A comparative study on the shrimp culture practices of *Litopenaeus vannamei* with automatic feeder and boat feeding technique along Karaikal region

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Abstract:
In seafood shrimp is given importance by several people around the world. Shrimp yield can be enlarged by applying recent modern farming techniques, it includes the strengthening of culture operation through regularise of their size, stocking density, aeration and formulation of the feed. If the shrimp is not consumed the feed properly, it leads to weakening the water and soil quality. So, using auto feeder which allows the shrimp farmers to feed in lesser quantity, more recurrent, and maintain the sanitation of pond. The present study was aimed to compare shrimp growth performance in culture ponds using automatic feeder and boat feeding ponds. The experiment was conducted from July to November 2016, in raja aqua farm, Karaikal. Two ponds (A and B) were assigned for the growth analysis. Each pond size is 4 ha area. Pond A selected for the evaluating the shrimp growth using automatic feeder and pond B using normal boat feeding technique. The final weight, feed intake, daily and total weight gain, and production yield increased for higher feed level, regardless the feeding period. Automatic feeder used pond showed the highest weight gain, FCR was very good compare to boat feeding pond. During culture period pond A showed the better FCR (1.2) and good growth (35grms). The suvival compare to Pond B , the pond A showed 2 percent higher. The total feed used in pond A is 5376kg and pond B is 6365 kg. the normal daily weight gain resulted in pond A and B is 0.25 and 0.20grams respectively. This study confirming that using auto feeder helped to increase shrimp growth rate and make shrimp healthier by living in the high water quality and were continuously fed. And also reduces risks from disease infections. This system has proved to have minimized feed and labour costs and thus maximizing profits for farmers.

Keywords: *Litopenaeus vannamei*, Shrimp culture, Automatic feeder, Boat feeding and FCR

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Introduction

Sea foods like shrimp are given importance by several people around the world and its farming has emerged to have noteworthy and considerable for foreign trade (Mathiesen, 2009). Many countries in the world contend to ensure their market determined, commercialize product globally and determined with quality guarantee at each stage of the distribute chain. In aquaculture, the culture was existed and reared either in a brackish or freshwater ecosystem for the higher manufacture for human uptake. The shrimp yield can be enlarged by applying recent modern farming techniques, it includes the strengthening of culture operation through regularise of their size, stocking density, aeration and formulation of the feed. It will increase financial and high technique inputs for the minor farmers in the emerging countries and it cannot be afford.

In India, especially in Andhra Pradesh the shrimp farming is extensively found and till the farmers are following traditional methods which include feed manipulation and cultural activities, etc. If the shrimp is not consumed the feed properly, it leads to weakening the water and soil quality (Phillips *et al*., 1993; Newport and Jawahar 1995). So, using auto feeder which allows the shrimp farmers to feed in lesser quantity, more recurrent, and maintain the sanitation of pond.

The Shrimp usually collects feed in their claws to keep the feed themselves and swim away. This will allow another shrimps to get a chance to catch their feed. However, shrimp gathers the food when they are in water. When the food reaches the bottom, it becomes unusable and it leads to decentralizing the water quality. Thus, the tactics of feeding affects the water quality and health of the shrimp (Cuzon *et al.*, 1982; Jorry 1995). By following traditional farming methods, the farmer has to throw the feed manually and cannot dispense feed for larger area. Therefore, shrimp will be challenged for feed causing violent behaviour leads to stress and get destroyed. Furthermore, the shrimp will not be able to eat the complete feed because the ratio of the feed distributed per time over certain area leaves some residues which results in settling down of food at the pond bedding resulting in declined water quality. When the feed is given similarly to all the shrimps, the broken shrimp sizes were doesn't any changes on them.

Around the world, the shrimp farm industries were facing aggregate task and pressure for dropping the broken shrimps and uphold the environment healthier for better growth of the shrimp (Naylor *et al*., 1998). The auto feeder was helps to reduce the broken size and also safeguards the better and improved growth of shrimp due to enhanced water quality and unceasing feeding. Water quality will slowly decreases the chances of death rate, thus provides larger profits with extra savings on man power and production costs. Furthermore, the feed with highest

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dressing enhancement can also be fed with auto feeder, but the feed must be air dried before putting into feed storage.

Distinct manual feeding, the automatic feeding helps not only achieve feeding more proficiently decreasing left over feed but reduces the labour costs. Any auto feeder responds to the questions of optimizing feed management efficiently, low feed conversion ratio (FCR), reduce cost, gain more productivity and maximize profits with minimal labour. It specifies the relationship between quantity of feed and effective feed distribution without disturbing the feeding practices.

An auto feeder is an automated system which has options to set frequency and quantity of feed by digital control, controlled by microcontroller installed in the machine. It is easy to use with a touch of a finger. Feeding system works on morning and evening time. Different feeding rate at different times of the day and night can be pre-set. It helps in excluding usage of labour at night-time. The types of feeds were different and the weight also varies among them to distress the spreading range for pelleted or powdered feed. More than six various sizes of feeds are available in Indian markets, where the feeders should comprise modification in their accuracy of control for pellets or powder form feed with abundant accurateness.

The feeder distributes the feed into a usually in a circular pattern in the pond. It assigns the feed in tiny but common doses preferably like rain water droplets and it permits the shrimp to catch the pellets previously it reaches the lowermost of pond. Spreading pattern and the diameter of the feed throw is exactly significant because the shrimp can take the feed in a competitive manner. So, manually throwing the feed by 5-10 metres or 14 to 20 metres is followed up to date in all ponds. When discussed with the farmers, the optimum situation is 14 metre throws is best for almost many farms. So that, each feeder can take up to 700,000 shrimp and it be contingent on the shape and size of the area of pond. After several years of trail running, the feed can be started from the 14^{th} day and its ideal for the shrimps to feed them.

Throughout first month, the feed is dispersed often and often, but in lesser rations due to shrimp feeding habits. Subsequently, progressively larger quantity failed with a greater gap is dispersed. Many of the feeders can operate round the clock in a day and we can check the feed tray anytime by checking the appearances of the left-over feed in the tray and the waste from shrimp. This evidence will help us to regulate the quantity of feed for the next meal. A common practice feeding shrimp should be followed for every 10 to 14 hours a day on usual food which includes feeding during night time is most advisable. The DO value will drop in the night time so it is desirable to add DO drops.

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Care must be taken by the farmers to consider shrimps health and regular monitoring is important in controlled percentage in order to increase the growth and viability, without over feeding. Shrimp aquaculture and farming is one of the business and they assure the increased manufacture during the harvest. Such requirements are so called as automatic feeders for controlled in time by varying the feeding system that can affects the growth of the shrimps. Almost all the shrimp farms, the feeding is completely by hand and it's a time-consuming process. The difficulties arise for shrimps by receiving diseases from unrestrained quantity of feeds, resulting to harmful harvests.

The arrangement is insensible in terms of provision in the feeds, with respect to time. It will allow adaptable feed quantity and period helpful in perpetuation of the shrimp's health because little portion of feeding at planned intervals and exact feeding at suitable times. It will also avoid the over spoiling by discharging the right amount of food, at programmed times and assures well fed, healthy shrimps. Hence, the current investigation was aimed to assess shrimp performance fed with using automatic feeder and boat feeding ponds.

Materials and method

This experiment was conducted from July to November 2016, in raja aqua farm, Karaikal. This farm located 15km away from Nagapattinam. Two ponds (A and B) were assigned for the growth analysis. Each pond size is 4 ha area. Pond A selected for the evaluating the shrimp growth using automatic feeder (Pond B normal boat feeding). In both culture ponds 1.2-meter water was maintained. Automatic feeder fixed in the end of the catwalk. Automatic feeders (Agostinho *et al.*, 2004) were programmed bestowing the breaks and predefined amounts for experimental design. They have a capacity to store 200 kilograms offered and they were supplied periodically according to feed consumption. Feeders were organized by a central power operated panel, installed outside the pond, including timers that handle the mechanism of feed supply.

The automatic feeder is planned in a right way, that feeders in aquacultures are programmed with digital intelligence to minimize the human energies to improve feeding methods. It helps the shrimp farmers to prevent feed and evade silt collected at the bottom of pond. The feed from an aqua feeder is spread in 12 to 40 meter radius. The comprehensive solution needs very less power to operate. Feeder is incorporated with zero crossing switching of loads to reduce the incoming currents during ON/OFF switching. The settings should not be disturbed when power fails or fluctuates. Once the setting is set manually by a user and it is saved, it lasts till that they can be overwritten by the users only.

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The feeder consists of mainly 3 areas: (a) Controller: A timer controls and allows the user to input the amount of feed and the time to disperse the feed, so that it allows the machine to work automatically. Feeder contains the holding drum which is made of plastic and lid to store and keep the feed. More details of the user interface used are described in the User Interface Design section. (b) Transferor: It is made of 4-watt synchronous motor. It releases feed from the holding drum in set amount. The spreading motor (35-watt feed dispenser) receives feed from the transferor and dispenses feed with speed of 2500 rpm. (c) Metal Legs: It handles weight from holding drum. Metal legs help position the machine to the desired location (Fig. 1).

Figure 1: Showing the system model

Automatic feeder is little bit weight and weighs about 15 kg and it makes very easy for fixing and control. Feeders motor consumes 50 watts only and its 10 -15 times lesser than the consistent auto feeder and it can consume around 220–240 watts. It can disperse at the maximum rate of 1.2 kilograms per minute and up to 2,000 times per day or every 45 seconds.

The shape of controller is planned and they are furrowed in their structure, so they can feed for all sizes and easily dispersed when the motor is ON. The feed dispenser has four pipes from which the feed will be thrown. The

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length of the pipes is varying for dispensing the feed ultimately across the pond.

The site of automatic feeder machine at the pond is exactly significant because it directly affects the proficiency of the machine and health of the shrimp. It is suggested to place the auto feeders at least 15 mts away from the aerators to evade strong water currents and the sludge area in the pond.

A solitary feeder can feed a little pond for about 1,000 m2 with a wide range of population to above 500,000 or overhead. Bigger ponds will need many auto feeders. Farmers should avoid overlying their distribution areas. In case of very long and narrow ponds auto feeders will be placed on the opposite end of each other. It is suggested to keep the auto feeder at least 45-50 cms directly above the water surface to cover the required area and works at its highest efficiency. The feed pellets are larger; it will cover larger area. Furthermore, shrimp farmers are very much considered about the feed type (whether it is crumbled or pelleted feed), different feed sizes, selection of brand, water solubility, etc.

Feeding tray is the traditional way for monitoring shrimp feeding. Two feeding trays per auto feeder were maintained. Each feeding tray was kept at above 15 cms above from the pond bottom to cover the broadcasted area. The first feeding tray was kept very close to the auto feeder, nearly by 1-2 mts away. The second tray was kept at 6 to 8 mts away from the feeder. Frequency, feed ration and time are adjusted by using feeding tray by observing and act as an indicator. Normally, feed ration can be adjusted by 2-3% depending on shrimp feeding, or feeding frequency modified. Theoretical shrimp weight and survival estimations are used as additional information for a more realistic feeding adjustment.

Advantages of Automatic feeder

- Feed conversion ratios (FCRs) increases by 30%
- Increases growth rate up to 30%
- Decreases the quantity of feed fed
- Reduces feed costs
- 80% of the labor costs was decreases
- Increases the harvest size of shrimp
- Increases the price you get for your shrimp
- Avoids leaching of nutrients
- Avoids degradation water quality
- Reduces the feed wastes from accumulating on the bottom of pond

Results

Growth Performance results obtained throughout the culture period was displayed in (Table 1). The final weight, feed intake, daily and total weight gain, and production yield increased for higher feed level, regardless the feeding period. Automatic feeder used pond showed the highest weight gain, although FCR was very good compare to boat feeding pond (Table 1).

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Table 1: During culture period pond A showed the better FCR (1.2) and good growth (35grms)

Details	A (automatic feeder)	B
Area (Ha)	0.4	0.4
Stocking Pcs	160000	160000
Density Pcs/m²	40	40
Stocking Date	05-July-16	05-July-16
Harvest Date	20-November-16	20-November-16
Culture Period	138	138
Harvest Size (GM)	35	28
Count(Pcs/Kg)	28.5	36
Shrimp Harvest (Kgs)	4480	3744
Survival %	80	78
Total Feed Used (Kgs)	5376	6365
FCR	1.2	1.7
ADG	0.25	0.20

From the present study, the daily amount of feed was based on body weight (2%, 3% or 4%) fractionated in several meals a day. This administration it may reduce the gastric overload, contributing to a better use of the feed (Fig. 2).

The suvival compare to Pond B , the pond A showed 2 percent higher. The total feed used in pond A is 5376kg and pond B is 6365 kg. the normal daily weight gain resulted in pond A and B is 0.25 and 0.20gms respectively (Fig. 3).

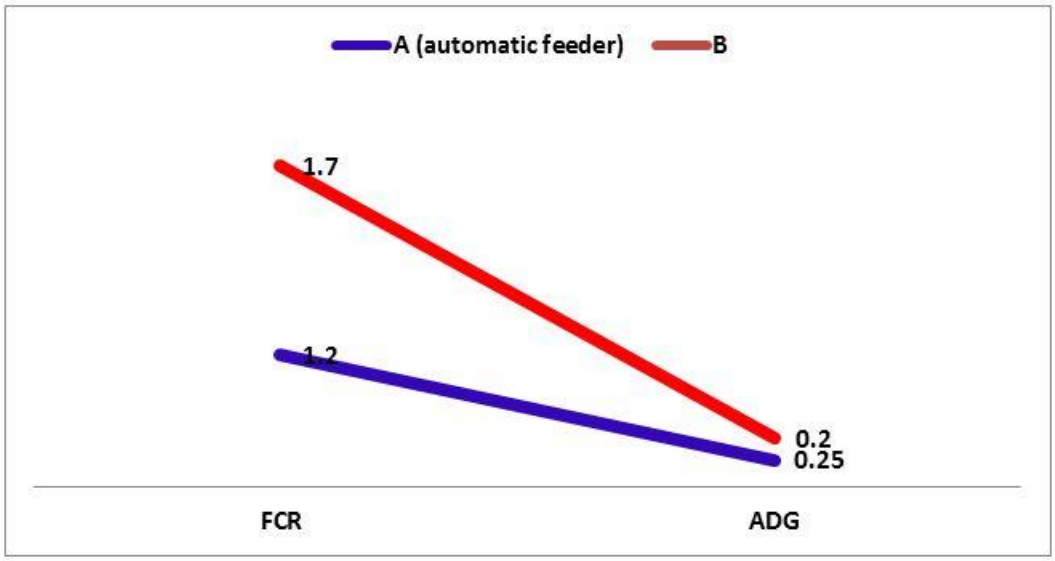

Figure 2: The graph shows the FCR of harvested ponds

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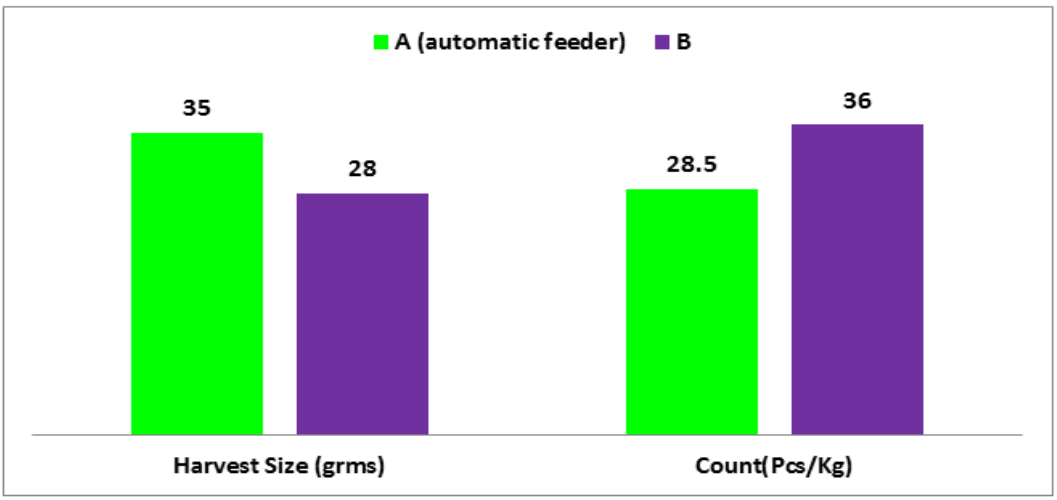

Figure 3: The graph displays the results of harvested ponds

Discussion

About 50% of the operational cost of shrimp farming comes from the aqua feed used. The shrimp feed descends to the bottom of ponds, and feeding accuracy cannot be visually monitored like in fish feeding. Feed necessities can changes daily because of weather conditions and water quality fluctuations. The use of automatic feeding technology has been widely spread in the last decade in South East Asian countries. In Thailand, there is auto feeder developed where shrimp is intensively produced.

More than half of total expenses in shrimp farming this leads to feed cost account. Therefore, benefits of using automatic feeder, apart from the feed expenses savings, are visible when compared to manual feeding. Manual feeding is the traditional method, which requires constant hand labour for multiple feeding applications. These feed generally are not fully consumed, results in weakening the water and soil quality.

The first use of auto-feeders in shrimp feeding was revolutionary. Earlier, it was thought that feed must be spread evenly in a pond so that all shrimp can feed optimally. But with auto-feeders, the shrimp learn to come to the feeders when they are hungry. An auto-feeder circulates little amount of feed irregularly in minutes. Much of the feed is trapped by the shrimp before it descends to the bottom of the pond. By using an auto-feeder, it will spread feed over an area of only 300 m^2 in a pond of 8,000 m^2 (Yong Thong, 2016). The growth, survival and feed conversion achieved good than the conventional method of dispersing the feed to all over the pond. In the present work the size of the both ponds is 4000m^2. Blue aqua international 2013 recommended the auto feeder can be set up at the completion of the feeding catwalk. In the present study, the auto feeder was placed at the end of catwalk.

According (Riche *et al*., 2004), when feed is delivered at regular intervals

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smaller than the time required for appetite return, gastric overload may occur, resulting in reduced absorption efficiency. From the present study, the feed consumption was good. Very limited work was supported for evaluating the shrimp growth using an auto feeder. But many works are carried out in fish ponds using auto feeder (Ng *et al.*, 2000; Romagosa *et al.*, 2000; Mihelakakis *et al.*, 2002; Barbosa *et al.*, 2005).

The present report shows that autofeeder pond1.2 and 1.7 feed conversion ratios by boat feed pond. Yingyuad *et al.* (2013) studied the 24 hours and 15 hours spreading of feed. But from the present findings, 24 hours feeding shows better results. In the present study, 10 hours shows good conversion ratio. The study concludes that, more efficient feeding management through feeding amount, effective feed distribution, and interval between broadcast adjustments enables a continuous shrimp feeding behaviour. For the prevention of feed waste accumulation at the pond bottom, the feeding management should ensure the lowest FCR and promotes shrimp growth. This latter is directly observed in larger average daily growth rates and shorter production cycles. A more common feeding enables a constant growth of all stocked shrimp, observed with lower broken size at harvest.

The automatic feeding reduces the oscillation of the most significant water quality parameters such as DO, ammonia and nitrites. Therefore, downward or upward peaks were not detected or significantly diminished. In overall, installing an automatic feeder ensures a healthier shrimp due to improved water quality and continuous feeding. Improving the water quality decreases the risks of death rate or disease outbreak, thus fetching larger profits with additional savings on labour and production costs.

This study confirming that using auto feeder helped to increase shrimp growth rate and make shrimp healthier by living in the high-water quality and were continuously fed. And also reduces risks from disease infections. This system has proved to have minimized feed and labour costs and thus maximizing profits for farms (Fig. 4).

Figure 4: Healthy harvested shrimps

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