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Physical, Milling, and Eating Quality of Local Rice from Yogyakarta Special Region

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***Abstract*— Yogyakarta Special Region is one of the provinces in Indonesia that is rich in local rice genetic resources. The purpose of this study is to examine the physical quality of grain, milling quality, and eating quality of eighteen local rice varieties from Yogyakarta Special Region. Grain samples were obtained from farmers in Yogyakarta Special Region. The results showed that the moisture content of rice and milled rice samples fulfilled the Indonesian National Standard (INS) (<14%). There were 5 varieties namely Jasmine, Srikuning, Rening, Similikiti, and Padi Merapi which fulfilled the requirement of class I INS grain (1993) in terms of the percentage of empty grain and green+chalky grain. The grain density of the eighteen local rice were 453-592 g /l, and the 1000 grain weight were 21,615-32,76 g. Seven varieties (Mentikputih, Srikuning, Mentiksusu, Kenanga, Cempo Putih, Lestari, Padi Merapi) fulfilled the requirements of medium 1 of INS (2015) milled rice based on the parameters of the percentage of head rice, broken rice, groats, green+chalky grain, and yellow+damaged grain. From eighteen samples, the whiteness degree of milled rice ranged from 37.1 to 57.9% while the transparency ranged between 1.13-3.56%, and the milling degree ranged from 80.5 to 143.5 Satake Milling Meter scales. Out of eighteen local rice varieties, panelists mainly preferred Menoreh Bercak Ungu, Pandanwangi, and Jasmine varieties based on the parameters of aroma, color, wholeness, shape, and cleanliness of milled rice. In general, panelists preferred the cooked rice from six varieties, namely Menoreh Bercak Ungu, Gandeng Melati, Pandanwangi, Merapi, Mentiksusu and Mentikwangi based on the parameters of aroma, color, transparency, texture, and taste. Overall, the rice and cooked rice most preferred by the panelists were Menoreh Bercak Ungu, followed by Pandan Wangi, Gading Mlati and Padi Merapi. A further study regarding the physicochemical properties of those varieties should be carried out to determine the texture of the cooked milled rice.**

Keywords: grain physical quality, rice milling quality, local varieties from Special Region of Yogyakarta

I. INTRODUCTION

At present, Indonesia is still dealing with the problems in achieving food security and stability. Food security covers four dimensions, namely food availability, access to sufficient food, stability of food stock and utilization of food that is related to cultural practices. Stability of food stock and utilization of food can be strengthened by utilizing local food resources including local rice varieties.

The Special Region of Yogyakarta is one of the provinces rich in local rice varieties. Local rice varieties are paddy that has long been adapted in certain areas so that the varieties have site-specific characteristics of the area. In 2014, there was an attempt to explore, collect, and compile local rice genetic resources in Yogyakarta Special Region although the results have not been recorded in the rice collection in Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development (ICABIOGRD). However, it was found out that there were around 68 germ plasm consisting of local rice varieties and glutinous rice grown by farmers in Yogyakarta[1].

Local rice variety, Segreng Handayani and Mandel Handayani have been released as new superior varieties from Gunung Kidul Regency in 2009. Then, in 2019, Sleman Regency has released Cempo Merah and Cempo Hitam as the new superior varieties alongside Sembada Merah and Sembada Hitam.

Rice quality is an important issue that must be considered in addition to high productivity. According to[2] rice quality could be classified into: 1) physical and milling quality, 2) flavor and cooking quality, and 3) nutritional quality. In general, the characteristics of rice quality are influenced by four main factors, namely: 1) genetic characteristics, 2) environmental and pre-harvest activities, 3) harvest treatment, and 4) post-harvest treatment. Each of these factors influences the characteristics of rice quality both dominantly and interchangeably. Cooking and flavor quality is largely determined by paddy genetic properties. Storage also influences the cooking and flavor quality of rice albeit moderately. The quality of grain can be evaluated by taking into account several properties including processing, physicochemical, sensory and nutritional properties. All these properties affect consumer preference and commercial

value of rice [3][4] [5]. Grain colour, size, shape, amylose content and gelatinization are essential physicochemical properties [6]. Rice can be classified as long-grain, short-grain or medium based on the length of rice grain[4][7].

Research on the quality of superior local postharvest rice in Yogyakarta is necessary to obtain information on the quality of local rice that in turns provide added value and increase the competitiveness of local rice in Yogyakarta. It is essential to obtain information on the physical characteristics of grain, physical and milling quality, and eating quality of milled rice. In addition, the results of the research can be used as baseline data on the character of genetic resources in producing new superior varieties. Furthermore, it provides beneficial information for farmers and rice producers who prefer rice with high production, high milled rice yields, and good quality. Therefore, this study aimed to assess the physical quality, milling quality, and eating quality of superior local rice from Special Region of Yogyakarta.

II. METHOD

The study was conducted at the Indonesian Center for Rice Research (ICRR) laboratory in 2016 in Sukamandi, West Java. The research materials consisting of eighteen local rice varieties were obtained from farmers in Yogyakarta. Each sample consisted of + 1 kg grain from each rice variety. Clean dry grains were peeled using a rice husker machine (Satake THU 35A). Then, the brown rice was milled with a rice polisher machine (Satake TM-05). The characterization of samples encompassed the physical properties of grain, and physical and milling quality of milled rice.

Grain physical quality is determined based on moisture content, grain density, 1000-grain weight, empty+dirty grain, green+chalky grain, and yellow+damaged grain. More specifically, physical traits of grain include the length and shape of rice, whiteness degree, translucency, and milling degree (Satake Milling Meter Scale).

Analysis of the milling quality of milled rice includes the yield of brown rice (BR), the yield of milled rice (MR), the percentage of head rice, the percentage of broken rice, the percentage of groats, the percentage of green+chalky grain, the percentage of yellow+ damaged grain and red grain [7]. Preference assessment is made on each milled rice and cooked rice in a hedonic scale (preference) with a score of 1 = very like; 2 = like; 3 = medium; 4 = dislike; 5 = very dislike [8] modified). The parameters of milled rice preference are aroma, color, shape/size, wholeness, cleanliness, and the overall rice quality. Meanwhile, the parameters of cooked rice preference are aroma, color, luster, texture, taste, and the overall rice quality.

The data were analyzed using analysis of variance (anova) test followed by a Duncan Multiple Range Test (DMRT) if there were differences. The SPSS 14.0 software was used for the test. The data are presented in the form of averages + standard deviations. The preference assessment data are presented in a descriptive style.

III. RESULTS

A. Grain physical quality

II. The physical quality of local rice grain from Specific Region of Yogyakarta which consists of moisture content, empty grain, grain density, 1000-grain weight, green+chalky, yellow+damaged, and red grain are presented in Table 1 and Table 2.

TABLE I. THE MOISTURE CONTENT, EMPTY GRAIN, GRAIN DENSITY, AND 1000-GRAIN WEIGHT OF LOCAL RICE VARIETIES FROM SPECIFIC REGION OF YOGYAKARTA

No	Varieties	Moisture Content (%)	Empty+Dirty Grain (%)	Density (g/l)	1000-grain weight (g)
1	Menur	11.40±0.00 c	0.41±0.02 h	592.00±0.00 a	22.41±0.02 ghi
2	Jasmine	10.45±0.00 e	0.82±0.01 gh	491.50±0.10 o	21.72±0.02 hi
3	Mentik Putih	12.70±0.00 a	0.65±0.03 gh	530.00±0.00 g	24.84±0.13 5 ef
4	Srikuning	12.45±0.00 a	0.59±0.08 gh	517.50±0.00 i	25.52± 0.30 de
5	Mentik Susu	12.60±0.00 a	1.10f±0.06 gh	510.50±0.00 k	21.62±0.22 i
6	Kenanga	10.45±0.00 e	2.82±0.02 bcd	533.00±0.40 e	22.73±0.01 gh
7	Cempo Putih	12.65±0.00 a	1.59±0.01 efg	535.50±0.00 c	24.29±0.02 f
8	Hoing Batang Biru	11.10±0.00cd	3.6±0.04 b	504.00±0.00 l	22.17±0.04 ghi
9	Lestari	9.72± 0.03 g	2.76±0.03bcd	512.00±0.00 j	32.76±0.02 a
10	Pandan Wangi	10.70±0.00 e	1.87±0.01 def	537.00± 0.00 b	26.07±0.34 d
11	Mayangan	10.50±0.00 e	6.07±0.04 a	430.5±0.10 r	22.58±0.24 ghi
12	Gading Mlati	11.85±0.02 b	3.08±0.04 bc	526.00±0.00 h	25.84±0.05 d
13	Menoreh Bercak Ungu	10.05±0,00 f	2.6±0.06 cd	534.50±0.03 d	26.36±0.03 d
14	Rening	11.40±0.00 c	0.24±0.01 h	503.00±0.00 m	22.82±0.02 g
15	Pangestu	10.70±0.00 e	2.25±0.01 cde	532.00±0.00 f	23.93±0.03 f
16	Similikiti	11.85±0.00 b	0.63±0.01 gh	497.50±0.10 n	28.79±0.13 b
17	Selendang Biru	8.85±0.03 h	1.25±0.04 fgh	453.00±0.00 q	27.61±0.22 c
18	Padi Merapi	10.80± 0.00 de	0.43± 0.01 h	480.00±0.00 p	27.83±0.05 c

The number in the same column followed by the same letter is not significantly different.

The moisture content of all varieties ranged from 8.85+0.03% (Selendang Biru) to 12.70+0.00 % (Mentik Putih). The percentage of empty+dirty grain of all samples ranged fromto 0.24+0.01 (Rening) to 6.07+0.04 (Mayangan). The grain density of all local rice samples ranged from 430.5 + 0.10 (Mayangan) to 592.0 + 0.00 g / l (Menur). The 1000-grain weight of all samples ranged from 21.62 + 0.22 (Mentiksusu) to 32.76 + 0.02 g (Lestari) (Table 1).

TABLE II. THE GREEN+CHALKY, YELLOW+DAMAGED, AND RED GRAIN OF LOCAL RICE VARIETIES FROM SPECIFIC REGION OF YOGYAKARTA

No	Varieties	Green+Chalky Grain (%)	Yellow+Damaged Grain (%)	Red Grain (%)
1	Menur	6.10±0.09a	2.34±0.37 d	0.00±0.00 b
2	Jasmine	0.24±0.05 ef	27.82±0.29 a	1.18±0.03 b
3	Mentik Putih	1.20±0.03 bc	13.83±0.09 bcd	0.00±0.00 b
4	Srikuning	0.21±0.04 ef	12.34±0.05 bcd	0.02±0.01 b
5	Mentik Susu	1.64±0.01 b	7.72±0.02 bcd	1.62±0.01 b
6	Kenanga	1.70± 0.02 b	3.97±0.01 bcd	0.00±0.00 b
7	Cempo Putih	0.09±0.02 f	10.18±0.03 bcd	0.00±0.00 b
8	Hoing Batang Biru	0.70±0.01 cdef	4.26±0.22 bcd	0.00±0.00 b
9	Lestari	1.16±0.01 bcd	3.68±0.18 cd	0.00±0.00 b
10	Pandan Wangi	0.15±0.01ef	4.35±0.11 bcd	4.62±0.04 b
11	Mayangan	1.53±0.02 b	5.95±0.08 bcd	43.15±0.09 a
12	Gading Mlati	0.19±0.03 ef	17.29±1.04 ab	0.00±0.00 b
13	Menoreh Bercak Ungu	0.08±0.01 f	4.65±0.05 bcd	0.48±0.03 b
14	Rening	0.49±0.05 def	4.04±0.07 bcd	0.00±0.00 b
15	Pangestu	0.62±0.01 cdef	7.33±0.05 bcd	0.14±0.01 b
16	Similikiti	0.06±0.01 f	17.1±0.08 abc	0.2±0.01 b
17	Selendang Biru	0.81±0.02 cde	6.07±0.02 bcd	1.14±0.02 b
18	Padi Merapi	0.74+0.03 cdef	13.7±0.04 bcd	0.06±0.01 b

The number in the same column followed by the same letter is not significantly different.

The percentage of green+chalky grain from the 18 samples ranged from 0.06 + 0.01 (Similikiti) to 6.10 + 0.09 (Menur). The percentage of yellow+damaged grain from the 18 samples ranged from 4.04+0.07 (Rening) to 17.29+1.04 (Gading Mlati). The percentage of red grain from the 18 samples ranged from 0.00+0.00 (Menur, Mentik Putih, Kenanga, Cempo Putih, Hoing Batang Biru, Lestari, Gading Mlati dan Rening) to 43.15+0.09 (Mayangan) (Table 2).

A. Physical and milling quality of milled rice

TABLE III. THE LENGTH, WIDTH, AND SHAPE OF LOCAL RICE VARIETIES FROM SPECIFIC REGION OF YOGYAKARTA

No	Varieties	Length	Width	Ratio L/W (Shape/Size)
1	Menur	5.66±0.02 j	2.58±0.01 ef	2.20±0.01 gh
2	Jasmine	7.30±0.04 b	2.27±0.01 k	3.21±0.02 a
3	Mentik Putih	5.79±0.02 i	2.70±0.01 c	2.55±0.01 h
4	Srikuning	6.71±0.02 e	2.42±0.01 i	2.77±0.01 b
5	Mentik Susu	5.89±0.02 hi	2.51±0.01 gh	2.45±0.01 e
6	Kenanga	5.98±0.01 h	2.64±0.01 de	2.27±0.01 f
7	Cempo Putih	6.57±0.01 f	2.34±0.03 j	2.81±0.02 b
8	Hoing Batang Biru	5.52±0.01 k	2.57±0.01 fg	2.16±0.01h
9	Lestari	7.13±0.03 c	2.22±0.02 kl	3.22±0.02 a
10	Pandan Wangi	7.00±0.02 d	2.85±0.01 b	2.46±0.01 d
11	Mayangan	6.73± 0.04 e	2.41±0.01 i	2.83±0.02 b
12	Gading Mlati	6.11±0.03 g	2.20±0.02 l	2.78±0.01 b
13	Menoreh Bercak Ungu	5.77±0.01 ij	2.04±0.01 m	2.83±0.01 b
14	Rening	5.85±0.01 i	2.46±0.01 hi	2.39±0.02 e
15	Pangestu	6.78±0.02 e	3.01±0.02 a	2.25±0.03 fg
16	Similikiti	6.94±0.03d	2.66±0.02 cd	2.62±0.01 c
17	Selendang Biru	6.22±0.04 g	2.24±0.01 kl	2.79±0.02 b
18	Padi Merapi	7.49±0.05 a	3.05±0.01 a	2.49±0.01 d

The number in same column followed by the same letter is not significantly different.

The physical quality of milled rice which consist of length, width, shape/size, whiteness degree, transparency, milling degree are presented in Table 3 and Table 4. The grain length of 18 samples ranged from 5.52±0.01 (Hoing Batang Biru) to 7.49±0.05 (Padi Merapi). The shape or size length of 18 samples ranged from 2.16±0.01 (Hoing Batang Biru) to 3.21±0.02 (Jasmine) (Table 3).

TABLE IV.THE WHITENESS DEGREE, TRANSLUCENCY, AND MILLING DEGREE OF LOCAL VARIETIES FROM SPECIFIC REGION OF YOGYAKARTA

No	Varieties	Whiteness Degree (%)	Transparancy (%)	Milling Degree
1	Menur	57.90±0.20 a	3.50±0.06 a	181.00±2.50 a
2	Jasmine	47.25±0.35 g	3.35±0.02 b	131.50±2.88 e
3	Mentik Putih	42.10±0.40 j	3.13±0.02 c	107.00± 1.95 i
4	Srikuning	43.50±0.15 i	2.74±0.03 de	110.50±1.60 hi
5	Mentik Susu	47.40±0.20fg	1.42±0.01 j	123.00±3.20 g
6	Kenanga	51.80±1.00 c	2.03±0.01 gh	142.50±2.45 cd
7	Cempo Putih	41.30±0.80 k	2.25±0.01 f	97.00±3.20 j
8	Hoing Batang Biru	44.60±0.50 h	1.84±0.03 hi	110.00±2.60 hi
9	Lestari	41.85±0.20 jk	3.22±0.08 b	106.00±0.35 i
10	Pandan Wangi	43.09±0.20 hi	2.03±0.05 gh	108.00±2.90 hi
11	Mayangan	47.80±0.10 fg	1.81±0.08 i	124.00±0.85 g
12	Gading Mlati	37.10±0.90 l	2.56±0.04 e	80.50±3.40 k
13	Menoreh Bercak Ungu	43.70±0.40 i	2.79±0.03 d	112.00±4.00 h
14	Rening	50.80±0,72 d	2.09+0.02 f	139.00±2.60 d
15	Pangestu	48.60±0.30 e	1.13±0.06 k	130.00±2.60 ef
16	Similikiti	51.90±0.10 c	1.24±0.05 jk	143.50±2.10 c
17	Selendang Biru	48.10±0.40 ef	0.29±0.04 l	126.00±3.50 fg
18	Padi Merapi	56.80±0.60 b	1.44±0.02 j	165.00±2.90 b

The number in the same column followed by the same letter is not significantly different.

The whiteness degree of 18 samples ranged from 37.10+0.90 (Gading Mlati) to 57.90+0.20 (Menur). The transparency of the 18 samples ranged from 0.29+0.04 l (Selendang Biru) to 3.50+0.06 (Menur). The milling degree of all local rice samples ranged from 107.00+ 1.95 (Mentik Putih) to 181.00+2.50 (Menur) (Table 4).

TABLE V. THE PERCENTAGE OF MOISTURE CONTENT, YIELD OF BROWN RICE (BR), YIELD OF MILLED RICE (MR) AND HEAD RICE OF LOCAL VARIETIES FROM SPECIFIC REGION OF YOGYAKARTA

No	Varieties	Moisture Content (%)	Yield of Brown Rice (BR) (%)	Yield of Milled Rice (MR) (%)	Head Rice (%)
1	Menur	10.35±0.00 e	76.62±0.08 b	63.61±0.09 f	74.92±0.94 f
2	Jasmine	10.35±0.00 e	72.82±0.06 gh	62.57±0.14 g	78.41±0.56 de
3	Mentik Putih	11.55±0.00 c	72.63±0.04 gh	62.34±0.10 gh	91.67±0.05 a
4	Srikuning	12.30±0.01 b	74.27±0.02 f	64.11±0.08 f	91.17±0.10 a
5	Mentik Susu	12.8±0.00 a	75.37±0.05 de	66.36±0.06 cde	80.00±0.16 d
6	Kenanga	10.75±0.00 d	75.56±0.05 de	66.67±0.04 cd	80.34±0.12 d
7	Cempo Putih	12.10±0.01 b	73.94±0.12 f	66.13±0.09 de	88.98±0.90 b
8	Hoing Batang Biru	11.00±0.01 d	76.39±0.06 b	68.4±0.06 b	63.6±0.75 i
9	Lestari	10.15±0.02 e	78.53±0.04 a	70.25±0.06 a	89.93±0.60 ab
10	Pandan Wangi	10.35±0.00 e	74.97±0.02 e	66.19±0.06 e	28.59±0.04 k
11	Mayangan	10.7±0.00 d	72.21±0.04 hi	61.62±0.06 i	70.24±0.45 g
12	Gading Mlati	11.7±0.02 c	73.02±0.03 g	64.22±0.21 f	67.53±0.15 h
13	Menoreh Bercak Ungu	9.75±0.01 f	74.33±0.02 f	66.175±0.04 de	48.37±0.70 j
14	Rening	10.20±0.04 e	75.98±0.14 bcd	66.96±0.02 c	62.10±0.45 i
15	Pangestu	10.15±0.03 e	78.31±0.10 a	68.65±0.08 b	76.53±0.25 ef
16	Similikiti	11.45±0.02 c	71.72±0.03 i	61.79±0.06 hi	70.86±0,38 g
17	Selendang Biru	8.90±0.00 g	65.95±0.02 j	57.06±0.09 j	26.05±0.08 l
18	Padi Merapi	10.9±0.00 d	76.17±0.07 bc	65.88±0.07 e	83.41±0.09 c

The number in same column followed by the same letter is not significantly different.

The milling quality of milled rice which consists of moisture content, yield of brown rice (BR), yield of milled rice (MR), head rice, broken rice, groats, green+chalky grain, yellow+damaged grain are presented in Table 5 and Table 6. The moisture content of all local rice samples were less than 14%. The yield of brown rice of all local rice samples ranged from 65.95+0.02 % (Selendang Biru) to 78.31+0.10 % (Pangestu). The yield of milled rice of all local rice samples ranged from 57.06+0.09 % (Selendang Biru) to 70.25+0.06 % (Lestari). The percentage of head rice of all samples ranged from 26.05+0.08 % (Selendang Biru) to 91.67+0.05 % (Mentik Putih) (Table 5).

TABLE VI. THE PERCENTAGE OF BROKEN GRAIN, GROATS, GREEN+CHALKY GRAIN, YELLOW+DAMAGED GRAIN OF LOCAL RICE VARIETIES FROM SPECIAL REGION OF YOGYAKARTA

No	Varieties	Broken Grain (%)	Groats (%)	Green+Chalky Grain (%)	Yellow+Damaged Grain (%)
1	Menur	23.95±0.70 h	1.14±0.02 def	0.49±0.21cb	0.09±0.15 k
2	Jasmine	20.23±0.62 i	1.37±0.01 de	0.02±0.08 d	1.99±0.12 fg
3	Mentik Putih	7.37±0.15 m	0.97±0.03 efg	0.05±0.09 d	5.78±0.10 c
4	Srikuning	8.58±0.15 lm	0.26±0.02 i	0.01±0.00 d	6.17±0.08 b
5	Mentik Susu	19.22±0. 12 i	0.78±0.04 fgh	0.27±0.01 c	2.20±0.06 f
6	Kenanga	18.83±0.10 i	0.84±0.02 fgh	0.79±0.07 a	0.63±0.12 j
7	Cempo Putih	10.54±0.12 k	0.48±0.01 hi	0.00±0.00 d	3.92±0.20 d
8	Hoing Batang Biru	35.06±0.32 d	1.34±0.01 de	0.00±0.00 d	0.78±0.32 j
9	Lestari	9.57±0.26 kl	0.51±0.03 ghi	0.02±0.00 d	0.64±0.22 j
10	Pandan Wangi	66.59±0.10 a	4.83±0.02 b	0.01±0.00 d	0.74±0.08 j
11	Mayangan	29.28±0.10 f	0.48±0.03 hi	0.44±0.02 b	1.75±0.12 gh
12	Gading Mlati	30.96±0.18 e	1.51±0.02 d	0.00±0.00 d	8.39±0.24 a
13	Menoreh Bercak Ungu	52.22±0.16 b	0.92±0.01 efgh	0.00±0.00 d	1.25±0.06 i
14	Rening	37.04±0.52 c	0.86±0.01 fgh	0.01±0.00 d	0.78±0.02 j
15	Pangestu	22.52±0.42 h	0.96±0.02 efgh	0.09±0.01 d	1.58±0.02 h
16	Similikiti	26.95±0.30 g	2.20±0.03 c	0.00±0.00 d	6.06±0.10 bc
17	Selendang Biru	66.4±0.24 a	7.55±0.02 a	0.05±0.00 d	2.09±0.08 f
18	Padi Merapi	15.56±0.12j	1.03+0.02 ef	0.00±0.00 d	3.30±0.12 e

The number in the same column followed by the same letter is not significantly different.

Mentik Putih has the lowest percentage of broken rice (7.37+0.15 %) while Pandan Wangi has the highest percentage of broken rice (66.59+0.10 %). Srikuning has the lowest percentage of groats (0.26+0.02 %) while Selendang Biru has the highest percentage of groats (7.55+0.02 %). The percentage of green+chalky grain of all local rice samples ranged from 0.01+0.00% (Srikuning) to 0.79+0.07% (Kenanga). The percentage of yellow+damaged grain of all local rice samples ranged from 0.09+0.15 (Menur) to 8.39+0.24 % (Gading Mlati) (Table 6).

C. Eating quality

The panelists' preferences for milled rice and cooked rice of local rice from Yogyakarta Special Region are presented in Table 7 and Table 8. In general, panelists' preference towards milled and cooked rice was influenced by several parameters including aroma, color, wholeness, shape/size, and cleanliness, luster, texture, and taste.

TABLE VII. PANELISTS' PREFERENCE FOR LOCAL RICE VARIETIES FROM YOGYAKARTA SPECIAL REGION

No	Varieties	Aroma (%)	Color (%)	Wholeness (%)	Shape/ Size (%)	Cleanliness (%)	Overall (%)
1	Menur	26.66	56.66	16.66	26.66	60.00	46.66
2	Jasmine	60.00	50.00	46.66	56.70	43.33	50.00
3	Mentik Putih	36.66	19.99	19.99	30.00	19.90	16.66
4	Srikuning	26.7	16.70	16.70	26.70	23.33	20.00
5	Mentik Susu	46.66	36.66	23.33	33.33	36.66	33.33
6	Kenanga	30.00	30.00	16.70	20.00	50.00	20.00
7	Cempo Putih	36.66	19.99	19.99	30.00	19.99	16.66
8	Hoing Batang Biru	9.99	0.00	46.66	36.66	9.99	0.00
9	Lestari	6.70	0.00	36.70	46.70	10.00	13.30
10	Pandan Wangi	60.00	60.00	30.00	33.33	50.00	53.33
11	Mayangan	13.33	0.00	6.66	9.99	3.33	3.33
12	Gading Mlati	60.00	56.66	43.33	46.70	53.33	50.00
13	Menoreh Bercak Ungu	69.99	56.66	23.33	60.00	60.00	60.00
14	Rening	33.33	19.99	19.99	30.00	19.90	16.66
15	Pangestu	43.33	56.66	16.66	43.33	50.00	46.66
16	Similikiti	3.33	0.00	3.33	6.70	0.00	3.33
17	Selendang Biru	6.66	3.33	3.33	6.66	0.00	0.00
18	Padi Merapi	19.99	46.66	33.33	43.33	36.66	39.99

The aroma of Menoreh Bercak Ungu rice was the most preferred followed by Jasmine, Pandan Wangi and Gading Mlati. In terms of color, Pandan Wangi rice was the most preferred followed by Menur, Gading Mlati, Menoreh Bercak Ungu, and Pangestu rice. In terms of wholeness, Jasmine and Hoing Batang Biru rice were the most preferred.

Menoreh Bercak Ungu rice was the most preferred in terms of the shape/size. Menur and Menoreh Bercak Ungu rice were the most preferred in terms of cleanliness (Table 7).

TABEL VIII.PANELISTS PREFERENCE FOR COOKED RICE OF LOCAL RICE VARIETIES FROM YOGYAKARTA SPECIAL REGION

No	Varieties	Aroma (%)	Color (%)	Luster (%)	Texture (%)	Taste (%)	Overall (%)
1	Menur	16.66	56.66	43.33	9.99	0.00	6.66
2	Jasmine	33.33	53.33	40.00	46.70	43.33	43.33
3	Mentik Putih	23.33	53.33	23.33	26.66	16.66	19.99
4	Srikuning	36.70	20.00	26.70	23.30	43.30	31.00
5	Mentik Susu	63.33	66.66	39.99	43.33	43.33	53.33
6	Kenanga	23.33	66.66	50.00	46.70	33.30	43.33
7	Cempo Putih	23.33	53.33	23.33	26.66	16.66	19.99
8	Hoing Batang Biru	23.33	9.99	13.33	26.66	26.66	16.66
9	Lestari	16.70	36.70	30.00	36.70	30.00	30.00
10	Pandan Wangi	66.66	60.00	36.66	63.33	66.66	69.99
11	Mayangan	6.66	16.66	13.33	16.66	19.99	13.33
12	Gading Mlati	70.00	63.30	43.30	60.00	53.30	69,99
13	Menoreh Bercak Ungu	73.33	76.66	76.66	50.00	63.33	79.99
14	Rening	23.33	53.33	23.33	30.00	16.66	19.99
15	Pangestu	46.66	53.33	39.99	39.99	23.33	50.00
16	Similikiti	23.30	33.30	30.00	36.70	30.00	30.00
17	Selendang Biru	19.99	9.99	13.33	16.66	19.99	9.99
18	Padi Merapi	66.60	60.00	50.00	56.66	69.99	69.99

The aroma of Menoreh Bercak Ungu cooked rice was the most preferred followed by Pandan Wangi rice. In terms of color, Menoreh Bercak Ungu cooked rice was the most preferred followed by Mentik Susu and Kenanga. The luster of Menoreh Bercak Ungu cooked rice was the most preferred while in terms of texture and taste, Pandan Wangi cooked rice was the most preferred (Table 8).

IV. DISCUSSION

A. Grain physical quality

There were significant differences in moisture content, percentage of empty+dirty grain, grain density and 1000-grain weight between the samples in Table 1. This was influenced by environmental conditions of planting and post-harvest handling. When compared with Indonesian National Standard (INS) 0224-1987 / SPI-TN / 01/01/1993 [9] concerning rice grain quality, the moisture content of all samples have met the requirements which was below 14%. Moisture content is the ratio between the weight of moisture in the sample and the initial weight of the sample. The moisture content of grain is very influential in the milling process. Grain with high moisture content or more than 14% are too soft thus prone to breakage. On the other hand, grain with less than 14% or equal to 14% is stronger and unlikely cracked when milled. In addition, high moisture content enables microorganisms to multiply, causing decay during storage. The different conditions at harvest time and drying process influence the level of moisture content. Reducing moisture content can slow down the occurrence of various chemical reactions and prevent the growth of microorganisms thus prolongs the shelf life of food [10].

Based on the percentage of empty+dirty grains, 7 samples fulfilled the requirements of class I which is 1% (maximum), 8 samples were considered as class II and class III (maximum 2%) and (maximum 3%), and the remaining 3 samples (Hoing Batang Biru, Mayangan, Gading Mlati) did not meet the requirements of class III. The percentage of empty+dirty grain of 19 promising lines of upland rice was 1.04-3.74% [11] while in other 30 promising lines of upland rice was 0.46-2.46% [12]. The percentage of empty+dirty grain of 4 local rice varieties from West Kalimantan was 3.30-6.41% [13]. The existing rice varieties in West Java have a percentage of empty+dirty grain at 2.45-10.00% [14]. The percentage of empty+dirty grain from the promising lines of salt tolerant rice ranged from 0.34 to 1.47% [15]. The percentage of empty+dirty grain of six lines of color rice was 0.56-2.46% [16], and in aromatic local rice was 1.02-17.12% [17].

The grain density of all local rice samples ranged from 430.5 + 0.10 (Mayangan) to 592.0 + 0.00 g / l (Menur) while grain density in Indonesia ranged from 454.4 to 577.0 g / l [18]. Grain density and 1000-grain weight affect the yield of milled rice (MR) and yield of brown rice (BR). The greater the grain density and the 1000-grain weight, the greater the production of yields of milled rice (MR) and yield of brown rice (BR) is. The grain density and 1000 grain weight of Aek Sibundong variety, a new superior red rice variety were 436.0 g / l and 27.64 g [19]. The 1000 grain weight of all samples ranged from 21.62 + 0.22 (Mentiksusu) to 32.76 + 0.02 g (Lestari). 1000-grain weight is the weight ratio of 1000 grains produced by a variety (Table 1). The 1000-grain weight in a variety is correlated with several other properties in crop productivity including panicle length and number of grains per panicle. Rice is said to have a high 1000-grain weight if its 1000-grain weight are over 30 g. On the other hand, it is considered as low if it is below 30 g. A practical application of 1000-grain weight is to determine the need for seed in one hectare land.

The grain density and 1000-grain weight from 19 promising lines of upland rice were 465.5-524.5 g / l and 21.23-27.84 g [11]; in 30 promising lines of upland rice were 422.5-548.5 g / l and 21.11-28.71 g [12]; in the local varieties from West

Kalimantan ranged between 552.5-565.0 g / l and 16.25-17.83 g [13]; in the existing rice varieties in West Java were 465-535.5 g / l and 25.40-28.32 g [14], in the promising salt tolerant rice were 465-578.5 g / l and 21.95-31.00 [15]; in the 6 promising lines of color rice ranged between 22.5-550.0 g / l and 21.86-27.31 g [16], Indonesian local rice varieties ranged between 429-586 g / l and 14.99-29.6 g (20); aromatic local rice varieties were 445-598.5 g / l and 17.29-30.49 [17].

Information about grain density is necessary in designing silos and grain storage containers. The difference in grain density parameters and 1000-grain weight can be caused by differences in environmental conditions during the process of filling grain and varieties [21]. The grain density of rice varieties in Indonesia were 454.4-577.0 g / l [18]. The goal of measuring grain density is to estimate the yield of milled rice. Previous study reported that 1000 grain-weight is a characteristic or inherited characteristic [22].

There were significant differences in the percentage of green+chalky grain, the percentage of yellow+damaged grain and red grain between the samples in Table 2. The percentage of green+chalky grain of 18 samples ranged from 0.06 + 0.01 (Similikiti) to 6.10 + 0.09 (Menur). A total of 11 samples met the requirements of class I (maximum 1%) in terms of the percentage of green+chalky grain. 5 samples fulfilled the requirements of class II (maximum 5%) while the rest (Menur) belonged to class III (maximum 10%) (Table 2).

The percentage of green+chalky grain of the promising lines of salt tolerant rice was 0.30-6.69%, [15]. The percentage of green+chalky grain of 30 promising lines of upland paddy was 0.03-2.27% [12], and in 19 promising lines of upland paddy was 0.13-2.10% [11]. The percentage of green+chalky grain of 6 promising lines of color rice were was 0.06-0.45% [16]. The percentage of green+chalky grain of local Indonesian rice was 0-1.47% [20] while in local aromatic rice varieties was 0.11-1.24% [17]. The existing rice varieties in West Java have a percentage of green+chalky grain at 0.06-2.47% [14]. The percentage of green+chalky grain of 4 local rice varieties from West Kalimantan was 0.27-1.54% [13].

Green+chalky grains or calcifying grains are kernels which are light green and chalky with soft texture caused by immature harvest, poor growth, or genetic factors. Green+chalky grains are not preferred by milling consumers because it will produce white chalk-like rice. In addition, green+chalky grains are easily damaged by pest thus the shelf life is low.

The percentage of yellow+damaged grain of 18 samples ranged from 4.04+0.07 (Rening) to 17.29+1.04 (Gading Mlati) (Table 2). A total of 7 samples met the requirements of class II (maximum 5%) based on the percentage of yellow+damaged grain, 2 samples (Selendang Biru and Mayangan) were considered as class III (maximum 7%), and the remaining 9 samples were excluded from class III (maximum 7 %) (Table2). The percentage of yellow+damaged grain of promising lines of salt tolerant rice was 0.21-4.55% [15]. The percentage of yellow+damaged grain of 30 promising lowland paddy lines was 0.0-4.39% [12], and and in 19 promising of lowland paddy lines rice between 1.08-11.50% [11]. The percentage of yellow+ damaged grain of 6 promising lines of color rice was 0.06-0.45% [16] whereas the percentage of yellow+damaged grain of local rice in Indonesia was 0-8.68% [20]. The percentage of local aromatic rice varieties was 0-6.24% [17]. The existing rice varieties in West Java have a percentage of yellow + damaged grain at 1.00-5.86% [14]. The percentage of yellow+damaged grain of 4 local rice varieties from West Kalimantan was 0.16-2.78% [13].

Yellow+damaged grains are brown rice which has pseudo-yellow to yellow outer layer. The change of color occurs during storage and other post-harvest processes. Grain yield that are not immediately dried will produce a lot of yellow grains especially in the rainy season. This occurs due to incomplete drying process of grain after harvest that causes fermentation, decay, or growth of fungi.

The percentage of red grain of 18 samples ranged from 0.00+0.00 (Menur, Mentik Putih, Kenanga, Cempo Putih, Hoing Batang Biru, Lestari, Gading Mlati dan Rening) to 43.15+0.09 (Mayangan).The percentage of red rice based on the red grain percentage in the 18 samples was as follows. 12 samples were considered as class 1 (maximum 1%), 4 samples met the requirements of class II (maximum 2%), and the remaining 2 samples (Pandanwangi and Mayangan) did not meet the requirements of class III (maximum 4%) (Table 2).

The red grain percentage of promising lines of salt tolerant paddy was 0.00-2.08% [15]. The red grain percentage of 30 promising lowland paddy lines was 0.00-1.41% [12] while in other 19 promising lowland paddy lines was 0.02-0.62% [11]. The percentage of red grain in 6 promising lines of color rice was 0-1.32% [16] while in local aromatic rice varieties was 0-6.24% [17]. The existing rice varieties in West Java have a percentage of red grain at 0.00-0.21% [14]. The red grain percentage of local rice varieties from West Kalimantan was 0.00-1.08% [13]. Red grains are whole rice grains, head rice, broken rice, and red groats that occur due to genetic factors.

B. Physical and milling quality of milled rice

The milled rice physical quality of the 18 samples can be seen in Table 3 and Table 4. The results of the statistical analysis showed differences in physical quality of rice including length, shape of rice, whiteness degree, translucency, and milling degree in all varieties (Table 3 and Table 4). [23] classifies the length of rice as follows: very long (> 7.5 mm), long (6.61-7.5 mm), medium (5.51-6.60 mm), and short (<5.50 mm). Based on the length classification, 8 samples included as long rice (Jasmine, Srikuning, Lestari, Pandanwangi, Mayangan, Pangestu, Similikiti, Padi Merapi), and the remaining 10 samples were medium rice (Menur, Mentik Putih, Mentik Susu, Kenanga, Cempo Putih, Hoing Batang Biru, Gading Mlati, Menoreh Bercak Ungu, Selendang Biru, and Rening) (Table 3).[24] reported that Mentikgrompol and Inpari 43 were considered as medium rice while Sembada Merah and Sembada Hitam were classified as long rice .

The International Rice Research Institute and Food and Agriculture Organization of the United Nations classify rice shape into 4 types: slender (> 3.0), medium (2.1-3.0), bold (1.1-2.0), and round (<= 1) [23]. In terms of rice shape, Jasmine and Lestari were considered as slender and the remaining sixteen were medium (Srikuning, Pandanwangi, Mayangan, Pangestu, Similikiti, Padi Merapi, Menur, Mentik Putih, Mentik Susu, Kenanga, Cempo Putih, Hoing Batang Biru, Gading Mlati, Menoreh Bercak Ungu, Selendang Biru, and Rening.

Another local paddy namely Mentikgrompol was considered as bold shape. Sembada Merah and Sembada Hitam were medium-shaped while Inpari 43 was classified as slender [24]. The length and shape of local rice from West Kalimantan were 5.43-7.04 mm and 2.64-3.86 (medium-slender) [13]. The length and shape of the 19 promising lines of lowland rice were 6.66-7.49 and 2.82-3.67 [11]. The length and shape of 30 promising lines of lowland rice were 5.49-7.70 mm and 2.06-3.60 [12]. Previous research reported that the length and shape of the promising lines of salt tolerant paddy were 5.72-8.83 mm and 2.10-4.27 [15]. In general, consumers prefer rice with long and slender grain shape. Shape, size, weight and uniformity of seeds are important factors in the rice industry. Long and slender rice is high in demand in the international market [25]. In addition, information on length and width ratios is needed in determining drying and processing equipment.

The range of whiteness degree of 18 local rice samples from DI Yogyakarta was 37.11 $\pm$ 0.90 (Gading Mlati) to 57.70 $\pm$ 0.20 (Menur) (Table 4). The whiteness degree of Mentikgrompol rice was 58%, and Inpari 43 was 36.30%[24]. The whiteness degrees of rice from local grain from West Kalimantan was 17.5-49.3% [13]. According to[26] the increase in whiteness degree is directly proportional to the length time of milling. Planting conditions and genetic factors are the main causes of the rice whiteness variations[22]. According to [18] whiteness degree is not always influenced by the level of rice translucency and the whiteness degree of rice in Indonesia ranged from 42-60%.

From 18 local rice samples that were analyzed, the range of rice translucency was 0.29 $\pm$ 0.04% (Selendang Biru) to 3.50 $\pm$ 0.06% (Menur) (Table 4). The translucency of Mentikgrompol rice was 2.61% while Inpari 43 was 2.42% [24]. The percentage of local rice translucency in West Kalimantan was 0.68-1.29% [13]. The translucency of rice is determined by genetic factors and milling method.

The milling degree of all local rice samples ranged from 80.50 + 3.40 (Gading Mlati) to 181.00 + 2.5 (Menur) based on the Satake Milling Meter scale (Table 4). The milling degree of Mentikgrompol rice was 175 Satake Milling Meter scale while the Inpari 43 was 76 Satake Milling Meter scale [24]. Milling degree is a scale to determine the intensity of grain milling. It indicates the level of bran removal (aleuron layer) during which rice is milled. The longer the grain milled, the higher the value of the embryo milling degree. Milling method also determines the whiteness degree of rice, the higher the whiteness degree the whiter the rice is. Consumers tend to choose whiter and cleaner rice rather than the opposite. In addition to the color of rice, the trait of milled rice that has a direct effect on consumer acceptance is transparency. High level of transparency indicates clearer rice. Rice consumers generally prefer clear and white milled rice.

There were significant differences in the percentage of moisture content, yield of brown rice, yield of milled rice, percentage of head rice (Table 5), percentage of broken rice, groats, green+chalky grain, yellow+damaged grain, and red grain (Table 6) in most samples. This is influenced by planting, environmental conditions, and postharvest handling. The moisture content of the 18 rice samples ranged from 8.90+0.00 (Selendang Biru) to 12.8+0.00 (Mentik Susu). The moisture content of all rice samples have met the INS milled rice requirements (6128: 2015) (maximum 14%) (Table 4).

Selendang Biru local rice has the lowest yield of brown rice (BR) and yield of milled rice (MR), at 65.95 + 0.02% and 57.06 + 0.09%. Lestari has the highest BR and MR yields, namely 78.53 + 0.04% and 70.25 + 0.06% respectively (Table 5). The higher the yield of MR, the higher the economic value of the varieties. The yield of brown rice ranged from 69.24% (Sembada Hitam) to 77.56 (Inpari 43), and the yield of milled rice ranged from 62,08% (Mentikgrompol) to 67,81 % (Inpari 43) [24]. The yield of BR and MR of 19 and 30 promising lines of lowland paddy were 76.89-80.10%, 64.93-69.90% [11], and 74.33-78.87 % and 64.24-72.12% respectively [12]. The yield of BR and MR of existing rice varieties in West Java amounted to 75.29-80.30% and 64.92-75.49% [14].

Another milling quality component that influences consumer acceptance is the percentage of head rice. Milled rice with high head rice levels is preferred by consumers rather than those that are low. Based on INS No.01-6128-2008, rice quality is divided into premium class, medium 1, medium 2, and medium 3 [27]. Based on the percentage of head rice, 9 samples met the requirements of medium 1 (minimum 78%), 2 samples belonged to medium 2 (minimum 73%), 4 samples were medium 3 (minimum 60%), and the remaining 3 samples (Pandanwangi, Menoreh Bercak Ungu and Similikiti) did not meet the requirements of medium 3 (minimum 60%). Head rice is good, healthy, or defective rice that has size greater than or equal to 0.80 parts of the average length of whole rice. Head rice is a component of physical quality of rice which directly affects the level of consumer acceptance [27].

Based on the percentage of broken rice, 7 samples met the requirements of medium 1 (maximum 20%), 3 samples were considered as medium 2 (maximum 25%), 2 samples belonged to medium 3 (maximum 35%), and the remaining 6 samples (Pandanwangi , Menoreh Bercak Ungu, Rening, Selendang Biru, Hoing Batang Biru, and Gading Mlati) did not meet medium 3 (maximum 35%). In contrast to the percentage of head rice, the level of consumer acceptance declined because high percentage of broken rice was undesirable. High percentage of broken rice and groats reduce the economic value of rice.

Broken grains are healthy and deformed rice grains that have a size smaller than 0.8 but greater than 0.2 of the average length of whole rice grains [27]. High percentage of broken

rice is mainly caused by high moisture content in dried paddy. The ruptured surfaces are easily attacked by both microorganisms and insects. Thus a high number of broken grain is more prone to pests attack.

The percentage of head rice and broken rice of 19 and 30 promising lines of lowland rice were 75.06-96.83% and 3.03-23.84%[11], and 56.63-96, 5% and 3.45-37.09% (12). The percentage of head rice and broken rice of the existing rice varieties in West Java was 42.00-94.93% and 4.95-37.79% [14].

Groats refer to broken rice grain, both healthy and defective which has a size smaller or equal to 0.20 parts of whole rice grains [27]. In terms of the percentage of groats, 15 samples met the requirements of medium 1 (maximum 2%), 2 samples were considered as medium 3 (maximum 5%), and 2 samples (Pandanwangi and Selendang Biru) did not meet the requirements of medium 3 (maximum 3%).

The percentage of chalky grain is another component of milling quality that determines consumer preferences. In Table 6, it can be seen that the percentage of chalky grain in all local rice samples fulfilled the requirements of medium 1 (maximum 2%). In general, consumers do not like milled rice with high level of chalky grain due to the fact that chalky grains are easily invested by pests during storage thereby reducing the storability of the rice. One of the factors of high chalky grain is less optimal harvest time which causes green rice grain and produces white-chalky rice.

Yellow+damaged grains are brown rice that is pseudo-yellow and/or yellow due to discoloration that occurs during processing. Analysis of yellow+damaged grains can be done directly by looking at the physical grain. Yellow grains have faded yellow or reddish color that indicates the presence of fungi on the outer layer. Yellowing is mainly caused by fermentation process, decay, and fungal growth [27] that occurs due to incomplete drying after harvest. The results of sample analysis showed that 10 samples met the requirements of medium 1 (maximum 2%), 2 samples fulfilled the requirements of medium 2 (maximum 3%), 2 samples belonged to medium 3 (maximum 5%), and the remaining four samples (Mentik Putih , Srikuning, Gading Mlati and Similikiti) did not meet the requirements of medium 3 (maximum 5%).

The percentage of groats, green+chalky grain, and yellow+damaged grain of 19 promising lines of lowland rice was 0.14-1.11%, 0.01-1.50%, and 0.10-7.40% respectively. [11]. Meanwhile, the percentage of groats, green+chalky grain, and yellow+damaged grain of 30 promising lines of lowland rice was 0.05-6.29%, 0.00-5.46%, and 0.09-2.76 % respectively [12]. The percentage of groats, green+chalky grain, and yellow+damaged grain of the existing rice varieties in West Java was 0.13-1.47%, 0.16-3.28%, and 0.53-2,10% respectively [14].

C. Eating quality

Table 7 shows the percentage of 30 panelists' preference towards local rice from Yogyakarta. The aroma of Menoreh rice was the most preferred (69.99%) followed by Jasmine, Pandan Wangi and Gading Mlati, each at 60%. In terms of color, the most preferred was Pandan Wangi (60%) followed by Menur, Gading Mlati, Menoreh Bercak Ungu and Pangestu, each at 56.66%. The wholeness of Jasmine and Hoing Batang Biru rice were the most preferred, each at 46.66%, followed by Lestari (36.70%). Then, regarding shape or size, the most liked was Menoreh Bercak Ungu (60.00%), followed by Jasmine (56.70%) and Gading Mlati (46.70%). Rice with the most preferred hygiene was Menur (60.00%), followed by Gading Mlati (53.33%) and Kenanga, Pandan Wangi and Pangestu, each at 50.00%. Based on the parameters of aroma, color, wholeness, shape / size, and cleanliness, the most preferred rice was Menoreh Bercak Ungu (60%), followed by Pandan Wangi (53.33%) then Jasmine and Gading Mlati each at 50%.

Table 8 shows the percentage of 30 panelists' preference towards cooked local rice from Yogyakarta. The aroma of Menoreh Bercak Ungu was the most preferred (73.33%) followed by Pandan Wangi and Padi Merapi (66.66%), and Mentik Susu (63.33%). In terms of color, the most preferred rice was Menoreh Bercak Ungu (76.66%) followed by Mentik Susu and Kenanga (66.66%), then Gading Mlati (63.30%). The luster of Menoreh Bercak Ungu was the most preferred (76.66%), followed by Kenanga and Padi Merapi, each at 50.00%. The most preferred cooked rice texture was Pandan Wangi (66.33%) and Gading Mlati (50.00%). The most preferred taste of cooked rice was Padi Merapi (69.99%) followed by Pandan Wangi (66.66%,) and Menoreh Bercak Ungu (63.33%). Based on the parameters of aroma, color, luster, texture and taste of cooked rice, the most preferred rice was Menoreh Bercak Ungu (79.99%), followed by Pandan Wangi, Gading Mlati, and Padi Merapi at 69.99 % respectively.

The preference of rice in three major cities in Indonesia namely Medan, Makassar and Jakarta has been evaluated [28]. They concluded that consumer preferences for rice quality varied greatly. Consumers in Medan and Makassar preferred hard cooked rice while consumers in Java liked soft and fluffy rice [29]. Respondents who owned rice mills and rice traders in Demak, Magelang, and Kebumen, Central Java had the same criteria for the quality of rice which was considered good such as the shape/size of rice, physical characteristics of rice (whiteness degree/milling degree, head rice, and moisture content), physicochemical characteristic of rice (texture), and physical appearance of rice [30].

Previous study reported that consumer preference towards rice was in general significantly affected only by amylose content and was not influenced by other parameters [20]. The whiteness degree of rice was significantly related to consumer preferences and was very significant based on luster and taste. The higher the value of the whiteness degree, the higher consumer's preference for rice in terms of color but the lower the level of preference based on luster and taste. Consumers in West Java did not choose rice based on whiteness degree while consumers in Yogyakarta did. In Central Java, consumers chose rice that is whiter than Ciherang variety while consumers in Banten and East Java chose rice with the same color as Ciherang [20].

Consumers in Malaysia considered the characteristics of the aroma, taste, and location of purchasing rice when choosing rice. In general, they preferred local white rice compared to imported rice [31]. Consumers in Brunei tended to like imported rice compared to local rice because of market availability and habitual factors inherited from their parents who always consume imported rice [32]. Nigerian residents preferred imported rice that is clean, long and slender in shape and enjoyed rice with medium to high amylose content [33].

V. CONCLUSION AND RECOMMENDATION

In terms of the percentage of empty grain and green+chalky grain, there were 5 varieties namely Jasmine, Srikuning, Rening, Similikiti, and Padi Merapi which fulfilled the requirements of class I INS grain (1993). The grain density of the eighteen local rice was 453-592 g /l while the 1000-grain weight was 21,615-32,76 g. Seven varieties (Mentikputih, Srikuning, Mentiksusu, Kenanga, Cempo Putih, Lestari, Padi Merapi) fulfilled the requirements of medium 1 of INS milled rice (2015) based on several parameters namely the percentage of head rice, broken rice, groats, green/chalky grain, and yellow/damaged grain. Out of eighteen samples, the whiteness degree of milled rice ranged from 37.1 to 57.9%, the transparency ranged between 1.13-3.56%, and the milling degrees ranged from 80.5 to 143.5 scales Satake Milling Meter. The most preferred milled rice and cooked rice were Menoreh Bercak Ungu, followed by Pandan Wangi, Gading Mlati and Padi Merapi. A further study regarding the physicochemical properties of those varieties should be carried out to determine the texture of the cooked milled rice.

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