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## Effect of Hot Water Treatment Temperatures and Auxin on Early Growth of Cane Plant (*Saccharum officinarum* L.) in Single Bud Planting

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**Abstract.** The use of superior and adequate sugarcane seeds are being an important factor either in tissue culture or quickly provision of seeds (Single Bud Planting). This study aims to determine the influence of Hot Water Treatment (HWT) temperature and auxin on the initial growth of sugarcane. The experiment was arranged factorially by using Completely Randomized Design which was repeated three times. The first factor of HWT immersion temperature comprising: without immersion and immersion with temperature of 30 ° C, 45 ° C, and 50 ° C; the second factor of auxin consisting of: without auxin, atonic, and onion extract. The variables that observed such as appearance and length of bud eye, plant height, number of leaves, stem diameter, root length and weight, wet weight of fiberplant. The data were analysed by ANOVA which was tested with 5% HSD test. The results showed that HWT temperature immersion and auxin administration, respectively, influenced the length of bud eye, plant height, number of leaves, stem diameter, wet weight of plant, weight and root length up to 60 days after treatment. There is an interaction effect between auxin administration and immersion of HWT towards shoot bud length, plant height, leaf number, wet weight; and immersion with HWT temperature of 50°C for 10 minutes and atonic treatment giving the best result. Thus, the treatment can be applied to sugarcane nursery.

### 1. Introduction

The using of ratoon in sugar cane cultivation at tropics area reaches 50-55% [1], however, production level is 20-25% less than sugarcane planting [2] and there is uneven plant growth with levels mortality of nearly 60% [3]. The application of single bud planting technique in sugar cane (*Saccharum officinarum* L.) production is often getting rheumatic disease obstacle (Ratoon stunting disease) that caused by *Leifsoni axyli* bacteria that attack xylem tissue, this condition makes the sugar cane's growth is stunted and reducing the number of tillers. The use of pesticide chemicals for disease control is not only doubtful of its effectiveness but will also increase production costs as well as the impact of toxicity for beneficial organisms and environmental pollution. The cheapest way that can



suppress the pathogenic bacteria disturbance is using hot water treatment (HWT) by soaking sugar cane's cuttings for about 10 minutes with 30-50°C temperature [4]. However, this method is often ineffective and damaging the bud [5, 6]. On the other hand, in cell and bud tissue growth initiation process are required various plant growth regulators activity, one of the most important among them is auxin. To fulfill the optimal growth is often required addition of exogenous auxin. Giving various compounds toward cane buds in an in vitro way such as 6-benzylaminopurine, kinetin, auxin, 2,4-D, indole-3-butyric acid, showed satisfactory results [7, 8]. Currently, the utilization of auxin is not only in the inorganic compounds but also organic compounds derived from plant extracts. Red onion extract has been reported to contain auxin in addition to containing thiamine that can stimulate cell growth [9]. Auxin is a compound whose activity can take place when it is in its optimum temperature range. Given the importance of HWT applications as an effective and efficient pathogen control method, it is necessary to test how wide the temperature range effectively suppresses pathogens but also does not inhibit auxin activity. On the other hand, it is also necessary to test the auxin ability embodied in the growth of buds or seed tissue in the HWT temperature range optimally.

This study aims to determine the effect of interaction between HWT immersion application for 10 minutes and the application of immersion auxin for 15 minutes on the initial growth of sugar cane plant.

## 2. Materials and methods

The research was carried out in the experimental garden of PG, Gempol Kerep, Mojokerto, East Java Province.

In this study we used 7 months single buds seeds. Single buds maintained in the manufacturing process are the eighth bud, while the other buds are removed. The soil is mixed with sand and manure (6: 3: 1 v / v) evenly and placed in polybags with a capacity of 5 kg as a planting medium. Meanwhile, atonic is prepared as inorganic auxin and organic auxin which is the extraction of shallot bulbs. A well-flung and flawless eye bud seeds are immersed in a vessel filled with hot water with a set temperature according to the treatment of 30°C, 40°C, and 50°C. After 10 minutes of immersion, the seedlings are lifted and drained at room temperature until no more water drips from the sugarcane cuttings. Furthermore, the seeds soaked in auxin according to the treatment of inorganic auxin and organic auxin with a concentration of 1 ml/litre of water aquades. As the cuttings control is immersed in aquades water only. Immersion done for 15 minutes. Cuttings planted by placing it on the planting medium with a depth of 3-4 cm with eye buds facing upwards. Watering is done every day in accordance with the needs of soil moisture and always avoid high frequencies so that the roots or parts of cuttings do not rot. The observed variables were plant height, number of leaves, stem diameter, root length, wet root weight, and wet plant weight. The observed data were analysed by variance analysis followed by 5% HSD test.

## 3. Results and discussion

Variance analysis result showed the effect of real interaction between HWT temperature immersion application and auxin immersion application almost in all observation variables such as shoot length (15 HST), stem diameter and plant height (30 HST), root length, wet root weight, and wet weight of plant stover (60 HST).

The mean of each variable in each treatment combination can be seen in Table 1 (destructive observation) and Table 2 (non destructive observation). The measurements of the shoot bud length at 15 HST are the growth of the shoot to be the main stem candidate with the starting position rather flat to reach more than 45° angle to the vertical axis. After 15 HST to 60 HST (end of observation) the buds extend into easy plant stems that start vertically upright.

Table 1: The average effect of hot water immersion (HWT) and auxin application to various variables of sugar cane plant early growth on destructive observation

Treatment <sup>*)</sup>	Long bud eye (15 DAP) (cm)	Plant height (60 DAP) (cm)	Number of leaves (60 DAP) (sheet)	Stem diameter (30 DAP) (cm)
A <sub>0</sub> S <sub>0</sub>	24.10 ab	118.33 ab	9.00	5.27 a
A <sub>0</sub> S <sub>1</sub>	21.57 a	117.00 ab	9.00	5.67 ab
A <sub>0</sub> S <sub>2</sub>	28.13 ab	119.00 ab	7.67	5.57 ab
A <sub>0</sub> S <sub>3</sub>	34.17 b	117.00 ab	10.00	6.67 bc
A <sub>1</sub> S <sub>0</sub>	25.53 ab	116.67 ab	9.00	5.57 ab
A <sub>1</sub> S <sub>1</sub>	28.90 ab	122.00 b	9.00	6.27 abc
A <sub>1</sub> S <sub>2</sub>	32.00 ab	118.33 ab	9.33	5.93 ab
A <sub>1</sub> S <sub>3</sub>	38.73 b	118.67 ab	9.67	7.20 c
A <sub>2</sub> S <sub>0</sub>	25.67 ab	116.33 ab	9.00	5.70 ab
A <sub>2</sub> S <sub>1</sub>	31.27 ab	111.33 a	9.33	5.97 ab
A <sub>2</sub> S <sub>2</sub>	32.40 ab	117.33 ab	9.33	6.57 abc
A <sub>2</sub> S <sub>3</sub>	24.30 ab	122.00 b	9.00	5.87 ab
HSD 5%	10.88	10.44	ns	1.38

\*) A<sub>0</sub> = without auxin, A<sub>1</sub> = inorganic auxin, A<sub>2</sub> = organic auxin; S<sub>0</sub> = without immersion of HWT, S<sub>1</sub> = the temperature immersion of HWT is 30°C, S<sub>2</sub> = the temperature immersion of HWT is 40°C, S<sub>3</sub> = the temperature immersion of HWT is 50°C; the average value followed by the same letter in the same column shows no difference based on the 5% HSD test.

Hot water treatment with an inorganic auxin gives a better growth response compared to organic auxin derived from onion extract. It is presumed that inorganic auxin is more stable against heating above the average normal temperature of tissue. In contrast, auxin derived from onion extract is relatively less stable if the temperature is above the normal temperature of tissue. This fact is clearly demonstrated in shoot response towards inorganic auxin administration and heating at a temperature of 50°C. The stability of auxin in the work facilitates cell division and the temperature around the tolerable hot level of room will lead to an increasing cell division rate. Shoot length, plant height, stem diameter and root weights, as well as wet weight of sterilization in A<sub>1</sub>S<sub>3</sub> treatment showed the highest relative value.



Table 2: The average effect of hot water immersion (HWT) and auxin application to various variables of sugar cane plant early growth on non destructive observation

Treatment <sup>*)</sup>	Root length (cm)	Root wet weight (gr)	Stover wet weight (gr)
A <sub>0</sub> S <sub>0</sub>	41.33 ab	3.55 ab	20.33 ab
A <sub>0</sub> S <sub>1</sub>	35.30 ab	4.31 ab	19.33 ab
A <sub>0</sub> S <sub>2</sub>	37.33 ab	3.80 ab	19.00 ab
A <sub>0</sub> S <sub>3</sub>	40.00 ab	3.67 ab	23.33 ab
A <sub>1</sub> S <sub>0</sub>	38.00 ab	2.67 a	18.67 a
A <sub>1</sub> S <sub>1</sub>	41.30 ab	5.38 b	23.00 ab
A <sub>1</sub> S <sub>2</sub>	47.00 ab	5.15 b	22.67 ab
A <sub>1</sub> S <sub>3</sub>	48.33 b	10.06 c	26.00 b
A <sub>2</sub> S <sub>0</sub>	40.67 ab	4.18 ab	20.67 ab
A <sub>2</sub> S <sub>1</sub>	32.70 ab	4.98 ab	20.33 ab
A <sub>2</sub> S <sub>2</sub>	32.33 a	3.44 ab	21.67 ab
A <sub>2</sub> S <sub>3</sub>	42.00 ab	8.97 c	24.00 ab
HSD 5%	16.20	2.31	7.17

\*) A<sub>0</sub> = without auxin, A<sub>1</sub> = inorganic auxin, A<sub>2</sub> = organic auxin; S<sub>0</sub> = without immersion of HWT, S<sub>1</sub> = the temperature immersion of HWT is 30°C, S<sub>2</sub> = the temperature immersion of HWT is 40°C, S<sub>3</sub> = the temperature immersion of HWT is 50°C; the average value followed by the same letter in the same column shows no difference based on the 5% HSD test.

Combination of HWT treatment with auxin showed that the role of both factors triggered a better plant growth response compared to control. Warmer temperatures will create molecular bonding conditions within the cell wall of the bud tissue, making it more ready for the cleavage process. Auxin encourages the emergence of roots in sugarcane [10, 11] and creates the optimum conditions for root growth [12, 13]. This hormone initiates callus induction, then, with the availability of sucrose and minerals it will encourage the process of cell division [14]. Fitohormone performance affects the tissue response which growing rapidly and it is free of disease [15].

From the application of in vitro propagation technology it is known that all treatment successes utilizing compound of growth regulator (fitohormon) are highly dependent on plant genotypes, weather conditions, soil types and planting media components, growth regulator types as well as interactions of all these aspects [16]. Similarly, the combination of HWT and auxin administration in the application of single bud planting technique is dependent on the interaction of both factors with the planting medium and its microchemistry.

#### 4. Conclusion

The combination of soaking application with hot water treatment for 10 minutes with subsequent application of immersion in auxin had an effect on long bud and plant height, rod diameter, root length, wet root weight and wet plant weight during early growth period of sugar cane. The implications of research is the best treatment can be applied in the sugarcane nursery.

#### 5 Acknowledgements

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