

Effect of auxin induction on root induction of Granola potato cultivar

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ABSTRACT

Potato is one of the horticultural crops that contains high carbohydrates so it needs to be developed because it has prospects for food diversification. However, in the breeding of potato plants there are obstacles found, the application of biotechnology in the form of in vitro culture or micro-breeding of potatoes is an alternative to overcome these obstacles so that high quality potato tubers can be produced. The purpose of this study was to determine the effect of auxin hormone on root induction of granola cultivar potato. This research is an experimental research with the research parameter is the number of roots of Granola variety potato plants for 2 weeks of observation. The results showed that the addition of auxin hormone to the root induction of potato plants affected the number of plant roots. This can be seen from the first week, October 1, 2022, root growth has occurred. Overall there was growth and increase in the number of roots from October 1 to October 13, 2022. So it can be concluded that auxin has a positive effect on root induction of Granola cultivar potatoes.

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1. INTRODUCTION

Potatoes are one of the horticultural crops that contain high carbohydrates so that they can be used as an alternative to rice as a staple food. Potatoes are even the third staple food after rice, wheat, and corn in the world and are considered a stable and healthy food crop in European countries and the United States [1]. Therefore, potatoes are prioritized for development due to their high carbohydrate content and prospects for food diversification [2], [3], [4].

The most popular potato variety and often cultivated by farmers in Indonesia is the granola variety from German breeding [5], [6]. [7]. Granola cultivars have the advantage of resistance to PVA and PVY diseases and are somewhat sensitive to PLRV, bacterial wilt (*Pseudomonas solanacearum*), and late blight (*Phytophthora infestans*) [7]. Granola cultivars are the only cultivars that dominate potato production in Indonesia. This is because the granola cultivar has the advantage of having superior quality because its productivity can reach 30-35 tons/ha, short life, can be harvested within 80 days and is often used as a vegetable or industrial raw material for chips and has a wide adaptation, and is tolerant of bacterial wilt attacks [8], [9], [10].

However, in the breeding of potato plants there are obstacles found, including propagation by vegetative means often produces low quality tubers and yields and takes a long time, other obstacles are diseases, fungal, bacterial, and viral diseases caused by intensification and lack of

experience of farmers which result in significant annual economic losses [11], [12], [13]. The application of biotechnology in the form of in vitro culture or micro-breeding of potatoes is an alternative to overcome these obstacles so that high quality potato tubers can be produced and can accelerate production [14], [12], [13], [15], [16]. In vitro culture technique is a way to isolate parts of a plant such as protoplasm, cells, a group of cells, tissues, organs and grow them under aseptic conditions so that these parts can develop and regenerate into complete plants (totipotency) [17].

The success of plant in vitro culture is strongly influenced by the composition of the media, environmental conditions, nutrients available in the planting medium, as well as tools, materials, and work environment that will be used in a sterile state [18], [19]. Thus, before planting explants, sterilization is necessary to remove contaminants. The media commonly used for in vitro culture is Murashige and Skoog (MS) media. The advantage of MS media compared to other media is that it contains complete macro and micro nutrients and vitamins [20].

It is also necessary to add hormones to spur plant growth to increase potato production [21]. Growth regulators play an important role in plant growth and development, especially regulating shoot and root repair in young plants propagated in vitro [22], [23]. In plants, auxins, cytokinins, and gibberellins are already produced but the amount is small so they need to be added from outside [24]. The use of phytohormones can be used to break the dormancy of potato tubers [25]. The hormone auxin functions for cell elongation so as to increase plant height, initiate callus and induce root elongation, embryo development, cell division and differentiation, induce initiation and growth of potato tubers [26], [16], [27], [28], [29], [30], [31], [32], [33], [34]. The purpose of this study was to determine the effect of auxin hormone on root induction of granola cultivar potato.

2. METHOD

2.1 Type and Material Research

This type of research is experimental research. The tools and materials used in this research are LAF, petri dish, culture bottle, tweezers, scalpel, rubber band, plastic, sprayer containing 96% ethanol, MS (Murashige & Skoog) media, granola potato cultivar, and label paper.

2.2 Time and Place

This research was conducted at the Plant Physiology Laboratory, Faculty of Biology, Universitas Jenderal Soedirman for 2 weeks, starting from September 28, 2022 to October 13, 2022.

2.3 Parameter

The parameters observed were the number of roots of Granola cultivar potato plants during the 2 weeks of observation.

2.4 Method

a. Sterilization of tools

The tools that will be used in the practicum are sterilized using a sprayer containing 96% ethanol.

b. Isolating tissue collection

Planlets that already contain granola cultivar potato plants are subcultured with the aim of multiplying according to the number of planlets that will be used as explants. Subculture is done in an LAF that has been sterilized with UV for 1 hour and 96% ethanol. Planlets were taken from the bottle and placed in a Petri dish then cut using a scalpel and planted in a new culture bottle. Each culture bottle was planted with 3 explants, then covered with plastic and tied with rubber bands and labeled.

c. Culture maintenance

Explants that have been planted in culture bottles are placed on a maintenance rack. The bottles containing the explants were arranged neatly to facilitate observation. Observations were made for 2 weeks, and every 3 days the number of potato plant roots was observed.

3. RESULTS AND DISCUSSION

3.1 Number of Potato Plant Roots

Table 1 shows the number of roots of Granola potato plants during 2 weeks of observation.

Table 1. Number of potato plant roots

Observation data	Number of potato plant roots					Description
	Bottle 1	Bottle 2	Bottle 3	Bottle 4	Bottle 5	
28/09/2022	-	-	-	-	-	No root growth yet
1/10/2022	3	4	3	2	7	There is already root growth
4/10/2022	3	7	3	2	7	There is already root growth
7/10/2022	3	9	3	2	9	There is already root growth
10/10/2022	3	13	4	2	12	There is already root growth
13/10/2022	4	14	4	3	14	There is already root growth

Potato (*Solanum tuberosum* L.) is one of the horticultural crops that has a high carbohydrate content besides rice, corn, and wheat. Potato yields in Indonesia are still relatively low compared to other countries such as America, the Netherlands, Switzerland, England and Germany where the yield in Indonesia is only about 14 tons ha⁻¹ [35]. One of the obstacles in potato cultivation is poor quality seedlings that result in low production, in addition to tuber rot disease.

Potatoes have several cultivars, namely Granola, Amudra, Cipanas, Merbabu 17, Andina, Kastanum, Vernei, Atlantik, Maglia, Amanbile, and Medians. Granola cultivar is the most widely planted cultivar by farmers, this cultivar also has a fluffier taste and a slight sweetness when processed by boiling [36]. Atlantic cultivars have the disadvantage that they are not resistant to diseases such as bacterial wilt [37].

Propagating potato plants in a conventional way using tubers can increase disease infection in seedlings, so a more efficient seedling alternative was found by using in vitro culture techniques using seeds, stems, and leaves of potato plants [38]. Tissue culture technique is a technique of growing plant parts in the form of cells, tissues or organs carried out in vitro [39]. The advantage of propagating potato plants through tissue culture or in vitro is that it produces plant seeds quickly and is free from pathogens [40], [41].

The key to the success of the tissue culture method is that the tools, materials, and work environment to be used must be sterile [19]. The purpose of sterilization is to destroy or destroy all contaminants so that tissue culture techniques can be successful [42]. The media commonly used for tissue culture is Murashige and Skoog (MS) media. The advantages of MS media compared to other media are that it contains complete macro and micro nutrients and also higher vitamins compared to other media such as Gamborg media, Vacin and Went, and white media [20], [43].

Based on the data from Table 1, it shows that the addition of auxin hormone in potato root induction affects the number of plant roots. This can be seen from the first week, October 1, 2022, root growth has occurred. The appearance of roots in the first week of the incubation period indicates that the explants can adapt to their environment and can absorb nutrients and nutrients provided in the growing medium [41]. Overall, there was growth and increase in the number of roots from October 1 to October 13, 2022. This is in accordance with the theory that the function of the hormone auxin is to spur root growth so that it can increase the percentage of live plantlets at the acclimatization stage [34]. The addition of hormones to tissue culture media greatly affects the growth and development process of the explants used [45].

Roots will easily form if the buds grow perfectly, the formation of these roots is spurred by the presence of the hormone auxin [43]. Explants naturally produce endogenous auxin to support root formation, the root elongation process begins with stimulation by endogenous auxin. A narrow/low concentration of auxin is needed to stimulate and spur root formation in tissues while at a wide/high concentration, auxin will actually inhibit root initiation [46].

4. CONCLUSION

Addition of auxin hormone to the root induction of potato plants affected the number of plant roots. This can be seen from the first week, October 1, 2022, root growth has occurred. Overall there was growth and increase in the number of roots from October 1 to October 13, 2022. So it can be concluded that auxin has a positive effect on root induction of Granola cultivar potatoes.

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