mail: autopack@bom3.vsml.net.in
Website: www.autopackmachines.com
Passion fruit jam

The refractometer is used to measure the sugar content.
Bellingham + Stanley Ltd.
Longfield Road, North Farm Industrial Estate
Tunbridge Wells, Kent TN2 3EY
United Kingdom
Tel: +44 1892 500400
Fax: +44 1892 543115
E-mail: sales@bs-ltd.com
Website: http://www.bs-ltd.com

International Ripening Company
1185 Pniridge Road
Norfolk
Virginia 23502-2095
USA
Tel: +1 757 855 3094
Fax: +1 757 855 4155
Email: info@QAsupplies.com
Web: www.qasupplies.com

References and further reading
Practical Action Technical Briefs:
- Jams, Jellies and Marmalades
- Lime marmalade
- Pineapple jam
- Strawberry jam
- Watermelon jelly
- Food labelling
- Fruit waste utilisation
- Juices and Drinks
- Snack Foods

Technical manual on small-scale processing of fruits and vegetables, Food and Agriculture Organization of the United Nations (FAO)
Setting up and Running a Small Fruit or Vegetable Processing Enterprise: Opportunities in Food Processing, CTA
Starting a Small Food Processing Enterprise by Peter Fellows, Ernesto Franco & Walter Rios Practical Action Publishing/CTA 1996
Fruit and Vegetable Processing UNIFEM Practical Action Publishing, 1993

This technical brief was updated by S. Azam Ali in March 2009. Dr. S Azam-Ali is a consultant in food processing and nutrition with over 15 years experience of working with small-scale processors in developing countries.

Practical Action
The Schumacher Centre
Bourton-on-Dunsmore
Rugby, Warwickshire, CV23 9QZ
United Kingdom
Tel: +44 (0)1926 634400
Fax: +44 (0)1926 634401
E-mail: inforserv@practicalaction.org.uk
Website: http://practicalaction.org/practicalanswers/

Practical Action is a development charity with a difference. We know the simplest ideas can have the most profound, life-changing effect on poor people across the world. For over 40 years, we have been working closely with some of the world’s poorest people - using simple technology to fight poverty and transform their lives for the better. We currently work in 15 countries in Africa, South Asia and Latin America.