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A Study on Growth & Economic Parameters of Stunted Yearling (Indian Major Carp) Culture Technique in Nine Village Ponds of Angul District, Odisha, India

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A B S T R A C T

The experiment was conducted from 28/09/16 to 20/06/17 in nine earthen ponds of 0.8 ha (3 no. ponds), 1.8 ha (3 no. ponds) & 0.4 ha (3 no. ponds) of three different villages of Angul district. The aim of this study is to assess the Growth & Economic parameters of stunted yearling (IMC) culture technique by multiple stocking and harvesting method. In the first phase farmers training was organized among a group of 25 farmers for proper dissemination of technology in different aspects of Pisciculture *viz.*, Preparation of Pond, liming, stocking, manuring, feeding, health management and harvesting. Pre-stocking pond preparation methods are followed i.e. removal of predatory and weed fishes by bleaching powder (10 mg/l chlorine) and then basal fertilization (3 tonn cow dung and 30 kg single super phosphate / ha) were carried out before stocking of fingerlings (Jena *et al.*, 2005). For better motivation of the farmers to adopt this new Technology, critical inputs were also provided i.e. fish seed, feed, lime and fertilizers. Regular fertilization schedules were followed as recommended practices for increasing natural fish food organisms production. Three different farming trials were taken i.e. Farmers practice (T1) (Catla : Rohu : Mrigal) fingerlings @ 15000 no./ ha and culture for 09 months in an Extensive manner. In Recommended practice (T2) (Catla: Rohu : Mrigal) fingerlings @ 5000 no. / ha and culture for 06 months in a semi-intensive method & in another trial Recommended practice (T3) (Catla : Rohu :Mrigal) stunted yearlings @ 5000 no. / ha and culture for 06 months in an Intensive method. Health management aspects were assessed by periodic sampling. Fish yield was recorded after harvesting. About 2.5-3 meter water depth was maintained throughout the study period. Water samples were collected from the ponds on quarterly basis preferably in the morning time and analyzed for important parameters were measured following standard methods (APHA, 2014). Then the data like fish weight (gm), fish yield (Quintal/hectar), average net return and B: C was recorded and analysed using statistical tools like Average mean value and percentage. From the results of the analysis it is found out that mean weight gain of stunted yearlings of IMC were higher in T3 compared to T1 and T2. Net fish yield and income in T2 and T3 were also higher than T1. In the present experiment stocking of IMC stunted yearlings of appropriate size and density in selective culture practice leading to 60.90 % increase in fish yield in Recommended practice T3 (35.4 q/ha) against farmer's practice (22 q/ha). Similarly Net profit of Rs. 3.78,580 was obtained from this technology with benefit: cost (B: C) ratio of 4.25 against Rs. 2,10,800 and 3.17 respectively from Farmers practice (T1) due to fast growth rate of fish in the second year of their culture.

Introduction

Majority of the villages of Angul district, Odisha having community ponds and the water bodies are not been utilized properly for fish production due to non-availability of good quality and quantity of seed. Hence stunted fingerlings & yearlings provide an opportunity for fish cultivation in this type of ponds.Since carps are shown fast growth rate during their second year of culture, now a days ponds are stocked with stunted yearlings (8-12 month-old) of 100 -150 g, instead of fry or fingerlings as practiced in the conventional system. The culture of stunted Indian major carps has become established in parts of India because the subsequent growth of the fish is supposed to be rapid (Nandeesha, Dathathri, Krishnamurthy, Vargese, Gangadar & Umesh 1994).

Stunted yearlings are the individuals which is having slow growth rate, early maturation, small size and their growth is restricted by density-dependent mechanisms and the diminished maximum size is not genetically determined. Typically these yearlings are defined as the fish fingerlings which have over wintered to add size/weight and to increase post-stocking survival in a hatchery, pond or tank. These are suitable stocking material for carp culture because of their higher survival rate. They have shown less vulnerability to predation, disease resistant and can withstand environmental fluctuations; can reach marketable size within a less time period i.e. grow upto 700-800 gm within 2.5 to 3 months leading to higher yield & income. These are having good market demand as they utilize seasonal grow-out ponds efficiently and the fishes can be sold at a higher price too (Radheysham and Saha, 2009). Multiple stocking and multiple harvesting (MSMH) is a method of composite fish farming, through which fish production can be increased by many folds (6 to 10 ton/hectare/year). The farmers need not to have a big capital to meet the various recurring expenditure of fish cultivation. He has to manage the pond for a maximum period of 4 months, thereafter he starts earning, which is reinvested for purchasing of various items required for further fish rearing. Therefore, the small & marginal farmers can also take up scientific fish farming with their small resources by adopting this system. There are several other advantages; however, the prime advantage is that the production is much higher than yearly composite fish culture system. Netting in short intervals results in release of noxious gases and mixing of bottom nutrients with surface water, which enhances primary productivity of the pond.

Materials and Methods

The experiment was conducted from 28/09/16 to 20/06/17 in nine earthen ponds of 0.8 ha (3 no. ponds), 1.8 ha (3 no. ponds) & 0.4 ha (3 no. ponds) of three different villages of Angul district. The aim of this study is to assess the Growth & Economic parameters of stunted yearling (IMC) culture technique by multiple stocking and harvesting method. In the first phase farmers training was organized among a group of 25 farmers for proper dissemination of technology in different aspects of Pisciculture *viz.*, Preparation of Pond, liming, stocking, manuring, feeding, health management and harvesting. Pre-stocking pond preparation methods are followed i.e. removal of predatory and weed fishes by bleaching powder (10 mg/l chlorine) and then basal fertilization (3 tonn cow dung and 30 kg single super phosphate / ha) were carried out before stocking of fingerlings (Jena *et al.,* 2005). For better motivation of the farmers to adopt this new Technology, critical inputs were also provided i.e. fish seed, feed, lime and fertilizers. Regular fertilization schedules were followed as recommended practices for increasing natural

fish food organisms production i.e. @ 2.5-5 qtl/ha. Poultry manure / month & 3-5 kg. multiplex/ pond culture. Three different farming trials were taken i.e. Farmers practice (T1): (Catla : Rohu : Mrigal) fingerlings @ 15000 no. / ha and culture for 09 months in an Extensive manner. In Recommended practice (T2): (Catla : Rohu :Mrigal) fingerlings @ 5000 no. / ha and culture for 06 months in a semi-intensive method & in third trial / Recommended practice (T3): (Catla : Rohu :Mrigal) stunted yearlings @ 5000 no. / ha and culture for 06 months in an Intensive method. Stunted yearlings were fed with @ 7.5 kg Ground nut Oil cake (GNOC) + 15 kg Rice bran (RB) on 1st month, @ 10 kg GNOC + 20 kg. RB on 2nd month & @ 12.5 kg. GNOC + 25 kg. RB on 3rd month. Feed was provided with the help of gunny bags hanging at regular intervals of fish pond.

A commercially available multiplex / vitamin mineral mixture was applied @ 3 gm/kg fish feed which is beneficial for enhancing plankton quantity in the fish pond. Salt was also added @ 0.5 to 2 percent along with the feed for better fish growth (Gangadhara *et al.*, 2012). Health management aspects were assessed by periodic sampling. Fish yield was recorded after harvesting. After every harvesting 10-15 % water exchange was also done and then again filled the pond with freshwater with the help of 100 mesh size screen net. At the beginning / 1 st week of October and January month, lime was applied @ 100-200 kg/ha & on the second month of every cropping system, CIFAX was used @ 1 lit/ha-mt. About 2.5-3 meter water depth was maintained throughout the study period. Water samples were collected from the ponds on quarterly basis preferably in the morning time and analyzed for important parameters were measured following standard methods (APHA, 2014). Then the data like fish weight (gm), fish yield (Quintal/hectar), average net return and B: C was recorded and analysed using statistical tools like Average mean value and percentage.

Results and Discussion

During the study, the pH of water varied between 7.21–8.44 with no marked difference among the treatments (Table 1). Dissolved oxygen also did not show marked difference among treatments and remained between 4.09 to 4.16 mg/l. Total Ammonia Nitrogen contents in water varied insignificantly in treatments within a range of 0.32 to 0.37 mg/l. Nitrite and Nitrate did not show any marked deviation among the treatments and ranged between 0.01 to 0.03 mg/l and 0.13 to 0.16 mg/l respectively. The phosphate content varied between 0.2 to 0.23 mg/l. The other water parameters like total alkalinity, free carbon dioxide and hardness did not record any marked trend in the treatments during the culture (Table 1).

Most of the water quality parameters in the selected ponds of Angul district during the experiment were within suitable limits for Carp culture. The similar observations were also reported by other researchers. (Das *et al.*, 2004; Jena *et al.*, 2002a, 2007a; Sahu *et al.*, 2007; Tripathi *et al.*, 2000). It might be due to adoption of proper pre and post stocking management measures as and when required during the study. From the results of the analysis it is revealed that mean weight gain of stunted yearlings of IMC were higher in T3 compared to T1 and T2 (Table 3). Net fish yield and income in T2 and T3 were also higher than T1 (Table 2). In the present experiment stocking of IMC stunted yearlings of appropriate size and density in selective culture practice leading to 60.90 % increase in fish yield in Recommended practice T3 (35.4 q/ha) against farmer's practice (22 q/ha) (Table 2). This is might be due to adoption of multiple stocking and

harvesting method (MSMH) instead of single stocking practice for stunted Carp yearling culture. (Jena *et al.,* 2002 & Hand book on fisheries statistics.2014). In MSMH method stocking as well as harvesting is done for more than once in a year. Important measures adopted for MSMH are stocking of yearlings by stunting the growth of fish seed during first year, restocking and performing multiple harvesting after the fishes attain a size of nearly 250-500 grams (Anon, 2010).

Similar findings are obtained from Andhra Pradesh by stocking with stunted fingerlings (yearlings and "zero point") at the rate of 5000 nos. ha^{-1} (Jayasankar and Das, 2017). Stunting is a phenotypic change appears due to unfavourable environmental conditions, such as overcrowding and limited food accessibility (Noakes and Balon 1982; Björnsson *et al.,* 2007). Several ecological factors, including increased survival from reduced predation and decreased food availability, may influence the development of individuals in stunted populations (Ylikarjula *et al.,* 1999; van Kooten *et al.,* 2007). This stunted growth in 1st year is might be due to Resource limitation (arising from intraspecific density dependence) size- or age-dependent survival probabilities. Fish whose growth was arrested as juveniles under controlled conditions can subsequently compensate growth when they get suitable conditions. Level of this compensation is mediated by the quality of the grow-out environment (Ylikarjula *et al.,* 1999). Similarly Net profit of Rs. 3.78,580 was obtained from this technology with benefit: cost (B: C) ratio of 4.25 against Rs. 2,10,800 and 3.17 respectively from Farmers practice (T1) due to fast growth rate of fish in the second year of their culture (Table 4). This fast growth is might be due to partial or complete starvation of tropical fish species is followed by a voracious feeding schedule and subsequent restoration of growth resulting favorable conditions during the second year of culture (Nikolsky, 1963).

Table.1 Estimation of Physico-chemical parameters of water for the different treatments during the culture period

Parameters	Treatments			Minimum	Maximum
	Farmers practice (T_1)	Recommended practice (T_2)	Recommended practice (T_3)		
pH	7.63 ± 0.54	7.71 ± 0.63	7.70 ± 0.62	7.21	8.44
Dissolved Oxygen (mg/l)	4.13 ± 0.036	4.12±0.015	4.13±0.02	4.09	4.16
Free Carbon dioxide (mg/l)	4.11±0.01	4.10±0.02	4.09±0.015	4.08	4.13
Alkalinity (mg/l)	41±1.0	40.67±1.53	42±1.0	39	43
Hardness (mg/l)	37.65±3.05	38.64±1.53	37.32±1.53	35	41
Ammonia (mg/l)	0.32±0.015	0.32±0.015	0.33±0.02	0.32	0.37
Nitrite (mg/l)	0.02±0.01	0.01±0.005	0.02±0.01	0.01	0.03
Nitrate (mg/l)	0.12±0.01	0.15±0.01	0.14±0.01	0.13	0.16
Phosphate (mg/l)	0.21 ±0.01	0.20 ± 0.015	0.22±0.015	0.20	0.23

Values (Mean±SD) for all treatments differ significantly (Pb 0.05, n=3)

Table.2 Abstract of fish yield

Sl No.	Pond area (ha)	Production from check pond (qtl.)	Yield of check pond (q/ha)	Production from Demonstrated pond (qtl.)	Yield of Demonstrated pond (q/ha)	Production from Demonstrated pond (qtl.)	Yield of Demonstrated pond (q/ha)
1	0.8	18	22.5	22.48	28.1	25.52	31.9
2	1.8	48.96	27.2	67.7	37.6	83.52	46.4
3	0.4	6.52	16.3	9.08	22.7	11.12	27.8
			Avg. = 22.0		**Avg. = 29.5**		**Avg. = 35.4**
Increase in yield (%) = 60.90							

Table.3 Abstract of growth parameters of Carp species

Treatments	Stocking density (No./ha) / Culture Duration (months) / Method of culture	Avg. Body weight of Carp (gm) 1st Crop (October – December)	Avg. Body weight of Carp (gm) 2nd Crop (January – March)	Avg. Body weight of Carp (gm)	Change in Body weight (%)
FP (T1)	15000 IMC fingerlings / 12 / Extensive	185	445	232	-
RP (T2)	5000 IMC fingerlings / 06 / Semi-Intensive	390	680	443	90.94
RP (T3)	3000 IMC Stunted yearlings / 06 / Intensive	645	1070	708	205.17

Table.4 Abstract of economic analysis of the Farming trial

Technology option	No. of trials	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross return (Rs/ha)	Net return (Rs./ha)	BC ratio
T1 **T2** **T3**	03	22.0 29.5 35.4	97,200 1,08,400 1,16,600	3,08,400 4,13,000 4,95,180	2,10,800 3,04,600 3,78,580	3.17 3.80 4.25

From the results of the analysis, it can be concluded that: Stunted fingerlings/ yearlings are the most preferred stocking material by grow out farmers and fetch a higher price than

the normal fingerlings. Farmers are now able to get an average yield of 8 tonnes/ha and some of the progressive farmers obtain a yield of more than 15 tonnes/ha/year due to high survivability nature of stunted fish (95%).

Therefore, Successful implementations of this stunted yearling culture technique by multiple stocking and harvesting method will open doors to: make the district self-sufficient in fish production, increase returns on available resources, reduce poverty through Entrepreneurship development, Create employment and income generating opportunities for the rural poor and enhance their food and nutritional security. (Randhir, 1984). It also adds to the foreign exchange earnings of the country (Anjani, 2004) & generate interest among perspective farmers to adopt yearling production as a lucrative Enterprise.

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