

Article

The Effect of Concentration and Time Interval of Golden Snail Liquid Organic Fertilizer on The Growth and Yield of Sweet Corn (*Zea mays var. saccharata* Sturt)

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Abstract. This research aims to obtain the correct concentration and time interval for administering golden snail Liquid Organic Fertilizer (LOF) on the growth and yield of sweet corn (*Zea mays var. saccharata* Sturt). The experiment was carried out in Korong Gadang Village, Padang, West Sumatra on Ultisol soil type with a height of 10 meters above sea level. The experiment used a factorial completely randomized design (CRD), the first factor was the LOF of golden snails 0ml/L, 50 ml/L, 100 ml/L, the second factor was the time interval for administering 5, 10, and 15 days with 3 repetitions. times to obtain 27 experimental units. The parameters observed consisted of plant height, ILD, age at which male flowers appeared, age at which female flowers appeared, weight of cobs with husks, weight of cobs without husks, length of cobs, number of rows of cobs, number of seeds per row, weight of fresh shells, production per plot and per Ha. The experimental results showed that there was an interaction between the concentration and the time interval for administering golden snail LOF on the weight of shelled cobs and the weight of fresh shelled shells when given a concentration of 100ml/L.

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1. Introduction

Sweet corn is a plant that has long been known in Indonesia. Apart from having a sweeter taste and a shorter plant life than ordinary corn, sweet corn also has high economic value so it can increase farmers' income [1-2]. This is because sweet corn is more profitable than regular corn. Sweet corn is more popular with people because it tastes sweet. Apart from being consumed fresh, sweet corn is also canned and the kernels are frozen after being popped from the cob. Sweet corn also has a distinctive aroma and better nutritional content [3].

Market demand for sweet corn continues to increase and the large market opportunities can not be fully utilized by Indonesian farmers and entrepreneurs due to various obstacles. The sweet corn productivity in the country is still low compared to other producing countries, due to the inappropriate cultivation system. Sweet corn productivity in Indonesia averages 8.31 tonnes/ha. The growth and quality of sweet corn yields are thought to be influenced by environmental factors, soil fertility. Therefore, organic fertilization is one method used to improve soil fertility [4-5]. Organic fertilizer is fertilizer with basic ingredients taken from nature with the amount and type of nutrients contained naturally [6].

One of the organic fertilizers that can increase soil fertility is liquid organic fertilizer from golden snails, golden snails contain macro nutrients consisting of Calcium (Ca) 5600 ppm, protein 12.2, Phosphorus (P) 60 mg. as well as various other nutrients such as C, Mn, Cu, and Zn. Which is useful for fertilizing agricultural and plantation crops [3].

According to Rosmawaty, giving golden snail LOF of 45ml/l affects the flowering time and harvest time of peanut plants [7]. The results of Carabio's research a concentration of 30 ml/l and NPK fertilizer had the best effect on the growth and production of lettuce plants [8]. According to Hasibuan, giving 21 ml/l LOF of golden snails has an effect on cucumber plant production [9].

In principle, when fertilizing via leaves, you must pay attention to the correct application time, through leaves must be done because nutrient uptake is limited. Therefore in the application it is necessary to pay attention to the concentration and time interval for administration to make it more efficient. Application time also determines plant growth [10]. The aim of this research was to obtain the interaction between the concentration and time interval of giving golden snail LOF on the growth and yield of sweet corn plants, to obtain the effect of the concentration of golden snail LOF on the growth and yield of sweet corn plants.

2. Method

Experiments were carried out on dry land in Korong Gadang Village, Kuranji District, Padang City. The materials used in this research were Bonanza variety corn seeds, golden snails, manure, Urea fertilizer, SP36, KCL, Pravatoin insecticide, Dithane M-45. The equipment used is a hoe, machete, jugular, hand sprayer, analytical scales, measuring tape, bucket, gembor, scissors, cutter knife, stakes, label boards and writing tools.

The experimental design used in this research was a completely randomized design (CRD) with 2 factors. The first is the concentration of golden snails with 3 levels, namely 0 ml/liter, 50 ml/liter, 100 ml/liter. The second factor is the time interval for administering golden snail POC, namely once every 5 days, once every 10 days, and once every 15 days. Combining each treatment, 9 treatments were obtained with 3 replications to obtain 27 experimental units. The data from the last observation is investigated for variance and if the calculated F is greater than the F table at the 5% and 1% levels, it is continued with Duncan's New Range Test (DNMRT) 5% and 1% [11-12].

Parameters observed included plant height, leaf area index, age at emergence of male flowers, age at emergence of female flowers, weight of cobs with husks, weight of cobs without husks, length of cobs without husks, number of rows per cob, number of seeds per row, weight of fresh shells per cob, and weight per Plot and per Ha [13].

3. Results and Discussion

3.1 Plant Height

Results of variance in plant height, concentration and time interval for administering golden snail LOF to sweet corn showed that the interaction was not significant. The same thing is that the single factor concentration and time interval for administering golden snail LOF did not have a significant effect on plant height.

Table 1. Shows plant height with a concentration of 0ml/L resulting in a plant height of 211.80 cm, a concentration of 50ml/L 211.61cm, 100ml/L 223.00. Meanwhile, with a time interval of giving every 5 days, the plant height was 215.33 cm, every 10 days 213.33 cm, every 15 days 217.75 cm. When compared with the description of sweet corn, the plant height is not much different, it can be classified as normal sweet corn plant height [13-14].

Table 1. Height of Sweet Corn Plants with Concentration and Time Interval for Administering Golden Snail Poc

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
0	208.58	208.42	218.42	211.80
50	213.87	210.00	210.96	211.61
100	223.54	221.59	223.87	223.00
Average	215.33	213.33	217.75	
KK=8.16%				

Giving a higher concentration of golden snail LOF of 100 ml/L did not give better results, as did the treatment without golden snail LOF, it is suspected that the contribution of LOF to the plant was not sufficient for plant height. The maximum plant growth will be achieved if the supply of nutrients to plants is in optimal conditions because a deficiency or excess of one nutrient will reduce the efficiency of other elements and can reduce the quantity and quality of plants [11],[15].

3.2 Leaf Area Index

The results of variance analysis of the leaf area index of sweet corn plants with the concentration and time interval of golden snail LOF showed no significant interaction. The single treatment factor of administering golden snail LOF concentration had a very significant effect and the time interval for administering golden snail LOF had no effect on ILD.

Table 2. Leaf Area Index of Sweet Cornplants with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
0	2.66	2.16	2.49	2.43B
50	2.72	3.15	3.09	2.98A
100	2.81	2.67	3.17	2.88A
Average	2.73	2.66	2.91	
KK=10.35%				

Column numbers followed by the same capital letter are not significantly different according to DMRT 5%.

Table 2. shows the ILD 0 ml/L 2.43, different from giving 50 ml/L 2.98, 100 ml/L 2.88. This different ILD is because the concentration of 50 ml/L applied through the leaves is sufficient for the plant's nutrient needs to add ILD. The optimum ILD value ranges from 2.96 to 5.93. The higher the plant population, the higher the number of leaves and leaf area produced by plants in a certain area compared to low populations [16-17].

Table 2 also shows that ILD once every 5 days is 2.73, once every 10 days is 2.66, once every 15 days is 2.91 and has no effect on the leaf area index. This is because a time duration that is too long for applying LOF to corn plants will cause the N levels provided in liquid fertilizer to be low. The low effectiveness of N absorption from golden snail LOF by plants is due to the loss of N fertilizers prayed on the leaves [18-19].

3.3 Age of Appearance of Male Flowers

The results of the variation in the age at which male flowers appeared showed that there was no interaction effect.

Table 3. Age of Appearance of Sweet Corn Male Flowers with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
	...Days After Planting (DAT)...			
0	45.18	45.92	45.92	45.67
50	45.75	46.00	46.90	46.21
100	45.75	46.83	46.08	46.22
Average	45.56	46.25	46.3	
KK=1.83%				

Table 3 shows that administering a concentration of 0 ml/L resulted in male flowers appearing at 45.67 days after planting (DAP), 50 ml/L at 46.21 DAP, and 100 ml/L at 46.22 DAP. Meanwhile, the time interval for administering LOF resulted in male flowers appearing at 45.56 DAP for every 5 days, 46.25 DAP for every 10 days, and 46.3 DAP for every 15 days. There was no significant effect of the concentration or the time interval for administering golden snail LOF on the age at which male flowers appeared. This was likely because the flowering age is more influenced by genetic factors. Whether plants flower quickly or slowly is determined by genetic characteristics and the environment in which the variety is tested [20].

Kuswito's research results this is related to the water needs of corn plants, where when flowering corn really needs a lot of water [21]. If the water content in the soil is higher, then the water requirement is always available. In this condition, the plant gets enough water during flowering so that it supports better flower growth [18].

3.4 Age of Appearance of Female Flowers

The results of the variation in the age at which the female flowers appeared showed that there was no interaction effect between concentration and the time interval for administering golden snail LOF. The same thing with the single factor of golden snail LOF concentration and the time interval for administering golden snail LOF showed no significant effect.

Table 4 shows that a concentration of 0 ml/L produces an age of emergence of female flowers of 51.27 DAP, 50 ml/L. 51.58DAP, 100ml/L51.39DAP. Meanwhile, the time interval of administration results in the age at which femalesemergeonceevery5days51.50HST, once every 10 days 51.64 HST, once every 15 day 51.30 HST.

Table 4. Age of Appearance of Sweet Corn Female Flowers with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
	...Days After Planting (DAT)...			
0	50.83	51.67	51.33	51.27
50	51.33	51.83	51.58	51.58
100	51.75	51.42	51.00	51.39
Average	51.50	51.64	51.30	
KK=1.04%				

There was no significant effect of the concentration or the time interval for administering golden snail LOF on the age at which female flowers appeared. This was likely because flowering age is more influenced by genetic factors. The timing of flowering is determined by genetic characteristics and environmental factors, such as photoperiod and temperature [22].

Recent research highlights that environmental conditions, including light and temperature, play critical roles in the timing of flowering. Flower formation is influenced by interactions between genetic factors and environmental signals that regulate developmental pathways [23].

3.5 Loose Cob Weight

The results of testing the variation in weight of golden snail LOF showed no interaction effect between the concentration and time interval of its application. For the single factor, the concentration of golden snail LOF had a significant effect, while the time interval of administration did not.

Table 5 shows that the weight of husked cobs at a concentration of 0 ml/L was 349.91 g, at 50 ml/L was 386.18 g, and at 100 ml/L was 374.09 g. This effect can be attributed to sufficient nutrient availability, as plants require nutrients in a form that is suitable for absorption and provided in adequate amounts to support growth and yield [3].

Table 5 also shows the weight of husked cobs with an interval of applying golden snail LOF every 5 days at 379.57 g, every 10 days at 354.22 g, and every 15 days at 377.00 g. These results suggest that the different intervals of application had no significant effect on the weight of husked cobs. This could be due to the plants' ability to efficiently utilize the nutrients provided at varying intervals [24-25].

Table 5. Weight of Husked Cobs of Sweet Corn Plants with Concentration and Time Interval for Administering Golden Snail

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
g.....			
0	363.33	324.17	362.25	349.91C
50	395.72	358.00	404.83	386.18A
100	379.67	380.50	363.92	374.09B
Average	379.57	354.22	377.00	
KK=6.72%				

Column numbers followed by the same capital letter are not significantly different according to DMRT 5%.

3.6 Cob Weight Without Lobes

The results of variance analysis, the weight of the cobs without shells showed that there was an interaction effect between the LOF concentration of golden snails and the time interval of administration.

Table 6 shows the weight of cobs without shells, a concentration of 0ml/liter of water at 5 day intervals produces 267.00 g, 10 day intervals produce 281.67 g, 15 day intervals 257.67 g. A concentration of 50 ml/liter at 5 day intervals produces 260.00, at 10 day intervals produces 234.67, at 15 day intervals 294.00g. Concentration 100 ml/liter at 5 day intervals 277.00 g, 278.00g at 10 day intervals, 266.00g at 15 day intervals.

Table 6. Weight of Sweet Corn Cobs without Husks with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
0	267.00Bb	281.67Aa	257.67Cc	267.00Bb
50	260.00Bc	234.67Cc	281.67Aa	260.00Bc
100	277.00AA	278.00Ab	234.67Cc	277.00AA
Average	267.00Bb	281.67Aa	278.00Ab	267.00Bb
KK=8.56%				

Numbers in a row followed by the same lower case letter and numbers in a column followed by the same capital letter are not significantly different according to DMRT 5%

The relatively similar weight of cobs without husks can be attributed to the allocation of more photosynthates to the seeds rather than the stems. This aligns with findings that during the growth and production phases of sweet corn, photosynthates are distributed between source and sink regions based on the plant's developmental needs [26-27]. The interaction between LOF concentration and application timing directly affects cob weight without husks, as the golden snail LOF fulfills the plant's nutrient requirements for optimal growth [3].

3.7 Cob Length Without Lobs

The results of testing variations in cob length without husks showed that there was no interaction effect between concentration and time interval for administering LOF for golden snails.

Table 7. Length of Sweet Corn Cobs without Husks with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
0	19.82	19.76	20.91	20.16
50	20.34	21.18	20.68	20.73
100	20.94	20.68	21.25	20.95
Average	20.36	20.37	20.94	
KK=4.13%				

Table 7 indicates that the length of cobs without husks at a concentration of 0 ml/L was 20.16 cm, relatively similar to 20.73 cm for 50 ml/L and 20.95 cm for 100 ml/L. This lack of significant variation suggests that the golden snail LOF concentration had no direct effect on cob length, as it may not guarantee sufficient nutrient provision to specifically promote cob elongation [3].

Plant metabolism, influenced by nutrient availability, plays a key role in supporting cell division, elongation, and differentiation. When these processes are optimal, they lead to enhanced weight and cob length [28].

3.8 Number of Cob Rows

Inspection of variations in the number of rows per cob by administering LOF concentration and administration time interval did not provide a real influence. Meanwhile, the single factor of giving LOF concentration had a very real influence on the number of rows per cob. Meanwhile, the single factor of application time interval did not have a real influence on the number of rows per cob.

Table 8. Number of Rows Per Cob of Sweet Corn with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
row.....			
0	14.67	14.50	14.33	14.50B
50	17.33	17.33	17.50	17.38A
100	17.70	17.33	17.67	17.56A
Average	16.56	16.38	16.50	
KK=2.34%				

Column numbers followed by the same capital letter are not significantly different according to DMRT 5%

Table 8 shows that a concentration of 0 ml/L resulted in 14.50 rows per cob, 50 ml/L resulted in 17.38 rows, and 100 ml/L resulted in 17.56 rows. These findings indicate that the application of golden snail LOF at various concentrations significantly improves the quality and yield of corn plants. If the phosphorus (P) element in corn plants is adequately supplied, cob formation will be more complete, with a larger size and fully developed rows of seeds. Phosphorus, nitrogen (N), and potassium (K) are essential for photosynthesis and nutrient transport, directly affecting cob formation and filling [24].

The absorption of nitrogen (N) by plants occurs throughout the growth period until seed ripening, but the uptake varies by growth phase. This necessitates a continuous supply of N to ensure optimal growth and seed development [3].

3.9 Number of Seeds per Row

Inspection of variations in the number of seeds per row by administering LOF concentration and the time interval of administration did not provide a significant effect. Meanwhile, the single factor of giving LOF concentration had a very real influence on the number of rows per cob. Meanwhile, the single factor of application time interval did not have areal influence on the number of rows per cob.

Table 9. Number of Seeds Per Row of Sweet Corn with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time Interval (Days)			Average
	5	10	15	
sed.....			
0	39.50	40.50	41.00	40.33B
50	40.33	41.00	40.67	40.66B
100	41.83	41.83	41.50	41.72A
Average	215.33	213.33	217.75	
KK=2.09%				

Column numbers followed by the same capital letter are significantly different according to DMRT 5%

Table 9 shows the number of seeds per row: 40.33 seeds for a concentration of 0 ml/L, 40.66 seeds for 50 ml/L, and 41.72 seeds for 100 ml/L. This indicates that golden snail LOF increases the number of seeds per row on each cob, likely due to sufficient availability of essential nutrients.

Adequate potassium (K), nitrogen (N), and phosphorus (P) are essential for photosynthesis, energy production, and seed formation, contributing to better seed development [16].

Nutrient availability plays a critical role in plant biomass and yield. Insufficient nutrients from fertilizers can disrupt plant growth and lower productivity, emphasizing the importance of balanced nutrient management for optimal seed formation [29].

3.10 Fresh Shelled Weight per Cob

The results of testing the variation in fresh shelled weight showed a significant interaction effect between the concentration and time interval for administering golden snail LOF. However, the single factors of LOF concentration and time interval did not show significant influences.

Table 10. Weight of Fresh Shelled Sweet Corn with Concentration and Time Interval for Administering

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
0	162.42Ab	156.00Cc	174.92Aa	162.42Ab
50	148.58Bc	160.75Ab	160.75Ab	148.58Bc
100	161.75Aa	152.67Bb	152.67Bb	161.75Aa
KK=6.88%				

Numbers in a row are followed by the same lowercase letter and numbers in a column are followed by an uppercase letters and the same are not significantly different according to DMRT 5%

Table 10 illustrates the fresh shelled weight per cob: at a concentration of 0 ml/L with intervals of once every 5 days, 162.42 g; once every 10 days, 156.00 g; and once every 15 days, 174.92 g. At a concentration of 50 ml/L, the weights were 148.58 g, 160.75 g, and 177.17 g for the respective intervals. At a concentration of 100 ml/L, the weights were 161.75 g, 152.67 g, and 147.58 g. These variations suggest that nutrient adequacy plays a key role in optimizing sweet corn production. Meeting nutrient requirements supports cob development and yield quality [3].

In sweet corn production, liquid organic fertilizers (LOF) enhance nutrient availability, increasing plant biomass and cob weight. Combining LOF with supplementary organic inputs has been shown to significantly increase cob yield and kernel development [18]. Additionally, recent studies indicate that optimal LOF application ensures the distribution of essential nutrients like phosphorus (P) and potassium (K), which are critical during the late vegetative and reproductive stages of corn [16].

3.11 Production per Plot and Production per Hectare

The results of testing the variance of weights per plot showed no interaction effect between LOF concentration and the time interval of administration. However, the single factor of LOF concentration had a significant effect, while the time interval did not.

Table 11. Production Per Plot and Per Hectare of Sweet Corn Plants with Concentration and Time Interval for Administering Golden Snail Lof

LOF of golden snail (ml/L)	Time interval (Days)			Average
	5	10	15	
kg/ha.....			
0	4.53	4.53	4.53	4.53B
50	5.27	4.53	5.00	4.93B
100	4.93	5.53	5.07	5.17A
Average	4.91	4.86	4.86	
KK=8.75%ton/ha.....			
0	15.09	14.43	14.87	14.79B
50	17.53	15.09	17.00	16.54B
100	16.42	18.87	17.22	17.50A
Average	16.34	16,13	16.36	
KK=9.35%				

Column numbers followed by the same capital letter are not significantly different according to DMRT 5%

Table 11 shows that a concentration of 0 ml/L produced a weight of 4.53 kg per plot, 50 ml/L produced 4.93 kg, and 100 ml/L produced 5.17 kg. This improvement can be attributed to the nutrient-rich composition of golden snail LOF, including essential macronutrients like potassium (K), phosphorus (P), and magnesium (Mg), which are vital for growth and yield improvement [16].

The production per hectare also increased with LOF concentrations, as shown by the weights: 14.79 tons/ha at 0 ml/L, 16.54 tons/ha at 50 ml/L, and 17.50 tons/ha at 100 ml/L. Organic fertilizers, when applied alongside optimal practices, not only improve soil physical properties but also act as a nutrient reservoir to support plant growth. Recent studies confirm that integrating LOF with organic amendments can significantly boost sweet corn yield while maintaining soil fertility [3]. Another study highlights that combining LOF with appropriate planting densities and supplementary organic inputs maximizes corn productivity and economic returns [30].

4. Conclusion

Based on the experiments that have been carried out, it can be concluded: The interaction between concentration and time interval for administering golden snail LOF was able to increase the weight growth of cobs without husks and fresh shelling of sweet corn plants. Providing golden snail LOF concentration can increase the growth and yield of sweet corn plants in terms of leaf area index, weight of husked cobs, number of rows per cob, number of seeds per row, and production per plot and per ha. With the best concentration of 100 ml/liter of water. There was no effect of the application time interval on the growth and yield of sweet corn. Based on the conclusions above, to get the best sweet corn production, it is recommended to use golden snail LOF with a concentration of 100 ml/liter of water.

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