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The Influence of Immersion Duration and Organic Growing Organics on Sugar Cane (*Saccharum omcinarum L*) Growth and Yield

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Abstract: The purpose of this research is to determine the influence of interaction between organic growth regulator concentration and immersion duration time, as well as the influence of each of these factors on germination sugarcane *(Saccharum officinarum L)* cuttings. This study uses a randomized group design (RAK) with two factors, immersion duration (P) in 4 levels of P1 (1 minute), P2 (2 min), P 3 (3minutes), and P4 (4 minutes) and two levels of organic plant growth regulator (K), 4 cc/ liter, and 5 cc per liter of water, each treatment is repeated 3 times to obtain 24 treatments. The results reveals that a) There is a significant interaction effect due to immersion duration and concentrations of organic growth regulator to the observed variables: number of roots per plant, root length per plant, gross weight per plant and net weight per plant at the end of the observation b). Each factor of both immersion and concentration of organic plant growth provide significant influence on all the variables studied. 0). The highest value on all the variables observed is achieved by K2P4 treatment with concentration of 5 cc/liter and 4 minutes immersion; yet statistically, the optimum value is achieved by treatment K2P3 or influence of K2 and P3treatment.

Keywords*: Sugarcane, plant growth regulator, RAK.*

1. INTRODUCTION

The increasing area of sugarcane plantations also affects the increase in Indonesian sugar production although currently cannot meet the needs of domestic consumption. To overcome this problem, the government imports sugar from various producing countries and increasing domestic production. The government effort to increase the production of sugar includes extentification by establishing a sugar factory and ing a new land or area outside Java. In addition to the results of sugar per unit area, intensification, rehabilitation and modernization are also optional by paying attention to its agronomy. One important agronomic aspect is in sugar cane cultivation is the condition of the seeds used (Anonymous, 1990).

The increasing area of sugarcane plantations also increases sugar production with approximately 2.8% growth to 2.85 million tons in 2009 from the previous year of 2.66 million tons. Increased production of sugar cane is also supported by the increasing price of sugar that

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encourages farmers to grow sugar cane (Anonimous, 2010). Furthermore, according to Mulyani S. (2008) efforts to increase sugar production especially sugar from sugar cane have been implemented since 1975 through Presidential Instruction No. 9 of 1975 and increased again in 1980 through accelerated sugar production program. Such efforts have been paid off with the achievement of the national sugar production reaching above the level of two million tons per year.

In meeting the need of domestic sugar, an effort to increase the yield is use of hormones to trigger early growth of sugarcane as good early growth encourages optimal increase of results as well. According Sarjadi (1997), treatment of stem cuttings to accelerate germination includes treatment with growth hormone (growth regulator). Risrnunandar (1991) mentions that hormone is a kind of organic material and can be classified in the types of proteins. Hormones serve as an element in the metabolism of carbohydrates and other substances.Each type of hormone in essence has the power to build, stimulate, and stimulate certain body parts. Growth regulators are complex organic compounds synthesized by high-level plants which affect plant growth and development. There are two classes of growth regulators crucially influence growth and morphogenesis in cell culture, tissue and organ, they are cytokinin and auxin.

According to Abidin (1987), Auksin is one of the growth hormones that cannot be separated from the process of growth and development of plants. Even if a cutting does not have shoots at the edge, root formation may also occur as long as it is given an IAA or a substance similar to it (Thiman and Went in Dwidjoseputr, 1985). Auksin is widely used in plant propagation through cuttings. The aim is to increase the percentage of cuttings to form roots (Hartmann et al., 1990).

Hormone is expected to mke germination of sugarcane to be faster, thus better growth and development. Therefore, organic growth regulator substance containing IAA auksin and cytokines is used in this study.

2. RESEARCH METHODS

This research uses Randomized Group Design (RAK), whwas arranged with two factors: Organic Growth Regulator concentration (K) with 2 levels of treatments and immersion duration (P) of 4 levels. Of the two factors, 8 combinations, 3 times repetitions makes 24

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combinations of treatments two plant samples for each combination of treatment. Factor I, concentration of growth regulator (K): - K1 = 4 cc/liter of water, and - K2 = 5 cc/liter of water. Factor II is immersion duration (P): - P1 = 1 minute, - P2 = 2 Minutes, - P3 = 3 Minutes and - P4 = 4 Minutes.

The media used is a mixture of garden soil and manure, 1 kg of manure for each plybag "RB" organic growth with TDN: 535.3100610AO98PT12009 is used as treatment under study both for ZPT concentration and immersion duration in sugarcane seedlings. Additional materials and equipment used in this study is polybag size 30 x 40 cm with a weight of contents ± 8 kg., Scales of analysis, oblique term, ruler, yells, hand spayer, marker, knife, tape measure and stationery. Pest and disease control use Basudin 60 EC and Ditbane M-45.

3. RESULTS AND DISCUSSION

3.1. Speed of Germination

Statistical analysis indicates that germination rate improved due to the two factors. The average observational result of speed germination is listed in seen in Table 1.

Table 1. Average Sugar Cane Growing Rate with Immersion and ZPT Organic Concentration at Early Germination.

Treatment Factor	Growing Speed (days)
P1	6.17 b
P2	5.67 b
P3	1 4.75 a
P4	4.17 a
BNT 5%	0.69
Oraganic ZPT concentration	
K1	5.71 b
K2	4.67 a
BNT 5%	0.49

Description: The numbers followed by the same letter in the same column are not differ significantly at 5% BNT test.

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Table 1 shows that P4 provides better results by 4.17 which is significantly differet from P3 by 4.75 days yet both were significantly different from other treatments. In PGR factor concentration treatment, K2 gives better effect than Kl treatment; organic ZPT concentration of 5 cc/liter is considered more optimal, thus it can stimulate during germination phase which still uses energy derived from the food reserves contained in the cuttings. Organic growth regulator is more activate physiological process of plants which leads to significant influence on germination speed. In general, to obtain the growth and development of the optimum sugarcane, early growth or germination and good reproduction can be done. A good germination means a good start of growth and will be the base of a good crop.

3.2. Leaf Amount

Statistical analysis shows that both factors do not show significant interaction, yet immersion duration give significant influence in 21 days of observation and 30 days after planting to variable 1, while PGR concentration factor does not show a significant effect on the variable of leaves numbers at all ages observations, as contained in appendix 2. The average number of leaves due immersion duration and and organi regulatorsc in plants can be seen in table 2.

Table 2. Average number of leaves due to immersion duration and organic plant growth regulator at different age of observation (days) after planting

Treatment	Observation of leaf number at various age of observation (day after planting)		
	14	21	30
P1	2.00	7.33 a	10.67 a
P2	2.08	7.58 a	11.25 b
P3	2.00	7.58 a	11.58 bc
P4	2.42	8.25 b	11.92 c
BNT 5%	tn	0.56	0.41
K1	2.02	7.67	11.33
K2	2.21	7.71	11.38
BNT 5%	tn	tn	tn

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Description: The numbers followed by the same letter in the same column, means no different eye on 5% BNT test.

Table 2 shows that the highest leaf number is reached at P4 treatment by 11.92 which was not significantly different from P3 treatment by 11.58; however, P3 and P4 treatments show better result compared with other treatments. This explains that organic ZPT with auxin and cytokinin content is able to stimulate growth, especially in the extension and number of plant leaves, thus affecting other physiological aspects.

According Rahardja, (1988), concentration of auksin solution provides optimal effect on leaves produced. Asicin helps the activity of cell division at the shoot, thus they grow faster and the cells in the young shoot tissue grow longer.

According to Agustina (1989) in Heddy, (1996) that once the seeds grow with root system and leaf size develop perfectly, leaf will support rapid rate of photosynthesis. The results of anabolism or preparation during that period allow for a rapid increase in the size of growth; but the rate of increase in total photosynthate does not always remain high. Gradually the plant will decrease the rate of increase of photosynthesis with increasing age of the plant, eventually stop growing and die.

3.3. Plants Length

The results of statistical analysis of plant length shows that two treatment factors does not show significant interaction, meanwhile immersion and organic ZPT concentration each has significant effect on all ages of observation on plant length variables, as listed in table 3. The averag of plant length due to immersion treatment and Organic growth regulator in sugar cane plant can be seen in table 3.

Table 3. Average length of plants due to immersion and organic PGR in observation

Treatment	Observation of leaf number at various age of observation (day after planting)		
	14	21	30
P1	12.33 a	26.00 a	54.67 a
P2	12.83 b	27.50 b	55.92 a

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http://agris cience.scientific -work.org/inde x.php/agris cience

P3	12.50 ab	27.67 b	57.83 ab
P4	13.25 c	29.00 c	59.75 c
BNT 5%	0.37	1.06	2.89
K1	2.02	26.92 a	55.92 a
K2	2.21	28.17 b	58.17 b
BNT 5%	0.26	0.75	2.04

Description: The figures are accompanied by the same letter are not significantly different shows on 5% BNT test.

Table 3 shows that at 30 days after planting, immersion shows that the highest plant length is achieved by P4 by 59,75 cm which is not significantly different from P3 treatment of 57,83 cm; both P3 and P3 are significantly different from other treatments such as P1 and P2. The same thing happened to the organic concentration treatment factor, showed that the highest average length of the plant was achieved by treatment of K2 of 58.17 cm which differed with 55,92 cm of Kl treatment at 30 days after planting observation.

Vegetative growth phase includes growth of roots, stems and leaves. In this phase plant requires result of photosynthesis in the form of carbohydrates which will then be converted into energy for growth. Carbohydrates come from endosperm of storage tissue, when growth begins since germination. Subsequently carbohydrates are formed from the process of photosynthesis after the plants have leaves. The high level of respiration causes the resulting energy increase, thus the reactions of carbohydrate, fat and protein ingredients in the food reserve quickly break down into soluble compounds and are transransferred to the root growing point. Besides carbohydrates, energy for plant is also formed during the process of photosynthesis (Ashari, 1995).

3.4. Number of Roots

The result of statistical analysis of root number shows that both treatment factors showed significant interaction, yet immersion and ZPT organic respectively also gave a significant effect at the end of observation of 30 days after planting to root variety, as contained in appendix 4 . the average results of the observation on number of roots per plant as a result of the combination treatment is provided in table 4.

AGRICULTURAL SCIENCE
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http://agriscience.scientific-work.org/index.php/agriscience

Table 4. Average number of roots per plant due to combination treatments at the end of observation (30 days) after planting

Combination treatment	Number of roots per plant
K1P1	5.33 a
K1P2	17.00 b
K1P3	22.00 bc
K1P4	26.33 c
K2P1	16.67 b
K2P2	17.00 b
K2P3	26.00 c
K2P4	27.67 c
BNT 5%	5.37

Description: The numbers followed by the same letter in the same column, means not significantly different 5% BNT test.

In Table 4, effect of the combination treatment between immersion and the concentration of organic ZPT on variable of root number per plant at the end of observation age 30 days after planting showed the highest root value per plant is reached at K2P4 treatment that by 27.67 which is not significantly different K2P3 treatment by 26,00, K1P4 treatment by 26,33, K1P3 treatment by 22,00; but the treatment is significantly different from other treatment.

Organic growth regulator substance is auxin hormone with mechanism to accelerate formation of root cuttings of sugarcane; first, auxin will increase diffusion of water influx into cell, so as fast water available in cells at high concentrations. This causes the process to start the activity of the cells and the enzymes in the cells will be accelerated by auxin which will further increase the respiration activity. The high rate of respiration causes the increase of energy produced, thus decomposition reactions of the ingredients of carbohydrates, fats and proteins contained in fast food reserves break down into compounds that dissolve and translocated to the point of growing roots.

AGRICULTURAL SCIENCE
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The development of plant roots causes its function in absorbing coal for plants will increase the availability and increasing metabolic processes for the growth and development of plants further. According to Sutejo (1992) some macro nutrients such as N, P, K as main nutrients for plant growth, are generally necessary for the formation or growth of vegetative parts of plants such as leaves, stems, and roots. Increased plant's photosynthesis process will lead to the synthesis of carbohydrates are increased, then mostly carbohydrates will also be converted into protein, wherein the protein is an essential part of the plasma cell and other functional components.

Rapid process of formation of roots and shoots of cuttings given organic PGR treatments will make better root system, thus more water and nutrients in the soil can be absorbed by the cuttings (Siagian, 1992).

3.5. Length of Root per Plant

Both treatments show significant interaction, yet immersion and concentration of organic ZPT respectively also gives a significant effect at the end of observation of 30 days after planting to variables of root length per plant, as stated in appendix 4. The average result of root length observation per plant due to combination treatment of immersion duration and concentration of regulator "grow organic in sugar cane plant can be seen in table 5.

Table 5. Average root length per plant due to combination treatment between length of immersion and organic growing factor at the end of observation (30 days) after planting.

Combination treatment	Number of roots per plant
K1P1	34.00 a
K1P2	57.00 b c
K1P3	40.33 a
K1P4	50.00 b
K2P1	41.33 a
K2P2	37.33 a
K2P3	54.33 b c
K2P4	65.67 c

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BNT 5%	13.37

Description: The numbers followed by the same letter in the same column means not significantly different at 5% BNT test.

Table shows that effect of combination of immersion and organic ZPT on root length is achieved at K2P4 treatment by 65.67 which was not significantly different from K2P3 treatment by 54.33 and KIP treatment of 57.00; but the treatment is significantly different from other treatments.

Table 5 also shows a statistically tendency that higher concentrations of organic ZPT concentrations will give less significant effect. This indicates that organic ZPT content is a growth hormone solution which can stimulate root formation and root growth. According to Salisbury and Ross (1992), auxin plays an important role in the process of cell division and enlargement, especially early in the formation of roots, so the formation of the callus will be faster and wider. The larger the part that forms the kallus, the more primordial roots are formed, the more root emerge.

According to Gardner et al. (1991), hormones are indispensable in the growth of organogenesis including in the formation of roots. Appropriate concentration treatment of the solution can increase root initiation and induction, so this concentration is an effective treatment for root induction.

3.6. Plants Gross Wight and Net Weight

The results of statistical analysis of gross weight and net weight per plant show that both treatment factors make significant interaction, but immersion and organic ZPT concentration respectively also gave a significant effect at the end of observation of 30 days after planting to variables of gross weight and net weight per plant, as listed in appendix 5. The average gross weight and net weight per plant due to combination treatment of immersion duration factor and concentration of organic growth regulator in sugar cane plant can be seen in table 6.

Table 6. Average gross weight and net weight per plant as a result of combination treatment between immersion duration and concentration of organic growing substances at the end of observation (30 days) after planting.

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Journal Of Agricultural Science And Agriculture Engineering
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http://agris cience.scientific -work.org/inde x.php/agris cience

Combination treatment	Number of roots per plant	Gross weight per plant
K1P1	79.20 a	23.76 a
K1P2	127.57 b	38.27 b
K1P3	149.53 c	44.86 c
K1P4	168.37 d	50.51 d
K2P1	170.40 d	51.12 d
K2P2	189.83 e	54.08 de
K2P3	189.83 e	56.95 e
K2P4	194.27 e	58.28 e
BNT 5%	5.37	3.63

Description: The numbers followed by the same letter in the same column, means not significantly different at 5% BNT test.

In Table 6, the effect of the combination treatment at the end of observation age of 30 days after planting shows the highest gross weight and net weight per plant is achieved by K2P4 treatment of 194.27 grams and 58.28 grams which is not significantly different from K2P3 treatment, respectively 189.83 grams and 56.95 grams; but the combination of treatments differed significantly with other treatment combinations.

Better results on variable wet weight of plants and dry weight per plant achieved by treatment K2P4 and K2P3, this is allegedly caused by the development of optimal plant roots due to the influence of organic ZPT causing more effective nutrient absorption in the soil, especially macro nutrients ie nitrogen, phosphorus, and potassium. Nitrogen as a component of plasma cells will increase and by increasing plasma cells, then the cell volume increases, so the weight of cells increases which causes the increase of wet weight of the plant. According to Gardner et al.(1991), plant growth is indicated by the increase in the size and gross weight of irreversible plants.

4. CONCLUSION

There are significant influences as a result of treatment between theimmersion duration and concentration of organic growth regulator on observed variables. The observed variables include number of roots per plant, root length per plant, gross weight per plant and net weight per plant at the end of observation. Each factor of both immersion and concentration of organic

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ZPT gave significant effect on all the variables studied. The highest value of all observed van'abel was achieved by K2P4 treatment of 5 cc/ liter and 4 min immersion, but statistically, the optimum value was achieved by K2P3 treatment or the effect of K2 treatment and P3 treatment, it can be seen in all variables studied.

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