The Effect of Eco-Enzyme Spraying on Chlorophyll Content of Hydroponic Lettuce (Lactuca sativa L.)

Resti Fevria[1(✉)], Vauzia Vauzia[1], Siska Alicia Farma[1], Reki Kardiman[1], and Edwin Edwin[2]

[1] Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang, Padang, , Indonesia
restifevria20@gmail.com

[2] Department of Agroecotechnology, Faculty of Agriculture, Andalas University, Padang, Indonesia

Abstract. The green pigment chlorophyll gives a plant's leaves and stems their color. In addition to being crucial to the process of photosynthesis, chlorophyll is also rich in antioxidant, anti-inflammatory, and wound-healing compounds. Many green vegetables, especially lettuce, contain chlorophyll. Lots of vitamins, proteins, minerals, calcium, phosphorus, sitosterol, and minerals, particularly iron, are present in lettuce leaves and are beneficial to the growth and wellness of the human body. Both hydroponically and non-hydroponically, lettuce can be grown. In a preliminary study completed in December 2020, it was discovered that lettuce grown hydroponically had a lower chlorophyll level than lettuce grown conventionally. The goal of this study is to determine how adding eco-enzymes affects the amount of chlorophyll in lettuce produced hydroponically. Eco-enzymes are created through the fermentation of organic kitchen waste, sugar, and water in a 3:1:10 ratio. These enzymes can speed up biochemical processes in nature and are helpful in the utilization of leftover fruit or vegetables. From April to August 2021, this study was carried out at the Wire House and Plant Physiology Laboratory, Department of Biology, Universitas Negeri Padang. This study used an experimental design with four treatments (addition of 1 ml, 2 ml, 3 ml, and 4 ml of eco-enzymes in 1 L of water) and two replications. The design was entirely randomized. The Spectrophotometric Method was used to analyze the chlorophyll content. According to the findings of the current study, lettuce grown hydroponically with eco-enzymes added has an average total chlorophyll content in mg/L of P1 (control), 3,181, P2, 5, 739, P3, 6,151, and P4, 6,755. The study's findings show that adding chlorophyll enhanced the overall chlorophyll content of lettuce grown hydroponically numerically, while adding eco-enzymes had no statistically significant impact at the 5 percent level.

Keywords: Lettuce · Chlorophyll · Hydroponics · Ecoenzyme · Spectrophotometry

M. Fadilah et al. (Eds.): IcoBioSE 2021, ABSR 32, pp. 297–303, 2023.
https://doi.org/10.2991/978-94-6463-166-1_39

1 Introduction

The green hue of a plant's leaves and stems is caused by a pigment called chlorophyll. In addition to this, chlorophyll plays a critical role in photosynthesis. A high concentration of anti-inflammatory, anti-oxidant, and wound-healing compounds can also be found in chlorophyll. Numerous green vegetables, including lettuce, contain chlorophyll. Lots of vitamins, proteins, minerals, calcium, phosphorus, sitosterol, and minerals, particularly iron, are present in lettuce leaves and are beneficial for the body's growth and well-being. Hydroponically and without, lettuce can be grown.

Hydroponics is an alternative technique to increase crop productivity, especially on small holdings. The mechanical cultivated hydroponics uses media other than soil and uses water as a nutrient. As explained by Chadirin, hydroponics is a way of cultivating plants without using soil media [1]. The hygiene of hydroponic cultivation is usually not only determined by the medium used, it is also determined by the nutrient solution given because the nutrients provided greatly affect the growth of plants that are cultivated hydroponically [2]. Nutrient solutions commonly used in hydroponic systems are inorganic fertilizers, namely AB mix. AB mix is a nutrient solution consisting of inorganic chemical compounds that have macro and micronutrients combined as nutrients for plants [3]. In addition to the high price, the use of inorganic fertilizers can pollute the environment. This is what makes researchers interested in adding eco-enzymes in hydroponic lettuce cultivation. Based on the results of a preliminary study completed in December 2020, lettuce grown hydroponically has a lower chlorophyll concentration than lettuce grown conventionally.

Eco-enzyme is a byproduct of the fermentation of organic waste from households along with sugar and water. Its hue is dark brown, and it smells strongly of sour and freshness [4]. Nevertheless, the fermentation process often lasts for 3 months. In the fermentation process, it has produced a lot of O3 (ozone). The solution of eco-enzyme and water will react and can be used as cleaning fluids for dishes, clothes, floor, and fridge, potentially used as shampoo and soap. In addition, it can be used to water plants in producing flowers, fruit, or harvest yields [5]. The goal of this study is to determine how adding eco-enzymes affects the amount of chlorophyll in lettuce produced hydroponically.

2 Materials and Methods

2.1 Tools and Materials

This study used tools such as an NFT system, tray, plastic cup, 250 mL measuring cup, 1000mL beaker glass, stirring rod, digital scale, TDS (Total Dissolved Solid) meter, pH-meter, oven, millimeter paper, glass funnel, bottles, spray, knife, scissors, nails, ruler, and camera. The material used is Eco-enzyme lettuce seeds obtained from hydroponic agriculture in West Sumatra, hydroponic nutrition (AB mix), water, black plastic, toothpick, rockwool, plastic, and label paper.

2.2 Experimental Design

With 5 treatments and 4 replications, the study's design was a completely randomized design (CRD). This design consists of control (K), 1mL eco-enzyme + 1 L water, 2mL eco-enzyme + 1 L water, 3mL eco-enzyme + 1 L water and 4mL eco-enzyme + 1 L water.

2.3 Research Procedure

2.3.1 Making Container Planting Medium

The first step is cleaning the NFT system pipe. Then the plastic cups are perforated using nails on each side and bottom with several parts which is a function to add nutrients. Then the plastic cups were arranged in the NFT system pipe.

2.3.2 Preparation and Seeding of Lettuce Seeds (Lactuca Sativa L.)

This seeding process is done for 7 days until the seedlings have 3–4 perfect leaves. The lettuce seeds were sown on rockwool that had been cut to a size of 2 x 2 x 2 cm. Then rockwool doused with water until moist, give a hole. Place it in a place exposed to sufficient sunlight.

2.3.3 Nutrition Making

Make a hydroponic system parent solution, namely AB mix nutrition. Each stock A and stock B was dissolved in 500 mL of water. The recommendation for using AB Mix for 1 dose is 5 mL of stock A and 5 mL of stock B with 1 L of water [6].

2.3.4 Treatment Making

Taking 1 mL of eco-enzyme is put into a glass beaker that already contains 1 L of water, then stirred until smooth. Repeat the same for the control, 2 mL eco enzyme, 3 mL eco-enzyme, and 4 mL eco-enzyme [7].

2.3.5 Seed Transfer

The 7 day old seeds or those that already have 3–4 leaves were transferred to the NFT system planting media container.

2.3.6 Observation

Observations were made on the growth of lettuce plants.

2.4 Observation

Observations of plant height were carried out every 6 days, until harvest, which is 5 weeks after planting.

2.5 Measurement of Chlorophyll Level

Chlorophyll content is analyzed using the spectrophotometry method. Up to 1 g of fresh hydroponically grown lettuce leaves were weighed and then sliced into little pieces. The pieces were then extracted using 95% alcohol by grinding them using a mortar until all the chlorophyll dissolved. Then the solution is filtered using gauze, making sure the kailan dregs are white. Then the chlorophyll solution was put into a 100 ml volumetric flask. After that 95% alcohol was added until the volume becomes 100ml. Then the solution was put into a cuvette and its absorbance was calculated at wavelengths of 649 and 665 nm.

2.6 Data Analysis

The chlorophyll content can be calculated using the wintermans and de mots formulas:

Total chlorophyll (mg/L) = $20.0OD_{649} + 6.1\ OD\ 665$.

Chlorophyll an (mg/L) = $13.7OD_{665} - 5.76\ OD_{649}$.

Chlorophyll b (mg/L) = $25.8OD_{649} - 7.7\ OD_{665}$ [8].

3 Result and Discussion

The result of the present study as follows:

3.1 Plant Height

Note: The 10 DMRT test finds no statistically significant difference between numbers in the same column that are followed by the same letter at the 5% level. P1 control, P2 (1 L water + 1 mL eco enzyme), P3 (1 L water + 2 mL eco enzyme), P4 (1 Lair + 3 mL ecoenzyme), P5 (1 L water + 4 mL eco enzyme).

The average plant height of 5 WAP can be seen in Fig. 1. The highest average plant height was in treatment 5. It can be seen in the lettuce plants which are sprayed with ecoenzyme, producing taller plants. Therefore, it can be said that the eco-enzyme

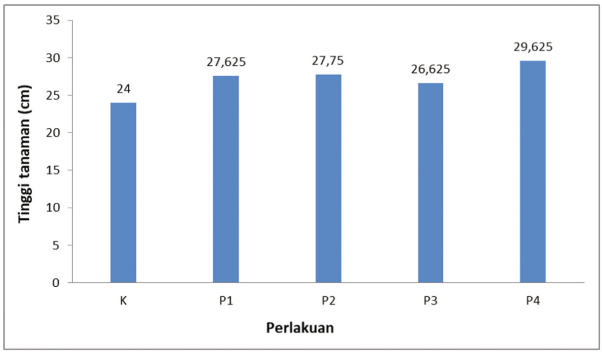

Fig. 1. Average plant height 5 MST

spraying affected the lettuce plants' height. The application of eco-enzymes to plants can affect the morphology in the form of height and number of leaves.

In treatment 4, the lettuce plant height was lower than in treatment P3, while P4 was greater than P3 this was because at the time of transplanting all the seeds taken were not the same height. Statistical analysis in (Fig. 1) showed that hydroponic cultivation of eco-enzyme had no effect on how many leaves lettuce plants grown hydroponically have. Plant height and number of leaves are parameters to determine vegetative growth. In addition to nitrogen, plant growth is also influenced by nutrients such as Mo and Zn. Zn plays a role in the process of dividing meristem cells, and plays a role in overall growth, especially in plant height [8].

3.2 Measurement of Chlorophyll Levels

The elements that affect the synthesis of chlorophyll include plant genetic factors, oxygen, carbohydrates, water, light intensity, temperature, and nutrients. The availability of nutrients in the soil varies depending on the habitat type.

Both chlorophylls a and b are found in all green plants. Of all the chlorophyll, chlorophyll makes up 75% of it. In plants, there is a little more than 1% dry weight of chlorophyll [9]. Chlorophyll plays a role in the light reaction, which converts solar energy into chemical energy while chlorophyll b is an accessory pigment that functions in absorbing light and transferring energy to chlorophyll in the light reaction. Chlorophyll a is blue-green while chlorophyll b is yellow-green.

From the present study, namely the effect of spraying eco-enzymes on lettuce chlorophyll levels, it can be seen in Fig. 2.

From Fig. 2, It is clear from the results that lettuce grown hydroponically with eco-enzymes has an average total chlorophyll content in mg/L of P1/control (3.181), P2 (5.739), P3 (6.151), and P4 (6.755). The study found that adding chlorophyll numerically enhanced the total chlorophyll content of lettuce grown hydroponically, but statistically, adding eco-enzymes had no statistically significant impact at the 5% level.

A mixture of intricate organic compounds called eco-enzyme is created when organic waste, sugar, and water are fermented. Eco-enzyme has a strong sour/fresh scent and dark brown color. Eco-enzymes can be used as plant fertilizers, repellents for various plant pests, and as a neutralizer for the environment to reduce the various pollutants.

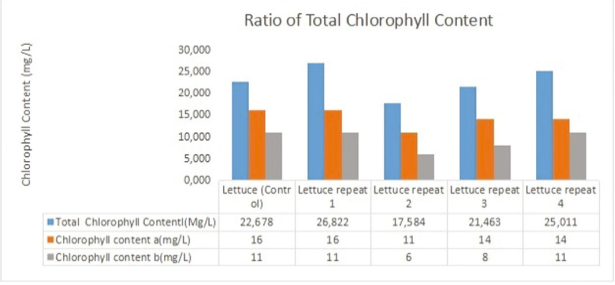

Fig. 2. Lettuce chlorophyll content in various treatments.

Chlorophyll in plants plays a role in photosynthesis, the process of absorbing and converting light energy into chemical energy [10]. The more chlorophyll content in the leaves, the higher the photosynthesis process in plants. Photosynthesis is an important process to maintain the growth and development of a plant. The higher the chlorophyll content, the more maximal the photosynthetic reaction will be, and vice versa. If the chlorophyll content is low or low, there is a possibility that the photosynthetic reaction will not be optimal.

In addition to affecting photosynthesis, chlorophyll also has many health benefits including as an antioxidant, promoting anticancer detoxification, and antiaging. Therefore, consuming vegetables that contain high chlorophyll, will be better for health.

4 Conclusion

According to the findings of the study, eco-enzyme spraying has an impact on the growth of hydroponically grown lettuce (Lactuca sativa L.). This can be seen from the observed plant growth parameters, namely plant height, and chlorophyll content. The highest average, plant height was at (P5) 29.625 cm and the highest average chlorophyll content was at Treatment 4, which was 6.775 mg/L.

Acknowledgments. The LP2M Universitas Negeri Padang, which provided funding for this study under contract number. 861/UN35.13/LT/2021, is acknowledged by the authors. Thank you to everyone who helped with the execution of this research, including the dean of the faculty of mathematics and natural sciences, the head of the biology department and his staff, the head of the biology laboratory and his team, and the head of the biology department.

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