

**THE GROWTH OF JACKFRUIT (*ARTOCARPUS HETEROPHYLLUS* L.) SHOOTS ON VARIOUS CONCENTRATION BENZYLAMINO PURINE (BAP) *IN VITRO****Frisca Nanda Bulo<sup>1)</sup>, Enny Adelina<sup>1)</sup>, Ramal Yusuf<sup>1)</sup>, Hawalina Kasim<sup>2)</sup>*<sup>1)</sup>Study Program of Agrotechnology Faculty of Agriculture Tadulako University, E-mail : friscanandabulo21@yahoo.com, ennyadelina@gmail.com, ryusufus@yahoo.com<sup>2)</sup> Tissue Culture Laboratory Staf, Faculty of Agriculture, Tadulako University, Jl. Soekarno-Hatta Km 9, Tondo-Palu 94118, Sulawesi Tengah. Telp. 0451-429738 Email : hawalinak@yahoo.com**ABSTRACT**

The development of Central Sulawesi superior commodity, which is Tulo-5, the drought-resistant cultivars, through tissue culture technique can be used as an alternative, in addition to conventional breeding. This study aims to determine the growth of jackfruit shoots in various concentrations of benzylamino purine *in vitro*. The research has been conducted at the Laboratory of Plant Biotechnology, Agriculture Faculty of Tadulako University, Palu. The research began on December 2017 and ended up on February 2018. This research used Completely Randomised Design of one-factor treatment which is BAP concentrations consist of 4 stage which is 1,5 ppm BAP, 2,0 ppm BAP, 2,5 ppm BAP, 3,0 ppm BAP. The result showed that 6 weeks after planting, BAP concentration had significant effect on shoots time to emerge and shoots number but no significant effect on leaf number. The result of Tukey's HSD test showed that concentration 2,5 ppm gave the fastest shoot emergence with an average of 2,875 days after planting, in concentration 2,0 ppm gave the highest number of shoots with an average of 2.125 shoots per explant, and for the highest number of leaves found in the concentration of 2,0 ppm with the average number of leaves is 1 strand per explant.

**Keywords:** BAP, Tulo jackfruit, Shoot, and Growth.**INTRODUCTION**

Jackfruit (*Artocarpus heterophyllus* L.) is a species of tropical fruits that can be found in almost regions in Indonesia. Nevertheless, the production, harvested area and export of this commodity is far behind compared to the five leading Indonesian fruits, namely banana, mangoes, pineapple and durian (BPS, 2015). There are varieties of superior jackfruit that can be developed such as jackfruit national superior varieties. Toaya is found in the Toaya area, Donggala Regency, Central Sulawesi. This type of jackfruit has superior physical, chemical and organoleptic properties (Adelina et al., 2010).

Development of superior jackfruit species in Central Sulawesi, namely Tulo-5 cultivar that is resistant to drought, through tissue culture techniques can be used as an alternative, in addition to conventional nursery (Adelina et al., 2010). As a fast

vegetative propagation method, tissue culture seedlings have advantages such as: having the same characteristics as the parent, free of pest, the amount that can be produced is much more relative per time unit (Basri, 2004).

Efforts to jackfruit propagation seeds through tissue culture with the addition of BAP and NAA have been reported, among others, by Ali et al., (2016), Ashrafuzzaman et al., (2012), Hamed et al., (2007) and Khan et al. (2010), but evaluation of concentrations of benzylamino purine (BAP) and naphthaleneacetic acid (NAA) has not been widely reported.

Based on the description above, it is deemed necessary to conduct research about jackfruit shoot growth in various concentrations of *in vitro* benzylamino purine (BAP).

**RESEARCH METHOD**

This research was carried out at Plant Biotechnology Laboratory, Faculty of

Agriculture, Tadulako University, Palu. It was conducted from December 2017 until February 2018.

The tools used in this study were beaker, measuring cup, pipette, petri dish, culture bottle, tweezers, scalpe, stirring rod, SA 300 VA microm series autoclaves, 100-800 modell oven, pH meter, laminar air flow cab -inet / Bio safety cabinet model J-BSCV, analytical balance AR1140 / C, hand sprayer, Bunsen burner, hot plate cimarec 2, magnetic stirrer, shaker, refrigerator, plastic, al-uminium foil, rubber band, funnel - filter bag, label paper, culture rack, and pipette noodles.

The materials used in this study were jackfruit shoots (Tulo cultivars) Murashige-Skoog media (Taji et al., 1997) vitamins, NAA and BAP growth regulators, agar, sucrose, 1 N HCl, 1 N NaOH, detergent, 70% alcohol, HgCl<sub>2</sub> 3 g / L, 5.25% NaOCl, sterile aquadest, and spritus.

This study was arranged using a completely randomized design (CRD) with a single factor treatment, namely BAP concentration consisting of 4 levels as follows:

- B1 = 1.5 ppm BAP
- B2 = 2.0 ppm BAP
- B3 = 2.5 ppm BAP
- B4 = 3.0 ppm BAP

The treatment was repeated four times so there were 16 experimental units. Each unit used two shoots of jackfruit, the number samples was 32. In order to find out the effect of the treatment, the data obtained were analyzed using a variety of methods. The results of variance which showed a significant effect were further tested by a mid-value test using the Honestly Significant Difference (BNJ) level of 5%.

The observation variables in this study were as follows: When shoots appeared, when the first shoot appeared from planting (HST), number of shoots, number of shoots formed at 6 weeks after planting (MST), the number of leaves (strands) were calculated the number of leaves formed at 6 MST.

Table 1. The Average When The Shoot Appeared.

Treatment	Average
B <sub>1</sub> (1,5 ppm)	3,750 <sup>a</sup>
B <sub>2</sub> (2,0 ppm)	4,125 <sup>a</sup>
B <sub>3</sub> (2,5 ppm)	2,875 <sup>a</sup>
B <sub>4</sub> (3,0 ppm)	7,625 <sup>b</sup>
BNJ 5%	1,578

Description: The numbers followed by same letter were not different at 5% BNJ test level.

Data obtained from each approach were analyzed by analysis of variance and if the treatment was significant or very real, then continued with BNJ test level of 5% to determine the difference between the mean values of the treatments being tried.

## RESULTS AND DISCUSSION

**When The Shoot Appeared.** The results of the variance analysis showed that the effect of BAP concentration had a very significant effect on the appearance of shoots. The average appearance of shoots is shown in Table 1.

A 5% BNJ test on average when shoots appeared showed that BAP was able to drive the formation of fast jackfruit shoot. The formation of shoot was most quickly obtained at a concentration of 2.5 ppm BAP (B3), which was an average of 2.875 days after planting and different with 3.0 ppm BAP treatment but not different from 1.5 and 2.0 ppm BAP treatment.

**The Number of Shoots.** The 5% BNJ test on the average number of shoots showed that the addition of BAP of 2.0 ppm (B2) resulted the highest average number of samples it was 2.125 shoots per explant and significantly different from the number of shoots at 1.5 ppm treatment ( B1) it was 1,500 per explant and 3,0 ppm (B4) with the lowest number of shoots it was 0,500, but, it was not significantly different from B3 treatment (2,5 ppm) with the number of shoots that was 1,875.

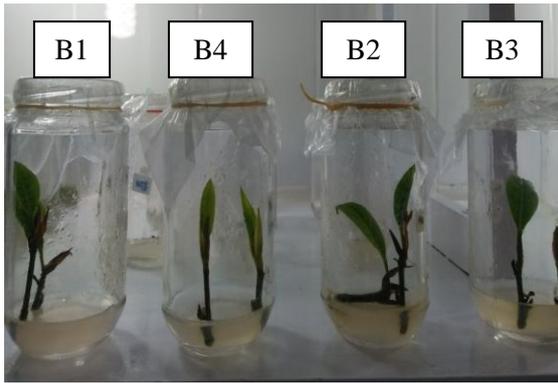


Figure 1. Plant Condition At Several BAP Conditions

B1= 1,5 PPM BAP B2= 2,0 PPM BAP  
B3= 2,5 PPM BAP B4= 3,0 PPM BAP

The results showed that BAP concentration can affect the growth of jackfruit shoots *in vitro* (See Figure 1).

**The number of leaves.** The results of variance analysis showed that the treatment of BAP concentration had no significant effect on the number of leaves at 6 MST. The highest average number of leaves was found in B2 treatment (1 strand) while the lowest was in the B4 (0.63 strand). The average number of leaves in B1 and B3 treatment produces the same number of leaves that was 0.75 strand.

The appearance of new shoots indicated the occurrence of the growth process in explants, namely the process of additional volume that was non-reversible. According to Steward (1969; 1970), cells isolated from adult plant organs in culture, with their totipotent properties act like zygote and grow like embryos that experience volume increase and irreversible function specialization. The growth process is influenced by the growth regulator in the plant.

According to Basri (2004), cytokines like BAP plays a role in stimulating cell division and shoot formation. Although the concentration of needed growth regulators is influenced by various factors, in general plant growth regulator worked effectively at low concentrations, while at high

concentrations it will inhibit growth (Moore, 1979 and Wattimena, 1988), for example, as in formation

The results obtained in this study with a range of BAP concentrations flattened between 1.5 to 3.0 ppm, in line with Ashrafuzzama et al., (2012) who reported that BAP at 2 mg / l has responded well to induction and shoot multiplication and number of leaves per explant on the same commodity. Likewise the results reported by Harb et al., (2015), which combined 2 ppm BA with 0.5 ppm kinetin. The study from Ali et al., (2016) stated that the combination of BAP and NAA significantly affected the number of shoots, shoot length and number of leaves, with a concentration of 2 mg / l BAP. Mardiyah et al. (2017) reported that a concentration of 2.50 ppm BAP can accelerate the formation of black grape shoots quickly

The increase in the concentration of growth regulator applied to induce *in vitro* shoots is not always linear with the growth rate, as seen from the results of this study, an increase in BAP concentration up to 3 ppm, it gave the appearance of shoots of 7.25 hst, on the contrary, Hamed et al., (2007) reported different results, where 3 ppm BA combined with 0.1 ppm NAA actually gave a higher number of shoots, leaves and length of jackfruit shoots. Other plant studies, showing higher BAP concentrations that also provides a better growth response, including 4 to 6 ppm in shallots (Kasim, 2017) and 4 ppm in anthurium (Yuniastuti et al., 2010).

As it is known that explant plants, among others indicated by the formation of new shoots in tissue culture, is determined by many factors, including the composition of the media, and the concentration of growth regulators used. The concentration of growth regulator substances in the media greatly affects the rate of shoots growth from cultured explants.

The use of explants in the form of shoot (shoot tips) in this study, is very helpful in observing the treatment response that was tried in a relatively short time,

because the meristematic nature of the shoot tip. Zhang and Lemaux (2005) stated that if explants have a growing point with meristematic cells planted in the right regeneration media, they can immediately regenerate to form shoot

The appearance of new shoots as a result of BAP addition with the right concentration is supposed to stimulate optimum hormone work. Hopkins (1999) stated, the regeneration of plant organs can be interpreted as the work of hormones that act as chemical messengers that carry information between cells, in addition to position effects and nutritional gradients. The addition of 0.1 ppm NAA in this study is supposed to give a good hormonal balance for growth, as stated that hormones can work singly or in combination that modifies gene expression or hormonal activities.

The number of leaves that had no effect was suspected, because the time span

of the observations made had not been able to detect different influences from the concentration of BAP which was tried on the number of leaves formed, although in the number of shoots, the effect had been seen clearly. Widyastuti and Tjokrokusumo (2001) stated that the number of leaves formed on explants depends on the speed of growth and the rate of formation of new shoots. It takes longer to grow new leaves from newly formed shoot.

## CONCLUSION AND SUGGESTION

A 2.5 ppm BAP concentration gave the fastest shoots appearance on average 2.875 days after planting, and BAP concentration of 2.0 ppm gave the fastest number of shoots averaging 2.125 per explant.

A 2 ppm BAP concentration can be recommended to initiate jackfruit shoot in *in vitro* cultivation.

## REFERENCES

- Adelina, 2009. *Penentuan Stadia Kemasakan Buah Nangka Toaya Melalui Kajian Morfologi Dan Fisiologi benih*. Media Litbang Sulteng, 2(1):56–61.
- Ali, J., Bantte, K., and Feyissa, T., 2016 *Protocol optimization for in vitro shoot multiplication of Jackfruit (Artocarpus heterophyllus L.)*, African. J. of Biotechnology, 16(2), pp. 87-90.
- Ashrafuzzaman M, Kar S, Khanam D, and Prodhan SH., 2012. *In Vitro Regeneration and Multiplication of Jackfruit (Artocarpus heterophyllus L.)*. Res. J. Of Biol, 2(2):59-65.
- Badan Pusat Statistik, 2015. *Statistik Produksi Hortikultura tahun 2014*. Direktorat Jenderal Hortikultura, Kementerian Pertanian.
- Basri, Z., 2004. *Kultur Jaringan Tanaman*. Universitas Tadulako Press: Palu.
- Hamed, A.M., Ali, E.A.M and Boshra, E.S., 2007. *In Vitro Propagation of Jackfruit (Arthocarpus heterophyllus L.)*. J. of Applied sciences Res. 3(3):218-226.
- Harb, E.M., Alhady, M.R.A., and Elsalam N.A., 2007. *In Vitro Rapid Propagation of Jackfruit (Artocarpus heterophyllus L.)*. J. Agric. and Environ. Sci., 15(2): 147-153.
- Hopkins. W.G., 1999. *Introduction to Plant Physiology*. John Wiley and Sons, Inc. Amerika.
- Khan, F.R., Rahman, H., Abbasi, N.A., Ibrahim, M., and Abbas, G., 2010. *In Vitro Shoot And Root Proliferation of Jackfruit as Affected By Different Concentrations Of Growth Regulators*. Sarhad J. Agric. Vol. 26, No. 4.

- Kasim, H., 2017. *Evaluasi Konsentrasi Benzylamino Purine pada Pertumbuhan Bawang Merah Lembah Palu di Laboratorium*. Prosiding Seminar Nasional Pranata Laboratorium Pendidikan Universitas Hasanuddin 11 September 2017. Makassar.
- Mardiyah, Basri Z, Yusuf R, dan Hawalina., 2017. *Pertumbuhan Tunas Anggur Hitam (Vitis vinifera L.) Pada Berbagai Konsentrasi Benzylamino Purin Dan Indolebutyric Acid*. J. Agro 24 (3) : 181-189.
- Moore, T. C. 1979. *Biochemistry and physiology of plant hormones*. Springer-Verlag. New York. 174 pp.
- Wattimena, G. A. 1988. *Zat Pengatur Tumbuh Tanaman*. Pusat Antar Universitas. IPB. Bogor.
- Widyastuti dan T. jokrokusumo, 2001. *Peranan Beberapa Zat Pengatur Tumbuh Tanaman pada Kultur in Vitro*. Jurnal Sains dan Teknologi Indonesia, 3(5): 55-63
- Yuniastuti, E., Praswanto, dan Harminingsih Ika., 2010. *Pengaruh Konsentrasi BAP Terhadap Multiplikasi Tunas Anthurium (Anthurium andraeanum L.) Pada Beberapa Media Dasar Secara In Vitro*. Fakultas Pertanian UNS jurusan Agroteknologi.
- Zhang and P.G. Lemaux. 2005. *Molecular aspect of in vitro shoot organogenesis*. In R.N. Trigiano and D.J Gray: 173-185