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Response of Celery Plant Growth and Production (Apium *Graveolens* L.) to Liquid Organic Fertilizer Goat Urine

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ABSTRACT

The increase in population has a great influence on the availability of land. As a result, there is a lot of degradation of productive land that should still be able to carry out agricultural activities. Along with the development of technology and the advancement of human civilization, humans began to look for solutions so that narrow yard land was still able to support family income. The purpose of this study is to determine the effect of liquid organic fertilizer of goat urine on the growth and production of Celery plants (*Apium graveolens* L.). The results of the study on the effect of the application of goat urine liquid organic fertilizer on the growth and production of celery plants had a real effect on the height of plants aged 1 and 2 MSPT, but had a very real effect on the age of 3 MSPT, The results of the variegated fingerprints showed a real effect on the application of goat urine liquid organic fertilizer on the number of seedlings, wet weight per sample and consumption weight per sample. Celery plants develop uniformly, thus allowing for better absorption of nutrients to encourage their growth. This shows that the application of Liquid Organic Fertilizer (POC) concentration is the most effective in encouraging plant growth and production

Keyword : Celery Plants; Liquid Organic Fertilizer; Goat Urine; Plant Production

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1. INTRODUCTION

Celery plants (*Apium Graveolens* L.) are an important group of leafy vegetables and have export value. The plant is the second most important crop of the type of spice plant after lettuce is reviewed in terms of its popularity and value. Therefore, celery is considered a luxurious crop. Even today it has been used as a diet food and is always available all year round. (Rabiatul and Musadia. 2018).

Celery plant (*Apium graveolens* L.) is one of the vegetables that is rich in fiber and nutrients, and has an important role in the culinary and health industries. The growth and production of this plant is greatly influenced by environmental conditions and proper fertilization. One of the innovations in fertilization is the use of liquid organic fertilizers, such as goat urine, which are known to have a high nutrient content and can increase soil fertility.

The increase in population has a great influence on the availability of land. As a result, there is a lot of degradation of productive land that should still be able to carry out agricultural activities. Along with the development of technology and the advancement of human civilization, humans began to look for solutions so that narrow yard land was still able to support family income. So, a solution was found by using yard land sustainably. This can be applied to the community in order to support a creative, independent, and financially advanced society (Khomah and Fajarningsih, 2015).

Basically, celery cultivation is still rarely carried out in big cities because of environmental conditions that are not in accordance with the conditions for its growth. Information from Horticultural Production Statistics in 2014 reports that the types of vegetables that are often cultivated are mustard greens, spinach, kale and cucumbers (Directorate General of Horticulture, 2014).

Celery plants have a history in ancient Roman times, celery plants are usually used to decorate garlands for deceased people, celery plants were also recognized as medicinal plants in 1942. This celery plant is known as a wild plant since 1000 years ago, the area that includes the origin of the Chinese plain celery plant, this Chinese plain is a plain that has 136 types of plants.

Celery plants include vegetable crops, celery leaves are often used for vegetable mixtures and food displays. The part of the celery plant that is consumed is the leaves and petioles, so the use of chemicals must be avoided, but this typical Korean and Japanese plant can actually function as medicine. Traditionally, celery plants are used as a booster of digestive enzymes or as an appetite enhancer and blood pressure lowering (Djojoseputro, 2012).

Celery (*Apium graveolens* L.) belongs to the Umbelliferae family and is one of the vegetable commodities that is widely used for flavoring and decorating dishes. Celery seeds are also used as a condiment and flavoring. The seed oil extract is useful as a medicine. Celery cultivation is very good in highlands of 1000-1200 m above sea level, it can also be done in lowlands by providing shade in the form of a reed or straw roof, the roof functions as a sun barrier and maintains moisture. Celery is less rain-resistant, therefore the optimum rainfall ranges from 60-100 mm/month. Celery plants can be divided into stalk celery, bulb celery and leaf celery.

Celery plants are one of the vegetable plants that have short stems whose leaves are curved and have long petioles. Celery has pinnate compound leaves, odd, pointed leaf bases and inching edges. The harvest period depends on the type, and market demand, but varies from 2-3 months. Celery grows well in very dense sandy loam soils as well as under mild climatic conditions (Sowbhagya, 2014).

However, the cultivation of celery plants has not received serious attention. This is due to several factors, including the lack of public interest in celery cultivation, the climate (celery mostly grows in highlands above about 900 meters above sea level) (Roidah. 2013).

Inadequate farming techniques and low soil fertility. One way to overcome the problem of the use of chemical fertilizers to increase plant productivity is to provide fertilization using organic fertilizers. Organic fertilizer is a fertilizer made from organic matter that can be enriched with other nutrients and has a positive effect on plants, with the help of microscopic bodies in the soil, organic matter given to the soil can turn into humus.

Goat urine liquid organic fertilizer contains macro and micro nutrients needed by plants, such as nitrogen (N), phosphorus (P), and potassium (K). The application of this fertilizer can stimulate the growth of roots, stems, and leaves and increase crop yields. In the context of research, several studies have shown that the application of goat urine liquid organic fertilizer can increase plant height, leaf count, and wet weight of sledri plants.

In the application of liquid organic fertilizers, it is important to take into account the dosage and frequency of application. Proper application can maximize the effectiveness of fertilizer, while excessive application can actually have negative consequences, such as the occurrence of nutrient leaching or damage to plant roots. Therefore, further research on the optimization of goat urine fertilization for sledri plants is urgently needed to increase agricultural productivity in a sustainable manner.

Overall, the use of goat urine liquid organic fertilizer as an alternative in fertilizing sledri plants shows significant potential. In addition to providing benefits for plant growth and production, this practice also supports agricultural sustainability by utilizing natural resources. This is in line with efforts to reduce dependence on synthetic chemical fertilizers that can damage the environment.

For this reason, the use of liquid organic fertilizer from agricultural waste used in cultivating horticultural crops can create healthy community food security. The need for horticultural plants has not been maximized, so it is necessary to increase the need so that the demand for horticultural plants can be met. Therefore, it is necessary to test the use of liquid organic fertilizer (POC) of goat urine on the growth and production of celery plants (*Apium graveolens* L.).

2. RESEARCH METHOD

A. Location and Time of Research

This research will be carried out in Sampe Cita Village, Kutalimbaru District, Deli Serdang Regency, North Sumatra Province. This research will be carried out in June – August 2024.

B. Population and Sample

This study used 20 units of research experiments consisting of 80 sample plants consisting of 4 replicates and 5 treatments.

C. Research Tools and Materials

The tools used in this study are polybags, padlocks, hoes, hand sprayers, scales, ice cream sticks, stationery and cameras. The materials used in this study were celery seeds, goat urine waste, coconut water, rice washing water, mahogany seeds, garlic, molasses, and Em4.

D. Data Collection Techniques

This study uses the Non-Factorial Group Random Design (RAK) method consisting of 1 factor and 5 treatments so that there are 20 units of research experiments. The factors studied consist of:

H0 = Control
H1 = 40 ml / 1 liter of water / treatment
H2 = 60 ml / 1 liter of water / treatment
H3 = 80 ml / 1 liter of water / treatment
H4 = 90 ml / 1 liter of water / treatment

Number of Repeats:

$t(n-1) \geq 15$
$5(n-1) \geq 15$
$5n-5 \geq 15$
$5n \geq 15+5$
$n \geq \frac{20}{5}$
$n \geq 4$ repetitions

E. Data Analysis

The data of the research results were analyzed with a Non-Factorial Group Random Design (RAK) using a variety of fingerprints and then tested further with honest real differences, with the linear model of the Non-Factorial Group Random Design (RAK) as follows:

$Yij = \mu + \alpha i + \beta j + \varepsilon ij$

Where:

- Yij = response or observation value of the ith treatment and the jth repetition
- μ = common middle value
- αi = influence of the ith treatment
- βj = influence of the jth block
- εij = Effect of experimental error from the ith and jth repeat.

If the results of this study have a real effect, further testing is carried out with the Duncan distance test.

3. RESULTS AND DISCUSSION

A. Result

1. Plant Height (cm)

Data on the measurement of the average plant height at the age of 1, 2 and 3 MSPT with the application of liquid organic fertilizer of goat urine that has been tested for difference in the average using the double distance test (Duncan) is seen in Attachments 5, 6 and 7.

Based on the analysis of various fingerprints on plant height parameters at the age of 1, 2 and 3 MSPT, it was found that the application of liquid organic fertilizer of goat urine had a real effect on plant height at the age of 1 and 2, but had a very real effect at the age of 3 MSPT

Data on the average height of plants with the application of liquid organic fertilizer with goat urine at the age of 1 to 3 weeks after transplanting can be seen in the following table:

Table 1. Average Observation of Plant Height (cm) at the Age of 1, 2 and 3 MSPT Effect of Liquid Organic Fertilizer Application of Goat Urine.

Treatment	Plant Height (cm)		
	1 MSPT	2 MSPT	3 MSPT
Goat Urine Liquid Organic Fertilizer (H)			
H0 = 0 ml/Liter of water/treatment	14.20 bB	16.30 bB	17.62 bB
H1 = 40 ml/Liter of water/treatment	18.63 aA	20.73 aA	22.48 aA
H2 = 60 ml/Liter of water/treatment	17.56 aA	20.28 aA	22.29 aA
H3 = 80 ml/Liter of water/treatment	17.84 aA	20.59 aA	22.91 aA
H4 = 90 ml/Liter of water/treatment	18.41 aA	20.58 aA	22.98 aA

Remarks: Numbers followed by the same letter in the same column show an unreal difference at the level of 5% (lowercase) and 1% (uppercase).

In Table 1 above, the application of liquid organic fertilizer from agricultural waste states a real effect on plant height at the age of 1 and 2, but has a very real effect at the age of 3 MSPT. The highest average was found in the treatment of 90 ml/liter of water/treatment (H4) which was 22.98 cm and the lowest was 0 ml/liter of water/treatment (H0) which was 12.50 pieces.
The results of the regression analysis of the application of goat urine liquid organic fertilizer to plant height at the age of 3 MSPT show a linear relationship, as presented in Figure 1.

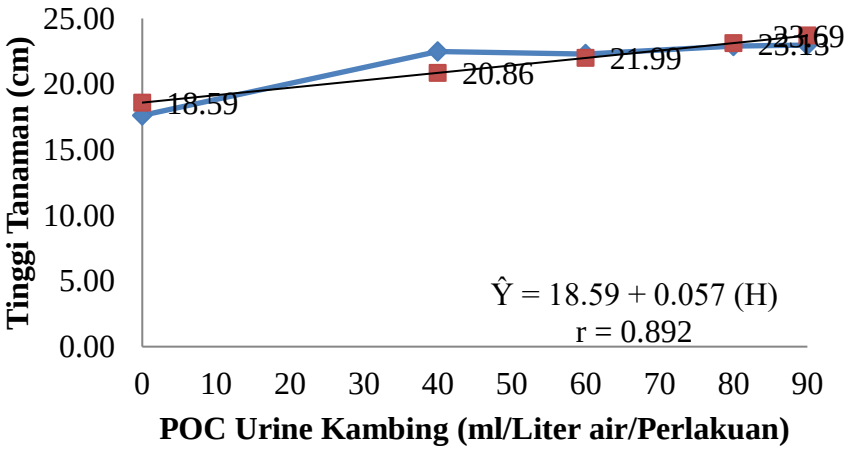

Fig 1. Graph of the Relationship Between the Application of Goat Urine Liquid Organic Fertilizer (ml/Liter of Water/Treatment) and Plant Height (cm) at the Age of 4 MST.

2. Number of Saplings (Saplings)

The average number of saplings with the application of liquid organic fertilizer of goat urine that has been tested differently by using the double distance test (Duncan) is seen in Appendix 8.
Based on the analysis of various fingerprints on the parameters of the number of chicks, it was found that the application of liquid organic fertilizer of goat urine had a real effect on the number of chicks.
The average data on the number of saplings with the application of liquid organic fertilizer for goat urine can be seen in the following table:

Table 2. Average Observation of the Number of Chicks (Chicks) Influence of Organic Fertilizer Application of Goat Urine Liquid.

Treatment	Number of Saplings (Saplings)
Goat Urine Liquid Organic Fertilizer (H)	
H0 = 0 ml/Liter of water/treatment	3.94 bB
H1 = 40 ml/Liter of water/treatment	4.19 abAB
H2 = 60 ml/Liter of water/treatment	4.75 aA
H3 = 80 ml/Liter of water/treatment	4.94 aA
H4 = 90 ml/Liter of water/treatment	5.25 aA

In Table 2 above, the application of liquid organic fertilizer from agricultural waste states a real influence on the number of tillers. The highest average was found in the treatment of 80 ml/liter of water/treatment (H4), which was 5.25 saplings and the lowest was 0 ml/liter of water/treatment (H0), which was 3.94 seedlings.

The results of the regression analysis of the application of goat urine liquid organic fertilizer to the number of saplings show a linear relationship, as presented in Figure 2.

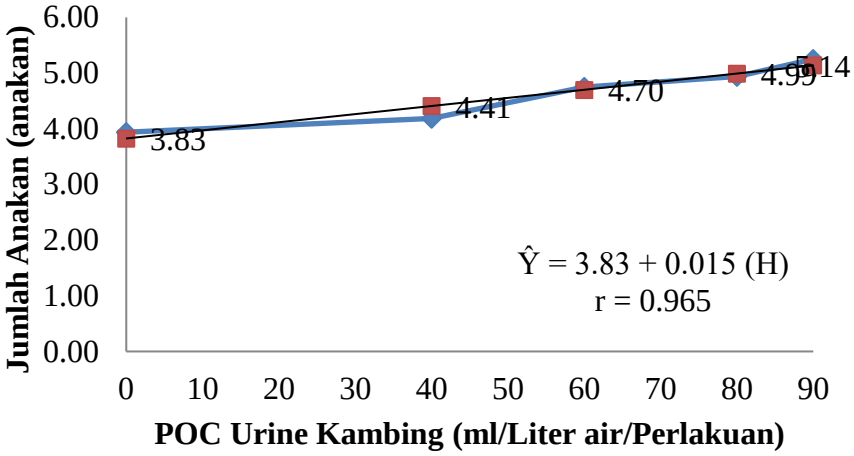

Fig 2. Graph of the Relationship Between the Application of Goat Urine Liquid Organic Fertilizer (ml/Liter of Water/Treatment) and the Number of Chicks (Chicks)

3. Wet Weight Per Sample (g)

The data on the measurement of the average wet weight per sample with the application of liquid organic fertilizer of goat urine that has been tested differently using the double distance test (Duncan) is seen in Appendix 9.

Based on the analysis of various fingerprints on the wet weight parameter per sample, it was obtained that the application of liquid organic fertilizer of goat urine had a very real effect on the wet weight per sample.

The data on the average wet weight per sample with the application of liquid organic fertilizer of goat urine can be seen in the following table:

Table 3. Average Observation of Wet Weight Per Sample (g) Effect of Liquid Organic Fertilizer on Goat Urine Supply.

Treatment	Wet Weight Per Sample (g)
Goat Urine Liquid Organic Fertilizer (H)	
H0 = 0 ml/Liter of water/treatment	207.88 dD
H1 = 40 ml/Liter of water/treatment	265.75 dC
H2 = 60 ml/Liter of water/treatment	330.00 abA
H3 = 80 ml/Liter of water/treatment	288.06 bcAB
H4 = 90 ml/Liter of water/treatment	352.75 aA

Remarks: Numbers followed by the same letter in the same column show an unreal difference at the level of 5% (lowercase) and 1% (uppercase).

In Table 3 above, the application of liquid organic fertilizer with goat urine states a real effect on the wet weight per sample. The highest average was found in the treatment of 90 ml/liter of water/treatment (H4) which was 352.75 g and the lowest was 0 ml/liter of water/treatment (H0) which was 207.88 g.

The results of the regression analysis of the application of goat urine liquid organic fertilizer to the wet weight per sample show a linear relationship, as presented in Figure 3.

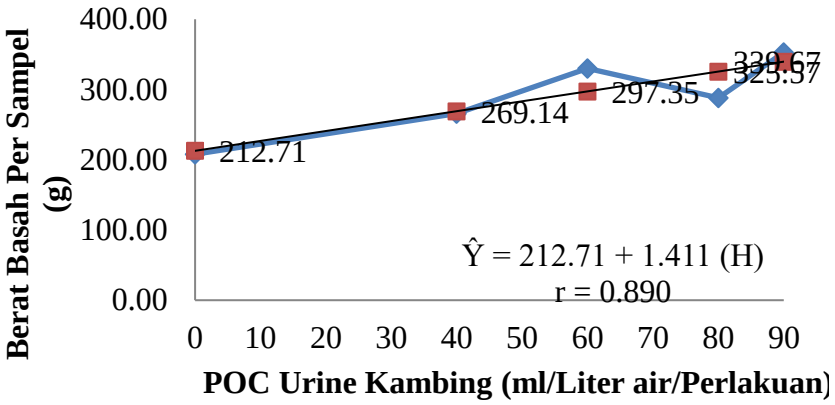

Figure 3. Graph of the Relationship Between the Application of Goat Urine Liquid Organic Fertilizer (ml/Liter of Water/Treatment) and Wet Weight Per Sample (g).

4. Consumption Weight Per Sample (g)

The data on the measurement of the average weight of consumption per sample with the application of liquid organic fertilizer of goat urine that has been tested differently using the double distance test (Duncan) is seen in Appendix 10.

Based on the analysis of various fingerprints on the consumption weight parameter per sample, it was obtained that the application of liquid organic fertilizer of goat urine had a real effect on the consumption weight per sample.

Data on the average weight of consumption per sample with the application of liquid organic fertilizer of goat urine can be seen in the following table:

Table 4. Average Observation of Consumption Weight Per Sample (g) Effect of Organic Fertilizer Application of Goat Urine Liquid.

Treatment	Consumption Weight Per Sample (g)

Goat Urine Liquid Organic Fertilizer (H)	
H0 = 0 ml/Liter of water/treatment	126.56 dD
H1 = 40 ml/Liter of water/treatment	176.63 dC
H2 = 60 ml/Liter of water/treatment	232.56 abAB
H3 = 80 ml/Liter of water/treatment	188.88 cBC
H4 = 90 ml/Liter of water/treatment	250.44 aA

Remarks: Numbers followed by the same letter in the same column show an unreal difference at the level of 5% (lowercase) and 1% (uppercase).

In Table 4 above, the application of liquid organic fertilizer from goat urine states a real effect on the weight of consumption per sample. The highest average was found in the treatment of 90 ml/liter of water/treatment (H4) which was 250.44 g and the lowest was 0 ml/liter of water/treatment (H0) which was 126.56 g.
The results of the regression analysis of the application of liquid organic fertilizer from goat urine to the weight of consumption per sample show a linear relationship, as presented in Figure 4.

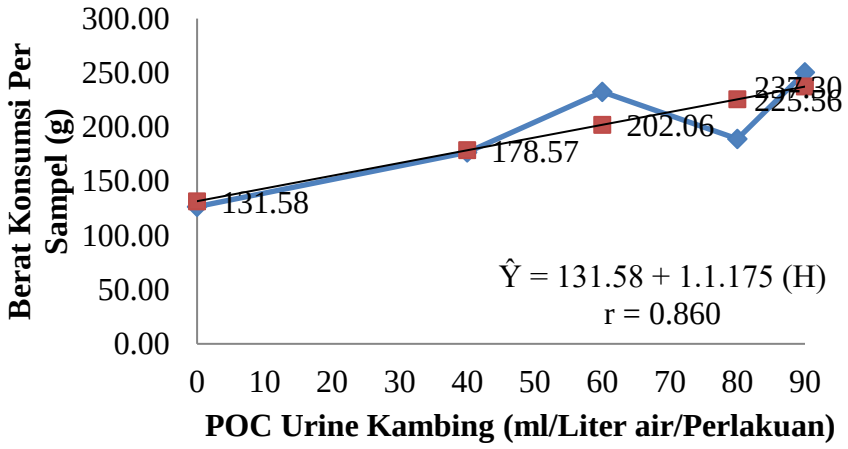

Fig 4. Graph of the Relationship Between the Application of Goat Urine Liquid Organic Fertilizer (ml/Liter of Water/Treatment) and the Weight of Consumption Per Sample (g).

B. Discussion

1. Effect of Growth and Production of Celery Plants (*Apium graveolens* L.) on the Use of Goat Urine Liquid Organic Fertilizer

The results of the study on the effect of the application of goat urine liquid organic fertilizer on the growth and production of celery plants have a real effect on the height of plants aged 1 and 2 MSPT, but have a very real effect on the age of 3 MSPT, this is because the application of goat urine liquid organic fertilizer in the H4 treatment is a fairly good treatment in supporting root growth and storing nutrients so that plant growth becomes better. Better soil conditions lead to increased plant height growth. This finding is in line with research conducted by Yuniti et al. (2023) which shows that the application of goat urine organic fertilizer can increase nutrient absorption in plants. The use of goat urine organic fertilizer has been proven to increase NPK levels, soil pH, crude fiber, protein, and moisture content, so that it has a positive impact on the growth of celery plants.
Celery plants develop roots uniformly, thus allowing for better absorption of nutrients to encourage their growth. This shows that the application of Liquid Organic Fertilizer (POC) concentration is the most effective in encouraging an increase in plant height. (Satriawi, 2019).
The results of the variegated fingerprint showed a real effect on the application of liquid organic fertilizer of goat urine on the number of calves, where the best influence was had by the H4 treatment. The carbohydrates produced by the leaves during the process of photosynthesis play an important role in stimulating the development of new organs, which leads to the formation of celery buds. This number

of buds significantly affects the total number of leaves. The increase in the number of leaves increases the plant's capacity for photosynthesis, as more sunlight can be absorbed by the leaves during this process, resulting in greater photosynthetal yields. The volume of photosynthes produced further affects the height of the plant, the number of leaves, and the appearance of additional shoots (Nurfadilah et, al., 2021).

The results of fresh weight variation fingerprints per sample showed a real effect due to the application of liquid organic fertilizer of goat urine, the best treatment was obtained in the H4 treatment which was able to make celery plants grow well. Liquid fertilizer derived from goat urine is rich in essential nutrients, including nitrogen (N), phosphorus (P), and potassium (K). As stated by Lestari et, al. (2020), nitrogen plays a fundamental role in the formation of protein compounds in plants. Its main function is to support the development of plant vegetative structures, such as leaves, stems, and roots. Phosphorus is essential for the storage and transfer of energy necessary for all metabolic processes in plants. Meanwhile, potassium aids in the absorption of water and nutrients, as well as the transport of asmylates from the leaves to other plant tissues. Collectively, these elements contribute significantly to the increase in the production of celery plants, especially in terms of their fresh weight. An increase in the fresh weight of plants correlates with an increase in growth rate.

The weight of consumption per sample had a real effect due to the application of liquid organic fertilizer for goat urine. The yield component in plants is influenced by the ability of plants to photosynthesize to produce photosynthetics during vegetative growth. An increase in plant height and a greater number of celery shoots was observed in H4 treatment compared to other treatments. The significant number of leaves makes an important contribution to improving the photosynthesis process, thus promoting plant growth and yield. According to Lesmanasari and Barunawati (2022), the application of nitrogen-containing fertilizers is very important for plant vegetative growth, because it stimulates growth, especially on stems and leaves, thereby causing an increase in plant yields, including the weight of consumption.

5. CONCLUSION

Based on the results of the study, it was shown that the application of liquid organic fertilizer from agricultural waste stated a real effect on plant height at the age of 1 and 2, but had a very real effect on the age of 3 MSPT. The highest average was found in the treatment of 90 ml/liter of water/treatment (H4) which was 22.98 cm and the lowest was 0 ml/liter of water/treatment (H0) which was 12.50 pieces. Based on the results of the study, it was shown that the application of liquid organic fertilizer from agricultural waste stated a real influence on the number of tillers. The highest average was found in the treatment of 80 ml/liter of water/treatment (H4), which was 5.25 saplings and the lowest was 0 ml/liter of water/treatment (H0), which was 3.94 seedlings.

Based on the results of the study, it was shown that the application of liquid organic fertilizer of goat urine stated a real effect on the wet weight per sample. The highest average was found in the treatment of 90 ml/liter of water/treatment (H4) which was 352.75 g and the lowest was 0 ml/liter of water/treatment (H0) which was 207.88 g. Based on the results of the study, it was shown that the application of liquid organic fertilizer of goat urine stated a real effect on the weight of consumption per sample. The highest average was found in the treatment of 90 ml/liter of water/treatment (H4) which was 250.44 g and the lowest was 0 ml/liter of water/treatment (H0) which was 126.56 g.

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