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Note

Evaluation of yield characteristics from short term farming practice of *Litopenaeus vannamei* (Boone, 1931)

P. P. SURESH BABU, P. RAMIREDDY, K. MURALI MOHAN, J. KRISHNA PRASAD, R. R. S. PATNAIK AND V. NARASIMHACHARYULU

Kakinada Centre of ICAR-Central Institute of Fisheries Education, Beach Road Kakinada - 533 007 Andhra Pradesh, India

e-mail: sbabu78@yahoo.com

ABSTRACT

Experimental farming of *Litopenaeus vannamei* was conducted at a lower stocking rate for two different culture durations in order to assess the variations in yield characteristics. Specific pathogen free (SPF) post-larvae of *L. vannamei* (PL 10) were stocked in six 0.08 ha ponds at a stocking rate of 32 nos. m^{-2}. The shrimps were harvested after two culture durations *viz*., 65 and 75 days of culture (DOC). Longer duration of farming (75 DOC) showed significantly higher production (6 t ha^{-1}), larger size (13.2±0.02 cm) and higher weight gain (18.94±0.08 g) at harvest than with the lower duration (65 DOC) farming which recorded a production of 4.3 t ha^{-1} with harvest size of 11.86±0.14 cm and weight gain of 14.28±0.11 g at harvest. However, specific growth rate, SGR (%) day^{-1} indicated that, as the culture duration increased the growth rate reduced. Feed conversion ratio (FCR) was not significantly different among the treatments. It was slightly lesser than one for both the treatments which may be attributed to the influence of the productivity of the ponds. Partial economic returns for the two different culture durations was US $ 2.16 and 3.25 kg^{-1} for shrimps produced in 65 and 75 DOC respectively.

Keywords: Economic returns, *Litopenaeus vannamei*, Short term farming, Yield

Litopenaeus vannamei farming has been established in India as a major brackishwater aquaculture activity leading to significant foreign exchange earnings. For low profile shrimp farmers, affording huge investments for the inputs such as seed, feed and labour is a major hurdle for achieving maximum profit and hence they generally adopt short term farming practices. Majority of the farmers go for only 60 to 90 days of farming practice for *L. vannamei* compared to the prolonged 90 to 120 days farming adopted in case of tiger shrimp *Penaeus monodon*. This is mainly due to the faster growth of the species during the initial phase of the life leading to an early marketable size.

The production potential and performance of *L. vannamei* at low intensive short term farming in earthen pond conditions has been reported by Suresh Babu *et al.* (2014). It was observed that *L. vannamei* farming could be made profitable for small and marginal farmers by adopting low stocking density (<30 m^{-2} and shorter culture period (≤ 80 days of culture. In continuation with the above study, the present investigation on experimental farming of *L. vannamei* at a stocking density of 32 nos. m^{-2} for two different culture periods was undertaken to assess the variation in yield characteristics.

The experimental farming was carried out at the brackishwater farm of the Kakinada Centre of ICAR-Central Institute of Fisheries Education, Kakinada, Andhra Pradesh, India in 0.08 ha ponds having a water depth of 1.2 m. Water quality parameters such as temperature (°C), pH, dissolved oxygen (ppm) and salinity (ppt) were monitored daily at 08.00 hrs in the morning and total alkalinity was analysed at weekly intervals following standard methods (APHA, 1998). Nitrite (NO_2) and ammonia nitrogen (NH_3-N) levels were analysed spectrophotometrically (Thermo Spectra, USA) at 10 days intervals following standard procedures (APHA, 1998).

Pre-stocking management as per Suresh Babu *et al.* (2014) and the guidelines for bio-security measures stipulated by the Coastal Aquaculture Authority of India (CAA) (Paul Raj *et al*., 2010) were adopted during the experiment. Specific pathogen free (SPF) post-larvae of *L. vannamei* (PL 10) were procured from a CAA approved hatchery and stocked in the ponds at a stocking rate of 32 nos. m^{-2}. Aerators were provided in each pond according to the stocking rate *i.e.,* one paddle wheel aerator with 1 HP motor for 1 lakh PL. Shrimps were fed 4 times a day with commercial pellet feed (32% protein) at 06.00, 11.00, 05.00 and 10.00 hrs by broadcasting from a boat as per the manufacturer's instructions and based on check tray observations. Weight of the shrimp was monitored using a

top loading balance with an accuracy of 0.1 g. Total feed consumed and the feed conversion ratio (FCR) for each pond were calculated according to the feeding schedule adopted. Statistical analysis (paired t- test) of the data was carried out using the statistical software SPSS version 16.

On completion of the two culture durations *i.e.,* 65 and 75 DOC, the ponds were completely drained out and the shrimps were harvested. Total production, specific growth rate (SGR), feed conversion ratio (FCR), survival rate and harvest size in each pond were assessed. Partial economic analysis was also carried out following Balasubramanian *et al.* (2004) and Suresh Babu *et al.* (2014). For this, fixed cost was assigned based on the lease amount for 1 ha pond prevailing in Andhra Pradesh in 2014. A uniform price of ₹0.5 per seed was assigned for calculating the seed cost and the feed cost was ₹67 per kg. Man power requirement was calculated assuming that ₹ 200 per day was spent for daily activities and ₹3000 spent for harvesting 1 ha pond. Approximate cost of ₹20 was assigned towards electricity and diesel for producing 1 kg shrimp. Market price for the harvested shrimp was ₹270 and 370 respectively for 65 and 75 DOC produces. After economic calculations, the values were converted into US dollar by assigning a value of ₹60 for 1 US dollar.

Physico-chemical parameters of water such as salinity (26-32 ppt), temperature (26-32^{o}C), pH (8.2-8.5), dissolved oxygen (4.2-6 ppm), total alkalinity (180-260 ppm), NO_2 (0.01-0.056 ppm) and NH_3-N (0.01-0.18 ppm) were within the optimum range required for shrimp farming. Details of growth performance of the shrimp after the two culture durations are presented in Table 1. Longer DOC farming showed significantly ($p<0.05$) higher production (6 t ha^{-1}), larger harvest size (13.2±0.02 cm) and better weight gain at harvest (18.94±0.08 g) than that of the lower duration farming which yielded production of 4.3 t ha^{-1}; harvest size of 11.86±0.14 cm and a weight gain of 14.28±0.11 g at harvest.

Table 1. Growth performance of the shrimp at different culture durations

Growth parameters	65 DOC		75 DOC	
	Length (cm)	Weight (g)	Length (cm)	Weight (g)
Initial	8.57±0.26	5.17±0.51	8.91±0.12	5.65±0.24
Final	11.86±0.14	14.28*±0.11	13.2±0.02	18.94*±0.08
% Gain	38.36	176.21	48.48	235.22
SGR (%) day-1		3.39		3.02

DOC = days of culture; SGR = specific growth rate; *Significant at $p<0.05$

Generally final weight of shrimp is directly related to the duration of cultivation (Ruiz-Velazco *et al.,* 2010). Suresh Babu *et al.* (2014) reported that the harvest size of *L. vannamei* ranged between 19 to 20 g at a similar stocking density (30 m^{-2}) with varying culture durations (78 to 88 days). Green (2008) opined that a harvest size of 17 to 19 g can be considered as the marketable size for *L. vannamei.* In the present study, the actual marketable size shrimps were produced only in 75 DOC, but the growth rate (SGR (%) day^{-1}) got reduced as the culture duration increased.

Harvest details of *L. vannamei* at different culture durations are given in Table 2. Higher DOC farming showed significantly higher ($p<0.05$) production. FCR was not significantly different among the treatments. It was slightly less than one in both the treatments which may be due to the influence of productivity of the ponds. Survival rate was slightly less ($p<0.05$) in shorter duration farming. In pond condition, FCR and survival parameters depend on a number of environmental conditions including natural productivity and nutrient cycles. Sookying *et al.* (2011) and Suresh Babu *et al.* (2014) also reported similar observations in survival rates and FCR in *L. vannamei* farming trials in pond conditions.

Partial evaluation of economic returns (Returns ha^{-1} crop^{-1} in US$) for the two crops is given in Table 3. Cost of production, revenue and the economic returns per kg of shrimp sold were higher with 75 DOC, which yielded 50% more return than them 65 DOC farming. Economics of shrimp farming mainly depends on the operational costs such as feed and seed (Griffin *et al.,* 1985; Kongkeo, 1997). The economic return per kilogram of shrimp was considerably higher with higher DOC in the present study, in comparison with that observed in the earlier study reported by Suresh Babu *et al.* (2014). The results of the present study revealed that 75 DOC is the more appropriate culture duration for getting maximum economical returns as the lower (65) DOC gave comparatively less economic return.

Table 2. Harvest details of crops of *L. vannamei* at different culture durations

Treatment	No. of treatment	DOC	Production (t ha^{-1})	Survival	FCR
65 DOC	3	65	4306*±9.5	94.19*±0.95	0.98±0.01
75 DOC	3	75	6034*±15.8	99.56*±0.16	0.97±0.05

DOC = days of culture; *Significant at $p<0.05$

Table 3. Partial evaluation of economic returns from different culture duration (Returns ha^{-1} $crop^{-1}$ in US$)

DOC	Fixed cost	Variable cost					Total cost	Revenue	Return	Return per kg
		Seed	Feed	Power + Diesel	Labour	others				
65	666.7	2666.7	4745.8	1435.3	266.7	300	10081.2	19378.5	9297.3	2.16
75	666.7	2666.7	6588.3	2011.3	300	333.3	12566.3	32181.3	19615	3.25

DOC = Days of culture

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