Production of tubifex - a new dimension of aquaculture in feeding juvenile fish

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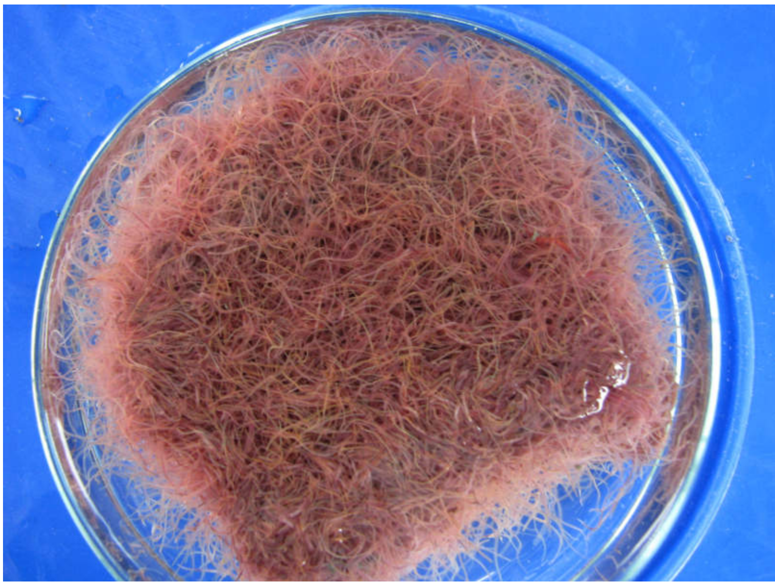
With the expansion of aquaculture, a variety of alternative, low cost feeds are being explored that are cheap to produce. Farmers are in need of appropriate food for spawn, particularly those of catfish species such as *Ompok* spp., *Mystus* spp, *Pangasius* spp., *Clarias* spp., and others such as climbing perch, *Anabas* spp. and murrel, *Channa* spp.

The use of sludge or 'tubifex' worm, *Tubifex tubifex*, as a live food for juveniles has been long practiced in farmers' fields. Behavioural studies have shown that catfish instinctively prefer to accept those food items which are easily detected and captured while swimming, moving or having any type of motility in the water bodies. Larvae are believed to be visual feeders adapted to capture moving prey. Also, the movement of live food is likely to stimulate larval feeding responses. Varieties of ornamental fish are commonly fed with tubifex worm. Tubifex worm is an important food item to freshwater intensive aquaculture throughout the world because of its high caloric value. Significantly, larvae of *Clarius batrachus* feeding upon tubifex had a higher survival rate and ten times more additional growth than those fed formulated fry feed. In such circumstances, a sincere effort is needed to develop the technique suitable to get a reliable supply of tubifex worm to be used as fish food at a large scale to sustain aquaculture, at least to catfish and ornamental fish farming.



Tubifex in a petri dish.

Fish farming and food

Ornamental fish farming has been recognised as an important trade internationally. Culture of catfish, murrels and climbing

A view of rectangular FRP tanks used for tubifex culture.

Harvesting tubifex.

Harvesting tubifex with nylon net.

perch are in array, particularly in Indian markets. These fishes, known as wild species, are now in demand due to their rich nutritional value, fewer bones, consumer preference and easy digestibility. Their increasing demand to consumers has attracted the attention of farmers for their extensive production. Present day aquaculture is drifting towards the culture of these fishes. With substantial nutritional properties, these fishes can easily be processed for preparation of a variety of value added products and different food items through the process of fortification. Fish farmers are aware of the commercial aspect of these fishes. Farmers need two basic items for their culture: (i) quality seed and (ii) suitable food for rearing of juveniles. Tubifex worm is one of the preferable live foods to feed them.

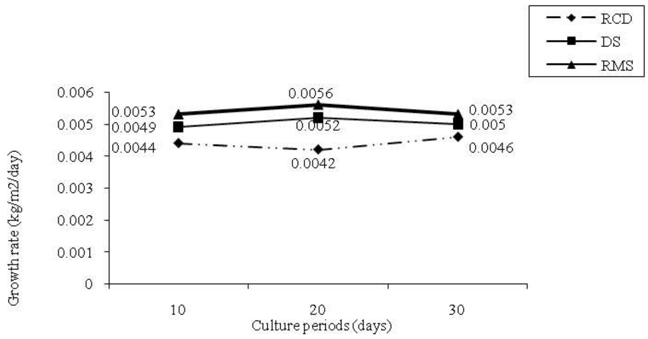
Why tubifex culture in captivity

Tubifex is found growing naturally in flowing water, particularly in sewage-fed water canals and in open drains. Tubifex has hitherto been supplied from collection of its population from such habitats. During summer, most of the open drains become dry and tubifex becomes scarce with market price becoming so high that common farmers are unable to afford it. There are also some problems in the collection of tubifex from the natural environment: (i) its collection is a most cumbersome task; skilled people can do it from very difficult zone, with risk of skin infection, (ii) lack of tubifex worm purity, and (iii) chance of transmission of fish pathogen from sewage fed water channels. Culture of tubifex in captivity is necessary to meet demand, provide a reliable supply and to assure human and animal health.

Advantages of tubifex culture

Tubifex is also known as sludge worm since it is found growing naturally in sludge loaded with organically rich substances. It grows in a wide spectrum of habitats, with a high level of biological oxygen demand. Its survival is, however, ensured because it is a very hardy organism and can withstand very low oxygen concentrations. On the other hand, there is a variety of wastes and by-products emanating from agricultural-based industries. These wastes along with cattle dung are available in huge quantities from dairy plants, rice mills, distilleries, breweries and food processing plants,

Harvested tubifex.



Growth rate (kg $m^{-2}day^{-1}$) of tubifex biomass treated with different wastes at 10, 20, 30 days culture.

etc. There is ample scope to utilise these wastes as nutrients to support the growth of tubifex. Culture of tubifex provides scope to utilise these wastes as food resources.

Procedure of culture

Selection of wastes

Waste substances were selected based on the easy availability and convenient distance of spective plant units from the Regional Research Centre of CIFA, Kolkata. Raw cattle dung, dairy sludge and rice mill sludge were collected and brought to the wet laboratory of the centre. Known as a suitable organic manure traditionally used in aquaculture, raw cattle dung was used as a food resource after decomposition with water before its use. Dairy sludge was considered as potential food resource in this experiment. After processing of different milk products, dairy effluent is drained out and stored in a large container exposed to the direct sunlight to avoid contamination. This semi-solid substance, stored oxidised dairy effluent, was collected from Metro dairy plants. Rice mill sludge is utilised as organic manure in paddy fields. Rice mill plants produce waste effluent after par boiling of paddy grain. The waste effluent is drained out into marshy places for its temporary storage. Organic substances from the waste effluent are suspended, resulting in a dark brown thick layer of organic matter that was utilised in this experiment.

Experimental design

Three time periods such as 10, 20 and 30 days were conducted separately for this production. Raw cattle dung, dairy sludge and rice mill sludge were tested in respective treatments, each with three replicates. A total of nine FRP tanks were established for each time period, with the 10 day period tests carried out initially, followed by 20 and 30 days. Each tank (2.4 m x 0.67 m x 1.0 m) was manufactured in a specific design with both inflow and outflow facilities. Inflow systems were made with a hole in the width side of tank whereas the outflow system was made in the floor of the opposite side. The hole of outflow was raised to 10 cm height through a plastic pipe adjusted with it. The inflow system was connected with a common PVC pipeline with individual regulatory tap to control water flow. Water was supplied at 0.75 litres per minute initially to avoid the erosion of base media, later raised to 1.2 litres per minute continuously.

Base medium, inoculum, and food substances

The floor of each tank was covered with soil mud containing sand, silt, clay and organic manure. The mud used as base medium was sieved through fine mesh nylon net in order to eliminate coarse and rough materials and allowed to be consolidated, with thickness of 2.0 cm. 100 g of tubifex @ 62.5 g per square metre was inoculated uniformly in each FRP tank covering the entire area. Wastes were applied as feed in each tank two hours after application of inoculum. Each waste (dry weight basis) was applied @ 4.0 g per gram of tubifex on a daily basis. 4.0 kg (4 g of waste × 100 g of inoculum × 10 days) of each waste was utilised for each treatment in 10 days culture. However, for 20 and 30 days culture, the amount of feed provided to the tubifex was adjusted every tenth day based on tubifex sampling in the FRP tanks.

Harvest of tubifex

Tubifex was harvested after the specified time period. Water from each tank was drained via the outflow system. The base media was segmented into five to six parts. The entire content of each part was put in mesh nylon net and washed with water. In the process, base media was sieved through the nylon net, leaving behind tubifex biomass within. Biomass was then collected and put in a beaker with fresh water. This process was continued until the entire biomass of each tank was harvested.

Evaluation

Production

Tubifex biomass production in all the three treatments was found significantly ($P<0.05$) different within respective culture periods. Net biomass production of all three experiments showed that rice mill sludge had the highest efficiency, with dairy sludge the second best and raw cattle dung the poorest.

The most efficient culture period was found to be 20 days of culture for both dairy sludge and rice mill sludge fed treatments ($P<0.05$), producing the most biomass. The growth rate of the same treatments declined thereafter, which was recorded at 30 days culture. On the contrary, the growth rate in the raw cattle dung treatment after 20 days of culture was found to be the poorest ($P<0.05$), but 30 days culture was the most efficient for the dung treatment ($P<0.05$).

Composition of tubifex

Carcass composition (% w/w basis) of harvested tubifex showed that rice mill sludge fed tubifex contained the highest amount of protein (6.38), crude lipid (3.02) and ash (2.98), followed by dairy sludge (protein 5.87, crude lipid 1.29, ash, 2.58) and raw cattle dung (protein 4.02, crude lipid 0.85, ash, 2.43) fed tubifex, respectively.

Tubifex culture – few important issues

Waste substances

Different workers have conducted tubifex culture using mustard oil cake, wheat bran, soybean meal, lettuce leaves and cow dung. All of these resources used as food substances for tubifex culture have substantial market price and need to be procured. The majority of fish farmers want

Dr. Meena Kumari, Former DDG (FY), ICAR observing tubifex production.

cheap substances which are easily available. Farmers find difficulties when any resource utilised for fish culture is costly one. However, both dairy sludge and rice mill sludge are easily available in huge amounts in respective production units and have also been found to be effective food substances for production of tubifex. Use of the waste substances is economical since no monetary transaction is involved.

Duration

Tubifex is considered as an essential food item. The duration of culture is an important factor for obtaining desirable product with optimal quantity in convenient time. The present experiment advocates 20 days as an ideal period for obtaining optimal production of tubifex subject to utility of dairy sludge and rice mill sludge as food substances. Comparatively, this experiment shows that the best yield is achieved despite the reduction of a number of days in culture purposes, particularly in dairy sludge and rice mill sludge treatments. Longer culture periods can lead to lower growth rates. The shorter duration brings advantages like less time required for management in the production system, along with other recurring expenditures.

Conclusion

Tubifex is an important fish food for spawn rearing. This needs to be produced by utility of suitable methods that are economically viable. Two important matters are to be considered for this production system. The easy availability of resources used as food substances for biomass production; poultry litter and other by-products may be tested subject to their ready availability in adequate quantities and non-toxic nature. A short culture duration also important to minimise use of labour and reduce risk, and to maximise yield and save water and electricity.