JOURNAL OF BIOLOGY EDUCATION
J O B E
E-ISSN 2656-3436/ P-ISSN 2615-3947
IAIN KUDUS
http://journal.iainkudus.ac.id/index.php/jbe

Application of Organic Fertilizer from Lamtoro Leaves (*Leucaena leucocephala*) in Traditional Ponds to Enhance the Growth of Vannamei Shrimp (*Litopenaeus vannamei*)

Dwimei Ayudewandari Pranatami[1]*, Saifullah Hidayat[2], Indy Naurah 'Atiqah[3]
[1,2,3] Biology Education Universitas Islam Negeri (UIN) Walisongo, Indonesia
*Corresponding Author: dwimeibiologi@walisongo.ac.id

ABSTRACT

Vannamei shrimp is one of the most in-demand aquaculture commodities. In East Java, traditional cultivation practices often use urea fertilizer before stocking. However, the long-term use of inorganic fertilizers can negatively affect pond soil quality and shrimp farming sustainability. As an alternative, organic fertilizers such as lamtoro leaves, which contain nitrogen similar to urea, may provide a more sustainable solution. The research used a completely randomized design with three concentrations of lamtoro leaf fertilizer (10%, 20%, and 30%), and a positive control using urea fertilizer. Each treatment was repeated three times density of 50 shrimp per pond. Shrimp growth was observed over a 40-day period.The results showed that a 30% concentration of lamtoro leaf fertilizer provided the best performance. Shrimp in this treatment achieved the highest survival rate (78%), with an average length of 11.62 cm and an optimal feed efficiency of 5.29. Although weight and length growth did not show statistically significant differences among all treatments, the survival rate was significantly higher in the 30% organic fertilizer treatment compared to the control. These findings indicate that lamtoro leaves have the potential to be an effective organic fertilizer in vannamei shrimp cultivation.

Keywords: *Leucaena leucocephala*, growth, organic fertilizer, *Litopenaeus vannamei*

INTRODUCTION

The potential of fisheries in Indonesia is very promising in marine, brackish, and freshwater areas. One of the aquaculture products with superior quality and high market demand is vannamei shrimp. According to KKP (2023), Indonesia's tropical regions ensure that domestically produced shrimp have the best quality throughout the year, with a delicious taste and high nutritional content. Shrimp is the largest contributor to Indonesia's fishery exports, accounting for 34.5%. Export volume reached approximately 180 thousand tons (KKP, 2023). Traditional pond systems are characterized by the use of plots or artificial ponds directly on soil. This system is used due to its relatively low cost compared to intensive pond systems (Kordi, 2010). One method commonly used by farmers in vannamei shrimp cultivation using traditional systems is by applying urea fertilizer to the soil before seeding.
Fertilization plays a crucial role in enhancing the natural productivity of shrimp aquaculture systems, primarily by stimulating the growth of phytoplankton that serves as natural feed for early shrimp stages (Boyd and Tucker, 1998). Urea fertilizer is one of the fertilizers used by

farmers in vannamei shrimp cultivation as it contains phosphorus and nitrate, which influence shrimp growth (Rahmawati, 2025). This is in line with Anisah's (2017) research, which found that phytoplankton utilize nitrate and phosphate in the water as chlorophyll producers (Anisah, 2017). The increase in phytoplankton biomass also contributes to the stability of the pond food web and helps regulate water quality parameters such as pH and ammonia through biological uptake and microbial interactions (FAO, 2020). Proper fertilization further influences the development of an ideal "water color," an important indicator of a balanced and productive rearing environment for Pacific white shrimp, as water color is closely associated with phytoplankton density and overall pond health (Furtado et al., 2011). As a result, selecting appropriate fertilization strategies is essential for ensuring stable ecosystem function and optimal growth performance in *Litopenaeus vannamei* culture (Boyd,2015).

One of the reason of crop failure, especially for farmers in Ujungpangkah, Gresik, is the scarcity and high price of urea fertilizer. Besides the high price, sustainable use of urea fertilizer leads to a decrease in nutrients in the soil. Poor soil fertility can affect the growth of plankton and "kelekap" (algae), which are the main food sources for vannamei shrimp, making their growth hampered. Excessive use of inorganic fertilizers can also trigger diseases such as ammonia or nitrite poisoning, resulting in decreased production and even crop failure (Effendie, 2022). The scarcity of urea fertilizer leads to high prices in the market, burdening shrimp farmers and causing low yields. The high cost and negative impacts of urea fertilizer have prompted the search for organic fertilizers as substitutes. Organic fertilizers have long been applied in shrimp aquaculture to enhance natural productivity by stimulating phytoplankton growth and improving nutrient availability in pond ecosystems (Boyd & Tucker, 1998). Materials such as fermented animal manure, compost, and agricultural by-products are widely used because they are inexpensive, environmentally friendly, and capable of increasing natural food availability for early shrimp stages (FAO, 2020). In addition, organic fertilizers contribute to improved water stability by enhancing microbial activity, which supports nitrogen cycling and reduces toxic ammonia concentrations (Avnimelech, 2012).

One widely available plant in Gresik that has potential as organic fertilizer is the lamtoro (*Leucaena leucocephala*) leaf. Based on literature studies, the nutrient content in lamtoro leaves can serve as an alternative for making organic fertilizer. The similarity in nutrient content between urea and lamtoro leaves prompted this study to investigate the use of lamtoro leaf extract as a fertilizer. Lamtoro is a plant species from the Fabaceae family that can absorb nutrients directly from the air. Nutrients found in lamtoro include Phosphorus (P) 0.2–0.4%, Nitrogen (N) 2.0–4.3%, and Potassium (K) 1.3–4.0% (Ratrinia et al., 2014). Lamtoro is abundantly available as it grows in many regions with sufficient rainfall intensity. It can be said that the nutrient content in lamtoro leaves closely resembles that of urea fertilizer. The assumption is that using lamtoro fertilizer with nearly the same nutrient content can help improve yields for farmers using traditional systems. Therefore, the objective of this study is to analyze the effectiveness of lamtoro fertilizer as a substitute for urea fertilizer in vannamei shrimp cultivation using traditional systems.

METHOD

Time and Place

The research was conducted from August to December 2024. It took place at a shrimp pond in Pangkah Kulon Village, Ujungpangkah, Gresik, East Java. Type of research: Experiment using a CRD (Completely Randomized Design). This study used three concentrations of lamtoro leaf fertilizer and one positive control using urea fertilizer. Each treatment was replicated three times. The concentrations of liquid organic lamtoro fertilizer used were 10%, 20%, and 30%. The selection of concentration variations in this study was based on previous research that only used lower concentrations as a preliminary study. Observation of shrimp growth rate was carried out for 40 days in the pond.

Tools and Materials

The tools used in this research include: shrimp pond, bamboo fencing, bamboo, netting, pipes, buckets, shovels, aeration hoses, aeration stones, measuring pipettes, tissues, pH meter, DO meter, thermometer, ruler, and digital scales. The materials used include: EM4, rice washing water, Lamtoro leaves, red sugar, aquades (distilled water), pond water, lime, shrimp seed (benur), urea fertilizer, and commercial feed.

Lamtoro Fertilizer Preparation

Lamtoro leaves used as raw material for the fertilizer were sorted first. The leaves were then washed clean to remove any dirt or foreign materials. The cleaned Lamtoro leaves were chopped to reduce size and ease decomposition. The leaves were then mixed with distilled : water rice : red sugar solution: : EM4 in a ratio sequentially of 10 kg : 20 L : 4 L : 11 L : 1 L (Monica, 2015). Fermentation of the organic lamtoro fertilizer was done for 14 days. After fermentation, the mixture was filtered, and the liquid was used as fertilizer. Before application, the fertilizer was diluted according to the desired concentration.

Pond Conditioning

The shrimp farming was conducted in a traditional pond. The pond was plowed and cleaned of weeds before being treated with lamtoro fertilizer. The concentrations used were 10%, 20%, and 30%. The fertilizer was added to the pond, and the pond was left undisturbed for 2–3 weeks before stocking with shrimp. The pond's water depth was maintained at about 1.0 m. Aeration was provided to ensure sufficient oxygen supply.

Shrimp Farming

After 7–10 days of pond preparation, vannamei shrimp seeds (benur) weighing 50 g each were stocked, with 50 seeds per pond. The shrimp were raised for 40 days. Every 10 days, the pond was re-treated with fertilizer. Every 10 days, water quality and shrimp parameters were also measured. Shrimp growth was measured on day 40. Feed was given 3 times a day at 08:00, 14:00, and 20:00.

Data Analysis

This study obtained quantitative results. To assess shrimp growth, the following parameters were measured:

Survival Rate

Survival rate was calculated using the formula from Zonneveld et al. (1991):

$$ST = (Nt / No) \times 100\%$$

SR: Survival Rate (%)
Nt: Number of live individuals at the end of the study (fish)
No: Number of individuals at the beginning of the study (fish)

Daily Growth Rate

The daily growth rate is calculated using the formula by Purnomo (2012), where data collection is carried out 4 times over 40 days of cultivation.

$$GR = (Wt - W0) / t$$

GR: Daily growth rate (g/day)
Wt: Average fish weight on day t (g)
W0: Average fish weight on day 0 (g)
t: Maintenance period (days)

Absolute Weight

Absolute weight is calculated using the formula from Effendie (1997). Absolute weight is the difference in shrimp weight on day 40 from the initial shrimp weight.

$$Wm = Wt - Wo$$

Wm: Absolute weight (g)
Wt: Fish biomass at time t (g)
Wo: Fish biomass at the beginning of the study (g)

Food Conversion Ratio (FCR)

The FCR value is calculated using the formula from Zonneveld et al., (1991).

$$FCR = F / (Wt - Wo)$$

FCR: Food conversion ratio
F: Total feed given during maintenance (g)
Wt: Final biomass (g)
Wo: Initial biomass (g)

In addition to shrimp growth rate, water quality in ponds is also observed, such as: pH, salinity, temperature, and others. Quantitative data will be tested using statistical tests including: Normality Test, Homogeneity Test. For Hypothesis Testing, ANOVA is used. If there is a significant difference between treatments, further testing will be conducted using the Least Significant Difference (LSD) test at a 95% confidence level.

RESULT AND DISCUSSION

The use of organic fertilizers in aquaculture is increasingly in demand, especially as an alternative to chemical fertilizers which have a negative impact on the environment and are expensive. This study aims to increase shrimp production by utilizing natural ingredients as organic fertilizers to replace chemical fertilizers. The choice of lamtoro leaves as the main ingredient of the organic fertilizer is based on previous studies, as lamtoro leaves contain high levels of nitrogen and phosphate, which can be used as a substitute for urea in shrimp pond fertilization. Lamtoro leaves have also been used as animal feed. Therefore, the use of lamtoro leaves as fertilizer adds more value beyond their current use. Measurement of survival rate, weight, and shrimp length can be seen in the following table.

Survival Rate (SR)

Calculating the survival rate is very important in aquaculture management because it provides a clear picture of the health and success of the cultivation activities. The results of the study on the application of lamtoro leaf fertilizer can be seen in Table 1.

Table 1. Survival Rate Results

	(No Fertilizer)	**(Urea Fertilizer)**	**10%**	**20%**	**30%**
Initial Count	50	50	50	50	50
Final Count	13	23	31	17	39
Survival Rate	26%	46%	62%	34%	78%

In this study, 50 shrimp seeds were stocked in each tank. Table 1 shows that the treatment using lamtoro leaf fertilizer at a 30% concentration had the highest SR value at 78%. In the 30% lamtoro leaf treatment, from the 50 shrimp initially stocked, 39 were still alive at the end. The second best SR result was from the 10% lamtoro treatment at 62%, followed by the positive control (urea fertilizer) with an SR of 46%, leaving 23 shrimp alive. The 20% lamtoro treatment had an SR of 34%, and the negative control (no fertilizer) had the lowest SR at 26%, with only 13 shrimp surviving. The best SR result in this study was achieved in the 30% lamtoro leaf treatment. In general, an SR of above 50% is considered good. A good survival rate indicates that the applied cultivation techniques, including seed selection, feed, and pond management, have been properly implemented.

Daily Growth Rate and Absolute Weight of Shrimp

Shrimp length and weight were measured weekly, and the results of length and weight gains are presented below:

Table 2. Shrimp Length Measurement (in cm)

	(No Fertilizer)	**(Urea Fertilizer)**	**10%**	**20%**	**30%**
Initial Length	5	5	5	5	5
Final Length (avg)	9.57	10	11.16	10.55	11.62

From Table 2 above, it can be seen that the fertilizer treatment with a 30% concentration had the greatest length gain, reaching a final length of 11.62 cm. At a 20% concentration, the shrimp had an average final length of 10.85 cm, and at 10%, they reached 11.16 cm. These three lamtoro leaf treatments had higher final lengths than the control treatments, whether negative or positive. The increase in shrimp length or growth rate is influenced by several factors, including environmental conditions and the shrimp's biology. In Vannamei shrimp aquaculture, farmers usually require 2-4 months for shrimp to reach adult size, while this study only used 40 days and juvenile shrimp. The quality of water such as temperature, pH, and salinity must be optimal to achieve maximum growth.

Table 3. Shrimp Weight Measurement (in grams) and Daily Growth Rate

	(No Fertilizer)	**(Urea Fertilizer)**	**10%**	**20%**	**30%**
Initial Weight	50	50	50	50	50
Final Weight	50.12	50.4	50.41	50.42	50.425
Daily Growth Rate	0.003	0.01	0.01025	0.0105	0.0106

From Table 3 above, it can be seen that the highest shrimp addition occurred in the treatment with 30% fertilizer concentration. However, this result is not significantly different from other treatments, as the weights ranged between 50.12 – 50.42 grams. Providing nutritious feed (especially those rich in protein) will accelerate shrimp growth. In this study, 0.05 grams of feed were given daily. Shrimp density that is too high in one area can inhibit their growth due to food competition and space limitations, so in this study, each pond was stocked with 50 shrimp seeds.

Feed Efficiency

Feed efficiency needs to be calculated to understand the effectiveness of the feed given during the shrimp cultivation process in supporting significant shrimp growth. This provides an overview to shrimp farmers to help predict the amount of feed needed and how efficient the feed administration is. The results of feed efficiency calculations in this study can be seen in Table 4.

Table 4. Feed Efficiency

(No Fertilizer)	**(Urea Fertilizer)**	**10%**	**20%**	**30%**
18.75	5.625	5.48	5.35	5.29

From Table 4, it can be seen that the highest feed efficiency is found in the 30% lamtoro fertilizer treatment. The smaller the feed efficiency value, the more efficient and optimal the feeding is. The feed efficiency value for the 30% lamtoro fertilizer treatment shows the smallest value among all treatments, which is 5.29. The next lowest efficiency value is in the 20% lamtoro fertilizer treatment at 5.35. Followed by the 10% fertilizer treatment at 5.48. The feed efficiency values from the use of urea fertilizer are still in the same range, though higher than those from the three lamtoro fertilizer treatments. The highest feed efficiency value is found in the treatment without any fertilizer at 18.75. This high feed efficiency value indicates that the feed was not efficiently utilized in this treatment. This is likely because no additional nutrients were added to the pond, unlike in other treatments where plankton growth was increased due to fertilizer. Fertilizer application encourages the growth of natural feed sources such as phytoplankton and zooplankton in the pond, increasing shrimp appetite.

pH

pH regulation in vannamei shrimp cultivation can affect health, growth, and productivity. The pH measurement results in this study can be seen in Table 5.

Table 5. Water pH Measurement Results

	(No Fertilizer)	(Urea Fertilizer)	10%	20%	30%
Week 1	8.49	8.41	8.57	8.64	8.69
Week 2	8.44	8.47	8.43	8.45	8.57
Week 3	8.65	8.34	8.31	8.18	8.42
Final	8.41	8.32	8.37	8.99	8.96
Average	8.63	8.44	8.99	9.16	8.92

There were five treatments in this study: negative control, positive control, 10% fertilizer concentration, 20% fertilizer concentration, and 30% fertilizer concentration. Each treatment had its pH measured weekly. Based on Table 5, the highest average pH was observed in the 30% fertilizer treatment at 8.71. The lowest average pH was in the positive control treatment at 8.40. The pH measurements in the table ranged between 8.40 to 8.71. From the table, it can be concluded that all treatments had pH values within the normal range. Only ponds treated with 20% and 30% fertilizer showed better pH stability compared to the other treatments.

The acidity level (pH) of aquaculture water that is optimal for shrimp growth is 6.8 - 8.5 (Rafiqie, 2021) According to Supriatna et al (2020), the ideal pH for shrimp cultivation in brackish water ranges between 7-9 (Supriatna, M. Mahmudi, M. Musa, 2020) The pH concentration can affect shrimp appetite. Furthermore, if the pH is below the tolerance limit, it can interfere with the molting process, making the shrimp's shell soft and reducing its survival rate. Water pH quality is an important factor in the growth of Vannamei shrimp. pH levels that are too high or too low can cause stress and death in shrimp and potentially cause the shell of Vannamei shrimp to become fragile (Rafiqie, 2021).

Water Salinity

Salinity affects the water quality in aquaculture ponds, particularly in relation to the stability of parameters such as pH, dissolved oxygen, and ammonia concentration. Water with appropriate salinity creates a more stable environment for Vannamei shrimp, thus increasing the chances of reproductive success. The salinity measurement results can be seen in table 6.

Table 6. Water Salinity Measurement Results (Unit: ppm)

	(No Fertilizer)	(Urea Fertilizer)	10%	20%	30%
Week 1	800	700	700	700	700
Week 2	700	700	700	700	700
Week 3	700	800	700	700	700
Final	700	700	700	700	700
Average	700	700	700	600	600

From Table 6, it can be seen that the average salinity in the aquaculture environment in this study ranged from 680 - 720 ppm. The lowest salinity was found in the treatments with 20% and 30% fertilizer concentration, both at 680 ppm. The highest salinity was found in the control treatments without fertilizer and with urea fertilizer. These salinity measurement results indicate suboptimal salinity control in the cultivation ponds. The aquaculture used freshwater, with the expectation that it would be more applicable in various areas far from the sea. The salinity range usually tolerated by shrimp in freshwater aquaculture is 500 - 40,000 ppm (Scabra et al., 2023). Vannamei shrimp (*Litopenaeus vannamei*) are freshwater shrimp whose cultivation continues to innovate and develop in the aquaculture industry. The goal is to increase production and expand the possibilities of aquaculture, especially in areas that do not have access to seawater.

Water Temperature

Temperature is one of the environmental factors that plays a significant role in controlling the ecosystem of a body of water. The temperature of a body of water reflects the heat or cold condition of the water, serving as a medium for shrimp to live. Temperature measurements can be seen in Table 7.

Table 7. Water Temperature Measurement Results (in degrees Celsius)

	(No Fertilizer)	**(Urea Fertilizer)**	**10%**	**20%**	**30%**
Week 1	27.70	27.20	28.43	28.60	29.07
Week 2	31.60	31.30	32.03	32.66	33.36
Week 3	28.50	28.70	29.10	29.36	29.36
Final	29.10	28.80	28.73	28.80	29.40
Average	30.30	29.50	29.46	29.56	29.76

There were five treatments in this study, namely negative control, positive control, 10% fertilizer concentration, 20% fertilizer concentration, and 30% fertilizer concentration. Each treatment's temperature was measured weekly. Based on Table 7, the highest average temperature was obtained in the 30% fertilizer treatment, which was 30.19°C. The lowest average temperature was recorded in the positive control treatment at 29.1°C. The temperature measurements in the table range from 30.19°C to 29.1°C. This temperature range in the study corresponds to normal temperature ranges suitable for vannamei shrimp life. This temperature range is optimal for shrimp growth.

Water temperature can optimize the growth of vannamei shrimp, which ranges from 28°C to 33°C, within which vannamei shrimp can live, grow, and develop well. This aligns with SNI 8037.1:2014 (Scabra et al., 2023). This aligns with SNI 8037.1:2014, stating that the optimum temperature range for maintenance is 24-34°C (BSNI, 2014). In the 30% fertilizer treatment, an average temperature of 30°C was observed, which can increase the metabolic and respiratory rates of aquatic organisms, thereby increasing oxygen consumption. Research by Rakhfid, A. et al, supports this, show that increased metabolism and respiration in aquatic organisms increase oxygen consumption, and a rise in water temperature can lead to increased appetite and higher ammonia levels from feces and feed waste. However, because temperature changes significantly impact aquatic organisms in a short time, it is best if the temperature change does not exceed 3°C.

Leucaena leaf fertilizer contains two important nutrients, namely Nitrogen (N) and Phosphorus (P), which make significant contributions to environmental quality and the success of shrimp farming. Nitrogen supports the growth of phytoplankton and zooplankton which become natural feed for shrimp, while phosphorus improves the quality of natural feed and supports the health of the pond ecosystem. The combination of these two elements helps create ideal conditions for the growth and success of shrimp farming, while also increasing feed efficiency and survival rate (Ratrinia et al., 2014). Therefore, fertilization with organic fertilizer from leucaena leaves is very beneficial in shrimp farming. Potassium (Kalium/K) plays a role in regulating the balance of water and nutrients in plant cells. This allows plants to absorb water and nutrients from the environment more efficiently, thus supporting growth. Potassium supports the growth and diversity of phytoplankton and algae which are natural food sources for shrimp. A healthy and abundant population of phytoplankton provides nutritious natural food for larvae and adult shrimp. Providing fertilizer with sufficient potassium content will increase natural feed production, reduce the need for artificial feed, and increase natural feed production (Windi et al., 2022).

Research results show that the application of organic fertilizer from leucaena leaves with a dose of 30% produces better growth compared to doses of 10% and 20%. The use of a 30% dose not only improves growth parameters, but also shows more significant results compared to commercial fertilizers. This improvement can be explained by the more balanced nutritional content of leucaena leaves, which are rich in protein and essential substances that support shrimp metabolism. Fertilizer made from leucaena leaves contains bioactive compounds that potentially improve nutrient availability in aquatic environments. The 30% dose has created optimal conditions for the growth of vannamei shrimp by improving water and substrate quality, and providing the necessary beneficial microorganisms. In addition, the bioactive compounds in leucaena leaves contribute to shrimp health, reduce stress, and increase growth response. Previous studies,by Septirosya (2019), revealed that leucaena leaves are rich in protein, vitamins, and minerals that support the growth of aquatic animals (Septirosya et al., 2019). This research is consistent with other findings showing that the application of leucaena leaf fertilizer can increase the growth of vannamei shrimp, especially at the 30% dose.

Based data on shrimp length and weight gain above, organic fertilizer from leucaena leaves can increase shrimp length and weight more effectively than commercial fertilizer use. Leucaena leaf fertilizer contains the nutrients needed by phytoplankton and microorganisms in the pond. Phytoplankton functions as a natural food source for shrimp and can thrive rapidly when there is sufficient nutrient supply. Organic fertilizer from leucaena leaves also increases the content of organic matter in the soil, which supports the growth of decomposing microorganisms that play a role in maintaining ecosystem balance (Septirosya et al., 2019). Better water quality, with lower concentrations of harmful compounds and lower ammonia levels, will support shrimp health. Improved water quality, due to the application of organic fertilizer, also impacts shrimp growth, because clean water with high oxygen content is important for shrimp metabolism and growth. The use of organic fertilizer from leucaena leaves can increase shrimp growth. The nutrients contained in this fertilizer not only support phytoplankton growth, but also play a role in providing better nutrition for zooplankton, thereby improving the quality of natural feed for shrimp (Parnata, 2010).

Optimal environmental conditions also support shrimp survival rates. In this study, the environmental parameters were already within normal limits but could still be optimized. The pH level affects the feeding habits and appetite of shrimp. pH levels that are too acidic can cause shrimp mortality, while pH levels that are too alkaline can inhibit shrimp growth and potentially cause death. Conversely, if the pH level is too high (above 9), it can accelerate shrimp metabolism and increase oxygen demand, leading to ammonia accumulation, which, if excessive, can result in shrimp mortality (Supriatna et al 2020). Vannamei shrimp naturally live in seawater and brackish water with high salinity. Thus, in low salinity environments, such as 700 to 800 ppm (0.7 to 0.8 ppt), shrimp struggle to maintain osmotic balance in their bodies. Low salinity facilitates water entry into the shrimp's body, disrupting the osmoregulation process. Shrimp must work hard to regulate the salt levels in their bodies, which can weaken their immune system and make them more susceptible to infections and diseases (Rakhfid, A. et al, 2019).

The use of fertilizer with a 30% dosage can create optimal conditions for vaname shrimp growth by improving water and substrate quality, as well as providing supportive microorganisms. Additionally, the presence of antioxidant compounds in lamtoro leaves can contribute to shrimp health, reduce stress, and enhance growth response. This reduces dependence on artificial feed, which is usually expensive and requires high costs.Natural feed, apart from being more affordable, is also more suitable for the natural nutritional needs of shrimp, which can improve their quality of life and health. Shrimp health itself is a vital biotic parameter in assessing the effectiveness of fertilization in shrimp farming. The appropriate application of organic fertilizer will create environmental conditions that support shrimp health, such as the stability of water chemistry parameters (pH, dissolved oxygen, and ammonia), and increase the availability of nutritious natural feed.

This research still requires further development, so it is recommended that further research expand the variation in the concentration of lamtoro liquid fertilizer, extend the maintenance duration to a full cultivation cycle, and conduct a more comprehensive water quality analysis, including parameters of dissolved oxygen, ammonia, nitrite, and turbidity. Furthermore, laboratory tests are essential to quantitatively determine the fertilizer's nutrient content so that it can be compared with inorganic fertilizers and to compare its effectiveness with other organic fertilizers to further measure the benefits of lamtoro. An economic feasibility analysis is also needed to assess the cost-effectiveness of lamtoro liquid fertilizer production on cultivation results, while tests on shrimp health and disease resistance can provide a more comprehensive picture of its benefits. Further research should also be conducted on a field scale with a larger stocking rate to ensure more representative and applicable results for farmers.

CONCLUSION

The research results indicate that the application of lamtoro leaf organic fertilizer at a 30% dosage results in better growth compared to 10%, 20% an urea fertilizer. The use of a 30% dosage not only improves growth parameters but also shows better results compared to commercial fertilizers. The survival rate (SR) of vaname shrimp at a 30% concentration is 78%, with the shrimp achieving the highest length increase, averaging 11.62 cm. The feed effectiveness at the 30% fertilizer concentration also shows the most optimal value, which is 5.29.

REFERENCES

Anisah, S. (2017). Kaitan Konsentrasi Nitrat (NO3) Dan Fosfat (PO4) Dengan Klorofil-a dari Fitoplankton pada Kondisi Lingkungan Perairan yang Berbeda di Pundata Baji, Kabupaten Pangkep. *Skripsi*, *3*, 1–56. https://core.ac.uk/download/pdf/132584599.pdf

Aulia Rahmawati, S.P., M.Sc., Prof. Dr. Ir. Mohamad Fadjar, M.Sc., Dr. Yunita Maimunah, S.Pi., M.Sc., Prof. Dr. Ir. Sri Andayani, M.S., Adit Aang Arifki, P. S. F. S. (2025). *Pemupukan Perikanan Secara Berkelanjutan*. Media Nusa Creative (MNC Publishing).

Avnimelech, Y. (2013). Application of organic fertilizer in aquaculture ponds. *Aquaculture*, 400–401, 157–162. https://doi.org/10.1016/j.aquaculture.2013.03.023

Bhandare, R., & Pawar, S. (2019). Effect of organic manures on plankton production and growth of shrimp. International Journal of Fisheries and Aquatic Studies, 7(3), 24–28. Retrieved from https://www.researchgate.net/publication/333421452

BSNI. (2014). *Udang Vanamei (Litopenaeus vannamei,Boone 1931)* (SNI 8037.1).

Boyd, C. E. (2015). Water quality: An introduction. Springer

Boyd, C. E., & Tucker, C. S. (1998). Pond aquaculture water quality management. Springer.

Effendie, M. I. (2022). *Biologi Perikanan*. Yogyakarta: Yayasan Pustaka Nusantara.

FAO. (2020). Aquaculture development: Aquaculture management guidelines. Food and Agriculture Organization of the United Nations.

Furtado, P. S., Poersch, L. H. S., & Wasielesky, W. (2011). Effects of organic matter enrichment on water quality and Litopenaeus vannamei performance. Aquaculture Research, 42(10), 1397–1405

Jena, J., & Das, B. K. (2021). Use of organic manures in aquaculture: Prospects and constraints. *Aquaculture Research, 52*(7), 3345–3356. Retrieved from https://www.researchgate.net/publication/34991863

KKP. (2023). *Profil Pasar Udang*. https://kkp.go.id/download-pdf/Materi - profil-pasar-udang667533620a258.pdf

Kordi, K. M. G. H. (2010). *Budidaya Udang Laut*. Jakarta: Agromedia Pustaka. https://books.google.co.id/books/about/Budi_Daya_Udang_Laut.html?id=HjX2EAAAQBAJ&redir_esc=y

Monica, R. (2015). *Pengaruh pemberian pupuk cair lamtoro (Leucaena leucocephala) terhadap pertumbuhan dan produktivitas tanaman kedelai (Glycine max) var. Grobogan*. Skrispi: Universitas Sanata Dharma. https://repository.usd.ac.id/499/

Parnata, A. S. (2010). *Meningkatkan Hasil Panen dengan Pupuk Organik*. Jakarta : Agromedia Pustaka.

Rafiqie, M. (2021). Analisa Kualitas Air Budidaya Udang Vaname (*Litopenaeus vannamei*) di Tambak Rakyat Kontruksi Dinding Semen Dan Dasar Tambak Semen Di Pantai Konang, Kecamatan Panggul Kabupaten Trenggalek. *Samakia : Jurnal Ilmu Perikanan*, *12*(1), 80–85. https://doi.org/10.35316/jsapi.v12i1.838

Rakhfid, A., Erna, E., Rochmady, R., Fendi, F., Lhu, M. Z., & Karyawati, K. (2019). Kelangsungan Hidup dan Pertumbuhan Juvenil Udang Vaname (*Litopenaeus vannamei*) pada Salinitas Air Media Berbeda. *Urnal Akuatikisle*, *3*(21), 23–29. https://doi.org/https://dx.doi.org/10.29239/j.akuatikisle.3.1.23-29

Ratrinia, P. W., Maruf, W. F., & Dewi, E. N. (2014). Pengaruh penggunaan bioaktivator EM4 dan penambahan daun lamtoro (*Leucaena leucocephala*) terhadap spesifikasi pupuk organik cair rumput laut Eucheuma spinosum. *Jurnal Pengolahan Dan Bioteknologi Hasil Perikanan*, *3*(3), 82–87.

Scabra, A. R., Cokrowati, N., & Wahyudi, R. (2023). Penambahan Kalsium Karbonat (CaCO3) pada Media Ir Tawar Budidaya Udang Vaname (*Litopenaeus Vannamei*). *Samakia : Jurnal Ilmu Perikanan*, *14*(2), 129–140. https://doi.org/10.35316/jsapi.v14i2.1382

Septirosya, T., Putri, R. H., & Aulawi, T. (2019). Aplikasi Pupuk Organik Cair Lamtoro Pada Pertumbuhan dan Hasil Tanaman Tomat. *AGROSCRIPT Journal of Applied Agricultural Sciences*, *1*(1). https://doi.org/10.36423/agroscript.v1i1.185

Supriatna, M. Mahmudi, M. Musa, and K. (2020). Hubungan pH dengan Parameter Kualitas Air Pada Tambak Intensif Udang Vaname (*Litopenaeus vannamei*). *Journal of Fisheries and Marine Research*, *4*(3), 368–374.

Tacon, A. G. J., & Forster, I. P. (2003). Aquafeeds and the environment: principles and practices. Aquaculture, 226, 181–189.

Windi, Y., Uska Peku Jawang, & Melycorianda H. Ndapamuri. (2022). Uji Kualitas Pupuk Bokasi Kombinasi Bahan Lokal Daun Tumbuhan Gamal, Kirinyuh dan Lamtoro. *Formosa Journal of Sustainable Research*, *1*(5), 655–670. https://doi.org/10.55927/fjsr.v1i5.1474

Xu, W., Pan, L., Sun, X., & Liu, H. (2019). Fertilization strategies in shrimp farming: Organic vs. inorganic. *Aquaculture and Fisheries,* *4*(5), 203–209. https://doi.org/10.1016/j.aaf.2019.04.005