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Original Paper

Growth and Production of Romaine Lettuce (*Lactuca sativa* L.) on Several Dosage of Rabbit Urine

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***Abstract*—Romaine lettuce is a vegetable with high economic value. Romaine lettuce needs to be grown organically. This research aimed to study the effect of various doses of rabbit urine on romaine lettuce. This research was conducted from June to August 2022 at the Smart and Urban Farming Laboratory Greenhouse, Campus F7, Gunadarma University, East Jakarta, Indonesia. The study used a randomized block design (RBD) with five replications, consisting of 5 treatments, namely: P0: without rabbit urine (control); P1: Concentration of rabbit urine 25%; P2: Concentration of rabbit urine 50%; P3: Concentration of rabbit urine 75%; P4: Concentration of rabbit urine 100%. The application of several doses of rabbit urine did not significantly affect the growth and yield of romaine lettuce. Based on this study result, the best rabbit urine concentration for romaine lettuce plants was 120 ml (P3).**

Keywords—biourine, growth, rabbit

I. INTRODUCTION

Vegetables are one of the horticultural commodities that many people consume. The high content of vitamins and minerals in vegetables makes this commodity beneficial for health. One of them is romaine lettuce (*Lactuca sativa* Var. Romana). Lettuce has a relatively high nutritional content. The nutritional value per 100 grams of lettuce was calories 15.00 Cal, protein 1.20 g, fat 0.20 g, carbohydrates 2.90 g, calcium 22.00 mg, phosphorus 25.00 mg, Fe 0.50 mg, Vit A 540 S. I, Vit B 10.04 mg, Vit C 8.00 mg, and water 94.80 gr [1]. These conditions cause romaine lettuce to have relatively high economic value.

The practical use of inorganic fertilizers can give satisfactory results. However, the long-term application of inorganic fertilizers can cause damage to the physical, chemical, and biological properties of the soil. So, it is necessary to make improvements by using fertilizers that can increase nutrients, soil structure, and biological activities through organic fertilizers. Through the application of organic farming, it is expected that the balance between organisms and the environment will be maintained. Soil organic matter consists of living soil organisms consisting of flora and fauna, living and dead plant roots, decomposed and modified, and new synthetic products derived from plants and animals. In mineralization, in relatively small quantities, organic materials release complete plant nutrients (N, P, K, Ca, Mg, S, and micronutrients).

Organic fertilizers are divided into solid organic fertilizers and liquid organic fertilizers. Solid organic fertilizers that can be used include manure, compost, and green manure. Chicken manure can make excellent fertilizer for vegetable and ornamental plants. At the same time, liquid organic fertilizers that can be used are fertilizers that utilize fermented livestock urine waste or bio-urine. One type of bio-urine that can be used is rabbit urine, but only a few uses rabbit urine as organic fertilizer. Liquid organic fertilizer derived from rabbit urine has a reasonably high nutrient content, namely 4% N, 2.8% P2O5, and 1.2% K2O, relatively higher than the nutrient content in cows (1.21% N, 0 P2O5, 0.65%, K2O 1.6%) and goats (1.47% N, 0.05% P2O5, 1.96% K2O) [2]. Rabbit manure contains organic matter C/N: (10 ± 12%) and pH 6.47 ± 7.52 [3]. This research aimed to study the effect of various doses of rabbit urine on romaine lettuce.

II. MATERIAL AND METHODS

A. Time and Location

This research was conducted from June to August 2022 at the Smart and Urban Farming Laboratory Greenhouse, Campus F7, Gunadarma University, East Jakarta, Indonesia.

B. Trial Design

The study used a randomized block design (RBD) with five replications consisting of 5 treatments, namely:

P0: Without rabbit urine (control)
P1: Concentration of rabbit urine 25%
P2: Rabbit urine concentration 50%
P3: Concentration of rabbit urine 75%
P4: Rabbit urine concentration 100%

C. Prosedure

The study procedure consists of the following:

1. Preparation of planting medium

The planting medium used is soil. The soil to be used is put in a polybag measuring 30x30 cm. The source of the soil used is a landfill originating from the Citayam area.

2. Sowing the romaine lettuce seeds

Romaine lettuce seeds are sown using seedling trays, soil planting media, and manure with a ratio of 1:1. Sowing is done for two weeks or until the plants have four leaves. During seeding, the seeds are watered two times a day in the morning and evening. 288 seeds were sown.

3. Transplant the romaine lettuce seedlings

Transplanting is done when the plants are 14 days old after sowing or when the plants have four leaves, and then the plants are planted in polybags with a size of 30x30cm with soil media.

4. Application of rabbit urine

The rabbit urine was applied with the following concentrations: 0%, 25%, 50%, 75%, and 100%. Rabbit urine was applied five times, 7 days after planting (DAP), 14 DAP, 21 DAP, 28 DAP, 35 DAP, and 42 DAP at a 100 ml/plant dose.

5. Maintenance

Maintenance includes watering two times a day, as much as 200 ml, weeding once a week manually, and stitching, done at 7 HSPT by embroidering seeds that do not grow. HPT control is carried out mechanically by pulling weeds around the main crop.

6. Harvesting

Harvesting is done when the plants are 49 HSPT by uprooting them from the ground.

D. Data Analysis

The data obtained were analyzed using Analysis of Variance (ANOVA). If the analysis results show a significant effect, then the DMRT (Duncan Multiple Range Test) test will be continued with a level of 5%.

III. Result And Discussion

A. Plant Height (cm)

The application of rabbit urine was not significantly different in plant height growth. The height of the romaine lettuce plant can be seen in Table 1.

TABLE I. HEIGHT OF ROMAINE LETTUCE BY VARIOUS DOSES OF RABBITE URINE

Treatment	Plant height (cm)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	49 DAP
P0	6.8	8.1	9.4	10.7	12.2	13.3	15.7
P1	7.4	8.9	10.6	11.9	14.9	17.1	19.7
P2	7.4	8.8	10.6	11.6	13.9	16.3	18.3
P3	7.2	8.5	9.6	10.3	11.7	14.2	15.8
P4	7.2	8.7	10.2	11.7	13.8	16	18.1
ANOVA	ns	ns	ns	ns	ns	ns	Ns

Note : ns = not significant

The results of the data analysis showed that giving rabbit urine to plants had no significant effect. It can be seen in Table 2. It shows that the final result of giving 40 ml of rabbit urine (P1) had the highest mean value, 19.7 cm, and the lowest in the control treatment (P0), which was 15.7 cm. The absence of a significant effect on these parameters following previous studies where researchers [4] stated that the application of rabbit urine to lettuce (*Lactuca sativa* L.) on the parameter of plant height aged 35 DAP showed no significant effect but was the highest from rabbit urine treatment (U) was found in treatment U2 (14.87 cm), followed by U0 (14.04 cm), and U1 (13.15 cm). This condition can be due to plants' low N nutrient content, as [5] stated that nitrogen is essential in forming chlorophyll, protoplasm, proteins, and nucleic acids. Nitrogen is also a component of auxin, where auxin plays a role in the growth of apical meristem tissue, which causes plants to increase in height. In addition to the nutrients that must be fulfilled, sunlight is also very influential during plant growth. According to [6], if the lettuce plants get enough sunlight, the lettuce plants will grow upwards, and vice versa. If the lettuce plants do not get enough light radiation, the lettuce plants will grow downwards.

B. Number of Leaves (leaves)

The application of various doses of rabbit urine was not significantly different in the number of romaine lettuce leaves. The number of lettuce leaves in rabbit urine application can be seen in Table 2.

TABLE II. NUMBER OF ROMAINE LETTUCE LEAVES BY VARIOUS DOSES OF RABBITE URINE

Treatment	Number of leaves (leaves)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	49 DAP
P0	3.8	4.5	4.9	4.9	6.0	6.7	7.1
P1	3.7	4.8	5.5	5.7	6.7	7.5	8.8
P2	3.7	4.7	5.7	6.1	6.7	8.1	9.1
P3	3.6	4.5	5.2	4.9	5.7	6.8	7.9
P4	3.8	4.7	4.9	6.0	7.0	8.4	9.5
ANOVA	ns	ns	ns	ns	ns	ns	ns

Note : ns = not significant

The results of the data analysis showed that the application of rabbit urine had no significant effect on the growth of the number of leaves. It can be seen in Table 3. It shows that the result of giving rabbit urine has the highest value, namely P4 (160 ml of rabbit urine) with an average growth value of 9.5

strands, and the lowest is found in P0 (control) with an average growth value of 7.1 strands. The absence of a significant effect on these parameters is inconsistent with previous research, where [7] research stated that the best results for plant height, number of leaves, most expansive leaf area, plant fresh weight, plant dry weight, fresh leaf weight, dry leaf dry weight were achieved of rabbit urine concentration of 40 ml/l water with a total of 17.49 leaves. The increase in plant height, number of leaves, most expansive leaf area, plant fresh weight, plant dry weight, fresh leaf weight, and dry leaf dry weight was due to sufficient nutrient availability. Plant growth and development are also influenced by external and internal factors (nutrients, temperature, humidity, light, soil pH).

According to [8], plant growth is affected by air temperature, for example, in the process of germination, budding, flowering, and others. The air temperature at the research location ranged from 28.10C - 34.30C. This temperature was still tolerant because lettuce did not show growth inhibition. According to [9], the ideal temperature for lettuce is 15 to 250 degrees Celsius. Air humidity at the location during the study ranged from 52-77%. This humidity is ideal for growing lettuce; the humidity suitable for cultivation is high, high humidity is more than 60% [9].

C. Stem Diameter (cm)

The application of various doses of rabbit urine did not differ significantly in the diameter of the romaine lettuce stems. The number of lettuce leaves in rabbit urine application can be seen in Table 3.

TABLE III. DIAMETER OF ROMAINE LETTUCE STEMS BY VARIOUS DOSES OF RABBITE URINE

Treatment	Stem diameter (cm)
P0	0.37a
P1	0.35a
P2	0.28a
P3	0.26a
P4	0.31a
ANOVA	ns

Note : ns = not significant

The results of the data analysis showed that the application of rabbit urine on the stem diameter parameter had no significant effect. It can be seen in Table 4 that treatment 0 (P0) as a control has the highest average value of 0.37 mm, while in treatment 3 (P3), the application of 120 ml of rabbit urine has the lowest average value of 0.26 mm. The absence of a significant effect on these parameters is different from similar previous studies using rabbit urine, where [10] stated that there was an effect of giving rabbit urine to the diameter of caisim plants at a dose of 40 ml of rabbit urine. Stem diameter can be affected by photosynthetic activity in plants. According to [11], the stem is one of the essential parts of the plant for growth because of the presence of nutrients that can encourage the vegetative growth of plants, including the formation of chlorophyll in the leaves so that it will spur the process of photosynthesis, which helps increase the diameter of the stem.

D. Leaf Area (cm^2)

The application of various doses of rabbit urine was not significantly different on the area of romaine lettuce leaves. The area of lettuce leaves on rabbit urine application can be seen in Table IV.

TABLE IV. LEAF AREA OF ROMAINE LETTUCE STEMS BY VARIOUS DOSES OF RABBITE URINE

Treatment	Leaf area (cm^2)
P0	43.08a
P1	54.38a
P2	49.76a
P3	50.33a
P4	41.48a
ANOVA	ns

Note : ns = not significant

The results of the data analysis showed that the application of rabbit urine had no significant effect on the leaf area parameter. Table 7 shows that treatment (P1) has the highest value, namely 54.38 cm2, while the lowest value is found in treatment 4 (P4), which is 41.48 cm2. The absence of a significant effect on these parameters differs from previous research, where [12] stated that the application of rabbit urine significantly affected the widest leaf area variable, with the best results achieved in treating two ml/l rabbit urine concentration. Providing rabbit urine with a concentration of 2 ml/l is optimal for lettuce growth. The available nutrients in optimal and balanced conditions largely determine plant growth. The primary role of N in plants is as a constituent of protein and is an element in the chlorophyll molecule. The leaf area will be higher if the nutrient content is sufficiently available in plants because most of the assimilate is allocated for leaf formation. The higher the absorption of nutrients by plants, the more photosynthates will be produced [13].

E. Total Fresh Weight, Harvested Weight, and Root Weight

The application of various doses of rabbit urine was not significantly different in total fresh weight, harvested weight, and root weight of romaine lettuce. The total fresh weight, harvest weight, and root weight of romaine lettuce on rabbit urine application can be seen in Table V.

TABLE V. TOTAL FRESH WEIGHT AND SHOOT WEIGHT OF ROMAINE LETTUCE BY VARIOUS DOSES OF RABBITE URINE

Treatment	Total Fresh Weight (g)	Harvested Weight (g)
P0	16.00	15,29
P1	18,27	17,15
P2	19,41	17,92
P3	21,63	20,17
P4	20,19	19,22
ANOVA	ns	ns

Note : ns = not significant

The results of data analysis on the parameters of total fresh weight, harvest weight, and root weight showed that the application of rabbit urine had no significant effect, as seen in Table 5. In these parameters, treatment 2 (P2) had the highest average value, weighing 7.4 grams, 66.89 grams, and 0.57 grams, respectively. In comparison, the lowest average value was found in the control treatment (P0) with a weight value of 3.48 grams, 3.24 grams, and 0.24 grams, respectively. The absence of a significant effect on these parameters is inconsistent with the previous study, where [7] stated that at intervals of giving rabbit urine, the difference was highly significant for plant height, number of leaves, most expansive leaf area, plant fresh weight, leaf fresh weight, weight dry leaves. The increase in these parameters is due to the need for macro and micronutrients. Nutrients that plants can absorb are one factor that can affect plants' growth and development [14]. Nutrient N in rabbit urine is the main component of chlorophyll. This chlorophyll plays a vital role in photosynthesis and plant metabolic processes such as respiration and plant genetics, which are primary in stimulating growth. According to [15], nutrients, especially nitrogen absorbed by plants, will combine with carbohydrates to form protein for the formation of leaves.

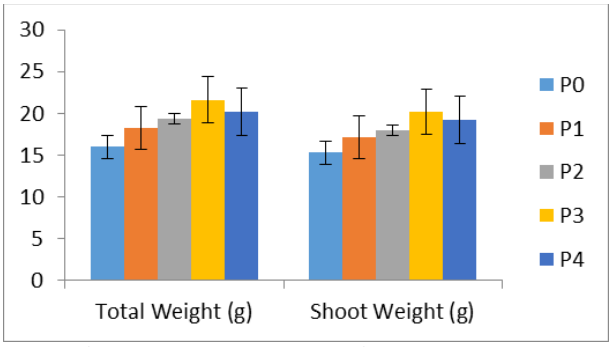

Fig. 1. Total fresh weight and shoot weight of romaine lettuce on several dose of rabbit urine

F. Root Volume (ml)

The application of various doses of rabbit urine was not significantly different in total fresh weight, harvested weight, and root weight of romaine lettuce. The total fresh weight, harvest weight, and root weight of romaine lettuce on rabbit urine application can be seen in Table 4.

TABLE VI. THE ROOT VOLUME AND ROOT FRESH WEIGHT OF ROMAINE LETTUCE STEMS BY VARIOUS DOSES OF RABBITE URINE

Treatment	Root volume (ml)	Root fresh weight (g)
P0	0.19	1.12
P1	0.30	0.97
P2	0.40	0.71
P3	0.30	1.49
P4	0.41	1.45
ANOVA	ns	ns

Note : ns = not significant

The results of the data analysis showed that the application of rabbit urine had no significant effect on the root volume parameter. It can be seen in Table 6 that the application of rabbit urine in treatment 4 (P4) had the highest average value of 0.41 ml, while the lowest average value was found in the control treatment (P0), which was 0.19 ml. There was no significant effect on these parameters by previous research. The application of rabbit urine was not significantly different in the variable number of leaves, root fresh weight, and root volume [12].

IV. CONCLUSION

The Application of Several Doses of Rabbit Urine Did not significantly affect the growth and yield of Romaine Lettuce. Based on the best productivity of fresh shoot weight and harvested weight, the best rabbit urine concentration for romaine lettuce plants was 120 ml (P3). However, Next Research requires better exploration in determining the best dose of the applied urine rabbit. The production process of urine rabbits also needs to be considered to get the best nutrient levels from the urine rabbit to be applied.

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