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GROWTH AND YIELD PERFORMANCE OF LETTUCE (LACTUCA SATIVA L.) USING DIFFERENT NUTRIENT SOLUTIONS IN AEROPONICS METHOD

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ABTRACT

Background: The study was conducted to determine the growth and yield performance of lettuce (Lactuca sativa L.) using different nutrient solutions in aeroponic system in Gonzaga, Cagayan. Specifically, it determined the growth parameters, their yield parameters. The study was undertaken for two months, from December 21, 2023 to January 30, 2024 at Cagayan State University Gonzaga Campus in Flourishing, Gonzaga, Cagayan. It used a single-factor experiment in Complete Randomized Design (CRD).
Findings: The study revealed that plant height (cm), plant leaves, weight (g) and average leaf production had a significant difference among the treatments. The most suitable for growing lettuce in aeroponics was the used of T2 (100%N+44%P+83%K) nutrient solution since it has recorded the best results in terms of growth and yield. The average plant height and average weight of the plant showed highly significant among all the five treatments. The least results were documented with the used of T4 (13%N+0%P+38.3%K) nutrient solution.
Conclusions: Based on the result of this study, it can be concluded that plant height (cm), plant leaves, weight (g) and average leaf production had a significant difference among the treatments.

Keywords: *Aeroponics, Lettuce, Nitrogen, Phosphorus, Potassium.*

INTRODUCTION

Asteraceae is a family of annual plants that includes lettuce (Lactuca sativa L.). Though occasionally grown for its stem and seeds, it is primarily produced as a leafy vegetable. While it can be grilled or added to soups, sandwiches, wraps, and other dishes, lettuce is most frequently used in salads. After millennia of human ingestion, in addition to its primary usage as a leafy green, it has acquired religious and medical value.

And one of the most produced and consumed leafy vegetables, because it is easy to acquired and prepared, it is produced throughout the year (FAO, 2012). In the Philippines, lettuce is predominantly grown in Benguet, Bukidnon and Cavite (Tagaytay). The production in the Cordillera region in 2010 was 1,486.15 MT from a production area of 160 hectares and the country had produced 3,634.12 MT from 465.98 hectares (BAS, 2010). Environmental factor like the effect of acidic soil is of utmost concern in upland crops. Moreover, acidity stress is the most limiting factor in upland crop production. Upland crops are not productive due to chemicals present that are high in Al and Mn but low in nutrients like N, P, K, Ca, Mg, and Mo, (Dutta et al., 2017). Alia et al. (2015) stated that a soil with high aluminum concentration reduces plant growth through reduction of root length and inhibit root growth which result to restriction of nutrient uptake.

In aeroponics, the nutrient solution was only sprayed as fine droplets at intervals, which may limit shoot growth and improve root growth, as the plant's response may be to adapt to the relative deficit of water and nutrients during the intervals (Tabatabaei., 2008). From this study, it can be concluded that aeroponics is beneficial to root growth, with significantly greater root/shoot ratio, root length, root area, and root volume. Thus, an aeroponic system may be superior for producing high value, true root crops, particularly for medicinal plants as suggested by Hayden. When growing root crops in aeroponics, clean products may be harvested sequentially. To grow crops like lettuce in aeroponics for harvesting above-ground parts, further research is necessary to determine suitable pressure, droplet size, and misting interval in order to improve the continuous availability of nutrients and water so that growth of above- ground parts of plants can be optimized (Hayden et al, 2004).

Soilless culture, including aeroponics, aquaponics, and hydroponics, is considered one of the more innovative agricultural strategies to produce more from less, in order to feed the estimated 11 billion people in the world by 2100 (Lal, R., 2016). Aeroponics is a promising technology that grows plants with their root systems exposed to a nutrient mist in a closed chamber (Jones., 2014). Plants grow well in aeroponics, primarily because of the highly aerobic environment it creates. It is even possible to control the root-zone atmosphere when it is combined with a gas delivery system (Kratsch.,2006). Integrated vertical aeroponic farming systems with manipulation of temperature and CO2 in the root-zone environment can achieve more efficient use of land area to secure a vegetable supply in space-limited cities (He., 2015). Aeroponics is also an excellent option for space mission life support systems that require optimum control of growth parameters (Resh., 2012). Hence, the study,

MATERIALS AND METHODS

A. Experimental Design and Treatments

The Complete Randomized Design (CRD) was used in the study. There were five (5) treatments replicated three (3) times with ten (10) samples per replication.

The treatments were as follows:

T1- (5% N + 2% P + 2.5% K)

T2- (100% N + 44% P + 83% K)

T3- (6.10% N + 0.376% P + 3.09% K)

T4- (13% N + 0% P + 38.3% K)

T5- (5% N + 7% P + 9% K)

B. Materials and Equipment

The materials, supplies and equipment used in the study were half inch PVC pipes, one eighty (180) degree and three hundred sixty (360) degree mist nozzles, plastic container, storage box, water, nutrient solutions, water hose, lettuce seed, and submersible water pump.

C. Pre- Experimental Procedures

1. Preparation of Experimental Area

The study was conducted in Cagayan State University-Gonzaga Campus, Flourishing, Gonzaga, Cagayan. The study area was taken under Greenhouse conditions to avoid pest that may affect the growth of the crop and temperature, relative humidity, typhoon and etc.

2. Preparation of Planting Materials

Lettuce was used as a commodity in an aeroponics system. Seed sowing was done in a seedling tray. Two (2) weeks old lettuce seedlings were transplanted in the aeroponic planting system.

3. Preparation of seedling plugs

Eight (8 oz) Styrofoam cups were used as the seedling plugs for the lettuce and a cutter was used to slice the button and side of the cup for the roots of the lettuce to grow. Sharp knife was used to make a hole to the cup.

4. Preparing the growing boxes

Fifteen (15) storage boxes were used as a growing bed of the lettuce. A two-inch hole was drilled to the surface of the box to hold the Styrofoam cups with a distance of 25cm. Where ever, set up the pipes with the mist nozzles in the boxes and was connected to the container that contained the mixture of water and the nutrient solution.

D. Experimental Procedures

1. Transplanting of lettuce seedlings

Two (2) weeks after sowing the lettuce seedlings with three to four (3-4) leaves were transplanted into an eight (8) oz styrofoam cups half-filled with carbonized rice hull as the medium, and one (1) seedling was planted each cup. Transplanting was done early in the morning.

2. Crop and maintenance

Daily monitoring of the crops was done to ensure the proper aeration of nutrient solution. It was found out that there was no infestation of the disease in the plant.

3. Harvesting

The crops were harvested thirty (30) days after transplanting. All the data needed for the experiment were gathered and recorded before packing the crop and selling it to the market.

E. Data gathered

a. Growth Components

1. Average plant height (cm)

Average height was done by measuring the sample plant seven (7) days after transplanting and before harvesting, the variable was measured from the highest leaf to the base of the sample plants from each box. After which, the average was computed.

$$Average\ plant\ height\ (cm) = \frac{Total\ plant\ height}{Number\ of\ sample\ plants}$$

2. Average number of leaves

Average number of leaves was taken by counting seven (7) days after transplanting. Average number of leaves was recorded by counting the data from the sample plants on each box. After so, the average was computed.

$$Average\ number\ of\ leaves = \frac{Total\ plant\ leaves}{Number\ of\ sample\ plants}$$

b. Yield components

1. Average weight (g) of plants

Average weight of the plant was recorded by weighing the sample plants after the harvest.

$$Average\ weight\ of\ plant = \frac{Total\ weight\ of\ plant}{Number\ of\ sample\ plants}$$

c. Cost and return analysis

1. Gross Return

Gross return = Production x Farmgate price

2. Net return

Net return = Gross return – Total cost

3. **Return of Investment**

Return of Investment = Net profit - Cost ratio x 100

F. Statistical Analysis

Data were subjected to Analysis of Variance (ANOVA) using Complete Randomized Design (CRD). Means Significance was tested using the Least Significant Different (LSD) at 5% level of significance. waste.

RESULTS AND DISCUSSION

A. Growth Parameters

1. Average plant height

Table 1. Average Plant Height (cm)

	No. of DAYS AFTER TRANSPLANTING(DAT)				
Treatment	7	14	21	28	35
T1- (5%N+2%P+2.5%K)	6.90 ^{b}	12.78 ^{a}	15.52 ^{b}	20.37 ^{a}	23.17 ^{a}
T2- (100%N+44%P+83%K)	6.77 ^{b}	12.95 ^{a}	15.87 ^{b}	20.47 ^{a}	24.27 ^{a}
T3-(6.10%N+0.376%P+3.09%K)	7.02 ^{b}	13.40 ^{a}	16.58 ^{a}	20.63 ^{a}	22.97 ^{a}
T4- (13%N+0%P+38.3%K)	7.60 ^{a}	12.73 ^{a}	14.62 ^{c}	16.67 ^{b}	19.68 ^{b}
T5- (5%N+7%P+9%K)	5.70 ^{c}	10.70 ^{b}	13.53 ^{d}	16.20 ^{b}	19.80 ^{b}
	6.798	**12. 512**	**15.224**	**18.868**	**21.978**
P-value	**	**	**	**	**

Means with the same letters are not significantly different at P≤ 0.05 level of (LSD).
ns– not significant
* - significant
** - highly significant

Table 1 shows the plant height of the lettuce grown in aeroponics filled with various growing solutions. Results revealed significant differences among treatment means (LSD, p0.05). It shows that the lettuce plant height ranging from 24.27cm to 19.68cm. The highest plant height of lettuce plants grown in aeroponics filled with T2 (100%N+44%P+83%K) nutrient solutions is 24.27cm. Followed by T1 (5%N+2%P+2.5%K) and T3 (6.10%N+0.376%P+3.09%K) with a mean of 23.17cm and 22.97cm respectively. The lowest plant height was recorded in the lettuce plants grown in T4 (13%N+0%P+38.3%K) nutrient solutions with 19.68cm.

On 7 DAT, the tallest plant was observed in T4 (13%N+0%P+38.3%K) and the result showed a highly significant difference over T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), and T5 (5%N+7%P+9%K). However numerically, T4 (13%N+0%P+38.3%K) had the tallest plant with a mean of 7.60cm followed by T3 (6.10%N+0.376%P+3.09%K), T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), and T5 (5%N+7%P+9%K) with a mean of 6.90 cm, 6.77 cm, 7.02 cm, and 5.70 cm respectively.

On 14 DAT, the table displays that there was a highly significant difference of the T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), and T4 (13%N+0%P+38.3%K) over T5 (5%N+7%P+9%K). However numerically, T3 (6.10%N+0.376%P+3.09%K) has the tallest plant with a mean of 13.40 cm, followed by T2 (100%N+44%P+83%K), T1 (5%N+2%P+2.5%K), and T4 (13%N+0%P+38.3%K) with a mean of 12.95 cm, 12.78 cm and 12.73 cm respectively T5 (5%N+7%P+9%K) has the shortest plant with a mean of 10.70 cm. And T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), and T4 (13%N+0%P+38.3%K) are comparable to its other.

On 21 DAT, result showed that there is a highly significant difference on the height of lettuce grown in T3 (6.10%N+0.376%P+3.09%K) nutrient solutions. It was observed from ranging 13.53 cm to 16.58 cm. Numerically, the tallest plant was recorded from T3 (6.10%N+0.376%P+3.09%K) with a mean of 16.58 cm, followed by T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), and T4 (13%N+0%P+38.3%K), with a mean of 15.52 cm, 15.87 cm and 14.62 cm respectively and the shortest plant mean was observed in T5 (5%N+7%P+9%K) with a mean of 13.53 cm.

In addition, at 28 DAT the tallest plant was observed in T3 (6.10%N+0.376%P+3.09%K), T2 (100%N+44%P+83%K) and T1 (5%N+2%P+2.5%K). And the result showed highly significant difference over T4 (13%N+0%P+38.3%K) and T5 (6.10%N+0.376%P+3.09%K). However numerically, T3 had the tallest plant with a mean of 20.63 cm, followed by T2 (100%N+44%P+83%K), T1 (5%N+2%P+2.5%K) with a mean of 20.47 cm and 20.37 cm respectively and the shortest plant was observed at T4 (13%N+0%P+38.3%K) and T5 (6.10%N+0.376%P+3.09%K) with a mean of 16.67 cm and 16.20 cm.

Moreover, at 35 DAT revealed that there was a highly significant difference of the plant's height. Numerically the tallest plant was observed in T2 (100%N+44%P+83%K) with a mean of 24.27cm, followed by T1 (5%N+2%P+2.5%K) and T3 (6.10%N+0.376%P+3.09%K) with a mean of 23.17 cm and 22.97 cm respectively. However, T4 (13%N+0%P+38.3%K) and T5 (6.10%N+0.376%P+3.09%K) are comparable to each other and the shortest was recorded in T4 (13%N+0%P+38.3%K) with a mean of 19.68 cm.

It contains similar compounds to nutrients required by plants, making it an excellent fertilizer that is easily absorbed by hydroponic lettuce plants (Khodijah et al., 2021). The higher concentration of the AB mix solution, the higher nutrients it contains which support the plant's vegetative growth such as an increase in length. Similarly, plants take nitrogen in the form of NO3-(nitrate) and NH4+ (ammonium) to stimulate plant growth, cell proliferation, and disease resistance (Leghari et al., 2016). However, in the premise of this study, increasing the amount of AB mix concentration doesn't always stimulate plant height, thus, the appropriate amount of Nitrogen in the AB mix concentration was necessary for plant growth. A similar result is obtained in the study of Hidayat et al., (2021).

2. Average number of leaves

Table 2 displays the leaf production of lettuce grown in aeroponics system filled with various growing solutions. Results revealed that significant differences among treatment means (LSD, p0.05). The table further shows that the average number of leaves is ranging from 11.43 to 12.23. The T3- (6.10%N+0.376%P+3.09%K) nutrient solution has the highest leaf production of lettuce plants among the others grown in aeroponics with a mean of 12.23. Followed by T2 (100%N+44%P+83%K), T4 (13%N+0%P+38.3%K), and T5 (5%N+7%P+9%K) have a comparable significant difference respectively. The lowest leaf production was recorded in the lettuce plants grown in T1 (5%N+2%P+2.5%K) nutrient solutions 11.43.

On 7 DAT shows that there was no significant difference among the treatments. However numerically, the highest mean average numbers of leaves were observed in T1 (5%N+2%P+2.5%K) and T4 (13%N+0%P+38.3%K) nutrient solution

Table 2. Average number of Leaves

	No. of DAYS AFTER TRANSPLANTING(DAT)				
Treatment	7	14	21	28	35
T1- (5%N+2%P+2.5%K)	5.13	6.63 [b]	8.13 [a]	9.50 [a]	11.43 [b]
T2- (100%N+44%P+83%K)	5.03	6.97 [a]	8.27 [a]	9.37 [a]	12.13 [a]
T3- (6.10%N+0.376%P+3.09%K)	5.10	6.97 [a]	8.17 [a]	9.57 [a]	12.23 [a]
T4- (13%N+0%P+38.3%K)	5.13	6.93 [a]	8.03 [a]	9.30 [a]	12.07 [a]
T5- (5%N+7%P+9%K)	4.97	6.33 [a]	7.57 [b]	8.93 [b]	11.90 [a]
	5.072	**6.76**	**8.034**	**9.33**	**11.95**
P-value	ns	*	*	*	*

Means with the same letters are not significantly different at P≤ 0.05 level of (LSD).
ns– not significant
* - significant
** - highly significant

with a mean of 5.13, followed by T3 (6.10%N+0.376%P+3.09%K), T2 (100%N+44%P+83%K) and T5 (5%N+7%P+9%K) with a mean of 5.10, 5.03 and 4.97 respectively.

On 14 DAT, the highest leaf production was observed in T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K) and T5 (5%N+7%P+9%K). And the result showed significant difference over T1 (5%N+2%P+2.5%K). However numerically, T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K) had the highest leaf production with a mean of 6.97 followed by T4 (13%N+0%P+38.3%K), T5 (5%N+7%P+9%K) and T1 (5%N+2%P+2.5%K) with a mean of 9.93, 6.63 and 6.33 respectively.

In addition, at 21 DAT, results showed that there was a significant difference of T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K) over T5 (5%N+7%P+9%K). However numerically, T2 (100%N+44%P+83%K) had the highest mean of 8.27 followed by T3 (6.10%N+0.376%P+3.09%K), T1 (5%N+2%P+2.5%K), and T4 (13%N+0%P+38.3%K). while T5 (5%N+7%P+9%K) had the lowest leaf production with a mean of 7.57.

Moreover, on 28 DAT the highest leaf production was observed in T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K) over T5 (5%N+7%P+9%K). The results showed significant difference over T1

(5%N+2%P+2.5%K). Numerically, the highest leaf production was determined in T3 (6.10%N+0.376%P+3.09%K) with a mean of 9.57 followed by T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), T4 (13%N+0%P+38.3%K) and T5 (5%N+7%P+9%K) with a mean of 9.50, 9.37, 9.30 and 8.83 respectively. And T1 (5%N+2%P+2.5%K), T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K) are comparable to each other.

Furthermore, on 35 DAT results showed that there was a significant difference of T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K) and T5 (5%N+7%P+9%K) over T1 (5%N+2%P+2.5%K). Numerically, T3 (6.10%N+0.376%P+3.09%K) had the highest mean of 12.23 followed by T2 (100%N+44%P+83%K), T4 (13%N+0%P+38.3%K), and T5 (5%N+7%P+9%K) with a mean of 12.13, 12.07, 11.90 respectively. The lowest leaf production was T1 (5%N+2%P+2.5%K) with a mean of 11.43. However, T2 (100%N+44%P+83%K), T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K) and T5 (5%N+7%P+9%K) are comparable to each other.

This result confirms the study of Ramos (2022), Santiago (2021) and Borres et al. (2022) who reported that using commercially available inorganic nutrient solution (SNAP & Master blend) had the optimum level of nutrients for horticultural growth and development. Using organic nutrient solution exhibited poor performance compared to using chemical nutrient solution as reported by Santiago (2021) and Phibun watthana wong & Riddech (2019).

B. Average weight of Lettuce

Table 3. Average weight of the plant (g)

Treatments	Average Weight (g)
T_1- (5%N+2%P+2.5%K)	16.60 ^{b}
T_2- (100%N+44%P+83%K)	23.43 ^{a}
T_3- (6.10%N+0.376%P+3.09%K)	17.17 ^{b}
T_4- (13%N+0%P+38.3%K)	15.10 ^{b}
T_5- (5%N+7%P+9%K)	15.43 ^{b}
P-value	**8.31**
	**

Means with the same letters are not significantly different at P≤ 0.05 level of (LSD).
ns– not significant
* - significant

As displayed in the Table 3, the weight of lettuce grown in aeroponics system filled with various growing solutions. The average weight of plant showed highly significant differences among all treatment means (LSD, p0.05). It can be seen that the lettuce weight is ranging 23.43g to 15. 10g. The heaviest plant weight in aeroponics filled with T2- (100%N+44%P+83%K) nutrient solutions is 23.23g followed by T3 (6.10%N+0.376%P+3.09%K) with a mean of 17.17 g, T1 (5%N+2%P+2.5%K) with a mean of 16.60, T5 (5%N+7%P+9%K) with a mean of 15.43 and T4 (13%N+0%P+38.3%K) with a mean of 15.10 respectively. Statistically, T2-(100%N+44%P+83%K) was highly significant difference over T1 (5%N+2%P+2.5%K), T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K), T5 (5%N+7%P+9%K) and T3 (6.10%N+0.376%P+3.09%K), T4 (13%N+0%P+38.3%K) and T5 (5%N+7%P+9%K) and T1 (5%N+2%P+2.5%K) are comparable to each other. Meanwhile, the lightest plant weight is recorded in the lettuce plants grown in T4- (13%N+0%P+38.3%K) nutrient solutions is 15.10g.

Moreover, T2 -(100%N+44%P+83%K) has the higher number of marketable yields, and higher harvest index, Bio voltin and Water with higher number of non-marketable head and Nutri Hydro with the higher non-marketable head weight per box. It was reported by William and Nelson (2014) using conventional inorganic fertilizer cultivation produced heavier of fresh weight as compared to lettuce grown in organic

nutrient solution.

This is similar to the findings of Harahap et al. (2020), who found that increasing the nutritional concentration of the AB mix increased the weight of Pak Choi (Brassica chinensis).

Cost and Return Analysis

In addition, the price cost of each material was divided depending on its life span (LS). Therefore, T1 (5%N+2%P+2.5%K) has a total amount of five hundred ninety pesos and thirtyeight cents (590.38), T2 (100%N+44%P+83%K) has five hundred eighty pesos and thirty-eight cents (580.38), T3 (6.10%N+0.376%P+3.09%K) has five hundred sixty-seven pesos and thirty-eight cents

Table 4. Cost and Return Analysis

	No. of DAYS AFTER TRANSPLANTING(DAT)				
Treatment	7	14	21	28	35
T1- (5%N+2%P+2.5%K)	5.13	6.63 [b]	8.13 [a]	9.50 [a]	11.43 [b]
T2- (100%N+44%P+83%K)	5.03	6.97 [a]	8.27 [a]	9.37 [a]	12.13 [a]
T3- (6.10%N+0.376%P+3.09%K)	5.10	6.97 [a]	8.17 [a]	9.57 [a]	12.23 [a]
T4- (13%N+0%P+38.3%K)	5.13	6.93 [a]	8.03 [a]	9.30 [a]	12.07 [a]
T5- (5%N+7%P+9%K)	4.97	6.33 [a]	7.57 [b]	8.93 [b]	11.90 [a]
	5.072	**6.76**	**8.034**	**9.33**	**11.95**
P-value	ns	*	*	*	*

Note: The price of lettuce, and all the cost of materials are based on year 2023-2024

Table 4, presents the of cost and return analysis. In which, among all the treatments, T2 (100%N+44%P+83%K) nutrient solution had the highest gross sale with PHP 1117.60, Cost and Return Analysis Treatments Gross Sale Total Expenses Net Income ROI% T1- (5%N+2%P+2.5%K) Php 798.60 590.38 207.62 35.16% T2- (100%N+44%P+83%K) Php1117.60 580.38 537.22 92.56% T3- (6.10%N+0.376%P+3.09%K) Php 811.80 567.38 244.42 43.07% T4- (13%N+0%P+38.3%K) Php 739.20 572.38 166.82 29.14% T5- (5%N+7%P+9%K) Php 737.00 670.38 66.62 9.93% followed by T3 (6.10%N+0.376%P+3.09%K) nutrient solution with PHP 811.80, T1 (5%N+2%P+2.5%K) nutrient solution with PHP 798.60, T4 (13%N+0%P+38.3%K) nutrient solution with PHP 739.20, whilst T5 (5%N+7%P+9%K) nutrient solution had the lowest gross sale with PHP 737.00.

₱567.38, T4 (13%N+0%P+38.3%K) has five hundred seventy-two pesos and thirty-eight cents ₱572.38, and T5 (5%N+7%P+9%K) has six hundred seventy pesos and thirty-eight cents ₱670.38 for the total expenses.

In term of Net income, T2 (100%N+44%P+83%K) nutrient solution had the highest net income with five hundred thirty-seven pesos and sixty-two cents ₱537.62. Meanwhile T5 (5%N+7%P+9%K) nutrient solution had the lowest net income with only sixty-six pesos and sixty-two cents ₱66.62.

Furthermore, the highest ROI is obtained by T2 (100%N+44%P+83%K) nutrient solution with 92.56 percent, followed by T3 (6.10%N+0.376%P+3.09%K) nutrient solution with 43.7 percent, T1 (5%N+2%P+2.5%K) nutrient solution with 35.16 percent, whereas while T4 (13%N+0%P+38.3%K) with 29.14

percent and T5 (5%N+7%P+9%K) nutrient solution have Return of Investment with only 9.93 percent.

CONCLUSION

The study was laid out using Completely Randomized designed (CRD) with five treatments and replicated thrice. The treatments used were; T1-(5%N+2%P+2.5%K), T2-(100%N+44%P+83%K), T3-(6.10%N+0.376%P+3.09%K), T4-(13%N+0%P+38.3%K), T5-(5%N+7%P+9%K).

Growth parameters of lettuce plants grown using different nutrient solutions in closed aeroponics system in greenhouse conditions. The plant height, and number of leaves showed significant differences among the five treatments wherein best results was recorded in the treatment using (100%N+44%P+83%K) nutrient solution (T2) and least result was documented in the use of (13%N+0%P+38.3%K) nutrient solution (T4).

Yield parameters such as weight, showed significant differences among treatments. Aeroponics grown lettuce in (100%N+44%P+83%K) nutrient solution (T2) gave the best results but showed comparable results with (13%N+0%P+38.3%K) nutrient solution (T4).

RECOMMENDATIONS

Based on the results, the utilization of T2-(100%N+44%P+83%K) nutrient solution enhances the production of lettuce in aeroponics system. The nutrient solutions should also be tested in other vegetable to elucidate the growth advantages brought by these aeroponics growing system.

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