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Optimizing Watering Strategies: Enhancing Zucchini (*Cucurbita pepo* L.) Growth and Yield Through Phase-Specific Water Management

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Abstract— *The primary issue in zucchini cultivation is water availability. As a member of the Cucurbitaceae family, zucchini is notably sensitive to water supply, which can significantly influence plant growth and productivity. Each growth phase of the plant has specific water requirements that must be met for optimal development. The aim of this study was to determine the optimal watering management, tailored to the growth stages of zucchini, ensuring sustainable cultivation practices. The study was designed using a randomized block design (RBD) with 12 treatments. Four levels of watering management, based on field capacity (40%, 60%, 80%, and 100%), were applied in combination with two main growth phases (vegetative and generative). The treatments were repeated three times, resulting in 36 experimental units. The findings of this study indicate that treatments $V_{40}G_{60}$, $V_{40}G_{80}$, and $V_{60}G_{60}$ led to a decrease in both growth and yield of zucchini plants. These included growth parameters such as plant length, number of leaves, number of male flowers, number of female flowers, plant fresh weight, and plant dry weight. Furthermore, the $V_{40}G_{60}$ treatment significantly reduced yield parameters, including fruit weight and plant yield.*

Keywords*—*Field capacity, Watering management, Water stress, Zucchini.

I. INTRODUCTION

Zucchini (*Cucurbita pepo* L.) is a high-value horticultural crop recognized for its significant economic and nutritional potential. In Indonesia, the market price of zucchini can reach up to Rp 40,000 (±2.51 USD) per kilogram, reflecting its premium status in the agricultural sector [1]. This substantial economic value is attributed to its increasing consumer demand, particularly in upscale dining establishments and premium retail outlets such as supermarkets [2]. The surge in its popularity is further supported by the dissemination of information via social media platforms, especially among younger generations who are increasingly adopting health-conscious lifestyles and dietary trends [3]. From a nutritional perspective, zucchini is a rich source of essential micronutrients and bioactive compounds. It contains B-complex vitamins, vitamin C, vitamin A, and dietary fiber, which play crucial roles in maintaining metabolic homeostasis, regulating blood sugar levels, and supporting overall health. Furthermore, it is an excellent source of potassium, an electrolyte critical for cardiovascular and muscular function [4]. Zucchini also stands out as a low-calorie food, providing only 14 kcal per 100 g, coupled with a remarkably high-water content of 96.5%, making it a suitable dietary choice for individuals aiming to manage weight or adopt a calorie-restricted diet [3]. These attributes, combined with its culinary versatility, contribute to its growing prominence as a staple in health-oriented dietary regimens.

The high economic value of zucchini can be attributed to the growing demand that is not matched by adequate domestic production. Limited cultivation insights and practices are among the primary factors contributing to the low production rates and the limited number of zucchini producers in Indonesia [1]. Moreover, zucchini remains an imported horticultural commodity in Indonesia, adding to its market exclusivity [5]. The significant market value of zucchini presents an opportunity for urban agriculture, as it does not require extensive land for cultivation. This characteristic makes zucchini suitable for production in residual spaces or home gardens, thereby leveraging limited urban land for agricultural purposes [6]. However, one of the main challenges in zucchini cultivation is its water requirement, particularly in arid or dryland areas. As a member of the *Cucurbitaceae* family, zucchini is notably sensitive to water availability, which can significantly impact plant growth and productivity [7]. Addressing these water management challenges is crucial for the successful and sustainable cultivation of zucchini in such regions.

Water scarcity potentially disrupt critical physiological processes in plants, such as photosynthesis, nutrient absorption, and fruit development, ultimately leading to reduced yields. Some researches conducted by [8,9,10] have demonstrated that water stress can decrease crop yields by up to 40%. This issue is particularly pressing in the context of urban farming, where resource efficiency is paramount. Hence, a deeper understanding of zucchini responses to water scarcity is essential to developing more effective and sustainable cultivation strategies.

Research has shown that timely irrigation during specific growth phases can significantly enhance crop yields [11]. Water demand typically increases during the peak growth stages, particularly during flowering and fruiting phases [12]. Therefore, understanding the growth phases and their duration is crucial for planning irrigation schedules, including both the timing and quantity of water application. By investigating the effects of watering management on zucchini growth and yield, this study aims to provide actionable recommendations for efficient water resource management. These insights could contribute to improving zucchini productivity while supporting sustainable agricultural practices, particularly in urban farming systems.

II. METHOD

The research was conducted from September to November 2024 located at Tlogo Indah St. No. 44, Tlogomas, Lowokwaru District, Malang City, East Java Province. The research area is geographically located at -7°56'17.6"S and 112°36'06.9"E. The elevation of the research area is at an altitude of 675 meters above sea level with an average temperature of 23-31°C, an average rainfall of 1,250 mm year^{-1}.

This study was conducted using a randomized block design (RBD). There were 12 treatments of water availability levels at each growth phase of zucchini plants referring to soil Field Capacity (FC) and repeated 3 times to obtain 36 experimental units. The treatments detailed:

$V_{40}G_{60}$: 40% FC in vegetative phase and 60% FC in generative phase

$V_{40}G_{80}$: 40% FC in vegetative phase and 80% FC in generative phase

$V_{40}G_{100}$: 40% FC in vegetative phase and 100% FC in generative phase

$V_{60}G_{60}$: 60% FC in vegetative phase and 60% FC in generative phase

$V_{60}G_{80}$: 60% FC in vegetative phase and 80% FC in generative phase

$V_{60}G_{100}$: 60% FC in vegetative phase and 100% FC in generative phase

$V_{80}G_{60}$: 80% FC in vegetative phase and 60% FC in generative phase

$V_{80}G_{80}$: 80% FC in vegetative phase and 80% FC in generative phase

$V_{80}G_{100}$: 80% FC in vegetative phase and 100% FC in generative phase

$V_{100}G_{60}$: 100% FC in vegetative phase and 60% FC in generative phase

$V_{100}G_{80}$: 100% FC in vegetative phase and 80% FC in generative phase

$V_{100}G_{100}$: 100% FC in vegetative phase and 100% FC in generative phase

The level of water supply is carried out in conditions of water shortages at field capacity and at normal water requirements at field capacity.

$$\text{Field Capacity} = \frac{\text{Soil FC weight} - \text{Oven dry soil weight}}{\text{Oven dry soil weight}} \times 100$$

Water treatment is done using a measuring cup based on the calculation results of watering on field capacity of 40% (1.08 L), 60% (1.62 L), 80% (2.16 L) and 100% (2.7 L) at a soil weight of 10 kg.

$$\text{Maximum water added to reach field capacity} = \frac{\text{FC moisture content} - \textit{air dry soil weight}}{100\%} \times \text{soil weight (10kg)}$$

Watering management treatments during the vegetative phase of zucchini commenced from the initial planting until 50% of the plant population had formed flowers (23 days after planting, DAP). Once 50% flowering was achieved, watering management treatments transitioned to the generative phase, covering 24–50 DAP. The observed parameters in this study were categorized into growth and yield metrics. Vegetative properties included the observation of plant height (cm) and number of leaves, assessed at 35 DAP. Generative properties included the observation of number of flowers, fruit weight (g/fruit and g/plant), fresh plant biomass (g/plant), and dry plant biomass (g/plant), all measured at harvest (50 DAP).

III. RESULT

3.1 Vegetative properties

The variation in watering managements at different growth stages of zucchini plants significantly affecting plant height at 35 DAP (Table 1). Plant length in the $V_{100}G_{100}$ treatment was longer by 40.16%, 39.54%, and 33.41% compared to the $V_{40}G_{60}$, $V_{40}G_{80}$, and $V_{40}G_{100}$ treatments. The $V_{100}G_{100}$ treatment was also 35.19%, 30.24%, and 15.23% longer than the $V_{60}G_{60}$, $V_{60}G_{80}$, and $V_{60}G_{100}$ treatments. In addition, the $V_{100}G_{100}$ treatment was 31.10% longer than $V_{80}G_{60}$, although not significantly different from $V_{80}G_{80}$ and $V_{80}G_{100}$, with an average length of 61.54 cm. Significant differences were also seen with the $V_{100}G_{60}$ treatment, which was 16.09% longer, but not significantly different from $V_{100}G_{80}$.

Table.1: The Effect of Watering Management During Vegetative and Generative Phases on the Length of Zucchini Plant at 35 DAP

Watering treatments	Length of plant (cm plant^{-1})
$V_{40}G_{60}$	47.01 a
$V_{40}G_{80}$	47.22 a
$V_{40}G_{100}$	49.39 ab
$V_{60}G_{60}$	48.74 ab
$V_{60}G_{80}$	50.59 ab
$V_{60}G_{100}$	57.18 b
$V_{80}G_{60}$	50.26 ab
$V_{80}G_{80}$	59.49 bc
$V_{80}G_{100}$	63.60 bc
$V_{100}G_{60}$	56.76 b
$V_{100}G_{80}$	62.03 bc
$V_{100}G_{100}$	65.89 c
HSD 5%	8.341
CV (%)	5.150

Note: number followed by the same letter in the same column represent non-significant result based on the 5% HSD test. HSD = honest significant difference, CV = coefficient of variation.

The watering management treatments showed significant result on the variable of the number of leaves. The leaf number parameter at 35 days after transplanting (DAP) showed that the $V_{100}G_{100}$ treatment had the highest number of leaves, with 15.83 in number. This was significantly higher than the $V_{40}G_{60}$, $V_{60}G_{60}$, $V_{80}G_{60}$, and $V_{100}G_{60}$ treatments, with increases of 23.38%, 20.20%, 17.26%, and 14.46%, respectively. Compared to the $V_{40}G_{80}$, $V_{60}G_{80}$, and $V_{80}G_{80}$ treatments, the increases were 21.77%, 15.80%, and 11.48%, respectively, but there was no significant difference with $V_{100}G_{80}$. Furthermore, compared to the $V_{40}G_{100}$ and $V_{60}G_{100}$ treatments, the increases were 18.75% and 11.71%, respectively, but no significant difference was observed with $V_{100}G_{100}$ watering management treatment.

Table.2: The Effect of Watering Management During Vegetative and Generative Phases on the Number of Leaves of Zucchini Plant at 35 DAP

Watering treatments	Number of leaves
$V_{40}G_{60}$	12.83 a
$V_{40}G_{80}$	13.00 a
$V_{40}G_{100}$	13.33 ab
$V_{60}G_{60}$	13.17 ab
$V_{60}G_{80}$	13.67 ab
$V_{60}G_{100}$	14.17 b
$V_{80}G_{60}$	13.50 ab
$V_{80}G_{80}$	14.20 b
$V_{80}G_{100}$	15.50 c
$V_{100}G_{60}$	13.83 ab
$V_{100}G_{80}$	15.17 bc
$V_{100}G_{100}$	15.83 c
HSD 5%	1.168
CV (%)	5.920

Note: number followed by the same letter in the same column represent non-significant result based on the 5% HSD test. HSD = honest significant difference, CV = coefficient of variation.

3.2 Generative properties

The analysis of variance showed that the watering management treatments during the vegetative and generative phases significantly affected the number of male and female flowers. For the number of male flowers in the $V_{80}G_{100}$ treatment produced 7,890 male flowers, showing increases of 33.95%, 31.50%, and 29.13% compared to the $V_{40}G_{60}$, $V_{40}G_{80}$, and $V_{40}G_{100}$ treatments, respectively. However, no significant differences were found when compared to the $V_{60}G_{60}$, $V_{60}G_{80}$, and $V_{60}G_{100}$ treatments (average of 6.74), as well as the $V_{80}G_{60}$, $V_{80}G_{80}$, and $V_{80}G_{100}$ treatments (average of 7.52), and the $V_{100}G_{60}$ and $V_{100}G_{80}$ treatments (average of 7.72).

Table.3: The Effect of Watering Management During Vegetative and Generative Phases on the Number of Flowers of Zucchini Plant at 35 DAP

Watering treatments	Number of male flowers	Number of female flowers
$V_{40}G_{60}$	5.890 a	3.310 a
$V_{40}G_{80}$	6.000 a	3.300 a
$V_{40}G_{100}$	6.110 a	3.280 a
$V_{60}G_{60}$	6.890 ab	4.440 b
$V_{60}G_{80}$	6.780 ab	4.480 b
$V_{60}G_{100}$	6.560 ab	4.440 b
$V_{80}G_{60}$	7.670 b	4.670 b
$V_{80}G_{80}$	7.560 b	4.590 b
$V_{80}G_{100}$	7.330 b	4.780 b
$V_{100}G_{60}$	7.780 b	5.000 b
$V_{100}G_{80}$	7.670 b	4.890 b
$V_{100}G_{100}$	7.890 b	5.110 b
HSD 5%	1.216	1.116
CV (%)	11.93	11.62

Note: number followed by the same letter in the same column represent non-significant result based on the 5% HSD test. HSD = honest significant difference, CV = coefficient of variation.

For the number of female flowers based on the $V_{100}G_{100}$ treatment resulted in 5,110 female flowers, with increases of 54.38%, 54.84%, and 55.48% compared to the $V_{40}G_{60}$, $V_{40}G_{80}$, and $V_{40}G_{100}$ treatments, respectively. However, no significant differences were observed when compared to the $V_{60}G_{60}$, $V_{60}G_{80}$, and $V_{60}G_{100}$ treatments (average of 4.45), as well as the $V_{80}G_{60}$, $V_{80}G_{80}$, and $V_{80}G_{100}$ treatments (average of 4.68), and the $V_{100}G_{60}$ and $V_{100}G_{80}$ treatments.

The watering management treatments had a significant effect on both the fruit weight and yield. The $V_{100}G_{100}$ watering management treatment exhibited a fruit weight of 393.0 g, which was significantly higher, showing increases of 28.47%, 28.30%, and 13.32% compared to the $V_{40}G_{60}$, $V_{40}G_{80}$, and $V_{40}G_{100}$ watering management treatments, respectively. Compared to the $V_{60}G_{60}$ watering management treatment, there was an increase of 25.11%, but no significant differences were observed when compared to the $V_{60}G_{80}$, $V_{60}G_{100}$ (average of 373 g), $V_{80}G_{60}$, $V_{80}G_{80}$, and $V_{80}G_{100}$ (average of 382.8 g), or the $V_{100}G_{60}$ and $V_{100}G_{80}$ (average of 384.1 g) watering management treatments.

The $V_{100}G_{100}$ watering management treatment yielded 883.9 g per plant, showing significant increases of 117%, 108%, and 64.44% compared to the $V_{40}G_{60}$, $V_{40}G_{80}$, and $V_{40}G_{100}$ watering management treatments, respectively. Compared to the $V_{60}G_{60}$, $V_{60}G_{80}$, and $V_{60}G_{100}$ watering management treatments, the increase was 89.39%, 43.81%, and 32.10%, respectively. This yield was 54.60% higher than that of the $V_{80}G_{60}$ treatment, but no significant differences were observed when compared to the $V_{80}G_{80}$, and $V_{80}G_{100}$ (average of 752.3 g), or the $V_{100}G_{60}$ and $V_{100}G_{80}$ (average of 696.7 g) watering management treatments.

Table.4: The Effect of Watering Management During Vegetative and Generative Phases on the Weight of Fruit and Yield of Zucchini Plant at 50 DAP

Watering treatments	Weight of fruit ($g\ fruit^{-1}$)	Yield ($g\ plant^{-1}$)
$V_{40}G_{60}$	305.9 a	406.0 a
$V_{40}G_{80}$	306.3 a	424.6 a
$V_{40}G_{100}$	346.8 b	537.5 ab
$V_{60}G_{60}$	314.1 ab	466.7 ab
$V_{60}G_{80}$	367.9 bc	614.6 b
$V_{60}G_{100}$	378.1 bc	669.1 b
$V_{80}G_{60}$	365.7 bc	571.7 ab
$V_{80}G_{80}$	390.5 c	720.2 bc
$V_{80}G_{100}$	392.3 c	784.5 bc
$V_{100}G_{60}$	376.0 bc	666.7 b
$V_{100}G_{80}$	392.2 c	726.7 bc
$V_{100}G_{100}$	393.0 c	883.9 c
HSD 5%	38.15	178.3
CV (%)	7.560	9.630

Note: number followed by the same letter in the same column represent non-significant result based on the 5% HSD test. HSD = honest significant difference, CV = coefficient of variation.

The fresh plant weight observations in the 50 DAP showed that the $V_{100}G_{100}$ watering management treatment exhibited a significantly higher, with increases of 39.06%, 37.31%, and 22.51% compared to the $V_{40}G_{60}$, $V_{40}G_{80}$, and $V_{40}G_{100}$ watering management treatments, respectively. When compared to the $V_{60}G_{60}$ and $V_{60}G_{80}$ watering management treatments, the fresh plant weight increased by 24.16% and 15.89%, respectively, although no significant difference was observed when compared to the $V_{60}G_{100}$ watering management treatment. The $V_{100}G_{100}$ watering management treatment also had a 16.89% higher weight than the $V_{80}G_{60}$ treatment, but no significant differences were found when compared to the $V_{80}G_{80}$, and $V_{80}G_{100}$ watering management treatments (average of 545.3 g). No significant differences were observed when compared to the $V_{100}G_{60}$ and $V_{100}G_{80}$ watering management treatments (average of 544.7 g).

The $V_{100}G_{100}$ treatment was 80.37% heavier than the $V_{40}G_{60}$ treatment, although no significant differences were found when compared to the $V_{40}G_{80}$, and $V_{40}G_{100}$ treatments. No significant differences were observed when compared to the $V_{60}G_{60}$, $V_{60}G_{80}$, and $V_{60}G_{100}$ treatments (average of 34.51 g), as well as with the $V_{80}G_{60}$, $V_{80}G_{80}$, and $V_{80}G_{100}$ treatments (average of 39.81 g). The $V_{100}G_{100}$ treatment also showed no significant differences when compared to the $V_{100}G_{60}$ and $V_{100}G_{80}$ treatments (average of 41.06 g).

Table.5: The Effect of Watering Management During Vegetative and Generative Phases on the Fresh Weight and Dry Weight of Zucchini Plant at 50 DAP

Watering treatments	Fresh weight of plant (g tan^{-1})	Dry weight of plant (g tan^{-1})
$V_{40}G_{60}$	417.6 a	26.24 a
$V_{40}G_{80}$	422.9 ab	27.57 ab
$V_{40}G_{100}$	474.0 ab	32.77 ab
$V_{60}G_{60}$	467.7 ab	31.03 ab
$V_{60}G_{80}$	501.1 b	34.37 ab
$V_{60}G_{100}$	533.5 bc	38.13 b
$V_{80}G_{60}$	496.8 b	33.40 ab
$V_{80}G_{80}$	530.3 bc	41.30 b
$V_{80}G_{100}$	560.3 bc	44.73 b
$V_{100}G_{60}$	532.0 bc	37.79 b
$V_{100}G_{80}$	557.5 bc	44.34 b
$V_{100}G_{100}$	580.7 c	47.33 b
HSD 5%	77.23	11.21
CV (%)	6.910	10.33

Note: number followed by the same letter in the same column represent non-significant result based on the 5% HSD test. HSD = honest significant difference, CV = coefficient of variation.

IV. DISCUSSION

Water is a critical component in the plants physiological processes, including photosynthesis, transpiration, and nutrient transport. Insufficient watering in plants, especially zucchini, significantly impact the plant growth and development, including plant length. In the age of 35 DAP, the watering treatment at 100% field capacity in both the vegetative and generative phases ($V_{100}G_{100}$) resulted in a significant increase of 40.16% and 39.53% compared to the treatment with 40% vegetative phase and 60% generative phase watering ($V_{40}G_{60}$), as well as the treatment with 40% vegetative phase and 80% generative phase watering ($V_{40}G_{80}$). This is supported by research that was done by [13], which indicates that plants experiencing water deficiency undergo stress that can inhibit growth, including plant length. In the cited study, a 40% field capacity watering treatment caused a 32% reduction in soybean plant length. When plants experience water stress, the plant ability to absorb carbon dioxide (CO_2) from the atmosphere is reduced. This leads to a decrease in photosynthetic efficiency, ultimately affecting plant growth, including the ability to increase its length [14]. The importance of proper watering in zucchini cultivation is further supported by studies on tomato plants, where water stress resulted in a decline in total plant biomass as an adaptation strategy to survive drought conditions. Furthermore, plants experiencing water stress tend to reduce the number of leaves and leaf surface area to minimize water loss through transpiration, which can lead to a decrease in overall plant length [15, 16].

Inadequate watering in zucchini plants can significantly impact the number of leaves, which is an important indicator of plant productivity. Optimal watering management at 100% field capacity during the vegetative and generative phases ($V_{100}G_{100}$) resulted in an increase of 23.38% and 21.80%, respectively, compared to the treatment with 40% vegetative phase and 60% generative phase watering ($V_{40}G_{60}$), as well as the treatment with 40% vegetative phase and 80% generative phase watering ($V_{40}G_{80}$). Water serves as a medium for nutrient transport and is essential in photosynthesis, both critical for plant growth. Water shortage causes plants to adapt by reducing leaf number or slowing down their growth as a response to environmental stress. Zucchini plants that experiencing water deficiency show a significant decrease in leaf number, especially under severe water stress (25% field capacity) [14, 17]. The reduction in leaf number is a strategy for conserving water. Adjusting leaf number and surface area is an adaptive strategy plants use to reduce water loss through transpiration, which ultimately affects plant biomass [16, 18]. Research that was done by [19] also indicates that drought stress negatively impacts the growth and leaf number of tomato plants. Overall, water deficiency significantly affects the reduction in leaf number, which, in turn, impacts photosynthesis, growth, and crop yield.

Water availability plays a crucial role in the physiological processes of plants in growing flower, as part of plants transition from vegetative phase to generative phase. Plants experiencing water deficiency can alter their flowering patterns, potentially reducing the number of flowers produced. Watering management in terms of male flower number showed significant differences, with the treatment of 100% field capacity during the vegetative and generative phases ($V_{100}G_{100}$) resulting in a 33.95% increase compared to the treatment with 40% vegetative phase and 60% generative phase watering ($V_{40}G_{60}$). In terms of female flower number, significant differences were observed with the 100% field capacity watering during the vegetative and generative phases ($V_{100}G_{100}$), showing a 55.79% increase compared to the treatment with 40% vegetative phase and 100% generative phase watering ($V_{40}G_{100}$). Water deficiency can disrupt the flowering process, reducing the number of both male and female flowers formed. Research that was done by [20] demonstrated that water stress in cucumber plants led to a decrease in flower number due to reduced energy for the flowering process. Water stress impacts cucumber plant to grow and produce, as well as in the flowering phase. A reduction in flower number can decrease the number of fruits produced, affecting yields through the disruption of the flower and fruit formation [21, 22].

Water deficiency leads to a reduction in fruit weight of plants, which in turn affects the overall yield. The watering management treatment with 100% field capacity during both the vegetative and generative phases ($V_{100}G_{100}$) resulted in significantly larger fruit weights, with increases of 28.47% and 28.30%, respectively, compared to the treatment with 40% field capacity during the vegetative phase and 60% during the generative phase ($V_{40}G_{60}$), as well as $V_{40}G_{80}$. In terms of plant's yield, the $V_{100}G_{100}$ treatment also showed a 117% and 108% increase compared to other treatments. Water stress can significantly impact yield of zucchini [17]. Based from the study, plants subjected to water stress exhibited a notable decrease in fruit weight. Adequate water availability is crucial for supporting optimal fruit growth. Water stress reduced both the weight and size of zucchini fruits, with a decrease of up to 37% in plants watered with 50% field capacity [14]. Water deficiency impedes fruit growth and leads to a reduction in overall yield. Water stress, particularly in zucchini plants, affects both the quality and quantity of the fruit produced [23, 24].

Water deficiency can lead to a reduction in the fresh weight of plants, which in turn affects the overall yield. The analysis of variance presented in (Table 5) shows that the treatment with 100% watering during both the vegetative and generative phases ($V_{100}G_{100}$) resulted in a 29.46% increase in fresh weight compared to the treatment with 40% watering during the vegetative phase and 60% during the generative phase ($V_{40}G_{60}$). Studies have shown that water stress affects the fresh weight of plants, as observed in cucumber plants, which experience a decrease in fresh weight due to less water shortage in the plant's tissue [25, 26]. This reduction is caused by the stress experienced by the plants, which reduces energy available for growth. Overall, adequate water availability is crucial for supporting optimal plant growth and increasing fresh weight [27]. Water stress in zucchini plants can significantly affect their dry weight. A decrease in dry weight occurs in water-stressed plants. The treatment with 100% watering during both the vegetative and generative phases ($V_{100}G_{100}$) resulted in a 47.11% increase in dry weight compared to the $V_{40}G_{60}$ treatment. The significant reduction in dry weight observed in water-stressed plants is related to the stress that reduces energy for growth [25, 26]. Overall, water stress negatively impacts the dry weight of zucchini plants, indicating that sufficient water availability is essential for supporting optimal growth.

V. CONCLUSION

Field capacity water application treatments $V_{40}G_{60}$, $V_{40}G_{80}$ and $V_{60}G_{60}$ decreased the growth and yield of zucchini plants which include growth parameters (plant length, number of leaves, number of male flowers, number of female flowers, plant fresh weight, plant dry weight). Additionally, the $V_{40}G_{60}$ treatment significantly reduced yield parameters (fruit weight g fruit^{-1} and fruit weight g tan^{-1}).

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