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FIELD EVALUATION OF FOUR CITRUS SPECIES CUTTINGS THRU BALANCE FERTILIZATION PROGRAM

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ABSTRACT

This study was conducted at the Southern Philippines Agri-Business and Marine and Aquatic School of Technology (SPAMAST), Buhangin Campus, Malita Davao Occidental – Philippines.

The study was carried out in a Randomized Complete Block Design (RCBD) in factorial arrangement Factor A: Four Citrus species while Factor B: Organic & Inorganic Fertilizers.

The study aimed to evaluate the effects of different citrus species as applied with organic and inorganic fertilizer thru balance fertilization program in terms of : plant height, number of branches , number of shoots, stem diameter, and length of shoots and length of branches.

Results revealed that among the five parameters namely : plant height, number of leaves, number of shoots, stem diameter, and length of shoots obtained significant difference in Factor A (Citrus species) , while there was no significant effect on Factor B (Fertilizer) and no significant interaction of both Factor A and B respectively.

On the other hand, length of branches showed significant results in Factor A, B and so with its interaction of both Factor A and B.

INTRODUCTION

Citrus is one of the most popular fruit commodities in the world because of its refreshing flavor and nutritional values. Citrus species are small to medium-size shrubs or trees that are cultivated throughout the tropics and subtropics. Citrus is adaptable to many subtropical and tropical environments and soils and has traditionally been cultivated in orchard together with other important species such as coconut, breadfruit, papaya, and numerous others. One could say citrus is an essential component of any Pacific island (and subtropical or tropical) orchard. Citrus is primarily valued for the fruit, which is either eaten alone (sweet orange, tangerine, grapefruit, etc.) as fresh fruit, processed into juice, or added to dishes and beverages (lemon, lime, etc.). All species have traditional medicinal value. Citrus has many other uses including animal fodder and craft and fuel wood. Although commercial production for export markets has not been significant in Oceania, there is potential for small farmers to supply local markets with fresh fruit and unique varieties.

Fertility of the soil is regarded as a prerequisite for citrus cultivation. The usage of inorganic fertilizers over lengthy periods of time causes the physical and chemical properties of the soil to deteriorate (Ge *et al.*, 2018). The demand for food and agricultural commodities has risen dramatically, outstripping available supply (FAO, 2017). Increased productivity per unit area of cultivated land has the greatest potential to close this disparity. This may be accomplished by using inorganic fertilizer to improve soil fertility (Abobatta, 2020). Chemical fertilizers can create a slew of environmental issues, including soil nutrient loss, soil deterioration, and a reduction in helpful microbes (Dinca*et al.*, 2022).

For all crops, organic fertilizer such as vermicompost is an important part of nutrient management (Lim *et al.*, 2015). It improves soil health, increases agricultural yields, improves fruit quality, reduces expenses, and conserves natural resources (Hazarika and Aheibam, 2019). According to Pathak *et al.*, (2018), combining organic and inorganic fertilizers can result in a novel fertilizing method that improves soil characteristics while also sustaining horticulture crop yield.

Sexual propagation has a number of disadvantages, including decreased seed size, poor germination percentages, and high biotic stress sensitivity (Yadav *et al.*, 2011). Clonal propagation by stem cuttings might be a viable option for propagation (Patel, 2015).

Therefore, the study was conducted to determine the effect of nutrient management through organic and inorganic fertilizers on growth of citrus species cuttings. To fill the gap of the proper combination rate of organic and inorganic fertilizer on growth of citrus species cuttings may can maximize the growth and production as well to promote sustainable environment.

OBJECTIVES

The study aimed to determine the growth performance of citrus species cuttings as applied with organic and inorganic fertilizer.

Specifically, it sought to answer the following questions:

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1. Is there a significant difference on the plant height of citrus species cuttings as applied with organic and inorganic fertilizer?
2. Is there a significant difference on the stem diameter of citrus species cuttings as applied with organic and inorganic fertilizer?
3. Is there a significant difference on the length of branches citrus species cuttings as applied with organic and inorganic fertilizer?
4. Is there a significant difference on the number of branches citrus species cuttings as applied with organic and inorganic fertilizer?
5. Is there a significant difference on the length of citrus shoots species cuttings as applied with organic and inorganic fertilizer?
6. Is there a significant difference on the number of shoots of citrus species cuttings as applied with organic and inorganic fertilizer?

Conceptual Framework of the Study

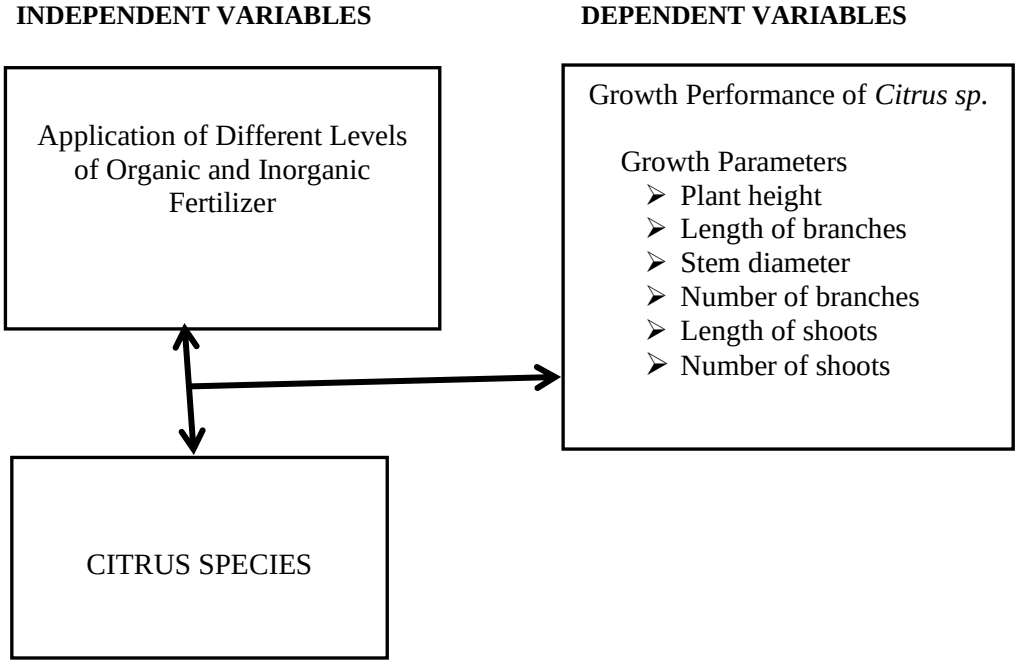

Fig. 1. Conceptual paradigm showing the relationship of independent and dependent variables

METHODOLOGY

Experimental Design and Treatments

The study was carried out using a Double Factor Randomized Complete Block Design (RCBD) with four treatments to be replicated three times. five sample cuttings were used per treatments. Citrus species stem cuttings seedlings were served as Factor A, while application of organic and inorganic fertilizers serve as Factor B. The following treatments were used:

Factor A(Species)	**Factor B(Fertilizer)**
V_1 – Pummelo	T_1 – 250 grams of Inorganic Fertilizer/hill
V_2 – Dalandan	T_2 – 2000 grams of Organic Fertilizer/hill
V_3 – Calamandarin	T_3 – 1000 grams of Organic and 125 grams of Inorganic Fertilizer/hill
V_4 - Calamansi	T_4 – 2000 grams of Organic and 250 grams of Inorganic Fertilizer/hill

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Experimental Field Layout

The study was conducted in a 2,450 m^2 area with a dimension of 35 x 70 meters. The area was divided into four (4) blocks with 5 x 20 meters per hills and alley of 10 meters, between replication and 5 meters between treatments was provided to facilitate farm management and gathering of data.

Sampling Materials and Randomization

A total of sixty (60) samples of different citrus species stem cuttings. There were 5 sample per replication with a total of 15 samples with tag for each treatment. Draw-lot technique was employed to identify the assigned treatment on its respective plots. Lay-outing and putting of placards for every treatment in each replication was established for proper identification.

Cultural Management and Practices

Area Preparation

This was a continuation research from previous study, which sixty (60) citrus seedling per species planted. The area was thoroughly cleaned by slashing to eliminate grasses and obstacles.

Fertilizer Application

Application of organic and inorganic fertilizer were applied separately. This was based on the fertilizer application recommendation for citrus plants. Organic fertilizer was applied at the rate specified on each treatment and replication. Second, application of inorganic fertilizer was done 1 week after application of organic fertilizer. Application of fertilizer was done only once using side dress approach was used to apply both fertilizers.

Weeding and Cultivation

Weeding was done as soon as weeds emerge while still young on the ground to avoid competition. Shallow manual cultivation was also done around the base after weeding to promote aeration and water absorption of the soil.

Pest and Disease Control

To prevent from the occurrence of pests and diseases monitoring was done. If pest was recurred, an appropriate control measures may be employed. Spraying of pesticide to the plants following the manufacturer's guide.

Data Gathered

Plant height

These data were taken by measuring the plant from the base to the last open leaf using a tape measure from 15 sample tagged in every treatment. This was done within 8 months after application.

Stem Diameter

Stem diameter was measured using digital caliper (mm); the measurement was made 3 cm above the ground in the own-rooted trees, and 10 cm above the ground (trunk diameter) from 15 sample tagged. This was done within 8 months after application.

Length of branches

This was taken from the primary branch of the citrus species cuttings measuring from the axil to twig of the cuttings using tape measure (cm). This was done within 8 months after application.

Number of branches

This was taken from by counting the number of branches of pomelo cuttings. This was done within 8 months after application.

Length of shoots

This was taken by measuring the length of shoots from the axil to twig using tape measure. This was done for 8 months after application.

Number of shoots

This was taken by counting of shoots of citrus species cuttings. This was done within 8 months after application.

Statistical Analysis

The various data to be collected was subjected to appropriate statistical data analysis. Analysis of Variance (ANOVA) was used to test or determine the significance among treatments at 0.5 % level.

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RESULTS AND DISCUSSION

Plant Height

Table 1 and Figure 1 revealed that on 8th month's observation, plant height of different citrus species increases over time. The data show that there were no interaction effects between different citrus species and application of organic and inorganic fertilizer on the plant height. The result revealed that there were highly significant among citrus on the plant height.

The combine application of both organic and inorganic fertilizers could increase the height of citrus species. Different citrus species was height significant to each other

Fertilizer provide and supply the nutrient of pomelo necessary for the growth and development. Combination of fertilizer with maximum amount showed the highest plant height compared to the application of organic and inorganic alone. This indicates the easy availability of nutrients from inorganic fertilizers and supplemented with organic fertilizer application, improves pomelo growth by supplying plant nutrients, including micronutrients, as well as improving the soil's physical, chemical, and biological properties, thereby providing a better environment for root development by improving the soil structure (Dejene and Lemlem, 2012).As a component of chlorophyll, nitrogen from fertilizer promotes cell proliferation and expansion in the apical meristem. The apical meristem's activity causes plant growth, which leads to an increase in plant height (Purbajanti *et al.,* 2019). This result was agreed by Getachew *et al*,(2016) found that the integrated application of organic with N fertilizer rate significantly improved productive plant height.

Furthermore, vermicompost stimulates to influence the microbial activity of soil, increases the availability of oxygen, maintains normal soil temperature, increases soil porosity and infiltration of water, improves nutrient content and increases growth, yield and quality of the plant (Arora *et al.,* 2011). However, result showed that the application of organic fertilizer obtained the lowest height of pomelo, in fact, that organic Fertilizer alone might not meet the plant's requirements due to the relatively low nutrient contents and the slow release of plant nutrients (Liang *et al.*, 2003). In addition, Kooij, (2020) reported that organic fertilizers must often be converted by soil organisms before becoming accessible to the plant as nourishment. A large amount of organic fertilizer should also be applied to provide the nutrients necessary by pomelo for its growth and development (Kooij, 2020).

Table 1. Plant height (cm) of Citrus Cuttings-derived Seedlings (CdS) as affected by the application of organic and inorganic fertilizer.

organic and inorganic fertilizer	Citrus species				B-Mean
	POMELO	DALANDAN	CALAMANDARIN	CALAMANSI	
Organic Fertilizer (RR)	294.13	256.6	145.87	131.67	207.07
Inorganic Fertilizer (RR)	289.77	209.13	140.87	103.47	185.81
50% RR (Organic and Inorganic fertilizer)	298.07	248.07	145.2	129.13	205.12
100% RR (Organic and Inorganic Fertilizer)	300.67	236.4	157.47	152.27	211.70
[1/] **A- Mean**	295.66[a]	237.55[b]	147.3525[c]	129.135[d]	

[1/]- means with the same letter superscript are not significantly different at 1% level of significant

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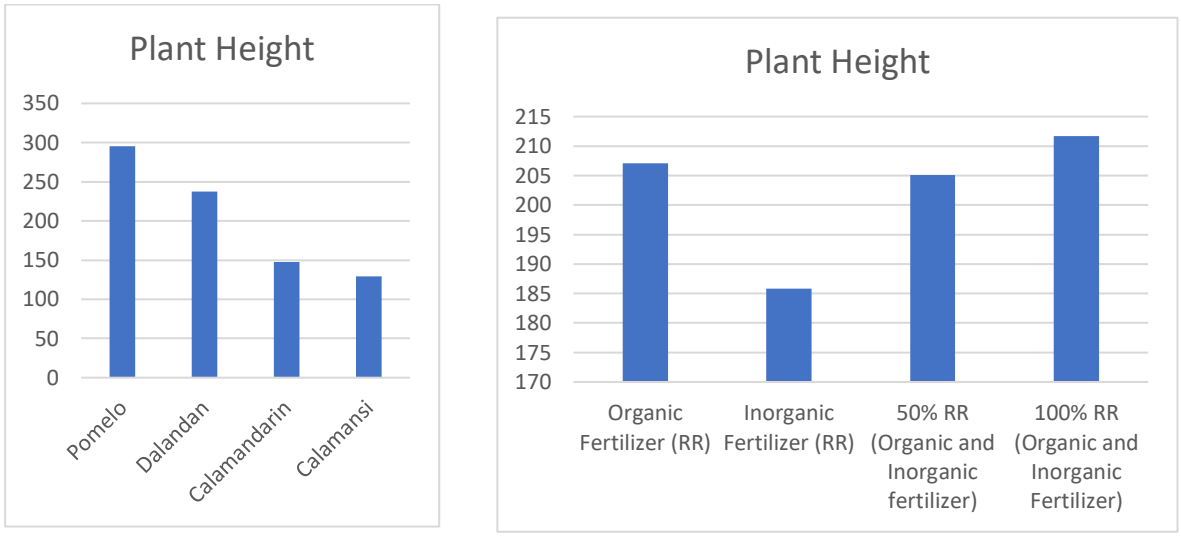

Figure 2. Plant height

Number of Branches

The data show in Table 2 that no significant interaction effects between different citrus species and application of organic and inorganic fertilizer on the number of branches. The result revealed that different citrus species affect the number of branches. Dalandan was height significant to three citrus species. but pomelo, calamandarin and calamansi are comparable. After 8 months of application of treatment, number of branches ranged from 17.03 to 21. 75 respectively.

Application of organic and inorganic fertilizer has showed effect for sustainability in soil and may positively affect length of branch (Choudhary *et al.*, 2021). Tolessa and Friesen (2001) reported that growth and yield were significantly increased by organic fertilizer application enriched with chemical fertilizers. Combined application of organic and inorganic sources of NPK reduces the nutrient losses, improves fertilizer use efficiency and thereby increased soil nutrient availability for the plants (Prativa and Bhattarai, 2011).

Further, organic fertilizers obtained lowest length of branch this was due to insufficient supply of nutrient. Organic fertilizer only release nutrients when the soil is warm and moist, which usually corresponds to when your plants are most in need. However, because organic matter is broken down by soil organisms, nutrients are released more slowly than with inorganic fertilizers (Miller, 2018). According to Agegnehu *et al.*, (2014) sole application of organic fertilizer is constrained by access to sufficient organic inputs, low nutrient content, high labor demand for preparation and transporting. Thus, the integration of organic and inorganic sources may improve and sustain crop yields without degrading soil fertility status.

Table 2. No. of branches of Citrus sp. Cuttings-derived Seedlings (CdS) as affected by the of organic and inorganic fertilizer.

Levels of organic and inorganic fertilizer	Citrus species				B-Mean
	POMELO	DALANDAN	CALAMANDARIN	CALAMANSI	
Organic Fertilizer (RR)	12.17	35.20	13.93	13.07	18.59
Inorganic Fertilizer (RR)	10.50	30.33	13.20	14.07	17.03
50% RR (Organic and Inorganic fertilizer)	13.97	31.27	13.53	16.20	18.74
100% RR (Organic and Inorganic Fertilizer)	18.40	32.27	21.13	15.20	21.75
[1/] -A- Mean	13.76[b]	32.27[a]	15.45[b]	14.64[b]	

[1/]- means with the same letter superscript are not significantly different at 1% level of significant

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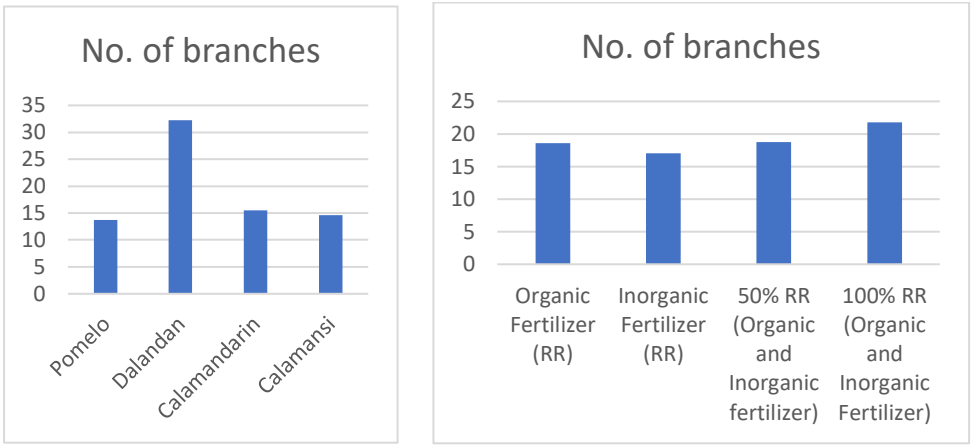

Figure 2. Number of branches

Number of Shoots

There was no significant effect between different citrus species cutting and application of organic and inorganic fertilizer on number of shoots developed per seedlings shown in (Table 3, Figure 3). Analysis reveal that different citrus species have significant different. Dalandan and calamandarin was significant to pomelo and calamansi but pomelo and calamansi were comparable. Regardless of the application of organic and inorganic fertilizer, the number of shoots developed per cutting mean ranged from 60.54 to 67.69 shoots. Result showed that Calamansi produced the greatest number of shoots with a mean of 67.69 shoots and the least was found in Calamandarin with a mean of 60.54 shoots.

The maximum combination of organic and inorganic fertilizer obtained the highest number of shoots this may due to the organic fertilizers help to improve the soil condition and inorganic fertilizers assure quick availability of essential nutrients, the combination of two proved better than single use of the each. Integrated use of organic and inorganic fertilizers may be a way to ensure sustainable agriculture and sustainable environment. Channaveerswami (2005) found better growth by using combination of organic and inorganic fertilizers than only inorganic fertilizers. Gonzalez et al. (2001), who reported that organic manure and chemical fertilizer which was supplied as essential nutrition at initial establishment stage of growth recorded the best results of the measured variables such as number of shoots of the plant.

Table 3. No. of Shoots of Citrus sp. Cuttings-derived Seedlings (CdS) as affected by the of organic and inorganic fertilizer.

Levels of organic and inorganic fertilizer	Citrus species				B-Mean^{ns}
	POMELO	DALANDAN	CALAMANDARIN	CALAMANSI	
Organic Fertilizer (RR)	29.90	125.33	73.27	37.93	66.61
Inorganic Fertilizer (RR)	25.23	107.73	73.07	42.67	62.18
50% RR (Organic and Inorganic fertilizer)	29.37	109.67	56.20	46.93	60.54
100% RR (Organic and Inorganic Fertilizer)	40.03	110.20	81.93	38.60	67.69
$^{1/-}$A- Mean	31.13^{c}	113.23^{a}	71.12^{b}	41.53^{c}	

$^{1/-}$ means with the same letter superscript are not significantly different at 1% level of significant

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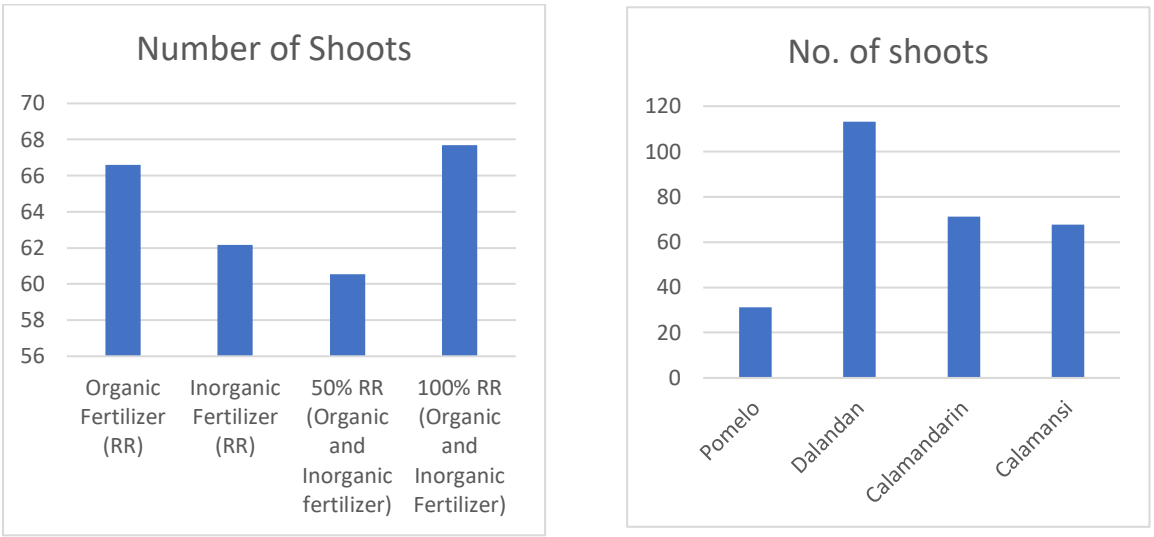

Figure 3. Number of Shoots

Stem Diameter

Table and Plate 2 statistically showed that there was highly significant in terms of stem diameter as applied with organic and inorganic fertilizer. The stem diameter increased at eight months of monitoring. The combination of fertilizer supplies the nutrient need to boost the development of stem diameter of pomelo. However, those plants grown organically and inorganically can be compared to pomelo applied with organic and inorganic alone.

According to Yang *et al.*, (2020), integrating organic and inorganic fertilizers significantly enhances soil organic matter and total nitrogen content, as well as improving the soil microenvironment that promote the growth of citrus resulting to increase of stem diameter. Qiu*et al.*, (2021) reported combining organic and inorganic fertilizer application stimulated root growth, enhanced the rate of nutrient distribution in citrus, and improved the exterior and internal quality of oranges. Stem diameter responds positively to the combined application of organic and inorganic fertilizers due to the presence of macro and micro nutrients in the organic matter (Muhammad *et al.*, 2003).

On the other hand, organic fertilizers resulted in the smallest stem diameter. This is due to the fact that organic fertilizers are frequently insoluble, and nutrients are only available when microbes convert them to soluble form (Phibunwatthanawong and Riddech, 2019). In comparison to inorganic fertilizers, organic sources deliver nutrients more gradually, decreasing the boom-and-bust pattern of plant growth development (Siavoshi *et al.*, 2011).

Table 4. Stem diameter of Citrus sp. Cuttings-derived Seedlings (CdS) as affected by the of organic and inorganic fertilizer.

Levels of organic and inorganic fertilizer	CdS				B-Mean
	POMELO	DALANDAN	CALAMANDARIN	CALAMANSI	
Organic Fertilizer (RR)	51.24	46.78	29.00	17.62	36.16
Inorganic Fertilizer (RR)	50.15	28.44	23.48	16.44	29.63
50% RR (Organic and Inorganic fertilizer)	55.28	32.55	21.85	19.81	32.37
100% RR (Organic and Inorganic Fertilizer)	56.56	35.26	25.58	19.94	34.34
A- Mean	53.31[a]	35.76[b]	24.98[c]	18.45[d]	

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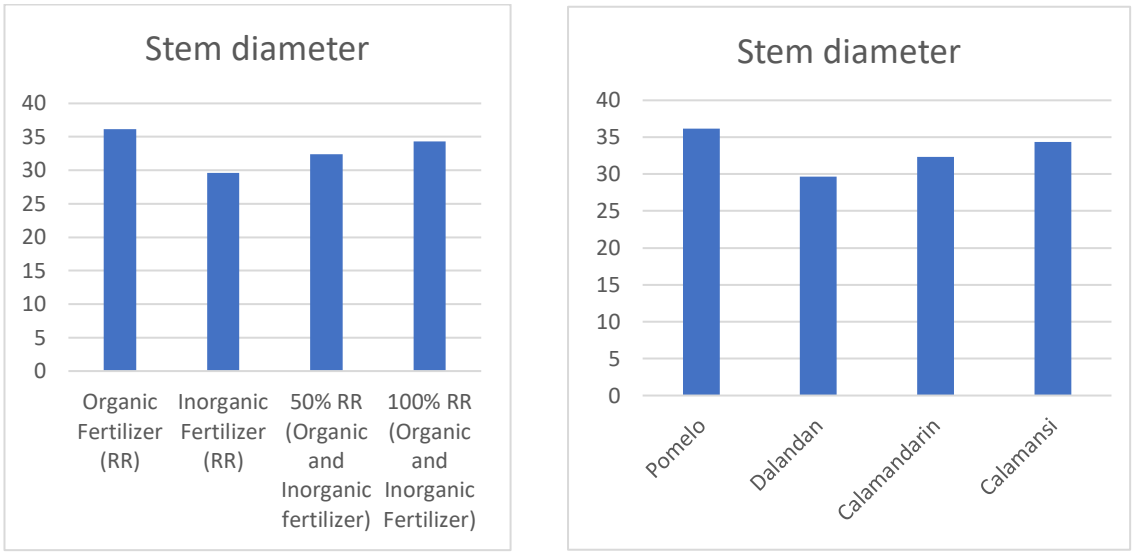

Figure 4. Stem Diameter

Length of Shoot

There was no significant interaction effect between citrus species and application of organic and inorganic fertilizer on the length of shoots (Table 5, Figure 5). Different citrus species showed significant difference in terms of length of shoots but not on the application of organic and inorganic fertilizer. Analysis of variance show that pomelo have significant different to the rest of species but dalandan, calamandarin and calamansi were comparable to this other.

It has been mentioned in the previous discussions pertaining to plant height that Nitrogen plays a significant role in plat growth. As stated by Leghari, et. al (2016), Nitrogen is most imperative element for proper growth and development of plants which significantly increases and enhances the yield and its quality by playing a vital role in biochemical and physiological plant. However, looking into the results of the study, there is no significant difference on the treatments with respect to different levels of fertilizers to the length of lateral branches.

A number of studies have been conducted on fertilizer practices of young citrus orchard trees. In general, young non-bearing trees are fertilized more frequently than mature trees, using smaller amounts of material for each application (Davies and Albrigo, 1994). Bester *et al.* (1977) studied application frequency of broadcast urea and liquid fertilizers on newly-planted 'Valencia' orange trees and found that trunk diameter was the same for trees fertigated six times per year compared with broadcasted fertilizer applied four times per year. Willis and Davies (1991) also found no effect on the length of lateral branches of 'Hamlin' orange when granular-type of fertilization is being utilized.

Table 5. Length of shoot of Citrus sp. Cuttings-derived Seedlings (CdS) as affected by the of organic and inorganic fertilizer.

Levels of organic and inorganic fertilizer	Citrus species				B-Mean
	POMELO	DALANDAN	CALAMANDARIN	CALAMANSI	
Organic Fertilizer (RR)	42.98	20.98	21.01	20.39	26.34
Inorganic Fertilizer (RR)	39.81	19.26	19.01	19.26	24.34
50% RR (Organic and Inorganic fertilizer)	48.49	22.01	18.65	22.08	27.81
100% RR (Organic and Inorganic Fertilizer)	50.25	23.15	18.73	23.15	28.82
[1/] A- Mean	45.38[a]	21.35[b]	19.35[b]	21.22[b]	

[1/] -mean with the same letter are not significantly different at 5% level l;

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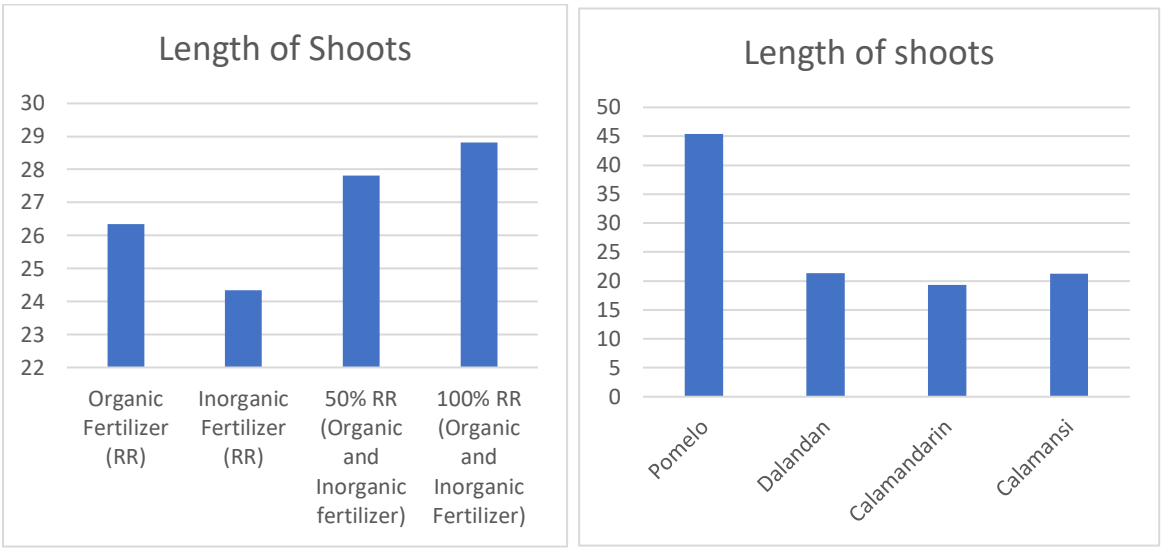

Figure 5. Length of shoots

Length of Branches

Table 6 and Figure 6 showed that application of fertilizer that there was no significant effect on the length of branch after 8th month of observation but on different citrus species there was a significant different. Pomelo obtained the highest length of branches. Inorganic fertilizers provide rapid release of nutrients and organic fertilizer (vermicompost) supply macro and micronutrients slowly for the plant (Akhter *et al.*, 2019). Application of organic and inorganic fertilizer has showed effect for sustainability in soil and may positively affect length of branch (Choudhary *et al.*, 2021). Tolessa and Friesen (2001) reported that growth and yield were significantly increased by organic fertilizer application enriched with chemical fertilizers. Combined application of organic and inorganic sources of NPK reduces the nutrient losses, improves fertilizer use efficiency and thereby increased soil nutrient availability for the plants (Prativa and Bhattarai, 2011).

Further, organic fertilizers obtained lowest length of branch this was due to insufficient supply of nutrient. Organic fertilizer only release nutrients when the soil is warm and moist, which usually corresponds to when your plants are most in need. However, because organic matter is broken down by soil organisms, nutrients are released more slowly than with inorganic fertilizers (Miller, 2018). According to Agegnehu *et al.*, (2014) sole application of organic fertilizer is constrained by access to sufficient organic inputs, low nutrient content, high labor demand for preparation and transporting. Thus, the integration of organic and inorganic sources may improve and sustain crop yields without degrading soil fertility status.

Table 6. Length of branches of Citrus sp. Cuttings-derived Seedlings (CdS) as affected by the of organic and inorganic fertilizer.

Levels of organic and inorganic fertilizer	Citrus species				B-Mean
	POMELO	DALANDAN	CALAMANDARIN	CALAMANSI	
Organic Fertilizer (RR)	121.32	56.86	51.78	56.83	71.69^{b}
Inorganic Fertilizer (RR)	112.54	43.86	49.58	43.53	62.38^{c}
50% RR (Organic and Inorganic fertilizer)	126.49	56.64	55.25	56.63	73.75^{b}
100% RR (Organic and Inorganic Fertilizer)	136.90	56.83	62.16	63.31	79.80^{a}
1/ A- Mean	124.31^{a}	53.54^{b}	54.69^{b}	55.08^{b}	

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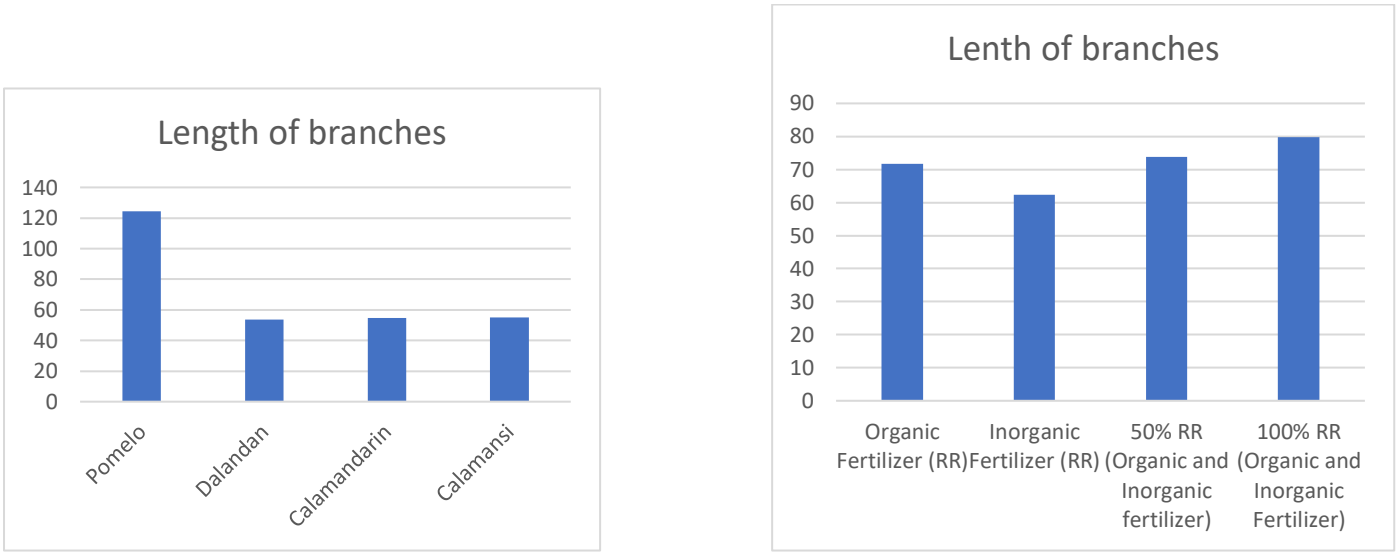

Figure 5. Length of branches

CONCLUSION

Field evaluation of different citrus species cuttings to applications of organic and inorganic fertilizers. Mainly, this study had two objectives: field evaluation of different citrus cuttings as applied by the application of organic and organic fertilizer under SPAMAST, Buhangin Campus, Malita, Davao Occidental condition

The results of the study are summarized as follows:

1. There were no significant interaction effects between the different citrus species and application of organic fertilizer on all parameter's treatment;
2. Fertilizer input increases pummelo growth over time. The highest growth and development were seen when an integrated organic and inorganic fertilizer was applied in a maximum ratio. It was found that fertilizer application provided the nutrients required for growth development specifically plant height, stem diameter, length of branch, and number of shoots of pummelo.
3. There was highly significant on citrus mean in all parameters but not significant in all parameter of treatment applied.

REFERENCES

1. ***ABOBATTA, W.F.*** *2020. Plant responses and tolerance to combined salt and drought stress. Salt and Drought Stress Tolerance in Plants, pp. 17-52.*
2. ***DINCĂ, L.C.; GRENNI, P.; ONET, C.; ONET, A****. 2022. Fertilization and Soil Microbial Community: A Review. Appl. Sci. 2022, 12, 1198. https://doi.org/10.3390/app12031198*
3. ***FAO.*** *2017. The future of food and agriculture – Trends and challenges. Rome. http://www.fao.org/3/a- i6583e.pdf*
4. ***GET, A. CHEW, A., NELSON, P. N AND BIRD, M. I.*** *2016. Crop yield, plant nutrient uptake and soil physicochemical properties under organic soil amendments and nitrogen fertilization on Nitisols," Soil Tillage Research, vol. 160, pp. 1–13*
5. ***HAZARIKA, T. AND AHEIBAM, B.*** *2019. Soil nutrient status, yield and quality of lemon (Citrus limon Burm.) cv. 'Assam lemon' as influenced by bio-fertilizers, organics and inorganic fertilizers. Journal of Plant Nutrition. 42. 1-11. 10.1080/01904167.2019.1584213.*
6. ***LIM, S.L., WU, T.Y., LIM, P.N. AND SHAK, K.P.*** *2015. The use of vermicompost in organic farming: overview, effects on soil and economics. J Sci Food Agric. 2015 Apr;95(6):1143-56. doi: 10.1002/jsfa.6849. Epub 2014 Aug 26. PMID: 25130895*
7. ***PATEL, D.K.*** *2015. Stem cutting propagation for ex-situ conservation of Stevia rebaudiana (Bertoni) Bertoni in herbal garden. Eur. J. Biotechnol. 3(9), 35-42.*
8. ***PATHAK, M., KULKARNI, M. AND PATIL, D.*** *2018. Effect of organic and inorganic fertilizers on yield and yield attributes of groundnut and wheat. 6. 87-90.*
9. ***YADAV, A. K., SINGH, S., DHYANI,D. AND AHUJA,P.S.*** *2011. A review on the improvement of stevia [Stevia rebaudiana (Bertoni)]. Can. J. Plant Sci., 91(1), 1-27. Doi: 10.4141/cjps10086.*