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Research paper

Efficiency Of Irrigation To Meet The Needs Of Rice Fields

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Abstract

Irrigation is an effort to provide and regulate water to support agriculture whose types include surface irrigation, swamp irrigation, underground water irrigation, construction of irrigation canals, so that the availability of water in the Irrigation Area will be fulfilled even though the Irrigation Area is far from surface water sources (rivers). or lake) Planning an irrigation system, the first thing that needs to be done is a hydrological analysis using the Modified Penman method including the water demand in the fields (GFR), the demand for water intake (DR), the clean water requirement in the fields (NFR) as well as the water availability factor which is calculated using FJ Mock method. The hydrological analysis of water demand in the Sumberejo irrigation area aims to determine whether the availability of water is sufficient to irrigate the Sumberejo irrigation area which covers an area of 42.37 Ha. The results of the calculation analysis, it is known that the water requirement for an area of 42.37 Ha, the water discharge in the 1st planting season is 0.16 m3/s, while the water requirement is 0.04 m3/s. the existing water discharge in the 2nd planting season is 0.05 m3/s, while the water requirement is 0.06 m3/s. The determination of the rice-paddy cropping pattern for the first planting season begins in April I and the second planting season begins in August II. Based on the results of the calculation of water needs in the second planting season has not been met.

Keywords:*Water Availability; Mainstay Discharge; Water Needs; Cropping Pattern*

1. Introduction

The construction of irrigation canals to support the national food supply is essential, so that water availability on land is ensured even if the land is far from surface water sources (rivers). This cannot be separated from irrigation engineering efforts, namely providing water of the right quality, at the right place and at the right time, efficiently and economically (Sudjarwadi, 1990). The contribution of irrigation infrastructure and facilities to food security has been quite significant, with 84 percent of national rice production coming from irrigation zones (Hasan, 2005), flowing water from available water sources onto a plot of land to meet the needs of plants. According to Sudjarwadi (1990), the term irrigation is defined as the activities related to efforts to obtain water for paddy fields, fields, plantations and other agricultural enterprises. Water problems for agriculture, especially in areas where water resources are low, are problems that often have secondary effects, negative and even cause losses to farmers. During the rainy season, for example, too much water will cause many rice fields to flood, and during the dry season it will cause drought, leading to poor harvests, lower yields than they should be, and Longer harvest times because water needs and supplies are not suitable. Therefore, appropriate, inexpensive and applicable technology is required to regulate water availability so that it can meet the water requirements both during the rainy season and during the rainy season.
In the dry season. The location that will be the subject of this research is Sumberjo Irrigation Area which is located in Sumberjo Village, District. Talang Ubi, PenukalAbabLematang Ilir (PALI) Regency. The irrigation area has an area of approximately 42.37 Ha and a canal length of 1500 m. The main source of water used to irrigate the rice fields comes from Lake Tapus.
As the building ages, the irrigation network experiences sediment deposition and many wild plants grow along the canal, leading to a reduction in the effectiveness and efficiency of the canal. During the dry season, Lake Tapus experiences a decrease in water flow, resulting in reduced water levels. water supply to irrigate the entire area of the rice fields. Based on this, the researchers are to carry out an "Analysis of Irrigation Water Availability to Meet Water Needs in Rice Fields in Sumberjo Village, Talang Ubi District, Pali Regency." Thus, by carrying out this research, it is hoped that it can provide solutions to the community and associated agencies. The purpose of this research is to calculate the availability of irrigation water and irrigation water requirements in the irrigation area of Sumberjo, PenukalAbabLematang Ilir Regency and the distribution efficiency of primary canals, secondary and tertiary in the Sumberjo irrigation zone, PenukalAbab. Lematang Ilir Regency.

2. Research methods

2.1.Search sites

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This research was conducted in Sumberjo Village Irrigation Area, located on Jl. Raya Sumberjo, North Talang Ubi Village, Talang Ubi District, PenukalAbabLematang Ilir Regency. The Sumberjo village irrigation canal irrigates a rice field area of 42.37 Ha with a canal length of 1500 m

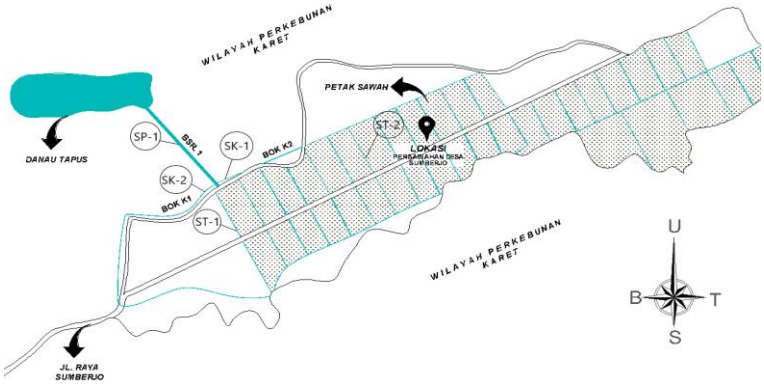


Fig. 1: Research Location.

2.2. Research flow

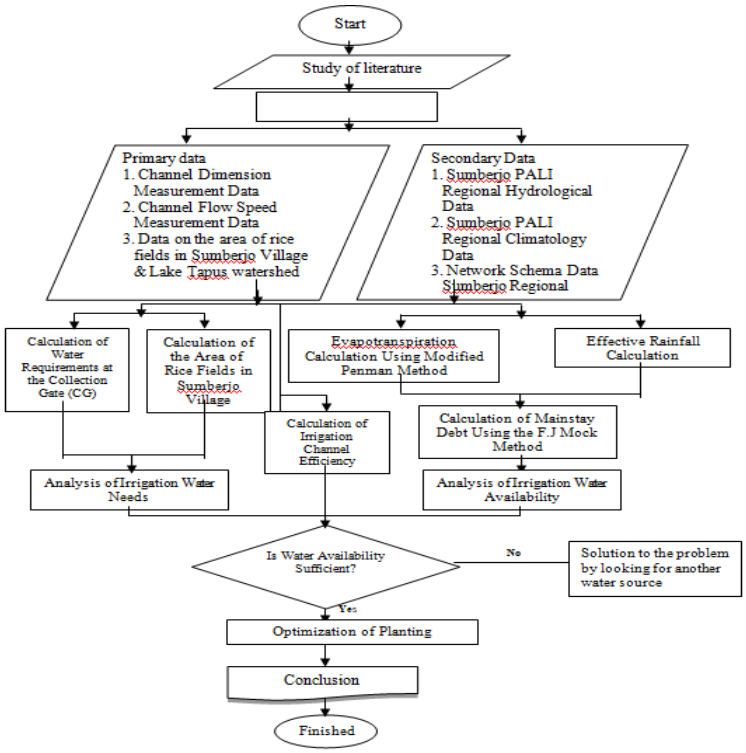


Fig. 2: Research Flow Char.

3. Results and discussion

3.1. Analysis of irrigation water availability

1) Effective precipitation analysis

The effective rainfall is determined by the amount of R_80, that is, the amount of rain whose amount can be exceeded by 80%, that is, it is exceeded 8 times out of 10 events. In other words, precipitation amounts below R_80 have a probability of only 20%. Effective precipitation is the amount of rain that falls during the plant growth period and is useful in meeting the water needs of plants.

2) Evapotranspiration

Potential evapotranspiration is calculated using the modified Penman method and actual evapotranspiration is calculated using a summarized equation and then tabulated as follows:

Table 1: Summary of Potential Evapotranspiration (Eto)

Month	Daily Evapotranspiration (mm/day)	Monthly Evapotranspiration (mm/month)
January	4,32	133,9

Month	Daily Evapotranspiration (mm/day)	Monthly Evapotranspiration (mm/month)
February	4,54	127,1
March	4,43	137,2
April	3,96	118,8
May	3,71	115,1
Juny	3,37	101,2
July	3,78	117,0
August	4,45	137,8
September	5,13	154,0
October	4,80	148,9
November	4,38	131,4
December	4,28	132,8

3) Summary of principal debt using the F.J Mock method

The calculation of the main flow is calculated by taking the value of 80% of the flow from 2017 to 2021. The summary of the available flow is 80% from January to December with a period of 5 years using the probability of occurrence in percentage and presented in table form. as following:

Table 2: Summary of Pillar Discharge Q_80

Month		Probabilitas (%) 1 16,7	2 33,3	3 50,0	4 66,7	Q 80,0	5 83,3
	0,06	0,08	0,05	0,06	0,08	0,06	16,7
	0,05	0,09	0,12	0,12	0,13	0,11	0,06
	0,08	0,15	0,12	0,13	0,13	0,12	0,05
	0,14	0,15	0,11	0,14	0,21	0,08	0,08
	0,17	0,13	0,09	0,14	0,19	0,11	0,14
	0,11	0,09	0,07	0,12	0,19	0,06	0,17
	0,11	0,09	0,03	0,10	0,10	0,10	0,11
	0,12	0,07	0,01	0,10	0,10	0,09	0,11
m^3/dtk	0,08	0,03	0,02	0,06	0,04	0,08	0,12
	0,15	0,06	0,06	0,06	0,06	0,06	0,08
	0,08	0,10	0,04	0,08	0,05	0,11	0,15
	0,08	0,10	0,08	0,04	0,02	0,07	0,08

3.2.Analysis of calculations of irrigation water needs

The planned planting pattern in the irrigation area of Sumberjo village is rice. The following is a summary of the calculation of irrigation water requirements for rice plants.

Table 3: Water Requirements of Rice and Secondary Crops

Planting Period			Rice - Paddy - Secondary Crops														
			Eto	P	Re	Crop Coefficient								Etc (Kc x Eto)	Total Water Requirements	NFR (mm/hari)	NFR (ltr/dtk/ha)
			mm/hr	mm/hr	mm/hr	WLR1	WLR2	WLR3	WLR	C1	C2	C3	kc				
			Data			50 mm / 15 hari				Tabel Koefisien Padi					Calculation		
Planting Season 1	April	1	3,96	2	7,69					LP/PL	LP/PL	LP/PL	LP/PL		9,33	1,64	0,19
		2	3,96	2	7,57					LP/PL	LP/PL	1,10	LP/PL		9,33	1,76	0,20
	May	1	3,71	2	7,13					LP/PL	1,10	1,10	LP/PL		9,14	2,01	0,23
		2	3,71	2	6,04			3,33	1,11	1,10	1,10	1,05	1,08	4,02	7,13	1,10	0,13
	Juny	1	3,37	2	5,10		3,33		1,11	1,10	1,05	1,05	1,07	3,60	6,71	1,61	0,19
		2	3,37	2	4,69	3,33		3,33	2,22	1,05	1,05	0,95	1,02	3,43	7,65	2,96	0,34
	July	1	3,78	2	5,01		3,33		1,11	1,05	0,95	0	0,67	2,52	5,63	0,62	0,07
		2	3,78	2	4,80	3,33			1,11	0,95	0		0,32	1,20	4,31	0	0
	August s	1	4,45	2	5,49					0			0	0,0	2,0	0	0
		2	4,45	2	4,91					LP/PL	LP/PL	LP/PL	LP/PL		6,89	1,98	0,23
	September	1	5,13	2	4,13					LP/PL	LP/PL	1,10	LP/PL		7,65	3,51	0,41
Planting Season 2		2	5,13	2	4,02					LP/PL	1,10	1,10	LP/PL		7,65	3,63	0,42
	October	1	4,80	2	4,59			3,33	1,11	1,10	1,10	1,05	1,08	5,20	8,32	3,72	0,43
		2	4,80	2	4,81		3,33		1,11	1,10	1,05	1,05	1,07	5,12	8,24	3,43	0,40
	November	1	4,38	2	6,09	3,33		3,33	2,22	1,05	1,05	0,95	1,02	4,45	8,67	2,58	0,30
		2	4,38	2	6,44		3,33		1,11	1,05	0,95	0	0,67	2,92	6,03	0	0
	December	1	4,28	2	6,42	3,33			1,11	0,95	0	0,50	0,48	2,07	5,18	0	0
		2	4,28	2	5,62					0	0,50	0,75	0,42	1,78	3,78	0	0
Planting Season 3	January	1	4,32	2	3,26					0,50	0,75	1,00	0,75	3,24	5,24	1,98	0,23
		2	4,32	2	3,15					0,75	1,00	1,00	0,92	3,96	5,96	2,81	0,32
	February	1	4,54	2	4,65					1,00	1,00	0,82	0,94	4,27	6,27	1,62	0,19
		2	4,54	2	5,92					1,00	0,82	0,45	0,76	3,44	5,44	0,00	0,00
	Marc	1	4,43	2	5,11					0,82	0,45		0,42	1,87	3,87	0,00	0,00
		2	4,43	2	4,92					0,45			0,15	0,66	2,66	0	0

Table 4: Water Requirements at the Inlet Lock

Month	Day / Month	NFR (ltr/dtk/ha)	DR (ltr/dtk/ha)	NFR (m^3/dtk/ha)	DR (m^3/dtk/ha)
April	1	0,19	1,17	0,01	0,05
	2	0,20	1,25	0,01	0,05
May	1	0,23	1,43	0,01	0,06
	2	0,13	0,78	0,01	0,03
Juny	1	0,19	1,14	0,01	0,05
	2	0,34	2,10	0,01	0,09
July	1	0,07	0,44	0,003	0,02
	2	0	0	0	0
Augusts	1	0	0	0	0
	2	0,23	1,41	0,01	0,06
September	1	0,41	2,50	0,02	0,11

	2	0,42	0,83	0,02	0,04
October	1	0,43	0,85	0,02	0,04
	2	0,40	0,98	0,02	0,04
November	1	0,30	0,74	0,01	0,03
	2	0	0	0	0
December	1	0	0	0	0
	2	0	0	0	0
January	1	0,23	0,75	0,01	0,03
	2	0,32	0,94	0,01	0,04
February	1	0,19	1,15	0,01	0,05
	2	0	0	0	0
March	1	0	0	0	0
	2	0	0	0	0

3.3. Results of calculating irrigation water requirements

Table 5: Summary of Irrigation Water Requirements for Planting Season I

Planting Season I	Apr		May		Juny		July		Agt	Average
	I	II	I	II	I	II	I	II	I	
Need (m^3/dtk)	0,05	0,05	0,06	0,03	0,05	0,09	0,02	0	0	0,04
Availability (m^3/dtk)	0,21	0,21	0,19	0,19	0,19	0,19	0,10	0,10	0,16	0,17
Information	E	E	E	E	E	E	E	E	E	E

Ket : E = Enough

Based on Table 5, the irrigation water requirements in the first rice planting season can be met properly. This can be seen in the average value of demand flow, which is 0.04 m^3/sec, while the average value of available flow is 0.17 m^3/sec, so the 1st rice planting season can be achieved because water availability exceeds the required water demand. In the second month of July, the irrigation water requirement was 0 m^3/sec because the Re value for that month was higher than the total water requirements, meaning there was excess water and that no additional water was needed. Meanwhile, on August 1, the land was left dry and without water due to the harvest season, to make it easier for farmers to harvest rice.

Table 6: Summary of Irrigation Water Requirements for Planting Season II

Planting Season II	Agt	Sep		Oct		Nov		Dec		Average
	II	I	II	I	II	I	II	I	II	
Need (m^3/dtk)	0,06	0,11	0,11	0,11	0,10	0,08	0	0	0	0,06
Availability (m^3/dtk)	0,10	0,04	0,04	0,06	0,06	0,05	0,05	0,02	0,02	0,05
Information	E	K	K	K	K	K	E	E	E	E

Ket : E = Enough

According to Table 6, irrigation water requirements during the second rice planting season were not adequately met. This can be seen in the average value of requested flow, which is 0.06 m^3/sec, while the average value of available flow is 0.05 m^3/sec, so the second season of rice planting n has not been achieved because the demand for water exceeds the available water supply. required. In November II, the irrigation water requirement was 0 m^3/sec because the Re value for that month was higher than the value of total water requirements, which means that there was excess water and that No additional water was needed.

Table 7: Summary of Irrigation Water Requirements for Planting Season III

Planting Season III	January		February		March		Average
	I	II	I	II	I	II	
Need (m^3/dtk)	0,06	0,075	0,05	0,00	0,00	0	0,03
Availability (m^3/dtk)	0,08	0,08	0,13	0,13	0,13	0,13	0,12
Information	E	E	E	E	E	E	E

Ket : E = Enough

Based on the summary of Table 7. calculation of irrigation water requirements above the calculation of water requirements and availability from January to March, the average requirement for the third planting season was obtained at a value of 0.03 m^3/sec, while for the average availability flow value - The average obtained is 0.12 m^3/sec. For this reason, the value of water availability available at the water source, namely Lake Tapus, may still be sufficient for the irrigation water needs of Sumberjo village in the third season of planting, only in January II, there is still a lack of water to irrigate the plants on agricultural land, but this can still be tolerated because the difference is relatively small.

3.4. Results of channel efficiency calculation values

Flow efficiency is an effort to use water that actually matches the needs of the plants with the amount of discharge available or reaches the plant's soil, so that plant growth can be well guaranteed by providing sufficient water. water. Here are the efficiency values for each channel:

Table 8: Summary of Efficiency Calculation Results

Channel Code	QBeginning(m^3/dtk)	Q End (m^3/dtk)	Water Loss(m^3/dtk)	Efficiency(%)	Information
SP-1	0,18	0,16	0,017	90,7	Efficient
SK-1	0,14	0,13	0,010	93,1	Efficient
SK-2	0,06	0,06	0,004	93,0	Efficient
ST-1	0,03	0,02	0,008	74,3	Less efficient
ST-2	0,03	0,02	0,011	67,8	Less efficient

Based on the results of the efficiency percentage for each channel in Figure 3, it can be seen that the efficiency value for each channel is different. Here is Figure 3. regarding the effectiveness of each channel:

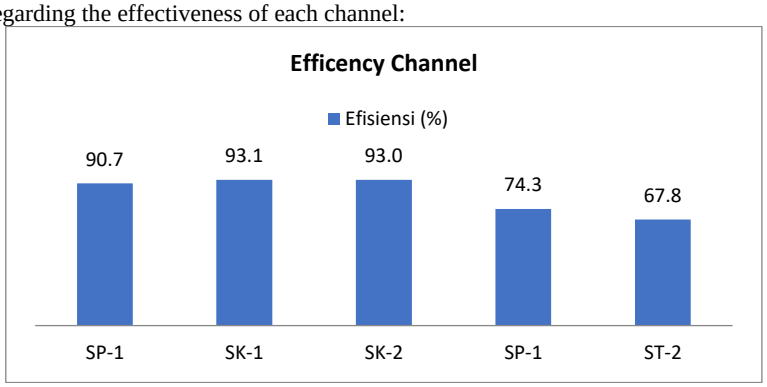


Fig. 3: Channel Efficiency Graph.

4. Conclusion

Based on the results of the analysis of the calculations carried out, it can be concluded that:

1) The irrigation water requirement for Sumberjo irrigation area, Talang Ubi district, in the 1st rice planting season (April-August), the average flow rate required is 0.04 m^3/s , the flow rate for irrigation water availability is 0.16 m^3 /s, which means the flow availability is adequate. And for the second rice sowing period (August – December), the average flow rate required is 0.06 m^3/s, the average flow rate available in irrigation water is 0.05 m^3/s, which means that for the second sowing season this is not enough.
2) Channel effectiveness

SP-1 = 90.9% > 90% = Effective
SK-1= 93.1% > 90% = Effective
SK-2= 93% > 90% = Effective
ST-1= 74.3% < 80% = Less effective
ST-2= 67.8% < 80% = Less effective

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