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Article

In Vitro Induction of Red Potato Sprouts (*Solanum tuberosum* L.) with Benzyl Amino Purine and Indole Acetic Acid

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Abstract: Potato (*Solanum tuberosum* L.) is one of the plants that use its tubers and is broadly developed. In vitro spread of potato plants enjoys a few benefits, for example, quick creation, the capacity to deliver huge amounts, not occasional, and the seeds created are sans microorganisms. One work to further develop seed quality in vitro is by adding development controllers. Subsequently, it is important to explore the fitting convergence of Days After Planting for potato plant development. This study aims to analyze the Plant Growth Regulator interaction of Benzyl Amino Purine and Indole Acetic Acid administration on the growth and development of red potato shoots (Solanum tuberosum L.) in vitro. This study uses the factorial Complete Random Design (CRD) method. The parameters observed were bud emergence time (DAP), bud height, and number of leaves. The data obtained was analyzed using ANOVA followed by a 5% DMRT test and if there is a real difference, it is tested using the 1% level. The results showed that the average time for the fastest sprouting in the B1I3 treatment was 5.00 DAP. The average number of shoots was highest in the B2I2 treatment, which was 4.93 cm. The highest number of leaves produced by B3I2 treatment was 23.00 leaves. The best combination of PGR on the growth and development of red potato shoots was found in the B1I3 treatment (0.5 mg/L BAP and 0.3 mg/L IAA).

Keywords: plant growth regulator; benzyl amino purine; indole acetic acid; red potato; in vitro

1. Introduction

Potato (*Solanum tuberosum* L.) is a plant used for tubers and is widely cultivated. Potato crops are included as the fourth most important food crop in the world, after rice, wheat, and corn (Asgar, 2013). Red potatoes are one of the types of local potatoes that need to be cultivated for production and conservation. Red potatoes have a red skin color but the inside is yellow. Red potatoes are still classified as a plant that has not been widely cultivated in the highlands even though the potential yield obtained in red potatoes can reach 28,671 tons/ha (Ismadi et al., 2021). Potatoes that are grown for a long time make the production of red potatoes in Indonesia still quite low, so the need for the progress of potato plant seedlings through tissue culture or in vitro is needed.

The proliferation of potato plants in vitro has several advantages compared to conventional, namely fast production, the ability to produce large quantities, regardless of the season and the seeds produced are pathogen-free. One attempt to improve the properties of the seeds produced is by providing regulatory agents through the growth of plant tissue cultures. In tissue culture, Plant Growth Regulators (PGR) are often used, namely auxins and cytokines (Rohmah, 2021). The growth regulators of the auxin group, namely IAA, and the cytokinin group, namely Benzyl Amino Purine (BAP). According to Septiani (2019), potato sprouts respond well to the use of IAA in small amounts (0.1 ppm; 0.2 ppm) and BAP concentrations of 2 and 3 ppm. Based on this background, it is necessary to research the effect of PGR BAP and Indole Acetic Acid (IAA) concentrations on the growth of red potato shoots in vitro.

2. Materials and Methods

This study used red potato sprout eye material, MS media components, gelatin, sugar, Clorox 5%, Clorox 10%, bactericides, fungicides, tween 20, aquades, sterile aquades, water, HgCl2 0.01 N, NaOH 0.1 N, alcohol 70%, alcohol 96%, PGR BAP, PGR IAA, sunlight, label paper, tissue, filter paper, aluminum foil, plastic wrap, latex gloves, and spirtus. The equipment used in this study was an autoclave, bunsen, erlenmeyer, measuring cups, goblet glasses, sterile knives, tweezers, scissors, spatula, measuring pipette, analytical balance, pH meter, hot plate stirrer, magnetic stirrer, laminar airflow (LAF), incubation chamber, culture bottle, Petri dish, scalpel, beker glass, pH meter, oven, label paper, culture shelf, and refrigerator.

This study uses a factorial complete random design (RAL) method, namely two factors. Each factor consists of three levels of treatment, namely the first factor is 0.5 mg/l BAP; 1 mg/l BAP; and 1.5 mg/l BAP. The second factor is IAA with a level of 0.1 mg/L; 0.2 mg/L; 0.3 mg/L. there were 9 treatments, each repeated 3 times until 27 treatment units were obtained. Each treatment unit had 3 samples so 81 treatment bottles were obtained. The parameters observed were the time of buds (DAP) emergence, height of buds (cm), and number of leaves. The data obtained was analyzed using ANOVA and further tests were carried out on Duncan's Multiple Range Test (DMRT) level of 5% if there were significantly different results, if there were very real different results, it was tested using the 1% level.

This research was carried out from September to December 2023. This research was carried out at the Jember State Polytechnic Tissue Culture Laboratory.

3. Results and Discussion

The results of the research on the induction of red potato shoots (*Solanum tuberosum* L.) in vitro with PGR BAP and IAA are obtained as shown in Table 1.

Table 1. The average effect of PGR BAP and IAA on bud growth

Combination BAP dan IAA	Average initial sprouts appear (DAP)	Average bud height (cm)	Average number of leaves (sheet)
B1I1	7.00 ^{ab}	4.17 ^{bc}	16.00 ^{bc}
B1I2	6.00 ^{ab}	4.60 ^{ab}	15.00 ^{bc}
B1I3	5.00 ^{a}	4.83 ^{ab}	21.33 ^{a}
B2I1	7.33 ^{ab}	4.57 ^{ab}	15.33 ^{bc}
B2I2	5.67 ^{ab}	4.93 ^{a}	15.33 ^{b}
B2I3	11.33 ^{c}	3.07 ^{de}	17.33 ^{b}
B3I1	14.00 ^{c}	2.50 ^{e}	13.00 ^{c}
B3I2	8.00 ^{b}	3.50 ^{cd}	23.00 ^{a}
B3I3	6.33 ^{ab}	4.50 ^{ab}	16.33 ^{bc}

Note: different letters in the column show a noticeable difference in the 1% DMRT analysis

3.1. Beginning of shoot emergence

The results of the observation of the time of budding in Table 1 show that the interaction between PGR, BAP, and IAA in terms of description from the numbers obtained has a real effect. In the B1I3 treatment, the average time for sprouting is the fastest, which is 5.00 DAP. The time of emergence of the fastest shoots is because the plantlet can grow buds. Septiani (2019), stated that the type of hormone given will have an impact on how the explant can sprout. The type of additional hormone added or the concentration of additional hormones can spur cell division. Exogenous hormones that are believed to encourage bud development are obtained from the administration of growth regulators. Growth regulators are classified into the cytokinin group and the auxin group. Auxins and cytokinins as well as endogenous hormones, if in equilibrium, will respond to exogenous hormones to produce sprouts. The development and morphogenesis of in vitro plantlets are constrained by the equilibrium and association of PGR contained in endogenous and exogenous plantlets (Sinulingga & Harahap, 2014). The addition of cytokinins in the medium is needed to increase cell division, while auxins play a role in encouraging the development of the cell wall. The difference in the speed at which buds appear is not only influenced by the increase in cell division speed because the effect of BAP and IAA is also influenced by genetic conditions, tissue age, plant type, and environmental factors including light, O_2 content, temperature, and air humidity as well as the ability of tissues to absorb available nutrients.

3.2. Bud height

The results of the variant analysis showed that the administration of PGR, BAP, and IAA had a real effect on the growth of the explant. The treatment that produced the highest average shoot height was the B2I2 treatment with an average shoot height of 4.93 cm. If the concentrations of cytokinins and auxins administered are appropriate, the explant will accelerate the process involved with bud extension. In low fixation of auxins combined with a certain focus cytokinins can accelerate the stretching of already-formed shoots (Klerk, 2006). Another factor that supports the successful growth of explants in this study is the use of MS media containing a complete composition for bud extension. The administration of PGR with several concentrations in MS media provides a good percentage of explant growth because the medium contains vitamins, macro and micronutrients, as well as iron and sucrose so that it is enough to spur the growth of explant in bud formation.

3.3. Number of leaves

The results of the analysis for the number of leaves formed parameters showed significant differences. The treatment that produced the highest number of leaves was found in the B3I2 treatment with an average number of leaves of 23.00 leaves. This is following the research of Suminar et al., (2021), the best and most effective treatment of leaf count variables was obtained from the treatment of adding BAP. Sagai et al., (2016), found that applying high concentrations of BAP to broccoli explants can result in the production of a large number of leaves. Another factor that affects leaf growth on plantlets is the high light intensity in the culture room because the number of leaves is closely related to the process of photosynthesis, pest absorption, and plant metabolism.

4. Conclusions

Based on the research that has been conducted, it can be concluded that: (1) There is a significantly different interaction in the treatment of PGR 0.5 mg/L BAP and 0.3 mg/L IAA on the time of bud appearance, increasing bud height and leaf count; (2) The concentration of 0.5 mg/L BAP had a significantly different effect on the initial variables of 5.00 DAP shoots, 4.83 cm shoot height, and 21.33 leaves; (3) The concentration of 0.3 mg/L IAA had a significantly different effect on the initial variables of 5.00 DAP buds, 4.83 cm shoot height, and 21.33 leaves.

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References

Asgar, A. (2013). Kualitas Umbi Beberapa Klon Kentang (Solanum Tuberosum L.) Dataran Medium Untuk Keripik* [Tuber Quality of Some Potato (Solanum Tuberosum L.) Clones of Medium Altitude Area for Chips Making]. *Berita Biologi*, *12*(1).

Ismadi, I., Annisa, K., Nazirah, L., Nilahayati, N., & Maisura, M. (2021). Karakterisasi Morfologi Dan Hasil Tanaman Kentang Varietas Granola Dan Kentang Merah Yang Dibudidayakan Di Bener Meriah Provinsi Aceh. *Jurnal Agrium*, *18*(1). https://doi.org/10.29103/agrium.v18i1.3844

Klerk, G. J. (2006). Plant Hormones In Tissue Culture, In Duchefa Biochemie. In *Biochemicals Plant Cell And Tissue Culture Phytopathogy, Duchefa Biochemie BV, Haarlem*.

Rohmah, A. S. (2021). Pertumbuhan Berbagai Macam Bahan Eksplan Kentang Atlantik secara In Vitro dengan Perlakuan IAA. *Agrosains : Jurnal Penelitian Agronomi*, *23*(2), 72. https://doi.org/10.20961/agsjpa.v23i2.49027

Sagai, E., Doodoh, B., & Kojoh, D. (2016). Pengaruh Zat Pengatur Tumbuh Benzil Amino Purin (BAP) terhadap Induksi dan Multiplikasi Tunas Brokoli Brassica oleraceae L. Var. Italica Plenck. *Jurnal Natural Science*, *IX*, 1–9. https://doi.org/10.35791/cocos.v7i6.13885

Septiani, S. M. (2019). *Multiplikasi Tunas Kentang Kultivar Granola Pada Dua Sistem Kultur Vitro* [Syarif Hidayatullah State Islamic University]. https://repository.uinjkt.ac.id/dspace/bitstream/123456789/47463/1/SHINTA MAGDALENA SEPTIANI-FST.pdf

Sinulingga, S., & Harahap, F. (2014). Pengaruh Pemberian Zat Pengatur Tumbuh (ZPT) Indole Acetic Acid (IAA) Dan Benzyl Amino Purine (BAP) Terhadap Pertumbuhan Planlet Nanas (Ananas comosus L.) Sipahutar Secara In Vitro. *Prosiding Seminar Nasional Biologi*, 204–209. https://digilib.unimed.ac.id/id/eprint/4904/1/Fulltext.pdf

Suminar, E., Sobarna, D. S., Mubarok, S., Sulistyaningsih, S., & Setiawan, A. (2021). Pertumbuhan tunas kunyit tinggi kurkumin pada berbagai jenis sitokinin dan auksin secara in vitro. *Kultivasi*, *20*(1), 42. https://doi.org/10.24198/kultivasi.v20i1.30705