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# Performance of Windu Shrimp (*Penaeus monodon*) Cultivated in a Silvofishery Pond with the Application of Phytoimmune®

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**Abstract**

This study aim to evaluated the effects of using FITOIMUN® (mixture *Boesenbergia pandurata* and *Solanum ferox*), in pellet feed on tiger prawn (*P. monodon*) survival, weight gain, daily growth rate, and feed conversion ratio. A t-test with two treatments and four replications was did in this investigation. In this treatment, phytoimmune concentrations were 0 mLkg (PO) and 24 mL/kg (P1). The UPTD Seed Center for Brackish Water and Seawater Manggar provided the tiger prawn (*P. monodon*) used by PL 42 0,10±0,30 g. Feeding the addition of the extract with a dose equal to 5% of the shrimp's weight three times per day at 08.00, 13.00, and 17.00 WITA. Shrimp are culturing in empang parit silvofishery ponds using cages that are 4x2x1,1 m in size with 8 plots of waring as barriers. Shrimp care is done for 4 weeks, and growth observations are made as well as weekly survival tests. According to the findings, survival was 70% at P1 and 68% at P0. The results of weighing the average value at PO (0,38 g) and P1 (0,48 g), the daily growth rate of the average value at PO (4,07%) and P1 (5,91%), and the conversion ratio feed at P0 (1,78) and P1 (1,73). In this investigation, the average water quality was 28,90°C, 19,2 ppt of salinity, 7,33 pH, and 4,31 ppm of DO. The results of feeding tiger prawns (*P. monodon*) FITOIMUN® 24 mL/kg feed revealed higher values for survival, weight increase, daily growth rate, and feed conversion ratio but no substantially different results (P>0, 05).

***Keywords***: Fitoimun, Silvofishery, Tiger Shrimp, Growth, Survival.

## 1. Introduction

Until now, tiger prawn cultivation is still one of the fisheries commodities that is popular with local consumers and has quite good market opportunities for export. As the demand for tiger prawns increases, mangrove forests in Indonesia have begun to experience damage, as has happened in the Mahakam Delta, East Kalimantan. The Mahakam Delta Mangroves had a total area of 113,553.44 ha in 2014; currently, 388.54 ha of primary mangrove forest and 25,429 ha of secondary mangrove forest remain (Kompas, 2021). This shows that the mangrove forests in the Mahakam Delta area are in the crisis category. This data shows that the dominant function of mangrove forests has changed to become cultivated land areas, so handling is needed so that mangrove damage does not continue to occur while cultivation activities, which are the community's livelihood, continue.

Silvofishery can be an alternative so that mangrove conservation and activities are maintained. Tiger prawn cultivation in the Mahakam Delta continues. Silvofishery is a farming system that combines fishing business activities and mangrove planting, followed by the introduction of a management system that minimizes input and reduce impacts on the environment (Macintosh et al., 2002). Fitzgerald & William (2002) stated that the trench pond silvofishery model provides the best results for reforestation efforts. Silvofishery pond management is still traditional, so it has various problems in production caused by seed quality, feeding, water quality, disease, and the continued use of chemicals. One of the efforts made is to carry out this research to overcome infectious diseases, increase growth, and increase pond production. with the application of natural ingredients such as tamarind eggplant extract and key curcuma, this research will test the application of FITOIMUN®, which contains sour eggplant extract and key curcuma extract, in shrimp cultivation in silvofishery ponds. Key (Boesenbergia pandurata) is a natural immunostimulant and antibacterial for fish and shrimp (Minapoli, 2017). Hardi et al. (2017) showed that ginger extract and eggplant extract in tilapia, apart from increasing immunity, also showed increased survival. The use of sour eggplant in feed for catfish can help increase the digestibility of the feed, reduce FCR, and also increase growth (Hardi, 2020). Furthermore, Hardi et al. (2022) stated that the use of FITOIMUN® on tiger prawns reared in traditional ponds can improve the quality of tiger prawn meat,

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especially the amino acid and fatty acid content. In this research, FITOIMUN® was added to the feed with the hope that, apart from increasing shrimp endurance, it could also improve shrimp performance (survival rate, growth, and the tiger shrimp feed conversion ratio).

## 2. Material and Methods

*2.1. Time and Place*

This research was carried out from September 2021 to January 2022. The research was carried out at Tambak Silvofishery, Salo Palai Village, Muara Badak District, Kutai Kartanegara Regency, East Kalimantan.

*2.2. Tools and materials*

The tools used in the research were a waring, bowl, AZ86032 water quality meter, pH meter, measuring cup, building iron, 4 inch pipe, electric scale, stationery, ancho, basin, spuid, scissors, needle, cement tub, mud pusher, and scoop. The materials used in the research were tiger prawns, pelleted feed, FITOIMUN®, TSP fertilizer, UREA fertilizer, and natural pesticides.

*2.3. Experimental Design*

In this research, the experimental design used was an independent T-test with 2 treatments and 4 replications. The treatment used is the administration of FITOIMUN® to the feed as much as:
P0 = Feed without FITOIMUN®
P1 = Feed with a dose of FITOIMUN® 24 mL/kg feed

*2.4. Research Procedure*

*2.4.1. Pond Preparation*

The pond used is a silvofishery pond with a ditch pond model with an area of 1.7 ha. Preparation of the pond takes ± 1 month, while the preparations carried out are improvements to the pond construction. The next step in reducing the thickness of the mud to ± 30 cm is to apply a natural pesticide made from clove extract. Leave it for a day, then collect the pests and burn them on the embankment, then rinse the pond. The next stage is to stabilize the pH in the pond by applying lime to the entire surface of the pond, after which prebiotics are applied to the pond water to provide food for the probiotic bacteria in the pond. The next day, the water in the pond was filled again until it was full. The next stage is fertilization to fertilize the pond water using UREA and TSP 36 fertilizer in a ratio of 4:1 (25:6.25 kg). This fertilization is done every 2 weeks or after changing the water.

*2.4.2. Preparation of Cages*

In this study, for the rearing container, a 4x2x1.1 m cage was used with 8 partitions inside. The volume of water in each plot is ±1 m3. The cage is made of 6 mm of iron as a frame and a 4 inch-diameter pipe as a float. Green gauze waring is used to divide shrimp.

*2.4.3. Shrimp Preparation*

This research used PL 12 tiger prawn seeds (P. monodon) with an initial size of ±0.01 g as the research object. The shrimp studied came from the UPTD Central Seed Center for Brackish Water and Manggar Sea Water. The shrimp that arrived were immediately acclimatized. The next stage is that the shrimp that have adapted are moved into cement tubs measuring 3x1x1 m with 2 tubs. Shrimp are kept for ±4 weeks until PL 42 shrimp measure 0.10-0.30 g. During rearing, shrimp are fed 5% of the shrimp biomass and then transferred to the pond. Once they arrive at the pond, they undergo acclimatization before being stocked. The density of shrimp when reared in cages is 20 individuals/$m^2$.

*2.4.4. Test Feed Preparation*

In this study, commercial pellet feed PV Stater Shrimp Feed (JAPFA®) was used, which has a protein content of 38%. For the treatment in this study, the feed will not be given FITOIMUN®, and the feed will be treated with a mixture of FITOIMUN® produced by CV Bioperkasa, 24 mL/kg of feed for treatment.
For the treatment of feed, 24 mL/kg of feed will be given FITOIMUN®. The initial mixing step is to dissolve FITOIMUN® according to the required dose in 100 mL of water until it is evenly mixed, then the feed is placed in a bowl, the FITOIMUN® solution water is poured evenly over the feed and stirred evenly until there are no lumps in the feed, and then the feed is dried. air dry. Feed can be used for a maximum of 9 hours.

*2.5. Parameters*

*2.5.1. Survival Rate*

At the end of the research, the survival rate (SR) calculation will be carried out by calculating the stocking number at the beginning of rearing and subtracting the number of shrimp at the end of rearing. The calculation of survival rate (SR) according to Effendie (1997) can be done using the following formula:

$$SR = (Nt/No)x100\%$$

Note:
SR: Shrimp survival (%)
Nt: Number of shrimp at the end of the study (tails)
No.: Number of shrimp at the beginning of the study (tails)

*2.5.2. Weight Addition*

Once a week, weight observations are carried out. The weight is measured by weighing the sample shrimp. The calculation of additional weight according to Effendie (1992) is as follows:

$$\Delta W = Wt-W0$$

Note:
ΔW: Additional weight of research shrimp (g)
Wt: Weight of shrimp when tested (g)
Wo: Previous weight of shrimp (g)

*2.5.3. Daily Growth Rate*

Once a week, weight observations are carried out. According to Stevens (1989), the calculation of the daily growth rate, or, in English, the Specific Growth Rate (SGR), uses the formula:

$$SGR = (LnWt - LnWo/t)x100\%$$

Note:
SGR: Daily growth rate (%/day)
Wt : Weight of shrimp at the end of rearing (g)
Wo : weight of shrimp at the beginning of rearing (g)
t : Time of rearing (days)

*2.5.4. Feed Conversion Rate*

At the end of the research, the feed conversion ratio (FCR) will be calculated to compare the amount of feed eaten during the rearing period, which can be calculated using the formula (Effendie, 1997; Bachruddin et al., 2018).

FCR = Feed given (g) / Increase in shrimp weight (g)

*2.5.5. Water Quality Parameters*

Water quality parameters measured include water temperature, sanitation, pH, and DO, which are measured directly on site (in situ). Measurements were carried out every three days using the AZ86032 water quality meter and pH meter.

*2.6. Data Analysis*

Data obtained, such as survival, absolute weight growth, daily growth rate, and feed conversion ratio, were tabulated using Microsoft Excel 2010 and then analyzed. used the independent t-test to determine the difference between control and treatment with the help of SPSS version 25. Water quality data was presented in tabular form and analyzed descriptively.

## 3. Results and Discussion

*3.1. Survival Rate*

Survival rate is the ability of shrimp to survive during rearing in ponds. The survival rate of tiger prawns (P. monodon) reared for 4 weeks in silvofishery ponds can be seen in Table 1.

Table 1. The survival rate of black tiger prawns reared in silvofishery ponds with a trench model in the 4th week

| SR | 4th Week |
|---|---|
| P0 | 68%a |
| P1 | 70%a |

Based on the results of statistical calculations for survival rates, it shows that there is no real difference ($P < 0.05$) at P0 and P1. However, in Table 1, it shows that the treatment given FITOIMUN® 24 mL/kg feed had a relatively better survival rate compared to the control. P1 has a survival rate of 70%, while controls have a survival rate of 68%.

Survival <70%; for the medium category, the survival rate is 50–60%; and in the low category, the survival rate is <50%. Survival rate is influenced by two factors, namely abiotic and biotic. Abiotic factors are the physical and chemical parameters of water. Shrimp physiological processes will run well if their living environment is within a tolerable range. Biotic factors include pathogens, pests, and the presence of microbes in the water (Marlina & Panjaitan, 2020). Furthermore, Effendie (2002) stated that internal and external factors greatly influence the survival of cultivated organisms, such as seed quality, stocking density, water quality, feed quality, and shrimp rearing management.

In this study, feed was given at 5% of the weight of the shrimp. and in the pond there is natural food so that food is considered sufficient, and the addition of FITOIMUN® to the feed helps increase the endurance of the shrimp so that the survival rate of the shrimp can be classified as good. This is in accordance with research by Hardi et al. (2017), who showed that giving curcuma extract and tamarind eggplant extract to tilapia showed an increase in survival.

*3.2. Growth*

*3.2.1. Addition of Weight*

The addition of weight is the increase in shrimp weight during rearing. Measurements are carried out once a week by weighing the shrimp. The weight gain of tiger prawns (P. monodon) over 4 weeks can be seen in Table 2.

Table 2. Weight gain of tiger prawns reared in silvofishery ponds with a trench pond model

| Weight Gain | 1st Week | 2nd Week | 3rd Week | 4th Week |
|---|---|---|---|---|
| P0 | 0,05±0,02a | 0,20±0,05a | 0,48±0,14a | 0,77±0,11a |
| P1 | 0,22±0,18a | 0,35±0,12a | 0,54±0,14a | 0,82±0,21a |

Table 2 shows that P1 has a higher average value compared to P0 each week. The first week P1 showed weight gain (0,22±0,20 g), whereas P0 (0,05±0,03 g), the second P1 week had weight gain (0,35±0.20 g), whereas the P0 week (0,20±0,06 g) The third P1 week had a weight increase (0,54±0,16 g) while P0 week (0,48±0.16 g), and the fourth P1 week had weight increases (0,82±0,24 g) and P0 day (0,77±0,12 g). On the statistical calculations obtained, the analysis table showed P0 and P1 have no real difference ($P > 0.05$).

The results of the study of the addition of FITOIMUN® 24 mL/kg feed increased the weight gain of shrimp. According to Effendie (1997), one of the factors that influences the growth of shrimp is its ability to use food. This is supported by Hardi's (2020)

statement that the use of acid clay in feedingstuffs can help improve the fertility of feedstuffs and boost growth. Syarpin et al. (2018) and Hardi et al. (2016) stated that acid tubers contain flavonoids, alkaloids, carbohydrates, proteins, fats, fibers, minerals, and vitamins. The acid tuber contents act as prebiotics or supplements for bacterial bacteria (probiotics) so that they can increase the number of Lactobacillus casei bacteria in the digestive tract of fish feed, which can ultimately enhance growth.

*3.2.2. Daily Growth Rate*

Daily growth rate, or specific growth rate (SGR). The daily growth rate of P. monodon for 4 weeks can be seen in Table 3.

Table 3. The daily growth rate of the windu shrimp kept in the silvofishery threshold model of the pebble

| SGR | 1st Week | 2nd Week | 3th Week | 4th Week |
|---|---|---|---|---|
| P0 | 2,33±1,23a | 4,13±1,03a | 4,91±0,53a | 4,91±0,24a |
| P1 | 7,62±4,24a | 5,84±1,72a | 5,24±0,81a | 4,96±0,60a |

In the first week P1 had a growth rate (7.42±4.90%) while P0 (2.33±1.42%), in the second week P2 had growth rates (5.84±1.99%) and P0 (4.13±1.18%), in the third week P1, the growth rate was (5.24±0.94%) whereas P0 (491±0.61%) and in the fourth week, P1, growth rates were (4.46±0.70%), while P0, the statistical calculations showed that P0 and P1 were not significantly different (P>0.05).

This is because the administration of FITOIMUN® 24 mL/kg can help increase appetite and sensitivity to the food of the shrimp so that the energy needed for their growth is obtained. It is consistent with Hardi (2020) that the use of acid thorns in fish feed can help improve the sensitivity to feed and increase growth, and the Mujiman (2004) statement that acid thunder extracts contain vitamins B and C. The vitamin B content contained in acid thunder extract plays a role in accelerating fish growth and fish appetite, as supported by Darmono (1993). If the energy required for shrimp growth is satisfied, then shrimp will experience good growth. Anonimous (2000) also says that the energy that shrimp obtain from food is used for activity and growth.

However, the daily growth rate indicates that there is a difference in the treatment trend between FITOIMUN® 24 mL/kg feeding and control. The P1 trend shows a decline (-43.16%), and the P0 trend shows an increase (49.69%). This is caused by the interference of small fish that eat shrimp feed, so that the feed that shrimp get is not satisfied for growth. This assumption is obtained from every feed inspection where there are small fish in the ancho, and when sampling, there are always small fish. There are enough small fish on the line for the treatment given FITOIMUN®, so the judged feed is not eaten entirely by shrimp caused by small fish disturbance. This can happen because in feed P1, there is an extract odor from the addition of FITOIMUN® that stimulates fish to eat, while in feed P0, there is no aroma extract, so fish do not interfere with the feed in P0. The statement is in line with Yolanda et al.'s (2019) statement that frogs on treatment P1 (machined foods without the addition of a combination of frog extracts and acid tubers) produce more stools compared to treatment P2 (machined foods with an addition of 0.1 mL of freg extract and acid tuber per gram of feed) and are not very responsive to the feed because there is no aroma of the extract that can enhance fish appetite, so the frog fish eat the feed given only to maintain their survival.

*3.2.3. Feed Conversion Ratio*

The food conversion ratio (FCR) is calculated to compare the amount of feed eaten during the maintenance period. The shrimp were incubated for 4 weeks with 5% biomass and a feeding frequency of 3 times a day. (pagi, siang dan sore). The FCR for this study can be seen in Table 4.

Table 4. Conversion ratio of feed for windu shrimp kept in silvofishery thresholds model 4th week dams

| FCR | 4th Week |
|---|---|
| P0 | 1,78±0,60a |
| P1 | 1.73±0,62a |

Based on the results of statistical calculations for the conversion ratio of feed, there was no real difference (P > 0.05) (Appendix Table 12). In P0 and P1, but in Table 4, the treatment of administration of FITOIMUN® 24 mL/kg feed had a food conversion ratio (FCR) relatively better than the control. P1 has a value of FCR 1.73, whereas P0 has a FCR value of 1.78.

This is according to Handayani (2008). Feed quality is one factor that affects a large or small FCR, and the statement by Haryanti (2009) is that the smaller the value of FCR, the better the quality of feeding, and the level of nutrition of the feed is higher. The foods that are added with FITOIMUN® from the extract of acid shrimp and keystone can act as a prebiotic that is useful for the probiotic bacteria L. casai so that the digestion of shrimp becomes better. It is in accordance with the statement of Arief et al. (2014) that the use of acidic lily extract containing carbohydrate can increase the number of L. casai bacteria in the intestines of lily fish. More Mardliyah (2018) in Hardi (2020) showed the mixing of acid lily extracts with probiotic L. casai in lily feed can boost growth up to 3x compared to the extraction and probiotics 2:1, whereas the protection effect against bacterial infection is best in comparison 1:2 (extract:probiotik).

*3.3. Water Quality*

The water quality measurements are performed three times a day, in the morning, afternoon, and

evening. As to the water quality parameters measured, they are temperature, sanitation, pH, and DO. The results of the measurement of the water level can be seen in Table 5.

Table 5. Quality of water-licked silvofishery model dams during the study

| Parameters | Week | | | | Average |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | |
| Temperature($^{O}$C) | 27-31 | 26-29 | 28-30 | 26-31 | 28,90 |
| Salinity(ppt) | 14,5-14,7 | 13,9-14,7 | 12,5-14,8 | 12,5-12,8 | 13,92 |
| pH | 7 | 8 | 7 | 7 | 7,33 |
| DO(ppm) | 5-6 | 2-3 | 3-4 | 5 | 4,31 |

The result of the temperature measurement during the study was 26–31°C, with an average value of 28.9°C. These results show that the temperature during the trial is still good; according to BBPBAP Jepara (2007), a good temperature for the shrimp is 28–31,5 °C. For growth, the temperature in this study is still optimal for shrimp. This is in line with the opinion of Rachmansyah et al. (2010) that the shrimp grows relatively fast and has a relatively high survival rate at a temperature range of 26–30 °C, and Tricahyo (1994) in Djunaedi et al. (2016) says that the optimal water temperature range for the growth and life of the shrew is 28–32 °C. However, due to bad weather, when research is done, there are often constant rains and heat that can cause sudden temperature changes that cause shrimp to suffer stress. Stressed shrimp can suffer from growth disorders and death. It is supported by Kasman et al.'s (2021) statements that temperature is one of the indicators that lilies need to beware of because a sudden temperature rise that occurs over a short period of time can cause a shock shell that can eventually inhibit shell growth or be fatal to the shell.

The results of the measurement of salinity during the study were 12.5–14.7 ppt, with an average value of 13.49 ppt. These results show that salinities during the research are still within the tolerance of shrimp for the survival rate, according to Tasrif (2020), i.e., the shrimp have a tolerance limit on the saltity of 5–25 ppt. According to the results of research carried out by BBPBAP Jepara (2007), the optimal range of saltity for the filling of shrimpers is 15–30 ppt. According to Suwoyo & Sahabuddin (2017), salinity is strongly related to the osmoregulation process, or the adjustment of shrimp ions to the fluid of their environment, and the process of skin change. (moulting).

The pH measurement during the study was 7-8, with an average of 7.33. These results suggest that the pH during the study is still good for the rate of survival and growth of shrimp. This is in line with Susana's (2005) statement in Tafsir (2020), which states that the appropriate pH range for cultivation activities is between 6.5 and 8.5. Plus with Boyd's (1990) statement, where the suitable water pH for post-growth of shrimp larvae is from 6.5 to 9.0. According to Kasmawati (2014), a pH of 6.4 can cause the post-growth rate of shrew larvaes to decrease by 60%; otherwise, a pH of 9.0-9.5 will cause an increase in ammonia levels, thereby indirectly harming the post-larvae of shrimp.

The DO measurement during the study was 2–6 ppm, with an average of 4.65. In the middle of the study, there was a drastic decrease in the DO to 2 ppm due to bad weather, which is high rainfall in a few days that interferes with the growth of shrimp. This is in accordance with the statement Taufiqull (2016) made in Tafsir (2020) that the DO series of 2-4 ppm can interfere with the development of the shrimp. In other weeks, the DO is still in a good range between 5 and 6 ppm.

## 4. Conclusion

Based on the results of research obtained from the performance study of the windu shrimp (Penaues monodon) grown on silvofishery trunks with the application of FITOIMUN®, it was concluded that the administration of 24 mL/kg of Fitoimun® in the food of the Windu shrub increases the survival rate, weight gain, and daily growth rate, as well as improves the FCR of the silvophishery shrubs based on the model of the barrier, but the improvement is no real difference ($P > 0.05$).

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