Effect of Ecoenzyme Addition on Vitamin C Levels of Spinach (*Amaranthus* Sp.) Cultivate Hydroponically

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Abstract. One of the vitamins that the body needs is vitamin C since it plays a crucial role as an antioxidant that can shield the molecules that the body needs. Vegetables that are green, like spinach, contain vitamin C. Both hydroponically and non-hydroponically, spinach can be grown. According to a study, spinach grown hydroponically had lower vitamin C concentrations than spinach grown conventionally. The purpose of this study was to ascertain how adding Ecoenzymes affected the amounts of vitamin C in spinach grown hydroponically. Eco-enzymes are produced by fermenting organic kitchen waste with sugar and water in a 3:1:10 ratio, It can quicken metabolic processes in the natural world to create enzymes that are helpful in processing leftover fruit or vegetable material. From April to August 2021, this study was carried out in the Wire House and Plant Physiology Laboratory at Padang State University. The analysis of vitamin C levels was done using the Spectrophotometric Method in this experiment with 5 treatments and 4 replications. According to the study's findings, spinach contains the largest amount of vitamin C at P2, which is when 2 ml of Ecoenzymee is added, or 0.347 ppm. + 1 L of water, 4 ml of Ecoenzymee, and 1 L of water, and the lowest vitamin C level in treatment 4 was 0.317 ppm.

Keywords: Spinach · Vitamin C · Hydroponics · Ecoenzymee · Spectrophotometry

1 Introduction

Vitamin C is ascorbic acid, which is a chemical compound that is soluble in water. Water-soluble vitamin C indicates that the vitamin is not stored by the body. Vitamins are included in the micro needs of the body but, although only needed in small amounts, the role of vitamin C cannot be replaced by other compounds. Vitamin C is needed by the body to increase collagen production, and help the process of absorption of iron, an important protein for skin tissue, tendons, and ligaments and supports bones and teeth. Vitamin C also acts as an antioxidant that can help prevent cell damage caused by free radicals. Antioxidants can delay aging and inhibit the development of medical problems such as arthritis, heart disease, and cancer.

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Lack of vitamin C can cause the wound healing time to be longer due to reduced levels of collagen synthesis. Defects in the formation of collagen give rise to bleeding (due to lack of formation of intercellular substances) in the skin, mucous membranes, internal organs, and muscles; impaired wound healing, and weak collagen structure in bone, cartilage, teeth, and connective tissue [1]. Spinach is only one of the veggies that contain vitamin C. (Amaranthus hybridus L.)

One of the plants that is frequently grown for the use of its leaves as a green vegetable and as a significant source of iron is spinach (Amaranthus hybridus L.). This plant comes from tropical America but is now spread throughout the world, including in Indonesia. This plant is very easy to grow because it is influenced by the climatic conditions of this country. People usually use it as a food ingredient, such as being processed into clear vegetables, or spinach. In cultivation, both hydroponically and non-hydroponically, spinach can be grown.

Hydroponics is a plant that is grown by utilizing water without using soil media but emphasizing the nutritional needs of plants in full to grow [2]. Other media substitutes for soil include red brick, rockwool, gravel, husk charcoal, etc. Although the hydroponic system uses water, the water needed by plants is only in small amounts. The most important thing in a hydroponic growing system is the fulfillment of plant nutrients in the form of a solution. The advantages of hydroponics include not using soil, more efficient use of water, can control of overall nutrient levels, can control of environmental pollution caused by chemicals. Obtain stable and high yields and can control pests and diseases [3]. However, traditional techniques utilizing soil media continue to predominate in the cultivation of red spinach. According to studies, spinach grown hydroponically has less vitamin C than spinach grown conventionally [4]. For this reason, treatment needs to be done in hydroponic spinach cultivation to increase the vitamin C content. The solution that the author does here is by spraying Ecoenzymees on hydroponically cultivated spinach.

Ecoenzymee is a solution of complex organic substances produced from the fermentation process of organic waste, sugar, and water. This Ecoenzymee liquid is dark brown in color and has a strong sour/fresh aroma [5]. Although the fermentation process is quite long, namely for 3 months. However, a solution that is produced has properties that very much. Ecoenzymee solution when mixed with water, can function as a plant fertilizer used to increase plant growth and used in the form of a spray that will provide better flower, fruit, or harvest yields for fruits and vegetables. This study's goal was to ascertain how adding Ecoenzymes affected the amount of vitamin C in spinach grown hydroponically.

2 Materials and methods

2.1 Tools and Materials

This research uses 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, camera.

The material used is Ecoenzymee taken from UNP biology lecturer Siska Alicia Farma S.Pd, M.Biomed, which is produced at home wire department of biology, lettuce seeds obtained from hydroponic agriculture in West Sumatra, hydroponic nutrition (AB mix), water, black plastic, toothpick, rockwool, plastic, label paper.

2.2 Experimental Design

The design used in this study was a completely randomized design (CRD) with 5 treatments and 4 replications. Consists of control (K), 1mL Ecoenzymee + 1 L water, 2mL Ecoenzymee + 1 L water, 3mL Ecoenzymee + 1 L water and 4mL Ecoenzymee + 1 L water.

2.3 Research Procedure

2.3.1 Making Container Planting Medium

Clean the NFT system paralon first. Then the plastic cups are perforated using nails on the sides and bottom with several parts that function to enter nutrients. Arrange the plastic cups in the NFT system paralon.

2.3.2 Preparation and Seeding of Spinach (Amaranthus Sp)

West Sumatra's hydroponic community provided the spinach seeds. Seeding 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 × 2 × 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 Application Treatment

Taking 1 mL of the Ecoenzymee 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 Ecoenzymee, 3 mL Ecoenzymee, and 4 mL Ecoenzymee [7].

2.3.5 Seed Transfer

Take the seeds that are 7 days old or those that already have 3–4 leaves and then transferred to the NFT system planting media container that has been prepared.

2.3.6 Application

Applications were made on the growth of spinach plants.

2.4 Measurement of Vitamin C

Hydroponically grown spinach from the hydroponic community of West Sumatra in Alai served as the study's major element. The Erlenmeyer 100 ml, 10 ml measuring pipette, 100 ml measuring flask, glass funnel, 50 ml burette, spray bottle, analytical balance, feeder, filter paper, and cotton were the instruments required for the investigation to measure the concentration of vitamin C. Supplies required Hydroponically grown spinach, a solution of 1 percent starch, a solution of 0.01 N iodine, and Aquades.

To create a slurry, the material is crushed. Put 10 g of slurry in a 100 mL measuring flask, dilution it to the limit, and weigh it. A cotton ball is used to filter, and the filtrate is then transferred to a 10 mL Erlenmeyer. Add 1% starch solution and quickly titrate with 0.1% iodine solution N until a discoloration appears (blackish blue color).

Calculations:

$$A = \frac{mL\,Iodine\,0.01\,N}{gram\,sample}\,x\,0.88\,x\,P$$

A = milligrams of vitamin C per gram of substance
p = quantity of dilution
Note: Use vitamin C from IPI as a comparative.

3 Results and discussions

Based on the research that has been done, the following results are obtained:

3.1 Measurement of Maximum Wavelength in Vitamin C. Solution

From the measurement of the maximum wavelength of the vitamin C solution sample, the maximum wavelength results are shown in Fig. 1.

From the Figure, it can be seen that the highest absorbance obtained at the maximum wavelength of vitamin C solution using a range of wavelength 5 is 230 nm with an absorbance value of 2.199.

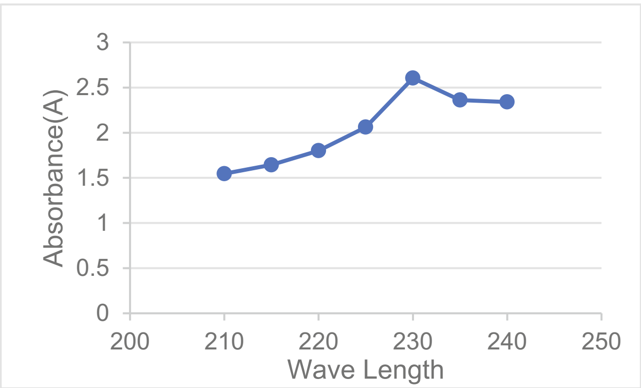

Fig. 1. Maximum wavelength of vitamin C solution

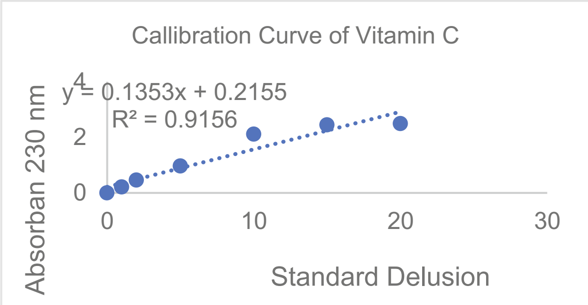

Fig. 2. Vitamin C Calibration Curve

The maximum absorbance value of this vitamin C solution was used to measure the vitamin C content in spinach samples using UV-vis spectrophotometry [8].

3.2 Making a Calibration Curve for Vitamin C Solution

The calibration curve was made by making a series of samples of vitamin C mother liquor whose absorbance was measured using UV-vis spectrophotometry. The results of the absorption of the sample series of vitamin C mother liquor can be seen in Fig. 2.

Seen in the Fig. 2, the highest standard delusion value is 15 with an absorbance value of 2.45 at a maximum absorption wavelength of 230 nm. The calibration curve produces a linear regression equation is Y = 0.1353 + 0.2155 with the value of the correlation coefficient R 2 of 0.9156 which shows the linearity of the equation. The standard curve will be used to show the concentration of the sample solution in spinach.

3.3 Measurement of Vitamin C Content in Spinach

Testing the level of vitamin C in spinach is depicted in Fig. 3 based on the results gathered..

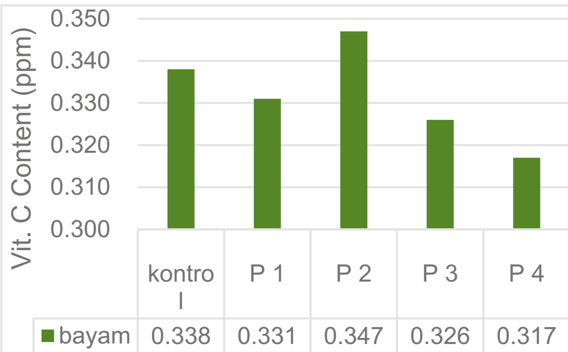

Fig. 3. Vitamin C Measurement Results (ppm)

Figure 3 shows that the P2 treatment, which sprays 2 ml of Ecoenzyme plus 1 L of water, results in the highest vitamin C content of 0.347 ppm, while the P4 treatment, which sprays 4 ml of Ecoenzyme plus 1 L of water, results in the lowest vitamin C content of 0.317 ppm. Figure 3 also shows that the amount of vitamin C rose up until the addition of 2 ml of Ecoenzyme and 1 L of water, but decreased when added to 3 ml Ecoenzyme + 1 L water until the addition of 4 ml Ecoenzyme + 1 L water.

Vitamin C is a type of substance that is insoluble in water [9]. Therefore, humans cannot synthesize vitamin C in their bodies because humans do not have the glucono-lactone oxidase enzyme. However, humans still need vitamin C to meet daily needs. Vitamin C acts as an antioxidant and is effective in counteracting free radicals that can damage cells and tissues [10].

Ecoenzyme is an environmentally friendly liquid that can be used as a multipurpose liquid [11]. Besides being able to be used as plant nutrition/Liquid Organic Fertilizer (POC), the addition of Ecoenzymees is only to a certain extent. According to Dr. Rosukon poompanvong invented the Ecoenzymee, that this liquid can convert ammonia into nitrate (N03), a natural hormone and nutrient for plants [12].

4 Conclusion

According to the research, the P2 treatment, which involved spraying 2 ml of Ecoenzyme + 1 L of water, produced the highest vitamin C content of 0.347 ppm, while the P4 treatment, which involved spraying 4 ml of Ecoenzyme + 1 L of water, produced the lowest vitamin C content of 0.317 ppm. Figure 3 also shows that the addition of 2 ml of Ecoenzyme and 1 L of water enhanced the amount of vitamin C, but decreased when added 3 ml Ecoenzyme + 1 L water until 4 ml Ecoenzyme + 1 L water was added.

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