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Modified Extensive Culture of *Penaeus monodon* Using Indigenous Feed

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Short-term monoculture of *Penaeus monodon* was done using an indigenously developed feed to evaluate the efficiency of the feed with respect to growth, survival, production, food conversion ratio and cost benefit ratio. *P. monodon* post-larvae were stocked at the rate of 5 nos.m^{-2} (12 mm; 7 mg) during 1995 and 3 nos.m^{-2} (15 mm; 10 mg) during 1996. The feeding schedule and other management practices were identical in both the trials. The shrimps were harvested at the end of 85 days and a production of 732.5 kg.ha^{-1} (average size: 150 mm; 20 g) was obtained in 1995 and 647.5 kg.ha^{-1} (average size: 160 mm; 26 g) in 1996.

Key words: Indigenous feed, growth, shrimp, *Penaeus monodon*

With the rapid progress of semi-intensive and intensive systems of shrimp culture, formulation and development of feeds meeting the nutritional requirements of candidate species for obtaining optimum growth and survival during the different phases of its growth were evolved. During the past two decades, considerable advances have been made in various aspects of feed technology and several types of compounded feeds are being used for the culture of shrimps in different countries (SEAFDEC 1981, Liao & Mancebo, 1983; Shiguen, 1984; Apud, 1984; Chiang & Lieu, 1985; New, 1989). The types of feeds presently used in India in various grow out systems include conventional feeds constituted of oil cakes, trash fish, clam meat, meat offal and different types of pelleted feeds. (Rajalakshmi, *et al.*,1982; Sunderajan *et al.*, 1979; Anon, 1983; Mathew *et al.*, 1987; Thampy *et al.*, 1988; Jose & Susheela, 1989; Singh, 1991; Vishwakumar, 1992). With the introduction of improved management practices, the use of artificial feed is gaining importance. The present paper is the outcome of a study for the formulation of an indigenous, nutritionally balanced, low cost feed derived from locally available ingredients for the culture of penaeid shrimps.

Materials and Methods

Two experiments ware conducted during 1995 and 1996 in the brackish water ponds in the Instructional Farm of the College of Fisheries (09°58°N lat, 76.28°E long). Preliminary preparations were done in the pond for eradication of predatory and weed fishes. Raw cow dung was applied at the rate of 2000 kg.ha^{-1}, for the production of benthic algae and diatoms. The water depth in the pond was maintained at 70 – 100 cm throughout the culture period. The tidal amplitude in the farm area oscillated between 60 and 65 cm. Slender casuarina twigs and concrete tubes were kept at different points for providing shelter to the post-larvae. Post-larvae of *Penaeus monodon* were obtained from a private hatchery and stocked at the rate of 5 nos.m^{-2} in 1995 (initial size: 12 mm; 7 mg) and 3 nos.m^{-2} in 1996 (initial size: 15 mm;10 mg). The nature of the feed, feeding schedule and other management practices were identical in both the experiments. Feeding was started on the same day of stocking. A feed with 40% protein was given at the rate of 100% of the body weight for the first fifteen days. Pelleted feed was provided during the

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Table 1. Feed ingredients(%)

Soya powder	35%
Prawn shell powder	10%
Fish meal	10%
Gingelly oilcake	3%
Coconut oilcake	10%
Vegetable oil	5%
Vitamin mixture	1%
Mineral mixture	1%
Rice bran	5%
Tapioca starch	20%

remaining period. Ration was reduced to 10% of the body weight during the next one month and after this, feed was offered at the rate of 5% and finally to 2% of the body weight till the end of the experiment, based on biweekly sampling. Feed was provided in trays placed at different points in the pond and the position of the trays was changed to avoid putrefaction in the same areas. Ration was offered twice daily, in the early morning and at 4 pm in the evening.

During the first month of stocking, water exchange was done twice a week, and afterwards daily. Weekly observations on water temperature, pH, salinity and dissolved oxygen were recorded during the culture period. In both the experiments, shrimps were harvested at the end of 85 days. Survival, growth and production were worked out and food conversion ratio was calculated. Feed was prepared by mixing the ingredients (Table 1) with a binder (guar gum). The mixture was extruded, dried and packed in polythene bags.

Results and Discussion

The initial salinity in the pond during 1995 experiment was 12 ppt whereas during 1996 it was 15 ppt. The range of water temperature, depth, salinity, pH and dissolved oxygen, zooplankton and zoobenthos in both the experiments are given in Table 2. Phytoplankton in the pond during the experimental period comprised of green algae (*Chlorococum* sp., *Scenedesmus* sp.), blue green algae (*Synechococcus* sp., *Spirulina* sp., *Oscillatoria* sp.) and diatoms (*Navicula* sp. and *Niztchia* sp.). The zooplankton was mainly constituted by calanoids, naupli, and rotifers whereas the benthos contained polychaetes (*Nereis* sp, *Dendronereis* sp.), tanaids, gammarids and *Melania* sp.

Table 2. Physico-chemical parameters during the experimental period in 1995 and 1996

Parameters	**1995**	**1996**
Depth of pond (cm)	70-95	70-100
Water temp (°C)	31.5-33	31.5-32.5
pH	7.0-8.5	7.0-8.7
Salinity (ppt)	12-25	15-27
Dissolved oxygen ($ml.l^{-1}$)	4.5-5.5	5.0-7.0
Zooplankton ($nos.l^{-1}$)	75-110	85-120
Zoobenthos ($nos.m^{-2}$)	100-120	110-123

The yield obtained for a culture period of 85 days was 732.5 $kg.ha^{-1}$ in 1995 and 647.5 $kg.ha^{-1}$ in 1996. The final mean size of the shrimps in the first experiment was 150 mm (20 g) and in the second experiment, it was 160 mm (26 g). The retrieval rate in the former culture was 73.25% whereas in the latter trial it was 83%. The food conversion ratio was 1.86 in the first trial, while it was 1.61 in the second trial. The daily growth rate of the shrimps was 1.62 mm (0.235 g) during 1995 and 1.7 mm

Table 3. Details of culture of *Penaeus monodon* during 1995 and 1996

Details	**1995**	**1996**
Area of pond (m^2)	400	400
Date of stocking	1.3.1995	4.3.1996
Date of harvest	24.5.1995	28.5.1996
Rearing period (days)	85	85 d
Stocking density ($nos.m^{-2}$)	5	3
Number stocked	2000	1200
Initial size (mm/mg)	12 (7)	15 (10)
Initial biomass (g)	14	12
Final size (mm/mg)	150 (20)	160 (26)
Daily growth rate (mm/mg)	1.62 (0.235)	1.7 (0.305)
Survival rate (%)	73.25	83
Quantity of feed given (kg)	56.975	47.265
Quantity of shrimps harvested (kg)	29.3	25.9
Food conversion ratio	1.86	1.61
Gross production rate ($kg.ha^{-1}$ $85d^{-1}$)	732.5	647.5

Table 4. Details of inputs and output of the experiments during 1995 and 1996

Inputs		Output	
1995			
Cost of 2000 seeds including packing charges	Rs.830 (44.27%)	Sales of 29.3 kg of shrimps @ Rs. 120 per kg	Rs. 3516
Labour	Rs. 150 (8.00%)	Net profit	Rs. 1641
Ammonium sulphate and slaked lime for pond preparation	Rs. 20 (1.07%)	Net profit per ha	Rs. 41025
Diesel	Rs. 50 (2.67%)	Cost-benefit ratio	1.88
Cost of feed (55kg)	Rs. 825	Net returns	87.5%
@ Rs.15 per kg	(44.00%)		
Total	Rs. 1875		
1996			
Cost of 1200 seeds including packing charges	Rs. 520 (35.90%)	Sales of 25.9 kg of shrimps @ Rs. 125 per kg	Rs. 3237
Labour	Rs. 150 (10.30%)	Net profit	Rs. 1792
Ammonium sulphate and slaked lime for pond preparation	Rs. 20 (1.38%)	Net profit per ha	Rs. 44812
Diesel	Rs. 50 (3.45%)	Cost-benefit ratio	2.24
Cost of feed (47.2 kg)	Rs. 708	Net returns	123.8%
@ Rs.15 per kg	(48.87%)		
Total	Rs. 1448		

(0.305g) in 1996 (Table 3). The cost of the feed worked out to be Rs.15 per kg since the feed contained only low cost ingredients. The net profit worked out to Rs. 41,025 ha^{-1} with a cost-benefit ratio of 1.88 in the former experiment and Rs.44,812 ha^{-1} with a cost-benefit ratio of 2.24 in the latter experiment (Table 4).

P. monodon has been grown in various semi-intensive and modified extensive culture systems with different types of feeds. In a set of experiments conducted in the Sunderbans area of West Bengal, the production of *P. monodon* ranged from 322- 400 $kg.ha^{-1}$ (Anon 1989). Bhowmick *et al.* (1984) reported that when *P. monodon* post-larvae was stocked at 30,000-50,000 $nos.ha^{-1}$, production ranged from 275 to 318 $kg.ha^{-1}$ for a culture period of 120 days with a survival rate of 30-57.3%. In most of these trials only conventional feeds were provided. Thampy *et al.* (1988) obtained a production of 498.63 $kg.ha^{-1}$ for a culture period of 72 days, with a survival rate of 91.25%. In their experiments, Thampy *et al.* (1988) used post-larvae with an initial weight of 2 g and the feed used was commercial pelleted feed with 40% protein rationed at 10% of the body weight. Mathew *et al.* (1988) stocked *P. monodon* at 2 $nos.m^{-2}$ with juveniles having an initial weight of 2 g and obtained a production of 575.5 $kg.ha^{-1}$ for a culture period of 3 months. Jose & Susheela (1989) stocked post-larvae of *P. monodon* (16 mm; 23 mg) at 2.5 $nos.m^{-2}$ and obtained a net production of 563 $kg.ha^{-1}$ for a culture period of 108 days with a survival rate of

67%. The production of 732.5 kg.ha^{-1} in 1995 and 647.5 kg.ha^{-1} in 1996, obtained in the present experiments for a culture period of 85 days are higher than those recorded by the earlier studies which may be attributed to higher stocking density, better growth rate and survival and efficiency of the feed provided. In both the experiments, *P. monodon* was stocked at post-larval stage of 7-10 mg which has not affected the survival percentage which was between 73.25 -83%. Production as high as 971.5-1129.04 kg.ha^{-1} for a culture period of 90 days has been reported in intensive monoculture in India where *P. monodon* was cultured at a rate of 1.5x10^5.ha^{-1} with heavy feeding and artificial oxygen supply (Anon, 1989). However, intensive farming faces a number of problems including diseases, environmental degradation and allied issues which in turn has paved the way for ecofriendly shrimp farming.

Feed conversion ratio (FCR) reported for *P. monodon* with commercial feeds (Hanaqua feeds) range between 1.2 and 1.5 (Anon, 1983). In Philippines, Liao & Mancebo (1983) recorded a FCR of 1.69-1.78 in *P. monodon.* In a semi-intensive culture experiment with *P. monodon* (SEAFDEC, 1983), a commercial prawn feed with 45% protein and an experimental feed with 35% protein produced FCR of 4.6 and 6.1, respectively. Mathew *et al.* (1988) obtained a conversion ratio of 3.7 for the species with supplementary feeds based on clam meat, ground nut oil cake, etc. The FCR obtained in the present experiments are comparable to the FCR reported by Liao & Mancebo (1983). However, in these studies, the natural productivity of the pond and its influence on final production had not been taken into consideration when FCR was worked out.

The cost-benefit ratios of 1.9 - 2.3 obtained in the present study are also indicative of an economically viable culture. Vishwakumar (1992) has worked out the percentage of major cost components in different shrimp production systems in India. He has reported that in the improved extensive system where pelleted feed is given, the feed cost was 58.25% of the total cost. In the present experiments, the feed cost constituted 44.0-48.8%. The cost of the pond preparation was 3.88% in Andhra Pradesh (Vishwakumar, 1992) which, in the present experiments also ranged between 3.73-4.83%. However, difference was seen in the cost of the seed which constituted only 12.62% in different regions of India whereas, in the present trials, it was between 35.9-42.6%. This may be due to the variable nature in the availability and cost of the brood stock, availability of hatcheries and production cost of post-larvae. The percentage of net returns in the experiment of 1995 was 87.5% and that of 1996 was 123.7%, which indicated that satisfactory production rates could be obtained with efficient indigenous feed and at stocking densities of 3-5 nos.m^{-2}

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References

Anon (1983) UNDP/FAO ADCP/REF/1983/ 18, 97

Anon (1989) *Proc. Fifth Workshop on All India Co-ordinated Research Project on Brackish Water Fish Farming,* Barrackpore, p. 97

Apud F.D., Gonzaliz, K. & Deatras, N. (1981) *Fish Res. J. Philippines* **6**, 1

Bhowmick, M.L., Das, S.R., Singh, K. Ghosh, P.K., Chakraborti, R.K., Mondal, S.K. & Sanfui, D. (1984) *Annual Rep.*, CIFRI, p. 132

Chiang, P. & Lieu, I.C. (1985) *J. World Maricul. Soc.* **16**, 297

Jose M.M. & Jose, S. (1989) *Second National Symposium on Fish and Their Environment*, p. 62

Liao, M.S. & Mancebo, V.J. (1983) *J. World Maricul Soc.* **14**, 75

Mathew, P.M., Jose, M.M., Jose, S. & Mrithunjayan, P.S. (1988) *J. Aq. Biol and Fish* **4**, 122

New, M.B. (1989) ASEAN/UNDP/FAO *Regional Small-scale Coastal Fish. Devt. Project*, Manila, Philippines

Rajalakshmi, T, Pillai. S.M., Roy, A.K. & Varghese P.U. (1982) *J. Inland Fish Soc. India* **19**, 28

SEAFDEC (1981) *Annual Report South East Asian Fish. Devt. Centre*, Aquaculture Dept., Ilolio City, Philippines, p. 35

SEAFDEC (1983) *Annual Report South East Asian Fish. Devt. Centre*, Aquaculture Dept., Ilolio City, Philippines, p. 26

Shigueno, K. (1984) *International Conference on Culture of Penaeid Prawns/Shrimps*, Philippines, 115

Singh B.N. (1991) *J. Inland Fish Soc. India* **23**, 99

Sunderajan, D., Bose, V.C.S. & Venkatesan, V. (1979) *Aquaculture* **16**, 73

Thampy, D.M., Jose, S., Mohan, M.V., Syed, M.S. & Ismail, K.(1988) *Proc. First Indian Fisheries Forum*, Asian Fish Soc., p. 139

Vishwakumar, M (1992) *Fishing Chimes* **92**, 30