Crops and consumer preferences of 20 local rice genetic resources of Yogyakarta, Indonesia

Kristamtini1*, S Widodo1, E W Wiranti1 and Sutarno1

1Assesment Institute for Agriculture Technology (AIAT) of Yogyakarta Jl. Stadion Maguwoharjo No. 22 Wedomartani, Ngemplak, Sleman, Yogyakarta, Indonesia

*Email: bptpyogya@yahoo.com

Abstract. The local genetic resources of rice was natural resources that need to be preserved from extinction. The aim of this research was to know the crop's preference and consumer preferences of 20 local rice of genetic resources from Yogyakarta. The study was conducted from July to October 2016 in Selomartani, Kalasan, Sleman, Yogyakarta, Indonesia. The research was conducted by planting 20 local rice genetic resources of repeated twice, using Integrated Crop management (ICM) with legowo planting system. Observations of plant performance included plant height, plant age, number of productive tillers, panicle length, leaf length, leaf width, grain amount of fill per panicle, 1000 grain weight and production. Data were analyzed using SAS software version 9. Consumer preferences for cropping are conducted directly with farmer, extension and related stakeholders' meetings on the level of consumer preference for agronomic cultivation of the local rice crops and to disseminate of specific local rice variety in Yogyakarta. Consumers/farmers meeting participants select the preferred local genetic resources of plant performance including age, plant height, number of tillers, panicles and production. Result of local rice consumers' preference in Yogyakarta by calculating frequency of emergence of local rice varieties selected and presented in histogram form. The results showed that the local rice varieties tested were found to differ according to the performance of the genetic potential of the Integrated Crop management (ICM) approach technology with legowo planting system. Three varieties of local rice farmers choice of crops with higher grain yield compared to Pandan Wangi (as a comparison) were “Mentiksusu”, “Mentikputih” and “Gadingmlati”. Four other local rice varieties with higher yields than Pandan Wangi (as a comparison) were “Lestari”, “Ho-ingbatangbiru”, “Sri kuning” and “Menur”. Local rice varieties that have the highest yield are “Mentiksusu” varieties, 42.67% higher than Pandan Wangi (as comparison) having yield 6.42 tons/ha, with plant height 115.2 cm, number of tillers 15.6, panicle length 24.97 cm, leaf length 29.47 cm, leaf width 13 mm, grain content per panicle 127.8 and production of 6.42 tons/ha.

1. INTRODUCTION

The diversity of Yogyakarta location at altitude of 0–2911 meter above the sea level [1], followed by diversity of Genetic Resources of crops, plantation and horticulture crops. Development of agriculture that produces new varieties, increasing the population so that the conversion of agricultural land to non-agricultural land. This causes the narrowness of agricultural land that can lead to reduced local planting of genetic resources by farmers, so the existence of the plant's genetic resources is increasingly scarce even lead to extinction.

Local rice was one of the genetic resources that need to be preserved to prevent extinction due to natural disaster, stolen by others or because it is not cultivated anymore as a result shifted by new
superior rice varieties. Therefore, in the year 2014 BPTP Yogyakarta to explore the local rice to the entire region of Yogyakarta. Approximately 80 local rice varieties of Yogyakarta are obtained from the exploration [2].

The next step after exploration was identification, characterization and evaluation. This was in accordance with [3] that operational activities in the management of plant genetic resources consist of: 1. exploration, inventory, and identification of plant genetic resources; 2. characterization and evaluation; 3. documentation (data base); and 4. conservation and rejuvenation.

The focus of the management of the genetic resources was to conserve, develop and utilize them sustainably both on terrestrial and marine ecosystems within agro-ecosystem and production areas and ex situ conservation programs [4]. Conservation of local genetic resources should not only be done by researchers as state apparatus, the role and participation of farmers or local communities, traders and consumers was absolutely necessary. Genetic Resources conservation by involving farmers, traders and consumers was called participatory breeding. In accordance with [5], participatory breeding was a plant breeding program that actively involves breeder users, including farmers, traders, processors and consumers. [6] and [7] suggest that genetic resources conservation was managed by plant breeders and was suggested to be done directly on farmer's land. The advantages of participatory breeding programs were feedback from farmers, farmers' direct choice, and genotypic suitability at the farming level [8].

Genetic resources was one form of natural property of a country. This natural biological richness was the foundation of human life in the world, no one human being can live without genetic resources. All humans on this earth will always seek this resource to be utilized in various levels and forms [9].

Genetic resources was the base material for assembling superior varieties that have properties of which were high productivity, pest-resistant, tolerant of specific environmental stress, and the quality that suits the public taste. High diversity of genetic resources was needed and can be obtained by exploration. Exploration was an activity of seeking, collecting, and researching certain types of local varieties (in certain areas) to secure from its extinction. The next step in genetic resources management after identification and characterization was evaluation. The evaluation aims to know the advantages, disadvantages and potentials of the genetic resources.

Plant genetic resources obtained from exploration were conserved (planted) at the origin of the plant's genetic resources (insitu) and outside its habitat (ex-situ) to maintain sustainability to prevent extinction as well as to explore its potential so that its usefulness and benefits can be enjoyed by the community. Ex-situ conservation in genetic resources gardens in government research institutions were helpful in the implementation of genetic resource management.

The aim of this research was to know the crop's preference and consumer preferences of 20 local rice of genetic resources from Yogyakarta.

2. MATERIALS AND METHODS

The study was conducted from July to October 2016 Selomartani, Kalasan, Sleman, Yogyakarta. This research was conducted by planting 20 local rice of specific genetic resources (Table 1) repeated twice on 1000 m² of land. Plants are kept up to harvest by following Integrated Crop Management (ICM) approach with legowo planting system.

Observations of morphological aspects include plant height, plant age, number of productive tillers, panicle length, leaf length, leaf width, grain amount of fill per panicle, 1000 grain weight and production. The data of agronomic observation were analyzed using SAS software version 9.

Evaluation of consumer preferences on crop performances was conducted at the end of the activity by meeting with farmers, extension workers and relevant stakeholders to find out the preferences / levels of consumer preferences to the local agronomy crops and to disseminate of specific local rice variety from Yogyakarta.

Consumers/farmers participating in the meeting selected of rice local genetic resources was preferred of plant performance including age, plant height, number of tillers, panicles and production.
Result of local rice consumers' preference in Yogyakarta by calculating the percentage of frequency of emergence of local rice varieties selected and presented in histogram form.

**Table 1.** List of local rice variety from Yogyakarta, Indonesia as materials of the research

| No. | Name of Variety | Origin          |
|-----|-----------------|-----------------|
| 1.  | Mayangan        | Gunung Kidul    |
| 2.  | Tangkilan       | Gunung Kidul    |
| 3.  | Ho-ing Batang Biru | Sleman        |
| 4.  | Pandan Wangi    | Sleman          |
| 5.  | Mentik Susu     | Merata Yogyakarta |
| 6.  | Jasmine         | Sleman & Bantul |
| 7.  | Selendang Biru  | Gunung Kidul    |
| 8.  | Srikuning       | Kulon Progo     |
| 9.  | Pangestu        | Kulon Progo     |
| 10. | Menoreh Bercak Ungu | Kulon Progo   |
| 11. | Padi Merapi     | Sleman          |
| 12. | Gadeng Mlati    | Sleman          |
| 13. | Rening          | Sleman          |
| 14. | Gogo Lembayung  | Gunung Kidul    |
| 15. | Mentik Putih    | Bantul          |
| 16. | Lestari         | Bantul          |
| 17. | Kenanga         | Sleman          |
| 18. | Menur           | Sleman          |
| 19. | Similikiti      | Gunung Kidul    |
| 20. | Cempo Putih     | Bantul          |

3. RESULTS AND DISCUSSION

3.1. The performance of 20 local genetic resources

Observations results of plant performance (plant height, number of productive tillers, leaf length, leaf width, panicle length, number of grain per panicle, and production) of 20 local rice genetic resources are presented in Table 2.
Table 2. Crop performance of 20 genetic resources of Yogyakarta local rice

| Variety           | PH    | NPT    | PL     | LL     | LW     | NGP    | Prod    |
|-------------------|-------|--------|--------|--------|--------|--------|---------|
| Lestari           | 92.1f | 13.1e  | 23.57g | 22.36gh| 10.03j | 75.53f | 5.67a   |
| Hoingbatangbiru   | 139.0b| 14.2d  | 26.73a | 34.32ab| 10.67rij| 139.23b| 5.33a   |
| Kenanga           | 127.1c| 14.4d  | 24.12de| 30.58ce| 13.43bc| 137.03b| 5.50a   |
| Jasmine           | 112.1de| 10.1e | 24.43cd| 32.47ab| 12.27cedf| 100.7de| 4.33ab  |
| Selendangbiru     | 107.5de| 9.6e  | 19.52hi| 26.20fg| 9.83j  | 61.53gh| 1.70bc  |
| Cempoputih        | 108.9de| 13.8bcd| 22.98d | 23.26gh| 10.03j | 75.53f | 5.67a   |
| Gogolembayung     | 81.0g | 18.6a  | 18.32i | 17.58i | 9.73j  | 56.97h | 4.50ab  |
| Mentiksusu        | 115.2d| 15.6abc| 24.97bc| 29.47c-f| 13.00b-d| 127.8bc| 6.42a   |
| Mayangan          | 144.5a| 3f     | 28.02a | 23.13gh| 11.30f-i| 73.93f | 1.17c   |
| Similikiti        | 81.7g | 12.4de | 21.80fg| 22.73gh| 10.50ij| 75.47f | 3.38abc |
| Padimerapi        | 82.3g | 11.9de | 23.53d-f| 21.68h | 12.20f-d| 72.07gh| 4.08ab  |
| Gadingmlati       | 106.7e| 11.6de | 23.18d-f| 29.50c-f| 12.80-e| 104.07de| 4.83a   |
| Pangestu          | 75.4g | 14.9bcd| 22.19fg| 21.09h | 10.13ij| 81.17eg| 3.67abc |
| Tangkilan         | 127.1c| 3.9f   | 27.16a | 27.93ef| 10.83g-j| 96.17f | 1.25c   |
| Sri kuning        | 90.7f | 14.3bcd| 20.98gh| 28.23ef| 10.33ij| 97.13f | 5.33a   |
| Mentikputih       | 109.3de| 14.9bcd| 23.05def| 28.12ef| 11.90d-f| 76.10f | 5.25a   |
| Menorehberakungu  | 92.9f | 9.7e   | 22.75d-g| 27.79ef| 12.80b-e| 101.87de| 3.83a-c |
| Pandanwangi       | 96.4f | 12.3cde| 22.67d-g| 32.08b-d| 32.36ab| 114.5cd| 4.50ab  |
| Menur             | 133.0bc| 16.6ab| 27.53a | 35.85a | 11.37f-i| 136bc   | 6.00a   |
| Rening            | 92.4f | 9.5e   | 26.28ab| 27.38ef| 14.67a | 160.33a| 3.8abc  |
| CV (%)            | 7.53  | 28.45  | 7.82   | 13.64  | 10.47  | 12.23  | 11.89   |

Information:
- PH = plant height,
- NPT = number of productive tillers,
- PL = panicle length,
- LL = leaf length,
- LW = leaf width,
- NGP = number of grain per panicle,
- Prod = productivity,
- CV = Coeffisien Variation

Table 2 shows that each of the local genetic resources of rice indicates its crop performance and genetic potential. Local rice tested showed mixed results. The highest yield of dried harvest was achieved by Mentiksusu, followed by Menur, Lestari, Kenanga, Hoingbatangbiru, Sri kuning, Mentikputih, and Gadingmlati. The difference of yield between local rice with Pandanwangi (local rice also), Pandanwangi as a comparison ranged from -74.00% to 42.67%. Pandanwangi was considered as a comparison, because local rice of Pandanwangi has long been known by farmers and consumers. Of the 20 genetic resources of local rice tested, 8 local rice varieties (Mentiksusu, Menur, Lestari, Kenanga, Hoingbatangbiru, Sri kuning, Mentikputih, and Gadingmlati) yielded an average grain of 16.89% (between 7.33 % to 42.67%) higher than Pandanwangi, while 12 varieties produce less grain than Pandanwangi.

The difference of other observation variables such as plant height, generative tillers, leaf length, leaf width, panicle length, number of grain of content per panicle,between Pandan Wangi as comparison with other local rice varieties were presented in Table 3 and Table 4.
Table 3. Differences of plant height variables, number of generative tillers, leaf length, leaf width, panicle length, number of grain of fill per panicle, and yield between Pandanwangi as comparison with Cempoputih, Mentiksusu, Gadingmlati, Mentikputih, and Rening.

|                      | Pandanwangi | Cempoputih | Mentiksusu | Gadingmlati | Mentikputih | Rening |
|----------------------|-------------|------------|------------|-------------|-------------|--------|
| The difference of plant height to Pandanwangi (%) | -           | 12.97      | 19.50      | 10.68       | 13.38       | -4.56  |
| Differences in number of productive tillers to Pandanwangi (%) | -           | 12.20      | 26.83      | -5.69       | 21.14       | -22.76 |
| Differences panicle length to Pandanwangi (%) | -           | 1.4        | 10.16      | 2.26        | 1.69        | 15.96  |
| Differences of leaf length to Pandanwangi (%) | -           | -11.27     | -8.13      | -8.05       | -12.36      | -14.65 |
| Differences leaf width to Pandanwangi (%) | -           | -13.93     | -4.64      | -6.11       | -12.71      | 7.58   |
| Differences in number of grain of fill per panicle to Pandanwangi (%) | -           | -9.84      | 11.62      | -9.11       | -14.76      | 40.03  |
| Differences yield to Pandanwangi (%) | -           | -5.56      | 42.67      | 7.33        | 16.67       | -15.56 |

Table 4. Differences of plant height variables, number of generative tillers, leaf length, leaf width, panicle length, number of grain of fill per panicle, and yield between Pandanwangi as comparison with Lestari, Ho-ingbatangbiru, Kenanga, Sri kining, and Menur.

|                      | Pandanwangi | Lestari | Ho-ingbatangbiru | Kenanga | Sri kining | Menur |
|----------------------|-------------|---------|------------------|---------|------------|-------|
| The difference of plant height to Pandanwangi (%) | -           | -4.46   | 44.19            | 38.15   | -5.91      | 37.97 |
| Differences in number of productive tillers to Pandanwangi (%) | -           | 6.50    | 15.45            | 17.01   | 16.26      | 34.96 |
| Differences panicle length to Pandanwangi (%) | -           | -1.44   | 17.92            | 6.41    | -7.42      | 21.45 |
| Differences of leaf length to Pandanwangi (%) | -           | -27.51  | 6.98             | -4.69   | -12.00     | 11.74 |
| Differences leaf width to Pandanwangi (%) | -           | -24.15  | -21.76           | -2.15   | -24.21     | -16.62|
| Differences in number of grain of fill per panicle to Pandanwangi (%) | -           | 21.60   | 21.60            | 19.68   | -15.17     | 18.78 |
| Differences yield to Pandanwangi (%) | -           | 18.44   | 18.44            | 22.22   | 18.44      | 33.33 |

Twelve varieties with grain yields were lower than Pandanwangi varieties (as comparison) because the local varieties were not sufficiently adapted in Sleman, or because of the low response of the rice varieties to the Integrated Crop Management with Legowo plant system.
As we all know that local varieties were more adaptive to organic farming. One of the content of organic agriculture was based on local resources such as the use and maintenance of local seeds, the reuse of organic waste and organic waste, so the value of wisdom on the management and structuring of resources by itself will be discussed at horizontal level become a point of view in organically farming [10]. In addition to local genetic resources, local knowledge or indigenous knowledge was a declining knowledge known today as organic farming with genetic resources or local varieties as organic farming materials. The harvested crops are then distributed to members and non-members of farmer groups with "ijol" mechanisms [Java language] [11]. This mechanism was the work of indigenous knowledge owned by farmers, maintained and developed continuously. In the interest of the "seed granary" the farmer who distributes the seed records who keeps the seed, and so on. Thus, the assurance of the availability of various and appropriate seeds will always be part of the community's (collective) responsibilities, such as in water use. In organic farming it was called a living community seed barn, because it was not a material such as a warehouse to place harvest grain, but instead it is planted, and replanted. This was actually a collective effort in the process of stabilizing strains (varieties) that match the local soil conditions. Strain / varieties that can be replanted as seeds were local varieties.

3.2. Consumer Preference to the performances of 20 local rice of genetic resources
Consumers / farmers participating in the meeting selects of local genetic resources of plant performance including age, plant height, number of tillers, number of grain content per panicle and productivity. Frequency of Local Genetic Resource Outcomes Preferred to Surviving Local Genetic Resources of Yogyakarta rice is presented in the form of a histogram in Figure 1.

![Figure 1](image)

**Figure 1.** The number of consumer preferences on the performance of 20 local rice Genetic Resources of Yogyakarta.

Figure 1 shows that of the 20 local rice of genetic resources evaluated, five variety favored by farmers were Cempoputih, Mentikusu, Mentikputih, Gadingmlati, and Rening. Fifteen other varieties have a lower number of fans. Farmers choose five local cultivars based on their crops such as plant age, plant height, number of tillers, number of grain per panicle and productivity. However, at the time of the discussion, some farmers who wanted to grow certain local variety, although not many fans, for
example was Ho-ingbatangbiru. Although the age is longer but the appearance of the grain form and the number of tillers per hill into consideration other than for conservation purposes. Overall, farmers were interested in the local rice of genetic resources that were evaluated and will require to plant the following season. This was a good step in the effort to conserve specific local rice in Yogyakarta.

4. CONCLUSION
The local rice varieties tested exhibit different performances according to their genetic potentials for the Integrated Plant Management technology approach with Legowo plant system. Three varieties of local rice farmers choice of crops with higher grain yield compared to Pandan Wangi as a comparison were Mentiksusu, Mentikputih and Gadingmlati. Five other local rice varieties with higher yields than Pandan Wangi (as a comparison) were Lestari, Kenanga, Ho-ingbatangbiru, Sri kuning and Menur. Local rice varieties that have the highest yield was Mentiksusu, 42.67% higher than Pandan Wangi (yield 6.42 tons/ ha), with plant height 115.2 cm, number of tillers 15.6, panicle length 24.97 cm, leaf length 29.47 cm, leaf width 13 mm, and grain content per panicle 127.8.

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