Kajian Limbah N dan P Pada Budidaya Udang Vaname (*Litopenaeus vannamei*) di Tambak Lahan Pasir. Oleh Gamal M. Samadan. Dibimbing oleh Prof.Dr.Ir. Rustadi, M.Sc.; Dr.Ir. Djumanto, M.Sc.; dan Dr.Ir. Murwantoko, M.Sc.

Abstrak

Udang vanamei (*Litopenaeus vannamei*) merupakan komoditas budidaya bernilai ekonomis tinggi yang telah berhasil dibudidayakan. Saat ini pemeliharaan udang vaname dilakukan dengan sistem budidaya semi intensif dan intensif dengan beragam padat tebar dan pemberian pakan yang berkualitas tetapi kurang memperhatikan keberlanjutan budidayanya. Akibatnya limbah yang dihasilkan akan semakin banyak terutama kandungan N dan P. Dampak lebih lanjut adalah timbulnya wabah penyakit yang menyebabkan terjadinya gagal panen. Berdasarkan hal tersebut maka telah dilakukan penelitian pada Juli 2016-Desember 2017 di Stasiun Penelitian Perikanan UGM Kabupaten Purworejo Jawa Tengah. Penelitian ini dilaksanakan dengan 3 tahapan, yaitu 1) budidaya udang vaname (*Litopenaeus vannamei*) dengan padat tebar berbeda menggunakan terpal di lahan pasir; 2) karakteristik dan kuantitas limbah budidaya udang vaname (*Litopenaeus vannamei*) di lahan pasir; dan 3) pengendalian limbah budidaya udang vaname (*Litopenaeus vannamei*) di lahan pasir.

Penelitian pertama bertujuan untuk mengetahui pengaruh padat tebar terhadap produksi, pertumbuhan, sintasan dan biomassa udang vaname di tambak lahan pasir dengan menggunakan terpal. Percobaan telah dilakukan menggunakan 9 petak tambak dengan ukuran 3x4m^2 (12m^2). Eksperimen dirancang dalam 3 kelompok padat tebar sebagai perlakuan (100, 200 dan 300 m^2) yang diulangi sebanyak 3 kali. Pemeliharaan udang dilakukan selama 75 hari dengan mengukur laju pertumbuhan, sintasan (SR), FCR dan produksi biomassa. Pengamatan fisika-kimia air dilakukan terhadap suhu dan kecerahan, pH, salinitas dan DO yang diamati setiap hari. Sedangkan nitrat, nitrit, amonia dan BOT diamati setiap dua minggu. Udang vaname ukuran PL-9 diberi pakan dengan protein 30% berbentuk serbuk, remah dan pellet dengan pemberian pakan 4 kali per hari. Pergantian air dan penyiponan dilakukan secara bersama dan secara berkala. Analisis dilakukan terhadap laju pertumbuhan, sintasan, bobot akhir, FCR dan produksi biomassa dilakukan dengan menggunakan sidik ragam. Hasil analisis menunjukan bahwa laju pertumbuhan harian udang adalah antara 0,1138-0,1655g, sintasan antara 61,75-97,99%, bobot akhir antara 9,58-12,93 g, FCR antara 1,0-2,0 dan produksi biomassa antara 14,99-22,37 kg/petak. Hasil tersebut menunjukan padat tebar berpengaruh pada pertumbuhan, sintasan, FCR dan produksi biomassa udang ($P<0,05$). Laju pertumbuhan dan sintasan udang menurun dengan meningkatnya padat tebar ($P<0,05$), sedangkan produksi biomassa berbeda nyata antara semua perlakuan ($P<0,05$). Dengan demikian, pada budidaya udang vaname di tambak lahan pasir menggunakan terpal dapat dilakukan dengan padat tebar rendah (100 ekor/m^2).

Penelitian kedua bertujuan mengkaji karakteristik dan kuantitas limbah nitrogen dan fosfor pada budidaya udang vaname di tambak lahan pasir dengan padat tebar berbeda. Percobaan ini telah dilakukan dengan mengikuti rangkaian penelitian pertama. Selama 75 hari pemeliharaan dilakukan pengukuran masukan (input) dan luaran (output) limbah budidaya udang yang meliputi total nitrogen (N) dan total fosfor (P). Hasil analisis menunjukan bahwa pakan merupakan penyumbang terbesar terhadap masukan total N dan total P dengan persentase antara 56,30-79,57% N dan 29,48-45,88% P, diikuti obat-obatan 9,95-21,46%N dan 20,79-28,48%P dan pupuk 7,65-16,24%N dan 16,87-20,00%P. Sedangkan luaran terbesar berasal dari komponen nutrien yang tidak terhitung (*unaccounted*) (60,88-68,78%N dan 54,55-77,87%P). Kuantitas nitrogen dan fosfor pada limbah budidaya udang vaname di lahan pasir meningkat dengan bertambahnya padat tebar benih.

Penelitian ketiga bertujuan mengkaji efektifitas pasir dan ikan nila merah (*Oreochromis* sp.) dalam pengendalian limbah nitrogen dan fosfor pada budidaya udang vaname di tambak lahan pasir. Penelitian terdiri dari dua tahap, yaitu percobaan penyaringan limbah N dan P menggunakan pasir (filter fisik) dan ikan nila merah (*biofilter*). Percobaan filter pasir dilakukan menggunakan 6 petak kolam dengan ukuran 1x1m^2. Percobaan dirancang dalam 3 perlakuan ketebalan filter (20, 40 dan 60 cm) yang diulangi sebanyak 2 kali. Sedangkan percobaan biofilter ikan nila merah dilakukan menggunakan 6 petak kolam dengan ukuran 2x1 m^2. Percobaan dirancang dalam 3 perlakuan padat tebar (20, 30 dan 40 ekor/m^2) yang diulangi sebanyak 2 kali. Kedua tahap percobaan mengikuti periode pemeliharaan udang vanamei. Pengamatan total N dan total P dilakukan setiap dua minggu. Analisis efektifitas filter (fisik dan biologi) menggunakan analisis sidik ragam. Hasil analisis menunjukan bahwa tidak ada perbedaan antara ketiga perlakuan ketebalan ($P<0,05$). Ketiga perlakuan ketebalan dikategorikan “kurang efisien” dalam menyaring limbah N. Namun demikian, cukup efisien dalam menyaring limbah yang mengandung P dan TSS. Hasil analisis biofilter nila merah memperlihatkan bahwa ketiga perlakuan padat tebar tidak berbeda nyata ($P<0,05$). Ketiga perlakuan padat tebar termasuk kategori “cukup efisien” dalam mengasimilasi N, sedangkan asimilasi limbah P oleh ikan nila merah kurang efisien ($P>0,05$). Filter pasir kurang efisien dalam menyaring limbah N dan cukup efisien menyaring limbah P. Biofilter ikan nila merah cukup efisien dalam mengasimilasi limbah N dan kurang efisien terhadap limbah P.

Secara umum dapat disimpulkan bahwa lahan pasir marginal sangat baik untuk budidaya udang vaname (*Litopenaeus* vannamei*)* dengan padat tebar 100 ekor/m^2. Dengan padat tebar ini akan menghasilkan pertumbuhan dan sintasan udang yang lebih baik. Disamping itu, kuantitas limbah N dan P pada budidaya yang dihasilkan relatif sedikit. Pengendalian limbah budidaya di lahan pasir dapat menggunakan pasir dan ikan nila merah secara bersama dan terintegrasi. Berdasarkan penelitian ini disarankan perlu penelitian mengenai pengelolaan pemberian pakan pada udang termasuk kebutuhan nutrisi, ukuran partikel pasir yang optimum dengan waktu tinggal limbah dalam wadah filter dan konstruksinya.

Kata kunci : *Litopenaeus vannamei*, ikan nila, pasir, biofilter, filter fisik, nitrogen, fosfor, limbah

Study of N and P Waste on Vaname Shrimp Culture (*Litopenaeus vannamei*) in Sand Land Ponds. by Gamal M. Samadan; Supervisor : Prof.Dr.Ir. Rustadi, M.Sc.; Dr.Ir. Djumanto, M.Sc.; dan Dr.Ir. Murwantoko, M.Sc.

Abstract

White leg shrimp (*Litopenaeus vannamei*) is a high economic value aquaculture commodity that has been successfully cultured. Nowadays, white leg shrimp is cultured with a semi-intensive and intensive system with a variety of stocking densities and quality feeds but lacks attention to the sustainability of its culture. As a result, the waste produced increase, especially on the N and P content. Further impact is the emergence of disease that causes harvest failure. Based on this, a study was conducted in July 2016-December 2017 at the UGM Fisheries Research Station in Purworejo District, Central Java. This research was conducted in 3 stages, namely 1) white leg shrimp (*L. vannamei*) culture with different stocking densities using tarpaulins in sand land; 2) waste characteristics and quantity of white leg shrimp (*L. vannamei*) culture in sand land; and 3) waste filtering of white leg shrimp (*L. vannamei*) culture in sand land.

The first study aimed to determine the effect of stocking density on the production, growth, survival, and biomass of white leg shrimp in sand land using tarpaulins. Experiments have been carried out using 9 plots of the pond with a size of 3x4m^2 (12m^2). The experiment was designed in 3 stocking densities as treatments (100, 200 and 300 shrimps/m^2) which were repeated 3 times. Shrimp culture was carried out for 75 days by measuring the growth rate, survival rate (SR), FCR and biomass production. Physical-chemical observations of water were carried out to measure temperature and transparency, pH, salinity and DO observe every day. Whereas nitrates, nitrites, ammonia, and BOT were observed every two weeks. The shrimp size of PL-9 was fed with 30% protein in the form of powder, crumbs, and pellets by feeding 4 times per day. Water exchange and siphoned were carried out at the same time and periodically. The analysis of the growth rate, survival rate, final weight, FCR, and biomass production was carried out using analysis of variance. The analysis showed that the daily growth rate of shrimp between 0,1138-0,1655g, survival rate between 61,75-97,99%, final weight between 9,58-12,93 g, FCR between 1,0-2,0 and biomass production between 14,99-22,37 kg/plot. These results showed stocking density affected growth, survival, FCR and shrimp biomass production ($P<0,05$). The growth rate and survival of shrimp decreased with increasing stocking density ($P<0,05$), while biomass production was significantly different between all treatments ($P<0,05$). Thus, in white leg shrimp culture in sand land using tarpaulins can be done with low stocking densities (100 shrimp/m^2).

The second study aimed to examine the waste characteristics and quantity of nitrogen and phosphorus in white leg shrimp culture in sandy land with different stocking densities. This experiment was conducted by following the first research series. During the 75 days of the culture period, measurements of input and output of shrimp culture were carried out which consisted the total nitrogen (N) and total phosphorus (P). The results of the analysis showed that feed was the biggest contributor to the input of total N and total P with a percentage between 56,30-79,57% N and 29,48-45,88% P, followed by medicines between 9,95-21,46% N and 20,79-28,48% P and fertilizer between 7,65-16,24% N and 16,87-20,00% P. While the largest output came from nutrient components that unaccounted between 60,88-68,78% N and 54,55-77,87% P. The quantity of nitrogen and phosphorus in white leg shrimp culture in sandy land increases with increasing stocking density.

The third study aimed to examine the effectiveness of sand and red tilapia (*Oreochromis* sp.) in controlling nitrogen and phosphorus waste of white leg shrimp culture in sand land. The research consisted of two stages, namely the filtering of N

and P waste using sand (physical filter) and red tilapia (biofilter). Sand filter experiments were carried out using 6 plots of the pond with a size of 1x1m2. The experiment was designed in 3 filter thickness treatments (20, 40 and 60 cm) which were repeated twice. While the red tilapia experiments were carried out using 6 plots of the pond with a size of 2x1 m2. The experiment was designed in 3 different stocking densities (20, 30 and 40 shrimp/m2) which were repeated twice. Both stages of the experiment followed the period of shrimp culture. Observation of total N and total P was done every two weeks. The effectiveness of filters (physical and biological) were analyzed by using analysis of variance. The results of the analysis showed that there were no differences between the three thickness treatments (P<0,05). The three thickness treatments were categorized as "less efficient" in filtering N waste. However, it is quite efficient in filtering waste containing P and TSS. The results of the analysis of red tilapia biofilter showed that the three stocking density treatments were not significantly different (P<0,05). The three stocking densities included as the quite efficient category in assimilating N, while the assimilation of P waste by red tilapia was less efficient (P<0,05). In short, sand filters were less efficient in filtering N waste and quite efficient to filter P waste. While biofilter of red tilapia is quite efficient in assimilating N waste and is less efficient against P waste.

In general, it can be concluded that marginal sand land is very good for the white leg shrimp (*Litopenaeus vannamei*) culture with a stocking density of 100 shrimp/m2. This stocking density resulted in better growth and survival of shrimp. Besides that, the quantity of N and P waste in the culture produced was relatively small. Using sand integrated with red tilapia can be utilized as waste controlling of shrimp culture in sand land. Based on this study it is recommended that future research is needed on the management of feeding in shrimp culture including nutritional needs, the optimum size of sand particles with the residence time of waste in the filter container and its construction.

Keywords: *Litopenaeus vannamei*, red tilapia, sand, biofilter, physical filter, nitrogen, phosphorus, effluent