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THE EFFECT OF LAND PREPARATION AND IRRIGATION TECHNOLOGY ON THE GROWTH OF RICE FIELDS (ORIZA SATIVA L.) M70D

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ABSTRACT: *M70D superior rice with a shorter growing period to harvest, as well as the application of appropriate soil management and irrigation technology are expected to increase the function of productive paddy fields so as to support rice growth and ultimately increase quality rice production with a short growing period. This study aims to study the effect of land management technology and irrigation technology on the growth of M70D variety of lowland rice. The design used in this study was a Randomized Block Design (RAK) with a Split Plot treatment design arranged in a factorial manner, consisting of 18 treatment plots with three replications. The main plot is Soil Processing Technology (T) which is perfect tillage and minimum tillage and Sub-plots are Watering Technology (A) which is tillage of inundated, intermittent and mack-macak. The results showed that the average growth rate of M70D rice with OTS (T1) and OTM (T2) technology with irrigation technology (A1), (A2) and (A3) was relatively the same and statistically not significantly different. The results showed that the F2 of M70D rice is not good if it is planted in the East Tondano area and in the wet season, further research is needed in other areas or in the dry season. The problems encountered are caused by climate mismatch. Does not apply as the name implies, namely M70D or 70 days rice*.

KEYWORDS: Oriza sativa, M70D, tillage, irrigation.

INTRODUCTION

The need for rice as a rice-producing food crop, which is the staple food for the people of Indonesia, has increased along with the growth of the population in Indonesia. The government stated that the growth of Indonesia's population which reached 260 million people was not accompanied by sufficient rice fields, so that it was difficult for Indonesia to achieve food self-sufficiency (Anggraeni, 2019) [1]. Domestic production has not met the needs so that every year it has to import hundreds of thousands of tons from abroad (Sugeng, 2001) [2].

Until now, national rice production has only reached an average of 50 million tons from a harvested area of 10 to 11 million hectares per year and the rate of production increase is 1.27% per year. The rate of increase in rice production for that amount is still not balanced with the

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population growth rate of 2% per year, so to meet the demand for rice, we must import 1,355 tons per year (Department of Agriculture, 2000) [3].

Rice is the second most important staple food in the world which meets 35-80% of calorie needs in Asia. The existence of the rice plant as a producer of rice is a top priority for the community in meeting the needs of carbohydrate intake which can be filling and is the main source of carbohydrates that are easily converted into energy. Rice as a food crop is consumed by approximately 90% of the total population of Indonesia for daily staple food (Saragih, 2001) [4].

General Chairman of the Indonesian Farmers Harmony Association (HKTI) General TNI (Retired) Moeldojo carried out a number of technological and cultural developments. The types of rice he found were named M400 and M70D. Rice M70 which is the result of scientific development by agricultural scholars together with the farming community. The harvesting age of the M400D is 90 days, while the M700D is 70 days after planting.

Per capita land availability has decreased from 0.34 ha in 1961 to 0.12 ha in 2015 (World Bank, 2018) [5]. Soil processing system is one of the activities in land preparation which aims to create suitable environmental conditions for plant growth. According to Indranada (1994) [6], tillage is an effort to regulate oxygen, water, toxic elements and nutrients which are determinants of soil fertility. Soil cultivation is aimed at improving plant root areas, soil moisture and aeration, increasing infiltration capacity and controlling plant pests so that plants can grow optimally.

Water management plays a very important role and is one of the keys to the success of increasing rice production in paddy fields. Lowland rice production will decrease if rice plants suffer from water stress. Common symptoms due to lack of water include leaf curling, leaf scorching, reduced tillers, stunted plants, delayed flowering, and empty seeds. Rice plants require different volumes of water for each phase of growth. Variations in water requirements also depend on rice varieties and paddy field management systems. Water settings for rice cultivation systems vary. This means that water management in paddy fields does not only concern the irrigation system, but also the drainage system at certain times of need, both to reduce the quantity of water and to replace the old water with new irrigation water so as to provide opportunities for circulation of oxygen and nutrients (Subagyono, 2016). [7]. Thus, water management techniques need to be specifically developed in accordance with the lowland rice production system. In order to increase rice production nationally so that domestic rice needs are met. Through efforts to use superior M70D rice seeds with a shorter growing period to harvest, as well as the application of appropriate soil management and irrigation technology, it is hoped that it can increase the number of productive paddy fields so as to support growth and increase quality rice production which is certainly beneficial for farmers

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and beneficial for the community. in general. So that domestic rice production can meet domestic needs and it is hoped that the ideals and goals for food self-sufficiency can be realized. The existence of Lake Tondano with its large rice field area attracted the interest of researchers, after making observations in several rice fields in Minahasa Regency the researchers found that suitable land for research was rice fields in Liningaan village, East Tondano sub-district because of the presence of soil and water that supported this research. Based on this, finally the author is interested in carrying out research for rice cultivation from vegetative parameters with the title "The Effect of Land Preparation and Irrigation Technology on the Growth of Rice Fields (Oriza sativa L.) M70D".

RESEARCH METHODS

This type of research is quantitative research. The research was carried out in the rice fields of Liningaan village, East Tondano district. October 2020 – March 2021.
The experimental design used was a Randomized Block Design (RAK).
Environmental Design:
Randomized Block Design (RAK)
Treatment Plan:
Split Plot (Split Plot)
Main Plot : Land Preparation Technology (T)
T1 = Perfect Tillage (OTS)
T2 = Minimum Tillage (OTM)
Sub-plot : Irrigation Technology (A)
A1 = Flooded Water (± 5cm)
A2 = Intermittent Watering
A3 = Macak-Macak Watering
Repeat: 3 times
Thus the number of experimental units is 2 x 3 x 3 = 18 units. One experimental plot measuring 4 x 6 m. Placement of treatment in each block was randomized independently.

RESULT AND DISCUSSION

The land used for the implementation of this research is paddy field with a minimum tillage system and by direct planting or scattering onto the land. The previously planted rice was Serayu rice. The availability of water in this research area is sufficient for water needs, so that research can be carried out.

Placement of the experimental group based on the slope of the land and the source of water intake. In one group, replicates were placed on the same slope of the land as the source of water intake. Seed germination is quite uniform, there is no pest and disease disturbance during the

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seedling period. Before the nursery, the rice grains are soaked for 3 days and 3 nights. Then after 21 days of sowing, the seeds are planted (using the transplanting method).
Before planting, the land is prepared and processed, for complete tillage, the land is unloaded or plowed using a tractor and then the second land demolition is by hoeing. Meanwhile, for minimum tillage, the soil is demolished once by plowing with a tractor. The land is then leveled and irrigated. Rice plants at 7 days after planting showed normal growth, where the color and shape of the leaves did not show any change.

Rice Plant Growth

1. Plant Height

The results of analysis of variance showed that the treatment of tillage was not significantly different to plant height at 3 WAP and 6 WAP. Likewise, the irrigation treatment showed no significant difference in plant height. There was a significant interaction between soil tillage and irrigation treatments on plant height at 6 WAP observations.

Effect of Tillage Technology

The height of rice plants in both perfect tillage (OTS) (T1) and minimum tillage (OTM) (T2) treatments at all times of observation was not statistically significantly different, but the average value showed that the highest plant height was obtained in the treatment OTM (T2) was 66.2 cm at 6 WST (table 1). Soil tillage will form mud which further facilitates the development of rice plants.

Table 1. Effect of Tillage Technology and Irrigation Technology on Rice Plant Height 3 WAP and 6 WAP

Treatment	Observation time	
	3 MST	6 MST
Soil processing		
OTS (T1)	40.3	65.3
OTM (T2)	40.5	66.2
Irrigation		
Flooded (A1)	41.6	66.6
Intermittent (A2)	38.3	65.3
Macak (A3)	41.3	65.3

Effect of Water Technology

The treatment of irrigation technology did not show a significant effect on plant height both at 3 WAP and 6 WAP observations. From table 1, it can be seen that the average height of rice plants grown with stagnant irrigation (A1) was higher than intermittent irrigation (A2) and mackerel irrigation (A3) at observations 3 WAP and 6 WAP.

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Table 2. Effect of Interaction of Tillage Technology with Irrigation Technology on Plant Height 6 WAP

Treatment	Persiapan lahan	
	T1	T2
Soil processing		
A1	65.66667 ab	67.66667 b
A2	67.66667 b	63 a
A3	62.6 6667 a	68 b

Values in the same column followed by the same letter are not significantly different at the 5% BNT level (6 MST)

Number of tillers

The results of the analysis of variance showed that the tillage treatment was not significantly different from the number of tillers at 3 WAP and 6 WAP. Likewise, the irrigation treatment showed no significant difference in the number of tillers. There was no significant interaction between the treatment of tillage and irrigation on the number of tillers at 3 WAP and 6 WAP observations. The highest number of tillers at 3 WAP was obtained in the OTS Soil Treatment treatment, namely 15 tillers and the Irrigation treatment at macak-macak irrigation, which was 16 tillers. While at 6 WAP, the highest number of tillers for tillage was in the minimum tillage treatment, which was 21 tillers and in the irrigation treatment the most was macak-macak irrigation, which was 21 tillers.

Table 3. Effect of Tillage Technology and Irrigation Technology on Number of Tillers 3 WAP and 6 WAP 6

Treatment	Observation time	
	3 MST	6 MST
Soil processing		
OTS (T1)	15	20
OTM (T2)	13	21
Irrigation		
Flooded (A1)	14	19
Intermittent (A2)	13	20
Macak (A3)	16	21

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Effect of Tillage Technology

The number of rice tillers was not affected by the tillage treatment. This is evident from the average obtained does not show a statistical difference. Both in the treatment of land preparation with perfect tillage and with minimum tillage treatment, tillers can grow well. Tillage at the beginning of land preparation causes the puddling process to occur properly so as to facilitate the development of rice roots and also cut the weed life cycle. In Minimum Tillage land, inundation has been proven to help the decomposition process of early vegetation mulch, improve soil porosity and soil organic matter content so that the root system can grow well (Orbanus, 2018) [8].

Effect of Watering Technology

The treatment of irrigation technology did not show a significant effect on the number of tillers, both at 3 WAP and 6 WAP observations. From table 3, it can be seen that the average number of rice tillers at 3 WAP was the highest, namely those planted with macak-macak irrigation (A3), which were 16 tillers and the same at 6 WAP, which was 21 tillers. The number of tillers is also influenced by the number of tillers that die as a result of competition between individuals in fighting over the means of growth, especially space and light.

Root Length

Treatment of soil tillage and irrigation technology was not significantly different to root length at 3 WAP and 6 WAP, indicating no significant difference to root length. There was no significant interaction between soil tillage and irrigation treatments on root length at observations 3 WAP and 6 WAP, see Tables in appendix 5 and Appendix 6. The average length of the longest root at 3 WAP was obtained in OTM Soil Treatment treatment, which was 21.3 cm and water treatment in macak-macak irrigation, which is 21.3 cm. While at 6 WAP, the average root length for tillage was 28.1 cm in the perfect tillage treatment and the longest irrigation treatment was macak-macak irrigation, which was 28 cm (see table 4).

Table 4. Effect of Tillage Technology and Irrigation Technology on Root Length of Rice 3 WAP and 6 WAP

Treatment	Observation time	
	3 MST	6 MST
Soil processing		
OTS (T1)	19.6	28.1
OTM (T2)	21.3	27.6
Irrigation		
Flooded (A1)	19.65	27.8
Intermittent (A2)	20.5	28
Macak (A3)	21.3	27.8

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Effect of Watering Technology

The treatment of irrigation technology did not show a significant effect on root length both at 3 WAP and 6 WAP observations. From table 5, it can be seen that the average root length of 3 WAP rice planted with macak-macak irrigation (A3) was longer than flooded irrigation (A1) and intermittent irrigation (A2) and at 6 WAP intermittent irrigation (A2) was more longer than flooded irrigation (A1) and mack-macak irrigation (A3).

Leaf Area Index

Tillage treatment and irrigation treatment had no significant effect on Leaf Area Index, there was no interaction between the two tested factors. Where the Leaf Area Index was highest in the OTM (T2) and macak-macak (A3) soil tillage treatments.

Effect of Tillage Technology

Tillage technique does not affect Leaf Area Index. This can be seen in table 5. Where from the two soil treatment treatments that were tried, the average value was not different. From this data, it is known that both tillage techniques, both perfect tillage and minimum tillage, have the same effect on Leaf Area Index.

Table 5. Effect of Tillage Technology and Irrigation Technology on Leaf Area Index

Treatment	ILD
Soil processing	
OTS (T1)	1.77
OTM (T2)	1.78
Irrigation	
Flooded (A1)	1.79
Intermittent (A2)	1.75
Macak (A3)	1.79

Effect of Watering Technology

Treatment of irrigation technology did not show a significant effect on Leaf Area Index. However, it can be seen that the average ILD of rice plants grown with stagnant irrigation (A1) and macak irrigation (A3) was higher than with intermittent irrigation (A2).

An increase in ILD will increase the ability of plants to capture solar energy followed by an increase in photosynthetic activity so that it can produce more assimilate which will then be followed by high grain yields.

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Plant Growth Rate

Soil tillage and irrigation treatments had no statistically significant effect on plant growth rate. Based on the average value of LPT in table 6, it shows that the treatment of Perfect Soil Cultivation produces LPT which tends to be higher than the minimum tillage. There was no interaction between the two tested factors. The highest LPT was found in the OTS soil treatment (T1), which was 0.479 and in the irrigation treatment it was seen that the average was not much different. This shows that tillage with the aim of silting is no different from OTS land preparation, because on OTM land the mulch that covers the soil surface has been completely decomposed by flooding for approximately one week before planting so that it will improve the physical and chemical properties of the soil and increase the availability of nutrients. and organic matter content in the soil. The availability of sufficient nutrients will support plant growth so that LPT increases.

Effect of Tillage Technology

Tillage technique does not affect Plant Growth Rate. This can be seen in table 6. From this data, it is known that the two tillage techniques, both perfect tillage and minimum tillage, have the same effect on plant growth rates.

Effect of Watering Technology

The treatment of irrigation technology did not show a significant effect on the plant growth rate. However, it can be seen that the average LPT of rice plants grown with stagnant irrigation (A1), intermittent irrigation (A2) and mackerel irrigation (A3) is not much different, see table 6.

Table 6. Effect of Tillage Technology and Irrigation Technology on Plant Growth Rate

Treatment	LPT
Soil processing	
OTS (T1)	0.479
OTM (T2)	0.160
Irrigation	
Flooded (A1)	0.163
Berselang (A2)	0.165
Intermittent (A3)	0.169

Net Assimilation Rate

The results of the analysis of variance, showed that the Soil Treatment and irrigation treatments had no significant effect on the Net Assimilation Rate, there was no interaction between the two factors tested. Where the highest Net Assimilation Rate is in the OTS tillage treatment (T1) and intermittent irrigation (A2).

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Effect of Tillage Technology

Tillage technique does not affect Net Assimilation Rate. This can be seen in table 7. Where from the two treatment treatments that were tried, the average difference was striking with OTS (T1), namely 1.77 (g/m2/day) and OTM (T2), which was 0.93 (g/m2/day). From this data, it is known that the two tillage techniques, both Perfect Soil and Minimum Tilling have the same effect on the Net Assimilation Rate. Even in tillage according to the observations of Branchon (2000) [9], straw mulch helps conserve moisture in the soil profile. Mulching did not significantly reduce the mean crack depth and the amount of water used in tillage.

Effect of Water Technology

The treatment of irrigation technology did not show a significant effect on the Net Assimilation Rate. However, it can be seen that the average Net Assimilation Rate of rice planted with stagnant watering (A1) and intermittent irrigation (A2) is higher than macak-macak irrigation (A3), see table 7.

Table 7. Effect of Tillage Technology and Irrigation Technology on Net Assimilation Rate

Treatment	LAB
Soil processing	
OTS (T1)	1.77
OTM (T2)	0.93
Irrigation	
Flooded (A1)	1.53
Intermittent (A2)	1.56
Macak (A3)	0.96

This shows that perfect tillage provides good conditions for the growth of rice plants, especially leaf development. This condition allows rice plants to produce asmylate in large quantities as a result of the activity of photosynthetic leaves. The net assimilation rate is largely determined by leaf area and the ability of plants to store dry matter.

As per Sivanappan (2016) [10] observations, increasing water production has become a necessity in developing countries like India, where groundwater levels are decreasing at an alarming rate. The proportion of water used for agriculture in India is likely to decrease from the current level of 84% to 69% by 2025 as demand from other sectors increases; but on the other hand the demand for water for agricultural purposes is expected to increase to produce more food and fiber to meet the needs of a growing population. Based on the research of Wen E. (2021) [11], on plant growth, enzyme activity, and bioavailability and absorption of As, Cd, and Pb by rice in rice soils with irrigation that is irrigated continuously or alternately wet and dry significantly increase soil pH. The research location is located at an altitude with suitable weather for rice growth. The quantity of water is sufficient and can be adjusted properly so that

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rice can grow well. However, the weather in the wet/rainy growing season causes extreme weather changes in several planting periods in the implementation of the research.

Observations showed that the F2 of the planted M70D rice was not good, due to the unsuitable climate that was planted during the wet month which caused the production of Malay to be hampered. In this wet month, what is spurred is the vegetative phase where the vegetative phase is longer (long photoperodism). At this time, the hormones auxin, cytokinin, and giberalin were still stimulated and fruiting was slowed down, due to the high level of cloudiness, the length of the day of irradiation to start the generative phase/sunlight was hampered so that the production of Malay was hampered. Does not apply as the name implies, namely M70D or 70 days rice.

Proper tillage is very important to reduce soil degradation in Telak (2021) [12]. The process of erosion is strongly influenced by climate, soil, topography and by soil management practices. The literature also shows differences in the effect of the same conservation practices on reducing soil erosion by conventional M. Biddocu (2020) [13]. The silting of the Perfect Soil tillage technology provides good conditions for rice plants because in addition to providing convenience for root development, it also causes weed seeds that are on the surface of the previously grown vegetation to sink. Based on the research of William (2020) [14] he mentions that Studies in agriculture allow us to consider various tillage in real agricultural settings and on variations in soil texture.

In addition, according to research from Wei Wei et al. (2010) [15] Water is delivered continuously across the root zone of the plant and moistens the root zone vertically by gravity and laterally by capillaries, thereby helping to conserve water by reducing losses due to evaporation of water in agricultural systems. According to Mohamed Ibrahim (2021) [16], groundwater content can play a role in stimulating and reducing the activity of decomposing organic matter. His research showed that the highest concentration of soil carbon was found in soil macro aggregates and the least carbon was found in mud and clay. Wang Hong (2020) [17], mentioned that the demand for rice will increase with the increase in global population. Globally, water management and nitrogen (N) application are the two main factors influencing rice production and greenhouse gas (GHG) emissions. In China, one of the largest rice-producing countries in the world, water scarcity also threatens rice production. Therefore, to meet these challenges, it is very important to find efficient irrigation management using water that also mitigates GHG emissions from rice fields.

Statistically the treatment of tillage technology, namely perfect tillage and minimum tillage and irrigation technology, namely stagnant watering, intermittent irrigation and macak irrigation gave results that were not significantly different. So that the recommendations that can be given to farmers are that there is no need for neat soil processing technology and also

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in carrying out land cultivation, it does not need to be processed three times In addition, the irrigation technology does not need to use a lot of water / irrigated a lot. Thus, farmers can save energy and time for land preparation, costs, and can save water to be used in other cultivations. This can offer solutions to problems facing developing countries.

CONCLUSION

The results showed that:
1. There is no significant difference in the treatment of tillage technology on the growth of rice (Oriza sativa L.) M70D
2. There is no significant difference in the treatment of irrigation technology on the growth of rice (Oryza sativa L.) M70D.

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