



# 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 ( $\text{NaHCO}_3$ ) before boiling (if the  $\text{NaHCO}_3$  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

#### Gardners Corporation

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

#### Narangs Corporation

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

### 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

#### Lakeland Mail order kitchenware

38 Alexandra Buildings  
Windermere  
LA23 1BQ  
United Kingdom  
Tel: +44 (0)15394 88100  
Website: [www.lakeland.co.uk](http://www.lakeland.co.uk)

#### 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](mailto:info@alvanblanch.co.uk)  
Website: <http://www.alvanblanch.co.uk>

#### Gardners Corporation

India (see above)

### 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](mailto:fisher@fisher.co.uk)  
Web: [www.fisher.co.uk](http://www.fisher.co.uk)

**Alvan Blanch**

UK (see above)

**Lakeland**

UK (see above)

**Gardners Corporation**

India (see above)

**Essae-Teraoka Ltd**377/22 6<sup>th</sup> 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](mailto: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](http://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](http://www.buhlergroup.com)**Delhi Industries**

4 Paharganj Lane,

New Delhi 110055

India

Tel: +91 11 2529720, 27525200,

27536888

Fax: +91 11 25791291

# technical brief

**Do-All-Engineering Industries**

87/12, Industrial Suburb, Yeshawanthpur  
Bangalore  
Karnataka 560022  
India  
Tel: +91 80 23345754, 23372298  
Fax: +91 80 23346138

**Eastend Engineering Company**

India (see above)

**Florachem**

Flat No. 1119, Hemkunt Chambers, 89,  
Nehru Place  
New Delhi 110019  
India  
Tel: +91 11 25589502

**Gardners Corporation**

India (see above)

**Food Packs Indiana**

Thrikkariyoor, Kothamangalam, Ernakulam  
Kerala 686692  
India  
Tel: +91 485-2522134, 2523610

**Geeta Food Engineering**

Plot No C-7/1 TTC Area  
Pawana MIDC Thane Belapur Road  
Behind Davita Chemicals Ltd  
Navi Mumbai 400 705  
India  
Tel: +91 22 2782 6626/2766 2098  
Fax: +91 22 2782 6337

**Narangs Corporation**

India (see above)

**For boiling**

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 500litres).

**Gardners Corporation**

India (See above)

**Alvan Blanch**

United Kingdom (See above)

**Praj Industries Ltd**

Praj House Bavdhan  
Pune, Maharashtra 411021  
India  
Tel: +91 20-22951511, 22952214  
Fax: +91 20-22951511 / 22952214  
Website: [www.praj.net](http://www.praj.net)

**Techno Equipments**

Saraswati Sadan  
1<sup>st</sup> Floor, 31 Parekh Street  
Mumbai 400004  
India  
Tel: +91 22 2385 1258

**Kundasala Engineers**

Digana Road  
Kundasala  
Kandy  
Sri Lanka  
Tel: +94 8 420482

**Udaya Industries**

Uda Aludeniya, Welligalla  
Gampola  
Sri Lanka  
Tel: +94 8 388586  
Fax: +94 8 388909

**Mark Industries (Pvt) Ltd**

348/1 Dilu Road  
Mokbazar  
Dhaka 1000  
Bangladesh  
Tel: +880 2 9331778/835629/835578  
Fax: +880 2 842048  
Email: [markind@citechco.net](mailto:markind@citechco.net)

**HRS Process Systems Pvt Ltd**

Asia Division, Praj House,  
Bavdhan, Pune  
Maharashtra 411021 India  
Tel: +91 20- 22951511  
Fax: +91 20- 22951718  
Website: [www.hrsasia.co.in](http://www.hrsasia.co.in)

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**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  
(10<sup>th</sup> 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](mailto:technical@sabplc.uk)  
Website: <http://www.sabplc.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

**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](http://www.giusti.co.uk)

**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](mailto:acufilmachines@yahoo.co.in),  
[acufilmachines@hotmail.com](mailto:acufilmachines@hotmail.com)  
Website: [www.indiamart.com](http://www.indiamart.com)

**Autopack Machines Pvt Ltd**

101-C Poonam Cambers  
A Wing, 1<sup>st</sup> 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.vsmi.net.in](mailto:autopack@bom3.vsmi.net.in)  
Website: [www.autopackmachines.com](http://www.autopackmachines.com)

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**Bombay Engineering Industry**

R NO 6 (Extn) Sevantibai Bhavan  
Chimatpada  
Marol Naka Andheri (East)  
Mumbai 400059  
India  
Tel: +91 22 2836 9368/2821 5795  
Fax: +91 22 2413 5828

**Eastend Engineering Company**

India (See above)

**Gardners Corporation**

India (see above)

**Gurdeep Packaging Machines**

Harichand Mill compound  
LBS Marg, Vikhroli  
Mumbai 400 079  
India  
Tel: +91 22 2578 3521/577 5846/579  
5982  
Fax: +91 22 2577 2846

**MMM Buxabhoj & Co**

140 Sarang Street  
1<sup>st</sup> Floor, Near Crawford Market  
Mumbai, India  
Tel: +91 22 2344 2902  
Fax: +91 22 2345 2532  
[yusufs@vsnl.com](mailto:yusufs@vsnl.com); [mmmb@vsnl.com](mailto:mmmb@vsnl.com);  
[yusuf@mmmb.in](mailto:yusuf@mmmb.in)

**Narangs Corporation**

India (see above)

**Orbit Equipments Pvt Ltd**

175 - B, Plassy Lane  
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, India  
Tel: +91 20 65706009  
Fax: +91 20 24393377

**Rank and Company**

A-p6/3, Wazirpur Industrial Estate  
Delhi – 110 052  
India  
Tel: +91 11 27376101  
Fax: +91 11 7234126  
[Rank@poboxes.com](mailto:Rank@poboxes.com)

**Mark Industries (Pvt) Ltd**

Bangladesh (See above)

**Alfa Technology Transfer Centre**

301 Cach Mang Thang 8  
Tan Binh District  
Ho Chi Minh City  
Vietnam  
Tel: +84 8 9700868  
Fax: +84 8 8640252

**Technology and Equipment Development  
Centre (LIDUTA)**

360 Bis Ben Van Don St  
District 4  
Ho Chi Minh City  
Vietnam  
Tel: +84 8 9400906  
Fax: +84 8 9400906

**Banyong Engineering**

94 Moo 4 Sukhaphibaon No 2 Rd  
Industrial Estate Bangchan  
Bankapi  
Thailand  
Tel: +66 2 5179215-9

**John Kojo Arthur**

University of Science and Technology  
Kumasi  
Ghana

**Alvan Blanch**

UK (see above)

**Refractometers**

The refractometer is used to measure the sugar content.

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**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](mailto:sales@bs-ltd.com)  
Website: <http://www.bs-ltd.com>

**Gardners Corporation**

India (see above)

**International Ripening Company**

1185 Pnieridge Road  
Norfolk  
Virginia 23502-2095  
USA  
Tel: +1 757 855 3094  
Fax: +1 757 855 4155  
Email: [info@QAsupplies.com](mailto:info@QAsupplies.com)  
Web: [www.qasupplies.com](http://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

[Small Scale Food Processing](#) 2<sup>nd</sup> Ed. P Fellows & S Azam Ali, Practical Action Publishing, 2003

[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.

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Website: <http://practicalaction.org/practicalanswers/>

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