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Potential Yield of Some Local Gogo Rice Varieties of North Sumatra and Aceh on Rainfed Rice Fields

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Abstract: ***Dry land utilization for agriculture is often overlooked by policy makers who are more interested in increasing rice production in paddy fields. This is probably due to assumption that increasing rice production in paddy field is easier and more promising than upland rice field which has a higher risk of failure. In fact, dry land is widely available and potential to be developed for upland rice. The research was conducted on rain fed, located at Suka Makmur Village, District of Binjai, Langkat Regency. The material is 9 local gogo rice cultivars of exploration results from Province of Aceh and North Sumatra, Indonesia and one local rice varieties of Sumatra namely Sigambiri Merah. The parameters observed were plant height (cm), number of tillers (stem), number of productive tillers (stem), flowering age (day), harvest age (day), number of grains per panicle, yield per sample (g) and production per plot (kg). The results showed that there were significant differences between cultivars observed for some parameter namely plant height, number of productive tillers, flowering age, harvest age, number of grains per panicle, production per sample, production per plot, but the number of tillers show no significant difference.***

Keywords: Local Cultivars, Gogo Rice, Rainfed Rice Fields

1. Introduction

Total rain fed area in Indonesia is around 2.02 million ha or 24% of the total wetland area, spread in Java (77,029 ha), Sumatra (550,940 ha), Kalimantan (339,700 ha), Sulawesi (279,295 ha), Bali and Nusa Tenggara (70,673 ha) [1]. There is around 120,215 ha of rain fed area in North Sumatra [2].

Dry land utilization for agriculture is often overlooked by policy makers who are more interested in increasing rice production in paddy fields. This is probably due to assumption that increasing rice production in paddy field is easier and more promising than upland rice field which has a higher risk of failure. In fact, dry land is widely available and potential for upland rice production, namely > 5t/h.

One of rain fed rice are in North Sumetera is located in Suka Makmur Village, District of Binjai, Langkat Regency. This rain fed is usually planted with wetland rice however for some seasons farmers experience crop failure due to unpredictable climatic conditions. Nevertheless, farmers continue to grow wetland rice (paddy) as the main food of farmer household in Suka Makmur village. The alternative is to plant the land with upland rice.

Rice cultivation for dry areas is using upland rice that genetically resistant to drought. Khairullah et al., (2003) suggests that upland rice exhibits various models of tolerance to unfavorable environmental conditions [3]. Thus, plants with such properties can be utilized in areas/lands with similar conditions and as alternative for marginal lands particularly for rain fed area. Nevertheless, drought is one of limiting factor in rice production because decrease the number of grain [4].

To get a more optimal yield, it is necessary to use appropriate cultivation technology and varieties that have a good adaptability and produce well. To the end, some local rain fed rice varieties of North Sumatra and Aceh will be tested.

2. Materials and Methods

The research materials is 9 local gogo rice cultivars obtained from Province of Aceh and North Sumatra, Indonesia and one local rice varieties of North Sumatra that have been released by the government, namely Sigambiri Merah. The research was conducted on rain fed area in Suka Makmur Village, District of Binjai, Langkat Regency. The study used a randomized block design with 4 replications. Wide of experimental plot area is 210 cm x 90 cm, spacing 30 cm x 30 cm, total population per experiment unit is 21 with 5 plants used as sample. The parameters observed were plant height (cm), number of tillers (stem), number of productive tillers (stem), flowering age (day), harvest age (day), number of grains per panicle, yield per sample (g) and production per plot (kg).

Data Analysis

The collected data was analyzed using F test (analysis of variance). If there is a significant difference, then followed by honestly different test at α 5% to find the best cultivars or varieties. F test and honesly different test were calculated using Microsoft Excel 2007.

3. Result and Discussion

Results of honestly different test of the parameters observed are presented in Table 1 and Table 2.

Table 1: Character performances of each cultivar on plant height, number of tillers, number of productive tillers, flowering age and harvest age.

Cultivar	Plant height (cm)	Number of tillers (stem)	Number of productive tillers (stem)	Flowering age (day)	Harvest age (day)
Sileso	132.20e	20.05	13.05a	118.40b	166.65bc
Sibontok	150.60b	19.05	12.70ab	117.05b	167.30b
Sigedul	150.35b	18.45	10.65bc	108.15c	157.20d
Angkop	139.10cd	17.75	10.95abc	98.50d	146.95e
Rias Kuning	179.15a	18.70	13.00a	123.10a	173.65a
Rias Putih	177.75a	18.15	10.95abc	123.15a	175.30a
Situmba	133.80de	17.85	10.60bc	75.90f	124.70g
Sigodang	124.60f	19.20	11.65abc	88.60e	137.15f
Sidenuk	144.05c	19.45	10.40c	116.00b	164.60c
Sigambiri Merah	141.00c	18.15	11.45abc	75.55f	125.15g
BNJ value	5.98	NS	2.19	3.13	2.56
Heritability	0.98t	0.09r	0.51t	0.99t	0.99t

Note: the numbers followed by the same letter in the same column are not significantly different according to honestly different test at α 5%
NS: not significant difference
t = high
r = low

The result of variance analysis showed that there were significant differences between cultivars observed on plant height, number of productive tillers, flowering age and harvest age, but did not significantly difference on the number of tillers. The lowest plant height was found in Sigodang (124.60 cm) which significantly different with all observed cultivars including with Sigambiri Merah as comparator varieties (141.00 cm).

Sileso cultivars have the highest number of productive tillers (13.05 stems) which are not significantly different than Sibontok, Angkop, Rias Kuning, Rias Putih, Sigodang and also than Sigambiri Merah (11.45 stems). Sidenuk variety (10.40 stems) and Sigedul (10.65 stems) have the lowest number of tillers.

Sigambiri Merah as comparator varieties has flowering age 75.55 days and harvest age 125.15 days which is shorter and not significantly different than Situmba but significantly different than all the other cultivars observed. Rias Putih cultivars have the longest flowering age and harvest age namely 123.15 and 175.30 days respectively which is not significantly different with Rias Kuning varieties with flowering age 123.10 days and harvest age 173.65 days.

Table 2: Character performances of each cultivar on the parameters of the number of full grains per panicle, production per sample, and production per plot

Cultivar	number of full grains per panicle (grain)	production per sample (g)	Production per plot (kg)
Sileso	127.20e	3.28g	0.78b
Sibontok	210.85b	5.91a	1.40a
Sigedul	215.95b	5.16cd	0.93b
Angkop	202.00c	4.63e	0.85b
Rias Kuning	233.80a	5.63b	1.40a
Rias Putih	235.30a	5.64b	1.08ab
Situmba	184.70d	4.25f	0.73b
Sigodang	189.65d	5.29c	1.08ab
Sidenuk	216.35b	5.82ab	1.13ab
Sigambiri Merah	185.15d	4.99d	0.95ab
BNJ value	8.50	0.24	0.45
Heritability	0.98t	0.98t	0.57t

Note: the numbers followed by the same letter in the same column are not significantly different according to honestly different test at α 5%
NS: not significant difference
t = high
r = low

Analysis of variance shows that the number of full grains, production per sample and production per plot is significant difference. The highest number of full grains per panicle was found in rias putih cultivars (235.30 grains) which were not significantly different than rias kuning (233.80 grains). Rias putih, Rias kuning, Sibontok, Sigedul, Angkop, and Sidenuk showed better performance compared to Sigambiri Merah (185.15 grains). Situmba and Sigodang cultivars showed no significant difference than Sigambiri Merah varieties on the parameters of the number of full grains per panicle. Sileso cultivars showed the lowest number of full grains per panicle (127.20 grain), that is significantly different from all observed cultivars including Sigambiri Merah.

In the parameter of production per sample, Sibontok cultivar showed the highest value (5.91 g) which was not significantly different with Cideruk (5.82g) but was significantly different with all other cultivars and also significantly different than Sigambiri Merah variety (4.99 g). Situmba cultivars had the lowest production per sample (4.25 g) compared to other cultivars.

In the production per plot, Sibontok and Rias Kuning cultivars showed the highest value (1.40 kg) which was not significantly different with Rias Putih (1.08 kg), Sigodang (1.08 kg), Sidenuk (1.13 kg) and also with Sigambiri Merah (0.95 kg) but significantly different than Sileso (0.78 kg), Sigedul (0.95 kg), Angkop (0.85 kg), and Situmba (0.73 kg). Nevertheless, Sileso, Sigedul, Angkop, and Situmba cultivars showed not significantly different with the Sigambiri merah.

4. Discussion

The results showed that there were significant differences in plant height parameters. Such significant differences of all cultivars observed were due to genetic factors. This is indicated by high heritability value of the parameter (0.98). Poespodarsono (1988) *in* Lubis (2012) states that heritability with value 0 means that phenotype diversity is only caused by environment whereas value 1 means phenotypic diversity is only caused by genetics. Closer to 1 means the heritability is higher and vice versa. High value heritability means that genetic factors are more influential on the character [5]. Mildaerizanti (2008) suggests that plant height differences are more determined by genetic factors than environmental factors [6].

The number of tillers showed no significant difference and heritability values is low. This shows that genetically cultivars ability to produce tillers is similar. Environmental differences allow cultivars to respond differently. The research was conducted at the same dry area so environmental differences have not yet appeared. Utama (2010) suggests the number of rice tiller grown on acid soils is differs among varieties because each variety has different genetic potentials in response to growing environments [5].

Sileso cultivars have the highest number of productive tillers but not significantly different than Sibontok, Angkop, Rias Kuning, Rias Putih, Sigodang and also Sigambiri Merah (11.45 stem). However, generaally the cultivars have high number of productive tillers and have a long life (more than 5 months) when compared with comparator varieties (only 4 months). Further efforts are needed in plant breeding program to improve the properties. Hairmansis *et al*. (2005) state that identification of important traits found in local rice should be continued to find its potential in breeding programs [8].

Grain quality is also one of the selected parameters. Number of full grain per panicle determines the crops productivity. If the panicles produce a lot of full grain then the productivity is high. The high quality of rice is reflected in high number of full grain and the least empty grain. Lots of empty grains affect crops productivity. This research show that the highest number of full grains found at Rias kuning and Rias putih, that is significantly different than comparator varieties. On the parameters of production per sample, the highest production is in Sibontok cultivar which is also significantly different than comparator varieties.

For production per plot, the highest production was found in Sibontok and Rias Kuning cultivars which did not significantly different with the comparator varieties. This result shows that some of Aceh and North Sumatera cultivars are potential to be developed on dry land such as rain fed land. Abdullah and Safitri (2014) argue that stable lines have good agronomic appearance, ie plant height, number of tillers and moderate harvesting, and total grain/panicle higher than comparable varieties [9]. Suardi (2002) states that one of the criteria of rice varieties that will grow well in environments with limited rainfall and is the ideal crops if : (a) crops is adaptive to water availability that allows to avoid drought at the end of growth season, (b) high yields in suitable environments as well as moderate high and having high harvest index and (c) drought tolerant and able to maintain the greenishness during drought [10].

5. Conclusion

According to the production per plot, there are several potential local cultivars to be developed in rainfed fields such as Sibontok and Rias Kuning cultivars whose production per plot is higher thaan Sigambiri Merah as comparator varieties.

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