Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01/10017
DOI URL: http://dx.doi.org/10.21474/IJAR01/10017
ISSN NO. 2320-5407

RESEARCH ARTICLE

IN VITRO MULTIPLICATION OF BARANGAN BANANA (MUSA ACUMINTA L.).

Armaniar, Rosmaria Girsang and Refnizuida.
Department of Agroecotechnology, Faculty of Agriculture, Pembangunan Panca Budi University, Medan, Indonesia.

Manuscript Info

Manuscript History
Received: 08 September 2019
Final Accepted: 10 October 2019
Published: November 2019

Key words:-
Barangan banana, Invitro, Multiplication.

Abstract

The in vitro multiplication of Barangan Banana Plants (Musa acuminta L.) was carried out to determine the effectiveness of growth regulator cytokines and coconut water in multiplying barangan banana. The pupose of this study was to obtained the concentration of benzyl amino purine (BAP) and concentration of coconut water which triggers the multiplication of Barangan bananas by in vitro method. The plant material used was the barangan banana (Musa acuminta L.), BAP growth regulator and coconut water. This research experiment uses a completely non factorial randomized design consisting of 5 levels, namely B0: control, B1: 0.5 ml, B2: 1 ml, B3: 10 ml, B4: 20 ml. The parameters observed included the number of leaves, leaf length, number of roots, root length, plant height, number of tillers. The results showed that the treatment of BAP concentration and coconut water significantly affected ($p < 0.05$) the number of roots and root length and did not significantly affect the number of leaves, plant height and also the number of Barangan Banana tillers.

Introduction:-

Barangan banana (Musa acuminata L.) has excellent nutritional content and is rich in minerals such as potassium, magnesium, phosphorus, iron, and calcium. Barangan bananas also contain vitamin C, B complex, B6, and serotonin which are active as neurotransmitters in smoothing brain function (Sunyoto, 2011). Banana plantations (Musa Paradisiaca L.) is a horticultural plant that has been widely developed in Indonesia. It is estimated that as one of the Southeast Asian regions, Indonesia has 200 banana cultivars that grow in various types of soil. bananas thus threatening the world banana industry (Nasir and Jumjunidang, 2003). Banana cultivation is now faced with problems of pests and diseases, the provision of quality and uniform seeds, and the existence of quality qualifications for export quality where banana peels must be smooth without spotting. The three problems above can be solve through tissue culture methods, through this method a large number of equal seeds will be obtained in a short time, free of pathogens, especially pathogens that infected young plants and smooth fruit skin without spotting (Suyanti and Supriyadi, 2008).

Tissue culture methods were developed to help propagate plants, especially for plants that are difficult to breed generatively. Seedlings produced from tissue culture have several advantages, it has characteristics that are identical to the broodstock, it also can be propagated in large numbers so that it does not really need a large place, able to produce large quantities of seeds in a short time, health and quality of seedlings more guaranteed, the speed of growing seedlings faster than conventional propagation (Harahap, 2011).According to Widyastuti (2006), Synthetic cytokinin groups that are often used as growth regulator is benzine amino purine (BAP). BAP is active in spurring

Corresponding Author:- Armaniar
Address:- Department of Agroecotechnology, Faculty of Agriculture, Pembangunan Panca Budi University, Medan, Indonesia, Gatot Subroto Street, Km 4.5 Medan, Indonesia.

the formation of shoots more active than kinetin and 2-iP. The multiplication process of shoots that are maintained under certain conditions so that at any time can be used for the next process is called multiplication. This condition requires the presence of cytokinin growth regulators such as benzyl adenine (BA), 2-iP and kinetin (Yusnita 2004). The application of the addition of growth regulators in tissue culture is one of the factors that causes high production costs. This is because the price of synthetic growth regulators is quite expensive. Therefore it is necessary to have a natural growth regulators which can be used to replace the role of synthetic growth regulators (cytokinin). Natural growth regulators can be obtained from a variety of fruits, including coconut water, bamboo extracts, corn extract, banana weevil and tomatoes (Seswita 2010). The use of coconut water as a natural growth regulators has proven effective in ginger tissue culture (Seswita 2010, Kristina & Syahid 2012), patchouli (Surrachman 2011), Propagation of shoots (Insani et al. 2011), and several other plant species. Seswita (2010) further explained that the addition of coconut water can increase growth response and multiplication of ginger as much as 3.4 shoots / 2 months, higher than the addition of growth regulators of benzyl adenine 1.5 mg / l which is 2.4 shoots / 2 months. Based on the previous reasearch, the purpose of this study was to determine the effect of coconut water as a substitute for the auxin hormone and BAP as a cytokinin hormone that can maximize the growth of barangan banana.

Material and methods:-

This research was carried out in plant tissue culture laboratory Pembangunan Panca Budi University. The tools used are Laminar Air Flow Cabinet (LAFC), autoclaves, analytical scales, refrigerators and use standard tissue culture tools. The material used is Banana Barangan (Musa acuminata L.).This research method uses completely non factorial randomized design consisting of 5 treatments so that 20 bottles are obtained with each bottle consisting of 1 explant. BAP dose with coconut water symbolized by "B", namely: B0 = Control Treatment without BAP, B1 = 0.5 ml / l BAP, B2 = 1 ml / l BAP, B3 = 10 ml / l Coconut water, B4 = 20 ml / l Coconut water, the parameters observed during the study namely include the number of leaves, leaf length, number of roots, root length, plant height and number of tillers.

Results and Discussion:-

Table 1:- Recapitulation of various parameters for various observations of in vitro Multiplicationof Barangan Banana (Musa acumin ta L.) at ages 2 to 8 week

Treatment Gropups	Plant height	number of tillers	Root lenght	Number of leaves				Number of Roots			
Week	8	8	8	2	4	6	8	2	4	6	8
B0	6.17	0.25	2.17 b	2.00	2.25	2.50	2.75	1.25 d	2.25 b	4.50 b	4.50 b
B1	9.02	0.50	8.27 a	2.25	3.00	3.75	4.25	5.00 a	5.50 a	6.50 a	6.50 a
B2	8.67	0.00	4.92 a	2.25	2.50	3.25	3.75	4.00 a	4.25 a	5.25 a	5.25 a
B3	6.35	0.00	1.70 c	3.25	3.25	3.25	3.25	1.75 c	2.00 b	3.00 c	3.00 c
B4	6.07	0.00	0.85 d	2.00	2.00	2.00	2.00	2.75 b	2.75ab	2.75 c	2.75 c

Note: Figures followed by the same letters in the same column show no significant effect on the level of 5% based on the Duncan Distance Test

Table 2:- Statistical analysis

	Plant height	number of tillers	Root lenght	Number of leaves				Number of Roots			
Week	8	8	8	2	4	6	8	2	4	6	8
Result	1.39 #	1.7 #	4.13*	1.3 #	0.78#	1.50 #	2.69#	11.84*	7.67*	6.85*	7.04*
coefficient of diversity	4.10%	3.94%	7.04%	2.63%	3.24%	2.94%	2.66%	2.35%	2.62%	2.55%	2.63%

Description: (#) = not significant (*) = significantly different

Table 1 shows that the growth response of barangan banana on some BAP concentrations and coconut water significantly influences the root length and root number parameters. The plant height, number of tillers, and root length were observed 8 weeks after planting, while the number of leaves and number of roots were observed starting 2 weeks after planting up to 8 weeks after planting from observations. Based on the results of observations made there are some characteristics of the plants found during the observation as shows in Figure 1.

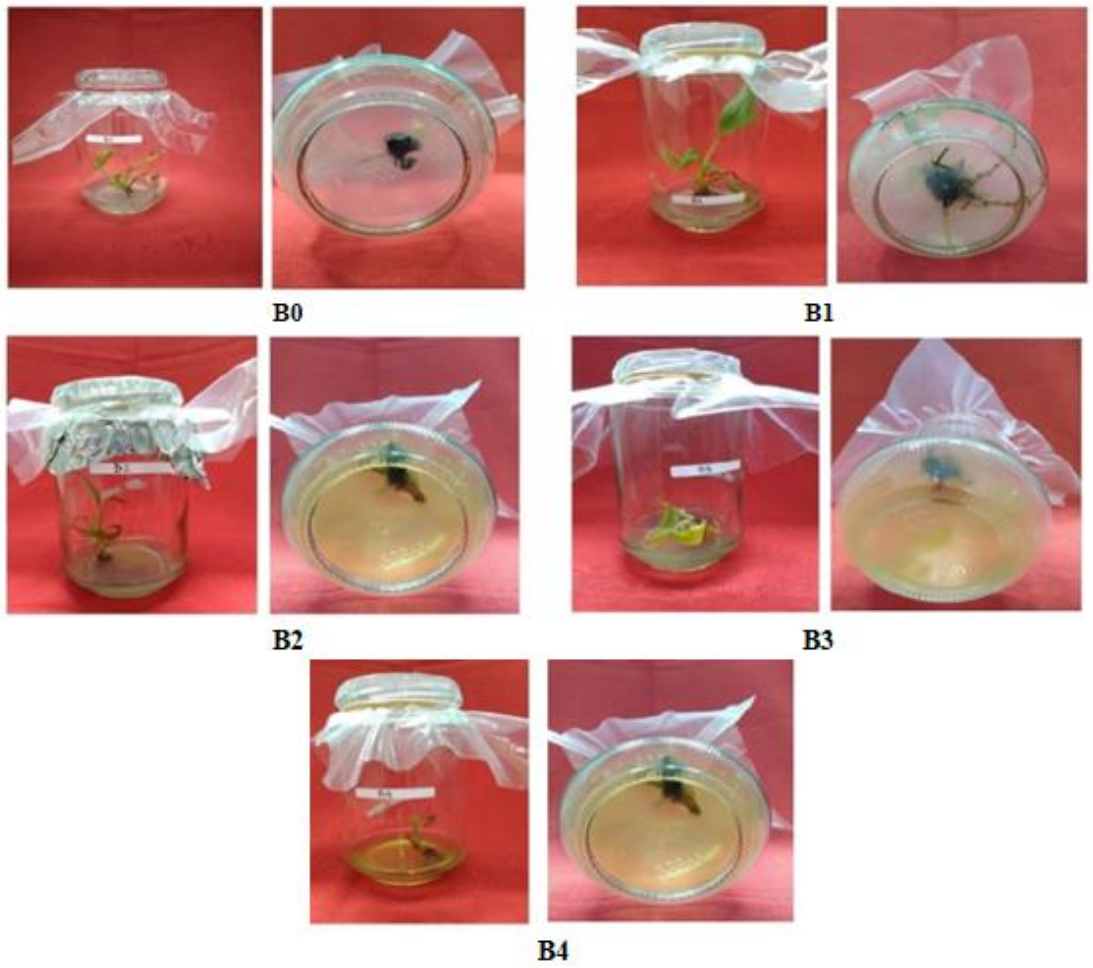

Figure 1:-Documentation of plant growth in several treatments of BAP and coconut water concentrations at the age of 8 weeks.

Based on observations while in the laboratory, contamination in the media often occurs. This is marked on the media affected by fungi and bacteria so it looks slimy (Figure B2, B3 and B4). To find out changes or contamination that occur before used, the media needs to be stored for two to three days. The bacteria and fungus appear less than 7 days, there were even some media that appeared contaminated for more than 7 days. Based on the author's observations, contaminated media are only in certain culture bottles that are not sterile so that the microorganisms can grow. To prevent these microorganisms from spreading to other media, the contaminated media must be quickly removed so that it does not spread to other media.

The results of observations from Figure 1 shows that the plants have yellowed leaves, it indicate that the plants have abnormal growth. The growth of these plants tends to fall on yellowing leaves and brown, the whole plants become turgescent, and some of the leaves do not have palisade tissue. In treatments B2, B3, and B4, the media looks to turn into a yellowish color, this occurs because the plant secretes something from its tissue to maintain its survival, it could also be due to the media concentration being given is too high for its growth so the plant secretes phenolic compounds to protect its tissue. Success in tissue culture is influenced by several factors such as external and internal factors during its growth.

In one of the B3 treatments, barangan banana explants experienced stagnation (Figure 1). Stagnant is a state of explants that not extinct but do not grow from planting to a certain period of time. The cause of stagnation can come from the media used or on the explants. It can caused by the cells in the explants that are not able to express the nature of totipotence so they do not experience growth and development (Smith, 2013). Statistical analysis shows that the response of BAP and coconut water did not significantly affect the number of Barangan Banana leaves. The

number of initial leaves in each explant on average amounted to 4 leaves. This is caused by the presence of some yellowing leaves, in the 2nd week after planting to 8 weeks after planting. Discoloration in leaves is caused by aging of leaves and chlorophyll content in leaves is decreases (Harahap, 2011). According to Hartati (2010) the number of leaves is one indicator of plant growth and can be used as supporting data to explain the growth process that occurs. Coconut water is a group of organic compounds that are usually added to tissue culture media, BAP can also affect the increasing number of leaves. The addition of BAP to the media will encourage the cells in the explants to divide and develop into buds and form leaves. The possibility that occurred in this research was BAP concentration that is too high so it does not affect the growth of the number of leaves.The addition of exogenous cytokinins with higher concentrations can inhibit endogenous cytokinin synthesis so that it can interfere with the cell division process (Magdalena et al, 2002).

The combination of BAP and Coconut Water showed a real influence on the number of roots, BAP and Coconut Water are growth regulators which are often used for multiplication of plants or for shoot growth, in the observation, the combination of BAP and Coconut Water instead results in the number of roots and root length more dominant. This possibility may occur because Coconut Water was able to increase auxin in tissues and meet the growth and morphogenesis needs of explants of barangan banana, but if the concentration is too high it inhibits root formation (Pisesha, 2008; Pamungkas 2015). According to research conducted by Ira (2010) revealed that the provision of 150 ml of coconut water / L provides optimum plant height and number of roots.

Figure 2:-Roots growth in treatment B1 (0.5 ml / l BAP) and B2 (1 ml / l BAP)

Root length measurements were carried out only in the 8th week. This is because, explants must be removed from culture bottles and put the explants on millimeter paper to measure their length. Based on the measurement results, the root length of each treatment varies. This is influenced by the endogenous response of explants to the addition of exogenous growth regulators. Based on observations made a combination of BAP and Coconut Water significantly influence the root length parameters. Root length is the result of an extension of meristematic tissue located at the root tip. The faster the growth of a root the longer the zone of differentiation. Coconut water contains Thiamin. Where Thiamin has a function to accelerate cell division in the root meristem. Thiamin contained in coconut water is one of the factors in increasing root length. Adding coconut water is able to produce energy, vitamins and as a growth regulator for plants (Murdad et al., 2010). However, if the concentration of Coconut Water is too high then the root length growth will decrease. This shows that the addition of organic material and cytokines will cover the activities of auxin (Pamungkas, 2015).

The treatment of BAP and coconut water on Murashige dan Skoog (MS) base media did not show growth of new shoots until the end of the observation. It causse by media used is MS, with the addition of BAP and coconut water, it has not been able to stimulate the formation of new shoots. Cytokinins growth regulators should generally stimulate the formation of new shoots as well as Coconut Water, because the addition of the auxin ratio is greater than the cytokinin,.Coconut water as much as 100 ml has a significant influence on the formation of shoots and number of leaves. This can occur because of the adequacy of the components needed for the formation of shoots and leaves. Growth and propagation of leaves and shoots are supported by adequate energy. In this case sugar in the form of sucrose is added to the media contained in coconut water. Coconut water contains sugar in the form of sucrose, glucose, fructose and mannitol (Rotinsulu et al, 1998).

The addition of coconut water at a concentration of 10 ml and 20 ml had no significant effect on the addition of the number of barangan bananaleaves. Based on research conducted Ira (2010) said that the provision of coconut water

at a concentration of 100 ml was the optimum concentration for the growth of shoots and leaves. This is likely due to the addition of sucrose in Lthe media. leaf growth is indicated by the process of auxin transportation in the media that transports to the shoots so that the formation of leaves and photosynthesis process will increase in line with the growth of the number of leaves (Rachmawati et al., 2017). It is also due to the provision of auxin, plants can respond to achieve a balance of concentrations of growth regulators in cells that determine leaf formation (Widiastoety, 2014).

Conclusion:-

Based the research, it can be concluded that, Coconut water and BAP administration on the invitro multiplication of barangan banana has a significant effect on the number of roots and root length. Results of analysis of variance showed that all treatments of coconut water and BAP had no significant effect ($p > 0.05$) on the number of tillers, number of leaves and height of plants.

References:-

1. Harahap, F. (2011). Plant Tissue Culture. Medan: Unimed Press.
2. Hasanah, A., Harahap F., and Silaban, R. (2018). The effect of Myo-Inositol and Indole Butyric Acid (IBA) on the formation of in vitro Pineapples root (Ananas comosus L.) From Sipahutar North Sumatra Indonesia, International Journal of Biological Research, 23-28
3. Insani, H., Harahap, F., and Diningrat, S. (2018). The effect of coconut water and benzyl purine (BAP) in addition to the Growth of Pineapple From Sipahutar North Sumatra, Indonesia on In Vitro Condition. International Journal of Biological Research, 6 (2) (2018) 29-33
4. Ira, D. (2010). Utilization of Banana and Coconut Water Waste as a Material for Culture of Orchid Tissue Tissue Month. BPPT. Jakarta.
5. Jumjunidang, Nasir, Risaka, and Handayani H. (2005). In vitro testing techniques of banana resistance to fusarium wilt disease using toxin filtrate from fusarium oxysporum f. sp. Cubense. J. Hort 15 (2): 135-139
6. Magdalena, T.S., L. Drozdowska., And M. Szota, (2002). Effect of cytokinins on in Vitro Morphogenesis and Ploidy of Pepper Capsicum annuum L. Electronic Journal of Polish Agricultural Universities Agronomy, 5 (1).
7. Murdad, R., Latip, M.A., Aziz, Z.A and Ripin, R. (2010). Effects of Carbon Source and Potato Homogenete on In Vitro Growth and Development of Sabah's Endangered Orchid Phalaenopsis gigantea. AsPac. J. Mol. Biol Biotechnol. 18 (1): 199-202
8. Pamungkas, S. S. T. (2015). Influence of NAA and BAP Concentration on the Growth of Cavendish (Musa paradisiaca L.) Banana Explants Plant Explants Through In Vitro Culture. Gontor agrotech Science Journal, 2 (1): 31-45.
9. Pisesha, P.A., Mattjik, N.A and Sukma, D. (2008). Effect of IAA, IBA, BAP, and Coconut Water Concentrations on the Establishment of Poinsettias (euphorbia pulcherrima wild et. Klotz) In Vitro. Paper Seminar for the Faculty of Agriculture, Bogor Institute of Agriculture, Bogor
10. Rachmawati, D. L., Roviq, M and Islami, T. (2017). Composition of Atonic and Coconut Water in the Growth of Cane Bud Chips (Saccharum officinarum L.). Journal of Plant Production, 5 (5): 851-859
11. Rotinsulu, Prihandarini and Sudiarso. (1998). Use of Coconut Water in Various Maturity Levels in Barangan Banana Tissue Culture Media (Musa paradisiaca sapientum L.). Research Report. Faculty of Agriculture, Sam Ratulangi University. Manado.
12. Santoso, R. D and Sobir. (2013). Growth of Pineapple Plantlet (Ananas comosus L. Merr.) Of Smooth Cayanne Varieties from In Vitro Culture at Several BAP Concentrations and Plantlet Age. Bul. Agrohorti, 1 (1): 54-61
13. Sunyoto, A. (2011). Cavendish Banana Cultivation is a lucrative side business. Berlian Media. Yogyakarta. Suyanti, Supriyadi, A. (2008). Banana Cultivation Processing and Market Peospek. Self-help Spreaders. Jakarta
14. Smith R, (2013). Plant Tissue Culture Third Edition: Techniques and Experiments. California: Elsevier Inc.
15. Seswita D. (2010). Use of Coconut Water as Growth Regulatory Substances in Curcuma xanthorrhiza Multipurpose Sprout (In Vitro). Littri's Journal, 16 (4): 135-140.
16. Widiastuti, D. (2006). Preliminary Experiments of Tissue Culture in Chrysanthemum (Chrysanthemum morifolium) Plants. Bull Penel Hort. 15 (2).
17. Widiastoety, D. (2014). Effect of Auxin and Cytokines on the Growth of Mokara Orchid Plantlet. J. Hort, 24 (3): 230-238.
18. Yusnita. (2004). Tissue Culture: How to Increase Plant Efficiency. Jakarta: AgroMedia Reader.