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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (4): 490-493, 2004
ISSN 1028-8880

Profitability of Manually Separated Monosex Gift Culture in Chicken-fish System

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Abstract: Genetically Improved Farmed Tilapia (GIFT) is one of the most successful one of all exotic fish species in Bangladesh from the view of acceptance and prevalence in cultured water bodies. Manual separation of male and female tilapia is one of the methods for obtaining single sex. In Bangladesh, abundance of sex reversed GIFT male is very limited, therefore, the experiment was conducted to compare the yield of manually separated GIFT with others. Highest yield (5285.3±289.9 kg ha^{-1}) and gross return (358343.7±23555.6 tk ha^{-1}) were found from manually separated male GIFT, which was significantly different from others. Even manually separated female GIFT gave the better production than culture of both sexes together and of carps also.

Key words: GIFT, Chicken-fish, manually separated, monosex

INTRODUCTION

As a cultured species tilapia displays many favorable attributes like general hardiness, resistance to disease, high yield potential, ability to grow on a wide range of natural and cheap artificial foods, ability to withstand low oxygen tensions, overcrowding and a wide range of salinities and still produce a highly acceptable flesh[1]. When any population of tilapia contains both male and female they breed very frequently, this makes population uncontrolled especially during culture. This causes difficulties in determining the ration size and creates great competition for food and space resulting in reduced growth rate. Reproductive activities also divert energy from growth to reproduction. Culture of single sex tilapias eliminates the problem. Tilapia male has a better growth rate than female for two reasons. One is the genetic capability of male, another is, female keep fertilized eggs and spawn in their mouth to protect youngs, thus preventing themselves from feeding. Manual separation of male and female tilapias is one of the easiest alternatives that are to perform for single sex culture of tilapia. In this experiment manually separated single sex tilapia was cultured in integration with broiler because, land use in an integrated manner minimizes conflicts, makes the most efficient trade-offs and links social and economic development with environmental protection and enhancement thus helping to achieve the objectives of sustainable development[2]. The objective of the study was to compare the profitability of manually separated male GIFT, female GIFT, GIFT of mixed sex and Carps in chicken-fish culture system.

MATERIAL AND METHODS

The experiment was conducted in seasonal ponds situated in Noakhali, Bangladesh. Fertilizer in the form of decomposed cowdung was applied at a rate of 2470 kg ha^{-1} in ponds and chicken sheds were raised over ponds. The sheds were made of bamboo splits with a roof of tin. Bamboo splits for the shed's floors were set with gaps to allow the chicken excreta and excess feed to fall directly into the water. The ponds were filled with rain feed water. Then four treatments each with three replications were plotted. In T_1, 19760 fishes ha^{-1} of male GIFT (*Oreochromis niloticus*), *Puntius gonionotus* and *Cyprinus carpio* at a rate of 4:3:1 was stocked. In T_2 instead of male GIFT, only female GIFT was used without changing the others. In T_3, Combined (both male and female) GIFT was used keeping the remaining factors unchanged. *P. gonionotus*, *Macrobrachium rosenbergi*, *C. carpio*, *Aristicthys nobilish*, *Catla catla* and *Labio rohita* at the rate of 16:5:8:6:2:3= 9880/ ha was stocked in T_4. Male and female GIFT was manually separated. With the stocking of fish, seven days old broiler chicken (strain: MPK) was introduced in the shed at the rate of 1976 ha^{-1}. Every 30 days, the old batch was replaced by new chicken batch, thus total six batches of chicken were reared within a total fish culture period of 186 days. At 62 days intervals, only GIFT was harvested from all 3 treatments (T_1, T_2 and T_3) by netting. The exact number of GIFT that was harvested was released again. The new recruits of GIFT were harvested during the final harvest. Initially fish sampling of each treatment was done at 15 days interval but later it was discarded as new recruits

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affected the sampling. Water depth, water pH and secchi disk reading was taken twice a week through out the culture period. After 186 days of culture period the experiment was concluded.

RESULTS AND DISCUSSION

Highest total yield was found in T_1, which significantly differed from T_4 (culture of carps), P value = 0.0002 (Table 1), with the mentioned physico-chemical condition of water presented in Table 3. On the contrary lowest yield was obtained from T_4 (culture of carps) may be due to the lower stocking density as well as less growth potentials.

Highest yield of released GIFT was found in T_1 (GIFT male), which is also significantly higher than others (P value=. 0011). Gift spawns that were recruited were not significantly different from each other (P value = 0.3394). Though the mean weight of recruited GIFT is different from each other however P value is 0.3394, because of large deviation among replications of different treatments (Table 2). The highest recruitment was found in T_2.

To facilitate manual separation of GIFT male and female, larger size (50 g) individuals were released, which also facilitated to p roduce three GIFT crop within the culture period (186 days), so every 62 days were proved to be sufficient for their growth, however it showed the highest specific growth rate (SGR) among all the treatments. Jauncey and Ross[3]; Lim[4], suggested that daily ration for *Oreochromis* sp. should be divided into three to four meals as tilapias are continuous feeders during day time[5]. In the present study continuous drops of chicken feed and excreta in ponds for sixteen hours a day matches very much with the tilapias feeding behavior, resulted in faster growth of GIFT (*O. niloticus)*. Mather and Nandlal[6] also found that the GIFT strain (*O. niloticus*) performed significantly better in integrated system than in non-integrated in Fiji. The cumulative weight of GIFT of 3 batches that were released in T_1, T_2 and T_3 was respectively 22.1, 20.5 and 28.9 % of gross fish yield. Similarly GIFT contributed 77.4, 76.1 and 75.8% of gross yield in T_1, T_2 and T_3 respectively. The total yield of GIFT was much higher even than the cumulative yield of *P. gonionotus* and *C. carpio*. If only GIFT were stocked instead of *P. gonionotus* and C. *carpio*, the yield could have been more, however those two species were stocked to make a balance in consumption of natural food, especially to control the phytoplankton bloom.

Though the GIFT were released after manual separation in two treatments however still recruitments

Table 1: Mean of Individual Weight, survival rate and Specific Growth Rate (SGR) of different fish species

Treatment	Species	GIFT (released)	*P. gonionotus*	*C. carpio*	*M.rosenbergi*	*A. nobilis*	*C. catla*	*L. rohita*
	Initial Wt.(g)	50.0	3.0	4.0	10.6	65.0	70.0	100.0
T_1	Survival rate (%)	87.2	54.8	60.8				
	Final Wt.(g)	183.9	175.7	320.8				
	SGR (%/day)	6.6	2.2	2.4				
T_2	Survival rate (%)	104.4	74.5	78.6				
	Final Wt.(g)	132.2	123.4	262.2				
	SGR (%/day)	6.0	2.0	2.3				
T_3	Survival rate (%)	86.5	50.7	33.0				
	Final Wt.(g)	121.4	153.8	343.9				
	SGR (%/day)	6.4	2.1	2.4				
T_4	Survival rate (%)		86.1	90.9		89.3	76.4	98.2
	Final Wt.(g)		157.8	416.9		460.5	420.0	611.3
	SGR (%/day)		2.1	2.5		1.1	0.9	0.9

$$\text{Specific Growth Rate (SGR) \% / day} = \frac{\text{Log (Final body Wt.(g)) – Log (Initial body Wt.(g))}}{\text{Number of culture days}} \times 100$$

Table 2: Species wise fish yield and total yield in different treatments

Treatment	GIFT (kg ha^{-1})	Small GIFT (kg ha^{-1})	Total GIFT (kg ha^{-1})	*P.gonionotus* (kg ha^{-1})	*C. carpio* (kg ha^{-1})	*C. catla* (kg ha^{-1})	*L. rohita* (kg ha^{-1})	*A. nobilis* (kg ha^{-1})	*M.rosenbergi* (kg ha^{-1})	Total (kg ha^{-1})	P value	Ranked order
T_1	3739.1	350.4	4089.5	713.8	481.9					5285.3	0.0002	a
	±405.9	±325.7	±649.4	±106.4	±353.9					±289.9		
T_2	2825.1	967.5	3792.6	681.4	509.1					4983.0		a
	±276.9	±548.3	±824.7	±89.6	±47.7					±861.8		
T_3	2154.4	531.4	2685.8	578.2	280.8					3544.8		b
	±280.9	±530.0	±607.6	±261.0	±333.5					±355.2		
T_4	536.9	749.4	158.5	444.6	614.2					2503.6		c
	±111.3	±49.7	±21.6	±139.9	±111.6					±238.6		

Table 3: Fish and Broiler production and water qualities of the experimental pond

Treatment	Total weight gain	P value	Ranked order	Gross return from fish (tk ha^{-1})	P value	Ranked order	Broiler Production (kg ha^{-1})	Rain fall (cm)	Water pH	Water Height (cm.)	Secchi Disc reading (cm)
1	4086.5 ±335.8	0.0004	a	358343.7 ±23555.6	0.000021	a	15985.0 ±212.6	239.4	8.7 ±0.9	72.8 ±9.6	17.9 ±5.8
2	3927.9 ±769.7		a	319777.4 ±50012.8		b	16042.7 ±111.2		8.5 ±0.9	68.4 ±9.4	16.5 ±6.3
3	2487.3 ±304.5		b	231099.3 ±24738.8		c	16092.1 ±93.2		8.4 ±0.9	79.3 ±10.2	17.1 ±4.2
4	2265.8 ±238.6		b	132373.6 ±16515.3		d	16141.5 ±149.7		8.6 ±0.8	78.4 ±10.3	18.5 ±4.8

$ 1= Tk 60 approximately

occurred due to error of manual separation. According to Mair and Little[7], it is difficult for even the most skilled workers to achieve greater than 90% accuracy in sexing and so breeding and reproduction is rarely completely controlled. The highest numbers of GIFT recruits as well as percentage (25.5% of total GIFT production) were found in T_2 (female GIFT) and lowest number as well as percentage (8.6% of total GIFT production) was found with the male GIFT (Table 2). The lowest GIFT yield was found in T_3 (both sex), with the second highest recruits (19.9% of total GIFT production). It qualifies that the amount of recruits depends on number of female but not male, prevailed in the population. However, manually separated male GIFT (T_1) gave the highest production with the less number of recruits. It provided the highest income in terms of money due to homogenous and large size of fish with less number of smaller size categories (p=. 000021). Culture of manually separated male GIFT in Poultry-fish system is more profitable, than GIFT culture of both sexes and culture of major carps in tested composition and density.

In all the treatments 1250 broilers ha^{-1} was used. Impact of broiler stocking density was good on all the fish species except *M. rosenbergi*. Wide range of chicken stocking density has been reported by various researchers like, Satia[8], Uddin, *et.al*.[9], Rahman, *et al*.[10]. However the experimental ponds were seasonal and remained in sun-dried condition during summer. So there was very low possibility of negative impact of current broiler stocking density on fish culture.

Survival rate of *P. gonionotus* and *C. carpio* in T_1, T_2 and T_3 was lower than their survival rate in T_4 (with carps). This means that *P. gonionotus* and *C. carpio* died from competition with tilapia but not for oxygen deficiency as in all 4 treatments, same number of chickens were used and secchi disk reading of all the treatments indicate that the plankton population in the treatment ponds was very good (Table 3). *P. gonionotus* showed the lowest yield (536.9±111.3 kg ha^{-1}) in T_4 because here it had to compete with another plankton feeder *A. nobilis* for plankton. On the other hand *C. carpio* performed best yield (749.4±49.7 kg ha^{-1}) in T_4 as its competitor *M. rosenbergi* died but in other three treatments it had to compete with omnivore GIFT. It may be that *M. rosenbergi* died due to competition with *C. carpio* or for less oxygen, as it is more susceptible but to be confirm data of dissolved oxygen content of water is required which was not measured. As among the species of T_4, two plankton feeder (*P. gonionotus* and *A. nobilis*) and two bottom feeder (*C. carpio* and *M. rosenbergi*) affected each other, so changes in species composition and stocking density could perform better yield in T_4.

In Bangladesh production as well as availability of monosex GIFT male fry is limited. Manual separation of GIFT male fingerling is a promising alternative to mixed sex culture till the GIFT monosex male fry become abundant for culture especially in chicken-fish system.

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