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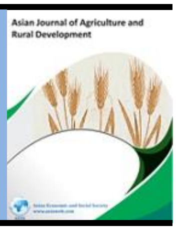

Effect of different electrical conductivity value and chamfer slope on the growth and results of kailan (brassica oleracea) acephala variety in hydroponic nutrient film technique

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ABSTRACT

Technically, hydroponic system can be used as a cultivation method with this narrow land availability. One of the hydroponic systems that have been developed is Nutrient Film Technique (NFT) Hydroponic. This study is Aimed to determine interaction between various values of Electrical Conductivity and gutter slope on the NFT system, Also to Determine the optimum effect of various values of EC and gutter slope towards kailan (Brassica oleracea var. Acephala) growth. The research was carried out in Sumedang, West Java, Indonesia on November-December 2015. This study used factorial completely randomized design (3 x 4), ie: various values of EC (n_1 = 2.5 mS cm^{-1}; n_2 = 3 mS cm^{-1}; and n_3 = 3.5 mS cm^{-1}) And Gutter slope (k_1= 1%; k2 = 3%; k3 = 5%; and k4 = 7%) with three replications. The results showed there were no interactions between the treatment of various values of EC and gutter slope. The treatment of EC 3.5 mS cm^{-1} (n_3) Influenced to results on all of the observation variables, Compared with EC 2.5 mS cm^{-1} (n_1) And 3 mS cm^{-1} (n_2). The treatment of gutter slope of 3% (k_2) Also affected to results on all of the variables Compared with other levels.

Contribution/ Originality

The research on Kailan plant with Hydroponics system especially in the use of Electrical Conductivity value and Tilt of chamfer will become the information material for farmers and related Institution in the effort of Horticulture Farming Development especially Kailan plant.

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1. INTRODUCTION

Kailan plants (*Brassica oleracea* var. Acephala) is one type of leaf vegetable, which tastes good and has the nutrients that the human body needs, such as proteins, minerals and vitamins. Kailan has a high nutrient content, ie in every 100 grams kalian contains 35.00 Kal calories, 3.0 g protein, 0.40 g fat, 6.80 g carbohydrate, 1.20 g fiber, 230 mg calcium, phosphorus 56 mg, 2 mg iron, 135 mg of vitamin A, vitamin B1 0.10 mg, 0.13 mg vitamin B2, vitamin B3 0.40 mg, vitamin C 93 mg and 78 mg of water. By consuming 100 grams kailan can meet third intake of vitamins needed by the body (Samadi, 2013).

Public awareness to consume vegetables is increasingly high, causing demand for vegetables including kailan be increased. These conditions encourage the need for increasing production through good Kailan agricultural cultivation technique.

Based on statistic data from the Agency (BPS), Kailan that classified cabbage family in Indonesia have ups and downs. In 1998 production kailan in Indonesia amounted to 1.45 million tonnes and continued to decline until 2002 to 1.23 million tons. In 2008 amounted to 1.32 million tons and in 2012 increased to 1.48 million tons (Central Bureau of Statistics, 2012).

Kailan cultivation could be done by the hydroponic system. Hydroponic is cultivation technique that uses a growing medium other than soil (Untung, 2000). Some of the advantages of hydroponic farming is that it can be done on a limited land, high quality products that have added value to the health benefits and attractive, more efficient fertilizer use, more efficient use of water, nutrients and pH control more thoroughly, the problem of pests and plant diseases can be reduced. It is engineering of cultivation and imitate the natural process. Subandi and Humanisa (2011) said man takes economic benefit from the empirical reality of natural process of natural growth and development.

One of the hydroponic system that has been developed as a Hydroponic Nutrient Film Technique (NFT). NFT Hydroponics is the cultivation of plants without soil by plant roots are in the flow circulating in the shallow water contain the necessary elements of the plant. Most plant roots submerged in water with nutrients and partly above the surface of circulating water for 24 hours continuously. This very thin layer of water about 3 mm (Untung, 2000).

In hydroponic systems, the plants require a level of *Electrical Conductivity* (EC) as appropriate. Electrical Conductivity (EC) is the electrical conductivity in a solution based on the level of salinity (salinity) (Resh, 2004). EC level of a nutrient solution can be measured using an EC meter. EC value indicates the level of deficiency, sufficiency, and excess nutrients in the media are absorbed by plant roots. The more nutrients contained in the nutrient solution, the higher the value of EC. EC value nutrient solution is very important to know because it deals with arrangements of essential nutrients for plants.

In the NFT system, the basic needs that must be fulfilled are: *Bed* (Gutters), tanks and pumps. Water or nutrients flowed in gutters planting. Gutter planting sloped so that nutrients can flow. The slope of the gutter is generally made 1-5% for the drainage of nutrient solution, incoming flow rate should not be too fast and wide gutters are sufficient to avoid blocked nutrient solution (Lingga, 2008).

Subandi (2012) stated that all cell requires water taken from their living medium that nutrition elements of light molecular weight can penetrate the cell membrance. Sutiyoso (2004) said if the slope is enlarged, the flow of the solution increases, the ripples flow increases, the encroachment of oxygen by the flow of the solution increases. Conversely if the slope is reduced, then the solution flow slows down. As a result of respiration is the only plant produces less energy, less roots can absorb nutrients and plant growth became stagnant

With the use of hydroponics system Nutrient Film Technique in cultivation is expected to increase growth and yield Kailan. EC value and the slope of the gutter is suitable as supporting the growth and yield of Kailan has not well known yet. Therefore we need for researching on the effect of various values of the EC and the slope of the gutter to learn and study the effect on growth and yield of Kailan.

2. MATERIALS AND METHODS

Materials used in this study is the seed of Kailan, nutrition AB Mix, round 2-inch PVC gutters, gutter cover 2 inch, 0.5 inch hose water distributor, the cover 2 inch hose, pipe joints, wood, rapia rope, cutter, thread, rockwool, water pump, net pots (pot planting), a bucket capacity of 8 liters and 30 liters.

The tools used in this study is a power drill, a pH meter, EC meter, luxmeter, thermometer, water pass, stirrer solution, measuring cups, analytical balance, an oven, a ruler or tape measure, crowbars, saws, scissors, tweezers, cameras, stationery and label.

The experimental design used in this study is completely randomized design (CRD) factorial two factors, the first 3 levels and factor II 4 levels with 3 repetitions obtained 36 experimental units. The variables used are rated EC (n) of 3 level and slope of the gutter (k) as much as 4 levels.

The study consisted of two factors: the value of EC (n) and the slope of the gutter (k). The first factor is composed of three levels and the second factor consists of four levels.

The first factor is the value of EC (n) consisting of:
n_1 = 2.5 mS cm^{-1}
n_2 = 3.0 mS cm^{-1} n_3 = 3.5 mS cm^{-1}

The second factor is the slope of the gutter (k) consists of:

k_1 = 1% or equal to 0.9^o, k_2 = 3% or equal to 2.7^o k_3 = 5% or equal to 4.5^o k_4 = 7% or equal to 6.3^o

These two factors obtained 12 combination of treatment levels, replicated three times so that there are 36 experimental units.

3. RESULTS AND DISCUSSION

3.1. Temperature and humidity

During the study, the average temperature contained in the study area from November to December 2015, namely 24.94^{o}C. The average humidity in the field of research is 65.90%.

3.2. Irrigation water uniformity (CU / *Coeffiecient Uniformity*)

Sapei (2003) states that the value of CU (Uniformity Coefficient) should be greater than 80%. Criteria for irrigation uniformity level can be seen in Table 1.

Table 1: Criteria of irrigation system droplets uniformity level according to ASAE

Criteria	Statistical Uniformity (SU) (%)	Coefficient of Uniformity (CU) (%)
Very Good	95 – 100	94 – 100
Good Enough	85 - 90	81 – 87
Good	75 - 80	68 – 75
Ugly	65 – 70	56 – 62
No worthy	<60	<50

Source: ASAE in Prabowo and Hendriadi (2004)

Irrigation uniformity measurement results on research obtained an average low of irrigation uniformity on the observation of one week after planting (WAP) by treatment with n_1k_2 and n_2k_2 with the same average is 98.96%. Meanwhile the average of highest irrigation uniformity on the observation of 3 weeks after planting (WAP) by treatment with n_3k_3 as much as 99.73%.

Based on observations of the irrigation uniformity, the value of uniformity (CU) of all observations gutters slope applications have been greater than 80% and suitable for use in NFT hydroponics system and NFT construction ready for transplanting. In accordance with that proposed by Sapei (2003), this suggests that the NFT hydroponic irrigation system capable of providing distribution solutions fairly evenly for each treatment.

3.3. Plant height (cm)

Results of analysis of variance showed no interaction between the treatment of various EC nutrients grades and gutters slope on plant height, however, the treatment of various EC value nutrients influence independently on plant height at ages 2, 3, 4 and 5 WAP. While the slope of the gutter treatment provides independent effect on plant height at 1, 2, 3, 4 and 5 WAP. Results of the analysis of the Advanced Test Duncan 5% significance level are presented in Table 2.

Table 2: Effect of various EC value nutrition and chamfer slope on the average height of plant (cm) by age 1 to 5 WAP

Treatment	The average plant height Weeks After Planting (WAP)				
nutrition	1 WAP	2 WAP	3 WAP	4 WAP	5 WAP
	---- Cm -----				
n_1	5,73a	11,71a	18,99a	25,87a	33,26a
n_2	5,87a	12,71b	19,96b	26,73b	34,71b
n_3	5,96a	12,50b	20,04b	29,08c	36,26c
chamfer tilt					
k_1	5,95ab	11,95a	19,22a	26,83b	33,58b
k_2	6,16b	13,01b	20,68c	28,45c	37,04d
k_3	5,69a	12,64b	19,96b	27,66c	35,97c
k_4	5,61a	11,63a	18,79a	25,96a	32,39a

Description: The average number followed by the same letter are not significantly different based on the Advanced Test Duncan at 5% significance level

Based on Table 2 it can be seen that the treatment of a variety of nutrients EC value with EC 3.5 mS cm^{-1} (n_3) On a total of 200 ppm N, independently increased plant height at age 4 WAP and 5 WAP with an average plant height of the highest compared with other treatments with a value in a sequence that is 29.04 cm and 36.26 cm. In general, the quality of the nutrient solution is determined by measuring Electrical Conductivity (EC) solution. If the EC is high then the nutrient solution more concentrated, thus increasing the availability of nutrients. Likewise, if the EC is low, the concentration of the nutrient solution low so fewer nutrients (Lingga, 2008). Macro nutrients in nutrition AB Mix very influential in the high growth of plants, especially nutrients N and P. The response of plants to the level of EC influenced age of the plant and crop growth stage. The role of nitrogen in the vegetative phase of the plant to the length and plant growth.

Nitrogen is used to stimulate growth in the vegetative phase, especially the leaves and stems (Lingga, 2008). Mulyani *et al*. (2009) states that the higher nitrogen supplied to a certain extent, the higher the plant growth variables, in this case mainly on plant height. Increased uptake nitrogen causes the chlorophyll content of plants to be higher so that the rate of photosynthesis increases. The rate of photosynthesis increases the synthesis of carbohydrates also increased. The formation of carbohydrates caused by photosynthetic rate will increase vegetative growth of the plants, including the growth of plant height and leaf formation.

Increased uptake of P able to increase vegetative growth of the plants. P element capable of forming energy in the form of ATP that play a role in the absorption of nutrients (Sastrahidayat *et al.,* 1999). ATP is then used as an energy source in the plants absorb other nutrients which are required to improve the N.. In addition to a plant height of macro nutrients N and P, micro nutrients such as Mo and Zn also affect the growth of plants. Zinc plays a role in the cleavage of the meristem cells, while Mo contributes to overall growth, especially plant height (Mairusmianti, 2011). This is evident in the parameters plant height at 4 and 5 WAP utilization of nutrients (n_3) EC 3.5 mS cm-1 showed the highest value compared to the treatment of other nutrients.

Based on Table 2 can be seen in every observation treatment gutters slope independently increased plant height. At each observation treatment gutters slope of 3% (k_2) Had an average plant height of the highest compared with other treatments to the value level in a sequence that is equal to 6.16 cm, 13.01 cm, 20.68 cm, 28.45 cm and 37.04 cm. This is presumably due to the different speed of the flow of nutrients in the gutters of different slope.

The availability of oxygen to be absorbed by plants through the roots is affected by the slope of the gutter. According to Sutiyoso (2004), the lower slope of the gutter, then the level of dissolved oxygen in the solution will be low. Conversely, the higher the slope of the gutter, then the level of dissolved oxygen in the solution will increase. According Harjoko (2009) which states that the nutrient solution flow rate is too high or too slow will make it difficult for roots to absorb nutrients.

3.4. Number of leaves

Results of analysis of variance showed no interaction between the treatment of various grades EC nutrients and gutters slope of the number of leaves, however, the treatment of various EC nutritional value and slope of the chamfer provides an independent effect on the number of leaves at ages 2, 3, 4, and 5 WAP. Test results Duncan Analysis further 5% significance levels are presented in Table 3.

Table 3: Influence of EC various value nutrition and chamfer tilt average amount leaves by age 1 to 5 WAP

Treatment	Average Number of Leaves			
	Weeks After Planting (WAP)			
Nutrition	2 WAP	3 WAP	4 WAP	5 WAP
	leaves			
$^{n}1$	3,78a	5,75a	7,61a	9,67a
n_2	4,11ab	6,11ab	7,94ab	9,94ab
n_3	4,31b	6,28b	8,17b	10,17b
chamfer tilt	leaves			
k_1	3,89ab	5,89ab	7,89b	9,89b
k_2	4,55c	6,48c	8,48c	10,48c
k_3	4,11b	6,11b	8,11b	10,15b
k_4	3,70a	5,70a	7,15a	9,18a

Description: The average numbers followed by the same letter are not significantly different shows based on the Advanced Test Duncan at 5% significance level

Based on Table 3 shows that the treatment of a variety of nutritional value of EC 3.5 mS cm^{-1} (n_3), Independently has an average number of leaves, the highest compared with other treatments with a value of 4.31 sequentially as many strands, strands 6,28, 8,17 strands and strands 10.17. This is because the nutrients contained therein sufficient for the growth of leaves in the treatment of EC 3.5 mS cm^{-1} (n_3).

According Prihmantoro and Indriani (2005) the growth and development of the leaves are affected by the elements N, Cl, and Zn. Furthermore Muliawati (2007) element of N in an amount sufficient to spur meristematic tissue at the point of actively growing stems. It encourages the formation of stem segments more and more so that the number of leaves produced too much. Has to be known that the role of nutrient nitrogen serves to stimulate the plant as a whole, especially the trunk, branches and leaves. Nitrogen also plays an important role in the formation of a green leaf that is useful in terms of photosynthesis, when photosynthesis goes perfectly, then the growth of the plant will also be better.

Based on Table 3 it can be seen that the slope of the gutter 3% treatment (k_2), Independently has an average number of leaves, the highest compared with the level of other treatments. This is because the slope of 3% (k_2), Supported by adequate water velocity that makes oxygen dissolved in the solution increases from a slope of 1% (k_1), So the absorption of nutrients in the plant can be run well.

Oxygen is required plants in the process of respiration. Respiration is the process to convert stored energy into energy that is ready for use. The energy produced will be used for photosynthesis. Adequate nutrition and oxygen are supported by a good effect on the process of photosynthesis of plants to produce photosynthate. According Salmin (2005) energy produced from photosynthesis is used for the process of making new cells that will extend the roots, trunk, branches and grow new leaves. During the day when the photosynthesis, the amount of dissolved oxygen is quite a lot. Instead at night, the oxygen that is formed during the day will be used for the plant.

3.5. Leaf Size (cm2)

Results of analysis of variance showed no interaction between the treatment of various grades EC nutrients and gutters slope of the leaf area, but the treatment of a variety of nutrient EC value and the slope of the gutter effect independent of leaf area. Results of the analysis of the Advanced Test Duncan 5% significance level are presented in Table 4.

Table 4: Effect of Various grades EC Nutrition and the slope of the average Gutter Leaf area (cm^2)

Treatment Nutrition	**Leaf Size cm^2**
n_1	184,37a
n_2	198,53b
n_3	202,37b
The slope of the Gutter	
k_1	188,40b
k_2	225,77c
k_3	198,10b
k_4	168,08a

Description: The average numbers followed by the same letter are not significantly different shows based on the Advanced Test Duncan at 5% significance level

Based on Table 4 it can be seen that the treatment of various grades of EC 3.5 mS cm^{-1} (n_3), Independently has an average leaf area widest 202.37 cm^2, But these results show is not significantly different from the treatment of an EC 3 mS cm^{-1} (n_2). It is suspected that the availability of nutrients needed by plants kailan fulfilled by treatment values EC 3 mS cm^{-1} (n_2) Nor the treatment of various grades of EC 3.5 mS cm^{-1} (n_3). Leaf area affected by the availability of N and P in the nutrient solution is given.

According to Gardner and Pearce (1991) Nitrogen element has a real influence on the development of broad leaf leaves mainly. In the vegetative phase, the plant requires a lot of carbohydrates used for networking, division, elongation and cell division. According Karsono *et al.* (2003) phosphorus-deficient plants will show symptoms of slow growth, small leaves and leaf stalks are narrow.

The plant to continue its growth and development must perform photosynthesis and cellular respiration. Assumed greater leaf area the higher the photosynthate or carbohydrates produced. Photosynthate was used for plant growth and development, among others, increase size of plant, the establishment of branches and leaves.

Based on Table 4 it can be seen that treatment of 3% slope (k_2), Independently have an average of the highest leaf area compared with other treatments is an area of 225.77 cm^2, It is suspected that the oxygen contained in the slope of 3% (k_2) Helped the process of respiration with both generating energy used for photosynthesis. Darmawan and Baharsyah (1983) states that the leaf is the most important organ as the photosynthesis that the result will be distributed throughout the plant for plant growth and development. The process of photosynthesis to produce carbohydrates that can be used as an energy source for the plant. The more energy is obtained the greater the ability of plants to absorb nutrients.

According to Susila (2013) in the hydroponic system Hydroponic NFT (Nutrient Film Technique) does not happen water stress so that the crop needs to be H_2O very fulfilled. Hydroponic systems, water and nutrient management is focused on the optimal mode of administration according to needs plants in order to achieve maximum results. Kramer (1980) stated that the plant is experiencing drought stress include changes in cellular and molecular level, such as changes in plant growth, cell volume becomes smaller, and the impact on the leaf area.

3.6. Plant fresh weight (g)

Based on the analysis of variance is known that there is no interaction, but the treatment of a variety of nutritional value and slope gutter EC provides independent effect on plant fresh weight. Results of the analysis of the Advanced Test Duncan 5% significance level are presented in Table 5.

Table 5: Influence of various EC value nutrition and chamfer tilt to the average weight of fresh plant (gram)

Treatment Nutrition	Fresh weight gram	potential Results Tonnes / ha
n_1	169,58a	60.29
n_2	173,06b	61.53
n_3	175,42c	62.32
chamfer tilt		
k_1	172,04b	61.17
k_2	176,30d	62.68
k_3	173,52c	61.69
k_4	168,89a	60.65

Description: The average numbers followed by the same letter are not significantly different shows based on the Advanced Test Duncan at 5% significance level.

Based on Table 5 it can be seen that the treatment of the value of EC 3.5 mS cm^{-1} (n_3), Independently have an average weight of fresh high of 175.42 grams plants. It is alleged treatment of EC 3.5 mS cm^{-1} (n_3) Contains nutrients required by plants kailan to increase the fresh weight of the plant. According Novizan (2002), micro-nutrients Mo role in the absorption of N and indirectly also play a role in the production of amino acids and proteins.

According Harjadi (1993) there is an element of N available and can be absorbed by plant roots will be utilized in the process of division and growth of cells by plant tissues, resulting in the formation of large vacuoles that can hold large quantities of water thereby increasing plant fresh weight.

Plant height and number of leaves affects the fresh weight of the plant canopy. The greater the height of plants and the more the number of leaves, the fresh weight of stover will increase. In addition to height and number of leaves, increased the fresh weight of the canopy as well as leaf area and chlorophyll. The wider the lettuce and the more the amount of chlorophyll then photosynthesis will run smoothly in the presence of sunlight that supports (Fahrudin, 2009).

Based on Table 5 it can be seen that treatment of 3% slope (k_2), Independently has the highest average value amounted 176.30 grams compared with another level of treatment. This matter because different tilt for each treatment that influence difference water absorption by plant.

Acording to Sutiyoso (2004) the higher the slope of the gutter, the higher oxygen levels, but on a slope that is too high will make it difficult for roots to absorb nutrients due to speed the flow of nutrients is also high. Conversely, the lower the level, the slope of the lower the flow of nutrients and oxygen by the flow of any encroachment slack resulting plant respiration to produce energy only slightly, and the roots are less able to absorb nutrients.

The water in the plant serves as a basic ingredient in the photosynthesis process, the solvent for various materials involved in important physiological processes and chemical plants, the source for the plant cell turgor, as well as a coolant in the process of transpiration. Approximately 85-95 percent of the fresh plant is composed of water (Resh, 2004).

3.7. Plant dry weight (g)

Based on the results of variance analysis, it is known that interaction did not happen, but the treatment of a variety of nutritional value and slope gutter EC provides independent effect on plant dry weight. Results of the analysis of the Advanced Test Duncan 5% significance level are presented in Table 6.

Table 6: Effect of various EC nutrition value and tilt chamfer on the average weight of dry plant (gram)

Treatment Nutrition	Dry weight gram
$^{n}1$	9,61a
n_2	9,69b
n_3	10,40c
chamfer tilt	
$^{k}1$	9,11b
k_2	12,12d
k3	10,37c
k_4	7,40a

Description: The average numbers followed by the same letter are not significantly different shows based on the Advanced Test Duncan at 5% significance level

The dry weight of the plant reflects the accumulation of organic compounds synthesized plants from inorganic compounds, especially water and carbon dioxide. Nutrients that have been absorbed by the roots contribute to plant dry weight gain. The dry weight of the plant is due to the efficiency of absorption and utilization of solar radiation available throughout the cropping period by the plant canopy.

Tippayawong *et al.* (2011), describes basically the elements of the main constituent chemical plant and the value range is: C 45.7%, H 4.3%, 49.7% O, and N 0.3%. In addition to the organic components are also inorganic components in the form of ash. The ash content varied from 0.8% - 9.7%, Silica is a major component of the epidermis with a value between 1.5 - 6.4% or above 5% depending on the type of plant. Dust consisting of silica, copper, zinc, iron, potassium, calcium, magnesium, manganese, and others.

According Harjadi (1993) the availability of nutrients absorbed by plants is able to stimulate the formation of carbohydrates, fats, and proteins through the process of photosynthesis, then protein synthesis will result in a plant cell size as well as the accumulation of carbohydrates in the form of dry weight. This statement is supported by Setyamidjaja (1986), which states that the nutrients in a form that is available will be quickly absorbed by the plant to be used in the metabolic process that will provide a response to plant growth and development.

Nyoman (2002) states that when deprived of nutrients, the visible symptoms include poor growth of roots, stems and leaves so that the results will fall. Measurement results can dry weight seen efficiency of absorption of nutrients. The efficiency of absorption of nutrients that are best demonstrated by the experimental unit in treatment EC nutritional value of 3.5 mS cm^{-1} (n_3). These results show that this treatment has the absorption of nutrients better than other treatments.

Based on Table 6 it can be seen that treatment of 3% slope (k_2), Independently has the highest average score is 12.12 grams. The dry weight of the plant affected by the fresh weight of the plant canopy. As well as the variables plant height, leaf number, leaf area and plant fresh weight, the slope of the gutter 3% treatment gives dry weight of plants better than the other treatments. It is suspected the plant can utilize oxygen levels that exist at an inclination of 3% (k_2) Well to perform respiration process that will generate energy for photosynthesis.

According Salisbury and Ross (1995) plant dry weight was the result of growth and the net result of the process of assimilation O_2 throughout the plant's growth and reflect the nutritional status of plants that rely heavily on the rate of photosynthesis. The development of the plant is a combination of a number of complex process which is a process of growth differentiation which leads to the accumulation of dry weight. And Subandi (2013) noted that the condition when a leaf is no more sink status or parasitic condition (measured comparatively between photosynthesis and respiration rates), because its function as a active photosynthetic organ.

Goldsworthy and Fisher (1992), states that the dry weight of stover plants can be used as a reference for the stated rate of vegetative growth of plants, since 90% of dry matter plant is the result of photosynthesis, the growth analysis generally expressed by weight of dry stover, especially for measuring plant as photosynthesis results.

3.8. Ratio shoot root

Results of analysis of variance showed that the treatment of various grades EC and gutters slope no interaction, but the treatment of various grades EC and gutters slope effect independent of the ratio dashed roots. Results of the analysis of the Advanced Test Duncan 5% significance level are presented in Table 7.

A ratio shoot root is translocated starch/glucose concentration. If the dry weight of the plant canopy is greater than the dry weight of the roots of plants, showed increased translocation of glucose into the plant canopy and vice versa.

Table 7: Effect of various EC value nutrition and chamfer tilt to average ratio shoot Root

Treatment Nutrition	Ratio of Pupus Root
n_1	8,23a
n_2	9,44b
n_3	10,60c
Chamfer tilt	
k_1	9,16b
$^k2$	11,32d
k_3	9,90c
k_4	7,31a

Description: The average numbers followed by the same letter are not significantly different shows based on the Advanced Test Duncan at 5% significance level

In Table 7 it can be seen that the treatment of the value of EC 3.5 mS cm^{-1} (n_3) independently has the highest average score is 10.60. According Yadi *et al.* (2012), the plant will achieve high production rates when the nutrients that plants need to be in a state of sufficient and well balanced macro nutrients N, P, K and other micro-nutrients are absolutely necessary plants. If one element is not met then it will affect the growth and yield of a plant. This indicates that the value of EC 3.5 mS cm-1 (N3) may increase growth phase to the generative phase, so that affect to the root ratio value.

Based on Table 7 it can be seen that the slope of the gutter 3% treatment (k_2) Independently have an average value ratio vanished highest root 11.32. It is presumed oxygen content of the 3% slope (k_2) Can meet the oxygen requirements kailan plants to grow well.

According Izzati (2006), which is enough dissolved oxygen in the water, will help the plant roots in binding oxygen. When high levels of dissolved oxygen respiration, the process will be smooth and the energy generated enough roots to absorb nutrients that can be absorbed by plants. The plants will have a rapid growth and can result in high productivity and quality. This was confirmed by Lesmana and Darmawan (2001), which states that the dissolution of oxygen into the water with regard to circulation, flow patterns and turbulence of the water movement in the form of ripples or waves will accelerate the diffusion of air into the water. Oxygen is required for respiration process which will produce energy that is ready for use. The energy produced will be used for photosynthesis that produces starch. Oxygen is the real fire, it is easily burn and imflamable in higher consentration.

Value ratio dashed root of value> 1 indicates plant growth more towards vanished, while the root-value ratio dashed <1 indicates plant growth more towards the root (Lizawati *et al.*, 2014). Observations were shoot root ratio performed in this study shows that the distribution of starch more because value ratio shoot roots produced > 1.

4. CONCLUSIONS AND SUGGESTIONS

4.1. Knot

Based on the results of research and analysis that has been done can be summarized as follows:

1. There is no interaction between the various Electrical Conductivity nutritional value and the slope of the gutter on the growth and yield of varieties acephala kailan.
2. Independently value of Electrical Conductivity 3.5 mS cm^{-1} (n_3) On a total of 200 ppm N effect on plant height, number of leaves, leaf area, plant fresh weight, dry weight of root crops and dashed ratio.

While the slope of the gutter 3% (k_2) Affects an effect on plant height, number of leaves, leaf area, plant fresh weight, dry weight of root crops and dashed ratio.

4.2. Suggestion

Suggestions to the authors provide is based on research that has been done is:

1. The need for further research on a variety of nutrition to Electrical Conductivity value of total N different slope and gutter with gutter different length.
2. We recommend that in making the construction of hydroponic technology *Nutrient Film Technique* (NFT) is made on a permanent floor that facilitate in making the construction.

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