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REARING AND NURSING OF THAI PANGAS, *PANGASIANODON HYPOPHTHALMUS* (SAUVAGE, 1978) WITH DIFFERENT FEEDS

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Abstract: Growth and survival of *Pangasianodon hypophthalmus* was assessed in relation to feeding of different feeds for a rearing period of 21 days. The experiment was designed with 3 treatments and 4 replications. The nursery ponds were stocked at a density of 0.6 million hatchling/ha with 3days old *P. hypophthalmus*. The highest growth performance, survival and production of the fry was found in treatment T_1 in terms of length, weight and number, where sustainable nursery management was implemented and egg yolk, mustard oil cake, nursery feed and Tubifex Chop were supplied. Poor growth performance and survival was recorded in treatment $T_{3,}$ where nursery management was poor with insufficient food supply. The highest average growth was recorded at 5.66±0.55 g, SGR 12.24±0.68, FCR 0.68±0.01and survival rate 52.15±0.78% in the treatment T_1. The treatment (T_1) also showed highest economic return (Bd Tk. 290543/ ha) than that of treatment T_1 and T_2. The physico-chemical factors were found to be in optimum level for fish culture.

Keywords: Food conversion rate, Hatchling, Stocking density, Supplementary feed, Survival rate.

INTRODUCTION

Pangasianodon hypophthalmus (Sauvage) is to be locally known in Bangladesh as pangas or Thai pangas. This species is an important fast-growing cat fish in the Asian region, particularly Vietnam, Myanmar, Thailand, India, Indonesia and Bangladesh (Phan *et al.*, 2009). Commercial Thai punus production was first started in 1993 (Ali and Haque, 2011) and it has rapidly developed into an economically significant activity (Ali *et al.*, 2013). The characteristics of this species are fast growth with high dense, large size and a high market demand (Sarker, 2000). So, pangas farming has rapidly extended as an important aquaculture industry in Bangladesh. The development of intensive pangasius farming has benefitted landless laborers by creating employment opportunities, particularly involving the provision of supporting goods and services in associated value chains (Belton and Azad, 2012; Ali *et al.*, 2013). This industry provides many livelihood opportunities with long backward and forward linkages for a wide range of value chain actors (Belton and Azad, 2012). The species has a significant local market demand and is mostly consumed domestically, providing a year round supply of animal protein to consumers in both rural and urban areas (Ali *et al*., 2013; Belton *et al*., 2014; Hernandez *et al.,* 2018).

Hence, for sustainable aquaculture method for nursing and rearing of *P. hypophthalmus* seed (spawn) are very important to ensure reliable and regular supply of fry. Improper care and lack of understanding about the biotic and abiotic factors in the nurseries may results in mass mortality of fry (Jhingran and Pullin, 1985). Success in fry nursing depends on a scientific knowledge of nutritional requirement and optimum environmental factors for the growth and survival of spawn and fry in the open aquatic ecosystem (Mollah, 1985). In order to meet up the increasing dietary demand nursery feed was supplied at 5 to 20% of the total biomass per day (Chakraborty *et al.,* 2019). Growth, survival and production of fry and fingerlings in nursery ponds depend on stocking density, fertilizers and supplementary feeds. The present experiment has been undertaken to develop a practical and economically viable methodology for mass seed production and rearing of *P. hypophthalmus* under controlled nursery management system.

MATERIALS AND METHODS

Study area and experimental design

The experiment was carried out for a period of 21 days from July to August, 2020 at the private nursery ponds (average area 0.08ha and depth 0.8m) of Fish Seed Farm, Sotota hatchery, Dhola, Thrisal (Treatment T_1), Rang Dhonu hatchery, Sadar (Treatment T_2), Rupali hatchery, Gouripur (Treatment T_3), Mymensingh, Bangladesh. The nursery ponds were having similar rectangular size, depth, basin conformation, contour and bottom type. Three treatments differing in different feeds of hatchlings were employed with two replicates each.

Pond preparation, fertilization stocking and supplementary feeding

a. Nursery Practice 1 (Treatment T_1)

The ponds having a well designed system of inlet and outlet were dewatered and the bottom was exposed to full sunlight for three days. After drying, the bottom of the pond was ploughed and laddered. During nursery practice, the bottom of the ponds laddered regularly. Quicklime ($CaCO_3$, 250 kg/ha) was spread over the pond bottom. The initial doses of manuring by cow dung 494kg/ha were accomplished in the treatment T_1 after the next day of liming. Replenishment of water was done after three days of sun drying with liming. The second manuring was done by liming again ($CaCO_3$, 250 kg/ha) just after the subsequent day of replenishment Mustard oil cake (MOC) at the rate of 494kg/ha and cow dung in slury form 247kg/ha were applied two days after liming. Murate of Potash (MP) in granule form was spread (200kg/ha) throughout the ponds just before the stocking. Seven days after manuring the pond water was sprayed with dipterex (1.0 ppm) to eradicate harmful insects and predatory zooplankton.

Egg yolk @ 0.31 kg/ha/twice in a day in first two days and milk power @9.88 kg/ha/twice in a day was provided for first three days. Supplementary feed was supplied only in the form of MOC @ 25g (dry weight)/ha/once in a day from 4^{th} to 10^{th} days, Soudi bangla nursery feed @ 55 kg/ha/fourth time in a day from 3^{th} to 7th days, @75 kg/ha/thrice in a day from 8^{th} to 14^{th} days and @ 95 kg/ha/thrice in a day from 15^{th} to 21^{th} days. Tubifex Chop @74.1kg/ha/six times in a day from 4^{th} to 7^{th} day and @74.1kg/ha thrice in a day from 7^{th} to 14^{th} days was provided as supplementary feed.

b. Nursery Practice 2 (Treatment T_2)

In this type of practice, just after the dewatering, the doses of quicklime ($CaCO_3$, 250 kg/ha) and cow dung (497kg/ha) was spread over the pond bottom. Replenishment of water was done after the subsequent day of bottom preparation. The second manuring was done by liming again ($CaCO_3$, 247 kg/ha) just after three days of dewatering and mustard oil cake (MOC) 494kg/ha and cowdung (CD) 247kg/ha were applied two days after liming. Murate of Potash (MP) was applied (200kg/ha) in the ponds just before the day of stocking.

Supplementary feed was provided in the form of MOC @ 247kg /ha/once in a day from 4^{th} to 10^{th} days, Soudi bangla nursery feed @ 494 kg/ha/fourth time in a day from 4^{th} to 8th days and @74.1 kg/ha/thrice in a day from 9^{th} to 21^{th} day. Tubifex Chop @37.05 kg/ha/six times in a day for first three days and @ 24.7 kg/ha/four times in a day from 4^{th} to 8^{th} days and 37.05 kg/ha/thrice in a day from 9^{th} to 14th day and also the milk power @4.94 kg/ha/twice in a day for first three days.

c. Nursery Practice 3 (Treatment T_3)

In this system, the ponds were poisoned by rotenone at a dose of 49.40 kg/ha and after three days water was replenished up to another 15 cm. Only after three days of liming at the rate of 247 kg/ha mustard oil cake (MOC) 370 kg/ha and cowdung (CD) in slurry form 173kg/ha was applied. Murate of Potash (MP) was applied (124 kg/ha) throughout the ponds just before the stocking.

Supplementary feed was supplied in the form of MOC @ 49.4 kg (dry weight)/ha/twice in a day from 4^{th} to 21^{th} days, Soudi bangla nursery feed @ 49.4 kg/ha/fourth time in a day from 4^{th} to 8th days and @74.1/ha/thrice in a day from 9^{th} to 21^{th} days. *Tubifex* Chop @ 61.75 kg/ha/six times in a day for first three days and Chop @ 61.75 kg/ha/four times in a day from 4^{th} to 10th days.

Seven days after manuring the pond water was sprayed with dipterex (1.0 ppm) to eradicate harmful insects and predatory zooplankton. The experimental ponds were stocked at a density of 0.6 million hatchling/ha with 3days old *P. hypophthalmus* having an initial length of 5.0±0.02 mm and weight of 0.11±0.001 mg, respectively.

Water Quality Parameters

Physico-chemical parameters of pond water were monitored weekly between 9.00 and 10.0 am. Water temperature, transparency, dissolved oxygen and pH were measured at spot by using a Celsius thermometer, Secchi disc, digital electronic oxygen meter (YSI, Model 58, USA) and an electronic pH meter (Jenway, Model 3020, UK), respectively. Total alkalinity was determined by titrimetric method (Clesceri *et al.*, 1989).

Estimation of growth, survival, production and feed utilization

Twenty five individuals from in each pond were sampled five days interval until they attained the fry stage. Growth in terms of length and weight, Average daily gain (ADG), Specific Growth Rate (SGR) and Food conversion rate (FCR) was estimated. SGR and FCR were calculated according to Brown (1957), Castell and Tiews (1980) and Gangadhara *et al.* (1997), respectively. After 21 days, the fingerlings were harvested by repeated netting, followed by drying the ponds. The fingerlings were counted and weighed. Survival (%) and production (number/ha) of fingerlings were then calculated and compared among the treatments.

Analysis of experimental data

The data were analyzed through one way analysis of variance (ANOVA) using MSTAT followed by Duncan's New Multiple Range test to find out whether any significant difference existed among treatment means (Duncan, 1955; Zar, 1984). Standard deviation in each parameter and treatment was calculated and expressed as mean ±S.D.

RESULTS AND DISCUSSION

Water quality parameters

Mean level of physico-chemical parameters over the 21 days nursing of fry is presented in Table

1. The mean water temperatures in treatment T_1, T_2 and T_3 were not statistically significant ($P>0.05$). The temperature of the experimental

ponds was within the acceptable range for pangas nursery ponds that agrees well with the findings of Haque *et al*. (1993) and Bhagde *et al*. (2020). Mean transparency differed significantly ($P<0.05$) increasing from T_1 to T_3. Transparency was consistently higher in T_3, possibly due to the reduction of the plankton population (Haque *et al*., 1998). The mean dissolved oxygen (DO) obtained in the morning hours was significantly different ($P<0.05$), decreasing from T_1 to T_3. Fluctuation of dissolve oxygen concentration might be attributed to photosynthetic activity and variation in the rate of oxygen consumption by fish and other aquatic organisms (Boyd, 1982). pH decreased from T_1 to T_3 but did not differ significantly ($P>0.05$). pH value agrees well with the findings of Chakraborty *et al*. (2003) and Rahman and Rahman (2003). Total alkalinity was decreased from T_3 to T_1 but differ significantly ($P<0.05$). Alkalinity levels indicate productivity of the ponds was medium to high (Bhuiyan, 1970). Higher total alkalinity values might be due to higher amount of lime

Table 1: Physico-chemical characters of water in nursery pond during the experimental period.

Parameter	Treatment		
	T_1	T_2	T_3
Temperature (0C)	28.74±2.41 (26.08-30.10)	28.26±2.26 (26.24-30.15)	28.22±2.62 (26.25-31.05)
Transparency (cm)	18.22±3.66^a (14.03-20.44)	27.34±4.44^b (25.05-30.62)	34.56±5.44^c (29.54-37.34)
pH	7.780±0.170 (7.40-8.20)	7.80±0.16 (7.3-8.6)	7.78±0.17 (7.4-8.8)
Dissolved oxygen (mg/L)	5.22±0.52 (5.02-5.48)	4.94±0.68 (4.22-5.15)	4.08±0.68 (3.80-4.18)
Total alkalinity (mg/L)	142.16±7.84^a (135.03-148.50)	134.08±7.24^b (127.44-138.67)	123.48±9.44^c (120.33-132.04)

Figure in the same row having the same superscript are not significantly different (P>0.05).
Figure in the parenthesis indicates the range.

Growth, feed utilization and production of fish

Growths (length and weight) of fry are shown in figures 1 and 2. The increase in length and weight was the highest in treatment T_1 followed by treatment T_2 and T_3. Growth and production parameters of fingerlings are shown in Table 2. The fish in T_1 treatment showed the highest gain in both length and weight over treatment T_2 and T_3 treatment, where sustainable nursery management and rich feed (egg yolk, mustard oil cake, nursery feed and Tubifex Chop) were supplied. However, the mean final length and weight of fry in different treatments were significantly different ($P<0.05$). The highest weight gain was in treatment T_1 and lowest in treatment T_3. SGR in treatment T_1 was significantly higher than treatment T_2 and T_3. The initial length and weight of spawn stocked in all the ponds was the same, 0.06±0.02 cm and 0.11±0.001 mg. It is evident from the data that the fry attained an average size of 6.06±0.09 cm in length and 5.77±0.56 g in weight in treatment T_1 with sustainable nursery management and rich feed were supplied. The fry attained an average size of, 5.11±0.06 cm in length and 4.98±0.47 g in weight in treatment T_2 where mustard oil cake, nursery feed and Tubifex Chop were supplied and achieved 3.90±0.04 cm in length, 3.97±0.8 g in treatment T_3 where poor nursery management and below standard feed and lower amount of mustard oil cake, nursery feed and Tubifex Chop were supplied. Maximum growth in length and weight in treatment T_1 was attained at the rich sustainable nursery management and quality feed supplied. Thus growth in terms of length, weight, weight gain and SGR of *P. hypophthalmus* fry was significantly higher in T_1 where sustainable nursery management and rich ingredients were supplied compared to those of T_2 and T_3 treatments. The causes might include competition for food, space and habitat of fry (Islam *et al.*, 1999; Islam, 2002; Rahman and Rahman, 2003; Chakraborty *et al.*, 2006 and 2019).

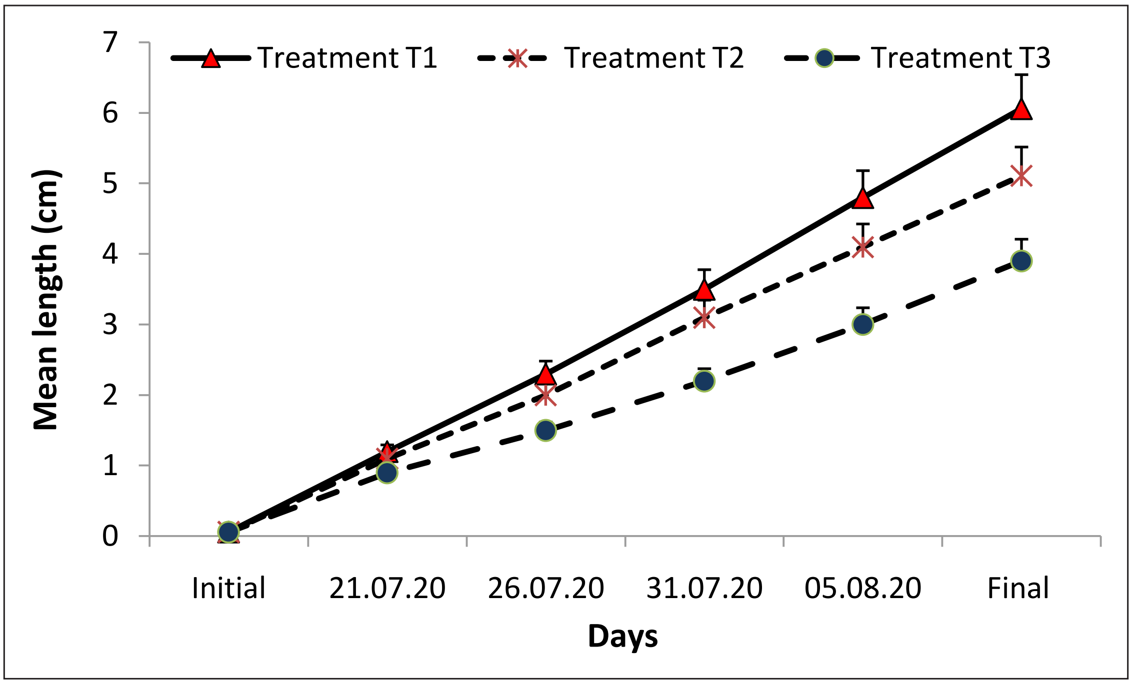

Fig.1: Length gain (cm) of fry *P. hypophthalmus* under different feeds.

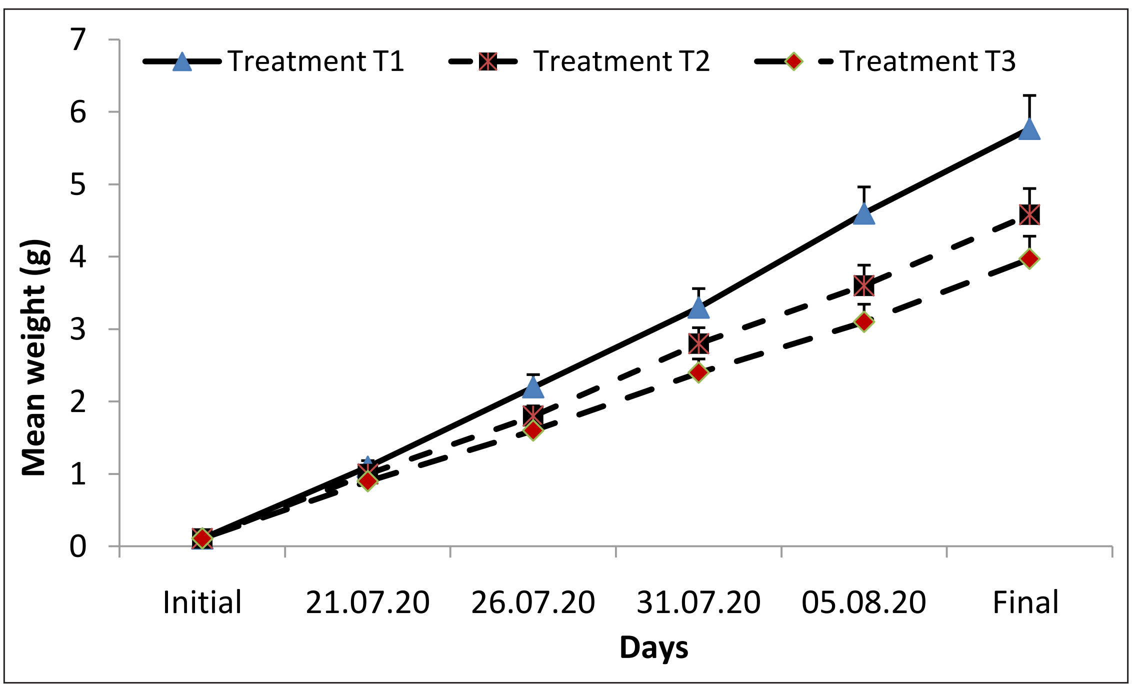

Fig. 2: Weight (g) gain of fry *P. hypophthalmus* under different feeds.

The FCR value of treatment T_1 is significantly lower than those of treatment T_2 and T_3. The FCR values reported in the present study are lower than the values reported by Das and Ray (1989) and Islam (2002). De Silva and Davy (1992) stated that digestibility plays an important role in lowering the FCR value by efficient utilization of food. Digestibility, in turn, depends on daily feeding rate, frequency of feeding, and type of feed used (Chiu *et al.,* 1987). However the lower FCR value in the present study indicates better food utilization efficiency.

The highest survival rate was also observed in treatment T_1, and the lowest in treatment T_3. There was a significant variation ($P<0.05$) in the survival rate of *P. hypophthalmus* fry among different treatments. Fingerlings of *P. hypophthalmus* had significantly higher survival in T_1, where, the stocking density was same in the treatment T_2 and T_3. The reason for reduced survival rate in the treatments T_2 and T_3 was due to poor sustainable nursery management and supplying various poor quality feeds as well as competition for food and space, and cannibalistic characteristics in the experimental ponds. This is clearly indicated that maximum growth in length and weight was attained at the rich sustainable nursery management and supplying various rich qualities feeds supplied, showing a negative correlation between nursery management and feed, and growth. Similar results were obtained by Tripathi *et al*. (1979), Rahman and Rahman (2003), Chakraborty *et al*. (2006) and Phuong *et al*. (2007) for fry of various pangas, carp and barb species.

Table 2: Growth performance, survival and production of *P. hypophthalmus* fry after 21 days of rearing.

Parameter	Treatments		
	T_1	T_2	T_3
Initial length (cm)	0.06±0.02 (0.02-0.06)	0.06±0.02 (0.02-0.06)	0.06±0.02 (0.02-0.06)
Final length (cm)	6.06 ± 0.09^a (5.12-6.88)	5.11 ± 0.06^b (4.88-5.67)	3.90 ± 0.04^c (3.50-4.16)
Initial weight (g)	0.11±0.001 (0.01-0.15)	0.11±0.001 (0.01-0.15)	0.11±0.001 (0.01-0.15)
Final weight (g)	5.77 ± 0.56^a (5.10-7.07)	4.58 ± 0.47^b (3.80-5.24)	3.97 ± 0.81^c (2.77-4.28)
Net weight gain (g)	5.66 ± 0.55^a (5.05-7.06)	4.47 ± 0.37^b (4.11-5.22)	3.86 ± 0.44^c (3.10-4.48)
Average daily gain(g)	0.27 ± 0.01^a (0.22-0.32)	0.21 ± 0.01^b (0.17-0.25)	0.18 ± 0.01^c (0.15-0.21)
Specific growth rate	12.24±0.68 (12.21-12.25)	12.03±0.66 (12.01-12.05)	11.89±0.67 (11.87-11.90)
Survival rate (%)	52.15 ± 0.78^a (40.61-47.22)	44.60 ± 0.61^b (29.28-35.17)	29.84 ± 0.46^c (18.22-24.18)
FCR	0.68 ± 0.01^a (0.66-0.71)	0.74 ± 0.01^b (0.71-0.76)	0.83 ± 0.01^c (0.80-0.84)
Production# (Number)	311952 ± 150.02^a (311805-312100)	267853 ± 471.77^b (267405-268302)	179805 ± 584.58^c (179509-180202)

Figure in the same row having the same superscript are not significantly different (P>0.05). Figure in the parenthesis indicates the range. # Total number of fry harvested after 21 days.

The mean productions (number/ha) of fry were 311952, 267853and 179805 in treatment T_1, T_2 and T_3, respectively. Production was higher in treatment T_1, and lowest in treatment T_3. However, production of fry differ significantly ($P<0.05$) among the three treatments (Table 2). On the other hand, cost of production in treatment T_1 was consistently higher than those treatments T_2 and T_3 (Table 3). The cost of production in treatment T_1 was consistently higher than those treatments T_2 and T_3. Highest net benefit (Tk./ha) was obtained in treatment T_1 (290543) followed by (194079) and T_2 (34736) in that order, which is very similar study of Ahmed *et al.* (2010) and Belton *et al.* (2017).

Finally, it can be concluded that the survival, growth, production of *P. hypophthalmus* fry were inversely related to the different feeding ingredients and rich sustainable nursery management. Stocking density of 0.06 million hatchlings/ha feeding with egg yolk, mustard oil cake, nursery feed 1 US$ =Tk. 84.00; MAEP= Mymensingh Aquaculture Extension Project, BKB= Bangladesh Krishi Bank. Sale price of fry Tk. 1.60/piece (T_1), Tk. 1.50/piece (T_2) and Tk. 1.30/piece (T_3). and Tubifex Chop in treatment T_1 may be advisable for rearing of *P. hypophthalmus* fry for 21 days nursing. Production of adequate quality seeds through application of present findings might be extremely helpful towards the production and meet up daily dietary demand of general people.

Table 3: Cost and benefits from the nursing of thai pangas, *P. hypophthalmus* fry in 1 ha earthen ponds for a nursing period of 21 days.

Item	Amount $TKha^{-1}day^{-21}$			Remarks
	T_1	T_2	T_3	
Total return (TR)	499123	401779	233746	Price is related with size and weight
a. Variable cost:				
1. Price of hatchlings	120000	120000	120000	
2. Feed (Tk. 100.00/kg)	55000	54000	46000	
3. Fertilizer	2500	2500	2500	
4. Human labour cost (Tk. 250.00/day)	5300	5300	5300	
5. Chemicals	3000	3200	3300	
6. Miscellaneous	2000	2000	2000	
Total Variable cost (TVC)	187800	187000	179100	
b. Fixed cost :				
1. Pond rental value	2000	2000	2000	Tk. 100.00/dec. according to MAEP, Mymensingh
2. Interest of operating capital	18780	18700	17910	10% interest according to BKB, Bangladesh
Total fixed cost (TFC)	20780	20700	19910	
Total cost (TC= TVC+TFC)	208580	207700	199010	
Gross margin (GM= TR-TVC)	311323	214779	54646	
Net return (TR-TC)	290543	194079	34736	

Figures with different superscripts in the same row varied significantly ($P<0.05$). Figures in the parenthesis indicate range. 1 US$ =Tk. 84.00; MAEP= Mymensingh Aquaculture Extension Project, BKB= Bangladesh Krishi Bank. Sale price of fry Tk. 1.60/piece (T_1), Tk. 1.50/piece (T_2) and Tk. 1.30/piece (T_3).

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