Guava

Guava is mostly consumed as fresh table fruit, though the fresh fruits have limited shelf life. Therefore, it is necessary to process fresh fruits into different value added products to increase its availability over an extended period and to stabilize the price during the glut season. The processed products have good potential for internal as well as external trade. Seasonal losses in surplus guava fruits can be avoided by processing into different value added products that make them more attractive to the buyer and/or more readily usable to the consumer. Some of the business opportunities that are suitable for FPOs are mentioned below and the technologies related to those businesses are detailed in this document.

S. No.	Business Opportunity	Brief description
1	Fresh Guava – Direct to Market	Fresh guavas with basic value add such as washing, sorting, and packaging
2	Fresh Guava – Store and sell	Guava can be stored for short-term to medium-term to sell at better prices
3	Guava Pulp	Low grade and over-ripe guavas can be processed to pulp and sold to B2B segment such as processors
4	Guava Juice	The Guava pulp can be filtered, diluted, and controlled for grit (through decantation) and sold as guava juice through B2B channels
5	Guava Powder	Guava slices can be dried and pulverized to get guava powder which can be sold to B2B segment
6	Dehydrated Guava	Guava slices can be dehydrated and sold to the B2B customers

Other business opportunities include ready-to-serve guava juice, clarified guava juice, guava concentrates etc. These business opportunities are not detailed in this document as they may not be suitable for FPOs due to high investment costs, significant volume of pomegranate required around the year for business viability, difficulties in marketing due to competition, unsuitability of varieties grown in Maharashtra, etc.

1 Fresh Guava – Direct to market

Guava can be sold directly to market post harvesting with basic post-harvest value addition such as washing, sorting, and packing in corrugated fibre boxes

Technology	Type	Eligible for Matching Grant
Plastic Crates	Implement	Yes
Foam Layers	Consumable	No
Packhouse	Civil construction	Yes
Conveyor Lines	Equipment	Yes

Technology	Type	Eligible for Matching Grant
Washer - Nozzle-spray brush washer (or) - Bubble washer	Equipment	Yes
Sorting machine - Mechanical sorter (or) - Optical sorter	Equipment	Yes
Pre-cooling chambers	Equipment	Yes
Corrugated Fibre Board boxes	Consumables	No

Process:

- Harvested guavas should be arranged in crates at the field to minimize damage to the fruit
- The harvested guavas can be pre-cooled using a pre-cooling chamber to bring down the temperature to around 10°C to minimize any loss immediately post-harvest
- At the packhouse, guavas can be washed either through a bubble washer or through a nozzle-spray brush washer to remove field dirt
- Washed guavas are then sorted either manually or through sorting machines. Low-cost mechanical sorters and high-cost optical sorters are available for sorting process
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- To prevent damage of produce during transportation, guavas can be packed in corrugated fibre board boxes lined with polyethylene sheets. The fibre board boxes can be covered with shredded paper during transfer or banana / guava leaves to keep out the heat

Advantages:

- Sorting of guavas helps FPOs to sell the guava through appropriate channels and realize higher prices (A and B grades to retailers and exporters, C and D grades to processors)

Disadvantages / Challenges:

- Guavas can face price crashes. During such times, having no controlled atmosphere storage facilities can lead to selling in low prices

2 Fresh Guava – Store and sell

Guavas can be stored in controlled atmosphere upto a month. Pre-fabricated cold storage rooms can be used to store guavas for later sales when the market scenario improves. The recommended storage conditions for storing guava are – 5 °C and 75 - 85% Relative Humidity (*RH*).

Technology	Type	Eligible for Matching Grant
Plastic Crates	Implement	Yes
Foam Layers	Consumable	No
Packhouse	Civil construction	Yes
Conveyor Lines	Equipment	Yes
Washer: - Nozzle-spray brush washer (or) - Bubble washer	Equipment	Yes
Sorting: - Mechanical sorter (or) - Optical sorter	Equipment	Yes
Pre-cooling chamber	Equipment	Yes
Cold Storage: - Cold Storage (or) - Container Cold Rooms	- Civil construction (or) - Equipment	Yes
Corrugated Fibre Board boxes	Consumable	No

Process:

- Harvested guavas should be arranged in crates at the field to minimize damage to the fruit
- The harvested guavas should ideally be pre-cooled using a mobile pre-cooler to bring down the temperature to around 10 °C to minimize any loss immediately post-harvest
- At the packhouse, guavas can be washed either through a bubble washer or through a nozzle-spray brush washer to remove field dirt
- Washed guavas are then sorted either manually or through sorting machines. Low-cost mechanical sorters and high-cost optical sorters are available for sorting process
- Conveyor lines can be used for manual sorting and to move produce from one machine to another
- The washed and graded guavas can be pre-cooled to about 10 °C using pre-cooler (if deemed necessary) before being shifted to a cold chamber/ cold storage for storage
- To prevent damage of produce during transportation, guavas can be packed in corrugated fibre boards boxes lined with polyethylene sheets. The fibre board boxes can be covered with shredded paper during transfer or banana/ guava leaves to keep out the heat

Advantages:

- Sorting of guavas helps FPOs to sell the guavas through appropriate channels and realize higher prices (A and B grades to retailers and exporters, C and D grades to processors)

- The guavas can be stored when the FPOs don't find any buyers or when the market prices are low, without the produce getting spoilt

Disadvantages / Challenges:

- Cold storages require significant initial investment and grid-powered cold storages have high operational cost. The increase in market prices may not be able to compensate for the storage cost incurred if the price increase is not significant

3 Guava Pulp

In view of changing consumer attitude, demand, and emergence of new market, it has become imperative to develop products that have nutritional as well as health benefits. In this context, guava has excellent digestive and nutritive value, pleasant flavor, high palatability, and availability in abundance at moderate price. Low grade guavas can be processed to guava pulp, which is an excellent raw material for preparation of juice, RTS beverages, wine, nectar, powder, candy and preserve. The product guava pulp is obtained by the commercial processing of sound, mature guava fruit by passing through sieves.

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil construction	Yes
Guava Pulper - Single stage (or) - Two stage	Equipment	Yes
Homogenization tank	Equipment	Yes
Pulp & Juice Pasteurizer Machine	Equipment	Yes
Pulp storage tank – Stainless steel tank	Equipment	Yes
Aseptic bags	Consumable	No
Pulp filling machine	Equipment	Yes
Mild steel drum	Equipment	Yes

Equipment for guava pulp manufacturing should be combined with the first two business activities suggested above. Higher grades (A, B) can be marketed as fresh since they fetch higher prices while lower grades can be used for processing into pulp.

Process:

- The washed and sorted guavas are then sliced into halves. The guavas can be manually destoned using a sterilized knife
- The sliced and destoned guavas are then fed into a guava pulper to obtain puree/ pulp

- The pulp obtained has to be homogenized to get a smooth creamy consistency. For this the pulp received is fed to a plate and frame filter to remove any solid/ grit, followed by feeding the pulp into a homogenization tank.
- The homogenization tank is allowed to run for a few minutes depending on the batch size. Citric acid is added to maintain acidity
- The guava pulp is pasteurized by heating up to 100 – 110 °C and stored in pulp collection tank
- Eventually, the guava pulp is packed in aseptic bags in MS drums with a poly liner inside

Advantages:

- C and D grades fetch very low prices in open-market. Processing them into pulp provides better prices to the FPO

Disadvantages / Challenges:

- The cost of establishment and operating the puree manufacturing lines are high
- FPO should maintain good utilization of the unit to breakeven and get profits on the products sold
- Since the pulp is sold in bulk form in the B2B market, the margin realized by the FPO may be low

4 Guava Juice

Natural Fruit juice consumption pattern has significantly changed in recent years and has become a potent alternative to traditional caffeine-containing beverages. Guava juice contains as much as four times higher Vitamin C than orange juice and with its unique flavor and aroma, is able to compete in the market, in any form. Guava juice can be prepared by diluting guava pulp in a storage. Raw guava juice is grey in color, very turbid and viscous and enzymatic treatment can be done to further clarify the guava juice.

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil construction	Yes
Dilution tank	Equipment	Yes
Decantation tank	Equipment	Yes
Mixing tank	Equipment	Yes
Shell and tube pasteurizer	Equipment	Yes
Semi–automatic filling machine	Equipment	Yes

Equipment for guava juice manufacturing should always be combined with guava pulp unit, as guava juice is obtained by further processing the guava pulp.

Process:

- The homogenized guava pulp is transferred to a dilution tank where the guava pulp is mixed with water as per the market requirement.

- The diluted guava pulp can be decanted to control for grit by allowing the guava juice to settle in a decantation tank. The juice can be transferred to a SS tank for mixing and further processing, once the grits settle down
- The decanted guava juice can be further clarified via enzymatic treatment. Pectinase enzyme is used for clarification and increasing the juice yield. Application of Pectinex Ultra SP-L® was optimal using **700 ppm enzyme for 1.5 hr at 50°C**
- The clarified juice is then pasteurized in a shell and tube pasteurizer before being packed in bottles using semi-automatic filling machines
- The packed bottles of guava juice are boxed are stored in well-ventilated storage rooms away from sunlight, dry and pest-free environment

Advantages:

- Guava juice fetches high price and hence can provide higher margins to the FPO in comparison to guava pulp

Disadvantages / Challenges:

- The cost of establishment and operating the juice manufacturing lines are high
- FPO should maintain good utilization of the unit to breakeven and get profits on the products sold
- Since the juice is sold in bulk form in the B2B market, the margin realized by the FPO may not be high

5 Dehydrated Guava

Guava can be dehydrated either through osmotic treatment or by drying the guava slices using dryers.

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil construction	Yes
Dryer - Tunnel dryer (or) - Tray dryer	Equipment	Yes
Continuous band sealer	Equipment	Yes

Equipment for manufacturing of dehydrated guava should be combined with the first two suggested business opportunities above. Only limited quantity of guava can be processed into dehydrated slices.

Process:

- Washed and sorted guavas are sliced using a sterilized knife and destoned manually
- The sliced guava pieces are passed through a tunnel dryer to obtain dehydrated guava slices. Tray dryers can also be used to obtain dehydrated guava

- Dehydrated guava slices are packed in pouches manually and sealed through a continuous band sealer

Advantages:

- C and D grades fetch very low prices in open-market. Processing them into dehydrated guava increases shelf life (upto 1 year) and provides FPOs higher margins
- Equipment required are low-medium cost when compared to guava pulp / juice manufacturing

Disadvantages / Challenges:

- Direct B2C sales through online channels is challenging, as it will require investments for marketing and competing with established brands
- The market for dehydrated guava slices is limited

Advances Process:

- Dehydrated slices can also be obtained through osmotic treatment. But drying through tunnel dryers / tray dryers requires less investment and is suitable for low quantities

6 Guava Powder

Guava powder has a growing market and can be used in various industries especially in confectionery industry. Guava powder can be added to a variety of recipes, e.g., natural cookies, granola bars and cakes

Technology	Type	Eligible for Matching Grant
Shed for unit	Civil construction	Yes
Pulverizer	Equipment	Yes
Vibratory sieve	Equipment	Yes
Form-fill seal packaging	Equipment	Yes

Equipment for guava powder manufacturing should always be combined with dehydrated guava slice unit, as guava powder is obtained by further processing the dehydrated guava.

Process:

- The dried guava slices are ground into a fine powder using Pulverizer
- Powder obtained is then passed through a vibratory sieve to separate any unwanted debris and to get fine powder
- The powder is then packed in pouches using a form-fill seal packaging

Advantages:

- C and D grades fetch very low prices in open-market. Processing them into powder increases shelf life and provides FPO with higher margins
- Equipment required are low-medium cost when compared to guava pulp / juice manufacturing

Disadvantages:

- Direct B2C sales through online channels is challenging, as it will require investments for marketing and competing with established brands
- The market for dehydrated guava slices is limited