THE EMPIRICAL RELATIONSHIP BETWEEN PRICE AND QUALITY OF RICE AT MARKET LEVEL IN WEST JAVA

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ABSTRACT

Rice consumers in Indonesia exhibit wide preference variability and consumption patterns, largely because of the archipelagic nature of the country. Nowadays, the consumers become more discriminating on the rice quality due to the higher incomes and better life. Consumers are willing to pay higher price for specific quality. The objective of the study was to analyze relationship between price and grades of rice and consumer preference. The study was based on survey conducted from April 2004 to March 2005 at three-rice market centers representing a village market (Pasar Inpres) in Subang, district capital market (Pasar Johar) in Karawang, and rice center market (Pasar Induk Cipinang) in Jakarta, respectively. Parameters evaluated were changes in the quality and price of rice over time. The quality of the rice at each market was sampled monthly from two traders consisting three samples each. The rice quality was graded using existing local standar, i.e. grade 1, grade 2, and grade 3, and the price of each grade was recorded. The physical qualities of the rice samples such as moisture content, grain dimensions, percentage of whole kernels, grain color, and impurities/dockage (foreign matters, unhulled grains, and milled rice) were determined by ISO 950:1979 (for cereals-sampling as grain). Whereas the chemical qualities such as amylose and gelatinization were analyzed using Rapid Visco Analisis. The study showed that rice quality varied, most of them were long and slender kernels, chalkiness ranged between 10-20% (scale 5), and head rice around 69-84%. The amylose content was intermediate (20-21%), the gelatinization temperature was high-intermediate (70-74°C), and the gel consistency was soft (65-70). The quality incentive, defined as the additional return assuming the quality level can be raised from grade 3 to grade 1, was up to Rp700 kg^{-1} (~25%). The price difference among markets could reach Rp630 kg^{-1} (~22%). The study indicated that rice color was the important parameter determining consumers' preference, and consequently ditermining price difference. The correlation between the rice price and its grade was significant (R= 0.95).

[*Keywords:* Rice, price, quality, consumers]

INTRODUCTION

As population improves purchasing power, their staple food tends to shift from roots, tubers, plan- tains and bananas to cereals, and later on from rice and corn to wheat product with higher fat content. In Japan, Korea, Taiwan and China, the efforts are being made to offset the declining consumption of rice food products by developing new value-added and con- venience rice foods. Developed countries also in- crease the importance of improving rice quality, packaging, and marketing to improve competitiveness in exporting countries (Yap 1996).

Although the importance of rice as a staple food tends to decline with economic growth, the demand for rice will increase in coming years, especially because of population growth. The world demand for rice has been projected to increase by at least 150 million tons in 2025, an increase of about 26% rela- tive to the production level of 580 million tons in 2002 (Sombilla 2004). To meet this challenge, continued growth in rice productivity is the key to meet the demand for more rice, and to solve the increasing problem of poverty in Asia. Moreover, high product- ivity in the rice sector will benefit the poor directly or indirectly due to production, employment, and income increase (De Datta 1981).

Rice consumers in Indonesia exhibit wide preference variability and consumption patterns, largely because of the archipelagic nature of the country (Toquero 1991). Consumers in Medan and Makassar, for example, prefer non-sticky cooked rice, while consumers in Java prefer sticky and soft-cooked rice. Poor rural Indonesians who live in the upland rainfed areas eat more non-rice staples such as corn, cassava and sweet potato, while people in the lowland wet areas consume more rice because of higher availability.

Damardjati and Oka (1989) evaluated consumer preference for rice in three big cities in Indonesia such as Medan, Makassar, and Jakarta. They con- cluded that consumer preferences for specific quality of rice varied widely. Their result also showed that the physicochemical characteristics observed affected quality and price of rice.

Nowadays, consumers have become more discriminating in terms of rice quality due to higher incomes and better life quality. Indonesian rice consumers are now willing to pay higher price for better quality desired. These imply requirement of technology generation for better quality and better distribution system for wider consumers. Inappropriate technologies, unsuitable management techniques, and lack of knowledge on grain harvesting, drying, storage, and milling often result in quality deterioration and low market price of rice. Rice quality deterioration can be in the form of high damaged and yellow grain, incomplete milling, discoloration, impurities or undesirable odors or taste (Bell and Dawe 1998; Bakker *at al*. 2001).

Historically, research on rice quality improvement has largely focused on the genetic plant improvement and partial effect of component technologies on qualitative changes in the grain. So far, research on grain quality management throughout the entire postharvest system has taken a backseat (Bell *et al*. 2000). It is therefore important to consider the entire postharvest systems and its various players as a system. The characteristics of such a program are that all research activities should take on a systems-based approach. Research should be focused on the entire postharvest system rather than on single component technologies. In addition, collaboration with the private companies involved in rice processing or manufacturing must be considered as a legitimate beneficiary of public sector research (Rickman *et al*. 2000). Better market information for rice producers will assist them in making better decisions to produce appropriate rice qualities and maximize their returns. The objective of the study was to evaluate the quality of rice in three different markets and analyze price quality relation-ship over time in each market.

MATERIALS AND METHODS

The research included surveys to monitor the change in price and quality of rice over time at three rice market centers, i.e. a rice center market "Pasar Induk Cipinang" in Jakarta, a district capital market "Pasar Johar" in Karawang, West Java, and a village market "Pasar Inpres" in Subang, West Java. The study was conducted in April 2004 to March 2005.

Rice samples (0.5 kg) were collected monthly from two traders of the three markets each. The rice quality was graded using existing local srandard, i.e. grade 1, grade 2 and grade 3 and the prices for each grade was recorded. Information on the variety, quality grades, and the prices of each sample was collected.

Physical quality of the samples was analyzed at the Karawang Postharvest Laboratory of the Indonesian Center for Agricultural Postharvest Research and Development (ICAPRD). Physical quality components were determined by ISO 950:1979 (for cereals-sampling as grain). Moisture content was measured by gravitational air oven method (130°C; 100 g sample; 16 hours), grain dimensions (length/width) by Vernier caliper (20 rice kernels), percentage of whole kernels by grain grader, grain color by chromameter, and impurities/dockage by selecting the weight of foreign matters, unhulled grains and milled rice.

The chemical quality of the samples was analyzed at the Rice Chemical Laboratory of International Rice Research Institute (IRRI), Los Banos-Philippines. The amylose content was measured by simplified iodine colometric procedure (20 grain kernels were selected and ground in the UDY Cyclone Mill) and the samples were categorized as low, intermediate and high. Gelatinization temperature was measured using the alkali-spreading value and continued by Rapid Visco Analysis (RVA).

The data on prices of rice versus time were collected monthly based on the information from the traders. Price fluctuation over the time was drawn to determine the trend.

RESULTS AND DISCUSSION

Determinants of Quality in Rice Markets

The major determinants found in the rice markets for the grades are head rice, discoloration, and moisture content as mentioned in Table 1.
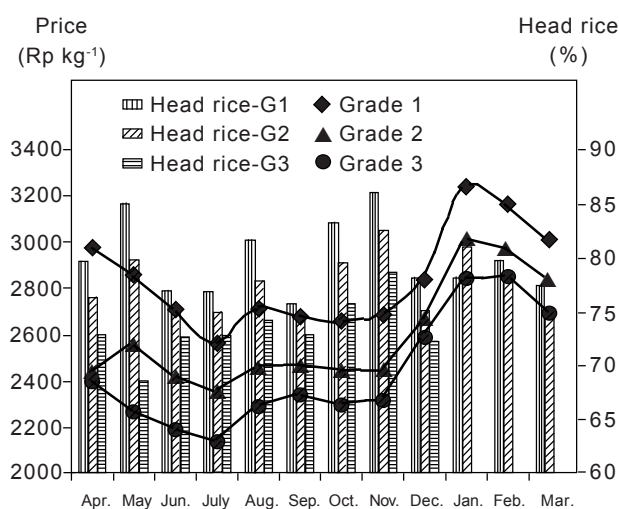
Head Rice

Rice qualities at the three-rice market centers in Subang, Karawang, and Jakarta fluctuated according to the time of sampling. The head rice percentage, grade, and price of the rice at the three-market centers are closely related; the higher the percentage the higher the price (Fig. 1). Grade of the rice in the three markets were classified into grade 1, 2, and 3 of the Indonesian National Standard (SNI 01-6128-1999) (Table 2). However, rice grades found in ordinary markets are lower, i.e. grade 3 or 4.

Patterns of rice price of different grades (grade 1, 2, and 3) in the three markets were different. At the district capital market in Karawang, the highest price was for the grade 1, i.e. Rp3250 kg^{-1} and the lowest

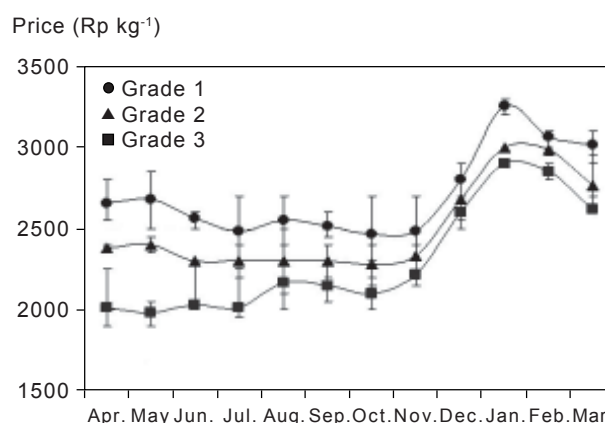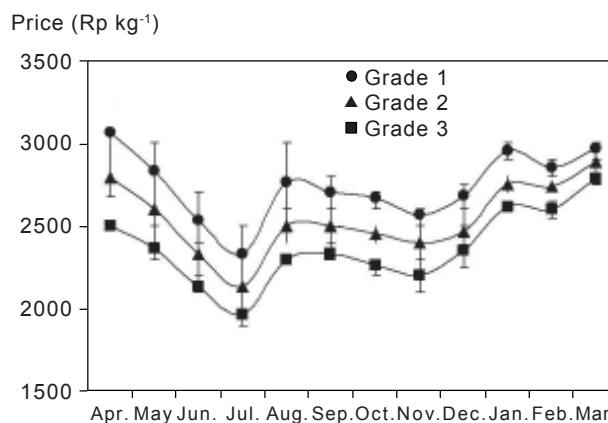**Table 1. Major components of rice qualities at the three market centers in Subang, Karawang, and Jakarta.**

Type of market	Locations	Components of rice quality				
		Moisture content	Color	Head rice	Damage kernels	Broken rice
Center market	Pasar Induk Cipinang, Jakarta	✓	✓	✓	✓	✓
District capital market	Pasar Johar, Karawang	✓	✓	✓	✓	✓
Village market	Pasar Inpres, Subang	✓	x	✓	✓	x

Fig. 1. Relationship between price and head rice for each grade at three-rice market center in Subang, Karawang, and Jakarta, 2004-2005

Table 2. Rice grade based on Indonesian National Standard 01-6128-1999.

Component	Grade				
	1	2	3	4	5
Milling degree (%)	100	100	100	>95	>85
Moisture content (%)	14	14	14	14	15
Head rice (%)	100	>95	>84	>73	>60

Fig. 2. Milled rice prices at the distric capital market of Pasar Johar, in Karawang, 2004-2005.

Fig. 3. Milled rice prices at the village market of Pasar Inpres in Subang, 2004-2005.

was for the grade 3, i.e. Rp1900 kg^{-1}. The maximum annual difference of the rice price was Rp1150 kg^{-1} for grade 1 and the minimum annual difference was Rp900 kg^{-1} for the grade 3 (Fig. 2).

In the village market of Pasar Inpres in Subang, the highest price of the grade 1 was Rp3300 kg^{-1} while the lowest was for grade 3, i.e. Rp1900 kg^{-1} (Fig 3). The maximum annual difference of the rice price was Rp1117 kg^{-1} for grade 1 and the minimum annual difference was Rp900 kg^{-1} for grade 2.

In the rice market center of Cipinang in Jakarta, the maximum price for grade 1 was Rp3800 kg^{-1} while the minimum price of grade 3 was Rp2000 kg^{-1} (Fig. 4). The maximum annual difference of the price was Rp1400 kg^{-1} for grade 2 and the minimum annual difference was Rp1200 kg^{-1} for grade 3.
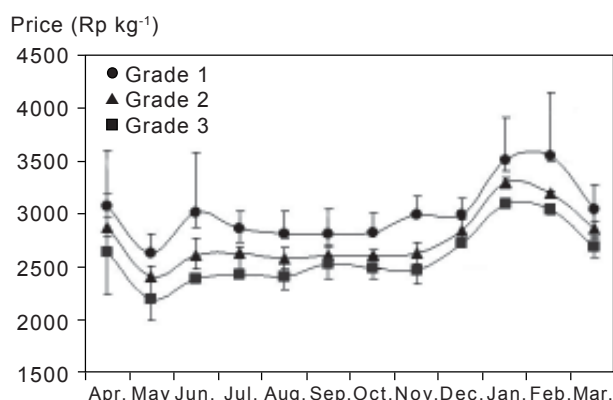
Price (Rp kg^{-1})

Fig. 4. Milled rice prices at rice center market of Cipinang, Jakarta, 2004-2005.
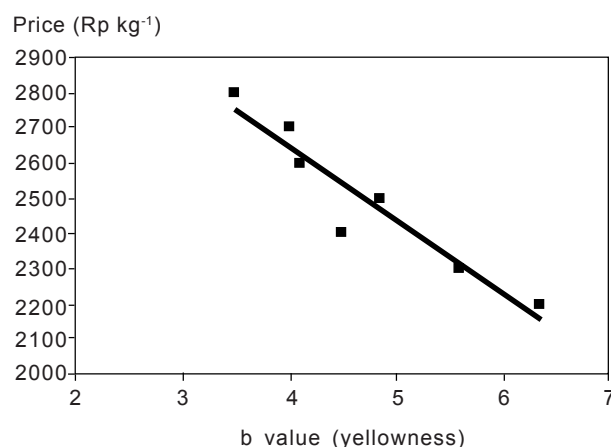
Price (Rp kg^{-1})

Fig. 5. Relationship between the yellowness (b value) of rice kernel and rice price at the three-rice market centers in Subang, Karawang, and Jakarta.

Discoloration

Rice consumers believe that the most easiest indicators of the rice quality was discoloration. In this survey, the discoloration was the common view between the rice traders and consumers that the yellowness color of the rice kernel indicated the value of the rice. In the trader side, there was a strong correlation (r = 0.95) between the price and the grade of rice as shown in Figure 5.

Price Difference at Different Markets

Information on the rice price differences in the village and district capital of Java is important especially for the rice traders in the center market of Pasar Induk in Jakarta because it will assist them a basis rice price and indication to where the rice will be distributed and sold. For example, the price difference among markets for rice grade 1 was Rp630 kg^{-1} or 22% (Fig. 6). The rice price differences between Cipinang and Karawang markets were highly fluctuated. The largest difference was in November coincided with lowest stock availability held both by farmers and in the markets due to the beginning of planting season.

The quality incentive defined as an additional return gained from increasing the quality level of rice from grade 3 to grade 1 is shown in Figure 7. The gaps between the grade and prices could potentially be an additional profit for farmers or traders who make quality improvement of rice. The graph showed that the maximum difference between grade 1 and grade 3 was Rp700 kg^{-1} or 25%.

Chemical Quality

The range of amylose percentage of all rice grades ranged between 20.7 and 21.4% (Table 3). Based on Juliano (2003), the amylose percentage of the rice was intermediate (containing 20-25%). Most consumers preferred rice with intermediate amylose content.

The gelatinization temperature of the rice sampled was classified as high to intermediate which meant that the temperature required for normal cooking time was 75-79°C. While the gel consistency of the rice sampled was 65-70 mm and it was categoried as soft which means the tendency of cooked rice to be soft on cooling.

The size of rice sampled was long (scale 3) and the shape was 1 meant it was categorized as slender (L/W more than 3), whereas the chalkiness (floury appearance) was 5 meant 10-20% area was with chalkiness (Table 4). Excessive chalkiness lowered the grades and reduced milling recovery.

The amylogram of the rice sampled from Subang, Cipinang, and Karawang markets indicated that the rice grade 1 in Karawang and Subang had the lowest amylose content than the rice grades 2 and 3. The grade 3 of rice at Cipinang market was the lowest amylose content than other grades.

The study recommends that producers and traders may increase their returns if new marketing channels (e.g. by selling to higher price markets) can be accessed. Through better postharvest technology and management, producers and processors can get higher returns if they can improve the quality.
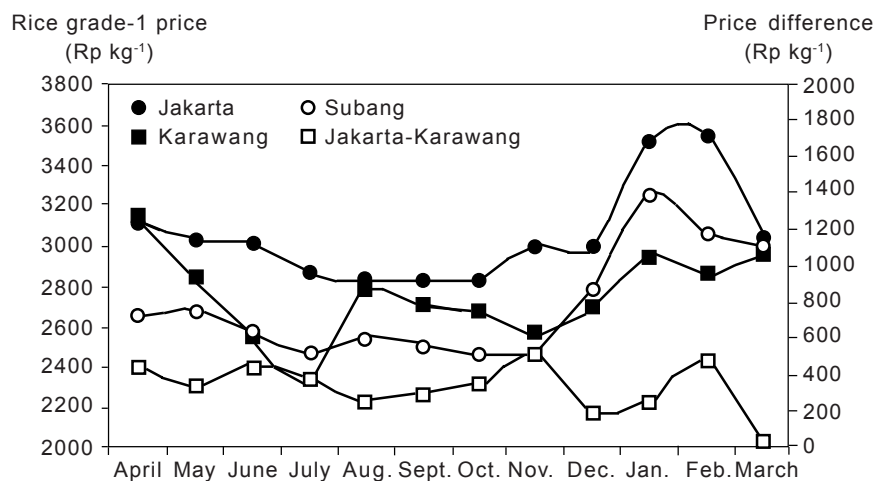
Fig. 6. Diference of rice price at the center market at Cipinang in Jakarta, the district capital market in Karawang, and village market in Subang, 2004-2005.
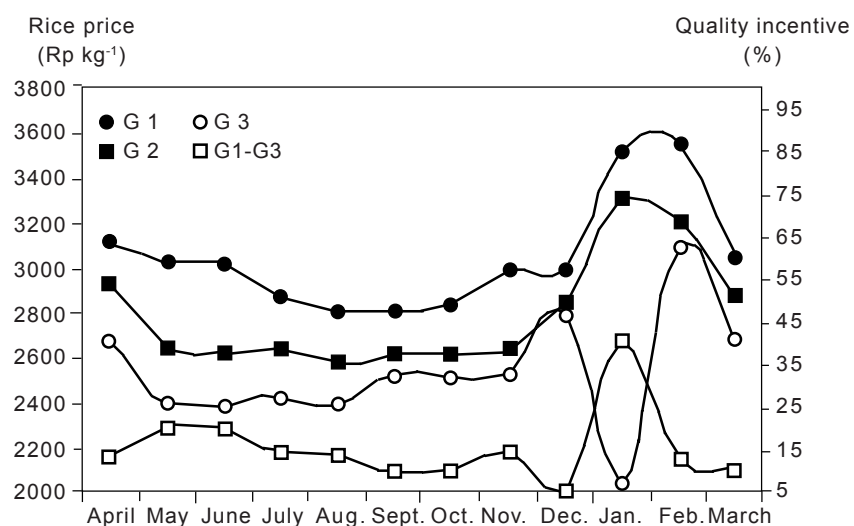

Fig. 7. Potential quality incentive by improvement of rice quality.

Table 3. Gelatinization properties of rice grade 1, 2, and 3 at market level.

Size classification			Amylose content classification	
Scale	Size category	Length (mm)	Class	Percent
1	Very long	>7.50	Waxy	0-2%
3	Long	6.61-7.50	Very low	3-9%
5	Medium	5.51-6.50	Low	10-19%
7	Short	<5.50	Intermediate	20-25%
			High	>25%

Shape classification			Gelatinization temperature	
Scale	Shape	Length/width	Class	Temperature (°C)
1	Slender	>3.0	Low	55-69
5	Medium	2.1-3.0	Intermediate	70-74
9	Bold	<2.0	High	>74

Source: Juliano (2003)

Table 4. Chemical characteristics of rice grade 1, 2, and 3 at the three-rice market centers in Subang, Karawang, and Jakarta, April 2004-March 2005.

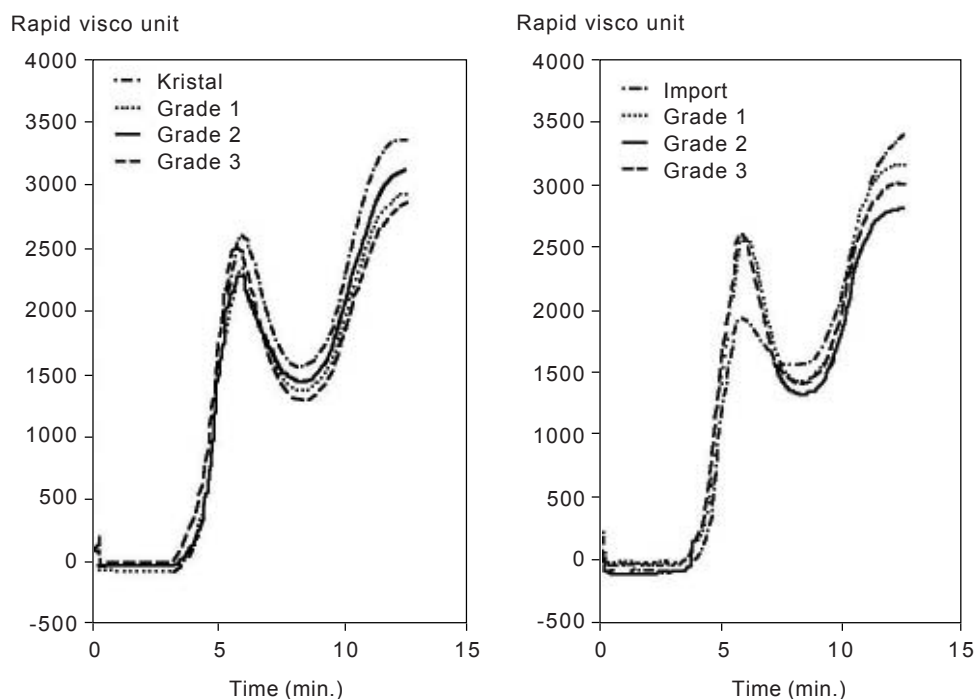| Grade	% amylose	Gelatinization temperature	Gelatinization consistency	Size	Shape	Chalkiness
1	20.7	HI/I	65	3	1	5
2	21.4	HI/I	70	3	1	5
3	21.2	HI/I	65	3	1	5

Note: HI = high, I = intermediate

Fig. 8. Amylogram of milled rice samples from the center market of cipinang in Jakarta (left) and village market in Subang (right) using Rapid Visco Analysis.

CONCLUSION

There was a strong correlation (r = 0.95) between retail price and the grades of rice at the three market levels (village, district capital and center) in West Java. The current study showed that rice grade is dependent on the physical and chemical characteristics such as color, amylose content, percent of head rice, and foreign matter.

The grading system in the existing markets does not refer to the Indonesian National Standard. There is a positive trend between grades and head rice content; the higher the content of head rice the better the grade.

A higher price of better quality of rice is a potential benefit for an agent interested in rice quality improvement. Rice producers could gain more margins if they were able to manage seasonal price fluctuations by temporary storing the harvest during harvest season and gradually releasing it during the lag season.

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