Influence of stocking densities of grass carp (*Ctenopharyngodon idella*) in Halwana plant leaves diet on water qualities and survival of the fingerlings

Swamy, A. V*. and Shivananda Murthy, H.

Department of Biosciences

Mangalore University, Mangalagangothri, Mangaluru-574 119

* E-mail: swamyifum@gmail.com

Abstract

Survivality is an important factor for fish production. Survival and growth depend upon feed utilisation, which is influenced by internal and external factors like quality of feed, type of feed, stocking density and also water quality parameters. In the present investigations, effect of different stocking density on water quality parameters and survivality of grass carp was studied. Minimum temperature 23.00 ˚C was observed on 15th sampling day in treatment T_2 and average maximum temperature of 27.83 ˚C was observed in T_4 on 120th day. The pH of the water was near alkaline throughout the experimental period. Minimum of 6.00 mg/l and maximum of 8.67 mg/l dissolved oxygen was observed in T_4 on 90th day and T_1 on 60th day respectively. The free carbon dioxide content fluctuated from 0.00 to 0.30 mg/l in different treatments during the experimental period. The lowest total alkalinity value of 61.0 ppm was observed in T_1 on 45th day and highest total alkalinity value of 134.00 ppm was observed in T_4 on 15th day respectively. All the parameters were in permissible range. Highest survival of 98.14 % was recorded in the T_3-10000 which was statistically on par with T_1-5000 (96.29 %), and T_2-7500 (95.23 %).

Key words: Grass carp, stocking density, Halwana leaves, water quality, and survivality.

1. Introduction:

In India, fisheries are one of the most important industries that contribute significantly to employment generation. The sector can be outlined by India's more than 12 fold increase in fish production in just six decades, from 0.75 million tonnes in 1950-51 to 14.16 million tonnes in 2020-21. The grass carp (*Ctenopharyngodon idella*) is a large species of the minnow family with a moderately compact body. Aquatic plants are almost completely eaten by grass carp. They will eat 2 to 3 times their body weight every day, gaining 2 to 4 kg in a year. They eat more plant material as they grow larger (Mandrak and Cudmore, 2004). Malnad region in Karnataka characterized with varied agro climatic conditions ranging from hilly terrains to plain lands. Plantation crops such as coffee, cardamom and pepper are the traditional crops which are grown in these regions. These plantations are the shade loving

crops, for providing shades to these crops majority of the farming community use to plant the shade trees like Halwana.

Halwana (*Erythrina variegata*) trees are fast growing in nature and give shade to the traditional crops. For maintaining the proper and normal shade the farmers used to trim these tree branches regularly and they considered these leaves are waste. *Erythrina variegata* is a small deciduous tree with prickly stems and roots, triangular leaflets, and large coral red flowers. Crude protein content ranges from 20 to 32%. Digestibility ranges from 45 to 60%, similar to levels for tropical grasses of moderate nutritive quality. For this reason, Erythrina foliage is generally used as a protein supplement, rather than a major feed component (Lahari et al., 2015). Water quality parameters and survivality also depend on stocking density of the fishes. The increased density can create toxic environment for fish growth. Studies to know optimum stocking density in different feed diet is need of the hour. Hence, different stocking densities of grass were evaluated to know their influence on water quality parameters and survivality of the grass carp.

2. Materials and Methods:

The experiment was carried out in Agriculture and Horticultural Research Station, Kademadkal, Mudigere (Karnataka). The experiment was started with four treatments in triplicate.

Feed: Halwana leaves (*Erythrina variegata*)

Seed Source

Normal fingerlings of grass carp (*Ctenopharyngodon idella*) were brought from Main Research Station, Hebbal, Bangalore.

Preparation of cement ponds

The cement ponds having a diameter of 6 m x 3 m x1 m with a soil base of 15 cm were drained and limed @ 200 kg/ha (360 g/pond) .these ponds were dried for a week. The cement ponds were then filled with water drawn from farm pond. The water level in the ponds was maintained at 70 to 75 cm throughout the experimental period.

Stocking and rearing

The normal fingerlings of grass carp (*Ctenopharyngodon idella*) were stocked in triplicate @ 5,000, 7500, 10000 and 12500 no/ha each stocking density was served as a different treatment. The average initial length and weight of the fingerlings were 5.2 cm and 3.5 g respectively.

Feeding

Chopped leaves of Halwana was fed daily once during morning hours @ 100% of their body weight and the quantity of feed given was adjusted based on the growth ascertained during every fifteen days sampling.

Water quality

Once in fortnight partial replace the water and refill the evaporation loss water. Normal water quality was maintained through the experimental period.

Water Sampling

Once in fifteen days water sampling was done. On each sampling day water samples of each pond was collected in morning hours. Temperature of the water in each treatment was noted with the help of thermometer. In addition to this water samples were also collected to analyze the pH, free carbon dioxide, dissolved oxygen & total alkalinity by following standard procedure (APHA, 1995).

Survivality

After completion of the experiment the percentage of survival of the fishes were calculated by accounting number of fish released and number of fishes harvested.

Statistical analysis

The standard error values were calculated using MS Excel (2007). One way Analysis of Variance (ANOVA) was carried for water quality parameters and survivality in different treatments. Duncan Multiple Range Test (DMRT) was applied to know the significance (0.05) difference between treatments.

3. Results and Discussion

The aim of any culture system is to achieve the highest yield per unit area possible. It is determined by the capacity of the specific water sources, the type of fish species stocked, stocking density, water quality, supplementary feeds and the culture species' feeding habits. The temperature is one of the important parameter which influencing on the growth performance of the fishes (Cowey and Luquet, 1983). Fish growth rate increases with increases in water temperature, but at the same time when the temperature reaches super optimal level it has a negative effects on growth performance of fishes. Similarly all parameters have their own advantage but it is only at certain threshold level, afterwards negative are seen on fish growth.

In present investigation, effect of different stock densities (5000 to 12500 no/ha) of grass carp fingerlings on water quality parameters and survivality was studied. The fluctuation in water temperatures was recorded on each sampling day. Average minimum temperature 23.00 $^{\circ}$C was observed on 15th sampling day in treatment T_2 and average maximum temperature of 27.83 $^{\circ}$C was observed in T_4 on 120th day (Table 1). The pH of the water was near alkaline throughout the experimental period. The average pH value in different treatments was fluctuating from 6.50 to 7.33 (Table 2). The dissolved oxygen level is expressed as mg/l. of water. The fluctuation in dissolved oxygen level in different treatments was recorded. It was observed that, minimum of 6.00mg/l and maximum of 8.67 mg/l was observed in T_4 on 90th day and T_1 on 60th day respectively (Table 3). The value of free carbon dioxide is expressed as mg/l.

The value varied from one sampling day to another sampling day. The free carbon dioxide content fluctuated from 0.00 to 0.30 mg/l in different treatments during the experimental period (Table 4). Total alkalinity values were recorded as ppm of $CaCO_3$ and it indicates the presence of calcium carbonate ($CaCO_3$) in water. The average lowest total alkalinity value of 61.0 ppm was observed in T_1 on 45th day and average highest total alkalinity value of 134.00 ppm was observed in T_4 on 15th day respectively (Table 5). Water temperature more than 23 ˚C and less than 32.30 ˚C is ideal for better growth performance of carp (Murthy et al., 1995). The pH value less than 4.8 and more than 10.80 has harmful effects on growth performance of fish (Swingle (1967). Ireland (2010) carried out the experiment on triploid Grass Carp were stocked for Hydrilla control in Lake Conroe (Texas) and reported that, there were no significant changes in water quality parameters *viz.*, CO_2 concentration and temperature. Hussain and Yadav (2016) studied on optimization of grass carp for supplementing feed and fertilizer in carp polyculture. They reported that, biweekly mean of dissolved oxygen during the course of experiment ranged from 5.8-10 mg/l, water temperature ranged from 14-30.4˚C, pH ranged from 7.6-8.9, conductivity ranged from 270- 446.3 µs/cm and total dissolved solids ranged from 110-144 mg/l respectively. All of the water quality parameters measured during the experimental period was not significantly different among treatments.

After completion of the experimental period of 120 days, each pond drained completely and recorded the survival percentage and net production. Highest survival of 98.14 % was recorded in the T_3-10000 which was statistically on par with T_1-5000 (96.29 %), and T_2-7500 (95.23 %). The lowest survival rate was noticed in T_4-12500 (78.25%) (Table 6). Similar study was carried out by Asadujjaman et al. (2016), on optimization of stocking density for Azolla based carp polyculture. Three stocking densities viz., 10000 fish ha^{-1}, 11500 fish ha^{-1} and 12500 fish ha^{-1} were evaluated. Among the evaluated densities, 12500 fish ha^{-1} showed the significantly higher production compared to other densities. But in terms of total cost, gross benefit, net benefit, net profit margin and cost benefit ratio, 10000 fish ha^{-1} stocking density was found to be best. Survival rate was non-significant among the treatments. They concluded that, stocking density @ 10000 fish ha^{-1} could be a good option for low cost Azolla based fish farming in Bangladesh. Sharma and Chakrabarti (1998) reported that, growth and survival of grass carp decreased with increasing stocking density.

4. Conclusion:

The evaluated stocking densities (5000 – 12500 no./ha) does not adversely affect the any of the water quality parameters. The parameters viz., water temperature, pH, dissolved oxygen, carbon dioxide and total alkalinity were in permissible range. Stocking density from 5000 to 10000 no./ha does not significantly affected the survivality of grass carp but at 12500 stocking density, survivality was significantly decreased.

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Table 1: Effect of different stocking densities of grass carp on average water temperature (˚C) in Halwana based diet

Treatments	Days								
		0	15	30	45	60	75	90	105	120
T_1 (5,000 no/ha)	1	24.75	23.50	23.20	23.50	24.30	26.00	26.00	27.50	27.00
	2	24.50	23.00	23.00	23.00	24.00	25.50	26.00	27.00	27.00
	3	24.66	23.00	23.10	23.10	23.70	25.50	26.00	26.50	27.00
	Avg	**24.50**	**23.16**	**23.10**	**23.20**	**24.00**	**25.66**	**26.00**	**27.00**	**27.00**
	SE±	**0.07**	**0.17**	**0.06**	**0.15**	**0.17**	**0.17**	**0.00**	**0.29**	**0.00**
	SD±	**0.13**	**0.29**	**0.10**	**0.26**	**0.30**	**0.29**	**0.00**	**0.50**	**0.00**
T_2 (7,500 no/ha)	1	24.00	23.50	23.50	24.00	24.50	26.50	26.50	27.00	27.50
	2	24.00	23.00	23.00	23.50	24.00	26.50	26.00	26.50	27.00
	3	24.00	22.50	23.50	23.00	24.00	26.00	26.00	26.00	27.25
	Avg	**24.00**	**23.00**	**23.33**	**23.50**	**24.16**	**26.33**	**26.16**	**26.50**	**27.25**
	SE±	**0.00**	**0.29**	**0.17**	**0.29**	**0.17**	**0.17**	**0.17**	**0.29**	**0.14**
	SD±	**0.00**	**0.50**	**0.29**	**0.50**	**0.29**	**0.29**	**0.29**	**0.50**	**0.25**
T_3 (10,000 no/ha)	1	24.00	23.50	23.00	23.00	24.00	26.00	26.50	27.50	27.00
	2	24.50	23.50	23.00	23.00	24.00	26.50	26.00	27.00	27.00
	3	24.50	24.00	24.00	23.00	24.50	26.00	26.50	27.00	27.00
	Avg	**24.33**	**23.50**	**23.33**	**23.00**	**24.16**	**26.16**	**26.33**	**27.16**	**27.00**
	SE±	**0.17**	**0.17**	**0.33**	**0.00**	**0.17**	**0.17**	**0.17**	**0.17**	**0.00**
	SD±	**0.29**	**0.29**	**0.58**	**0.00**	**0.29**	**0.29**	**0.29**	**0.29**	**0.00**
T_4 (12,500 no/ha)	1	24.00	23.40	23.00	24.00	24.00	26.50	26.50	27.00	27.00
	2	23.50	23.00	23.00	23.50	24.00	26.00	26.50	26.50	27.00
	3	23.50	23.50	3.00	23.50	24.00	26.00	26.00	26.50	26.50
	Avg	**23.66**	**23.30**	**23.00**	**23.66**	**24.00**	**26.16**	**26.33**	**26.66**	**27.83**
	SE±	**0.17**	**0.15**	**6.67**	**0.17**	**0.00**	**0.17**	**0.17**	**0.17**	**0.17**
	SD±	**0.29**	**0.26**	**11.55**	**0.29**	**0.00**	**0.29**	**0.29**	**0.29**	**0.29**

Table 2: Effect of different stocking densities of grass carp on average pH in Halwana based diet

Treatments		Days								
		0	15	30	45	60	75	90	105	120
T_1 (5,000 no/ha)	1	6.50	6.75	6.89	6.80	7.00	7.00	7.50	7.30	7.00
	2	6.50	6.50	7.00	6.90	6.75	7.00	7.00	6.90	6.80
	3	6.50	6.79	6.90	7.00	7.00	7.00	7.50	7.50	7.50
	Avg	**6.50**	**6.68**	**6.93**	**6.90**	**6.91**	**7.00**	**7.33**	**7.23**	**7.10**
	SE±	**0.00**	**0.09**	**0.04**	**0.06**	**0.08**	**0.00**	**0.17**	**0.18**	**0.21**
	SD±	**0.00**	**0.16**	**0.06**	**0.10**	**0.14**	**0.00**	**0.29**	**0.31**	**0.36**
T_2 (7,500 no/ha)	1	6.50	7.00	7.00	7.20	7.00	7.25	7.50	7.25	7.30
	2	6.50	7.50	7.00	7.00	7.10	7.50	7.50	7.00	7.20
	3	6.50	7.00	7.00	7.10	7.30	7.50	7.50	7.25	7.20
	Avg	**6.50**	**7.16**	**7.00**	**7.10**	**7.13**	**7.41**	**7.50**	**7.16**	**7.23**
	SE±	**0.00**	**0.17**	**0.00**	**0.06**	**0.09**	**0.08**	**0.00**	**0.08**	**0.03**
	SD±	**0.00**	**0.29**	**0.00**	**0.10**	**0.15**	**0.14**	**0.00**	**0.14**	**0.06**
T_3 (10,000 no/ha)	1	6.50	7.00	7.00	7.00	7.00	7.00	6.90	7.00	6.80
	2	7.00	7.00	6.75	7.00	6.80	7.00	7.20	7.50	7.50
	3	6.50	7.00	7.00	7.00	6.90	7.00	7.00	7.00	7.00
	Avg	**6.66**	**7.00**	**6.91**	**7.00**	**6.90**	**7.00**	**7.03**	**7.16**	**7.10**
	SE±	**0.17**	**0.00**	**0.08**	**0.00**	**0.06**	**0.00**	**0.09**	**0.17**	**0.21**
	SD±	**0.29**	**0.00**	**0.14**	**0.00**	**0.10**	**0.00**	**0.15**	**0.29**	**0.36**
T_4 (12,500 no/ha)	1	6.50	7.00	7.00	7.00	7.20	7.00	7.30	7.00	7.20
	2	6.50	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
	3	6.50	7.00	6.90	7.00	7.30	7.00	6.90	7.00	7.10
	Avg	**6.50**	**7.00**	**6.96**	**7.00**	**7.16**	**7.00**	**7.06**	**7.00**	**7.10**
	SE±	**0.00**	**0.00**	**0.03**	**0.00**	**0.09**	**0.00**	**0.12**	**0.00**	**0.06**
	SD±	**0.00**	**0.00**	**0.06**	**0.00**	**0.15**	**0.00**	**0.21**	**0.00**	**0.10**

Table 3: Effect of different stocking densities of grass carp on average dissolved oxygen (mg/lt) in Halwana based diet

Treatments		Days								
		0	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**
T_1 (5,000 no/ha)	1	8.60	8.50	8.65	8.20	8.70	8.60	8.30	8.40	8.50
	2	8.20	8.70	8.40	8.10	8.56	8.54	8.20	8.33	8.40
	3	8.70	8.69	7.70	7.70	8.75	7.82	7.86	8.08	8.45
	Avg	**8.50**	**8.63**	**8.25**	**8.00**	**8.67**	**8.32**	**8.12**	**8.27**	**8.45**
	SE±	**0.15**	**0.07**	**0.28**	**0.15**	**0.06**	**0.25**	**0.13**	**0.10**	**0.03**
	SD±	**0.26**	**0.11**	**0.49**	**0.26**	**0.10**	**0.43**	**0.23**	**0.17**	**0.05**
T_2 (7,500 no/ha)	1	8.30	8.20	8.00	7.80	7.40	7.30	7.00	7.20	6.90
	2	8.20	8.00	7.90	7.50	7.20	7.00	6.70	6.80	6.50
	3	7.50	7.80	7.80	7.20	6.40	6.37	5.80	6.70	6.10
	Avg	**8.00**	**8.00**	**7.90**	**7.50**	**7.00**	**6.89**	**6.50**	**6.90**	**6.50**
	SE±	**0.25**	**0.12**	**0.06**	**0.17**	**0.31**	**0.27**	**0.36**	**0.15**	**0.23**
	SD±	**0.44**	**0.20**	**0.10**	**0.30**	**0.53**	**0.47**	**0.62**	**0.26**	**0.40**
T_3 (10,000 no/ha)	1	8.20	8.00	7.50	7.00	6.80	7.00	7.20	7.00	6.90
	2	8.10	7.90	7.00	6.60	6.00	6.90	6.83	6.80	6.52
	3	7.70	6.60	7.40	6.50	6.70	6.77	6.82	6.00	6.02
	Avg	**8.00**	**7.50**	**7.30**	**6.70**	**6.50**	**6.89**	**6.95**	**6.60**	**6.48**
	SE±	**0.15**	**0.45**	**0.15**	**0.15**	**0.25**	**0.07**	**0.13**	**0.31**	**0.25**
	SD±	**0.26**	**0.78**	**0.26**	**0.26**	**0.44**	**0.12**	**0.22**	**0.53**	**0.44**
T_4 (12,500 no/ha)	1	8.50	8.00	7.80	7.00	6.80	6.84	6.20	6.30	6.20
	2	8.00	7.50	7.40	6.50	6.60	6.26	6.40	6.20	6.00
	3	8.25	6.25	6.40	6.00	5.89	6.10	5.40	6.10	5.80
	Avg	**8.25**	**7.25**	**7.20**	**6.50**	**6.43**	**6.40**	**6.00**	**6.20**	**6.00**
	SE±	**0.14**	**0.52**	**0.42**	**0.29**	**0.28**	**0.22**	**0.31**	**0.06**	**0.12**
	SD±	**0.25**	**0.90**	**0.72**	**0.50**	**0.48**	**0.39**	**0.53**	**0.10**	**0.20**

Table 4: Effect of different stocking densities of grass carp on average free Carbon dioxide (mg/l) in Halwana based diet

Treatments		Days								
		0	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**
T_1 (5,000 no/ha)	**1**	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.10
	3	0.00	0.00	0.40	0.40	0.00	0.60	0.00	0.10	0.00
	Avg	0.00	**0.10**	**0.10**	**0.20**	**0.00**	**0.20**	**0.00**	**0.03**	**0.03**
	SE±	**0.00**	**0.15**	**0.13**	**0.12**	**0.00**	**0.20**	**0.00**	**0.03**	**0.03**
	SD±	**0.00**	**0.21**	**0.23**	**0.20**	**0.00**	**0.35**	**0.00**	**0.06**	**0.06**
T_2 (7,500 no/ha)	**1**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
	3	0.10	0.10	0.00	0.30	0.20	0.40	0.90	0.00	0.60
	Avg	**0.03**	**0.03**	**0.06**	**0.10**	**0.06**	**0.13**	**0.30**	0.00	**0.20**
	SE±	**0.03**	**0.03**	**0.07**	**0.10**	**0.07**	**0.13**	**0.30**	**0.00**	**0.20**
	SD±	**0.06**	**0.06**	**0.12**	**0.17**	**0.12**	**0.23**	**0.52**	**0.00**	**0.35**
T_3 (10,000 no/ha)	**1**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00
	3	0.00	0.30	0.00	0.40	0.00	0.20	0.10	0.10	0.30
	Avg	0.00	**0.10**	0.00	**0.13**	**0.10**	**0.06**	**0.03**	**0.03**	**0.10**
	SE±	**0.00**	**0.10**	**0.00**	**0.13**	**0.10**	**0.07**	**0.03**	**0.03**	**0.10**
	SD±	**0.00**	**0.17**	**0.00**	**0.23**	**0.17**	**0.12**	**0.06**	**0.06**	**0.17**
T_4 (12,500 no/ha)	**1**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.20	0.00
	3	0.00	0.30	0.20	0.10	0.00	0.25	0.30	0.00	0.60
	Avg	0.00	**0.10**	**0.06**	**0.03**	**0.05**	**0.08**	**0.10**	**0.06**	**0.20**
	SE±	**0.00**	**0.10**	**0.07**	**0.03**	**0.05**	**0.08**	**0.10**	**0.07**	**0.20**
	SD±	**0.00**	**0.17**	**0.12**	**0.06**	**0.09**	**0.14**	**0.17**	**0.12**	**0.35**

Table 5: Effect of different stocking densities of grass carp on average total alkalinity (ppm of $CaCO_3$) in Halwana based diet

		Days								
Treatments		**0**	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**
T_1 (5,000)	**1**	72.00	97.00	76.00	70.00	68.00	73.00	91.00	95.00	99.00
	2	85.00	110.00	82.00	60.00	57.00	61.00	78.00	82.00	87.00
	3	92.00	129.00	85.00	53.00	64.00	88.00	98.00	102.00	105.00
	Avg	**83.00**	**112.00**	**81.00**	**61.00**	**63.00**	**74.00**	**89.00**	**93.00**	**97.00**
	SE±	**5.86**	**9.29**	**2.65**	**4.93**	**3.21**	**7.81**	**5.86**	**5.86**	**5.29**
	SD±	**10.15**	**16.09**	**4.58**	**8.54**	**5.57**	**13.53**	**10.15**	**10.15**	**9.17**
T_2 (7,500)	**1**	94.00	103.00	86.00	72.00	63.00	77.00	84.00	82.00	97.00
	2	97.00	125.00	62.00	58.00	71.00	75.00	89.00	85.00	91.00
	3	88.00	135.00	89.00	59.00	70.00	61.00	85.00	76.00	88.00
	Avg	**93.00**	**121.00**	**79.00**	**63.00**	**68.00**	**71.00**	**86.00**	**81.00**	**92.00**
	SE±	**2.65**	**9.45**	**8.54**	**4.51**	**2.52**	**5.03**	**1.53**	**2.65**	**2.65**
	SD±	**4.58**	**16.37**	**14.80**	**7.81**	**4.36**	**8.72**	**2.65**	**4.58**	**4.58**
T_3 (10,000)	**1**	88.00	112.00	86.00	75.00	71.00	87.00	94.00	82.00	91.00
	2	82.00	108.00	70.00	71.00	68.00	80.00	89.00	71.00	81.00
	3	88.00	110.00	63.00	67.00	65.00	85.00	87.00	75.00	89.00
	Avg	**86.00**	**110.00**	**73.00**	**71.00**	**68.00**	**84.00**	**90.00**	**76.00**	**87.00**
	SE±	**2.00**	**1.15**	**6.81**	**2.31**	**1.73**	**2.08**	**2.08**	**3.21**	**3.06**
	SD±	**3.46**	**2.00**	**11.79**	**4.00**	**3.00**	**3.61**	**3.61**	**5.57**	**5.29**
T_4 (12,500)	**1**	89.00	122.00	73.00	80.00	71.00	86.00	108.00	112.00	117.00
	2	95.00	138.00	89.00	82.00	75.00	90.00	112.00	121.00	118.00
	3	98.00	142.00	96.00	87.00	79.00	97.00	122.00	127.00	122.00
	Avg	**94.00**	**134.00**	**86.00**	**83.00**	**75.00**	**91.00**	**114.00**	**120.00**	**119.00**
	SE±	**2.65**	**6.11**	**6.81**	**2.08**	**2.31**	**3.21**	**4.16**	**4.36**	**1.53**
	SD±	**4.58**	**10.58**	**11.79**	**3.61**	**4.00**	**5.57**	**7.21**	**7.55**	**2.65**

Table 6: Effect of different stocking densities on net production of grass carp in Halwana based diet

Treatment		Survival (%)
T_1 (5000 no/ha)	1	100.00
	2	88.88
	3	100.00
	Average	**96.29[a]**
	SE±	**3.71**
	SD±	**6.42**
T_2 (7500 no/ha)	1	100.00
	2	92.85
	3	92.85
	Average	**95.23[a]**
	SE±	**2.38**
	SD±	**4.13**
T_3 (10,000 no/ha)	1	100.00
	2	94.44
	3	100.00
	Average	**98.14[a]**
	SE±	**1.85**
	SD±	**3.21**
T_4 (12,500 no/ha)	1	78.26
	2	73.91
	3	82.60
	Average	**78.25[b]**
	SE±	**2.51**
	SD±	**4.35**