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EFFECT OF DIFFERENT FEEDING RATES ON THE GROWTH PERFORMANCE OF JAYANTI ROHU FISH REARED UNDER BHUTANESE CONDITIONS

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ABSTRACT: A study was conducted to investigate the growth performance of Jayanti rohu fish fed with commercially produced sinking pellet at different feeding rates over a period of six months. The experiment consisted of three treatments (T1, T2 and T3) with feeding rate of 1%, 1.5% and 2% of the body weight respectively. The production performance of Jayanti rohu was conducted in an earthen pond with the dimensions of 270 m^2 x 1.5 metre depth. A total of 130 random samples were weighed and measured to record the morphometric indices on a monthly basis. The data was analyzed using SPSS. Bonferroni post hoc multiple comparison tests was run to determine the significant differences among the means of treatment group. The result indicated that Jayanti rohu responded significantly to different feeding rate. The highest growth rate of 416.08 ± 130.64 g with 95.83% survival rate was recorded for T2, fed at the rate of 1.5% of body weight. Besides, a unit area (m^2) fish production was significantly higher in T_2 (0.62 kg) when compared to other treatments. Thus, feeding rate of 1.5% of the body weight may be recommended for Jayanti rohu when reared under sub-tropical climatic condition of Bhutan. However, in-depth station and on-farm participatory evaluation of this feeding regime with more replicates is suggested to draw better inferences and for wider application.

Keywords: Jayanti rohu; feeding rate; commercial feed; growth performances.

1. INTRODUCTION

In Bhutan, aquaculture was initiated in 1984 with the establishment of a cultivable carp hatchery unit in Gelephu, Sarpang district. The then centre started with six exotic carp fish species such as Grass carp (*Ctenopharyngodon Idella)*, Silver carp *(Hypophthalmichthyx molitrix)*, Common carp (*Cyprinus carpio)*, Rohu (*Labeo rohita*), Mrigal *(Cirrhinus mrigala)* and Catla (*Catla catla)*. These species were selected and introduced based on its taste, adaptability to crowded conditions, faster growth rate and efficient utilizer of natural food resources of the pond. Fishes are efficient converter of artificial feed, hardy and not easily susceptible to disease with good market demand that fetch high price. It has comparative advantage over other cultivable species, more palatable with high nutritive values. The Indian major carps like *Labeo rohita, Cirrhinus mrigala* and *Catla catla* were initially introduced from India, and Chinese major carps such as *Ctenopharyngodon idella* and *Hypophthalmichthyx molitrix* were imported from Nepal and European Carp, *Cyprinus carpio* from Hungary.

The hatchery unit at National Research and Development Centre for Aquaculture (NRDCA), Gelephu since its establishment has been promoting and supporting the development of carps farming in the country. The carp farming activities started gaining its momentum steadily with the production of 1.34MT in 2007 (Department of Livestock [DoL] 2007) to 209.28MT in 2019 (DoL 2019). Today, 469 farming households in the country are actively engaged in carp production (Thinley 2019) which are spread across twelve districts viz. Chukha, Dagana, Mongar, Pemagatshel, Punakha, Samdrup Jongkhar, Samtse, Sarpang, Tsirang, Trashigang, Wangdue and Zhemgang. However, farmers' preferences for fish species

differs with field-based knowledge and experiences they have acquired from aquaculture farming over the period of time. Based on live inputs production and distribution record of NRDCA, the fish farming communities prefer *Ctenopharyngodon idella* and *Cyprinus carpio* the most. Other four species are the least preferred by fish farmers because of their poor growth performance in the field when compared to *Ctenopharyngodon idella* and *Cyprinus carpio*. In view of giving wider choice/preference to farmers, the centre explored new species for polyculture with the import of genetically improved strain called Jayanti Rohu from India. This species has 18% higher growth performance over ordinary *Labeo rohita (*Jayansankar 2016). Its culture is growing popularity over ordinary *Labeo rohita* due to high growth rate and consumer preference (Sarkar et al. 2015). The salient features include substantial additive genetic variance and negligible heterosis (hybrid vigor) for growth. It can be marketed two months earlier than other Carp species. Owing to above positive attributes over other Carp species, the centre has selected Jayanti rohu as future brooders. However, until date, very limited information is available on actual feeding rate for Jayanti rohu to minimize feed cost and improve production efficiency. Thus, this study was designed to assess the growth performance of Jayanti Rohu through feeding commercial feeds at different feeding rates during its culture period under Bhutanese station conditions.

2. METARIALS AND METHODS

2.1 Study site

The study was conducted at NRDCA, Gelephu which is located at 26°51.790' N and 090°31.961' E at an elevation of 252 masl. The area falls under sub-tropical climatic condition with warm and dry winter and wet and hot summer. The rainfall ranges from 1500-3500 mm per annum and the temperature ranges from 16-30°C. The study was carried out from October, 2019 to March, 2020 for the duration of six months.

2.2 Experimental fish

The centre introduced Jayanti Rohu fingerlings as a brood stock on 18th June, 2018 from Gangamatal Jhalgar, West Bengal, India. The fingerlings were acclimatized to Bhutanese environment and culture system by rearing in an earthen pond for thirteen months in line with the protocol of Devaraj et al. (2014). Jayanti rohu growers having initial mean weight of 241.06 g and mean length of 27.74 cm were randomly divided into three groups and then stocked randomly into respective treatment ponds of 270 m^2 @ 1.6 fish/m^2 following research protocols of the centre (Thinley et al. 2018).

2.3 Research methods

A randomized block design was used to assign the treatments (Bora & Das 2013). The experiment consisted of three treatments with the following feeding rates assigned to Jayanti rohu;

1. T_1 - feeding commercial feed @ 1% of body weight.
2. T_2 -feeding commercial feed @ 1.5% of body weight.
3. T_3 -feeding commercial feed @ 2% of body weight.

In total, 1296 numbers of fish were used in the study as indicated in Table 1.

Table 1: Experimental design of Jayanti rohu

Treatments	Stocking rate (fish/m^2)	Total no. of fish
T_1	1.6	432
T_2	1.6	432
T_3	1.6	432
Total		1296

2.4 Sample size and sampling procedure

Through random sampling technique, 130 numbers of fish were weighed and their body length measured to assess monthly culture performances. Thirty percent fish from each treatment (n=432) were considered as representative sample size for this study. The sampling frequency was restricted to monthly basis mainly to address fish welfare through implementation of standard operating procedure to record the performance in terms of body weight and total body length (DoL 2019).

2.5 Feeding regimes

The experimental animals were fed with commercially produced sinking pellet containing 25% crude protein. Feeding rates of 1, 1.5 and 2% per day of their body weight respectively were assigned to the animals in which has reference to Jena et al. (2001). The

total biomass changes observed in the research ponds were estimated on a monthly basis in line with the sampling data adopted from Thinley et al. (2018). The animals were fed three times in a day (i.e., 8 AM, at noon and at 4 PM as per the standard protocol (Thinley et al. 2018).

2.6 Water quality parameters

Essential water quality parameters such as Water Temperature (WT), Dissolved Oxygen (DO), pH, Water Transparency (WTr) and Water Color (WC) were recorded on forth-nightly basis. The measures like uniform manuring and liming of the ponds were done to keep the key water quality parameters within the optimum range for Jayanti rohu (FAO 2019).

2.7 Performance variables

The different performance indices of Jayanti rohu were determined as follows;

a) *Mean gain in length (cm): Mean final length (cm) – Mean initial length (cm)*

b) *Mean gain in weight (g): Mean final weight (g) – Mean initial weight (g)*

c) *Specific Growth Rate, SGR (% per day):*

$$= \frac{LogW2 - LogW1}{T} \; X\ 100$$

Where, W2 = mean final weight (g), W1 = mean initial weight (g), T is the culture period (days)

d) *Survival rate (%):*

$$= \frac{No.\ of\ fishes\ harvested}{No.\ of\ fishes\ stocked} \; X\ 100$$

e) *Feed Conversion Ratio (FCR):*

$$= \frac{Total\ feed\ consumed\ (kg)}{Total\ weight\ gained\ (kg)}$$

f) *Production (kg/ha/six months):*

$$= No.\ of\ fish\ harvested\ *\ mean\ weight\ at\ harvest\ (kg)$$

2.8 Data analysis

The quantitative data such as weight gain, body length, survival rate, FCR and other variables were analyzed using SPSS version 23.0.

3. RESULTS AND DISCUSSIONS

3.1 Water quality parameters Temperature, DO, pH, water temperature, transparency & color

Water quality parameters such as WT, DO, pH, WTr and WC were found within the normal range during the entire culture period which is similar to the study conducted by the FAO (2011). Figure 2 depicts the mean and standard deviation (M±SD) of pH, DO, WT and WTr during the experimental period. The overall WC was observed greenish brown including muddy water during the peak summer due to incessant rain along the upstream water source which is in agreement with the findings of the FAO (2011). Similar findings on water quality parameters were also reported by Murmu et al. (2019) while experimenting on genetically improved Jayanti rohu.

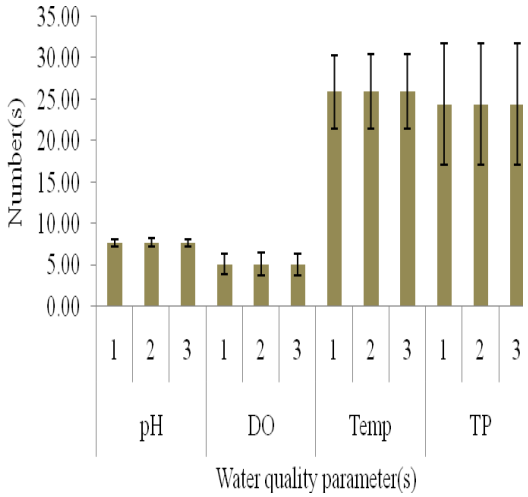

Figure 2: Key water quality parameters

3.2 Performance of Jayanti Rohu

The performance of Jayanti rohu after six months of culture period is indicated in Table 2. The results indicated that fish production from one-meter square unit and one hectare fish pond was 0.49 kg (T_1), 0.62 kg (T_2), 0.54 kg (T_3) and 4896.31 kg (T_1), 6247.11 kg (T_2), 5360.64 kg (T_3) respectively, with recorded survival rate of 73.84% (T_1), 95.83% (T_2) and 92.36% (T_3). Vivek et al. (2018) also reported similar growth performance and survival rate ranging from 76-84% in Jayanti rohu fingerlings. The same authors have observed similar trend of specific growth rate and average daily gain during their 31-day study period.

Table 2: Performances of Jayanti rohu reared under station conditions.

Parameters	T_1	T_2	T_3
Mean Initial Weight (g)	241.66	241.53	241.45
Mean Final Weight (g)	314.28	416.08	362.75
Mean Weight gain (g)	72.63	174.55	121.29
Mean Length gain (cm)	1.00	2.23	0.58
SGR (%/day)	0.89	1.07	0.99
Survival rate (%)	73.84	95.83	92.36
FCR	6.89	4.39	5.47
Production (kg/m2/6 months)	0.49	0.62	0.54
Production (kg/ha/6 months)	4896.31	6247.11	5360.64

Bonferroni post hoc multiple comparison tests revealed that there was a significant difference ($p < 0.05$) between treatments in the final mean body weight. Moreover, a significant difference in mean body length gain across different treatment was also recorded (Table 3). The highest mean body weight of 416.08 g was recorded in T_2 followed by 362.75 g (T_3) and 314.28 g (T_1) with 95.83%, 92.36% and 73.84% survival rate respectively. The findings are in concurrence with Vivek et al. (2018) and Murmu et al. (2019) respectively. The current study indicated that fish has responded better in terms of growth performance and survivability with feeding @ 1.5% body weight.

Table 3: Comparison of multiple growth (M±SD) indices.

Treatment	Initial BW (g)	Initial BL (cm)	Final BW (g)	Final BL (cm)
T_1	241.6± 65.54^a	27.65± 2.71 ^{a}	314.28± 92.30^a	28.85± 2.23^a
T_2	241.5± 52.30^a	27.59± 2.33 ^{a}	416.08± 130.64^b	29.72± 2.96^b
T_3	241.4± 64.02^a	27.98± 2.45 ^{a}	362.75± 107.83^c	28.41± 1.90^a

Different superscripts within the column indicates significant differences ($p < 0.05$).

The result indicated that there was a significant difference among the treatments in the final body weight of the fish. Moreover, a significant difference in terms of final body length of fish was observed between T1 & T2.

The overall monthly growth pattern of Jayanti rohu is presented in Figure 3. There was a continuous growth of fish cultured in T_2 and T_3 starting from October, 2019 till April, 2020. However, Jayanti rohu exhibited exponential growth by the month of May, 2020 except in T_1 which could be attributed to low feeding rate.

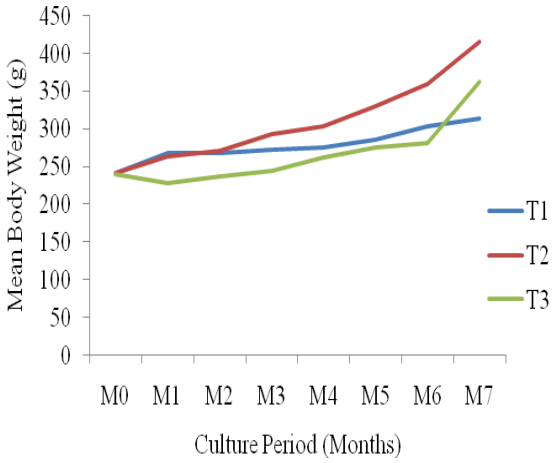

Figure 3: Monthly growth pattern of Jayanti rohu with different treatments.

4. CONCLUSION

Carp production is predominantly practiced using non-commercial feeds in Bhutan and feeding rate ranges from 1 to 2% of the body weight. The production of fish from a unit area is generally poor. However, fish farmers are switching over to commercial fish feed owing to its comparative advantage when compared to non-commercial feed to achieve desired growth indices. The study found that feeding rate at 1.5% of body weight yielded better fish production from a unit area under station conditions. However, owing to absence of treatment replicates, the findings from the current study cannot be inferred in general and recommended for wider application in the field. Thus, it is recommended to undertake further in-depth study with more replicates both at the station and on- farm (with farmers) to validate the current findings.

REFERENCES

Bora J and Das AK. (2013). Costs and Returns of Integrated Fish Farming in Jorh at District of Assam. Agriculture Science Disgest, 289-293.

De HK, Saha GS, Kumar K, and Mahapatra KD. (2008). Impact of farmers meet on popularizing jayanti rohu. Fishing chimes, 28(5): 46.

Devaraj C, Mohanty SN, Rath SC, Sarkar S and Giri SS. (2014). Fasting and postprandial energy metabolism in Jayanti rohu, Labeo rohita fry fed on variable protein containing diets. International Journal of Research in Fisheries and Aquaculture, 14(1): 14-17.

DoL. (2007). Livestock Statistics. Department of Livestock.

DoL. (2019). Livestock Statistics. Department of Livestock.

DoL. (2019). Strategy & Management Plan of Livestock Input Farms. Department of Livestock.

Dzongkhag Administration, Sarpang (n.d). Royal Government of Bhutan. www.sarpang.gov.bt. Accessed 19 August 2019

FAO. (2011). Better Management Practices for Carp Production in Central and Eastern Europe, the Caucasus and Central Asia. Ankara: Turkey. FAO Fisheries and Aquaculture Technical Paper.

FAO. (2019). Cultured aquatics species information programmes. Rome: Italy. Fisheries and Aquaculture Department. Food and Agriculture Organization.

Jena J, Ayyappan S, Aravindakshan P and Muduli H. (2001). Comparative Evaluation of Growth, Survival and Production of Carp Species at Different Stocking Densities under Polyculture. Indian Journal of Fishery, 17-25.

Jayasankar P. (2016). Genetically Improved Rohu "Jayanti" for Sustainable Aquaculture Production. Odisha: India, Indian Council of Agriculture Research-Central Institute of Freshwater Aquaculture.

Murmu K, Rasal KD, Rasal A, Sahoo L, Nandanpawar, Udit UK, Patnaik M, Mahapatra KD and Sundaray JK. (2019). Effect of salinity on survival, hematological and histological changes in genetically improved rohu (Jayanti), Labeo rohita (Hamilton, 1822). Indian Journal of Animal Research. DOI: 1018805/ijar. B-3801:1-6.

Sarkar S, Mhanty SN, Nayak KC, Pradhan C, Mohata KN and Devaraj C. (2015). Protein requirement of IR-Jayanti (Labeo rohita) fingerlings. International Journal of Fisheries and Aquatic Studies, 3(2): 324-330.

Thinley P, Drukpola and Dorji N. (2018). Effect of Stocking Density on Performance of Cultivable Carps in Southern Bhutan. Bhutan Journal of Animal Science, 2(1): 26-30.

Vivek SB, Anurag S, Sagar VK, Vibha L and Ram RN. (2018). Maternal and Paternal Characters Affecting the Growth and Survival of Progeny of Jayanti Rohu (Female) x Rohu (Male) and Jayanti Rohu (Male) x Rohu (Female). International Journal of Current Microbiology and Applied Sciences, 7(12): 844-855.