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Improving food security in Asia through consumer-focused rice breeding



Marie Claire Custodio*, Matty Demont, Alice Laborte, Jhoanne Ynion

International Rice Research Institute (IRRI), Los Baños, Laguna, Philippines

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ABSTRACT

Public rice breeding plays a crucial role in food security in Asia, but it is often supply-focused. Consumer-focused rice breeding incorporates consumer preferences in varietal development and benefits (i) consumers by fostering availability of affordable rice with characteristics that meet their food preferences, and (ii) farmers by facilitating market access and enabling them to capture consumer surplus. We review historical evidence and survey urban consumers across 24 cities in seven Asian countries to assess heterogeneity and trends of consumer preferences for intrinsic attributes of rice. We conclude that to improve food security in Asia, public rice breeding programs should incorporate widely preferred attributes such as softness in Southeast Asia and slenderness in South Asia, while considering geographic heterogeneity and specificity of preferences.

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1. Introduction

Since the seventies, the concept of food security has evolved from a predominant focus on supply to a multi-dimensional construct. The initial focus, reflecting the global concerns of 1974, was on the volume and stability of food supplies. Food security was defined in the 1974 World Food Summit as “availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices” (FAO, 1996). Twenty years later, food security was defined to “exist(s) when people, at all times, have physical, social or economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life” (FAO, 1996).

In this article, we focus on “preference-matching” as a component of food security and define it as “physical and economic access to a diversity of food options that enables consumers to match their food choice to their preferences.” We limit our study to intrinsic attributes or grain quality that can be upgraded and tailored to urban consumers through rice breeding. Attributes are product characteristics which can be classified as intrinsic or extrinsic. Color, cleanliness, purity, grain shape and size, grain homogeneity (i. e. uniformity in size, shape, head rice recovery), aroma, taste, and volume expansion are examples of intrinsic attributes of rice

while packaging, labeling, branding, reputation and information are extrinsic attributes (Demont and Ndour, 2013).

The importance of preference-matching in a food security context is best understood by looking at situations in which access to diversity is denied, e. g. in the case of import bans. In South Korea, for example, a desire to achieve national food self-sufficiency in the 1970s led the government to ban rice imports and impose on farmers the involuntary adoption of *Tong-il* rice, a high yielding hybrid with inferior sensory characteristics compared to traditional varieties (Kim and Sumner, 2005). Although this policy helped the country in achieving self-sufficiency by 1976, it came at the expense of consumers, who were denied access to varieties with sensory attributes that matched their preferences. After political power turn-over in 1980, planting of *Tong-il* was eventually discontinued due to a lack of effective consumer demand.

This example illustrates the role of physical access to consumers’ preferred food as a component of food security. But even when consumers are physically able to access their preferred food, their economic access may be hampered if the food is too expensive and they cannot afford it. For example, governments may invest in the development and affordability of food crops with higher productivity that do not necessarily match consumer preferences, while underinvesting in “orphan” crops or food with certain quality characteristics valued by consumers. Therefore, consumer preferences should be considered in policy efforts to increase food security; otherwise these may turn out to be unsustainable.

* Corresponding author.

E-mail address: m.custodio@irri.org (M.C. Custodio).

Public rice breeding has mostly focused on sufficiency of supply, which may have constrained varietal adoption by farmers and impact on their livelihood (Baroña-Edra, 2013), probably due to the initial emphasis of food security in addressing supply constraints. But the definition has evolved and this should be reflected in the goals and priorities in public rice breeding, which is at the basis of food security in many rice consuming countries in Asia. Therefore, preference-matching has become a crucial ingredient in the new breeding approach of the International Rice Research Institute (IRRI) (Baroña-Edra, 2013) and in strategies for rice value chain upgrading (Demont and Ndour, 2015). Better targeting of varieties to consumers allows better optimization of use of limited breeding funds by developing varieties that more effectively increase farmers' livelihood and hence reducing resources spent on varieties with less likelihood of adoption due to lack of demand and price discounts. Such endeavor entails incorporating consumer preferences on a broad scale, market segments and dynamics.

Evaluating consumer preferences is not without challenges. A recent assessment of preferred rice quality characteristics conducted by grain quality experts across the world, for example, uncovered a large diversity and specificity of consumer preferences, identifying at least 18 unique quality trait combinations of physical and biochemical characteristics (Calingacion et al., 2014). In this article, we combine historical evidence from the literature with new evidence from a

multi-country survey conducted in major urban zones to unravel trends in consumer preferences for intrinsic attributes of rice to support rice breeding priorities in selected countries in Southeast Asia (Philippines, Indonesia, Thailand, Vietnam, and Cambodia) and South Asia (Bangladesh and India).

Urban consumers in Asia spend more on food than rural consumers due to higher income (Reardon and Timmer, 2014) and given rapid urbanization trends currently occurring in Asia, urban consumption zones provide important market opportunities for rice farmers to tap into if they manage to get the quality right.

2. Historical trends in consumer preferences

We review global, regional and national studies on consumer preferences for rice conducted in selected countries in Southeast Asia (SEA) and South Asia (SA) throughout three decades (Unnevehr, 1986; Choudhury, 1991; several chapters in Unnevehr et al., 1992; Juliano and Villareal, 1993; Rachmat et al., 2006; Calingacion et al., 2014; Hossain et al., 2015). Different sampling schemes and methods in data collection were used in these studies. Hedonic price analysis was mostly conducted to analyze determinants of price under the assumption that preferences for rice quality are revealed by consumers through the

Table 1
Historical trends in consumers' preferred rice characteristics in selected countries in South and Southeast Asia.

	1980 s ^a	1990 s ^b	2000s–2010 s ^c
Philippines	Softer and stickier (intermediate AC); slender grains; white, translucent; short cooking time; high head rice recovery <i>Urban consumers in Metro Manila:</i> soft (low to intermediate AC); short grains; short cooking time; high head rice recovery; minimal impurities	Softer and stickier (intermediate AC); medium size-medium shape; short cooking time	Softer and stickier (intermediate AC); long-slimmer grains; aromatic; short cooking time (low to intermediate GT)
Indonesia	Softer and stickier (intermediate AC); medium shape; white; short cooking time; high head rice recovery <i>Jakarta:</i> soft/more sticky <i>Medan:</i> soft <i>Ujung Pandang:</i> hard-cooked	<i>Java:</i> smooth texture (<i>pulen</i>) with intermediate AC (softer and stickier) <i>West & North Sumatra:</i> easily separating, high AC (firm and dry) with hard texture (<i>pera</i>); medium size-medium shape	Softer and stickier (intermediate AC); medium-slimmer grains <i>West Java:</i> softer and stickier (intermediate AC); long and slender grains <i>West and Central Java:</i> aromatic
Thailand	Softer and stickier (intermediate AC); slender grains; white; aromatic; high head rice recovery <i>Non-glutinous rice:</i> soft (low to intermediate AC); long grains; translucent grains (not chalky); aromatic; high head rice recovery; <i>Glutinous rice:</i> high head rice recovery	Long-slimmer grains; translucent grains <i>Northeast region:</i> quite soft and sticky (low AC) <i>Northern region:</i> waxy or sticky texture <i>Central region:</i> softer and stickier (intermediate AC)	Long-slimmer grains; aromatic; short cooking time <i>North & Northeast:</i> waxy or sticky texture; <i>Other regions:</i> low to high AC (quite soft and sticky to firm and dry)
Vietnam		Softer and stickier (intermediate AC); short size-medium shape grains (traditional varieties)	Long grains; aromatic <i>Southern region:</i> quite soft and sticky (low AC) <i>Other regions:</i> softer and stickier (intermediate AC)
Cambodia		Softer and sticky (intermediate AC); medium size-medium shape; short cooking time	Quite soft and sticky (low AC); long-slimmer grains; aromatic; short cooking time
India		Medium size-medium shape <i>Basmati consuming regions:</i> softer and stickier (intermediate AC) <i>Other regions:</i> firm and dry (high AC) <i>Parboiled rice:</i> Hard texture; translucency; high head rice recovery	Softer and stickier (intermediate AC) to firm and dry (high AC); size varies by location (short, medium, extra-long); shape varies by location (mainly slender and medium-slimmer); <i>Basmati in Punjab and Haryana:</i> extra-long grains and aromatic
Bangladesh	<i>Parboiled rice:</i> firm and dry (high AC); slender; short cooking time; high head rice recovery	<i>Parboiled rice:</i> firm and dry (high AC); short size-medium-shaped grains	Firm and dry (high AC); medium-slimmer grains; fine grains

Note: The grain quality terms used are adopted from IRRI's (2015) Rice Knowledge Bank.

Sources:

^a Unnevehr (1986), Abansi et al. (1992), Choudhury et al. (1992), Damardjati and Oka (1992), Sriswasdilek et al. (1992);

^b Choudhury (1991), Juliano and Villareal (1993);

^c Rachmat et al. (2006), Calingacion et al. (2014), Hossain et al. (2015).

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