

Publication Paper

The influence of Azolla Ekastrak and mixed media on Wick hydroponics system to Caisin plant (*Brassica juncea* L.)

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ABSTRACT

The purpose of this research is to understand the influence of azolla extract and mixed media on Wick hydroponics system to Caisin plant and to find the best combination of organic nutrient of wick hydroponics system on Caisin plant. This research was held in February - March 2016, the research was done in the Green House Faculty of Agriculture, Universitas Muhammadiyah Yogyakarta.

This research uses an experiment with Single Factor Experimental design in Completely Randomized Design consisting 5 treatments combination of Azolla extract nutrient solution and various media mixture, as follows A: Azolla extract 200 ml/l + Coal husk 10 g + Vermicompost 94 g, B: Azolla extract 200 ml / l + Charcoal husk 10 g + Compos Azolla 86 g, C: Azolla extract 200 ml /l + Charcoal husk 10 g + Vermicompost 47 g + Compos Azolla 43 g, D: Azolla extract 200 ml/l + Charcoal husk 20 g, E: AB MIX + Charcoal husk 20 g. The observation was taken for 5 weeks including higher plants and number of leaves measurement. At the end of the research period was including poriferation of roots, long root, weight of fresh root, weight of dried root, weight dry plant, weight dry plant, broad leaves and the color of leaves measurement.

The results of the research showed the same results between commercial nutrition and organic nutrition. The best combination of natural nutrients was C: Azolla extract 200 ml / + Charcoal husk 10 g + Vermicompost 47 g + Compos Azolla 43 g compound than other treatments for plant height parameters (25.50 cm), fresh weight of plants (32.83 grams), Plant dry weight (2.1 grams), number of leaves (9.7 strands) and leaf area (397cm²).

Keywords: azolla extract, media, Hydroponics Wick System and caisin.

INTRODUCTION

Caisin is a popular commodity among Indonesian people because it is often processed into various dishes because it contains various kinds of minerals and vitamins are good for health. Based on data from the Central Bureau of Statistics (2015) caisin production in Indonesia from 2011 to 2013 increased from 580,969 tons to 635,728 tons, but from 2014 to 2015 has decreased from 602,468 to 580,510 tons. The data show that the fluctuation of caisin production, has even decreased in the last three years. The cause of Caisin's production decline is due to constraints in its cultivation. Therefore it is necessary to improve and improve the cultivation technology in Caisin plant. One solution for the cultivation of caisin plants can use hydroponic system. Cultivation of hydroponic system using AB mix nutrient, to get the nutrition of AB mix need expensive cost so that need alternative nutrition as replacement of AB mix which have equal ability. Organic nutrients have properties that are easily absorbed by plants so that the use of organic nutrients can be used as a source of more economically affordable replenishment nutrisi. However, nutrients in organic nutrients are still incomplete when compared with the nutrient AB mix. Some compost planting media has become an option in hydroponic cultivation. Compost azolla and kascing in some studies have a very good influence for caisin plants. The combination of nutrients from azolla extracts as organic nutrients and a mixture of azolla kascing and composting media is expected to increase production in caisin cultivation. Problems Caisin plants need macro and micro nutrients to meet the needs of the growth process. Hydroponic cultivation usually uses special inorganic nutrients for hydroponic cultivation, but to get it required a high enough cost so that the need for alternative nutrients. Organic Nutrition has been used as an alternative nutrient in some previous studies but the results have not been able to match the inorganic nutrients, so need to add additional nutrients for maximum results. Kascing and azolla compost is a nutrient that has high nutrient content and is easily absorbed by plants so it can be utilized as an additional nutrient. Therefore it is necessary to conduct research on the effect of giving azolla extract as organic nutrient and mixture of kascing media and azolla compost as additional nutrient to meet the nutritional requirement of caisin plant as substitute of inorganic nutrient on Wick hydroponics system.

The purpose of this study is as follows:

- 1). Know the effect of azolla extract and media mixture on Wick hydroponics system on caisin plant
- 2). Determine the best organic nutrient combination of Wick hydroponics system on caisin plant.

RESEARCH PROCEDURES

Time and place: This research was conducted from January to March 2017. The research was conducted at Green House of Agricultural Faculty of Muhammadiyah University of Yogyakarta and analyzed in Research laboratory of Faculty of Agriculture University of Muhammadiyah Yogyakarta, Tamantirto Village, Kasihan District, Bantul Regency, Special Province of Yogyakarta.

Materials: materials used in this research are kascing, azolla compost, caisin seed varieties Tosakan, charcoal husk, water, nutrient solution AB mix and azolla extract.

Equipment: equipment required in this research is 1.5 liter mineral water bottle, axis, analytical scales, scales, measuring cups, ovens, scissors, cutter, labels, baskets, bucket 30 liters, Air \] pump (air pump) , 12 x 6 hole seed tray, brown map, black pilok paint, Muncell Color Chart, Leaf Area Meter (LAM) and root poriferation glass

Research methods. The study was arranged in a Completely Randomized Design with a Single Factor experimental design consisting of 5 treatments, which was a combination of azolla extract and various media mixtures, as follows: A: Azolla extract 200 ml / l + Kascing 94 g + Charcoal husk 10 g, B : Azolla extract 200 ml / l + Azolla compost 86 g + Charcoal husk 10 g, C: Azolla extract 200 ml / l + Kascing 47 g + Compos Azolla 43g + Charcoal husk 10 g, D: Azolla extract 200 ml / l + Charcoal Husk 20 g, E: AB MIX + Charcoal husk 20 g, Each treatment repeated 3 times to obtain 15 units. Each unit consists of 3 sample plants and 2 reserve plants to obtain 75 units of observation (layout in Appendix 1).

Management Procedures. This research begins with Preliminary Research (Determining the type of axis) and then the preparation of research includes tools and planting materials, extracting azolla, hydroponic pot making (preparation), preparation of planting medium, making nutrition solution.

Further planting and maintenance. Which includes pest control and addition of nutrients and water solutions. The last stage is the harvest Parameter Observed The parameters observed include Root length (cm), Fresh Root Weight (g), Root Dry Weight (g), Root Proliferation, Caisin Plant Height (cm), Fresh Weight Height (g) (G), Number of Leaves (Leaf), Leaf Area (cm²), Leaf Color.

Data analysis. Periodic observation data are presented in histogram and graph form, while the final result is analyzed by analysis of variance using F test with error rate α 5%. For different treatments significantly tested further with Duncan Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

A. Rooted Root Development

Table 1 : Rate Root Poriferation, Root Length, Root Fresh weight and Root Dry weight Caisin

Treatment	Root Poriferation (%)	Root Length (cm)	Root Fresh weight (g)	Root Dry weight (g)
A	77	15.63	2.67 b	0.30
B	67	16.00	3.51 b	0.21
C	58	13.00	4.28 b	0.43
D	94	14.67	6,04 a	0.36
E	50	14.33	3.28 b	0.37

Description: - Average numbers followed by unequal letters in one column indicate that there is a real difference based on DMRT result at α 5% .

- There is no real difference Based on the F-Specific test for root poriferation, The higher the percentage value indicates more and more root distribution.

A: azolla extract 200 ml / l + kascing 94 g + charcoal husk 10 g,

B: azolla extract 200 ml / l + azolla compost 86 g + charcoal husk 10 g,

C: azolla extract 200 ml / l + kascing 47 g + Compost azolla 43g + charcoal husk 10 g,

D: azolla extract 200 ml / l + charcoal husk 20 g,

E: AB mix + charcoal 20 g,

1. Root Poriferation

Based on the results of scoring parameters of root poriferation showed treatment of azolla extract 200 ml / l + 20 g chaff charcoal has the highest root proliferation percentage of 94% then followed by Kascing treatment that is 77%. The availability of nutrients in the azolla acyl treatment 200 ml / l + 20 g of rice husk is very limited. In addition this is also due to the low water binding capacity on charcoal husk charcoal media compared with other treatments. In the condition of water shortage, most of the asimilat in the body of plants obtained from the source will be distributed to the roots, so the roots can grow and can meet the needs of the crops for water (Kurniasih and Wulandhany, 2009) .

2. Root Length

The effect of natural nutrition on the root length is relatively the same. In addition, the root development of Wick's hydroponics system tends not to grow downward but tends to spread laterally (Aida, 2015). It is also supported in accordance with the results of root poriferation observations that have a significant percentage of root distribution. This is due to the process of water absorption and nutrients in the hydroponics Wick system with an axis intermediate.

3. Root Fresh weight

Based on the results of DMRT fresh root weight, in the treatment of azolla extract 200 ml / l + charcoal husk 20 g showed the highest average fresh weight of root is 6.03 cm is different with other treatments. The fresh weight of the roots is related to the amount of water in the roots and length and the number of roots in the plant. Hall (1976) in Aida (2015) states that roots develop with intensive lateral roots growing in nutrient-rich regions. Roots are able to respond to the distribution of nutrients and water.

4. Dry Weight Roots

Based on the analysis results of the dry root weighing variety showed no significant difference between treatments. The average dry weight of the roots has a relative weight of about 0.21 g - 0.43 g. The dry weight of the plant indicates the plant pattern accumulates the product from the process of photosynthesis and is an integration with other environmental factors, so that the dry weight of the roots closely related to the root biomass. According to Lakitan (1996) the dry weight of plants reflects the accumulation of organic compounds successfully synthesized plants from inorganic compounds, especially water and carbon dioxide.

B. Development of Headings

Plant growth and development is an important process in the life and development of a species. Growth and development take place continuously throughout the life cycle, depending on the availability of meristems, assimilation results, hormones and other growth substances, and a supportive environment (Gardner et al., 1991). The nutritional adequacy is very important for the plant because it will affect the process of plant growth. The use of various natural nutrients in Wick hydroponics system to caisin plant will give effect to plant growth through plant height, fresh weight of plant and dry weight of plant

Table 2. Plant height, Fresh Weight, PotentialYield of Caisin Dry Root at 5th week (End of observation) .

Treatment	Plant height (cm)	Plant Fresh weight (g)	Potensial Yield (ton/ha)	Plant dry weight (g)
A	23.83 ab	29.90 a	3.3	1.90 ab
B	22.26 b	20.43 b	2.3	1.28 c
C	25.50 a	32.83 a	3.6	2.08 a
D	22.60 b	19.60 b	2.2	1.40 bc
E	25.67 a	30.83 a	3.4	1.64 abc

Description: - Average numbers followed by unequal letters in one column indicat.

There is a real difference based on DMRT results at α 5% level.

A: azolla extract 200 ml / l + kascing 94 g + charcoal husk 10 g,

B: azolla extract 200 ml / l + azolla compost 86 g + charcoal husk 10 g,

C: azolla extract 200 ml / l + kascing 47 g + Compost azolla 43g + charcoal husk 10 g,

D: azolla extract 200 ml / l + charcoal husk 20 g,

E: AB mix + charcoal 20 g,

1. **Plant height** based on the high variety of plants showed there is a real difference between the treatments. Treatment of A, C and E has the highest mean height of plant is significantly different from other treatments. Plant vegetative growth is strongly influenced by the availability of macro nutrients N, P and K and supported by sufficient micro nutrients. Kascing and azolla compost also contain some plant hormones and microorganisms that are good for plant growth. According to Zahid (1994) kascing contains growth regulators such as giberellin, cytokinin and auxin, as well as nutrients N, P, K, Mg and Ca and Azotobacter sp which are nonsymbiotic N-blocking bacteria that will help enrich the N elements needed by plants. The growth rate of plant height is shown on graph 1 of the effect of natural nutrient on the high mean of Caisin plant during the observation in annex 1.

2. **Plant fresh weight** of the canopy The weight of fresh canopy can be seen in table 2 indicating that Treatment A and C are not significantly different from E treatment but significantly different from other treatments. Sunaryo (2009) states that the fresh weight of the canopy of a plant depends on the water contained in organs - plant organs both on stems, leaves and roots, so that the water content can result in higher fresh weight of the plant canopy. Sitompol and Guritno (1995) The number of leaves not only affects the leaf area will also affect the fresh weight of the canopy on a plant, the more the number of leaves, the fresh weight of the crown tends to increase followed by the large leaf area of a plant.

3. Potential Yield based on the average yield of caisin crops showed no significant difference between all treatments. The production potential of Taisakan caisin varieties reaches 150-250 grams / plant or 20 tons - 25 tons / hectare (East-west Seed, 2017). Based on these data it is known that giving of azolla extract and mixed media have not yet reached the potential of caisin crop result, low yield potential caused by some causes of cultivation using hydroponics wick has some deficiencies such as inability to support the best growth of plants because it can not provide enough oxygen through rooting (Kunto and Budiana, 2014). In addition the wick hydroponics principle is static or passive because the nutrient solution is only stationary in one place so that the longer the nutrient solution will settle in the bottom of the nutrient container, this results in the difficult axis to drain the nutrients optimally (Titondp, 2016). These conditions result in the carrying capacity of caisin plants to be not maximal so that caisin plant growth also becomes less than the maximum and has not been able to reach the potential of caisin that should

4. Plant Dry weight Headings The dry weight of the canopy shows no significant difference between treatment A, C and E but is significantly different from other treatments. The dry weight of the plant is affected by the process of photosynthesis that occurs in the plant. The accumulation of photosynthesis and the absorption of nutrients into organic compounds will form a plant biomass. The larger the biomass of a plant, the metabolic process in the plant goes well, and vice versa if the small biomass indicates an obstacle in the process of plant metabolism (Fuat, 2009). DaunDaun development includes the basic organ of the plant body. Related to that, the leaf has a leaf mouth structure (Stomata) which is useful for the exchange of CO₂, O₂, and water vapor from leaf kealam around and vice versa. According to Sitompul and Guritno (1995) Leaf observation is indispensable, besides being an indicator of growth as well as supporting data to explain the growth process that occurs as in the formation of biomass plants.

Table 3. The average number of leaves and leaf area Caisin at the fifth week

Treatment	Number of Leaves)	Leaf Area (cm ²)	Leaf Color (%)
A	9,20 ab	302.67 b	78
B	7.33 c	227.00 b	72
C	9,70 a	397.00 a	75
D	8,13 b	269.67 b	67
E	8, 90 ab	388,67 a	75

Description: - Average numbers followed by unequal letters in one column indicate a real difference based on DMRT result at α 5% .
 - Especially for Leaf Color, The higher percentage value indicates the more green leaf color.
 A: azolla extract 200 ml / l + kascing 94 g + charcoal husk 10 g,
 B: azolla extract 200 ml / l + azolla compost 86 g + charcoal husk 10g,
 C: azolla extract 200 ml / l + kascing 47 g + Compost azolla 43g + charcoal husk 10 g,
 D: azolla extract 200 ml / l + charcoal husk 20 g,
 E: AB mix + charcoal husk 20 g,

1. **Number of leaves** Analysis results show that treatment C and A is not significantly different from E , But significantly different from other treatments. Combination of C treatment or giving of azolla extract of 200 ml / l + kascing 47 g + azolla compost 43 g + 10 g of charcoal husk containing N and P elements that can stimulate leaf growth. Increased elements of N will eventually be followed by increased yield of new cell forming materials which will further increase the formation of plant vegetative organs such as plant height and number of leaves. The leaf growth rate shown in Fig. 2 (appendix 1) shows that the action of E or AB mix + 20 m husk husk and C treatment or azolla extract 200 ml / l + kascing 94 g + charcoal husk 10 g has more dominant leaf growth rate Compared to other treatments.

2. **Area of Leaves** The total area of Caisin plant leaves can be seen in Table 3 shows that Treatment C is not significantly different with treatment E and is significantly different from other treatments. The development of leaf area is the addition and division of plant cells, the process of cell division requires nutrients and energy to form new cells. Treatment of azolla extract 200 ml / l + kascing 47 g + azolla compost 43 g + charcoal husk 10 g and treatment AB mix + 20 g husk charcoal has the highest leaf area. The content of N, P and K on the treatment is able to increase the growth of caisin plants and increase the leaf area of caisin plants.

Wikinson et al. (1989) in Aida (2015) the presence of P elements can increase the area of plant leaves.

3. **Leaf color** Based on the results of scoring the color of the leaves showed all the treatment has a percentage of leaf color is not much different that is at vulnerable 72% - 78%. The process of photosynthesis requires chlorophyll, so chlorophyll is generally synthesized on the leaves to capture sunlight. (Lakitan, 2004). Nutrient element is one factor that can influence the chlorophyll content in the leaf, nitrogen is a nutrient element that acts as a constituent of chlorophyll synthesis. High nitrogen content makes the leaves greener and last longer. This is in accordance with the statement of Junear (2008) nitrogen is an essential element in various compounds of plants including chlorophyll constituents. So it will look green.

CONCLUSIONS AND SUGGESTIONS

A. Conclusion

1. Effect of natural nutrition on hydroponic wick system on caisin plant shows the same result with commercial nutrition seen from all parameters.
2. The use of a combination of natural nutrients azolla extract 200 ml / l + kascing 47 g + azolla compost 43 g + 10 g of charcoal rice showed the best combination of plant height (25.50 cm), fresh weight of plant (32.83 grams), dry weight Plant (2.1 gram), number of leaves (9,7 strands) and leaf area (397 cm²).

B. Suggestion

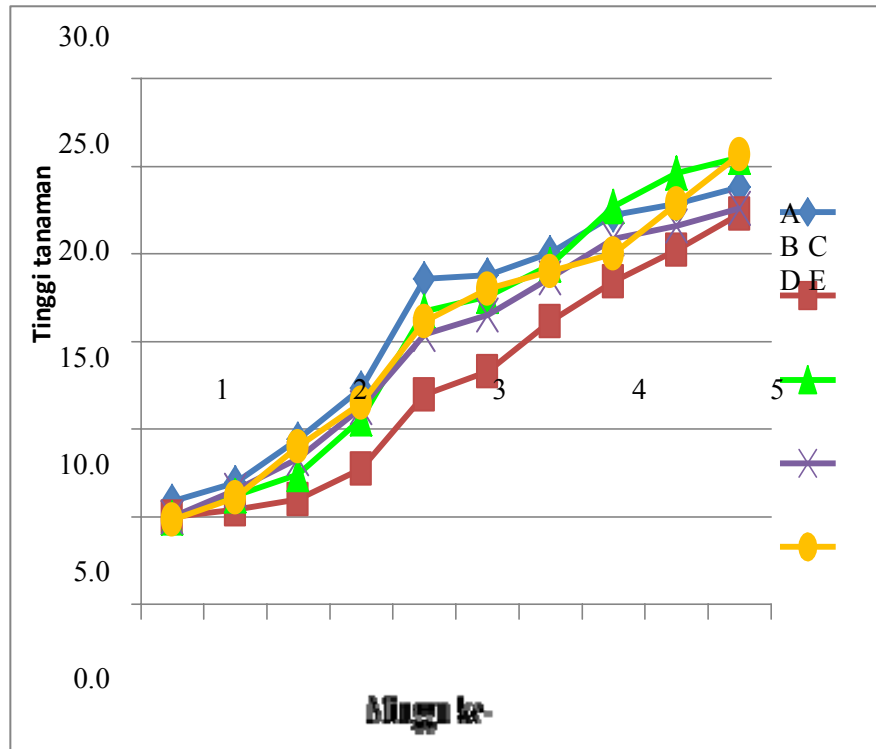
1. Substitution of nutrient solution should be done routinely to prevent the developm of bacteria in nutrient solution to prevent pathogen attack on caisin plant.
2. The use of axis should use a quality axis, have high kapilaritas and not easily damaged when submerged in water and nutrients continuously.

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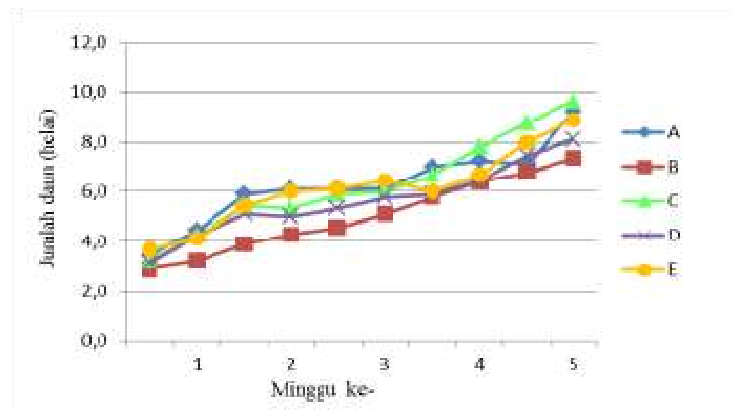
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LAMPIRAN 1



Gambar 1. Grafik pengaruh pemberian nutrisi alami terhadap rerata tinggi tanaman caisin selama 5 minggu pengamatan.

- A: azolla extract 200 ml / l + kascing 94 g + charcoal husk 10 g,
- B: azolla extract 200 ml / l + azolla compost 86 g + charcoal husk 10 g,
- C: azolla extract 200 ml / l + kascing 47 g + Compost azolla 43g + charcoal husk 10 g,
- D: azolla extract 200 ml / l + charcoal husk 20 g,
- E: AB mix + charcoal husk 20 g,



Gambar 2. Grafik pengaruh pemberian nutrisi alami terhadap rerata jumlah daun tanaman caisin selama 5 minggu pengamatan.

A : ekstrak azolla 200 ml/l + kascing 94 g + arang sekam 10 g,

B : ekstrak azolla 200 ml/l + kompos azolla 86 g + arang sekam 10 g,

C : ekstrak azolla 200 ml/l + kascing 47 g + kompos azolla 43g + arang sekam 10g,

D : ekstrak azolla 200 ml/l + arang sekam 20 g,

E : AB mix + arang sekam 20 g,

