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*RESEARCH PAPER*

# Assessment of productivity of pangas catfish (*Pangasius pangasius,* Hamilton-1822) culture in jute retting pond in Murshidabad district

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**Abstract :** Murshidabad district is the highest jute producer district in West Bengal where maximum numbers of ponds beels, canals and irrigational channels are being used for jute retting from July to September and after retting, water bodies remain uncultured. But few farmer's, they were culture traditionally with IMC and exotic carps and getting very low yield (3.66q $ha^{-1}yr^{-1}$). In that condition Murshidabad KVK has designed one OFT trails having three treatments, Farmer's Practice (FP), Technology Option-I (TO-I) and Technology Option-II (TO-II) on air-breathing fish pangas (*Pangasius pangasius*) and conducted in farmers' field for three years. To find out the suitable fish species, observed water parameters (pH, DO mg $L^{-1}$), stocking density (nos./ha), length (cm), weight (g), survival rate (%), yield (q $ha^{-1}yr^{-1}$), cost of culture (Rs. $ha^{-1}yr^{-1}$) gross return (Rs. $ha^{-1}yr^{-1}$), net return (Rs. $ha^{-1}yr^{-1}$), BC ratio and disease incidence etc. The effect of water pH and DO (mg $L^{-1}$) in post jute retting pond and fish stocking pond indicate, there were a statistically significant difference between three treatments at ($p$ <.05). Stocking density in three treatments were 15000 nos. $ha^{-1}$ (IMC and exotic carps), 11250 nos. $ha^{-1}$ and 15000 nos. $ha^{-1}$ (pangas, size 2.5") . In this trial it was observed that the mean (SD) initial length (cm), initial weight (g) and final length (cm) were not statistically significant at $p$ >.05 but in case of final weight (g) and weight gain (g) there were statistically significant at p<.05. The survival rate (%) was lowest in FP (35.04±4.51) and highest in TO-I (67.55±17.50) and not statistically significant ($p$ >.05). The mean (SD) yield (q $ha^{-1}yr^{-1}$) was high statistically significant difference found among three treatments ($p \leq 001$). The average net profits were Rs.65680.0, Rs. 223841.0 and Rs. 337551.0 $ha^{-1}yr^{-1}$. in FP, TO-I and TO-II, respectively. The highest mean B:C ratio was 2.44 in TO-II. With the all concerned it was observed TO-II gives the best result among these three treatments in these three years trials.

**Key Words :** Pangas fish, Jute retting pond, Water quality, Feeding habit, Yield

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## INTRODUCTION

Aquaculture is one of the fastest growing sectors in India (Ayyappan, 2012), freshwater aquaculture contributes more than 95 per cent of total aquaculture production in India. Recently, catfish has started playing

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a very significant role in world aquaculture (Ahmed and Hasan, 2007). Catfish (*Pangasius*) is an important and fastest growing group of fish in the world aquaculture after tilapia and carps (Phan *et al.*, 2009 and Lakra and Singh, 2010). Among the most popular catfish species, *Pangasius hypophthalmus* and *Pangasius pangasius* are promising fish species for prospective and progressive fish aquaculturists due to their fast growth, easiness of culture, high resistance to disease and wide range of environmental factors (Begum *et al.*, 2012), air breathing, tolerance to low dissolved oxygen and compatibility to polyculture (Ahmed and Hasan, 2007), has increased by six folds during the last decade (FAO, 2009). Keeping in view its attributes, *Pangasius* was introduced in India during 1995-96 from Thailand through Bangladesh (Ahmed, 2007 and Rao, 2010). Culture of *Pangasius* spread very fast in India and largest producers of pond cultured *Pangasius* (Rao, 2010). Government of India, through National Fisheries Development of Board (NFDB), Hyderabad is promoting cage-culture of *Pangasius* (Anon, 2011). *Pangasius* is widely distributed in India, Bangladesh, Pakistan, Myanmar, Malaya-peninsula, Indonesia, Vietnam, Java and Thailand (Talwar *et al.,* 1991; Chondar, 1999; Day, 1878; Job *et al*., 1955; Mishra, 1959; Roberts *et al.*, 1991 and Tripathi, 1996). Adult pangas is bottom feeder, carnivorous in habit; mainly prefer molluscs (David, 1963; Rahman, 2005; Hora, 1952; Alikunhi, 1957; Menon *et al*., 1958; Ramakrishniah, 1986 and Sengupta *et al.*, 2011). Apart from molluscs, fishes, insects, crustaceans etc. have also been documented from the gut content of adult pangas (Menon *et al.*, 1958 and Ramakrishniah, 1986). Ghosh *et al.,* 1981 and Ali *et al.*, 1985 have reported adult pangas as an omnivorous fish. Larval and post-larval stages of this fish species live mainly upon the planktonic food and small insects (Chondar, 1999 and David, 1963).

Jute is one of the important commercial crops in India next to cotton (Nayak *et al*., 2012) and India is ranked in 1st position (Gupta *et al.*, 2009). West Bengal, Assam and Bihar are the major jute growing states (State of Indian Agriculture, 2016-2017) and Murshidabad district is the highest jute producer district in West Bengal and here 8000 ha area under jute cultivation. Retting is the most important postharvest operation (Dasgupta *et al.*, 1976 and Majumdar and Day, 1977), mainly adopted two types, dew and water retting (Elena *et al.,* 2004). Commonly water-retting procedure is selected Huda *et al.*, 2012) to obtain the fibres (Huda *et al.*, 2012) from the woody stem (Basak *et al.*, 1998) which involves various biochemical, chemical and enzymatic reactions (Ahmed and Akhter, 2001; Banik *et al.,* 1993) and results in the generation of waste liquor, and scum that appears on surface of the water (Banerjee and Dastidar, 2005). Water quality of the retting water was change due to the retting process (Ahmed and Akhter, 2001) water becomes acidic (Ali *et al.*, 1968 and Debsharma, 1976) and there is an ecological consequence of this problem (Mondal and Kaviraj, 2008). It was found that native freshwater species also lose their breeding and nursery ground during monsoon season due to bad water quality in jute retting water bodies. For this very reason, most of the jute retted water bodies are infested with different aquatic weeds and persist without any production but few farmers like Mr. Madhab Sarkar (Dakshin Basudebpore, Bhagwangola-II block), Milton Sk, Harun Al Rasid (Kanapukur, Bhagwangola-I block), Moinuddin Sk (Dahapara, MJ block) and Piware Islam (Milebasa, Bhagwangola-I block) they stock huge amount of IMC (Indian Major Carp) and exotic carps fish seeds. Due to not proper pond preparation and not to stock suitable fish species with proper sizes those farmers were getting low yield. In that situation Murshidabad KVK introduced air-breathing species like pangas (*Pangasius pangasius*) through OFT programme and farmers are getting success because pangas is an air-breathing fish can withstand in low level of DO, high organic loaded pond.

**Objectives:**

The main objective of the present trials was to check and compare the yield performance of pangas (*P. pangasius*) in jute retting pond using three different treatments to get a suitable fish species.

## MATERIAL AND METHODS

This on farm trial (OFT) programme was carried out in the 63 numbers of farmers' pond in 3 adoptive blocks (MJ block, Bhagwangola-I and II block) of Murshidabad district (Lat 24.2290° N and Long. 88.2461° E) in West Bengal.

**Pond preparation:**

The jute retting ponds were netting completely for two to three times with drag net to remove all left out jute retting materials, aquatic weeds, and carnivorous fishes first then apply lime 225kg-300kg per ha. After 3 to 4 days of liming, apply potash ($KMnO_4$) 1500g to

1875g per ha and left exposed to sunlight for about 11 to 12 days. There is no need to apply any organic fertilizer like RCD in all jute retting ponds. Apply inorganic fertilizer like urea and SSP (1:2) at the rate of 37.5 kg/ha after 5 to 6 days of liming. It increases the primary productivity of pond water.

**Fish seed stocking:**

Pangas (*Pangasius pangasius*) through on farm trial (OFT) in farmers' fields with three treatments namely Farmers' practice: IMC culture with a stocking rate of 15000 nos. per ha, *Pangasius pangasius* (Pangas) with a stocking rate of 11250 nos. per ha with stocking size of 2-2.5 inches and *Pangasius pangasius* with a stocking rate of 15000 nos. per ha with stocking size 2-2.5 inches. This OFT was repeated for 3 years (2012-13, 2013-14 and 2014-15) with seven replication and above mentioned three treatments.

**Data collection:**

The following data should be collected for this trial.

– Water quality parameters : The water quality parameters such as pH and dissolved oxygen (DO, mg $L^{-1}$) were recorded fortnightly. Water pH and DO were recorded by a pH meter and DO testing kit.

– Fish survival rate (%), fish length (cm) and weight (g), Diseases incidence, fish yield (q $ha^{-1}yr^{-1}$) and farmers feedback.

**Economic analysis:**

An economic analysis was conducted to estimate the net profit from different treatments. The analysis was based on local market prices for harvested fish and all other items. The cost of leasing ponds was not included in the total cost. The net return was measured by deducting the gross cost from the gross return per hectare. The benefit cost ratio was also measured as a ratio of net benefit to gross cost.

**Statistical analysis:**

For the statistical analysis of data, single and two factor analysis of variance (ANOVA) of the mean values of growth, survival and yield was done using SPSS software. The mean values were compared according to DMRT test (Gomez and Gomez, 1984). Significance was assigned at .05% level.

## RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

**Water quality parameters:**

Different parameters (mean ± SD) measured throughout the experimental period are presented in Table 1.

A two-way anova was conducted for compare the water pH level, a dependent variable on two independent variables post jute retting pond and fish stocking pond through three treatment trials FP, TO-I and TO-II. All effects were statistically significant at the .05 significance level except for combination effect with seasons*trials. The main effect water pH for independent variable seasons yielded an $F$ ratio of $F$ (1,36) =291.940, $p \leq .001$, indicating a highly statistically significant difference between post jute retting pond (M=5.93, SD=.256) and fish stocking pond (M=7.28, SD=.519). The pH effect on different trials yielded an $F$ ratio of $F$ (2,36) =31.134, $p \leq .001$, indicating a high level of statistically significant mean difference between three treatments FP (M=6.17, SD=.673), TO-I (M=6.88, SD=.726) and TO-II (M=6.77, SD=.831). The interaction effect of seasons and trials on water pH will have no statistically significant difference was found an $F$ ratio of $F$ (2,36) =2.15, $p > .05$.

From the analysis of Fig.1 which shows variation of pH value among the three treatments namely FP, TO-I and TO-II in post jute retting pond and fish stocking pond. pH was varied between 5.6 to 6.6 during post jute retting period and 6.1 to 8.1 during fish stocking period. Although pH was always falling on the acidic side

**Table 1: Mean (±SD) values of water quality parameters of different experimental ponds under three treatments**

| Parameters | Conditions | FP | TO-I | TO-II |
|---|---|---|---|---|
| pH | Post jute retting pond | 5.60±0.00 | 6.20±0.00 | 6.00±0.00 |
| | Fish stocking pond | 6.74±0.47 | 7.55±4.76 | 7.54±4.77 |
| DO (mg $L^{-1}$) | Post jute retting pond | 1.98±4.15 | 1.99±4.15 | 1.98±4.15 |
| | Fish stocking pond | 3.12±3.95 | 5.40±3.60 | 5.38±3.58 |

(6.08±0.35 to 6.73±5.06), comparatively lower pH was found during post jute retting pond and fish stocking pond in case of all treatments but after pond preparation before fish seed stock it was found that the pH acidic (6.73±5.06) in FP compare to another two TO-II and TO-I (7.54±4.77 and 7.55±4.76). In case of post jute retting pond water pH acidic (5.99±0.26-6.08±0.35) in all trials it may due to decomposition of jute when various organic acids diffuse and get mixed with retting water from the jute plant and finally lowers the water pH this same observation done by Ali *et al.*, 1968 and Debsharma, 1976.

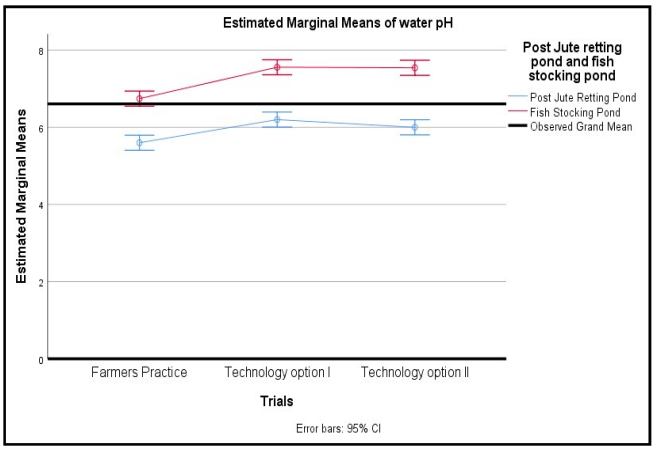


**Fig.1: Relation of means water pH in post jute retting pond and fish stocking pond in different treatments**

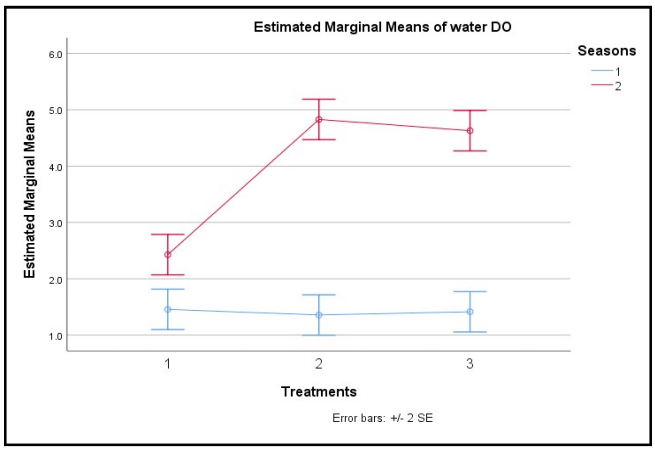


**Fig. 2: Relation of mean water DO in Post jute retting pond and fish stocking pond**

To compare the DO (mg $L^{-1}$) level in pond water, a two-way anova was conducted for a dependent variable on two independent variables, post jute retting pond and fish stocking pond through three treatment FP, TO-I and TO-II. All effects were statistically significant at the .05 significance level. The main effect analysis showed that the water DO (mg $L^{-1}$) for treatments yielded an $F$ ratio of $F$ (2,36) =3.29, $p \leq .05$, indicating a statistically significant difference between three treatments FP (M=3.114, SD=1.88), TO-I (M=4.857, SD=.369) and TO-II (M=3.593, SD=1.192). In case of seasons yielded an $F$ ratio of $F$ (1,36) = 332.30, $p \leq .001$, indicating a high level of statistically significant mean difference between post jute retting pond (M=1.83, SD=.65) and fish stocking pond (M=4.78, SD=.602). The interaction effect of treatments and seasons on pond water pH will have statistically significant difference was found an $F$ ratio of $F$ (2,36) =7.36, $p$ <.01.

From the analysis of Fig. 2 it was shows, means DO (mg $L^{-1}$) value among in case of post jute retting pond it was very low for all three treatments but in case of fish stocking pond in TO-I (M=5.73, SD=5.77) it was maximum increased and in FP was lowest (M=3.17, SD=6.57). This result indicate that DO (mg $L^{-1}$) level in all time stay below the recommended level (4-6 mg/liter) for FP but in TO-I and TO-II having recommended level of DO (mg $L^{-1}$). That why if farmers were stocked IMC and other exotic carps, fishes become stressed due to low level of oxygen in jute retting pond. If they were prepared properly post jute retting pond before stocking not faced this condition for that reason survivability rate was very low in FP treatment. The same observation was found by Kundu *et al.*, 2019 and Roy *et al.*, 2016 lowering of DO (mg $L^{-1}$) during retting period can be due to jute retting.

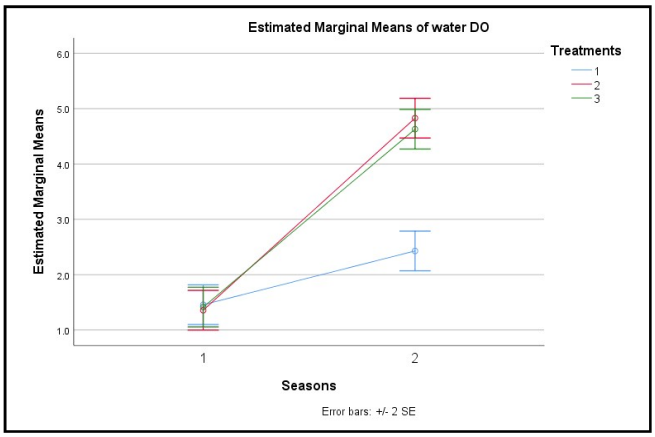


**Fig. 3: Relation between means water DO (mg $L^{-1}$) with treatments**

In this trial it was observed that the mean (SD) initial length (cm) and initial weight (g) were 6.94±3.95,

7.56±3.50, 7.56±3.50 and 6.99±3.82 7.34±3.65, 7.51±3.43 in FP, TO-I and TO-II, respectively. Final length (cm) and final weight (g) in three treatments FP, TO-I and TO-II were 22.25±4.24, 35.79±8.97, 31.58±9.14 and 346.19±185.55, 669.45±3.4.42, 606.38±236.08. The highest length (cm) and weight (g) was found in TO-I. It was observed that the max. length and weight were 49 cm and 1.2 kg in 8 months of culture with low inputs found in TO-I. It was found that survival rate (%) lowest in FP (35.04±4.51) and highest in TO-I (67.55±17.50).

In Fig. 4 showed that the highest mean length observed in TO-I followed by TO-II and FP and in case of Fig. 5 showed that initial weight (g) in all three treatments there was no more difference but final weight (g) and weight gain (g) vary in TO-I and TO-II than FP.

A one-way between groups analysis of variance

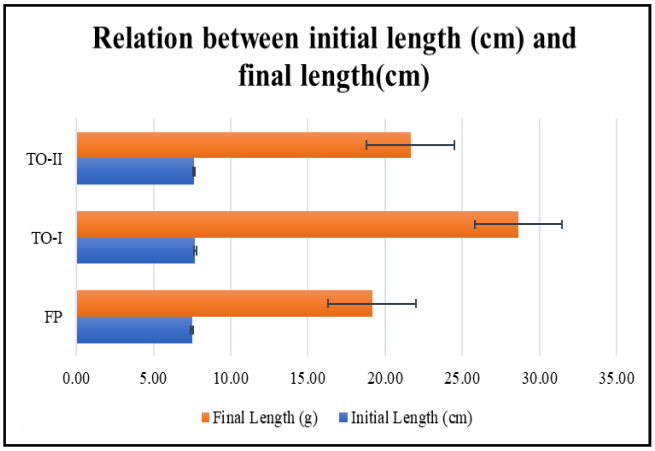


**Fig. 4: Relation between initial length (cm) and final in different treatment**

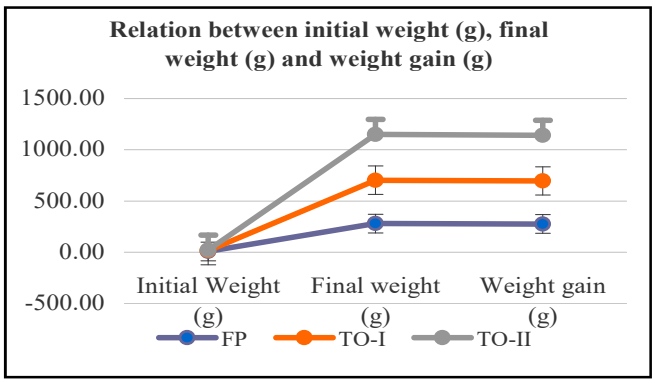


**Fig. 5: Relation with initial weight (g), final weight (g) and weight gain (g) in different treatment**

was conducted to explore the impact of treatments on yield. Technology having three treatments FP, TO-I and TO-II. All effects were statistically significant at the .05 significance level. There was a statistically significant difference among three treatments on yield, $F$ (2,18) = 1456.95, $p \leq .001$. The effect size, calculated using Eta-squared ($\eta^2$) was .99. A post-hoc comparisons using the Tukey HSD test indicated significant difference between them and the mean score for TO-II (M=78.71, SD=3.2) gives the highest performance on yield than TO-I (M=67.43, SD=2.22) and FP (M=13.53, SD=1.5). TO-II and TO-I treatment groups were significantly higher than the FP group yield production.

In case of yield and treatments it was found that maximum yield in TO-II then TO-I and in FP there was lowest yield found. This due to species selection was incorrect for FP and the same observation was found by Mondal *et al.*, 2008 that physicochemical parameters of

**Table 2 : Growth performance (mean ± SD) and survival rate (%) of pangas catfish and IMC and exotic carps in different treatments**

| Treatments | Parameters | | | | | | |
|---|---|---|---|---|---|---|---|
| | Initial length (cm) | Final length (cm) | Initial weight (g) | Final weight (g) | Weight gain (g) | Survival rate (%) | Yield ($qha^{-1}yr^{-1}$) |
| FP | 6.94±3.95 | 22.25±4.24 | 6.99±3.82 | 346.19±185.55 | 340.59±185.06 | 35.04±4.51 | 13.5286±1.52 |
| TO-I | 7.56±3.50 | 35.79±8.97 | 7.34±3.65 | 669.45±304.42 | 662.12±303.32 | 67.55±17.50 | 67.4286±2.23 |
| TO-II | 7.56±3.50 | 31.58±9.14 | 7.51±3.43 | 606.38±236.08 | 600.88±235.57 | 65.91±12.47 | 78.7143±3.20 |
| S.E.± | 2.02 | 5.85 | 1.89 | 5.85 | 164.22 | 10.58 | 0.91 |
| C.D. (P=0.05) | 6.23 | 18.03 | 5.83 | 18.03 | 505.97 | 32.60 | 2.79 |

**Table 3 : Economic performance of different treatments under seasonal condition**

| Treatments | Parameters | | | |
|---|---|---|---|---|
| | Cost of cultivation (Rs. /ha/yr.) | Gross return (Rs. /ha/yr.) | Net return (Rs. /ha/yr.) | BCR |
| FP | 115985.0 | 186809.0 | 65680.0 | 1.65 |
| TO-I | 205655.0 | 430456.0 | 223841.0 | 2.10 |
| TO-II | 238812.0 | 577811.0 | 337551.0 | 2.44 |

water were changes for jute retting and made to evaluate their impact on the survival of two species of freshwater fish (*Labeo rohita* and *Hypophthalmicthys molitrix*) fingerlings of both species of fish were highly susceptible. Mortality of fish was significantly correlated with the percentage of JRW.

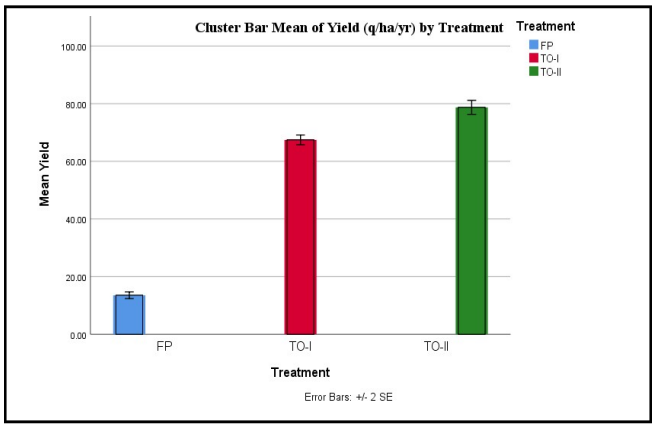


**Fig. 6: Relation between mean yield in different treatments**

The average net profits were Rs. 65680.0/ha/yr., Rs. 223841.0/ha/yr. and Rs. 337551.0/ha/yr. in FP, TO-I and TO-II, respectively. Here TO-II was given the highest profit Rs. 428985.0/ha/yr. and the highest average B:C ratio was 2.44 in TO-II and in other treatments were 2.10 and 1.65 for TO-I and FP, respectively.

During this trials some diseases like myxobolus, ulcer, fin rot, dropsy and gill diseases were found in FP and in TO-I and TO-II found fin rot and stroke in winter season that should be treated by using different antibacterial and antifungal agents and fish stroke in winter season found in case of pangas that should be prevented to give advices to farmers to stop netting in winter season.

## Conclusion:

Through the findings of present trial, we can recommend (TO-II) that 15000 fingerlings of *Pangasius* (2.53) stocked in per ha water bodies gives maximum fish growth and maximum per cent increase in fish yield with properly maintaining the feeding schedule and fish health.

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