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Agronomic performance and profitability of coffee wildlings using different soil media mixtures

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ABSTRACT

The study was conducted from November, 2021 to April, 2022 at Cagayan State University Lal-lo, Cagayan, Philippines, to evaluate the agronomic performance and profitability of robusta coffee wildlings under nursery management using these parameters: (a.) NPK and pH analysis; (b) plant height; (c) number and length of leaves; (d) Stem girth; (e) Leaf Area Index, and (f) Cost and Return Analysis. A Randomized Complete Block Design was utilized using these treatments: Treatment 1- Alluvial soil (control), Treatment 2- Composted animal manure and Forest soil: CRH (1:1:1), Treatment 3- Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1),Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1), Treatment 5- Composted animal manure and Forest soil (1:1) and Treatment 6- Alluvial soil and CRH (1:1). The result of the study revealed that all the treatment tested were suitable for seedling propagation. The Analysis of Variance found that Treatment 4 acquired the tallest plant height, most numbered of leaves, stem girth, Leaf Area Index, Net Income, and Return On Investment at 60, 90, 120, 150, and 180 days after transplanting. However, the latter produced equivalent outcomes to Treatment 3. The results implied that whatever of the two (2) treatments used in the study had the same effects on the growth and development of coffee wildlings. Furthermore, all the treatments used resulted in a net profit and a strong Return on Investment. Hence, this study particularly Treatment 4 is highly recommended. Additionally, another trial of the study during wet season is also advised.

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INTRODUCTION

One of the world's most popular beverages is coffee and global consumption is predicted to expand. Non-traditional coffee-drinking countries in Africa, Asia, and Oceania are leading the way at plus 4.1 percent. Demand for conventional markets is predicted to increase by 1% in Europe and 2.5% in North America. The coffee industry's key growth drivers are out-of-home consumption innovations, online commerce potential, and unique brewed beverage types. Consumers are concerned about coffee quality and provenance, as well as the industry's social, environmental, and economic sustainability.

Coffee contains more antioxidants than tea, fruit, and vegetables combined. After analyzing the most popular beverages for bioactive non-nutrient content, instant coffee was discovered to have the highest total biophenol concentration. In two further studies, coffee was found to have the highest total antioxidant capacity when compared to other beverages such as green and black tea, and herbal infusions. The biochemical composition of a cup of coffee is determined by the level of roasting, the kind of bean (Arabica versus Robusta) and the coffee brewing procedure, which includes grind type.

Moreover, CSU-Lal-lo campus has a total land holding of more or less 1,500 hectares (based form latest land relocation survey by the Department of Environment and Natural Resources (DENR). Greater portion of this lot is utilized for poultry and livestock production, production of various annual crops such as cereals, legumes and high-value vegetable commercial crops (HVCC); and some for plantation crops like mango, coconut, cacao, coffee and other perennials.

Despite this, land utilization in the campus has never been maximized due to insufficient fund. It has an existing 11.4 hectares coffee plantation with a total of 3,801 trees (approximately 55-60 years old) at the Valena-Villa Verde site. Some of this were not productive and the plantation was most likely become forest because of grasses, forest trees, wild vine plants, and bamboo in between the coffee plants. Thus, because the previous administration did not pay attention on the existing coffee plantation, inventory of the coffee plants is not accessible and coffee berries were not harvested,thus, a coffee wildlings are scattered under the coffee trees everywhere in the area.

Thus, *Afrizal et. al.* 2023 state that nursery media is very important to producing healthy and goods robusta coffee and according to *Ali et. al. 2025* that improving the quality of coffee plant growth is one of the keys to a coffee plantation's success. The author's own experience demonstrated that Robusta coffee (*Coffea robusta* L.) with stems as thick as a common pencil or more can flower within a year. Thus, this investigation was undertaken to produce and manage coffee wildlings using different mixture of growing media (subtrates). To determine the N, P, K and pH analysis of the different growing medium (substrates. To evaluate the seedlings performance of the coffee wildlings using the following parameters: height of the plant, leaves length, number of leaves , stem girth, Leaf Area Index (LAI) and cost and return analysis.

MATERIALS AND METHODS

Securing supplies and materials

The supplies and materials needed in the study was purchased from a reliable dealer in the province.

Hauling of alluvial soil, rice hull, forest soil and animal manure

Alluvial soil, rice hull and animal manure were successfully collecting and hauled in the barangay of Sta Maria and in the Goat Project of the Campus. Forest soil was hauled in the forest area of coffee old plantation.

Soil media preparation

The rice hull was carbonized using improvised carbonizer for about 24 hours. Different soil media such as forest soil, alluvial soil, CRH and composted animal manure were mixed with enough water and bagged in a polyethylene bag.

Experimental design and treatments

The study used a Randomized Complete Block Design (RCBD). One thousand eight hundred polyethylene bags with a capacity of one kilogram soil were used in the study. Fifty polyethylene bags per treatment were filled-up with different mixture of growing media which represents the nine (9) treatments with four blocks and were replicated four times. The treatments were as follows:

Treatment 1- Pure Alluvial soil or control,

Treatment 2- Composted animal manure: Forest soil: CRH (1:1:1),

Treatment 3- Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1),

Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1),

Treatment 5- Composted animal manure and Forest soil (1:1) and

Treatment 6- Alluvial soil and CRH (1:1).

Soil media (substrates) analysis

To get the exact fertilizer grade of the subtrates (soil media) and recommended rate of fertilizer applied to the plants, a one (1) kilogram sample per treatment was submitted to the Department of Agriculture-Cagayan Valley Integrated Agricultural Laboratory (DA-CVIAL) for the analysis.

Collecting and transplanting of coffee wildlings

A one to one point five (1-1.5) inches robusta coffee wildlings in the old coffee plantation were successfully collected and transplanted immediately to into polyethylene bags filled with various soil media mixtures.

Weeding

Weeding was done two (2) times a month to ensure sanitation in the surroundings of the nursery and seedlings.

Fertilizer application

Fertilizer was applied based on the imposed recommended rate of the growing media analysis and was applied to the plants through drench method.

Pest management

A program for effective control of pests and diseases was carried out. Spraying of metharhizium was done early in the morning and late in the afternoon. This was applied upon damage of insects on leaves were appeared.

Data gathered

The data gathered from the study were the following:

a. NPK and pH of the Soil Media- to obtain the Nitrogen, Phosphorus, Potassium and pH content of the of the soil media, a one (1) kilogram of sample per treatment were submitted to the DA-CVIAL for the analysis.

b. Plant height (cm) - a 10 sample plants was measured using a meter stick from the base up to the tip of the seedlings. This was gathered from 30, 60, 90, 120, 150 to 180 days after transplanting.

c. Number of leaves developed (#) - this was determined by counting the total leaves of the 10 sample plants produced in every month until 6 months of its operation.

d. Length of leaves (cm) - this was obtained through measuring the leaves from the base up to the tip of the ten samples plants.This was gathered from 30, 60, 90, 120, 150 to 180 days after transplanting.

e. Stem girth (Ø) - stem girth of the 10 sample plants was measured using the vernier caliper. This was gathered from 30, 60, 90, 120, 150 to 180 days after transplanting.

f. Leaf area Index (LAI)- this was obtained through measuring the four (4) leaves per sample plant in a treatment from top to bottom of the leaves using graphing paper.

Cost and return analysis

Considering various assumptions, this was obtained by dividing net income with cost of production multiplied by 100.

$$\text{ROI (\%)} = \frac{\text{Net Income}}{\text{Total Cost of Production}} \times 100$$

Analysing the data

The gathered data was analyzed using the Analysis of Variance (ANOVA) of the Randomized Complete Block Design (RCBD) under STAR software.

RESULTS AND DISCUSSION

pH, Nitrogen, Phosphorous and Potassium Analysis of the mixed growing media

The soil analysis and fertilizer analysis in terms of pH, nitrogen, phosphorus and potassium content of the growing media used to the potted coffee wildlings is presented in Table 1. The pH of the soil in the different treatment did not show any significant differences with mean values ranging from 5.38 to 6.86. Thus, the pH indicated that the growing media used is under neutral which is very safe to use for coffee wildling production.

Table 1. NPK and pH Content of the different growing media (substrates) used in propagating of coffee wildlings.

Treatment	pH content	N %	P (ppm)	K (ppm)
Treatment 1- Alluvial soil (control)	5.38	2.00c	113.47b	283.33c
Treatment 2- Composted animal manure, Forest soil and CRH (1:1:1)	6.15	3.86a	172.23a	580.00a
Treatment 3- Alluvial soil, Composted animal manure, Forest soil and C RH (1:1:1:1)	6.86	3.96a	178.13a	583.33a
Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1)	6.64	3.80a	165.97b	543.33a
Treatment 5- Composted animal manure and Forest soil (1:1)	5.53	3.18b	129.18b	463.33b
Treatment 6- Alluvial soil and CRH (1:1)	5.50	3.00b	136.25b	370.00b
ANOVA result	ns	**	**	**

Significant result was obtained in the nitrogen content of the growing media that was analyzed at DA-CVIAL used for coffee wildlings production. Results shows that T_3 (Alluvial soil, Composted animal manure, Forest soil and CRH) obtained the highest nitrogen content of 3.96%, followed T_2 (Composted animal manure, Forest soil and CRH) with an analysis of 3.86%, T_4 (Alluvial soil, Composted animal manure and CRH) with an analysis of 3.80%, T_5 (Composted animal manure and Forest soil) with an analysis of 3.18%, T_6 (Alluvial soil and CRH) The with an analysis of 3.00%, and the least was obtained in T_1 with an analysis of 2.00%.

Significant result was also obtained in terms of the phosphorus content of the growing media that was applied in the coffee wildlings. Thus, the highest phosphorus content was observed in T_3 (Alluvial soil, Composted animal manure, Forest soil and CRH) with an analysis of 178.13 ppm, T_2 (Composted animal manure, Forest soil and CRH) with an analysis of 172.23 ppm, T_4 (Alluvial soil, Composted animal manure and CRH) with an analysis of 165.97 ppm, T_6 (Alluvial soil and CRH) with an analysis of 136.25 ppm, T_5 (Composted animal manure and Forest soil) with an analysis of 129.18 ppm. The least was observed in T_1 (Alluvial soil or control) with an analysis of 113.47 ppm.

The potassium content of growing media varied significantly among treatments. Highest content of potassium were observed T_3 Alluvial soil, Composted animal manure, Forest soil and CRH with an analysis of 583.33 ppm, followed by T_2 (Composted animal manure, Forest soil and CRH) with an analysis of 580.00 ppm, T_4 (Alluvial soil, Composted animal manure and CRH) with an analysis of 543.33 ppm, T_5 (Composted animal manure and Forest soil) with an analysis of 463.33 ppm, T_6 (Alluvial soil and CRH) with an analysis of 370.00 ppm, and the least was found in T_1 (Alluvial soil or control) with an analysis of 283.33 ppm.

Table 2. Plant height (cm) of coffee wildlings for six (6) months of seedling production using using different soil media mixtures.

Treatment	Plant Height					
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT
T_1- Alluvial soil (control)	18.00	39.18c	60. 28_c	81.32_c	112.33_c	154.68_c
T_2-Composted animal manure:Forest soil: CRH (1:1:1)	18.90	48.05b	68.44_{ab}	89.64_a	118.98_a	158.65_b
T_3- Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1)	20.21	51.34a	71.89_a	91.00_a	119.97_a	161.33_a
T_4- Alluvial soil, Composted animal manure and CRH (1:1:1)	19.92	50.62a	71.95_a	91.34_a	120.64_a	162.88_a
T_5- Composted animal manure and Forest soil (1:1)	18.08	45.93b	65.97_b	86.90_b	117.61_b	158.01_b
T_6- Alluvial soil and CRH (1:1)	18.06	44.87_b	64.56_b	86.50_b	116.30_b	156.70_b
Statistical Inference -Significant at *5%	ns	*	*	*	*	*

The significant result of these necessary nutrients which includes Nitrogen (N), Phosphorus (P) and Potassium (K) from analysis is very vital to the coffee wildlings for their growth and development. Hence, this study is in accordance to the study of Fernandez ML, 2020 titled "Yield and Nutrient Quality of peanut as influenced by mudpress and vermicast as organic fertilizer" where in the organic fertilizers that were applied to the plants could influenced a lot to our coffee plants.

Plant height of coffee wildlings for six months of operation

Table 2 shows the height result of the coffee wildlings using different soil media mixtures from 30, 60, 90, 120, 150 to 180 Days after Transplanting (DAT). Insignificant result was obtained to the coffee wildlings at 30 Days After Transplanting (DAT). However, the outcome revealed that the tallest plant height was obtained in Treatment 3 (Alluvial soil, Composted animal manure, Forest soil and CRH) with a mean of 20.21 cm, followed by plants applied in Treatment 4 (Composted animal manure, Forest soil and CRH), with a mean of 19.92 and 51.34 (cm), Treatment 2 (Composted animal manure: Forest soil: CRH) with a mean of 18.90 cm, Treatment 5 (Composted animal manure and Forest soil) with a mean of 18.08, Treatment 6 (Alluvial soil and CRH) with a mean of 18.06 cm and the least was found in T_1- Alluvial soil (control) with a mean of 18.00 cm.

Table 3. Number of developed leaves of coffee wildling for six months of operation using different soil media mixtures.

Treatment	Number of developed leaves (#)					
	30 DAT	60 DAT	90 DAT	120DAT	150 DAT	180 DAT
Treatment 1- Alluvial soil or control	4.59	5. 94	6.81_c	10.59_c	12.96_c	14.80_c
Treatment 2- Composted animal manure, Forest soil and CRH (1:1:1)	4.73	6. 69	7.98_{bc}	11.40_b	13.50_b	15.70_b
Treatment 3- Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1)	4.90	7.89	9.95_a	12.45_b	14.82_a	16.75_a
Treatment 4- Alluvial soil, Composted animal manure and C RH (1:1:1)	4.96	7.95	9.98_a	12.70_a	14.96_a	16.88_a
Treatment 5- Composted animal manure and Forest soil (1:1)	4.70	7.69	8.86_b	11.31_b	13.24_b	15.61_b
Treatment 6- Alluvial soil and CRH (1:1)	4.68	7.13	8.84_b	11.26_b	13.15_b	15.00_b
ANOVA Results	ns	ns	*	*	*	*

Plant height of Coffee wildlings at 60, 90, 150 and 180 DAT revealed significant results. Thus, Treatment 3 (Alluvial soil, Composted animal manure, Forest soil and CRH) and Treatment 4 (Alluvial soil, Composted animal manure and CRH) had a comparable results, but they were also comparable to Treatment 2, Treatment 5 and Treatment 6, and these three (3) treatments are also comparable to Treatment 1, where in results shows that Treatment 1(Pure Alluvial soil or control) obtained the lowest height of the plants in the six (6) month operation of the study. According to *Desta et al 2021,* the application of plant growth regulators to crops modifies hormonal balance and growth leading to increased yield, enhanced crop tolerance against abiotic stress and improved physiological trait of crops. This outcome is likely due to the increased amount of organic material in the substrate, which can improve infiltration, water retention, aeration, temperature, and root penetration.

Number of developed leaves of coffee wildlings for six months of operation

Table 3 shows the number of developed leaves of coffee wildlings using different soil media mixtures from 30, 60, 90, 120, 150 to 180 days after transplanting. Insignificant results was obtained at 30 days after transplanting with a mean ranging from 4.59 to 4.96.

However, significant results were garnered on the 60, 90, 120, 150 and 180 days after transplanting of the coffee wildlings. It showed that T_4 (Alluvial soil, Composted animal manure and CRH) obtained the most number of developed leaves with a mean of 7.95, 9.98, 12.70, 14.96 and 16.88, respectively.

It was followed by T_3 (Alluvial soil, Composted animal manure, Forest soil and CRH) with a mean of 7.89,9.95, 12.45, 14.82 and 16.75. T_2 (Composted animal manure, Forest soil and CRH) with a mean of 6.69, 7.98, 11.40, 13.50 and 15.70.T_5 (Composted animal manure and Forest soil) with a mean of 4.70, 7.69, 8.86, 11.31, 13.24, and 15.61. T_6 (Alluvial soil and CRH) with a mean of 7.13, 8.84, 11.26, 13.15 and 15.00, respectively and the least was found in T_1 (Alluvial soil or control) with a mean of 5.94, 6.81, 10.59, 12.96 and 14.80, respectively.

The significant outcome of this study is in supports to the results of Chiarawipa *et al* 2025 which states that Robusta coffee (*C. canephora*) influences the gas exchange in the leaves and carbon absorbed by the coffee plants.

Table 4. Stem girth (Ø) of coffee wildlings for six months of operation using different soil media mixtures.

Treatment	Stem Girth (Ø)					
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT
Treatment 1- Alluvial soil or control	0.20	0.90	1.01	2.95	3. 05	4. 00
Treatment 2- Composted animal manure and Forest soil: CRH (1:1:1)	0.40	0.85	1.17	2.20	3. 23	4.60
Treatment 3: Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1)	0.56	0.87	1.20	2.28	3.95	4.90
Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1)	0.58	0.97	1.28	2.32	3.98	4.96
Treatment 5- Composted animal manure and Forest soil (1:1)	0.35	0.60	1.09	2.12	3. 19	4.43
Treatment 6- Alluvial soil and CRH (1:1)	0.33	0.57	1.98	2.00	3.15	4.20
Statistical Inference	ns	ns	ns	ns	ns	ns

Stem girth of the coffee wildlings for six months of operation

Table 4 shows the stem girth of the coffee wildings using different soil media mixture from 30, 60, 90, 120, 150 to 180 Days after Transplanting. Outcomes revealed that the widest stem girth of the coffee wildings were obtained in Treatment 4 (Alluvial soil, Composted animal manure and CRH) with a mean of 0.58 dm, 0.97 Ø, 1.28 Ø, 2.32 Ø, 3.98 Ø and 4.96 Ø, respectively. This was followed by Treatment 3

(Alluvial soil, with a mean of 0.56 dm, 0.87 dm, 1.20 Ø, 2.28 Ø, 3.95 Ø and 4.90 Ø, Treatment 2 (Composted animal manure, Forest soil and CRH) with a mean of 0.40 Ø, 0.85 Ø,1.17 Ø, 2.20 Ø, 3.23 Ø and 4.60 Ø, Treatment 5 (Composted animal manure and Forest soil) with a mean of 0.35 dm, 0.60 Ø, 1.09 Ø, 2.12 Ø, 3.19 Ø and 4.43 Ø, Treatment 6 (Alluvial soil and CRH) with a mean of 0.33 Ø, 0.57 Ø, 1.98 Ø, 2.00 Ø, 3.15 Ø and 4.20 Ø, and the least was found in Treatment 1 (Alluvial soil or control) with a mean of 0.20 Ø, 0.90 Ø, 1.01 Ø, 2.95 Ø, 3.05 Ø and 4.00 Ø, respectively.

However, there were no significant numerical differences between treatments for this parameter, as evidenced by the Analysis of Variance (ANOVA). This basically means that whatever treatments were employed in the study could affect the stem girth of the coffee wildlings.

Length of leaves of the coffee wildlings using different substrates for six months of operation

The length of leaves of the coffee wildlings from 30, 60, 90, 120, 150 to 180 days after transplanting is presented in Table 5. Significant result was obtained on the length of leaves from 30 days to 180 days after transplanting, where in Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1) obtained the longest length of leaves with a mean of 13.25 cm, 17.50 cm, 21.97 cm, 27.40 cm, 31.82 cm and 34.96 cm, respectively. But the latter had a comparable effect to Treatment 3: Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1) with a mean of 13.18 cm, 17.34 cm, 21.83 cm, 27.25 cm, 31.44 cm and 34.66 cm. On the other hand, Treatment 6- Alluvial soil and CRH (1:1) and Treatment 5- Composted animal manure and Forest soil (1:1) is also comparable to Treatment 2- Composted animal manure and Forest soil: CRH (1:1:1) with a mean of 9.87 cm, 14.65 cm, 20.55 cm, 24.22 cm, 27.55 cm and 31.25 cm but this treatment is also comparable to Treatment 1- Alluvial soil or control with a mean of 9.43 cm, 13.04 cm, 19.44 cm, 21.21 cm, 25.05 cm and 28.32 cm ,respectively.

The length of leaves on coffee plants significantly influences their physiological and anatomical characteristics, which in turn affects photosynthesis and overall productivity. Research indicates that variations in leaf size can lead to changes in hydraulic properties and anatomical traits, impacting the plant's ability to photosynthesize effectively. This study conforms to the result on the study of leaf anatomical traits, including thickness and stomatal density, are strongly correlated with photosynthetic performance in Coffea arabica (*Xiao et. al.,* 2022).

Table 5. Length of leaves (cm) of the coffee wildlings for six months of operation using different soil media mixtures.

Treatment	Length of leaves (cm)					
	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT
Treatment 1- Alluvial soil or control	9.43$_c$	13.04$_c$	19.44	21.21$_c$	25.05$_c$	28.32$_c$
Treatment 2- Composted animal manure and Forest soil: CRH (1:1:1)	9.87$_c$	14.65$_b$	20.55$_b$	24.22$_b$	27.55$_b$	31.25$_b$
Treatment 3: Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1)	13.18$_a$	17.34$_a$	21.83$_a$	27.25$_a$	31.44$_a$	34.66$_a$
Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1)	13.25$_a$	17.50$_a$	21.97$_a$	27.40$_a$	31.82 $_a$	34.96$_a$
Treatment 5- Composted animal manure and Forest soil (1:1)	10.58$_b$	13.10$_c$	19.56$_c$	21.10$_c$	25.34$_c$	29. 47$_{bc}$
Treatment 6- Alluvial soil and CRH (1:1)	10.64$_b$	13.48$_c$	19.67$_c$	21.16$_c$	25.47$_c$	29.55$_{bc}$
Statistical Inference	*	*	*	*	*	*

Leaf Area Index (LAI) of coffee wildlings for six months of operation

The leaf area index of coffee wildlings from 30, 60, 90, 120, 150 to 180 days after transplanting using different soil media mixtures is presented in Table 6. Insignificant result was obtained on the leaf area index at 30 days after planting with mean values ranging from 5.25 to 5.88.

Table 6. Leaf Area Index (LAI) of Coffee Wildlings for six months of operation using different growing media.

Treatment	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	180 DAT
Treatment 1- Pure Alluvial soil or control	5.25	5.81$_{c}$	8.21$_{c}$	10.51$_{c}$	12.51$_{c}$	14.27$_{c}$
Treatment 2- Composted animal manure and Forest soil: CRH (1:1:1)	5.66	7.88$_{ab}$	9.22$_{ab}$	12.40$_{ab}$	15.88$_{ab}$	17. 95$_{ab}$
Treatment 3- Alluvial soil, Composted animal manure, Forest soi l and CRH (1:1:1:1)	5.77	8.81$_{a}$	10.69$_{a}$	13.18$_{a}$	16.92$_{a}$	18.80$_{a}$
Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1)	5.88	8.95$_{cd}$	10.93$_{a}$	13.51$_{a}$	16.98$_{a}$	18.85$_{a}$
Treatment 5- Composted animal manure and Forest soil (1:1)	5.58	6.50$_{b}$	8.87$_{b}$	11.92$_{b}$	13.63$_{b}$	15.88$_{b}$
Treatment 6- Alluvial soil and CRH (1:1)	5.48	6.46^{b}	8.84$_{b}$	11.88$_{b}$	13.58$_{b}$	15.69$_{b}$
Statistical Inference (*-Significant at 1% level)	ns	*	*	*	*	**

The leaf area index from 60, 90, 120 to 150 days after planting showed a significant results in using different growing media. Results revealed that T_4 (Alluvial soil, Composted animal manure and CRH) obtained the highest Leaf Area Index with a mean of 8.95 cm, 10.93 cm, and 13.51 cm, respectively. However, the latter had a comparable effects to T_3 (Alluvial soil, Composted animal manure, Forest soil and CRH) with a mean of 8.81 cm, 10.69 cm, and 13.18 cm, respectively. Thus, these two (2) treatments were comparable to T_2 (Composted animal manure, Forest soil and CRH) with a mean of 7.88 cm, 9.22 cm, 12.40 cm, and 15.88 cm. Next in rank was observed on the plants used with Composted animal manure and Forest soil (T_5) and Alluvial soil and CRH (T_6), which also had a differ effect in the application of Alluvial soil or control (T_1).

On the other hand, there was a highly significant result of the leaf area index at 180 days after transplanting. The results shows that T_4 (Alluvial soil, Composted animal manure and CRH) and T_3 (Alluvial soil, Composted animal manure, Forest soil and CRH) were comparable to each other but they also comparable to T_2 (Composted animal manure, Forest soil and CRH).

Table 7. Cost and Return Analysis of 1200 coffee willdlings using different soil media mixtures.

Treatments	Total cost of production	Gross income	Net income	ROI (%)
Treatment 1- Alluvial soil or control	3,000.00	6,000.00	3,000.00	100.00
Treatment 2- Composted animal manure and Forest soil: CRH (1:1:1)	3,450.00	7,000.00	3,550.00	102.89
Treatment 3- Alluvial soil, Composted animal manure, Forest soil and CRH (1:1:1:1)	3,650.00	7,400.00	3,750.00	102.73
Treatment 4- Alluvial soil, Composted animal manure and CRH (1:1:1)	3,400.00	7,400.00	4,000.00	117.64
Treatment 5- Composted animal manure and Forest soil (1:1)	3,300.00	7,000.00	3,700.00	112.12
Treatment 6- Alluvial soil and CRH (1:1)	3,300.00	7,000.00	3,700.00	112.12

Total	20,000.00	42,000.00	21,700.00

Thus, the latter was also comparable to T_5 (Composted animal manure and Forest soil) and T_6 (Alluvial soil and CRH) and these treatments also had a differ effect on T_1 (Pure Alluvial soil or control) with a mean ranging from 17.95 cm to 18.85 cm, respectively.

Moreover, the overall results revealed that T_4 (Alluvial soil, Composted animal manure and CRH) got the biggest leaf area and this simply imply the findings of Shekar D. *et al* 2014 which states that the larger the leaf area, the greater the plant's photosynthetic capacity. Furthermore, the Leaf Area Index indicates how much light passes through the coffee plant canopy.

Cost and return analysis of the coffee wildlings for six months of operation

Table 7 shows the cost and return analysis of 1,200 coffee wildlings generated for six months of production using different soil media mixtures. The Return on Investment (ROI) for the various treatments is listed in descending order: T_4 had 117.74%, T_5 and T_6 had both 112.12%, T_2 had 102.89%,T_3 had 102.73% and T_1 had 100.00%. The results showed that among the treatments used with various growing media, T_4-Alluvial soil, Composted animal manure and CRH (1:1:1) produced the best Return On Investment (117.74%), which simply means that for every peso invested in the study, there was a corresponding return of 1 peso and 17 centavos.

CONCLUSION

Based on the study's findings, it was determined that all of the treatments utilized in the study were suitable for coffee wildlings seedling production because the researcher generated a high income and ROI. It was further concluded, that among the growing media used in coffee wildlings production, Treatment 3 (Alluvial soil, Composted animal manure, Forest soil and CRH) obtained the highest neutral pH and NPK analysis. However, Treatment 4 (Alluvial soil, Composted animal manure and CRH) obtained the highest plant height, most developed leaves, longest Leaf Area Index (LAI) and Return On Investment (ROI), but the latter had a comparable results to Treatment 3 (Alluvial soil, Composted animal manure, Forest soil and CRH). This simply means that whatever of the two treatments utilized in the study had identical impacts on the growth and development of the coffee wildlings.

RECOMMENDATION

Based from the findings of the study, Treatment 4 (Alluvial soil, Composted animal manure and CRH) is highly recommended because it obtained the tallest plant height, produced more number of leaves, longest Leaf Area Index (LAI) and highest ROI. It is further recommended that another trial be undertaken for the wet season to provide more conclusive results.

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