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THE EFFECT OF WATERING ON WATER MANAGEMENT BY HYDROGELS ON THE GROWTH OF Shallot Plants

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Abstract

Onion red is Wrong One commodity vegetables flagship that has been for a long time attempted by farmer in a way intensive . Commodity vegetables This including to in group spice No working substitution _ as spice flavoring food as well as material drug traditional . Onion red Also is Wrong One commodity vegetables that have mark economical high , fine reviewed from side fulfillment consumption national , source income farmers , as well as its potential as producer foreign exchange country. Efforts to cultivate shallots have recently often failed due to climate change in the form of El-Nino or La-Nina. The occurrence of drought due to a long dry season causes watering costs to increase, whereas when there is high rainfall the water supply becomes excessive so that planting locations become flooded, which results in suboptimal plant growth. To overcome this, a technology package is needed that is able to manage water so that plant growth remains normal. Hydrogel is network macromolecules that can absorb And release the hanging water on stimulation external , such as pH, humidity , temperature , and pressure environment surroundings . Application hydrogel in the field agriculture has proven capable increase efficiency water usage , which is also capable decrease erosion. Objective from study This For know influence sprinkling to water management by hydrogel on growth plant onion red . Study This use Design Random Complete (RAL) Non Factorial with watering interval treatment consisting of of 4 levels namely A 0 (2 x 1 day), A 1 (1 x 3 days), A 2 (1 x 2 days) and A 3 (1 x 1 day). Observed parameters is tall plants , quantity leaves , quantity sapling And heavy tubers . Data analyzed with analysis of variance (ANOVA) and if there is influence real so done test carry on use test distance double Duncan on level significance 5%. The results showed that the watering interval treatment have a real effect on is tall plants , quantity leaves , quantity sapling And heavy tubers . Application hydrogel can save sprinkling from One One day become once a day , however No effective in overcome puddle consequence excessive water supply.

Keywords: shallots, hydrogel, watering interval

INTRODUCTION

El Nino is an event where the sea water temperature in the Pacific Ocean heats up above the normal average temperature and humidity in the atmosphere above. This event causes the formation of clouds which also increases rainfall in the area. And it also causes air pressure in the western Pacific Ocean which inhibits the growth of clouds in the eastern part of the Indonesian Sea which causes rainfall to decrease abnormally in several regions in Indonesia, in the agricultural sector, especially shallot plants which cannot tolerate drought. Meanwhile, La Nina is caused by sea surface temperatures in the western and eastern Pacific which are higher than usual. This incident caused air pressure at the Pacific equator to decrease, which led to the formation of excessive clouds and caused high rainfall in the affected areas. (Kahya, E. and MC Karabork. 2001). To overcome water shortages, farmers use manure which, apart from functioning as fertilizer, can also maintain soil moisture so that the manure can increase the water holding capacity in the soil. However, difficulties are often experienced in providing manure, because the price and transportation costs are expensive (Maskuddin and Subronto, 1990). For this reason, an alternative substitute for manure can be used hydrogel which can absorb large amounts of water, namely 300 times its mass and the absorbed water can remain available for absorption by plant roots. By administering this hydrogel, water use efficiency can be increased (Maskuddin and Subronto, 1990).

Hydrogel is a material whose function is to bind water, maintain the availability of ground water and loosen the soil, so hydrogel is very suitable for use to overcome soil loss due to little rainfall or long dry seasons (Anonimus, 2014). Plant onion red allegedly originate from Central Asia , namely around India, Pakistan to Palestine . On VIII century spread to Europe , then from Europe spread to America , East Asia and Southeast Asia. Deployment This relate with hunting herbs and spices by Europeans _ to region East And start enter to Indonesia at the same time with colonialism Netherlands . In the past, it was said that shallots could be useful, among other things, as a preventative measure against stomach aches due to colds, healing wounds or infections, preventing cholera, dysentery and diarrhea, and in India it was considered a cure for bacillary dysentery (Wibowo S, 2009). Shallots most like areas with dry climates and slightly hot temperatures and sunny weather. An open place, not foggy, and a gentle breeze. Planting in a protected place will result in poor tuber formation and small size. Foggy areas are also not good for shallots because they often cause disease. Areas that receive sufficient sunlight are prioritized and it is better if the duration of sunlight is more than 12 hours (Singgih Wibowo, 2009).

The highest shallot production in 2015 is estimated to be in June at 122.8 thousand tons, followed by January at 116.3 thousand tons and August at around 110.9 thousand tons. Meanwhile, the lowest production is estimated in March at 65.27 thousand tons, followed by November 81.01 thousand tons and October 83.85 thousand tons. Shallot production is uneven throughout the year and depends on the season. Production is reduced in the rainy season and abundant in the dry season . In the rainy season attacks by plant pests on shallots increase so that production decreases. Regarding red onion production in 2015 compared to the previous year, there was a decline because in 2014 it reached 1.22 million tons with a harvest area of 119,966 hectares. Development onion The 2015 Revised APBN-P was carried out in 27 provinces covers 64 districts / cities with targeted area of 1,732 ha capable produce production 17,701.04 tons or 1.81 percent from estimation need national 978,451 tons/ year (Subagyo , 2015). Indonesia is currently experiencing a climate anomaly (non-normal climate). The beginning and end of the rainy season is uncertain, as is the dry season. Hydrogel is expected to be able to overcome the problem of climate anomalies in Indonesia currently and in a sustainable manner.

METHOD

This research was carried out in the greenhouse of the Faculty of Agriculture, Islamic University of North Sumatra, Gedung Johor Village , Medan Johor District, Medan City, North Sumatra Province. This location is at a height place ± 25 m above sea level with flat topography. This research was carried out from March to June 20 21 . This research used a non-factorial completely randomized design. The factor studied was the interval of water administration with a flush volume of 300 ml which consisted of 4 levels, namely: A0 = 2 x 1 day (control) , A1 = 1 x 3 days (low) , A2 = 1 x 2 days (medium) , A3 = 1 x 1 day (high) . Each treatment was repeated 4 times to produce 16 sets of experiments. Research data was obtained by direct observation of plants for each treatment and replication. To determine the effect of water supply intervals, the data obtained were analyzed using analysis of variance (ANOVA) which was tested at a significance level of 5%. If there was a real effect, it was continued with Duncan's multiple range test . Data analysis used Microsoft Office Excel 2013 and SPSS 15.0 software .

The planting medium used in this research was a jar with a volume of 5 liters which was then filled with soil. The soil that will be used is first cleaned of rubbish by sifting it, then the soil is sterilized from various diseases, bacteria or fungi in the soil by drying it in the sun, then the soil that has been cleaned and sterilized is then put in a jar with volume 5 liters. The hydrogel was administered by mixing it with 500 ml of water and 1g of hydrogel/jar except in the control treatment, then waiting for 5 minutes. Next, fill the jar with soil half the size of the jar. Then sprinkle the hydrogel on the surface of the soil in the jar and make a hole for planting the onion seeds. Then put the onion seeds into the planting hole and cover them again with soil, then water them with water. In this research, the watering technique used was a measuring cup with a volume of 500 ml. Then the plants were watered evenly with a volume of 108 ml of water in each treatment. Watering is carried out from 07.00 to 10.00 WIB according to the treatment that has

been determined, with watering times including: A0 (2x1 day), A1 (1x3 days), A2 (1x2 days), A3 (1x1 day) until the plants are 50 days old.

RESULTS AND DISCUSSION

Plant height

The results of the analysis of variance showed that the watering interval treatment had a significant effect on shallot plant height (Table 1).

Table 1. Average height of shallot plants (cm) with watering interval treatment

Treatment	Average
A_0 (2 x 1 day)	29.67 b
A_1 (1 x 3 days)	35.36 c
A_2 (1 x 2 days)	32.81 BC
A_3 (1 x 1 day)	0.00 a

Note: Numbers followed by letters that are not the same in the same column are significantly different based on the Duncan test at the 5% level.

Table 1 shows that watering intervals have a significant effect on shallot plant height. The tallest plants were obtained at a watering interval of once three days (A 1) namely 35.36 cm which was not significantly different from a watering interval of once two days (A 2) namely 32.81 cm. However, at a watering interval of twice a day without hydrogel with a hole in the pot (A 0) there was a significant reduction in the height of the shallot plants to 29.67 cm, while a watering interval of once a day (A 3) caused the plants to die due to flooding. Watering intervals of one time three days (A 1) and one time two days (A 2) with the addition of 1 g hydrogel/pot resulted in better plant height growth when compared with watering intervals of two times one day without hydrogel application (control). Even though the water supply is reduced, it does not show any disruption to the growth of shallot plants, this is because the addition of hydrogel plays a role in maintaining the availability of water in the soil so that the plant's water needs are still met. Hydrogel is capable of storing up to 300 times its mass of water and channeling it back when plants need it. Apart from that, the hydrogel also absorbs the nutrients provided, thereby preventing leaching . This is in line with the statement by El-Hady and Abo Sedera (2006) that the addition of hydrogel to the planting media can increase the water available to plants so that the root zone improves and water can be absorbed by plants.

Hydrogel polymer is a soil conditioner that focuses on water and nutrient retention so that it can reduce the use of irrigation water and increase the ability of plants to grow (Poormeidany and Khakdaman, 2006). The results of this research show that hydrogel application can be a solution to save water use when there is a long dry season due to abnormal climate change (El Nino).

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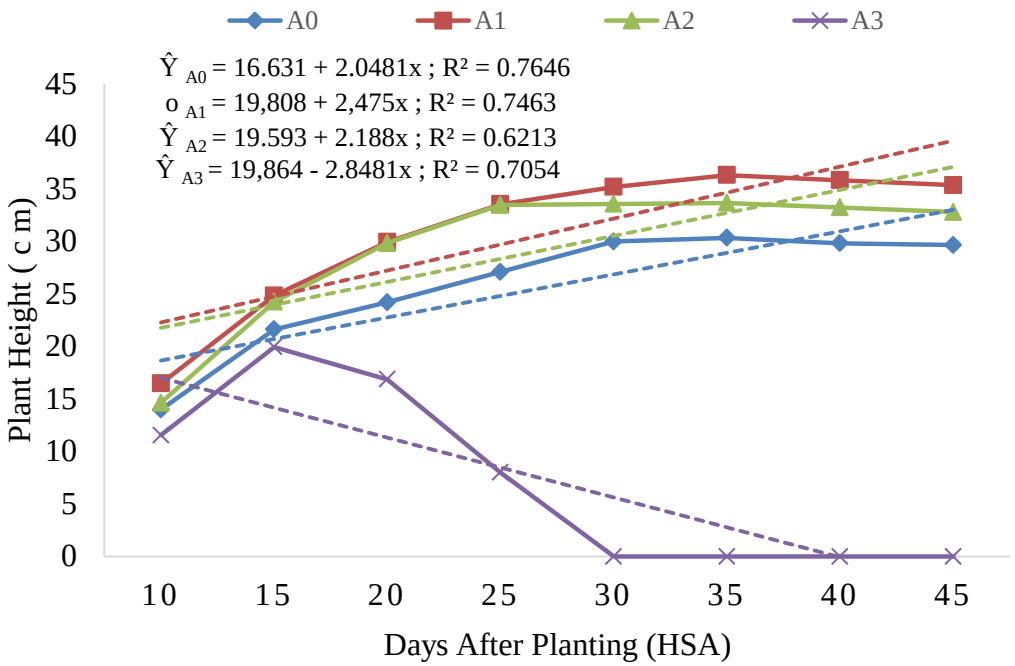

Figure 1. Graph of shallot plant height with watering interval treatment.

The graph shows that the height of shallot plants increased for each observation time, except for plants with treatment A3 (watering 1x1 day). Correlation regression analysis in treatments A 0 , A 1 and A 2 shows that the growth rate of shallot plants produces a positive linear equation, but the situation is different in treatment A 3 where the equation formed has a negative value. This is because during this treatment flooding occurs which disrupts plant growth. Flooded planting media conditions cause abnormal growth of shallot plants and ultimately death .

Figure 2. Plants die due to flooding

Watering shallots at intervals of once a day as much as 300 ml with the addition of 1 g hydrogel/pot (A 3) is intended to test the ability of the hydrogel to absorb water when there is excessive water supply due to high rainfall which has frequently occurred recently due to changes in global climate (La Nina). However, it appears that the hydrogel failed to carry out its function in creating a microclimate that meets the requirements for growth in the planting medium, as indicated by the death of shallot plants. The flush volume of 300 ml per day has exceeded the water holding capacity of the hydrogel which causes waterlogging. This means that the application of hydrogel is not effective in overcoming flooding problems in shallot planting areas. The death occurred because shallot plants really don't like wet (flooded) soil. Plant roots are not only exposed to very low oxygen and high carbon dioxide levels, but also to inorganic toxic conditions (Fitter and Hay, 1994). The main cause of plant damage due to the effects of standing water is a lack of oxygen which causes plants to wilt, and even affects nutrient uptake when covered by excess water.

Waterlogging causes hypoxic conditions (low oxygen concentration) in the soil, due to the low solubility of oxygen in water. (Ashraf, 2012).

Number of leaves

The results of the analysis of variance showed that the watering interval treatment had a significant effect on the number of shallot leaves (Table 2).

Table 2. Average number of red onion leaves (strands) by watering interval treatment

Treatment	Average
A $_0$ (2 x 1 day)	27.50 b
A $_1$ (1 x 3 days)	34.75 c
A $_2$ (1 x 2 days)	30.75 BC
A $_3$ (1 x 1 day)	0.00 a

Note: Numbers followed by letters that are not the same in the same column are significantly different based on the Duncan test at the 5% level.

Table 2 shows that watering intervals have a significant effect on the number of leaves of shallot plants. The highest number of leaves was obtained at a watering interval of once three days (A 1), namely 34.75 pieces, not significantly different from a watering interval of once two days (A 2) , namely 30.75 pieces . However _ watering interval twice a day (A 0) caused a significant decrease in the number of leaves to 27.5 sheet while the watering interval once a day (A 3) causes plants experience death consequence flooded . Increasing the watering interval from once every three days (A 1) to once every two days (A 2) showed a significant difference in the number of leaves of shallot plants. Likewise, increasing the watering interval from once every two days (A 2) to once a day (A 3) causes plants to die.

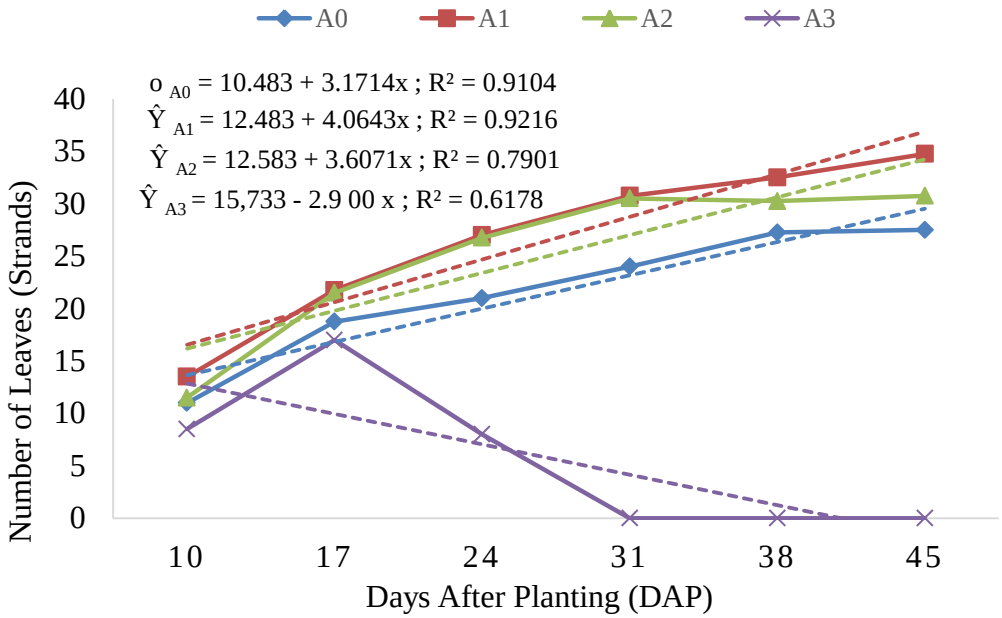

Figure 3 . Graph of the number of shallot leaves with watering interval treatment

The graph shows that the number of shallot leaves increased for each observation time, except for plants with treatment A3 (watering 1x1 day). The plant (treatment A 3) died because the watering volume exceeded the water holding capacity of the hydrogel, which caused water to pool in the experimental pot. This situation causes plant roots to rot so that the plant does not receive a supply of nutrients and ultimately dies. Leaves are a very important growth component in the process of forming carbohydrates from carbon dioxide (CO 2) and water (H 2 O) with the help of sunlight through the process of photosynthesis. Furthermore, roots are organs that are more sensitive to flooding. The function of the root organ is to absorb water and substances from the soil that are needed for the photosynthesis process. The root functions as a support for the plant so that

the plant can stand firmly. Roots function to carry substances that have been absorbed and also transport water to the body parts of the plant. According to Sudarma et al., (2017) flooding of shallot plants will trigger damage to the plant's roots, the tips of the plant's roots will rot which will cause the roots to not work optimally and in a period of more than five days this can cause the onion plant to die.

Number of tubers

The results of the analysis of variance showed that the watering interval treatment had a significant effect on the number of tubers (Table 3).

Table 3. Average number of shallot bulbs by watering interval treatment

Treatment	Average
A_0 (2 x 1 day)	5.9b
A_1 (1 x 3 days)	6.5b
A_2 (1 x 2 days)	6.3b
A_3 (1 x 1 day)	0.0a

Note: Numbers followed by letters that are not the same in the same column are significantly different based on the Duncan test at the 5% level.

Table 3 shows that watering intervals have a significant effect on the number of shallot bulbs. The highest tuber weight was obtained at a watering interval of once every three days (A 1) namely 6.5 tubers. Increasing the watering interval to once every two days did not show a significant difference in the number of tubers, namely 6.3 tubers, as did the watering interval to twice a day (A0) , namely 5.9 tubers. On watering interval once a day (A 3) there is a significant difference where treatment This No produce tubers Because experience death consequence flooded.The decrease in the number of tubers was caused by rotting of the tubers as a result of flooding.

Ashraf (2012) stated that inundation causes hypoxia in the soil. Lack of oxygen in the soil causes plants to carry out anaerobic respiration which ultimately produces ethyl alcohol which has an impact on plasmolysis in the roots, even in the tubers. et al , (2006) explained that flooding is a phenomenon that can reduce the growth and survival of land plants. The inability of plants to survive in flooded conditions causes losses due to the plant's failure to produce. The stagnant water is thought to cause metabolic disorders in plants.

Tuber Weight

The results of the analysis of variance showed that the watering interval treatment had a significant effect on tuber weight (Table 4).

Table 4 . Average weight of shallot bulbs (g) with watering interval treatment

Treatment	Average
A_0 (2 x 1 day)	24.5b
A_1 (1 x 3 days)	37.5c
A_2 (1 x 2 days)	27.8b
A_3 (1 x 1 day)	0.0a

Note: Numbers followed by letters that are not the same in the same column are significantly different based on the Duncan test at the 5% level.

Table 4 shows that watering intervals have a significant effect on shallot plant height. This is thought to be because the hydrogel applied to the planting medium can still absorb water so that plant growth is still normal. The highest tuber weight was obtained in treatment A 1 (1x3 days) namely 37.5 g which was significantly different from treatment A 0 (2x1 day) namely 24.5 g, treatment A 2 (1x 2 days) namely 27.8 g and treatment A 3 (1x1 day) namely 0 g . The ability of plants to produce vegetative organs will have an impact on plant yields. The vegetative organs that greatly influence plant yields are the leaves as the place where photosynthesis takes place and the roots as the absorbers of nutrients from the soil. Roots that do not function optimally will result in

insufficient photosynthesis material which will affect plant production. Flooded soil conditions will reduce germination ability because plants lack oxygen. Respiration, electron transport and ATP formation are inhibited during germination when oxygen is low. Plants under drought and waterlogging will show reduced growth, low SLA (Specific Leaf Area), rejection of photosynthesis, closure of stomata, decreased respiration and biomass production and protein degradation (Hsu, et al ., 2000).

CLOSING

Conclusion

Watering has a significant effect with the presence of hydrogel on the growth of shallot plants (Allium a scolanicum L).

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