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Production of Pacific white shrimp in sandy soils in Indonesia

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Study demonstrates viability of lined ponds and high stocking densities



Results of this study show that *L. vannamei* culture in sandy soil lined ponds using relatively high shrimp densities is viable.

Culture of Pacific white shrimp (*Litopenaeus vannamei*) in ponds with plastic liners began in 2013 in the Special Region of Yogyakarta, and then developed along the southern coastal area of Central Java. Soils in this area include sand dunes, acid to neutral pH, low conductivity and a water permeability of 5 cm/hour. Water is pumped from groundwater wells and has salinities of 10 to 25 ppt.

Currently, there are an estimated 1,100 ponds ranging in size 1,000 to 4,500 square meters. Initially, farms successfully produced shrimp crops but then the onset of White Feces Syndrome seriously affected production. Farmers have erroneously assumed that to increase production and profits, a higher stocking density is needed, even with limited technology, resources and water quality.

Widely reported data on *L. vannamei* culture systems and stocking densities are very diverse, and to date, its optimum density for production in sandy soils is not available. This article (adapted and summarized from the original publication in *Revista Acuicultura – Cámara Nacional de Acuicultura*, No. 126, December 2018) reports on a study carried out to determine the effect of stocking densities of Pacific white shrimp and its productive performance in an intensive system using ponds built on sandy soils.

Study setup

This study was conducted on the coast of the village of Keburuhan, Ngombol Purworejo district, Central Java. This location includes sandy and clay farm land and aquaculture areas. Nine plastic-lined ponds (3-by-4-by-1 meters) were built on sandy soil, and filled with water (80 cm water column) from a 20-meter well. Each pond had a 1 HP paddlewheel for aeration and was stocked with *L. vannamei* PL-9 seedstock from a commercial hatchery.

The shrimp were fed with commercial feeds (30 percent), including meal, crumbs and pellets, applied depending on animal size, and amounts were adjusted after day 25 after stocking according to the shrimp density of each treatment.

Water quality monitoring and shrimp condition assessments were carried out regularly. Periodic pond water exchanges were carried out to maintain pond water quality, from 1 to 5 percent until the second month of culture, and then 5 to 7 percent until harvest. To reduce the organic matter, the bottom of the ponds were siphoned after 25 days of shrimp culture and then, every week. Shrimp were harvested after reaching a market size of approximately 12 to 13 grams, or after 75 days of culture.

For detailed descriptions of the experimental design, ponds and equipment; animal husbandry procedures and water quality monitoring; data collection and statistical analyses; and references, please contact the first author.

Results and discussion

The results of our study demonstrate the viability of *L. vannamei* culture in sandy soil, lined ponds using relatively high shrimp densities. The data for final weight, survival rate, daily growth, feed conversion ratio (FCR) and biomass are shown in Table 1. Average final weights varied between 9.58 ± 0.54 and 12.93 ± 0.7 grams, and the treatment with the density of 300 shrimp per square meter was significantly different to the treatments with 100 and 200 shrimp per square meter.

Resulting daily growth rates ranged between 0.1118 ± 0.006 and 0.1526 ± 0.011 grams per day, with significant differences between the density treatments, and with an inverse relationship between high density and weight. Survival rates were significantly different among all treatments; the 100 animals per square meter treatment had a survival of 96.54 percent, followed by the 200 and 300 shrimp per square meter treatments, (83.46 and 64.98 percent, respectively).

Samadan, sandy ponds, Table 1

Parameter	100 (shrimp per square meter)	200 (shrimp per square meter)	300 (shrimp per square meter)
Final weight (g)	12.93±0.7a	10.18±0.66b	9.58±0.54c
Survival rate (%)	96.54±1.47a	83.46±5.72b	64.98±4.58c

Absolute growth (g/day)	0.1526±0.011a	0.1225±0.08b	0.1118±0.006c
FCR	0.99±0.07a	1.47±0.005b	2.00±0.05c
Biomass production (kg/ha)	14.99±1.09a	20.33±0.14b	22.37±0.57c

Table 1 Final weight, survival rate, daily growth, FCR and biomass production of *L. vannamei* in sandy ponds. Different letters indicate significant differences ($p < 0.05$).

The shrimp biomass produced ranged from 14.99 ± 1.09 to 22.37 ± 0.57 kg per square meter, with significant differences between density treatments. The feed conversion rate (FCR) varied between 0.99 ± 0.07 and 2.00 ± 0.05 , and varied significantly between density treatments. Figs. 1 and 2 show growth rates and mean weights after the 75 days of culture in the study.

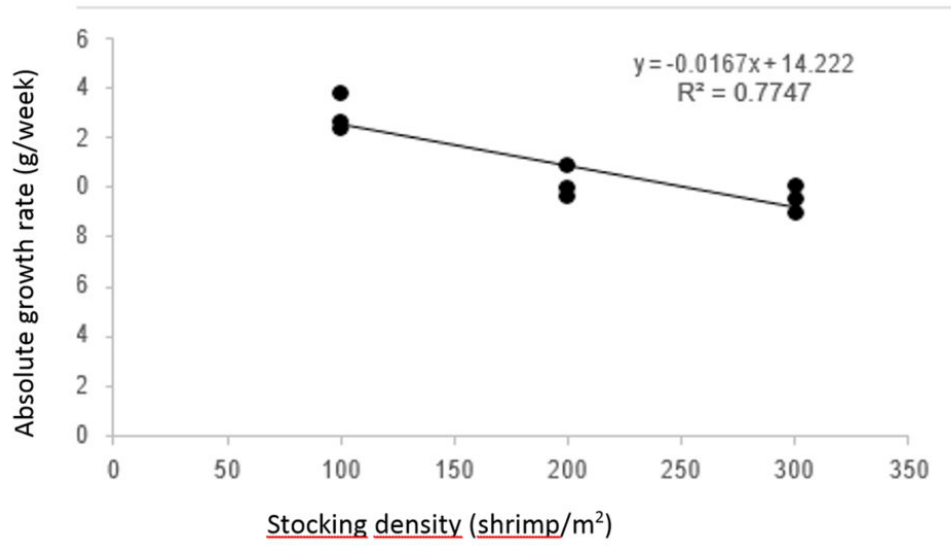


Fig. 1: Absolute growth (\pm SE) of *L. vannamei* cultured at different stocking densities in sandy ponds.

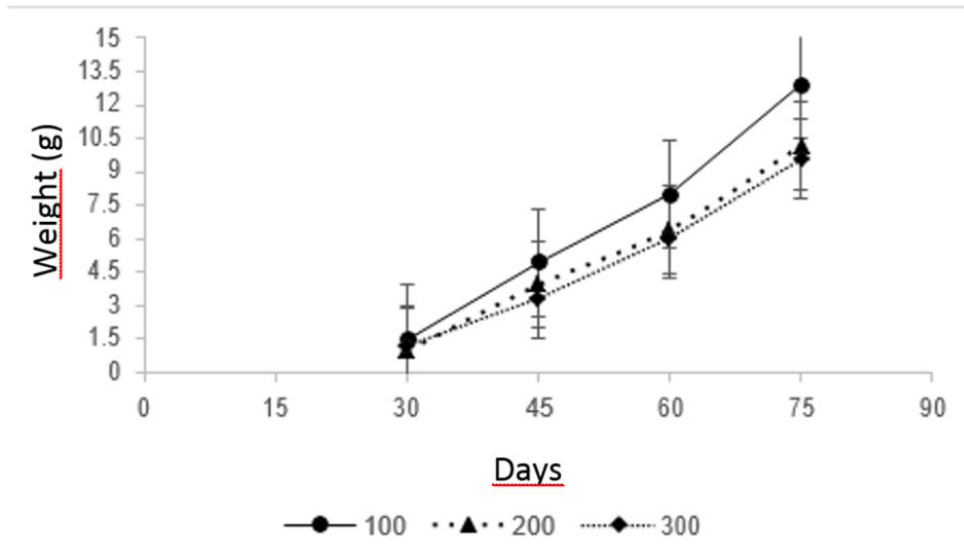


Fig. 2: Mean weight (\pm SE) of *L. vannamei* cultured at different stocking densities for 75 days.

Regarding water quality parameters, water temperature in the study ponds ranged from 29.23 to 29.60 degrees-C, pH 7.96 to 7.99, salinity 22.07 to 25.07 ppt, dissolved oxygen 4.24 to 4.51 mg/L, nitrite 1.35 to 1.96 mg/L, ammonia 1.63 to 2.49 mg/L, total organic matter (TOM) 185.15 to 248.20 mg/L and turbidity 38.07 to 39.64 cm.

Perspectives

The culture of *L. vannamei* in sandy ponds with liners is effective when stocking at a density of 100 shrimp per square meter. This stocking density produced better growth rates (0.1526 grams per day), survival rates (96.5 percent) and FCR (0.99). The stocking density of 300 shrimp per square meter produced the highest biomass, 22.37 kg per cubic meter, but with low final weights and survival rates compared to the lower stocking density schemes. Effectively culturing *L. vannamei* in sandy, lined ponds requires attention to the seasons as well as to water management.

References available from first author.

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