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VEGETATIVE GROWTH RESPONSE OF NORTH HALMAHERA LOCAL RICE TO INUNDATION

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Abstract

Research on the Vegetative Growth Response of Halut Local Rice to inundation has been carried out. This study aims to examine the morphological response of local rice plants in North Halmahera to flooding during the growth phase.

This research was carried out using polybags in the greenhouse of the Agriculture Service of North Halmahera Regency using a completely randomized basic design experiment consisting of 2 factors, the first factor was variety and the second factor was the provision of inundation stress. Data were analyzed by analysis of variance (ANOVA). The characters observed in this study included plant height, number of leaves, root length, and speed of stem elongation.

The results showed that the treatment factors had significant differences when experiencing 10 days of inundation stress which was found in the observation character of the number of leaves. Meanwhile, the treatment factor, the variety factor, and the interaction between the treatment factor and the variety showed a very significant difference when experiencing a 20-day inundation on the observation of the number of leaves. The character of plant height, root length, and speed of stem elongation showed no significant effect on treatment factors, varietal factors, and interactions between treatment factors and varieties.

The morphological response of Halut rice varieties to flooding was that only the number of leaves was significantly influenced by flooding factors compared to other parameters (plant height, root length, and stem elongation speed). Based on the agronomic character of the number of leaves, the singing variety is more resistant/tolerant to flooding.

Keywords: Inundation, Morphological Response, North Halmahera Local Rice

INTRODUCTION

One of the causes of disasters is the impact of global climate change in Indonesia, including high rainfall in several places and rising sea levels which result in flooding, these conditions are a serious threat to agricultural businesses (Manikmas, 2008). The decline in rice yields due to flooding ranges from 30% - 60% and this can directly affect the welfare of farmers and national rice production (Hairmansis et al., 2009). Fluctuations in water availability are a problem in rice growth. Availability of sufficient water is an advantage for the growth of rice plants. Inundation of rice plants during several periods of growth until harvesting can change the chemical, microbiological, and nutrient availability of the soil. Rice plants are generally resistant to standing water, but if the puddle is too long then the plant will die. This is because when the plant is submerged in water, the supply of oxygen and carbon dioxide is reduced, thereby disrupting the process of photosynthesis and respiration (Setyorini and Abdulrachman, 2008).

Rice (*Oryza sativa*. L) is one type of plant that is favored by the government in an effort to increase production and food self-sufficiency. Rice (Oriza sativa. L) is also the main source of material for a third of the world's population, especially Asia because 90% of rice is produced and consumed in Asia. The diversity of genetic resources (SDGs), such as cultivars, local varieties, ecotypes, and wild relatives of plants is very useful for improving important characteristics, expanding the genetic base of cultivars, and also new sources of diversity for agriculture (Sultan and Rao, 2013). The rice plant itself can

adapt to a variety of agro-ecosystems, including irrigated rice fields, rainfed rice fields, dry land (upland), and swamps, especially lebak swamps (Hairmansis et al., 2012).

Indonesia is one of the regions in Southeast Asia which is famous for the diversity of local rice varieties, which have various agroecological types (Rais, 2004) which causes there are many rice cultivars that are tolerant to local conditions or specific locations. Local rice varieties planted by farmers are varieties that have been planted and selected by nature for decades. Local rice cultivation is favored by farmers because some of them have good adaptability to sub-optimal environments, including peatland ecology, delicious rice taste, fragrant aroma, proven resistance to pests, and good rice quality, although the production is not as high as new rice varieties. Research on the morphological response of local rice plants in North Halmahera to flooding during the growth phase has not been done much. This study aims to examine the morphological response of local rice plants in North Halmahera to inundation during the growth phase.

METHODS

This research was carried out for 9 weeks (starting in October to December 2021) in the greenhouse of the North Halmahera Regency Agriculture Office.

The materials used in this study were North Halmahera local rice and national rice (Misiri, Singing, and Mekongga varieties), soil, NPK fertilizer (10-30 grams) Gandasil-D (10-30 grams), and water. The tools used in this study were polybags, buckets, dippers, small shovels, markers, meters, scales, cameras, and stationery.

The research was conducted using a completely randomized basic design experiment consisting of 2 factors.

The first factor includes rice varieties.

V1 = The local rice plant HALUT, Misiri variety

V2 = The local rice plant HALUT Manyanyi variety

V3 = Mekongga rice varieties

The second factor is stress (inundation) at field capacity conditions
G0 = Control or without stress (watered every 2 days until field capacity)
G1 = 10 days inundation
G2 = 20 days inundation
G3 = Full inundation (for 30 days)

Thus, from these two factors, there were 12 treatment combinations. Each treatment was repeated 3 times so that 36 experimental units were obtained. The parameters observed in this study were plant height and the number of leaves.

The work procedures carried out in the study were, Seed Selection, Determination of Field Capacity in Soil, Nursery, Rice Seed Planting, Maintenance and Treatment of Inundation Stress, Observation, and Data Collection.

The data obtained were analyzed by ANOVA at the 95% confidence level. If there is a significant difference, it will be continued with the 5% LSD test.

RESULTS AND DISCUSSION

Plant height

The results of the analysis of variance on plant height in the treatment of 10 days of inundation, 20 days of inundation, and 30 days of inundation showed that the variety factor, treatment factor, and the interaction between varieties and treatment (stress) showed no significant effect (Tables 1, 2 and 3).

Table 1. The average effect of 10 days of inundation stress and three varieties of rice plants on plant height

Stressing	Varieties			Average
	Misiri	Manyanyi	Mekongga	
G0	17.10$_{ns}$	22.11$_{ns}$	18.69$_{ns}$	19.30$_{ns}$
G1	18.90$_{ns}$	22.63$_{ns}$	24.23$_{ns}$	21.92$_{ns}$
G2	16.18$_{ns}$	20.44$_{ns}$	15.93$_{ns}$	17.52$_{ns}$
G3	17.03$_{ns}$	20.31$_{ns}$	19.73$_{ns}$	19.03$_{ns}$
Average	17.30$_{ns}$	21.37$_{ns}$	19.64$_{ns}$	

Description: G0=Control (without stress), G1=Stress 10 days inundation, G2=Stress 20 days inundation, G3=Stress for 30 days inundation. V1=Misiri Variety, V2=Manyanyi Variety, V3=Mekongga Variety (ns)=No interaction

Table 2. The average effect of 20 days of inundation stress and three varieties of rice plants on plant height

Stressing	Varieties			Average
	Misiri	Manyanyi	Mekongga	
G0	18.13$_{ns}$	24.52$_{ns}$	20.35$_{ns}$	21.00$_{ns}$
G1	19.38$_{ns}$	26.05$_{ns}$	28.17$_{ns}$	24.53$_{ns}$
G2	16.75$_{ns}$	20.05$_{ns}$	17.75$_{ns}$	18.18$_{ns}$
G3	16.96$_{ns}$	21.32$_{ns}$	21.88$_{ns}$	20.05$_{ns}$
Average	17.80$_{ns}$	22.99$_{ns}$	22.04$_{ns}$	

Description: G0=Control (without stress), G1=Stress 10 days inundation, G2=Stress 20 days inundation, G3=Stress for 30 days inundation. V1=Misiri Variety, V2=Manyanyi Variety, V3=Mekongga Variety (ns)= No interaction

Table 3. The average effect of 30 days of inundation stress and three varieties of rice plants on plant height

Stressing	Varieties			Average
	Misiri	Manyanyi	Mekongga	
G0	18.01$_{ns}$	24.06$_{ns}$	19.92$_{ns}$	20.66$_{ns}$
G1	18.73$_{ns}$	27.26$_{ns}$	28.39$_{ns}$	24.79$_{ns}$
G2	16.60$_{ns}$	19.49$_{ns}$	19.16$_{ns}$	18.42$_{ns}$
G3	16.83$_{ns}$	19.81$_{ns}$	21.28$_{ns}$	19.31$_{ns}$
Average	17.54$_{ns}$	22.66$_{n}$	22.19$_{ns}$	

Keterangan: G0=Kontrol (tanpa cekaman), G1=Cekaman 10 hari genangan, G2=Cekaman 20 hari genangan, G3=Cekaman 30 hari genangan. V1=Varietas Misiri, V2=Varietas Manyanyi, V3=Varietas Mekongga (ns)=Tidak ada interaksi

From the results of the research that has been carried out, it shows that the plant height of the three varieties in all treatments showed that the Masung variety rice plant had a higher plant height when subjected to 10 days of inundation treatment compared to other treatments. This is thought to be more able to adapt when experiencing inundation stress, so that this variety has the highest plant height of both local and national rice varieties (Misiri and Mekongga), and compared to the control treatment, this may be because the flooding causes nutrients to become more abundant. available for plants which are then used for growth, but if they experience prolonged inundation the plant is no longer able to respond so it will die.

This result is similar to the research conducted by Kawano et al., (2009) that inundation will stimulate stem elongation as an escape strategy against inundation to help meet the needs of oxygen and carbon dioxide to support aerobic respiration and photosynthesis. The same is true of the research results of Poluan et al. (2017) who reported that the Burungan variety had the highest plant height of other varieties

(Superwin, Temo and Ombong) when experiencing flood stress. So it can be said that the Manying variety rice plant is able to adapt to inundation stress. Although the three varieties of rice plants in all treatments showed no significant difference. This is in line with the research of Racmahwati and Retnaningnum (2013), that the height of the rice plant is not affected by the given inundation time.

Number of Leaves

Table 4. The average effect of 10 days of inundation stress and three varieties of rice plants on the number of leaves

Stressing	Varieties			Average
	Misiri	Manyanyi	Mekongga	
G0	6.67	10.53	10.63	9.28a
G1	9.33	10.73	9.00	9.69a
G2	8.87	10.60	9.93	9.80a
G3	7.93	8.87	9.20	8.67a

Description: G0=Control (without stress), G1=Stress 10 days inundation, G2=Stress 20 days inundation, G3=Stress for 30 days inundation. V1=Misiri Variety, V2=Manyanyi Variety, V3=Mekongga Variety

Table 5. The average effect of 20 days of inundation stress and three varieties of rice plants on the number of leaves

Stressing	Varieties			Average
	Misiri	Manyanyi	Mekongga	
G0	6.5a	10.1def	10.6ef	9.1a
G1	9.4cde	11.1f	9.1cde	9.9a
G2	8.9bcd	10.2def	9.4cde	9.5a
G3	7.4ab	8.9bcd	8.5bc	8.2a
Average	8.03a	10. 1b	9.4ab	

Description: G0=Control (without stress), G1=Stress 10 days inundation, G2=Stress 20 days inundation, G3=Stress for 30 days inundation. V1=Misiri Variety, V2=Manyanyi Variety, V3=Mekongga Variety

Table 6. The average effect of 30 days of inundation stress and three varieties of rice plants on the number of leaves

Stressing	Varieties			Average
	Misiri	Manyanyi	Mekongga	
G0	6.2_{ns}	9.8_{ns}	10.2_{ns}	8.8_{ns}
G1	9.3_{ns}	10.7_{ns}	9.4_{ns}	9.8_{ns}
G2	9.0_{ns}	9.3_{ns}	9.1_{ns}	9.1_{ns}
G3	7.8_{ns}	8.4_{ns}	7.3_{ns}	7.9_{ns}
Average	8.1_{ns}	9.6_{ns}	9.0_{ns}	

Description: G0=Control (without stress), G1=Stress 10 days inundation, G2=Stress 20 days inundation, G3=Stress for 30 days inundation. V1=Misiri Variety, V2=Manyanyi Variety, V3=Mekongga Variety (ns)=No interaction

The results of the analysis of variance on the number of leaves in the 10-day inundation treatment showed that the treatment factor (stress) showed a significant difference, while in the 20-day inundation treatment, it showed that the treatment factor (stress), the varietal factor and the interaction of treatment and variety showed a significant effect so that A further test of 5% LSD was carried out (Tables 4 and 6), while the 30-day inundation treatment showed no significant effect.

The average number of leaves

between treatments under the stress of 10 days of inundation can be seen in Table 5. The results showed that the three varieties of rice plants had the highest average number of leaves, which was when they were treated for 20 days of inundation (9.80 strands) and were greater than the number of leaves. with the control treatment, 10 days of inundation and 30 days of inundation and significantly different from the treatment of 30 days of inundation based on the 5% LSD follow-up test. Whereas in the treatment of 20 days of inundation and 30 days of inundation, the average number of leaves was the highest when experiencing inundation of 10 days compared to other puddles. In this study, varieties also caused differences in the number of leaves in the treatment given. The results of this study, which was the result of the analysis of variance and continued with the 5% LSD test, showed that rice plants had the highest number of leaves, namely the Manning variety and were significantly different from the Misiri variety, but when subjected to longer inundation the rice plants were no longer able to respond so that it will cause death.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions :

1. Morphological response of Halut rice varieties to inundation, namely only the number of leaves was significantly influenced by inundation factors compared to other parameters (plant height, root length, and stem elongation speed).
2. Based on the agronomic character of the number of leaves, the singing variety is more resistant/tolerant to flooding

Recommendations :

Further research is needed with the timing of stressing or differences in stress in other growth phases.

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