



Intelligence Performance Evaluation of Mini Fertigation with Rainfall Harvester & Bio-Fertilizer (Plant booster) from kitchen and Market Waste: Effect on Lettuce *Lactuca sativa* for Home Agriculture

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Abstract

Fertigation system by using drip irrigation is one of the famous method or technique that will use in agriculture especially for chili, and also leafy vegetable. Rainfall is the natural water source that comes from water cycle from the water on surface to sky and from sky back to surface as called rainfall. Due to waste of vegetable and also waste of food consumption at home, the combination of waste by rainfall water can be used as bio-fertilizer or plant booster by process of fermentation to overcome the waste and rainfall water problems. This study intends to analyze the different physical properties changes in between treated with bio-fertilizer and untreated on lettuce *Lactuca sativa* growth performance. Result show the application bio-fertilizer + chemical fertilizer is showing more positive in growth performance compare to T1 (Control- soil + chemical fertilizer +rainfall). Statistically, there is significant different was observed between treatments with high different showing effect each treatment. This study suggested positive effects of bio-fertilizer + chemical fertilizer + rainfall on growth performance of lettuce and recommend that much studies should be conducted to broaden the scope of study.

Keywords: Bio-fertilizer (Plant booster); Rainfall; Lettuce; Soil

Abbreviations: DID: Drainage and Irrigation Department; MCO: Movement Control Order.

Introduction

Malaysia is largely free from extreme natural disasters such as earthquakes, volcanic eruptions and typhoons but is not safe from other disasters including floods, manmade disasters, landslides and heavy haze. Nowadays, flooding is the major problem occurring in Malaysia as shown in Figure

1 where the green shading shows flood prone areas derived from the Drainage and Irrigation Department (DID) for Peninsular Malaysia. In Malaysia there are two main forms of flooding that are flash flooding and monsoon flooding. Flash flood typically occurs due to heavy rainfall associated with severe thunderstorm over a time scale of less than six hours, while monsoonal flood triggers due to prolonged heavy widespread rain lead to land flooding. Moreover, the eastern and southern coasts of Peninsular Malaysia, Sabah and also Sarawak were generally affected by floods during December

through January. The average annual rainfall for Peninsular Malaysia is usually 2,420 mm, for Sabah 2,630 mm, and for

Sarawak, 3,830 mm [1].

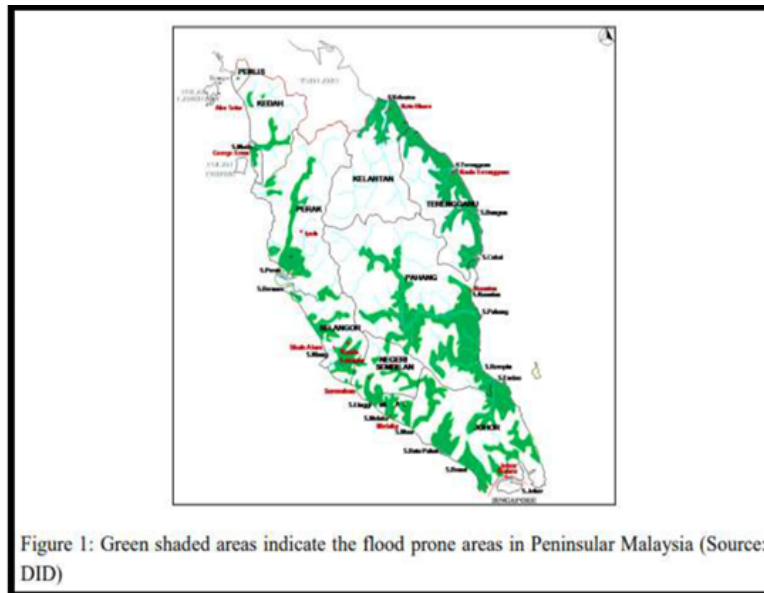


Figure 1: Green shaded areas indicate the flood prone areas in peninsular Malaysia (Source: DID).

Chemical fertilizer is one of the famous fertilizer type that been use due to its effectiveness and easy to be get make farmer nowadays choose this type of fertilizer [2]. So it been widely used by farmer around the world including Malaysia itself. Continuously usage of chemical fertilizer can affect the microorganism which can cause dead and cause soil to be infertile [3]. Vegetable, fruit and plant are the most important part of source of food that contain the quality of our diet due to its nutrients [4]. People nowadays had been more aware about important of health and start to eat well balance diet. Due to new adaptation of healthy life style, vegetables are among the highest consumption beside fruit. Vegetables or know to be part of plant which the flowers, stems, leaves, root and seed [5]. High production of vegetable and agriculture sector due to better income offered and healthy lifestyle that promoting the vegetables. But then the production is increasing dramatically and yet over the consumption rate in the world. This cause excessive of vegetable and agriculture product in worldwide. The increased food waste generation is a global problem. Agriculture waste is one of the main sources of municipal waste.

Significant of Study

Rainwater harvester is one of the new innovations that harvest the water from the rain to use for agriculture planting operation. This study conducts the effective of rainwater harvester use as irrigation system for farm or home crop. This experiment also need to be carried out to recycle the

waste of plant in our market while provide benefit toward us and environment. By recycle the plant waste it can reduce the cost of the farmer such as land needed to dispose the waste and fertilizer use. In fertilizer expect is the reduction of chemical fertilizer usage due to bio-fertilizer can be make from the plant waste. It can also resupply the nutrient toward the soil which it been absorb by the plant waste when plant it.

Scope of Study

This experiment is focus mini fertigation system by manual operation and kitchen wastage due to increasing in number recently. The wastages of plant/kitchen will be collect at kitchen/market around Pengkalan chepa which only plant that damage or cannot been use will be select. This experiment will determine the effect of rain water and effect by the fermented plant juice that will test on lettuce growth and health. The fermented plant juice will be done outside house with shaded area to provide suitable environment which it require high humidity and low light intensity while for lettuce crop will done at same sport. 3 parameters will be used to analyse the physical appearance of the lettuce growth, height of lettuce, number of leaves, and length of leaves. While for environment analysis is light intensity/light meter, temperature and humidity. The growth and health of lettuce crop will be checking every 2 days interval start from day 4, 6, 8, and day 10.

Material and Method

Mini fertigation setup and design

Mini fertigation setup is the simple fertigation with rainfall water harvester that cheap in cost and easy to use with recycling some product such as fermentation wastage of kitchen and more as bio fertilizer use in this mini fertigation setup. The material use is 2 tanks (more bigger more better) for rainfall water harvester that connects with the PVC pipe from the roof house. The best recommend by using filter before water flow from the roof direct to tank for prevention from toxic and more. The filter can be use like gravel to filter the toxic that come from atmosphere such as nitrogen oxide combine with water to become weak acid that not suitable for our crop. The piping system is normally as fertigation system but this mini fertigation system is very simple that objective from this project is everyone can become planters only at their home for their own consumption. This mini fertigation do not required pump either big or small pump, it only use gravity force from higher place to lower place. That mean the tank is at higher place from the crop. The piping for mini fertigation is required only 3 meter of 20mm black LDPE, 4 L connector (20mm size), 2 T connector (20mm size), 4 stopcocks, and 2 straight joint with grommet rubber (20mm size). All for this things and plus with planting container it only cost RM30.00 for making mini fertigation system at home as in figure 2.



Figure 2: Mini fertigation system at house.

There is no micropipe that needed in this simple mini fertigation, but it only need to make a hole at plastic container for our crop, and insert the 20mm black LDPE through each container. The water use for watering or irrigate to plant is around 3 – 5 second with full open stopcock or valve that can supply around 40 – 50ml of water. This mini fertigation required manual operation and only take around 1 minute to handle this operation per day.

Sample Preparation

For all this material can get in Kedai Pertubuhan Peladang Kota Bharu, Kelantan, and also can get in online shopping that easy for people to get it because of pandemic covid-19. The lettuce seed get from New Trio Products at Pantai Timur Hypermarket Pengkalen Chepa, Kota Bharu, Kelantan, and also can get it from any Kedai Pertubuhan Peladang and also online shopping. The most recommended during this Movement Control Order (MCO) by our government because of covid-19, the best and selected media to choose is online shopping to get all this item.

Physical analysis determination

The physical analysis determination is one of the simple experiment can be conduct at home for the best treatment selection. For this experiment, physical analysis that was taking is height of plant, number of leaves and length of leaves. This 2 parameter (height and length) will measure by using ruler to measure the parameter by using cm unit. The height of plant will measure start from the soil surface until the end of leaves (shoot). The number of leaves will count every leaves that remain at plant and for length of leaves will measure by using ruler start from start of leaves until end of leaves only for 1 selected leaves (leaves that have more length from other leaves).

Environment analysis determination

Environment is something that we cannot changes and control for short period. This mini fertigation concept is on the recycling the rainfall water and also fermentation of kitchen and market wastage for organic fertilizer that can supply to the crop. For the environment analysis or parameter that measure is light intensity, temperature and humidity of place. This environment analysis also taken same day with physical analysis by using special app from the phone. The several app can be use and this experiment was use galaxy sensors and also weather app build in app in phone by developer and it more using in google services. The example of this app like in figure 3.

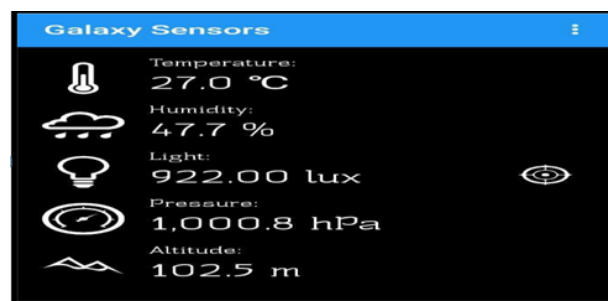


Figure 3: Galaxy sensor that use in this experiment for environment analysis.

Result and Discussion

Physical analysis

For the physical analysis, the height of plant, number of leaves

and length of leaves, there are significant different between treatment. Treatment with fermented wastage + chemical fertilizer growth better than T1 show in figure 4 and 5.

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Height	T1	12	.5583	.33699	.09728	.3442	.7724	.10	1.00
	T2	12	1.8917	.53676	.15495	1.5506	2.2327	1.20	2.80
	Total	24	1.2250	.80986	.16531	.8830	1.5670	.10	2.80
No. Leaves	T1	12	2.0000	.00000	.00000	2.0000	2.0000	2.00	2.00
	T2	12	3.7500	1.54479	.44594	2.7685	4.7315	2.00	6.00
	Total	24	2.8750	1.39292	.28433	2.2868	3.4632	2.00	6.00
Length of leaves	T1	12	.2750	.07538	.02176	.2271	.3229	.20	.40
	T2	12	1.0000	.53428	.15423	.6605	1.3395	.30	1.80
	Total	24	.6375	.52570	.10731	.4155	.8595	.20	1.80

Figure 4: the descriptive data from SPSS for physical analysis.

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Height	Between Groups	10.667	1	10.667	53.112	.000
	Within Groups	4.418	22	.201		
	Total	15.085	23			
No. Leaves	Between Groups	18.375	1	18.375	15.400	.001
	Within Groups	26.250	22	1.193		
	Total	44.625	23			
Length of leaves	Between Groups	3.154	1	3.154	21.665	.000
	Within Groups	3.203	22	.146		
	Total	6.356	23			

Figure 5: ANOVA table of physical analysis from SPSS.

From figures 4 and 5 above, clearly T2 is much better than T1 in height of plant, number of leaves, and also length of leaves. This happen because the supply additional nutrient from organic matter of fermentation process to plant prove that the different in positive of physical appearances.

Environment analysis

Environmental analysis is very important that influence the growth performance of crop. For this experiment, there is limited in special equipment to test the parameter especially for physico chemical properties of bio-fertilizer (plant booster), soil nutrient available and more. So, for the simple way that everyone can do at home, this experiment just use app from the google play store to determine the light intensity, temperature and also humidity level. The result

show in tables 1-3.

Days	4	6	8	10
Reading	922	912	849	937

Table 1: Average of light meter reading LUX.

Days	4	6	8	10
Reading	27	27	26	27

Table 2: Temperature.

Days	4	6	8	10
Reading	70	74	72	71

Table 3: Humidity.

Based from tables 1-3 there is maintain in all parameter that do not have any significant different in days and measurement of parameter. Tables 1 and 2 using the galaxy sensors while for table 3, humidity parameter taken from weather build in application from phone that connect with google system. All this parameter measure at same clock, 8.00-8.30am and all this parameter is measure start in 1 July 2020 until 31 July 2020.

Conclusion

As a conclusion, this mini fertigation project is very simple that everyone can do it and it do not cost in money. But, for the big area can have high space for high planting density may increase the cost and it suitable with low capacity pump to pump the water from rain water harvester and utilize the wastage from kitchen and also market for agriculture at home.

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