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Application of inorganic fertilizer combination with various kinds of organic fertilizer in the nursery phase of white shrimp (*Litopenaeus vannamei*)

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Abstract. The purpose of this research is to determine the effect of natural feed growth on the growth and survival rate of white shrimp, specifically in relation to the usage of inorganic fertilizers in conjunction with various organic fertilizers. The experimental design consisted of four treatments, each replicated three times. The treatments included a combination of urea, SP-36, and organic fertilizer derived from superintensive shrimp pond waste (Treatment A), a combination of urea, SP-36, and petroganic (Treatment B), a combination of urea, SP-36, and chicken manure (Treatment C), and a control treatment consisting of only urea and SP-36 without any organic fertilizer (Treatment D). Urea was administered at a dosage of 5.2 grams per container, SP-36 at a dosage of 2.6 grams per container, and organic fertilizer at a dosage of 52 grams per container. The factors that were monitored included the composition of plankton, the growth of benthic algae, the growth and survival of white shrimp, and the quality of pond water. The study's findings revealed no statistically significant difference in the growth of live feed when inorganic and organic fertilizers were combined ($P>0.05$). However, the survival rate of white shrimp exhibited a significant difference ($P<0.05$). Using a mixture of inorganic fertilizer (namely urea and sp-36) and organic fertilizer, within the context of a super-intensive shrimp pond, yielded the most favorable outcome regarding white shrimp survival rate, with a recorded percentage of 94.67%.

1 Introduction

Litopenaeus vannamei, commonly known as white shrimp, holds significant importance as a prominent fishery export commodity within the Indonesian market. The existence of this entity holds significant strategic value in bolstering the national economy by generating

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national foreign exchange, fostering employment and business prospects, and augmenting the income of cultivators. The augmentation of vaname shrimp production can be achieved by several growing methods, including extensive, semi-intensive, intensive, and super-intensive approaches system has developed. The difference from the system lies in the application of management technology levels, namely stocking density, feeding patterns and water and environmental management systems [1]. Extensive cultivation systems are carried out simply with minimal input and management, semi-intensive systems use medium inputs, and intensive to super-intensive cultivation systems usually require more resource input and management [2].

The shrimp production system may be broadly categorized into two distinct phases. The first phase is a single-phase system, where fry or post-larvae are maintained in dedicated ponds until they reach the desired size for eating and subsequent sale. The second phase is a double-phase culture system, whereby fry or post-larvae are raised in two separate stages. Initially, the aquatic organisms are raised in ponds or transition tanks, sometimes referred to as nurseries. Subsequently, they are transferred and stocked into grow-out ponds [3]. The implementation of nursery practices has been identified as a viable approach to enhance the overall quality of white shrimp seeds. It is imperative to conduct proper maintenance procedures during the nursery phase in order to ensure the well-being of shrimp during the grafting process, since this will ultimately impact their growth rate and survival during the subsequent rearing phase [2]. The effective management of postlarvae throughout the nursery period is of utmost importance in ensuring their growth and survival, with the ultimate goal of achieving optimal growth performance in juvenile individuals [4]. Nurseries function as quarantine facilities to monitor potential infections and as a strategy for cultivating shrimp with consistent size, hence enhancing survival rates and improving tolerance to environmental variations. This ultimately contributes to enhanced biosafety in aquaculture systems [5]. In contrast to direct stocking (PL-10), the survival rate of white shrimp in rearing ponds exhibited higher values at the 10-day and 20-day intervals during the nursery phase. Utilizing juvenile specimens for a minimum duration of 10 days has been observed to positively impact both the survival rate and the uniformity of harvested shrimp sizes. The utilization of underage individuals for a duration of 20 days is strictly forbidden [6].

Pond fertilization has been identified as a strategy to enhance shrimp farm yield. Aquatic fertilization, in principle, is the supplementation of essential nutrients necessary for aquatic organisms to enhance the generation of live feed for shrimp. In the realm of agriculture, inorganic fertilizers, such as urea and TSP, are frequently employed, alongside organic fertilizers, including bran, chicken dung, and cow manure [7]. Both organic and inorganic fertilizers possess distinct advantages and disadvantages; yet, their combined use can yield synergistic effects. Organic fertilizers offer comparable advantages to inorganic fertilizers in terms of enhancing soil microorganism activity, facilitating anions and cations exchange, augmenting organic matter and soil carbon levels, and enhancing the quality and yield of aquaculture production [8]. Nevertheless, it does not have any adverse effects on the environment. There are a variety of natural feed sources that play a crucial role in facilitating the growth of shrimp within the pond ecosystem, particularly during the initial phases of shrimp cultivation. Benthic algae, plankton, and benthos are representative examples of these categories. [9].

The research described above involved the application of a combination of inorganic fertilizer and various types of organic fertilizer during the nursery phase of white shrimp. The objective of this research is to assess the impact of combining inorganic fertilizer with different types of organic fertilizer on the growth, live feed, and survival rate of white shrimp (*L. vannamei*).

2 Materials and methods of research

The study was conducted at the Experimental Pond Installation, which is part of the Research Institute for Brackishwater Aquaculture and Fisheries Extension (RIBAFE), located in Maros Regency, South Sulawesi, Indonesia.

The research containers utilized in the study had dimensions of 70 x 37 x 26 cm^3 and were comprised of 12 separate components, with each component capable of holding a volume of 50 L of water. In this experiment, a methodology known as a completely randomized design (CRD) was employed. The CRD consisted of four treatments and three replications. The experimental treatments consisted of four combinations: A) a mixture of urea, SP-36, and organic fertilizers derived from solid waste acquired from a super intensive shrimp farm, B) a mixture of urea, SP-36, and commercially available organic fertilizer, C) a mixture of urea, SP-36, and chicken manure fertilizer, and D) a mixture of urea and SP-36 without any additional organic fertilizers. Urea was applied at a rate of 200 kilograms per hectare (equivalent to 5.2 grams per container), SP-36 was applied at a rate of 100 kilograms per hectare (equivalent to 2.6 grams per container), and organic fertilizer (consisting of super intensive shrimp pond solid waste, commercial organic fertilizer, and chicken manure fertilizer) was applied at a rate of 2,000 kilograms per hectare (equivalent to 52 grams per container) [7], [10], [11].

The growth media was made by obtaining dirt from a shrimp pond and subjecting it to thorough mixing until a homogeneous mixture was achieved. Subsequently, the mixture was placed in a container with a thickness of 5 cm. The cultivation of natural feed involved a process of soil drying for a period of 3-7 days until it exhibited signs of cracking. Subsequently, fertilizer was used based on the specific treatment requirements. Finally, the container was filled with brackish water to a height of 3 cm. During the course of the natural feed development process, the water level was increased to a volume of 50 liters. Following a period of cultivating organic feed for a duration of three weeks, the PL-12 vaname shrimp fry were introduced into the rearing system at a stocking density of one individual per liter or fifty individuals per container. The duration of the vaname shrimp nursery phase is one month.

The study encompassed the assessment of many parameters, including the composition and abundance of plankton species, the extent of benthic algae (klekap) coverage, the growth and survival rate of white shrimp, and the evaluation of water quality parameters such as temperature, dissolved oxygen, salinity, pH, alkalinity, NO_3, PO_4, and TOM.

The growth and survival rate of white shrimp were assessed by the utilization of analysis of variance (ANOVA) in the SPSS program version 21.00. Subsequently, a Tukey test was conducted at a confidence level of 95% to further analyze the data. The descriptive examination encompassed an analysis of the composition and abundance of plankton, the extent of benthic algae coverage, and data pertaining to water quality.

3 Results

The average absolute weight growth of vaname shrimp exhibited variation across all treatments, with an upward trend as the rearing duration rose. According to Figure 1, Treatment A exhibited the highest absolute weight of white vaname shrimp, measuring 0.2514 g. This was closely followed by Treatment B, which recorded a weight of 0.2510 g. On the other hand, Treatments C and D had lower weights of 0.2233 g and 0.2096 g, respectively. The statistical study using analysis of variance (ANOVA) indicated that the application of various combinations of fertilizers did not have a statistically significant impact ($P > 0.05$) on the growth of the absolute weight of white vaname shrimp. The reason for this phenomenon can be attributed to the fact that the natural feed provided in all treatments is capable of satisfying the dietary needs of vaname shrimp. The utilization of natural feed has the potential to provide a wide range of essential nutrients necessary for the optimal growth and development of shrimp.

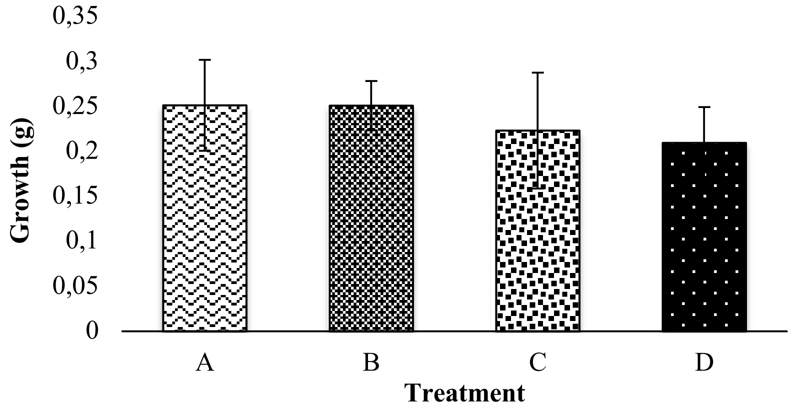


Fig. 1. The growth of the white shrimp *L. vannamei* under different types of fertilizers application in nursery phase during 30 days rearing period.

The utilization of natural feed has the potential to provide a wide range of essential nutrients necessary for the optimal growth and development of shrimp. The natural feed possesses a comprehensive nutritional composition and is readily digested by the fry. Additionally, its relatively diminutive body size is well-suited for the fry's mouth opening, allowing for efficient consumption. Furthermore, the active behavior of the natural feed stimulates the fry to consume it [12]. Various external factors, including as the aquatic environment, parasites, and diseases, and internal ones like inheritance, sex, age, and metabolic capacity, collectively exert an influence on growth [13].

The present study found that the absolute weight of the average white shrimp did not exhibit a significant difference compared to previous studies, specifically [14]. These previous studies reported growth rates of white shrimp as 0.109, 0.152, and 0.134 g/individual over a 15-day rearing period in happa systems located in ponds with densities of 4,000, 6,000, and 8,000 individuals/m^3, respectively. The study conducted for a duration of one month focused on the growth of tiger prawns (*P monodon*) in pond plots equipped with an aeration system. The results indicated that the final weight of the prawns ranged from 0.229 to 0.331 g/individual [15]. The study examined the average weight of *Penaeus semisulcatus* in a happa system colonization with varying densities. The prawns were reared for a period of 35 days. The results showed that at a density of 1000 individuals/m^2, the average weight of the prawns was 0.348 grams per individual. At a density of 1500 individuals/m^2, the average weight decreased to 0.286 grams per individual. Finally, at a density of 2000 individuals/m^2, the average weight slightly increased to 0.300 grams per individual. [16]. During the winter season, the growth of white shrimp was constrained. Consequently, the white shrimp were reared in tanks for a duration of 1-5 weeks until they attained a size range of 0.2 – 0.5 g/individual. Subsequently, they were transferred to ponds for further cultivation [17]. The weight of white shrimp that resulted from a 21-day rearing period using different feed combinations ranged from 0.027 to 0.047 g per individual [18]. The average weight of white shrimp, which were cultivated in different mixed ion solutions for a duration of 21 days, ranged from 0.260 to 0.305 grams per individual [19]. According to a study conducted by [20], the mean ultimate weight of white shrimp cultivated at different densities varied between 0.39 and 1.26 g/individual. According to the study, white shrimp that were raised for a period of 21 days had average final weights of 0.292 g/individual and 0.320 g/individual, while being subjected to densities of 1.653 individuals/m^3 and 909 individuals/m^3, respectively [4]. According to the study conducted by [21], the white shrimp exhibited a range of ultimate weights between 0.20-0.3 g/individual, with an average weight falling within the range of 0.11-0.26 g/individual. These results were obtained following a rearing period of 21 days, during which the shrimp were maintained at a density of 5,000-20,000 post-larvae per cubic meter (PL/m^3). The study observed that tiger prawns reared using the happa technique for a duration of 30 days exhibited an average final weight ranging from 0.331 to 0.351 g/ind [22]. The growth of white shrimp is influenced by various factors, such as water quality, temperature, seed quality, feed quality, feed volume, and stocking density [23].

Based on the data presented in Figure 2, the treatment A involving the application of urea, SP-36, and super intensive pond solid waste fertilizer exhibited the best survival rate of 94.67%. This can be attributed to the observed trend of an increasing average percentage of complete sealing from the initial maintenance week. White shrimp effectively utilize natural food sources to enhance their growth rate. The quantity of natural feed consumed by shrimp decreases as they mature and expand. This observation aligns with the quantity of organic feed provided after the initial stocking, as well as the subsequent two sampling events. The decline in density observed during the second and final sampling suggests that the feed was being consumed by the shrimp for growth, as evidenced by the increase in average weight at the end and the growth of shrimp under improved maintenance and water quality conditions. The level of maintenance is sufficiently satisfactory to support the growth and survival of shrimp. In contrast, the combination of urea and SP-36 (control) yielded the lowest survival rate, specifically 82.67±1.15%. This outcome can be attributed to the comparatively limited coverage percentage, which consequently provided an adequate quantity of food intake for the shrimp's sustenance. This aligns with the assertion [24], which claims that the parameters that most influence shrimp survival rate are food management and water quality control in rearing media. The length of the nursery phase influences the survival and growth of white shrimp until they reach market size (consumption) [6]. Because it is related to space utilization competition, there is an optimal stocking density that will produce the greatest reaction to white shrimp survival rate. Opportunities for contact between individuals concerns cannibalism, pathogen dissemination, and feed competition [25].

The data presented in Figure 2 illustrates the results obtained from observations conducted on the mean survival rate of white shrimp in various treatment groups over a period of 30 days. Treatment A achieved the highest survival rate, reaching 94.67%. This was followed by treatment B with a survival rate of 90.67%, treatment C with a survival rate of 86.00%, and treatment D with the lowest survival rate of 82.67%. The statistical analysis of variance indicated a highly significant impact ($P<0.01$) of various fertilizer combinations on the survival rate of white shrimp juveniles. This suggests that the application of different fertilizer combinations to the white shrimp had a substantial influence on the observed survival rate. The subsequent test results indicated the outcomes of treatments A.

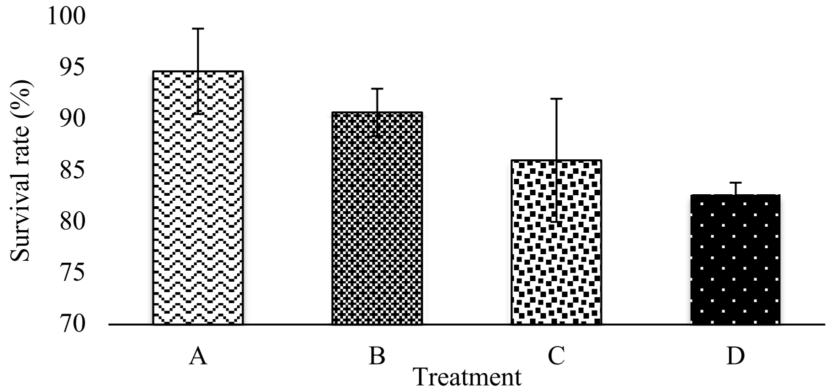


Fig. 2. The survival rate of white shrimp *L. vannamei* in the nursery phase during a 30-day growing period when different types of fertilizers.

The observed survival rate of young vaname shrimp did not exhibit a statistically significant difference when compared to previous studies on vaname prawn. According to the cited source [26], the initial survival rate of vaname prawns kept at a density of 2000 individuals/m^2 for a duration of 14 days was recorded at 95.7%. However, this rate experienced a decline to 91.32% after a period of 28 days. According to a study conducted by [27], the survival rate of vaname shrimp exhibited a range of 76.67% to 94.81% when subjected to different salinity levels (ranging from 15 to 45 ppt) throughout a 30-day culture period. The experiment was carried out in an aquarium environment with a density of 6 individuals per liter. The research findings indicate that the survival rate of white vaname shrimp, which were cultivated in a 30-ton fiber tank equipped with a water recirculation system and stocked at a density ranging from 800 to 1200 individuals/m^2, was seen to be approximately 80 to 100% over a period of 30 to 50 days [2]. The survival range of vaname shrimp grown for a duration of 42 days using a clear water recirculation system was found to be between 85.0% and 98.4% at a stocking density ranging from 1,500 to 9,000 individuals/m^3 [28]. According to a study conducted by [29], the survival rate of vaname shrimp produced using the biofloc technology reached 95.45% after a duration of 28 days. The survival rate of white shrimp was observed to be 85.1% in the biofloc heterotrophic system, 93.8% in the chemoautotrophic system, and 73.5% in the mature system after a rearing period of 35 days. These results were obtained at a stocking density of 2,000 individuals per cubic meter, as reported in reference [30]. The salinity levels observed in this study were as follows: a concentration of 2 g/L with a range of 89.2-92.5%, a concentration of 6 g/L with a range of 85.0-95.0%, and a concentration of 15 g/L with a range of 89.0-94.0% [19]. The observed survival rate of white shrimp reared at different densities exhibited a range of 80.1% to 98.9%. The study conducted by [20] observed that the implementation of clear-water recirculating aquaculture systems (CW-RAS) at a density of 1,500 individuals/m^3 resulted in the lowest survival rate. The average survival rate of white shrimp, which were culture for a period of 21 days, was found to be 86.40% and 95.61% at densities of 1,653 ind/m^3 and 909 ind/m^3, respectively. [4]. There are numerous elements that exert an influence on the survival of shrimp. Parameters such as shrimp density, ambient conditions, water quality, and feed, specifically the composition and quantity of feed, are among the factors that need to be considered. Optimal water quality and enough diet are crucial factors contributing to the growth and survival of shrimp. The duration of shrimp seed cultivation necessitates careful consideration due to the inherently cannibalistic nature of shrimp, which significantly affects the viability and production of shrimp offspring. As the duration of juvenile maintenance increases, there is a corresponding increase in the weight of shrimp biomass. This development in size leads to heightened competition for resources such as space, feed, and oxygen, which in turn has ramifications for the survival of shrimp seeds and the general quality of water. Moreover, it is hypothesized that variances in size may contribute to decreased survival rates among individuals of the white species. shrimp fry [31], [32], [33], [34].

Plankton present in aquatic ponds serves as a vital source of sustenance for fish and prawns, while also serving as an ecological indicator of water quality. Treatment B had the highest diversity of phytoplankton species, encompassing a maximum of 16 genera. This was followed by treatment A, which contained 13 genera, treatment C with 8 genera, and treatment D with a maximum of 5 genera. Treatment A resulted in the highest number of zooplankton genera, with a maximum of nine. Treatment B produced eight genera, treatment D produced six genera, and treatment C gave only five genera. Figure 3 displays the distribution of plankton species within each treatment.

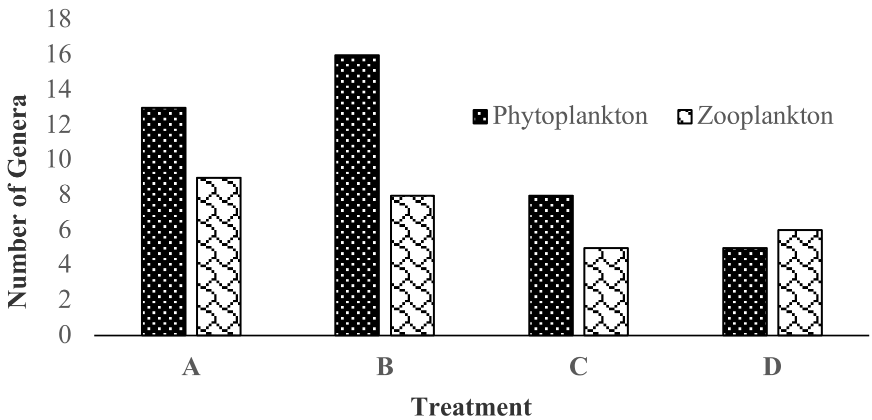
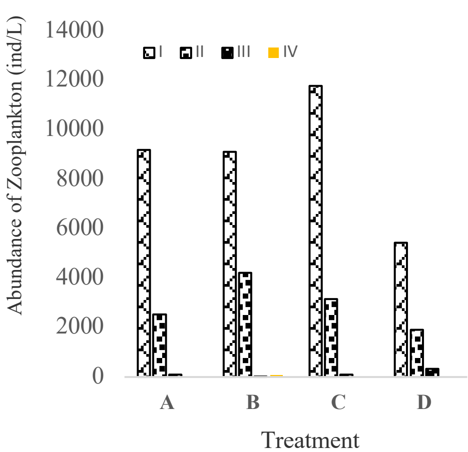


Fig. 3. Phytoplankton and zooplankton species composition in each treatment during rearing period

During maintenance, the following plankton species were collected: *Amphiprora* sp, *Aphanothocea* sp, *Gymnodinium* sp, *Gyrosigma* sp, *Navicula* sp, *Oscillatoria* sp, *Pyrophacus* sp, *Pleurosigma* sp, *Synechocystis* sp, *Surirella* sp, *Thallasionema* sp, *Caratium* sp, *Chaetoceros* sp, *Coscinodiscus* sp, *Clindropyxis* sp, *Cyclotella* sp, *Ditylum* sp, *Eutreptia* sp, *Guinardia* sp, *Globigerina* sp, *Gyrodinium* sp, *Lyngbia* sp, *Strombidium* sp, *Thallassiorira* sp, *Chlorella* sp, *Melosira* sp, *Nitzschia* sp, *Branchionus* sp, *Acartia* sp, *Apocyclops* sp, *Echinocamptus* sp, *Naupli Copepoda, Onychocamptus* sp, *Balanus* sp, *Copepoda* sp, *Nitocra* sp, *Polychaeta, Schamackeria* sp, and *Tintinnopsis* sp.

The phytoplankton community is largely dominated by the species Chlorella sp, but the zooplankton community is primarily dominated by Apocyclops sp. Apocyclops sp belongs to the taxonomic class Crustaceae and serves as a favoured natural food source for prawns. The prevalence of crustaceans in both intensive and traditional ponds can be attributed to their classification as seawater plankton, which exhibits a remarkable ability to withstand fluctuations in aquatic environmental conditions. These organisms often enter ponds during water changes and subsequently thrive as a natural source of animal feed, particularly favoured by prawns. The crustacean class, specifically the copepod group, holds significant importance within the zooplankton population [35]. In traditional shrimp pond management, plankton (including phytoplankton and zooplankton) is commonly relied upon as the primary natural food source. Its cultivation and preservation are achieved through fundamental fertilisation practises, particularly during the early stages of pond preparation. [36]. In aquaculture ponds, the use of fertilizer is employed to stimulate the growth of naturally occurring food sources like as plankton, klekap, and benthos [37]. The utilisation of fertilizer with a varying N/P ratio in each experimental group exerts an impact on both the abundance and composition of phytoplankton. Previous studies have indicated that ponds that have undergone fertilisation exhibit a greater abundance of phytoplankton compared to ponds that have not undergone fertilisation (38, 39). Organic fertilizers have the capacity to accumulate essential macronutrients including nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulphur (S). Additionally, they also possess the ability to acquire trace elements such as zinc (Zn), copper (Cu), molybdenum (Mo), cobalt (Co), boron (B), manganese (Mn), and iron (Fe), albeit in relatively low concentrations [40]. Organic nitrogen fertilizers are of significant importance in enhancing the soil's physical, chemical, and biological characteristics within pond environment [41].

Treatment A, which consisted of urea fertilizer, SP-36, and organic fertilizer derived from super intensive pond waste, exhibited the highest mean abundance of individual phytoplankton at 13.748 ind/L. Following closely behind was treatment B, which involved urea fertilizer, SP-36, and a commercial petroganic organic fertilizer, with an average abundance of 13.698 ind/L. Treatments D (urea fertilizer + SP-36) and C (urea fertilizer + SP-36 + organic fertilizer from chicken farm waste) displayed lower mean abundances of 12.701 ind/L. Treatment A, consisting of urea fertilizer, SP-36, and organic fertilizer derived from super intensive pond waste, exhibited the highest mean abundance of individual zooplankton at 3.933 ind/L. Treatment C, involving urea fertilizer, SP-36, and organic fertilizer sourced from chicken farm waste, demonstrated the second highest mean abundance at 3.754 ind/L. Conversely, treatment B, which incorporated urea fertilizer, SP-36, and petroganic commercial organic fertilizer, displayed the lowest mean abundance at 3,349 ind/L.



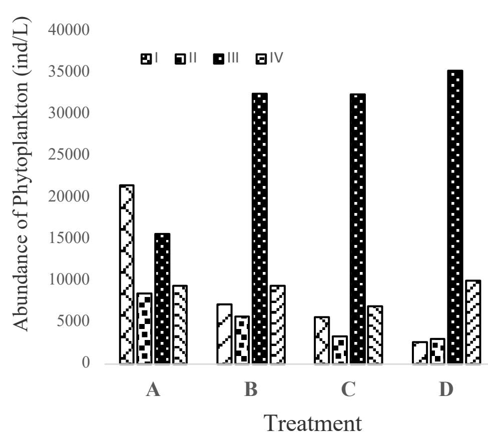


Fig. 4. Phytoplankton and zooplankton abundances in each treatment during the rearing period.

According to the data presented in Figure 4, there is a definite negative relationship between the abundance of phytoplankton and zooplankton. During the initial observation, it was seen that the abundance of phytoplankton was comparatively low, although the quantity of zooplankton was high. This discrepancy can be attributed to the aggressive predation of zooplankton on phytoplankton during the early stages of the experiment. During the second observation, there was an observed rise in the number of phytoplankton, accompanied by a drop in zooplankton. This occurrence can be attributed to the consumption of cultured organisms, specifically zooplankton, by white prawns, resulting in an observed rise in the population of phytoplankton. Following the completion of the maintenance period, there has been a notable reduction in the population of zooplankton, accompanied by a concurrent fall in the number of phytoplankton. This happens because the nutrient content in the maintenance media has begun to decrease, the low nutrient content in the maintenance media greatly affects the plankton to grow and develop. The abundance of plankton, particularly phytoplankton, in water is regulated by nutrient availability, particularly nitrogen (N) and phosphorus (P). As long as there are no other limiting variables, the nutritional concentration of pond waters influences the number of phytoplankton. The input of nutrients for phytoplankton growth, such as nitrate, phosphorus, and organic matter, influences the number of plankton, particularly phytoplankton, in waterways [42]. One of the most important requirements for phytoplankton growth is adequate nutrient availability in the water [43], [44]. The abundance of plankton, particularly phytoplankton, in water is regulated by nutrient availability, particularly nitrogen (N) and phosphorus (P). An increase in nutrient levels in the water causes an increase in plankton abundance. Factors promoting phytoplankton growth are extremely complex, interacting with physico-chemical water factors such as light intensity, dissolved oxygen, temperature stratification, and the availability of nitrogen and phosphorus nutrients, while biological aspects include animal predation, natural mortality, and decomposition [45].

Benthic algae is a group of several types algae that form a webbing, which are attached by mucus-like substance each other. The benthic algae forms a brown sheet, greenish brown, yellowish to bluish green, depending on the type and percentage of the algae. According to qualitative observations, treatment A (urea + SP-36 + organic fertilizer from super intensive pond waste) had the highest percentage of benthic algae coverage on the bottom surface of the cultivation container at 73.33%, followed by treatment B (urea + SP-36 + commercial organic fertilizer (petroganic) at 55.83%, treatment C (urea + SP-36 + chicken manure fertilizer) at 54.33%, and treatment D (urea + SP-36) had the lowest at 54.17%. The examination of the various percentages of benthic algae coverage revealed that the administration of fertilizers in various combinations had no significant ($P > 0.05$) effect on the percentage of benthic algae coverage in the vannamei shrimp cultivation. Figure 5 depicts the proportion of benthic algae coverage in each treatment.

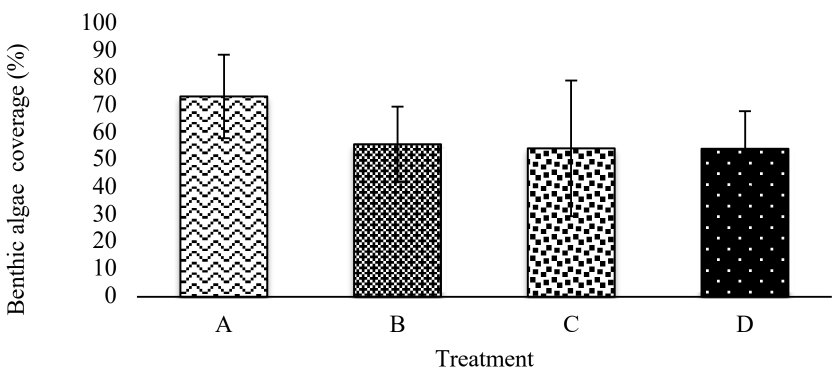


Fig. 5. Percentage of benthic algae coverage (%) in each treatment during rearing period.

The growth of benthic algae is influenced by various factors, including the supply of nutrients, seasonal variations, and ambient conditions. In the dry season, fluctuations in periphyton abundance, diversity, and evenness are influenced by environmental parameters like as salinity, nitrate levels, inorganic phosphate levels, and dissolved oxygen concentrations. The organisation of the periphyton community, species makeup, and succession response are influenced by environmental conditions. [46], [47].

The observed rise in both the absolute growth and daily growth rate of vaname shrimp across all experimental conditions suggests that the white vaname shrimp effectively consumed the naturally occurring feed, consisting of plankton and benthic algae, which had undergone growth. There is a tendency for the average percentage of complete closure to grow from the second week to the third week. The quantity of natural feed used by prawns diminishes as they mature and increase in size. This finding aligns with the patterns observed in natural feed availability subsequent to the introduction of stocked organisms, as well as the first sampling that indicated a decrease in population density. The population of benthic algae exhibited an initial increase at the onset of the experiment, then peaking during the third week, and thereafter experiencing a decline in the subsequent weeks. The reduced slack observed on the surface of the rearing media, which serves as the nutritional source for white vaname prawns, indicates the visibility of this phenomenon [48]. The reliance of prawns on benthic algae as a primary food source highlights the significant function of natural feed in the early stages of their growth [49]. Within extensive aquaculture systems, there exist four distinct types of natural feed sources, namely benthic algae/lab lab (including bentic mat, cyanobacteria, diatoms, and allied fauna), *Ruppian mantima*, filamentous green algae, and plankton [50]. Lablab production is identified as one of the factors that exert an influence on the growth and production of vaname shrimp in traditional ponds [51]. The benthic algae discharge in large ponds reached a maximum value of 3.33 g/100 cm^2. [52]. According to the findings of this study, it was observed that the mean biomass production of benthic algae for the lime application treatments of 600 kg/ha, 800 kg/ha, and 1000 kg/ha amounted to 6.38 g/100 cm^2, 10.18 g/100 cm^2, and 8.95 g/100 cm^2, respectively [53]. Treatment B (super intensive pond waste organic fertilizer) exhibited the highest average biomass production of benthic algae, measuring 3.94 g/100 cm^2. This was followed by treatment A (commercial organic fertilizer), D (Urea Fertilizer +SP-36 + organic fertilizers originating from super intensive shrimp farm), and C (urea fertilizer + SP-36 + commercial organic fertilizer), which recorded biomass productions of 3.29 g/100 cm^2, 3.15 g/100 cm^2, and 3.03 g/100 cm^2, respectively [54]. The biomass production of benthic algae was measured in four different treatments: treatment A, which involved the application of urea fertilizer, SP-36, and organic fertilizers derived from a super intensive shrimp farm; treatment C, which involved the application of urea fertilizer, SP-36, and chicken manure fertilizer; treatment B, which involved the application of urea, SP-36, and a commercial organic fertilizer; and treatment D, which involved the application of urea and SP-36 fertilizer [11].

The quality of the water Is critical to the growth and survival of the reared shrimps. Table 1 shows the findings of water quality observations made during the investigation. Throughout the course of the inquiry, a variety of temperatures was recorded, range from 22.7 to 29.9 ºC. The viability of vaname shrimp survival in this region remains intact. The optimal temperature range for the growth of vaname prawns is reported to be between 26-32 ºC (55). The temperature range that is considered best for white prawns is often reported to fall between 23-30 ºC. Please provide more context or information for me to rewrite in an academic manner. The optimal water temperatures for tropical species, which promote optimal growth, fall between the range of 29-30ºC. Conversely, water temperatures ranging from 26-28ºC are associated with reduced growth rates. Temperatures below this range, namely between 10-15ºC, are considered deadly thresholds for these species. Shrimp mortality can occur when subjected to temperatures below 15ºC or above 33ºC for a duration exceeding 24 hours. Sublethal temperatures range from 15 to 22 ºC and 30 to 33 ºC. [56]. For 21 days of growing, the temperature of the vannamei shrimp nursery pond ranges from 25 to 31ºC [4].

Tabel 1. Range of water quality variable's values measured during 30 days rearing period

Variable	Treatment			
	A	B	C	D
Temperature (⁰C)	23.7-29.9	23.3-29.0	22.7-29.1	23.3-29.2
pH	7.50-8.50	7.50-8.50	7.50-8.50	7.50-8.50
Salinity (ppt)	21-23	23-24	23-26	23-27
DO (mg/L)	2.60-3.50	2.31-2.59	1.81-3.01	2.13-2.95
Alkalinity (mg/L)	66.24-140.76	74.52-144.90	70.38-153.18	74.52-144.90
NO_3-N (mg/L)	0.0909-6.7200	0.1036-6.3031	0.2492-4.4987	0.0894-4.8449
PO_4-P (mg/L)	0.0021-0.7186	0.1227-0.6903	0.1103-1.7458	0.0105-0.2052
TOM (mg/L)	47.55-65.69	43.17-66.94	48.80-60.06	43.79-59.43

During the study, the pH values observed fell between the range of 7.5 to 8.5. The temperature range remains optimal for the cultivation of vaname shrimp. According to the literature, the optimal pH range for the cultivation of vaname shrimp is reported to be between 7.3 and 8.5, with a tolerance range of 6.5 to 9 [57]. The optimal pH value for the cultivation of vaname shrimp is 8.0, falling within a pH range of 7.4 to 8.9. [2].

The salinity measurements indicated a range of 21-27 parts per thousand (ppt), within which the vaneme shrimp were seen to have a preference for and thrive in. The Vaname shrimp species has been observed to inhabit a wide range of salinities, spanning from 0.5 to 45.0 parts per thousand (ppt). However, it has been noted that these shrimp demonstrate optimal growth in salinities that fall between the range of 10 to 15 ppt [58]. The white prawn species exhibits a notable capacity to endure a broad spectrum of saline levels, ranging from 0.5 to 60 parts per thousand (ppt). However, aquaculture practitioners still encounter challenges pertaining to the ion composition of pond water [59]. The ideal salinity range for the growth of Vaname shrimp is reported to be between 15-25 ppt [60].

The presence of dissolved oxygen in water is essential for the process of respiration, since it directly impacts the efficiency of nutrient uptake and metabolic activities. Throughout the course of the observation, the concentration of dissolved oxygen exhibited a range of 1.81-3.50 mg/L. According to the cited source [57], the mortality risk associated with dissolved oxygen is seen to be 2.0 mg/L. In the context of white prawn farming, the recommended level of dissolved oxygen is 3 mg/L, with a permissible range of tolerance of 2 mg/L. Adequate quantities of dissolved oxygen range from 4 to 6 mg/L [55].

The recorded values for alkalinity measurement varied between 66.24 and 153.18 mg/L. The recommended alkalinity range for vannamei shrimp culture activities is typically between 90 and 150 ppm. In the event that the alkalinity value exceeds 150 parts per million (ppm), it becomes imperative to undertake measures such as diluting the salinity and concentration of plankton, as well as ensuring adequate oxygenation. The elevated alkalinity levels contribute to the provision of calcium necessary for cellular osmoregulation in the shrimp's body. Alkalinity, also referred to as total alkalinity, denotes the comprehensive measure of basic constituents present in water, which can be equated to calcium carbonate ($CaCO_3$) [61]. The alkalinity of pond water should not exceed a maximum threshold of 80 mg/L. The application of lime has been found to be effective in raising the alkalinity levels of pond water in cases when it is determined to be low [62].

The findings of nitrate measurements in the present investigation shown a range spanning from 0.0894 to 4.4987 mg/L. According to a study [63], the nitrate concentration required for optimal algae development falls within the range of 0.900 to 3.500 mg/L. The study examines the impact of varying nitrate concentrations on the phytoplankton population, leading to subsequent changes in the chlorophyll-a content of the pond [64]. The required nitrate concentration for the proliferation of algae in aquatic environments ranges from 0.2 to 0.9 mg/L, with an ideal range of 0.1 to 4.5 mg/L (65).

The phosphate measurements obtained in this study exhibited a range of values spanning from 0.0021 to 0.2052 mg/L. The introduction of phosphorus-containing substances into aquatic environments, such as through the use of phosphorus fertilizers (e.g., SP fertilizer), has had an impact on the phosphorus levels in these bodies of water. The optimal range of phosphate concentration for promoting algae growth in the presence of nitrate nitrogen is between 0.018-0.090 mg/L P-PO_4 as the lower limit, and 8.90-17.8 mg/L P-PO_4 as the upper limit. The upper threshold for the concentration of N in the ammonium form is 1.78 mg/L P-PO_4 [7].

The aggregate organic content of water encompasses dissolved, suspended, and colloidal organic materials. The findings from the measurements of the total organic matter content (TOM) exhibited a range of values, ranging from 43.17 to 66.95 mg/L across all experimental conditions. The specified range was considered optimal in the cultivation process of vannamei prawns. The optimal range of total organic matter in vannamei prawn culture is reported to be 55 mg/L [67].

4 Conclusions

The combination of inorganic and organic fertilizer was not considerably different in terms of live feed growth and absolute weight, however it was significantly different in terms of white shrimp survival rate. The use of inorganic fertilizer (urea+SP-36) mixed with organic fertilizer created from a super intensive shrimp pond solid waste resulted in the highest survival rate of white shrimp (94.67%). Throughout the duration of the trial, the water quality was seemed suitable for the cultivation of live feed and white shrimp.

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