Effect of Tapioka Liquid Waste on Growth of *Ipomoea Reptans* Poir Using Floating Raft Hydroponic Technique

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Abstract. Tapioca industry is one type of industry that produces liquid waste that can cause pollution if not managed properly. To solve this problem, tapioca liquid waste can be utilized to produce organic nutrients for plants. The purpose of this research is to know the influence of tapioca liquid waste on the growth of *Ipomoea reptans* Poir. using floating raft hydroponic technique. The results of this research showed that tapioca liquid waste affects the growth of *Ipomoea reptans* Poir. However, the growth of plants treated with tapioca liquid waste is no better than those given by AB-Mix that commercially used by farmers.

1. Introduction
The Developments in the industrial sector sometimes have a negative impact on agriculture. Some of the impacts are reduced agricultural land. Beside that the waste from industrial processes which if not managed properly will cause environmental pollution\textsuperscript{[1]}. One type of pollution that occurs in the food industry process is tapioca liquid waste.

Tapioca industry need so many water to separate starch from fiber, for about 40 -60 m3 water per ton tapioca. The waste produced by tapioca industry is sometimes discharged into the waters directly\textsuperscript{[2]}. It can be environmental pollution. Tapioca liquid waste still contains nutrients that can be used for plant growth.

The reduction of the agricultural land makes the farmers apply narrow land farming. One of narrow land farming that can apply is floatingraft hydroponic technique. The advantages of hydroponics include shortening the growing period of plants from seed germination to plant maturity and the ability to move hydroponically grown plants with great ease and with substantially no damage to the root structures of the plants, whereby the plants may be rearranged to maximize the use of space during all stages of their growth cycle\textsuperscript{[3]}. Planting vegetables with hydroponic systems is a solution for urban areas. One of the vegetables commonly known in Indonesia and suitable for planting with a floating raft hydroponic system is *Ipomoea reptans* Poir. To increase the sale value, *Ipomoea reptans* Poir is cultivated organically\textsuperscript{[4]}. One alternative of organic nutrition can we get from tapioca liquid waste.

2. Materials and Methods
This research was carried out in Horti Park Lampung, from December 2016 to January 2017. The method of this research is a Completely Randomized Design (CRD) with 5 treatments, 4 replications.
K1 (negative control) = air  
K2 (Positive control) = AB-Mix  
K3 = tapioca liquid waste 20%  
K4 = tapioca liquid waste 30%,  
K5 = tapioca liquid waste 40%  

Tapioca liquid waste was fermented using EM4 for about 28 days. Then we analyze the chemical content. The planting medium is prepared by assembling styrofoam into a floating raft hydroponic circuit. The planting stage begins with seeding of Ipomoea reptans Poir seeds on rockwool media. The seeds will grow after three to five days. Then it is transferred to the floating raft hydroponic circuit. Plant observations are carried out on the 15th day after seeding or after the true leaves grow. The study was carried out until the plant was 3 weeks.  

The parameters of this research are plant height, width of leaves, number of leaves and wet weight of plants. Data were analyzed using ANOVA (Analysis of Variant). If the data are real differences, then proceed with the BNT test (the Smallest Real Difference) at the level of 5%.  

3. Results and Discussion  
The results of liquid waste fermentation analysis found that the content of Nitrogen, Phosphorus, and Potassium were in accordance with SNI criteria. The high phosphorus content is influenced by the high Nitrogen content. If the Nitrogen content is higher, the microorganisms that break down phosphorus will increase [1].  

The results of this research showed that there was an effect of tapioca liquid waste on Ipomoea reptans Poir growth. However, the growth of plants treated with tapioca liquid waste (K3, K4, and K5) is no better than those given by AB-Mix (K2). AB-Mix already contains all the nutrients needed by plants, namely macro nutrients N, P, K, Mg, Ca and micronutrient Fe, Mn, Zn, B, Cu and Mo [5]. Based on the research it was found that in K5 treatment, Ipomoea reptans Poir can only survive for approximately two days on the 2nd and 4th replication. In the 1st and 3rd replications the plants look dwarfed.  

| No | Parameter | Satuan | Hasil Penelitian | Metode | SNI PCO |
|----|-----------|--------|------------------|--------|---------|
| 1  | N (Total) | %      | 0,77             | Kjeldahl-Spektro | >0,40%  |
| 2  | PO4-Fosfat | %      | 1,58             | Spektosometri | >0,10%  |
| 3  | Kalium-dd | %      | 1,25             | AAS    | >0,20%  |
| 5  | C-Organik | %      | 1,65             | Walkley-Black | >9,80%  |
| 6  | Ph        | -      | 5,13             | Potensiometri | 6,8-7,5 |
| 7  | Magnesiu(Mg) | ppm  | 27,97             | AAS    | -       |
| 8  | Kalsium(Ca) | ppm  | 23,70             | AAS    | -       |

The K5 treatment shows that plants growing stunted and decaying. The more doses of tapioca liquid waste that is given does not make plant growth better. High concentrations in solution can cause nutrient imbalances that can cause poisoning and death in plants [6].  

The pattern of height plant growth is related to the location of the apical meristem. Apical meristems are found at the root tips and shoot tips [7]. Plants that lack N and K nutrients will be dwarf [8].  

The number of leaves in K2 and K4 treatment gives results that are not significantly different. It can be said that 30% concentration treatment is good enough.
Leaf color in treatment K1, K3, K4 and K5 from 1st, 2nd to 3rd weeks when harvesting showed changes. The color of the leaf turns yellowish, like it will wither. In the K3 treatment also appears that the stem of leaves dry out and wither. It may of elemental N (Nitrogen) decreases and the element K (Potassium) increases in tapioca waste. Lack of nutrients N causes Chlorosis [10]. Decreasing of N content will affect rate P. Reduction of nitrogen causes microorganisms that break down phosphorus also decrease. Due to decreased P and N elements, the K element in tapioca waste becomes excessive. Excessive K elements cause of low absorption of Ca and Mg. There is an antagonistic nature between K and Ca and also between K and Mg. the imbalance of these elements causes not optimal absorption by plants. Element K is absorbed more quickly by plants than Ca and Mg [9]. As a result plant growth is hampered. It’s like the case in the research.

**Tabel 2. LSD test for hight plant at 5% level**

| No | Treatment | Result |
|----|-----------|--------|
| 1  | K1        | 13.12a |
| 2  | K2        | 40.41b |
| 3  | K3        | 21.55c |
| 4  | K4        | 33.19d |
| 5  | K5        | 19.71c |

**Tabel 3. LSD test for width leaf at 5% level**

| No | Treatment | Result |
|----|-----------|--------|
| 1  | K1        | 0.7a   |
| 2  | K2        | 3.4b   |
| 3  | K3        | 1.1c   |
| 4  | K4        | 2.2d   |
| 5  | K5        | 1.5e   |

**Tabel 4. LSD test for number of leaf at 5% level**

| No | Treatment | Result |
|----|-----------|--------|
| 1  | K1        | 4.31a  |
| 2  | K2        | 9.91b  |
| 3  | K3        | 5.47c  |
| 4  | K4        | 8.97b  |
| 5  | K5        | 6.17c  |

**Tabel 5. LSD test for weight wet at 5% level**

| No | Treatment | Result |
|----|-----------|--------|
| 1  | K1        | 1.36a  |
| 2  | K2        | 14.62b |
| 3  | K3        | 3.19ad |
| 4  | K4        | 8.10c  |
| 5  | K5        | 3.49d  |
4. Conclusion
The results of this research showed that tapioca liquid waste affects the growth of Ipomoea reptans Poir. However, the growth of plants treated with tapioca liquid waste is no better than those given by AB-Mix that commercially used by farmers.

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