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Rooting System and Character of Agronomist Several Genotypes Rice (*Oryza sativa* L.) On The Conditions Cultivation of Aerobic

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Abstract : *This research is related to aerobic organic cultivation. Aerobic cultivation systems have advantages in plant roots that can make plant roots get more oxygen so that their development becomes better, plant growth gets better and gives optimal results. Aerobic cultivation requires less water at the field level than conventional rice cultivation. The aerobic system is also most suitable for upland rice or rainfed rice that requires relatively little water. This study aims to determine the root system and agronomic characters of several rice genotypes under conditions of aerobic cultivation. This study did not use non-factorial randomized block design consisting of 16 genotypes of rice cultivated organically. The results of this study indicate that aerobic rice cultivation organically has a very significant effect on plant height at harvest, 1000 grain weight and yield index. However, no significant effect on the weight of filled and empty grains.*
Keywords: *aerobic, cultivation, organic, rice, roots*

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I. Introduction

Rice (*Oryza sativa* L.) is a staple food for most of the Indonesian people which is processed into rice. Rice is one food that contains enough nutrients and boosters energy for the human body, because it contains ingredients that are easily converted into energy. However, with the high rate of population growth, the need for rice has also increased (Humaedah *et al*., 2010).

The need for rice increases every year, along with the rate of population growth. One effort to increase rice production is by extensification and intensification. Extensification efforts are the opening of new agricultural areas (expansion of agricultural areas). Meanwhile, intensification efforts are proper land processing, use of superior varieties, provision of water management, balanced use of fertilization, and control of pests / diseases. Rice production can be increased again by good cultivation, so that production will increase (Fageria, 2007).

Upland rice is one variety of paddy cultivation in dry land. Upland rice is planted first at the beginning of the rainy season. Low production of upland rice, one of which is the soil that is always in dry conditions. According to Islami *et al*. (1995); Sadimantara and Muhidin (2012), drought stress can affect the physiological and biochemical processes of plants and cause modification of plant anatomy and morphology. Drought is one of the main constraints in rice production (Mostajeran and Rahimi-Eichi 2009).

Alternative that can be done to overcome this problem is to repair or process the soil aerobically. Aerobic cultivation systems have advantages in plant roots that can make the roots of plants get more oxygen so that their development becomes better, plant growth becomes better and provides optimal results. In addition, aerobic conditions allow soil microbes to get more oxygen, so that their survival is maintained which helps in the absorption of nitrogen around the roots of rice plants (Maida, 2013).

Based on the results of a study by Sandhu *et al*. (2012), it was stated that aerobic rice cultivation has good adaptability to culture systems because of limited water and tolerance to drought stress. However, studies of aerobic rice cultivation on root systems and agronomic characteristics of local varieties have not been widely carried out. So, research needs to be done to evaluate the root system and the agronomic character of some rice varieties under conditions of aerobic cultivation.

Based on this description, aerobic rice cultivation in upland rice has not been widely known. Therefore, this study aims to find out to determine the root system of several genotypes and agronomic characteristics of several rice genotypes (*Oryza sativa* L.) under aerobic cultivation conditions.

II. Research Methods

This research was conducted from February 2016 to June 2016 at the Laboratory of Seed Technology and Experimental Gardens, Faculty of Agriculture in the East Sector, Syiah Kuala University, Banda Aceh. The location of the study is at the point 5°34'01,63" LU and 95°22'23,09" BT and 3 meters above sea level (Google Earth, 2014). The materials used were rice seeds which were used consisted of several genotypes, namely local Aceh cultivars and national varieties (Inpago 8, Situ Patenggang, Inpari-33 Blas, Inpari-32 HBD, Bastari, Sulutan Unsrat 1, Batutegi, Unsyiah-1 Sanberasi , Unsyiah-2 Sanberasi, East Aceh Red Rice, Sipula Merah, Sipula Putih, Sikuneng, Sanbei, Sigupai, Hipa 19 and national varieties, namely Ciherang as a comparison). Rice seeds are taken from those stored at the Seed Science and Technology Laboratory, Faculty of Agriculture, Syiah Kuala University. The tool used in this study consisting of cameras, tweezers, hoes, ovens, is a tool, meter, Purity Desk, analytical and sprinkler counterpart. This research was carried out using non-factorial randomized block design consisting of 16 rice genotypes. Each replication of each variety was planted as many as 18 plants and repeated three times, so that 54 experimental units per variety were obtained.

Implantation

Planting seeds, the first seeds chosen have good physical appearance and are protected from pests and diseases, rice seeds that have been labeled and cultivar numbers are revoked and planted with one per planting hole, in the revocation of rice seeds must be carefully so as not to damage especially in the roots of plants that will be used as research material.

Fertilization

Fertilization is done by using 10 tons of organic PIM fertilizer (40 g/ plant).Fertilization is carried out as a basic fertilizer given 1 week before planting. Fertilization is done by mixing it during soil treatment (2-3 times).Supplement fertilizer given by sowing around the stem of plants given at 3 days after planting, 30 days after planting and age 60 days after planting with each dose of 40 g/ plant.

Observation

Plant height at harvest

Plant height at harvest is measured when after harvesting from the base of the stem to the tip of the leaf or panicle (centimeter unit).

Heavy grain contains

The amount of weight of grain contained is done by observing the grain contained in each panicle taken from the sample plant using a purity desk (percent).The criteria for pithy grains are characterized by a clean, clear and dense appearance. Calculation of percentage weight of grain meaty:

$$\text{Weight percentage of grain meaty} = \frac{\text{weight of total grain} - \text{weight of empty grain}}{\text{weight of total grain the weight of empty grain}} x\ 100\%$$

Unhulled rice weight empty

The amount of empty grain weight is done by observing empty grain on each panicle taken from the sample plant using it purity desk (percent). The criteria for empty grains are indicated by the appearance empty grain that looks white and dry.Calculation of percentage of empty grain weight:

$$\text{Empty grain weight} = \frac{\textit{The weight of the total grain} - \textit{weight of the grain contains}}{\textit{Total grain weight}} x\ 100\%$$

Weight of 1000 Grains

The number of filled grains separated and calculated by the formula, to meet 1000 grain values by weighing 25 grains of rice plants with analytical scales (grams).

$$\text{Weight1000 grain} = \frac{\text{weight 1000 grain } r}{25gr} \text{x calculated sample weight}$$

Harvest Index

The result index is the ratio of dry grain weight to total dry weight, or calculated by:

$$HI = \frac{\textit{Dry grain weight filled}}{\textit{Total dry weight}}$$

III. Result and Discussion

The height of rice plants at harvest (cm)

The average plant height at harvest can be seen in Figure 1. Of the several rice accessions tested, the highest crop height was found in Sikuneng rice accession. This shows that the height of plants at harvest is determined by genetic and environmental factorsThis is in line with the opinion (Efendi *et al*., 2012) that variations in plant height delivered by varieties are because each variety has different genetic and character factors in other words the presence of genes that control the nature of this variety. Sugeng, (2001) added that in addition to genetic influences, each of these varieties is also influenced by environmental factors that can cause gene mutations.Gene mutation will occur if the variety is planted in an area with cold temperatures, the results are propagated in areas with hot temperatures.

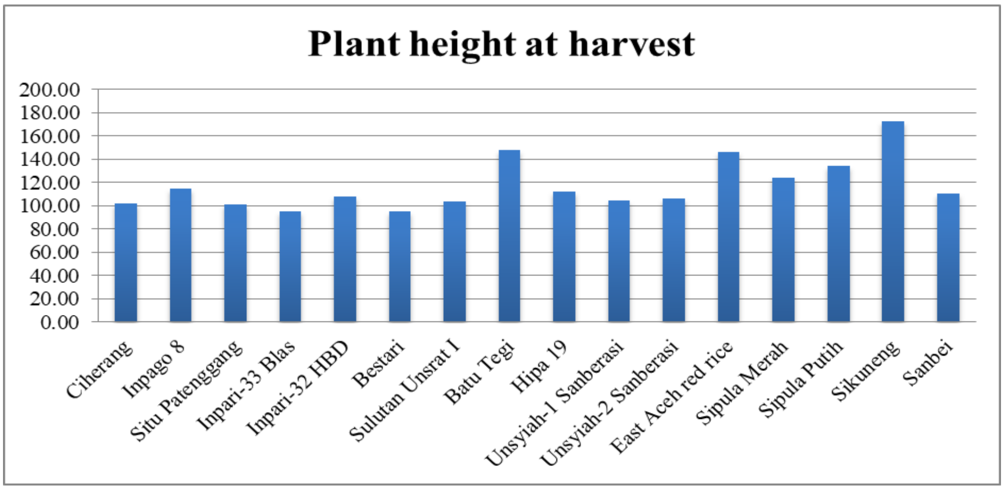

Fig 1. Average plant height when harvesting several rice varieties under aerobic cultivation conditions

Percentage of Grain Contains and Percentage of Grain

The average percentage of grains containing contained and the percentage of empty grains from several rice varieties under aerobic cultivation conditions can be seen in Table 1.

Table 1. The average of grains that contain percentage and grain empty of the percentage of some rice varieties aerobic cultivation conditions.

Varieties	Percentage of Grain Contains	Percentage Grain Empty
Ciherang (Control)	89.39	10.61
Inpago 8	90.12	9.88
Situpatenggang	83.32	16.68
Inpari-33 Blas	87.40	12.60
Inpari-32 HBD	91.75	8.25
Bastari	89.43	10.57
Sulutan Unsrat	90.22	9.78
Batutegi	84.22	15.78
Hipa 19	86.11	13.89
Unsyiah-1 Sanberasi	90.43	9.57
Unsyiah-2 Sanberasi	86.50	13.50
East Aceh Red Rice	91.28	8.72
Sipula Merah	92.98	7.02
Sipula Putih	90.30	9.70
Sikuneng	82.59	17.41
Sanbei	72.68	27.32

Table 1 shows that the percentage of unhulled rice that is found mostly in Sipula Merah rice accessions and the percentage of unhulled rice is mostly found in Sanbei rice accession although it is not statistically significantly different from other rice accessions.The Sipula Merah rice accession has a high percentage of rice grains compared to other rice accessions this shows that rice grains can express optimally so that the percentage of pithy grain and grain weight per plot is better. This is in line with Yoshida (1976), environmental factors such as high and low temperatures during cooking or unfavorable weather during antesis (fully open flowers), determine the number of pithy grains per clump.

The highest percentage of unhulled rice is found in Sanbei rice accession. This shows that the respiration of rice plants is determined by certain air temperatures in various stages of growth. If the ideal temperature at a certain growth stage is exceeded, then the phenomenon of photosynthetic leakage can occur.

This phenomenon will make hampered filling of unhulled grain and consequently the level of emptying of wheat will be high (Afandi *et al*., 2014).

Weight of 1000 Grains

The average weight of 1000 dry grains and the yield index of several rice varieties under aerobic cultivation conditions can be seen in Figure 2.

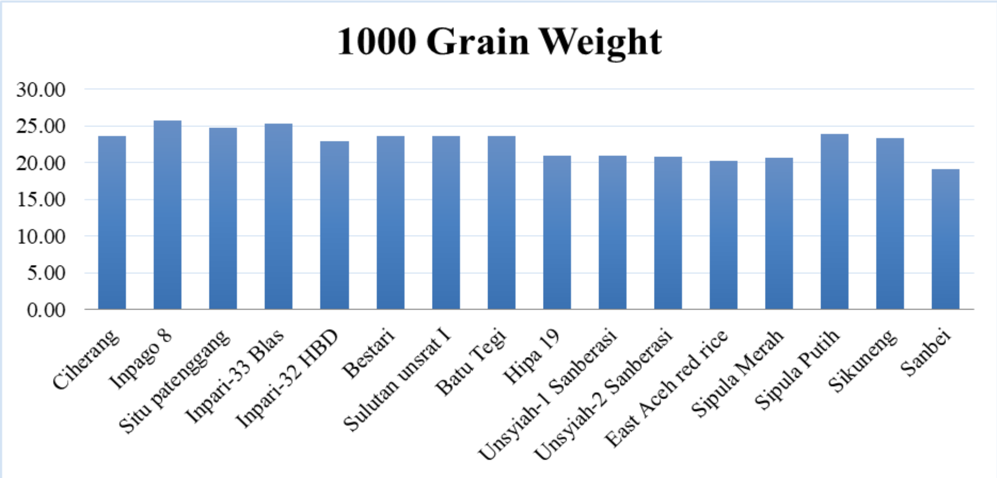

Fig 2. Average weight of 1000 dry grains and yield index of several rice varieties under aerobic cultivation conditions

Figure 2 shows that the heaviest weight of 1000 grain of dry rice was found in Inpago 8 rice accession which was different from other rice accessions, but it was no different from the Inpari Blas rice accession. In opinion with Suita (2014) the opinion that 1000 grain weight is affected by water content. If the high water content of 1000 increase will grain weight and if the water content is low then the weight of 1000 grains will be low. Sitompul and Guritno (1995), added that the late generative phase would reduce the generative period it self, so that the number of photosynthates allocated to generatives like seeds decrease. In irrigation with 3 (three) times (planting phase, Vegetative phase and generative phase) with Inpago 8 variety, the weight of 1000 grains increased.The difference in weight of 1,000 seed grains between genotypes shows that there is a difference in seed filling because of the different supply of assimilates to seeds by different conditions of sink and source strengths (Venkateswarlu and Visperas, 1987).

Results index

The average yield index of several rice varieties under aerobic cultivation conditions can be seen in Figure 3.

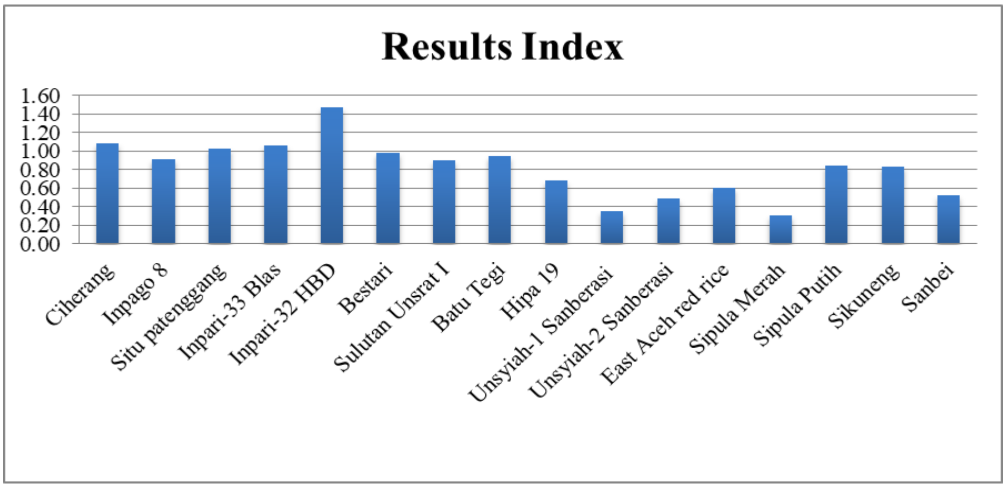

Figure 3. Average and yield index of several rice varieties under aerobic cultivation conditions

The highest yield index is found in Inpari-32 HDB rice accessions which are different from other rice accessions. This is thought to be related to the generation speed of the generative phase and long this phase takes place in aerobic cultivation conditions that will affect the yield of plants. This is supported by the statement of Sitompul and Guritno (1995), that the generative phase that is too late to form will reduce the generative period self, so that the number of photosynthates allocated to generative like seeds will decrease. Dwidjoseputro (1983) That is a plant will thrive if all the nutrients needed are sufficiently available and in a form suitable plants for absorbing.

IV. Conclusion

The results showed of the root system of rice plants and the agronomic character of some rice varieties under aerobic cultivation conditions has a very real effect on plant height at harvest, weight of 1000 dried grain grain and yield index. However, no significant effect on the percentage grains of contain and the percentage of empty grain.

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