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## Effect of Calcium on the Growth of Melon (*Cucumis melo* L.)

By

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### Abstract

Melon (*Cucumis melo* L.) is an important crop for the world economy, and it is one of the most valuable crops in the market. The cultivation of melon in Cambodia is still low due to the unclear use of varieties and the inappropriate cultivation techniques that cannot achieve high yields. This is the reason why this research is conducted. The objectives of this research are: 1. to compare the growth of melon varieties with calcium in Svay Rieng province condition, 2. to study the appropriate level of calcium fertilizer on melon yield in the supplementary stage, and 3. to study the fruit quality of the five melon varieties. This experiment was arranged into Randomized Complete Block Design (RCBD) with 4 replications and 20 treatments equivalent to 80 plots totally at the Agricultural Station of Svay Rieng University. The results showed that the application of calcium fertilizer and foliar spraying once every 7 days resulted in the highest growth of melon plants. The use of different varieties showed that the melon varieties V4 (Lady Green = 547) and V2 (Lady Gold = 518) received the highest number of seeds. Thus, in summary, comparing the growth of 5 melon cultivars with 4 levels of calcium fertilizer, the results showed that the application of calcium fertilizer and leaf spray every 4 days, every 7 days, made the melon crop. Growth, yield, and fruit quality are excellent. The use of different varieties showed that only the melon varieties V4, V1, and V2 are the best.

### Keywords

Melon, stem height, number of leaves, fruit size, flesh thickness, sugar level, fruit weight, melon yield



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## 1. INTRODUCTION

Cambodia is a country in Southeast Asia with a population of over 18 million in 2023, most of whom live in rural areas. Agriculture benefits from the Mekong River, which flows through the country's central lowlands, and the Tonle Sap Lake, the largest lake in Southeast Asia and an important source of water (Socheth, 2012). Not only that, Cambodia is also in the tropics, where hot and humid climates lead to very favorable conditions for growing almost all kinds of crops. The growth of population is very rapid, which is why the demand for food is increasing day by day. Agriculture can provide a source of food for daily life, provide employment, and provide income to the rural people. In addition, agriculture has contributed to the development of the national economy of Cambodia, as well as to the growth of national income and income from the export of agricultural products (MAFF, 2015). The Royal Government of Cambodia still considers agriculture as an existing sector to support economic growth, ensure food security, and promote rural economic development (MAFF, 2019). Melon (*Cucumis melon* L.) is an important crop for the world economy, producing more than \$28 billion. In 2015, Brazil exported more than 223,000 tons of melon. Brazil produces melons in the northeastern part of the country due to the favorable climatic conditions of the region for growing this crop (Ferreira *et al.*, 2018). It is a kind of crop that has the appearance of a vine and has a fruit that tastes sweet and delicious and is eaten all over the world. For this reason, some companies have brought many varieties of melons from abroad to grow in Cambodia to supply the local market. Due to local interests and needs and to improve the living standards of Cambodian farmers, as well as to boost the national economy and reduce agricultural imports from abroad, the Department of Agriculture has cooperated with the international research institutes to import some melon seeds to study, evaluate, and research cultivation techniques to disseminate to Cambodian farmers the benefits of this crop for agribusiness, increase household income, and promote prosperity (Belavadi, 2019).

Melon is one of the most valuable crops in the market, and it reappeared in Cambodia since 2005. The cultivation of melon is still low due to the unclear use of varieties and the inappropriate cultivation techniques that cannot achieve high yields. This is the reason why this research is conducted.

The objectives of this research are: 1. to compare the growth of melon varieties with calcium in Svay Rieng province condition, 2. to study the appropriate level of calcium fertilizer on melon yield in the supplementary stage, and 3. to study the fruit quality of the five melon varieties.

## 2. METHODOLOGY

### 2.1. Location and Climate

The experiment was carried out at the Agricultural Station of Svay Rieng University, located in Thmor Sar village, Sangkat Chek, Svay Rieng town, Svay Rieng province. The environmental temperature during the experiment was ranged from 37 to 40 degrees centigrade.

### 2.2. Experimental Design and Treatments

This experiment was arranged into Randomized Complete Block Design (RCBD) with 4 replications and 20 treatments equivalent to 80 plots totally. There were 10 seedlings a plot equivalent to 800 seedlings totally, and the planting density was 40 cm each. The experiment was designed in 2\*2 factorial arrangement which the first factor had 4 levels of calcium and the second factor had 5 melon varieties. The factors and treatments are as follows:

- First factor: Four fertilizer levels:
  - F0: No calcium fertilizer (control treatment)

- F1: Calcium fertilizer spraying 4 days/time
- F2: Calcium fertilizer spraying 7 days/time
- F3: Calcium fertilizer spraying 10 days/time
- Second factor: Five melon varieties:
  - V1: Sweet Net 77
  - V2: Lady Gold
  - V3: Yellow Emperor
  - V4: Lady Green
  - V5: JET

## **2.3. Land Preparation, Soil Sampling and Nursery**

### **2.3.1 Soil preparation**

For good soil preparation, it is important to kill the virus, pests, and unwanted seeds that come with it, as well as to make the melon seedlings healthy, fast-growing, resistant to disease and climate change, and have a high yield. Raw materials for soil mixture preparation include: 25% dry cow dung, 20% topsoil or mulch, 25% rice husk charcoal (soaked for 2 to 3 nights), 30% coconut husk, agricultural lime or organic lime, and trichoderma powder. The method of preparation is to apply each mixture in layers, then mix together well, then water in enough moisture but not too wet. Then, cover the soil for 2 weeks using a plastic bag after compaction, and after two weeks, the soil mixture should be turned over again, adding water to moisten the soil mixture so that it mixes quickly and becomes compost and the heat is under 40°C. Then, plant the seeds in a bag, weighing 5 kg per bag.

### **2.3.2 Preparation of the melon nursery**

The preparation of the melon nursery is important to kill the virus, pests, and unwanted seeds that come with it, as well as to make the melon seedlings healthy, fast-growing, resistant to disease and climate change, and have a high yield. Raw materials for making the melon nursery include: 2 parts of dry cow dung or compost, 1 part of topsoil or mulch, 4 to 6 parts of rice husk charcoal (soak for 2 to 3 nights). The method of preparation is to take 2 parts of compost to mix with 1 part of topsoil and 4 parts of rice husk charcoal, then mix together well, and soak in hot water, and then dry. Leave the mixed nursery soil to dry before putting it in the nursery tray. Before sowing, soak the seeds in warm water (40°C to 42°C) for 1.5 to 2 hours. Wipe 3 to 4 layers of moist tissue for 24 hours before putting the sprouted seeds in the nursery tray. Place the tray in the nursery and place it in direct sunlight and water moderately, watering twice a day, morning and evening.

### **2.3.3 Growing melon seedlings**

Before planting, the site should be selected and the soil sample taken to be analyzed in the laboratory to find the pH level of N, P, K, and EC in the soil. Water quality was analyzed before irrigating crops. The use of Trichoderma powder is to prevent major diseases caused by fungi on the melon and help digestion faster. Use compost in the process of growing melon to help them grow, and the fruit tastes sweeter. Planting melon should be done immediately after preparing the soil mixture in the planting bag. The life of young melon seedlings can be 9 to 12 days from the date of planting the seeds in the bag or tray. The best time to plant seedlings is in the afternoon, from 2:00 p.m. onwards. To grow melon quickly, we need to dig a hole about 5 cm deep in the center of the planting bag,

gently remove the seedlings from the tray, put the seedlings in the hole, and bury the soil at the base of the seedlings. Open the drip irrigation system to keep it moist, not too wet.

#### 2.3.4 Hanging and pruning the melon plant

Hanging the melon plant is to tie the red cord with a wire attached to the beam of the net house and then wrapped with a melon stem to the top of the plant.

Pruning the melon plant begins when it starts to flower at the base of the stem, but it is cut so that the stems and pods can retain good fruit and grow faster. The tool used for cutting is scissors with alcohol for disinfection. Remember that after cutting each branch, soak the scissors with alcohol. Cut branches and leaves should be collected in plastic bags and burned away from the field to prevent infection. The lower leaves, especially the ones attached to the plastic bag, are completely cut from the base to prevent the disease from spreading from the soil to the stem, and the upper leaves can spread throughout the entire stem. After 12 days of planting, start pruning by cutting from the first branch to the seventh branch and take care the bud from the eight to fourteen branches. After holding the buds, we should cut the stem at the second node (after the stalks have bud) so that the stalks of the bud will retain the fruit well. Next, cut the melon shoots when there are more than 20 branches to a height of about 1.7 to 2 meters.

#### 2.3.5 Pollination

Pollination is the process by which pollen is transformed in a plant flower to allow fertilization and production to take place (Koop, 2021). Pollen agents are essential in the development of all varieties of melon. Pollen must be transferred from the pollen ovary to the stigma by pollen agents, either by hand or by animals (Fisher & Pomeroy, 1989). Growing melon in net house should be bred in the morning between 7.30 and 8.30 a.m. by gently tap the male flower on the female flower, then monitor for 7 to 10 days to see if the flower holds the buds.

#### 2.3.6 Fruit tying

After deciding to leave one last fruit, cut off the other buds. For the fruit to be stored, it should be tied with a rope to help hold the stem and prevent it from touching the ground or plastic cover, which can cause the fruit to rot and sting by the insects. Tying the fruit also uses a red string to tie the face (not slipping hard) to the fruit stalks, leaving a loose space between the strings and the fruit stalks. Use strings that are not bright colors, such as black, silver, gray, or white, which are less attractive to insects. After leaving the buds to pick the fruit, continue to cut the branches and buds that do not need to be discarded. When the melon leaves the 24<sup>th</sup> leaf we should cut the main stem. Cutting-off unwanted shoots and flowers not only saves fertilizer and nutrients for the fruit; it also reduces the damage to the melon plant.

#### 2.3.7 Watering

Melon is a crop that needs enough water because too much water causes fungal diseases on the leaves, stems, and fruits. A good irrigation method is to use a drip irrigation system that can help control the amount of water and nutrients that the crop needs for growth and the sweetening of the fruit. Do not water the melon by spraying water on the leaves, as it can easily cause disease on the leaves and stems. Watering with no fertilizer should be done in the morning, and watering with fertilizer (compost) in the evening. Watering can be done 2 to 3 times a day.

## 2.4. Data Collection

All data were collected and recorded on the seedlings of melon one day after planting, and the data were collected every 7-day interval on stem height, number of leaves, fruit size, flesh thickness, sugar level, fruit weight, and total yield. Fruit quality from the beginning until the end of the trial is tested. The stem height is measured in meters from the base to the bud. The number of leaves counts from the bottom up. When the melon is ripe, measure the size of the melon fruit using a centimeter wire. Fruit weight is measured when the melon is ripe, harvest the melon fruit in each treatment, then weigh each fruit and calculate the average and total weight. Flesh thickness is measured by cutting the ripe melon fruit and measure its thickness. Brix refractometer is used to measure the sugar level of each melon fruit in each treatment. When the melon is ripe, we harvest the melon fruit in each treatment, then cut the melon fruit and collect the seeds in order to count the number of seed.

## 2.5. Statistical Analysis

The data from this experiment, which included stem height, number of leaves, fruit size, flesh thickness, sugar level, fruit weight, and total yield, were prepared and entered into Microsoft Excel and use the Statistix 8 software program to analyze ANOVA through a linear model, Least Significant Difference (LSD) at the 5% probability level, and the sources of variation were fertilizer, varieties, fertilizer \* varieties, CV, and error.

## 3. RESULTS AND DISCUSSION

### 3.1 Stem height of melon plant (cm)

Based on the ANOVA analysis on the growth of stem height of melon plant by utilizing calcium spray on different days, it is found that the height of the melon plants on the day of planting did not differ significantly ( $p > 0.05$ ). However, there was a substantial 1% ( $p < 0.01$ ) difference in the stem growth and the height of the melon plants at week 1, week 3, week 4, week 5, week 6, and week 7. Additionally, there was a significant difference in the height of the melon plants at weeks 5, 6, and 7 of 1% ( $p < 0.05$ ). Different melon cultivars' growth in stem height revealed that the height of the melon plant on planting day, week 1, week 2, week 3, week 4, week 5, week 6, week 7, and the increase in stem height were 1% ( $p < 0.01$ ) difference in mean. The height of the melon plant on the fifth day of planting was determined by the interaction between the usage of different melon cultivars, the application of calcium fertilizer, and water spraying on leaves on different days. The meaning of weeks 6 and 7 did not differ significantly ( $p > 0.05$ ), however the height of the melon plants in week 2 varied by 5% ( $p < 0.05$ ) in comparison to plant height. The growth of stem height and the melon during the first, third, and fourth weeks showed a significant difference of 1% ( $p < 0.01$ ). The maximum stem growth was thus observed in the melon crop, and this difference was significant when compared to the non-fertilization, fertilization every 4 days, and fertilization every 10 days groups ( $p < 0.01$ ). When comparing the V3 melon cultivar to the V1, V2, V4, and V5 melon cultivars, the results indicated that only the V3 melon cultivar had the maximum stem height increase ( $p < 0.01$ ).

**Table 1. Stem height of melon plant (cm)**

Treatment (Tr)		Height (cm)								
Fertilizer level (F)	Varieties (V)	Planting day	1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week	5 <sup>th</sup> week	6 <sup>th</sup> week	7 <sup>th</sup> week	Increase
No fertilizer (F0)	Sweet Net 77	12.1 <sup>ab</sup>	14.1 <sup>e</sup>	27.5 <sup>de</sup>	40.6 <sup>f</sup>	55.0 <sup>i</sup>	86.2 <sup>c</sup>	121 <sup>c</sup>	164 <sup>cde</sup>	152 <sup>cdef</sup>
	Lady Gold	11.8 <sup>ab</sup>	14.5 <sup>de</sup>	29.9 <sup>de</sup>	46.7 <sup>ef</sup>	66.8 <sup>fghi</sup>	98.4 <sup>bc</sup>	131 <sup>bc</sup>	157 <sup>de</sup>	145 <sup>ef</sup>
	Yellow Emperor	11.1 <sup>ab</sup>	14.1 <sup>e</sup>	26.3 <sup>de</sup>	42.4 <sup>ab</sup>	54.7 <sup>i</sup>	94.3 <sup>bc</sup>	130 <sup>bc</sup>	199 <sup>ab</sup>	188 <sup>ab</sup>
	Lady Green	13.8 <sup>ab</sup>	16.5 <sup>bcd</sup>	42.2 <sup>abc</sup>	64.7 <sup>ab</sup>	85.4 <sup>abcd</sup>	98.5 <sup>bc</sup>	121 <sup>c</sup>	151 <sup>e</sup>	137 <sup>f</sup>
	Jet	13.7 <sup>ab</sup>	14.5 <sup>cde</sup>	30.6 <sup>cde</sup>	56 <sup>bcd</sup>	84.7 <sup>abcd</sup>	105 <sup>abc</sup>	127 <sup>bc</sup>	159 <sup>de</sup>	145 <sup>def</sup>
4 days/time (F1)	Sweet Net 77	12.8 <sup>ab</sup>	15.7 <sup>bcd</sup>	30.4 <sup>cde</sup>	49.8 <sup>def</sup>	64.2 <sup>fghi</sup>	98.4 <sup>bc</sup>	130 <sup>bc</sup>	184 <sup>abc</sup>	172 <sup>abcde</sup>
	Lady Gold	12.7 <sup>ab</sup>	16.3 <sup>cde</sup>	33 <sup>bcd</sup>	50.6 <sup>def</sup>	75.9 <sup>cdef</sup>	109 <sup>ab</sup>	136 <sup>abc</sup>	153 <sup>de</sup>	140 <sup>ef</sup>
	Yellow Emperor	11.3 <sup>ab</sup>	15.7 <sup>cde</sup>	29.9 <sup>de</sup>	46.6 <sup>ef</sup>	61.8 <sup>ghi</sup>	99.2 <sup>bc</sup>	132 <sup>bc</sup>	207 <sup>ab</sup>	196 <sup>ab</sup>
	Lady Green	13.4 <sup>ab</sup>	20.3 <sup>a</sup>	49.3 <sup>a</sup>	73.2 <sup>a</sup>	96.7 <sup>a</sup>	112 <sup>ab</sup>	129 <sup>bc</sup>	154 <sup>de</sup>	141 <sup>ef</sup>
	Jet	14.3 <sup>a</sup>	15.6 <sup>cde</sup>	31.8 <sup>cde</sup>	62.6 <sup>abc</sup>	90.1 <sup>ab</sup>	110 <sup>ab</sup>	140 <sup>abc</sup>	184 <sup>abc</sup>	170 <sup>abcdef</sup>
7 days/time (F2)	Sweet Net 77	14.2 <sup>a</sup>	16.2 <sup>bcd</sup>	31.5 <sup>cde</sup>	47.1 <sup>ef</sup>	56.9 <sup>hi</sup>	96.5 <sup>bc</sup>	127 <sup>bc</sup>	206 <sup>ab</sup>	192 <sup>ab</sup>
	Lady Gold	14.7 <sup>a</sup>	17.7 <sup>abcd</sup>	36.7 <sup>bcd</sup>	57.9 <sup>bcd</sup>	82.7 <sup>abcd</sup>	122 <sup>a</sup>	160 <sup>a</sup>	210 <sup>a</sup>	196 <sup>ab</sup>
	Yellow Emperor	9.9 <sup>b</sup>	16.1 <sup>cde</sup>	30.5 <sup>cde</sup>	50.3 <sup>def</sup>	63.4 <sup>fghi</sup>	97.3 <sup>abc</sup>	131 <sup>bc</sup>	194 <sup>ab</sup>	200 <sup>a</sup>
	Lady Green	13.6 <sup>ab</sup>	17.8 <sup>abc</sup>	36.5 <sup>bcd</sup>	57.7 <sup>bcd</sup>	73.3 <sup>defg</sup>	112 <sup>ab</sup>	133 <sup>bc</sup>	178 <sup>bcd</sup>	164 <sup>bcd</sup>
	Jet	13.6 <sup>ab</sup>	16.1 <sup>bcd</sup>	34.8 <sup>bcd</sup>	60.7 <sup>bcd</sup>	89.9 <sup>abc</sup>	107 <sup>abc</sup>	144 <sup>abc</sup>	192 <sup>abc</sup>	178 <sup>abcd</sup>
10 days/time (F3)	Sweet Net 77	13.2 <sup>ab</sup>	15.1 <sup>cde</sup>	25.4 <sup>c</sup>	43.2 <sup>f</sup>	57.9 <sup>hi</sup>	96.0 <sup>ab</sup>	133 <sup>bc</sup>	201 <sup>ab</sup>	188 <sup>ab</sup>
	Lady Gold	13.5 <sup>ab</sup>	19.2 <sup>ab</sup>	37.9 <sup>abcd</sup>	57 <sup>bcd</sup>	71.9 <sup>defg</sup>	113 <sup>ab</sup>	147 <sup>ab</sup>	194 <sup>abc</sup>	180 <sup>abc</sup>
	Yellow Emperor	10.9 <sup>ab</sup>	15.8 <sup>cde</sup>	27 <sup>de</sup>	47.9 <sup>ef</sup>	69.7 <sup>efgh</sup>	105 <sup>abc</sup>	141 <sup>abc</sup>	205 <sup>ab</sup>	194 <sup>ab</sup>
	Lady Green	10.5 <sup>ab</sup>	15.6 <sup>cde</sup>	44.4 <sup>ab</sup>	64.2 <sup>ab</sup>	81.6 <sup>bcd</sup>	109 <sup>ab</sup>	141 <sup>abc</sup>	205 <sup>ab</sup>	194 <sup>ab</sup>
	Jet	13.9 <sup>ab</sup>	17.3 <sup>abcd</sup>	35.9 <sup>bcd</sup>	51.6 <sup>cdef</sup>	73.0 <sup>defg</sup>	106 <sup>abc</sup>	133 <sup>bc</sup>	192 <sup>abc</sup>	178 <sup>abcd</sup>
CV (%)		14.3	7.64	13.6	8.19	7.13	8.09	6.68	6.4	7.21
Sig (F)		ns	**	*	**	**	**	*	*	**
Sig (V)		**	**	**	**	**	**	**	**	**
Sig (F*V)		ns	**	*	**	**	**	ns	ns	**

**Note:** \* The means of all treatments are significantly different at 5% ( $P < 0.05$ ).

\*\* The means of all treatments are significantly different at 1% ( $P < 0.01$ ).

<sup>ns</sup> The means of all treatments are non-significant ( $P > 0.05$ ).

Means with the same letter are not significantly different from each other ( $a > b > c > d$ ).

### 3.2 Number of leaves of melon plant (leaves/plant)

Based on the ANOVA analysis on the growth of leaf number of melon plant in the application of calcium fertilizer, water spraying on different days, the number of leaves of melon plant on the week 1 and week 2 were not significantly different ( $p > 0.05$ ). However, the number of leaves of the melon plant in weeks 3, 4, 5, 6, and 7 and leaf growth were significantly different at 5% ( $p < 0.05$ ). Anyway, the leaf growth of melon by different melon varieties showed that the number of melon leaves in week 1, week 3, week 4, week 6, and week 7 was significantly different by 1% ( $p < 0.01$ ). The melon leaves on the day of planting were significantly different at 1% ( $p < 0.05$ ). The interaction between the application of calcium fertilizer, water spraying on the leaves on different days and the use of different melon cultivars showed that the number of melon leaves on the day of planting, week 1, week 2, week 3, week 4, week 5, week 6 and week 7 and leaf growth did not differ significantly ( $p > 0.05$ ). Overall results showed that the application of calcium fertilizer with leaf spray once every 4 days resulted in the highest increase in leaf number of the melon plant, which was significant compared with non-fertilization, spraying every 7 days, and spraying the fertilizer every 10 days ( $p < 0.05$ ). The use of different cultivars showed that only the V3 melon cultivar had the highest leaf growth if compared to the V1, V2, V4, and V5 melon cultivars ( $p < 0.01$ ).

**Table 2. Number of leaves of melon plant (leaves/plant)**

Treatment (Tr)		Number of leaves of melon plant (leaves/plant)								
Fertilizer level (F)	Varieties (V)	Planting day	1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week	5 <sup>th</sup> week	6 <sup>th</sup> week	7 <sup>th</sup> week	Increase
No fertilizer (F0)	Sweet Net 77	2.8	5.2 <sup>ab</sup>	9.35 <sup>ab</sup>	11.9 <sup>abc</sup>	14.1 <sup>abc</sup>	17.4	17.9 <sup>bc</sup>	19.8 <sup>bc</sup>	16.9 <sup>bc</sup>
	Lady Gold	3	5.05 <sup>ab</sup>	8.45 <sup>ab</sup>	11.6 <sup>abc</sup>	14.0 <sup>abc</sup>	19.4	18.2 <sup>bc</sup>	20 <sup>bc</sup>	17 <sup>bc</sup>
	Yellow Emperor	2.75	4.7 <sup>ab</sup>	8.2 <sup>b</sup>	10.1 <sup>c</sup>	11.9 <sup>c</sup>	14.5	15.9 <sup>c</sup>	16.7 <sup>c</sup>	13.9 <sup>c</sup>
	Lady Green	2.85	6.0 <sup>ab</sup>	10.3 <sup>ab</sup>	13.0 <sup>ab</sup>	14.4 <sup>abc</sup>	16.2	16.6 <sup>c</sup>	18.9 <sup>bc</sup>	16.1 <sup>bc</sup>
	Jet	2.9	5.2 <sup>ab</sup>	9.3 <sup>ab</sup>	11.9 <sup>abc</sup>	14.4 <sup>abc</sup>	16.5	17 <sup>bc</sup>	18.6 <sup>bc</sup>	15.7 <sup>bc</sup>
	Sweet Net 77	2.9	5.5 <sup>ab</sup>	10.2 <sup>ab</sup>	12.5 <sup>abc</sup>	14.8 <sup>abc</sup>	18	21.3 <sup>abc</sup>	22.5 <sup>abc</sup>	19.6 <sup>abc</sup>
4 days/time (F1)	Lady Gold	3.1	5.35 <sup>ab</sup>	9.35 <sup>ab</sup>	12.7 <sup>ab</sup>	16.1 <sup>ab</sup>	18.4	25 <sup>a</sup>	26.2 <sup>a</sup>	23.1 <sup>a</sup>
	Yellow Emperor	2.7	4.8 <sup>ab</sup>	8.85 <sup>ab</sup>	10.6 <sup>bc</sup>	12.3 <sup>c</sup>	15.8	16.8 <sup>c</sup>	17.9 <sup>bc</sup>	15.3 <sup>bc</sup>
	Lady Green	3	6.45 <sup>a</sup>	11.4 <sup>a</sup>	13.4 <sup>a</sup>	15.3 <sup>abc</sup>	16.9	19.7 <sup>abc</sup>	20.9 <sup>abc</sup>	17.9 <sup>abc</sup>
	Jet	2.85	5.35 <sup>ab</sup>	10.1 <sup>ab</sup>	13.1 <sup>a</sup>	16.1 <sup>ab</sup>	17.5	18.3 <sup>bc</sup>	19.6 <sup>bc</sup>	16.8 <sup>bc</sup>

	Sweet Net 77	3.05	5.45 <sup>ab</sup>	10.0 <sup>ab</sup>	12.1 <sup>abc</sup>	14.2 <sup>abc</sup>	16.9	18.9 <sup>bc</sup>	20 <sup>bc</sup>	16.9 <sup>bc</sup>
	Lady Gold	3.25	6.25 <sup>ab</sup>	9.65 <sup>ab</sup>	13.2 <sup>a</sup>	16.6 <sup>a</sup>	18.6	20.5 <sup>abc</sup>	21.7 <sup>abc</sup>	18.4 <sup>abc</sup>
7 days/time (F2)	Yellow Emperor	2.55	4.75 <sup>ab</sup>	8.25 <sup>ab</sup>	11.2 <sup>abc</sup>	14.1 <sup>abc</sup>	15.6	16.4 <sup>c</sup>	17.7 <sup>bc</sup>	15.2 <sup>bc</sup>
	Lady Green	3.05	5.65 <sup>ab</sup>	9.75 <sup>ab</sup>	12.4 <sup>abc</sup>	15.2 <sup>abc</sup>	18.3	18.9 <sup>bc</sup>	20.3 <sup>abc</sup>	17.3 <sup>abc</sup>
	Jet	2.65	5.25 <sup>ab</sup>	10.1 <sup>ab</sup>	12.5 <sup>abc</sup>	14.9 <sup>abc</sup>	17.6	18.9 <sup>bc</sup>	19.9 <sup>bc</sup>	17.3 <sup>abc</sup>
	Sweet Net 77	2.75	5.35 <sup>ab</sup>	9 <sup>ab</sup>	11.8 <sup>abc</sup>	14.6 <sup>abc</sup>	17.2	19.6 <sup>abc</sup>	20.7 <sup>abc</sup>	17.9 <sup>abc</sup>
	Lady Gold	3	5.8 <sup>ab</sup>	10.7 <sup>b</sup>	12.9 <sup>ab</sup>	15.2 <sup>abc</sup>	18.4	22.5 <sup>ab</sup>	23.4 <sup>ab</sup>	20.4 <sup>ab</sup>
10 days/time (F3)	Yellow Emperor	2.45	4.6 <sup>b</sup>	8.1 <sup>b</sup>	10.6 <sup>bc</sup>	13.1 <sup>bc</sup>	15.1	16.8 <sup>bc</sup>	18.2 <sup>bc</sup>	15.8 <sup>bc</sup>
	Lady Green	2.65	5.75 <sup>ab</sup>	10.2 <sup>ab</sup>	12.7 <sup>ab</sup>	14.7 <sup>abc</sup>	15.3	17.9 <sup>bc</sup>	19 <sup>bc</sup>	16.4 <sup>bc</sup>
	Jet	2.75	5.3 <sup>ab</sup>	9.6 <sup>ab</sup>	11.7 <sup>abc</sup>	13.8 <sup>abc</sup>	16.5	18.7 <sup>bc</sup>	19.9 <sup>bc</sup>	17.2 <sup>abc</sup>
CV (%)		14.3	13.9	12.7	11.4	7.27	8.96	11.9	10.9	10.7
Sig (F)		ns	ns	Ns	ns	*	*	*	*	*
Sig (V)		**	*	**	**	**	**	**	**	**
Sig (F*V)		ns	ns	Ns	ns	Ns	ns	ns	ns	ns

**Note:** \* The means of all treatments are significantly different at 5% ( $P < 0.05$ ).

\*\* The means of all treatments are significantly different at 1% ( $P < 0.01$ ).

<sup>ns</sup> The means of all treatments are non-significant ( $P > 0.05$ ).

Means with the same letter are not significantly different from each other ( $a > b > c > d$ ).

### 3.3 Maximum leaf surface growth of melon plant (cm<sup>2</sup>/leaf)

According to ANOVA analysis on the leaf surface growth of melon plants using calcium fertilizer, leaf spray on different days showed that the leaf surface of melon was highest in weeks 1, 2, 3, 5, and 7, and leaf growth was significantly different at 1% ( $p < 0.01$ ). The leaf surface of melon in weeks 4 and 6 is 5% different ( $p < 0.05$ ). The growth of leaf surface by different melon cultivars showed that the leaf surface of melon on the day of planting in weeks 2, 4, 5, 6, and 7 was significantly different at level 1% ( $p < 0.01$ ). The leaf surface of melon in weeks 1 and 3 was significantly different by 5% ( $p < 0.05$ ). The interaction between the application of calcium fertilizer and water spray on the leaves on different days and the use of different melon cultivars showed that the surface of the melon plant increased on the days of planting (weeks 1, 2, 3, 4, 5, and 6), and the leaf growth was significantly different at 1% ( $p < 0.01$ ). The largest leaf growth was significant compared with non-fertilization, fertilization every 7 days, and fertilization every 10 days ( $p < 0.01$ ). The use of different cultivars showed that only the V3 melon cultivar had the highest leaf surface growth, significantly if compared with the V1, V2, V4, and V5 melon cultivars ( $p < 0.01$ ).

**Table 3. Maximum leaf area of melon plant (cm<sup>2</sup>/leaf)**

Treatment (Tr)		Maximum leaf surface of melon plant (cm <sup>2</sup> /leaf)								
Fertilizer level (F)	Varieties (V)	Planting day	1 <sup>st</sup> week	2 <sup>nd</sup> week	3 <sup>rd</sup> week	4 <sup>th</sup> week	5 <sup>th</sup> week	6 <sup>th</sup> week	7 <sup>th</sup> week	Increase
	Sweet Net 77	21.3 <sup>bcd</sup>	42 <sup>cd</sup>	98.3 <sup>abc</sup>	125 <sup>abcde</sup>	157 <sup>bc</sup>	168 <sup>bcd</sup>	171 <sup>bcd</sup>	183 <sup>cde</sup>	162 <sup>cdef</sup>
	Lady Gold	23.5 <sup>bc</sup>	41.6 <sup>cd</sup>	108 <sup>abc</sup>	121 <sup>bcde</sup>	156 <sup>bc</sup>	179 <sup>bc</sup>	186 <sup>abc</sup>	196 <sup>abcde</sup>	173 <sup>abcdef</sup>
No fertilizer (F0)	Yellow Emperor	22.1 <sup>bcd</sup>	50.6 <sup>b</sup>	78.8 <sup>c</sup>	105 <sup>de</sup>	136 <sup>c</sup>	146 <sup>d</sup>	166 <sup>cd</sup>	186 <sup>cde</sup>	164 <sup>cdef</sup>
	Lady Green	23.6 <sup>bc</sup>	43.6 <sup>c</sup>	119 <sup>abc</sup>	103 <sup>e</sup>	162 <sup>bc</sup>	174 <sup>bcd</sup>	185 <sup>abc</sup>	192 <sup>bcd</sup>	168 <sup>bcdef</sup>
	Jet	23.6 <sup>bc</sup>	54.8 <sup>a</sup>	84.5 <sup>bc</sup>	120 <sup>bcde</sup>	150 <sup>bc</sup>	156 <sup>cd</sup>	179 <sup>abc</sup>	175 <sup>de</sup>	151 <sup>ef</sup>
	Sweet Net 77	25.9 <sup>ab</sup>	67.5 <sup>a</sup>	103 <sup>abc</sup>	120 <sup>bcde</sup>	154 <sup>bc</sup>	172 <sup>bcd</sup>	182 <sup>abc</sup>	190 <sup>cde</sup>	164 <sup>cdef</sup>
4 days/time (F1)	Lady Gold	24.6 <sup>abc</sup>	65.9 <sup>a</sup>	110 <sup>abc</sup>	127 <sup>abcde</sup>	163 <sup>bc</sup>	181 <sup>bc</sup>	185 <sup>abc</sup>	194 <sup>abcde</sup>	170 <sup>bcdef</sup>
	Yellow Emperor	22.1 <sup>bcd</sup>	52.8 <sup>d</sup>	129 <sup>a</sup>	154 <sup>a</sup>	200 <sup>a</sup>	213 <sup>a</sup>	196 <sup>abc</sup>	222 <sup>ab</sup>	202 <sup>a</sup>
	Lady Green	23.7 <sup>bc</sup>	61.4 <sup>b</sup>	125 <sup>ab</sup>	143 <sup>ab</sup>	162 <sup>bc</sup>	173 <sup>bcd</sup>	186 <sup>abc</sup>	197 <sup>abcde</sup>	173 <sup>abcde</sup>
	Jet	23 <sup>bcd</sup>	57.1 <sup>c</sup>	91 <sup>abc</sup>	124 <sup>abcde</sup>	146 <sup>bc</sup>	167 <sup>bcd</sup>	177 <sup>abcd</sup>	225 <sup>a</sup>	200 <sup>ab</sup>
	Sweet Net 77	30.8 <sup>a</sup>	64.3 <sup>a</sup>	97.8 <sup>abc</sup>	118 <sup>bcde</sup>	155 <sup>bc</sup>	160 <sup>cd</sup>	175 <sup>abcd</sup>	187 <sup>cde</sup>	156 <sup>def</sup>
7 days/time (F2)	Lady Gold	25.4 <sup>ab</sup>	50.2 <sup>d</sup>	123 <sup>ab</sup>	136 <sup>abc</sup>	172 <sup>ab</sup>	195 <sup>ab</sup>	201 <sup>ab</sup>	211 <sup>abc</sup>	186 <sup>abcde</sup>
	Yellow Emperor	16.4 <sup>d</sup>	56 <sup>c</sup>	107 <sup>abc</sup>	130 <sup>abcde</sup>	170 <sup>ab</sup>	171 <sup>bcd</sup>	204 <sup>a</sup>	205 <sup>abcd</sup>	189 <sup>abc</sup>
	Lady Green	25 <sup>abc</sup>	57.9	106 <sup>abc</sup>	112 <sup>cde</sup>	150 <sup>bc</sup>	152 <sup>cd</sup>	147 <sup>d</sup>	171 <sup>e</sup>	146 <sup>f</sup>
	Jet	24.6 <sup>abc</sup>	58.5 <sup>b</sup>	121 <sup>abc</sup>	114 <sup>bcde</sup>	156 <sup>bc</sup>	151 <sup>cd</sup>	180 <sup>abc</sup>	181 <sup>cde</sup>	157 <sup>cdef</sup>
	Sweet Net 77	19.1 <sup>bcd</sup>	55.7 <sup>bc</sup>	116 <sup>abc</sup>	135 <sup>abcd</sup>	155 <sup>bc</sup>	166 <sup>bcd</sup>	174 <sup>bcd</sup>	184 <sup>cde</sup>	165 <sup>cdef</sup>
10 days/time (F3)	Lady Gold	23.2 <sup>bcd</sup>	58.7 <sup>a</sup>	113 <sup>abc</sup>	144 <sup>ab</sup>	171 <sup>ab</sup>	177 <sup>bc</sup>	196 <sup>abc</sup>	204 <sup>abcd</sup>	181 <sup>abcde</sup>
	Yellow Emperor	18.3 <sup>cd</sup>	56.8 <sup>ab</sup>	85.8 <sup>bc</sup>	139 <sup>abc</sup>	168 <sup>abc</sup>	173 <sup>bcd</sup>	189 <sup>abc</sup>	193 <sup>bcde</sup>	175 <sup>abcdef</sup>
	Lady Green	22.7 <sup>bcd</sup>	57.7 <sup>ab</sup>	123 <sup>ab</sup>	143 <sup>ab</sup>	146 <sup>bc</sup>	157 <sup>cd</sup>	174 <sup>abcd</sup>	175 <sup>de</sup>	153 <sup>ef</sup>
	Jet	22.9 <sup>bcd</sup>	58.6 <sup>a</sup>	111 <sup>abc</sup>	126 <sup>abcde</sup>	163 <sup>bc</sup>	169 <sup>bcd</sup>	179 <sup>abc</sup>	187 <sup>cde</sup>	164 <sup>cdef</sup>
CV (%)		14.3	11.38	11.9	12.16	8.93	7.68	7.04	6.46	6.26
Sig (F)		ns	*	**	**	**	*	**	*	**

Sig (V)	**	**	*	**	*	**	**	**	**
Sig (F*V)	ns	**	**	**	**	**	**	**	**

**Note:** \* The means of all treatments are significantly different at 5% ( $P < 0.05$ ).

\*\* The means of all treatments are significantly different at 1% ( $P < 0.01$ ).

<sup>ns</sup> The means of all treatments are non-significant ( $P > 0.05$ ).

Means with the same letter are not significantly different from each other ( $a > b > c > d$ ).

### 3.4 Weight and yields of melon fruit (tons/ha)

According to ANOVA analysis, the weight and yield of melon fruit in the application of calcium spray on different leaves on different days showed that the weight of melon fruit on harvest day was significantly different by 1% ( $p < 0.01$ ). The yield of fruit by different melon cultivars showed that the weight of melon on harvest day was significantly different by 1% ( $p < 0.01$ ). The interactions between the use of calcium spray on leaves and the use of different melon cultivars showed that the weight of melon fruit on harvest day was significantly different by 1% ( $p < 0.01$ ). Overall results showed that the application of calcium fertilizer with leaf spray every 4 days and 7 days resulted in the melon crop gaining the heaviest fruit weight, which is significant compared to not fertilizing and spraying in 10 days once ( $p < 0.01$ ). The use of different cultivars showed that only melon cultivars V1, V4, and V2 had the heaviest fruit weight, significantly if compared with melon cultivars V3, and V5 ( $p < 0.01$ ).

According to Heang Seiha (2017), research on the influence of potassium fertilizer on the yield and sugar level of melon showed that the highest average yield is  $T4 = 35.7$  tons/ha. This result is low if compared to the current experiments, in which the average yield is 36.4 tons/ha. However, according to Yang Phara (2015), which researched the comparison of different types of natural fertilizers on the growth and yield of melon in the net house condition in Kandal Steung district, Kandal province, the highest average yield is  $T4 = 44.13$  tons/ha. This result is higher than the current experiment, whose average yield is 36.4 tons/ha.

**Table 4. Weight and yields of melon fruit (tons/ha)**

Treatment (Tr)		Yields	
Fertilizer level (F)	Varieties (V)	Weight (g)	Total weight (t/ha)
	Sweet Net 77	21.3 <sup>bcd</sup>	42 <sup>cd</sup>
	Lady Gold	23.5 <sup>bc</sup>	41.6 <sup>cd</sup>
No fertilizer (F0)	Yellow Emperor	22.1 <sup>bcd</sup>	50.6 <sup>b</sup>
	Lady Green	23.6 <sup>bc</sup>	43.6 <sup>c</sup>
	Jet	23.6 <sup>bc</sup>	54.8 <sup>a</sup>
	Sweet Net 77	25.9 <sup>ab</sup>	67.5 <sup>a</sup>
4 days/time (F1)	Lady Gold	24.6 <sup>abc</sup>	65.9 <sup>a</sup>
	Yellow Emperor	22.1 <sup>bcd</sup>	52.8 <sup>d</sup>

	Lady Green	23.7 <sup>bc</sup>	61.4 <sup>b</sup>
	Jet	23 <sup>bcd</sup>	57.1 <sup>c</sup>
	Sweet Net 77	30.8 <sup>a</sup>	64.3 <sup>a</sup>
	Lady Gold	25.4 <sup>ab</sup>	50.2 <sup>d</sup>
7 days/time (F2)	Yellow Emperor	16.4 <sup>d</sup>	56 <sup>c</sup>
	Lady Green	25 <sup>abc</sup>	57.9
	Jet	24.6 <sup>abc</sup>	58.5 <sup>b</sup>
	Sweet Net 77	19.1 <sup>bcd</sup>	55.7 <sup>bc</sup>
	Lady Gold	23.2 <sup>bcd</sup>	58.7 <sup>a</sup>
10 days/time (F3)	Yellow Emperor	18.3 <sup>cd</sup>	56.8 <sup>ab</sup>
	Lady Green	22.7 <sup>bcd</sup>	57.7 <sup>ab</sup>
	Jet	22.9 <sup>bcd</sup>	58.6 <sup>a</sup>
CV (%)		14.3	11.38
Sig (F)		ns	*
Sig (V)		**	**
Sig (F*V)		ns	**

### 3.5 Fruit quality of melon plant

According to the ANOVA analysis on the quality of melon fruit in the application of calcium fertilizer and leaf spray on different days, it showed that the size of the fruit, the thickness of the flesh, and the number of seeds of the melon on the day of harvest are significantly different by 1% ( $p < 0.01$ ). The sugar level of melon on the day of harvest was not significantly different ( $p > 0.05$ ). The interactions between the application of calcium fertilizer on leaf spray on different days and the use of different melon cultivars showed that the fruit size and sugar content of melon on harvest day were not significantly different ( $p > 0.05$ ). The interactions between the application of calcium fertilizer and water spray on leaves on different days and the use of different melon cultivars showed that the flesh thickness and number of melon seeds on harvest day were significantly different by 1% ( $p < 0.01$ ).

Overall results showed that the application of calcium fertilizer and foliar spraying every 4 days, 7 days, and every 10 days resulted in the sweet fruit crop achieving the largest fruit size significantly compared to no fertilization ( $p < 0.01$ ). The use of different varieties showed that the largest fruit size was V4, and if compared with melon varieties V1, V2, V3, and V5, they were not significantly different ( $p > 0.05$ ). The application of calcium fertilizer and leaf spray once every 7 days resulted in the highest sugar content of melon fruits, but compared with non-fertilization, spraying every 4 days and spraying every 10 days is non-significantly different ( $p > 0.05$ ). The use of different varieties showed that the V3 melon cultivar had the highest sugar level; if compared with the melon cultivars V1, V2, V4, and V5, it did not differ significantly ( $p > 0.05$ ). The application of calcium fertilizer and leaf spray once every 7 days resulted in the melon crop having the highest flesh thickness compared to non-fertilization, spraying every 4 days, and spraying fertilizer every 10 days

( $p < 0.01$ ). The use of different varieties showed that the melon varieties V1, V2, and V4 obtained the largest flesh thickness of the fruit, significantly if compared with melon varieties V3 and V5 ( $p < 0.01$ ). The application of calcium fertilizer and leaf spray once every 7 days resulted in the melon crop having the highest number of fruit seeds, compared to non-fertilization, spraying every 4 days, and spraying fertilizer every 10 days ( $p < 0.01$ ). The use of different varieties showed that the melon varieties V2 and V4 received the highest number of seeds if compared to the melon varieties V1, V3, and V5 ( $p < 0.01$ ).

**Table 5. Fruit quality of melon plant**

Treatment (Tr)		Fruit quality			
Fertilizer level (F)	Varieties (V)	Size (cm <sup>2</sup> )	Brix (%)	Thickness (cm)	No. of seed (number)
No fertilizer (F0)	Sweet Net 77	48.3 <sup>bc</sup>	8.95	1.61 <sup>c</sup>	86.7 <sup>i</sup>
	Lady Gold	44.6 <sup>c</sup>	9.35	1.52 <sup>c</sup>	86.5 <sup>i</sup>
	Yellow Emperor	45.1 <sup>c</sup>	9.9	1.40 <sup>c</sup>	89.7 <sup>i</sup>
	Lady Green	47.5 <sup>bc</sup>	9.3	1.58 <sup>c</sup>	83.5 <sup>i</sup>
	Jet	47 <sup>bc</sup>	8.45	1.4 <sup>c</sup>	88.5 <sup>i</sup>
4 days/time (F1)	Sweet Net 77	62.3 <sup>a</sup>	10.8	2.65 <sup>b</sup>	187 <sup>efgh</sup>
	Lady Gold	54.8 <sup>abc</sup>	10	2.42 <sup>b</sup>	270 <sup>cd</sup>
	Yellow Emperor	61.6 <sup>a</sup>	11.4	2.36 <sup>b</sup>	170 <sup>gh</sup>
	Lady Green	59.8 <sup>a</sup>	11.1	2.41 <sup>b</sup>	178 <sup>fgh</sup>
	Jet	56.2 <sup>ab</sup>	9.2	2.39 <sup>b</sup>	208 <sup>defgh</sup>
7 days/time (F2)	Sweet Net 77	62.5 <sup>a</sup>	9.5	3.77 <sup>a</sup>	436 <sup>b</sup>
	Lady Gold	62.3 <sup>a</sup>	9.3	3.68 <sup>a</sup>	518 <sup>a</sup>
	Yellow Emperor	59.6 <sup>a</sup>	11.5	2.48 <sup>b</sup>	347 <sup>c</sup>
	Lady Green	64.8 <sup>a</sup>	10.2	3.84 <sup>a</sup>	547 <sup>a</sup>
	Jet	64 <sup>a</sup>	11.1	2.51 <sup>b</sup>	246 <sup>defg</sup>
10 days /time (F3)	Sweet Net 77	60.6 <sup>a</sup>	10.1	2.67 <sup>b</sup>	47 <sup>defh</sup>
	Lady Gold	60.7 <sup>a</sup>	9.5	2.75 <sup>b</sup>	249 <sup>def</sup>
	Yellow Emperor	63 <sup>a</sup>	11.4	2.99 <sup>b</sup>	239 <sup>defg</sup>
	Lady Green	57.2 <sup>ab</sup>	10.4	2.42 <sup>b</sup>	59 <sup>hi</sup>
	Jet	60.4 <sup>a</sup>	9.35	2.42 <sup>b</sup>	261 <sup>de</sup>
CV (%)		14.3	6.71	14.6	10
Sig (F)		ns	**	Ns	**
Sig (V)		**	Ns	*	**

Sig (F\*V)

ns

Ns

Ns

\*\*

#### 4. CONCLUSIONS

Comparing the growth of five melon cultivars with four levels of calcium fertilizer, it can be concluded that the application of calcium fertilizer and foliar spraying once every 7 days resulted in the highest growth of melon plants. The use of different varieties showed that only the melon variety V3 (Yellow Emperor = 200 cm) had the highest growth in stem height. Melon plants get more leaf growth, and the melon variety V2 (Lady Gold, 23.1 leaves/stem) has the highest number of leaf growths. Applying calcium fertilizer to the foliar sprays every 4 days resulted in the greatest growth of the leaf surface of melon, and melon variety V3 (Yellow Emperor = 213 cm<sup>2</sup>/leaf) has the largest leaf surface growth. Yields showed that the application of calcium fertilizer and leaf spray every 4 days and every 7 days made the melon crop get the heaviest fruit weight. The use of different varieties showed that only melon varieties V4 (Lady Green = 36.4 tons/ha), V1 (Sweet Net 77 = 34.6 tons/ha), and V2 (Lady Gold = 31.4 tons/ha) gained the heaviest fruit weight. On the other hand, the quality of the fruit showed that the application of calcium fertilizer and leaf spray every 4 days, every 7 days, and every 10 days made the melon crop get the largest fruit size. The use of different varieties showed that the melon variety V4 (Lady Green = 64.8 cm<sup>2</sup>) has the largest fruit size. Applying calcium fertilizer to the foliar application every 7 days has resulted in the sweetest and highest sugar levels. The use of different varieties showed that the melon variety V3 (Yellow Emperor = 11.5%) had the highest sugar level. Applying calcium fertilizer to the foliar spray every 7 days gives the melon crop the thickest flesh, and the melon varieties V4 (Lady Green = 3.84 cm), V1 (Sweet Net 77 = 3.77 cm), and V2 (Lady Gold = 3.68 cm) obtained the thickest flesh of the fruit. Applying calcium fertilizer to the leaves every 7 days resulted in the highest number of melon seeds. The use of different varieties showed that the melon varieties V4 (Lady Green = 547) and V2 (Lady Gold = 518) received the highest number of seeds. Thus, in summary, comparing the growth of 5 melon cultivars with 4 levels of calcium fertilizer, the results showed that the application of calcium fertilizer and leaf spray every 4 days, every 7 days, made the melon crop. Both growth, yield, and fruit quality are excellent. The use of different varieties showed that only the melon varieties V4, V1, and V2 are the best.

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