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UTILIZATION OF GOAT MANURE AND GOLDEN SNAILS AS LIQUID ORGANIC FERTILIZER TO INCREASE AVAILABLE P, GROWTH AND PRODUCTION OF PEANUTS (*ARACHIS HYPOGAEA* L.) IN ULTISOL

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ABSTRACT
Goat dung and golden snail Liquid Organic Fertilizer (LOF) can be used to improve nutrient P in ultisol, which is categorized as a marginal soil with low nutrient content, particularly P, and an acidic reaction. The purpose of this study was to assess how the growth and yield of peanuts affected the soil's P-availability by applying fertilizer made of goat dung and golden snail LOF. The study was conducted at the UISU Gedung Johor Experimental Garden, Medan, using a factorial randomized block design, three replications, and treatments consisting of goat manure and golden snail LOF at different concentrations. The study's findings demonstrated that adding goat manure and golden snail LOF together could raise P-available ultisol levels. Additionally, when applied separately, goat manure and golden snail LOF could boost peanut growth and yield in comparison to the control treatment. Separately, the best goat manure dosage is 1800 g/plot, and the best golden snail LOF concentration is 300 mL/L/plot, both of which can boost peanut plant growth and yield. In a similar manner, 1800 g/plot of goat manure and 300 mL/L/plot of golden snail LOF combined to raise the P-available ultisol in comparison to the control treatment.

KEYWORDS: Peanut, P-available, Ultisol, LOF.

INTRODUCTION

Indonesia has various types of soil, each with features that distinguish one type of soil from another. Red Yellow Podsolic Soil, also known as Ultisol soil, is included in the category of marginal soil because it is less fertile, has low nutrient content, and an acid reaction (Handayani and Karnilawati, 2018).

The distribution of Ultisol soil in Indonesia is quite extensive and is widely used in agriculture even though it has soil with a high acidity level, with an average pH of less than 4.50, high Al concentration, low macronutrient content especially P, K, Ca, Mg, and organic matter (Pasang et al., 2019).

One way to increase the fertility of Ultisol soil is to provide organic fertilizer to improve the physical, chemical, and biological properties of the soil. One of the organic fertilizers that can be added is the golden apple snail, which is a pest in rice plants, as a liquid organic fertilizer (LOF).

Pomaceae canaliculata or golden apple snails are pests that must be controlled in rice fields. They can cause damage to up to 40% of rice planting areas in Java, Sumatra, Kalimantan, NTB, and Bali. Yudi et al. (2013) found that the shell and meat of golden apple snails contain 12.2 mg of protein, 60 mg of P, and 17 mg of K, as well as additional elements such as C, Mn, Cu, and Zn. According to Prayitna's research (2017), LOF Golden Snail contains 52.7% protein, 3.20% fat, 5.59% fiber, and minerals such as Ca (7593.81 mg/100g), Na (620.84 mg/100g), K (1454.32 mg/100g), P (1454.32 mg/100g), Mg (238.05 mg/100g), Zn (20.57 mg/100g), and Fe (44.16 mg/100g).

Studies show that LOF golden snail can increase soil fertility and plant growth and yield. Among the research results of Kurniawati and Tunada (2019) on spinach plants and Setiawan et al. (2020) on cucumber plants. From the results of the study, it was found that LOF golden snails with doses of 35 mL/m2 and 4 mL/L of water can increase the growth and yield of spinach and cucumber plants, respectively. Likewise, the results of

the study by Siregar et al. (2021) showed that giving LOF golden snails 150 mL/L of water/polybag can increase the availability of P in Andisol soil and increase the growth and production of green beans. However, LOF has weaknesses, namely the amount of nutrient content is small and the release is slow. Therefore, it is necessary to add other fertilizers in certain amounts (Baharuddin, 2016).

Other fertilizers that can be added include goat manure. Surya and Suyono (2013) found that this was caused by a mixture of goat manure and urine, which also contains nutrients that are usually not found in other manures. Goat manure contains 20.45% organic C, 2.27% N, 1.56% P, 3.21% K, and 12.56% water content (Trivana et al., 2017). The advantages of using goat manure include[1] increasing the amount of nutrients in the soil;[2] creating micropores;[3] reducing metal toxicity bound to clay, thereby increasing soil aggregate formation;[4] increasing water holding capacity;[5] increasing soil aeration; and[6] containing N nutrients that can encourage photosynthesis of plant organs such as leaves (Dewi, 2016).

It is expected that the provision of organic fertilizer LOF golden snails and goat manure will help overcome the problems of Ultisol soil, as well as increase the growth and yield of peanuts. Based on this, the purpose of this study was to determine the reaction of peanut plants to the provision of LOF golden snails and goat manure as organic fertilizers. It is estimated that the provision of these two fertilizers will increase the growth and yield of peanut plants and increase the level of P available in ultisol soil.

MATERIALS AND METHODS

This study was conducted from November 2021 to February 2022 at the UISU Faculty of Agriculture Experimental Garden, Gedung Johor in Medan, North Sumatra. This location has an altitude of ± 25 meters above sea level with flat topography. The concentration of LOF Golden Snail (M) and the dose of goat manure (K) were two treatment factors arranged in a factorial Randomized Block Design research method.

The dose of Goat Manure (K) consisted of three aspects: without Goat Manure (K0), 4 tons/ha (900 g/plot) (K1), and 8 tons/ha (1800 g/plot) (K2). The concentration of LOF golden snail (M) consisted of four aspects: without LOF (M0), 100 mL LOF/L water/plot (M1), 200 mL LOF/L water/plot (M2), and 300 mL LOF/L water/plot (M3). All treatment combinations were repeated 3 times.

Making of Golden Snail LOF: To make LOF golden snails, the ingredients used are one kilogram of live golden snails, four liters of rice washing, two liters of coconut water, four liters of clean water, one kilogram of brown sugar, and 160 milliliters of EM-4. In addition, the tools used are a bucket, mineral water bottle, plastic hose, strainer, jerry can, and a pestle.

How to make LOF Golden Snails is to put the rice washing water and EM4 into a bucket and mix them properly. Then, the flesh and shell of the live golden snails are pounded until completely crushed, then mix the molasses liquid and coconut water in one place. Combine the ingredients and stir until smooth. Insert a small hose into the jerry can after the lid is tight, the hole is the size of the hose, and the logs are tight. Then, insert a mineral water bottle that has been half filled with clean water into the jerry can. The purpose of this treatment is to find out how long the fermentation process takes. Wait for ten to fifteen days for fermentation. According to Gloryana (2019), the fermentation process is considered successful if it smells like tape. However, if the smell is unpleasant, the process has failed.

Peanut Seed Preparation: The peanut seeds used are of high quality. Soaking the seeds in warm water for thirty minutes is a way to find out whether the seeds are good or not. Good seeds will not float when soaked.

Fertilizer Treatment: One week before planting, goat manure was given by spreading the fertilizer on each plot with a dose according to the treatment, namely 0 tons/ha, 4 tons/ha (900 g/plot), 8 tons/ha (1800 g/plot). The administration of golden snail LOF was carried out two weeks before planting by sprinkling LOF on each experimental plot with a dose according to the treatment.

Planting: The process of planting peanut seeds begins by planting two seeds per hole in a plot with a depth of 2 cm from the ground surface. The hole is then covered with a thin layer of soil and watered as needed to ensure that the peanut seeds grow well. Watering is carried out every two days with a volume of 100 milliliters of water per plot during the growth process of peanut sprouts.

Observed Variables: Soil available P content and peanut plant growth and yield were the observed variables. The observation data obtained during the study were processed according to the research method used. If there was a significant difference, it was continued with the Duncan test at the 5% level. Data processing was carried out using Minitab 19 Software.

RESULTS AND DISCUSSION

P-available: The results of the analysis of variance showed that, both independently and in interaction, the goat manure and golden snail LOF treatments had no significant impact on the available phosphorus content in the soil before treatment (Table 1). On the other hand, this treatment had a significant impact on the available phosphorus content in the soil after treatment (Table 2).

In the treatment of golden snail LOF, it was seen that the higher the concentration of LOF given, the higher the available P content, where the highest available P content was 31.88 ppm in the 300 mL/L water/plot treatment (M3) which was classified as high, and the lowest was found without golden snail LOF (M0), which was 12.22

ppm which was classified as low. This is because the golden snail LOF given has a P_2O_5 content of 0.10% and is an organic-based LOF, namely decomposed golden snails. The same results were found in the study of Siregar et al. (2021), that the provision of golden snail LOF can increase the availability of P in Andisol soil. According to Stevenson (2001), organic matter in decomposed soil can increase the availability of N, S, and P nutrients, as well as increase the soil cation exchange capacity (CEC) and improve soil texture.

Table 1. Available P content (ppm) of soil before treatment with LOF golden snails and goat manure.

Treatments	Golden Snail LOF (mL/L/plot) (M)				Average (K)
	Control (M0)	100 (M1)	200 (M2)	300 (M3)	
Goat Manure (g/plot) (K)					
Control (K0)	9.68	9.67	9.68	9.66	9.67
900 (K1)	9.67	9.68	9.66	9.68	9.67
1800 (K2)	9.65	9.66	9.67	9.66	9.66
Average (M)	9.67	9.67	9.67	9.67	

Note: Numbers in the same column without notation are not significantly different at the 5% level based on Duncan's test.

The available P content of ultisol soil is low, as shown in Table 1 and is homogeneous for all experimental plots. However, after the administration of LOF golden snails and goat manure, there was a significant difference in the available P content (Table 2).

Table 2. Available P content (ppm) of soil after treatment with LOF golden snails and goat manure.

Treatments	Golden Snail LOF (mL/L/plot) (M)				Average (K)
	Control (M0)	100 (M1)	200 (M2)	300 (M3)	
Goat Manure (g/plot) (K)					
Control (K0)	7.84 l	15.02 j	20.54 e	26.73 d	17.53 c
900 (K1)	11.54 k	15.64 i	19.34 f	32.47 b	19.75 b
1800 (K2)	17.28 g	16.88 h	29.19 c	36.43 a	24.95 a
Average (M)	12.22 d	15.85 c	23.02 b	31.88 a	

Note: Numbers in the same column without notation are not significantly different at the 5% level based on Duncan's test.

Table 2 shows that the administration of goat manure also had a significant impact on the available P of the soil, where the highest available P content was found in the goat manure treatment of 1800 g/plot (K2), which was 24.95 ppm which was classified as moderate, and the lowest in the control treatment (K0), which was 17.53 ppm which was also classified as moderate. In accordance with the findings of research conducted by Poblete-Grant et al. (2020), which also found that available P in the soil increased with the administration of manure and in the control treatment through three mechanisms, namely[1] direct contribution from available P from the fertilizer given,[2] slow release from other P pools, and[3] activation of the original P pool of the soil.

Interaction treatments also had a significant impact on the amount of phosphorus available in the soil (Table 2). The M3K2 interaction treatment (300 mL LOF/L water/plot + 1800 g/plot goat manure) had the highest phosphorus content, 36.43 ppm, which is a very high criterion; the M0K0 interaction treatment (control) had the lowest phosphorus content, 7.84 ppm, which is a very low criterion.

In the M3K2 interaction treatment (300 mL LOF/L water/plot + 1800 g/plot goat manure), there was an increase in available P of 277.12%, while in the control treatment there was a decrease in available P content of 19%. This shows that the provision of goat manure and golden snail LOF can increase the availability of P in ultisol soil. Harahap et al. (2020) stated that the presence of organic matter, either directly or through the mineralization process, or the provision of fertilizers containing organic matter to release fixed P can be the cause of phosphorus availability in the soil. Furthermore, Nest et al. (2016) stated that organic matter given in the form of organic fertilizer will release organic acids which will increase P-available through[1] competition between organic acids and orthophosphates at the binding sites of Al and Fe oxides, or[2] reducing the number of binding sites through chelation and dissolution of Al and Fe oxides with organic acids.

Peanut Growth: Analysis of variance showed that the treatment of golden snail LOF and goat manure had a significant impact on the height of peanut plants at four weeks after planting (WAP). In contrast, the interaction of treatments had no significant impact on the height of peanut plants at four WAP (Table 3).

Table 3. Average plant height (cm) of peanuts at 4 WAP with the provision of LOF golden snails and goat manure.

Treatments	Golden Snail LOF (mL/L/plot) (M)				Average (K)
	Control (M0)	100 (M1)	200 (M2)	300 (M3)	
Goat Manure (g/plot) (K)					
Control (K0)	23.67	28.83	29.17	32.50	28.54 b
900 (K1)	26.67	31.67	35.50	42.50	34.08 a
1800 (K2)	32.83	38.33	38.25	46.08	38.88 a
Average (M)	27.72 c	32.94 b	34.31 b	40.36 a	

Note: Numbers in the same column without notation are not significantly different at the 5% level based on Duncan's test.

Table 3 shows that the provision of golden snail LOF significantly affected the height of peanut plants, where the provision of golden snail LOF 300 mL.L water/plot (M3) produced the highest peanut plant height, which was 40.36 cm, and the lowest peanut plant was found in the control treatment (K0), which was 27.72 cm. This is due to the content of N, P, and K nutrients in the golden snail LOF. Based on laboratory results, the golden snail LOF contains 0.95% organic C, 0.27% total N, 0.10% P_2O_5, and 0.25% K_2O. This is different from the results of the study by Setiawan et al. (2020), that the LOF content of golden snails from the results of their research was 0.22% N, 0.08% P, and 2,534% K. However, the nutrient content in the LOF of golden snails in this study was still in accordance with the Indonesian National Standard (SNI 19-7030-2004), N more than 0.40%, P more than 0.10%, and K content more than 0.20% (Madusari et al., 2021).

Pincus et al. (2016) stated that the balance of nutrients in the soil will affect the absorption of nutrients by plants, which is expected to increase plant growth and production. The same thing was found in the research of Theodora et al. (2021) and Novianto et al. (2021) that the provision of LOF golden snails can increase the growth of winged bean plants. Table 3 shows that the provision of goat manure also had a significant impact on the height of peanut plants, where 1800 g/plot goat manure (K2) produced the highest peanut plant height, which was 38.88 cm, while the lowest plant height was found in the control treatment (K0), which was 28.54 cm. This is because based on the results of laboratory analysis, the goat manure used contained 18.91% organic C, 0.72% total N, 0.41% P_2O_5, and 0.25% K_2O. According to the research results of Safitri et al. (2017), that the provision of goat manure can stimulate the growth of corn plants. Mansyur et al. (2021) stated that goat manure has a round grain texture that is difficult to break down physically, so if it is to be used as fertilizer, it is better to compost the goat manure first.

Goat manure contains quite high N (0.72%) to increase vegetative growth. Mansyur et al. (2021) stated that N is a component of protein, amino acids, and fat, as well as a component of leaf chlorophyll, which plays an important role in plant photosynthesis so that it can trigger vegetative plant growth. In addition, Tania et al. (2012) stated that more photosynthate will be used to increase plant growth if sufficient N is available to plants. This means that the chlorophyll content in the leaves will increase as a result of the faster photosynthesis process.

nalysis of variance showed that LOF of golden snails and goat manure had a significant impact on the number of peanut plant branches at four weeks after planting (WAP). In contrast, the interaction of treatments had no significant impact on the number of peanut plant branches at four WAP (Table 4).

Table 4. Average number of peanut branches (twigs) with the provision of golden snail LOF and goat manure.

Treatments	Golden Snail LOF (mL/L/plot) (M)				Average (K)
	Control (M0)	100 (M1)	200 (M2)	300 (M3)	
Goat Manure (g/plot) (K)					
control (K0)	6.50	6.42	6.42	7.83	6.79
900 (K1)	6.67	6.58	7.00	7.08	6.83
1800 (K2)	6.42	6.58	7.00	7.67	6.92
Average (M)	6.53	6.53	6.81	7.53	

Note: Numbers in the same column without notation are not significantly different at the 5% level based on Duncan's test.

Table 4 shows that there is no significant difference between each treatment used, both golden snail LOF and goat manure. However, when viewed from the data, it can be seen that there is an increase in the number of branches with increasing concentration of golden snail LOF and the dose of goat manure given. This shows that golden snail LOF and goat manure can contribute macronutrients such as N, which are very important for plant vegetative growth. Hanafiah (2019) explained that N nutrients are essential for the formation of vegetative parts of plants such as leaves, stems, and roots. N nutrients also play an important role in the formation of

green leaves, helping to improve the photosynthesis process, the quality of leaf-producing plants, and the growth of microorganisms in the soil. Increasing the photosynthesis process in plants will cause an increase in photosynthesis results, which will have an impact on branch formation. According to Lakitan (2004), photosynthesis results contribute 90% to plant growth.

Peanut Yield: Analysis of variance showed that the treatment of golden snail LOF and goat manure had a significant impact on the number of pods per peanut plot, while the interaction treatment had no significant impact (Table 5).

Table 5 shows that the provision of golden snail LOF had a significant effect on the number of pods per peanut plant plot, where the highest number of pods per plot was found in the golden snail LOF treatment of 300 mL/L/plot (M3), which was 394.22 pods, while the lowest number of pods per plot was found in the control treatment (M0), which was 309.40 pods. According to Bunyani (2021), the N contained in the golden snail LOF is an important element in protoplasm and helps leaf formation. Golden snail extract also increases decomposer microorganisms in the soil which accelerates the decomposition process of organic matter in the soil and can provide the protein and carbohydrates needed in pod formation.

Table 5. Average number of peanut pods with the provision of golden snail LOF and goat manure.

Treatments	Golden Snail LOF (mL/L/plot) (M)				Average (K)
	Control (M0)	100 (M1)	200 (M2)	300 (M3)	
Goat Manure (g/plot) (K)					
Control (K0)	285.60	327.60	327.60	352.80	323.40 b
900 (K1)	285.60	352.80	403.20	415.80	364.35 a
1800 (K2)	357.00	378.00	407.40	414.07	389.12 a
Average (M)	309.40 c	352.80 b	379.40 ab	394.22 a	

Note: Numbers in the same column without notation are not significantly different at the 5% level based on Duncan's test.

LOF golden snails, in addition to containing N nutrients, also contain P which plays an important role in cell division and enlargement (Ardy et al., 2022). Furthermore, Dahlia and Setiono (2020) stated that P is needed by plants to stimulate nutrient absorption by increasing the number of nodules in the plant root system, thereby expanding the reach of the roots and maximizing the absorption of nutrients from the soil to the plants. This can affect the number of peanut pods.

Goat manure also had a significant effect on the number of pods per peanut plot. The highest number of pods per plot was found in the goat manure dose treatment of 1800 g/plot (K2), which was 389.12 pods, followed by the treatment of 900 g/plot goat manure (K1), which was 364.35 pods and the lowest in the control treatment (K0), which were 323.40 pods (Table 5). This was because the provision of goat manure caused the soil P-available content to be higher compared to the control treatment (Table 1), so that P was more easily absorbed by plants which were used for pod formation and seed filling, reducing the number of empty pods, and accelerating the ripening of pods (Adisarwanto, 2000). In addition, goat manure also contains elements N, and K, where N plays a role in the vegetative growth of plants, and can accelerate the carbohydrate synthesis process, while the K element can improve the quality of fruit in plants (Sutedjo, 2010). Analysis of variance showed that the LOF treatments of golden snails and goat manure had a significant effect on the weight of pods per peanut plant plot, while the interaction treatment had no significant effect (Table 6).

Table 6. Average weight of pods per plot (g) of peanuts with the provision of LOF golden snails and goat manure.

Treatments	Golden Snail LOF (mL/L/plot) (M)				Average (K)
	Control (M0)	100 (M1)	200 (M2)	300 (M3)	
Goat Manure (g/plot) (K)					
Control (K0)	237.55	290.00	325.00	345.83	299.60 b
900 (K1)	266.67	325.00	354.17	392.53	334.59 a
1800 (K2)	295.83	341.67	392.50	396.00	356.50 a
Average (M)	266.68 c	318.89 b	357.22 ab	378.12 a	

Note: Numbers in the same column without notation are not significantly different at the 5% level based on Duncan's test.

Table 6 shows that the provision of golden snail LOF has a significant impact on the weight of peanut pods per plot, where the heaviest pod weight per plot was found in the treatment of golden snail LOF 300 mL/L/plot (M3),

which was 378.12 g, followed by the treatment of golden snail LOF 200 mL/L/plot (M2), which was 357.22 g, the treatment of LOF 100 mL/L/plot (M1), which was 318.89 g, while the lowest was found in the control treatment (M0), which was 266.69 g. This is because the golden snail LOF can increase the available P in the soil which is higher compared to the control treatment (Table 1), so that the plant's need for P is more available which causes the number of pods formed to be greater (Table 5) and become heavier in weight. According to Syamsudin et al. (2010), P nutrients play a role in changing carbohydrates which will contribute to the formation of pods, both in size and weight.

P available in the soil will increase the size and weight of the pods. In addition, P has the ability to increase the capacity of roots to absorb nutrients N and K. In the process of photosynthesis, N and K form chlorophyll, which produces carbohydrates and proteins that are useful in the formation of pods. In addition, Hisani and Mallawa (2017) stated that the element K plays a role in photosynthetic translocation, which has an impact on the weight of the pods formed.

Table 6 also shows that goat manure has a significant effect on the weight of peanut pods. The heaviest peanut pod weight was found in the goat manure treatment of 1800 g/plot (K2), which was 356.50 g, followed by the goat manure treatment of 900 g/plot (K1), which was 334.59 g, while the lowest pod weight was found in the control treatment (K0), which was 299.60 g. This is also partly due to the higher content of soil-available P in the K2 and K1 treatments compared to the K0 treatment (Table 1), so that the plant's need for P elements is more fulfilled. In addition, goat manure also contains N and K nutrients.

Putri et al. (2023) stated that P nutrients are very much needed by plants during the flowering and fruiting process to accelerate pod formation. In addition, Wardhani et al. (2014) stated that N and K nutrients also play a role in pod formation, because they form carbohydrates, fats, proteins, minerals, and vitamins to be transferred to the pod storage section.

CONCLUSION

The administration of 300 mL/L/plot of golden snail LOF and 1800 g/plot of goat manure can increase soil-available P in ultisol soil by 277.12% after treatment compared to the control treatment which experienced a decrease in soil-available P by 23.47%.

Golden snail LOF and goat manure independently had a significant effect on the growth and yield of peanut plants. The results of the study found that the increasing concentration of golden snail LOF and the dose of goat manure, the higher the growth and yield of peanut plants. The best concentration of golden snail LOF and dose of goat manure to increase the growth and yield of peanuts were 300 mL/L/plot and 1800 g/plot, respectively.

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