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24d Netafim Sprinkler Meganet Performance Test on Discharge Variations for Urban Agriculture

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Abstract. In cities, many rice fields have changed their function to housing, offices, hotels, and others, so that agricultural land is getting narrower, many irrigation canals have turned into drainage channels, and some are even closed so that irrigation access for land that is still productive cannot be done. So that land that is still productive does not have access to irrigation water. To support agricultural activities, it is necessary to select an appropriate irrigation method from conventional to more technical methods such as the use of mini sprinklers that are already on the market, so that they are not disturbed by the existing irrigation canals. For this reason, it is necessary to test the mini mega net 24D Netafim sprinkler irrigation system with various variations discharge of the pump. The performance test was carried out on an area of 0.98 are using a source of irrigation water from a Shimizu PS-121-BIT type pump. The testing phase starts from the preparation of materials and tools, preparation of the irrigation network, testing of the flow of discharge, and testing of irrigation sprinklers. Meanwhile, the analyzed data includes data of discharge variations, radius data, and irrigation uniformity data. The results showed that the test with discharge variations Q1 = 0.59 l / s, Q2 = 0.54 l / s, Q3 = 0.46 l / s and Q4 = 0.37 l / s obtained uniformity (Cu) respectively 85,759, 85,760, 87,109 and 87,603%, on the average number is more than 85%. The shower radius of each of the above discharge variations is R1 = 4.54, R2 = 4.31, R3 = 4.13 and R4 = 3.96 m. So, the performance of the irrigation system with the 24D Netafim sprinkler is good, so it can be applied for certain types of agricultural crops.

INTRODUCTION

Based on data from the Agriculture Office of Mataram City, West Nusa Tenggara Province (NTB), it is stated that currently approximately 1,500 hectares of agricultural land on the island of Lombok are used for agriculture. Due to the conversion of land from agricultural land to housing, hotel buildings, and infrastructure such as roads. This conversion of land functions is very difficult to contain due to the rapid growth and development of the community. This condition has an impact on the reduction of agricultural land that farmers can use. When viewed from the total land area in NTB (2.015.315 hectares), 1,673,476 hectares (or about 83.25%) is dry land consisting of 1.057.054 ha of forest land, 395,18 ha of agricultural land, 117.996 ha of bush. For 72.694 ha of grass, 26.066 ha of the village, 4.024 ha of reeds land, and 28.693 ha of other uses. The rest are wetlands 94.741 ha of irrigated rice fields, 6.996 ha of fisheries, 4.322 ha of reservoirs, 1.755 ha of land, and others [2]. There are still many people in Mataram who are still livelihoods of farmers, with relatively narrow land areas and limited irrigation access and even closed, the activities of farmers must still be able to carry out farming business. To overcome this, there must be a more specific irrigation method so that farmers' activities are not disturbed by irrigation network conditions. One of the technologies that can be found in the market is such as the Meganet 24D Netafim mini sprinkler irrigation device, which can be used as an alternative for use in crop irrigation with a limited land area. Besides having a small irrigation capacity, the required discharge is not large, so by making dug wells around the land, it is estimated that the Meganet 24D Netafim tool can be applied to agriculture in urban areas. Another type of mini sprinkler test in the serial network in research obtained the irrigation radius of 4.88m at the maximum setting, and while at the minimum setting, the irrigation radius

was 3.5m [1]. With the previous test results, it is possible to compare the irrigation radius's performance in the Meganet 24 D test.

Another research was conducted in the dry land of North Pringgabaya, Lombok Timur Regency using a three nozzle sprinkler reported that the uniformity of mini sprinkler irrigation (Cu) is above 70% on average, classified as good with a depth of irrigation performance of about 0.3 cm. - 7 cm [3]. The average mini sprinkler discharge size is 0.023 m3 / s with an irrigation radius (rs) = 2.6m. Based on existing research, to determine the performance of the Meganet 24D Netafim mini sprinkler, which is simpler if applied to agricultural land, it is necessary to test its performance on variations of pump discharge for applications on land area and the size of the limited discharge among several types of sprinklers on the market. The performance that needs to be known is the wetting area's ability and the uniformity that the system can provide to various variations of pump discharge. Therefore, what needs to be known more clearly is the radius of the sprinkler irrigation obtained at the pump discharge variation being tested, how is the sprinkler irrigation uniformity occurs due to variations in the pump's flow rate of the pump. It is very important to know because the limited water sources and land area are expected to be still able to do farming by the community.

Based on research [7] entitled "Pakchoy Plant Portable Sprinkler Irrigation Design," states that the uniformity value of irrigation is calculated using the Christiansen method using a block type (square measurement) with a spacing between the containers of (2 x 2)m. Irrigation uniformity (CU) is produced with a pump operating pressure of 1 bar with a sprinkler distance of (10 x 10) m. Based on the observation data, it was found that the average flow of water for 30 containers for 30 minutes was 2.25 mm, with the resulting uniformity value of irrigation flow (CU) of 79.9% at a pipe discharge of 1.45 l/s and sprinkler discharge of 0.29 l/s. Reported research on mini three nozzle sprinkler irrigation was concluded that the effect of duration with mini sprinkler irrigation systems on infiltration depth and soil area obtained data that the test results were obtained in 17 cm infiltration during 1-hour irrigation and with an average discharge of 0.563 l/sec, resulting in an average wet distance of 5.35 meters [5]. The longer the mini sprinkler irrigation is used, the deeper the absorption performance is produced, and the greater the water pressure that occurs, the greater the radius of the resulting wetting. Meanwhile, The three-nozzle sprinkler on soil moisture provision shows that the maximum soil moisture that can be given during the tested irrigation duration is still below 20% on average [4].

Sprinkler Irrigation

The sprinkler system is an alternative method of providing water with a higher water efficiency compared to surface irrigation. This system is expensive but very easy to operate.

The bulk irrigation components are generally as follows. The source of driving power, the pump can be an electric motor or a combustion motor. The types of pumps commonly used in a bulk irrigation system are centrifugal and turbine pumps. Centrifugal pumps are used when the required discharge and pressure are relatively small, while turbine pumps are used when the required flow and pressure are relatively large.

The main pipe (mainline), is a pipe that flows water from the pump to the lateral pipe. The main pipe is made permanent above or below ground level. It can also be moved (portable) from one land to another. The main planted pipe, is generally installed at a depth of 0.75 m below ground level. The diameter of the manifold pipe is between 75-200 mm. Types of pipes commonly used as lateral, manifold, and main pipes include GIP, PVC, PE, and aluminum.

A lateral pipe acts as a pipe that drains water from the main pipe to the sprinkler. Lateral pipes are usually available on the market in lengths of 4, 6, or 12 meters per piece. The lateral pipe is smaller in diameter than the manifold pipe, generally lateral diameter 50 - 125 mm, can be permanent or movable.

Uniformity Coefficient

To calculate the uniformity coefficient of the Critiansen (1942) equation it can be used as a reference in planning:

$$Cu = 100(1 - \frac{\sum^{i=n} |xi-x|}{X.n}) \quad (1)$$

with: Cu = uniformity coefficient (Uniformity of application), xi = storage yield (ml), x = average storage yield and n = number of observation points

Irrigation Radius (Rs)

The area of the sprinkler wetting area is the area of the circular shape produced by sprinkler irrigation. The most important thing in this calculation is knowing the radius or diameter of the sprinkler irrigation. To calculate the resulting wet radius, the formula below is used

$$A = \pi \times r2 \quad (2)$$

where: A = area (m2), r = the radius of the circle (m).

Flow discharge, (Q) for the calculation of Discharge the following equation is used:

$$Q = V / t \quad (3)$$

where: Q = Discharge (m^3/s), V = volume of container storage (m^3), t = length of time to hold until the glass is full (in seconds).

Flow velocity, in this study the flow velocity is calculated by the formula

$$V = \frac{Q}{A} \quad (4)$$

where: V = velocity of flow (m/s), Q = Discharge (m3 / s), A = area of pipe (m2).

METHOD

This research was conducted on agricultural land located in Rembiga Village, Selaparang District, Mataram City, on an area of 0.98 acres. The flow chart for the implementation of the assessment can be seen in Figure 1.

Research Tools and Materials, the research material used 3 mini Meganet 24 D Netafim sprinklers; PVC pipe networks ¾ "and ½"; water pressure using 1 shimizu PS 121 BIT pump with a power of 125W and a capacity of 31 l / minute. See Figure 2 and Figure 3.

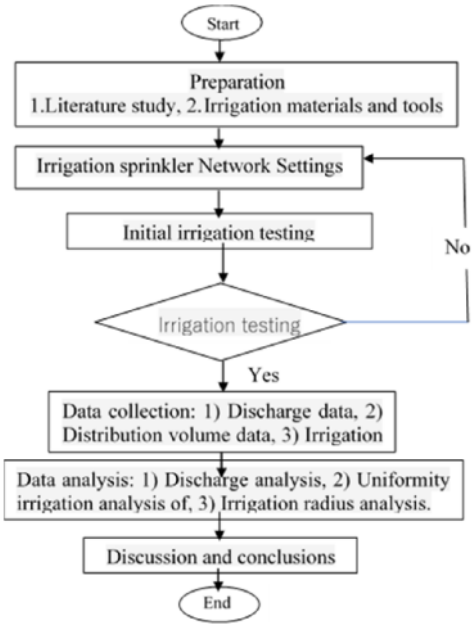

FIGURE 1. Research Flowchart

FIGURE 2. Meganet 24 D Netafim

FIGURE 3. Shimizu PS 121 BIT pump 125W power

Equipment used in assisting this research includes, pipe saw; water meter to measure pipe discharge, 10 ml measuring cup is used to measure the volume of water from the mini sprinkler; stopwatch to record the flow time of AI, meter, stationery, to record measurement data, camera, water reservoir with a diameter of 6.2 cm, stop valve ¾ inch, pipe connection, seal tape, and pipe glue.

Research Implementation

Land preparation and sprinkler irrigation network design, at this stage, the network testing and discharge variation test are carried out by adjusting the stop valve openings. The valve stop opening consists of 4 variations, namely for the perpendicular opening at the full opening with an angle of $\alpha = 90$ °, $\alpha = 70^0$, $\alpha = 50^0$ and $\alpha = 30^0$.

The research implementation stage consisted of testing sprinkler irrigation with discharge variations, recording data uniformity and irrigation radius for each variation of the test, and preparing the analysis data.

Data analysis

In the data analysis stage, data analysis was carried out on the results of the Cu irrigation safety test data for each discharge variation which was presented in graphical form. While the results of the discharge variation test were also carried out on the results of the irrigation radiation radius at each test discharge variation. The results of this analysis are also presented in tables and graphs and concluded descriptively.

RESULT AND DISCUSSION

Pump Discharge Analysis

This pump discharge test is carried out 5 times for data collection. Then the pump discharge calculation is carried out.

TABLE 1. Pump discharge test results

α (°)	Volume (liter)	Time Mean (t)	Variations Discharge
90	10.45	17.66	0.59 l/s
70	10.45	19.50	0.54 l/s
50	10.45	22.80	0.46 l/s
30	10.45	28.00	0.37 l/s

(Source: Calculation Results)

Based on the results of the calculation of the test data, 4 variations of the discharge are obtained as in Table 1. So, the maximum discharge used in the study is 0.59 l/s or 0.00059 m^3/s, lower than the discharge used (2), which is 0.023 m^3/s.

Irrigation Radius Analysis

Analysis of irrigation radiation radius by operating three sprinklers simultaneously and collecting data of irrigation radius of each sprinkler is done 3 times. The graph of the analysis results in the form of the relationship between discharge variations and irrigation radius can be seen in Figure 4.

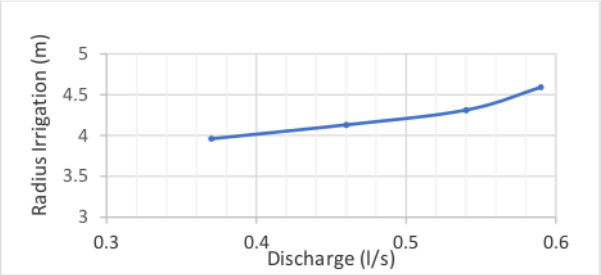

FIGURE 4. Graph of the relationship between discharge variations and irrigation radius

Based on the graph in Figure 4, it is known that the Meganet 24 D Netafim mini sprinkler at a discharge of 0.37 l/s - 0.59 l/s is able to produce an irrigation radius ranging from 3.96 meters - 4.54 meters. So the range of wetting this sprinkler irrigation is wider than the three nozzle sprinkler in [3], which is only capable of 2.6 meters. At a flow rate of 0.37, the Meganet 24D Netafim mini sprinkler is still able to provide an irrigation radius of up to about 4 meters. However, when compared with Nopianti [5] the sprinkler tested produced an irrigation radius of up to 5.35 meters with a used flowrate of 0.563 l / s, but the uniformity was still low as stated in the results of the study [3]. The Meganet 24 D Netafim sprinkler is better than three nozzles because of its low flow rate with good irrigation distribution. However, compared to the previously reported paper [1], the sprinkler tested in this study is still better because the deviation of the irrigation radius variation is very low.

Sprinkler Irrigation Uniformity Coefficient (Cu)

Irrigation uniformity in the four tested discharge variations can be seen in Table 2 to Table 6 below.

Sprinkler irrigation uniformity (Cu) at a discharge of 0.37 l / s

The amount of irrigation uniformity that occurs in the three Meganet 24 D Netafim sprinklers tested in Table 2 shows the results of uniformity above 87%. The three sprinklers showed good performance with high categories, and the difference in distance from the water source did not show a large difference in Cu performance.

TABLE 2. Uniformity coefficient (Cu) at Q = 0.37 l / s

No *Sprinkler*	Uniformity Coefficient (%)	Average Uniformity (%)
1	87.26	
2	87.77	**87.60**
3	87.78	

Source: Analysis Results

Sprinkler irrigation uniformity (Cu) at a discharge of 0.46 l / s

The amount of irrigation uniformity at the second discharge of 0.46 l/s on the three 24 D Netafim meganet sprinklers tested in Table 3 shows the uniformity results vary, ranging from 84 to 87.8%. The three sprinklers have shown differences in the performance of each sprinkler but are still in the high uniformity category. The difference in distance from the water source has given a large difference in Cu to the average of sprinkler 3 which is around 2.28% in performance.

TABLE 3. Uniformity coefficient (Cu) at Q = 0.46 l / s

No *Sprinkler*	Uniformity Coefficient (%)	Average Uniformity (%)
1	87.73	
2	88.78	87.11
3	84.82	

Source: Analysis Results

Sprinkler irrigation uniformity (Cu) at a discharge of 0.54 l / s

The resulting irrigation uniformity at the second discharge of 0.54 l/s on three Netafim 24 D meganet sprinklers tested in Table 4 shows that the uniformity results vary, ranging from 83 to 88%. The three sprinklers showed clear differences in performance but were still in the high uniformity category. The highest uniformity difference occurred in sprinkler 3, which was about 2.48% of the average Cu.

TABLE 4. Uniformity coefficient (Cu) at Q = 0.54 l / s

No *Sprinkler*	Uniformity Coefficient (%)	Average Uniformity (%)
1	86.08	
2	87.92	**85.76**
3	83.28	

Source: Analysis Results

The sprinkler irrigation uniformity (Cu) at a discharge of 0.59 l / s

Sprinkler irrigation uniformity (Cu) at a discharge of 0.59 l/s The resulting irrigation uniformity at the second discharge of 0.59 l / s on three Netafim 24 D meganet sprinklers tested in Table 5 shows the uniformity results that vary widely with values ranging from 81 to 93%. The three sprinklers showed a significant difference in Cu values but still in the high uniformity category. The highest uniformity difference occurred in sprinkler 3 which was about 4.27% of the average Cu.

TABLE 5. Uniformity coefficient (Cu) at Q = 0.59 l / s

No *Sprinkler*	Uniformity Coefficient (%)	Average Uniformity (%)
1	83.58	
2	92.20	**85.76**
3	81.49	

Source: Analysis Results

So the difference in the uniformity of Cu produced by the three will seem bigger if the discharge given is greater. So that in sprinkler irrigation, the system is expected to provide even uniformity, so that the provision of irrigation water to plants can be evenly distributed, which will greatly affect the growth and production of crop products. Compared to the results of the uniformity test in previous studies [3,5], the 24D Netafim meganet study results have much higher uniformity. This type of sprinkler is more likely to be used for irrigation of certain crops in urban agricultural land than the sprinkler used in previously reported data [3,5]. The results of the Cu uniformity test for the three sprinklers as the average value can be seen in Table 6.

TABLE 6. Results of 24 D Netafim Sprinkler Irrigation Uniformity

Name	Discharge variation (l/s)	Uniformity (Cu) (%) irrigation
Q1	0.59	85.76
Q2	0.54	85.76
Q3	0.46	87.11
Q4	0.37	87.60

Source: Analysis Results

Based on Table 6, it is known that overall all discharge variations provide a high average uniformity of above 85% so that it has the potential to be used for irrigation on certain types of plants. Maybe it can be tested on horticultural crops because of their short life so that the evaluation of the irrigation system will be done more quickly to support further agricultural efforts. Whereas in previous studies [3,5], it is very difficult to obtain uniformity as in the table above.

CONCLUSION

The conclusions that can be drawn from the results of this study are as follows: 1. The results showed that the test with discharge variations Q1 = 0.59, Q2 = 0.54, Q3 = 0.46 and Q4 = 0.37 l/s, obtained uniformity (Cu) amounting to 85.759, 85.760, 87.109 and 87.603%, respectively, more than 85% including high. 2. The irrigation radius of the variety of large to small discharge is obtained R1 = 4.54 m, R2 = 4.31 m, R3 = 4.13 m and R4 = 3.96 m. So, the Netafim 24D sprinkler irrigation system's performance is good so that it can be applied and tested for certain types of agriculture.

REFERENCES

1. Ardhiawan, et al, Civil Spectrum of Scientific Journal and Civil Engineering Applications, **1**, 3 pp. 163-238, (2010).
2. Bappeda NTB, *NTB Province Dryland Policy and Development*, (Bappeda Press. Mataram, 2003).
3. I. D. G. J. Negara, et al., Spectrum Civil Scientific Journal and Civil Engineering Applications, **2**, 1 pp. 1-104, (2015).
4. D. Maulana. *Analysis of Provision of Mini Sprinkler Irrigation Water Against Soil Moisture in Dry Land in North Pringgabaya*, (Mataram University, 2015).
5. Nopianti., *Analysis of the Effect of Provision of Mini Sprinkler Irrigation Water and Inundation on the Depth of Infiltration and Wet Area of Dry Land in Pringgabaya*, (Mataram University, 2015).
6. I. Syaifudin, *Performance Test of Semi-Permanent Sprinkler Irrigation Systems,* (Lampumg University, 2016).
7. A. Tusi, *Pakchoy Plant Portable Sprinkler Irrigation Design*, (Lampung University, 2016).

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