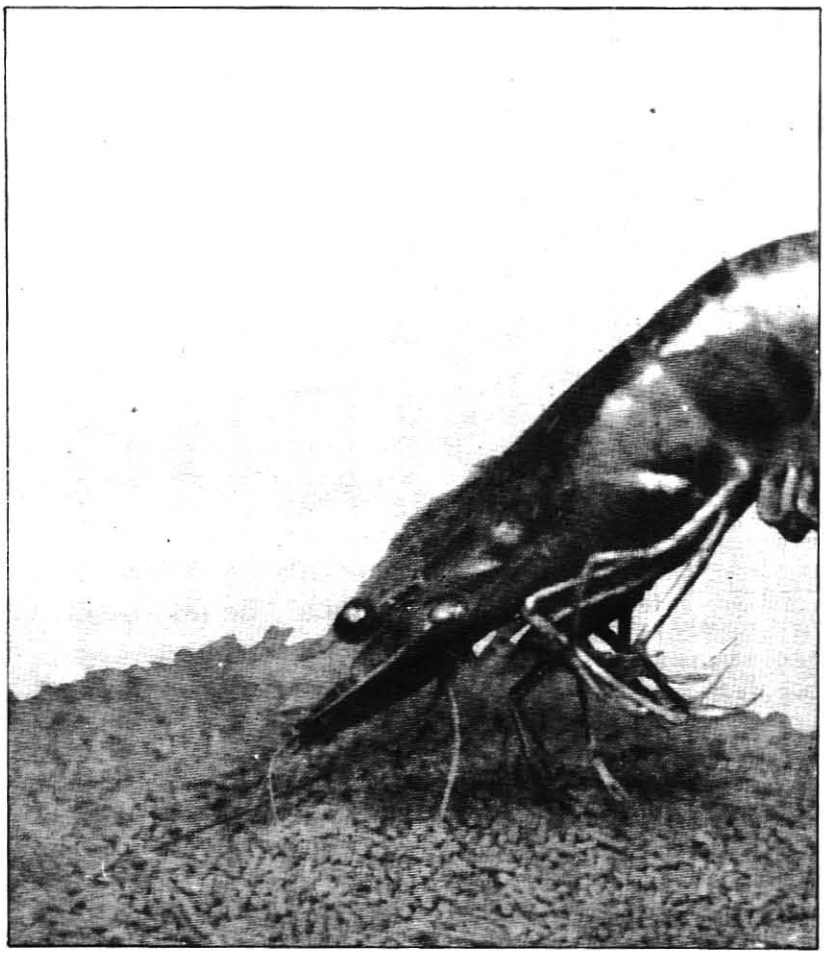
Status of feed management

Feed management is playing a vital role in aquaculture as half of the operational cost comes from feed. Great care must be taken unless the farmer will incur loss.

By Dr. (Mrs) Manpal Sanhotra &
Dr. M. Peer Mohamed
C.M.F.R.I, Kochi

'Feed' on the context of shrimp culture implies not only the formulation, production and utilisation of artificial or processed diets within a farming system as is generally believed, but also the production of live food through pond fertilisation and substrate enhancement and supplementary feeding within semi-intensive, improved extensive and extensive pond based farming systems. It is often believed that the only economic way of feeding shrimp is by using a high quality complete pelleted diet but this is not so and farmers should not be misled to believe so.



As feed constitutes nearly 50 - 80 % of the total variable cost of the farm, its proper management is very crucial not only in terms of expenditure but also in terms of production. Feed management is therefore, the most critical factor in determining the profitability of a shrimp farm, as even the best shrimp feed in the world will give poor results if not properly used. It is known that in poultry and mammals proper husbandry techniques have been responsible in part at least, in making the enterprises cost effective. Apart from providing a suitable diet and reducing the ingredient cost, farmers should be trained to perfect their culture operations with optimum benefit from the existing resources. This is because of the high input costs related to feeding shrimp and the feeds effect on the culture conditions, water and substrate quality.

Feeding option: Shrimp feeding practices can be broadly classified into four basic food management options depending upon the level and form of nutrient input into the farming system.

I)No external nutrient input: This is the basic system where shrimp growth is totally dependent upon natural productivity of the water body (both plant and animal origin). This management option is employed within extensive farming systems in large water bodies or ponds with very low stocking densities.

II) Application of fertilisers:The production capacity of the culture system is increased by the application of chemicals or organic manures as a source of nutrients to enhance the production of live food organism within the water body and this management option is typical of a semi-intensive or improved extensive farming.

III) Supplementary diet feeding : The use of exogenous feed as a supplementary source of nutrients for direct consumption by the cultured shrimp.The dietary nutritional requirement of the aquaculture species are supplied by a combination of live food organisms and supplementary feed which consists of low-cost locally available agricultural materials and byproducts and may include live or fresh natural food items (insects, annelid worms, crustaceans, molluscs, terrestrial and aquatic macrophytes, animal slaughter house offal and/or the use of one or more processed feed items (ie mill sweepings, rice bran, oilseed residues) in the form of a feed mash, dough-ball or pellets. Supplementary diet feeding strategies generally allow higher stocking densities when used in conjunction with pond fertilization, and are typical within semi-intensive farming systems.

IV) Complete diet feeding : Employs the use of an external feeds as a complete source of dietary nutrients for direct consumption by the cultured shrimp, which meets the nutritional requirements of the species. Traditionally, complete diets have taken the form of dry or moise pelleted feed consisting of a combination of different processed feed ingredients, the nutrient profile of which approximates as far as possible to the known dietary requirements of the cultured species. Complete feeds may consists of the continuous use of single, natural food items with a high nutritive value such as 'trash fish' or hatchery cultured live food organisms (Artemia nauplii and adults, rotifers, algae or a combination of both. Complete diet feeding is employed within intensive farming systems and because of the high stocking densities employed no nutritional benefit is assumed to be gained by the cultured species from the natural food organisms present in the waterbody.

Some 40 nutrients are required by shrimp which are provided in varying degrees by the natural foods and supplementary feeds.

In the selection of an appropriate feed type to match the farming system, several factors need to be considered and these include farm management expertise, the farm infrastructure (pumps, paddle wheels) farm and pond size the desired production yields, as all these factors are interrelated. Given that fixed costs are high, availability of technical knowledge and farm infrastructure one could achieve a high yield requiring complete feed. However, if fixed costs are low and either technical expertise or farm infrastructure not available, then a more cost - effective system of production with a lower yield may be more appropriate. In such a case a supplementary feed would be sufficient, while a complete feed would be too expensive, and of superior quality for the farmers need. Therefore, feed quality should be of an appropriate level as required by the farming system.

Shrimp being nocturnal, continuous, intermittent feeders, their feeding behaviour dictates the feed management strategy.

Feed requirements: Some 40 essential nutrients are required by shrimp which are provided in varying degrees by the natural foods and supplemented feeds. If shrimps are grown in less than optimum culture conditions the required nutrients will be higher. As the subject is very vast only those which are of concern at the farm level, not species specific and required where no natural food is present are dealt with here.

Proteins are the major organic materials in animal tissues and used continuously by shrimp for normal growth and metabolism, while lipids are a highly digestible source of energy and essential for normal growth and functions in shrimp. The recommended protein and lipid levels in commercial shrimp feeds are given below.

Table 1: Recommended protein and lipid levels in commercial shrimp feeds (as fed basis)

Size of shrimp (gm)	%	
	Protein level	Lipid level
0-0.5	45	7.5
0.5-3.0	40	6.7
3.0-15.0	38	6.3
15.0-40.0	36	6.0

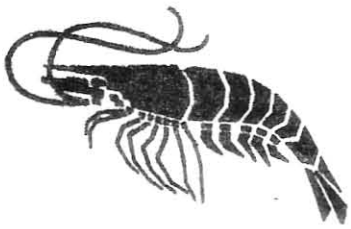
Fibre is not very significant in shrimp nutrition but feeds with high levels of it increase production and consequently pollute the water. As fibre levels in feed should not exceed 4%, this limitation increases the cost of feed. Under less-intensive systems the fibre level may be increased, thereby reducing cost of feed.

Ash is the inorganic (mineral) element in feeds. Some 20 minerals are required by shrimp which are essential as constituents of exoskeleton and co-factors for normal growth and metabolism. Shrimp can absorb or excrete minerals directly from the aquatic environment via gills and body surfaces and sea water and brackishwater are rich in many minerals. Ash levels in commercial feeds should not exceed 15%.

Feed characteristics: A feed may be nutritionally balanced, but unless acceptable to the shrimp is of little value if not consumed. Prawns pick up their food with the help of the second pair of chelate legs and it to the mouth the tactile organs and antennae helping in feed location. Therefore, it is highly essential that feed ingredients should be bound in a particular shape, size and consistency.

Shrimp feed by smell and not sight, hence colour is not significance. When shrimp are fed 'attractants' (amino acids) leach from the pellets and are detected with chemoreceptors distributed throughout their body. Feed with good attractability will bring the shrimp to the feed and once they start eating the shrimp should continue to eat without interruption, hence attractability and palatability are both important and can be usually observed when the shrimps are fed. Within seconds the shrimp approaches the feed, the feed is attractive. If however, after coming close it is dropped, the feed though attractive is not palatable. Feed pellets should also be of uniform colour as colour variation indicates inproper mixing or variation in cooking as it passes through the pellet diet. The former is indicative of unequal distribution of nutrients, while the latter loss of nutrients (vitamins and minerals) due to overcooking. Moreover, the particles of feed should not be large but of the size which can be ingested by the prawns. The texture should be uniform as any cracks result in poor water stability and variations show poor processing. Clumping of pellets indicates improper drying before bagging leading to poor shelf-life. Feeds should contain not more than 2% dust or fines as excess indicates poor processing and handling and is a waste leading to water pollution. Shrimp feeds should be water stable as shrimp are slow continuous feeders and leaching of attractants is necessary for consumption. But a minimum stability of 2-21/2 hours is sufficient as within this time all nutrients would have leached and food will not be consumed. Feeds which are not

CUTS COSTS NETS MORE OPTIMUM FEED FOR MAXIMUM YIELD.



REVITALISING BLUE REVOLUTION IN INDIA

MAHARAJA SEA FOODS (INDIA) PVT. LTD.

INTRODUCES

QUALITY SHRIMP FEED FROM

SANMIGUEL FOOD INC; PHILIPPINES.

B-MEG CE-90

SEMI-INTENSIVE SHRIMP FEEDS

B-MEG SD-90

EXTENSIVE SHRIMP FEEDS

Importers and Distributors in India

MAHARAJA SEA FOODS (INDIA) PVT. LTD

NO.1, Fifth Street, Dr. Radha Krishnan Salai,

Madras - 600 004 - India.

Phone: 8252772,

Telex: 41-6754, ADJ .IN Fax: 44 - 8257306.

CUTS COSTS NETS MORE OPTIMUM FEED FOR MAXIMUM YIELD.

CUTS COSTS NETS MORE OPTIMUM FEED FOR MAXIMUM YIELD.

CUTS COSTS NETS MORE OPTIMUM FEED FOR MAXIMUM YIELD.

stable and disintegrate rapidly result in feed waste, poor feed conversion ratio and water pollution. However, optimum water stability depends on the feed management ie. feeding frequency. The more the number of times the shrimp are fed the less is the required stability.

Size of pellets : The size of pellets is not related to the mouth size. As shrimp carry the pellets and swim around in the water, they should be small enough to be carried to the mouth and swim around in the water. Not more than 3 sizes are recommended viz. 1mm crumbles for post larvae : 2mm x 4mm pellets for juveniles and 2.5mm x 5mm pellets for adult shrimp. However, the smaller the particle size the more per unit weight would be available feeding a greater number of shrimp.

Feeding frequency : Shrimp should be fed several times of the day with the major portion of the ration being administered at night when they are most active.

Table 2: Time and % of ration to be fed daily *

Time	% to be fed
6.00 AM	20 %
10.00AM	10 %
2.00 PM	10 %
6.00 PM	30%
10.00 PM	30 %

* Subject to change as per convenience

As dissolved oxygen concentrations are very low during mid night hours it is advisable not be feed between 10.00 PM to 6.00 AM.

Ration size : The amount of ration to be fed daily is not a fixed amount and should be modified according to the age and size of shrimp. Recommended ration sizes are given in Table 3.

Feed management should be regulated by feed consumption as shrimp appetite will vary according to environmental conditions ie. water quality and physiological stage (disease and moulting) of the animal . Feeding trays (Fig.1) can be used to help in monitoring feed and the number of trays varies with the farmers ability to monitor. Generally 4-6 feeding trays/hectare are recommended with a minimum of 3 trays/pond regardless of ponds size. The location of the trays is important as areas before aerators should be avoided.

The feed in trays should be consumed within 1-11/2 hour after feeding in the case of adult shrimp and within 2 hours in the case of juvenile shrimp. If the feed is exhausted earlier the ration can be increased by about 5% of the total allowance/meal at each time. As feed

Table 4: Estimated daily feed allotment for shrimp of two stocking densities A and B. A = 5 per m^2 with estimated production of 1.2 tonnes and FCR of 1.4. B = 10 per m^2 with estimated production production of 2.5 tonnes and FCR of 2.0

Weeks of culture	Weight of shrimp (gms)	Survival (%)	Ration size (%)		Feed quantity (kg/day)	
			A	B	A	B
6	0.5	90.0	10	15	2.3	6.8
12	1.0	88.9	8	15	3.6	11.6
18	1.5	87.9	6	10	4.0	13.2
24	2.5	86.8	4	9	4.3	19.5
30	3.5	85.8	3.8	8	5.7	24.0
36	4.5	84.7	3.6	7	6.9	26.7
42	6.0	83.7	3.4	6	8.5	30.1
48	7.5	82.6	3.2	5.5	9.9	34.1
54	9.0	81.6	3.0	5.0	11.0	36.7
60	11.0	80.5	2.8	4.5	12.4	39.8
66	13.0	79.5	2.6	4.0	13.4	41.3
72	15.0	78.4	2.5	3.8	14.7	44.7
78	17.0	77.4	2.4	3.5	15.8	46.1
84	19.5	76.3	2.3	3.3	17.1	49.1
90	22.0	75.3	2.2	3.0	18.2	49.7
96	24.5	74.2	2.2	2.8	20.2	50.9
102	27.0	73.2	2.1	2.6	20.8	51.4
108	30.0	72.1	2.1	2.5	22.7	54.1
114	33.0	71.0	2.0	2.4	23.4	56.2
120	36.0	70.0	2.0	2.3	25.2	58.0

Table 3: Recommended ration sizes * (% body weight/day)

Stage	Supplementary feed	Complete feeds
Post larvae	10-4.0	15-8
Juveniles	4-2.5	8-4
Adults	2.5-2.0	4-2

* to be used as guidelines only

consumption may vary within a day due to environmental factors and condition of shrimp it is desirable to monitor it at each feeding.

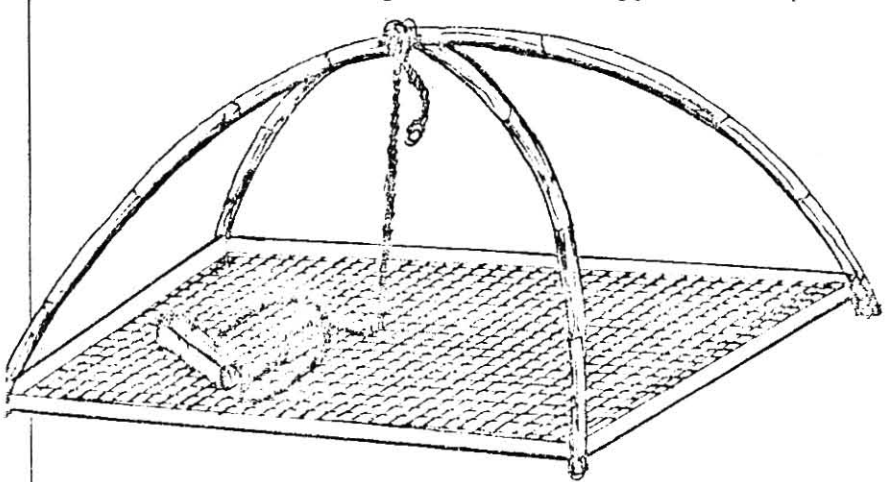
The amount of feed to be given at each feeding is dependent on the biomass present (total weight of animals). The exact estimates of shrimp weight and survival are difficult to obtain, but may be obtained by sampling from the feeding trays for small prawns and by cast nets for larger ones. If a pond contains 30,000 animals weighing 9 gm on an average and the recommended ration size is 4% per day, the amount of feed to be given daily is -

$$\frac{30000 \times 9 \times 4}{100} \text{ x } 10800 \text{ of or } 10.8 \text{ kg/day}$$

The per cent of biomass to be fed is not a fixed amount, but decreases as the animal grows to reflect the decreasing metabolic rates and ratio of weight of feed/day to animal weight (biomass) is high at the start of the growth period and lower towards the time when they reach marketable size. Survival rates may be calculated by taking 90% at stocking (10% mortality due to stocking stress)and 70% at harvest, so survival is reduced evenly each week to that expected at harvest. (Table 4). However it is best to monitor feed by consumption than by calculation.

The feed conversion ratio (FCR) is affected by feed management and feed quality. A feed can be of superior quality, but if improperly managed, the FCR will be high (poor). On the other hand, while feed management may be excellent and feed quality inferior the FCR will decrease (be better). Evaluation of feed quality may be monitored by impartial analysis ie. nutrient analysis, pellet water stability and hardness, attractability etc. but feed management is subjective.

Properly managed feeds improve shrimp production and increase profitability. However, overfeeding reduces profits and increases mortality. Uneaten food increases the food conversion ratio, thereby increasing the cost of production and decreasing profits. Most important, uneaten food will pollute the water and pond bottom. These in turn will cause stress to the prawn resulting in reduced shrimp growth rates, increased susceptibility to infection and death. If prawn are slightly underfed, they'll grow slowly but not die. Therefore, overfeeding is more problematic than underfeeding.



IFL's 'Shrimpro' feed proves mettle

Bangalore: International Fisheries Limited, a subsidiary of the Tata Oil Mill Co Ltd, Bangalore, is one of the few companies which was striving for manufacturing quality shrimp feed. The company is marketing "Shrimpro" brand prawn feed. Rising to the expectations of aquaculture

Mr G S Sabnis

farmers, the company is manufacturing four varities of feed basing on the growth of prawn. They are starter, grower, finisher, popular shrimpro and now introducing premium feed.

Talking to ***Fisheries World,*** Dr G S Sabnis, Manager of the company, said the company's highly advanced R & D department is undertaking extensive trials to produce premium quality of shrimp feed to ensure rich nutrients, liberally fortified with vitamins, minerals and attractants. The reseults after using "Shrimpro" brand feed have proved that the quality feed always gives high yield.

He said special technology has made pellets underwater stability hence macro and micro nutrients do not leach easily. IFL is taking measures for good packing to ensure upkeeping the quality in transmit and storage.

Dr Sabnis expressed the hope that the aquaculture industry will flourish in the years to come and India could produce 2 lakh tonnes of cultured shrimp by 2000 AD. He wanted the seafood exporters to maintain international quality standards to keep up image of Indian shrimp.

Underscoring the need for setting up of more processing plants in the country, he said there is much demand for value-added seafoods in the international market but it should be tapped in a proper way.

Role of artificial diets

Natural food organisms remain the major food sources in semi-intensive culture. The role of artificial diets is vital in intensive culture.

Prof.K.Madhusudhana Rao,
Nava Bharat Enterprises,
Hyderabad.

One of the most important operational functions in shrimp culture is the provision of adequate food supply to ensure that the cultured animals attained the desired harvesting size within the targetted time frame. Feed is among the largest operational cost of shrimp farming and every efforts should be made to ensure efficient utilisation of feeds for growth. It is, therefore, necessary to have adequate knowledge on the feeding habits and behaviour of the cultured organisms, their nutritional requirements and efficiency in dietary protein conversion for growth. Traditional shrimp farms in most Asian countries employ extensive culture operation in which the growth of shrimps fully depends on natural food organisms. In semi-intensive culture operation, supplementary feeds are given while natural food organisms remain the major food source. In intensive culture operation, shrimp growth is completely dependent on artificial diets.

Feeding behaviour : In the natural habitat, shrimps feed on other small crustaceans, finfish, molluscs, polychaetes, ophlufolds and other slow-moving benthic organisms. They catch food with their pereiopods, take to their buccal-cavity and nibble slowly. They are omnivorous but cannibalise if food is insufficient or of poor quality. They are also scavengers, feeding on any kind of decaying matter available in the habitat.

Natural food in pond: Natural food organisms are allowed to grow in well prepared pond fertilised with organic or inorganic fertilisers. These food organisms in the form of benthic blue-green algae, diatoms green algae and various species of microscopic zooplankton and microbenthos serve as the natural food of the cultured shrimp. The nutrient composition of the major natural food organisms growing within ponds is shown in Table 1 The main types of natural food predominate in shrimp ponds are:

(a) **Lablab** - This is a kind of microbenthos composed of bluegreen algae, diatoms and other microscopic plants and animals. In the Phillippines, shallow brackishwater ponds below 40cm are heavily fertilised to grow lablab for the culture of milkfish. However, lablab is also providing natural food for shrimps. Growth of lablab requires higher salinity which is not conducive for growth of the tiger shrimp. However, lablab is used as natural food for the post-larvae and juveniles in the first two months after stocking.

(b) **Lumut** - This is composed mostly of filamentous algae such as Chaetomorpha which are also growing in milkfish ponds. The lumut can be grown in low salinity compatible with the growing conditions for shrimps. Other living organisms attached to the lumut are also eaten by the shrimps. Herbivorous fish are often stocked to control the density of lumut in the pond.

(C) **Phytoplankton** :- Fertilisation in pond promotes growth of microscopic plants known as phytoplankton. These primary producers serve as the main food of zooplankton and benethic organisms which in turn become the food of shrimps. The presence of yellowish-green colour in pond water signifies good growth of desirable panktonic organisms, organisms conducive for shrimp growth. Other sources of food for the shrimps include macrophytes such as *Najas graminen* and *Ruppia maritima* which thrive at low salinities. These grow in abundance promoting also the growth of numerous benthic organisms attached to the plants. The shrimps grow well in pond with prolific growth of these plants since the shrimps feed on the benthic organisms as well as the decaying parts of the plants.

Supplemental feeding : As the shrimp grow, consumption increase and the natural food in the pond becomes insufficient. Thus, many shrimp farmers provide suplemental feeds. The types of feed used are:

Moist/wet feeds - These are freshly prepares feeds using locally available ingredients. The feeds should be given fresh immediately after preparation. However, these could also be frozen and thawed when needed. The commonly used feeds include the following :

- Rice bran with trash fish
- Carabao and cattle hides, house discards/leftovers (hide are cut into left pieces, attached to sticks and distributed in the pond)
- Chopped toads and frogs
- African snails with shells crused
- Mussel and calm meat
- Snails from the ponds with shells

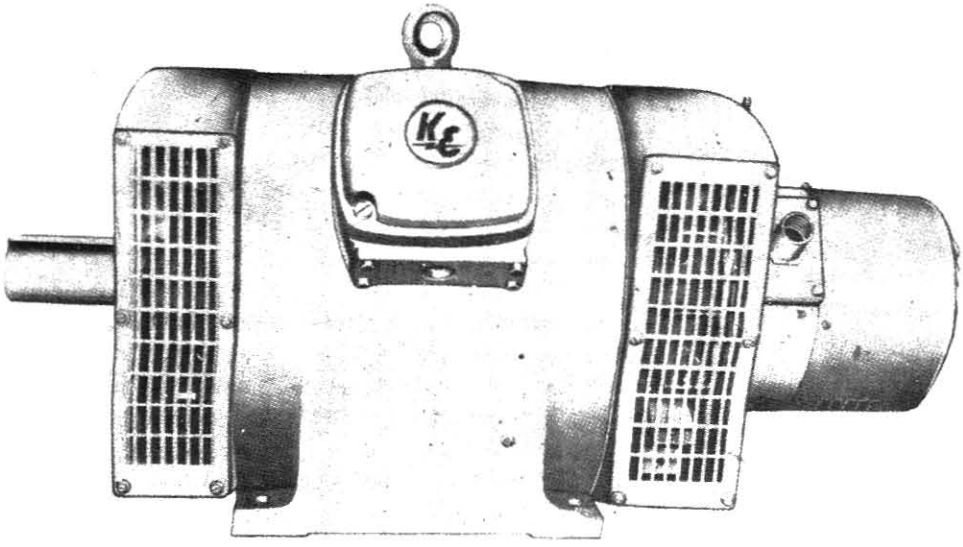
Table I

Nutrient composition of natural food commonly found with ponds.

	% Dry Matter				
	Crude Protein	Crude fte	Crude fiber	ash	Nitrogen-free extract
Lablab	6.73	0.86	5.27	74.38	12.77
Limit,	15.26	2.17	15.07	31.39	36.09
Najas graminen	18.38	2.43	18.73	23.88	36.58
Ruppia maritima	15.38	3.70	17.26	14.24	49.49

KIRLOSKAR SLIPRING MOTORS FOR AQUA FEED MILLS

Kirloskar



- ✳ **Built-in reliability**
- ✳ **Suitable for continuous duty**
- ✳ **Sturdy construction**
- ✳ **Best after-sales service**
- ✳ **Early delivery**
- ✳ **Attractive prices**

Authorised Distributors

Sieberg Sales Pvt. Ltd.,

12-10-2, Convent Street,
Vijayawada - 520 001. Phone: 422313, 424253.
H.O: 5-4-187/7, M.G. Road,
Secunderabad- **Phone : 822610, 823441.**

SIEBERG

'President' feed a proven product

Nava Bharat Enterprises Ltd (NBEL), a Hyderabad-based company, is marketing 'President' brand shrimp feed manufactured by renowned President Enterprises Corporation, Taiwan. The NBEL is also setting up an integrated shrimp project at Momodi, Chillakur mandal, Nellore district, Andhra Pradesh with the technical assistance from President Enterprises Corporation.

Explaining the salient features of 'President' brand shrimp feed, Prof. K Madhusudhana Rao, Chief Executive of NBEL said the feed is known for its quality and proven its efficiency all over the world. The 'President' feed is being supplied to 100% EOUs and farmers for tiger prawn in extensive and semi-intensive systems and giant fresh water prawn. The comany is also distributing hatchery feeds and fish feeds.

Prof Madhusudhana Rao

He said the feed has excellant water stability with special binders, rich in diverse macro molecules such as proteins, liquids and carbohydrates. The feed is blended with finest combinations of vitamins, minerals, trace elements, attractants, moult accelerating substances which meet the total shrimp nutritional requirements. The shape and size of the feed in the granular and pellet forms perfectly match the necessities during different stages of growth. Well balanced 'President' brand feed prevents cannibalism and boosts up the survival to maximum extent. The presentation and quality of the feed helps in cost economics by saving in labour, feed quantity, storage facilities and necessitates no usage of any additional supplementary feeds, he added.

Prof. Madhusudhana Rao said NBEL's shrimp project envisages 200 acres of grow-up farm, hatchery of 80 million (PL-20) capacity, feed mill of 6,000 MT per year and processing plant with a capacity of 100 MT per year. The NBEL is monopolising the distribution of 'President' brand shrimp feed in the country under an agreement with President Enterprises Corporation.

crushed.

Dry pelleted feeds-Pelieted feeds are available commercially to be used as supplementary or full feeds of shrimps. These are also prepared using locally available ingredients. A good pellet feeds not only should meet all the nutritional requirements of shrimp but also stable in water for a certain period of time. The feeds should have also a longer shelf-life. Usually, commercial pellets are brought in bulk and should be properly stored in storage room with low humidity to minimize fungi occurence and insect infestation. It is advisable to ensure rapid turn over of feed supply.

Tiger prawn culture requirements:

1. Water temperature :

Accute water temperature change should be avoided when stocking post larve into ponds.

Suitable temperature range 18-40 'C

Optimum temperature range 25-30 'C

2. Salinity :

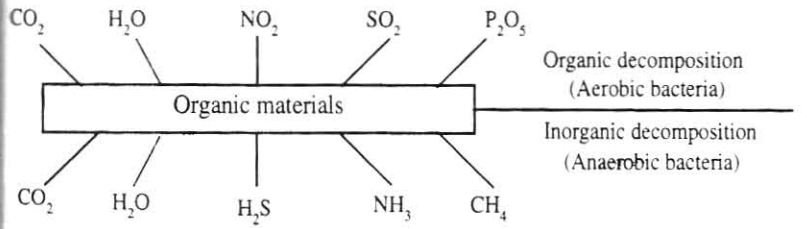
Sutitable salinity range : 4-45%

Optimum salinity range : 20-25% (for juvenile prawns)

10-15% (for large prawns)

3. Pond bottom:

Loam, clay, sandy loam, sandy and cement pond bottoms are generally used. Each type of pond bottom has a different capacity to decompose and absorb uneaten feeds, faces and dead planktonic organisms.



4. pH: Suitable pH : 7.5 - 9.5

Optimum pH: 8.0 - 8.5

5. D.O: Keep the pond bottom not less than 4 ppm

6. Water colour : Maintenance of light green or light brown colour.

7. Transparency: Keep 30 * 10 cm

8. NH_3 : Not more than 2 ppm

9. HNO_2 : Not more than 0.5 ppm

10. H_2S : Not more than 0.3ppm

11. Fe^{++}: Not more than 1ppm.

Natural food organisms remain the major food sources in semi-intensive culture. The role of artificial diets is vital in intensive culture.

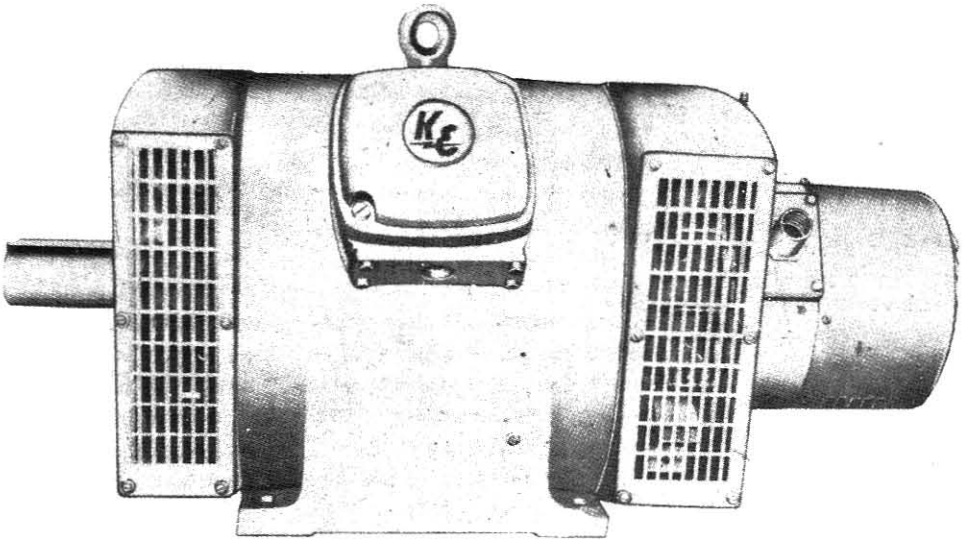
CLFMA to hold symposium

Vijayawada : The Compound Livestock Feed Manufacturers' Association of India (CLFMA) in association with MPEDA is organising a symposium on "Aquaculture : The New Horizon" at Hotel Ilapuram, Vijayawada, Andhra Pradesh on September 30, 1994.

Dr P U Verghese, Director, MPEDA, Dr Ronian, Dr Dean Akyana COMPFED, Mr T Kolp of Duhler India Ltd and Dr A Parthasarathy, consultant will speak on various subjects. Information regarding delegation and stall booking can be obtained from Mr R C Chandha, CLFMA, 404, Purnima Apartments, King Koti, Hyderabad.

KIRLOSKAR SLIPRING MOTORS FOR AQUA FEED MILLS

Kirloskar



- ✳ **Built-in reliability**
- ✳ **Suitable for continuous duty**
- ✳ **Sturdy construction**
- ✳ **Best after-sales service**
- ✳ **Early delivery**
- ✳ **Attractive prices**

Authorised Distributors

Sieberg Sales Pvt. Ltd.,

12-10-2, Convent Street,
Vijayawada - 520 001. Phone: 422313, 424253.
H.O: 5-4-187/7, M.G. Road,
Secunderabad- **Phone : 822610, 823441.**

SIEBERG