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Seedling Vigor of Fuji Apple (*Malus Domestica* Var. Fuji) on Different Soil Media

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ABSTRACT

The fuji apple seedling is one of the varieties of an apple that can withstand tropical conditions. In the Philippines, no apple production despite of high consumption and demand. This study aimed to determine the seedling vigor of fuji apple on different soil pot mixes under polyhouse conditions. The study was conducted at the Plant Science Area, College of Agriculture, Mindanao State University Main Campus, Marawi City for 1 month and 17 days duration. The treatments were: Garden soil + sand (GS) a ratio of 1:1 (control); Bokashi (BK) a fermented organic matter; Cocopeat + garden soil + sand (CPGS) a ratio of 1:1:1; Vermicast + garden soil + sand (VCGS) a ratio of 1:1:1; and Rice hull + vermicast + garden soil + sand (RVGS) a ratio of 1:1:1:1. The experiment was laid out using Randomized Complete Block Design with four replicates. Depending on these results, it can be suggested that treatment CPGS could be used to fuji apple seedlings in a pot under polyhouse conditions. The treatment BK showed the lowest result on all parameters. However, it is recommended to conduct a further study on the bokashi by adding soil to assess the effect on the growth and development of fuji apple seedling.

INTRODUCTION

Apple (*Malus domestica*) is one of the most important temperate fruit crops in the North Western Himalayan region of India. It belongs to the family Rosaceae. It is liked throughout the world by all the people due to its pleasant taste and nutritional value. Apple is one of the leading fruits which are being grown in the temperate region of the world (Padhan *et al.*, 2019). In the past, it was generally regarded as a crop of the temperate zones but is increasingly cultivated under sub-tropical and even tropical conditions (Luckwill, 1984).

Filipinos have been familiar with apples since the Spanish colony from the 16th to the 19th century. Apple became a popular fruit in the Philippines and the apples that are sold in the market are imported from other countries. China supplied 96% of fresh apples imported into the Philippines in 2018, with 2.9% originating from the faraway United States and just 0.9% coming from New Zealand's apple orchards (Santiago, 2021).

Fuji is an apple variety that comes from Japan, where it was developed in the 1940s and released in 1962. Fuji is a cross between the widely grown Red Delicious, and Ralls Janet, which is much less well known but is probably the reason for Fuji's attractive pink flush. Fuji apples are quite widely grown, the main northern hemisphere production comes from Japan, China, and the USA. For most of the 20th century, the USA dominated world apple production (mainly with Golden Delicious and Red Delicious), but China is now the biggest single apple-growing region. Fuji accounts for more than 70% of apple production in China (Orangepippin, 2019).

Fuji is surely one of the more attractive modern apple varieties. Its main characteristic is the lovely pink speckled flush over a yellow-green background. It is also crisp and juicy, with dull white flesh which snaps cleanly. The flavor is predominantly sweet, very refreshing (especially if slightly chilled), but not particularly outstanding (Orangepippin, 2019).

Apple consumption will continue to grow at a moderate pace following rising income and population growth. There was an upward trend in apple consumption with an annual growth rate of 3.5% per year (IndexBox, 2018). The trend pattern, however, indicated some noticeable fluctuations being recorded throughout the analyzed period. The most prominent rate of growth was recorded in 2014 with an increase of 16% year on year. Global consumption peaked in 2019 and is expected to retain growth in the immediate term (Fruit Growers News, 2020). Its consumption is also encouraged as it goes in the saying that "an apple a day keeps the doctor away". The United States Department of Agriculture (USDA) said the Philippines importation of apples fluctuates from time to time as manifested in per capita consumption. From 1.03 kg per capita consumption in 2010 down to 0.61 kg in 2017, apple consumption becomes less. The three varieties with the greatest volume of production for the organic market are, in order, Gala, Fuji, and Honeycrisp (AgMRC, 2021).

This study was conducted to determine the suitable soil potting mix for fuji apple seedlings in a polyhouse condition. The growth of seedling must be secured first before indulging toapple fruit production. Many attempts were made to make success seedling production. However, no positive effects were observed. Furthermore, seedling vigor will be determined by looking at its parameters like seedling size, health, growth rate, and other factors. Effective seedling establishment is the first step in sustainable and profitable crop production and is therefore important for farmers (Taylor, 2016).

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Objectives of the Study

This study will be guided by the following objectives:

1. To determine the best soil pot mixing of fuji apple seedlings under polyhouse conditions.
2. To evaluate the growth and development of fuji apple seedlings under polyhouse conditions.

MATERIALS AND METHODS

Location and Duration of the Study

The experiment was conducted in a polyhouse in the nursery area of the Plant Science College of Agriculture, Mindanao State University Main Campus, Marawi City. It was conducted starting on February 17, 2022, and ends on April 6, 2022, with a 1-month and 17 days duration.

Crop/Variety Used

Fuji apple was used in the study because it belongs among the varieties that are adaptable to tropical conditions. This variety is a cross between Red Delicious and Ralls Janet apple. The Fuji apple was bought at Mindanao State University Commercial Center (MSU Comcent) Main Campus, Marawi City, Lanao Del Sur.

Treatments Used

This study uses the following treatments
T1 Garden soil + Sand (GS)- the ratio of 1:1
T2 Bokashi (BK)
T3 Cocopeat + Garden soil + Sand (CPGS)- the ratio of 1:1:1
T4 Vermicast + Garden soil + Sand (VCGS)- the ratio of 1:1:1
T5 Rice hull + Vermicast + Garden soil + Sand (RVGS)- the ratio of 1:1:1:1
The bokashi that was used in this study was procured from the Integrated Organic Farm in Kauswagan, Lanao Del Norte. Their bokashi is a mix of coco peat, rice hull, carbonized rice hull, and chicken dung. Also, the 1 liter of EMAS and 1 liter of molasses were mixed in 200 liters of water and added to the mixed bokashi for decomposition. The Effective Microorganism Activated Solution (EMAS) was from the mix of Effective Microorganisms (EM1) and molasses.

Materials in this study

Black polyethylene (3x3x5 inches), foot ruler plastic, digital vernier caliper, garden soil, cocopeat, vermicast, bokashi, rice hull, and sand.

Experimental Design Used

The experimental design used was Randomized Complete Block Design (RCBD) with five (5) treatments and four (4) replications. The treatment combinations were assigned randomly to the experimental units within a block. The presence of the nuisance factors will introduce systematic variation in this study. By using this RCBD experimental design can be controlled by blocking and can reduce the experimental error thereby increasing the precision of the experiment.

Cultural Practices and Management

Germination

The apple seeds were carefully removed from the apples. After extracting the seeds from the apples, the seed coat is also carefully removed to help the seeds to sprout fast. Keep the uncoated apple seeds (660 seeds) in a plastic container with a moistened paper towel and the paper towel should not over wet to avoid seed rot. Each container contains thirty (30) seeds. Cover the plastic container to avoid evaporation and to maintain the most. In about 1-3 days the seeds will sprout and in 4 days place them in a polybag of potting soil, but in this study, it was transplanted in 8 days. Each treatment was composed of 13 fuji apple seedlings in a total of 260 seedlings samples.

Fertilizer Application

The seedlings were fertilized using a 1% complete (14-14-14) solution. The 1% complete (14-14-14) solution was prepared by dissolving 10 g of the fertilizer materials in one liter of distilled water and applied to the fuji apple seedlings every 2 weeks after transplanting.

Weed Control

Weed was controlled throughout the duration of the study using manual method.

Water Management

The fuji apple seedlings were irrigated 3 days per week and irrigated early morning only.

Pest and Control

The fuji apple seedlings were placed in a polyhouse. The insect pest (green apple aphids and leafroller) occurrence was removed immediately. The disease (stem rot, root rot, damping off, fire blight, and apple scab) occurrence on fuji apple seedlings was not treated. No pesticides were applied in this study.

Data Gathered

The following data was gathered

Five sample seedlings from each replication were measured for the following parameters:
The following data was gathered:
Height (cm): The height was measured on days 12, 21, 30, and 36 by using a foot ruler plastic from the stem base to the tip of the longest leaf.
Number of Leaves: The total number of leaves was counted every 3 days after translating starting on day 3.
Girth: This was determined by using a Vernier caliper measuring stem size every 7 days after transplanting starting at day 10.
Crop Stand (%): This was calculated on day 36 after transplanting by using the formula:
Crop Stand = (Number of Plants Survive)/(Total Number of Seedlings Planted) x 100

Data Analysis

The data gathered were statistically analyzed using Statistical Tools for Agricultural Research (STAR).

Analysis of Variance was used to determine significant differences among treatment means. Least Significant Differences or LSD was used to separate means with significant differences.

RESULTS AND DISCUSSION

Seedling Height (cm)

The effect of the five treatments on the seedling height of fuji apple seedlings is presented in table 1. The result of the Analysis of Variances (ANOVA) in the height (Table 1) revealed that there were significant differences among treatments on day 12, day 21, day 36, and day 30. The Coefficient of Variance (CV) of the study result shows that below 10 means very good which is homogenous per plot followed by 11-20 is good, 21-30 is acceptable, and 31 above is unacceptable.

On Day 12, the CPGS, RVGS, and VCGS had a mean seedling height of 7.3 cm, 6.4 cm, and 6.3 cm respectively. These treatments were found comparable to GS with 6.9 cm. Only BK was found not significantly different from GS with a mean of only 5.8 cm.

On Day 21, CPGS had the highest seedling height with a mean of 10.3 cm and was found to perform better than the control with a mean of 8.6 cm. The RVGS had a mean seedling height of 9.3 cm and VCGS with a mean seedling height of 8.2 cm was found comparable to the control GS. BK performed the lowest with 7.1 cm.

On day 30, the CPGS had the highest mean of 12.8 cm followed by RVGS with 12.0 cm and VCGS with 10.6 cm. These treatments were found comparable to GS with 10.1 cm. The BK was found lowest mean with 7.3 cm and also this treatment was comparable to GS.

On day 36, still CPGS had the highest seedling height with a mean of 14.0 cm followed by RVGS with 13.4 cm, and VCGS with 11.7 cm. They are comparable to GS with 11.2 cm. The BK always performed the lowest with a mean of 7.0 cm.

A good growing medium or a soil combination can affect plant growth. A soil that contains, nitrogen and phosphorous are a critical determinant of plant growth and productivity (Razaq *et al*., 2017). A high N availability and its concomitant affect root and shoot biomass production (Barraclough *et al*., 1989). A Phosphorus is considered a primary nutrient for plant growth (Hinsinger, 2001), and P plays an important role in lateral root morphology and root branching (Lopez, 2003). Also, the presence of K is vital for plant growth because K is known to be an enzyme activator that promotes metabolism (Uchida, n.d.). Furthermore, the requirements of an apple to grow best could have a pH range of 5.5-6.5.

Among the five (5) treatments, treatment CPGS obtained the highest seedling height of fuji apple seedlings based on the result of the study from day 12 to day 36. In this treatment CPGS contains a growing medium of cocopeat (CP), according to Schell (2020) coir possesses significant amounts of natural potassium (K) and phosphorus (P). It also contains trace amounts of nitrogen (N), calcium (Ca), magnesium (Mg), boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn). Coconut coir is initially high in potassium (Kuack, n.d.) which this nutrient is vital for plant growth. The pH of coco coir is neutral approximately 5.8-6.8 (Coco and Coir, 2019). Based on the soil analysis, garden soil (GS) contained 0.11% of total N, 1.06 ppm of P2O5, and 104.72 ppm of K, and with a pH of 5.6. The coconut coir also has a total porosity plus the river sand (S) added in the mixture of treatment CPGS which gives better drainage that is preferable required need of fuji apple seedling. In addition, coco peat is a hormone-rich medium that offers plants an ideal rooting medium and provides protection against root diseases and fungus (Pill and Ridley, 1998), and is good for water retention and air characteristics.

The treatment RVGS has a growing medium of rice hull (R). The application of rice hull increased organic matter in the soil which in turn increased nitrogen in the soil and consequently increased nitrogen content in plant tissues (Kaniz and Khan, 2013). Based on the result of the conducted study by Akter *et al*. (2017), the phosphorus and potassium content in plant tissues also increased. Moreover, the rice hull improved the water holding capacity of the soil. The vermicast (V) was also added to the mixture of treatment RVGS. Typical nutrient analysis of casts is 1.5%–2.5% N, 1.25%–2.25% P_2O_5 and 1%–2%, K_2O at 75%–80% moisture content. The slow-release granules structure of earthworm casts allows nutrients to be released relatively slowly in sync with plant needs (Chaoui, 2010). The pH of the vermicast is neutral between 7.0 to 7.5. The garden soil (G) is also added in this treatment and river sand (S) which adds porosity for easy water and air movement.

The treatment VCGS has a combination of vermicast (VC) which enhances the rate of seedling growth, increases root numbers and biomass, improves root stress tolerance (Chelsea Green Publishing, n.d.), and has soil aeration, porosity, and water retention (Sherman, 2018). The vermicast contains 1.5%–2.5% N, 1.25%–2.25% P_2O_5 and 1%–2%, K_2O at 75%–80% moisture content (Chaoui, 2010). The garden soil (G) and river sand (S) were also added to this mixture.

A growing medium that contains treatment GS is garden soil (G). Soil organic matter serves as a reservoir of nutrients for crops, provides soil aggregation, increases nutrient exchange, retains moisture, reduces compaction, reduces surface crusting, and increases water infiltration into the soil (USDA-NRCS, n.d.) and river sand (S) also added in this treatment which adds porosity.

In treatment, BK obtained the lowest plant height from day 12 to day 36. Based on some research that used bokashi (BK) as an organic fertilizer or organic soil amendments (Pohan *et al*., 2019 and Christel, 2017) and has beneficial effects on plants. It increases microbial activity and helps your plant uptake nutrients at a higher rate (Way To Grow, 2019). However, in this study bokashi was used as a growing media, and no other media was mixed with the bokashi resulting in a slow increase in

plant height of the fuji apple seedlings.

Furthermore, 10 grams of complete fertilizer (14-14-14) was mixed with 1 liter of water and added to each treatment every 2 weeks. There is an additional nutrient NPK to the fuji apple seedlings that helps in increasing plant height.

In overall, the findings of the result on the highest plant height were found in treatment CPGS due to the soil combination contained which the required need of fuji apple seedling to grow. In addition, the soil pH is a key variable that affects plant growth (Gentili *et al.*, 2018) which causes fuji apple seedlings in treatment CPGS to have the highest plant height.

Table 1: Height (cm) on fuji apple seedlings by using different soil media

Treatments	Day 12	Day 21	Day 30	Day 36
GS	6.9^{ab}	8.6^{b}	10.1^{ab}	11.2^{a}
BK	5.8^{c}	7.1^{c}	7.3^{b}	7.0^{b}
CPGS	7.3^{a}	10.3^{a}	12.8^{a}	14.0^{a}
VCGS	6.3^{bc}	8.2^{b}	10.6^{ab}	11.7^{a}
RVGS	6.4^{bc}	9.3^{ab}	12.0^{a}	13.4^{a}
Anova	**	**	*	**
Cv (%)	6.32	7.71	20.54	19.41

**=significant at 5%, **=highly significant at 1%*

Treatment means with the same letter are not significantly different from each other at 5% and 1% level of significance by Least Significant Difference Test (LSD).

Number of leaves

The effect of the five treatments in increasing the number of leaves of fuji apple seedling is presented in table 2. The result of the Analysis of Variance (ANOVA) on several leaves (Table 2) there was no significant difference on day 3, day 6, day 9, day 12, day 15, day 21, day 30, day 33, and day 36, but there was a significant difference at day 18, day 24 and day 27. The Coefficient of Variance (CV) of the study result shows that below 10 means very good which is homogenous per plot followed by 11-20 is good, 21-30 is acceptable, and 31 above is unacceptable.

The findings showed that on day 3, the number of leaves among the soil pot mix used ranged from 3.42 to 3.62 leaves. On day 6 ranged from 4.10 to 4.33 leaves, at day 9 ranged from 4.67 to 5.07 leaves, at day 12 ranged from 5.07 to 5.67 leaves, at day 15 ranged from 5.61 to 6.54 leaves, at day 21 ranged from 6.66 to 7.81 leaves, at day 30 ranged from 6.73 to 10.19 leaves, at day 33 ranged from 7.08 to 10.91 leaves and at day 36 ranged from 8.04 to 11.34 leaves.

On Day 18, CPGS had the highest number of leaves produced with a mean of 7.19 and was found most produce more leaves than the control with a mean of 6.67. The RVGS had a mean of 6.83 and VCGS with 6.55 was found comparable to the control GS. BK produces the lowest number of leaves with 5.94.

On Day 24, CPGS, RVGS, and VCGS had a mean number of leaves of 8.70, 8.55, and 7.85 respectively. These treatments were found comparable to GS with 7.80. BK was found not significantly different from GS with a mean of only 5.45.

On Day 27, RVGS are now the highest number of leaves produced with a mean of 9.59 followed by CPGS with a mean of 9.49, and VCGS with a mean of 8.98. These treatments are comparable to GS with 8.53 leaves. Still, BK had the lowest number of leaves produced with a mean of 5.78.

Overall, the highest number of leaves produced from day 6 to day 24 was found in treatment CPGS, but from day 27 to day 36, the treatment RVGS were found the highest leaves produced (Table 2). Therefore, the treatment of CPGS and treatment RVGS are significantly influenced due to the combination and concentration of mineral nutrients available in the soil (Morgan and Connolly, 2013). Agronomist speaks of optimum soil health as a desirable physical condition in which the soil is a loose, porous assemblage of aggregates that permits relatively

Table 2: Number of leaves on fuji apple seedlings by using different soil media

Treatments	Day 3	Day 6	Day 9	Day 12	Day 15	Day 18	Day 21	Day 24	Day 27	Day 30	Day 33	Day 36
GS	3.56	4.22	4.86	5.38	6.11	6.67^{b}	7.25	7.80^{a}	8.53^{a}	9.05	9.87	10.11
BK	3.62	4.26	4.67	5.07	5.61	5.94^{c}	6.66	5.45^{b}	5.78^{b}	6.73	7.08	8.04
CPGS	3.54	4.33	5.07	5.67	6.54	7.19^{a}	7.81	8.70^{a}	9.49^{a}	10.00	10.75	11.13
VCGS	3.58	4.22	4.72	5.19	6.17	6.55^{b}	7.12	7.85^{a}	8.98^{a}	9.63	10.31	10.83
RVGS	3.42	4.10	4.82	5.33	6.17	6.83^{ab}	7.52	8.55^{a}	9.59^{a}	10.19	10.91	11.34
Anova	ns	ns	ns	ns	ns	**	ns	**	*	ns	ns	ns
cv (%)	5.44	4.92	4.45	5.33	5.98	4.27	7.39	12.88	20.08	21.71	21.04	22.77

*Note: ns=not significant. *=significant at 5%**=highly significant at 1%*

rigid movement of air and water and unobstructed germination and root growth. All treatments certain a considerable amount of organic matter which improves soil tilth (Hillel, 1998).

Treatment means with the same letter are not significantly different from each other at 5% and 1% level of significance by Least Significant Difference Test (LSD).

Girth

The effect of the five treatments in increasing stem girth by day of fuji apple seedling is presented in table 3. The Analysis of Variance (ANOVA) on girth (Table 3) revealed that there was no significant difference among treatments on day 10 and day 17, but there was a significant difference on day 24 and day 33. The Coefficient of Variance (CV) of the study result shows that below 10 means very good which is homogenous per plot followed by 11-20 is good, 21-30 is acceptable, and 31 above is unacceptable.

The research findings showed that on Day 10, the girth among the soil pot mix used ranged from 0.061 to 0.066 cm, and on Day 17 ranged from 0.066 to 0.074 cm. On Day 24, CPGS, RVGS, and VCGS had a mean girth of 0.090 cm, 0.083 cm, and 0.080 cm respectively. These treatments were found comparable to GS with 0.082 cm. Only BK was found not significantly different from GS with a mean of only 0.063 cm.

On Day 33, CPGS had the biggest value on girth with 0.115 cm. The CPGS, RVGS (0.109 cm), and VCGS (0.092 cm) were found comparable to the control, GS (0.100 cm). Still, BK had the smallest girth with 0.061 cm. Overall, the treatment CPGS obtained the biggest girth of fuji apple seedlings. This is due to the nutrient availability, favorable balance between air and water, and ideal for rooting medium of the growing media. An effective substrate should sustain a favorable balance between air porosity and water holding capacity, promoting root development and nutrient uptake (Barrett *et al*., 2016; Landis *et al*., 1990) to affect the development (girth) of a plant.

Table 3: Girth (cm) on fuji apple seedlings by using different soil media

Treatments	Day 10	Day 17	Day 24	Day 33
GS	0.063	0.074	0.082a	0.100a
BK	0.061	0.066	0.063b	0.061b
CPGS	0.066	0.072	0.090a	0.115a
VCGS	0.064	0.073	0.080a	0.092a
RVGS	0.066	0.073	0.083a	0.109a
Anova	ns	ns	**	*
Cv (%)	9.73	9.36	9.05	20.19

*Note: ns=not significant. *=significant at 5% **=highly significant at 1%*

Treatment means with the same letter are not significantly different from each other at 5% and 1% level of significance by Least Significant Difference Test (LSD).

Crop stand (%)

The effect of the five treatments on the crop stand of fuji apple seedlings is presented in table 4. The Analysis of Variance (ANOVA) revealed there was a significant difference among treatments with a Coefficient Variance (CV) of 20.79 (Table 4).

Among the five (5) treatments presented in Table 4, treatment CPGS has the largest value (84.62) in terms of crop stand, and next was treatment RVGS (73.08). This was followed by treatment VCGS, and GS respectively had 61.54 and 53.85 mean values. Then, the lowest in the treatment BK with a mean value of 11.54.

Therefore, the treatment of BK is not suited alone based on the result of the study. This will be suitable when added to other growing media to affect fuji apple seedlings. The cause of crop death on every treatment was due to damping off, root rot, and stem rot.

Treatment means with the same letter are not significantly different from each other at 5% and 1% level of significance by Least Significant Difference Test (LSD).

Table 4: Crop stands on fuji apple seedlings by using different soil media.

Treatments	Means (Day 3 to Day 36 crop stand %)
GS	53.85^{c}
BK	11.54^{d}
CPGS	84.62^{a}
VCGS	61.54^{bc}
RVGS	73.08^{ab}
Anova	**
cv (%)	20.79

*Note: **=highly significant at 1%*

Summary

The crop variety that was used in this study is the fuji apple (*Malus domestica* var. fuji). This study was conducted to determine the seedling vigor of fuji apple using different soil media. The experiment was conducted at the polyhouse located at the allotted research ground beside the Old Plant Science Building of the College of Agriculture, Mindanao State University-Main Campus, Marawi City, Lanao Del Sur from February 17, 2022, to April 6, 2022. Specifically, the objectives of this study are to evaluate the growth rate of apple seedlings, determine the best soil media, and evaluate the development of apple seedlings.

The experiment was laid out in a Randomized Complete Block Design (RCBD) with five (5) treatments and four (4) replications. The treatment was: GS (Garden Soil), BK (Bokashi), CPGS (Cocopeat + Garden soil + Sand), VCGS (Vermicast + Garden soil + Sand), and RVGS (Rice hull + Vermicast + Garden soil). The data gathered in this study are plant height (cm). several leaves, girth (cm), and crop stand.

It was observed that the highest plant height on day 12 was found in treatment CPGS with a mean of 7.3 cm followed by GS (68.8 cm), RVGS (64.3 cm), VCGS (63.1 cm), and BK (58.1 cm). On day 21, treatment CPGS still obtained the highest plant height. Next are treatment RVGS, GS, VCGS, and BK. From day 30 to day 36, still, the treatment CPGS obtained the highest plant height, followed by treatment RVGS, VCGS, and GS. The smallest plant height was still found in treatment BK.

Based on the number of leaves observed on day 3, treatment BK obtained the highest number of leaves, followed by VCGS, GS, CPGS, and RVGS. On day 6, treatment CPGS was now the highest number of leaves produced, and the next are treatment BK, GS, VCGS, and RVGS. So far, from day 9 to day 24 still, the treatment CPGS obtained the highest number of leaves produced. On treatment GS, VCGS, and RVGS are interchangeable when comes to second to the fourth most number of leaves produced, and the lowest number of leaves found in treatment BK. From day 27 to day 36, treatment RVGS was now the highest number of leaves produced, followed by CPGS, VCGS, and GS. And the lowest number of leaves were still marked under treatment BK.

In terms of the girth, the result shows that on day 10, the biggest value was found in CPGS and RVGS with the same mean of 0.066 cm and followed by VCGS, GS, and BK with the mean value of 0.064, 0.063, and 0.061 cm respectively. On day 17, the treatment GS obtained the biggest girth, and next are treatment RVGS and VCGS with the same mean, followed by treatment CPGS and BK. From day 24 to day 33, the biggest girth was now obtained on treatment CPGS and followed by RVGS, GS, and VCGS. The smallest girth is still marked under treatment BK.

At the end of the study, the result shows that the highest death of fuji apple seedlings was found in treatment BK with a mean of 11.54, followed by treatment GS (53.85), VCGS (61.54), and RVGS (73.08). The treatment CPGS has the highest in terms of crop stand with a mean of 84.62.

CONCLUSION

The study was carried out to assess the effect of different soil combinations on the growth and development of the fuji apple seedling. The target of using different soil combinations (CPGS, RVGS, CVGS, GS, and BK) was to obtain reasonable growth and development for seedling establishment. The study has revealed that treatment CPGS performed the best soil mix, which has a combination of cocopeat, garden soil, and sand on all parameters investigated. Thus, the soil condition found in the treatment CPGS is preferable for fuji apple seedlings. The relatively slow growth and development were recorded in treatment BK, and this could be a result of the soil characteristics that are not good for the fuji apple seedling to grow.

The result of the study can be used by the researchers in the production of more vigorous and healthy seedling of apple which can be planted in the tropical setting.

RECOMMENDATION

Based on the findings of the study the researcher recommends the best soil pot mix for growing fuji apple seedlings in a polybag or any container is treatment CPGS, a combination of cocopeat, garden soil, and sand. The researcher recommends conducting a study by adding any soil media to the bokashi to assess the effect on the growth and development of fuji apple seedlings. Also, the researchers and farmers can use this as a guide when they conduct a similar study but in other soil pot mix combinations on growing fuji apple seedlings.

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