Rain Water Harvest and Use Pattern as an Efforts to Improve the Economy of Farmers in Timor Dried Area, East Nusa Tenggara

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Abstract. This study aims to find out how much rainwater is able to be accommodated during one rainy season period and its utilization in horticulture plants and forage feed from the integration results through drip irrigation systems. The method of shelter that is by utilizing the cage roof of cattle that is accommodated in plastic tarps and the use of rainwater through drip irrigation on plants using a modified bottle of mineral water with an additional hose. The results obtained are the amount of rainwater that can be accommodated during one rainy season period which is an average of 32 m³ while the utilization with the drip irrigation system to meet the water needs of chili horticulture plants on average is 6 m³, cucumber at 7.2 m³ and forage grass feed mulato at 12 m³ for one harvest period, with chili production of 1.2 tons / ha, cucumber at 1.6 tons / ha and production of fresh material grass mulato material at 2.4 ± 0.13 tons / ha, dry material production 0.81 ± 0.02 tons / ha, ratio of stems and leaves 61.26 : 38.74%. The conclusion of this study is that rainwater harvesting uses the cage roof method and its utilization through drip irrigation systems is able to supply the water needs of horticulture plants so as to have an impact on farmers' incomes while meeting the forage needs of livestock dry material production.

Keywords: rain water harvesting, utilization patterns, farms, dry land

1. Introduction

East Nusa Tenggara (ENT) in general and the island of Timor in particular is a region with a dry climate characterized by a long dry season (8-9 months) and a relatively short rainy season. With extreme climatic conditions and low rainfall, people on the island of Timor need to strive to use rainwater efficiently during the winter season so that it can be used when water availability is reduced. The average annual rainfall on Timor Island is 1,183 mm / year [1]. Rainfall which is quite high and lasts for 3-4 years, needs to be utilized as optimally as possible through the rainwater harvesting process, so that it can contribute to livestock-farming efforts for the people of Timor island. Rain water harvesting is an attempt to utilize rainwater through shelter and storage which is then distributed or utilized in dry land...
areas for certain needs, thus giving an impact on the income of farmers in dry land areas. While harvesting rainwater by utilizing building roofs is generally an alternative in obtaining clean water sources that require little processing before being used for human needs [2]. The use of rainwater as an alternative source of water is very potential to be applied in Indonesia considering that Indonesia is a tropical country that has high rainfall [3]. This study aims to find out how much rainwater is able to be accommodated during one rainy season period and its utilization in horticulture plants and forage feed from the integration results through drip irrigation systems.

2. Methodology
This research was conducted in Oelatsala Village, Taebenu District, Kupang Regency, the materials used were 25 used drum capacity of 200 liters, a container using 10x12m tarpaulin as many as 4 pieces, a 1 liter bottle of mineral water modified with an additional 0.5 cm diameter for drip irrigation on the plants and also used 2 pieces of cattle cages measuring 12x2.20m.

Procedures and data collection related to research variables:
The shelter process is done by utilizing a cage roof fitted with gutters on the side of the roof which is then channeled to drums with a capacity of 200 liters which have been modified with additional water taps with the aim of delivering water to the prepared reservoir, but before being channeled into a reservoir, the water accommodated on the drum is recorded to be known. While the amount of water used in drip irrigation is known by summing the water used in bottles of mineral water in liters which are filled continuously if it runs out during one planting period (4 months). This is done until the rainy season is finished, the total amount of water collected is calculated as follows:

\[ TWC = C_1 + C_2 + C_3 + C_4 \ldots \]

Where:
- \(TWC\) = Total water is collected
- \(C\) = collected

Measurement of harvest production:
The measurement of harvest production is carried out by using a 10x10m plot in each commodity, after the measurement is complete, followed by harvesting each commodity at each plot, the yield is then weighed to know the amount and converted to total production per hectare.

3. Result and Discussion
Water scarcity in the dry season is the main limitation in the management of dry land which can only be managed in the rainy season while in the dry season the land cannot be utilized, this limitation causes a decline in the product of agricultural commodity production which the farmers feel on Timor island because it is followed by a decrease in income level. Alternative rainwater harvesting and its use through drip irrigation systems on horticulura and mulato grasses on their production are presented in the following Table 1 and Table 2.

| commodity    | Total Vol is accommodated (m³) | Total usage / planting period (m³) | Total production / harvest (ton/ha) |
|--------------|--------------------------------|----------------------------------|-----------------------------------|
| Water        | 32                             | -                                | -                                 |
| Chili        | -                              | 6                                | 1.2                               |
| Cucumber     | -                              | 7.2                              | 1.6                               |
| Mulato grass | -                              | 12                               | 2.4                               |

Note: processed data
Table 2. Average agricultural and livestock commodity production

| Parameter                        | Mulato grass | Chili | Cucumber |
|----------------------------------|--------------|-------|----------|
| Fresh material production (ton/ha)| 2.4 ± 0.13   | -     | -        |
| Dry material production (ton/ha) | 0.81 ± 0.02  | -     | -        |
| Ratio of stems and leaves (%)    | 61.26 : 38.74| -     | -        |
| Fruits production (ton/ha)       | -            | 1.2 ± 0.21 | 1.6 ± 0.22 |

Note: processed data

In this study obtained the amount of rainwater that can be harvested which is equal to 32 m³ from the cage roof area of 52.8 m² and the average rainfall of 851.4 mm, this result is not enough because of the modest roof surface area but if the roof area is wider than the number higher rainfall due to compliance [4] roof system uses the roof of the house individuals allow the water to be collected not too significant, however if applied massively, the water collected is very abundant but the total use during the dry season is able to meet the water needs of 6 m³ chili, 7.2 m³ cucumber and grass mulato 12 m³ and total chili production of 1.2 tons / ha, cucumber 1.6 tons / ha and grass mulato 2.4 tons / ha.

Some previous researchers have conducted studies / research on rainwater harvesting to be used as a source of clean water at the community level which can provide benefits as an alternative source of clean water by utilizing existing instruments (roofs, parking lots, parks, etc.) others), saving the procurement of new instruments and minimizing environmental impacts such as the occurrence of flooding after rain because it can seep into excess rainwater to the ground to reduce the volume of flooding on roads both in rural and urban areas. Rainwater collected is relatively cleaner and the quality meets the requirements as raw water for clean water with or without further processing. Rainwater as a reserve of clean water is very important in its use during emergencies or disruption of clean water supply systems, especially in the event of a natural disaster, rainwater can be obtained at the location without the need for a water delivery system. Rainwater harvesting can reduce dependence on clean water supply systems as a conservation effort; and rainwater harvesting is an easy and flexible technology and can be built according to needs. Development, operation and maintenance do not require workers with particular expertise. [4] Data / information on rainwater harvesting to be used as a source of water for plant productivity both feed crops and horticulture crops in dry land areas is still very limited.

From the amount of rainwater harvested, it can meet the water needs of agricultural commodities, but its use needs to be considered according to the needs of the plants, while the use of drip irrigation is able to reduce the water requirements for plants so that it is not wasted. According to [5], rain water harvesting has considerable potential to overcome the problem of the water supply crisis. Sustainable management of water resources is based on the principle that water sources should be used in accordance with the quantity of water needed [6]. But the amount of water volume that can be accommodated depends on the roof area and rainfall [3]. Added [7] mention that in the world of international current efforts harvesting rain has become an important part in global environmental water resources agenda management in the context of mitigation water imbalance in the rainy and dry season (lack of water).

The two methods used in this study are quite efficient because they are able to overcome water problems in dry land areas and are able to save water needs without affecting or reducing agricultural commodity crop production in dry land areas such as Timor island, this also indirectly affects farmers' income because of land sleeping in the dry season can be activated in meeting the economic needs of the household. Innovations in drip irrigation network technology at the farmer level need to be done so that the benefits obtained in drip irrigation (efficient use of water and facilitating water delivery) can be achieved with affordable investment costs. [8]. The economic value of water using drip irrigation is better than surface irrigation [9]. This drip irrigation network serves to conserve water according to the needs of plants with fruit or vegetable production which is not inferior to the watering of the boiling system.

While the production of agricultural commodities produced through this method is also quite good because it is able to contribute 38.5% of the fulfillment of the household economy. While livestock
commodities include mulato grass production with high production of fresh ingredients and dry matter, especially in the dry land area of Timor island which is identical to the relatively short rainy season and relatively long dry season. However, seeing the production of grass produced is able to meet the feed needs of one 10% beef cattle from an initial body weight of 152 kg for 5.3 months with a daily weight gain of 0.30 kg per day. The weight gain obtained in this study is the same as the weight gain obtained by [10] in Bali cattle that consume local feed from Timor Island farmers of 0.20-0.30 kg / e / h.

Then the average ratio of mulatto grass stems and leaves is 61.26%: 38.74%. The results obtained in this study are slightly lower than the results obtained [11] on Hawaiian cv elephant grass grass is 59: 41 and cv African elephant grass 57: 43. For forage which is very much needed from its production are leaves that can be consumed by livestock. The percentage of leaf percentage is due to the difference in location and type of planting media, where in this study planted in dry land areas by utilizing rain water and irrigation through drip irrigation or in other words suppressing water requirements for plants without reducing production specifically during the dry season.

4. Conclusion
The conclusion of this study is that rainwater harvesting uses the cage roof method and its utilization through drip irrigation systems is able to supply the water needs of horticulture plants so as to have an impact on farmers' incomes while meeting the forage needs of livestock.

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