IMPACT: International Journal of Research in Applied, Natural and Social Sciences (IMPACT: IJRANSS)
ISSN (P): 2347-4580; ISSN (E): 2321-8851
Vol. 5, Issue 9, Sep 2017, 111-120

IRRIGATION WATER MANAGEMENT SYSTEM FOR PLANTING RICE VARIETIES SULUTTAN UNSRAT I AND SULUTTAN UNSRAT 2

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ABSTRACT

Land area for rice cultivation in North Sulawesi, which rely on rain water is approximately 25.792 ha. Therefore, regulation in water-saving procedure is necessary. There are two varieties of rice: suluttan insert 1 and solution, insert 2 which were produced by the researchers of BATAN and Unsrat, that were good in result and growth performance. The aim of this research was to study the effect of irrigation system in water-saving settings for the growth and production of rice varieties salutation UNSRAT 1 and solution UNSRAT 2. This Research was conducted in a randomized block design with factorial experiment. The variable factor G1: suluttan UNSRAT 1 and G2: suluttan UNSRAT 2 and input patterns of water factor: muddy condition from transplanting until harvest (P1); Flooding condition with 5-7 cm high water from the transplanting until harvest (P2) and intermittent condition: muddy condition after transplanting up to 30 days; 10 days flooding 5-7 cm and after that muddy condition until harvest (P3). There is no interaction between varieties and patterns of irrigation water in continuous and intermittent muddy condition does not suppress the growth and yield of rice varieties Sultan Unsrat 1 and 2. The water savings can occur in rice cultivation with continuous muddy irrigation pattern or intermittent muddy condition. Flooding irrigation pattern of excessive use of water.

KEYWORDS: Water Usage System, Suluttan Unsrat 1 and 2 Suluttan Unsrat 2 Rice, Flooding, Muddy

INTRODUCTION

In Indonesia, the rice field rain water areas of 2.1 – 2.6 million ha and 900,000 ha are located in Java (Ministry of Agriculture Agricultural Research Agency, 2011). The data of rice field rain water and dry land in North Sulawesi are presented in Table 1

Table 1: Total area of Paddy Field and Dry Land According to its use in North Sulawesi

Land Use	Kab. Bowman (ha)	Kab. Minahasa (ha)	Kab. Sangihe (ha)	Kab. Talaud (ha)	Kab. Mainsail (ha)	Kab. Minute (ha)	Total (ha)
Technical Irrigation	12.34	-	-	790	-	350	13.48
Semi Technical Irrigation	6.80	4.13	25	-	2.47		14.47
Simple Irrigation	957	733	-	66	2.01	1.03	5.20
Local irrigation	2.87	508	25	715	475	2.47	4.66
Rice field rain water	3.55	1.147	152	410	680	2.01	6.65

Source: Department of Agriculture and Animal Husbandry of North Sulawesi

From the Table 1, there the rice field rain water lands consists of 6658 ha; land with local irrigation 4661 ha; simple irrigated land 5206 ha and semi-technical irrigated land area of 14473 ha. These lands generally rely on rainwater. Therefore, a problem arises during the dry season because of the limited water supply and rice crops will experience a shortage of water or water stress. In respect of this, the needs for rice resistant or tolerant to drought stress are necessary (Mandang et al, 2013).

Two varieties of rice that Sultan Unsrat 1 and 2 those were produced by researchers of BATAN (National Nuclear Energy Agency) and UNSRAT (Sam Ratulangi University) have good results and growth performance. Madden et al (2013) in their research found that the pattern of drying (without treatment of water) in the vegetative growth stage, the reproduction turned out to produce to dry grain harvest per plot with no different although it is less approximately 0.8 to 1 kg each plots (12 m^2). From their results, it can be concluded that even though the results are slightly lower, it is still meaningful.

This study tried to create a muddy not a dry condition with improvement results similar to those with flooded conditions at the same growth stage. The purpose of this study was to assess the effect of water saving irrigation on the growth and production of solutions UNSRAT 1 and 2 rice varieties.

RESEARCH METHODOLOGY

Time and Place

The study was conducted in rural district Warukapas, Dimembe, Minahasa starts from march 2014 until November 2014.

Experimental Design

This study was conducted with the basic design of a randomized block design and factorial experimental design. Factor I: Varieties: Rice Suluttan Unsrat 1 (G1) and Rice solution UNSRAT 2 (G2). Factor II: water supply system: Muddy condition from planting to harvest (P1): Flooding conditions, 5-7 cm from transplanting to harvest (P2) and intermittent condition: the muddy condition after transplanting up to 30 days, then 10 days flooding 5-7 cm and after that muddy until harvest (P3).

Variables Measured

- Plant height measured at vegetative phase and harvest phase;
- The number of total tillers per plant;
- The number of productive tillers per plant;
- Age of heading 50%;
- Age of crops, harvest phase;
- Length of panicles;
- The number of grains per panicle:
- The number of filling grains per panicle;

- The number of unfilled grains per panicle;
- Weight of dry grain harvested per clump and
- The weight of dry grain harvested per plot.

Data Analysis

The data were analyzed by analysis of variance and if there were any significant effect will be continued with the analysis of Honestly Significant Difference.

RESEARCH RESULT

Plant Height

Plant Height Vegetative Phase

The height of rice crops in the vegetative phase Suluttan rice varieties Sultan Unsrat 1 and 2 on the condition of different irrigation patterns are presented in Table 2.

Table 2: Plant height (cm) on Vegetative Phase Rice Varieties Sultan Unsrat 1 and Suluttan Insert 2 in Different Irrigation Systems Condition

Varieties	Irrigation pattern			Average
	P1	P2	P3	
Suluttan 1	68.13	64.23	68.23	66.86[a]
Suluttan 2	74.20	77.87	72.57	74.88[b]
Rata-rata	71.16	71.05	70.40	
BNT 0.05, Varieties = 3.35				

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re-muddy condition until harvest.

The results in Table 2 indicate that there is no correlation between varieties and irrigation systems. Likewise, the irrigation system showed no difference except between varieties. Suluttan UNSRAT 2 variety was significantly higher than Suluttan UNSRAT 1 variety.

Plant Height Harvest Stage

The height of rice crops varieties Suluttan Unsrat 1 and 2 at the harvest phase on the condition of different irrigation Patterns are presented are presented in Table 3.

From Table 3 it can be seen that there is no correlation between varieties and water regulation system. Also, that the influence of a single system of water regulation does not lead to differences in crop height at harvest phase, unless there is a differences in crop height at harvest phase, unless there is a difference between varieties. Suluttan Unsrat 2 variety has higher height than Suluttan Unsrat 1 variety.

Table 3: Height of Rice Crop (cm) of Suluttan Unsrat 1 and 2 variety in Condition Different Irrigation Patterns

Varieties	Irrigation pattern			Average
	P1	P2	P3	
Suluttan 1	88.83	87.67	88.70	88.40[a]
Suluttan 2	96.57	98.57	93.03	94.06[b]
Rata-rata	92.70	93.12	90.87	
BNT 0.05, Varieties = 3.00				

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re-muddy condition until harvest.

The results of this study indicate that treatment of muddy water during the vegetative do not suppress crop growth. These results supports the results obtained by Mandang et al (2010) that water stress (50% field capacity) does not cause a reduction in vegetative growth. It also shows that the muddy conditions are enough to supply the water needs to support the growth of rice crops of both varieties.

Crop height difference occurs only between the two varieties. It shows that the state of the environment can alter the response of both varieties in the vegetative crop height although the difference is only about 8cm.

The Total Tillers Per Plant

Total numbers of tillers per clump of rice varieties Suluttan Unsrat 1 and 2 on the condition of different irrigation systems are presented in Table 4.

Table 4: Total Number of Tillers Per Clump of Rice Varieties Suluttan Unsrat 1 and Suluttan Unsrat 2 on Different Pattern of Watering Condition

Varietas	Irrigation Pattern			Average
	P1	P2	P3	
Suluttan Unsrat 1	12.43	12.70	12.80	12.64
Suluttan Unsrat 2	12.27	13.90	12.60	12.92
Rata-rata	12.35	13.30	12.70	

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re- muddy condition until harvest.

The Number of Productive Tillers Per Plant

The number of productive tillers presented Table 5

Table 5: Total Productive Tillers Each Cluster of Rice Varieties Suluttan Unsrat 1 and Suluttan Unsrat 2 in Different Watering System

Varietas	Irrigation Pattern			Average
	P1	P2	P3	
Suluttan Unsrat 1	10.50	10.57	10.90	10.66
Suluttan Unsrat 2	11.07	12.10	10.67	11.28
Rata-rata	10.78	11.33	10.78	

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re- muddy condition until harvest. Table 4 it is seen that there are no differences in the number of tillers per clump for both varieties at different water distribution pattern. This shows that the use of muddy water throughout growth and in most of the growth cycle does not limit the growth of seedlings of both varieties.

From Table 5, the number of productive tillers did not differ among treatments in both varieties and patterns of water governance. This shows that the muddy irrigation during vegetative growth does not limit growth, including the establishment of productive tillers.

Age of crops Flowering 50% (Time of heading)

Age of crops flowering 50% of both varieties Sullutan Unsrat 1 and 2 at the

different water setting conditions are presented in Table 6.

From Table 6 it can be seen that 50% of flowering age did not differ between varieties and patterns of water condition.

Length of Panicles (Panicle length)

The rice panicle length of Suluttan Unsrat 1 and 2 on the condition of different irrigation patterns are presented in Table 7.

Table 6: Age of Crops Flowering 50% (Days After Planting) of Suluttan Unsrat 1 and 2 Different Water-Setting Conditions

Varietas	Irrigation pattern			Average
	P1	P2	P3	
Suluttan Unsrat 1	68.33	66.67	68.00	67.67
Suluttan Unsrat 2	66.00	65.67	65.00	65.57
Rata-rata	67.16	66.17	66.50	

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re- muddy condition until harvest.

Table 7: Length of Panicles (cm) of Rice Varieties Suluttan Unsrat 1 and 2 in Different Watering Conditions

Varietas	Irrigation pattern			Average (cm)
	P1	P2	P3	
Suluttan Unsrat 1	21.91	23.95	22.21	22.69
Suluttan Unsrat 2	23.93	25.43	24.65	24.67
Rata-rata	22.92	24.69	23.43	

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re- muddy condition until harvest.

From Table 7 it can be seen that there is no difference in the length of panicles of different irrigation patterns on both varieties. It also shows that the crop water needs are fulfilled at the muddy condition, for generative growth of both varieties.

Number of Filled Grain

The Number of grains contained per panicle in rice varieties of Suluttan Unsrat 1 and 2 on the condition of different irrigation patterns are presented in Table 8.

From Table 8 shows that the different water pattern setting do not affect the number of grains contained per panicle. It shows that muddy water does not limit grain formation. Differences only occur between varieties.

Table 8. Number of Filled Grain Contained per Panicles of Suluttan Unsrat 1 and 2 varieties in Different Irrigation Patterns Condition

Variety	Irrigation Pattern			Average
	P1	P2	P3	
Suluttan Unsrat 1	90.87	97.02	92.82	93.57[a]
Suluttan Unsrat 2	11.63	117.73	121.11	117.49[b]
Rata-rata	102.25	107.38	106.97	
BNT 0.05, Variety = 12.13				

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re- muddy condition until harvest.

Weight of Dry Unhusked Rice / Clumps

Weight of dry unhusked rice / clumps of rice varieties Suluttan Unsrat 1 and 2 on the condition of different irrigation patterns are presented in Table 9.

Table 9. Weight of Dry Unhusked Rice / Clumps (G) Rice Varieties Suluttan Unsrat 1 and 2 in Condition of Different Irrigation Patterns

Varietas	Irrigation pattern			Average
	P1	P2	P3	
Suluttan Unsrat 1	25.46	28.75	24.44	26.22
Suluttan Unsrat 2	34.69	33.93	30.06	32.89
Rata-rata	30.07	31.34	27.25	

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re- muddy condition until harvest.

From Table 9 it can be seen that the weight of dry unhusked rice per clump was no difference in each treatment varieties and patterns of water condition

Grain Yield Per Plot

The weight of dry unhusked rice (GKG) / plot (kg) of rice varieties Suluttan Unsrat 1 And 2 on the condition of different irrigation patterns are presented in Table 10.

Grain yield per plot of rice varieties Suluttan Unsrat 1 and 2 on the condition of different irrigation patterns are presented in Table 10.

Table 10: Weight of Dry Unhusked Rice (GKG) / Plot (Kg) of Rice Varieties Suluttan Suluttan Unsrat Unsrat 1 and 2 in Condition Different Irrigation Patterns

Varietas	Irrigation Pattern			Average
	P1	P2	P3	
Suluttan Unsrat 1	7.63	5.80	5.52	6.31
Suluttan Unsrat 2	7.47	5.73	6.63	6.61
Rata-rata	7.55	5.76	6.07	

Description

P1 = Continuous muddy condition;

P2 = Water Flooding Conditions 5-7 cm continuously

P3 = 30 days after transplanting muddy condition, water intake of 5-7 cm during the 10 days, re- muddy condition until harvest.

From Table 10 it can be seen that the weight of unhusked rice per plot are not different among treatments varieties and patterns of water conditions. This supports the research obtained by Fagi and Manwan in Setiobudi and Fagi (?), that there is no difference in the treatment of rice production at the muddy condition for 30-50 HST; 50-85 HST; 35-85 HST; continuous muddy and continuous puddles with consecutive results of 7.1; 6.9; 6.8; 7.0 and 7.2 tons / ha.

The results of previous studies shows that rice crops are relatively sensitive to water shortages, especially in the

third phase of the reproductive (flowering anthesis until 100%). When the rice crops experienced water stress, especially on reproductive phase it can directly influence the decrease water use efficiency (Setiobudi,2001).

The result showed no difference between the flooding drainase patterns continuously with continuous or discontinuous muddy irrigation pattern. It show that the muddy irrigation pattern does not restrict the growth and production of rice varieties Suluttan Unsrat 1 and 2. It also supports previous studies on different varieties of rice plant. Tabala et.al, (2002) found that treatment of rice plant in continues muddy

wetland conditions has good results especially on transplanting seedlings and planting seeds directly where water demand respectively 373 mm and 324 mm. the result obtained of each 6743 kg/ha and 7,338 kg/ha are no different from those by irrigating 5-7 cm continuously. Muddy methods were also profitable in rice cultivation. The center Great rice crop research (2009) states that the cultivation of muddy water aimed at reducing the water response to the soil, seepage, and water pressure due to the different height of water so that the needs of water irrigation can be reduced. The efficiency of water usage is 40 – 50% compared to flooding continuously condition.

CONCLUSIONS AND RECOMMENDATIONS

From there results, it can be concluded that:

- There is no correlation between the treatment varieties and the irrigation water patterns on the growth and yield of rice.
- The irrigation water pattern in continuous and uninterrupted muddy condition does not suppress the growth and yield of rice varieties Suluttan Unsrat 1 and 2.
- 3. Water saving can occur in rice cultivation with continuous of interrupted muddy irrigation pattern. Flooding irrigation patterns are patterns that use water excessively.

RECOMMENDATIONS

This research needs to be done or tested in the other area.

ACKNOWLEDGMENTS

The authors are thankful to Prof. Muggon who collaborated in the development the suluttan unsrat 1 and 2 rice varieties.

Thankful to Ministry of Research, Technology of Higher Education for providing the necessary facilities for the preparation of this research.

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