

ORIGINAL RESEARCH ARTICLE

Assessment of Water Depth Variability in Rice paddy fields at the Lower Moshi Irrigation Scheme, Tanzania

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ABSTRACT

Variability of water depth in rice paddy fields has become a major problem in many irrigation schemes, jeopardizing rice growth. This study assesses water depth before and after irrigation in the rice paddy fields. The research methods used were field surveys to empirically evaluate the variability of water depth in rice paddy fields at the lower Moshi Irrigation Scheme in Tanzania. The empirical findings of the study confirm that the average variability of water depth measurements taken every day before and after irrigation for twelve consecutive days range from 0.00 to 14 centimeters. This range was due to amount of water discharge and the rice paddy fields conditions. Understanding the extents, causes and effects of water depth variability in the rice paddy fields could help irrigation engineers, researchers, academicians and farmers to improve water depths of rice paddy fields.

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1. INTRODUCTION

Irrigation agriculture is considered necessary to mitigate climate constraints and to stabilize agricultural production and ensure food security in many countries, particularly developing countries. An increased availability of irrigation and less dependency on rain fed agriculture are one of the means to increase food production (Shumye, 2018; Eltarabily et al., 2023). An inventory conducted by the National Irrigation Masterplan Project (NIMP) in 2002 indicates that in Tanzania there were 1,428 irrigation schemes, out of which 1,328 were smallholder schemes, 85 private schemes and 15 government managed schemes (Sisila, 2007). It is ascertained that water use for irrigation accounts for about 70% of all freshwater worldwide, and irrigation has been ranked as one of the activities that utilize a large fraction of fresh water in many countries (Serede et al., 2014; Samir et al., 2023).

In fact, rice (*Oryza sativa* L.) is the staple food of more than half of the population of the world and its production is an important target to provide food security and livelihood for millions (Yaligar et al., 2017). Lower Moshi Irrigation Scheme is a rice production centre that is located in the South-East of Moshi town, Kilimanjaro Region, along the Rau River. This Irrigation Scheme is a farmer-managed irrigation scheme, as regulated by the National Irrigation Commission (NIRC). Other supporting partners include Kilimanjaro Agricultural Training Center (KATC), Japan International Cooperation Agency (JICA) and Japan International Research Center for Agricultural Sciences (JIRCAS). According to Bell et al. (2015) and Shinji et al. (2025) the scheme is housed in an area of 2,300 hectares of land under gravity-fed irrigation, aimed to develop rice cultivation and enhancing local food production and income. However, rice is an aquatic crop and mostly grown under submergence or variable ponding conditions (Yat-Sen et al., 2018; Talpur et al., 2013). Additionally, water depth is an important parameter for the prediction of rice growth (Yat-Sen et al., 2018; Talpur et al., 2013). It is ascertained that to satisfy the immense need for water used in paddy cultivation, a large amount of water is always the key to meet irrigation needs (Han et al., 2022). Nevertheless, rice plants have the ability to survive better at shallow water depth than deeper ponding water depths (Yat-Sen et al., 2018; Talpur et al., 2013).

Investigation conducted by Simeón et al. (2025) reveals that the temperature of the irrigation water, which is determined by the height of the water depth, influenced rice seed germination and plant growth rate. Iwasa et al. (2025) investigated on the optimum water depth for suppressing late watergrass growth with minimizing rice growth inhibition under different temperature conditions. In fact, several studies (Talpur et al., 2013; Balan & Saparudin, 2023; Mairghany et al., 2022; Andri et al., 2022; Yat-Sen et al., 2018; Xu et al., 2023) on water depth in paddy fields were carried out, however, they are mainly carried in Asian regions (Japan, China, Malaysia and Indonesia) contrary to the context of East Africa Region, particularly in Tanzania

where measurement of water depth variability could improve suitability of the rice paddy fields. Moreover, most of these studies were not able to clearly demonstrate the need to evaluate water depth variability in paddy fields. Markedly, previous studies were not able to collect primary data to better measure the extent of water depth variability in paddy fields in the context of Tanzania. For instance, Kimaro et al. (2019) claims that irrigation is essential for maintaining crop production during the dry season. Materu et al. (2018) points out that the increased rainfall variability due to climate change is likely to exacerbate water availability in the future, fueling the need to develop alternative farming systems that can increase or sustain rice yields with reduced water footprint to ensure food security in Tanzania. In fact, research on water depth variability particularly in rice paddy fields is still low. For instance, Ashour et al. (2023) insists that the deficiency of water depth in the canal could be the cause of water loss, yet there is a paucity of research on issues relating to water depth variability in paddy fields. Noticeably, though recommendations from those previous studies were beneficial, they are not sufficient to address issues on water depth in paddy fields, stimulating the need to examine variability of water depth deficiency in paddy fields to enhance rice production. This paper contributes to filling such a gap. Specifically, the study evaluates water depth before and after irrigation in the rice paddy fields. The study results promote efficiencies of rice paddy fields. The rest of the paper presents methods, discussions and conclusion sections to summarize the theme and main contributions of the study.

2. MATERIALS AND METHODS

2.1 Study design

The research design was the field survey of irrigation situation which focuses on understanding the actual irrigation practices at the lower Moshi Irrigation Scheme (LMIS) in Tanzania. As depicted in **Figure 1**, plots in blocks were selected for the survey and the unit of measurement was the plot water depth. The field measurements were conducted every day for twelve consecutive days including Saturday and Sunday. The survey of irrigation situation in rice paddy fields focuses on understanding actual irrigation practices in the selected two blocks at LMIS. In this study, both primary and secondary data were used for the study. The empirical data was obtained from field measurements preceded by observation of physical characteristics of rice paddy fields. Conversely, secondary data was from reviewed relevant literature such as scientific publications from reputable journals, websites of relevant themes, classic materials and some textbooks that became helpful in building the context of the study. Previous researchers (Ashour et al., 2023; Jaiswal et al., 2024) have successfully used field survey design in their studies.

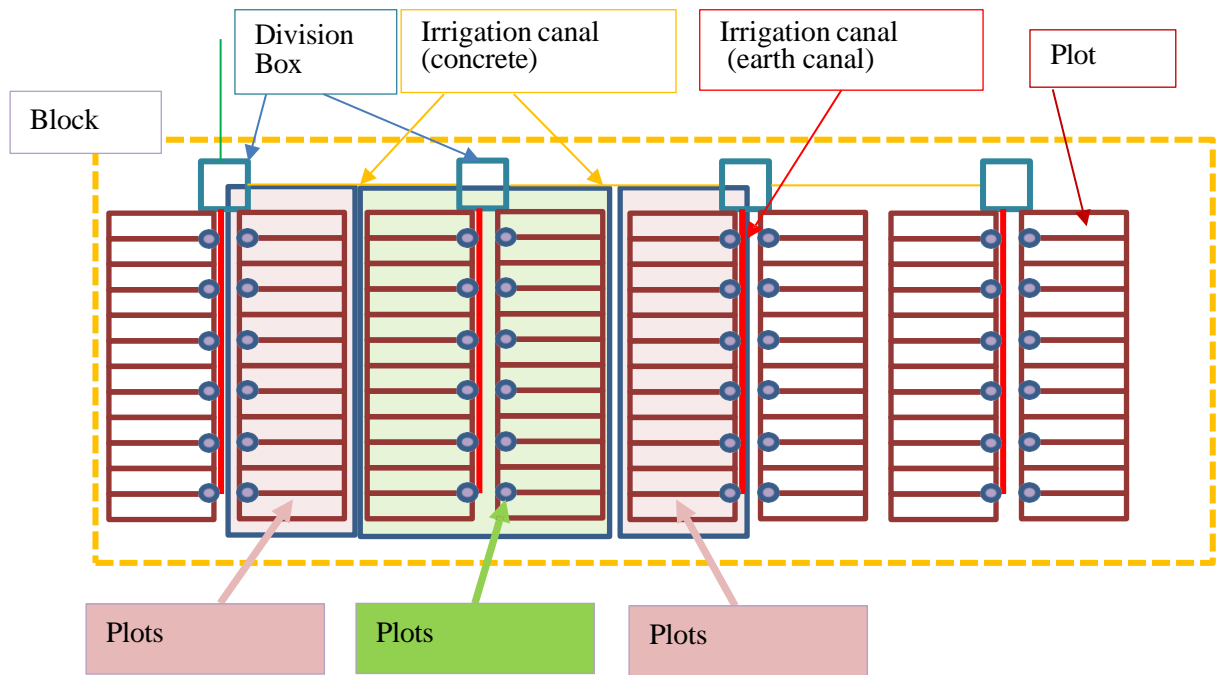


Fig 1. Layout of rice paddy fields

2.2 Location of study area

The LMIS is a farmer-managed irrigation scheme in Moshi District of Kilimanjaro Region, utilizing Rau and Njoro rivers for water supply through two intake weirs (Mabogini and Rau) as illustrated in **Figure 2**. The LMIS is located between 3 and 15 kilometers South-East of Moshi urban and is between 3.40° South latitude and 37.36° East latitude

(Bell et al., 2015). Furthermore, LMIS is a modern irrigation area that was developed in 1984 with Japanese loan assistance (Shinji et al., 2025). According to Bell et al. (2015) and Shinji et al. (2025) the LMIS has a total area of 2,300 ha and was identified as having the highest economic viability for irrigation scheme development projects in the area.

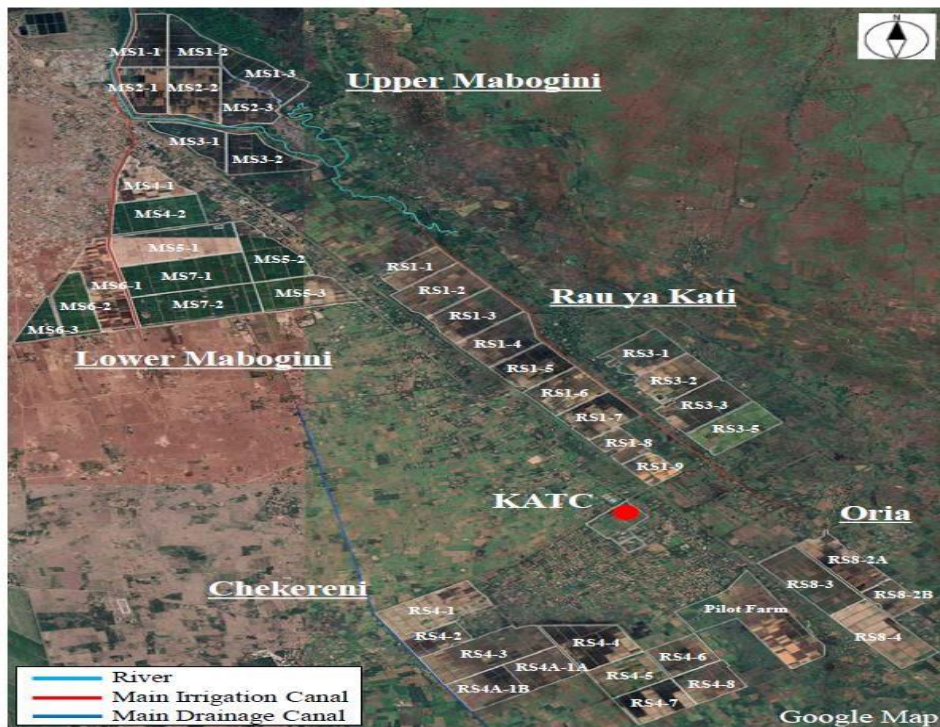


Fig 2. Location of the study area - LMIS. Source: Shinji et al., (2025).

2.3 Sampling unit and sample size

The sampling unit for the study was taken from rice paddy fields and plot water depth was a unit of measurement. Based on the heterogeneous nature of plots in blocks at the LMIS, a purposive sampling technique was used to obtain a representative sample for the study. Palinkas et al. (2015) affirm that purposive sampling is a useful technique widely used in research for the identification and selection of information-rich cases for the most effective use of limited resources. Tongco (2007) insists that a purposive sampling technique is a deliberate choice of an informant due to the qualities that the informant possesses. Purposive sampling defines a process where a researcher uses own judgement to select a group of people who know about the problem. Moreover, this type of sampling technique is convenient and cost effective (Rahi, 2017). The purposive sample size for the study was 55 plots out of 125 plots from block MS (4-2) and 55 plots out of 138 plots from block MS (7-1), respectively. The field measurements were conducted directly in the field for twelve consecutive days by an observer and his assistant, where field measurements of standing water depths were taken from 55 plots every day for each block as illustrated in **Table 1** and **Table 2**, respectively. Plots were irrigated more than four times within twelve research days. Others were irrigated less than four times within the research period, and one plot out of 55 was not irrigated in twelve consecutive research days. It was necessary to conduct field measurements to determine the variability of water depth in the rice paddy fields (Ashour et al., 2023). Jaiswal et al. (2024) insists that water conveyance efficiency depends on several factors including water depth.

2.4 Field data collection

Field data collection from the study area was based on the required parameters to measure the variability of water depth in the rice paddy fields. Measuring tools (devices) such as calibrated steel tape measure, notebooks, pencils, blue and red pens, mark pens, laptop, and scientific calculator were used for field measurements and recording of measured data. Irrigation water depths were measured before and after irrigation following the standard procedures using measuring tools such as those shown in **Figure 3**. Ashour et al. (2023) in their studies have used ponding method to measure water depth in earthen canals. Mairghany et al. (2022) affirms that water depth in centimeter (cm) was measured before and after the third tillage and transplanting using a metal ruler taking thirty measurements from each plot.

2.5 Data analysis

Excel software was employed to process collected data. Data were carefully analyzed statistically using descriptive statistics and frequencies to draw inferences. The data analysis was done based on the water depth measurements collected from 55 plots from block 4-2 and 55 plots from block 7-1, respectively, at the lower Moshi irrigation schemes. Parameters such as water depths in centimeter,

irrigation and measurement frequencies were ascertained. The data analysis approach of descriptive statistics and frequencies has been used by many researchers (Yat-sen et al., 2018; Talpur et al., 2013; Han et al., 2022; Simeon et al., 2025; Balan & Saparudin 2023) to draw inferences in their studies. The data analysis was done based on the water depth measurements collected from blocks MS (4-2) and MS (7-1), respectively, each block having 55 rice paddy fields.



Fig 3. Measuring device and ponding method

3. RESULTS AND DISCUSSION

3.1 Water depth measurements in block MS (4-2)

Water depth measurements in block MS (4-2) were simultaneously taken every day for twelve days consecutively. In this block, 55 plots were surveyed whereby 23.6% of the plots were irrigated more than four times within twelve research days, and 75% of the total plots were irrigated less than four times within the research period and lastly 1.4% which is one plot out of 55 was not irrigated in twelve consecutive research days. However, high frequencies of irrigation maintain high soil moisture and less frequencies of irrigation maintain less use of water and could be more sustainable in water use.

Results in **Table 1** illustrate the average of water depth measurements taken before and after irrigation of rice paddy fields. These results correlate with the work of Mairghany et al. (2022) who affirms that water depth in centimeter was measured before and after the third tillage and transplanting using a metal ruler taking thirty measurements from each plot. The measured maximum and minimum field water depths (water levels) for 55 plots in block MS (4-2) were 14 cm and 0.0 cm, respectively. These results are supported by Talpur et al. (2023) who found that 5 cm water depth is suitable for vegetative and mid stage of rice crop growth, while 10 cm water depth is appropriate for mid drainage till late stage. Furthermore, previous studies (Talpur et al., 2013; Balan & Saparudin, 2023; Mairghany et al., 2022; Andri et al., 2022; Yat-Sen et al., 2018; Xu et al., 2023) affirm that the presence of water depth variations in rice paddy fields are likely to affect the yields of rice. Arguably,

high depths of water maintain high soil moisture and less depths of water maintain less soil moisture.

For instance, Talpur et al. (2013) found that the different water depths at 5 cm, 10 cm, 15 cm and 20 cm in rice paddy fields produced different rice yields. In their study, Yat-Sen et al. (2018) observed variations in plants growth in the

paddy field measured at different water depths of 5 cm, 10 cm, 15 cm, and 20 cm, respectively.

Table 1. Average water depth in centimeters for 55 plots in block 4-2

S/N	Plot No.	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug
1	201	0	6.5	2.6	1.3	0	4.3	1	0	4.1	1.5	0	3.2
2	202	0.6	7.4	4.9	5.9	4	5.5	4.6	1.6	4.5	7	2	5.4
3	203	2.4	1.9	0.6	2.5	1.5	3.2	1.8	0.4	0.7	1	1.5	3.2
4	204	1.8	1	1.5	2.3	1.4	4.2	4.2	2	2	1.7	2.1	3.2
5	205	3.6	2.4	0.8	0	7.8	3.4	7	4	2.5	0.9	6	4.9
6	206	2.1	0.3	2.7	1	0.8	0.1	4.6	1.2	5.2	1.5	4.6	2.1
7	207	0.8	0	0.5	0.5	0	0	4.2	0.8	0.8	0.1	7.8	3.6
8	208	2.6	0.2	5.1	3.2	0.6	0	1.4	0	4	1.2	4.4	1.5
9	209	2.2	0	6.2	4.6	2	0.3	5.2	3.3	1.6	0.5	5.7	2.8
10	210	1.4	0.2	0	0	3.1	1.2	0.4	0	4.6	2.1	0.3	0
11	211	0.9	0	6.8	5.1	3.2	1.4	0.6	5.8	3.4	0.8	3.9	3.4
12	212	2.5	0.6	4.4	3.7	1.5	0.1	0	0.3	3	0.7	4	3.1
13	213	1.4	0.8	0.4	4.4	1.5	1.2	1.4	0.4	0	2.5	1.9	0.8
14	214	0.9	0.4	0.1	4.6	2.8	2.6	2	1.5	0	5.1	3.1	0.6
15	301	3.2	2.1	3.2	2.1	1.5	2.9	6	2	4.6	5.5	3.7	3.1
16	302	1.9	0.8	2.8	1	2	1.2	3.7	1.3	0.8	3.6	1	0
17	303	1	0	4.3	2.8	1.8	0.6	7.8	5.2	5	8	3.4	5
18	304	3.4	0.2	6.2	4.1	2.5	1.8	4.6	8	7.4	10.5	5	6
19	305	1.3	0	0	3.4	2.5	2.4	4.7	2.8	5	6.5	3.2	4
20	306	2.2	0.1	0	4.6	0.8	4.2	4	3.7	4	2.5	8.1	8
21	307	1.1	0.2	8.5	7.6	5	6	4.8	3	2.6	1.2	9	7.5
22	308	0.7	0.1	4.5	3.7	3	2.1	1.4	0.3	0.1	0	5	4.2
23	309	1.4	0.2	0	2.6	1.2	0.6	0	0	2	5	0.8	9.7
24	310	2.8	1.4	6	3.1	0.6	4.8	1.6	0	4.3	2.1	0.2	3
25	311	1.3	0.3	3	1.6	0.4	0.6	0.1	0	0	1.1	0.3	1.2
26	312	0.5	8	6.5	5.9	2.6	1.2	4.1	1	3.8	2.8	1.6	6.4
27	313	1.9	0.1	0	4.7	1.4	0.2	3.8	1.1	0	4.3	1.8	6.5
28	314	5.3	3.1	1.9	0.1	3.1	1.4	0	2.3	0.8	0	6.6	4.5

Table 1. Average water depth in centimeters for 55 plots in block 4-2 *cont...*

S/N	Plot No.	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug
29	315	6.7	4	1.2	2.6	1.2	0.4	2.4	2.2	1.2	0	2.2	1.3
30	316	0	8.5	5.7	5.1	4	3.2	1.9	0.8	4.8	3.9	3.7	2.8
31	317	1.6	0.2	2.6	1.4	1.2	0.8	2.6	1.4	0.6	0.2	3.7	6.6
32	318	1.6	0	3.3	1.3	0	3	2	0.3	4.6	1.3	6.9	3
33	319	0.8	0	3	1.2	0	2.8	1.7	0	1.9	0.8	5.6	2.4
34	320	0.9	0.2	6.2	4.5	4	6.5	0	3.6	2.4	1.2	0.5	6
35	321	1.7	0.1	4.6	2.4	4.2	2.8	4.1	2	0.4	4.5	1.8	5.6
36	322	2.4	1.3	0.5	0.2	7.5	3.1	2	0.5	0.1	1	0.8	0.5
37	323	0.85	0.2	0.1	0.1	0	0	2	0.1	0	4	5	2.1
38	324	5.2	3.4	1.2	0	2.1	0	2.8	2.1	1.5	0.3	4.5	2.4
39	325	2.1	1	0	6.4	5.6	3.2	0.5	0	4.2	3.6	1.8	0.8
40	326	0.6	0.1	0	2.2	0.8	0.1	1.7	0.2	2	0.5	2	0.3
41	327	1.2	0.05	0	3	1.3	1	1	0.3	0	6.3	4.5	2.7
42	328	1.5	0.2	5.9	2.4	1	2.5	1.5	0.4	0	3	2.1	0.4
43	401	3.1	1.8	0	2.6	0.7	0	1.4	0.8	0	3.6	2	0.6
44	402	3.4	2.5	3.1	2.3	2.6	2	1.5	0	2.6	3.9	3	3.6
45	403	4.3	2	2	2.4	3	2.8	2.5	0.8	0	4.1	2.7	4
46	404	4.6	2.3	2.3	1.2	5.3	4.1	2.2	1.3	7.5	6	5	5.4
47	405	1.8	1.5	1.3	0.9	0	3.2	2.3	1.5	3	3.2	2.7	1.1
48	406	2.8	2.1	1.8	1.2	2.8	1.3	0.7	0.2	0	2.3	1	4.5
49	407	2.5	1.6	1.8	6.8	1.6	1.9	8	2	2.7	1.4	3.5	7
50	408	1.4	0.6	2.7	0.7	0	3	2.5	0.6	1.2	4.5	1	1.9
51	409	8.7	7	10.9	14	9.5	7.5	8.4	7	6.2	9.5	6	8.9
52	410	3.2	2	0.4	6	4.6	3.4	2	0.4	0	5.4	1.5	0.4
53	411	4.1	3	3.2	1.8	0.4	0	3.6	1.4	0.2	4.2	1.2	0.4
54	412	2.7	1.8	0.4	4.9	2.8	1.8	1	0	7.8	5.4	3	0.8
55	413	1.3	5	3.7	4	3.9	3.2	2.7	0.2	0	5.6	5	5.9

3.2. Water depth measurements in block MS (7-1)

The water depth measurements for all 55 plots in block MS (7-1) were simultaneously taken every day for twelve days consecutively. In this block, 55 plots were surveyed in which 22.0% plots were irrigated more than four times within the twelve research days, and 74% of the total plots were irrigated less than four times within the research schedule, and lastly 4% which is two plot out of 55 were not irrigated in twelve consecutive research days. Results in **Table 2** illustrate the average of water depth measurements taken before and after irrigation of rice paddy fields. The measured maximum and minimum field water depths (water levels) for block MS (7-1) were 13 cm and 0.0 cm, respectively. These results

were supported by Iwasa et al. (2025) who evaluated the seedling growth of rice and late watergrass in Japan under the different water depths of 5 cm, 10 cm, 15 cm, and 20 cm, respectively.

Simeón et al. (2025) assessed water depth variability in rice farming in Spain and found that there was a need for farmers to understand the relationship between water depth and final crop yield. In fact, studies conducted (Han et al., 2022; Talpur et al., 2013; Andri et al., 2022; Iwasa et al., 2025; Simeón et al., 2025) in Malaysia, China, Indonesia, Japan and Spain affirm the existence of variations of water depth in the rice paddy fields.

Table 2. Average water depth in centimeters for 55 plots in block 7-1

S/N	Plot No.	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug
1	101	11.3	8	7	10	5	3	4.5	0	3.2	4.5	2	0.3
2	102	1.6	3.1	2.7	1.1	0	3.6	2.5	6	4.2	3.5	2	0.6
3	103	4.7	3	2.5	0.5	2.5	4.7	2.8	9.2	7.6	5.5	3.1	1.3
4	104	6.3	5.2	4	6	3.4	1	3.7	1.2	0	6.9	4.2	1.8
5	105	1.2	0	5	3.5	1.3	0	3.2	1.6	0	3.8	1.8	0.2
6	106	0.3	4.5	2.7	0.6	0	6.5	4.3	2.6	0.9	0	4.1	2.9
7	107	1.7	0	3	2	4.2	2.1	0	6	1	3	5	2.6
8	108	0.4	0	5.6	3	6.7	4.5	2.3	3.7	2	6.5	4.8	2.1
9	109	8.2	5	2.6	1	5.1	3	6.3	2	4	1.5	2	4
10	110	0.4	4.8	3.2	2.2	6	4.3	2.5	1.2	0	5.3	4.1	2.6
11	111	6.2	4.3	2	0	5.2	3.8	2.5	1	4	2.5	1.2	0.3
12	112	6.6	5	3	3.5	9	8.3	6.4	3.4	1	6.5	4.2	3.1
13	113	0.7	5	2.5	0	4.4	3.6	2.1	1	5	4.1	2.8	1.3
14	114	7.6	5.5	2.1	0	2	1.2	3	2	7.4	5.6	3.2	1.4
15	201	3.3	2	4	2.6	1.3	0	5.3	2.7	1.4	0	4	2.5
16	202	7.2	6.4	5.2	4	8	7.5	7.6	5.8	3.5	2.3	1	0.2
17	203	4.2	1	0	3.1	1.1	0	3	0	3.5	1.8	2.5	4
18	204	5.3	2.6	1	5.8	3.7	2	2	5	2.5	1.6	1	0.5
19	205	3.4	2	0	5.2	4.5	3	9	8.1	6.6	4	2.1	0.3
20	206	5.2	4.3	3	2	5	4	2	0	4.3	2.1	1	0
21	207	5.6	2	1.5	2.5	3.5	8	5.4	1.7	0	3	5	7
22	208	6.1	4	2.5	3	2.5	6.2	4.5	2	0	1	5.5	3.5
23	209	0.2	10.2	8.3	6.1	8	5.1	4	7.5	4.5	7.8	5.4	2.5
24	210	0.7	6.2	4.4	2.9	1.8	0.9	0	4	1	6.5	4.1	2.6
25	211	9.1	7	5	0	8	6.3	4	2.1	0	7	9	6.5
26	212	2.4	10.5	8.4	6.2	7.5	5	2.4	1.2	0	3	1.5	0.5
27	213	0.6	0	6.5	4.3	3.1	2	6	4.1	2.2	1.5	2	1.2
28	214	1.3	2	5	8.5	6.9	3.3	1	0	6	4.5	2.1	0

Table 2. Average water depth in centimeter for 55 plots in block 7-1 *cont...*

S/N	Plot No.	24-Jul	25-Jul	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31-Jul	1-Aug	2-Aug	3-Aug	4-Aug
29	215	0.1	0	1.9	0	0	2	0	4	0	5.5	0	4.5
30	216	2.3	2.1	3.4	1.7	0	2.6	0.8	0	4.6	2.1	3.3	1.6
31	217	7.6	5.2	3.1	0.9	0	2.4	3	0.9	5.4	3.2	1.4	0
32	218	4.9	2.6	0.6	0	0	3.5	5	3.8	2.9	1.3	0.7	0
33	219	5.1	2.2	0.4	0	3.6	1.2	3	1.7	6	4.6	2.5	0.8
34	220	5.5	3.6	1.2	0	5	2.7	6.3	4.6	1.8	5	3.1	0.5

35	221	6.6	3.1	1	2	5.6	3.4	1.8	1	0.1	0	5	2.9
36	222	0.9	0	6.8	4.6	3	4.4	2.1	0	3	1.1	0.2	0
37	223	3.3	2	0	4	3.1	1.1	0	6.5	5.3	3.2	1.1	0.7
38	224	2	0.4	0	4.5	2.7	0.6	0	4.3	3.5	2.1	1.3	0.1
39	225	1.9	0	2	2	0	3.5	0	5	3	1.2	0.8	0
40	226	2.1	0.7	0	5	3.2	1.3	0	3.5	1	5	2.5	1.5
41	227	5.1	4	10	8.4	6.5	3.3	0.9	0	3.5	1.3	0.4	0
42	228	3.2	1	4	7	9	7	6	2.5	1	1.5	5	3.5
43	301	6.4	5.3	3	13	7.3	4.5	1.2	0	5.5	2.5	0.2	0
44	302	5.1	3	2	3	8	6.3	4.2	2.1	0	7.8	4	2.2
45	303	4	2.4	0	5	3.5	2.3	1	0	4	7.9	2.5	4.2
46	304	0	7.1	5.7	3.2	2	6.2	4.1	2	0	4.5	2.8	0.4
47	305	4.3	2.1	1	8.5	6.2	4.4	1.9	0	6.5	3.7	1.9	0.5
48	306	2.2	0.5	0	2.3	0.5	9	8.4	6.5	5.1	4	2.8	1.3
49	307	0	9	8.1	6.5	4	9.3	7.4	5.1	3	3	1.8	1
50	308	10.2	9.4	8	6.5	4.4	3	6.4	5.8	4.5	3.1	0	5.9
51	309	1.6	5.4	3.6	2.2	1	0.1	5.6	3.9	2.1	1.7	1	8.6
52	310	8.3	6.5	4.8	2.4	1	5	2.2	0	6.5	3.8	1.9	0.5
53	311	7.1	6.2	4	6.6	3.2	1.8	0.7	0	5.2	3.5	1.4	0.8
54	312	3.8	2	4	7	3.6	0	6	2.5	1	5.2	3.5	2.4
55	313	6.1	4.3	2	7.2	6	6.1	2.9	1.2	0	4.5	3.1	0.7

CONCLUSION

The objective of the study was to evaluate the extent of water depth variability in the rice paddy fields at the Lower Moshi Irrigation Scheme (LMIS). The empirical findings of the study confirm that the average variability of water depth measurements taken before and after irrigation of 55 plots from block MS (4-2) and 55 plots from block MS (7-1) range from 0.00 cm to 14 cm and 0.00 cm to 13 cm, respectively, attributed to water discharge and the rice paddy fields condition. In fact, when water levels in paddy fields are not well regulated, it could lead to wasting of water. Assessing water depth variability could help farmers to understand the need of controlling water levels in the rice paddy fields. Furthermore, awareness of farmers with regard to water depth variations in paddy fields could enhance food production in the country. Likewise, it was observed that the high-water level in block 4-2 as compared to water level in block 7-1 could result into one block receiving excessive water while the other block experiences water shortages. Therefore, based on the research objective and the findings of the study, the following were recommended to irrigation practitioners, farmers, researchers, and policymakers governing the irrigation systems in the agriculture sector:

- The Authority responsible for maintaining irrigation systems should continue allocating enough funds for proper maintenance of irrigation infrastructure, particularly maintenance of rice paddy fields to hold appropriate water that could increase yields to enhance food production.

- Awareness on water depth variability in rice paddy fields should be provided to irrigation practitioners including farmers to enhance rice production at LMIS.
- Sporadic and routine maintenance of rice paddy fields should be done adequately and in a timely manner to reduce the negative impacts of water depth variability in the rice paddy fields.
- Farmers should be provided with relevant training on water control and management, particularly on the effect of water depth variability in paddy fields, to increase food production.
- Further research was suggested on developing an appropriate approach in capturing data with regard to the variability of water depth in paddy fields to improve production of rice.

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