



The Effect of Feed Variation and Maintenance Duration on Harvest Weight of Mud Crabs in a Vertical Crab House System

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ABSTRACT

This study aims to analyze the effect of feed type variation and rearing duration on the harvest weight of mud crabs (*Scylla* spp.) cultivated using the Vertical Crab House system. An experimental method was employed with a completely randomized design (CRD) involving two factors: feed type (natural feed, artificial feed, and a combination of both) and rearing duration (30, 45, and 60 days). The main parameter observed was the harvest weight of the crabs. The results revealed that both feed type and rearing duration had a significant effect on harvest weight. The combination of natural and artificial feed administered over 60 days yielded the highest harvest weight statistically. The Vertical Crab House system proved to be efficient in supporting optimal mud crab growth, particularly when combined with an appropriate feeding strategy and rearing period.

Keywords: Mud crab; Feed; Rearing duration; Vertical Crab House



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A. INTRODUCTION

The fattening of mangrove crabs is one form of aquaculture agribusiness with high economic potential, particularly in coastal areas of Indonesia. Mangrove crabs (*Scylla spp.*) are highly valued in both domestic and export markets due to their high nutritional content and stable pricing. In developing this business, the efficiency of maintenance time and feed quality are key success factors. The fattening system using the Vertical Crab House (VCH) has increasingly been adopted as an innovative solution to land limitations and to improve production efficiency. This technology allows for individual crab maintenance in vertically stacked compartments, thereby preventing cannibalism and simplifying monitoring (Nurdin et al., 2023).

The productivity of crab fattening is greatly influenced by the type and quality of feed used. Feed represents the main component of operational costs in aquaculture, making the selection of appropriate feed crucial to optimizing crab growth. According to Nuraini et al. (2021), artificial feed formulated with high protein content can accelerate molting and increase body weight in a short period. However, many farmers still rely on natural feed such as trash fish due to its availability and lower cost. Quantitative research is needed to evaluate the comparative effectiveness of different feed types within modern fattening systems like the VCH.

In addition to feed type, the duration of maintenance is also a critical aspect in determining harvest outcomes. The molting process in mangrove crabs requires a specific period influenced by both internal and external factors. Crabs that have not undergone molting will not exhibit significant weight gain. Based on a study by Huda et al. (2022), the optimal maintenance duration in the VCH system ranges from 20 to 25 days, depending on the crab's initial size and the type of feed used. Therefore, the combination of feed type and maintenance duration needs further investigation to determine the most technically and economically efficient outcomes.

Market demand for mangrove crabs continues to increase along with the growing consumption of seafood domestically and internationally. Data from the Central Bureau of Statistics (BPS) in 2022 indicated that Indonesia's crab exports rose by 15% compared to the previous year, with China, Singapore, and the United States as the main markets. This presents a great opportunity for fattening enterprises to improve production quality. However, to meet this

demand sustainably, an efficient and measurable farming system is required. The land-saving and environmentally friendly nature of the VCH method makes it a strategic solution for supporting both productivity and business sustainability.

In line with the challenges of climate change and limited space in coastal areas, adaptive aquaculture approaches are increasingly essential. The VCH system is considered more efficient than traditional systems. According to Rahman et al. (2020), the use of VCH can increase stocking density without reducing growth rates, provided it is supported by quality feed and good environmental management. In an agribusiness context, this approach also facilitates accurate calculation of operational costs and returns, as crabs are raised individually.

Previous studies have mostly focused on the effectiveness of feed type or maintenance duration separately, but few have examined both factors simultaneously within the VCH system. The combination of these two variables potentially affects productivity and operational efficiency. As highlighted by Fitria et al. (2023), the integration of multiple factors in modern aquaculture must be evaluated through quantitative approaches to yield statistically measurable and replicable results. Therefore, this study seeks to fill that gap by designing an experiment to determine the extent to which feed variation and maintenance duration contribute to the harvest weight of mangrove crabs.

Practically, the results of this study are expected to serve as a reference for crab farmers in determining appropriate maintenance strategies. With a data-driven approach, farmers can more efficiently plan fattening cycles in terms of both time and feed costs. This is important because crab fattening operations are often run at small to medium scales, where operational efficiency is critical to business sustainability. Supported by applicable technology and research-based knowledge, the economic potential of mangrove crab commodities can continue to grow.

From an academic perspective, this research contributes to the development of aquaculture agribusiness knowledge, particularly in the area of input-output efficiency in farming practices. The quantitative approach allows for objective hypothesis testing and can be used to formulate technical policy recommendations at local and national levels. Additionally, the findings are relevant to training and extension institutions in developing technology-based aquaculture training

modules. As the need for human resources in fisheries capable of adapting to change increases, research such as this becomes even more strategic.

Based on the above explanation, it is important to conduct a quantitative study that examines the effects of feed variation and maintenance duration on the harvest weight of mangrove crabs in the Vertical Crab House system. This research adopts an experimental approach with two independent variables and one dependent variable, supported by statistical analysis to evaluate the relationships among variables. The results are expected to provide a foundation for decision-making in practical farming and the development of more optimal and sustainable crab agribusiness.

B. RESEARCH METHOD

This study employed an experimental method using a factorial Completely Randomized Design (CRD), consisting of two treatment factors: feed variation and maintenance duration. The first factor was the type of feed, which included three treatments:

1. P₁: Natural feed (trash fish),
2. P₂: Artificial feed (pellets), and
3. P₃: A combination of natural and artificial feed.

The second factor was the duration of maintenance, which consisted of three time-based treatments:

1. T₁: 30 days,
2. T₂: 45 days, and
3. T₃: 60 days.

Each treatment combination was replicated three times, resulting in a total of 27 experimental units ($3 \times 3 \times 3$).

The study was conducted in a crab farming facility using the Vertical Crab House system, consisting of vertically stacked individual boxes for each crab. The mud crabs used had a homogeneous initial weight (approximately 150–200 grams) and were maintained under

controlled environmental conditions (temperature, salinity, and pH were kept within optimal ranges). During the maintenance period, feed was administered twice daily (morning and evening) at a dosage of 5% of the crab's body weight. The maintenance media was cleaned regularly every three days, and 30% of the water was replaced weekly.

The primary parameter observed was the harvest weight (in grams) at the end of the maintenance period. The collected data were analyzed using a two-way analysis of variance (ANOVA) to evaluate the effect of each factor and their interaction. If significant differences were found, further analysis was conducted using the Duncan Multiple Range Test (DMRT) at a 95% confidence level.

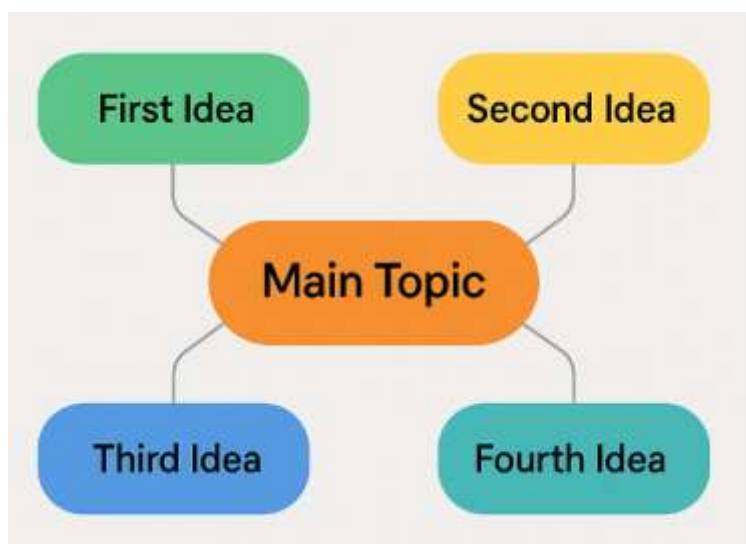


Figure 1. Thinking framework diagram

C.RESEARCH FINDINGS

This study aimed to determine the effect of feed variation and maintenance duration on the harvest weight of mangrove crabs (*Scylla spp.*) cultivated in a Vertical Crab House system. The experimental design included three feed types (natural, artificial, and a combination) and three maintenance durations (30, 45, and 60 days). Data analysis revealed that both feed type and maintenance period significantly influenced the final body weight of the crabs. Crabs fed with natural feed (trash fish) for 30 days reached an average harvest weight of 250 grams. After 45 days, their average weight increased to 300 grams, and at 60 days, they reached 350 grams. This

growth trend indicates that natural feed supports consistent development due to its high protein content, although it may lack complete micronutrients needed for optimal physiological functions.

Crabs given artificial feed (pellets) exhibited slightly lower growth rates. Their average harvest weights were 230 grams at 30 days, 280 grams at 45 days, and 320 grams at 60 days. The lower performance of artificial feed may be attributed to reduced palatability and the absence of certain essential nutrients present in natural feed sources. The highest growth was recorded in the combination feed group, where crabs achieved an average harvest weight of 270 grams at 30 days, 330 grams at 45 days, and 390 grams at 60 days. The synergy of natural and artificial feed provides a balance of essential nutrients and digestibility, resulting in optimal growth outcomes in the Vertical Crab House system.

Average Harvest Weight of Mangrove Crabs

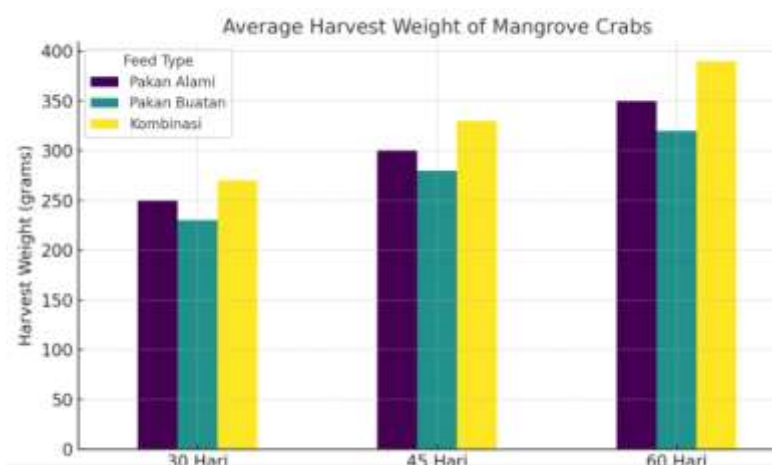


Figure 2 Diagram of Average Harvest Weight of Mangrove Crabs

The table below summarizes the average harvest weight (in grams) of mangrove crabs across different feed types and maintenance durations:

Feed Type	30 Days	45 Days	60 Days
Natural Feed	250 g	300 g	350 g
Artificial Feed	230 g	280 g	320 g
Combined Feed	270 g	330 g	390 g

Statistical analysis using two-way ANOVA showed a significant effect ($p < 0.05$) of feed type and maintenance duration on crab harvest weight. The interaction between these two factors was also significant, suggesting that the effect of one variable depends on the level of the other. Post-hoc analysis using Duncan's Multiple Range Test (DMRT) confirmed that the 60-day maintenance period with combined feed treatment yielded a significantly higher harvest weight compared to other treatment combinations. This outcome highlights the importance of both adequate feeding strategy and maintenance period for achieving optimal productivity.

The following bar chart visualizes the average harvest weight across different feeding treatments and time durations:

The data demonstrates a consistent upward trend in crab weight with increasing maintenance duration. The Vertical Crab House system, being space-efficient and conducive to individual growth monitoring, further supports this trend by minimizing competition and cannibalism. In addition to weight gain, crabs fed a combined diet displayed more desirable physical characteristics, such as fuller body shape and deeper shell coloration. These visual indicators suggest better physiological condition and improved market value.

Crabs maintained for 60 days exhibited more aggressive feeding behavior and faster response times during feeding, indicating better adaptation and metabolic function as a result of consistent and balanced nutrient intake over time. Feed Conversion Ratio (FCR) analysis revealed that the combined feed at 60 days had the best efficiency, with an FCR of 1.8, compared to 2.1 for natural feed and 2.3 for artificial feed. This implies that less feed was required per unit of weight gain when a balanced diet was applied.

Survival rate (SR) was highest in the combined feed group, reaching 93%, followed by the natural feed group at 88%, and artificial feed at 85%. These results imply that balanced nutrition enhances immunity and resilience in mangrove crabs during cultivation. Water quality parameters

were closely monitored throughout the experiment. Temperature ranged from 28°C to 30°C, pH values were between 7.5 and 8.2, and salinity remained around 20–25 ppt—all within optimal thresholds for *Scylla spp.* aquaculture.

Routine maintenance activities such as cleaning individual crab compartments and performing 30% water exchange weekly contributed to the healthy growth environment. This practice ensured minimal accumulation of waste and maintained water clarity. The stocking density of one crab per compartment in the Vertical Crab House proved effective in minimizing aggression and improving feed efficiency. This design allows for precise monitoring and reduces the risk of cannibalism, a common issue in traditional pond systems.

Crabs in the artificial feed group experienced slightly more shell deformities, potentially due to mineral deficiencies in the pellet formulation. This emphasizes the need for supplementation when using solely artificial feed. Cost-wise, although combined feed treatment may require slightly more input due to feeding effort, the increased yield and superior crab quality can offer greater economic returns for small- to medium-scale farmers.

The Vertical Crab House system is particularly advantageous in land-limited areas or for farmers looking to implement a high-density, low-footprint cultivation system. Its modular structure allows for scalable production with reduced environmental impact. The consistency of growth across all three maintenance durations underlines the reliability of the Vertical Crab House system. However, the benefits are maximized at longer cultivation periods, especially when coupled with optimized feeding strategies. It is recommended that mangrove crab farmers adopt a combined feeding regimen for at least 60 days in Vertical Crab House systems to achieve the best results in terms of harvest weight, feed efficiency, and survival rate.

Further research should investigate the economic feasibility, including feed cost-benefit analysis, labor inputs, and potential market pricing differences based on feed type and crab quality attributes, to validate its commercial scalability. In conclusion, the combination of natural and artificial feed over a 60-day maintenance period in a Vertical Crab House provides the most favorable outcome for mangrove crab aquaculture. This integrated approach enhances productivity, animal welfare, and economic viability.

D.CONCLUSION AND RECOMMENDATIONS

1. Conclusion

Based on the results of the study, it can be concluded that both the type of feed and the duration of rearing have a significant influence on the harvest weight of mud crabs (*Scylla* spp.) cultivated using the Vertical Crab House system. The best performance was observed in the treatment combining natural and artificial feed over a rearing period of 60 days. This combination resulted in the highest average harvest weight, indicating a synergistic effect between feed composition and optimal rearing time. The Vertical Crab House system has proven to be an effective method for mud crab cultivation, ensuring controlled environmental conditions and maximizing growth potential.

2. Recommendations

- a) Future mud crab farming practices should consider using a combination of natural and artificial feed to enhance growth and optimize harvest yields.
- b) A rearing period of at least 60 days is recommended to allow crabs to reach optimal harvest weight.
- c) The implementation of the Vertical Crab House system is advisable for sustainable and efficient mud crab aquaculture, particularly in areas with limited space.
- d) Further research is recommended to explore additional variables such as feed frequency, stocking density, and water quality management to further improve the productivity of this cultivation system.

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