Application pineapple liquid waste to increase fruit weight and vitamin C pineapple as biological learning resources

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Abstract. Pineapple Liquid Waste (PLW) is waste that has acidity characteristics and contains organic material which can be utilized as a substrate for bacterial growth. Researchers are trying to provide the latest breakthroughs to utilize Pineapple Waste (PLW) as organic fertilizer to reduce waste increases and increase agricultural yields. The purpose of this research is to find out the effect on the weight of pineapple and find out whether it will increase vitamin C levels in pineapple. This study used an Experimental Method, the design of the design used was a Complete Random Design Variety and analyzed using a multivariate test. the conclusion of this study is the variation of PLW has a significant effect on fruit weight \( p > 0.05 \) and on vitamin C levels \( p < 0.05 \), so that no significant effect on fruit weight and significant effect on increasing levels of vitamin C, so this research can potentially design learning resources for biology.

1. Introduction
Indonesia is the third largest producer of pineapple after Thailand and the Philippines. Based on data in 2011 there were five provinces in Indonesia as the centre of pineapple production including Lampung, with 32.80% contribution to national pineapple production. Central Lampung is able to produce more than 50,000 tons annually or or 99.78% of the total pineapple production in Lampung Province [1], so the impact of the pineapple processing industry produces by-products and will cause problems if not resolved immediately.

Pineapple contains calcium, potassium, fiber, vitamins B1, B6, low in fat and cholesterol, and bromelain. Pineapple is good for the digestive system and natural anti-inflammatory [2-3]. Pineapple contains a low glycemic diet (GL = 7), because in portions (100 g) it contains a low carbohydrate concentration (11 g) and a high water content (around 90%) [4]. Bromelain in pineapple has physiochemical properties with activity in the temperature range of 30-70ºC and a pH range of 5-8, bromelain is a good enzyme to use. [5]. Phenolic compounds, ascorbic acid, β-carotene, and flavonoids in pineapple are the main bioactive components. Pineapple is also rich in β-glucans, proteoglycans, lectins, polysaccharides, triterpenoids, diateryfibre, lentinan, steroids, glycopeptides, terpenes, saponins, xanthones, coumarins, and alkaloids [6].

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Pineapple Liquid has a high organic matter content so it cannot be broken down naturally by bacteria in waters or rivers, due to the high volume, and the inadequate amount and type of bacteria in the waters, so the quality of LCN must meet the emission quality standard. One way of treating wastewater that is safe and environmentally friendly is by using potentially decomposing bacteria. Naturally to obtain these bacteria by isolating the waste itself (indigenic bacteria), [7].

Pineapple Liquid Waste (PLW) is a waste that has acidity characteristics and contains organic matter including 4.41% protein [8], which can be used as a substrate for bacterial growth. In addition, pineapple contains proteolytic enzymes that can catalyze the hydrolysis reaction of a peptide bond of a protein known as bromelain.

Species of PLW indigenous bacteria selected as inoculants in the biodegradation test are Bacillus cereus, Acinetobacter baumannii, Bacillus subtilis and Pseudomonas pseudomallei. The selection criteria for these four species are based on species that degrade organic matter. B cereus, A baumannii have the ability to degrade organic acids. B subtilis and P pseudomallei specifically have the ability to degrade organic matter in addition to organic acids, this is shown by the dominant degradation ability of BOD. The four bacteria also have a positive correlation with the increase in pH, A baumannii has the highest influence on the increase in pH [8].

In connection with the above, researchers try to provide the latest breakthroughs to utilize Pineapple Liquid Waste (PLW) as organic fertilizer to reduce the increase in waste and to increase agricultural yields. This research application will be used to support learning resources in the world of education. The results of this study are PBL (Problem Based Learning) based learning resource designs that are utilized in learning activities. In accordance with the current curriculum, the 2013 curriculum aims to foster students' ability to think, work, and be scientifically applied as life skills, so that learning places more emphasis on providing direct learning experiences, developing scientific skills and attitudes. The Problem Based Learning (PBL) model is a learning approach that accent educational learning [9], where students are required to be active in obtaining concepts by solving problems. Through problems presented by the teacher in the learning process, students use their scientific reasoning abilities to develop an experiment that includes the ability to formulate problems, make hypotheses, determine variables, design experiments, analyze data, and make conclusions based on data.

Nature has a wealth of knowledge, so does the environment. What students cannot learn indoors, students get lessons outside the room, so students can learn to draw conclusions and test what they get in class. Three stages can be done by students to facilitate the entry of information, namely listening, writing or drawing and seeing and doing their own experiments. For example, the natural phenomenon of using organic fertilizers to increase crop production and vitamins. Students can learn from nature about the causes, fertilizer content, impacts and so on.

2. Research Methods
This research is an experimental and development research. Experimental research, namely variations in the consortia of indigenic bacteria in the manufacture of pineapple waste liquid fertilizer (Ananas comosus, L. Merr). This study uses a Completely Randomized Design (CRD), with the use of 3 treatments and 1 control, each treatment is repeated 8 times and 128 pineapple plants were used. Controls are (without doses of bacterial consortia indigen), the first treatment by giving 5 consortia of indigenic bacteria, the second treatment by giving 10 consortia of indigenic bacteria, the third treatment by giving 15 consortia of indigenic bacteria. What was observed in this treatment was the yield weight and vitamin C levels in each treatment. So that the acquisition of data is based on the number of pineapple plants that have changed.

In the PLW there are 15 bacterial isolates that play a role, namely: bacteria from various species that have different abilities, including bacteria. a) B licheniformis, b) B cereus, c) B cereus, d) B subtilis, e) B cereus, f) B subtilis, g) A baumannii, h) A baumannii, i) Klebsiela oxitoca, c) B cereus, f) B subtilis, g) A baumannii, h) A baumannii, i) K oxitoca, j) B cereus, f) B subtilis, k) B cereus, l) P Pseudomallei, m) Achnobacillus iwoffii, n) A iwoffii, o) Bacillus firmus.
The difference in PLW variation lies in the administration of the number of bacteria, in the variation of the bacterial A (a-e), in the B variation in bacterial administration (a-j), in the variation in the C of bacterial administration (a-o). The selection criteria for these four species are based on species that degrade organic matter. B cereus, A baumannii have the ability to degrade organic acids. B subtilis and P pseudomallei specifically have the ability to degrade organic matter in addition to organic acids, this is shown by the dominant degradation ability of BOD. The four bacteria also had the highest positive correlation with pH increase. A baumannii affected the increase in pH. These bacteria break down pineapple liquid waste into a useful fertilizer, which is to increase soil nutrients. Increased soil nutrients both macro and micro will increase the quality of crop production, the nutrients that are considered in this study are micronutrients namely Mn that plants need for the formation of proteins and vitamins, especially vitamin C.

3. Result and Discussion
The results showed that there were significant differences in effect between control, treatment 1 (A), 2 (B) and 3 (C) on pineapple fruit weight and vitamin C levels. In the treatment of giving variations of the PLW A, B and C fertilizer formulas and without the variation of PLW fertilizer dosage as a control can be explained in Figure 1.

![Figure 1. Graph of Fruit Production and Vitamin C Levels](image-url)

In the first treatment (PLW A) pineapple plants yield at the best fruit weight with an average of 812.9grm, in the second treatment (PLW B) pineapple plant weight is lower than the first treatment, but higher vitamin C levels are 29, 9017mg/100gr, in the third treatment (PLW C), pineapple plants produced the best levels of vitamin C, with an average of 30.8582mg / 100gr. From the multivariate test results showed that there was a significant influence between variables, the three treatments that had the best effect on vitamin C levels. This was because the fruit weight of Sig was 0.828 <α = 0.05, so H0 was accepted. At vitamin C levels Sig 0,000 <α = 0.05, so H0 is rejected. So, the three types of treatment do not affect the weight of pineapple and only affect the level of vitamin C. Organic fertilizers made from pineapple liquid waste use native bacteria (local strain bacteria), because the role of native bacteria is generally more adapted to existing waste. Nutrient content in Pineapple Liquid Waste according to [7] namely C, Ca, Mg, Na, Fe, Zn, Mn, S, N, P, K.

The application of PLW fertilizer to pineapple plants has a significant effect where the plants are given the PLW A 812.9gr fruit weight fertilizer yields pineapple production better than 771.9gr control. The good weight of pineapple fruit is the influence of the content contained in the PLW namely C, Ca, Mg, Na, Fe, Zn, Mn, S, N, P, K. Among the umpteen nutrient elements contained in the PLW fertilizer that Effect the pineapple fruit weight, namely elements K and P. Between the variations of the PLW A, B and C fertilizer formulation with dilution and control give a significant difference in effect, this is because the K and P content contained are different, the K elements, namely: PLW A (26.82913 ppm), PLW B (18.90194ppm), PLW C (22.6698ppm) thus the effect is different.
Potassium (K) is a macronutrient that is very important for plants because it has a direct effect on the physiological process. The function of potassium is to regulate enzymes, protein synthesis, photosynthesis, cell expansion and stomata movement. Potassium is not only an important nutrient for plants, but also can be a modifier and increase plant resistance to biotic and abiotic stresses [10]. Potassium is also very important in maintaining the physiological and stressful conditions of a plant, as well as functioning in the regulation of biochemical and physiological processes for plant growth and development. [11]. Element K can increase crop production and growth is good [12]. Pineapple fruit weight is influenced by macronutrients K and P which are the main elements needed by all types of plants not only pineapple plants, pineapple plants need these elements to produce maximum fruit because these plants that are widely used by the community are high quality fruit.

The application of PLW fertilizer on pineapple plants significantly affected where plants given PLW C fertilizer with vitamin C levels of 30.8582mg / 100gr produced pineapple production better than control of 24.6664mg / 100gr. The increasing level of vitamin C of pineapple is the influence of the content contained in PLW, namely C, Ca, Mg, Na, Fe, Zn, Mn, S, N, P, K. Among the umpteenth nutrient content contained in the PLW fertilizer effect on the vitamin C content of pineapple, namely the element Mn. Between variations of the PLW A, B and C fertilizer formulas with dilution and control give a significant difference in effect, this is because the Mn content contained is different namely: PLW A (1.621429ppm), PLW B (1.228571ppm), PLW C (1 , 478511ppm) thus the effect is different. Micronutrients such as manganese (Mn) are important nutrients for plants that are consumed in low quantities. Mn plays an important role in plant growth, development and metabolism. If deficiencies can cause several diseases and can reduce the quality and quantity of plants [13][14].

Based on the results of this study has the potential as a biology learning resource design for students because in this study has covered three domains of education, namely attitudes, knowledge and skills in the learning process and in accordance with the 2013 curriculum. The results of the study are related to the 2013 curriculum about skills the scientific process, facts, and research process, can potentially be developed into PBL-based biological learning resources (Problem Based Learning). PBL learning model is related to this research, because it is seen from environmental problems (pineapple liquid waste) and how to overcome them and use them, according to [15] PBL is a pedagogical approach that involves teachers working with other teachers, parents, and students to jointly overcome problems in learning. This model causes motivation and curiosity to increase and can also be a place for students to develop critical thinking and higher thinking skills. PBL consists of presenting authentic and meaningful problems so that they can facilitate students to investigate [16].

4. Conclusion
The conclusion of this research is, no significant effect on PLW variation on the weight of pineapple Sig p> 0.05. Effect of vitamin C levels p <0.05. So it only affects the level of vitamin C. The three variations of the PLW (Pineapple Liquid Waste) fertilizer formula has a significant effect on increasing vitamin C levels in pineapple. The results of the study can be potential as a source of learning biology resources.

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