



## Utilization of extract hyacinth weed (*Eichhornia crassipes* [mart.] Solms) on Tomato (*Lycopersicon esculentum*)



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### ABSTRACT

This study aims to determine the effect of water hyacinth weed extract on plant height, fresh weight, and dry weight of tomato plants (*Lycopersicon esculentum*) grown in polybags. The method was experimental with a completely randomized design (CRD) with 5 treatments and 5 repetitions. The treatments in question were P0 (treated without water hyacinth weed extract/control), P1 (treated with 25% water hyacinth extract weed), P2 (treated with 50% water hyacinth extract weed), P3 (treated with 75% water hyacinth extract weed), P4 (treated with water hyacinth extract weed 100%) The best results for the three parameters namely plant height, fresh weight, and dry weight were shown in treatment P4 (100% water hyacinth extract weed treatment) with values of 15.94 cm, 0.756 g, and 0.08 g respectively It can be concluded that the application of water hyacinth extract weed affected plant height, fresh weight, and dry weight of tomato plants planted in polybags.



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## Introduction

Water hyacinth (*Eichhornia crassipes* Mart. Solms) has been acknowledged as the world's most pervasive, most productive, free-floating in the water<sup>1</sup>. In Indonesia, people recognize water hyacinth (*Eichhornia crassipes* [mart.] Solms) as a type of aquatic plant, considered a weed in water areas<sup>2</sup> because it spreads very quickly and cannot be controlled and causes many losses, namely reducing the productivity of aquatic land<sup>3</sup>. Water hyacinths can cause environmental problems because of their fast growth, which can cover the water's surface. Another benefit of water hyacinth is that it can degrade organic and inorganic compounds<sup>3</sup>, such as heavy metals in water<sup>4</sup>.

Water hyacinth has a fairly high protein content of between 12-18% and a sufficiently complete amino acid content so that it can be used as a substitute for the hormone gibberellins<sup>5</sup>. Protein is one of the important compounds that make up organisms. Shella<sup>6</sup> stated that doses of water hyacinth green manure of 22.5 tons/ha showed good vegetative growth for eggplant plant growth, especially increasing leaves by 19.42 strands.

Tomato (*Lycopersicon esculentum*) is a popular vegetable plant in Indonesia that belongs to the Solanaceae family. Tomato agricultural products have a fairly high economic value. Aside from being a vegetable, tomatoes are also often consumed as fruit. The nutritional content of tomatoes is quite complete and useful for body health. The dominant vitamin content in tomatoes is vitamins A and C<sup>7</sup>. Furthermore, the nutritional content of tomatoes contained in 100 grams is 1 g of protein; 4.2 g of carbohydrates; 0.3 g of fat; 5 mg of calcium; 27 mg of phosphorus; 0.5 mg of iron; 1500 of vitamin A (carotene); 60 mg of B vitamins (thiamine); and 40 mg of vitamin C<sup>8</sup>. In addition, tomatoes also have a distinctive and fresh taste that is liked by almost everyone and is used in almost every type of cuisine.

Every year the demand for tomato commodities is always increasing. Tomatoes are one of the favorite fruit plants in every household. This is related to the population that continues to grow and the increasing awareness of the importance of nutrition in society. The Central Bureau of Statistics states that national tomato production in 2015 was 877,801 tons, while in 2016 it increased to 883,234 tons, in 2017 it increased to 962,849 tons, and in 2018 it increased to 976,809 tons<sup>9</sup>.

Lately, tomato production has increased, but the fertilizers used are inorganic fertilizers, for example, NPK which is expensive has limited availability, and causes negative impacts on the environment such as damage to soil structure which will result in reduced soil fertility and decreased yields. Therefore the use of water hyacinth extract will be a better alternative to increase soil fertility and increase crop yields by applying the use of organic-based extracts<sup>10</sup>.

Based on the description above, in order to reduce the weed population from water hyacinth and increase soil fertility, the use of water hyacinth extract to stimulate the growth of tomato plants (*Lycopersicon esculentum*) needs to be further researched so that production increases and is maximized by applying the use of organic-based extracts.

## Method

This research was carried out in Tridayasakti Village, South Tambun District, Bekasi Regency in May - June 2021. The type of research used in this study was experimental using a Completely Randomized Design (CRD) method with a single factor of water hyacinth extract consisting of various concentrations, namely P0 = 0%, P1 = 25%, P2 = 50%, P3 = 75%, P4 = 100%. Each treatment was repeated 5 times, resulting in 25 experimental units.

Extract of water hyacinth (*Eichornia crassipes* (Mart.) Solms.) by collecting fresh and not rotten water hyacinth roots and stems from the river. Then the water hyacinth (root and stem parts) is washed thoroughly. Then weighed until it reaches a weight of 7 kg. Water hyacinth (root and stem parts) mashed using a blender. The refined hyacinth is then filtered and squeezed to obtain water hyacinth extract. Part of the water hyacinth extract was stored to be used as an extract with a concentration of 100%. The other portion is then diluted with distilled water, in order to obtain the desired concentration of 25%, 50%, and 75%. Then the mixture is stirred until it is evenly mixed<sup>11</sup>.

Tomato plants that have gone through the seeding process (7 days) are transferred to polybags filled with planting media in the form of a mixture of fertile soil and manure with a ratio of 1:1. Water hyacinth extract was applied by spraying it on the surface of the plants and leaves of the tomato plants with the help of a 50 ml spray bottle. Watering with water hyacinth extract is done every three days, namely in the morning.

Parameter data collection used in this study included plant height, fresh weight, and dry weight of tomato plants. It was carried out at 21 HST. The research data were processed using one-way ANOVA (analysis of variance) at a significance level of 0.05. If the results are significant, then a further test is carried out to find out the difference between each treatment which is carried out using the LSD (Smallest Significant Difference) Test with a significance level of 0.05. This data analysis was performed using IBM SPSS Statistics 24.

## Results and Discussion

Based on observations made on the administration of water hyacinth weed extract (*Eichhornia crassipes* [mart.] Solms) on the growth of tomato plants (*Lycopersicon esculentum*) at 21 HST, the results obtained were tomato plant growth as measured by several parameters, namely: tomato plant height, wet weight, and dry weight listed in the Table 1.

Table 1. The average yield of plant height, fresh weight, and dry weight of tomato plants (*Lycopersicon esculentum*) aged 21 DAP

Treatment of water hyacinth weed Extract (%)	Average of growing tomato		
	High plant (cm)	Gross weight (g)	Dry weight (g)
0% (P0)	6.2 <sup>a</sup>	0.12 <sup>a</sup>	0.018 <sup>a</sup>
25% (P1)	10.82 <sup>b</sup>	0.372 <sup>b</sup>	0.042 <sup>b</sup>
50% (P2)	14.6 <sup>cd</sup>	0.518 <sup>cd</sup>	0.058 <sup>c</sup>
75% (P3)	15.3 <sup>de</sup>	0.628 <sup>de</sup>	0.07 <sup>de</sup>
100% (P4)	15.94 <sup>e</sup>	0.756 <sup>e</sup>	0.08 <sup>e</sup>

Note: numbers follow with alphabet same superscript direction to different significance 5%

In general, the administration of different concentrations of water hyacinth extract had a significant effect on the growth of tomato plants which had been observed for 21 HST. Tomato plant height after administration of water hyacinth extract concentration with the highest average of 15.94 cm was shown in tomato plants given 100% water hyacinth extract and the lowest average was 6.2 cm shown in tomato plants given water hyacinth extract 0%. The higher the concentration of water hyacinth extract given, the higher the nutrient content received by the tomato plants. This is because the organic matter contained in water hyacinth has been decomposed by microorganisms so that the organic elements in this liquid organic fertilizer help provide N for plants<sup>12,13</sup>.

Water hyacinth serves as a source of organic matter that can improve soil chemical properties. Water hyacinth can also improve soil chemical properties because it contains 4.05% total N, 1.13% total P, and 2.68% total K<sup>14</sup>. Water hyacinth extract contains sufficient nitrogen, phosphorus, and potassium to meet the nutrients of tomato plants during the vegetative period thereby increasing plant growth<sup>13,15</sup>. The availability of nutrients in sufficient and balanced amounts for plant growth can cause the process of cell division, enlargement and elongation to take place quickly resulting in several plant organs growing rapidly<sup>16</sup>.

The wet weight of tomato plants after administration of water hyacinth extract concentration with the highest average of 0.756 g was shown in tomato plants that were given 100% water hyacinth extract, and the lowest average was 0.12 g which was shown in tomato plants that were given water hyacinth extract 0%. This shows that water hyacinth extract has a good element of N<sup>17</sup>; if the N element supplied by the fertilizer is available properly, the plant will experience good growth<sup>18</sup>.

This is due to the high concentration of water hyacinth extract given, making the wet weight of the tomato plants even heavier. The taller the plant, the heavier the weight of the plant<sup>19</sup>. This is consistent with this study where the administration of 100% water hyacinth extract concentration was the treatment that had the highest plant height. Therefore, in the wet weight parameter observed, the administration of 100% water hyacinth extract was the treatment that had the highest wet weight.

The dry weight of tomato plants after administration of water hyacinth extract concentration with the highest average of 0.8 g was shown in tomato plants given 100% water hyacinth extract and an average of 0.018 g was shown in tomato plants given 0% water hyacinth extract. If the chlorophyll content in the plant is sufficient, the process of photosynthesis will run optimally. Plants that are given sufficient N elements will form optimal chlorophyll so that

the photosynthesis process will run well<sup>20</sup>. If photosynthesis runs optimally, plant growth will increase and the dry weight produced by plants will also increase. Nitrogen becomes an integral part of the chlorophyll molecule which also controls a lot of the ability of plants to photosynthesize<sup>21,22</sup>. Water hyacinth extract contributes to the growth of tomato plants, thereby increasing the quality of growth based on height and weight.

## Conclusion

Utilization of water hyacinth weed extract affected plant height, fresh weight, and dry weight of tomato plants. At a concentration of 100%, water hyacinth weed extract gives maximum results for the growth of tomato plants. Extracts need to be developed with implementation on other plants which are a primary need for the community.

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### Author contributions

All authors contributed to the study's conception and design. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript