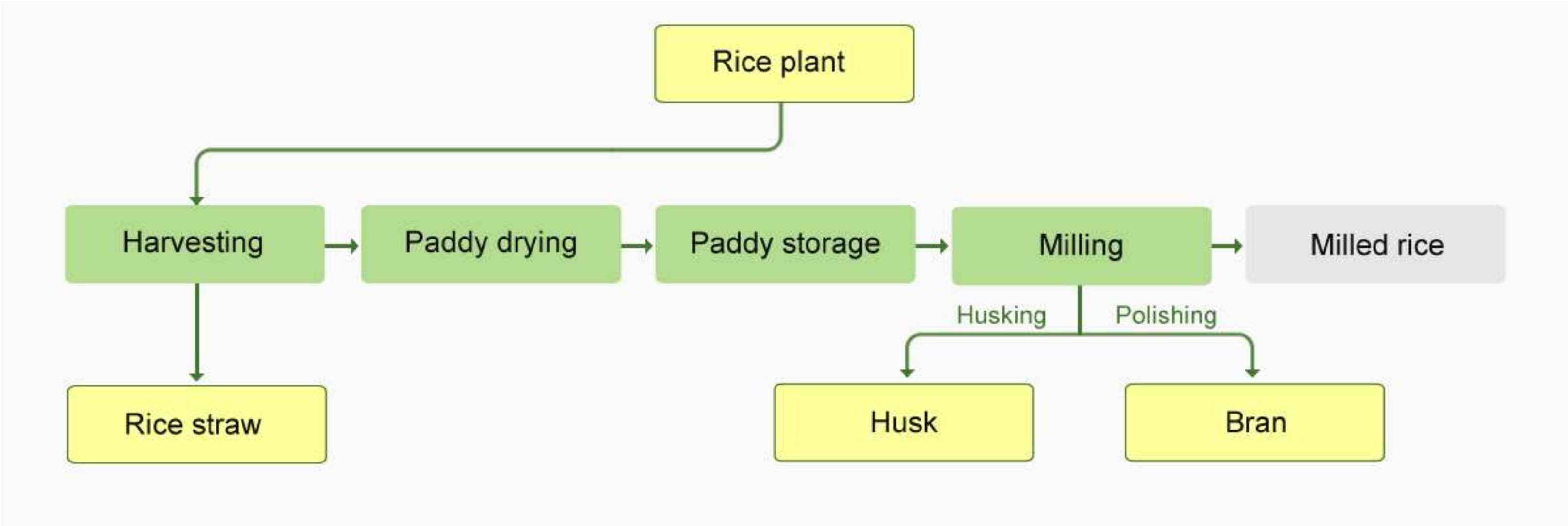


The main by-products of rice are rice straw, rice husk or hull, and rice bran.



- [Rice straw](#) is produced when harvesting paddy. Straw comes from what is left on the plant after it is harvested and the grains are threshed.
- [Rice husks or hulls](#) are generated during the first stage of rice milling, when rough rice or paddy rice is husked.
- [Rice bran](#) is produced during the second stage in milling, the whitening or polishing process, when the bran layer is removed from the brown rice kernel.

Rice straw

What is rice straw?

Rice straw is a rice by-product produced when harvesting paddy. Each kg of milled rice produced results in roughly 0.7–1.4 kg of rice straw depending on varieties, cutting-height of the stubbles, and moisture content during harvest. Rice straw is separated from the grains after the plants are threshed either manually, using stationary threshers or, more recently, by using combine harvesters (Figure 1).



Figure 1. Harvesting grain and straw using the combine harvester.

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Rice husk

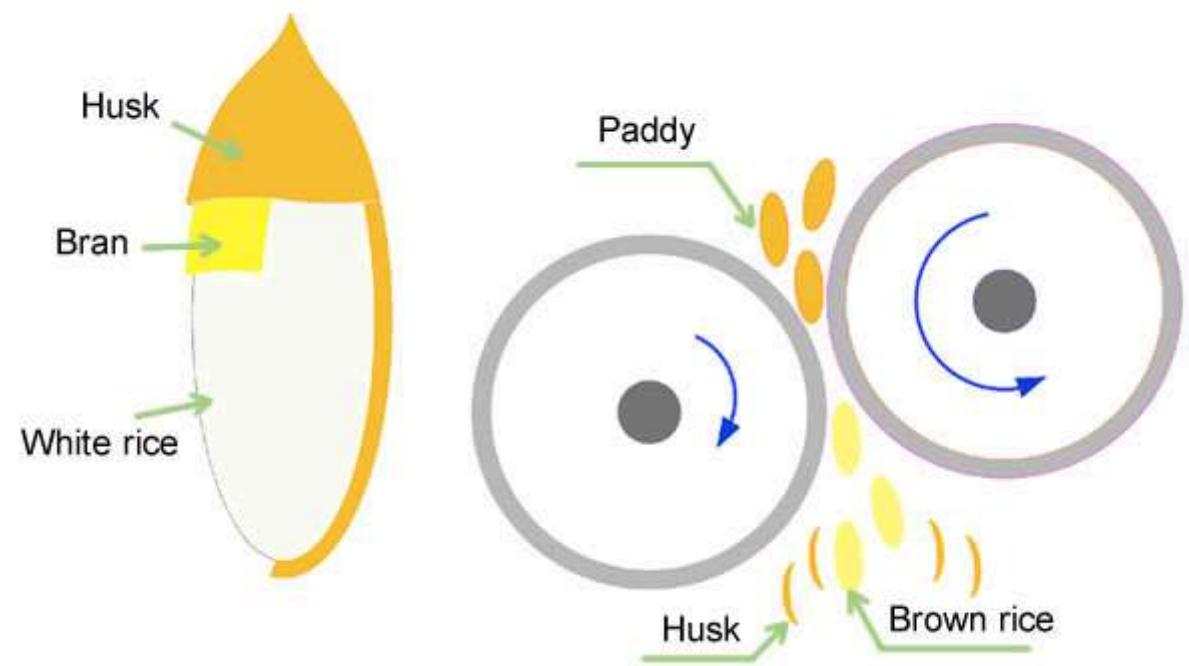


Fig. 1. Paddy grain (left) and its products after husking.

What is rice husk and what are its major products?

The rice husk, also called rice hull, is the coating on a seed or grain of rice. It is formed from hard materials, including silica and lignin, to protect the seed during the growing season. Each kg of milled white rice results in roughly 0.28 kg of rice husk as a by-product of rice production during milling.

Common products from rice husk are: solid fuel (i.e., loose form, briquettes, and pellets), carbonized rice husk produced after burning, and the remaining rice husk ash after combustion.

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Rice bran

One hundred kilogram (100 kg) of paddy rice will generate approximately 5–10 kg of bran. Rice bran is a mixture of substances, including protein, fat, ash, and crude fiber. In many cases, bran contains tiny fractions of rice hull, which increases the ash content of bran. Bran composition is largely dependent on the milling process.

In modern rice mills, several different kinds of bran are produced: coarse bran (from the first whitening step), fine bran (from second whitening step) and polish (from the polishing step). Polish consists of part of the endosperm and is often referred to as meal.

Rice bran has a high nutritive value. Besides proteins, rice bran is an excellent source of vitamins B and E. Bran also contains small amounts of anti-oxydants, which are considered to low cholesterol in humans. Rice bran contains 10–23% bran oil. The oily nature makes bran an excellent binder for animal feeds. Bran oil, once stabilized and extracted, is a high quality vegetable oil for cooking or eating. The conventional use of rice bran is as ingredient for animal feeds, in particular ruminants and poultry. In recent years however, advances in stabilization techniques have been made which has led to new uses for bran and its derivatives, most notably bran oil for cooking and waxes for cosmetic products. In the developing countries, rice bran is underutilized due to a lack of suitable stabilization techniques.



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Rice straw



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Rice bran

Rice husk



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Rice bran is generated when brown rice moves through the whiteners and polishers. When paddy is hand-pounded or milled in a one-pass Engleberg steel huller, rice bran is not produced separately but mixed with rice hulls.

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