Comparison of three feeding formulas with *Pangasius hypophthalmus* at Ban Hat Station, Khong District, Champassak Province, Lao PDR

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ABSTRACT

The experiment on the indigenous catfish (*Pangasius hypophthalmus*) consisted of testing three different feeds during grow-out. Fishes were stocked in small net cages (3.9m^3) held in the Mekong River at the Ban Hat Village, Champassak Province. The experiment lasted for three months from May 30 to August 30 2005. Two feeds were prepared locally by grinding, mixing and pressing the ingredients with a small press. The ingredients for the feed 1 were rice bran (25%), maize (25%), beer brewing waste (24%), broken rice (5%), fish meal (20%) and premix (1%). The ingredients for feed 2 were rice bran (40%), maize (15%), soybean oilcake (20%), broken rice (10%), fish meal (14%) and premix (1%). The third feed was commercial extruded pellets used for *Clarias* catfish (30% protein). The juvenile fish initially weighted 130g and measured 24cm in total length on the average. After three months, the fish fed with the commercial pellet showed better growth than the two others in terms of body weight and total length ($P < 0.05$). There was no significant difference between the two local feeds. The mean final body weight and total length were 833g and 41cm (F3), 577g and 38 cm (F2), and 506g and 36.5cm (F1). The food conversion ration (FCR) was not significantly different among the three treatments (average 1.84:1) as well as the survival rate (average 87 %). The net income per kilo of fish harvested was highest with the third feed (US$ 0.29) and second was with feed 1 (US$0.13) ($P < 0.05$); the net income with the feed 2 was in-between at US$0.19.

INTRODUCTION

Fish cage culture has become popular in the Lao PDR. There are several suitable water resources for this type of aquaculture including large reservoirs and rivers with appropriate depth and flow. However, the availability and the cost of fish feed imported from neighboring countries limit the profitability, especially for farmers living in remote areas. To reduce the production cost, local-made feed could be formulated by using local raw materials. The Nile tilapia (*Oreochromis niloticus*) is only one species being raised in cages in Lao PDR. The indigenous catfish *Pangasius hypophthalmus* (formerly named *P. sutchi*) seems to be a good candidate for the intensive form of cage culture. This fish is named '*Pa-suai*' in Lao language. *P. hypophthalmus* shows several interesting features including fast growth, high market value and seed availability. The development of the aquaculture of this species is a priority for the LARReC. The objective of this study was to assess the growth performances of *P. hypophthalmus* by testing three different feeds, including two locally made feeds and one commercial feed.

MATERIALS AND METHODS

The study was conducted at the Ban Hat Fisheries Station located along the Mekong River in the Khong District, Champassak Province, in the South of the Lao PDR. Fishes were stocked in floating

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cages on the River. Cages were made of nylon net and measuring 1.5 x 2 x 1.5m (width x length x depth) with 3.9m^3 for the water volume. Large juveniles of *P. hypophthalmus* have been used; the initial body weight was 130g and ranged from 90g to 140g. Fishes aged about five months were issued from a hatchery and nursery ponds at the Ban Na station (Muang Khong District). Cages were stocked with 45 fish.; the stocking density was 15 fish/m^2 or 11.5 fish/m^3. It should be noted that such density is quite low regarding to the usual density in similar conditions for *P. hypophthalmus* (150 fingerlings/m^3) according to Oupasirth (2003), and for the tilapia (about 60 fingerlings/m^3) according to Koranankoun (2004). The experiment was designed with three treatments (i.e. three different feeds) including three replications for each treatment. The location of the cages was established randomly as shown in Figure 1.

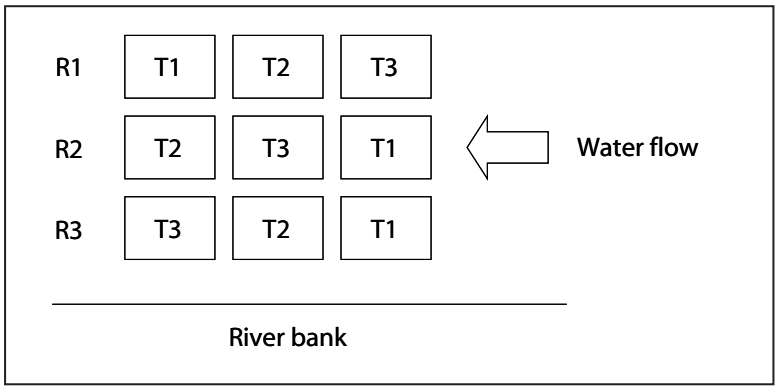

Figure 1. Location of the floating cages on the Mekong River for the three treatments in the three rows

Ten fishes per cage were sampled and measured at the stocking and then every month during three months from the 30th May to 30th August 2005. The body weight was measured to the nearest 10g and the total length of the fish was measured to the nearest millimeter. The condition factor K was determined as indicator of the fitness of the fish [K = 10^5 x body weight (g) / total length (mm)^3].The total amount of fish was determined at the end of the experiment and the survival rate calculated.

Three different feeds were tested including two local feeds prepared at the station according to Nakasen and Phanapheth (2001). Method for calculated feed formula for animal and one commercial feed imported from Thailand (Table 1). The local feeds were prepared weekly with 10 to15 kg of feed each time. Ingredients were mixed thoroughly and then passed through a small electric press (power 3.7 kwatt). Little water was added before pressing for sufficient stickiness. We have followed the method indicated by Vudphanxay (1993) and Unpasirth (2004) for the preparation of the feed. After pressing, the pellet was dried with a drying machine and also sun dried, then stored in the fridge (5-6 °C). Basic produced fish feed for farmers. The three feeds were distributed at the same feeding rate equivalent to about 3% of the biomass per day. Fish were fed twice a day at about 8:30 AM and 5:30 PM. The water quality was assessed twice a month and

the data are summarized in the Table 2. The rainy season has started in June and it has affected the water temperature and also other parameters (tubidity, velocity).

Table 1:.Composition *of the three feeds used in the experiment.*

	Feed 1 [(a)]	Feed 2 [(a)]	Feed 3 [(b)]
Type of feed	Sinking dry pellet locally made	Sinking dry pellet locally made	Floating extruded pellets imported from Thailand
Ingredients			
Rice bran	25	40	x
Maize	25	15	x
Byproduct from brewing	24	-	-
Soybean oil cake	-	20	x
Soybean steaming	-	-	x
Broken rice	5	10	x
Fish meal	20	14	x
Coconut oil cake	-	-	x
Premix +Vitamin C	1	1	-
Vitamin and mineral	-	-	x
Antioxidants	-	-	x
Proximate composition [(c)]			
Moisture (% TM)	14.86	14.37	9.00
Proteins (% DM)	18.64	18.43	30.00
Carbohydrates (% DM) [(d)]	46.09	43.57	35.5
Lipids (% DM)	4.81	7.65	11.00
Ash (% DM)	7.24	7.99	6.50
Fiber (% DM)	8.36	7.99	8.00
Price (USD/kg)	0.32	0.34	0.55

[(a)]: Proportion of the raw materials,[(b)]: the proportion of the ingredients composition is unknown, [(c)]: composition issued from the analysis of one sample per feed (100 g); amounts are given in percents of total matter (TM) or dry matter (DM),[(d)]: calculated value.

Table 2. *Evolution of the water quality two measurements per month.*

Parameter	June [(*)]	July [(*)]	August [(*)]	Minimum	Maximum
Temperature (°C)	28.2	26.4	25.4	24.5	30
DO (mg/liter)	6.1	6.6	6	4.8	7.3
pH	7.1	7.2	7.3	6.7	7.9

Data were analysed with One-way analysis of variance (ANOVA) and Duncan's test with the SPSS statistical software.

RESULTS

After three months the fish fed with the feed 3 (commercial feed) showed higher body weight than that of the fish fed with the two local feeds by 1.6 times (feed 1) and 1.4 times (feed 2) ($P < 0.05$); the two local feeds were not significantly different from each other (Table 3).

Table 3. *Growth performances after (average ± SD). Significant differences between the feeds for each duration are indicated by different letters (a, b, c; $P < 0.05$).*

	Feed 1	Feed 2	Feed 3
Initial conditions			
Density (fish/m^3)	11.5	11.5	11.5
Biomass (kg/m3)	0.97 ± 0.01 ^{a}	0.99 ± 0.04^a	0.99 ± 0.02 ^{a}
Body weight (g/fish)	129 ± 28 ^{a}	132 ± 30^a	130 ± 35 ^{a}
Length (cm/fish)	24 ± 1.9 ^{a}	23.25 ± 1.9^b	24 ± 1.8 ^{a}
K	1 ± 0.08 ^{a}	1.1 ± 0.08^a	1 ± 0.05 ^{a}
Final conditions			
Biomass (kg/m^3)	3.4 ± 0.2^b	3.6 ± 0.03^b	5.4 ± 0.2^a
Net production / m^3 / month	0.8 ± 0.14^b	0.9 ± 0.03^b	1.5 ± 0.12^a
Body weight (g/fish)	506 ± 39^b	577 ± 51 ^{b}	833 ± 59 ^{a}
Length (cm fish)	36 ± 1.5^b	38 ± 1.7^b	41 ± 1.6^a
K	1.06 ± 0.13^a	1.09 ± 0.1^a	1.2 ± 0.1^a
Daily weight gain (g)	4.2 ± 0.5^b	5 ± 0.3^b	7.8 ± 0.4^a
Daily length gain (mm)	1.4 ± 0.2 ^{c}	1.6 ± 0.6 ^{b}	1.9 ± 0.1 ^{a}
Specific growth rate total (%)	1.52 ± 0.10 ^{b}	1.64 ± 0.04 ^{b}	2.06 ± 0.03 ^{a}
FCR	1.87 ± 0.1^a	1.91 ± 0.14^a	1.74 ± 0.1^a
Survival rate (%)	91 ± 4 ^{a}	84 ± 3 ^{a}	87 ± 4 ^{a}

The same result was obtained with the total length although the difference was more limited. There was no significant difference for the condition factor K although it tended to be higher for the fish fed with the commercial feed.

The feed conversion ration (FCR) was not significantly different among the treatments although it tended to be slightly lower with the commercial feed.

The survival rate was also not different among the treatments. The growth between the three treatments varied already from the first month as presented in the Figure 2. The growth rate in body weight tended to increase from the first to the second month for the three feeds and then it was much lower during the third month (Figure 3).

The commercial feed is more profitable than the two local feeds by 3.7 times (feed 1) and 2.1 times (feed 2) while considering the net income per cage ($P < 0.05$; Table 4).

The net income per kilo of fish showed the same pattern although the feed 2 (local feed) was not significantly different from the two others. It should be noticed that the net income with the

commercial feed is equivalent to about one fourth or one fifth of the income while considering the cage or the kilo of harvested fish, respectively.

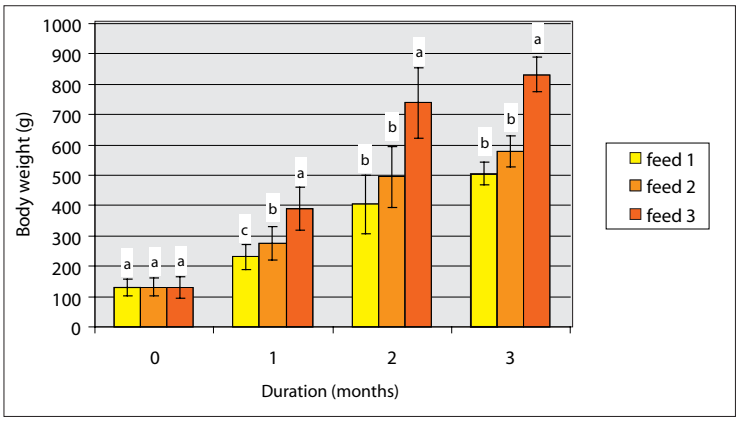

Figure 2 . Evolution of the fish body weight along the experiment (average ± SD). Significant differences between the feeds for each month are indicated by different letters (a, b, c; $P < 0.05$)

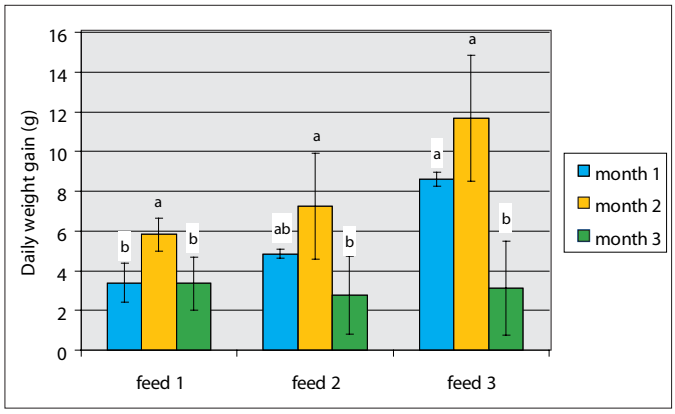

Figure 3. Evolution of the daily weight gain of the fish along the experiment (average ± SD). Significant differences between the months for each feed are indicated by different letters (a, b, c; $P< 0.05$).

DISCUSSION

Fish fed with commercial feed grew faster than those fed with local feed. The main reason might be the higher protein content in the commercial feed. Otherwise, the commercial pellets are extruded, so are probably more digestible. The FCR is not significantly different between the feed although it tended to be slightly lower with the commercial feed; this might be due to the fluctuation of the survival in the different replications. The extruded pellet floats so its consumption is indeed usually optimal compared to the local and sinking pellet. For the latest, the feed should be consumed right

after distribution otherwise it is lost in the River. Lastly, the commercial feed led to a much higher profit although its price per kilo is higher than that of the ingredients for the local feeds. Preparation of the latter requires specific equipment and labor, which caused higher fixed and operational costs. It is to notice that the fixation of proteins by the fish could be better with the local feed but the protein content in the harvested fish was not determined.

Table 4. *Cost and profit per feed (amounts in US$; average values). Significant differences between the feeds are indicated by different letters (a, b, c; P < 0.05).*

	Feed 1	Feed 2	Feed 3
	Per cage		
Cages			
Equipment for the feed (*)	3.01	3.01	0.00
Scale	0.13	0.13	0.13
Total fixed cost	7.18	7.18	4.16
Ingredients or feed	9.05	11.06	25.98
Fingerlings	3.33	3.33	3.33
Electricity	0.14	0.14	0.14
Labor	8.45	8.45	5.91
Total Operational cost	[c] 20.97	[b] 22.99	[a] 35.23
Total cost	[c] 28.15	[b] 30.17	[a] 39.39
Income (**)	[b] 31.60	[b] 36.07	[a] 52.04
Net income	[b] 3.45	[b] 5.91	[a] 12.65
Net income (% income)	10.9%	16.4%	24.3%
	Per kg of fish harvested		
Fixed cost	[a] 0.31	[b] 0.28	[c] 0.11
Operational cost	[a] 0.94	[a] 0.94	[a] 0.99
Total cost	[a] 1.27	[ab] 1.22	[b] 1.10
Income	1.39	1.39	1.39
Net income	[b] 0.13	[ab] 0.17	[a] 0.29
Net income (% income)	9.3%	12.0%	20.7%

(*): Includes mixing, pressing and drying machines and containers,

(**): The quantity of fish harvested per cage was: [c] 22.8 +/- 2 kg (feed 1), [b] 26 +/- 1.4 kg (feed 2) and [c] 37.5 +/- 1.8 kg (feed 3). The net income is calculated by multiplying the quantity harvested by the price of selling per kilo of fish (1.39 USD whatever the feed used).

Note: 1 US$ = 10,800 Kip.

In Thailand, Oupasirth (2003) mentioned that cultivation of *P. hypophthalmus* is made in cages with the stocking density of 150 fish/m^3. Local feed is used and given with the feeding rate of 3 per cent of the biomass per day. After one year, the average body weight is 1.5kg. Therefore, the daily weight gain is about 4.1g that is similar to that obtained here with the feed 1 (local feed). The tilapia is also raised in similar conditions as reported by Koranankoun (2004). The stocking density in cage is 60 fish/m^3 and the grow-out lasts 63 days. The commercial feed is used with the feeding rate of 4 per cent of the biomass per day. Harvested fish weight was 300g on average, therefore the daily weight gain is about 4.8g which is similar to that obtained with feed 2 (local feed). Based on

the two last references, the growth of *P. hypophthalmus* fed with commercial pellet in the present experiment was quite high (7.8 g per day).

The growth rate increased during the second month probably because the fish adapted to the new condition since they initially came from pond. The growth rate decreased during the third month probably because of the fast change in water quality due to the rainy season. The turbidity usually increases as well as the water velocity while the temperature decreases as observed here (- 2.8°C between June and August). Such changes have caused a reduction in the feed consumption. Otherwise several fishes produced sperm by the end of the experiment which indicates that the sexual maturation in the male occurs at the age of about eight months. Such maturation might have also impaired the growth.

CONCLUSIONS

Our experiment showed that the use of local feed is profitable although the profit was much lower than that with the commercial feed tested here. The fish growth was good on the whole even if it was affected by the change in the water quality during the last month whatever the feed used. The fluctuations in the survival rate between the replications do not allow any conclusions to be made regarding FCR values between the different feeds. Better profit with the local feed would likely be obtained with higher stocking density since it was quite low in the present experiment. Moreover, higher protein content in the local feed would probably lead to better result. The same experiment could be repeated by testing the two kinds of feed (commercial and local) with similar contents for both proteins and lipids: 25 per cent and 5-7 per cent could be tested, respectively. Stocking density ranging from 20 to 60 fingerlings/m^3 could be reasonably tested. Lastly, the local feed could be tested in pond where the consumption of the sinking pellet can be delayed (i.e. consumption on the bottom).

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