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STUDY OF AGRONOMIC TRAITS IN LOCAL RICE OF WETLAND SWAMP DISTRICT BATANGHARI IN JAMBI PROVINCE

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ABSTRACT

Swamp land is one of the areas of agricultural development that is perspective where the agroecosystem has the characteristics, and very unique with specific inundation and soil propertiescompared to other agroecosystems. At present, in some of these areas rice cultivation is still using local varieties. Local rice is one of the genetic resources which is quite diverse. The ability to adapt to extreme environments is the reason for most farmers to continue to plant and cultivate local rice. The study of the agronomic traits of local rice in swamp land is carried out in order to see the agronomic character and obtain varieties that have superior traits based on their agronomic character. The research activity was carried out in the Rantau Kapas Mudo Village, Batanghari Regency, Jambi Province from April to October 2016. The study used a single plot method. The local rice varieties used are genetic resources of swamp land rice planted in single plots measuring 10 m x 5 m, the distance between plots is 1 m with a spacing of 25 cm x 25 cm. The local varieties used were as many as 11 varieties, consisting of: Serendah Halus, Rimbun Daun, Karya, Serendah Bawang, Sereh Aek, Botol, Pontianak, Semut, Dawi, Ketan Itam and D.I. The characters observed consisted of plant height at harvest, number of productive tillers, age of harvest, number of grains per panicle, number of filled grains per panicle, number of empty grains per panicle, weight of 1,000 grains, seed shape and production. The results showed that there were differences between the local rice varieties of swamp land observed. The results showed that the highest production (3.32 tons / ha) was found in the Leafy variety, evidenced by the Dawi variety (2.86 t / ha). The results showed that there were two local rice varieties, Rimbun Daun and Dawi which had the potential to be developed and were expected to become the leading regional rice varieties in the swamp land.

Keywords: local rice, swampy land, agronomic traits

INTRODUCTION

Swampland is one of future agricultural development areas, and each swampland has characteristics that make it a very uniqueagro-ecosystem, with its specific inundation and land properties compared to other agro-ecosystems (Noor and Fadjry, 2008). Swamp land can also be distinguished by the presence or absence of the influence of asurrounding river. Swampy land can also be distinguished based on the presence or absence of the influence of the surrounding river. Swamp land that is inundated by the surrounding river is called the river swamp while the free or unaffected swamp is called a caged or half-caged swamp (Kosman and Jumberi, 1996).

Swampland is characterized by the presence of stagnant water for a long period of time. The stagnant water is not an accumulation of tides, but originates from surface runoff in the region and from surrounding areas due to its low topography. The condition of the inundation is influenced by the river and local rainfall and the surrounding area (Ismail *et al*., 1993).

Water can stagnate for longer than six months, due to an inner basin known as the valley swamp. The study location was classified as low-lying, lower topography with a pool of water between 50 and 100 cm deep during a period between three and six months. The condition of swamp land is generally muddy and has a medium to high fertility level (Waluyo and Suparwoto, 2016).

Increasing rice production in swamp land can increase farmers' income, and can support food self-sufficiency (Djafar, 1992). The main obstacle in the cultivation of rice in swamp land is the water system that is still uncontrolled, so that during the rainy season the entire area is inundated quite deep and for quite a long time. This makes it difficult for farmers to guess the rice planting period. Puddles that are too high during the vegetative phase due to flooding and heavy rains that occur after the seedlings are moved into the field are growth constraints that cause low production of low-yield rice. The risk of crop failure can also occur due to drought if there is no rain when the rice plants bloom (Swamp Research Center, 2008). Based on the above conditions, in general, farmers plant local rice which is a genetic resource of rice plants that have adapted to the growing environment in swamp land.

Genetic resources are the basic ingredients for assembling superior varieties that are in accordance with people's tastes. Assembling superior varieties requires diversity of germplasm, so that sustainability must always be maintained. The genetic resources of rice currently in each region are very necessary for the formation of plant varieties that have high yield, resistance to pests and diseases, and tolerance to environmental stress. Local varieties play an important role as parents who are adaptive to specific locations, while wild relatives and introduced varieties can be used as parents of resistance to pests and diseases (Rais, 2004).

Germplasm is the fourth natural resource in addition to water, land and air resources which are very important to be conserved. Preservation of germplasm as a genetic source will determine the success of agricultural development programs. The desirable food sufficiency will depend on the diversity of germplasm that is owned, because in reality superior varieties, which have been, are being, and will be assembled are a collection of specific genetic diversity that is expressed in the desired superior qualities. Genetic resources in each region are very necessary for the formation of plant varieties that have high yield, resistance to pests and diseases, and tolerance to environmental stress (Situmeang, 2015).

Diwyanto and Setiadi (2008) state that agricultural genetic resources (agrobiodiversity) is one of the most important germplasm to be secured from extinction and the occurrence of genetic potential erosion. This is because agricultural genetic resources in real terms has been and continues to be utilized for the survival and welfare of the community, both at the local, regional, national, and global levels. At present there is a lot of confusion, that as a mega-biodiversity country, Indonesia is rich in germplasm collection. The existing condition is the opposite, Indonesia is actually very poor collection of germplasm which can be utilized in real terms in the process of assembling varieties or superior seeds.

Genetic diversity is an economic, tourism, health and cultural resource. The existence of genetic diversity itself is not evenly distributed in each region, depending on the ecosystem of the region (Wardana 2002). The use of natural resources can ideally be directed towards human welfare accompanied by the preservation of diversity and uniqueness that is owned so that it can be carried out continuously from one generation to the next. Indonesia, which is an archipelagic country and consists of various tribes and cultures, will be closely related to the use of genetic resources which is very diverse between regions and agro-ecology. Cultural diversity accompanied by the diversity of agricultural genetic resources will produce diverse knowledge of the community in utilizing these resources for food, shelter, clothing, medicines and industrial raw materials (Diwyanto and Setiadi 2008).

In Jambi Province, among various wetland agroecosystems (irrigation, rainfed and swamp), swamp land agroecosystems are the widest, namely 137,132 ha. In the swamp land agroecosystem, the swamp land area is 25,157 ha which is currently found in some areas of local varieties of rice (CPM, 2016). Various types of local rice from various agroecosystems have the potential to be alternative food resources that need to be inventoried and conserved to be developed to become local superior varieties. According to Hajoeningtijas and Purnawanto (2013), local rice varieties are rice varieties that have long been adapted in certain areas. The use of local rice is generally as food in the form of rice. This not only supports the fulfillment of future food needs, but also supports the development of genetic resources.

These local rice varieties need to be maintained and preserved as assets and assets of regional genetic resources and used as a source of parent material for crossing in future varieties improvement programs (ARDA, 2013; Rais, 2004). The characteristics of local rice varieties are largely not well identified, so the potential and opportunities for their development as superior local rice varieties are unknown. The appearance of the local variety population in the field still looks diverse, especially the character of plant height, ripe age, shape, and grain color.

Local rice varieties have been adapted to suit the conditions of certain areas based on various criteria, such as low production rate, high and strong trunk, longlived lack of response to input or fertilization, diverse physical characteristics, delicious taste, popularity among many consumers, and high market price. The local rice needs to be preserved and preserved as a wealth and asset of the regional germplasm, and can be used as a source of genetic diversity and as a parent material for crossbreeding in a variety improvement program for the future.

The characteristics of local rice varieties of wetland have not been well identified so that their potential and development opportunity as superior local rice varieties are not yet known. The performance of local variety populations is still diverse, especially in terms of plant height and age of harvest. This will affect farmers' production of rice. Seeds of local rice varieties used by farmers are also of low quality because they are continuously obtained from farmers' rice crops and inherited from generation to generation (Bobihoe, 2014). The purpose of this study is to determine the characteristics of local rice in swamp land and to discover the varieties that have superior characteristics based on a number of agronomic characteristics. The results of this research are expected to help increase the opportunity to assemble new rice varieties and to improve rice productivity in swamp land.

MATERIALS AND METHODS

The research activities were carried out in Rantau Kapas Mudo Village, Batanghari Regency, Jambi Province from April to October 2016. Many as 11 local varieties of swamp land rice, which consisted of : Serendah Halus, Rimbun Daun, Karya, Serendah Bawang, Sereh Aek, Botol, Pontianak, Semut, Dawi, Ketan Itam, and DI were studied. The research method used is a single plot method. Each variety is planted in a single plot measuring 10 m x 5 m, the distance between plots is 1 m with a spacing of 25 cm x 25 cm.

Characters observed include characters in the vegetative and reproductive phases. The vegetative phase consists of : plant height at harvest (measured from the base of the stem to the highest tip of panicle), the number of productive tillers (calculated at the time of harvest). The generative phase consists of : harvest age (calculated the number of days after planting), number of grain (counted number of grain) per panicle, number of filled grain (calculated number of filled grain) per panicle, number of empty grain (calculated number of empty grain) per panicle, weight 1,000 items (weighed 1000 grains of grain content), and yield (ton/ha). Plant data and results were observed agronomically for 10 clumps of rice plants and processed by tabulation.

RESULTS AND DISCUSSION

A number of local swamp rice varieties consisting of Serendah Halus, Leaf Rimbun, Karya, Serendah Bawang, SerehAek, Bottle, Pontianak, Semut, Dawi, KetanItam, and DI were characterized in terms of agronomical traits in farmers' fields located in Rantau Kapas Mudo Village, Muaro Tembesi District, Jambi Province, Indonesia. The results are presented in Table 1.

Vegetative Phase of Rice Plants

In the vegetative phase, the observed growth of rice plants was plant height and number of productive tillers, in Table 1.

Table 1. Vegetative components of the local rice of swamp land

No.	Variety name	Plant height (cm)	Number of productive tillers (tiller)
1.	Botol	86,2	10
2.	Pontianak	139	10
3.	Semut	120,8	10
4.	Dawi	91,3	13
5.	Ketan Hitam	111,4	9
6.	DI	104,7	10
7.	Serendah Halus	141,4	7
8.	Rimbun Daun	132,9	10
9.	Karya	140,6	9
10.	Serendah Bawang	147,6	6
11.	Sereh Aek	143,6	9

Note : Average plant height at harvest (cm) and number of productive tillers (tillers), local rice varieties in swamp land

Plant Height

Our observation data indicate that in general the tested local rice varieties have a plant height between 86.2 and 147.6 cm. Serendah Bawang was found to have the highest plant height (147.6 cm), while Botol was found to have the lowest plant height (86.2 cm). Local rice plants were generally high (>130 cm) (scale 5) except Botol, Dawi, and DI (<110 cm) (scale 1). Those rice crops can be classified into three classes based on their height, i.e. short (<110 cm), medium (110 to 130 cm), and high (>130).

Observation of plant height was carried out in the generative phase when the harvest begins. Medium-grade plants (110–130 cm) are more likely to be developed than high crops, as high crops use photosynthesis for vegetative growth, making the use of photosynthesis less efficient. Leaf is a place of photosynthesis because the leaves are part of plants that contain a lot of chlorophylls. The stem serves as the body support of the plant. Plants require strong stems. An ideal proportion of plant height and stem rotation is required to prevent plant splinter. The growth of leaves, stems, and roots increased in the vegetative phase in preparation for the generative phase. Differences in plant height can be due to the genetic factors of a variety. The difference in genetic makeup is one of the factors that contributes to the diversity of plant physical characteristics—in this case, the plant height. The results showed that the rice cultivation system produced higher plants than the upland cultivation system did. Plant height in rice plants can be used as a parameter of rice growth, but high plant growth does not guarantee greater yields (Kristia A. and Iskandar L., 2018). Plant height is one component that influences a plant's weight. The desired characteristics in the development of superior varieties of rice are stems that are short and stiff, because plants that have this characteristic will be resistant to fall, be responsive to fertilization, and have a more balanced proportion between grain and straw. Another characteristic is the absorption of N nutrients by plants: the higher the performance of a plant, the higher the likelihood of its vulnerability (Kristia A. and Iskandar L., 2018).

The selection criteria for rice plants are, among other things, the height of rice plants, where the height of the plants is related to the length and shortness of the panicles and also to the resistance of plants to shedding. Plants will be lower at locations higher than sea level (Simanulang, 2001). Plant height is also one of the selection criteria for rice plants, but high growth has not guaranteed the level of production (Suprapto and Dradjat, 2005).

High plant growth does not guarantee high plant productivity. Optimal plant growth has a large influence on the relationship between panicle length and yield. Plants that grow well can absorb nutrients in large quantities. Availability of nutrients in the soil has a bearing on photosynthetic activity, so plants can increase growth and yield components of crops (Ida Bagus, 2012).

Number of productive tillers

The number of productive tillers of each observed local rice variedfrom 6 to 13 tillers. The highest number of tillers was found in Karyalocal rice (13 tillers) and the lowest number of tillers was found in Serendah Bawang local rice (6 tillers). This low number of tillers is due to the fact that during the seedling period the crops were submerged for about a week, thus inhibiting the formation of saplings (ICR, 2016).

High and low plant growth and yield are also influenced by internal factors which include genetic traits and plant derivatives, and external or environmental factors, such as soil climate and biotic factors (Cepy and W. Wayan, 2011). The difference in the number of tillers of each variety is thought to be due to the influence of these factors. This is in line with previous research which states that the number of tillers and plant height are different because each variety has different gene properties (Manurung S.O. and M. Ismunadji, 1988).

Productive tillers per clump is a determinant of the number of panicles thus productive tillers are one component of the results that directly affect the high and low yields of grain (Simanulang, 2001). The formation of productive tillers greatly determines the number of panicles from rice plants. The more productive tiller the more number of panicles. There is a correlation between the number of panicles with the results, because the more the number of panicles the higher the yield of rice plants.

Generative Phase of Rice Plants

In the generative phase of the growth of rice plants observed were harvest age, number of grains, amount of filled grains, empty grains, weight of 1000 grains, age of harvest and yield.

Table 2. Yield components of the local landraces of swamp land

No.	Variety Name	Harvest age (DAP)	Number of grain per panicle (grain),	Number of filled grains per panicle (grain)	Number of empty grain per panicle (grain)	Weight of 1000 grains (gr)	Production (ton/ha)
1.	Botol	150	132	74	58	22	2,32
2.	Pontianak	150	122	88	34	23	2,24
3.	Semut	150	113	49	64	14	1,26
4.	Dawi	150	172	80	92	16	2,86
5.	Ketan Hitam	150	136	82	54	21	2,05
6.	DI	150	132	78	54	23	2,42
7.	Serendah Halus	150	151	61	90	21	1,77
8.	Rimbun Daun	150	173	86	87	24	3,32
9.	Karya	120	137	47	90	19	1,97
10.	Serendah Bawang	150	170	103	67	25	2,04
11.	Sereh Aek	150	165	73	83	20	2,37

Note : Average age of harvest (day after planting), number of grain per panicle (grain), number of filled grains per panicle (grain), number of empty grain per panicle (grain) (Empty grains are generally found at the base of panicles), weight of 1000 grains (gr), form of grain, and production (ton/ha) of swamp local rice varieties in swamp land.

Harvest period (number of days after seedling)

In terms of age, in general rice crops are categorized into early age (about 110 days and more than 120 days). Local rice varieties are generally old (>151 days after seedling), while high yielding varieties are mature (105–124 days after seedling) (ICRR, 2016).The local varieties of swamp rice cultivars can generally be cultivated within 150 days, while the local variety which can be cultivated at an early age is Karya (120 days). Harvest period is one of the characteristicswhich farmers take into consideration. Short harvest age is preferred because the harvest can be faster, and the harvest period can also be increased.

Number of grains per panicle (grains), number of filled grains per panicle (grains), number of empty grains per panicle (grains).

The results of our observation onthe grain number showed that Dawi and RimbunDaun varieties produced the highest number of grains per panicle, i.e. 172 and 173 grains per panicle, respectively, while Semut variety produced the least numbers of grains per panicle, i.e.113 grains.

The results of our observation on the number of filled and empty grains indicated that Serendah Bawang variety had the highest grain content, i.e. 103 filled grains, while Semut variety had the least grain content, i.e. 42 filled grains. The lowest number of unhulled grainswas found in Pontianak variety, i.e. 34 grains,while the highest number was found in Dawi variety, i.e. 92 grains.

This high number of empty grains shows the inability of those plants to fill their own grains. Such a low yield can be due to genetic or environmental factors. Empty grains will affect the rice yield: the higher the percentage of empty grains, the greater the effect on the rice yield. In other words, higher proportion of empty seeds would result in lower rice production. The number of filled grains per panicle has a real correlation with rice yield, so the number of filled grains per panicle is one of the criteria for selecting a rice variety which can produce a high yield. The number of filled grains is markedly correlated with rice crop yield, but the latter variable is also strongly influenced by the number of empty grains. Likewise, the weight of grain contentsalso serves as one determinant of the weight of the yield. Empty seeds will affect the yield of rice: the higher the percentage of empty grains, the greater the effect on rice yields. The number of filled grains per panicle is significantly related to crop yield, but is also strongly influenced by the number of empty grains. New types of rice with potentially high yield generally have good characteristics, i.e. (1) the number of grains per panicle is between 150 and 250 grains; (2) the percentage of filled grainsis between 85 and 95%; and (3) the percentage of empty grains is between 5 and 15% (Abdullah,2008).

The number of filled grains per panicle is one component of the results that affect rice yield. Generally, the number of grains per panicle is positively correlated with panicle length. The longer the panicle is formed, the more chance the amount of grain is accommodated by the panicle concerned. Meanwhile, the number of filled grains and the weight of 1000 grains formed in one panicle is highly dependent on the photosynthesis (seed filling) of plants during their growth and the genetic properties of cultivated rice plants (Ida Bagus, 2012).

Weight per 1,000 grains (gr) and weight of yield (t/ha)

Based on our test results, the weight per 1,000 grains of each variety varied between 14 and 25 gr. The highest weight per 1,000 grainswas found in the Serendah Bawang variety, i.e. 25 gr, while the lowest was found in Semut variety, *i.e*. 14 gr. Weight per 1,000 grains indirectly describes the size or magnitude of a rice grain variety. The higher the weight per 1,000 grainsof a rice variety, the larger its grain size, and vice versa. The size of grain is affected by its genetic properties and adaptability to its growing environment. In the highlands in the dry season with low temperatures, it affects the weight of 1000 grains of grain.

The difference in weight per 1,000 grains is one characteristic of plants where the ability of a variety to produce a lot of grains is often inversely proportional to its ability to produce large and heavy grains, but a high production rate can also be achieved with a large number of grains, even though the grain size is not very large (Simanulang Z.A., 2001). Weight of 1000 grain indirectly illustrates the grain size of a line or rice variety. Strains/varieties whose grain is large, weighing 1000 grains will be high, and vice versa. Grain size is influenced by genetic traits and adaptability to the growing environment. The yield of rice is determined by the yield component such as the weight of 1000 items.

The results showed that, of all the varieties tested, the one which produced the highest yield was RimbunDaun (3.32 t/ha). This result was in line with that of our calculation of the number of grains perpanicle, where RimbunDaun variety produced the highest yield of 173 grains, while the lowest number is found in Semut variety (1.26 t/ha). This result is also in line with that indicated by the number of filled grains per panicle and the weight per 1,000 grains of Semut variety, both of which were found to be the lowest in comparison to others. The yield of a plant is determined by the components of its yield. The results of plants are determined by the components of a plant, the imbalance between the components of the results will greatly influence the potential result obtained. Likewise, rice yield is determined by its yield components, such as the number of filled grains per panicle and weight per 1,000 grains. Correlation of the plant’s tangible yieldwith its weight per 1,000 grains and its number of filled grains per panicle is one of the criteria for selecting the rice variety which can produce a high yield (Manurung S.O. and M. Ismunadji, 1988).

The results of our calculation of yield per hectare of all varieties showed that, of the eleven tested local swamp rice varieties planted on *lebak*swamp land, there are two local varieties that have a high yield potential of more than2.5 tons per ha, namelyRimbunDaun (3.32 t/ha) and Dawi (2.86 t/ha). Thesetwo varieties have the potential for being developed and are expected to become local superior rice varieties. By implementing good cultivation technology, it is expected that those local rice swamp varieties will produce the same yield as their potential yield.

CONCLUSION

Local varieties that have high yield potential above 2.5 tons per hectare, namely; Rimbun Daun varieties (3.32 t / ha), and Dawi (2.86 t / ha), the highest yields were produced by Rimbun Daun varieties (3.32 t / ha GKP). The local rice varieties of swamp have the potential to be developed and are expected to become the leading rice varieties in the swamp land.

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