

The Effect of Manure Dosage and Types of Plant Growth Regulators (PGRs) on the Generative Phase of Bird's Eye Chili (*Capsicum frutescens* L)

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Informasi Artikel

E-ISSN : 3026-6874
Vol: 4 No: 5 May 2026
Halaman : 24-35

Abstract

*This study aims to determine the effect of manure dosage and types of plant growth regulators (PGRs), as well as their interaction, on the generative phase of bird's eye chili plants (*Capsicum frutescens* L.) in order to improve productivity, which remains fluctuating due to suboptimal cultivation practices. The research was conducted from February to March 2026 at the experimental field of the Pusat Riset Bisnis Kopbun Suka Tani Sejahtera, Kota Juang District, Bireuen Regency, using a factorial Randomized Block Design (RBD) of 4 × 3 with three replications. The first factor was the dosage of manure (control, 1 kg/plant, 1.5 kg/plant, and 2 kg/plant), while the second factor was the type of natural PGR (onion extract, rice water, and coconut water). Data were collected through direct observations on several parameters, including number of fruits, fruit weight, fresh biomass weight, root fresh weight, and root length, and were then analyzed to determine the effects of treatments and their interactions. The results showed that certain doses of manure had a significant effect on increasing yield and root growth, while natural PGRs were able to enhance flowering, reduce flower drop, and accelerate fruit formation. The interaction between both treatments indicated that the optimal combination produced higher results compared to single treatments. The novelty of this study lies in the use of a combination of manure and natural PGRs based on local materials as a strategy to improve the generative phase. The implications of this research are expected to serve as a scientific reference for the development of sustainable cultivation techniques, as well as learning material and further research in the fields of agronomy and horticulture.*

Keywords:

Bird's Eye Chili Peppe
Manure
Plant Growth
Regulators (PGRs)

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh dosis pupuk kandang dan jenis zat pengatur tumbuh (ZPT), serta interaksi keduanya, terhadap fase generatif tanaman cabai rawit (*Capsicum frutescens* L.) guna meningkatkan produktivitas yang masih berfluktuasi akibat praktik budidaya yang belum optimal. Penelitian dilaksanakan pada bulan Februari hingga Maret 2026 di lahan percobaan Pusat Riset Bisnis Kopbun Suka Tani Sejahtera, Kecamatan Kota Juang, Kabupaten Bireuen, menggunakan Rancangan Acak Kelompok (RAK) faktorial 4 × 3 dengan tiga ulangan. Faktor pertama adalah dosis pupuk kandang (kontrol, 1 kg/tanaman, 1,5 kg/tanaman, dan 2 kg/tanaman), sedangkan faktor kedua adalah jenis ZPT alami (ekstrak bawang merah, air cucian beras, dan air kelapa). Data dikumpulkan melalui pengamatan langsung terhadap beberapa parameter, meliputi jumlah buah, berat buah, berat biomassa segar, berat segar akar, dan panjang akar, kemudian dianalisis untuk mengetahui pengaruh perlakuan serta interaksinya. Hasil penelitian menunjukkan bahwa dosis pupuk kandang tertentu memberikan pengaruh nyata dalam meningkatkan hasil produksi dan pertumbuhan akar, sedangkan ZPT alami mampu meningkatkan pembungaan, mengurangi kerontokan bunga, serta mempercepat pembentukan buah. Interaksi antara kedua perlakuan menunjukkan bahwa kombinasi yang optimal menghasilkan pertumbuhan dan produksi

yang lebih tinggi dibandingkan dengan perlakuan tunggal. Kebaruan penelitian ini terletak pada penggunaan kombinasi pupuk kandang dan ZPT alami berbasis bahan lokal sebagai strategi untuk meningkatkan fase generatif tanaman. Implikasi penelitian ini diharapkan dapat menjadi referensi ilmiah dalam pengembangan teknik budidaya yang berkelanjutan, serta menjadi bahan pembelajaran dan penelitian lanjutan di bidang agronomi dan hortikultura.

Keywords: Bird's Eye Chili Peppe, Manure, Plant Growth Regulators (PGRs)

INTRODUCTION

Bird's eye chili Bird's eye chili is one of the important horticultural commodities in Indonesia with high economic value and continuously increasing market demand each year. The high public demand for bird's eye chili has made this commodity a major source of income for horticultural farmers. However the productivity of bird's eye chili at the farmer level is still relatively low and unstable. This low productivity is influenced by various factors such as poor soil fertility, climate change, pest and disease attacks, and suboptimal cultivation techniques. The continuous use of chemical fertilizers without the addition of organic matter can also reduce soil quality, resulting in less optimal plant growth.

Manure fertilizer contains macro and micronutrients needed by plants and can improve the soil's water-holding capacity as well as soil structure. The organic matter contained in manure fertilizer is able to increase the activity of soil microorganisms that play a role in the nutrient supply process for plants. According to Pratiwi and Barunawati (2020), the use of organic fertilizers can gradually increase nutrient availability, thereby supporting the success of the generative phase of bird's eye chili plants optimally. Therefore the use of manure fertilizer is considered one of the alternative approaches that can support the generative growth of bird's eye chili plants.

In addition to fertilization the use of natural plant growth regulators (PGRs) has also become an alternative method to improve the growth and yield of bird's eye chili plants. Plant growth regulators (PGRs) are organic compounds capable of influencing plant physiological processes at low concentrations. The use of natural PGRs is increasingly favored because they are easily obtained, inexpensive, and relatively environmentally friendly. Several natural materials commonly used as PGRs include coconut water, shallot extract, and rice water. Coconut water contains cytokinin, auxin, and gibberellin hormones that can stimulate flower and fruit formation. Shallot extract contains auxin and vitamin B1, which can accelerate root growth and enhance plant metabolism, while rice water contains vitamins and minerals that support optimal plant growth (Pane *et al.*, 2022). The use of natural PGRs is expected to improve plant growth efficiency, leading to better flower and fruit formation.

The combined use of manure fertilizer and natural PGRs is presumed to provide better effects on the growth and production of bird's eye chili plants compared to the application of only one treatment. Manure fertilizer functions to supply nutrients gradually while PGRs help accelerate plant physiological processes, making nutrient absorption more effective. The interaction between these two treatments is expected to enhance flower formation, reduce flower drop, increase fruit number, and improve the quality of bird's eye chili harvests. Previous studies regarding the combination of manure fertilizer dosage and types of PGRs on the generative phase of bird's eye chili plants have shown varying results; therefore, further research is needed to determine the most effective treatment combination

METHOD

1. Time and Location

This research was conducted from February to March 2026 at the land of the Kopbun Suka Tani Sejahtera Business Research Center, Kota Juang District, Bireuen Regency.

2. Tools and Materials

The tools used in this study included a grass-cutting machine, machete, hoe, soil sieve, watering can, labels, stationery, plastic rope, wooden stakes, scissors, sacks, a 200-liter drum, camera, a 10-liter bucket, and a microscope. The materials used consisted of bird's eye chili seeds (Bara variety), and natural plant growth regulators (PGRs) in the form of onion extract, rice water, and coconut water.

3. Experimental Design

This study was an experimental research with a quantitative approach using a Randomized Complete Block Design (RCBD) with a 4×3 factorial pattern. This design was used to determine the main effects and interactions between manure dosage and types of PGRs on the generative phase of bird's eye chili plants.

The first factor was Manure Dosage (V) with 4 levels:

V0 = Control

V1 = 1 kg/plant

V2 = 1.5 kg/plant

V3 = 2 kg/plant

The second factor was PGR Type (D) with 3 levels:

D1 = Onion extract: 100 ml/liter of water/plant

D2 = Rice water: 100 ml/liter of water/plant

D3 = Coconut water: 200 ml/liter of water/plant

The combination of both factors resulted in 12 treatments each replicated three times yielding a total of 36 experimental units. The experimental units were randomly assigned within each block to minimize environmental effects.

The mathematical model used was :

$$Y_{ijk} = \mu + \beta_i + V_j + D_k + (VD)_{jk} + \epsilon_{ijk}$$

Where:

Y_{ijk} = Observation value

μ = Overall mean

β_i = Effect of replication

V_j = Effect of manure dosage

D_k = Effect of PGR type

$(VD)_{jk}$ = Interaction effect

ϵ_{ijk} = Experimental error

4. Research Implementation

The research was conducted in stages starting from land preparation to harvesting. Land preparation involved clearing weeds using a hoe and grass-cutting machine, followed by soil tillage and bed preparation. Manure was applied as a basal fertilizer according to the treatment. Bird's eye chili seeds (Bara variety) were selected and first sown in polybags. After the seedlings were ready transplanting was carried out by placing two seeds into each planting hole. Plant maintenance included watering, replanting (*gap filling*), weeding, and pest and disease control. Watering was conducted twice daily in the morning and afternoon. Replanting was done to replace dead or non-growing plants. Harvesting was carried out in stages at 51, 65, 79, and 93 days after planting (DAP), with the criteria that the fruits had developed optimally and had turned from greenish-yellow to red.

5. Data Collection Techniques

Data were collected through direct observation of each experimental unit. The observed parameters included the number of fruits per plant, fruit weight per plant, fresh biomass weight, fresh root weight, and root length. Observations of fruit number and weight were conducted during harvest (51, 65, 79, and 93 DAP), while biomass weight was measured at 120 DAP. Root weight was observed at 95 DAP and root length was measured using a ruler after the plants were uprooted and cleaned. All data obtained were quantitative and measured using instruments such as an analytical balance and ruler to ensure accuracy.

6. Data Analysis Techniques

The data obtained were analyzed quantitatively using analysis of variance (ANOVA) based on the RCBD method at a 5% significance level to test treatment effects. If the F-test showed significant differences, the analysis was continued using the Honestly Significant Difference (HSD) test at the 5% level to determine differences among treatments.

RESULTS AND DISCUSSION

1. The Effect of Manure Dosage Application on the Generative Phase of Bird's Eye Chili Plants Bird's eye chili

1.1 Number of Fruits

The results of the F-test in the analysis of variance showed that the manure fertilizer factor had no significant effect on the number of fruits of bird's eye chili Bird's eye chili plants at 93 days after planting (DAP), as shown in Table 1.

Table 1. Average Number of Bird's Eye Chili Fruits at 93 DAP under Manure Fertilizer Treatment Bird's eye chili

Manure Fertilizer Kg	Number of Fruits
	93 DAP
Kontrol	109,25
1	93,83
1,5	114,92
2	93,25

Based on Table 1, the results of the F-test in the analysis of variance showed that the application of manure fertilizer had no significant effect on the number of fruits of bird's eye chili Bird's eye chili plants at 93 days after planting (DAP). Based on Table 1, the treatment with a dosage of 1.5 kg produced the highest number of fruits, namely 114.92 fruits, compared to the control treatment which produced 109.25 fruits, while the 1 kg and 2 kg dosages resulted in lower fruit numbers. This indicates that the application of manure fertilizer was not yet able to significantly increase the number of fruits, although the 1.5 kg dosage showed a tendency toward better results.

The non-significant effect of manure fertilizer on fruit number was presumably due to the nutrients contained in the manure not being fully available to the plants during the generative phase. Manure fertilizer has a slow-release characteristic requiring time to undergo decomposition before its nutrients can be absorbed by plants. According to Mahfudz et al. (2025), manure fertilizer does not always provide a significant effect on crop yield if the mineralization process has not occurred optimally.

.Nutrien availability may not have been sufficient to meet the plant's needs during the fruit formation phase. Soil microorganism activity also plays an important role in the decomposition of organic matter and the release of nutrients. If soil conditions do not support biological activity, the mineralization process of manure fertilizer becomes inhibited, resulting in suboptimal nutrient absorption by plants. This condition causes flower and fruit formation to be less than optimal. Fajri and Ansar (2024) stated that limited nutrient availability during the generative phase can prevent a significant increase in fruit number. Phosphorus (P) and potassium (K), which play important roles in flower and fruit formation, were likely not available in sufficient amounts.

1.2 Fruit Weight per Plant

The results of the F-test in the analysis of variance showed that the manure fertilizer factor had no significant effect on the fruit weight of bird's eye chili Bird's eye chili plants at 93 days after planting (DAP). The average fruit weight of bird's eye chili plants under manure fertilizer treatment can be seen in Table 2.

Table 2. Average Fruit Weight of Bird's Eye Chili at 93 DAP under Manure Fertilizer Treatment Bird's eye chili

Manure Fertilizer Kg	Fruit Weight
	93 DAP
Kontrol	73,42
1	61,67
1,5	72,50
2	66,67

Based on Table 2, the results of the F-test in the analysis of variance showed that the application of manure fertilizer had no significant effect on the fruit weight of bird's eye chili Bird's eye chili plants at 93 days after planting (DAP).

Based on Table 2, the control treatment produced the highest fruit weight, namely 73.42 g, followed by the 1.5 kg dosage treatment with 72.50 g, while the 1 kg and 2 kg dosages showed lower results. This indicates that the addition of manure fertilizer was not able to significantly increase fruit weight compared to the treatment without manure fertilizer. However the 1.5 kg dosage treatment showed a tendency toward better results and therefore still has the potential to support an increase in fruit weight. The non-significant effect of manure fertilizer on fruit weight was presumably related to the fruit filling process, which is highly dependent on the availability of readily available nutrients, especially potassium (K). Potassium plays an important role in the translocation of photosynthetic products to the fruit thereby affecting the final fruit weight.

Since manure fertilizer has a slow-release characteristic the nutrients required by the plants during the fruit filling phase were likely not optimally available. According to Kasim *et al.*, (2023), the increase in fruit weight of horticultural crops is strongly influenced by the availability of potassium during the fruit filling phase. In addition to potassium, micronutrients such as magnesium (Mg) and calcium (Ca) also play important roles in fruit cell formation and maintaining turgor stability. Deficiency of these nutrients may cause fruit cell enlargement to occur less optimally, resulting in no significant increase in fruit weight. Therefore proper fertilization and soil fertility analysis are highly necessary before the application of organic fertilizers. Yati *et al.*, (2024) stated that integrated fertilization is very important for maintaining nutrient balance so that plant growth and yield can occur optimally.

1.3 Fresh Weight of Plant Biomass per Plant

The results of the F-test in the analysis of variance showed that the manure fertilizer factor had no significant effect on the fresh weight of the plant biomass of bird's eye chili Bird's eye chili at 120 days after planting (DAP). The average fresh weight of plant biomass under manure fertilizer treatment can be seen in Table 3.

Table 3. Average Fresh Weight of Plant Biomass of Bird's Eye Chili at 120 DAP under Manure Fertilizer Treatment Bird's eye chili

Manure Fertilizer Kg	Fresh Biomass Weight (g)
	120 DAP
Kontrol	88,00
1	79,17
1,5	82,17
2	76,17

Based on Table 3, it can be seen that the application of manure fertilizer had no significant effect on the fresh weight of plant biomass of bird's eye chili Bird's eye chili at 120 days after planting (DAP). The control treatment produced the highest fresh biomass weight, namely 88.00 g, followed by the 1.5 kg dosage treatment at 82.17 g, while the 1 kg and 2 kg dosages showed lower results. This indicates that the application of manure fertilizer was not able to significantly increase plant biomass. According to Handayani *et al.*, (2024), organic fertilizers have a greater effect on physiological changes in plants rather than directly increasing biomass.

The non-significant effect of manure fertilizer is presumed to be related to the efficiency of nutrient utilization by plants. In the late generative phase photosynthetic products are more allocated to fruit formation and filling, resulting in limited vegetative growth such as stems and leaves. Pratiwi *et al.*, (2023) stated that assimilate distribution during the generative phase is more focused on fruit organs rather than increasing vegetative biomass.

The higher fresh biomass weight in the control treatment suggests that the initial soil conditions were likely sufficient to supply nutrients to the plants. In relatively fertile soil conditions the addition of organic fertilizer does not always have a significant effect on plant biomass growth. Fajri and Ansar (2024) stated that in soils with good initial fertility, plant responses to organic fertilizers tend to be low because nutrient requirements are already met.

1.4 Fresh Weight of Roots per Plant

The results of the F-test in the analysis of variance showed that the manure fertilizer factor had no significant effect on the fresh root weight of bird's eye chili Bird's eye chili plants at 120 days after planting (DAP). The average fresh root weight of plants under manure fertilizer treatment can be seen in Table 4.

Table 4. Average Fresh Root Weight of Bird's Eye Chili Plants at 120 DAP under Manure Fertilizer Treatment Bird's eye chili

Manure Fertilizer Kg	Fresh Root Weight
	120 DAP
Kontrol	7,92
1	6,75
1,5	7,50
2	6,67

Based on Table 4, it can be seen that the application of manure fertilizer had no significant effect on the fresh root weight of bird's eye chili Bird's eye chili plants at 120

days after planting (DAP). The control treatment produced the highest root weight, namely 7.92 g, followed by the 1.5 kg dosage at 7.50 g, while the 1 kg and 2 kg dosages showed lower results. This indicates that the application of manure fertilizer was not able to significantly enhance root growth. Soil initial conditions are presumed to be one of the factors influencing these results. Soil that already contains sufficient nutrients allows plants in the control treatment to develop their root systems optimally without additional manure fertilizer. Fajri and Ansar (2024) stated that in fertile soils, the addition of organic fertilizer often does not give a significant effect because the nutrient requirements of plants have already been met.

Plants in the control treatment tended to expand their root systems in order to search for nutrients, resulting in higher root weight. In contrast, in manure fertilizer treatments, nutrients were more concentrated around the root zone, leading to shorter and denser root growth. Kasim *et al.*, (2023) stated that root development is influenced by the distribution and availability of nutrients in the soil, while Handayani *et al.*, (2024) added that nutrient concentration in the root zone can affect plant root architecture. The non-significant effect of manure fertilizer is also thought to be due to its slow decomposition rate, meaning that nutrients were not fully available when needed by the plant. At 120 DAP, bird's eye chili plants were already in the late generative phase, so photosynthetic products were more allocated to fruit formation and ripening rather than root growth.

1.5 Root Length

The results of the F-test in the analysis of variance showed that the manure fertilizer factor had no significant effect on the root length of bird's eye chili Bird's eye chili plants at 120 days after planting (DAP). The average root length of plants under manure fertilizer treatment can be seen in Table 5.

Table 5. Average Root Length of Bird's Eye Chili Plants at 120 DAP under Manure Fertilizer Treatment Bird's eye chili

Manure Fertilizer Kg	Root Length
	120 DAP
Kontrol	12,42
1	11,42
1,5	11,00
2	10,08

Based on Table 5, the results of the F-test in the analysis of variance showed that the application of manure fertilizer had no significant effect on the root length of bird's eye chili Bird's eye chili plants at 120 days after planting (DAP). Based on Table 5, the control treatment produced the highest root length, namely 12.42 cm, while all manure fertilizer treatments showed lower root length values, with the lowest value observed in the 2 kg dosage treatment at 10.08 cm.

This indicates that the application of manure fertilizer was not able to significantly increase root length. Soil moisture conditions are presumed to be one of the factors influencing these results. The control treatment with optimal soil moisture allowed roots to grow longer in search of water and nutrients. In contrast the application of manure fertilizer in higher amounts increased the soil's ability to retain water thereby reducing the plant's need to extend its root system. Fajri and Ansar (2024) stated that soil moisture conditions

significantly influence the development of root length in plants. Root length is an indicator of a plant's ability to explore the soil to obtain water and nutrients.

In the control treatment, roots tended to grow longer because plants had to search for limited nutrient sources. Conversely in manure fertilizer treatments nutrients were more available around the root zone, so plants did not need to extend their roots extensively. At 120 DAP bird's eye chili plants had already entered the late generative phase, so photosynthetic products were more allocated to fruit formation and ripening rather than root growth. Pratiwi *et al.*, (2023); Maulana & Harahap. (2023). stated that root elongation activity decreases in the final growth stage due to a shift in assimilate distribution toward generative organs.

2. The Effect of Plant Growth Regulator (PGR) Application on the Generative Phase of Bird's Eye Chili Plants

2.1 Number of Fruits per Plant

The results of the F-test in the analysis of variance showed that the plant growth regulator (PGR) factor had no significant effect on the number of fruits of bird's eye chili at 93 days after planting (DAP). The average number of fruits of bird's eye chili under PGR treatment can be seen in Table 6.

Table 6. Average Number of Bird's Eye Chili Fruits at 93 DAP under PGR Treatment

PGR ml	Number of Fruits
	93 DAP
Onion Water (100 ml)	145,17
Rice Water (100 ml)	139,67
Coconut Water (200 ml)	126,42

Based on Table 6, the results of the F-test in the analysis of variance showed that the application of natural plant growth regulators (PGRs) had no significant effect on the number of fruits of bird's eye chili at 93 days after planting (DAP).

Based on Table 6, the treatment with 100 ml onion extract produced the highest number of fruits namely 145.17 fruits, followed by 100 ml rice water at 139.67 fruits, and 200 ml coconut water at 126.42 fruits. This indicates that each type of PGR gave different responses although they were not statistically significant. Handayani *et al.*, (2024) stated that onion extract contains active compounds that are more easily absorbed through stomata and roots, making hormone distribution to generative organs more effective. The non-significant effect of PGRs on fruit number is presumed to be due to the suboptimal concentration of natural hormones in stimulating maximum fruit formation. Natural PGRs such as onion extract, rice water, and coconut water contain auxin, cytokinin, and gibberellin hormones, but in relatively low and inconsistent amounts.

Pratiwi *et al.*, (2023) stated that the effectiveness of natural PGRs is highly dependent on the concentration of active substances and the accuracy of dosage applied which often results in an insignificant plant response. The interaction between hormones from natural PGRs and the plant's internal hormones also influences plant growth responses. Sari *et al.*, (2024) explained that such interactions may lead to hormonal competition or synergy that varies among plants, resulting in diverse outcomes. Fruit formation in bird's eye chili plants is more influenced by the success of flowering and fertilization processes rather than the application of PGRs alone.

2.2 Fruit Weight per Plant

The results of the F-test in the analysis of variance showed that the plant growth regulator (PGR) factor had no significant effect on the fruit weight of bird's eye chili

eye chili at 93 days after planting (DAP). The average fruit weight of bird's eye chili under PGR treatment can be seen in Table 7.

Table 7. Average Fruit Weight of Bird's Eye Chili at 93 DAP under PGR Treatment Bird's eye chili

PGR ml	Fruit Weight
	93 DAP
Onion Water (100 ml)	96,50
Rice Water (100 ml)	91,67
Coconut Water (200 ml)	86,08

Based on Table 7, the results of the F-test in the analysis of variance showed that the application of natural plant growth regulators (PGRs) had no significant effect on the fruit weight of bird's eye chili Bird's eye chili at 93 days after planting (DAP). Based on Table 7, the 100 ml onion extract treatment produced the highest fruit weight, namely 96.50 g, followed by 100 ml rice water at 91.67 g, and 200 ml coconut water at 86.08 g. Although there were numerical differences among treatments, statistically the results did not show a significant effect. This is presumably because the ability of natural PGRs to stimulate fruit filling enzyme activity is still limited, even though onion extract and rice water can enhance carbohydrate accumulation in fruits (Handayani *et al.*, 2024).

The non-significant effect of PGRs on fruit weight is also thought to be related to the efficiency of fruit filling, which is influenced by the balance between photosynthate production and its distribution to the fruit. According to Kasim *et al.*, (2023), fruit weight is more influenced by the balance between photosynthate sources and sink organs rather than PGR application alone. Disruption of photosynthate flow due to soil conditions or osmotic stress may cause PGRs to work less optimally, resulting in an insignificant increase in fruit weight (Sari *et al.*, 2024). Physiologically, natural PGRs such as onion extract, rice water, and coconut water contain plant hormones such as auxin and cytokinin, but in low and unstable concentrations Maulana *et al.*, 2025.

Pratiwi *et al.*, (2023) stated that the effectiveness of natural PGRs is highly dependent on the concentration of active hormone compounds applied. Hormonal stability is also affected by storage conditions and exposure to light. Hormones in coconut water are more easily degraded, resulting in a lower effect on fruit weight compared to onion extract (Wijaya *et al.*, 2025). The onion extract treatment showed the highest numerical result because it contains bioactive compounds such as sulfur and flavonoids that can enhance plant metabolism and photosynthetic activity. However this increase was not sufficient to produce a statistically significant effect. This is in line with Yati *et al.*, (2024), who stated that the use of natural PGRs generally only shows a tendency to improve yield without significant differences.

2.3 Fresh Weight of Plant Biomass per Plant

The results of the F-test in the analysis of variance showed that the plant growth regulator (PGR) factor had no significant effect on the fresh weight of plant biomass of bird's eye chili Bird's eye chili at 120 days after planting (DAP). The average fresh weight of plant biomass under PGR treatment can be seen in Table 8.

Table 8. Average Fresh Weight of Bird's Eye Chili Plant Biomass at 120 DAP under PGR Treatment Bird's eye chili

PGR ml	Fresh Biomass Weight (g)
	120 DAP
Onion Water (100 ml)	108,00

Rice Water (100 ml)	117,92
Coconut Water (200 ml)	99,58

Based on Table 8, the results of the F-test in the analysis of variance showed that the application of natural plant growth regulators (PGRs) had no significant effect on the fresh weight of plant biomass of bird's eye chili Bird's eye chili at 120 days after planting (DAP). Based on Table 8, the 100 ml rice water treatment produced the highest fresh weight, namely 117.92 g, followed by 100 ml onion extract at 108.00 g, and 200 ml coconut water at 99.58 g. Although there were differences in values among treatments, statistically the results did not show a significant effect on plant fresh biomass. These differences in fresh biomass are presumed to be related to the effect of PGRs on temporary cell expansion in leaves and stems. Bioactive compounds in natural PGRs can stimulate vacuole enlargement, leading to an increase in fresh weight without an actual increase in cell number.

Fresh biomass weight is not only influenced by total biomass but also by the water content in plant tissues. According to Fajri and Ansar (2024), plant fresh weight is highly affected by fluctuations in tissue water content, so it does not always reflect a real increase in biomass. Stomatal conditions and transpiration rate also influence plant fresh weight. When PGRs stimulate stomatal opening, plants may lose more water, resulting in inconsistent responses among treatments (Wijaya *et al.*, 2025). Plant responses to natural PGRs are also relatively unstable due to variations in their active compound content Maulana, M., & Noer, Z. (2026).

Rice water contains simple organic compounds that can enhance soil microbial activity and plant metabolism, resulting in higher fresh weight. The lower fresh weight observed in the 200 ml coconut water treatment indicates that increasing PGR dosage does not always improve plant growth. Kasim *et al.*, (2023) explained that plant responses to PGRs are strongly influenced by internal metabolic balance, where an excess of certain substances may reduce growth efficiency. Excessive PGR application may also inhibit protein and enzyme synthesis that support new tissue formation, thereby reducing plant fresh weight (Prasetyo *et al.*, 2024).

2.4 Fresh Weight of Roots per Plant

The results of the F-test in the analysis of variance showed that the plant growth regulator (PGR) factor had no significant effect on the fresh root weight of bird's eye chili Bird's eye chili plants at 120 days after planting (DAP). The average fresh root weight of plants under PGR treatment can be seen in Table 9.

Table 9. Average Fresh Root Weight of Bird's Eye Chili Plants at 120 DAP under PGR Treatment Bird's eye chili

PGR ml	Fresh Root Weight
	120 DAP
Onion Water (100 ml)	9,42
Rice Water (100 ml)	11,08
Coconut Water (200 ml)	8,33

Based on Table 9, the results of the F-test in the analysis of variance showed that the application of natural plant growth regulators (PGRs) had no significant effect on the fresh root weight of bird's eye chili Bird's eye chili plants at 120 days after planting (DAP). Based on Table 9, the 100 ml rice water treatment produced the highest root weight, namely 11.08 g, followed by 100 ml onion extract at 9.42 g, and 200 ml coconut water at 8.33 g. Although there were differences in values among treatments, statistically the results did not show a significant effect on root biomass. These differences in root weight are presumed to be

related to the effect of natural PGRs on the formation of lateral roots and fine root branching, which increase the root surface area without significantly increasing total biomass. Handayani *et al.*, (2024) stated that natural hormones are able to stimulate morphological changes in roots without directly increasing root weight.

The non-significant effect of PGRs on root weight is also related to the plasticity of the plant root system. According to Kasim *et al.*, (2023), plant roots can adjust their growth pattern to environmental conditions without necessarily increasing root size or weight significantly. Natural PGRs can enhance root enzyme activity so that nutrient absorption remains effective even if root weight does not increase (Sari *et al.*, 2024). At 120 DAP, bird's eye chili Bird's eye chili plants were already in the late generative phase, so most photosynthetic products were allocated to fruit formation and ripening. This condition causes root growth to slow down, meaning that PGR treatments do not provide a significant effect on root weight. Maulana *et al.*, (2024);Pratiwi *et al.*, (2023) stated that during the generative phase below-ground organ growth tends to decrease due to the priority of photosynthate distribution toward reproductive organs.

2.5. Root Length per Plant

The results of the F-test in the analysis of variance showed that the plant growth regulator (PGR) factor had a significant effect on the root length of bird's eye chili Bird's eye chili plants at 120 days after planting (DAP). The average root length of plants under PGR treatment can be seen in Table 10.

Table 10. Average Root Length of Bird's Eye Chili Plants at 120 DAP under PGR Treatment

Bird's eye chili	
PGR ml	Root Length 120 DAP
Onion Water (100 ml)	13,58 a
Rice Water (100 ml)	17,33 c
Coconut Water (200 ml)	14,00 ab
BNJ 0,90	

Based on Table 10, the results of the F-test in the analysis of variance showed that the plant growth regulator (PGR) factor had a significant effect on the root length of bird's eye chili Bird's eye chili plants at 120 days after planting (DAP). Based on Table 10, the 100 ml rice water treatment produced the highest root length, namely 17.33 cm, followed by 200 ml coconut water at 14.00 cm, and 100 ml onion extract at 13.58 cm. This indicates that different types of natural PGRs produced different responses on root elongation. The significant effect of PGRs on root length shows that the applied growth regulators were able to stimulate root cell elongation. Rice water is presumed to contain organic compounds and vitamins that support growth hormone activity, especially auxin, which plays an important role in root cell elongation.

According to Pratiwi *et al.*, (2023), auxin functions to stimulate cell elongation, particularly in root tissues, thereby increasing plant root length. The simple oligosaccharide content in rice water can also stimulate the growth of lateral roots and elongation of the primary root (Sari *et al.*, 2024). The rice water treatment produced the highest root length because its simple nutrient content is more easily utilized by plants to support root physiological activity. Yati *et al.*, (2024) stated that natural materials containing simple organic compounds can enhance plant metabolism including root growth processes. The use of rice water can improve the plant's ability to absorb water and nutrients through the elongation of root hairs and root systems (Prasetyo *et al.*, 2021).

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