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Application of IBA PGR Concentration On Germination of Sugarcane (*Saccharum Officinarum L*) Cuttings

Bambang Wicaksono Hariyadi [1,] Sri Purwanti [2]
Faculty of Agriculture
Agrotechnology Study Program
[1.2,] Merdeka University Surabaya
E-mail: wicaksonounmer@gmail.com

Abstract: The purpose of this study is to determine the effect of IBA plant growth regulators (Indole Butyric Acid) on germination of sugarcane cuttings (Saccharwn o_mcinarum L). The experimental materials include PSJT 941 variety of sugarcane cuttings, soil and manure as medium with 2: 1 ratio. IBA and 50% alcohol is used as treatment. Pest and disease controls used Basudin 60 EC and Dithane M-45. This study uses Randomized Block Design (RAK) with three replicates and each replicate consisted of 2 sample plants. The treatment is as follows: Ko: without treatment, K1: 500 ppm, K2: 1000 ppm, K3: 1500 ppm, K4: 2000 ppm. The study reveals that treatment of K4 IBA solution (2000 ppm) has very significant effect on variables of germination speed, shoot length, number of leaves and number of roots, and significantly different at root length. Administration of IBA solution at concentration of 1500 ppm accelerated germination time of sugar cane cuttings, occurred on the fourth day (fourth). Administration of IBA solution at 2000 ppm gave the highest result which was not different with 1500 ppm concentration on shoot length, leaf number, root length and root number. The higher the concentration of IBA, the higher the shoot length, the number of leaves, the length of the roots and the number of roots of sugar cane produced.

Keywords: *PGR, Germination of sugarcane stek, RAK*

1. INTRODUCTION

Sugarcane (*Sacharum of ofcinarum L.)* is one of the important crops as a sugar producer. More than half the world sugar production is derived from sugar cane. Sugar industry in Indonesia is currently facing severe challenges. These challenges come from the flood of imported sugar, the relatively low productivity of sugarcane, low performance and efficiency of PG (Sugar Factory), transfer of sugar cane to non-agricultural land, and competition with other commodities. The last two factors have caused the sugar cane to move to moor land (subiyono 2005).

According Sarjadi (1977), treatment of stem cuttings to accelerate germination includes treatment with growth hormone (growth regulator). Rismunandar (1991) mentions that hormone is a kind of organic material, and can be classified in the types of proteins. Hormone serves as an element in metabolism, Carbohydrate and other substances. Each type of hormone in effect

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has the power to build, encourage, and stimulate certain body parts. This is supported by Heddy's (1996) opinion that hormones are molecules whose activity regulates important metabolic reactions. These molecules are formed in metabolic processes of organisms and do not work in nutrition.

The term growth substances includes plant hormones (natural) and artificial compounds that can change the growth and development of plants. Plant hormone consists of three groups of compounds: auksin, gibberellins and kinin (Heddy, 1996). With hormonal or growth regulator, germination of sugar cane is expected to be faster and produce better seeds. Therefore, the present research use substance or hormone called IBA (Indole Butyric Add).

2. MATERIALS AND METHODS

The research materials include PSJT 941 seed cuttings, soil and manure as medium with 2: 1 ratio. As treatment, IBA solution and 50% alcohol with Ko: concentration without treatment, K1: 500 ppm = 0,5 mg /ml, K2: 1000 ppm = 1 mg/ml, K3: 1500 ppm = 1.5 mg/ml, K4: 2000 ppm = 2 mg/ml are used. Pest and disease controls used Basudin 60 EC and Dithane M-45. The research tool includes polybag size 30 x 20 cm, cuttings knife, measuring cylinders, ruler, measuring ruler, spoon, scales analysis, ohaus scales, sprayer, plastic bucket and stationery.

This study uses a randomized block design (RBD) with three replicates and each replicate consisted of two plants. $K_{0:}$: without treatment $K_{1:}$:500 ppm $K_{2:}$:1000 ppm $K_{3:}$:1500 ppm and K_{4}: 2000 ppm. To determine the effect of treatment, analysis of variance or F is used. BNT Test is used to determine differences in treatment with trust level P = 0.05 (Yimosumarto, 1991).

3. RESULTS AND DISCUSSION

3.1. Speed of Germination

Results of analysis of variance indicate that treatment on IBA has real influence. Germination is more rapid at a concentration of 1500 ppm IBA solution ($K_{3),}$ on the

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4th day after planting compared to treatment with K_4, K_2, K_1 and K_0 observations. Average germination rates are presented in Table 1.

Table 1. Average Speed of Sugar Cane Germination with Treatment of IBA solution

Treatment	Speed of Germination
K_3 (1500 ppm)	4.00 a
K_4 (2000 ppm)	5.30 b
K_2 (1000 ppm)	5.30 b
K_1 (500 ppm)	5.50 b
K_0 (0 ppm)	6'50 c
BNT 5%	0.73

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

In Table 1, it appears that treatment with hormone IBA (K_3) 1500 ppm on cuttings of sugar cane soaked for 20 seconds indicates that the speed of germination is more rapid and has significant difference on growth speed on average occurred on day four (4) after planting compared with other treatments. Furthermore, the speed of germination is as follows, with treatment concentration (K_4) 2000 ppm and (K_2)1000 ppm, the average result is 5.3 days, (K_1)500 ppm, the average result is 5.5 days and (K_0)0 ppm, the average result is 6.5 days.

Analysis of variety of IBA hormone in cane cuttings shows that it is effective to increase the speed of germination at a concentration level of 1500 ppm. Cane cuttings germinated on the fourth day, indicating that IBA hormone has a positive effect in stimulating germination rate, creating faster rooting.

IBA hormone is one of the hormones included in auxin group, besides being used to stimulate rooting, it also has other benefits such as increasing germination, stimulating the growth of leaf and extending the shoots (Kusumo, 1984).

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3.2. Shoots length

The result of variance analysis showed that treatment of IBA solution was highly significant. The highest shoot length after planting was indicated in the treatment of solution concentration of 2000 ppm IBA (K_4),followed by treatment with K_3, K_2, K_1 and K_0. The higher the concentration of the given IBA solution, the higher the length of the resulting shoots length. . Observation data on shoot length average is presented in table 2.

Table 2 Average of Sugar Cane shoots length with IBA Concentration Treatment on Final Observations

Treatment	Shoots length
K_0 (0 ppm)	133.00 a
K_1 (500 ppm)	133.33 a
K_2 (1000 ppm	138.67 ab
K_3 (1500 ppm)	146.33 b
K_4 (2000 ppm)	149.33 b
BNT 5%	8.06

Description: The numbers followed by the same letter in the same column are not significantly different at LSD 5%.

In Table 2, it is seen that the higher concentration of IBA given up to a certain amount indicates a very significant effect on shoot length. This is in accordance with IBA hormone function as a growth hormone as inseparable process of growth and development *(growth and development)* of a plant, which can stimulate the growth of IBA cleoptile or shoot of a plant (Anonymous, 2008).

Application of IBA on sugarcane cuttings is effective to spur high growth buds. This result is consistent with the Staba and Cheng (1981) research that successfully grew buds *explan* of sugarcane to form a *plantet* with the addition of IBA because the use of IBA may spur shoot extension.

According to Abidin (1980), IBA is part of the active ingredient that has ability in supporting the extension of cell at the shoot and increases the length of stem without affecting

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the number of sections. This is supported by Dawam (1994), stating that IBA is capable of spurring stem elongation. At a concentration level of 2000 ppm, it gives optimal shoot length.

3.3. Leaf Amount

The result of variance analysis showed that IBA treatment had a very real effect. The highest number of leaves at the end of observation is indicated by treatment of IBA solution concentration of 2000 ppm (K_4), followed by treatment with concentration of K_3, K_2, K_1 and K_0. The higher IBA concentration solution, the higher the number of leaves generated. This suggests that higher concentrations of IBA at certain amount have a very significant effect on the number of leaves. Observational data on the average number of leaves is presented in table 3.

Table 3. Average Number of Leafs on Cane Plant by Treatment of IBA Solution Concentration at the End of Observation.

Treatment	Number of leaves
K_0 (0 ppm)	7.33 a
K_1 (500 ppm)	7.67 a
K_2 (1000 ppm)	8.00 ab
K_3 (1500 ppm)	8.67 b
K_4 (2000 ppm)	9.33 b
BNT 5%	0 80

Description: The numbers followed by the same letter in the same column are not significantly different at BTN 5%.

In Table 3, it is seen that the higher concentration of IBA given up to a certain number indicates a very significant effect on the number of leaves. This corresponds to the nature of IBA solution included in the growth hormone which can stimulate the extension and number of leaves. Besides, it is also very influential on genetic traits during germination as well as other physiological aspects (Heddy, 1996).

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Concentration of IBA solution gives an optimum effect to the number of leaf produced. IBA assists in the activity of cell division at the shoot, so the growth of the shoots will be faster and the extent of the cells in the young shoot tissue (Rahardia 1988).

3.4. Root Length

Analysis of variance indicate that treatment of IBA solution have real effect. The highest root length at the end of the observation after planting is indicated by treatment solution concentration of 2000 ppm IBA ($K_{4)}$ subsequent treatment concentration of $K_{3,}$ $K_{2,}$ K_1 and $K_{0.}$ While it is not significantly different from the treatment of K_3 (1500 ppm) and K_2 (1000 ppm), it is significantly different from treatment of K_1 and $K_{0.}$ Observational data on average root length are presented in Table 4.

Table 4. Average of cane root length with IBA Treatment at the End of Observation

Treatment	Root length
K_0 (0 ppm)	32.00 a
K_1 (500 ppm)	32, 67 a
K_2 (1000 ppm)	39 67 ab
K_3 (1500 ppm)	42.00 b
K_4 (2000 ppm)	46.67 b
BNT 5%	8 07

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

In table 4, it appears that the higher the concentration of IBA given up to a certain amount, the higher the length of the root. This is considered due to the influence of the IBA hormone, the energy present in the cuttings used for the root elongation stage. This is in line with Hartman's opinion, et al (1990), that IBA hormone can stimulate root formation and spur root growth (Sabanek & Jesko, 1989).

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3.5. Number of Roots

Analysis of variance indicates that treatment of IBA solution has a very real effect. The highest total root at the end of the observation is indicated by treatment of IBA solution concentration of 2000 ppm (K_4) subsequent treatment concentration K_3, K_2, K_1 and K_0, The higher the concentration of IBA solution, the higher number of roots generated. This suggests that the more concentration of IBA administered to a certain amount has a very significant effect on the number of roots. The data of the average number of roots are presented in Table 5.

Table 5: Average Number of Root of Sugar Cane with Treatment of IBA Solution on Final Observations.

Treatment	Number of Roots
K_0 (0 ppm)	13.00 a
K_1 (500 ppm)	18.33 a
K_2 (1000 ppm)	20.33 a
K_3 (1500 ppm)	29.33 b
K_4 (2000 ppm)	30.67 b
BNT 5%	8.07

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

Table 5 shows that the higher concentrations of IBA given up to a certain number indicate a very significant effect on the number of roots. This is because IBA can accelerate the growth of new roots in plants (Rismunandar, 1991).

Treatment with solution of IBA K_4 (2000 ppm) resulted in a higher rooting treatment compared with K_3, K_2, K_1 and K_0 while it is not significantly different from treatment of K_3 (1500 ppm). Kusumo (1984) suggests that IBA typically produces little roots that quickly become long and form strong fiber roots. This is in line with Salisbury and Ross (1992), stating that IBA plays an important role in the process of cell division and enlargement, especially in the early formation of roots. Furthermore Zaer and Mapes (1935) stated that the absorbed plants depends on concentrations given and will determine the cell division.

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If the IBA to be absorbed is high, the process of cell division will take place fast that callus formation will be faster and broader. The larger the part that makes up the callus, the more the primordial roots are formed that more root initiation occurs. This resulted in the growth of roots in the treatment with a particular IBA concentration which is better than treatment with a lower concentration of IBA.

4. CONCLUSION

Application of IBA *(Indole Butyric Acid)* growth regulator concentration on germination of cuttings of sugar cane was highly significant to variables of speed of germination, shoot length, number of leaves and number of roots , and significantly different in root length variables. Administration of IBA solution at 1500 ppm concentration accelerates the time of germination of sugar cane cuttings, which occurs on the fourth day. Administration of IBA solution at 2000 ppm gave the highest result which was not significantly different with 1500 ppm concentration in shoot length, leaf number, and root length and root number. The higher the concentration of IBA, the higher the shoot length, the number of leaves, the length of the roots and the number of roots of sugar cane produced.

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