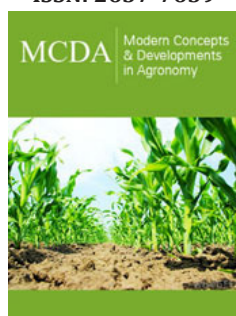


# Rice Technology in General

Vasudeva Singh\*

Department of Bio-Engineering, Food Science Division, India

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**\*Corresponding author:** Vasudeva Singh,  
Department of Bio-Engineering, Food  
Science Division, Gauhati, Assam-781 014,  
India

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## Introduction

Cereal production in the world is around 2800 million tons (MT). India produces around 285MT as of 2021. Wheat production in the world is 780MT and we produce around 110MT. Rice production as paddy in the world is around 788MT and India produces around 150MT. Production of the maize in the world is ~1200MT and India produces around 25MT. Coarse grain production in India is ~47MT. Millet production in the world is ~31MT and our country produces around 13MT. Pulses production in the world is ~90MT and our country produces around 25MT. Soya production in the world is ~384MT and our country produces around 13MT. From 150MT of paddy, around 10% goes for the production of rice products viz. Expanded rice, Popped rice and Flaked rice (~15MT). The remaining 135MT, of which 50% i.e., ~68MT goes for the production of raw rice and another 68MT goes for the production of parboiled rice.

Main cultivated rice species in the world is *Oryza sativa L.* In some parts of Africa, *Oryza Giberama* is cultivated. Among Sativa, Indica and Japonica are cultivated. Indica is tropically grown, and they cook long and flaky. Japonica is mainly grown in sub-tropical and temperate countries. Japonica cooks pasty and appears mashy. Hence people of Korea, Japanese, use sticks for consuming the cooked rice. There is another group, viz Bulu varieties, which are grown in Indonesia. There are 1.2 lakh varieties of rice in the World. From this, ~80000 germ plasm is maintained by IRRI, Philippines. 4000 to 6000 varieties are commercially exploited, as they are of high yielding type. There are different forms of rice, flaky, pasty rice, aromatic or scented rice, Basmati rice, medicinal rice, iron rice, iron rich rice. There are different forms of specialty rice. Basmati from India and Pakistan. Khaodawk mali from Bangladesh, Texamati from America etc. They are all of intermediate amylose content. 2-Acetyl-1-Pyroline is the aroma component in these aromatic rices.

By judicious harvesting the rice can be processed easily. If the paddy is harvested at lower moisture like 12, 13 or 14%, lot of breakage occurs. Hence paddy should not be dried continuously in sun or in a dryer. After first hour of drying, the paddy should be heaped or bagged and kept for 2 to 3h, by this the internal moisture, which comes out by diffusion, a slow process, the whole moisture spreads over whole grain, after this, the grains are dried, stress on the grain will be less, cracks will not occur, such grains on milling, breakage will be minimum and yield of the head rice will be high.

## Tiny Rice Mill

Generally, rice available in the market is completely white in colour, which indicates they have undergone high polish and maximum nutrients have lost. Our Institution, CSIR-CFTRI, Mysore has developed a Tiny Rice Mill. This mill will help in converting 100g of paddy into brown rice, less polished rice or high polished rice. If high polish, the capacity is ~10kg/h and if low polish is required it will be around 20kg/h. This TRM can be used for processing any type of rice variety (paddy variety).

## Nutri Rice

CSIR-CFTRI has developed Nutri rice, where the less polished rice can be kept without spoilage up to 6 months. Normal half polished rice can be kept for less period i.e up ~40 days. This nutri rice is prepared by steaming around 8 tonnes of paddy, dried using LSU (Louisiana State University Dryer) drier and shelled and polished in horizontal emery polisher. This rice is superior to highly polished rice w.r.t no. of nutrients and phytochemicals. Sensory-wise this rice is also considered to be superior. There are different capacity rice mills in India. 2 tonnes per day, 10 tonnes per day and 120 tonnes per hour capacity. The highest capacity rice mills are located in Punjab State of our country.

## Curing

After harvesting and drying the paddy, the milled rice obtained cooks pasty. To get good, cooked rice, flaky type, either paddy or rice is stored for about 8 months. In order to get the aged rice quickly, scientists from CSIR-CFTRI, (Dr. H.S.R. Desikachar, Dr. K.R. Bhattacharya) Mysore, developed cured rice. Here dry paddy is steamed for about 10 min. and stored for about 40 min, and dried, shelled and milled. This rice cooks like an aged rice. In another method, the milled rice is steamed for about 45 min., in a round roaster, removed, and kept for drying and kept as such. This rice is also named as Cured rice, which is generally practiced in South Indian States specially Tamilnadu, Karnataka. Generally fresh rice volume expansion is less, aged or cured rice the expansion will be high. The cooked rice grains will be flaky in nature. It may be noted that the gruel from fresh rice will be thick and whitish in nature, whereas that from aged rice will be thin in nature.

## Parboiling

Parboiling is nothing but partially boiling. In general paddy is soaked, water is drained off, and the soaked paddy is cooked either by steaming or by roasting or by dry air heating or and this paddy is named as parboiled paddy. Generally, this is commercially followed. On a smaller scale, soaked paddy is roasted in Gram Roaster, where the soaked paddy is poured at one end and at the other end the roasted paddy comes out, the roaster is heated by any means like by gas or by firewood or by saw dust. The roasted paddy is sieved through a sieve, and the sand return back to the roaster and again used. The paddy is said to be obtained by Dry heat parboiling. This process is economical, but the capacity is hardly 800 to 1000kg/h.

On a commercial scale, the paddy around 50 tonnes will be taken in a very rectangular tank, from here the paddy is dropped into two big tanks of around 25 tonnes capacity. This dry paddy is steamed for about 2 min. This hot paddy is dropped into another tank containing lukewarm water. In this condition the paddy is soaked for about 3 h. Next the water is drained off, the soaked paddy is steamed for about 8 min. This hot paddy, which is named as parboiled paddy is moved by elevators and dried by LSU drier and then we get parboiled paddy which is further processed by shelling, milling and parboiled rice is obtained. Nutrition point of

view, the parboiled rice is hard, highly nutritious, with high amount of Thiamine, good amount of proteins, minerals. Economically parboiling is advantageous, as it minimizes the broken and good amount of head rice is obtained, which is commercially superior.

## Classification of Rice

World raw rice has been classified into 8 groups. The first 3 groups are of high amylose; 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> groups are considered to be of Intermediate amylose group, 7<sup>th</sup> group is considered to be low amylose group and 8<sup>th</sup> group are considered to be waxy rice group. All these classifications have been done based on total amylose, insoluble amylose contents, alkali score, viscosity of the rice flour on cooking, hardness of the rice on cooking, fragility of the starch granule, range of gelatinization temperature etc.

## Products from Rice

The main products of rice are prepared on a small-scale industry basis. Flaked rice is prepared from parboiled paddy. Here the soaked paddy is roasted in a gram roaster, the paddy is tempered, and flaked in an idle roller flaker. If no. revolutions are less, the flakes obtained will be thick in nature and if the grains are flaked for longer durations, the flakes will be thin in nature. Sometimes in order to get uniform shaped rice flakes, the flakes obtained are passed through another roller pass, where the flakes will be uniform in shape. By this some nutrients will be lost while processing.

## Expanded Rice

Here the paddy is soaked in hot water. After soaking for about 5h, the water is decanted, and the soaked paddy is roasted in sand. The whole material is sieved, the sand is separated, the paddy obtained in shelled and milled. This rice is called dry heat parboiled rice. This is roasted and added with saturated salt solution. They are tempered for about 1h and next it is roasted in sand and the rice expands. This is sieved and expanded rice is obtained.

## Popped Rice

Here the raw paddy is dried for some time. Its moisture is raised to 14% and tempered. This is roasted in sand, the paddy grains popps and the contents were sieved, the popped rice is obtained by sieving the contents. Similarly, we have a number of rice products like Ready to cook products like Fermented dry mix of idli and dosa. Pregelatinized rice from raw rice, parboiled rice, germinated rice etc. are also familiar. Quick cooking rice, rice noodles, fast cooking parboiled rice are some of the other rice products.

## Medicinal Rice

This rice is generally grown in Kerala. This rice in the form of dehusked one which is red in colour is cooked in milk along with some herbs. This is rubbed on the body of the person whose nerves are weak in nature. By rubbing like this the health of the persons improves. Generally, this rice is named Njwara. This is generally sold as dehusked one, in Ayurvedic shops.