

Article

Effect of Rain Harvesting Irrigation for Home Farming on the Growth Performance of Brassica Juncea grown on Different Soil Types

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A B S T R A C T

Water scarcity is a major problem that usually occurs in areas that received an insufficient amount of rainfall. Rainwater harvesting irrigation is a technique used to solve this issue by collecting water from rain falls and stored it for future use. This irrigation system does not only suitable to be applied at the field but also for home farming. The main objective of this study is to build and evaluate the effectiveness of rain harvesting irrigation for home farming on the growth performance of Brassica juncea grown on different soil types. There are three treatments (T1 Mineral Soil (MS), T2 Organic Soil (OS) and T3 Mixture of mineral and organic soil (MS + OS) involved in this study with three replications each. The data were taken every 3 days starting from 7 Days After Sowing (DAS) until 19 Days After Sowing (DAS). The result obtained shows no significant difference in plant height and number of leaves that grow under different treatments. In conclusion, rain water harvesting irrigation can be applied for home farming as it is effective to water the plant and cost-saving.

Keywords: Brassica Juncea, Growth Performance, Rainwater, Irrigation, Soil

Introduction

Righteous book of Al-Quran mentioned that the variety of the plants showing the greatness of Allah Subhanahuwataala (Hudzari et al., 2013 and 2016). Some plants having roots that deeply grow in earth while other extend on the surface like vegetables. Brassica juncea or commonly known as Chinese mustard came from the Brassicaceae family and it is an annual plant that is native to southern and eastern Asia. Brassica juncea has been cultivated for food in Europe and Asia for hundreds of years. This plant contains many nutrients that had been proven good for human health such as vitamins (A, B, C, E and K), iron, calcium, pantothenic acid and many more (Jahan et al., 2014 and Faiz et al., 2013). In addition, it is an economically important plant that not

only be consumed as a vegetable but it also widely being used as an oil source and medicine (Sharma et al., 2017). According to Rathore et al., (2019), this mustard plant is also used in phytoremediation to remove heavy metals such as lead from the soil in hazardous waste sites because it has a higher tolerance for these substances and stores the heavy metals inside its cells. Besides that, Brassica juncea is reported can tolerate to annual precipitation of 500 mm, 4200 mm, annual temperature of 6°C-27°C and pH between 4.3 to 8.3.

Water is an important source of life. In agriculture, water is supply to plants from various sources such as groundwater, river, lake, municipal water and others. However, farmers nowadays also used rainwater as a water source to water

their crops. Rainwater harvesting is one of the irrigation techniques that collected water from surfaces on which rainfalls and subsequently storing this water to make it available for agriculture production or domestic purposes (Nashriyah et al., 2014 and Syazili et al., 2013a). This technique is used as an alternative to solve the water scarcity issue in areas that have insufficient rainfall for crop growing (Velasco-Muñoz et al., 2019). It also helps to improve agricultural production by making water available during the time of dry periods. Rainwater can be harvested in two ways which are in-situ (capturing the rainfall on the farmland itself) and ex-situ (capturing rainfall from outside the farmland) (Hartog, 2013). The implementation of rainwater harvesting irrigation offered many advantages such as ensure water availability to the crops, mitigation of flooding in urban catchments, reduce nutrient loads to waterways, low cost-technique, required low level of qualification and many more (Wan et al., 2013). This irrigation technique is not only suitable to be implemented in the field but it also can be adopted in home farming. The main objective of this study is to build and evaluate the effectiveness of rain harvesting irrigation for home farming on the growth performance of Brassica juncea grown on different soil types.

Methodology

Samples Preparation

The seed of Brassica juncea was obtained from a certified seller which is Aeonbig, Ampang. The germination process was carried out by soaking the seeds in a container that filled with water for 24 hours to initiate the imbibition process. This method can help to accelerate the germination process of the Brassica juncea seeds. Then, all floating seeds were removed by using a strainer to eliminate any poor filled or dead seeds. Next, the germinated seeds were directly planted in each of the paper cups that had been filled with different types of soil (T1 Mineral Soil (MS), T2 Organic Soil (OS) and T3 Mixture of Mineral and Organic Soil (MS + OS). Lastly, the fertilizer which is NPK (15:15:15) was applied 2 weeks after sowing the seeds.



Figure 1. Shows the Materials used to Build the Irrigation System

Materials

This irrigation system was constructed by using a recycled bottle (9.5L) that acts as a rain water collector, a wood enstick to support the host, 1 meter of a medium-size host (16 mm) and 1 meter of a small-size host (4.5 mm) (Figure 1). The cost incurred to build up this irrigation system is only RM 3.00 which is affordable and cheap.

Method to Build their Irrigation

This irrigation system used gravity force to deliver the water and does not required any power or pump to function. There are several steps involved to construct this irrigation system. Firstly, a hole was made at the bottom part of the bottle and a medium-size hose (16 mm) has been inserted into the hole. The end part of the hose was sealed to prevent water from flowing.

Next, a wooden stick was placed at the bottom of the hose as a support and it was secured by using tape. Then, 3 small holes were made along the main hose. The small size hose (4.5 mm) had been divided into 3 and the end part was sealed by using tape. Each of the hose was attached to the holes that have been made at them in hose. Lastly, small cuts were made along the small size hose to allow water to exit the hose.



Figure 2. Shows the Irrigation System that was Built to Water the Plant

Parameter Observation

The parameters that were observed in this study are plant height and number of leaves which the basic measurement performance plant growth (Syazili et al., 2013b). Plant height was asured by using a ruler meanwhile the number of leaves were counted manually. All data were taken every 3 days interval starting from 7 Days After Sowing (DAS) until 19 Days After Sowing (DAS).



Figure 3. Shows the Weather Information that Provided in the Application

Weather Analysis

Weather is one of the important factors that can affect the growth and development of plants. A detailed and accurate real-time weather information can help to track the growth status of plants. The example of weather analysis taken during this study are temperature and humidity which were measured by using a mobile application (apps) called Weather. This application provided real-time information about the temperature and humidity based on our current location. In this study, the data for temperature and humidity were taken every day starting from 1st Day After Sowing (DAS) until 19 Days After Sowing (DAS).

The results obtained from the Weather apps are shown as below:

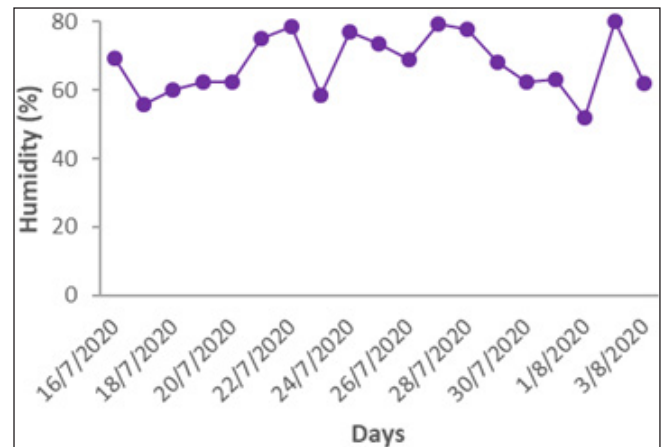


Figure 5. The Average Humidity

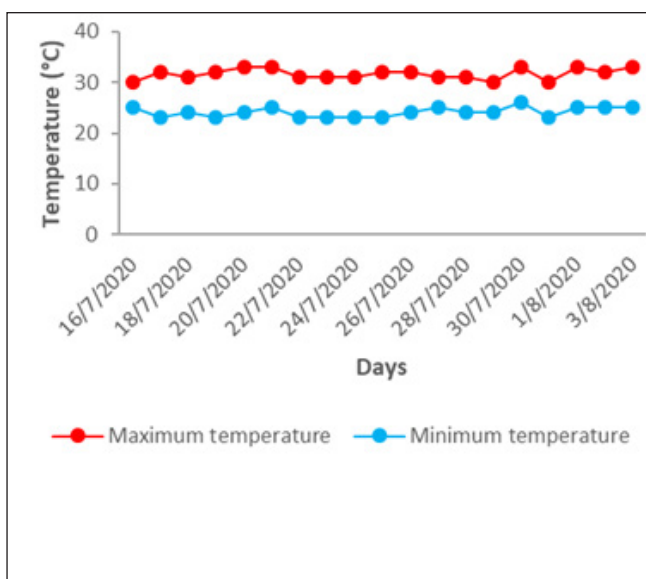


Figure 4. The Average Temperature

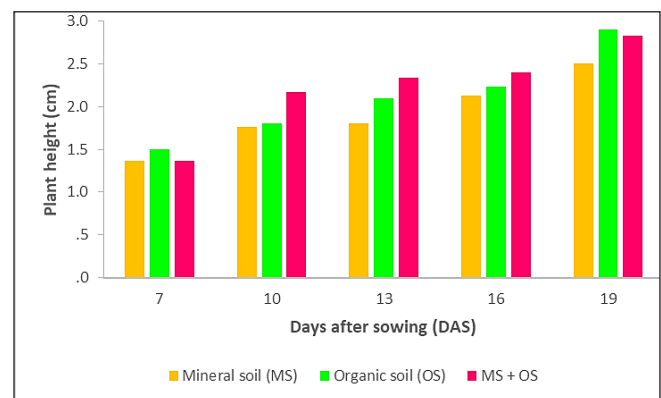


Figure 6. Shows the Height of Brassica Juncea under Different Treatments

Result and Discussion

Plant Height

Based on above Figure 6, the data analysis for plant height showed no significant difference ($P>0.05$) among treatment

sat all days after sowing. The plant height has increased consistently from 4 Days After Sowing (DAS) until 19 Days After Sowing (DAS). However, the height of Brassica juncea that are grown on Mineral Soil (MS) is slightly low compared to other treatments. This could be due to soil compaction that occurs during the vegetative stage and caused the plant root difficult to penetrate deep into the soil. As a result, its lows down the plant growth.

Number of Leaves

Based on Figure 7, the data analysis for the number of leaves shown no significant difference ($P>0.05$) among treatments at all days after sowing. The number of plant leaves are gradually increased over time and shows no negative response to the treatments.

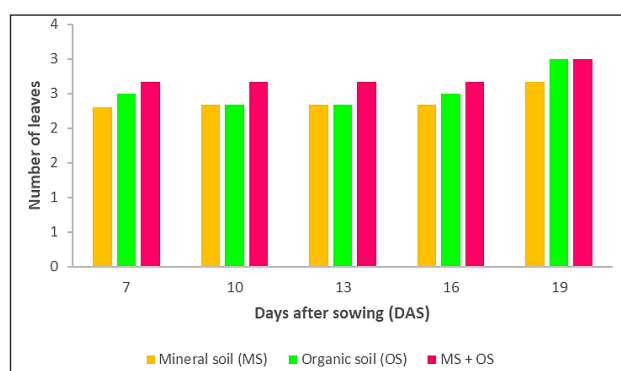


Figure 7. Shows the Number of Leaves that Emerged under Different Treatments

Conclusion

In conclusion, the implementation of this irrigation system is successful as it does not affect the growth performance of plants that are grown on different types of soil. Thus, this irrigation system is recommended to be build and used at home or small scale farms to ease the watering process of plants. The application of this system can help to save water because it used water from the rainfall to irrigate the plant and rainfall water can be stored for future irrigation purpose (Mohd et al., 2010). Not only that, it also does not require any power or pump to operate as it used gravity force to deliver water to the plants. In addition, the materials used to set up this irrigation system are cheaper and easy to be obtained from the hardware store.

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