Bull. Nat. Inst Oceanogr. & Fish. ARE, 15,(2), 1989: 143 - 150

RAISING YOUNG GRASS CARP WITH PELLETED FEED CONTAINING VARIOUS LEVELS OF TWO AQUATIC PLANTS, POTAMOGETON PECTINATUS AND NAJAS ARMATA.

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ABSTRACT

Grass carp fingerlings of 3.8 cm initial average standard length and body weight of 0.55 gm were reared in concrete ponds and fed diets containing different levels of the aquatic plants, **Potamogeton pectinatus** (P_p) and **Najas armata** (N_a). The experiment lasted for 68 days. The best growth and highest survival rates were achieved when fish fed 100% or 50% P_p. At the end of the experiment, the average weight increase of these fish was significant'y better than any other experimental group. Feeds containing (N_a) produced the least growth and survival rates. The differences in weight between fish fed this weed and poultry feed were not significant. Feed conversion ratio was best for the ration containing P_p.

INTRODUCTION

The grass carp (**Ctenopharyngodon idella**), sometimes known as the white amur, is a large cyprinid indigenous to certain large rivers in Siberia and China that has been widely introduced throughout Asia, much of eastern Europe, and more recently into the United States and Egypt. It has a unique development of the pharyngeal teeth which facilitates the cutting and shredding of plant material, and has become the subject of wide interest because of its potential use in the biological control of aquatic weeds (Prowse, 1971; Homer et al. 1975; and Shirman et al., 1983), thus, increase the opportunity for fishermen to use the lakes. However, the grass carp has not been investigated sufficiently to determine its potential for feed on pelleted aquatic plants. This study was initiated to determine growth and survival rates of grass carp fed two different aquatic plants and plant-prepared diet combination.

MATERIALS AND METHODS

The present work was undertaken in Alexandria at the Governorate Fish Farm near El-Nozha Airport. On 14 Septemper, 1988, grass carp fingerlings of 3.8 cm initial average standard length (S.L.) and body weight (Wt) of 0.55 g were stocked at a rate of 10 fish/m^3, in ten concrete ponds, each with an area of 9 m^2 water capacity and a mean depth of about one meter, and with a water flow of approximately 1.5 l/min. The fish used in the present study were spawned at the above mentioned Fish Farm, and acclimated for two weeks prior to initiation of the experiment. Five experimental diets were formulated from two local aquatic plants and a poultry ration as follows: 1) Diet A: 100% poultry feed (PF); 2) Diet B: 50% poultry feed + 50% of the aquatic plant, *Najas armata* (N_a); 3) Diet C: 50% poultry feed + 50% of the aquatic plant, *Potamogeton pectinatus* (P_p) and 5) Diet E: 100% of the aquatic plant (N_a). The approximate chemical analyses of these diets are shown in Table 1. Diets A, B, and C were given to the fish in pelleted form, while diets D and E were used in dried form. Fish were fed to satiation twice daily, with a measured quantity of feed, and the uneaten quantity was weighed.

Table 1

The proximate analysis of the experimental diets

Type of diets	Chemical composition						
	Moisture %	Fiber %	Protein %	Ash %	Ether extract%	NFE %	Total %
Diet A: 100% poultry feed#	9.5	9.75	14.00	14.47	2.40	49.88	100.00
Diet B: 50% poultry feed + 50% aquatic plant, *Najas arm.*	8.93	6.83	15.90	21.80	1.22	45.34	100.00
Diet C: 50% poultry feed + 50% aquatic plant, *Potamogeton pectinatus*	9.75	8.85	14.0	7.95	1.24	58.21	100.00
Diet D: 100% aquatic plant, *Potamogeton pectinatus*	10.50	9.50	13.90	3.22	0.70	62.18	100.00
Diet E: 100% aquatic plant, *Najas armata*	8.37	4.50	18.56	29.00	0.30	39.27	100.00

Commercial poultry feed.

Dissolved oxygen, pH, and water temperature were determined daily at 7.0 a.m., while ammonia was monitored once a week according to the American Public Health Association (1980). The condition factor (K) was estimated according to Lagler (1956).

Body weight was recorded bi-weekly, Sampling consisted of measuring 50% from all experimental population. At the and of the experimental period (68 days), the ponds were compoletely drained and the fish were collected, counted and weighed.

Growth rate and daily feed consumption were estimated according to Kilambi and Zdinak (1982) as follows:

$$\text{Growth rate (\% /day)} = \frac{W_2 - W_1 \quad \times 100}{t}$$

$$\text{Feed consumption} = \frac{FC \quad \times 100}{0.5\ (W_1 + W_2)\ t}$$

Where FC = feed consumed ; t = 68 days ; W_1 = initial weights of fish ; W_2 = weights of fish at the end of rearing period.

RESULTS AND DISCUSSION

1. Water quality :

The recorded data in Table 2 clearly indicated that water quality in all ponds were adequate for grass carp. The water temperature ranged from 17.6 to 26.9°C. Grass carp is a warm-water fish, the upper lethal temperature for fry is 38-39°C, but it can winter at 1 - 2°C (Bettoli et al., 1966; and Opuszynski, 1972). Its oxygen requriment is low and the lethal level for fry is 0.32-0.60 mg/l (Opuszynski, 1972). In the present study, the level of dissolved oxygen ranged from 4.0 to 5.1. The pH value was not less than 7.0 during the experimental period (Table 1). Huet (1972) recommended that the most suitable pH value for pond culture was from 6.5 to 9.0. As for the ammonia level suitable for fish culture, Sharma and Olah (1986) reported that an ammonia level not exceeding 2.1 mg/l is suitable for fish farming. In the present study, this level ranged from 0.1 to 0.17 mg/l, and the lowest value was observed when fish fed diets containing the P_p aquatic plant (Table 2).

2. Feed consumption and feed conversion ratio:

The results in Table 3 clearly demonstrated that grass carp fed on the diets containing the aquatic plant P_p had lower feed consumption rate and best feed conversion ratio. In contrast, the fish fed on the diets containing the aquatic plant N_a had consumed relatively more feed but used it less efficiently. These result seemed to be positively correlated with the increase in the relative amount of both experimental aquatic plants (Table 3).

The experimental diets including the aquatic plant P_p proved to have better feed conversion than the poultry feed (Table 3). Blackburn and Sutton (1971) found that grass carp fed on aquatic plants gained more weight than that fed on dried fish food. It was observed that this fish did not use supplementary fish feed efficiently (Pretto, 1976; and Tal and Ziv, 1978). In the present work the poultry feed proved to be slightly better than diets containing the aquatic plant (N_a). Mitzner (1978) and Leventer (1981) found that grass carp consumed all major plant grobe ups with greatest preference for Potamogeton sp., while Douglas et al. (1978) observed opposite attitude for Najas sp. Hossain (1959) reported that lack of palability of water hyacinth was probably associated with the presence of high percentage of potash and chlorine in water hyacinth. The aquatic plant **Najas armata** was found to have a high ash percentage (Table). This might influence its value. Boyd (1968) stated that on a dry weight basis, many aquatic plants contained as much or more crude protein, [illegible] le fat and mineral matter as many conventional forage cr[illegible]. Fiber value was usually lower than for these crops. But high quantities of tannin might decrease the digestibility of protein. The superiority of the diets containing the aquatic plant (P_p) might be the

Table 2
The average physical and chemical properties of the of he basins water

Basin no.	September				October				November			
	Temp. C°	pH	D.O.*. mg/l	Ammonia mg/l	Temp. C°	pH	D.O.*. mg/l	Ammonia mg/l	Temp. C°	pH	D.O.*. mg/l	Ammonia mg/l
1 and 2	26.0	8.2	4.1	0.17	22.9	7.8	4.6	0.14	18.1	7.1	4.5	0.14
3 and 4	26.5	8.2	4.4	0.14	23.0	7.8	4.8	0.13	18.3	7.2	4.4	0.14
5 and 6	26.7	8.3	4.3	0.12	23.3	7.8	5.1	0.10	18.6	7.1	4.5	0.10
7 and 8	26.9	8.3	4.0	0.11	23.4	7.8	4.3	0.10	18.9	7.0	4.3	0.10
9 and 10	26.4	8.1	4.1	0.17	22.7	7.7	5.1	0.17	17.6	7.1	4.3	0.14

* D.O. : Dissolved oxygen.

Table 3
Percent feed consumption, feed conversion and condition factor (K) of grass carp fed, four vegetation diets and prepared pelleted feed.

Type of diets	% Daily feed consumption	Feed conversion ratio	Condition factor (K) Initial	Final
Diet A: 100% poultry feed	15.56	5.6	0.95	1.20
Diet B: 50% poultry feed + 50% aquatic plant, **Najas armata**	17.73	6.4	0.95	1.20
Diet C: 50% poultry feed, + 50% aquatic plant, **Potamogeton pec.**	12.42	4.9	0.95	1.30
Diet D: 100% aquatic plant, **Potamogeton pectinatus**	11.22	4.0	0.95	1.30
Diet E: 100% aquatic plant, **Najas arm**	19.21	6.9	0.95	1.20

result of better assimilation of nutrients from the ration. Also, the ash percentage of the aquatic plant (P_p) as shown in Table 1 was not high as in the aquatic plant (N_a).

3. Survival and Growth rates:

The fish survival percentage was fair and ranged from 83.33% to 100% (Table 4), indicating the posibility of rearing grass carp fingerlings on the tested diets. The highest percentage (90% and 100%) were achieved with the diets which contained the aquatic plant (P_p). The higher was its percentage in the diet, the higher was the fish survival rate (Table 4). It was of interest to observe that the lowst level of ammopnia (0.1 mg/l) was recorded in the water where the fish were fed (P_p) diets.

Table 4
Survival and growth rates of grass carp fed four vegetation diets and prepared pelleted feed.

Type of diets	Stocking rate fish/m^3	Av. initial weight gm	Av. final weight gm #	Gain in weight % / day	Survival %
Diet A: 100% poultry feed	10	0.55	22.40^b	5.45	86.67
Diet B: 50% poultry feed + 50% aquatic plant, **Najas armata**	10	0.55	22.10^b	5.43	83.33
Diet C: 50% poultry feed, + 50% aquatic plant, **Potamogeton pec.**	10	0.55	22.90^a	5.48	90.00
Diet D: 100% aquatic plant, **Potamogeton pectinatus**	10	0.55	23.10^a	5.44	100.00
Diet E: 100% aquatic plant, **Najas arm.**	10	0.55	22.30^b	5.44	89.63

in the same column insignificant differences between means with same letter (P 0.05).

The growth rate of the grass carp fingerlings (Table 4) followed similar trend as observed above on water quality, feed consumption, feed conversion ratio and survival rate. Although grass carp grew on all experimental diets, they did best when fed diets which contained 50% or 100% (P_p). The differences in weight between fish fed (N_a) and fish fed poultry feed were not significant (Table 4). Also, the condition factor (K) for fish fed diets contained (P_p) was the best. These findings could be explained as previously mentioned about feed consumption (Hossain, 1959; Douglas et al., 1978; Tal and Ziv, 1978; and Leventer, 1981).

CONCLUSION

It may be concluded that the aquatic macrophites especially **Potamogeton pectinatus** may be used efficiently as additional feed for grass carp production, and this in turn may help decreasing production expenses of this fish species.

ACKNOWLEDGEMENT

Grateful acknowledgment is made to prof. Dr. Hussein El-Ibiary, professor Emeritus at the University of Alexandria, Faculty of Agriculture, for his valuable suggestion in revising the manuscript. The auther also sincerely thanks Dr. A. Essa, National Institute of Oceanography and Fisheries, Alexandria, for providing all facilities and equipments necessary for this experiment. Thanks are also made to the staff members of Alexandria Governorate Fish Farm for their help.

REFERENCES

Anon., 1980. American Public Health Association, **Standard Method for Examination of Water and Wastewater**. 15th Edition, Inc., New York.

Bettoli, P.W.; W. H. Neill and S. W. Kelsch, 1966. Temperature preference and heat resistanace of grass carp, **Ctenopharyngodon idella,** bighead carp, **Hypophthalmichthvs nobilis,** and their hybrid. **J. Fish Biol**, 27 (3): 239-247.

Blackburn, R.D. and D. L. Sutton, 1971. **Growth of white amur (Ctencpharyngodon idella) on selected species of aquatic plants.** Proc. Eur. Weed Res. Counc. Int. Symp. Aquat. Weed, 3: 87-93.

Boyd, C.E., 1968. Evaluation of some common aquatic weed as possible feed stuffs. **Hyacinth** Control J., 7: 26-7.

Douglas, E.C.; V. S. Jerome and W. R. Roger, 1978. Food selection by grass carp fingerlings in a vegetated pond. Trans. **Am. Fish** Soc., 107 (1): 149-152.

Homer, B.; D. R. J. Baur and C. R. Rose, 1975. Comparison of the effect of grass carp and the herbicide diuron in densely vegetated pools containing Golden Shiners and Bluegills. **Prog. Fish-Cult.**, 37 (4): 185-190.

Hossin, W., 1959. Investigation of water hyacinth as fodder. **J. Agric.** Pak., 10 (4): 513-8.

Huet, M., 1972. **Textbook of fish culture-breeding and cultivation of fish.** Editions Ch. De Wyngaert, Brussels.

Kilambi, R.V. and A. Zdinak, 1982. Food intake and growth of hybrid carp (female grass carp, **Ctenopharyngodon idella** X male bighead, **Aristchthys nobilis**) fed on zooplankton and Chara. **J. Fish Biol.**, 21: 63-67.

Lagler, K.F., 1956. **Fresh water fishery biology.** WMC Brown Com. Publishers. Dubuque, Iowa.

Leventer, H.,1981. Biological control of reservoirs by fish. **Bamidgeh**, 33 (1): 3-23.

Mitzner, L., 1978. Evaluation of biological control of nuisance aquatic vegetaion by grass carp. **Trans. Am. Fish. Soc.**, 107: 135-145.

Opuszynski, K., 1972. The use of phytophagous fish to control aquatic plants. **Aquaculture**, 1 (1): 61-74.

Pretto, R., 1976. **Polyculture systems with channel catfish as the principal species.** Ph. D. Dissertation auburn Univ. Ala., 190 pp.

Prowse, Q.A., 1971. Experimental criterion for the study of grass carp feeding in relation to weed control. **Prog. Fish-Cult.**, 33 (3): 128-131.

Sharma, B.K. and J. Olah, 1986. Integrated fish-pig farming in India and Hungary. **Aquaculture**, 54: 135-39.

Shireman, J.W., R. W. Rottmann and F. J. Aldridge, 1985. Consumption and growth of hybrid carp fed four vegetation diets and trout chow in circular tanks. **J. Fish. Biol.**, 22: 685-693.

Tal, S. and I. Ziv, 1978. **Culture of exotic fishes in Israel.** In Culture of Exotic Fishes, Symposium Proceedings. Fish Culture Section, pp. 1-9 Auburn, Alabama: American Fisheries Society.