Jurnal Biodjati 10(1): 146–157, May 2025
e-ISSN : 2541-4208
p-ISSN : 2548-1606

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

The Effect of Prohexadione-Ca on Starch Content of Potato (*Solanum tuberosum*) G0 Median in Medium Plains

Dewi Hernawati *[1], Tati Krinstanti[2], Edi Kusnadi[3]

Received: September 27, 2024
Revise from: December 12, 2024
Accepted: April 17, 2025

DOI :10.15575/biodjati.v9i2.39555

[1,2,3]Biology Education Study Program, Faculty of Applied Sciences and Science, The Indonesian Institute of Education Garut, Pahlawan Street No. 32 Garut, 4415, (0262) 233556, Indonesia.

e-mail:
*[*1]dewiherna@institutpendidikan.ac.id,*
[2]tatikristianti36@gmail.com,
[3]Kedi9432@gmail.com,

**Corresponding author*

Abstract. *The research conducted is entitled "The Effect of Prohexadione-Ca Concentration on Potato Plant (Solanum tuberosum) G0 Medians Cultivar Tubers in Medium Plains". This study aimed to determine the effect of Prohexadione-Ca concentration on potato plant (Solanum tuberosum) G0 Medians Cultivars tubers in Medium Plains and to determine the concentration of Prohexadione-Ca to produce the best quality starch content. This research was conducted at the Rancabango screen house, Tarogong Kaler District, Garut Regency, from July to October 2023. The research method used was an experimental method with a Completely Randomized Design (CRD) using 4 treatments, namely Prohexadione-Ca concentration of 0 ppm (Control), 100 ppm, 150 ppm, and 200 ppm. The parameters measured in this study were two types of parameters, namely supporting and main parameters. Supporting parameters include chlorophyll content, photosynthesis rate, and stomatal conductance, while the main parameter is the potato tuber starch content. The benefits of this research are determining the best quality results of potato tubers from the aspect of potato starch content by planting with the best concentration of prohexadione. The study showed an effect on the potato tuber starch content by administering Prohexadione-Ca. The most effective administration of Prohexadione-Ca to produce the quality of potato tuber starch content in medium plains is at a concentration of 100 ppm with a starch content of 9.35%.*

Keywords*: medium plain, potato, prohexadione-Ca, starch*

Citation
Hernawati, D., Kristanti, T., & Kusnadi, E. (2025). The Effect of Prohexadione-Ca on Starch Content of Potato (*Solanum tuberosum*) G0 Median in Medium Plains. *Jurnal Biodjati*, 10(1), 146-157.

Jurnal Biodjati 10(1): 146–157, May 2025

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

INTRODUCTION

Potatoes (*Solanum tuberosum*) are one of the horticultural commodities most consumed by the community, ranking fourth after rice, wheat, and corn. Indonesia itself is the largest potato-producing country, especially in Southeast Asia (Setiadi, 2009). The Indonesian people use potatoes as vegetables or as processed ingredients. From 2002 to 2012, the need for potato consumption increased by an average of 1.76% per year (Agricultural Data Center and Information System (Pusdatin), 2013).

Potatoes contain a lot of carbohydrate compounds, one of which is starch. The nutritional content of potatoes per 100 grams is 77 kcal of energy, 19 g of carbohydrates, 15 g of starch, 0.1 g of fat, 2 g of protein, and 75 g of water (Samadi, 2011). Sunarjono (2007) states that potato plants grow well in highland or mountainous areas at 800 - 1,500 m above sea level. Potato plants have difficulty forming tubers when grown in lowlands (below 500 m above sea level). However, this is indeed the case if potato planting in the highlands is continuously not balanced with wise land management following ecological principles, it can damage the environment, especially erosion, and reduce soil productivity (Wijana, 2014). Therefore, there is an alternative to increase potato production, namely the development of potato planting in medium plains at an altitude of 300-700 m above sea level, which is widely available in Indonesia (Sumadi et al., 2016). However, the climate is an obstacle to planting potatoes in medium plains. Air temperature is among the climate factors that significantly affect the growth and formation of tubers (Adisarwanto, 1990). Potatoes that grow in areas with high temperatures will experience increased endogenous gibberellin synthesis, which can inhibit tuber incision (Tekalign & Hammes, 2004). This can interfere with photosynthesis activity, reducing the translocation of photosynthesis results to tubers and the starch content in tubers. The solution to overcome the problem of decreasing starch levels in potato tubers (*Solanum tuberosum*) cultivars medians in medium plains is by applying Plant Growth Inhibitor Substances (PGR) Prohexadione-Ca. Prohexadione-calcium (prohexadione-Ca), an acylcyclohexanedione, is a PGR that inhibits the final stages of gibberellin biosynthesis in the cytosol of cells (Rademacher, 2015).

Prohexadion-Ca, Paclobutrazol, and strangulation accelerate flowering and increase the number of flowers and fruits on mandarin citrus plants. Prohexadion-Ca treatment may accelerate the onset of flowers to appear faster than Paclobutrazol treatment and may increase the number of flowers and fruits equal to Paclobutrazol. Prohexadion-Ca can be used to produce off-season citrus fruit without leaving residues in the environment (Darmawan et al., 2014). Prohexadione-Ca caused some changes in the physiological pathways of vines, resulting in alterations in the grape (Thomidis et al., 2018).

Prohexadione-Ca is a relatively new PGR, with a short residual effect lasting only a few weeks (Rahim et al., 2011). Thus, its use can inhibit vegetative plant growth and induce flowering without risk to the soil. Pro-Ca, a gibberellic acid inhibitor, shortens cell length and positively affects plant growth, yield, and fruit quality at appropriate dosage and administration time (Başak, 2021). Prohexadione-Ca application changed the tuber-size distribution pattern, also increased the DM, starch, and protein content of the tubers (De Oliveira et al., 2021).

Potato plants planted under high temperature conditions can reduce the translocation of photosynthesis results to tubers and increase their translocation to leaves and stems, so that the starch content in

in tubers is low. However, the sugar in the upper part of the plant is higher. A decrease in sucrose synthase enzyme activity of 72% occurs in potatoes that are sensitive to high temperatures, while in tolerant potatoes it only decreases by 59%. In addition, the activity of enzymes that play a role in starch metabolism will be suppressed at soil temperatures of 30ºC, inhibiting the conversion of sugar to starch (Prabaningrum et al., 2014).

Efforts that can be made to reduce the effects of gibberellin in inhibiting the formation of potato tubers in medium plains can be done by using an anti-gibberellin compound such as Prohexadione-Ca. The use of Prohexadion-Ca is very good for potato plants, especially those planted in medium plains and this inhibitor has been proven to be environmentally friendly because it does not leave residue in the soil (Hernawati et al., 2022). According to Kofidis et al (2008) Prohexadione-Ca causes a decrease in vegetative growth by blocking gibberellin biosynthesis. This shows that the effects of high temperatures in medium plains can be overcome by administering anti-gibberellin compounds to potato plants. The results of research conducted by (Kusandriani, 2016), which was conducted in Cikandang Village with an altitude of 1,300 m above sea level, Cikajang District, Garut Regency, obtained average observations of starch content ranging between 8.464 - 12.320%. The Medians genotype has a starch content of 12.320%, higher than the Atlantic processed variety, which is only 11.053%. Moreover, the results of research conducted by Asgar, A (2013) which was carried out in the medium Lembang plains showed that potato clone starch ranged between 3.50-6.67%. This study examines the increase the starch content in potato cultivar median plants grown in medium plains by adding optimal concentrations of Prohexadion-Ca, helping the community meet its individual nutritional needs and can be developed or cultivated in medium plains, whereas previously potato cultivation could only be done in highlands.

MATERIALS AND METHODS

Materials and Tools

This study certainly material and tools to support the research process, The materials used in this study were G0 potato seeds of the median cultivar, inceptisol soil, cocopeat, rice husk charcoal, compost, Prohexadione-Ca, NPK, 70% alcohol, desiccant, demolis, fungicide curazate 8/64 WP, 5% phenol, concentrated H_2SO_4, distilled water.

The tools used in this study are: Plastic polybag 20 x 30, shovel, embrat, 50 mL measuring cup, digital scales, stationery, 1 Liter handsprayer, Chlorophyll meter, photosystem, porometer, mortar, pestle, filter cloth, 100 mL test tube, 100 mL measuring flask, dropper, stirrer, waterbath, 250 mL measuring flask, 250 mL beaker, cooler, 300 mL Erlenmeyer flask, 250 mL Erlenmeyer flask, Uv-Vis Spectrophotometer.

Measuring Photosynthesis Rate

Leaves are measured by wrapping the leaves in a closed and transparent chamber and measuring the decrease in carbon dioxide concentration as a function of time. Light flux density is measured in the outdoor chamber and must be corrected for the room transmittance of 0.9.

Analysis of chlorophyll levels in potato plant leaves

Chlorophyll levels were measured according to (Aisoi, 2019) with some modifications. Potato plant leaves were crushed with a mortar, added with 10 ml of 80% acetone, and incubated for 30 minutes. The leaf extract was filtered with Whattman filter paper and its absorbance was measured

Jurnal Biodjati 10(1): 146–157, May 2025

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

with a spectrophotometer with wavelengths of 647 nm and 663 nm. Chlorophyll levels were calculated following the formula total chlorophyll (mg/l) = 21.50 A647 + 5.10 A663.

$$\text{Chl a} = 12{,}25 \times A_{663} - 2{,}79 \times A_{647}$$
$$\text{Chl b} = 21{,}50 \times A_{647} - 5{,}10 \times A_{663}$$
$$\text{Total} = [(1000 \times A_{470}) - (1{,}82 \times \text{Chl a}) - (85{,}02 \times \text{Chl b})]/198$$

Stomatal Conductance Analysis

Stomatal conductance (gs, mmol m^{-2} s^{-1}) measured on leaves in which well develop (third node from the top), formula for caculating stomatal conductance (gs) is gs=1/rs, where rs is the stomatal resistance.

Phenol-Sulfuric Acid Method

Making a standard glucose solution and making standard glucose solution (0.02 g anhydrous glucose/100 mL of distilled water). From the solution, 5 dilutions were carried out to obtain standard glucose solutions with concentrations of 5, 10, 15, 20, and 25 mL/100 mL. Prepare 6 clean test tubes, then fill each with 1 mL of the standard glucose solution above. One tube is filled with 1 mL as a blank. Then 1 mL of 5% phenol is added to the test tube, and then 5 mL of concentrated H2SO4 is added. Heat with a water bath at 30ºC for 20 minutes. The standard curve is made by connecting the glucose concentration with OD (Opical density). The optical density of each solution is read at a wavelength of 490 nm.

Starch Content Analysis.

Starch content analysis using the AOAC method (Anugrahati & Widjanarko, 2018) with the following steps: 1 gram of potato was extracted using a mortar and pestle, then put into a 250 mL beaker, added 100 mL of distilled water, and stirred for 30 minutes. The resulting solution was filtered, and the filtrate was taken. The filtrate was pipetted as much as 2 mL then put into a 300 mL beaker, added 300 mL of distilled water and stirred for 2 minutes. The solution was taken 2 mL then put into a test tube, added with 1 mL of 5% phenol and shaken. The mixture was added with 5 mL of concentrated acid sulfate, left for 10 minutes, and shaken. Then, they were placed in a water bath for 15 minutes at 40ºC and in a cuvette. The absorbance was measured at a wavelength of 490 nm.

Starch Content Calculation

Calculate starch content by knowing the absorbance value of the sample measured with a UV-Vis spectrophotometer at a wavelength of 490 nm. Glucose content g/mL) is determined using a standard curve, while starch content is calculated using the formula:

$$\text{Starch Content \%} = \frac{\text{glucose weight} \times \text{fp} \times 0{,}9}{\text{sample weight (mg)}} \times 100$$

Information:
fp : Dilution Factor
0,9 : Conversion Factor

Research Steps

Taking median potato cultivar seeds in the form of G0 taken from PT Champ located in Cilame Village Cisurupan, Garut, Carrying out the process of planting G0 potato seeds that are ready to plant, then putting them in a polybag measuring 20 x 30 cm with a planting distance of 30 x 20 cm between plants, Providing Prohexadione-Ca treatment which is applied to the foliar or leaves of potato plants at 30 HST, 40 HST and 50 HST in the afternoon, measuring chlorophyll content using a chlorophyll meter, photosynthesis rate using a photosystem tool and stomatal conduction using a poromter at 40 HST and 70 HST, harvesting potato tubers when the plants have reached the age of 100-110 HST, Determination of potato starch content using the phenol sulfuric acid method with method with measurements using a UV-Vis spectrophotometer.

Jurnal Biodjati 10(1): 146–157, May 2025

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

RESULTS AND DISCUSSION

1. Planting Site Conditions

The research conducted on the Effect of Prohexadione – Ca Concentration on the Starch Content of Potato Plants (*Solanum tuberosum*) G0 Median Cultivars in Medium Plains was carried out at SH (Screen House) in Rancabango, Tarogong Kaler, Garut. The location was obtained through information from Rancabango Village data where Rancabango (7°11'18"S 107°52'40"E), which was used as the location for this research, has an altitude of around 700 m above sea level.

Humidity and air temperature are components of microclimate that greatly affect plant growth, and each is related to realizing optimal conditions for plants (Wijayanto & Nurunnajah, 2012). In the temperature measurements as presented in Table 1 at 08:00, 13:00, and 17:00, it appears that it has a large temperature value of around 31.0ºC during the day. While in humidity measurements, the condition with the highest humidity at 08:00 is an average of 80%. The increase in high temperatures during the day will cause a lack of pressure from tuber respiration and carbohydrate translocation from tuber leaves. In addition, the activity of enzymes that play a role in starch metabolism will be suppressed at soil temperature conditions of 30ºC, inhibiting sugar conversion to starch (Prabaningrum et al., 2014).

2. Physiological Response of Potato Plants (Solanum tuberosum) in Medium Plains

Potato plants (*Solanum tuberosum*) are quite sensitive to climate changes that occur (Aliche et al., 2018). The influence of high temperatures in this medium plain greatly affects the physiological processes of potato plants, such as disrupting photosynthesis activity (Yordanov et al., 2003). So this can interfere with photosynthesis activity, reducing the translocation of photosynthesis results to tubers and reducing the starch content in tubers. The solution to overcome the problem of decreasing starch levels in potato plants (*Solanum tuberosum*) cultivars medians in medium plains due to the influence of high temperatures is by applying Plant Growth Inhibitor Substances (PGR) Prohexadione - Ca. Next, we present the effect of prohexadion-Ca on photosynthesis rate, the effect of prohexadion-Ca on chlorophyll content and the effect of prohexadion-Ca on stomatal conductance as shown in Table 2, Table 3 and table 4.

3. Analysis of Potato Plant Tubers (*Solanum Tuberosum*) Starch Content

This analysis was conducted to determine the Effect of Prohexadione – Ca Concentration on Potato Plant Tubers (*Solanum tuberosum*) G0 Median Cultivar Starch Content in medium plains. The samples used in this analysis were potato tubers that had been harvested from potato plants that were previously planted in medium plains carried out at SH (Screen House) in Rancabango, Tarogong Kaler, Garut. The starch content in potato tuber samples (*Solanum tuberosum*) was determined using a Uv-Vis spectrophotometer.

a. Determination of Standard Curve

To be able to measure the starch content of potato tubers, of course, a standard solution is first made using a standard glucose solution with 5 concentration variations. This Uv-Vis Spectrophotometer is used to be able to determine the absorbance value of 5 variations in the concentration of the standard glucose solution that has been made as presented in Table 5.

Jurnal Biodjati 10(1): 146–157, May 2025

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

Table 1. Temperature and Humidity Conditions at the Planting Location (Average from August to October 2023)

Planting Location	Time	Environmental Conditions	
		Temperature (ºC)	Humidity (%)
Rancabango, Tarogong Kaler, Garut	Morning (08 :00)	23,0ºC	80%
	Afternoon (13:00)	31,0ºC	48%
	Night (17:00)	25,7ºC	63%

Table 2. Independent effect of Prohexadione-Ca on physiological responses of photosynthesis 40 and 70 DAP (Average of 6 repetitions)

Treatment	Photosynthesis Rate (µmol CO2/m2/ detik)
Control (No Treatment))	27,10
Prohexadione -Ca 100 ppm	38,83
Prohexadione -Ca 150 ppm	30,33
Prohexadione -Ca 200 ppm	30,53

Table 3. Independent effect of Prohexadione-Ca on physiological response of chlorophyll content 40 and 70 DAP (Average of 6 repetitions)

Treatment	Klorofil (CCI)
Control (No Treatment)	19,55
Prohexadione -Ca 100 ppm	30,18
Prohexadione -Ca 150 ppm	23,50
Prohexadione -Ca 200 ppm	21,96

Table 4. Independent effect of Prohexadione-Ca on physiological responses Stomatal conduction 40 and 70 DAP (Average of 6 repetitions)

Treatment	Stomatal Conduction (mmol m-2s-1)
Control (No Treatment)	26,75
Prohexadione -Ca 100 ppm	42,90
Prohexadione -Ca 150 ppm	28,61
Prohexadione -Ca 200 ppm	31,88

Table 5. Absorbance Value of Glucose Standard Solution

Concentration (ppm)	Absorbance Value (A)
5	0,414
10	0,556
15	0,847
20	1,014
25	1,271

Based on the absorbance value data on the standard glucose solution, a standard solution curve was then made (Figure 1). The curve functions to determine the potato starch content in the sample using a UV-Vis Spectrophotometer. The standard glucose solution curve is as follows.

The standard glucose solution curve results obtained a correlation value of R^2 of 0.9905, which shows a strong linear relationship between the measured concentration and the resulting absorbance value. After a linear regression calculation of the standard solution curve, Y = a + bx, y = 0.1688 + 0.0434x was obtained, so the concentration of each sample could be calculated from this equation.

b. Determination of Potato Tubers (*Solanum tuberosum*) Starch Content Using a UV-Vis Spectrophotometer

The highest absorbance value was found in the Prohexadione-Ca 100 ppm treatment (0.132), and the lowest was found in the Control treatment (0.010), as the results can be seen in table 6. Futhermore, Based on Table 7, the results of the starch content of the potato samples were obtained where the highest value of the sample absorbance was found in the 100 ppm prohecadione treatment with a starch content of 9.35% and the lowest starch content was found in the control treatment with a value of 5.56%.

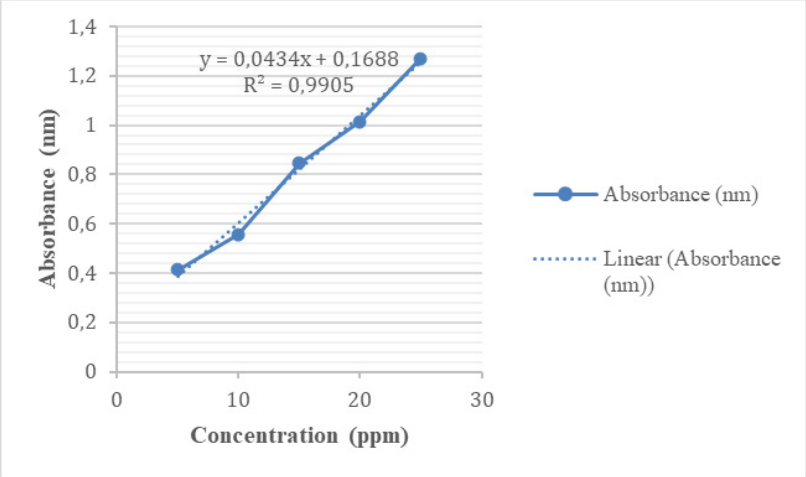

Figure 1. Glucose Standard Solution Curve

Table 6. Sample Absorbance Results

Sample	Absorbance of Potato Samples
Control (No Treatment)	0,010
Prohexadione-Ca (100 ppm)	0,132
Prohexadione-Ca (150 ppm)	0,085
Prohexadione-Ca (200 ppm)	0,042

Table 7. Obtaining potato starch (Solanum tuberosum) content in samples

Sample	Starch content (%) Potato samples
Control (no treatment)	5,56%
Prohexadione-Ca (100 ppm)	9,35%
Prohexadione-Ca (150 ppm)	7,89%
Prohexadione-Ca (200 ppm)	6,55%

Jurnal Biodjati 10(1): 146–157, May 2025

JURNAL BIODJATI

http://journal.uinsgd.ac.id/index.php/biodjati

From the results of this research, several results were obtained as follows:

1. Effect of Prohexadione-Ca concentration on starch content of potato tubers (Solanum tuberosum) G0 cultivar median in medium plains

The potato tubers (*Solanum tuberosum*) used in this study were potato tubers of the median cultivar obtained from previous plantings in medium plains carried out at the SH (Screen House) in Rancabango, Tarogong Kaler, Garut. The location was obtained through information from Rancabango Village data where the Rancabango area used as the location of this study has an altitude of around 700 m above sea level with the seeds planted in the form of G0 potatoes originating from PT Champ located in Cilame Village, Cisurupan Garut.

The planting of the median cultivar potato was previously treated using a growth inhibitor, namely Prohexadione-Ca. in the treatment of Prohexadione-Ca administration during the planting process using 4 different concentration variations, namely Prohexadione-Ca control 100, 150 and 200 ppm as ZPT during planting given at 30, 40 and 50 HST which will later be analyzed for the starch content of potato tubers produced in each treatment.

The starch content of potato tubers produced from planting in medium plains will usually decrease, because planting potatoes in medium plains has a high daytime temperature of around 30ºC. At a soil temperature of 30ºC, the activity of several enzymes that play a role in starch metabolism is suppressed so that there is a decrease in tuber starch content which directly inhibits the conversion of sugar into starch (Sumarni et al., 2013). High temperatures also reduce the rate of photosynthesis, assimilates translocation to roots and tubers, and the rate of sucrose conversion into starch which results in inhibited tuber formation and growth. Therefore, using growth inhibitors or retardants has the ability to inhibit gibberellin synthesis due to high temperatures, one of which is using Prohecadione-Ca. The influence of concentration on the ability of prohexadione-Ca by minimizing the negative effects of high temperatures in medium plains with the application of anti-gibberellin compounds (Syahbudin, 2016).

With the presence of anti-gibberellin compounds, one of which is Prohecadione-Ca, of course this will help potato plants planted in medium plains to minimize the effects of high temperatures so that it inhibits the increase in gibberellin hormone synthesis so that the growth of the upper part of the plant will not be more dominant than tuber growth, then gibberellin at the end of the stolon will not inhibit the formation of stolons into tubers, so that previously when the temperature in the medium plains reached 30ºC, the activity of enzymes that play a role in starch metabolism.

2. Prohexadione – Ca concentration to obtain the best quality of potato tuber starch content (Solanum tuberosum) G0 cultivar medians in medium plains

Based on the results of testing potato tuber starch content samples with Prohexadione-Ca treatment showed different results in each concentration treatment, namely in the Control treatment the starch content was 5.56% Prohexadione-Ca 100 ppm the starch content was 9.35%, Prohexadione-Ca 150 ppm the starch content was 7.89%, Prohexadione-Ca 200 ppm the starch content was 6.55%.

From the results of the study, the most effective way to increase the starch content of potato tubers planted in medium plains was the Prohexadione-Ca 100 ppm treatment because this value exceeded the starch content

value planted in medium plains. The content of tuber starch planted in medium plains, the results of research conducted by Asgar, (2013) conducted in medium plains of Lembang showed that potato clone starch ranged from 3.50-6.67%. The content of potato tuber starch in the control treatment had low starch content because the plant did not have an anti-gibberellin inhibitor compound, namely Prohexadione-Ca because high temperatures stimulate the synthesis of gibberellic acid while gibberellic acid inhibits tuber initiation (Darmawan et al., 2016).

In addition, potato plants planted with high temperature conditions can reduce the translocation of photosynthesis results to tubers and increase their translocation to leaves and stems, so that the starch content in tubers is slightly low, chlorophyll content, photosynthesis rate and stomatal conduction in control plants also affect the starch content in potato tubers because high temperatures affect a series of physiological processes of potato plants such as disruption of photosynthesis activity (Yordanov et al., 2003). The following image of chlorophyll and stomatal conductance is presented in Figure 2 below.

As in the research data for the physiological response of this control treatment, it has the lowest value because its physiological process is disrupted due to high temperatures and the gibberellin synthesis process also increases and as a result the tuber initiation process is inhibited, the activity of enzymes that play a role in starch metabolism will also be suppressed at soil temperatures of 30ºC which results in inhibition of the conversion of sugar to starch (Prabaningrum et al., 2014).

In the Prohecadione-Ca 100 ppm treatment, it has the highest starch content and exceeds the starch content planted on the previous medium plains which only ranges from 6.67% (Asgar, 2013). This happens because the administration of Prohexadione-Ca 100 ppm provides the most optimal inhibition in inhibiting gibberellin synthesis so that the process of its physiological response will be optimal with the presence of the inhibitor Prohexadione-Ca with a concentration of 100 ppm because the inhibitor is able to increase plant tolerance to high temperatures because it has a role in increasing photosynthesis activity, enzymes so that the physiological response is very good and affects the levels of starch formed because the activity of enzymes that play a role in starch metabolism is minimized, there is no pressure at a soil temperature of 30ºC which results in good conversion of sugar to starch. Based on the results of sample testing,

Figure 2. Chlorophyll and stomatal conductance

it is highly recommended for potato farmers to be able to get the quality of median cultivar potatoes with the best starch content in medium plains, namely by using growth inhibitors or ZPT types of Prohexadionne-Ca. The parameters that support the analysis of tuber starch levels of potato plants (*Solanum tuberosum*) G0 in medium plains are temperature, chlorophyll content, photosynthesis rate and stomatal conduction. Asandhi & Gunandi, (1989) explained that areas with a maximum temperature of 30ºC and a minimum air temperature of 15ºC are areas that are very good for growing potato plants compared to areas with a relatively constant temperature, namely an average of 24ºC. Increased temperature due to decreased altitude can cause plants to experience high temperature stress. Then the chlorophyll content and photosynthesis rate affect the formation of potato starch because starch is produced through the process of photosynthesis, namely the process of converting sunlight energy into chemical energy. This process occurs in parts of plants that contain chlorophyll. The more optimal the content of chlorophyll, the rate of photosynthesis and stomatal conduction as in the data that has been produced, namely at a concentration of Prohexadione-Ca 100 ppm, the chlorophyll content value is 30.18 CCI, the photosynthesis rate is 38.83 µmol CO2/ m2/second, and stomatal conduction is 42.90 mmol m-2s-1 can produce the highest starch content of 9.35%.

The starch content in potato tubers is not affected by the size of the potatoes, although the potatoes in this study used G0 potatoes, it would not affect the starch content in the potatoes. But it is greatly influenced by environmental conditions during growth and the characteristics of the potato cultivar (Asgar, 2013). The characteristics of this median potato cultivar are based, that the starch content of this median potato cultivar is only around 12.320% (Kusandriani, 2016). When this potato is planted in medium plains, there will be a decrease in starch content such as the results of Asgar's research which was planted in medium plains without any ZPT treatment only reaching 6.67%. This decrease in starch content is influenced by the planting location which uses medium plains which have a high temperature climate factor.

CONCLUSION

Based on the research results, a conclusion was obtained that there was an effect of Prohexadione-Ca administration on the tuber starch content of potato plants (*Solanum tuberosum*) G0 in medium plains. Variations in Prohexadione-Ca concentrations showed an effect on potato plants' tuber starch content formation. Then the effective concentration of Prohexadione-Ca in producing the quality of tuber starch content of potato plants in medium plains was at a concentration of 100 ppm with a starch content of 9.35%. Researchers should further study the effect of the growth regulator prohexadion-Ca on potato plants or other plants. Then, for farmers, the growth regulator Prohexadion-Ca can be used as one of the growth regulators recommended for use.

AUTHOR CONTRIBUTION

D.H designed, supervised all the studies and write journal manuscripts, T.K.performed data collection and analyzed and E.K. collected samples from wet and dry laboratories and drafted the hypothesis.

ACKNOWLEDGMENTS

The authors are grateful to PT. Champ provide G0 potatoes seed and palnting media. Further more, the authors are grateful to Lemlit head IPI Garut who have helped during the study.

CONFLICT OF INTEREST

We do not have any conflict of interest regarding the publication this study.

REFERENCES

Adisarwanto, T. W. (1990). *Pengaruh Suhu Tinggi Terhadap Pembentukan Umbi Kentang (Solanum Tuberosum) Di Dataran Rendah.* Institut Pertanian Bogor.

Aisoi, L. E. (2019). Analisis Kandungan Klorofil Daun Jilat (*Villebrune rubescens* Bl.) Pada Tingkat Perkembangan Berbeda. *Simbiosa,* 8(1). DOI: 10.33373/sim-bio.v8i1.1893

Aliche, E. B., Oortwijn, M., Theeuwen, T. P. J. M., Bachem, C. W. B., Visser, R. G. F., & van der Linden, C. G. (2018). Drought response in field grown potatoes and the interactions between canopy growth and yield. Agricultural Water Management, 206. DOI: 10.1016/j.agwat.2018.04.013

Anugrahati, N. A., & Widjanarko, A. M. (2018). Karakteristik Tepung Kacang Merah Hasil Autoclaving, Cooling, dan Autoclaving-Cooling. *Jurnal Sains Dan Teknologi*, *2*(2).

Asandhi, A. A., & Gunandi, N. (1989). Syarat tumbuh tanaman kentang. In Kentang.

Asgar, A. (2013). Kualitas umbi beberapa klon kentang (*Solanum tuberosum L.*) dataran medium untuk keripik. Berita Biologi, 12(1).

Başak, H. (2021). Effects of prohexadione calcium applications on growth and yield characteristics of cucumber (*cucumis sativus* l.). Sains Malaysiana, 50(8). DOI: 10.17576/jsm-2021-5008-01

Budi Samadi. (2011). Kentang Dan Analisis Usaha Tani (Cet. 5). Kanisius.

Darmawan, M., Poerwanto, R., & Susanto, S. (2014). Aplikasi Prohexadion-Ca , Paclobutrazol , dan Strangulasi untuk Induksi Pembungaan di Luar Musim Pada Tanaman Jeruk Keprok (*Citrus reticulata*) Strangulation for Off Season Flowering Induction of Mandarin. *Jurnal Hortikultura*, 24(2). DOI: 10.21082/jhort.v24n2.2014.p133-140

Darmawan, M., Poerwanto, R., & Susanto, S. (2016). Aplikasi Prohexadion-Ca, Paclobutrazol, dan Strangulasi untuk Induksi Pembungaan di Luar Musim Pada Tanaman Jeruk Keprok (*Citrus reticulata*). Jurnal Hortikultura, 24(2). DOI: 10.21082/jhort.v24n2.2014.p133-140

De Oliveira, L. S., Fernandes, A. M., Soratto, R. P., Han, D., & da Silva, R. M. (2021). Shoot growth, tuber yield and quality of two potato cultivars as affected by prohexadione-calcium application. Revista Ceres, 68(5). DOI: 10.1590/0034-737X202168050006

Hendro Sunarjono. (2007). Petunjuk Praktik Budi Kentang. Agromedia Pustaka.

Hernawati, D., Sauman, J., Mubarok, S., Semekar, Y., & Alfiya, M. (2022). Physiological response, yield and quality of G0 potato (*Solanum tuberosum*) seed yield to various concentrations and time of application of prohexadione-ca bioregulator. Research on Crops, 23(3). DOI: 10.31830/2348-7542.2022.ROC-842.

Kofidis, G., Giannakoula, A., & Ilias, I. F. (2008). Growth, anatomy and Chlorophyll fluorescence of coriander plants (*Coriandrum sativum L.*) treated with prohexadione-calcium and daminozide. Acta Biologica Cracoviensia Series Botanica, 50(2).

Kusandriani, Y. (2016). Uji Daya Hasil dan Kualitas Delapan Genotip Kentang untuk Industri Keripik Kentang Nasional Berbahan Baku Lokal. Jurnal Hortikultura, 24(4). DOI: 10.21082/jhort.v24n4.2014.p283-288

Prabaningrum, L., Moekasan, T. K., Sulastrini, I., Handayani, T., Sahat, J. P., Gunadi, Sofiari, E., & Nikardi. (2014). Teknologi Budidaya Kentang Di Dataran Medium. In Journal of Chemical Information and Modeling (Vol. 53, Issue 9). https://repository.pertanian.go.id/handle/123456789/15933

Pusat Data dan Sistem Informasi Pertanian (Pusdatin). (2013). Statistik Hortikultura. In Sekretariat Jendral Kementrian Pertanian. https://hortikultura.pertanian.go.id/wp-content/uploads/2016/02/Statistik-Produksi-Hortikultura-2013.pdf

Rademacher, W. (2015). Plant Growth Regulators: Backgrounds and Uses in Plant Production. Journal of Plant Growth Regulation, 34(4). DOI: 10.1007/s00344-015-9541-6

Rahim, A. O. S. A., Elamin, O. M., & Bangerth, F. K. (2011). Effects of growth retardants, paclobutrazol (PBZ) and prohexadione-Ca on floral induction of regular bearing mango (*Mangifera indica* L.) cultivars during off-season. ARPN Journal of Agricultural and Biological Science, 6(3). https://www.arpnjournals.com/jabs/research_papers/rp_2011/jabs_0311_248.pdf

Setiadi. (2009). Budi Daya Kentang. Penebar Swadaya.

Sumadi, Hamdani, J. S., & Andianny, M. (2016). Pertumbuhan dan Hasil Benih Beberapa Varietas Kentang di Dataran Medium yang Ditanam di Bawah Naungan. Prosiding Seminar Nasional Hasil-Hasil PPM IPB 2016.

Sumarni, E., Suhardiyanto, H., Boro Seminar, K., & Saptomo, S. K. (2013). Pendinginan Zona Perakaran (*Root Zone Cooling*) pada Produksi Benih Kentang menggunakan Sistem Aeroponik. J. Agron. Indonesia, 41(2), 154–159.

Syahbudin. (2016). Pengembangan Kentang di Dataran Medium Sebagai Upaya Peningkatan Produksi Kentang Nasional.

Tekalign, T., & Hammes, P. S. (2004). Response of potato grown under non-inductive condition to paclobutrazol: Shoot growth, chlorophyll content, net photosynthesis, assimilate partitioning, tuber yield, quality, and dormancy. *Plant Growth Regulation*, 43(3). DOI: 10.1023/B:GROW.0000045992.98746.8d

Thomidis, T., Zioziou, E., Koundouras, S., Navrozidis, I., & Nikolaou, N. (2018). Effect of prohexadione-Ca on leaf chlorophyll content, gas exchange, berry size and composition, wine quality and disease susceptibility in *Vitis vinifera* L. cv Xinomavro. Scientia Horticulturae, 238. DOI: 10.1016/j.scienta.2018.05.008

Wijana, D. A. N. G. (2014). Budidaya Kentang Ramah Lingkungan Melalui Aplikasi Pupuk Organik Shisako. Agrotrop: Journal on Agriculture Science, 2(2). https://jurnal.harianregional.com/agrotrop/id-7823.

Wijayanto, N., & Nurunnajah. (2012). Intensitas Cahaya, Suhu , Kelembaban dan Perakaran Lateral Mahoni (*Swietenia macrophylla King* .) di RPH Babakan Madang, BKPH Bogor, KPH Bogor. Jurnal Silvikultur Tropika, 03(01). DOI: 10.29244/j-siltrop.3.1.%25p

Yordanov, I., Velikova, V., & Tsonev, T. (2003). Plant Responses to drought and stress tolerance. *Bulg. J. Plant Physiol.*