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Comparative Econometrics of Tiger Shrimp (*Penaeus monodon*, Fabricius) Monoculture against Polyculture at Selected Regions of Coastal Purba Medinipur of West Bengal During, 2014

S. Sahu

HOD & Associate Professor, Faculty of Fishery Sciences, WBUAFS, 5, Buderhat Road, Panchasayar, Kol -94

Abstract: ***The culture potential of Tiger shrimp (Penaeus monodon, Fabricius) is well known due to its performance and economic profitability. Shrimp farming is a good opportunity to earn strong currencies. The production economics depend mainly on pond facilities, stocking density, food and fertilizer supply, water quality management, yield, technical skill and other inputs. For semi-intensive system in large areas, will require greater amount of inputs, high-level technical skills and constant supervision. The idea of polyculture is based on the principle that each species stocked has its own feeding niche that of other species. Therefore, a more complete feed schedule should be in use, which must be made of the food resources and space availability in polyculture than in monoculture. Several benefits have been achieved in shrimp polyculture systems when using fish, bivalves and seaweed as subordinate species, viz. no need to maintain stocking density, availability of natural feeds and manure and low investment than monoculture. Tiger shrimp monoculture has several disadvantages with respect to benefits, viz. high input cost, maintain the stocking density with respect to pond size, perform soil and water quality parameters regularly and no partial income is earn with respect to polyculture.- that is why the common farmers in the study area show affinity to polyculture. By means of governments intervention and support this will in turn accelerate the employment generation.***

Keywords: Tiger Shrimp, Polyculture, Semi-intensive, Technical skill, Livelihood generation.

1. Introduction

Aquaculture is of great importance worldwide, serving as an alternative source to traditional food production systems to help accommodate expansion of the human population. The tiger shrimp, *Penaeus monodon*, FAO, 1998. is one of the largest penaeid shrimps in the world, reaching 270 mm in body length (Motoh, 1985), and is of considerable commercial importance in international markets. Taking into account current population trends, while assuming constant consumption per capita and the falling productivity of ocean fisheries since the late 1980s, Food and Agricultural Organization (FAO), estimates that by the year 2000 there will be a deficit of 19.6 million tonnes of fish and other seafood (Csavas, 1994b:50). The phenomenal increase in shrimp farming can be attributed to a variety of reasons such as high prices in international markets, decline in wild catches. Some studies have considered the economic viability of aquaculture shrimp production vis-à-vis natural land uses (Srinath *et* al.2000; Bhatta and Bhat 1998). Shrimp are almost exclusively produced for export to meet the demands of high purchasing power consumers in Japan, United States and Western Europe (Csavas, 1992:15). Environmental, economic and social issues have created much concern over how to produce shrimp in a more environmentally benign, economically profitable and socially acceptable manner. These three factors are commonly considered as the triple pillars for sustainability (Wikipedia, 2011). The key environmental problems associated with shrimp aquaculture include nutrient and sediment loads in water ways, chemical pollution, salinization of water supplies, infection of native stocks and the destruction of mangroves.). Tiger shrimp (*Penaeus monodon*) stocked with fish, mollusk has been devoted to profitability and increase marked returns (Tian *et al*., 2001). Due to the high market prices of shrimp, polyculture may hold the key to the economical feasibility of mariculture in India. Shrimps were by far the dominating species group, in combination with tilapia, milkfish and other aquatic organisms. Shrimp culture in ponds together with fish was practiced on commercial term in West Bengal. Due to the high market prices of tiger shrimp, polyculture may hold the key to the economical feasibility of mariculture in this state. *Penaeus monodon* polyculture in bheris is mainly done in North 24 Parganas, West Bengal.

2. Materials and methods

The research has been conducted in Purba Medinipur (Coordinates between 20^0 46' 00'' North and 18^0 14' 00'' East), west Bengal to analyse the environmental aspects, social and economical aspects of shrimp farmers, economic feasibility, sustainability, cost-production, market value and profitability of *Penaeus monodon* farming.Purba Medinipur district which has 5618.22 ha of culturable brackishwater area and intensive and semi-intensive farming systems are mainly practised here. Among this 3,342 ha of potential areas are suitable for tiger shrimp farming (Upadhyaya, A.S., 2001). The primary and secondary data collection was conducted in **Egra** and **Contai** sub-divisions in Purba Medinipur. Among these two stations total six villages are covered for purposive sampling. The proposed study is mainly conducted to the shrimp farmers by random sampling for collecting the raw data. A questionnaire was scheduled for collection of data from the respondents. The collected data on both social and economic parameters were statistically analyzed for econometrics with the help of SPSS- 13.0, R- 2.14.2, Tinn- R, Microsoft Office Excel for

Windows and STATISTICA (Version- 6) software packages.

3. Results and Discussion

During study period it is depicted that the maximum percentage (60%) of shrimp farmers age were within medium age group (i.e. age group between 36-45 years) with educational qualifications 67.8% literacy. Under economic parameters the average capital cost for both Egra(Station 1) and Contai (Station 2) were Rs. 1,48,985 and Rs. 1,16,448 respectively. The value of lease amount of Station- 1 is Rs. 12,000 and station 2 is Rs. 7,680. The value of pond construction is Rs. 33,882 in Station- 1and Rs. 34,933 in station 2. The value of inlet and outlet structures of Station-1 is Rs. 5,816 and station 2 is Rs. 9,794. 9,794. The value of watchman shed for station 1 is 5333 and for station 2 is 4286.

From the table 1, the Correlation matrix considering all the variables under consideration, the results are depicted in the following manner. Firstly, considering the correlation between Stocking with other variables, there exist a significant high positive correlation with equipments, total capital cost ,moderate positive correlation with watch man, low positive correlation with construction, electrification, high negative correlation with Miscellaneous, total variable cost, total input, total output, lease amount, cost of seed, moderate negative correlation with liming and manuring, chemical, fuel charge, electric charge, annual maintenance and repair, profit and low negative correlation with labour charge, and Miscellaneous. Secondly, considering the correlation between Construction with other variables there exist a significant moderate positive correlation with watch man, total capital cost, annual maintenance, profit low positive correlation with equipments, high negative correlation with electrification, Miscellaneous, Chemicals, Fuel charges, Labour charges, moderate negative correlation with Cost of seeds, Electricity charges, Total Variable Cost, Total Input, low negative correlation with Total Output, Miscellaneous, equipments. Thirdly, considering the correlation between Electric installation with electrification other variables there exist a significant moderate positive correlation. Fourthly considering the correlation between Equipments with electrification other variables there exist a significant high positive correlation. Fifthly considering the correlation between Watchman shed with electrification other variables there exist a significant high positive correlation. Sixthly considering the correlation between Miscellaneous with electrification other variables there exist a significant high positive correlation with Total Capital Cost, high negative correlation with Lease amount and other variables. Seventhly considering the correlation between Total Capital Cost with electrification and other variables there exist a significant high positive correlation with Lease amount and other variables. Eighthly considering the correlation between Lease amounts Cost with electrification other variables there exist a significant high positive correlation with other variables. Ninthly considering the correlation between Liming and manure Cost with electrification other variables there exist a significant high positive correlation with Chemicals and other variables. Tenthly considering the correlation between Chemicals Cost with electrification and other variables there exist a significant high positive correlation with Cost of seeds and other variables. Eleventh considering the correlation between seeds with electrification and other variables . Twelfth considering the correlation between Fuel charges with electrification and other variables there exist a significant high positive correlation with Labour charges and other variables. Thirteenth considering the correlation between Electricity charges with other variables there exist a significant high positive correlation with Miscellaneous and other variables. Fourteenth considering the correlation between Labour charges with electrification other variables there exist a significant moderate positive correlation with Total Variable Cost, Total Input, and low positive Miscellaneous, total out put, low negative correlation with Annual maintenance and repairing cost, Profit. Fifteenth considering the correlation between Annual maintenance and repairing cost with electrification other variables there exist a significant high positive correlation with, moderate positive correlation with Miscellaneous, total output, low positive with correlation with Variable Cost ,Total Input. Sixteenth considering the correlation between Miscellaneous with electrification other variables there exist a significant high positive correlation with Total Variable Cost, Total Input, Total Output, moderate positive correlation with profit. Seventeenth considering the correlation between Total Variable Cost with electrification other variables there exist a significant high positive correlation with Total Input, Total Output, and low positive correlation with profit. Eighteenth considering the correlation between Total Input electrification other variables there exist a significant high positive correlation with Total Output, and low positive correlation with profit. Ninetieth considering the correlation between Total Output electrification other variables there exist a significant high positive correlation with profit.

The linear regression equation for the purpose of modelling of station 1 in the year of 2013 taking Profit as dependent variable and other variables; the equation revealed as below:
Profit(2012)= -7639.747+ (-6.185x Electric installation with electrification) + (.609x Total Output)

The equation clearly indicates that the most important variables (average value calculated for 1 ha area, in all the cases) are Cost of feed and Total Output, where cost of feed has negative impact upon profit and Total Output has positive impact upon profit.

The linear regression equation for station 2 in the year of 2013 taking profit as dependent variable and other variables viz Stocking, Construction , Electric installation with electrification , equipments , Miscellaneous ,Watchman shed ,Total Capital Cost ,Lease amount , Liming and manure ,Chemicals ,Cost of seeds, Fuel charges , Electricity charges ,Labour charges ,Annual maintenance and repairing cost ,Miscellaneous ,Total Variable Cost ,Total Input ,Total Output, as independent variables. The equation revealed as below:
Profit(2013)= 449615.911+(-1.165x Total Input) + (449615.911x Total Output)

The equation clearly indicates the most important variables (average value calculated for 1 ha area, in all the cases) are

Lease amount and Total Output. Where lease amount has negative impact upon profit and Total Output has positive impact upon profit.

4. Conclusion

Purba Medinipur is highest shrimp producing district in West Bengal through intensive and semi-intensive farming. Considering all the assignable constraints, still Shrimp culture can give miracles towards socio- economic development for a large number of rural people. But the only factor that is pulling them back is because of many uncertainty and unpredictability existing there on. An optimum output cannot be assured even after taking the risk of huge investment. Here lies the popularity of polyculture which eradicates the problems in monoculture of shrimp. The export policy promotion, distinct quality measures, application of scientific method, proper quality control mechanism targeted to marketing strategy, and presence of modern technology, sustainable market price, insufficient supply of institutional credit and such other ancillary facilities are the crucial factors, for sustainability and long term viability of both the industries. For the sustainability of these industries, it is essential that extensive training programme be conducted for farmers, in order to develop confidence to practice shrimp culture. Crop insurance facilities should be introduced so that the farmers would not bury them under debt burden if there is a loss. The motto should be to practice an economically and ecologically viable culture practice.

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Appendix

Table 1: Correlation Matrix for Average Economics in connection with Variable Cost (V.C.), Fixed Cost (F.C.) and Total Expenditure for Shrimp farming at Purba Midnipur, West Bengal during 2013.

	Construction	Electric Installation	equipments	Watchman shed	Miscellaneous	Total capital cost	Lease amount	Liming and manure	Chemicals	Cost of seeds	Cost of Feed	Fuel charges	Electricity charges	Labour charges	maintenance / repairing cost	Miscellaneous	Total Variable Cost	Total Input	Total Output	Profit
Construction	1																			
Electric installation	.869	1																		
equipments	.981	.949	1																	
Miscellaneous	.993	.803	.950	1																
Watchman shed	.774	.986	.882	.692	1															
Total Capital Cost	.988	.935	.999*	.962	.862	1														
Lease amount	.983	.763	.928	.998*	.643	.943	1													
Liming and manure	.553	.893	.705	.448	.956	.674	.389	1												
Chemicals	.474	.847	.636	.363	.924	.603	.302	.996	1											
Cost of seeds	-.745	-.319	-.602	-.821	-.155	-.635	-.856	.143	.234	1										
Cost of Feed	.995	.817	.957	1.000*	.708	.968	.996	.469	.385	-.807	1									
Fuel charges	.002	.496	.197	-.119	.635	.155	-.183	.834	.882	.665	-.096	1								
Electricity charges	.937	.987	.987	.888	.946	.980	.856	.809	.751	-.466	.898	.351	1							
Labour charges	-.014	.482	.181	-.135	.622	.139	-.200	.825	.874	.677	-.112	1.000*	.336	1						
maintenance /repairing	.975	.957	1.000*	.942	.894	.998*	.918	.723	.656	-.580	.949	.222	.991	.206	1					
Miscellaneous	.867	1.000**	.948	.801	.986	.933	.760	.894	.849	-.315	.814	.500	.986	.486	.956	1				
Total Variable Cost	.431	.820	.598	.318	.905	.564	.256	.990	.999*	.281	.340	.903	.718	.896	.619	.823	1			
Total Input	.569	.901	.718	.466	.961	.689	.407	1.000*	.994	.124	.486	.823	.820	.814	.736	.903	.987	1		
Total Output	.063	.548	.256	-.059	.681	.215	-.124	.866	.909	.618	-.035	.998*	.407	.997*	.281	.551	.928	.856	1	
Profit	-.132	.375	.063	-.251	.525	.021	-.314	.753	.810	.759	-.229	.991	.222	.993	.089	.379	.838	.740	.981	1

** Correlation is significant at the 0.01 level (2- tailed) * Correlation is significant at the 0.05 level (2 tailed)

Table 2: Coefficients Matrix for Average Economics taking Total Capital Cost (TCC) as dependent variable comprising *Penaeus monodon* Monoculture in Purba Midnipur over 2013

	Unstandardized Coefficients	95% Confidence Interval	
		Lower Bound	Upper Bound
(Constant)	65036.100	65036.100	65036.100
Construction of ponds	2.194	2.194	2.194
Inlet and out structure of the ponds	.117	.117	.117
Pump house cum workshop	.662	.662	.662
Watchman shed	1.066	1.066	1.066
Electric installation with electrification	-.698	-.698	-.698

Author Profile

Dr. Somen Sahu completed B.Sc. Honours in Statistics from Ramkrishna Mission Residential College, Narendrapur (Calcutta University) in 1991, Post-graduated in Statistics from Burdwan University in 1993, M.B.A. from National Institute of Personnel Management in 1995 with Gold Medal. He completed his Ph.D. from Jadavpur University in 2006. He was a National Scholar. He published number of articles in National & International Journals, and edited and contributed to several significant publications. His areas of interest are Bio-Statistics, Statistical Software Handling, Biomonitoring, Management Information System and Extension Education in different Agricultural fields. He introduced a new Model viz. Dr. Sahu's Networking Model which was adopted by Department of Fisheries, Government of West Bengal. He is the founder Secretary of International Organisation of Biological Data Handlers. He has life membership with various scientific & professional societies & organizations He is currently working as an Associate Professor and Head in the Department of Fishery Economics and Statistics, Faculty of Fishery Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata for last 15 years.