GUIDELINES

Adopting Improved Technology for Increasing Production and Productivity in Traditional and Improved Traditional Systems of Shrimp Farming

Aquaculture Authority
Government of India
Ministry of Agriculture
Department of Animal Husbandry and Dairying
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Publication sponsored by the FAO's Bay of Bengal Programme for Fisheries Management,
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Justice G Ramanujam

Chairman

Aquaculture Authority

PREFACE

Coastal aquaculture has been recognised as an important tool for employment generation and as a vital source of supply for meeting the food security and nutritional requirements of our growing population.

The Supreme Court in its judgement dated 11th December, 1996 regarding shrimp aquaculture activities in coastal areas, directed the setting up of an Aquaculture Authority to regulate shrimp farming in the country. The intention behind the judgement is to develop shrimp aquaculture in a sustainable and eco-friendly manner. The Apex Court in its judgement also permitted farmers practising traditional and improved traditional systems of shrimp farming to adopt improved technology for increased production, productivity and returns with the prior approval of the Aquaculture Authority.

The Aquaculture Authority in pursuance of this direction constituted a Technical Committee which has formulated guidelines for adopting improved technology. These guidelines are comprehensive and lay down specific parameters for adopting improved technology by shrimp farmers practising traditional/improved traditional systems of shrimp aquaculture.

I believe that the practical guidelines evolved by the Technical Committee would be beneficial for shrimp growers, the scientific community and planners in achieving the objectives of sustainable and eco-friendly coastal aquaculture.

(G. Ramanujam)

New Delhi

1.5.1999

Dr. Yugraj Singh Yadava

Member Secretary

Aquaculture Authority

FOREWORD

The Guidelines for Adopting Improved Technology for Increasing Production and Productivity in Traditional and Improved Traditional Systems of Shrimp Farming have been formulated with the objective of optimising yield levels in such systems on sustainable basis. The Guidelines also aim at improving the management of shrimp aquaculture in traditional systems to ensure long-term sustainability of the farming practices and environmental security.

In preparation of the Guidelines, efforts have been made to incorporate data based on scientific experiments conducted in India and abroad. The Guidelines are, however, dynamic and would be subject to periodical revisions. Further, the Guidelines are illustrative and not exhaustive. Suitable modifications may have to be made by the farmers while adopting the improved technologies.

With great pleasure, I record my thanks to Dr. Kee-Chai Chong, Programme Coordinator, Bay of Bengal Programme, Chennai, and his staff for their valuable inputs towards publication of the Guidelines. Thanks are also due to Shri G.D. Chandrapal and other Officers and Staff of the Fisheries Division, Department of Animal Husbandry & Dairying, for their unstinted cooperation and support in preparation of the Guidelines.

New Delhi (Y.S. Yadava)

1.5.1999

BACKGROUND

The Honourable Supreme Court in its orders on the Writ Petition (Civil) No.561 of 1994 dated 11.12.1996, held that "The Shrimp culture industry/the shrimp ponds are covered by the prohibition contained in para 2(1) of the CRZ Notification. No shrimp culture pond can be constructed or set up within the coastal regulation zone as defined in the CRZ Notification. This shall be applicable to all seas, bays, estuaries, creeks, rivers and backwaters. This direction shall not apply to traditional and improved traditional types of technologies as defined in Alagarswami's Report which are practised in the coastal low lying areas."

The traditional and improved traditional systems as defined in Alagarswami's Reports are as follows.

> **TRADITIONAL**: Fully tidal-fed; salinity variations according to monsoon regime; seed resources of mixed species from the adjoining creeks and canals by auto-stocking; dependent on natural food; water intake and drainage managed through sluice gates depending on local tidal effect; no feeding; periodic harvesting during full and new moon periods; collection at sluice gates by traps and bagnets; seasonal fields alternating paddy (monsoon) crop with shrimp/fish crop (inter-monsoon)
>
> **IMPROVED TRADITIONAL:** System as above but with stock entry control, supplementary stocking with desired species of shrimps seed (Penaeus monodon and P.indicus); practised in ponds of smaller area 2-5 ha.

The Court in its Orders also permitted the farmers operating traditional and improved traditional systems of shrimp aquaculture to "adopt improved technology for increased production, productivity and return with prior approval of the Authority".

Accordingly, the Aquaculture Authority constituted a committee comprising the following members for preparing guidelines for enabling farmers to adopt improved technology:

1. Dr. G.R.M. Rao — Chairman
   Director, Central Institute of Brackishwater Aquaculture,
   Chennai

2. Dr. Satish Chandra — Member
   Member, Aquaculture Authority
   29, Doctor's Society
   4, Vasundhara Enclave
   New Delhi

3. Director of Fisheries — Member
   Government of West Bengal
   Calcutta

4. Shri V. Venkatesan — Member
   Director, Marine Products
   Export Development Authority
   Kochi

5. Shri G.D. Chandrapal — Member Secretary
   Deputy Commissioner of Fisheries
   Ministry of Agriculture,
   Department of Animal Husbandry & Dairying,
   New Delhi

The terms of reference of the Committee are:

i) To examine the relevant portion of the Supreme Court's judgement dated 11.12.1996 under which the suggestion has been made by the Apex Court for adoption of improved technology for increased production and productivity from traditional and improved farming systems.

ii) To define the specific parameters that are considered for improved traditional systems of shrimp aquaculture.

iii) To specify permissible activities that can be practised by the shrimp farmers within the CRZ area under the improved technology for increasing production and productivity from traditional and improved traditional farming systems.

iv) To suggest the measures that are to be taken by shrimp farmers while undertaking improved technology to protect the eco-system within the framework of the Supreme Court's Judgement dated 11.12.1996.

1. INTRODUCTION

1.0 Coastal shrimp aquaculture is an age-old practice in the States of West Bengal and Kerala. More than 50,000 ha is under traditional and improved traditional methods of shrimp farming. As per the classification mentioned in Alagarswami's Report and adopted by the Honourable Supreme Court, the traditional sytstem of culture is fully tide-fed; salinity variations according to monsoon regime; seed resource of mixed species from the adjoining creeks and canals by auto-stocking; dependence on natural food; water intake and drainage managed through sluice gates depending on local tidal effect; no feeding; periodic harvesting during full and new moon periods; collection at sluice gates by traps and bag nets; seasonal fields alternating paddy crop (monsoon) with shrimp/fish crop (inter-monsoon). The improved traditional system is different from the traditional system only in stock entry control and supplementary stocking with desired species of shrimp seed (*Penaeus monodon* and *P. indicus*) The average production levels in these types of systems range between 300 and 500 kg/ha/season. However, with the adoption of improved environment-friendly technology, the production and productivity of the system can be increased with the yield levels varying between 1000 and 1500 kg/ha/crop, resulting in optimum utilization of the resources available with the farmer. The Supreme Court, while permitting the traditional and improved traditional systems within the Coastal Regulation Zone (CRZ), has also permitted improvement in technology for these systems to increase production, productivity and returns.

2. EXISTING PRACTICES

2.0 Traditional coastal shrimp aquaculture followed in certain states of India is best described as the "trap and culture" method in large and shallow impoundments. This is largely dependent on the tidal flow for the water supply as well as for the seeding material. All the impounded organisms are allowed to grow, and periodical harvesting of the shrimps and fishes is carried out after an initial rearing for 2-3 months. Harvesting is generally through trapping during the spring tide period. Auto stocking results in the entry of unwanted predators and other aquatic organisms, which compete for food and space with the desirable species apart from preying on them. The organisms in the system depend on the natural productivity of the soil and water for the production of natural food materials. Hence the growth and survival of the target fin/shell fish is less and the profit very meager. Similarly, in the improved traditional method, though selective stocking is followed, preventing the entry of eggs/larvae of undesirable species is difficult which subsequently compete for food with the target species

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Small-scale tidal-fed shrimp farms with feeder canals

2.1 Thus, for optimum utilization of the resources and increased production, productivity and returns to the farmer, improvement in the existing technology is necessary. Such improvements should aim at the following:

a) Improved farm design – for operational ease
b) Optimum soil and water condition
c) Removal of pests and predators
d) Qualitative and quantitative aspects for stocking shrimp larvae
e) Supplementary feeding
f) Soil and water quality management
g) Monitoring of growth and health
h) Improved methods of harvesting post-harvest management

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Examining a shrimps's intestines to check and ensure correct feeding

3.TECHNOLOGY FOR IMPROVING PRODUCTION AND PRODUCTIVITY

The guidelines aim at increasing the production, productivity and returns from traditional and improved traditional systems of shrimp farming with sustainable and environment-friendly farming practices.

3.1 FARM DESIGN

3.1.1 Generally, the traditional and improved traditional farms are vast and the individual units range up to 100 – 200 ha. In such large water bodies, the adoption of improved culture technology may not be possible since management of such water bodies is very difficult. For better water management, individual culture units should be within 5 ha areas. Hence changes in farm design should be made wherever possible depending on the local conditions to reduce the unit culture area within manageable limits. The reduction in size should accompany formation of a suitable feeder channel system within the farm so that the water intake can be effectively managed in all the individual units. The water intake should be through sluices provided with net screens. The sluice gates should be watertight so as to retain the required amount of water in the ponds.

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Sluice gate to control flow of water from feeder channel

3.1.2 The water depth in traditional fields is low at 50-60 cm. For improving the growth and survival of the shrimps, at least a minimum depth of 80 – 100 cm should be maintained. Deepening of the farms is called for wherever necessary. The soil excavated after deepening should be used for the bunds etc.

3.1.3 The traditional/improved traditional systems of culture adopting improved technology may resort to the use of pumps whenever necessary

3.1.4 All farms above 5 ha should keep 10% of the area reserved as waste stabilization ponds.

3.2 OPTIMUM WATER AND SOIL CONDITIONS:

3.2.1 The low stocking and low feeding envisaged under the present system does not lead to accumulation of organic matter at the pond bottom. However, for better growth and survival of the shrimps, the soil needs to be conditioned. The best way to improve the pond bottom conditions is to dry the pond wherever possible and till the surface layer. This process shall enhance the mineralisation of organic load at the bottom.

3.2.2 Application of lime is useful in correcting the pH of the soil. It is a disinfectant; it also increases the mineralisation process. If the pH of the soil is not below 7.5, a basal dose of 300-500 kg/ha can be applied. However, in acid soils, where the soil pH is low, the quantity of lime is to be applied should be calculated on the basis of the pH and the type of lime used. The following dosages of quick lime/slaked lime are advocated for low pH soils.

Soil pH	Quick lime* (tonnes/ha)	Slaked lime** (tonnes/ha)
5.0	9.2	17.0
5.5	6.9	12.7
6.0	4.6	8.5
6.5	2.3	4.2

* During pond preparation

**During culture

3.2.3 The cultured species largely depend on the natural feed. To achieve sustained production, it is essential that supplementary additions of fertilizers should be resorted to. Both organic manures and inorganic fertilizers are generally used for the purpose. The dosage of organic manure to be applied is dependent on the organic carbon content of the soil. The following basal doses are prescribed

Dosage of manures in relation to organic carbon content of soil

Organic carbon in soil (%)	Prescribed basal dose Raw cow dung (kg/ha)	Dry chicken manure (kg/ha)
1	500	175
0.5	1000	350
0.25	2000	700

3.2.4 Similarly, application of inorganic fertilizers should be based on the nitrogen and phosphorous content of the soil which is detailed below

Application of urea in relation to available N

Available N in soil (mg/100g soil)	Urea to be applied (kg/ha)
12.5	100
25.0	50
50.0	25

Application of super phosphate in relation to available phosphorus

Available P in soil (mg/100 g soil)	Super phosphate to be applied (kg/ha)
1.5	100
3.0	50
6.0	25

3.2.5 While using inorganic fertilizers, care should be taken to avoid over-fertilization. The fertilization dosage given may not hold good for all the waters. The best way to regulate the fertilization schedule is through monitoring the algal bloom conditions based on the colour or transparency of the water.

3.3 REMOVAL OF PESTS AND PREDATORS

3.3.1 Pests and predators are the major problems encountered by the traditional farmers. Even when the selective stocking method is followed after screening the water intake, the entry of larvae/eggs of some of the unwanted species cannot be avoided. Before initiation of a new culture, it is essential that all unwanted organisms are removed from the pond. In drainable ponds, this is achieved by drying the pond bottom.

3.3.2 In cases where complete drying is not possible, organic, biodegradable piscicides such as Mahua oil cake and tea seed cake can be used. No chemical piscicide should be used. After the application of the pisscicide, at least a minimum period of 10 days should be given for its toxic effect to be degraded.

3.3.3 Piscides like Mahua oil cake (100-150 ppm) and tea seed cake (15-20 ppm) act as organic fertilizers after their toxicity is eliminated. The piscicides are applied with a minimum of water. The water dosage is calculated on the basis of the volume of water as given in the following table

Piscicide	Dose for 1000 m^3 of water (10 cm of water in 1 ha area) (kg)
Mahua oil cake	100-150
Tea seed cake	15-20

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3.4 QUALITATIVE AND QUANTITATIVE ASPECTS FOR STOCKING OF SHRIMP LARVAE

3.4.1 Stocking of healthy seed (post-larvae) solves most of the disease problems that are encountered by farmer. Only hatchery-reared and healthy seed should be used. The quality seed is characterized by active movement against the current in the container; absence of bright colouration; and adaptability to stress conditions of reduced salinity and formalin content. The presence of viral and bacterial pathogens/diseases should be identified by trained microbiologists.

3.4.2 The number of seed stocked has a strong bearing on its growth rate during culture. The stocking densities should be decided on the basis of the management practices followed. For improved traditional systems, the stocking densities should be in the range of 4-6 no./m^2

3.5 SUPPLEMENTARY FEEDING

3.5.1 With the above stocking densities, supplementary feeding becomes essential after 4 – 6 weeks of rearing, when the natural feed cannot sustain their growth. Only formulated feed (dry pellets) with a minimum 4-hour water stability should be used. The feeding rate prescribed by the manufacturer varies, depending on the quality of the feed. Generally, the feeding rates given in the following table are followed.

3.5.2 The feeding schedule should be regulated on the basis of the feeding check trays placed in the ponds. Feeding through trays placed in various parts of the pond is found to be more economical and beneficial. Excess feeding can be avoided by increasing the frequency of feeding. The daily feed requirement can be split into smaller rations, and given 4-6 times a day, with a major percentage during the evening and night feeding.

Size of the shrimp (gm)	Feeding rate (%)
2-5	4.0 – 3.0
5-10	3.0
10-15	3.0-2.5
15-20	2.5-2.0
20.35	2.0

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How shrimp in a small fond are fed

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3.6 MONITORING OF GROWTH AND HEALTH:

3.6.1 Disease manifestation in shrimps occur when the equilibrium between the host, the pathogen and the environment is altered. Most of the diseases occur only when the water quality conditions are stressful to the cultured shrimps. Water quality should therefore be maintained as suggested in para 3.7. The growth of the shrimps should be monitored continuously to adjust the feeding rate and to assess their well being. Shrimp with any one or more of the following conditions are diagnosed be disease-inactive and sluggish: empty gut, bluish/blackish colouration, with blisters or flared up gills, broken appendages, black/white spots, coloured gills and opaque muscles. In case of disease outbreak a trained pathologist should be consulted.

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The length of cultured shrimp is measured periodically

3.7 WATER QUALITY MANAGEMENT

3.7.1 Water quality management in shrimp culture ponds aims at maintaining optimal levels of certain important quality parameters as listed in the following table. In the present system of culture, periodical water exchange shall be necessary to maintain optimal water quality conditions. While exchanging water, care should be taken to avoid wide fluctuations in water quality conditions.

Optimal levels of water quality parameters

Water quality parameters	Levels
1. Temperature (°C)	28-33
2. Turbidity (cm)	25-45
3. Ph	7.5 – 8.5
4. Dissolved oxygen (mg/l)	5-7
5. Salinity (ppt)	15-35
6. Total alkalinity (ppm)	200
7. Dissolved inorganic phosphorus (ppm)	0.1 – 0.2

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Testing of water quality in shrimp pond

3.8 HARVESTING

3.8.1 Harvesting can be done by completely draining the pond, either by gravity or through pumping and hand-picking or trapping.

3.8.2 The water drained out for harvesting should be pumped into the waste stabilization ponds and kept for a few days for settlement before releasing into the open water.

3.8.3 Shrimps are generally harvested from the ponds over a period of 10-12 hours and the shrimps are liable to be spoiled during the period. The quality of the shrimps should be maintained so that it fetches a good price. Icing should be done immediately after harvest. Processors/buyers generally collect the harvest from the farm site and transport it in refrigerated vans. When such a facility is not available and the produce has to be transported over a long distance, the shrimps should be deheaded and stored in ice to prevent spoilage

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Shrimps should be iced immediately after the harvest to preserve shrimp quality

3.9 EXPECTED IMPROVEMENT IN PRODUCTION:

3.9.1 Adoption of improved technology shall enable the farmer to achieve production ranging between 1 and 1.5 tonnes/ha/crop. Two crops per year can be taken, leading to an annual production level of 2.0 to 3.0 tonne/ha

4. SECONDARY AQUACULTURE

Waste stabilization ponds which are mandatory in farms above 5 ha area, may be used for secondary aquaculture, depending on the available technology

5 CONCLUSION

The present guidelines for adoption of sustainable and environment-friendly technology by farmers practicing traditional and improved traditional shrimp farming are illustrative and not exhaustive. Suitable modifications may have to be made while adopting the improved technologies.

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Use of a cast net to harvest cultured shrimp

FARM DATA