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Various Water Source Tests and Type of Axis On Growth and Results of Lettuce Plant (Latuca Sativa L.) With The Hydroponic Media Wick System

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Abstract: *Using hydroponic technology is one of effort to increase lettuce production continuously. Hydroponic is one of the cultivation techniques using water as a media planting. One form of hydroponic cultivation is a wick system that is by using an axis. The combination of various water sources and the use of various types of axis are expected to produce optimal lettuce growth. This study aims to analyze the effect of interactions between various water sources and various types of axis as well as the single factor of various axis with different types of water on the growth and yield of lettuce plants. The research was hold in Tanah Grogot District, Paser Regency from July to September2018. The design used in this study was a Randomized Block Design (RBD). Which is arranged in factorial with 2 factors. The first factor is that Various Water Sources (A) consist of 3 levels, they are : a1 = Well Water, a2 = River Water, and a3 = Lake Water. The second factor is the various types of Axis (S) consisting of 3 levels namely s1 = Stove Axis, s2 = Flannelette, and s3 = Wool Fabric. The results showed that there were no interactions between various water sources and axis types (A x S) on the all observed parameters. The treatment of various water sources significantly affected the parameters of plant height, number of leaves, leaf length, and plant wet weight. The treatment of various types of axis significantly affected the parameters of plant height, number of leaves, leaf width, and leaf length.*

Keywords: ***Lettuce, Wick Hydroponic System, Water Source, Axis Type***

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I. Introduction

Lettuce (Lactuca sativa L.) is one of horticultural commodity that has good commercial prospects and value. The nutritional content on vegetables, especially vitamins and minerals cannot be substituted by main foods (Haryanto.E and T. Suhartini, 2002).Using hydroponic technology is one of effort to increase lettuce production continuously. (Lingga, P. 2005). The advantages of hydroponicely farming that can be done without depending on the season, has better quality, hygiene is more guaranteed, the use of fertilizer is more efficient, maintenance is more practical and does not require much labor. One form of hydroponic cultivation is the wick system (Alviani, P. 2015).Water has an important role in the cultivation of plants by hydroponics. To be able to produce hydroponic plants that are hygienic, fresh and healthy, it turns out that not all water sources can be used as growing media for hydroponic plants (Ginting, 2010). Hydroponic wick system is influenced by the type of wick fabric, growing media or substrate, nutritional composition, electrical conductivity (EC) value. The axis plays an important role in flowing water and nutrients from the container of the nutrient solution to the growing media (Fahrurroji, A. 2016).Based on the description above, a study was carried out on a combination of various water sources and the use of various types of axis which were expected to produce optimal lettuce growth.
This study aims to analyze the effect of interactions between various water sources and various types of axis as well as the single factor of various axis with different types of water on the growth and yield of lettuce plants.

II. Material And Methods

Time and place

The study was hold in the District of Tanah Grogot, Paser Regency from July to September 2018.

Materials and tools

The materials used in this study were lettuce seeds, AB MIX nutrition, water, fruit basket, plastic, netpot, styrofoam, rockwool, stove wick, flannelette, wool fabric.

The tools used in this research are, solder for perforating the board of foam, knife, scissors, hammer, nails, saws, ruler / meter, bucket, wood, hand sprayer, pH meter, TDS / EC meter, analog scales, digital scales, stationery, name tags and cameras.

Research design

The design used in this study was a Randomized Block Design (RBD). Which is arranged in factorial with 2 factors.

The first factor is the Various Water Sources (A) consisting of 3 levels, they are :

a1 = Well Water
a2 = River water
a3 = Lake water

The second factor is the various types of Axis (S) consisting of 3 levels, they are :

s1 = Cooker Axis
s2 = Flannel
s3 = Wool

Research Implementation

1. Preparation for Planting Media
2. Seeding
3. Planting
4. Plant Maintenance
5. Harvest

Observation Parameters

1. Plant Height (cm)
2. Number of Leaves (strands)
3. Leaf Width (cm)
4. Leaf Length (cm)
5. Wet Weight (grams)

Data analysis

The additive linear model used in analyzing each observed variable is:

$$\mathbf{Yijk = \mu + \alpha i + \beta j + \sigma k + (\beta\sigma)\, jk + \varepsilon ijk}$$

Details :

i = 1,2,3 (groups)
j = 1,2,3 (water source treatment)
k = 1,2,3 (treatment of axis type)
Yijk = observation response to the I experimental unit which obtained a combination of j treatment from factor I and k from factor II
μ = general midpoint
αi = the influence of the i
βj = the influence of the j from the treatment of water sources
σk = influence of the k from the treatment of the axis type
(βσ) jk = the influence of the j-level factor I speculation of the treatment of water sources and factor II of the axis type treatment
εijk = random effect of the experimental unit receiving the j-I and k-II factors in the i

To determine the effect of various water sources and types of axis on the growth and yield of lettuce, the data obtained were analyzed using analysis of variance. If the results of analysis of variance have no significant effect (F calculated treatment <F table 0.05) no further tests are performed. Whereas if the results of the analysis of variance have a significant effect (F treatment count> F table 0.05), it will be continued with the smallest markedly dissimilar (BNT) at the 5% level.

III. Result

Plant Height (cm)

The results of analysis of variance showed that the treatment of water sources (A) and the treatment of axis type (S) significantly affected plant height, while the interactions (A x S) did not significantly affect the average height of plants aged 4 MST can be seen in table 1.

Table 1. Testsof Various Water Sources and Types of Axis to Plant Age 4 MST (cm)

Treatment of water sources (A)	Treatment of wick type (S)			Average
	s1 Stove Axis	s2 Flannel Fabric	s3 Wool Fabric	
a1 Well Water	21,97	19,62	18,67	20,09[b]
a2 River Water	23,18	20,75	19,97	20,30[b]
a3 Lake Water	25,69	23,18	23,08	23,98[a]
Average	23,61[a]	21,18[b]	19,57[b]	

* The average number followed by unequal letters shows significantly different in the the 5% BNT test (BNT = 2.40).

Based on the 5% BNT test in the treatment of water sources (A) shows that the treatment of lake a3 water sources has the highest average plant height (17.73) and is significantly different from treatments a2 and a1, but a2 treatment is not significantly different from a1. Based on the 5% BNT test on the axis type treatment (S) shows that the treatment of the axis type stove s1 has the highest average plant height (23.61) and significantly different from the s2 and s3 treatments, but the s2 treatment is not significantly different from s3.

Number of Leaves (strands)

The results of analysis of variance showed that the treatment of water sources (A) and the treatment of axis type (S) significantly affected the number of leaves, while the interaction (A x S) did not significantly affect the average number of leaves aged 4 weeks after planting can be seen in the table 2

Table 2. Tests of Various Water Sources and Types of Axes Against the Number of Leaves Age 4 MST (strands)

Treatment of water sources (A)	Treatment of wick type (S)			Average
	s1 Stove Axis	s2 Flannel Fabric	s3 Wool Fabric	
a1 Well Water	7,50	6,92	7,42	7,28[b]
a2 River Water	9,25	7,42	7,75	8.14[a]
a3 Lake Water	7.08	7,00	6,67	6.92[b]
Average	7,94[a]	7,11[b]	7,28[b]	

* The average number followed by unequal letters shows a significant effect on the BNTtest (BNT = 0.51).

Based on the 5% BNT test on water source treatment (A) it shows that the treatment of river water source a2 has the highest average number of leaves (8.14) significantly different from treatments a1 and a3, but the treatment of a1 is not significantly different from a3. Based on the 5% BNT test on the axis type treatment (S) showed that the treatment of the axis type stove s1 had the highest average number of leaves (7.94) significantly different from the s3 and s2 treatments, but the s3 treatment was not significantly different from s2.

Leaf Width (cm)

Results of analysis of variance showed that the treatment of the axis type (S) significantly affected the width of the leaves, while the treatment of water sources (A) and their interactions (A x S) had no significant effect on the average width of the leaves 4 weeks after planting can be seen in the table 3.

Table 3. Tests of Various Water Sources and Axis Types on Leaf Width 4 MST Age (cm)

Treatment of water sources (A)	Treatment of wick type (S)			Average
	s1 Stove Axis	s2 Flannel Fabric	s3 Wool Fabric	

a1 Well Water	10.69	10.38	10.07	10.38
a2 River Water	11.47	10.08	9.81	10.45
a3 Lake Water	10.20	10.69	10.08	10.33
Average	10,79[a]	10,39[b]	7,28[b]	

*The average number followed by unequal letters shows a significant effect on the BNT test (BNT= 0.52).

Based on the 5% BNT test on the axis type treatment (S) shows that the treatment of the axis type stove s1 has the highest average leaf width (10.79) and significantly different from the s2 and s3 treatments, but the s2 treatment is not significantly different from s3.

Leaf Length (cm)

The results of analysis of variance showed that the treatment of water sources (A) and the treatment of the type of axis (S) significantly affected the length of the leaves, while the interaction (A x S) did not significantly affect the average length of leaves at 4 weeks after planting can be seen in the table 4

Table 4. Tests of Various Water Sources and Axis Types on Leaves Length of 4 MST (cm)

Treatment of water sources (A)	Treatment of wick type (S)			Average
	s1 Stove Axis	s2 Flannel Fabric	s3 Wool Fabric	
a1 Well Water	16,96	14,51	12,02	14,50[b]
a2 River Water	18,69	17,95	14,84	17,16[a]
a3 Lake Water	17,31	16,01	16,25	16,52a[b]
Average	17,65[a]	16,16[b]	14,37[b]	

* The average number followed by unequal letters shows a significant effect on the BNT test (BNT = 1.67).

Based on the BNT test of 5% in the treatment of water sources (A) shows that the treatment of river water sources a2 has the highest average leaf length (17.16) and is significantly different from treatments a3 and a1, but the treatment of a3 is not significantly different from a1. Based on the 5% BNT test on the axis type treatment (S) shows that the treatment of the axis type stove s1 has the highest average leaf length (17.65) and significantly different from the s2 and s3 treatments, but the s2 treatment is not significantly different from s3.

Wet Weight (gram)

The results of analysis of variance showed that the treatment of water sources (A) significantly affected the wet weight, while the treatment of the axis type (S) and its interactions (A x S) did not significantly affect the average wet weight of the plants can be seen in table 5.

Table 5. Tests of Various Water Sources and Axis Types on Wet Weight of Plants (g)

Treatment of water sources (A)	Treatment of wick type (S)			Average
	s1 Stove Axis	s2 Flannel Fabric	s3 Wool Fabric	
a1 Well Water	21,67	23,00	26,00	23,56[c]
a2 River Water	45,92	45,92	34,83	42,22[a]
a3 Lake Water	39,75	29,50	27,58	32,28[b]
Average	35,78	32,81	29,47	

* The average number followed by unequal letters shows a significant effect on the BNT test (BNT = 5.66).

Based on the 5% BNT test on water source treatment (A) it shows that the treatment of a2 river water sources has the highest average wet weight (42.22) and significantly different from treatments a3 and a1.

IV. Discussion

The results of variance showed that the treatment of water sources significantly affected plant height, number of leaves, length of leaves and plant wet weight. The results showed that the influence of river water sources (a2) produced better growth compared to well water (s1) and lake water (s3). This is because river water (a2) has a pH of 7.0 which is neutral with macro and micro nutrients, such as nitrogen (N), calcium (Ca), potassium (K), manganese (Mn), iron (Fe), magnesium (Mg), zinc (Zn), sulfur (S), boron (B), molybdenum (Mo), nutrients contained in river water obtained from soil erosion eroded by rain water and organic industrial waste or non-organic dissolved in water, so as to increase the number of leaves more. This is in accordance with the opinion of Mardalena, S., et al (2013) which states that nutrients contained in river water (N, K, Ca, Mg, Cu, Fe, Mn and Zn), can cause overall plant growth, especially in the formation of green leaves which is very useful in the process of photosynthesis and the development of plant parts to grow actively on the roots, stems, length and number of leaves. The same thing was also stated by Harlina, N. (2003), the provision of sufficient N and P nutrients could change the carbohydrates produced in the process of photosynthesis into proteins that would help increase the width, length and number of leaves.

Results of analysis of variance showed that the treatment of various types of axis significantly affected plant height, number of leaves, leaf width, and leaf length. The results showed that the influence of the type of stove wick (a1) produced better growth compared to the wick type flannel (s2) and wool fabric (s3). This is because the stove wick is made of fabric fibers that use materials from fine cotton that easily absorb water so that the water and nutrient requirements at the roots of plants are met and make plant growth better. According to Supandi (2009) in the journal Embarsari, et al (2015) the excess axis of the stove can store water and release the water slowly, so that nutrient solutions can be well distributed through the axis to the rooting zone. This allows lettuce to grow better compared to other types of axis. Furthermore Agoes, D. (2010), states that the stove axis absorbs more water, making it easier for plant roots to absorb nutrients.

The results of the analysis of variance showed that between the two treatment water sources and axis types did not cause interactions. This is due to a single factor, namely water sources and types of axis working independently and acting independently of each other.

V. Conclusion

Based on the research results of various water source tests and types of axis to the growth and yield of lettuce (Lactuca sativa L.) with hydroponic media the wick system can be concluded as follows:

1. There is no interaction between various water sources and axis types (A x S) on all parameters.
2. The treatment of various water sources significantly affected the parameters of plant height, number of leaves, length of leaves, and wet weight of plants.
3. The treatment of various types of axis significantly affected the parameters of plant height, number of leaves, width of leaves, and length of leaves.

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