

Efficacy of Fermented Cow Manure and Madre de Cacao (*Gliricidia sepium*) Leaves as Nutrient Solution in Hydroponic Lettuce

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Abstract

Aim: The study was conducted to evaluate the use of fermented Madre de cacao leaves and cow manure as a nutrient solution for hydroponically grown lettuce and determine its effect on the growth and yield of the crop.

Methodology: The study used a two-factor experiment following the Completed Randomized Design (CRD) with two varieties of lettuce as Factor A and fermented cow manure and Madre de cacao leaves solutions as Factor B. The significant differences between two varieties of lettuce and level of solutions along growth and yield were further analyzed using Tukey Kramer Multiple Comparison Test at 0.01 alpha to determine its reliability.

Results: Results showed that when applied with 450 ml fermented Madre de cacao leaves and cow manure per 10 liters of water, the green lettuce obtained more leaves and achieved a heavier weight of lettuce and higher return on investment; Red variety was taller when applied with SNAP solution. The prepared solution has the potential for hydroponic production, especially in the rural areas where materials like Madre de cacao and cow manure are available.

Conclusion: For better yield performance and higher return on investment, the use of 450 ml fermented Madre de cacao and cow manure with 10 liters of water can be used as an alternative solution to hydroponic green lettuce production.

Keywords: Fermented, Cow Manure, Nutrient Solution, Hydroponic Lettuce

INTRODUCTION

Lettuce is usually grown in calm areas like Baguio City and some highland municipalities of Ilocos Sur. Thus, growing lettuce in lowland areas is difficult, especially during the dry season. It is why farmers seldom plant this kind of vegetables. Gonzaga et al. (2017) explained that leafy vegetable production in the Philippines is less diversified than in many other countries, especially those used in salads. As a result, Filipino farmers are less familiar with the production of leaf-type lettuce that is increasing in popularity with consumers.

The lettuce vegetables were mainly found in high-class restaurants and supermarkets. These nutritious vegetables are consumed mainly by high-profile families because ordinary citizens cannot afford high prices. The high cost of lettuce in the locality was brought about by transportation and spoilage.

Nowadays, hydroponic solutions are available in the market that is readily available and used by the growers, but because of limited growers' agricultural supply seldom get stocks for these products, so interested growers must buy online, which causes additional expenses. Lettuce grown in hydroponic using old Styrofoam fruit boxes is an alternative solution in the lowland area; it does not require large land areas, but it can be grown under the trees and some other shaded areas, and more production can be achieved using minimal water requirements.

Lagomarsino (2019) revealed that the advantages of using any of these hydroponic systems are manifold. Since there is no soil, there is no need to worry about having a plot of land, weeds, pathogens living in dirt, or treating the crops with pesticides. Water is also remarkably conserved due to the nutrient reservoir because the same water can be reused. Moreover, as most of these hydroponics farms are indoors, food can be produced all year round and even in the middle of a large city, like New York City.

Griffiths (2014) stated that hydroponics is an established branch of agronomy today. Progress has been rapid, and results obtained in various countries have proved it to be thoroughly practical and to have very definite advantages over conventional methods of agriculture. There are two chief merits of the soil-less cultivations of plants. One is that it may potentially produce much higher yields. Another is that hydroponics can be used in places where in-ground agriculture or gardening are not possible. Qureshi (2017) pointed out that hydroponics is a skill of plants growing in a soil-less medium. The plant roots feed the rich nutrient mixture, which contains all essential elements vital for developing a typical normal plant. The hydroponically grown plants are not organically different from those raised in normal soil. The organic and inorganic constituents must be broken down into inorganic components to feed the plant in the growing hydroponic system.

Badayos (2010) tested the potential of Madre de cacao as bio-organic fertilizer in an earlier study for eggplant production in Laguna. Observation revealed that the eggplants fertilized with 50 percent inorganic fertilizer plus 50 percent Madre de cacao were the most vigorous-growth rate faster. Also, the fruits were heavier than the other treatments. Among the plant resources documented, 'Kakawate' *G. sepium Leguminosae* is popularly known to farmers for its nutrient composition and pesticide property. The advantages of Madre de cacao as soil ameliorant presented in the reports of Badayos and Pangga (2002) and Pangga (2010).

Avya Agro (2021) stated that composted cow manure also contains beneficial bacteria, which gradually converts nutrients into readily accessible forms to release them without burning tender plant roots. Composting cow manure also produces about a third fewer greenhouse gases, making it environmentally friendly. Alcazar states that Madre de cacao leaves are rich in nitrogen and have anti-pest capabilities as a pesticide and fungicide to control different pests. It is also used as a forage crop for ruminants like goats and cattle. Applying fertilizer to plants has different methods, and one of them is foliar application. Moreover, Smart Fertilizer (2020) states that foliar feeding is a common practice of supplying nutrients to plants through their foliage. It involves spraying water-dissolved fertilizers directly on the leaves. Many believe that foliar feeding is favorable over soil application, and it is associated with higher yields and better fruit quality.

With the cited studies, the researchers seek to find out if fermented Madre de cacao leaves and cow manure can be used as an alternative hydroponic solution to the growth and yield of lettuce. This study, therefore, showcases the effectiveness of the available materials in the community, which usually the farmers do not utilize, and gave importance to these materials. Therefore, it can be a good extension service to make lettuce available in every home.

Objective

The study was conducted to determine the efficacy of fermented cow manure and Madre de cacao leaves as a nutrient solution in hydroponic for lettuce.

Precisely, to determine the growth and yield performance of lettuce vegetables using fermented Cow Manure and Madre de cacao leaves; the significant differences between Factor A and Factor B along with growth and yield and to determine the cost and return analysis on the yield of lettuce vegetables grown in a hydroponics system.

Hypothesis

Fermented Madre de cacao and cow manure do not favor lettuce plants' growth.

METHODS

Research Design

The study utilized the Factorial in Complete Randomized Design. It was a two-factor experiment conducted inside the greenhouse. According to Jayaraman (1999), A completely randomized design (CRD) is one where the treatments are entirely assigned at random so that each experimental unit has the same chance of receiving any one treatment.

Procedure

Treatments: The green variety and red variety used as factor A and for Factor B -levels of solution; T0 used as control following the manufacturer's recommendations. T1 used 250ml fermented Madre de cacao and cow manure added with 10 liters of water; T2 used 350ml fermented Madre de cacao and cow manure added with 10 liters of water and T3 used 350ml fermented Madre de cacao and cow manure added with 10 liters of water. Five kilograms of Madre de cacao and five kilograms of dried cow manure were collected and pulverized using mortar and pestle. The pulverized materials were positioned in a container with 10 liters of water added with 2 kilograms of molasses. The container was covered with manila paper and fermented for fifteen days until the juice was ready to harvest before the establishment of the study. The fermented juice was strained using a strainer placed in a clean container prepared according to the needed mixture and was distributed carefully to all the Styrofoam boxes used in the study. The 270 seedling plugs in water-culture are improvised/ recycled like cups of refresh and master. All Cups used were 8 oz size. Making eight holes in the bottom of cups is through the cutter, knife, sickle, and scissor. The coconut husk was prepared by removing the hard coat of the husk and chopping the inner part up to ¼ inch so that it would not drop from the holes of the cup. Then, sterilize the coco coir dust to ensure that free from diseases before putting it into the cups that serve as the growing medium in a hydroponic system. The ten-day-old seedling was transplanted singly to each cup, ensuring that roots reach the bottom of the cup before being placed to the Styrofoam box at least ½ inch of the bottom dipped into the solution. Plant debris was removed before the set-up of the experiments to avoid contamination. Therefore, the study was limited to evaluating the efficacy of prepared solutions to the growth and yield performance of the green and red variety of lettuce.

Ethical Consideration

The ethical considerations of the research are based on the BOT Resolution number 519 series of 2011.

Treatment of Data

All data gathered were arranged, tabulated, presented, and analyzed using the Two-way Analysis of Variance in Factorial CRD. For further analysis, A post hoc comparison test using Tukey's Honest

Significant Difference was used to compare the efficacy of the different levels of solution applied with the two varieties of lettuce in hydroponic production under the screen house.

RESULTS and DISCUSSION

Effects of Solution

Plant Height. T0 (SNAP Solution) garnered the highest means of 15.930 while T1 has a means of 8.625 which means that the SNAP solution is more effective when compared to the prepared solution. Analysis of variance shows a significant difference between treatment means on T0, T1, and T2. Significant differences were observed between T0 VS T1 to T3, but no significant difference was found in T2 VS T3. It was further tested with Tukey Kramer Multiple comparison tests at a 0.05 level of significance. The result implies that using SNAP solution significantly affects the height of lettuce plants in the hydroponics system compared to the prepared solutions. It shows that the fermented Madre de cacao and cow manure have lesser effects on hydroponics' height. The nutrients needed by the plants were highly associated with the available nutrients present in the SNAP solution. The results collaborate the statements of Agron (2012) that the main difference between SNAP hydroponics and other forms of hydroponics systems, according to Dr. Santos, is their nutrient solution, which they developed in their laboratory. "This is what we call the complete fertilizer supplementation. Usually, the fertilizers that can find in the market are just the essential nitrogen, phosphorus, and potassium (NPK), which we consider a misnomer. The nutrient solution that we have developed contains all the essential nutrients needed. This solution is now available in liquid form.

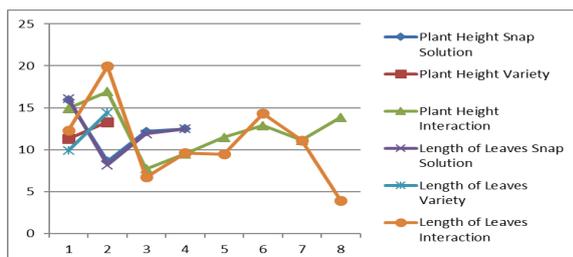


Figure 1. Height and Length of leaves of lettuce as affected by Individual Treatments in cm

Significant at Alpha=0.01 Means with the same subscript are not significantly different at Tukey Kramer Multiple Comparison test

Length of leaves. In terms of length of leaves, T0 appears the highest means of 16.120 while the lowest was T1 8.169. The result shows that the use of SNAP solution is more effective when compared to Fermented cow manure and Madre de cacao leaves because the nutrient present in SNAP solution is more suitable in the production of lettuce. However, the analysis of variance showed significant differences among treatment means even further tested using

Tukey Kramer Multiple Comparison. However, no significant difference was observed bet T2 vs. T3. According to Gapasin and Salas (2018), hydroponics production increases crop quality and productivity, which results in higher competitiveness and economic incomes. Simple Nutrient Addition System (SNAP) hydroponic had grown vegetables such as lettuce, sweet pepper, cucumber, and celery. Hydroponics is the growing of plants without soil, which uses a liquid nutrient solution with or without artificial media. Gonzales et al. (2020) state that the height of the lettuce plant, one to the fourth week after transplanting (WAT), reveals a consistent result that the Emperor- Crisphead produced the tallest lettuce with a mean of 8.4 to 29cm. It was followed by Greenwave Romaine with a mean of 7.6-29.7cm, and the shortest is NRBL-2 – Loose-leaf with a mean of 4.2cm to 19.6cm. The result shows that Emperor (Crisphead) variety was significantly used the nutrients available in the solution as manifested by its height which is significantly higher than Greenwave (Romaine).

Effects of varieties

Plant Height. V2 (green) marks the highest means of 13.303 while V1 (red) has a means of 11.309 T-test shows significant difference even when further tested to at 0.05 level of significance. Results imply that the green variety was taller than the red variety, and the result is related to the agronomic characteristics of the green variety that is more robust than the red variety. The findings support the statement that lettuce has a shallow roots system a constant supply of moisture is required during the growing season to maintain an actual plant growth rate (agriculture.vic.gov.au). Romaine requires 65-70 days to mature from seed. Providing plants with plenty of water and good soil will speed growing. The faster Romaine grows, the crisper the leaves. The mature plant can reach up to 20 inches tall. Romaine has compact dark green leaves with taller heads compared with other types of lettuce. It will shoot up quickly if provided with higher fertility (Gardening Channel, 2020).

Length of leaves. V2 (green variety) has obtained a mean of 14.443, while V1 (red variety) has a mean of 9.905. The result shows that the green variety is more robust when compared to the red variety. T-test shows a significant difference at 0.05 level of significance. The results collaborate the findings of Lagadan (2019), the successful growth of the varieties green wave lettuce and lettuce red leafy Rossa solar were almost the same as the growth of other vegetables in hydroponics. It includes vegetables such as lettuce, sweet pepper, cucumber, and celery successfully grown using SNAP hydroponics. However, they may differ in response to growth.

Effects of Varieties and Treatment Solution

Plant Height. In terms of height, the combination of T0V1 has the highest mean of 14.923. Alternately, the lowest is found in the T1V1 with a means of 7.721. It specifies that Red Variety(V1), when applied with SNAP solution, is taller when compared to green variety(V2). Analysis of variance shows no significant difference among treatment means. Results cooperate the statement of Lei and Engeseth (2021) that color, size, and compaction are strongly related to sensory attributes of lettuce, which further affect consumers' preferences evaluated and compared the visual quality of five lettuce varieties: Romaine, Green leaf, Red leaf, Butter, and Common lettuce growing in hydroponic, conventional, and organic conditions. No differences in lettuce visual quality were apparent between different growing systems, which was consistent with the researchers' observation.

Length of leaves. As reflected in figure 1, the length of leaves the combination of T0V2 marks the highest mean of 19.943. However, the lowest is the combination of T1V1 with a mean of 6.738. The result shows that the green variety responds well when applied to the Simple Nutrient Addition Program (SNAP solution), resulting in longer leaf than the red variety. The environment inside the screen house was favorable to the growth of the green lettuce variety. However, the micronutrients present in the prepared solution were insufficient to obtain complete leaves. A significant difference was observed when further tested on Tukey Kramer multiple comparison test at 0.01 alpha. According to Sanduy et al. (2021), lettuce needs proper nutrition to produce a marketable and nutritious head in soil systems. Many formulations are available on the market to provide the necessary amounts of N, phosphorus (P), and potassium (K), or N-P-K, along with the other required plant macronutrients. Additional formulation of secondary nutrients and micronutrients might be needed to supplement nutrition.

Effects of Solution

Table 1. Number of Lettuce Leaves and Width of Leaves as affected by Individual Treatments

Treatments	PARAMETERS (mean)		
	Number of leaves	Width of leaves	of
T ₀	0.000 _s	0.000 _s	
T ₁	9.674 _c	13.557 _c	
T ₂	6.026 _a	7.819 _a	
T ₃	8.117 _b	10.802 _b	
T ₃	8.397 _b	10.191 _b	
Variety	0.000 _s	0.000 _s	
V ₁ -Red	6.588 _b	9.092 _b	
V ₂ -Green	9.510 _a	12.092 _a	
Solution x Variety of lettuce	0.022 _s	0.000 _s	
T ₀ V ₁	7.586 _b	10.733 _{cd}	
T ₀ V ₂	11.762 _d	16.381 _e	

T ₁ V ₁	4.938 _a	7.038 _a
T ₁ V ₂	7.113 _b	8.600 _b
T ₂ V ₁	7.033 _b	9.410 _{bc}
T ₂ V ₂	9.200 _c	12.193 _d
T ₃ V ₁	6.793 _b	9.188 _b
T ₃ V ₂	9.966 _c	11.195 _d

Number of leaves. T0 obtained the highest mean of 9.674 and the lowest observed in T1 6.026. Results show that the SNAP solution plays an essential role in producing lettuce leaves in hydroponics; the nutrients present in the solution substantiate the requirements of the cultivar to produce more leaves. The nutrients that our presence in the prepared solutions was not enough to supply the needed nutrient requirements of the plant to produce more leaves. Analysis of variance revealed a significant difference between treatment means at 0.05 level of significance when further tested with Tukey Kramer test were observed between T0 vs., T1 to T3 but found no significant difference between T2 vs., T3. The findings corroborate the statements of Qureshi (2017), in hydroponics production, the roots are directly underwater, dissolved nutrients are given up to the plant right away without absorbing into the soil.

Width of leaves. T0 obtained the highest mean of 9.674, and the lowest was T1 which is 7.819. Analysis of variance proves significant differences between and among treatment means. The results prove that the SNAP solution was more effective when compared to fermented cow manure and Madre de cacao leaves when applied at lower concentration/250 ml per 10 liters of water. However, when applied at a higher concentration of 350ml to 450ml, every 10 liters of water can be enough to increase the width of leaves of lettuce plants. When further analyzed at Tukey Kramer, multiple comparison tests revealed a significant difference at 0.01 between T0 vs. T1 and T2 but no significant difference between T2 vs. T3. According to Sapkota (2019), Even though hydroponic culture can produce optimal plant growth (better yield and quality), its efficiency depends on many factors such as nutrient availability, crop genotype, growing method, and pest management. Although studies on the hydroponic culture of lettuce, the results have been inconclusive about the influence of cultivar and nutrient solution composition on lettuce performance.

Effects on Varieties

Number of leaves. The number of leaves green variety (V2) outrank the red variety (V1) with a mean of 9.510 and 6.588. T-test shows a significant difference between treatments at 0.01 level of significance. Results show that the number and length of roots in the green variety play a significant factor in the uptake of nutrients for the plants to grow. The results support the findings of Qureshi (2017) that plant roots take feed from the rich nutrient mixture, which consists of all essential elements that are very important for developing a typical plant.

Width of Leaves. The width of leaves of lettuce plant V2 (green variety) registered a mean of 12.092, and V1 (red variety) had a mean of 9.092. Results show that green lettuce is more robust than the red variety when planted in hydroponics and the ability of the plant to adapt itself in the lowland areas under greenhouse conditions. It has also been observed that most red varieties of lettuce characteristics are small to medium in size, elongated in shape, and curly. T-test showed a significant difference between treatment mean. The results substantiate the statement of Kaiser and Ernest (2016), Hydroponics is a method of growing plants without soil. Plants may be grown in a nutrient solution only (liquid culture) or supported by an inert medium (aggregate culture). All of the plants' nutritional needs are supplied through irrigation water in both systems.

Solution x Variety of lettuce

Number of leaves. T0V2 appears to be the highest number of leaves, and the lowest was T1V1 with a mean of 11.762 and 4.938. Results show that green variety V2, when treated with SNAP solution (T0), appeared to be the greatest number of leaves in lettuce plants. Significant differences were noticed in the analysis of variance. When further tested using Tukey Kramer Multiple Comparison test at 0.01 level of significance, the results imply that SNAP solution contributed to the development leaves and the nutrient in the solution is readily available for plant uptake compared to the prepared solutions. Significant differences between T0 V1 vs. T0V2 and T1V1. The results collaborate the statement of Aureus (2020) that plants require 16 nutrients, divided into three categories. First: carbon, hydrogen, and oxygen; Second: the macro/major nutrients: calcium, potassium, magnesium, nitrogen, phosphorus, sulfur; and third, the micronutrients: boron, chlorine, copper, iron, manganese, molybdenum, and zinc.

Width of leaves. T0V2 16.381 registered the highest mean, while T1V1 has a mean of 7.038, being the lowest. Results imply that the SNAP solution has a positive impact on the variety used in the study that contributed to the growth and development of the leaves. The prepared solutions did not provide enough nutrients that contributed to the increase in the width of lettuce used in the study. However, results also show a significant difference in ANOVA and further test by Tukey Kramer Multiple Comparison Test at 0.01. It supports the claim of Qureshi (2017) that hydroponic have several systems employed in the greenhouse production of crops. However, it has common nutrient elements that contain all essential macronutrients and micronutrients required by plants for growth, development, yield, and nutritional value. The plant roots take feed from the rich nutrient mixture, which consists of all essential elements that are very important for developing a typical plant.

Circumference of Stalk and Yield of Lettuce Effects of Solution

Circumference of the stalk. Table 2, T0 garnered the highest mean of 3.240 while T1 obtained the lowest mean of 2.386. Results show that the fermented cow manure and Madre de cacao leaves did not contribute to enormous stalk than the SNAP solution. It is because the nutrients present in the prepared solution might not be readily available for plant up-take, and the microelements needed by the plants to more enormous stalks have a slight amount that leads to smaller stalks. Analysis of variance showed significant effect even when further tested through Tukey Kramer multiple comparison test. The results corroborate the statement of Bo (2015) that raising plants in a non-soil medium will allow us to grow crops rapidly. Also, produce greater yields using the limited space of hydroponics farmlands and SNAP hydroponics. Also, he added that the SNAP hydroponics system saves on labor requirements.

Table 2. Circumference Of Stalk, and Yield of Lettuce After Harvest (cm)

Treatments	PARAMETERS (mean)	
	Circumference of stalk	Yield(grams)
Solution	0.000 ^s	0.025 ^s
T ₀	3.240 _b	113.762 _a
T ₁	2.386 _a	114.675 _{ab}
T ₂	2.887 _b	121.367 _b
T ₃	3.131 _b	120.000 _b
Variety	0.000 ^s	0.000 ^s
V ₁ -Red	2.238 _b	109.211 _b
V ₂ -Green	3.584 _a	125.691 _a
Solution x Variety of lettuce	0.000 ^s	0.051 ^{ns}
T ₀ V ₁	2.460 _a	100.333
T ₀ V ₂	4.021 _b	127.19
T ₁ V ₁	2.083 _a	107.517
T ₁ V ₂	2.690 _a	121.833
T ₂ V ₁	2.237 _a	116.167
T ₂ V ₂	3.567 _b	126.567
T ₃ V ₁	2.172 _a	112.828
T ₃ V ₂	4.090 _b	127.172

Significant at Alpha=0.01; s= significant; ns= not significant
Means with the same subscript are not significantly different at the Tukey Kramer Multiple Comparison tests, and means with no subscript are insignificant.

Yield. T2 obtained the highest mean of 121.367 grams, and T0 has a mean of 113.762 grams, being the lowest in terms of yield. It means that the application of 350 ml of fermented cow manure and Madre de cacao leaves significantly influences the weight of lettuce plants because of the nutrients present in the leaves of Madre de cacao and cow dung. Analysis of variance significantly different

between treatment means even when further analyzed using Tukey Kramer Multiple Comparison Test. Pagluan and Anical (2010) state that fermented plant juice contains rich nutrients that plants can easily absorb and bioactive substances that stimulate plant growth. Thus, cowpea and eggplant applied with fermented plant juice of spiny amaranthus produced the most significant number of fruits, resulting in a higher yield per hectare.

Effects of Varieties

Circumference of Stalk. As shown in table 3, variety 2 (green) marks the highest mean of 3.584. In contrast, variety 1 (red) has a mean of 2.238 which means that variety 2 (green lettuce) has a bigger stalk than the V1 (red variety) when applied with 450 ml Madre de cacao and cow manure added with 10 liters of water. The results are associated with the agronomical characteristics of the green varieties that are more vigorous compared to the red variety. T-test showed significant differences among treatment means. The results corroborate the statement that green lettuce is medium to large, growing in an elongated shape, and is narrow and small at the base fanning out to a wide, curly, loose top. The edge connects of the leaves connect to a central stalk, branch out in all directions, and are tender, smooth, and broad with many curls and frills (Specialty Produce, n.d.).

Yield. As shown in table 3, green variety or variety 2 registered the mean of 125.691 while variety 1 (red) was the lowest, 109.211. It displays that the green variety is productive when compared to the red variety. The vigorous characteristics of green lettuce contributed to the increase in weight at harvest. T-test showed significant differences among treatment means. The results collaborate the statements of Hamblin (2020) in the 29 best lettuce varieties for your garden that this hybrid cultivar is notable for being resistant to aphids, lettuce mosaic virus, and water mold. Soft, overlapping, crumpled leaves form a dense, rounded shape.

Solution x Variety of lettuce

Circumference of the stalk. The combination of T3V2 garnered the highest mean of 4.090, and T1V1 marks the lowest mean of 2.083. Results imply that 450 ml mixed with 10 liters of water application, the green variety V2 obtained an enormous stalk compared to the red variety. Analysis of variance revealed a significant difference between means and the same results when further analyzed using Tukey Kramer Multiple Comparison Test at 0.01 level of significance. According to Montegrando (2015), Madre Cacao is a nitrogen-fixing tree that can restore and maintain soil fertility. In addition, it contains phosphorus and potassium, which are also ideal for the growth and development of plants. Avaya Agro revealed that composted cow manure fertilizer makes an excellent growing medium for garden plants. Cow manure becomes a nutrient-rich fertilizer when turned into compost and fed to plants and vegetables. In the

study of Calleja (2010), the eggplants fertilized with 50 percent inorganic fertilizer plus 50 percent Madre de cacao were the most vigorous – growth rate was quicker, and the fruits were heavier than the other treatments.

Yield. Based on table 2, the combination of T3V2 obtained the highest mean in terms of yield with a mean of 127.172, while the lowest in T0V1 was 100.333. Results imply that green variety (V2), when applied with 450 ml of the solution mixed with 10 liters of water, contributed to a higher plant yield. ANOVA results show the significant difference among treatment means, the same results when further analyzed using the Tukey Kramer Multiple comparison tests at 0.05 level of significance. The results support the claim of uponics.com that the essential nutrients for the plant raised in hydroponics are Nitrogen, Potassium, Phosphorous, Calcium, Magnesium, Sulphur, Iron, Manganese, Copper, Zinc, Molybdenum, Boron, Chlorine, which is present in Madre de cacao leaves as proven by Plant Resources of South East-Asia that the analysis of gliricidia prunings (leaves and twigs) grown on an alfisol in Nigeria indicated a nutrient content per 100 g dry matter of N 3.1-3.6 g, P 0.13-0.20 g, K 2.6-2.7 g, Ca 1.2-1.6 g, Mg 0.3-0.45 g, lignin 11.6 g, cellulose 19.4 g, hemicellulose 12.2 g, polyphenols 1.6 g and a C/N ratio of about 13, and animal manure is rich in nutrients, including trace elements necessary for crop growth.

Table 3, T3V2 obtained the highest ROI at 1.678, being the highest, while T0V1 has an ROI of 0.68. Results show that V2 green lettuce, when applied with 450 ml mix with 10 liters of water, will give the highest return on investment.

Conclusion

Based on the study results, the growth performance of lettuce plants, green lettuce applied with SNAP solutions was taller, and leaves are more extensive than lettuce applied with 450 ml Fermented Madre de cacao and Cow Manure added with 10 liters of water. In terms of yield, green lettuce applied with 450 ml Fermented Madre de cacao and Cow Manure added with 10 liters of water are heavier than lettuce applied with SNAP solutions. Therefore, to achieve a heavier weight of lettuce and higher return on investment, the use of 450ml fermented cow manure and Madre de cacao leaves added with 10 liters of water solution can be used as an alternative input in hydroponic production. Another study shall be conducted to evaluate the reliability of the results, and phytochemical analysis shall also conduct to know the nutrient contents available in the prepared solution.

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Table 3. Cost and Return Analysis with ROI

Treatment	Yield Plants/g	Yield/ Harvest (kg) 288 hills	Cost Production set-up	Gross Income (150/kg)	Net Income	ROI
T ₀ V ₁	100.333	28.90	4651.8	4335	316.8	0.068
T ₀ V ₂	127.19	36.63	4651.8	5494.5	842.7	0.181
T ₁ V ₁	107.517	30.96	2051.8	4644	2592.2	0.792
T ₁ V ₂	121.833	35.09	2051.8	5263.5	3211.7	1.565
T ₂ V ₁	116.167	33.46	2051.8	5019	2967.2	1.446
T ₂ V ₂	126.567	36.45	2051.8	5467.5	3415.7	1.665
T ₃ V ₁	112.828	32.49	2051.8	4873.5	2821.7	1.375
T ₃ V ₂	127.172	36.63	2051.8	5494.5	3442.7	1.678

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