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THE EFFECT OF KEPOK BANANA PEEL EXTRACT (*Musa acuminate balbisiana* Colla) AND BAP ON THE GROWTH OF RED POTATO PLANLETS (*Solanum tuberosum* L.) IN VITRO

Syahmi Edi [1*], Tiropa Oktavia Parhusip[2], Nurul Huda Panggabean[3]
[1,3] Biologi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Medan, Indonesia
[2] Biologi, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Medan, Indonesia
* Corresponding author : syahmiedibiologi@gmail.com

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ABSTRACT

This research aims to determine the effect of from kepok banana peel extract (*Musa acuminata balbisiana* Colla) and BAP and their interaction on the growth of red potato plantlets (*Solanum tuberosum* L.) in vitro. This research was conducted in September-October 2023 at the G10 Agrotech Medan Plant Tissue Culture Laboratory Jl. Sei Bahorok No. 47 F Medan Baru. This research used a factorial Completely Randomized Design (CRD) with two factors. The first factor is the concentration of Kepok banana peel extract in 3 levels, namely (0, 25 and 50 g/L) and the second factor is BAP which consists of 4 levels, namely (0, 0.5, 1 and 1.5 mg/L). 12 treatment combinations were obtained and each treatment was repeated 3 times to obtain 36 experimental units. The research parameters were plantlet height, number of shoots, number of leaves and number of roots analyzed using *Analysis of Variance* (ANOVA) and if they were significantly different, further tests would be carried out using the *Duncan Multiple Range Test (*DMRT) at the 5% level. The results showed that the treatment of kepok banana peel extract and BAP had a significant effect on plantlet height, number of shoots, number of leaves and number of roots. The highest average plantlet height was produced by banana peel extract 50gr/L (7.60 cm), BAP 1mg/L (6.70 cm). The highest number of shoots was produced by banana peel extract 50gr/L (6.33 shoots), BAP 1.5 mg/L (6.33 shoots). The highest number of leaves was produced by sweet corn extract 25 gr/L, namely (10.00 leaves), BAP 0.5 mg/L as much as (8.00 leaves). The highest number of roots was produced by the 50gr/L sweet corn extract treatment, namely (12.00 roots), the highest number of roots was produced by BAP 1 mg/L, namely (7.33 roots). The highest average plantlet height, number of shoots and leaves were produced by the A2B1 treatment interaction, namely 7.40 cm plantlet height, 6.33 shoots and 16.33 leaves. The highest number of roots was produced by the A2B2 treatment interaction, namely 8.67 roots.

INTRODUCTION

Potatoes (Solanum tuberosum L.) are one of the carbohydrate sources most in demand by the public besides rice and corn, so potatoes have the potential to be developed in Indonesia (Nurcahayati et al, 2019). According to Fauzi et al., (2016) the red potato variety itself is a horticultural commodity that has great opportunities to be developed in the agribusiness and agro-industry sectors. This is

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due to the superiority of the red potato type itself. It is known that red potatoes have a relatively stable price, the business potential is high, business segments can be chosen according to capital, the market is guaranteed and certain. Apart from that, red potatoes have advantages in terms of post-harvest treatment, compared to other types of vegetable crops such as cabbage, shallots and beans, red potatoes have a longer shelf life.

Potatoes have a high nutritional content as a food ingredient, potatoes contain complete carbohydrates, protein and vitamins. The protein in potatoes contains a balance of amino acids, so it is good for human health. Potatoes have high carbohydrate and nutritional content which makes this vegetable its own attraction. The nutritional content of potatoes per 100g of tubers is protein 2 g, fat 0.1 g, carbohydrates 19.1 g, calcium 11 mg, phosphorus 50 mg, iron 0.7 mg, fiber 0.3 g, vitamin B1 0.09 mg, vitamin C 16 mg and calories 83 kcal (Yulianti and Yefriwati, 2020). Red potatoes can be processed into various types of preparations and consumed in various forms, people generally consume potatoes in the form of boiled, fried, cakes, various light snacks, and various other forms of processed food (Fauzi, 2018).

Improving the quality of medium plain potatoes is important to increase production yields. One way to improve the quality of potatoes in Indonesia is through in vitro culture techniques, namely the technology for producing seeds from plantlets or micro tubers (G0). There are several factors that must be considered in inducing and growing potato micro tubers, namely growth regulators (ZPT) (Asmono and Sari, 2020)

Mohapatra and Batra (2017) also stated that tissue culture techniques could become technology as an alternative method for vegetative propagation of plants. Because its advantages make a plant have a very fast multiplication rate and in a relatively short time. Generally, tissue culture media uses materials of high quality and purity, such as MS (*Murashige and Skoog*), VW (*Vacint and Went*), and other supporting materials such as synthetic growth regulators that are pro-analytical in nature. However, providing these main materials requires expensive costs, relatively long ordering times, and the availability of materials that are difficult to obtain. So, to overcome this problem, it is important to try to use alternative materials to support plant nutrition that are cheap and easy to obtain using tissue culture techniques. The use of natural ZPT is very profitable when compared to the use of synthetic ZPT. Natural ZPT is certainly more efficient, cheaper and easier to obtain, besides that its application is also simpler and the effect is not much different from using synthetic ZPT (Pangestu, Nurhayati, & Triyono, 2023)

The success of tissue culture is largely determined by aseptic conditions and the planting media used. The media must contain all the substances needed for the growth and development of an explant (Sulichantini *et al.,* 2021). The composition of the medium depends on the exact type and concentration of organic, inorganic compounds and growth regulators (ZPT) used (Lestari, 2008).

The type and concentration of each plant growth regulator (ZPT) depends on the purpose and stage of plant cultivation. The PGR that is generally used is from the cytokinin class of adenine derivatives such as benzyl amino purine. Meanwhile, from the auxin group ZPT, such as *indoleacetic acid* (IAA), and *napthalenacetic acid* (NAA), and *indolebutyric acid* (IBA) (Yusnita, 2015). The use of organic ZPT has been widely used, especially the use of plant parts of bananas. These include banana fruit extract and banana hump extract. Bananas themselves contain vitamins, minerals and carbohydrates, apart from that, bananas contain natural hormones, namely auxin and cytokinin, which function as ZPT in plants (Pratom e*t a.,l* 2019). Apart from that, the part of the banana plant that has been used is the banana tuber. The hormones contained in the banana tuber are cytokinins

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and gibberellins. The cytokinin content in banana weevils is in the form of zietin and kinetin. Other contents contained in banana humps are carbohydrates of 66% and protein levels of 4.35% (Setiawan et al., 2017; Budiyani et al., 2016; Liana et al., 2022).

Based on research on the effect of giving a combination of banana extract and BAP on MS Media on the growth of dendrobium sp. orchid shoots. conducted by Sitanggang (2022), showed that the combination of banana extract and BAP had a significant effect on the number of leaves, plant height and number of roots. The combination of 50 g/L banana extract and 0.3 mg/L BAP is the best concentration for growing shoots, leaves and root length. The combination of 75 g/L banana extract and 0.15 mg/L BAP produced a good number of roots. The combination of 50 g/L banana extract and 0.15 mg/L BAP produces the best plant height. Meanwhile, the type of cytokinin hormone generally uses the hormone benzyl amino purine (BAP). In research on testing various potato explants (Solanum tuberosum L.) using different concentrations of BAP and NAA conducted by Lestari et al., (2018) shows a BAP concentration of 1 mg L^{-1} is the best treatment in producing the number of shoots, branches, leaves and nodes in intercalary meristem explants.

Based on the introduction, research on "The Effect of Kepok Banana Peel Extract (*Musa acuminatea balbisiana* Colla) and BAP on the Growth of Red Potato Plantlets (*Solanum Tuberosum* L.) In Vitro is important to carry out."

MATERIALS AND METHODS

Location and Time of Research

This research was carried out at the G10 Agrotech Laboratory on Jl. Sei Bahorok No. 47 F, Babura, Kec. Medan Baru, Medan City, North Sumatra. The research was carried out from September to October 2023.

Tools and Materials

The equipment used in this research is Beaker Glass, Culture Bottles, Analytical Scales, Magnetic Stirer, Bunsen, Glass Stirrer, Aluminum Foil, Heat Resistant Plastic, Rubber Bands, pH meter, Funnel, Petridish, Autoclave, Scissors, Tweezers, Milliphore Filter, Wrapping Plastic, Camera, and Laminar Air Flow Cabinet (LAFC). The materials used in this research were MS media, Banana Kepok (*Musa acuminate balbisiana* Colla) peel extract with concentrations of 25 g/L and 50 g/L and BAP with concentrations of 0.5 mg/L, 1 mg/L, and 1. 5 mg/L, liquid detergent, spirit, distilled water, 70% alcohol, 95% alcohol and red potato plantlets (*Solanum tuberosum* L.).

Making Kepok Banana Peel Extract

Making banana extract is done as follows: (a) Peel the outer skin of the banana. (b) Take the flesh of the banana peel by crushing it slowly and weighing 200 grams of banana. (c) Cut the banana peel thinly and put it in the pan. (d) Put the distilled water into a pan containing 300 ml of banana peel pieces, boil. While boiling, stir gently continuously so that the banana extract comes out. (e) Turn off the stove when the boiled water has boiled. (f) Prepare a measuring cup and filter the banana peel extract. (g) The banana peel extract that has been obtained is autoclaved again at 121oC, 1.5 atm pressure for 20 minutes and the extract is ready for use (Rinanti, 2021).

Research Design

This research was conducted using a two-factorial Completely Randomized Design (CRD) method with the following treatments:
Kepok Banana Peel Extract (*Musa acuminate balbisiana* Colla) (A) which consists of three levels, (Sitanggang, 2022):
A_0 = Kepok banana peel extract 0 g/L
A_1 = Kepok banana peel extract 25 g/L
A_2 = Kepok banana peel extract 50 g/L

The growth regulator BAP (*Benzyl Amino Purin*) (B) consists of four levels (Lestari *et al.,* 2018):
B_0 = ZPT BAP 0 mg/L

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B_1 = ZPT BAP 0.5 mg/L
B_2= ZPT BAP 1 mg/L
B_3= ZPT BAP 1.5 mg/L

With a combination of treatments as follows:

A_0B_0 A_0B_1 A_0B_2 A_0B_3
A_1B_0 A_1B_1 A_1B_2 A_1B_3
A_2B_0 A_2B_1 A_2B_2 A_2B_3

The combination of 12 treatments was carried out in 3 repetitions to obtain 36 treatment bottles.

Data Analysis

The data collection technique in this research uses direct observation techniques by directly observing the symptoms that occur in each treatment and repetition. Data taken include: plantlet height, number of shoots, number of leaves and number of roots. To determine the effect of Banana Kepok (*Musa acuminata balbisiana* Colla) peel extract and BAP (Benzyl Amino Purin) on the growth of Red Potato (*Solanum tuberosum* L.) plantlets, the data were analyzed by two way ANOVA using SPSS. If the ANOVA results are significant then a further test is carried out with DMRT (*Duncan's Multiple Range Test*) with a level of 5%.

RESULTS AND DISCUSSION

1. Height of Red Potato Plantlets (*Solanum tuberosum* L.)

Tabel 4.1 Average height of red potato plantlets (*Solanum tuberosum* L.) at various concentrations of banana peel extract and BAP at 30 days after planting (DAP).

Height (cm)				
Treatments	**BAP**			
banana peel extract	**B_0 (0 mg/L)**	**B_1 (0,5 mg/L)**	**B_2 (1 mg/L)**	**B_3 (1,5 mg/L)**
A_0 (0 g/L)	$4,83^{ab}$	$4,47^{ab}$	$6,70^{de}$	$4,57^{ab}$
A_1 (25 g/L)	$6,37^{cde}$	$5,03^{abc}$	$5,33^{bcd}$	$3,57^{a}$
A_2 (50 g/L)	$7,60^{e}$	$7,40^{e}$	$5,13^{bc}$	$4,80^{ab}$

Note: Numbers followed by the same letter mean they are not significantly different at the 5% DMRT test level

Based on the table of DMRT further test results at the 5% significance level, it shows the height of Solanum tuberosum L. plantlets at various concentrations of banana peel extract and BAP. The table shows that the highest plantlet height was produced by the A2B0 treatment (50 gr/L banana peel extract), namely 7.60. The treatment combination that was able to produce the highest plantlet height was A1B2 (25 gr/L banana peel extract + 1 mg/L BAP), namely 5.33 cm plantlet height. The lowest plantlet height was produced by the A1B3 treatment interaction (25 gr/L banana peel extract + 1.5 mg/L BAP), namely 3.56 cm. From the table it is known that treatment A2B0 is not significantly different from A1B0, A0B2, A2B1, A1B2 but is significantly different from other treatments. Treatment A1B2 is not significantly different from A0B1, A0B3, A2B3, A0B0, A1B1, A2B2 but is significantly different from other treatments. Treatment A1B3 was not significantly different from treatments A0B1, A0B3, A2B3, A0B0, and A1B1.

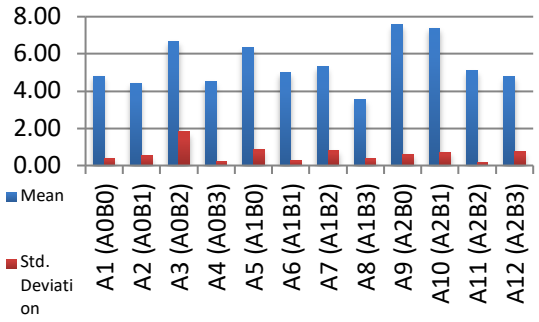

Figure 4.1 Effect of banana peel extract and BAP treatment on the height of red potato plantlets (*Solanum tuberosum* L.) at 30 DAP

2. Number of Shoots of Red Potato Plantlets (Solanum tuberosum L.)

Tabel 4.2 Average shoots of red potato plantlets (*Solanum tuberosum* L.) at various concentrations of banana peel extract and BAP at 30 DAP.

Number of Shoots

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Treatments	BAP			
Banana Peel Extract	B_0 (0 mg/L)	B_1 (0,5 mg/L)	B_2 (1 mg/L)	B_3 (1,5 mg/L)
A_0 (0 g/L)	$2,00^{a}$	$6,33^{cde}$	$6,67^{de}$	$4,33^{b}$
A_1 (25 g/L)	$7,00^{def}$	$7,67^{ef}$	$6,00^{cd}$	$6,33^{cde}$
A_2 (50 g/L)	$8,33^{f}$	$7,33^{def}$	$5,00^{bc}$	$4,67^{b}$

Note: Numbers followed by the same letter mean they are not significantly different at the 5% DMRT test level

Based on table 4.2, the results of further DMRT tests at the 5% significance level show the number of shoots of Solanum tuberosum L. at various concentrations of banana peel extract and BAP. Table 4.6 shows that the highest number of shoots was produced by the A2B1 treatment (50 gr/L banana peel extract + 0.5 mg/L BAP) namely 7.33, while the lowest number of shoots was produced by the A2B3 treatment interaction (50 gr/L banana peel extract + 1.5 mg/L BAP) which is 4.67 shoots. From the table it is known that treatment A2B1 is not significantly different from A0B1, A0B2, A1B1, A0, B3, A1B0, A2B0, A1B3 but is significantly different from other treatments. Treatment A2B3 is not significantly different from A1B2, A2B2 but is significantly different from other treatments.

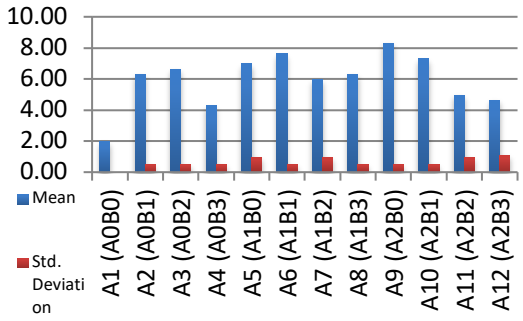

Figure 4.2 Effect of banana peel extract and BAP treatment on the shoots of red potato plantlets (*Solanum tuberosum* L.) at 30 DAP

3. Number of Leaves of Red Potato Plantlets (Solanum tuberosum L.)

Tabel 4.3 Average Leaves of red potato plantlets (*Solanum tuberosum* L.) at various concentrations of banana peel extract and BAP at 30 DAP.

Number of Leaves				
Treatments	BAP			
Banana Peel Extract	B_0 (0 mg/L)	B_1 (0,5 mg/L)	B_2 (1 mg/L)	B_3 (1,5 mg/L)
A_0 (0 g/L)	$6,00^{a}$	$8,00^{ab}$	$7,00^{a}$	$6,33^{a}$
A_1 (25 g/L)	$12,33^{bc}$	$8,33^{ab}$	$6,33^{a}$	$6,67^{a}$
A_2 (50 g/L)	$10,00^{ab}$	$16,33^{c}$	$8,33^{ab}$	$6,67^{a}$

Note: Numbers followed by the same letter mean they are not significantly different at the 5% DMRT test level

Based on table 4.3, the results of further DMRT tests at the 5% significance level show the number of Solanum tuberosum L. leaves at various concentrations of banana peel extract and BAP. Table 4.9 shows that the highest number of leaves was produced by the A2B1 treatment combination (Banana peel extract 50 gr/L + BAP 0.5), namely 16.33 number of leaves. The lowest number of leaves produced by the A1B2 treatment combination (25 gr/L banana peel extract + 1 mg/L BAP) was 6.33 leaves. From the table it is known that treatment A2B1 is not significantly different from A0B1, A1B1, A2B2, A2B0, A1B0 but is significantly different from other treatments. Treatment A1B2 is not significantly different from A0B3, A1B2, A1B3, A2B3, A0B2 but is significantly different from other treatments.

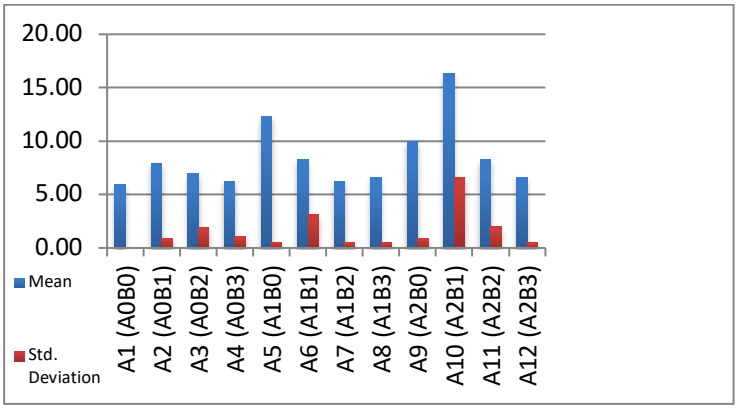

Figure 4.3 Effect of banana peel extract and BAP treatment on the leaves of red potato plantlets (*Solanum tuberosum* L.) at 30 DAP

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4. Number of Roots of Red Potato Plantlets (*Solanum tuberosum* L.)

Tabel 4.4 Average Leaves of red potato plantlets (*Solanum tuberosum* L.) at various concentrations of banana peel extract and BAP at 30 days after planting (DAP).

Number Of Roots				
Treatments	**BAP**			
Banana Peel Extract	**B_0 (0 mg/L)**	**B_1 (0,5 mg/L)**	**B_2 (1 mg/L)**	**B_3 (1,5 mg/L)**
A_0 (0 g/L)	$3,33^{a}$	$6,00^{bcd}$	$7,33^{cde}$	$5,67^{abc}$
A_1 (25 g/L)	$6,00^{bcd}$	$7,33^{cde}$	$7,33^{cde}$	$5,00^{abc}$
A_2 (50 g/L)	$12,00^{f}$	$8,33^{de}$	$8,67^{e}$	$4,67^{ab}$

Note: Numbers followed by the same letter mean they are not significantly different at the 5% DMRT test level

Based on table 4.4, the results of further DMRT tests at the 5% significance level show the number of Solanum tuberosum L. roots at various concentrations of banana peel extract and BAP. Table 4.4 shows that the highest number of roots was produced by the A2B0 treatment (50 gr/L banana peel extract + 0 mg/L BAP), namely 12.00, while the lowest number of roots was produced by the A2B3 treatment interaction (25 gr/L banana peel extract+ 1.5 mg BAP /L) which is 4.67 roots. Meanwhile, the interaction between banana peel extract and BAP which produced the highest number of roots was A2B2 (banana peel extract 50 gr/L + BAP 1 mg/L) with 8.67 roots.

From the table it is known that treatment A2B0 is significantly different from all treatments. Treatment A2B3 is not significantly different from A0B0, A1B3, A0B3 but is significantly different from other treatments. Treatment A2B2 was not significantly different from treatments A0B2, A1B2, A1B1.

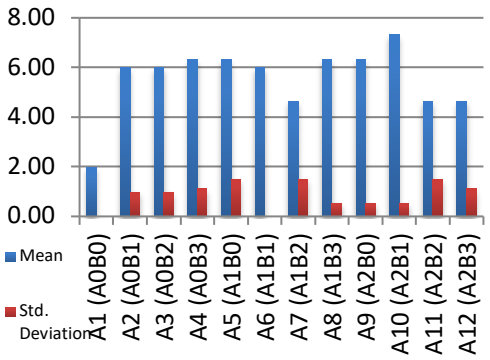

Figure 4.4 Effect of banana peel extract and BAP treatment on the roots of red potato plantlets (*Solanum tuberosum* L.) at 30 DAP

DISCUSSION

1. Plantlet Height

The treatment of Kepok banana peel extract and BAP had a significant effect on plantlet height. The highest plantlet height treatment interaction was produced by the A2B0 treatment (50 gr/L banana peel extract), namely 7.60. The treatment combination that was able to produce the highest plantlet height was A2B1 (Banana peel extract 50 gr/L + BAP 0.5 mg/L) namely 5.33 cm plantlet height. The lowest plantlet height was produced by the A1B3 treatment interaction (25 gr/L banana peel extract + 1.5 mg/L BAP), namely 3.56. This shows that the most appropriate and optimal treatment in meeting the needs of red potato plantlets (Solanum tuberosum L.) is the A2B0 treatment (50 gr/L banana peel extract) and the combination of A2B1 treatment (50 gr/L banana peel extract + BAP 0.5mg/L) is the best combination for plantlet growth. This is in accordance with research by Sitanggang (2022), which stated that 50g/L extract treatment had an effect on plantlet height. The increase in height in plants by cell enlargement is caused by the hormone auxin. Auxin works to influence the elongation of plant cells by flexing the cell wall as an initiation process for cell elongation. Auxin stimulates certain proteins in the plasma membrane of plant cells to pump H+ ions into the cell wall. The H+ ion will work to activate certain enzymes so that

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they are able to break several hydrogen cross-links in the cellulose molecular chains that make up the cell walls. The plant cells then elongate due to water entering by osmosis (Lestari, Suminar, & Mubarok. 2018). Giving BAP had a significant effect on plantlet height. Treatment A0B2 shows that the treatment with BAP 1mg/L resulted in an average plantlet height of 6.70 cm and was very significantly different from treatment A0B3 (BAP 1.5mg/L). This shows that the concentration of BAP that is good for plantlet height growth is 1mg/L. This is in accordance with research by Lestari et al (2018) where auxin ZPT was given in low concentrations because the shoot height parameter, the higher the ZPT concentration given, the more stunted shoot growth was.

2. Number of Shoots

The highest number of shoots was produced by the A2B1 treatment (50 gr/L banana peel extract+ 0.5 mg/L BAP), namely 7.33. Meanwhile, the lowest number of shoots was produced by the A2B3 treatment interaction (50 gr/L banana peel extract+ 1.5 mg/L BAP), namely 4.67 shoots. The results of the A2B1 treatment are in line with the research of Kaur et al., (2015) which stated that good shoot rejuvenation was obtained on MS media supplemented with BAP (0.5mg/L) because BAP has an important role in shoot regeneration. This is in accordance with research by Lestari et al., (2018) which stated that the administration of the growth regulator BAP at a concentration of less than 2 mg/L gave good results on the number of branches or axillary shoots in various potato explants compared to controls and other treatments. In line with research, giving 50g/L of organic material from banana plants as ZPT can stimulate the multiplication of shoots and leaves (Garvita and Handini, 2011)

The treatment with the highest banana extract (A2B0) produced 6.33 number of shoots, not significantly different from the A2B1 treatment which produced 7.33 number of shoots. This is in line with organic ZPT treatment added to tissue culture media which can stimulate cell division and encourage cell differentiation, so that shoots can grow well (Nurfadilah *et al*., 2018).

3. Number of Leaves

The combination of A2B1 treatment (banana peel extract 50 gr/L + BAP 0.5) had a very significant effect on the number of leaves, namely 16.33 leaves. In line with research by Sitanggang (2022), it shows that organic ZPT treatment with banana extract 50g/L and giving BAP less than 0.5mg/L has an effect on all parameters including the number of leaves. This is thought to be because the exogenous ZPT given depends on the endogenous ZPT. The exogenous ZPT given to plants is at its maximum point, triggering the emergence of leaves. The response that appears in the A2B1 treatment interaction is dependent on the ability of the explant to absorb and use existing endogenous ZPT and exogenous ZPT absorbed from the growing medium so that plant growth occurs well during leaf formation (Lerekeng, 2012). The number of shoots parameter is in line with the number of leaves. This is thought to be influenced by the endogenous or exogenous auxin given (banana peel extract). The number of leaves is in line with the height and number of shoots due to the presence of added endogenous auxin and exogenous auxin (belaster *et al.,* 2018).

Treatment A2B1 was not significantly different from treatment A2B2 (banana peel extract 50g/L + BAP 1mg/L). In line with research by Lestari *et al*., (2018), it shows that a BAP concentration of 1 mg/L has an effect on leaf formation. According to Pandia (2023), the parameters observed in plant growth that indicate the success of plant tissue culture are the number of leaves and nodes. The presence of one leaf on the plantlet stem indicates the presence of one node on the potato plantlet**.**

4. Number of Roots

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The interaction of banana peel extract and BAP which produced the highest number of roots was A2B2 (Banana peel extract 50 gr/L + BAP 1 mg/L) with 8.67 roots. This is almost the same as research by Lestari *et al*., 2018 where 1mg/L BAP treatment stimulated lateral root formation by activating pericycle cells to divide and develop and then triggering the emergence of roots. This shows that the ratio of auxin and cytokinin in plants is in optimal conditions. A balance between cytokinins and auxins will produce better roots. Even though potato plantlets contain their own endogenous auxin which can grow roots without the help of exogenous auxin, the presence of auxin and cytokinin concentrations can grow roots (Setiawati et al., 2018).

Treatment A2B0 (Banana peel extract 50g/L) is the best treatment for root growth. In line with research by Sitanggang (2022), 50g/L treatment of an organic PGR has a real effect on a plant. The process of root elongation begins with stimulation by auxin. The presence of auxin has been proven to stimulate organogenesis and lead to the formation of roots. Auxin is able to increase growth by encouraging the formation of a number of cells in plants, but these cells do not divide, so many of them are polyploid with several nuclei (Pandia, 2023).

Conclusion

Based on the research results, the following conclusions were drawn:

1) treatment of 50gr/L banana peel extract had a significant effect on all parameters. The most leaves were produced by 25 gr/L banana peel extract.

2) The highest average plantlet height produced by BAP 1 mg/L. The highest number of shoots was produced by BAP 1.5 mg/L. The highest number of leaves produced by BAP 0.5 mg/L and the highest number of roots was produced by BAP 1 mg/L.

3) The highest average plantlet height, number of shoots and leaves was produced by the A2B1 treatment combination, and the highest number of roots was produced by A2B2,

Referensi

Asmono, S. L., & Sari, V. K. (2019). Induksi Umbi Mikro dan Regenerasi Tunas Langsung Tanaman Kentang Dataran Medium pada Beberapa Jenis Auksin dan Konsentrasi Sukrosa yang Berbeda. *Agrin*, 23(1), 71-81.

Asyahidah, R. K., Nugrahani, P., & Makhziah, M. (2023). Pengaruh kombinasi ekstrak bawang merah dan air kelapa pada tahap multiplikasi planlet kentang (*Solanum tuberosum* [L.] cv. Granola) Menggunakan Media Murashige dan Skoog (MS). Plumula: Berkala Ilmiah Agroteknologi, 11(1), 45-52.

Fauzi, D. (2018). Analisis Tingkat Keuntungan Petani Kentang Merah di Kabupaten Solok. *Menara Ilmu*, 12(9), 32-39.

Fauzi, D., Baga, L. M., & Tinaprilla, N. (2016). Strategi Pengembangan Agribisnis Kentang Merah di Kabupaten Solok. AGRARIS: Journal of Agribusiness and Rural Development Research, 2(1), 87-96.

Garvita, R. V., & Handini, E. (2011). Pengaruh penambahan berbagai kadar pisang dan ubi jalar pada pertumbuhan kultur tiga jenis phalaenopsis. *Botanic Gardens Bulletin*, 14(2), 9-18.

Larekeng, S. H. (2012). Optimasi Kombinasi NAA, BAP dan Ga3 Pada Planlet Kentang Secara In Vitro. *Jurnal Galung Tropika*, 1(1).

Lestari, E.G., dan Yunita, R. (2008). Induksi Kalus Dan Regenerasi Tunas Padi Varietas Fatmawati. *Jurnal Buletan Agronomi. 36(2), 106-110*

Lestari, E.G., dan Yunita, R. (2008). Induksi Kalus Dan Regenerasi Tunas Padi Varietas Fatmawati. *Jurnal Buletan Agronomi*. 36(2), 106-110

Lestari, F. W., Suminar, E., & Mubarok, S. (2018). Pengujian berbagai eksplan

ISSN 2443-1230 (print)
ISSN 2460-6804(online)
DOI: https://doi.org/10.24114/jbio.v10i1.60290

kentang (*Solanum tuberosum* L.) dengan penggunaan konsentrasi BAP dan NAA yang berbeda. *Jurnal Agro*, 5(1), 66-75.

Lintong, R. T. J., Mandang, J. P., & Lengkong, E. F. (2022). Pertumbuhan Dan Morfogenesis Krisan (*Chrisanthemum Morifolium*) Kulo Dengan Eksplan Pucuk Dan Nodus Pada Media Ms Yang Diberi Benzil Amino Purin (Bap). *Agri-Sosioekonomi*, *18*(1), 239-246.

Mohapatra, P. P., & Batra, V. K. (2017). Tissue culture of potato (*Solanum tuberosum* L.): A review. *International Journal of Current Microbiology and Applied Sciences*, 6(4), 489-495.

Nurchayati, Y., Setiari, N., Dewi, N. K., & Meinaswati, F. S. (2019). Karakterisasi morfologi dan fisiologi dari tiga varietas kentang (*Solanum tuberosum* L.) di Kabupaten Magelang Jawa Tengah. *NICHE Journal of Tropical Biology*, 2(2), 38-45.

Nurchasanah, S., Farid, N., Ulinnuha, Z., & Januarso, J. (2022). Pengaruh Konsentrasi NAA dan BAP terhadap Pertumbuhan Tunas Kentang Varietas Tedjo MZ Secara In Vitro. *AGROSCRIPT: Journal of Applied Agricultural Sciences*, *4*(2), 69-74.

Pandia, W. (2023). Respon Pertumbuhan Tanaman Kentang (Solanum tuberosum L.) Varietas Granola Secara In Vitro dengan Penambahan NAA dan BAP. *Jurnal Agroteknosains*, 7(2), 227-234.

Pangestu, D. M. K. (2023). Pengaruh Pemberian Ekstrak Bawang Merah (*Alium cepa*) Sebagai ZPT Alami Untuk Meningkatkan Pertumbuhan Anggrek Bulan (*Phalaenopsis hibrida*) Pasca Aklimatisasi. Biofarm: *Jurnal Ilmiah Pertanian*, 19(1), 131-135.

Pratomo, B., Aji. S., Agustina L.T. (2019). Respon Ekstrak Ubi Jalar (*Ipomoea batatas*) Dan Bubur Pisang Sebagai ZPT Hayati Pada Pertumbuhan Bibit Kelapa Sawit (*Elaeis guineensis* Jacq) Pada Pre Nursery. *Agroprimatech*, *3*(1), 37-45.

Rinanti, R. P. B. (2021). Pengaruh Ekstrak Jenis Pisang dan Konsentrasi Air Kelapa terhadap Pertumbuhan Anggrek Cattleya pada Media VW. Naskah Publikasi Program Studi Agroteknologi.

Setiawan, A. K., Hastuti, P. B., & Rahayu, E. (2017). Pengaruh Konsentrasi dan Frekuensi Pemberian Mol Bonggol Pisang terhadap Pertumbuhan Kacangan (*Mucuna bracteata*). *Jurnal Agromast*, 2(2).

Setiawati, T., Zahra, A., Budiono, R., & Nurzaman, M. (2018). Perbanyakan *in vitro* tanaman kentang (*Solanum tuberosum* [L.] cv. Granola) dengan penambahan meta-topolin pada media modifikasi MS (*Murashige & Skoog*). *Jurnal Metamorfosa*, 5(1), 17-22.

Sholikhah, R. I. (2022). Pertumbuhan Planlet Tanaman Pisang Cavendish (*Musa Acuminata*) Tahap Multiplikasi Akibat Penambahan IAA dan Beberapa Macam Hormon Alami Pada Media MS secara *In Vitro* (*Doctoral dissertation*, UPN" Veteran" Jawa Timur).

Silalahi, M. (2015). Kultur Jaringan. Jakarta: Fakultas Keguruan dan Ilmu Pendidikan. Universitas Kristen Indonesia. Sitanggang, S. M. (2022). Pengaruh Pemberian Kombinasi Ekstrak Pisang dan BAP pada Media MS terhadap Pertumbuhan Tunas Anggrek *Dendrobium* sp (*Doctoral*

ISSN 2443-1230 (print)
ISSN 2460-6804(online)
DOI: https://doi.org/10.24114/jbio.v10i1.60290

Dissertation, Universitas Sumatera Utara).

Sulichantini, E. D., Eliyani, E., Dewinazari, A. P., Susylowati, S., & Saputra, A. (2021). Respon pertumbuhan Anggrek Tebu (*Grammatophyllum speciosum* Blume) secara *in vitro* terhadap pemberian *Benzyl Amino Purin*, Kinetin, *Naftalena Acetic Acid* dan ekstrak Pisang Ambon dalam media dasar setengah Murashige and Skoog. *Ziraa'ah Majalah Ilmiah Pertanian*, 46(1), 59-69.

Yulianti, U. Yefriwati. (2020). Pengaruh Jarak Tanam terhadap Pertumbuhan Umbi Tanaman Kentang (*Solanum tuberosum* L.) di Balai Pengkajian Teknologi Pertanian Sumatera Barat. *Jurnal Hortuscoler*, 1(2), 40-47.

Yusnita, Y. (2015). Kultur Jaringan Tanaman Sebagai Teknik Penting Bioteknologi untuk Menunjang Pembangunan Pertanian. Orasi Ilmiah Guru Besar Bidang Bioteknologi Pertanian, Fakultas Pertanian, Universitas Lampung 4 Agustus 2015.