**EFFECT OF MEDIA AND FREQUENCY OF WATERING FOR GROWTH AND YIELD OF CHRYSANTHEMUM POT VAR *Avanthe agrihorti* ON THE MEDIUM LAND**

**IKA RAHMAWATI1 and ENDANG SULISTYANINGSIH1,\***

**1** **Study Program*of*Agronomi, Faculty of Agriculture, Gadjah Mada University**

**Bulaksumur Yogyakarta 55281**

**\*Correspounding author: endangsih@ugm.ac.id**

**ABSTRACT**

*Having mostly clay soil in Samigaluh are soil useful for the cultivation of potted chrysanthemum plants and can be mixed with the organic material to improve soil chemical and physical properties. That condition certain effect water irrigation need. This research Avanthe agrihorti had be planted in different organic material mixed with clay and different watering frequency. The study was carried out by using 2-factor split plot design with 3 replications of blocks, at altitude 462 m above sea level in the village of Gerbosari, Samigaluh, within March to June 2018. The main plot consisted of once a day, every three days and every five days watering. The subplot included the types of media: clay+manure, clay+manure+cocopeat, clay+manure+rice husk and clay+manure+rice husk charcoal. Data on growth and quality of chrysanthemum plants were statistically analyzed under the 5% ANOVA and continued with a mean DMRT test when significant differences. The results showed that organic material can applied on potted chrysanthemum var. Avanthe agrihorti plants could increase field water capasity, relatif humidity, transpiration rate, photosinthesis, plant dry weight, relative water content, plant height, number of flowers, flower diameter, and make harvest fast. The highest at clay+manure+cocopeat than on other organic media. Watering frequencies once a day can reduce leaf temperature, proline and chlorophyll content, but it’s can increase the relatif water content and plant dry weight. Interaction two treatment factor significant to leaf area at harvest. Plant in clay+manure+cocopeat at all level water frequent show wides leaves than other media.*

***Keywords: watering frequent, chrysanthemum, organic media***

**INTRODUCTION**

Cultivation of potted chrysanthemums in Samigaluh has not been intensified than the cut chrysanthemum. Its cultivation in Samigaluh sub-district has begun since 2012. Although Samigaluh is situated on a medium land of 450-500 asl altitude with air temperature and humidity that supports plant growth and development, but in general, its soil is unsuitable to grow chrysanthemum plants.

Especially for the cultivation of pot chrysanthemum plants has not shown optimal results. Based on the communication carried out with several farmers in Samigaluh, it means using land for media, chrysanthemum pots have not produced good growth, because the soil in the pot uses solids. This is because most of the land in Samigaluh consisted 72.2% clay latosol. Gerbosari village is one of 29 villages in Samigaluh (Bappeda Kulon Progo, 2011; Meifiyanto, 2017). Latosol contains low organic matter (BO) and poor drainage (Hendrata and Sutardi, 2010). Clay is not qualified for crop cultivation due to its mildly acidic soil reaction and low/very low NPK content. It compresses in dry condition and it is slippery during wet conditions. In line with the statement from farmer that they has planted chrysanthemum pots, but the media become compact and solid.

At certain times, farmers must buy new land to increase the carrying capacity of the existing land. Instead of buying new mineral soil, a possible alternative to improve the physical and chemical properties of the soil would be providing organic materials and manure. Such additional organic material increases the water storability that will reduce the compressive properties in dry condition and slipperiness in wet conditions.

In areas with overflow water conditions, water is not an matter, but in areas with limited water conditions, it is necessary to look for appropriate and efficient watering frequency and volume, for example, twice a week even once a week. The purpose of adding organic media is to save water, so the frequency of watering takes longer. The results of the study by Minasny and McBratney (2017), an increase in water content with the addition of organic materials can also increase direct and indirect ground water retention. In order to create good water governance, watering factors are important in the cultivation of potted plants, because they relate to the availability of water that must be added from the outside, considering the root system of potted plants is limited by planting containers with very limited soil volumes, proper watering and fertilization are very important in maintaining attractive potted plants throughout the growing season.

In addition, water resources in Gerbosari come from wells and mountain springs. Wells can be very deep and require large capacity water pump. Water sources from mountain springs are channeled using pipes managed by Drinking Water Enterprise of the village. When dry season is prolonged, in times of water scarcity, water should be shared for various needs of both agricultural irrigation and household consumption.

**MATERIALS AND METHODS**

The research was carried out in plastic houses in Dusun Karang, Gerbosari village, Samilgaluh sub-district, Kulon Progo, DIY (Yogyakarta), within March to May 2018.

The materials used in this study included chrysanthemum cutting of *Avanthe agrihorti* varieties; this description plant are 27,5-29,0 cm tall, flower appear 40-50 days after planting, spay and double type flower, the colour are purple with diametre flower of 3,89-4,11 cm, potential yield 30-40 of flower/ m2/ season, the vaselife about 14-21 days.

The experimental design consisted of Split Plot Design of 2 factors. The first was the watering frequent including once a day, every three days and every five days watering. The second was the type of media used, such as clay+manure, clay+manure+cocopeat, clay+manure+ rice husk, clay+manure+ rice husk charcoal. Each treatment was repeated 3 times.

 Experiments of initial watering volume and moisture content of watering treatment was carried out in the Laboratory. The volume of media treatment each 600 grams is filled into a plastic pot 15 cm diameters. The field capacity of each media is reached after 24 hours and then water is added according to the frequency of watering.

a. Step to find the initial watering volume for the frequency of once a day watering :

1.Measured moisture content of dry media.

2.Given water (Volume V1), left 24 hours until there is no more water dripping.

3.Calculated volume of wasted water (Vs)

4.The volume of field capacity water is V1-Vs

5. Sample media about 10 gram at a depth of 2 cm, measure wet weight (w) and then put oven at 110 oC until 24 hours to get the dry weight (d).

 Moisture content formula are:

 MC = w-d x 100%.

 d

b. Step to find the initial watering volume for the frequency of every three days watering :

1.Given water, left 24 hours until there is no more water dripping.

2. Left media about three days or 3X24 hours

3.Given water (V3) until first water dripping on the pot hold. This volume as field water capacity for every three days

4.Measure the moisture content the field capacity water used formula MC

c. Step to find the initial watering volume for the frequency of every three days watering :

1.Given water, left 24 hours until there is no more water dripping.

2. Left media about five days or 5X24 hours

3.Given water until first water dripping on the pot hold. This volume as field water capacity for every five days

4.Measure the moisture content the field capacity water used formula MC

The growing media was mixed in a volume ratio (v/v) based on the treatment and put into a pot (φ 15 cm) at the same weight (600 grams). Before cutting were planted, the media was wetted to reach saturation and drained in 24 hours. After planted and reached 7 days, the cuttings were watered to saturation and the water came out through the pot hole down wards to have the roots to stick well to the media. On day eight, watering based on the field capacity of each media (Table 1), as indicated by the water dripping on the pot holder, was carry out. A placement was set on the base of the pot. The next day, water was given based on the media capacities, which were once a day, every three days and every five days.

**Table 1. Volume watering**

Additional light was given daily every 4 hours between 22.00-02.00 from the beginning of the planting to 21 days and arranged by a timer. Basic fertilizer in the form of Gandasil D of 2-3 grams per liter of water was given when the plant reached 5 days. Fertilizer in the form of red KNO3 of 400 ppm was given once a week until flower buds appear and continued with white KNO3 of 400 ppm given in once a week until they were ready for sale.

Observations of media samples before planting required physical and chemical analysis that included analysis of pH, EC, porosity, moisture content, weight, density, KPK, C-organic, and NPK available. Media observations during the growth included the humidity and temperature of the media. Plant observations consisted of plant height, fresh and dry weight of plants, leaf area, density and width of stomata openings, chlorophyll content and leaf proline, fresh and dry weight of flowers, flower diameter, number of flowers, transpiration rate, leaf photosynthesis and relative leaf water content.

**RESULTS AND DISCUSSIONS**

This research used latosol soil with 31% sand, 40.6% dust, and 28.3% clay, pH 5.53 (rather acid), low C-organic, very low NPK and 2.37 particle density. Available cation values ​​(CEC) were high (> 28 me / 100 g). The EC of pure latosol soil was quite high (62.3). Based on the USDA classification system, it was classified into the clay loam texture.

Adding organic material (cocopeat/husk/husk charcoal) to the latosol soil would cause changes on the soil physical and chemical properties, as presented on Table 2. Additional organic matter not change pH, increased NPK, CEC and EC, decreased C-organic and particle density. The particle decreased, as the indication of reduced soil density. The optimal EC of chrysanthemum plants were between 1.8-2.5 ms.cm-1 (Syekhfani, 2009).

**Table 2.** Initial media analysis

 Water content in media field capacity can be seen in graph 1. The clay+manure media has the lowest field water content (38.7%) and clay+manure+cocopeat has the highest field water content (43.0%) (Graph 1).

**Graph 1.** Field Water capacity

Adding organic material could increase the field water capasity in the media about 5% in compare to without the addition. Water stored in the media was used for the plant growth. According to Siahaya (2007), water has a direct influence on the preparation of plant bodies and photosynthesis and moves the nutrients to the plant roots for the growth process.

The higher level of field water capacity in the media would lower the soil temperature (Table 3). According to (Anetasia et al., 2013), soil with a lot of media water content usually has temperatures low, but on the contrary media has lower water content usually that has hight temperature.

**Table 3.** Media temperatures

**Table 4.** Media moisture

Media with high field water capacity showed lower leaf temperature (Table 5). Marjenah (2010), the hight availability water content in the media will make it easier for the root to absorp more water, thus transpiration rate becomes faster and causing the leaves to become cool quickly. High transpiration rates also cause water loss very fast and then can reduction in leaf temperature (Monteiro *et al*., 2016).

In this study, clay+manure+cocopeat with the highest field water capacity (Graph 1) produced the lowest leaf temperature (31.93 oC) High water availability in the media caused faster rate of transpiration (25.28 seconds.cm-2). This indicated rapid water vapor movement that passed through the stomata into the air. Thus, carrying moisture from the media and releasing it on the surface of the leaves brought the impact of wider stomata opening (3.44 µm2). Due to the continuous and abundant supply of water from the roots to the leaves, the leaves cooled faster than the surrounding air.

**Table 5.** Leaves temperatures, transpiration rate, stomata-opening widht and number of leaves

Leaf temperature was influenced by both treatment factors but there was no interaction. Often, watered plants showed lower leaf temperatures than those rarely watered. The number of leaves was influenced by the watering frequent and media combination, although there was no interaction between the two factors. Plants that received every five-days watering interval produced the least number of leaves than once and every three days watering interval. This was possible because the available water content in the watered media within every five days interval was lower than the other two intervals, although not significantly different. The highest number of leaves was plants grown on clay+ manure + cocopeat, and the number of leaves was not different from those grown on the clay + manure + husk (table 5).

Media with high available water content also produced wider and more leaves. This was possible because the volume of water absorbed by plant roots for the growth metabolic processes was more than on other media, so that photosinthesis product for the formation of leaves area and number also increased. According to Busaifi (2017), leaf area is quite influencing in photosynthesis. It affects the number of branches and leaves, fresh weight and dry weight of the plants.

The higher the water content in the media, would be the greater the fresh weight of the plant. Media with greater water content produced a higher rate of photosynthesis, so that the photosynthate used for cell and organ formation would also be greater (Table 6). The condition of cell turgidity would also be maintained as indicated by the relatif water content (RWC) of the leaves so that the cell formation was carried out better and able to reach the plant maximum fresh weight. According to Guritno and Sitompul (1996), fresh weight describes the amount of fluid contained in plants.

**Table 6.** Photosynthesis, Relative Water content (RWC) in the leaves and plant Fresh Weight

Table 7 shows the interaction between the two treatment factors to the leaf area at the harvest time. If given with longer watering frequent treatment (every five days), the leaves tended to become narrow, except for plants in clay+manure+cocopeat. The moisture content of such media allowed wider leaf than of other media.

**Table 7.** Leaf area at harvest time

If the leaf area increased, the assimilation will also be likely to increase to form more leaves. The leaf area can be used as a measure of water content status in a planting media. Sufficient water conditions allowed maximum expansion of leaves, and vice versa, scarce or limited water would result in decreasing leaf area.

Wider leaf conditions enabled more CO2 absorption and consequently better photosynthesis. Photosynthate results would likely be more translocate to parts of plant organs and useful for subsequent plant growth process (Siahaya, 2007).

The shoot root ratio (SRR) was influenced by the watering frequent. Every five-days watering indicated the highest SRR which was significantly different from other watering frequent. The increasing SRR indicated the proportion of dry material formation allocated for the shoots decreased and focused more on the roots. Thus, it acted as the plant protection mechanism in the face of stress due to water scarcity. According to Boutraa, (2010), rising SSR indicates decreasing proportion of dry material allocated for the shoots than the roots in soybean plants. Anggraini *et al*., (2015) mentions that longer frequency of watering treatment is one of the efforts to expand the root system in taking water for the canopy growth.

 The leaf proline and chlorophyll content were influenced by the watering frequent. The longer the watering frequent, the greater the proline and chlorophyll content would be. Resistance to longer watering frequent was observed by the proline compounds produced. The leaf proline level increased in line with the duration of the watering frequent (table 7). The proline content in the leaves of plants watered every three days and five days was significantly different from those watered once a day. Meanwhile, it was identified that the dry weight was the lowest (4.58 grams), due to the need for carbohydrate reformation based on the transfer of carbohydrate and other material changes into compounds that maintain the cell osmotic stability (Mostajeran and Rahimi-Eichi, 2009). Thus, such condition results in decreasing dry weight of the plants.

Various researches mention that proline is one of the indicator for plant in tolerance for drought (Hamim *et al*.,1996). It is an osmoregulation and osmoprotectant compound for membranes and plant enzymes facing drought stress. It is also produced by eggplant stress by drought after 14 to 21 days (Kurniawati *et al*., 2014). Chlorophyll levels were also observed, given that chlorophyll is a supporting organelle for photosynthesis. Similar results also occurred in chlorophyll, which was influenced by the watering frequency. Leaf chlorophyll levels increased in line with the duration of the watering frequent (table 8). The every three and five day frequent resulted in significantly different from once a day watering. High levels of chlorophyll in leaves with longer watering frequency indicated the chrysanthemums ability to adapt with water shortages. This was in line with the results by Anggraini *et al.,* (2015), that the chlorophyll content of *Black locust* (*Robinia pseudoacacia*) leaf increased within water shortages condition and 7-day watering intervals as the adaptive indicators of this plant.

 In general, plants being in water stress, will show low chlorophyll content, as the result of low photosynthesis. But this study showed the opposite. Plants watered every 5 days showed averagely high chlorophyll content. It was expected that the chrysanthemum plant had not reached the stress condition, considering that the water capacity requirement of each media indicated that the plants were still able to synthesize the chlorophyll pigments. Chrysanthemum plants were included as moderate to the effect of the watering interval. Limited water supply showed the same pattern: decreasing chlorophyll a,b, a/b concentration, transpiration, stomata conductance and the result were associated with the increasing proline (Mafakheri *et al*., 2010).

 **Table 8.** SRR, Prolin and Chlorophyll content

The growth of chrysanthemum plants in media added with organic material was higher than without organic matter. According to Suntoro (2003), the effect of adding organic material to the soil was that in heavy clay soil, its coarse and strong lumpy structures became finer, not coarse, with improvements of the soil pH, cation and anions exchange capacity, structure, through soil aggregation and aeration as well as its capacity to hold water on the ground. Media added with organic material produced plant with average heights of 22.44-23.55 cm, while the addition of single manure on clay produced plant heights of 20.22 cm (table 9).

**Table 9.** Plant height (cm) and dry weight (gram)

 When the maximum vegetative growth phase reached 35 days, plants experienced vegetative peak to immediately switch to flower production. Data on the harvest of potted *Avanthe agrihorti* showed the influence of the media type. Plants given with additional organic material reached harvest quicker, with larger numbers and diameter of flowers than without organic media. Types of organic media applied did not show significant difference of harvest. However, clay + manure + cocopeat showed quicker harvest than clay + manure media. The harvest time was around 2 days (table 10). The largest number of flowers that bloom on clay + manure media + cocopeat (14.11 buds / pot). According to Padhiyar *et al.,* (2017), the increasing number of flowers per plant was due to the influence of the overall vegetative growth of plants grown on the media so that carbohydrate accumulation to increase photosynthesis was obtained in addition to the balance and availability of nutrients in such media. Media by adding organic matter produces larger flower diameters (3.43-3.61 cm) than without organic matter media.

**Table 10** Flower age, numbers of flowers bloom and diameter of flower at the harvest time

**CONCLUSION**

The result of the research conclude that: (1) The root areas of *Avanthe agrihorti* given with five days watering frequent did not experience water shortages because the water volume was suitable with the capacity of each media pot. Plants with adequate water availability produced good growth and yield. This indicated that once in five-days watering is suitable for the production of potted chrysanthemum. (2) Adding organic matter to the media can increase field water capacity, relatif humidity, so resulted in rapid transpiration rates as well as increasing photosynthesis values, plant dry weight, relative water content in the leaf, plant height, number of flowers, flower diameter, as well as quicker in reaching harvest than without such addition. The highest yield was obtained from plants on soil+ manure media + cocopeat than on other organic media. This indicated that the addition cocopeat to the planting media would provide better conditions than other organic media. (3) Watering frequencies that are more often done can reduce leaf temperature, proline content and chlorophyll content, but can increase the relatif water content and plant dry weight. (4) Interaction between to two treatment factor was saw in leaf area at harvest. Plant in soil+manure+cocopeat at all level water frequent show wides leaves than other media.

**REFERENCES**

Abdillah, D., R. Soedradjad dan Tri Agus Siswoyo. 2016. Pengaruh Cekaman Kekeringan terhadap Kandungan Fenolik dan Antioksidan Tanaman Sorgum (*Sorghum bicolor L. moench*) pada Fase Awal Vegetatif. Skripsi Univ Jember. [online]. <http://repository.unej.ac.id/handle/123456789/68809>

 [accessed 21 September 2018]

Anetasia, Afandi, M., Hery Novpriansyah , Manik, K.E.S., dan Prio Cahyono. 2013. Perubahan Kadar Air dan Suhu Tanah Akibat Pemberian Mulsa Organik pada Pertanaman Nanas PT Great Giant Pineapple Terbanggi Besar Lampung Tengah. *Jurnal Agrotek Tropika.* 1(2). pp.213 – 218.

Anggraini, N., Faridah, E., dan Indrioko S. 2015. Pengaruh Cekaman Kekeringan terhadap Perilaku Fisiologis dan Pertumbuhan bibit *Black locust* (*Robinia pseudoacacia*). *Jurnal Ilmu Kehutanan*. 9(1), pp.40-56.

Bappeda Kulon Progo, 2011. Jenis-jenis tanah di Kabupaten Kulon Progo (Tabel Dinas Pertanian dan Kehutanan Kabupaten Kulon Progo).

[Boutraa](https://www.sciencedirect.com/science/article/pii/S1658365512600193#!), T., [Abdellah Akhkha](https://www.sciencedirect.com/science/article/pii/S1658365512600193%22%20%5Cl%20%22%21)., [Abdul khaliq A.Al-Shoaibi](https://www.sciencedirect.com/science/article/pii/S1658365512600193%22%20%5Cl%20%22%21)[Ali dan Alhejeli](https://www.sciencedirect.com/science/article/pii/S1658365512600193#!),R. 2010. Effect of Water Stress on Growth and Water Use Efficiency (WUE) of some wheat cultivars (*Triticum durum*) grown in Saudi Arabia. [*Journal of Taibah University for Science*](https://www.sciencedirect.com/science/journal/16583655)*.*(3) pp: 39-48

Buechel, T., 2017. Growing media. Greenhouse Herb and Vegetable Production-part 4/4.

Busaifi, R., 2017. *Correlation of Shading Levels and Drought Stress to Relatively Growth Rate Variables of Ageratum conyzoides* Linn. *Agriprima*: *Journal of Applied Agricultural Sciences.* 1 (2). pp.172-181.

Hamim, D. Sopandie, Jusup, M., 1996. Beberapa Karakteristik Morfologi dan Fisiologi Kedelai Toleran dan Peka Cekaman Kekeringan. *Jurnal* *Hayati* 3. pp.30-34.

Hendrata, R dan Sutardi, 2010. Evaluasi Media dan Frekuensi Penyiraman terhadap Pertumbuhan Bibit Kakao (*Theobroma cacao* L). *Agrovigor*. 3(1). pp.10-18.

Kurniawati, S., Nurul Khumaida, Sintho Wahyuning Ardie, Hartati, N.S., dan Enny Sudarmonowati, 2014. Pola Akumulasi Prolin dan Poliamin Beberapa Aksesi Tanaman Terung pada Cekaman Kekeringan. *Jurnal Agronomi Indonesia* . 42 (2). pp.136 - 141

Mafakheri, A. Siosemardeh, Bahramnejad, B., Struik, P.C., Sohrabi, Y. 2010. *Effect of Drought Stress on Yield, Proline and Chlorophyll Contents in Three Chickpea Cultivars. Australian Journal of Crop Science,* 4(8). pp.580-585.

Marjenah, 2010. Pengaruh Kandungan Air Tanah Terhadap Pertumbuhan dan Transpirasi Semai *Sorea leprosula* Miq. *Jurnal Penelitian Dipterokarpa*. 4(1). pp.11-24

Mayangsari, I., Tri Umiana S., Liana Sidharti dan Betta Kurniawan, 2015. *The Effect of Krisan Flower (Chrysanthemum morifolium) Extract as Ovicide of Aede Aegeypt is Egg*. *Jurnal Majority*. 4 (5). pp.29-34.

Meifiyanto, A.S., Priyana, Y., Munawar C dan Sigit, AA. 2017. Analisis Kerawanan dan Kejadian Tanah Longsor di Kabupaten Kulon Progo Daerah Istimewa Yogyakarta. Skripsi. Fak. Geografi. UMS [online] <http://eprints.ums.ac.id/id/eprint/57012> [accessed 29 Januari 2019]. p.23.

Mostajeran, A., and Rahimi-Eichi. V. 2009. *Effect of Drought Stress on Growth and Yield of Rice (Oryza sativa L.) Cultivars and Accumulation of Proline and Soluble Sugars in Sheath and Blades of Their Different Ages Leaves*. *American Jurnal Agric & Environ. Sci.* 5. pp.264- 272.

UPBS Balithi, 2014. *Laporan Pendistribusian Benih Krisan Unit Pengelola Benih Sumber*. Balai Penelitian Tanaman Hias.

Padhiyar, BM., Dipal S Bhatt, Desai, K.D., Patel V.H. and Chavda, J.R. 2010. *Influence of Different Potting Media on Growth and Flowering of Pot Chrysanthemum var. Ajina purple.* *International Journal of Chemical Studies.* 5(4). p.1667-1669.

Siahaya, L., 2007. Pengaruh Media Tumbuh dan Frekwensi Penyiraman terhadap Pertumbuhan Awal Semai Salimuli (*Cordiasubcordata*, Lamk). *Jurnal*  II (1). p.19-26.

Sriwijaya, B dan Hariyanto, D., 2013. Kajian Volume dan Frekuensi Penyiraman Air terhadap Pertumbuhan dan Hasil Mentimun pada Vertisol. *Jurnal Agri Sains*. 4(7). p.77-89.

Suntoro, AW., 2003. Peranan Bahan Organik terhadap Kesuburan Tanah dan Upaya Pengelolaannya. Pidato Pengukuhan Guru Besar Ilmu Kesuburan Tanah Fakultas Pertanian Universitas Sebelas Maret. p.36.

Syekhfani, 2009. Konduktivitas Listrik [from Soil, Eating Soil, Back to Soil – Leading a decent life](http://syekhfanismd.lecture.ub.ac.id). Brawijaya University.

Vaz Monteiro, M., Blanuša, T., Verhoef, A. 2016. *Relative Importance of Transpiration Rate and Leaf Morphological Traits for The Regulation of Leaf Temperature. Australian Journal of Botany*. 64 (1). pp. 32-44.

**ATTACHMENT**

Table 1.Volume watering (ml)

|  |  |
| --- | --- |
| Media | Frequency of watering |
| One a day | Every three days | Every five days |
| clay+manure | 30 | 100 | 150 |
| Clay+manure+cocopeat | 45 | 135 | 215 |
| Clay+manure+rice husk | 40 | 120 | 190 |
| Clay+manure+rice husk charcoal | 43 | 130 | 200 |

Table 2. Initial media analysis

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Types of media | clay+manure | clay+manure +cocopeat | clay+manure+rice husk | clay+manure+rice husk charcoal |
| pH | 5.87 (rather acid) | 5.70 (rather acid) | 5.70 (rather acid) | 5.83 (rather acid) |
| C-organic (%) | 12.67 (very high) | 12.08 (very high) | 13.94 (very high) | 11.62 (very high) |
| N (%) | 0.07 (very low) | 0.25 (very low) | 0.20 (very low) | 0.23 (very low) |
| P (%) | 0,03 (very low) | 0.04 (very low) | 0.05 (very low) | 0.06 (very low) |
| K (%) | 0,07 (very low) | 0.25 (very low) | 0.23 (very low) | 0.23 (very low) |
| Types of media | clay+manure | clay+manure +cocopeat | clay+manure+husk | clay+manure+husk charcoal |
| Particle density (gr/cm) | 2,13 | 2,12 | 2,12 | 2,09 |
| CEC me/100 g | 39.20 (high) | 39.78 (high) | 44.61 (very high) | 40.92 (very high) |
| EC | 2.32 (medium) | 2.75 (medium) | 2.74 (medium) | 3.26 (high) |

 Remark : parameter values according to Hardjowigeno (1995).

Figure 1. Moisture content on Field water capacity (%)

 Table 3. Media temperatures and moistures until 81-83 dap (days after planting)

|  |  |
| --- | --- |
| Treatment | Media Temperature (oC) |
| Watering frequent |  |
| Once a day | 32.65 p |
| Three times a day | 32.97 p |
| Five times a day | 33.35 p |
| Types of Media  |  |
| clay + manure  | 33.03 a |
| clayl+manure +cocopeat powder  | 32.68 a |
| clay+manure +husk | 33.02 a |
| clay+manure charcoal husk | 33.22 a |
| Interaction | (-) |
| CV(%) | 3.78 |

Remark : The numbers followed by the same letters in the same column and treatment factor do not show significant differences based on the DMRT 5% confidence level. The sign (-) shows no interaction between factors

 Table 4. Media moisture (%)

|  |  |  |
| --- | --- | --- |
| Treatments | Types of media | Average |
| clay+manure  | clay+manure +cocopeat | clay+manure +husk | clay+manure + husk charcoal  |
| Once a day | 61.55 ab | 66.26 a | 64.56 ab | 65.46 a | 64.72  |
| Every three days | 55.73 bc | 66.90 a | 52.06 c | 62.26 ab | 59.24 |
| Every five days | 35.43 d | 66.76 a | 26.96 e | 39.56 d | 42.68 |
| Average | 49.57 | 67.31 | 47.86 | 55.76 | (+) |

 Remark: The same number in the same column and row shows significant difference. Sign (+) means there is an interaction between the two treatment factors.

 Table 5. Leaves temperatures, transpiration rate, stomata-opening widht and number of leaves

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatment | Leaves temperature (oC) | Transpiration Rate (second/cm2) | Stomata-opening widht (µm) | Number of Leaves (sheet) |
| Water frequent |  |  |  |  |
| Once a day | 29.87 q | 78.58 q | 2.84 p | 121,41 a |
| Every three days  | 30.18 q | 95.53 b | 2.92 p | 121,25 a |
| Every five days  | 31.38 p | 137.29 p | 2.96 p |  98,66 b |
| Types of Media  |  |  |  |  |
| clay + manure | 30.94 a | 118.42 a | 2.49 b | 105,11 b |
| clay+manure +cocopeat | 29.55 b | 86.47 b | 2.71 ab | 127,22 a |
| clay+manure +husk | 30.66 a | 114.62 ab | 3.47 a | 114,11 ab |
| clay+manure +charcoal husk | 30.75 a | 95.70 ab | 2.98 ab | 108,66 b |
| Interaction | (-) | (-) | (-) | (-) |
| CV (%) | 2.42 | 16.04\* | 15.9 | 9,45 |

 Remark : The numbers followed by the same letters in the same column and treatment factor do not show significant differences based on the DMRT 5% confidence level. The sign (-) shows no interaction between factors

 Table 6. Photosynthesis, Relative Water content (RWC) in the leaves and plant Fresh Weight

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Photosynthesis(μmol CO2 m-2 s-1) | RWC (%) | Plant fresh weight (g) |
| Watering Frequent |  |  |  |
| Once a day | 4.97 p | 77.67 a | 36.37 a |
| Every Three days  | 5.03 p | 77.19 a | 38.44 a |
| Every five days  | 4.80 p | 76.06 a | 33.77 a |
| Types of Media  |  |  |  |
| clay + manure  | 3.28 b | 74.97 b | 27.13 b |
| Clay +manure +cocopeat  | 5.91 a | 80.82 a | 43.82 a |
| Clay +manure +husk | 4.57 ab | 74.79 b | 36.81 a |
| Clay +manure + husk charcoal | 5.97 a | 77.32 ab | 37.02 a |
| Interaction | (-) | (-) | (-) |
| CV(%) | 26.55 | 3.68 | 14,47 |

Remark : The numbers followed by the same letters in the same column and treatment factor do not show significant differences based on the DMRT test at the 95% confidence level. The sign (-) shows no interaction between factors

 Table 7. Leaf area at the harvest time (cm2)

|  |  |  |
| --- | --- | --- |
| Treatments | Types of media | Average |
| clay+manure  | clay+manure +cocopeat | clay+manure +husk | clay+manure + husk charcoal  |
| Once a day | 408.63 bc | 416.31 bc | 416.13 bc | 399.53 bc | 410.15 |
| Every three days | 388.47 bc | 589.36 a | 361.10 bc | 363.90 bc | 425.71 |
| Every five days | 291.95 c | 434.15 b | 324.17 bc | 360.44 bc | 352.68 |
| Average | 363.02 | 479.94 | 367.13 | 374.62 | (+) |

Remark : The same number in the same column and row shows significant difference. Sign (+) means there is an interaction between the two treatment factors.

 Table 8. SRR, Proline and chlorophyll content

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | shoot root ratio  | Prolin (μg.g-1) | Chlorophyll (mg.g-bsd) |
| Watering frequent |  |  |  |
| Once a day | 0.18 q | 32.49 q | 0,59 q |
| Every Three days  | 0.20 pq | 39.08 p | 0,71 p |
| Every five days  | 0.23 p | 41,73 p | 0,76 p |
| Types of Media  |  |  |  |
| clay + manure  | 0.17 a | 40,10 a | 0,68 a |
| clay+manure +cocopeat | 0.20 a | 36,74A a | 0,73a |
| clay+manure +husk | 0.25 a | 37,01 a | 0,69a |
| clay+manure +charcoal husk | 0.20 a | 37,20 a | 0,64a |
| Interaction | (-) | (-) | (-) |
| CV(%) | 21.85 | 14,86 | 18,87 |

 Remark : The numbers followed by the same letters in the same column and treatment factor do not show significant differences based on the DMRT test at the 95% confidence level. The sign (-) shows no interaction between factors

Table 9. Plant height (cm) and dry weight (gram)

|  |  |  |
| --- | --- | --- |
| Treatment | Height (cm) | Dry weight (gram) |
| Watering Frequent |  |  |
| Once a day | 23.00 p | 5.49 a |
| Every Three days  | 22.58 p | 5.45 a |
| Every five days  | 21.55 p | 4.58 b |
| Types of Media  |  |  |
| clay + manure  | 20.22 b | 4.16 c |
| Clay +manure +cocopeat | 23.33 a | 6.15 a |
| Clay +manure +husk | 22.44 a | 5.12 bc |
| Clay +manure +charcoal husk | 23.55 a | 5.28 ab |
| Interaction | (-) | (-) |
| CV | 8.17 | 16.72 |

Remark:The numbers followed by the same letters in the same column and treatment factor do not show significant differences based on the DMRT test at the 95% confidence level. The sign (-) shows no interaction between factors

Table 10. Flower age, numbers and diameter at the harvest time

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Days of harvest (dap) | Numbers of flowerbloom/pot | Flower diameter (cm) |
| Watering Frequent |  |  |  |
| Once a day | 81.50 p | 13.25 p | 3.34 p |
| Every three day  | 81.25 p | 11.16 p | 3.29 p |
| Every five days  | 82.75 p | 12.16 p | 3.28 p |
| Types of Media  |  |  |  |
| clay + manure  | 83.77 a | 9.88 b | 2.64 b |
| clay+manure +coconut coir powder  | 80.88 b | 14.11 a | 3.63 a |
| clay+manure +husk | 81.33 b | 12.50 a | 3.51 a |
| clay+manure +charcoal husk | 81.33 b | 12.20 a | 3.43 a |
| Interaction | (-) | (-) | (-) |
| CV(%) | 2.62 | 23.89 | 12.16 |

 Remark:The numbers followed by the same letters in the same column and treatment factor do not show significant differences based on the DMRT 5% confidence level. The sign (-) shows no interaction between factors