MARINE PEARL PRODUCTION IN ONSHORE TANKS

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INTRODUCTION

Marine pearls are precious gems which are the most attractive objects of human adoratio
The natural pearl (Orient/Basera) producation is very limited and their harvest affects th
pearl oyster population, in course of time. In view of this, the technology of sea based pea
(raft) culture was developed in Japan and later in a few other countries including Indi
There are only a very few locations along our coast suitable for pearl culture. Consequentl
the marine pearl culture in India has not attracted entrepreneurs, in spite of the availabili
of technology including hatchery production of seeds. Till date marine pearl culture work
caried out in the Gulf of Mannar area only where natural beds (pars) exist in the sea at
to 20 m depth. Against this background the Central Marine Fisheries Research Institu
(CMFRI) has recently developed the land based marine pearl production technology, whi
has several advantages over the sea based raft technology.

Present state of world production

About 32 countries are in some stage of pearl culture of various species, from pilot sca
research to substantial production and in recent years some of them have expanded th
industry very quickly. However, India is yet to attain the status of pearl production countr

The present world production of marine pearls from different species is estimated at abo
70t compared to the demand of over 100t. Japan continues to dominate the marine pea
trade followed by China. The production of Japanese cultured pearls was respectively 72,9
63,000 and 60,000 Kg. during 1993-1995. Among the world's marine cultured pear
production from *Pinctada fucata* accounts for 93% followed by *P.maxima* an
P.margaritifera. Thus the Indian pearl oyster *P.fucata* (=Japanese *P.f.martensi*) is ve
important as commercial pearl culture of this species is practised mainly by Japan an
China. Although exact statistics are not available, India imports sizable quantity of pea
from Japan. India being a pearl importing country, it will be a great achievement for Ind
if it can produce cultured marine pearls, to meet internal requirement, leave alone expor
As marine pearls are in great demand in India, there exists an unlimited market for cultur
marine pearls.

ONSHORE PEARL CULTURE

The integrated onshore (land based) pearl production technology can be divided into thr
phases, Viz., the hatchery, mother oyster rearing and nucleus implantation and post-oper
tive rearing. The entire operation can be carried out in about 1 hectare area of suitable lan
In this system site selection plays a very important and critical role.

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Suitability of land

1. The land for onshore pearl culture should be closer to the sea. The water intake should be only from the sea and in no circumstance from a creek.
2. The area should be free from domestic/industrial pollution .
3. The sea water salinity should not fall below 18 ppt at any time of the year.
4. Loose sandy areas should be avoided as there are chances of large scale accumulation of sand particles in the culture system by wind.

Backyard hatchery

The hatchery shed shall be of low height, thatched/asbestos roofing of 6 x 20 m including indoor phytoplankton culture labs. It will have the following facilities.

1. Air conditioned room of 6 x 4 m (fitted with 2 t AC) for algal culture, broodstock maintenance etc.
2. Hatchery shed of 6 x 16 m provided with filtered sea water and facility to drain sea water. This shed can easily accommodate 12 FRP tanks of 1 t capacity, and other required equipments. The above two structures are of brick and cement construction of 7 ft (2.2m) high walls with false ceiling.
3. Sand filter of standard design, with a sump to store the filtered sea water for supply to the hatchery.

The above facility can be used to produce at least one million pearl oyster seed/year. It has the capacity to produce 400 l of algae of desired species (*Chaetoceros* / *Isochrysis*) for hatchery use.

Properly maintained brood stock can be used for spawning by thermal stimulation. It requires 3 months to get seeds from hatchery. The methods of hatchery seed production of *P. fucata* have been already standardised by the CMFRI.

Oyster rearing

After a brief nursery period when the oyster spats reach 5-10 mm size (dorso-ventral measurement) they are transferred to the rearing tanks. Each rearing tank is of about 250 to 500m^2 area depending on the location. The total rearing water spread area is 4,000m^2. The depth of the tank is 1.2m. It will be a dug out tank with an outer projection of 30cm to protect it from the entry of rain water etc. The entire inner surface of the tank is to be plastered with cement to avoid seepage of water. The entire tank area is covered with a low roof of asbestos/thin PVC sheets. The height of the shed at the central place from the bottom of the tank shall be 270 cm, to allow persons to work inside the tank. Box cages of suitable dimensions 40x40x10cm to 100x50x15 cm made of PVC pipes/PVC rods with thick nylon mesh are suspended 15 cm above the bottom of the tank. The box cages will have the facility to open at any time for inspection of the oysters and the mesh of nylon netting varies with the size of the oysters.

The pearl oyster spat of 5-10mm are transferred into the cages. At this stage th mesh size of the cages will be 2-3mm. They can be stocked at a rate of 1000/m². Th population will be thinned in tune with their growth so as to reach an average den sity of 200/m² at the final stage of above 40 mm (DVM). It takes about six months fo oyster seed of 5-10 mm size to reach nucleus implantation size. It may be mentione here that, it takes one year in the open sea raft culture for the pearl oyster to attai implantation size.

Feeding

The pearl oysters are fed with a mixed diet of *Chaetoceros* 75% and *Tetraselmis Isochrysis* 25% at cell density varying from 20,000 to 80,000/ml depending on the size, water temperature, season etc. Roughly about 125 to 150t of phytoplankton of million cells/ml is required to feed the entire stock of pearl oysters. This require adequate numbers of outdoor tanks for mass culturing phytoplankton of 2 or 3 spe cies. For algal production, sand filtered sea water has to be used. The basic inocului can be obtained from the algal culture room and mass cultured in the open area using large transparent containers and outdoor cement tanks.

Sea water requirement

The total waterspread area is about 4,000 m². The ideal water retention capacity tanks is about 4,000t. The exchange of water is at the rate of 25% per day. The botto water is let off into the drainage and fresh seawater is pumped in, to make up th volume and maintain a depth of about 1 m.

Implantation and rearing

Implantation of 3-4 mm shell bead nucleii (imported) is carried out when the pear oysters reach a mean size of 50mm, by specially trained persons with the help surgical instruments available for this purpose. This operation is carried out in implantation shed provided with FRP tanks, sea water etc. After implantation, th operated oysters are kept in FRP tanks for 2 hours for recovery and transferred bac to the rearing tanks, where they are reared for about 5 to 6 months before harvest pearls. The chance of nucleii rejection is about 50% as revealed by the experiment This rate can be reduced by better management of implantation and feeding. Althoug about 46% of gross pearl production was obtained under onshore tanks condition only 25% can be taken for economic projection as a measure of abundant precaution

The rejections are likely to continue for about 60 days from the date of implantation By X-ray screening, the rejected oysters can be segregated and re-implanted afte two months, thus enhancing the rate of pearl production.

The rate of pearl growth has to be monitored in relation to environmental param eters while the "pearl" is still inside the body of the oysters. This will help to dete

mine the exact period of harvest and quality, in advance. By the computerised image processing of pearl oyster X-rays, it is possible to monitor the minute details of the growth of pearls.

Thus, it takes about 1 year from spat to pearl production in land based pearl production technology compared to 1.5 years under sea based raft culture in India and 2.5 years in Japan.

Disease and pollution control

The used sea water (discharge) from the tanks is let into a separate tank, stored for about 24 hours and green mussels are cultured in that water. The mussels have the capacity to feed on the organic matter contained in the discharged water, thus effecting filtration and purification of the water. Thus clean sea water free from pollution is let out into the sea. The green mussel meat and shell have good demand. As green mussels are proposed as pollution controlling agents, their monetary utility is not taken into account here when calculating the economics of the technology. As the pearl oysters are fed with live feed (phytoplankton) and no chemicals are used, environmental parameters are not expected to vary from the natural conditions. This is a natural preventive measure from the occurrence of diseases.

Future developments

There is possibility of rapid development of land based pearl production. It is suggested that the three phases described above are taken up by different entrepreneurs, one category of entrepreneurs could concentrate on hatchery producation of seed, while another group can concentrate on rearing of mother oysters while the third category of entrepreneurs can concentrate on implantation of nuclei, rearing of implanted pearl as the land based pearl culture is still in an infant stage.

ABSTRACT ECONOMIC PROJECTIONS (1 ha area)

INFRASTRUCTURE	Rs. (in lakhs)
1. Hatchery	7.0
2. Growout tanks (4000 m².)	10.0
3. Oyster cages	10.0
4. Outdoor algal culture structures	6.5
5. Implantation shed	2.5
6. Other buildings	3.0
7. Miscellaneous	2.0

8.	Power installation and generator	3.0
9.	Pumping system including filters	5.0
10.	Blowers and associated aeration system	2.0
	Total	51.0

Cost of land, land development, vehicles, staff quarters are not included.

RECURRING EXPENDITURE

		Rs. (in lakhs)
1.	Wages	6.0
2.	Nucleii	7.0
3.	Surgical instruments	0.5
4.	Chemicals & glasswares	1.5
5.	Power charges/annum	4.0
6.	Miscellaneous	2.0
	Total	21.0

EXPECTED REVENUE

Total oysters proposed for implantation = 640,000

Pearl yield (at 25%) 160,000 at a price Rs.40/- pearl Rs. 64.0 lakhs