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Research Paper

PERFORMANCE OF AGRONOMICAL CHARACTERISTICS OF RAINFED RICE VARIETIES AT OGAN ILIR DISTRICT, SOUTH SUMATRA PROVINCE

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One of the efforts to achieve food tenacity in South Sumatra was carried out by utilization of lowland swamp during dry season for rain-fed rice cultivation because this land is available in relatively extensive area. From the existing land area, only about 370,000 ha that had been used for rain-fed rice cultivation. Rain-fed rice has several disadvantages such as low production, long growing period and low quality in term of taste so that farmers have low eagerness to cultivate this crop. Therefore, new varieties of rice which have high production and high quality are needed to increase the eagerness of farmers to conduct rain-fed rice cultivation. The initial step in achieving this objective is to find stock varieties that well-adapted to land condition in South Sumatra as well as had high production and short growing period that will be crossbred with rice variety having fragrant aroma. Adaptation test of stock varieties toward new environment in which new rice varieties would be grown is important because productivity of a variety is varied with different growing environments. The research objective was to determine the growth and production levels of some rain-fed rice varieties planted in lowland swamp during dry season in order to find crossbred stock and to produce new superior variety of locally specific. Field experimentation was done by using Randomized Block Design with six treatments and four replications for each treatment. Treatments were consisted of six rain-fed rice varieties. The results showed that Jati Luhur variety had the highest production with magnitude of 4.2 ton.ha⁻¹ and growing period of about 3.5 months so that it was chosen as stock variety for subsequent cross breeding.

Keywords: Agronomical characteristics, Rain-fed rice, Lowland swamp, Dry season

INTRODUCTION

The development potential for rain-fed rice is available in Sumatra, Kalimantan and Papua islands. Development opportunity for rain-fed rice in Sumatra is not only at traditional land, but also

as intercropping crop in relation to new land development for plantation areas (Suryana, 2008; Yusuf, 2009). Rain-fed rice cultivation is not only can be done dry land area, but also in lowland swamp areas during dry season. If this potential

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can be properly utilized, the food necessity at province level can be fulfilled. This development opportunity is supported by relatively extensive area of lowland swamp available in South Sumatra with magnitude of 2.98 million ha in which only about 3.9% of this area had been utilized for food crops cultivation (Puslitbangtanak, 2002).

The current attention towards development of rain-fed rice cultivation was less than that of paddy field rice due to lack of studies related to advantages of rain-fed rice. In addition, rain-fed rice cultivated by farmers had low productivity with magnitude in the range of 1.5 to 2.5 ton.ha⁻¹ or 43% of paddy field rice productivity (BPS, 2007).

The cause of low productivity of rain-fed rice at farmer level was due to under optimum cultivation technique such as the use of improper variety, i.e. local rice variety (Deptan, 2008). According to Yoshida (1975) in Nazirah (2008), the characteristics of local rice variety are as follows: low crop height, smaller leaf area, slower flowering stage, lower productive tiller numbers, higher empty grain numbers, lower dry matter production and yield index lower than that of paddy field rice. However, local rice variety also has advantages such as high adaptation characteristics to local condition and taste characteristic that is preferred by community members. On the other hand, some of local rain-fed rice varieties have short growing period and specific advantage characteristics which tend to produce high yield.

There is local rain-fed rice called Dayang Rindu variety in Musi Rawas District, South Sumatra Province that has specific aroma and taste that is preferred by community members and has high economic value. Selling price at local market

for this rice variety was up to Rp10,000.kg⁻¹ and usually it had been previously ordered before harvest time by buyers from Musi Rawas District and other areas. Dayang Rindu rice even is used as a gift for officers from central government during their visit to this area. Dayang Rindu rice is not only has good tasting characteristic, but also has fragrant aroma. However, Dayang Rindu rice variety had longer growing period of about six months and low productivity in the range of 1.9 to 2.0 ton.ha⁻¹ (Portal Nasional RI, 2012). If these disadvantages of Dayang Rindu rice variety can be overcome, then there is possibility that most farmers are eager to cultivate this variety because they can fulfill their own needs as well as increase their income.

The objective of this research was to find local rice variety which has high production and shorter growing period in order to cross breed the new superior variety which is locally specific having high quality and production. Characteristics of shorter growing period and high production are also expected come from local rice variety because the cross breed of superior variety with local genetic materials will be more adaptive toward local environment and easier to be adopted by farmers. In addition, community member preference to taste is different amongst areas. This was supported by field survey results which showed that most farmers were cultivated local rice variety by using rice seeds from the previous harvest season. They argued that local rice variety is more adaptive to local environment as well as has taste in accordance to their preference. Therefore, identification of local rice variety as new genetic resource which has potential for rain-fed rice development is highly

needed because many germ plasmshad not been yet identified. Moreover, each variety generally has its specific tolerance in an area (BBPTP, 2010). Thus, the developed new rice variety should be adaptive to propose location in which it will be planted.

Rice variety with specific superior characteristics is a key success for increasing of rice production. Rain-fed rice cultivation using proper variety, supporting climatic condition and proper fertilization in Peru showed yield level of 7.2 t.ha⁻¹(Datta (1975) *cit.* Pirngadi *et al.* (2008)). The use of superior variety followed by improvement of fertilization and water management could contribute to production increase with magnitude of 75% (Fagi *et al.*, 1966).

The objective of this research was to identify several varieties of local rain-fed rice in order to obtain a variety that has shorter growing period and/or high yield which is subsequently used as crossbreed stock with the main objective to produce new superior variety of rain-fed rice with locally specific characteristics.

MATERIALS AND METHODS

Location and Time

This research was conducted at Pulau Semambu Village, North Indralaya Subdistrict, Ogan Ilir District from January to June 2015.

Research Method

Field experimentation was conducted by using Randomized Block Design with six treatments and four replications for each treatment. The tested rice varieties are Situ Begendit, Situ Gintung, Telang Sari, Aek Sibundo and Jati Luhur. Superior rice variety of Impago-7 was used as the control variety.

RESULTS AND DISCUSSION

Results

The results of variance analysis (Table 1) showed that rice variety types used in this study had highly significant effect on crop height, maximum tiller numbers, harvest period, tassel length, grain numbers per tassel, fully grain numbers per tassel, percentage of empty grains, grains weight per cluster, weight of 1000 grains, grains weight

Table 1: Results of Variance Analysis in Relation to Effect of Variety Types on Observed Parameters

Observed Parameters	Variety Types (V)	Variation Coefficient (%)
Crop height (cm)	**	6.46
Productive tiller numbers	tn	17.39
Harvest time (HST)	**	0.77
Tassel length (cm)	**	2.38
Grain numbers per tassel	**	4.28
Fully grain numbers per tassel	**	4.29
Empty grains percentage (%)	**	1.17
Grains weight per stump (g)	**	9.17
Weight of 1000 grains (g)	**	1.81
Grains weight per plots (kg)	**	10.13
Dry matter weight (g)	**	7.40

Remarks: tn = not significant; ** = highly significant; V = variety types.

per plot and dry matter weight, but had no significant effect on productive tiller numbers.

The Growth of Rain-fed Rice

a. Crop Height (cm): Situ Gintung (V₁) and Inpago-7 (V₂) varieties had produced the highest growth average up to 145.20 cm which were not significantly different than that of Jati Luhur (V₃) and Talang Sari (V₄) varieties. The lowest growth was found on Aek Sibundo (V₅) variety with magnitude of 95.88 cm (Table 2).

b. Productive Tiller Numbers: The highest average numbers of productive tillers in descending order were as follows: Situ Bagendit (V₁) = 16.00; Aek Sibundo (V₅) = 14.75; Inpago-7 (V₃) = 14.50; Talang Sari (V₄) = 13.75, whereas the lowest average numbers of productive tillers were found on Situ Gintung (V₂) and Jati Luhur (V₆) with magnitude of 11.75 and 11.70, respectively (Table 2).

c. Harvesting Period (Days After Planting): Harvesting period of Situ Bagendit (V₁) rice variety was highly significantly different than that of Inpago 7 (V₃), Talang Sari (V₄) and Jati Luhur (V₆) varieties, but it was not significantly

different than that of Situ Gintung (V₂) and Aek Sibundo (V₅) varieties (Table 2).

d. Dry Matter Weight (g): Talang Sari (V₄) variety had produced the highest dry matter weight with magnitude of 51.83 g which was highly significantly different than that of other varieties, but it was not significantly different than that of Jati Luhur (V₆) variety which produced dry matter weight with magnitude of 45.2 g (Table 2).

f. Tassel Length (cm): Inpago-7 (V₃) variety had the longest tassel with magnitude of 26.39 cm, whereas varieties of Situ Bagendit (V₁), Situ Gintung (V₂), Talang Sari (V₄), Aek Sibundo (V₅) and Jati Luhur (V₆) had produced tassel lengths which were not significantly different, i.e. between 22.98 to 24.20 cm (Figure 2).

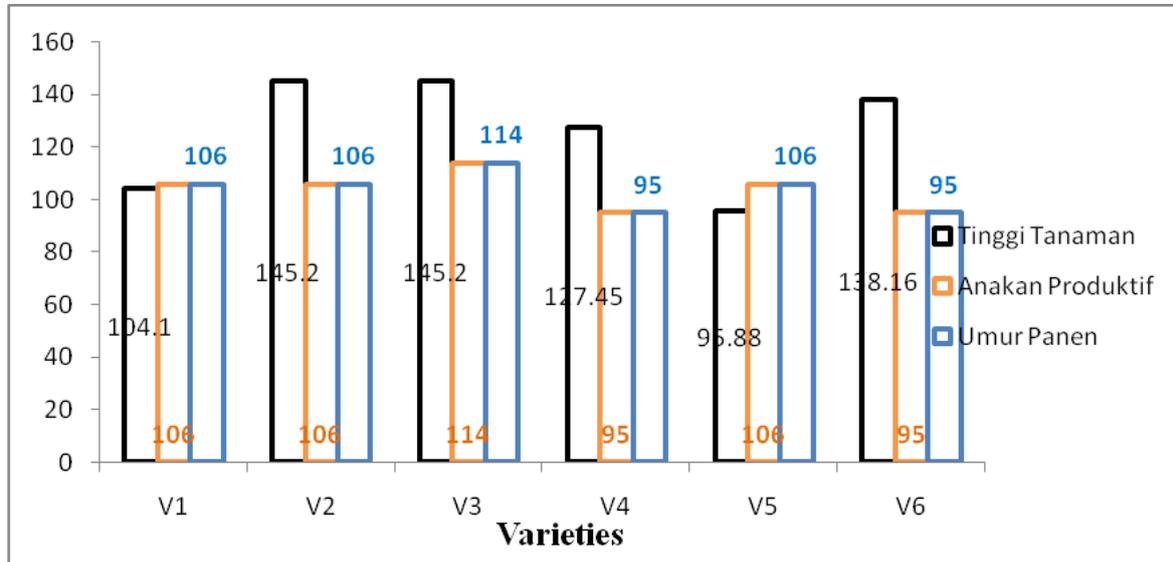
g. Grain Number per Tassel: Jati Luhur (V₆) variety had produced the highest grain numbers per tassel with magnitude of 225.63 grains which was highly significantly different than that of other varieties, but it was not significantly different than that of Inpago-7 (V₃) variety that had produced 209.25 grains per tassel (Table 3).

Table 2: The Effect of Rice Varieties on Growth Parameters

Varieties	Crop Height (cm)	Productive Tiller Number (Days after Planting)	Harvest Time	Dry Matter Weight (g)
V1	104,10 a	16,00 ab	106,00 b	43,75 ab
V2	145,20 b	11,75 a	106,00 b	44,03 ab
V3	145,20 b	14,50 a	114,00 c	37,63 a
V4	127,45 b	13,75 a	95,00 a	51,83 c
V5	95,80 a	14,75 a	106,00 b	42,48 ab
V6	138,16 b	11,70 a	95,00 a	45,20 bc

Remarks: Numbers followed by the same letters showed that they are not significantly different.

Figure 1: Crop Height (Cm), Productive Tiller Numbers, and Harvest Time (Days After Planting) for Several Varieties of Rain-fed Rice



Remarks: V₁ = Situ Bagendit V₂ = Situ Gintung V₃ = Inpago 7 V₄ = Talang Sari
 V₅ = Aek Sibundo V₆ = Jati Luhur

Table 3: The Effect of Rice Varieties on Production Parameters

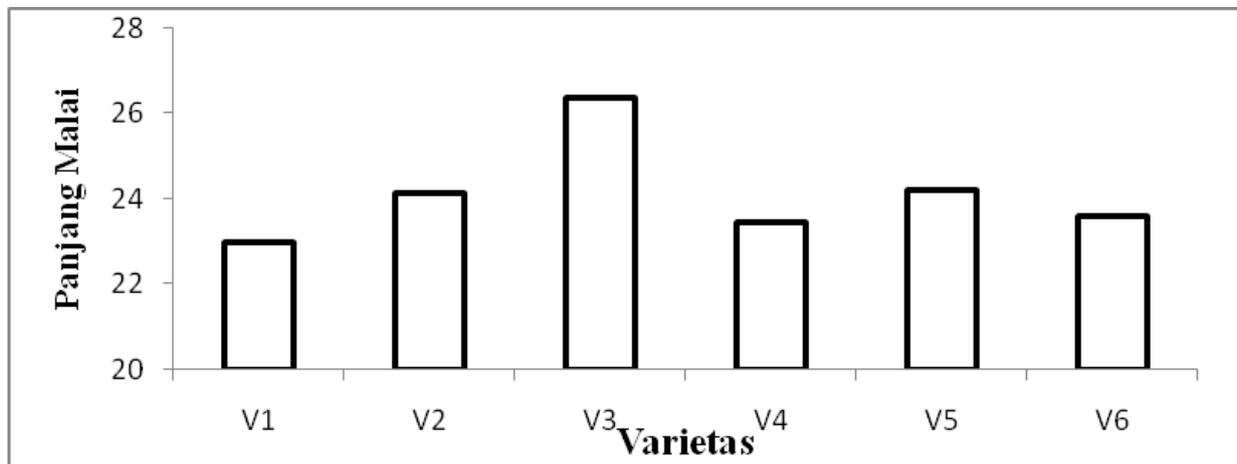
Varieties	Tassel length (cm)	Σ grains/ tassel	Σ fully grains/ tassel	(%) empty rains/tassel	Grains weight /cluster	Grains /plot (kg) weight	Weight of grains
V1	22,98 a	119,00 a	102,00 a	5,63 bc	19,23 ab	2,06 a	24,75 a
V2	24,15 a	201,50 bc	178,25 c	4,22 ab	26,33 c	2,78 bc	26,00 bc
V3	26,39 b	209,25 cd	162,00 c	6,78 c	24,05 bc	2,68 b	24,50 a
V4	23,47 a	185,25 b	166,00 c	3,35 a	28,09 cd	2,98 bc	25,50 abc
V5	24,20 a	119,75 a	98,50 a	6,05 c	18,74 a	1,99 a	25,00 ab
V6	23,59 a	225,63 d	204,75 d	2,33 a	31,60 d	3,36 c	26,25 c

Remarks: Numbers followed by the same letters showed that they are not significantly different

h. Fully Grain Numbers per Tassel: The highest value of fully grain numbers was produced by Jati Luhur (V₆) variety with magnitude of 204.75 grains which was highly significantly different than that of other varieties. Next, Situ Gintung (V₂) variety with magnitude of 178.25 grains was

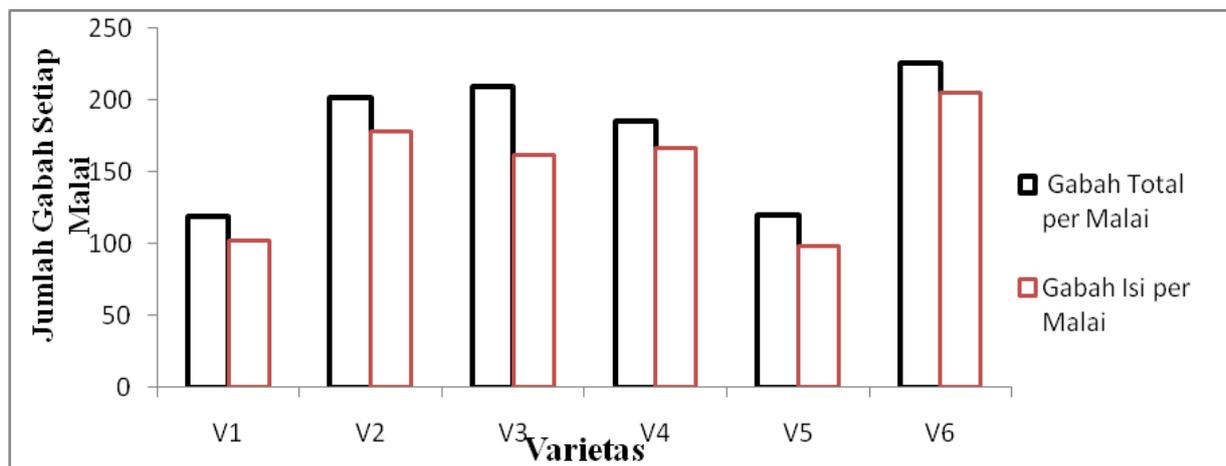
not significantly different than that of Talang Sari (V₄) variety. The lowest value of fully grain numbers was produced by Aek Sibundo (V₅) variety with magnitude of 98.50 grains which was not significantly different than that of Situ Bagendit (V₁) variety (Table 3).

Figure 2: Tassel Length (Cm) of Several Varieties of Rain-fed Rice



Remarks: V₁ = Situ Bagendit V₂ = Situ Gintung V₃ = Inpago 7 V₄ = Talang Sari
 V₅ = Aek Sibundo V₆ = Jati Luhur

Figure 3: Total Grain Numbers and Fully Grains per Tassel for Several Rain-fed Rice Varieties.



Remarks: V₁ = Situ Bagendit V₂ = Situ Gintung V₃ = Inpago 7 V₄ = Talang Sari
 V₅ = Aek Sibundo V₆ = Jati Luhur

i. Percentage of Empty Grains (%): Jati Luhur (V₆) variety had produced the least percentage of empty grains with magnitude of 2.33% that was not significantly different than that of Talang Sari (V₄) variety and Situ Gintung (V₂) variety, but it was highly significantly different than that

of other varieties. The highest percentage of empty grains with magnitude of 6.78% had produced by Inpago 7 (V₃) variety followed by Aek Sibundo (V₅) variety with magnitude of 6.05% and Situ Bagendit (V₁) variety with magnitude of 5.63% (Table 3).

- j. Grains Weight per Cluster (g):** Jati Luhur (V_6) variety had produced the highest grains weight per tassel with magnitude of 31.60 g which was highly significantly different than that of other varieties, but it was not significantly different than that of Talang Sari (V_4) variety with magnitude of 28.09 g.
- k. Grains Weight per Plot (kg):** Jati Luhur (V_6) variety had produced the highest grains weight per plot with magnitude of 3.36 kg which was highly significantly different than that of other varieties, but it was not significantly different than that of Situ Gintung (V_2) variety with magnitude of 2.78 kg and Talang Sari (V_4) variety with magnitude of 2.98 kg (Table 3).
- l. Weight of 1000 grains (g):** The weight of 1000 grains for Jati Luhur (V_6) variety was 26.25 g which was not significantly different than that of Situ Gintung (V_2) variety with magnitude of 26.00 g and Aek Sibundo (V_4) variety with magnitude of 25.5 g, but it was highly significantly different than that of other varieties (Table 3).

Discussion

The variety differences have effect on crop height because each variety has different genetic characteristics and nutrients absorption capacity which in turn affect the crop height. According to Lakitan (1996), each crop has different growth characteristics and requires different condition depending on the crop species and variety. Therefore, even for crop grown in the same environment and the same treatment will show different response due to different variety.

Similar phenomena are also related to the yield of productive tiller numbers. All rice varieties used in this research (Situ Bagendit, Talang Sari, Situ Gintung, Aek Sibundo, Inpago 7, and Jati

Luhur) were not showed significant different in term of productive tiller numbers in the range of 11 to 16, except Situ Bagendit variety which tend to show more productive tiller numbers with magnitude of 16 tillers. According to Wirjoprajitno (1980), a crop grown in the same environmental condition, the same nutrients availability and the same planting time has different productive tiller numbers due to variety factor.

The dry weight of crop represent crop pattern in accumulating product from photosynthesis process and it is integrated with other environmental factors (Goldworthy and Fisher, 1992). Accumulation of photosynthesis products can be reflected from the growth and production parameters. Therefore, dry weight value of crop has positive correlation with one or more parameter values of growth and production. Product accumulation from photosynthesis process for Talang Sari variety is reflected in form of stem perimeter size. Although stem perimeter size is not parameter in growth parameter in this study, but morphologically Talang Sari variety had high stem perimeter size which in turn had produced the highest value of dry weight with magnitude of 51.83 g although its tiller numbers was lower than that of Situ Bagendit variety and its crop height was lower than that of Situ Gintung variety.

The harvesting period is highly affected by variety type of rain-fed rice used in cultivation which is considered as genetic factor. Jati Luhur and Talang Sari varieties had the shortest harvesting period with magnitude of 95 days followed by Situ Bagendit, Situ Gintung and Aek Sibundong varieties with harvesting period of 106 days, respectively and the longest harvesting period was found in Inpago-7 variety with magnitude of 114 days.

The size of tassel length is not always determines the grain numbers per tassel produced in this study. This is shown by the fact that Inpago-7 variety with the longest tassel size of 26.39 cm had 209 grain numbers per tassel, whereas Jati Luhur variety with tassel size of 23.59 cm had 225 grain numbers per tassel and the least grain numbers per tassel with magnitude of 185 was found in Talang Sari variety.

Grain numbers per tassel, weight of 1000 grains, empty grains percentages and fully grains numbers had effect on grains weight per cluster produced in this study. This was shown by Jati Luhur variety that had advantages in term of grain numbers per tassel, weight of 1000 grains, empty grains percentages and fully grains numbers which produced the highest value of grains weight per cluster with magnitude of 31.60 grams and the lowest value of grains weight per cluster with magnitude of 18.74 grams was found in Aek Sibudong variety.

Grains production per cluster determines grains production per plot. Jati Luhur variety had the highest grains production with magnitude of 3.36 kg per plot followed by Talang Sari variety with magnitude of 2.98 kg, Situ Gintung variety with magnitude of 2.78 kg, Inpago 7 variety with magnitude of 2.68 kg and Situ Begendit variety with magnitude of 2.06 kg. The lowest grains production per cluster was found in Aek Sibudong variety with magnitude of 1.99 kg per plot.

CONCLUSION

1. Situ Gintung and Inpago 7 varieties had the highest crop height with magnitude of 145.20 cm, Situ Bagendit variety had advantage in term of productive tiller numbers with magnitude of 16, and Talang Sari and Jati Luhur

varieties had the shortest harvest period with magnitude of 95 days.

2. Inpago 7 variety had the longest tassel with magnitude of 26.39 cm, Jati Luhur variety had advantage in term of grain numbers per tassel with magnitude of 225.63 grains, fully grain number per tassel with magnitude of 204.75 grains, grains weight per cluster with magnitude of 31.60 g, weight of 1000 grains with magnitude of 26.25 g, the highest weight per plot with magnitude of 3.36 kg and the lowest empty grains with magnitude of 2.33 %.
3. The advantage in growth is not always produce high production, for instance Situ Begendit, Talang Sari, Situ Gintung and Inpago 7 varieties had advantage in growth, but the highest production was found in Jati Luhur variety.

RECOMMENDATION

It is important to carry out further study covering more extensive area, different locations and other varieties by using Jati Luhur variety as one of reference variety.

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