

TREATMENT OF SEEDING TUBER CLOSING AND FUNGICIDE IMMERSION ON GROWTH AND PRODUCTION OF POTATO PLANTS (*Solanum tuberosum* L)

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ABSTRACT

This research was conducted at BBI Kuta Gadung Berastagi, aims to: . a. To determine the effect of seed tuber division on the growth and production of potato plants. b. To determine the effect of soaking Functionda solution on the growth and production of potato plants and c. This study aims to determine the interaction between potato seed tuber division and Functiona solution on growth and production. The experimental design that will be carried out in this study is a factorial randomized block design (RAK). The first factor was the potato seed tuber division test (Y) consisting of Yo (without division), Y1 (splitting into 2), Y2 (splitting into 4). Factor II is testing the fungicide dose (D) consisting of Do (without fungicide), D1 (1g/lt water), D2 (3 g/lt water) and D3 (6 g/lt water).

Based on the results of the research conducted, it can be seen that the use of seed tuber division gave a significantly different effect ($p > 0.05$) on plant height growth at 5 and 6 mst, Production (per sample and plot) and as seed the best was without division (Yo . The use of fungicide dose (D) also had a significantly different effect ($p > 0.05$) on plant height growth (5 and 6 wt.) and production. The effect of treatment combinations based on the analysis did not show a significantly different effect ($p < 0.05$) and as a recommended dose. The method used was a combination of seeds without division and the use of fungicides at 3 g/l water (YoD2).

Keywords: Potato, Cleavage of tubers, Fungicide.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is a plant of the Solanaceae family that has edible stem tubers. This plant is a short plant, not annual woody and likes a cool climate suitable for planting in the highlands (Samadi, 2007). Farmers usually make seeds by setting aside production that is between 30-50 grams in size, without defects, in good shape and harvested at an early age. The best storage warehouse is 80-95% humidity, 6-7 months storage time at 25°C. Perform control and selection every month, discard the damaged or rotten (Fitri Surya Setiadi. (1999). By using a spacing of 70 x 30 cm, the need for seeds is 1,300 - 1,700 kg/hectare, tubers are ready for planting with shoots of 2 cm long and can be planted directly. Data from the Ministry of Agriculture shows that the need for potato seeds reaches 120,000 tons for a total land area of about 80,000 hectares, while the transfer rate of certified seeds only reaches 4.9% (Anonymous, 2008).

During the last four years the number of potato seeds has always been lacking and the price has skyrocketed, this is due to the lack of seed production from the Potato Seed Center (BBK) in Indonesia. Cleavage of seed tubers is able to suppress the need for potato seeds, therefore the authors conducted a study entitled "Treatment of Cleavage of Seed Bulbs and Functional Soaking of Potatoes (*Solanum tuberosum* L.) Growth and Production". Soaking

with a fungicide solution aims to kill and prevent pathogen attacks, where the function is a substance to poison or kill fungi which are plant diseases.

THEORETICAL FRAMEWORK

Potato Plant Botany

The stems are rectangular or pentagon-shaped, depending on the variety, not woody, and slightly hard textured. Potato stems are generally weak so they easily collapse when exposed to strong winds. Stem color is generally dark green with purple pigment. The surface of the stem is smooth, branched, and each branch is overgrown by lush leaves, the stem segments where the branches grow. (Samadi, 2007).

The leaves of the potato plant are leafy, alternate on the stem, oval, slightly rounded and tapered, and bony. The leaves are wrinkled and the lower surface of the leaves is hairy. Leaf color is light green to dark green to gray. Medium leaf size with short stalks, (Hendro Sunaryono, 2007). Potato plants have a tap and fibrous root system. The taproot can penetrate the soil to a depth of 45 cm, while the fibrous roots grow to the side. Plant roots function to absorb nutrients and to strengthen the establishment of plants (Samadi, 2007). Some potato plants are flowering and some are not flowering, the color of the flowers varies, the stamens are yellow while the pistils are white. Potato flowers grow from the axils of the top leaves. The number of flower bunches varies, potato flowers have two sexes (perfect flowers). Pollinated flowers will produce fruit and seeds. The fruit is round, measuring 2.5 cm, in which there are many seeds (Setiadi, 2007). Potato tubers are formed from the swollen tips of the stolons, which consist of carbohydrates, proteins and minerals. At the end of the tuber there are many scaly buds, these eyes can grow into new plants (Hendo Sunaryono, 2007).

Growing Conditions

Areas with an average rainfall of 1500 mm/year are very suitable for cultivating potatoes. Its effect on plant growth will be closely related to the availability of ground water. Areas that often experience strong winds are not suitable for potato cultivation, because strong winds can accelerate the evaporation of groundwater. As a result, the soil becomes dry and hardens quickly. Long irradiation 9-10 hours / day, optimal temperature for growth 18-21°C, humidity 80-90%, high humidity makes plants susceptible to pests and diseases. Good soil for growing potato plants is sandy loam, sandy loam, crumbly structure, loose, rich in organic matter, well drained and has a deep tillage layer.

The suitable soil pH for potato plants varies between 5.0 - 7.0, depending on the variety. Absolute liming is given to soils that have a pH value of less than 5.0 (Julkarnain, 2013). Areas suitable for growing potatoes are highlands with an altitude of between 1,000 – 2,000 m above sea level. The ideal altitude ranges from 1000 - 1300 m above sea level (Julkarnain, 2013)

Bulbs are ready to be planted when 2 cm shoots have been grown, tubers can be planted directly without splitting. But with tuber division, more seeds can be produced so that it can save the need for seed tubers. Cut the tuber into several parts according to the buds; The Role of Fungicides Against Cleavage of Potato Seed Bulbs: Protects against fungal diseases, Keeps sprouts growing properly, Prevents decay. Fungicides are substances to poison or kill fungi which are plant diseases, in powder form to control fungal diseases and prevent the formation of spores in fungi.

METHOD

The design used in this study was a factorial randomized block design (RAK) with 3 replications, while the treatments to be tested were as follows: Factor I: Splitting of seed tubers with symbols: Y: Y0: Without splitting (control), Y1: Splitting into 2, Y2: Split 4. Factor II: Giving the fungicide with the symbol "D" namely: D0: No fungicide, D1: Soaking at a concentration of 1 gr/liter, D2: Soaking at a concentration of 3 gr/liter, D3: Soaking at a concentration of 6 gr/liter. Parameters Observed: Plant height (cm), Number of main branches, Bulb weight per sample (kg), Bulb weight per plot (kg).

DISCUSSION

Plant height.

The growth of potato plant height from potato seedling division testing and fungicide application was carried out since the plants were 2 weeks after growing (WST) until the age of 6 weeks with 1 week intervals. The results of the measurements for each observation carried out by statistical analysis showed that there was no significant difference ($p < 0.05$) since the plant was 2 weeks to 4 weeks old, but the effect of the treatment was visible and showed a significant difference ($p > 0.05$) after the plants were 5 weeks old as shown. in Table 1.

Table 1. Average plant height growth from the effect of potato seedling division and the use of fungicides 2, 3, 4, 5 and 6 weeks after growing (wag).

Treatment	2 wag	3 wag	4 wag	5 wag	6 wag
Yo	10.24 a	18.53 a	26.52 a	36.53 a	49.94 a
Y1	10.17 a	18.20 a	25.83 a	35.68 ab	49.08 ab
Y2	9.74 a	17.45 a	25.36 a	34.90 b	48.32 b
Do	9.77 a	17.13 a	25.14 a	34.73 c	48.23 c
D1	10.59 a	18.14 a	25.71 a	35.02 b	48.52 bc
D2	9.94 a	17.72 a	26.44 a	36.43 ab	49.56 ab
D3	9.90 a	19.26 a	26.32 a	36.64 a	50.14 a

Note : The letters in the same average column are not significantly different at the 5% level.

The results of the analysis from observations of plant height growth (Table 1) showed that since observation 2 mst with the growth of each treatment with an average of 9.74 to 10.24 cm, the effect of seedling division on plant height growth continued to increase according to the ability of the treatment to reach 6 mst. The effect of potato tuber seedling division was clearly visible at 6 mst. The use of seeds divided by two (Y1) is the provision of seeds that can still be used optimally with plant height at 6 mst an average of 49.08 cm with no significant difference to intact seeds (Yo) an average of 49.94 cm ($p < 0.05$) and to seedlings divided by 4 (Y2) with an average of 48.32 cm. However, Yo treatment was significantly different from Y2 ($p > 0.05$).

Table 1 also shows that plant height growth is affected by the use of fungicide doses. The effect of fungicide dose on plant height growth since 2 mst showed that the plant height was not significantly different between the doses used ($p < 0.05$). Observations of plant height

were carried out at 6 mst. It could be seen (Table 1) that there was a significant difference ($p > 0.05$) from the effect of using different doses of fungicides.

Observations of 6 mst plant height could be carried out with a fungicide dose of 3 g/liter of water (D2) with an average plant height of 49.56 cm, with no significant difference compared to a higher dose in the D3 treatment (6 g/l water) on average. plant height was 50.14 cm taller but not significantly different ($p < 0.05$). Without fungicide, it had a negative effect on plant height growth with an average of 48.23 cm with no significant difference to the use of a dose of 3 g/l water (D1) with an average height of 48.52 cm.

The combination treatment between the use of cleavage tubers as seeds on plant height growth gave an effect that was not significantly different ($p < 0.05$). The use of dividing the tubers into 2 (Y1) and a dose of fungicide at 3 g/l of water (D2) as shown in Table 1 (Y1D2) gave optimum plant height growth, although the use of each shoot dose was increased with the average plant height being increased. higher, but not significantly different ($p < 0.05$). Growth will decrease if one factor is the dose of fungicide or tuber division is increasing.

Number of Main Branches

The results of observing the number of main branches of potato plants during growth from the effect of division of tubers that were used as seeds and the use of fungicide doses carried out before harvest with analyzed data obtained a significant difference ($p < 0.05$). The results of the average number of main branches from the effect of tuber division and the use of fungicide doses can be seen in Table 2.

Table 2. Average number of main branches of potato plants from the effect of tuber division and use of fungicide doses.

Treatment	Yo	Y1	Y2	Total	Average
Do	1.92	1.50	1.33	4.75	1.58 a
D1	2.25	1.83	1.17	5.25	1.75 a
D2	1.75	1.83	2.00	5.58	1.86 a
D3	1.83	2.00	2.08	5.92	1.97 a
Total	7.75	7.17	6.58	21.50	
Average	1.94 a	1.79 a	1.65 a		1.79

Notes: The letters in the same column and row on average are not significantly different at the 5% level.

The treatment of dividing tubers into seeds (Y) had an insignificant effect on the formation of the number of main branches of potato plants, however, complex seeds (Yo) were the number of main branches with the highest average of 1.94 branches and the use of cleavage treatment gave more results. which is not significant to the number of main branches. As can be seen, the seedlings were split into 4 (Y2), which was the lowest number of branches with an average of 1.58 branches. Fungicides in different doses show that the higher the dose used, the greater the number of main branches. This can be seen in the use of a dose of 6 g/l water (D3) with an average number of main branches of 1.97 branches, while without fungicide (Do) is the least number of main branches with an average of 1.58 branches, but the two are not significantly different ($p < 0.05$). The combination of treatment between potato tuber seedling

division treatment and the use of fungicides on the production of the number of main branches based on the results of statistical analysis did not provide significantly different interactions ($p < 0.05$).

Bulbs Production per sample (grams).

The results of observations of tuber weight per sample from the effect of divided seeds (Y) and fungicide dose (D) on potato plants and their analysis can be seen in Table 3.

Table 3. Average tuber weight per sample (g) of the effect of tuber division and fungicides at harvest on Potato plants.

Treatment	Yo	Y1	Y2	Total	Average
Do	487.75	493.39	440.79	1421.92	473.97
D1	502.55	471.88	489.40	1463.83	487.94
D2	511.60	490.87	492.73	1495.20	498.40
D3	520.62	498.72	493.18	1512.52	504.17
Total	2022.51	1954.85	1916.11	5893.47	
Average	505.63	488.71	479.03		491.12

Note: The letters in the same column and row on average are not significantly different at the 5% level

The results of observations of potato production for tuber weight per sample, the effect of potato seedling division (Y) there was a significant difference ($p > 0.05$). It can be seen that the weight of tubers per sample obtained in the treatment of using [cleavage into 2 (Y1), the average tuber/plant weight was 505.63 grams, followed by higher production with treatment without tuber division (Yo) an average of 488.71 grams with not significantly different ($p < 0.05$). Compared to seeds from division into 4 seedlings (Y2), they produced the fewest tubers/plants with an average of 479.03 grams, with no significant difference to Y1 but significantly different to Y2.

The administration of several levels of fungicide dose (D) on production with tuber weight per sample gave a significant effect ($p > 0.05$). It can be seen that the optimum production was obtained at a dose of 3 g/lt water (D2) with an average of 498.40 g/plant, with no significant difference to a higher dose ($p > 0.05$) at 6 g/lt water (D3) with an average of 504.17 g/plant also the use of a dose of 1 g/lt of water (D1) resulted in an average production of 487.94 g/sample which was not significantly different ($p < 0.05$). Without the use of fungicides (Do) was the lowest yield of potato tuber production an average of 473.97 g/plant with a significant difference to the treatment using fungicides on D1, D2 and D3 ($p < 0.05$). The results of observations and analysis showed that there was an interaction that was not significantly different between the treatment of tuber division for seeds (Y) and fungicides (D) on the yield of the number of tubers per plant. However, to obtain the optimum production weight per plant, the seeds were used without division with a fungicide at 3 g/lt water (YoD2).

Bulbs Production/Plot (kg)

The results of observations of tuber weight/plot from the effect of seeds by division (Y) and fungicide dose (D) on potato plants and their analysis can be seen in Table 4.

Observations on potato production for tuber weight per plot showed that the effect of potato seedling division (Y) was significantly different ($p > 0.05$). It can be seen that the highest tuber weight/plot was obtained in the treatment using bulbous seeds without division (Yo), an average weight of 5.54 kg/plot with a significant difference to the treatment with tuber division into seeds (Y1 and Y2). The tubers were divided into 2 (Y2) with a production of 5.38 kg/plot, but it was not significantly different ($p < 0.05$) against Y3 (seeds divided by 4) with an average of 5.27 kg/plot.

Table 4. Average tuber weight per plot (kg) of the effect of tuber division and fungicides at harvest on Potato plants.

Treatment	Yo	Y1	Y2	Average
Do	5.37	5.43	4.85	5.21 c
D1	5.53	5.19	5.38	5.37 b
D2	5.63	5.40	5.42	5.48 ab
D3	5.64	5.49	5.43	5.52 a
Average	5.54 a	5.38 b	5.27 b	5.40

Note: The letters in the same column and row average are not different real at 5% level

The administration of several levels of fungicide dose (D) on production with tuber weight per plot gave a significant effect ($p > 0.05$). It can be seen that high production with the recommended dose was obtained at a dose of 3 g/lt water (D2) with an average of 5.48 kg/plot, with no significant difference ($p < 0.05$) to higher doses ($p > 0.05$).) at 6 g/lt water (D3) with an average of 5.52 kg/plot also the use of a dose of 1 g/lt water (D1) resulted in production with an average of 5.37 kg/plot not significantly different ($p < 0.05$). Without the use of fungicides (Do) was the lowest yield of potato tuber production an average of 5.21 kg/plot with a significant difference to the treatment using fungicides on D1, D2 and D3 ($p < 0.05$).

The results of observations and analysis showed that there was an interaction that was not significantly different between the treatment of tuber division for seeds (Y) and fungicides (D) on the yield of the number of tubers per plant. However, to obtain the optimum production weight per plant, the seeds were used without division with a fungicide at 3 g/lt water (YoD2).

Discussion

Effect of tuber division on growth and production Potato Plant

From field observations and statistical analysis results, it was found that the effect of the treatment of tuber division into seeds (Y) showed a significant difference ($p > 0.05$) on plant height at 5 and 6 mst, number of tubers per plot, tuber weight per plant and production/plots. But the treatments were not significantly different to plant height at 2, 3 and 4 mst. Overall, the higher the dose of organic fertilizer given to potato plants during growth will increase growth and production.

The production per plot produced is the most important in potato planting using round potato seeds (100% or Yo). This was due to the undisturbed food reserves of the shoots as a

result of the cuts made. Apart from that, cuts caused by cuts result in uncontrolled discharge of water <http://winnamags.blogspot.com/2013/04/>.

Apart from that, by cutting the tubers, the plants will become infected with diseases caused by fungi that cause plant growth to be disrupted. This happens as a result of seeds that contain a lot of water so that the humidity is high. With high humidity, it is easy for plants, both still seeds and in growth, to be contaminated with fungi that cause disease (Soelarso, 1997). Cut seeds or tubers cause disruption of hormones that exist during growth. This is supported by Setiadi (2000) which states to determine growth and hormone-dependent production as a crop stimulant in addition to other factors that are not supportive during plant growth (Bukit, 2008; Soewito, 1990).

Setiadi (2000) states that one of the limiting factors in plant growth and development is the absorption of essential (essential) nutrients. In the growth process, plants absorb nutrients so that metabolic processes occur, including cell growth. With the division of seedlings, the apical shoots of the plant can inhibit the growth of lateral shoots. These shoots lateral shoots can reduce growth so that the number of stems is reduced (Holmes et al., 1970, Sekhon and Singh, 1984).

Potato growth and production is highly dependent on rainfall and its distribution, rainfall between 200-300 mm per month or an average of 1000 mm during growth is one of the conditions for growing potato plants (Mad Rais Zauhari et al, 1994). Apart from that, air temperature affects the increase in starch and sugar content in tubers. Soil temperature less than 15°C can cause low starch content in tubers. If the temperature exceeds 23°C the leaves will usually be small and the internodes will be long. (Soelarso, 1997). Air humidity suitable for potato plant growth is 80% - 90% and rainfall of 1,500 mm per year is very suitable for potato cultivation (Samadi, 1997).

Good and suitable soil for potato plants is crumb structure, loose, rich in organic matter, fertile, easy to bind water and deep soil solum with little sand content (Rukmana, 2002). The degree of soil acidity (pH) suitable for potato plants varies between 5.0 – 7.0 depending on the variety. (Samadi, 1997). Good and suitable soil for potato plants is crumb structure, loose, rich in organic matter, fertile, easy to bind water and deep soil solum with little sand content (Rukmana, 2002: Samadi, 1997).

Effect of fungicide dose on growth and production Potato Plants.

The results of statistical data analysis showed that the effect of fungicide application with several doses had a significant effect on plant height (5 and 6 mst), number of tubers per plant (knor), tuber weight per plant (g), tuber production/plot (kg). But the treatment was not significant ($p < 0.05$) on plant height (2, 3 and 4 mst). Overall, the higher the dose of fungicide given to the plant will suppress the humidity that can invite infection of tubers and as a result of complete growth can increase the growth and production of potatoes that can be produced in potato plants.

The addition of fungicides in sweet potatoes, especially tubers that are cut off is to increase the strength to grow which can disrupt plants by consuming nutrients from the soil. Nutrient supply can be increased by taking optimum action that will increase the potential of plant production. While the level of application of fungicides that are too low or too high will

result in inhibition of the physiological process of plant growth. The application of fungicides has an effect on increasing the absorption of water and nutrients in plants so that they can prevent plants from wilting, increase disease resistance, enlarge tubers and increase tuber shelf life (Soelarso, 1997).

There was no significant effect on the onset of plant height growth from 2 to 4 mst presumably because the role of fungicides in suppressing disease had not been seen, whereas after 5 weeks the effect of fungicides in suppressing several diseases was seen, resulting in different production.

In accordance with the opinion of Rukmana (2002), that if the production component increases, then at some point the increase will decrease, where by increasing the dose exceeding the maximum, it does not maximize production results. By giving different doses, there is an effect on all the parameters observed, this is because inorganic fertilizers are able to add nutrients to the soil and are sufficient for plant development. One factor is more dominant than other factors, then these other factors will be covered and have no effect on plants, Gomez and Gomez (1995).

CONCLUSION

The shape of tuber seeds (Y) is very influential on increasing growth and production in potato plants by using seeds without division (Yo), compared to seeds that experience division. Dosage of fungicides to avoid disease infection can change the growth and production of potato plants with the use of fungicide doses of 3 g/l water (D3). This study used a fungicide dose of 3 g/l of water and without division of tubers the seeds provided good growth and production of potato plants, therefore further research was needed using different commodities.

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