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Analysis of Water Requirements for Irrigation of Green Honey Water Apple (*Syzygium aqueum*) in Pots

Analisis Kebutuhan Air Irigasi Tanaman Jambu Air (*Syzygium aqueum)* dalam Pot

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ABSTRACT

Plant irrigation water needs are important things to be met so that the plant growth is optimal starting from the vegetative phase to the generative phase. The current hot issue among potted fruit growers is the problem of dropping the ovary (pistil) on the plant. Many factors cause the fall of plant fruit, one of which is lack of water. This certainly needs special attention considering the nature of the water apple plant itself, in this study, especially the green honey water apple, it consumes quite a lot of water every day. To overcome the problem of water shortages in the green honey water apple plant, it is necessary to first know the average plant water requirement in pots through water content analysis in the laboratory at three stages of analysis and calculation of Pot Water Requirements (PWR) and Efficiency Needs Irrigation Water. Average Field Capacity Moisture Content of the potted planting media sample was 49.37%, Air Dry Moisture Content was 24.27 % and PWR 4.36 liters with an efficiency of irrigation water requirement for bulk systems (hand move or portable) of 5, 12-5.81 liters and a drip irrigation system (point source emitter) of 4.84-5.45 liters.

Keywords: *Green honey water apple, Plant Water Needs, Irrigation*

ABSTRAK

Kebutuhan air irigasi tanaman merupakan hal yang penting untuk dipenuhi agar pertumbuhan tanaman tersebut optimal mulai dari fase vegetatif sampai fase generatif. Permasalahan yang sedang hangat di kalangan petani tanaman buah dalam pot saat ini adalah masalah gugurnya bakal buah (putik) pada tanaman tersebut. Banyak faktor penyebab gugurnya bakal buah tanaman, salah satunya adalah kekurangan air. Hal ini tentu perlu mendapat perhatian khusus mengingat sifat dari tanaman jambu air sendiri, dalam penelitian ini khususnya jambu air madu hijau, mengkonsumsi air cukup tinggi setiap harinya. Untuk mengatasi masalah kekurangan air pada tanaman jambu air madu hijau tersebut, perlu diketahui terlebih dahulu kebutuhan air tanaman rata-rata dalam pot melalui analisis kadar air di laboratorium pada tiga tahap analisis dan perhitungan *Pot Water Requirements* (PWR) serta Efisiensi Kebutuhan Air Irigasi. Rata-rata Kadar Air Kapasitas Lapang dari sampel media tanam dalam pot berkisar 49,37 %, Kadar Air Kering Udara berkisar 24,27 % dan PWR 4,36 liter dengan efisiensi kebutuhan air irigasi sistem curah (*hand move* atau *portable*) sebesar 5,12-5,81 liter dan sistem irigasi tetes (point source emitter) sebesar 4,84 – 5,45 liter.

Kata kunci: Jambu Air Madu, Kebutuhan Air Tanaman, Irigasi

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INTRODUCTION

Green honey water apple is a type of tropical fruit plant that is widely cultivated in Indonesia, either planted directly in the ground or planted in pots, this is motivated by the high public interest in consuming the fruit. The main use of this green honey water apple plant is as a food ingredient. The main advantage of green honey waterapple is its very high water content, reaching 89.82% (Lim & Rabeta, 2013).

Fruit Plants in Pots is a method of cultivating fruit plants where they grow in pots with the aim of being ornamental plants in the yard of the house.

For some people who have limited land ownership but have a desire and passion for cultivating plants, of course the technique of growing plants in pots is a promising solution. In urban environments or densely populated settlements, people can even have various types of fruit plants around the house (Tabulampot) which can be juxtaposed with various other types of garden plants, besides being useful as a source of nutrition for family members, it can also add to the aesthetic value of the environment (family garden). Reservoirs can be used as a source of surface water for various community activities, both for irrigation, domestic (Julia and Novita, 2020). Soilless farming includes hydro farming (Hydroponics), water farming (Aquaponics) and aerobic farming (Aeroponics) as well as substrate cultivation (Novita and Refanda, 2021).

Although it is classified as a plant that is easy to grow using the tabulampot method, problems often arise that are often faced by farmers or among fans of green honey water apple tabulampot, namely when the water apple fruit plant is approaching its fruiting period. Before the plant bears fruit, of course it will go through a flowering period first, when the green honey water apple flowers mostly fall before becoming fruit. The causes of this green honey water apple flower falling also vary, one of which is the lack of adequate water intake for plants, especially during the long dry season which requires more watering intensity (Wibowo, 2016).

The need for water resources which tends to increase due to population growth has resulted in increasingly limited water resources, especially for cultivated plants such as vegetables and fruits that are vulnerable to water needs. Therefore, the availability of water resources must be utilized efficiently and effectively. (Pasaribu et al., 2013).

In meeting water needs for various farming needs, water (irrigation) must be provided in the right amount, time and quality, otherwise the growth of plants will be disrupted which in turn will affect agricultural production (Directorate of Water Management, 2010). The basis of this theory is one of the reasons why the analysis of irrigation water needs on the green honey water apple plant is considered important,

In response to the above problems, it is necessary for farmers and fans of the water apple tabulampot, especially the farmers and fans of the Deli Hijau to know about how much water the water apple plant needs when it enters the productive period, so by taking into account the rate of water loss during watering, the farmers and fans of tabulampot can estimate the amount of water that must be given (irrigation water needs). With sufficient water needs of plants during the productive period, it is certainly expected to reduce the percentage of flowers (fruits) that fall and can increase crop yields.

Based on this, it is deemed necessary to conduct research to analyze the need for irrigation water during the productive period of water apple, in this case the object of research is centered on the type/variety of Deli Green Honey water apple.

MATERIALS AND METHODS

The study was conducted from January to October 2019 in Hamlet IV, Kota Rantang Village, Hamparan Perak District, Deli Serdang Regency, North Sumatra using pots with a diameter of 50 cm and a height of 42 cm. The soil samples tested were soil samples in experimental pots where the green honey water apple plants were at their

productive age (six months after transplanting the plants into pots).

The tools used in the research include: hoes, sprinklers, scales, stationery, cameras.

The materials used in the research include: green honey water apple plant, pots, planting media, NPK fertilizer, compost, water

Analysis of Plant Water Demand (ETc)

Analysis of the level of plant water needs was carried out by giving water to each pot in each treatment. The stages of analysis of the level of plant water demand include: giving water to the point of field capacity, recording the given water, taking soil samples (field capacity), taking permanent wilting point soil samples, analyzing plant water requirements.

Field capacity is measured first by saturating the soil and then allowing it to drip until the dripping of water stops. The water content of the field capacity can also be measured gravimetrically and determined by the equation as in equation (Susilo, 1987)

$$w = \frac{Mw}{Ms}$$

where :

w : Soil water content field capacity (%)

Mw : Water mass (initial soil weight, under field capacity conditions – oven dry soil weight) (g)

Ms : Mass of solids (weight of oven dry soil) (g).

The wilting point is a temporary wilting point. It is said to be a temporary wilting point because the plant is still alive, it's just that the plant does not get water because the water in the planting medium has run out, if the plant is watered again with water, the plant will live/refresh (Abdurachman dan Hidayat, 1999). The limitation used to determine whether the water-honey water apple plant is ready to be watered again is that one plant that is experiencing wilting symptoms has been found.

Research Stages

Preparation Stage

The stages of preparation include: preparation of planting media, application of basic fertilizer, filling of planting media in polybags, and preparation of green honey water apple plant.

Planting and Maintenance Stage

The maintenance of the green honey water apple plant is carried out by providing irrigation water according to data collection, nutrition, and spraying pesticides.

Data Collection Stage

Data on water requirements were observed from the amount of water given until the plants experienced temporary wilting symptoms. Symptoms of temporary wilting are wilting experienced by plants because the available water in the growing media has run out or cannot be absorbed by plants, but the plants will be refreshed when they are given irrigation water again. Irrigation water requirement (ETc) can be calculated by dividing the amount of water given by the time between the application of water until the plants experience temporary wilting.

$$ETc = \frac{amount\ of\ water\ given\ (ml)}{wilting\ time\ (day)}$$

RESULTS AND DISCUSSION

Analysis of Physical Properties of Soil (Planting Media)

Observation of soil texture at the Laboratory of Soil Science, Faculty of Agriculture USU was carried out using the "texture by feel" method, where the object of observation was a soil sample taken directly from the tabulampot planting medium. The results of the laboratory analysis showed that the texture of the soil sample used was included in the dusty clay texture class, while the soil structure sample was included in the crumb structure class with medium

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size (0.2-0.5 cm) and also with a level of development. medium structure (unclear and rather stable structural unit, when kneaded into grains and aggregates). The crumb structure is a form of soil structure that is dominant in dust and is located in the A horizon, the structural unit is spherical, the particles are loosely arranged, highly porous and an example of a surface soil horizon that is rich in organic matter (Muhlisin, 2010).

The consistency of the soil in a wet state from the results of observations in the laboratory obtained a slightly sticky degree of stickiness and a degree of plasticity. Meanwhile, the consistency of the soil in a moist state is included in the loose category.

Soil Density

Loot Density (Particle Density = PD) or Also known as particle density (Ps) is the ratio of the total mass of the solid phase of the soil (Ms) and solid phase volume (Vs). Mass of organic matter and organic matter is calculated as the mass of soil solids in determining the density of soil particles (Agus and Marwanto 2006). Particle Density (PD) value observed in the laboratory is 1.79 gr/cm3. Particle density is a function of the ratio between components mineral and organic matter. Particle density for mineral soils ranging from 2.6 g/cm^3 up to 2.7 g/cm^3, with an average value of 2.65 g/cm^3 while the density of organic soil particles is around 1.30 g/cm^3 up to 1.50 g/cm^3 (Pandutama, et al., 2003).

Filling weight (bulk density = BD) or often too called the volumetric weight of the soil is a property of soil physics is often defined. BD defined as the solid phase mass of the soil (Ms), divided by total soil volume (Vt). BD is very closely related with soil density, ease of root penetration soil, soil drainage and aeration as well as soil physical properties other. The value of Bulk Density (BD) observed in the laboratory is 0.7 gr/cm3 where the high organic matter also causes the soil to become more porous, so the BD becomes lower. Land with high organic matter content have a relatively low BD (Agus et al., 2006).

Low organic matter, correlated with poor physical and chemical properties of other soils such as density (bulk density = BD), total pore space, pore aeration and K are available (Nurida 2006).

The porosity of the observed soil sample is 61% where the value of the porosity of a soil has a relationship with the bulk density and particle density. By knowing the value of bulk density and particle density of a soil can be known levels and air contained in the soil pores so that it can determine when the soil needs to be given water or air contained in the soil pores so that it is still loose. If a soil has a small pore space then plants growing on it will lack oxygen, caused by the difficulty gas or air exchange with too small pores (Suharyatun, 2019).

Average Field Capacity Moisture Content and Air Dry Moisture Content

Based on the results of the analysis in the laboratory, the average value (from the three stages of analysis) of the field capacity moisture content and air dry moisture content is as follows:

Table 1. Field capacity water and air dry moisture content (%)

Sample pot	Field capacity water content (%)	Air dry moisture content (%)
1	48,85	29,43
2	51,80	24,65
3	50,58	21,72
4	48,04	22,94
5	48,48	25,46
6	50,53	23,83
7	49,90	23,46
8	48,98	24,88
9	47,25	22,48
10	49,25	23,89
Average	49,37	24,27

Pot Water Requirement (PWR)

The depleted percentage of moisture content is calculated by the equation below:

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$$PV = \frac{d}{D} x100\%$$

Where:
PV : Percentage of volumetric water content
d : depth of the total available water
D : Depth of soil

Hence, the equivalent volume of water depleted is been calculated and applied in volume (liters).

PWR or V = A x d

Where:
V : the volume of water applied is,
A : area irrigated
d : the depth of total available water depleted (Idris et al., 2020)

The soil in each pot (sample pots 1 – pots up to 10) had a relatively similar weight of ± 17 kg, so that the PWR for each sample pot was obtained as follows:

Table 2. Pot water requirement

Sample pot	PWR (Liter)
1	3,37
2	4,72
3	5,01
4	4,36
5	3,99
6	4,64
7	4,59
8	4,18
9	4,30
10	4,40
Average	4,36

Irrigation Efficiency

The average irrigation water requirements for various irrigation systems (which are suitable for the tabulampot system) are as follows:

Table 3. Irrigation efficiency

Irrigation system	PWR (Liter) per pot
Surface irrigation	
Border	X
Basin	X
Basin	X
Bulk irrigation	
Solid set or permanent	5,12 – 5,81
Hand move or portable	5,12 – 5,81
Center pivot and linear move	4,84 – 5,81
Traveling gun	5,81 – 6,71
Drip irrigation	
Point source emitter	4,84 – 5,45
Line source	5,12 – 5,81

CONCLUSION AND SUGGESTIONS

Conclusion

Water water apple plants in pots with a diameter of 50 cm and a height of 42 cm have an average water requirement of 4.36 liters of water from the beginning of watering until the plants show symptoms of wilting. Meanwhile, for the efficiency of irrigation water needs for bulk systems (hand move or portable) of 5.12-5.81 liters and drip irrigation systems (point source emitters) of 4.84-5.45 liters.

Suggestions

It is necessary to further study the effective and efficient method of giving water to achieve high plant productivity.

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