



## White, shiny, aromatic and more...signals of finesse and identity - How consumer choice affects agricultural biodiversity?



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Agro-biodiversity, bewildering types of agricultural crops and their visible and invisible features, is central to our sustainable food system. Like biodiversity, there are many players that crafted the rich spectra of cultivated crops. Human agency has been at the focal point in multifarious forms and capacities. One such key player in the origin of crop diversity has been the choice of consumers or crop eaters, who used to select the specific type(s) of crop or a variety or a landrace from a fairly large collection. As a result of the inclination to a specific set of grains or lentils and less so to the other kinds, the demand for the preferred-type would have risen; that would, in turn, have fostered its production in a positive feedback manner. In other words, choice of consumers anticipated to have a large impact on what crop to be sown or what variety to produce at the farmers level, and that seems to be a great actor in origin, conservation, utilization as well as in the loss of agricultural biodiversity.



**Figure 1 – Rice diversity on consumers' plate**

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Let us simplify the situation taking an example from rice types and rice eaters around the world, and it would demonstrate how different features of rice influence rice-eaters' choice. Rice (*Oryza sativa*) enjoys lions share in terms of global calorie intake, it is a staple food of the world especially around south, south-east, and East Asia, a sizable part of Europe, the North and South America. However, the rice-eaters of the world are not all similar, but form a



perplexingly heterogenous group and their choice tend to vary widely when confronted with the question, how and what rice is to be eaten?

Let's begin this exploration with one urban individual, say our Mr. X who heads to a shop, a grocery shop or a dedicated rice shop or a supermarket, to purchase rice for monthly consumption. The different colored rice bags or smaller packets are displaying different price tag and different quality of rice. Oh! Different quality! But, Mr X is dumbfounded in front of this wide range and thus undecided, which one to buy? It is not an easy job as Mrs X used to do this most of the time. All bags contained price tag, you may choose the highest one but it may not stand for the best quality. Mr. X decides to purchase the pricey one and to his surprise, there are at least five to six varieties of rice very closely priced. So, flabbergasted Mr. X decides to shake his memory box to pull out decisive information. And to his surprise, there is a lot of information... white rice, aromatic rice, sweet rice, slim-long rice, brown rice, thick rice or the rice taking less time to cook, or short-reddish-nutritious rice and so on... which is the best rice quality (Figure 1)? He has heard of 'whiter rice', fine and fluffy that his wife used to cook, does whiteness stand for finesse or does it have something to do with the taste, or simply because white is a signal of purity and better acceptance. So, many questions bubbled in this mind thus making an easy selection far more complex than he imagined.

So, Mr. X is not alone in the row; rice quality is, indeed, such a complex integration of features that finally determines rice-consumers' choice. And there are dedicated groups of researchers across the globe continuously working on to define the parameters or important traits of rice quality. A research group argued that quality traits encompass physical appearance, cooking and sensory properties and, more recently, nutritional value (Fitzgerald *et al.* 2009). On the other hand, Meilgaard and others used the descriptive sensory analysis tool to characterize and analytically measure aroma, flavor, and texture (Meilgaard *et al.* 1999).

According to various studies, physical appearance or search attributes are the most important quality trait. Search attributes can be verified easily prior to purchasing by actual inspection of the goods like price, quality, dimension, size, color, style, safety, warranty, etc. For rice grain, it is a combination of length-width, uniform shape, color, chalk, and aroma (Figure 2).

**Length and width ratio:** The finesse of rice is dependent on the ratio of length and width. According to ISO classification based on length-width ratio, there are four main classes of milled rice available, namely slender ( $>3.0$ ), medium (2.1-3.0), bold (1.1-2.0) and round ( $<1.0$ ). Though the preferences of consumers tend to vary from one geography to another the extra-long grains like Basmati rice is relished throughout India and abroad. And the longer grains (e.g., *Basmati* etc) is synonymous to premium category and most sought-after across a larger section of the society.

**Uniformity in shape:** Uniformity is one of the important traits. Grains with different shape mill differently, likely to retain moisture unevenly and thus cooked differently. The uniformity of rice grain, a sought-after quality, is directly proportional to its price.

**Colour:** The degree of whiteness of raw and cooked rice is one of the essential attributes among others (Suwansri *et al.* 2002). The whiteness ranges from white to yellow. The ageing of rice grain or the higher amount of protein content leads the yellowness in rice grain. One of the recent studies showed that the presence of yellow color in raw rice is significantly lower in premium varieties compared to their second-best counterparts (Champagne *et al.* 2010). On the

contrary, whiteness is suggestive of purity and finesse that renders higher acceptance among consumers. In contrast, black, purple or red rice entices a dedicated niche of eaters, e.g., black rice of Manipur (*Chakhao*) is regionally very famous.

**Chalkiness:** Another important appearance trait is chalk, the opaque area of the grain, that cause grains to break during polishing<sup>5</sup> and decreases the quantity of edible rice. The presence of chalk reduces the overall market value of rice (Fitzgerald *et al.* 2009). The chalky part of rice grains is used for animal feed and used as an ingredient for the brewery industry. However, it also finds its use in mouth-watering dishes like *Khuder Bhat* (broken rice), prepared with

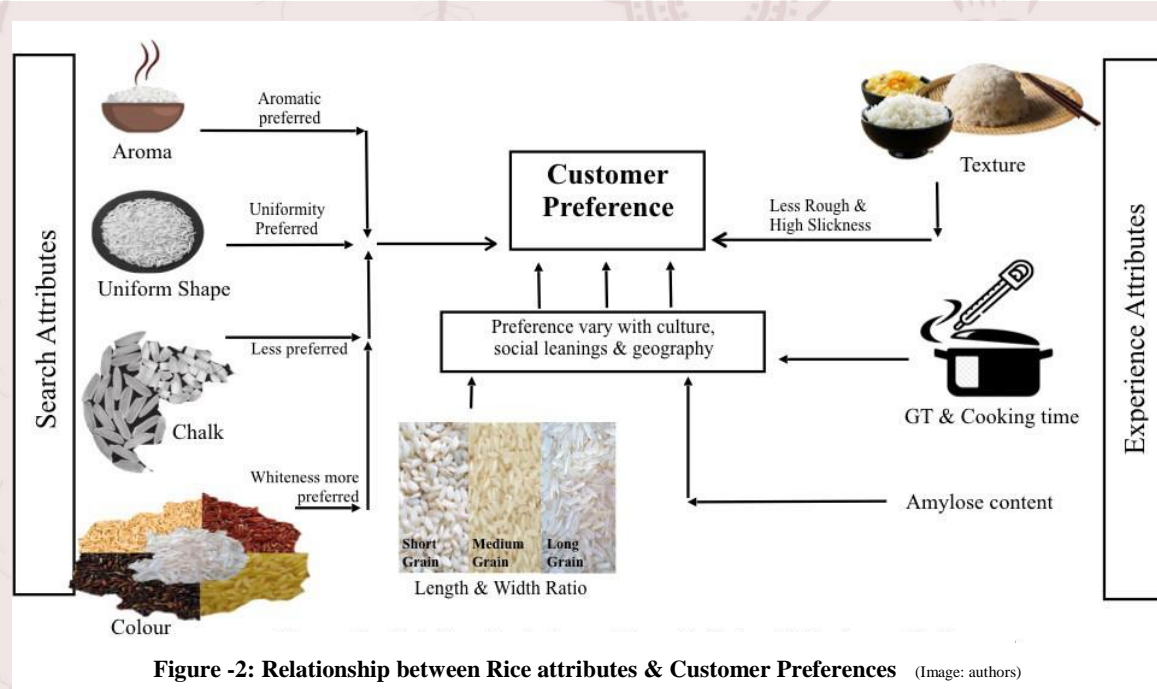


Figure -2: Relationship between Rice attributes & Customer Preferences (Image: authors)

broken rice grains in West Bengal and Bangladesh.

**Aroma:** The aromatic rice is deeply embedded in human cultural tradition and history. Researchers pointed out that the aroma of rice is one of the important traits that not only determines its market price but also marks its identity (Fitzgerald *et al.* 2009). One recent study supported the fact that aromatic rice varieties tend to fetch a higher market price than non-aromatic rice (Calingacion *et al.* 2014). Consumers are often lured by differing aroma intensity of the rice varieties and precedence is often laid on the strongly aromatic ones. There are many local landraces famous in their respective regions, e.g., *Gobindobhog* from West Bengal, *Joha* from Assam, *Chakhao* from Manipur, *Gandhaksale* or *Gandhasale* from Karnataka. Those traditional varieties are often used on special occasions, during sacred ceremonies and also in sweet-dish preparation at households. Talk about aroma, *Basmati* pops up in our mind; indeed, *Basmati* may be an iconic one, but there are many other folk varieties that may compete with *Basmati* in terms of aroma, e.g., *Swarnolata*, *Radhunipagol* and so many short grain aromatic rice locally or regionally appreciated in India or Bangladesh (Chakraborty *et al.* 2016).

Now, the second set of drivers are eating and cooking qualities of the rice grain, such as amylose content, texture, gelatinization temperature and cooking time. Together, these traits are also known as experience attributes - cannot be perceived prior to the trial or use of the product (Nelson 1970) and these determine consumers' repeat purchase behavior (Cuevas *et*



al. 2016). Repeat purchases are mostly based on the routine, past experience, and habitual buying decisions.

*Amylose content:* It strongly influences the cooking qualities and eating experience of rice. According to amylose content, the grains are classified as waxy or sticky (0-2%), very low (3%-9%), low (10%-19%) intermediate (20%-25%), or high (25%>) (Fitzgerald *et al.* 2009). Grains with high amylose content cook firm, dry, and non-sticky whereas one with low amylose content is quite soft and sticky. The stickiness largely governs the acceptance level of cooked rice among rice-eaters with different cultural background. Generally, less-sticky cooked rice is preferred in South Asia, e.g., in India, Sri Lanka, and Bangladesh whereas the east and south-east Asians prefer sticky or waxy rice. Moreover, there are other extreme kinds of hard or thick rice, *Kerala Matta or Palakkadan Matta rice* or red parboiled rice, cherished throughout the Western Coast of India.

*Gelatinization (GT) and cooking time:* Quite related to amylose content is GT, it is the temperature at which the starch begins to melt and ranges between 55<sup>0</sup> C – 85<sup>0</sup>C (Tan and Corke 2002). The GT for the soft or waxy rice is low and thus takes less time to cook.

*Texture:* It describes what consumers feel during eating rice like mouth-fullness, roughness, slickness, etc. Champagne and co-researchers (2010) have found that slickness or smoothness is higher in premium variety than other types. It has also shown that slickness is negatively correlated with protein and amylose content of the rice quality.

The ongoing discussion urges to consider that fact that the traits or attributes of the rice grain are a directive force to shape the market value and thus play a critical role in the selection of a variety (Fitzgerald *et al.* 2009). In other words, it suggests that the rice quality attributes and consumer choice is intricately related (Figure 2), i.e., divergent consumers' needs mean more rice types.

This essentially brings us to a very important dimension of agricultural diversity where consumer choice is a major player in the game. Diverse choice embraced grains, vegetables, fruits, and other crops of different colors, shapes, sizes, palatability, storability for various necessities and thereby creating, utilizing, nurturing, and conserving the diversity. Divergent consumer choice is rooted in their ethnicity, cultural preference and identity, taste inclination, socio-economic status, cooking and other qualities. The choice not only drives a variety of rice grains to be available in the market place but also keeps the agricultural cycle rolling. Simply put, more the consumers prefer certain types of grains farmers would be more likely to produce the same type; given this demand cycle, these act in a positive feedback loop with the choice-influencing production in various manner. Here, rice with its enormous diversity and the vast spatial limit is a good example to demonstrate how various factors acted in tandem to generate such a huge diversity.

A few examples would depict, on one hand, the stories where the choice of specific group fostered cultivation of a set of traditional rice landraces at a regional scale, thus cultivating and conserving the same. Literature abounds with examples of many local or regional landraces which are appreciated at a relatively smaller part and that have not been globalized, e.g., *Joha*, a group of aromatic short-grain rice of Assam or the various *Balam* rice of Barisal; they have been much-desired items on the plate of rice-eaters. On the other hand, there are also stories of decline, when strong advocacy and fierce marketing have promoted a few specific kinds at the cost of countless existent varieties and caused a significant drop in folk rice diversity. We are

talking about the Green Revolution that underlies the huge loss of folk rice diversity in the south and south-east Asian countries. Prior to the Green Revolution, a great diversity of folk rice dominated rice eater's world. During the invasion of the Green Revolution, various high yielding and resource-hungry varieties commenced flooding the market, they were heavily subsidized by government and farmers were wooed or coerced to grow HYVs only that eventually replaced a majority of heirloom landraces in the field as well as on the plate (Pretty 1995).

Altogether, it says propensity of consumers or eaters has been a divisive force though underappreciated in the genesis of agricultural biodiversity. Here, we strive to draw a relatively simpler picture to depict their role in agro-biodiversity but the actual context is far more complex than laid out in this narrative, e.g., how and to what extent consumer preference has shaped our food diversity or agricultural biodiversity across a local, regional or global scale over time? Is multifarious consumer choice a common driver that nurtured the variety of crops we grow? Had it acted in a similar manner in the past? Were all the crops subjected to it in a similar manner or it has been contingent on the economic importance of the specific crop? How did other factors act in harmony to influence the outcome? And so on. These few representative questions would be the missing links for our future discourse.

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