

## The Effect of Providing Chicken Manure and Chicken Egg Shell Powder on the Growth and Yield of Tomato (*Solanum Lycopersicum L.*) Plant

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**ABSTRACT:** This study aims to determine the growth response and production of tomato plants (*Solanum lycopersicum L.*) provision of chicken manure and chicken eggshell powder. This research was conducted in Blang Ciri Village, Peusangan Siblih Krueng District, Bireuen Regency, taking place from July to September 2023. The method used in this study was a factorial Randomized Block Design (RBD) consisting of 2 factors and 3 repetitions. The first factor is the application of chicken manure which consists of 4 levels, namely A0 = control (without chicken manure), A1 = 150 grams/polybag, A2 = 300 grams/polybag and A3 = 450 grams/polybag. The second factor was giving chicken egg shell powder which consisted of 4 levels, namely C0 = control (without chicken egg shell powder), C1 = 60 grams/polybag, C2 = 80 grams/polybag and C3 = 100 grams/polybag. Parameters observed were plant height, number of productive branches, fruit number, fruit diameter, fruit weight and fruit weight per plant. The results showed that the application of chicken manure affected all observed parameters and the administration of chicken egg shell powder affected all observed parameters, but did not affect the number of harvest I fruit. The treatment interaction had a significant effect on plant height at 45 HST, weight fruit and fruit diameter harvest I. The best application of chicken manure was found in treatment A3 450 grams/polybag and the best application of chicken egg shell powder was found in treatment C3 100 grams/polybag to increase the growth and yield of tomato plants.

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### INTRODUCTION

Tomato plants (*Solanum lycopersicum L.*) are one of the horticultural commodities of the family Solanaceae has high economic value and has great potential for development. Tomato is a vegetable This annual fruit is in the form of a shrub with a unique fruit taste, namely a combination of sour, sweet and fresh. According to Wijayanti and Susila (2013), apart from being a vegetable, tomatoes are also used as raw materials for medicines, cosmetics as well as raw materials for food processing such as sauces, fruit juices and others, which are tomatoes It is very multipurpose, making tomatoes very popular among various groups society. Market demand for tomatoes continues to increase, this cannot be separated from the role of tomatoes as one of the horticultural commodities that has many uses. Based on data from the Central Statistics Agency (2020), production tomatoes in Aceh in 2019 amounted to 20,821 tons, then in 2020 there was a decrease of 20,781 tons. The decline in tomato production in Aceh is thought to have occurred due to soil degradation due to the use of chemical fertilizers in the long term by tomato farmers. Tomato farmers generally use chemical fertilizers for increase the productivity of tomato plants. Chemical fertilizers applied to the soil can cause soil pollution, decreased soil nutrient levels and soil compaction (Triyono, 2013). Fertilizer use chemicals in the long term besides having a bad impact on the land or the environment, also have an impact bad for humans because chemical fertilizers are made from unfriendly chemicals or inorganics environment. The increasingly expensive price of chemical fertilizers is also very burdensome for tomato farmers, because It requires appropriate alternatives for this condition. One alternative that can be used to overcome this. The negative impact of the use and high price of chemical fertilizers is using organic fertilizers like chicken manure.

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Chicken manure is a type of organic fertilizer in solid form that contains lots of water and mucus. Chicken manure has natural properties and does not damage the soil, providing macronutrients nitrogen, phosphorus, potassium, calcium and sulfur and micronutrients iron, zinc, boron, cobalt and molybdenum (Putra et al, 2019). Based on research from Supriadi (2014), it shows the provision of fertilizer chicken coop with a dose of 500 grams per tomato plant produces plant height, number of leaf branches, flowering age and the number of fruit at harvest are more optimal in the growth of tomato plants. Besides chicken manure, egg shell powder also has the potential as an organic fertilizer that can be used by tomato farmers in meeting the nutrient needs of tomato plants. Egg shell powder is a powder which comes from egg shells that have undergone a drying and sieving process. Egg shell has potential as an organic fertilizer because it contains nutrients that plants need, such as calcium carbonate, nitrogen, potassium and phosphorus. According to Syahren et al (2012), the use of egg shell powder is proven can reduce the development of fruit butt rot or blossom end rot significantly, so the powder Egg shells are suitable for use as fertilizer for tomato plants that often experience blossom end rot.

Based on the research results of Halid et al (2021), it shows that giving eggshell fertilizer with a dose of 80 grams per tomato plant produces plant height, number of leaves, number of branches, emergence time fastest flowering, highest number of fruit plants, highest fruit weight, highest fruit length and fruit circumference largest compared to other treatments.

### **RESEARCH MATERIALS AND METHODS**

#### **Time and Place of Research**

This research was carried out in Blang Cirih Village, Peusangan Siblih Krueng District, Bireuen Regency. The research will take place from July to September 2023.

**Tools and materials** The tools used in this research consisted of seedling polybags measuring 10 x 15 cm and planting polybag size 35 x 40 cm with a volume of 10 kg, manual scales, digital scales, calipers, stakes, raffia rope, gembor, processing board, measuring tape, hoe, tray, blender, sieve, scissors, writing equipment and digital camera. The materials used in this research consisted of Servo F1 variety tomato seeds, fertilizer chicken coop, egg shell powder, soil and water.

#### **Experimental design**

The experimental design used in this research was a factorial Randomized Group Design (RAK) which consists of two treatment factors, namely chicken manure (A) and egg shell powder (C). Factor I: Chicken Manure (A) consists of 4 levels: A0 = Without giving chicken manure (Control) A1 = 150 gram/polybag (30 tons/Ha), A2 = 300 grams/polybag (60 tons/Ha), A3 = 450 grams/polybag (90 tons/Ha. Factor II: Egg shell powder (C) consists of 4 levels C0 = Without giving egg shell powder (Control) C1 = 60 gram/polybag (12 tons/Ha), C2 = 80 grams/polybag (16 tons/Ha), C3 = 100 grams/polybag (20 tons/Ha).

The mathematical model used for the factorial Randomized Block Design (RAK) is:

$$Y_{ijk} = \mu + \beta_i + A_j + C_k + (AC)_{jk} + \epsilon_{ijk}$$

#### **Research Implementation**

##### **Making egg shell powder**

The egg shells are cleaned of egg remains, washed thoroughly and dried in the sun under sunlight for 2 days, after that the dried egg shells are crushed using hand then blend and sift using a sieve so that the resulting powder is not mixed with egg shells that are still rough and the powder can be used directly. To produce 1 kg of powder egg shells, 300 egg shells are needed.

##### **Land Clearing**

Land cleaning is carried out by clearing the land of various types of weeds, plant roots and other plant remains so that they do not become a nest for pests and diseases that can disturb the plants cultivation, as well as making it easier when placing polybags. Land clearing is carried out using hands, hoes and machetes.

##### **Nursery**

The seeding is carried out in polybags measuring 10 x 15 cm filled with planting media in the form of soil and husks in a ratio of 2:1, then the tomato seeds are planted 1 cm deep. Each polybag contains 1 tomato seed, then cover the seed again with planting medium and water it. Do watering every 2 times a day, then place the polybag nursery in a shady place but still gets sunlight sufficient. Seeds are sown for 21 days.

##### **Planting Media Preparation**

Preparation of the planting medium is done by hoeing the top soil to form chunks of soil to become more loose, then the soil is sifted and filled into planting polybags.

##### **Transplanting Seedlings**

Transplanting seeds is done by moving tomato seedlings that are 21 days old into polybags measuring 35 x 40 cm. The seedlings are transferred in the afternoon by carefully opening the polybag for the seedlings, after that take 1 tomato plant seed along with the seedling soil and plant it in a new polybag in position. Tomato plants are replanted in the middle of the polybag, then the roots of the tomato plants are covered. Again, use the planting medium with the area around the roots compacted and pressed so

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that the plant grows tomatoes do not shake, then the tomato plants are watered. Water twice a day, namely in the morning and evening. In accordance with conditions in the field.

### Providing Chicken Manure

Chicken manure is given once, namely 14 days before transplanting the seedlings plant tomatoes by mixing chicken manure with the planting medium.

Chicken manure given according to treatment.

### Giving Chicken Egg Shell Powder

Chicken egg shell powder was given once, namely 14 days before transfer tomato plant seeds by mixing egg shell powder with the planting medium. Powder Chicken egg shells are given according to treatment.

### Maintenance

Plant maintenance includes:: watering, replanting, weed control, loosening, pruning water shoots, installing stakes, and controlling plant pest organisms.

### Harvesting

Harvesting is done when the plants are 70 HST. Determination of harvest time is determined visually, namely by looking at the color of the skin and texture of the fruit, the color of the pistil and stem and the edges of the leaves old dries up. Harvesting is done manually using sharp scissors.

### Observation

The observation parameters carried out include: plant height, number of productive branches, number of fruit, fruit diameter, fruit weight per fruit and fruit weight per plant.

## RESULTS AND DISCUSSION

### 1. Effect of Chicken Manure

#### 1. Plant Height (cm)

Average value of tomato plant height at 15, 30 and 45 HST due to manure treatment chickens after the BNT0.05 test are presented in Table 2.

**Table 2. Average Value of Tomato Plant Height at the Age of 15, 30 and 45 DAP Due to Manure Treatment Chicken**

Chicken Manure Treatment	Plant height (cm)		
	15 HST	30 HST	45 HST
A0 = Kontrol	16,05 <sup>a</sup>	31,26 <sup>a</sup>	49,80 <sup>a</sup>
A1 = 150 grams/polybag	17,73 <sup>b</sup>	34,98 <sup>b</sup>	66,93 <sup>b</sup>
A2 = 300 grams/polybag	17,20 <sup>b</sup>	36,85 <sup>b</sup>	64,30 <sup>b</sup>
A3 = 450 grams/polybag	18,75 <sup>c</sup>	43,48 <sup>c</sup>	74,50 <sup>c</sup>
BNT0,05	0,72	2,58	3,22

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05

Based on Table 2, it shows that chicken manure treatment has a very significant effect on tomato plant height at 15, 30 and 45 HST. The highest plant height is at the age of 15, 30 and 45 HST was found in treatment A3 (chicken manure 450 grams/polybag), while the lowest plant height at the ages of 15, 30 and 45 HST were found in treatment A0 (control). This is thought to be due to the application of fertilizer 450 gram/polybag chicken coop is able to increase the availability of macro and micro nutrients in the chicken soil becomes more available as the availability of nutrients that are much needed for supports the growth and development of tomato plants, especially in the vegetative phase, which is the phase. This N element plays an important role in stimulating overall plant growth, especially stems tomato plants so that the height growth of tomato plants in treatment A3 is better than tall tomato plants in treatment A0.

The nitrogen element contained in chicken manure is 3 times higher than in manure other. The presence of sufficient nitrogen can facilitate the process of plant cell division well because Nitrogen has a major role in stimulating overall growth, especially in stem growth thus affecting plant height growth (Riyawati, 2012).

#### 2. Number of Productive Branches (branches)

The average value of the number of productive branches at the age of 45 HST due to chicken manure treatment after the BNT0.05 test is presented in Table 3.

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**Table 3. Average Value of the Number of Productive Branches of Tomato Plants at the Age of 45 HST due to fertilizer treatment chicken coop.**

Perlakuan Pupuk Kandang Ayam	Jumlah Cabang Produktif (cabang)
	45 HST
A0 = Kontrol	1,83 <sup>a</sup>
A1 = 150 gram/polybag	2,16 <sup>b</sup>
A2 = 300 gram/polybag	2,33 <sup>c</sup>
A3 = 450 gram/polybag	3,00 <sup>d</sup>
BNT0,05	0,23

Note: Numbers followed by the same letter in the same column are not significantly different test BNT 0.05

Based on Table 3, it shows that chicken manure treatment has a very significant effect on the number of productive branches of tomatoes at 45 HST. The best number of productive branches at 45 HST found in treatment A3 (450 gram chicken manure/polybag) and the lowest number of productive branches at the age of 45 DAP it was found in treatment A0 (control). This is thought to be due to the role of the nutrients N, P and K contained in chicken manure can increase the growth of productive branches of tomato plants.

The N element plays a role in forming amino acids which will be converted into proteins that will later be used in the formation of new cells, tissues and organs, while the elements P and K play a role in stimulating removal and formation of fruit so that this can increase the number of productive branches of the plant tomato.

According to research by Pradana (2013), giving a dose of 20 tons/ha of chicken manure gave the highest results for plant height, number of leaves, fruit diameter and weight per fruit, 25 tons/ha of chicken manure gave the highest results for number of branches, number of flower bunches, number of fruit and total fruit weight.

### 3. Number of Fruits (Fruits)

The average value of the number of fruit in harvests I, II and III due to chicken manure treatment after the BNT0.05 test is presented in Table 4.

**Table 4. Average Value of Number of Fruits on Tomato Plants in Harvest I, II and III Due to Chicken Manure Treatment**

Chicken mature Treatment	Number of Fruits (fruits)		
	Harvest I	Harvest II	Harvest III
A0 = Kontrol	2,33 <sup>a</sup>	3,50 <sup>a</sup>	2,50 <sup>a</sup>
A1 = 150 grams/polybag	3,16 <sup>b</sup>	5,50 <sup>b</sup>	4,00 <sup>b</sup>
A2 = 300 grams/polybag	3,16 <sup>b</sup>	6,16 <sup>c</sup>	4,50 <sup>b</sup>
A3 = 450 grams/polybag	3,83 <sup>c</sup>	6,83 <sup>d</sup>	4,66 <sup>b</sup>
BNT0,05	0,54	0,53	0,66

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05.

Based on Table 4, it shows that chicken manure treatment has a very significant effect on the number of tomatoes in harvest I, II and III. The best number of tomatoes in harvests I, II and III were found in treatment A3 (chicken manure 450 grams/polybag). This is thought to be due to the nutritional content contained in chicken manure is able to meet the nutritional needs of tomato plants in the generative phase so that the process of tomato fruit formation runs normally, which can increase the number of tomatoes produced. In accordance with the statement by Jannah et al (2012) that chicken manure is included organic fertilizer that undergoes a process of changing the chemical composition and condition of the feces over time fast, so the decomposition process of organic material with planting media is also fast, hence the availability and the uptake of nutrients in tomato plants increases. According to Budiman (2004) metabolism plants will be more active if the nutrients available to the plant are sufficient during growth the process of cell elongation, division and differentiation will be better and ultimately will encourage increased the number of fruit, so that the number of tomatoes in treatment A3 (chicken manure 450 gram/polybag) in harvests I, II and III had a very significant effect compared to treatment A0 (control).

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## 4. Fruit Diameter (cm).

Average value of fruit diameter in harvests I, II and III due to chicken manure treatment after the BNT0.05 test is presented in Table 5.

Chicken Mature Treatment	Fruit Diameter (cm)		
	Harvest I	Harvest II	Harvest III
A0 = Kontrol	3,35 <sup>a</sup> 3,64 <sup>a</sup>		3,62 <sup>a</sup>
A1 = 150 grams/polybag	3,93 <sup>b</sup> 3,82 <sup>b</sup>		3,78 <sup>b</sup>
A2 = 300 grams/polybag	3,92 <sup>b</sup> 3,95 <sup>c</sup>		3,88 <sup>c</sup>
A3 = 450 grams/polybag	4,04 <sup>c</sup> 3,97 <sup>c</sup>		3,93 <sup>d</sup>
BNT0,05	0,09 0,06		0,09

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05.

Table 5 shows that chicken manure treatment has a very significant effect on diameter tomatoes in harvest I, II and III. The best tomato fruit diameters in harvests I, II and III were found in the treatments A3 (chicken manure 450 grams/polybag). This situation is thought to be due to the provision of chicken manure able to increase the availability and absorption process of P and K nutrients to increase weight and size tomatoes so as to increase the diameter of the tomatoes produced.

The element phosphorus plays an important role in plant reproduction, such as playing a role in fruit formation (Arifah et al, 2019). The K nutrient helps increase yields in the form of flowers, fruit, color and flavor carbohydrates and proteins are useful for fruit growth, so they can influence enlargement fruit size and fruit diameter (Putra et al, 2019).

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05.

## 5. Fruit Weight and Fruit Weight Per Plant (Fruit)

Average value of fruit weight and fruit weight per plant at harvest I, harvest II and harvest III. The effects of chicken manure treatment after being tested at BNT0.05 are presented in Table 6.

**Table 6. Average Value of Fruit Weight and Fruit Weight Per Tomato Plant in Harvest I, II and III Due to treatment chicken manure**

Chicken Mature Treatment	Fruits Weight (grams)		
	Harvest I	Harvest II	Harvest III
A0 = Control	24,48 <sup>a</sup>	30,64 <sup>a</sup>	31,17 <sup>a</sup>
A1 = 150 grams/polybag	36,78 <sup>b</sup>	34,91 <sup>b</sup>	33,05 <sup>b</sup>
A2 = 300 grams/polybag	36,39 <sup>b</sup>	36,34 <sup>b</sup>	34,02 <sup>b</sup>
A3 = 450 grams/polybag	39,37 <sup>c</sup>	37,44 <sup>c</sup>	34,76 <sup>c</sup>
BNT0,05	2,11	1,95	1,65

  

Chicken Mature Treatment	Fruit Weight Per Plant (gram)		
	Harvest I	Harvest II	Harvest III
A0 = Kontrol	56,60 <sup>a</sup>	107,23 <sup>a</sup>	77,57 <sup>a</sup>
A1 = 150 grams/polybag	114,78 <sup>b</sup>	192,22 <sup>b</sup>	131,97 <sup>b</sup>
A2 = 300 grams/polybag	116,06 <sup>b</sup>	223,83 <sup>c</sup>	153,91 <sup>b</sup>
A3 = 450 grams/polybag	150,70 <sup>c</sup>	255,22 <sup>d</sup>	161,92 <sup>c</sup>
BNT0,05	21,62	19,05	23,18

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05.

The results in Table 6 show that chicken manure treatment has a very significant effect on fruit weight and fruit weight per plant at harvest I, II and III. Best tomato fruit weight at harvest I, II and III were found in treatment A3 (450 gram chicken manure/polybag) and the lowest weight of tomatoes in harvests I, II and III were in treatment A0 (control), as well as fruit weight per tomato plant. The best results for harvests I, II and III were in treatment A3 (450 gram chicken manure/polybag) and heavy. The lowest fruit per tomato plant in harvests I, II and III was in treatment A0 (control). This is expected because giving chicken manure can not only increase the nutrients in the soil, but also improve the physical and chemical conditions of the soil which is very good

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in supporting the life of microorganisms soil, there by increasing soil fertility and quality. This situation can increase absorption capacity nutrition in the generative phase becomes optimal, thereby increasing the formation and quality of tomato fruit effect on fruit weight and fruit weight per tomato plant.

### 2. Effect of Eggshell Powder

#### 1. Plant Height (cm)

Average plant height at 15, 30 and 45 HST due to treatment with chicken egg shell powder after the BNT0.05 test is presented in Table 7.

**Table 7. Average Height of Tomato Plants at 15, 30 and 45 HST Due to Eggshell powder treatment chicken**

Eggshell Powder Treatment chicken	Height Plant (cm)		
	15 HST	30 HST	45 HST
C0 = Kontrol	16,05 <sup>a</sup>	31,26 <sup>a</sup>	49,80 <sup>a</sup>
C1 = 60 grams/polybag	17,51 <sup>b</sup>	35,85 <sup>b</sup>	53,21 <sup>b</sup>
C2 = 80 grams/polybag	17,21 <sup>b</sup>	35,18 <sup>b</sup>	57,25 <sup>c</sup>
C3 = 100 grams/polybag	17,93 <sup>b</sup>	36,06 <sup>b</sup>	57,93 <sup>c</sup>
BNT0,05	0,72	2,58	3,22

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05

Based on Table 7, it shows that the treatment of chicken egg shell powder has a very big effect significant effect on tomato plant height at 15, 30 and 45 HST. The highest plant height is at the age of 15, 30 and 45 HST found in C3 treatment (chicken egg shell powder 100 grams/polybag) and plant height the lowest at the ages of 15, 30 and 45 HST were in the C0 (control) treatment. This is suspected to be due to the administration of powder Chicken egg shells are able to increase the availability of nutrients in the soil such as increasing elements Ca nutrients are needed in large quantities but not in excess for growth and development tomato plants. Egg shells have the potential to be used as organic fertilizer because they contain the nutrients needed by plants are calcium carbonate, sodium, magnesium, phosphorus, potassium, iron and copper, this element is very good for plant growth (Macrodania et al, 2015) Ca is macro nutrients that play an important role in the formation and growth of plant root hairs. Root hairs functions to expand the reach of the roots in absorbing water and nutrients optimally, so that Tomato plants receive enough nutrients to support their growth processes, such as height growth plant. In accordance with the explanation of Lingga and Marsono (2013), the role of calcium is to stimulate plants formation of root hairs, hardening of plant stems, and stimulating seed formation. Benefits of Calcium on the leaves and stems to neutralize compounds or cause unfavorable conditions in the land.

Symptoms of Ca deficiency in plants result in abnormal root growth plants that cause plants not to get enough nutrients to support vegetative growth plants, so that plant height becomes disturbed and not optimal. According to Sutedjo (2010), there are deficiencies the calcium element causes symptoms such as slightly white, curled, curly or misshaped leaf tips, and abnormal rooting in plants. Excessive Ca nutrients can affect soil pH and causes the soil to become alkaline (with a high pH). Plants find it difficult to grow optimally in alkaline soil, the same as in soil with low or acid pH (Cybext, 2019). According to Ariwibowo's research results (2012), that the provision of egg shells affects the growth and yield of tomato plants. Dose The egg shells used were 0 grams, 10 grams and 15 grams, a dose of 15 gram egg shells had an effect the best for the growth of tomato plant height.

#### 2. Number of Productive Branches (Branch)

The average number of productive branches at the age of 45 DAP due to treatment with chicken egg shell powder after testing BNT0.05 is presented in Table 8.

**Table 8. Average Number of Productive Branches of Tomato Plants at the Age of 45HST Due to Powder Treatment Chicken Egg Shells**

Powder Treatment Chicken Egg shells	Number of Productive Branches (Branch)
	45 HST
C0 = Kontrol	1,83 <sup>a</sup>
C1 = 60 grams/polybag	2,00 <sup>a</sup>
C2 = 80 grams/polybag	2,16 <sup>b</sup>
C3 = 100 grams/polybag	2,33 <sup>b</sup>
BNT0,05	0,23

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05

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Based on Table 8, it shows that the chicken egg shell powder treatment had a significant effect on the number of productive branches of tomatoes at age 45 HST. The best number of productive branches at the age of 45 HST was found in the C3 (egg shell powder) treatment chicken 100 grams/polybag). This is thought to be because giving chicken egg shell powder can increase this. The vegetative growth of tomato plants is influenced by the role of the nutrients contained therein egg shell powder such as the nutrients Ca and Mg. Branches on tomato plants are important because the more branches there are, the more opportunities there are for bigger flowers to appear, so impact on the number of tomatoes.

According to Rosmarkam and Yuwono (2012), in plants Ca plays a role in encouraging earlier root formation and growth, improving plant vigor and resilience, affects the transport of water and other nutrients, necessary for cell elongation, protein synthesis and cell division, helps carbohydrate translocation, cell acidity and permeability, promotes production plants, helps neutralize toxic organic acids. Calcium has the ability to increase plant resistance, this cannot be separated from its role in influencing the work of enzymes and plant metabolism. According to Setiawan's (2019) research results, treatment of chicken egg shell powder 45 g/plant is able to increase the number of productive branches, the number of fruit and the weight of the fruit per plant tomatoes compared to the control treatment.

### 3. Number of Fruits (Fruits)

Average number of fruit in harvests I, II and III due to eggshell powder treatment chickens after the BNT0.05 test are presented in Table 9.

**Table 9. Average Number of Fruits on Tomato Plants in Harvest I, II and III Due to Powder treatment chicken egg shells.**

Powder treatment chicken egg shells	Number of Fruit (Fruit))		
	Harvest I	Harvest II	Harvest III
C0 = Kontrol	2,33	3,50 <sup>a</sup>	2,50 <sup>a</sup>
C1 = 60 grams/polybag	2,66	4,66 <sup>b</sup>	3,33 <sup>b</sup>
C2 = 80 grams/polybag	3,00	4,83 <sup>b</sup>	3,50 <sup>b</sup>
C3 = 100 grams/polybag	3,16	5,66 <sup>c</sup>	3,66 <sup>c</sup>
BNT0,05	-	0,53	0,66

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05

Based on Table 9, it shows that the chicken egg shell powder treatment had a significant effect on the number of tomatoes in harvest II and III. The best number of tomatoes in harvests II and III were found in C3 treatment (chicken egg shell powder 100 grams/polybag), but the number of tomatoes in the first harvest was not have a real impact. It is suspected that giving chicken egg shell powder can increase its availability Ca and P nutrients for plants which influence the quantity of tomato production such as the number of fruit tomatoes in harvest II and II. In line with the statement by Suhastyo and Raditya (2021) that the calcium content contained in egg shell powder is 97%. Chicken egg shell powder is also thought to be capable increasing the phosphorus element in the soil which affects the number of tomatoes produced because increasing the phosphorus element in the soil can increase the percentage of formation flowers become fruit, so the number of tomatoes produced in the C3 treatment has a significant effect on tomato plants compared to the C0 treatment. The number of tomatoes produced in the first harvest did not have a significant effect, it is suspected that this was caused by environmental factors, because at the beginning of the tomato plant removal, the level of rainfall intensity on the land research is so high that this causes the loss of some tomato flowers. This has an impact on the lack of quantity produced in the first harvest, in addition to the ripening of tomatoes at the time. The first harvest was uneven, this is thought to be caused by the very high environmental temperature of the tomato plant research area heat which makes ethylene gas production not optimal so that the number of tomatoes in the first harvest is reduced equally. This is in line with Priyono's (2017) explanation that ethylene gas production is affected by external conditions such as stress from the environment (excessive heat, drought, flood), presence of injuries, number low oxygen and pathogen attack.

### 4. Fruit Diameter (cm).

Average of fruit diameter in harvests I, II and III due to shell powder treatment chicken eggs after testing BNT 0.05 are presented in Table 10.

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**Table 10. Average Fruit Diameter of Tomato Plants at Harvest I, II and III Due to Powder treatment chicken egg shells**

Eggshell Powder Treatment Chicken	Fruit Diameter (cm)		
	Harvest I	Harvest II	Harvest III
C0 = Kontrol	3,35 <sup>a</sup>	3,64 <sup>a</sup>	3,62 <sup>a</sup>
C1 = 60 grams/polybag	3,78 <sup>b</sup>	3,77 <sup>b</sup>	3,68 <sup>a</sup>
C2 = 80 grams/polybag	3,78 <sup>b</sup>	3,82 <sup>b</sup>	3,75 <sup>b</sup>
C3 = 100 grams/polybag	3,85 <sup>b</sup>	3,91 <sup>c</sup>	3,82 <sup>b</sup>
BNT0,05	0,09	0,06	0,09

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05

Table 10 shows that the chicken egg shell powder treatment had a very significant effect on tomato fruit diameter in harvests I and II, but had a significant effect on tomato fruit diameter at harvest III. The best tomato fruit diameters in harvests I, II and III were found in the C3 treatment (shell powder chicken eggs 100 grams/polybag) and the lowest diameter of tomatoes in harvests I, II and III was found in C0 treatment (control). This is thought to be due to the phosphorus content contained in egg shell powder. Chickens are able to improve the quality of tomato production so that they can increase the diameter of tomato fruit. In line with the statement by Syamsudin et al (2014) that the function of the nutrient element phosphorus, namely changing carbohydrates as in the conversion of flour into sugar.

The results of these changes in carbohydrates play a role in fruit formation which has an impact on fruit size and weight, if the availability of phosphorus elements in the soil available to plants will increase the size and weight of the harvested fruit, in addition to phosphorus able to increase the ability of roots to absorb the nutrients N and K. Research results of Halid et al (2021) showed that giving eggshell powder at a dose of 80 grams per crop (p4) produced high yields plants, number of leaves, number of branches, time of fastest flower appearance, highest number of fruit plants, weight highest fruit, highest fruit length and largest fruit circumference compared to other treatments.

**5. Fruit Weight and Fruit Weight Per Plant (fruit)**

Average of fruit weight and fruit weight per plant in harvests I, II and III due to treatment chicken egg shell powder after testing BNT0.05 is presented in Table 11. Table 11. Average Fruit Weight and Fruit Weight Per Tomato Plant in Harvest I, II and III Due to Treatment chicken egg shell powder

Eggshell Powder treatment Chicken	Fruit Weight (grams)		
	Harvest I	Harvest II	Harvest III
C0 = Kontrol	24,48 <sup>a</sup>	30,64 <sup>a</sup>	31,17 <sup>a</sup>
C1 = 60 grams/polybag	33,80 <sup>b</sup>	32,59 <sup>a</sup>	32,33 <sup>a</sup>
C2 = 80 grams/polybag	31,85 <sup>b</sup>	33,93 <sup>b</sup>	33,04 <sup>b</sup>
C3 = 100 grams/polybag	35,94 <sup>c</sup>	34,79 <sup>b</sup>	33,66 <sup>b</sup>
BNT0,05	2,11	1,95	1,65

  

Eggshell Powder Treatment Chicken	Fruit Weight Per Plant (gram)		
	Harvest I	Harvest II	Harvest III
C0 = Kontrol	56,60 <sup>a</sup>	107,23 <sup>a</sup>	77,57 <sup>a</sup>
C1 = 60 grams/polybag	91,17 <sup>b</sup>	151,92 <sup>b</sup>	107,77 <sup>b</sup>
C2 = 80 grams/polybag	95,80 <sup>b</sup>	163,21 <sup>b</sup>	115,65 <sup>b</sup>
C3 = 100 grams/polybag	113,47 <sup>c</sup>	196,66 <sup>c</sup>	123,15 <sup>b</sup>
BNT0,05	21,62	19,05	23,18

Note: Numbers followed by the same letter in the same column are not significantly different test BNT0.05

The results in Table 11 show that chicken egg shell powder treatment had a significant effect on fruit weight and weight per tomato plant in harvests I, II and III, but it has a big influence significant effect on fruit weight per plant in harvests II and III. Fruit weight and weight per tomato plant the best results in harvests I, II and III were in the C3 treatment (chicken egg shell powder 100 grams/polybag) and The best fruit weight and weight per tomato plant in harvests I, II and III were found in the C0 treatment



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(control). It is suspected that giving chicken egg shell powder can increase the calcium content in the fish soil which influences fruit weight and weight per tomato plant. According to Lingga and Marsono (2013) that calcium fertilization can also affect tomato production yields, namely by increasing volume and weight of fruit and is effective in controlling fruit cracking in plants such as tomatoes and Watermelon. Chicken egg shell powder also contains the nutrient element phosphorus which plants need in the absorption of other elements such as the nutrient K which plants need in the formation of proteins and carbohydrates and improve the quality of seeds and fruit in tomato plants. Ispandi and Munip (2004) explained that phosphorus plays a role in the absorption of other nutrients into the soil, including potassium. The availability of sufficient phosphorus nutrients can encourage the absorption of potassium nutrients into the soil. Potassium is a macro nutrient that plants really need for growth and repair fruit quality on plants. According to Goldsworthy and Fisher (2002) in Maftuah et al (2013), fruit becomes The main organ where carbohydrates are stored, the higher the photosynthesis process, the bigger it is the carbohydrate content contained in the weight of the fruit, nutrient absorption and photosynthesis run well so that the accumulated photosynthate also increases protein and fat which will have an impact fruit formation.

### Interaction effects

The average interaction between chicken manure and chicken egg shell powder treatment on heightplants at the age of 45 HST, fruit weight and fruit diameter at the first harvest after being tested for BNT0.05 are presented in table 12.

**Table 12. Average Plant Height at 45 HST, Fruit Weight and Fruit Diameter in the First Harvest of Tomato Plants Consequences of Treatment with Chicken Manure and chicken eggshell powder**

Chicken mature	Egg shell powder				BNT0,05
	C0 = 0	C1 = 60	C2 = 80	C3 = 100	
Palnt Heigth 45 HST					
A0 = Kontrol	149,40 <sup>aA</sup>	159,65 <sup>bA</sup>	171,75 <sup>cA</sup>	173,80 <sup>cA</sup>	6,44
A1 = 150 grams	200,80 <sup>bC</sup>	191,75 <sup>aB</sup>	189,50 <sup>aB</sup>	196,45 <sup>bB</sup>	
A2 = 300 grams	192,90 <sup>aB</sup>	216,30 <sup>bC</sup>	235,25 <sup>cC</sup>	234,90 <sup>cC</sup>	
A3 = 450 grams	223,50 <sup>aD</sup>	241,30 <sup>aD</sup>	247,35 <sup>aD</sup>	263,50 <sup>aD</sup>	
Harvest Fruit Weight I					
A0 = Kontrol	73,45 <sup>aA</sup>	101,40 <sup>cA</sup>	95,56 <sup>bA</sup>	107,84 <sup>dA</sup>	4,21
A1 = 150 grams	110,36 <sup>bB</sup>	105,25 <sup>aA</sup>	109,58 <sup>bB</sup>	107,29 <sup>aA</sup>	
A2 = 300 grams	109,19 <sup>aB</sup>	111,02 <sup>aB</sup>	111,13 <sup>aB</sup>	119,35 <sup>bB</sup>	
A3 = 450 grams	118,13 <sup>aC</sup>	119,61 <sup>aC</sup>	120,10 <sup>aC</sup>	119,65 <sup>aB</sup>	
Harvest Fruit Diameter I					
A0 = Kontrol	10,06 <sup>aA</sup>	11,35 <sup>bA</sup>	11,34 <sup>bA</sup>	11,57 <sup>cA</sup>	0,18
A1 = 150 grams	11,79 <sup>aB</sup>	11,87 <sup>aB</sup>	12,23 <sup>bB</sup>	11,94 <sup>aB</sup>	
A2 = 300 grams	11,77 <sup>aB</sup>	12,07 <sup>bB</sup>	12,19 <sup>bB</sup>	12,19 <sup>bC</sup>	
A3 = 450 grams	12,14 <sup>aC</sup>	12,19 <sup>aC</sup>	12,33 <sup>bC</sup>	12,29 <sup>aC</sup>	

Note: Numbers followed by the same letter in the same row and column are not significantly different at the  $P \leq 0.05$  level (BNT test), uppercase letters are read vertically and lowercase letters are read horizontally.

Table 12 shows that the combination treatment of chicken manure and chicken egg shell powder showed a significant interaction on plant height at 45 DAP, fruit weight and tomato fruit diameter at harvest I. The highest plant height at 45 DAP was found in the A3C3 combination. The best fruit weight in the first harvest was found in the A3C2 combination. The best fruit diameter in the first harvest was found in the A3C2 combination.

There is an interaction in the combination of chicken manure and chicken egg shell powder, which is thought to occur because chicken manure contains high levels of N, P and K nutrients and chicken egg shell powder is rich in the element Ca. In line with the explanation of Suriadikarta and Setyorini (2015) that the nutrients generally contained in chicken manure are N, P and K with a percentage content of 1.17% N, 1.87% P and 0.38% K. According to Butcher and Richard (2012) dry eggshells contain around 95% calcium carbonate, eggshells also contain 0.3% phosphorus and contain 0.3% microelements (magnesium, sodium, potassium, zinc, manganese and copper).

The nutrients N, P, K and C are essential nutrients that are needed in large quantities but not excessive to support the growth and development of tomato plants, where if all these elements are sufficient then the growth and development process such as height

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of tomato plants aged 45 HST, weight fruit and tomato fruit diameter in the first harvest can run optimally. This is in line with the explanation of Syukur et al (2016) that if large amounts of macro nutrients, namely N, P and K, will cause proper cell formation, the results of photosynthesis will be greater so that more photosynthesis results are translocated to all parts of the plant. The nutrients Mg and Ca in chicken egg shell powder are very necessary in the synthesis of chlorophyll to determine the progress of the photosynthesis process. An optimal photosynthesis process is very necessary in the plant growth process, especially in the fruit formation phase, thus determining the yield of the plant. Mg functions as a form of chlorophyll and carbohydrates and can function as an activator in the photosynthesis process, while the Ca element functions to activate meristem cell division and increase plant organs such as increasing fruit diameter (Kuswandi, 2005).

The interaction between fruit weight and fruit diameter in the first harvest is because the number of fruits in the first harvest is not large, so more assimilate is transferred into the tomatoes in the first harvest, which causes the weight and diameter of the tomatoes produced to increase. In line with the statement by Haspari et al (2017), that the greater the number of fruit kept, the smaller the fruit size, the number of fruit has a significant influence on the weight of fruit per plant.

### **CONCLUSIONS AND RECOMMENDATIONS**

#### **Conclusion**

1. Chicken manure treatment affects plant height at 15, 30 and 45 DAP, number of productive branches at 45 DAP, number of fruit, fruit diameter, fruit weight and fruit weight per harvest plant I, II and III. The best chicken manure treatment was found in the A3 fertilizer treatment (450 grams/polybag).
2. Eggshell powder treatment affected plant height at 15, 30 and 45 DAP, number of productive branches at 45 DAP, number of fruit, fruit diameter, fruit weight and fruit weight per harvest plant I, II and III, but had no effect on the number of harvested fruit. I. The best eggshell powder treatment was found in the C3 treatment (100 grams/polybag).
3. There was an interaction between the combination of chicken manure and eggshell powder on plant height at 45 DAT, fruit weight and harvest fruit diameter I. The best treatment of chicken manure and eggshell powder was found in the A3C3 treatment (450 grams/polybag : 100 grams/polybag ) for plant height 45 HST and in the A3C2 treatment (450 grams/polybag : 80 grams/polybag) for fruit weight and fruit diameter in harvest I.

#### **Suggestion**

To produce better tomato plant production, you can use chicken manure at a dose of 450 grams/polybag and use eggshell powder at a dose of 100 grams/polybag.

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