Analysis of Leb Irrigation Patterns of Pipe System in Sorgum Plants in Sand Dry Lands Akar Akar Village

by Jaya Negara

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Abstract To take advantage of the dry land potential in North Lombok district which reaches 38,000 ha, the government has facilitated groundwater irrigation networks (JIAT). The most visible use of groundwater irrigation networks so far has been in the community for maize farming with wasteful water use, and it is necessary to develop crops such as sorghum in order to obtain more feed availability that supports the provision of animal feed. An adequate irrigation system is necessary so that it can provide economic improvement or reduce costs used. This study aims to examine the pattern of leb pipe irrigation water use in sorghum to until harvest on a land area 500 m^2. Leb irrigation network using 2 inches pvc pipe on 6 blocks of sorghum crop land, with irrigation duration of 20 and 30 min. The irrigation test is carried out on the uniformity, depth irrigation and soil water content. The test results show that the irrigation uniformity produced is 94% very good, reaching a soil depth of about 20–30 cm with a water content of about 35–40% so that this irrigation system has the potential to support irrigation of sorghum plants.

Keywords Uniformity · Pipe width · Irrigation pattern

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1 Introduction

The Akar-Akar area of Bayan District, North Lombok Regency is one of the dry land potentials in the province of West Nusa Tenggara with an area of about 38,000 ha. The obstacle to providing plant irrigation water that is often faced in the field is the provision of irrigation water on land using open boxes, which causes a lot of water loss due to evaporation of the land surface during the trip and uneven infiltration into the soil resulting in uneven plant growth and crop yields. not good. The results of the optimization survey on the use of deep groundwater wells show that only 10–15% of the total deep groundwater wells built by the government are utilized by farmers while the rest is optimal due to high operational costs [1]. The practice of inundation irrigation systems has been carried out so far. 1 ha of land requires irrigation for about 14 h, the results of the study [2] show that the inundation irrigation system that has been carried out is a system that is very wasteful of water and is not profitable for farming. irrigation on dry land so it is necessary to develop an irrigation system to support agricultural development on dry land which is more water efficient.

To increase the productivity of agricultural land in this area, it has been tried to apply water-efficient irrigation techniques such as JIAT, sprinkler and drip systems to increase agricultural yields on dry land so that it can work well, especially in maize and horticultural crops. Based on field experience, it is not enough to improve the welfare of people in dry land, but other innovations are still needed, especially in the selection of plant types so that the community can benefit from multiple economic effects. Besides, the harvest can produce fruit multiple times, but it is also able to provide a continuous reserve of animal feed, so that livestock production and sales can contribute together in helping the economy of dry land communities.

To increase the productivity of agricultural land in this area, water-efficient irrigation techniques such as the JIAT system, big gun and drip sprinklers have been tried to increase agricultural yields on dry land. Based on field experience, in order to improve the welfare of the community on dry land, the irrigation system requires new investment which is expensive, so that it is not necessarily possible for the general public in JIAT to implement it. For this reason, it is necessary to develop an existing irrigation system so that the irrigation method becomes more efficient and agricultural crops can provide a higher economic effect. Sorghum plants are considered suitable, so it needs to be tested on land with over-pipe irrigation so that water use is known according to its growth phase. With this effort, it is hoped that later sorghum can be cultivated so that it can help livestock businesses towards improving the economy of the community on dry land. According [3], an irrigation system over a pipe with a duration of 10 min in dry land with finely graded soil can provide irrigation up to 30 cm with an average humidity of 25% and at 30 min it can provide about 32% moisture. After four days of testing, the soil moisture is obtained, the remaining moisture is above 20%. So the irrigation system may be more suitable to be applied to sandy soil such as in this study location, to support future development of sorghum crops.

Test of over-irrigation pipe system at the Salut location, North Lombok, shows that the over-irrigation test system on an area of about 1 acre requires a shorter irrigation time than the inundation system, with a uniformity of more than 91%. At irrigation duration of 10 min, 20 min and 30 min, the irrigation duration efficiency was 0.42 h, 0.83 h and 0.63 h, respectively, with cost efficiency of 25%, 33% and 25%, respectively [4]. Based on this test, irrigation provides water more efficiently than the inundation system, so that the puddle irrigation method which is also applied to JIAT needs to be developed with a pipeline system.

Soil moisture is water in the soil in the root area/root zone that fills part of the soil pore space expressed in units of weight percent or volume percent. According to [5], the most accurate measure of water content is the gravimetric method, namely by weighing the soil sample, drying it in an oven at 100–110 °C for 24 h and weighing it again.

High output uniformity is very important in the development of irrigation systems. The goal is to achieve a uniform irrigation water output level at each pipe outlet that can meet the needs of plants, especially in the root zone. Irrigation uniformity can be calculated by the formulation of Christianes [6].

To overcome this, it is necessary to innovate dry land plants in order to obtain a double economic effect in future farming. Tests need to be carried out on types of sorghum plants that have the ability to grow long with a long harvest period. The stover from the sorghum harvest can be used as animal feed, and can grow more and more so that animal feed reserves will be obtained due to repeated harvesting. Plant testing needs to be applied with a drip irrigation system and a wide pipe so that the distribution of water to plants can be evenly distributed to support optimal sorghum planting results.

To overcome the above problems, it is necessary to innovate dry land plants in order to obtain a double economic effect in future farming. Plant tests need to be carried out on types of sorghum plants that have the ability to grow longer than corn plants with a harvest period of more than once. The stover from the sorghum harvest can be used as animal feed, and can grow more and more so that animal feed reserves will be obtained due to repeated harvests. Plant testing needs to be applied with an over-pipe irrigation system, so that the water distribution pattern to the land is known and the discharge size and duration required for the depth of sorghum roots can be known. With this effort, sorghum plants will later be developed in a certain area with more water efficiency, and provide better economic benefits to farming communities.

This study aims to determine the amount of irrigation water demand for sorghum farming tests, pipeline and drip irrigation systems including irrigation time and irrigation duration. It also includes how the water services are carried out by the two irrigation systems until the sorghum plants can be harvested and what are the advantages and disadvantages of the irrigation system used during the growing season.

2 Materials and Methods

The equipment used during the study was a water meter, sample pipe, hoe, oven, gravimetric, hammer and stop time. For the research material consists of 2 "pvc pipe, 2" pvc dop, L 2 inches pvc, T 2 inches pvc and pvc 2 inches timer. This research was carried out by field test research where drip irrigation and over-irrigation systems with sorghum plants were tested directly in the dry land of Akar Akar, North Lombok district Fig. 1. The stages of conducting field research were carried out as follows.

The preparation stage consists of preparing references, tools and materials for the location of sorghum plants including clearing 4 acres of land for two irrigation systems, making 6 blocks of more irrigation test fields. In 6 irrigation blocks, block 1 consists of 9 outlet holes, land 2 has 6 outlet holes, test area 3 has 9 outlet holes, test area 4 with 4 outlet holes, test area 5 has 6 outlet holes and test area 6 there are also 6 irrigation outlet holes.

Testing the uniformity of irrigation over pipes, taking soil samples before and after irrigation at 3 (three) different location points in one plot of land and testing the initial soil moisture content. Provision of irrigation water for over-pipe irrigation systems is carried out in 20 and 30 min. The recording of the discharge of water used is carried out at each different irrigation time. Take a soil sample before and after irrigation, and test soil moisture.

Data analysis and discussion. Data analysis of test results was carried out on used discharge data, soil moisture data and irrigation uniformity. The need for irrigation water at each stage of plant growth is calculated as the volume of used water at each provision of irrigation water and the amount of water used until the initial harvest is used as data on the use of early harvest irrigation water. The results of the analysis were presented in tables and graphs and concluded descriptively.

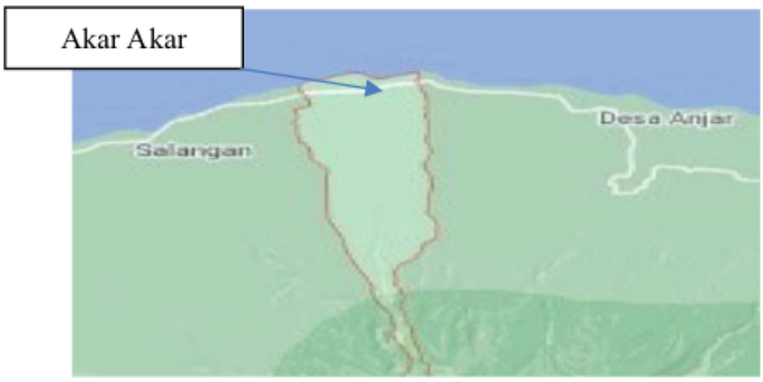

Fig. 1 Akar Akar, North Lombok district

3 Discussion

Based on the results of the analysis of the test data using the Chrietiansen's formula, the irrigation uniformity value is 94% so that it is considered good, so that this irrigation system is thought to be applicable for farming such as sorghum. The results of the analysis are shown in Table 1.

This indicates that over-piped irrigation will be able to provide irrigation services as well as drip irrigation, but the application of over-irrigation on a wider plot of land and on a large availability of discharge.

The amount of water flowing through the cross section for each unit of time is called the flow rate and is given the notation Q. for the calculation of the discharge, the following equation can be used [7] Table 2.

For irrigation, the discharge given is around 0.00017 m^3/s.

Soil moisture is water in the soil of the root area/root zone that fills part of the soil pore space expressed in units of weight percent or volume percent. According [5], the most accurate measure of water content is the gravimetric method, namely by weighing the soil sample, drying it in an oven at 100–110 °C for 24 h and weighing it again. The results of soil moisture analysis from wide irrigation can be seen in Figs. 1 and 2.

The result of providing irrigation to land is in the form of soil moisture, which is the amount of water stored in the soil layer which will later be used by plant roots for plant growth. Based on the existing soil conditions, soil moisture that can be given from wide irrigation is shown in Fig. 1. Based on this figure, the irrigation is given with a duration of 20 min, at three sample points a depth of 10–15 cm where soil

Table 1 Uniformity of pipe Leb irrigation system

Outlet pipe	CU (%)
1	94.02
2	93.89
3	93.44
4	97.24
5	93.80
6	93.38

Table 2 Irrigation hole discharge over

Outlet pipe	leb (m^3/dt)
1	0,00,016
2	0,00,017
3	0,00,016
4	0,00,018
5	0,00,017
6	0,00,017

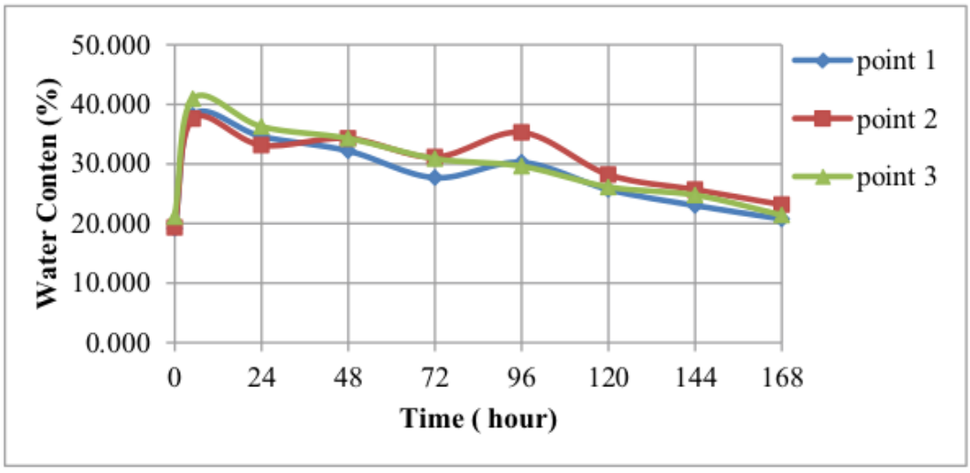

Fig. 2 Soil moisture and daily changes at a depth of 10–15 cm

moisture after irrigation is obtained at 38.88%, and after 7 days of irrigation, the remaining moisture is 21.77% approaching the initial soil moisture.

The result of providing irrigation to land is in the form of soil moisture which will later be used by plant roots at a depth of 30 cm for plant growth shown in Fig. 2. Based on this figure, irrigation is given with a duration of 30 min, at three sample points a depth of 20–30 cm where Soil moisture after irrigation was obtained by 40.66% and after 7 days of irrigation, the available moisture in the soil depth was 25.15%. This moisture is still higher than the initial soil moisture.

Based on the moisture condition of the soil obtained from excessive irrigation, the provision of irrigation in its application can still follow the JIAT irrigation pattern in general, where irrigation is given in 7 turns so that it does not change the irrigation schedule of the existing pumper. However, the provision of irrigation will be shorter than the existing JIAT irrigation system. With more irrigation it is still possible to adjust the uniformity of irrigation into the soil and this can shorten the irrigation time, reduce irregularity in soil and plant growth critical down that will be detrimental to plant growth and irrigation can be done sooner than 7 days.

The graph of the results of pipe irrigation for sorghum plants on sandy dry land can be seen in Fig. 4. So the amount of irrigation water used is irregular and follows the conditions of the plant so that it will follow the growth phase of the sorghum plant.

Based on Fig. 3, it is known that the provision of irrigation water on average in one irrigation in the initial growth phase is 1.242 m^3 and at the planting age of 20 days to 40 days is given irrigation water of 1.242 m^3, at the age of the plant 41 days to 67 days it is given irrigation water. an average of 1.446 m^3 and after the plants are 70 ^{days} old until harvesting, the average amount of irrigation water given by sorghum plants is 1.86 m^3. Increasing the provision of irrigation water from the initial phase to harvest to 1.242–1.86 m^3 when the sorghum plants are ready to be harvested at 88 days.

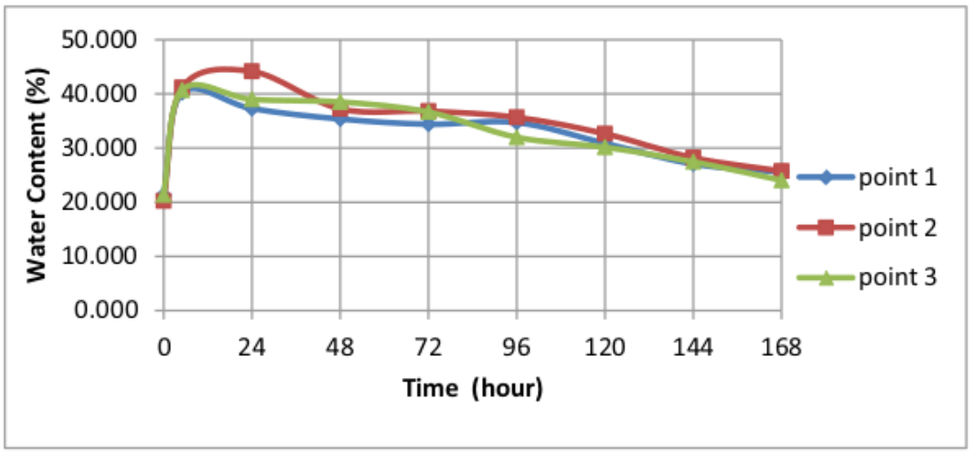

Fig. 3 Soil moisture and daily changes at a depth of 20–30 cm

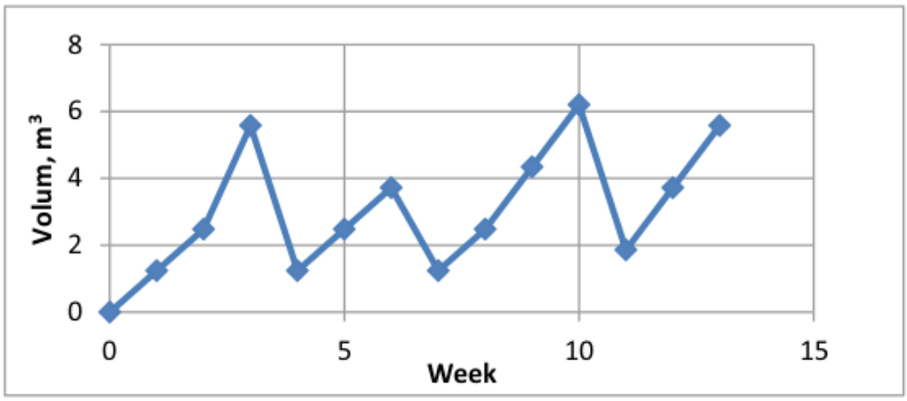

Fig. 4 Provision of low irrigation water for each planting phase

The provision of irrigation water during the growing season for each growth phase of sorghum is certainly not the same, because it depends on plant development. When compared with the provision of more irrigation water, it can be seen in Fig. 5.

Leb irrigation water is given every 1 week with the amount of water used for initial irrigation of 1.242 m^3, plant age up to 20 days, plant age 21 days to 43 days given irrigation water of 1.242 m^3, at 44 days to 67 days of 1.46 m^3 and at the age of 70 days of sorghum until harvest 1 is given 1.86 m^3 of water in one irrigation.

When compared to the irrigation water distribution pattern of the two irrigation systems above, it is very different, in drip irrigation the variation of the discharge from the irrigation system is still very high, whereas in irrigation the pattern is very regular.

Based on Fig. 6, it is known that, for the over-pipe irrigation system in the 5-acre sorghum area, it is irrigated once every 7 days with the amount of irrigation 13

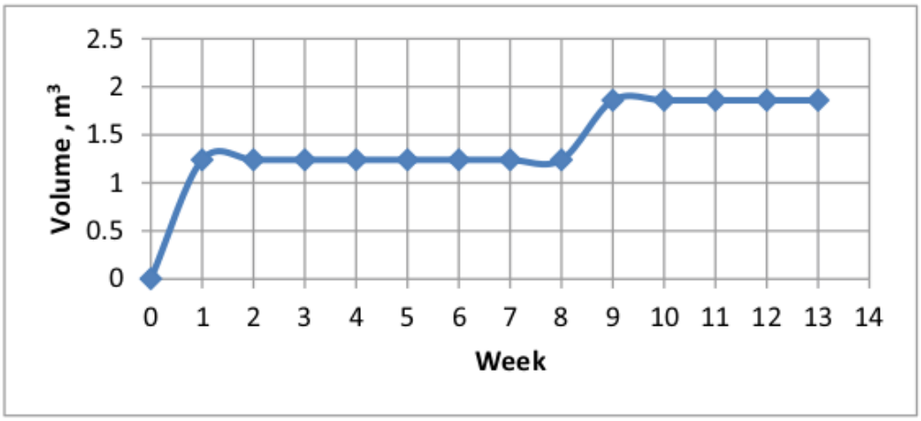

Fig. 5 Distribution of Leb irrigation water supply to harvest 1

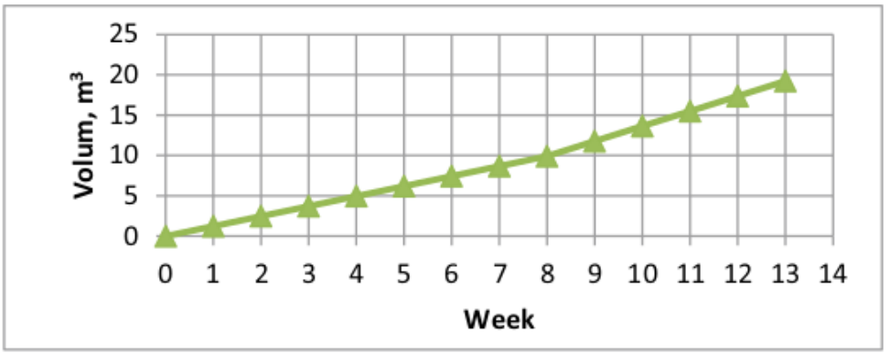

Fig. 6 Accumulation of irrigation water Leb

times, and the water used is 21.8 m^3. So the use of water by irrigation is lower than by pipeline irrigation, by a difference of about 4.75 m^3.

In irrigation, plants are given water with irrigation duration, namely the duration of irrigation is 20 and 30 min with the aim of achieving water at the roots with a depth of 10–15 cm and 20–30 cm. Irrigation is given once every 6 days with 8 times the duration of the irrigation is 20 min and 5 times the duration of the irrigation is 30 min. The total duration of irrigation over pipes needed to harvest crops is 26 h, with a used water volume of 21.80 m^3.

4 Conclusions

The test results show that the irrigation uniformity produced is 94% very good, reaching a soil depth of about 20–30 cm with a water content of about 35–40% so that this irrigation system has the potential to support irrigation of sorghum plants.

References

1. Eterna and Suwardji (2003) Survey of deep groundwater pump utilization throughout Lombok Islan, Collaborative research report on the groundwater development project section of the NTB Provincial Public Works Office And The Unram Dryland Research and Development Center. 76h
2. Suwardji (2005) Assessment of irrigation water needs for inundation systems and sprinkle big gun systems. Research Report of the Mataram University Research Institute
3. Zulvarisandy I (2017) Analysis of providing combined water for irrigation LEB pipes and mini sprinklers against changes in daily soil moisture in Pringgabaya District, Mataram
4. Muta'al Atha Hadi (2018) Analysis of time and costs of irrigation in the Leb pipe irrigation system in the dry land of Arungan Bali Hamlet, Akar-Akar Village, Bayan District, North Lombok, FT Unram Thesis, Mataram
5. Soemarto CD (1986) Engineering hydrology. National Business, Surabaya
6. Triatmodjo B (2003) Hidraulika II, Beta Offset, Yogyakarta
7. Negara JDG, Supriyadi A (2016) Analysis of the design of integrated water-saving irrigation systems based on groundwater irrigation network (JIAT) on dry land, smoothly degraded soils in Pringgabaya, East Lombok Regency, Mataram

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