FACTORY IN A BOX
and
BREADFRUIT FLOUR PRODUCTION
By Trees That Feed Foundation
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The steps for producing breadfruit flour are as follows:

1. Selecting “fit” breadfruit
2. Cleaning and/or peeling
3. Slicing or shredding
4. Drying
5. Grinding
6. Packaging
7. Marketing and sales
8. Recipes

Each step is described in detail, below.

Selecting “fit” breadfruit
The fit breadfruit will have sap leaking out of the sides.

Left photo … too green … right photo, ready to pick. The green breadfruit is too firm and does not make tasty flour; overripe breadfruit is too soft.

Cleaning
Bacteria and other contamination must be carefully avoided. The fruit should be washed in water with a 10 percent chlorine bleach, then rinsed in clean water. The breadfruit when picked ideally should never touch the ground.

Peeling
Peeling is necessary for making breadfruit chips, but optional for making flour. Peeled breadfruit produces a whiter flour, while unpeeled breadfruit flour has less waste, more fiber and more nutrition. If unpeeled breadfruit is used the cleaning process has to be very thorough.

Many groups peel by hand with a sharp knife. A prototype electric peeler is under development. Meanwhile, here is a low cost peeler design partially electric powered.

The photos show a variable speed electric drill driving a shaft supported at both ends. A sharp knife is held to peel the breadfruit skin.

Thanks to our friends at Effort Vision, Haiti, for the photos and the idea.

Slicing or shredding

Opinion varies whether slices or shreds dry faster. Most people work with shreds, however there may be less waste using slices. The slices need to be very thin. Small or medium sized operations should use a food processor with slicing or shredding blades. Robot Coupe make an excellent commercial duty processor, model R2N. http://www.robot-coupe.com/en-usa/catalogue/combination-processors-bowl-cutter-and-vegetable-prep,2/r-2-n-ultra,22834/ about US$1,400 including blades and accessories. Hobart makes a continuous feed processor, http://www.hobartcorp.com/products/food-prep/food-processors/Continuous-Feed/ , about US$3,000, however we have not had direct experience with it.

For smaller operations there are many other excellent vendors include KitchenAid. Large commercial operations may choose to use a Hobart shredder with power attachment. Hobart makes excellent durable equipment although prices tend to be high.

Slicer and shredder: http://www.hobartcorp.com/products/food-prep/accessories/
Power attachment: http://www.hobartcorp.com/products/food-prep/power-drive-units/

To source equipment like this, always check locally for new or good condition used products. Importing from the US is also possible.

Drying

Fresh breadfruit contains approximately 75 percent moisture. Fresh breadfruit spoils rapidly, in just a few days, but if the fruit is dried, the moisture is removed while the nutrition quality remains high. The dried fruit has a long shelf life, measured in months, under good storage condition.

Drying can be a production bottleneck. Electric heating tends to be very expensive. Fuel heating is possible but also tends to be expensive. Solar drying if possible should be explored.

Most groups currently are drying in the sun on an open flat surface. In tropical climates on sunny days, the fruit will dry within a day. The food should be covered with a mesh to keep off dust and other contaminants.

A better approach is to build a solar dryer. One design by TTFF is the hybrid cabinet design. In this design solar collectors feed warm air into a cabinet. Breadfruit (or other fruit) shreds or slices are spread out on a shelf inside the upper cabinet. The shelf is typically made of stainless steel or food safe plastic mesh. A solar fan on the rooftop helps pull air through at the desired rate.

The first prototype was constructed out of plywood but for production purposes, black painted sheet metal is preferable for faster drying and better food safe conditions.

Ideally, 10 percent moisture or less is desirable. As a practical test, the shreds or slices are dry when they snap in the fingers, instead of bending.

For more details visit http://www.treesthatfeed.org/resources/891-2.

Additional prototypes are currently being built, with various design improvements being considered. Many other designs are possible, including cabinets with glass or clear acrylic plastic walls.

The shreds or slices when completely dry can be stored for a long time and ground into flour as desired. The flour also has a long shelf life, six months or more.

Grinding/milling

The ideal equipment depends on capacity. Initially TTFF supplied manual grinders but it is very heavy work and not suitable for anything except the smallest quantities. But check out Compatible Technology Inc.'s hand powered grinders which are being used successfully in Haiti. Visit http://www.compatibletechnology.org/our-tools/current-technologies/grinder.htm.

Electric powered machines are ideal. Small quantities can be prepared using the Nutrimill or Wondermill. Each brand has their fans. http://grainoftruthbreadcompany.com/nutrimill-vs-wondermill/. Each is suitable for small capacities.

Co-ops or commercial grinding requires equipment of 1 to 5 horsepower. Suitable choices include the Meadows 8 inch stone burr mill or the Penagos mill.

http://www.meadowsmills.com/sbm8.html
http://www.penagos.com/eng/producto/molino-de-discos-mdp-60-2/

If the mill does not incorporate a sifting screen, the ground flour may need to be sifted manually for best consistency.

There's an excellent short video on Youtube, prepared by our friends in Hawaii, that gives additional detail on smaller scale breadfruit ("ulu" in Hawaii) flour production.
https://www.youtube.com/watch?v=_8YgPW-En4c

Packaging

Breadfruit flour should be weighed carefully and packaged in food safe bags, typically 1 or 2 pound bags. One source for bags is www.stockbagdepot.com.

Packaging machines are available but due to cost, are only suitable for very large production factories.

A clear and legally compliant food label is essential, including nutrition information. A sample is shown below from one of TTFF's preferred vendors.

Quality control

Most likely each producer will need to have food quality tested initially and periodically for coliform bacteria, organic material (aerobic plate count, yeast, mold) and dust. It's very easy to fail these quality tests unless strict cleanliness procedures are followed.

Marketing and Sales

TTFF will buy a limited quantity of breadfruit flour from each producer, limited of course to what we can afford. Producers will need to handle their own marketing locally and potentially for export. Suggested purchasers include online retail, restaurants, hotels, supermarkets, schools, orphanages, hospitals, church groups, wholesale resellers, exporters, bakeries.

Sales have to be made easy for the purchaser. A website store is ideal. Shipping by post office is typically less expensive than the various courier services such as Fedex and UPS.

Recipes

A final nice touch is to include recipes for cooking or baking with breadfruit flour. Several ideas are here:
http://www.treesthatfeed.org/programs/recipes

Tasty, easy recipes will help to popularize this excellent food product.

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