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Quality assessment of fish feed used in different shing (*Heteropneustes fossilis*) farms of Muktagacha upazila in Mymensingh district

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ABSTRACT

A study was carried out on the quality assessment of fish feed used in different shing (*Heteropneustes fossilis*) farms of Muktagacha Upazila in Mymensingh District. A total of 10 shing feeds viz. as C.P, Nourish, Arab, Quality Feed, New Hope, Paragon, Chamok, Mega, Cherish and a Farm made feed were collected at monthly interval during February to April 2014. The samples were analyzed for proximate composition in the Fish Nutrition Laboratory, Department of Aquaculture, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. Growth data were collected from farms record book and analyzed later on. The moisture content of feeds varied from 13.96 to 10.57%. Lipid content varied from 10.38 to 2.69%. The highest 33.60% protein was observed in Quality feed and the lowest (25.9%) observed in Arab feed. The highest ash (14.09%) was observed in farm made feed and the lowest ash (8.50%) observed in New Hope feed. Crude fibre content ranged between 6.60 to 4.20%. The carbohydrate varied from 40.45 to 24.84%. The maximum final weight 68.96g was observed in C.P feed while the lowest 21.05g for Arab feed. The highest weight gain (63.63g) exhibited by C.P feed whereas the lowest (19.11g) for Arab feed. The highest SGR (70.43%) exhibited by C.P feed and lowest SGR (20.55%) exhibited by Cherish feed. The maximum Production 57.99kg/dec./90 days exhibited by Chamok feed while the lowest 26.25kg/dec./90 days exhibited by Arab feed. The best FCR observed was 2.97 by feeding C.P feed and the lowest FCR observed in 4.12 by feeding Mega feed. Survival rate was varied from 96.39 to 78.36%. The maximum Benefit Cost Ratio (BCR) 2.81 and the minimum 0.89 was found with Abu Suffian Khan farm and Sabuj farm respectively. The results of the present work will be very much helpful to fish farmers for feed selection and bargain with the feed traders to select suitable feed for their fish to ensure profitable aquaculture operation.

Introduction

Fisheries sector also plays an important role in rural employment generation and poverty alleviation. Aquaculture production is increasing remarkably day by day. Aquaculture contributes 50% of the total inland fish production (capture and culture) is important in Bangladesh for food security of the fish eating nation (DoF, 2012). Aquaculture is also creating employment opportunities for both the urban and rural people. Bangladesh produced a total of 30, 61,686 MT of fish in 2010-11 and it was 28,99,198 MT in 2009-2010 (DoF, 2012). Bangladesh achieved a rank of 5th position among the top 20 aquaculture produced countries in the World (BBS 2010). It has been considered as the fastest growing food sector in the World.

The air-breathing catfishes, stinging catfish (*Heteropneustes fossilis*) is very popular and high valued fish in Bangladesh. This fish is locally known as Shingi or Shing. It is considered to be highly nourishing, palatable, tasty and well preferred because of its less spine, less fat and high digestibility in many parts of Indian subcontinent (Khan et al., 2003). The species compared a very high content of iron (226 mg 100g-1) and fairly high content of calcium compared to many other freshwater fishes. Due to high nutritive value, the fish is recommended in the diet of sick and convalescents. It is a very hardy fish and can survive for quite a few hours outside the water due to presence of accessory respiratory organs. It can tolerate slightly brackish water.

Two types of culture systems have been practiced in Bangladesh for shing farming: monoculture (following intensive culture strategy) and poly culture (following semi-intensive culture strategy). During the last few years rapid development of farming is achieved in Mymensingh District of Bangladesh. Farmers have been converting their rice fields into shing farms for quick profit. In recent years, shing has become one of the most popular commercial cultivable species due to its high market demand and price.

Aquaculture production largely depends on the quality of feed. Fish feed and feeding play important roles in sustainable development of aquaculture. Improved feed composition and better-feed efficiency results in higher fish production, lower feed cost and low waste production. A nutritionally

balanced feed and adequate feeding are important factors that help to maximize fish production and profitability. Inappropriate feed and feeding strategy could result in environmental degradation, disease outbreak, poor growth and high mortality of fishes in the farm. Aqua feeds must satisfy the nutrient requirements of the cultured species in terms of protein and essential amino acids, lipid and essential fatty acids, energy, vitamins and minerals. Farmers as well as different companies are producing feed which may not contain appropriate nutrient composition for shing as they have no quality assessment system. On the other hand, one of the major problems in Bangladesh arises due to the fact that most raw materials that comprise aqua feed such as fish meal, meat and bone meal, maize, wheat, and soya meal are imported from different countries. Thus, it is very difficult for a feed manufacturer to keep continuous track of each raw material consignment. The problem is further aggravated by the lack of proper technologies for processing the raw materials. Feed quality in Bangladesh is thus generally variable. Fish farm owner's use both farm made and company produced feed. Farm made feed cost less than the company produced feed. Farms produce their own feed in different qualities according to their need. Therefore, it is crucial to know the nutritional requirements particularly protein, carbohydrate and lipid for optimum growth of a fish species as well as in formulating a balanced diet. With increasing demand and market value of aqua feed, farmers are defrauded by some dishonest manufacturer, trying to increase the volume of feed mixing with different adulterants such as sand, dust, lime etc. There is no evaluation of the stated nutritive value of' fish feed produced by different feed industries in our country at the users level. The farmers have, to depend only on the existing information provided by the companies, about the feed composition and growth performances. From the economic point of view, feed cost appears to be one of the major constraints against the expansion of aquaculture. Therefore, it is an urgent need to assess the actual chemical composition of the commercial fish feeds available in the market and the feed produced in the farm for getting better production. Fish production has increased in Mymensingh region but the supplied fish feed composition was not satisfactory. Fish feed manufacturer deliver their products as per farmers demand except quality maintenance. It is great importance to the fish farmers to utilize their investments in feed as optimal as possible. The study was undertaken to determine the proximate composition of aqua feed used by selected farmers at different shing farms of Muktagacha Upazila in Mymensingh district and to assess the growth performance of the shing, FCR and economic return by feeding different feeds.

Materials and methods

Study area

Many shing fish farms have been constructed in the Muktagacha Upazila with in last decade. Therefore the study was conducted at Basati and Kheruajani Union of Muktagacha Upazila of Mymensingh district.

Collection of feed samples

Quality assessment of commercial and farm made feed used in different shing farms was conducted for the period of three months from February to April, 2014 to determine the nutrient availability in the feed to have sustainable fish production. Feed samples were collected from 10 catfish farms owned by Abu Sufian Khan, Kamarujjaman, Shahin Talukdar, Rabi, Abul Miah, Salim Hossain, Abu Hanif, Saddam Ali, Sabuj, Munjurul Islam Khan. The farm owners used C.P, Nourish, Arab, Quality Feeds, New Hope, Paragon, Chamok, Mega, Cherish, and a Farm made feeds respectively. Collected samples were kept in a refrigerator in the laboratory, then the samples were analyzed for proximate composition on a later date. Before starting the experiment farmers were motivated to keep a registrar, recording all about farm activities like growth performance data of fish and economic input-output data. The growth performance data as well as input-output data were collected from the farm’s record book.

Sample preparation and analysis

The samples were taken from the refrigerator and kept to the room temperature for few hours. Then the required amount of samples was finely ground by a small mortar and kept it airtight container for subsequent chemical analysis. The analysis of feed was carried out in the Fish Nutrition Laboratory of the Department of Aquaculture in the Faculty of Fisheries, Bangladesh Agricultural University (BAU). The proximate composition of different fish feeds were analyzed in duplicate according to the standard procedure given in Association of Official Analytical Chemists (AOAC, 2000).

Growth parameters and economic analysis

Every month interval, growth in weight (g) was measured. The weight gain (g), specific growth rate (SGR % day), feed conversion ratio and production (Kg/dec/90days) was measured to evaluate the growth of fish. Feed conversion ratio (FCR), Survival rate, Production/ yield and economic analysis including fixed cost, operating cost, total cost, revenue income and net profit were calculated and evaluated.

Results and discussion

Growth of fish and other aquatic animals are primarily dependent upon an adequate supply of nutrient both in terms of quantity and quality irrespective of the culture system in which fish and animals are grown. Therefore, supply of inputs (feeds, fertilizers etc.). Now-a-days commercial fish feeds are widely used to get more production. Side by side farm made feed prepared from available ingredients by the farmers themselves are also in practice.

Nutritional quality of different shing farm's feeds

Moisture %

The moisture content was found 11.91, 12.26, 13.96, 13.41, 13.29, 13.47, 10.57, 12.10, 11.28, and 12.27% in C.P, Nourish, Arab feed, Quality Feed, New Hope, Paragon, Chamok, Mega, Cherish, and a Farm made feed respectively. A variation was observed among different types of shing feeds, in case of moisture content. The highest (13.96%) moisture was observed in Arab feed and the lowest (10.57%) moisture was observed in Chamok feed. The second highest (13.47%) moisture was observed in Paragon feed and the second lowest (11.28%) was observed in Cherish feed (Table 1). The moisture content of all the feeds was higher than the standard value of ≤ 10%. Some variation was observed among different types of Shing feeds in case of moisture content. Some of the parameters studied lies between desired values and some deviated from the desired values. The highest (13.96%) moisture was observed in Arab feed which was similar (13.47%) to Paragon feed, whereas medium value (11.91%) was observed in C.P feed and Mega feed (11.28%). The lowest (10.57%) moisture was found in Chamok feed. The moisture content of all the feeds was higher than the standard value of ≤ 10%. Seenapa et al. (1991) found that a diet containing 9.9% moisture was optimum for the growth of catla fry. Roy (2002) reported that a diet containing 9.8% moisture were more suitable for GIFT tilapia.

Crude lipid %

The lipid content was found 2.69, 9.59, 8.95, 10.38, 9.7, 9.78, 9.59, 7.51, 7.55, and 8.00% in C.P, Nourish, Arab Feed, Quality Feed, New Hope, Paragon, Chamok, Mega, Cherish, and a Farm made feed respectively. A variation was observed among different types of shing feeds, in case of lipid content. The highest (10.38%) lipid was observed in Quality feed and the lowest (2.69%) lipid observed in C.P feed, which seems to be very low (Table 1). The lipid content varied between 10.38 and 2.69%. The high lipid value of Quality feed, Nourish feed, New Hope feed and a farm made feed might be due to the use of high amount of oil meal/cake in formulation procedure. The maximum (10.38%) lipid content was found in Quality feed which was very close to Nourish feed (9.59%) as well as New Hope feed (9.7%). The minimum lipid content (2.69%) was found in C.P feed, which seems to be very low. The present finding is higher to the findings of Wilson (2000) who reported that lipid level in catfish feeds should be 5 to 6%. Luquet (2000) stated that dietary lipid levels of 5 to 6% are often used in tilapia diet. Singh (1991) reported that the optimum lipid requirements of Indian major carp were determined to be 4-6%. Akand et al. (1991) found that SGR, and weight gain (%) were significantly high ($P<0.05$) in *H. fossilis* fed 10% lipid diet but at highest SGR and weight gain (%) were obtained with the diet containing 5% lipid.

Crude Protein %

The crude protein content was found 26.96, 29.76, 25.9, 33.60, 32.35, 32.21, 31.86, 27.3, 26.25, and 27.66% in C.P, Nourish, Arab Feed, Quality Feed, New Hope, Paragon, Chamok, Mega, Cherish, and a Farm made feed respectively. A variation was observed among different types of shing feeds, in case of crude protein content. The highest (33.60%) protein was observed in Quality feed and the lowest (25.9%) protein observed in Arab feed (Table 1). For young catfish like shingi protein content should be at least 30% of the feed, some of the value seems to be inferior. The crude protein content ranged from 25.9 to 33.60% in case of commercial feed and a farm made feed respectively. Fish feed traders of this region has been selling this type of feeds in ample although the quality of feeds are mostly unknown to fish farmers. The highest (33.60%) protein content was observed in Quality feed and the lowest (25.9%) protein content was obtained in Arab feed. Protein is the major nutrient for growth. The protein requirement of fish is influenced by various factors such as fish size, water temperature, feeding rate, availability and quality of natural foods, overall digestible energy content of diet (Wilson, 2000 and Hepher, 1990) found that most fishes required 35-50% protein in their diets. Lall (1991) found that protein requirements of common carp, grass carp and tilapia were 31-38, 41-43 and 30-40 % respectively. Wilson (2000) reported that most of the commercial catfish feeds contain 32% crude protein. Li et al. (1991) found that diet containing 25.7% protein, meet the requirements of amino acid for juvenile Nile tilapia. Roy (2002) reported that a diet containing 27.87% protein appears to be more suitable for GIFT tilapia. Mollah and Hossain (1990) reported that 39.5% protein appeared suitable for rearing of *C. batrachus.* Begum et al. (2008) found that the feed at a level of 40% protein was most effective in changing the growth and maturity of *M. gulio.* The protein (%) content of the feeds was less than the standard (35-50%) for carnivorous fish as prescribed by (MOFL 2004). Different manufacturer maintained less protein (%) and low quality protein to make the feed cost effective as farmers wanted. Furthermore, farmers often could not get sustainable or high fish production, therefore, they would like to buy low cost feed for cost effective production. Moreover, the causes of less protein (%) might be due to the low quality of raw material as well as quality fall due to storage facilities and manufacturing process.

Ash %

The ash content was found 12.59, 12.26, 10.00, 13.37, 8.50, 10.56, 8.54, 12.71, 12.67, and 14.09% in C.P, Nourish, Arab Feed, Quality Feed, New Hope, Paragon, Chamok, Mega, Cherish, and a Farm made feed respectively. A variation was observed among different types of shing feeds, in case of ash content. The highest (14.09%) ash was observed in Farm made feed and the lowest (8.50%) ash observed in New Hope feed (Table 1).

Ash content of all the feed were found within the acceptable range. The ash content of the feeds used was ranged from 14.09%, to 8.50%. The highest (14.09%) ash noted from a farm made feed and the value is close (13.37%) to Quality feed. The lowest (8.50%) ash content was estimated from New Hope feed which was similar (8.54%), to Chamok feed. Paragon feed (10.56%) and Arab feed (10.00%) stands at the middle. Results revealed that the ash content of commercial as well as farm made feeds was in the acceptable range of the recommended value.

Crude fibre %

The crude fibre content was found 5.40, 4.60, 6.50, 4.40, 4.70, 4.20, 4.50, 6.35, 6.60, and 6.70% in C.P, Nourish, Arab Feed, Quality Feed, New Hope, Paragon, Chamok, Mega, Cherish, and a Farm made feed respectively. A variation was observed among different types of shing feeds, in case of crude fibre content. The highest (6.60%) crude fibre was observed in Farm made feed and the lowest (4.20%) crude fibre observed in Paragon feed (Table 1). Fiber content varied among different Shing feeds from 6.70 to 4.20%. The highest (6.70%) fiber content was in the farm made feed which was similar to Arab feed (6.50%). The lowest (4.20%) fiber was measured from Paragon feed which was more or less identical to Chamok feed (4.50%), New Hope feed (4.70%), Quality feed (4.40%) and C.P feed (5.40%) holds on intermediate portion in respect of fibre content. Roy (2002) reported that a diet containing 10.75% crude fiber appears to be more suitable for GIFT tilapia.

Carbohydrate %

The carbohydrate content was found 40.45, 31.53, 34.69, 24.84, 31.46, 29.78, 34.94, 34.03, 35.65, and 31.28% in C.P, Nourish, Arab Feed, Quality Feed, New Hope, Paragon, Chamok, Mega, Cherish, and a Farm made feed respectively. A variation was observed among different types of shing feeds, in case of carbohydrate content. The highest (40.45%) carbohydrate was observed C.P feed and the lowest (24.84%) carbohydrate observed in Quality feed (Table 1). Some of the feed contain more carbohydrate than the standard one (<30% for carnivorous or omnivorous fish feed) especially the C.P, Arab, Chamok, Mega and Cherish feeds. The amount of Carbohydrate ranged between 40.45% and 24.84% of different Shing feeds. The maximum (40.45%) Carbohydrate was observed in C.P feed. The minimum (24.84%) Carbohydrate was found in Quality feed. In between maximum and minimum lied other feeds like Arab feed (34.69%), Chamok feed (34.94%), Mega feed (34.03%), Paragon feed (29.78%) and the farm made feed (31.28%). Ali et al. (2008) reported that the diet containing 13% CHO were more suitable for Nile tilapia. Bhuiyan (2002) found that the diet containing 34.53% CHO were more suitable for carp poly culture. Roy (2002) reported that a diet containing 29.18% CHO appears to be more suitable for GIFT tilapia. Carbohydrate content of the feed used by different farmers of Muktagacha Upazila seems to be a bit higher.

Table 1. Proximate composition of different feeds used in shing farms.

Name of farm's	Protein %	Moisture %	Lipid %	Ash %	Fibre %	Carbohydrate %
Abu Suffian Khan farm (C.P)	26.96	11.91	2.69	12.59	5.40	40.45
Kamarujjaman farm (Nourish)	29.76	12.26	9.59	12.26	4.60	31.53
Shhain Talukdar farm (Arab Feed)	25.9	13.96	8.95	10.00	6.50	34.69
Rabi farm (QFL)	33.60	13.41	10.38	13.37	4.40	24.84
Abul Miah farm (New Hope)	32.35	13.29	9.7	8.50	4.70	31.46
Salim Hossain farm (Paragon)	32.21	13.47	9.78	10.56	4.20	29.78
Abu Hanif farm (Chamok)	31.86	10.57	9.59	8.54	4.50	34.94
Saddam Ali farm (Mega)	27.3	12.10	7.51	12.71	6.35	34.03
Sabuj farm (Cherish)	26.25	11.28	7.55	12.67	6.60	35.65
Munjurul Islam Khan farm (Farm made)	27.66	12.27	8.00	14.09	6.70	31.28

Growth Parameters of fish

Initial weight (g)

The initial weight of shing used in different farms was not identical. Fish were used by different farmers from the nearby availability hatchery fry. The highest weight (5.57g) was denoted from Abu Suffian khan farm using C.P feed, whereas the lowest (1.94g) was observed in Shahin Talukdar using Arab feed, Abul Miah using New Hope feed, and Salim Hossain farm using Paragon feed. The second highest initial weight (4.44g) was found in Munjurul Islam Khan using Farm made feed, and the second lowest (2.32g), was found in Saddam Ali farm using Mega feed. The fish used in different

farms were not identical. Fish were used by different farmers depend on the availability of the fry nearby. The initial weight varied from 5.57 to 1.94g. The highest initial weight (5.57g) was denoted from Abu Suffian Khan farm using C.P feed whereas the lowest weight (1.94g) was observed in Shahin Talukdar farm using Arab feed.

Final weight (g)

The final weight of the shing in different farms were not identical. In the present study variable final weight of fish in different farms were observed. The maximum final weight (68.96g) were observed from Abu Suffian Khan farm using C.P feed, while the lowest (21.05g) was Shahin Talukdar using Arab feed, and Sabuj farm using Cherish feed, The second highest (52.63g) weight was found in Rabi using Quality feed and Abu Hanif farm using Chamok feed, and the second lowest (23.52g), found in Saddam Ali farm using Mega feed, (Fig. 1).

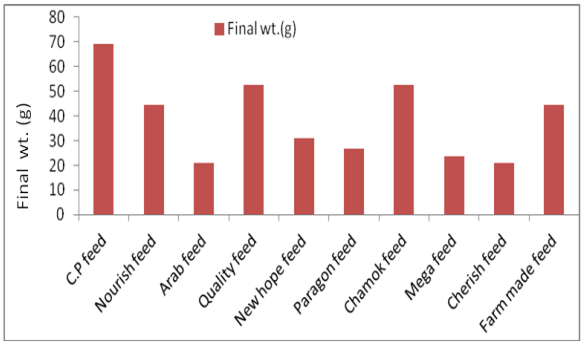

Figure 1. The final weight of shing feeding different feeds in different shing farms of Muktagacha Upazila.

Weight gain (g)

The weight gain of shing in different farms were not identical. In the present study variable weight gain of shing feeding different feeds were observed. The highest (63.39g) weight was gained in Abu Suffian Khan farm using C.P feed, whereas the lowest (19.11g) was observed in Shahin Talukdar farm using Arab feed, which was very close (21.2g) to Saddam Ali farm using Mega feed (Fig.2).

Specific growth rate (SGR %/ day)

The Specific growth rate of shing in different farms was not found to be identical. In the present study variable specific growth rate were observed in different farms. The highest specific growth rate (70.43%) was found in Abu Suffian Khan farm using C.P feed. On the contrary, the lowest (20.55%) Specific growth rate was denoted in Sabuj farm using Cherish feed. The second highest (55.6%) was found in Rabi farm using Quality feed, and the second lowest value (21.23%) was found in Shahin Talukdar farm using Arab feed (Table 2). Specific growth rate in different farms indicate that different parameters like stocking density, protein content of feed, pond management etc combine determines the growth.

Production (kg/dec./90days/)

The production of shing in different farms should not be identical. In the present study variable production were observed in different farms. The maximum Production (57.99kg) was obtain from Abu Hanif farm using Chamok feed, while the lowest (26.25kg) production in Shahin Talukdar using Arab feed, which was similar (29.69kg) to Sabuj farm using Cherish feed (Table 2). The final production of shing in different farms should not be identical. In the present study variable production were observed in different farms. Like growth production depended on various factors like culture environment, stocking, feed and feeding as well as other related management those were different in different farms. The result of this study much higher than the findings Kohinoor et al. (2012) reported the final production 36.56/dec. for *H. fossilis* fed with commercial feed during four months experimental period.

Table 2. The Growth parameters of shing in different farms.

Farm name	Weight gain(g)	SGR (% /day)	Production (kg/dec./90days)
Abu Suffian Khan farm	63.39	70.43	53.17
Kamarujjaman farm	42.11	46.78	46.78
Shahin Talukdar farm	19.11	21.23	26.25
Rabi farm	50.04	55.6	45.79
Abul Miah farm	28.82	32.02	33.38
Salim Hossain farm	24.72	27.46	37.51
Abu Hanif farm	49.2	54.66	57.99
Saddam Ali farm	21.2	23.55	30.09
Sabuj farm	18.50	20.55	29.69
Munjurul Islam Khan farm	40	44.44	44.11

Feed conversion ratio (FCR)

Feed conversion ratio of different feeds used in different farms ranged between 2.97 and 4.12. The highest (4.12) feed conversion ratio was observed in Saddam Ali farm using Mega feed, and the lowest (2.97) feed conversion ratio was found in Abu Suffian Khan farm using C.P feed (Fig.2). A low FCR value is an indicator of better food utilization efficiency of formulated feed. Feed conversion ratio of Shing in different farms ranged between (4.12 and 2.97). The higher FCR obtained indicated that feeds used were not up to the mark and further research are needed to find out a standard feed for the shing.

Figure 2. Feed conversion ratio of different feeds used in different shing farms of Muktagachfa Upazila.

Survival rate (%)

The survival rate of shing in different farm varied from 78.36 to 96.39%. The maximum (96.39 %) survival rate was noted in Abu Suffian Khan farm using C.P feed, where as the lowest (78.36 %) was found in Sabuj farm using Cherish feed. Survival rate is satisfactory in all the farms. Survival rate inversely related the density of fish in the culture system (Fig.3). The survival rate of shing in different farm varied from 78.36% to 96.39%. Survival rate is satisfactory in all the farms. Survival rate is supported to inversely related the density of fish in the culture system, the result of study is more or less similar to the expectation Kohinoor et al. (2012) reported that the survival rate of 87% for *H. fossilis* culture fed with commercial feed during four months experimental period.

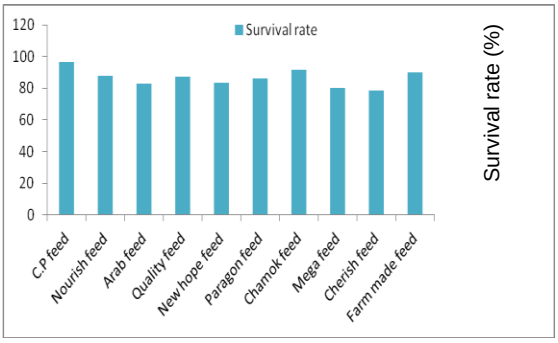

Figure 3. Survival rate of shing feeding different feeds used in different shing farms of Muktagacha Upazila.

Economic analysis

The economics of different farms varied both in terms of input provided and output received. The inputs are pond preparation, maintenance, fry, and feeding cost and output means total sale price of the produced fish. Cost for pond preparation and maintenance was varied distinctly for per decimal pond area. The maximum (1,975 BDT/dec.) cost in pond preparation and maintenance was observed in Munjurul Islam Khan farm, while the lowest (958 BDT/dec) was observed in Abu Suffian Khan farm. On the other hand feeding cost varied from 3,694 to 9,134 BDT/dec. The highest (9,134 BDT/dec.) was observed in Abu Hanif farm using Chamok feed and the lowest (3,694 BDT/dec.) was observed Shain Talukdar farm using Arab feed (Fig.4.5). Fluctuation of cost among different shing farms in case of fry purchasing was observed and it was ranged between 2,200 and 1,200 BDT. The highest (2,200 BDT/dec.) and the lowest (1,200 BDT/dec.) were observed in Munjurul Islam Khan farm and Kamarujjaman farm respectively. The total cost also varied in different farms. The maximum total cost was found to be (12,825 BDT/dec.) in Abu Hanif farm using Chamok feed and the lowest total cost observed (6,286 BDT/dec.) in Shahin Talukdar farm using Arab feed. The maximum net income was obtained (20,571 BDT/dec.) in Abu Suffian Khan farm using C.P feed, Where as a negative income (-676 BDT/dec) was observed in Saddam Ali farm using Mega feed. The BCR of different shing farms ranged between 2.81 and 0.89 the maximum (2.81) and the minimum (0.89) was found Abu Suffian Khan farm using C.P feed and Sabuj farm using Cherish feed respectively. The BCR less than 1.0 indicate loss i.e. spending more and selling less than the spending. The economics of different farms were presented in table 3 and 4. From the economic analysis it is evident that pond preparation, maintenance, fry and feeding costs were found variable in different farms and the total revenue received was also variable even negative economic return was also observed for two farms. Thus it can be said that farmers aptitude level, management skills as well as feed quality and feeding determines the economic viability of the farms in the studied area.

The benefit cost ratio of different Shing farms ranged between 2.81 and 0.89. The maximum (2.81) and the minimum (0.89) was found in Abu Suffian Khan farm using C.P feed and Sabuj farm using cherish feed respectively. In Muktagacha Upazila shing farmers got variable net income from 20,571 BDT/dec./90 days to minus -676 BDT/dec./90 days. This variability might be due to different factors of which feed is the main influencing factors.

Table 3. Estimated cost and income of different Shing farms using different feeds.

Item cost/decimal	Abu Suffian Khan farm	Kamaruzzaman farm	S.T farm	Rabi farm	Abul Miah farm	S.H farm	Abu Hanif farm	Saddam Ali farm	Sabuj farm	M.I.K farm
Pond preparation and maintenance cost (BDT/dec.)	958	1153	1392	1568	1531	1486	1772	1700	1617	1975
Fry cost (BDT/dec.)	1600	1200	1200	1250	1040	1222	1920	1920	2160	2200
Feed cost (BDT/dec.)	8772	7556	3694	6901	5177	6911	9134	6084	4552	5937
Total cost (BDT/dec.)	11,308	9,909	6,286	9,719	7,749	9,621	12,825	9,704	8,330	10,112
Return per decimal in(BDT)										
Revenue (BDT/dec.)	31,907	21,054	6,562	22,898	13,353	13,131	28,996	9,027	7,423	19,851
Net income (BDT/Dec.)	20,571	11,145	275.76	13,178	5,603	3,509	16,170	-676	-907	9,739

Table 4. Cost- benefit analysis of different Shing farms of Muktagacha Upazila using different feeds.

SL. No	Fixed cost	Operating cost	Total cost (T.C)	T.C/dec	Revenue income	Benefit Cost Ratio (BCR)	Net profit (N.P)	N.P/dec.
1.	38,166	1,88,440	2,26,166	11,308	6,38,142	2.81	4,11,432	20,571
2.	38,825	2,08,906	2,47,731	9,909	5,26,365	2.12	2,78,634	11,145
3.	47,200	1,16,255	1,63,455	6,286	1,70,625	1.04	7,170	275
4.	47,250	1,95,731	2,42,981	9,719	5,72,455	2.35	3,29,474	13,178
5.	34,880	1,35,602	1,70,482	7,749	2,93,768	1.72	1,23,286	5,603
6.	41,625	1,79,673	2,21,298	9,621	3,02,015	1.36	80,717	3,509
7.	46,060	1,84,807	2,30,867	12,825	5,21,930	2.26	2,91,063	16,170
8.	64,500	1,78,105	2,42,605	9,704	2,25,699	0.93	Loss (-16,906)	-676
9.	48,720	92,897	1,41,617	8,330	1,26,192	0.89	Loss (-15,425)	-907
10.	59,000	1,43,244	2,02,244	10,11	3,97,039	1.96	1,94,795	9,739,75

Each manufactured product must be tested and certified by the government authority before marketing under the regulations to be practiced. From the study it can be said that some of the marketed feed were much below standard. Fish farmer of this region are mostly unconscious about fish feed composition. They brought feed from feed industry. The industry owners or dealer has been taking the opportunities of farmers illiteracy and economic constrains and they are supplying low quality fish feed indiscriminately even by offering partial payment first then remainder after harvesting. Fraud traders are exploiting farmers and making money on feed business. But the farmers are getting less benefit even some times losing by culturing shing feeding with available feeds they are getting from feed traders. The results of the research work on fish feed of different fish feed companies will be very much helpful to fish farmers to decide the feed selection and bargain with the feed traders to select suited feed for their fish for profitable aquaculture production.

Sometimes farmers use low quality feed of some feed companies or they use their own made feed of unknown quality, result in low growth and production of fishes. The research work is very helpful for determining the quality of feed that farmer use (both commercial and farm made), the findings will certainly help farmers to adjust formulation of feed towards

balanced diet for getting more quality production also getting acceptable profit margin.

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