

## Bean Flour and Flour Products

Solution Holder is **Robert Fungo** and can be contacted through **[r.fungo@cgiar.org](mailto:r.fungo@cgiar.org)**

### Summary

The time and energy required to prepare whole beans for consumption restricts their appeal to urban consumers, even for pre-cooked products described in Technology 11. In response, an increasing number of processed and ready to eat products made from common bean are emerging across Sub-Saharan Africa. Preparing high-quality flour from common beans is the first step in the manufacture of these products, and use of this flour by homemakers is becoming increasingly appreciated. In comparison to conventional bean preparation by lengthy boiling, use of flour offers substantial savings on cooking time and fuel cost, and improves the bioavailability of vitamins and micronutrient in derived food products. Bean flour is produced by similar milling processes as performed for cereal grains and other legumes. This technology provides a diversity of bean-based products and recipes that are useful among rural and urban communities. Manufacturing of flour and food products from common bean creates a lucrative market that benefits the livelihood of both farmers and entrepreneurs.

### Technical Description

Common beans contain substances that interfere with absorption of proteins, starch and minerals in the human gut. Processing bean grains into flour serves to ameliorate digestibility and nutritional qualities, increases consumer appeal, extends shelf-life and generates additional income. Freshly harvested and hard-to-cook beans can be made into flour through various procedures. Wet methods generally involve a combination of soaking, malting, dehulling, pressure cooking or steaming, oven drying and fine milling. Soaking dry beans prior to cooking is a common practice which extrudes substances that cause flatulence. Malting and sprouting provides this same service but also increases the availability of vitamin C, folic acid and iron. Dehulling eliminates phytates and tannins, and increases protein digestibility. Apart from making foods more palatable and safe, the cooking or pressure steaming of beans inactivates and leaches anti-nutritional compounds. In the case of dry milling methods, whole beans first are desiccated in the sun or an oven before being ground, then the flour is passed over a sieve for removing chaff and large particles, and lastly it is vacuum packed, allowing it to be stored for longer periods of time under room temperature.

### Uses

Production of bean flour is appealing for rural and urban communities alike. As blended flour, it improves food self-sufficiency and promotes business development. Equipment requirements for both small and large milling are widely available and simple to install or build. Milled bean flour presents opportunities to improve existing supply chains and open up trade in new areas since it increases markets to producers, offers savings on transportation costs and provides manufacturers opportunity to create new product lines.

### Composition

Smaller manually-operated equipment is used in cottage level production of bean flour, whereas larger automated systems are employed for industrial-scale processing. Manufacturing bean flour through the wet procedure requires soaking baths, solar dryers, hot air furnaces, boiler plates and steaming vessels. The malting and germination step occurs by placing whole beans inside moist cloths that are rinsed daily with water to prevent mold formation. Dehulling soaked beans involves abrasive rolling by hand or within a motorized friction chamber. Flour mills have a canister fitted with stainless steel blades that operate at high frequency to strike and grind the whole beans. Meshes placed within the mill determine the particle size of flour, and prevent excessive grinding. A water cooling system inside the mill ensures that the bean flour is not overheated due to friction while being processed.

### Means of application

Bean flour produced through either wet or dry milling can be used in a wide range of products and foods. It is an all-purpose, gluten-free flour suitable for composite blends with cereal flour to prepare bread, pastry or porridge. Pure bean flour serves as a texturing ingredient for crisps and pasta, as thickener for soups, sauces and beverages, and as protein replacement in meat analogues.

|                               |   |
|-------------------------------|---|
| <b>Agroecologies</b>          | Moist savanna, Highlands.   |
| <b>Regions</b>                | Africa South of Sahara.   |
| <b>Developed in Countries</b> | Burkina Faso, Malawi, Burundi, Nigeria, Ivory Coast, Senegal, Benin, Uganda, Tanzania, Rwanda, Kenya, Ethiopia, Democratic Republic of the Congo, Central African Republic. |
| <b>Available in</b>           | Burkina Faso, Malawi, Burundi, Nigeria, Ivory Coast, Senegal, Benin, Uganda, Tanzania, Rwanda, Kenya, Ethiopia, Democratic Republic of the Congo, Central African Republic. |
| <b>Solution Forms</b>         | Equipment.  |

|                                 |  |
|---------------------------------|--|
| <b>Solution Applications</b>    | Value addition, Agri-Food Processing.                                      |
| <b>Agricultural Commodities</b> | Common bean.   |
| <b>Target Beneficiaries</b>     | Small-scale farmers, Women, Youth, Agro-manufacturers, Commercial farmers. |

## Commercialization

### Commercialization Category

Commercially available

### Startup Requirements

The following steps are needed for enterprise development around bean flour and its widespread replication: 1) Raise awareness with farmers, agri-food companies and investors on the economic benefits of the technology, 2) Formulate appropriate product standards, packaging sizes and prices based on consumer demand, 3) Identify profitable, durable and equitable strategies for taking bean flour products to local, regional and international markets, 4) Establish reliable supply of beans to processing plants through contracted farming, 5) Set up equipment and production lines that make efficient use of energy and labor, and 6) Train operators and workers on safety and quality adherence throughout the manufacturing process.

### Production Costs

Prices of whole beans and the cost of labor and equipment for processing and packaging determine the overall investment. Small motorized bean dehullers that can process 50 kg hour<sup>-1</sup> have a base cost of US \$370, while machines with a capacity of 2 ton hour<sup>-1</sup> are sold for US \$3,000. Soaking tanks of 500 liter cost about US \$1,500 and those with a capacity of 5,000 liter cost US \$8,800. Mills with a capacity of 300 kg hour<sup>-1</sup> start in price from US \$2,000. Large industrial-scale milling setups with a capacity of several ton per hour have to be built on-site and cost upwards from US \$100,000.

### Customer Segmentation

Bean flour and processed foods have a large and diverse customer base which ranges from rural poor communities to middle-class urbanites.

### Potential Profitability

Currently, the market is served by few local and regional processors. In Nigeria bean flour is sold at about US \$4 per kilogram while the wholesale price of beans is US \$2, thus creating a sufficient margin to repay capital and operational investments.

## **Licensing Requirements**

Producers of bean flour and flour products must comply with food safety regulations depending on the target country and market. Most of the simple cottage style machinery and equipment can be fabricated free of license, while industrial systems fall under intellectual property protection.

## **Innovation as Public Good**

Knowhow about bean flour processing is a Public Good, and ABC and its partners are responsible for disseminating this knowledge in Africa.

## **Solution Images**





## Institutions



## Accompanying Solutions

Biofortified Beans for Improved Nutrition

[Biofortified Beans for Improved Nutrition](#)