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EFFECT OF DRIED DUCK MANURE (DDM) LEVELS ON GROWTH TRAITS OF COMMON CARP (*CYPRINUS CARPIO L.*)

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Abstract

This study was conduced during a period from May 25th 1993 to December 1st of the same year on common carp fish using twelve 5 x 50 m2 concrete ponds with earthen bottom at Abbassa farm which belongs to Cenral Laboratory for Aquaculture Research (CLAR), Agricultural Research Centter. It was undertaken in order to investigate the effect of DDM levels on growth traits and the relations among them at different post-stocking stages of growth. The twelve ponds were divided into four groups (three ponds/group) assigned for the treatments (zero, 500, 750 and 1250 kg DDM per 1050 m2). Results are summarized as follows:

- Actual means of body weight and body length of common carp increased successively with advance of period of the study from stocking up to 180 days post-stocking. Those of condition factor fluctuated with advance of that period but showed in general a decreasing trend.
- Level of duck manure constituted a significant ($P<0.05$, $P<0.01$ or $P<0.001$), important and sizing soucre of variation in body weight, body length and condition factor at all or most post-stocking growth stages.
- Body weight and body length increased with the increase of duck manure level from zero to 120 kg /1050 m2 at all post-stocking stages of growth.
- Specific growth rate % values evaluated during summer months were generally higher than those evaluated during autumn months.
- Specific growth rate % ranked the first for fish ponds manured with 1250 kg duck manure/1050 m2, then, followed in a descending order by fish ponds manured with 50, 500 and zero kg per 1050 m2.

A strong positive significant ($P<0.01$) phenptypic association (r = 0.76-0.98) between body weigh and body length was detected at most stages studied.

- A negative association bettween condition factor and each of body weight and body length was found at most stages studied.
- Prediction equations for body weight at 90 and 180 days post-stocking through the knowledge of body length at these two stages were formulated.

INTRODUCTION

There utilizattion of manure as the principal nutrient input to fish ponds is a traditional managerial practice in Asian Aquaculture (Pekar, 1994). The duckfish system has existed for over 60 years in Hong Kong and is practiced throughout inland fish culture areas (Ching Sin, 1980). Woynarovich (1980) reported that the histtory of duck-fish farming in Europe and Asia was reviewed and the quantitative aspects of duck manuring on carp culture in Hungary were described in details.

The increase of carrying eapacity can be achieved by using the manure (faeces mixed with urine). The properties of manure depend on several factors, viz., animal species, feed, age, physiological status of animal, environment and stage of production. Organic fertilization is an accepted technique in fish culture throughout many areas of the world (Bardach *et al.,* 1972), and has recently become the subject of research by aquaculturists in different countries (Tang, 1970, Schroeder, 1974, 1975a & b, Wohlfarth and Schroeder, 1979, Rappaport *et al.,* 1977, Edwards, 1980 and Milstein *et al.,* 1991). Woynarovich (1980) reported that duck-fish farming developed in Europe at a time when common carp (*Cyprinus carpio*) monoculture was the only type of fish culture, and that each duck produced about 7 kg fresh manure over a 36-day period. The same author added that each 100 kg duck manure, disributted continuously in the pond water, increased common carp production in monoculture by an average of 4 to 5 kg per ha, and stated that common carp is still the major species cultured in Europe due to market demand and climate.

Pekar (1994) reported that the manure can be used in direct or indirect integration of fish and livestock. In the direct integration system, fresh manure is continuously added to the ponds, while, in indirect integration, the manure is transported to the ponds and used in fresh or treated forms in different manuring regimes. The same invesigator reported that, intensive manuring of the fish ponds, i.e. daily or at least weekly introduction of high doses of manure to the ponds, is an effective method to increase practically all nutrient compartments and fish food resources in fish ponds of ecosysems, and that the use of manure in fish farming is based on the assumption that the manure acts two pathways.

The present work was carried out in order to study the effect of duck manure level on growth traits (body weight, body length, condition factor and specific growth rate) of common carp.

MATERIALS AND METHODS

The experimental work of this study was carried out from May, 25th 1993 to

December 1st of the same year in the fish farm located in Abbassa village, Abu Hammad disttrict, Sharkia Governorate. This farm belongs to Central Laboratory for Aquaculture Research Centre, Ministry of Agriculture, Egypt. Twelve 250-(5x50) m2 concrete ponds with earthen bottom were used, and divided into four groups (three pond/ group) assigned for treatments of the experiments. The first group used for treatment one (manuring with 500 kg dried duck manure/1050 m2, the second group for treatment two (manuring with 750 kg duck manure/1050 mg), the third group for treatment three (manuring with 1250 kg duck manure/1050 m2) and the fourth group for treatment four (zero kg duck manure/1050 m2). In order to establish natural food in ponds and to ensure the blooms of plankton to be used directly for fish feeding, each of the ponds of treaments one, two and three was fertilized with initial amount (29.76 kg) of duck manure to be a source of nitrogen, while, ponds of treatment four (control treatment) were left without manuring. Just after that, all ponds were supplied with fresh water from Ismailia channel to reach a depth of 80 cm. One week later, the fish were stocked as fingerlinges. Just after stocking and weekly thereafter till the end of the experimental pond of treatment one, two and three were provided with 4.46, 7.44 and 13.39 kg duck manure/pond, respectively. The chemical anlysis of duck manure used in the experiment is present in Table1.

Table 1. The averages of chemical analysis of dried duck manure used.

Moisture %	Dry matter %	Protein %	Fat %	Ash %	NFE %
7.01	92.99	7.01	13.10	50.91	31.30

Quality of water in ponds was checked prior to stocking and every week thereafter to determine its water temperature, pH, dissolved oxygen, secchi disk visibility and depth. Water quatily of ponds was also checked prior to stocking and every two weeks thereafter to determine its salinty, total alkalinity, total hardness, nitrate, ammonia and electric conductivity (E.C.) according to Boyd (1979).

Average weight of fingerlings per pond at stocking, ranged from 4.19 to 6.31g and that of their body length ranged from 6.00 to 6.50cm. The differences among averages in both traits were non-significant. Number of fingerlings stocked in each pond was 270 fingerlings per pond i.e. at a rate of 270-fish/200 m3. At the beginning of the experiment all fish were used to determine individual body weight and length.

Thereafter, random samples of 100 or 120 fish were taken by seinig from each pond every 15 day post-stocking to record individual body weight and body length. All fish of the samples were returned to their ponds after recording except at harvest.

The condition factor (K) was estimated according to Lagler (1959) as K= (100W/L3) wher k= condition factor, W=the observed fish weight and L=the observed actual length.

Specific growth rate (SGR)% was calculated according to Jauncey and Rose (1982) by using least square means of body weight, at stocking and harvest, resulting from the analysis as: SGR% = [(Ln Wt2 - Ln Wt1) / period in days] X 100 where Ln = log, Wt1 = least square means of initial weight in grams and Wt2 = least square means of final weight in grams obtained from the results of the analysis.

Data collected and obtained by calculations during the experimental period included growth traits (individual fish weight, body length and condition factor).

The Mixed Model Least squares and Maximum likelihood program of Harvey (1990) was used for the satistical analysis. Data of individual body weight and body length and condition factor of the fish were analyzed by using the following fixed model

(Model 1)

Yijk = M + ti + Pij + eijk

where:

Yijk = the observation on the ijkth fish;

M = overall mean, common element to all observations;

ti = the fixed effect of the ith manuring level

Pij = the fixed effect of jth pond nested within the ith manuring level and

Eijk = a random deviation of the Kth fish, assumed to be independently randomly distributed

(o,o^2e). It includes all the other effects not specified in the model.

Data of individual body weight of the fish at 90 and 180 days post-stocking were reanalyzed by using the following linear model in order to use the results of the analysis in establishing prediction equations for fish body weight (adjusted for factors included in model) by the knowledge of fish body length.

(Model 2)

$$Y_{ij} = M + t_i + P_{ij} + b_l (x_{ij} - \bar{x}) + e_{ijk}$$

Where:

Y_{ijk}= the body weight of the ijkth at a particular time;

M = overall mean, a common element to all observations;

t_i = the fixed effect of the ith manuring level, (1=500 kg duck manure/1050 m2, 2 = 750 kg duck manure/ 1050 m2, 3 = 1250 kg duck manure/1050 m2 and 4 = zero kg duck manure/1050 m2);

P_{ij} = the fixed effect of the jth pond nested within the ith manuring level;

b_l = the estimate of partial linear regression of fish body weight on its corresponding body length;

x_{ijk} = fish body length which corresponds the ijkth fish body weight;

x = the mean of x_{ijk} ; and

e_{ijk} = a random deviation of the kth fish, assumed to be independently randomly distributed $(o,\sigma^2 e)$.It includes all the other effects not specified in model.

The predicted equation for fish body weight and body length either at 90 or 180 days post- stocking were established as:

$$Y = M + b_l (BL - XM)$$

where :

Y = the predicted value of body weight at given time;

M = the overall mean adjusted for factors in model 2;

b_l = the estimate of partial linear regression coefficient of fish body weight at a certain time on its corresponding fish body length;

BL = the observed fish body length; and

XM= the average body length.

RESULTS AND DISCUSSION

The Actual means and variation

1. Body weight

The actual means,standard deviations and coefficients of variability for body weight of common carp at stocking as fingerlings and at different post-stocking stages of growth during the experimental period of the study are given in Table 3. Means in that table indicate that the body weight of common carp fish of the study increased with advance of the period of study from 5.88 at stocking as fingerlings to 72.50 g at harvest (180 days post-stoking). These results clearly illustrate the relationship between period of stocking and body weight. Similar results were obtained by Hafez (1991) on carp and Abdel-Hakim and Hafez (1995) on silver carp. Data in Table 3 proved that common carp of the study gained 66.62 g/fish during a period of 180 days post-stocking. In this concern, Abdel-Hakim (19950 stated that the silver carp gained an average 39.36 g in weight from July till October, i.e. during a period of 90 days post-stocking.

Standard deviation of body weight increased with advance of post-stocking stage (Table3). This may be due to that, as the fish advance in age, they have the opportunity to express better their genotypes, i.e. the increase of variability, as age advance may be due to differences in individual genotypes.

Body length

The actual means presented in Table 3 show that the common carp body length increased from 6.11 cm at stocking to 16.06 cm at the end of the experimental period 180 days post- stocking). These means revealed that, body length of common carp fish increased, on the average, by 9.95 cm allover the period of the study.The increase in body length did not differ considerabley from one to another.

Condition factor

Data in Table 3 indicate that the mean of condition factor fluctuated with advance of post-stocking stage, but showed in general a trend indicating the decrease of condition factor as the post-stocking period advanced. This decrease may be attributed to the increase of body length wich occurs with advancement of post-stocking stage.

Factors affecting growth traits

-Body weight

-Level of duck manure

Data presented in Tables 4 and 5 revealed that, individual body weight of common carp fish of the study varied with level of duck manure, the differences were significant (P<0.001) at all stages of growth studied. These are in agreement with those reported by Abdel- Hakim and Hafez (1995) working on the effect of poulty manure on silver carp which proved that the difference in body weight among fish groups of different manuring levels (500, 750 and 1000kg/ha were sigificant (P<0.001). They added that increasing poultry manure levels increased significantly (P<0.001 growth performance of silver carp fish in the form of body weight and body length. Also, Mahmoud (1997), with silver carp, proved the significant (P<0.05 effect of level of duck manure on fish body weight.

The comparison of F-value of the factors included in the model of analysis indicated that the manuring level was the most important factor influencing individual body weight of the fish at the different stages of the experimental period.

Results of the statistical analysis showed that the heavlest weight was the always for the fish of ponds manured with 1250 Kg dried duck manure/1050 m2, then, followed in a descending order by fish of ponds manured with-750, 500 and zero kg duck manuure/1050 m2. These observations indicated that body weight, at the different stages of growth increased with the increase of manuring levels. In agreement with these results, Abdel-Hakim and Hafez (1995), using poultry manure and Mahmoud (1997) using duck manure found that body weight of silver carp increased with the increase of level of duck manure at different stages of the study. In this respect, results of Cremer and Smitherman (1980) and Hepher and Pruginin (1981) indicated the favourite high levels of manure.

Ponds within level of duck manure

Results of the least squares analysis of variance presented in Table 4 show that differences between ponds within each manuring level in individual fish body weight at different growth stages studied were mostly non-significant. This means that the environmental factors within ponds were mostly similar and of negligible effects.

Body length

Results of the analysis showed that fish varied significantly (P<0.001) in their body length with duck manure level in all stages of the study (Table 6). Abdel Hakim and Hafez (1995) reported similar observations.

As in individual body weight of common carp fish, body length of the fish was the longest for fish of ponds applied with 1250 kg duck manure/1050 m2, then, followed in a descending order for fish manured with-750, 500 and zero kg duck manure/1050 m2 (Table 6). As observed on body weight, differences among fish body length of different manuring level increased with advance of stage of growth (Table 7).

Ponds within manuring level

The least squares analysis of variance presented in Table 6 showed that body length of the common carp fish varied from pond to another within each of the different manuring levels, but in most, without significant differences. This may lead to note that differences in body length caused by the effect of pond within level of duck manure were not pronounced and unimportant.

Condition factor

Results presented in Table 8 showed that condition factor of common carp fish varied with manuring level; the differences were significant (P<0.05 or P<0.01 or P<0.001) at growth stages from stocking as fingerlings up to 105-day post-stocking, while, they were non-significant during the following stages to 180-day post-stocking.

The square means of condition factor was found to decrease, in general, with advance of growth stage (Table 9. This trend was opposie to that observed for body weight and body length. This observation may be due to the nature of calculating the condition factor because it equals the value resuulting from dividing body weight at a certain time by cubic value of body length.

Specific growth rate

Specific growth rate (SGR % values, calculated by using the least square means for fish of different manuring levels at different stages of the study, are presented in Table 10. Specific growth rates of the fish in ponds with the highest manuring rate (1250 kg duck manure/1050 m2) at different stages of the study were always the highest, and decreased as manuring level decreased (Table 10). These observations were confirmed by results of Mahmoud (1997) with silver carp which showed that, specific growth rate increased linearly with each increase in level of manuring. Calculated specific growth rate indicated that the highest values were shown during June and decreased thereafter in general with advance of months of the year up till the end of the experiment. Hafez (1991) with tilapia, mullet and carp showed similar trend for specific growth rate in the two years of her study. Data in Table 10 also, revealed that values of specific growth rate evaluated during suumme months were generally higher than during autumn months. Hafez (1991) attributed that trend to the higher temperature during summer months than autumn months. In this concern, Boyd and Lichkoppler (1979) noted that warm fish grow better at temperature between 25 and 32^{o}C. They added that chemical and biological reactions of pond fish culture double their rate with every 10^{o}C increase which lead to increase the decomposable of manure, and consequently, increase the availability of natural food.

Associations among growth traits

Residual phenotypic correlation coefficients between body weight and body length of the fish obtained from analyzing the data of the present study at different stages of growth are presented in Table 11. The values of these coefficients indicated that correlation coefficients between body weight and body length of the fish were generally high (above 0.75) and significant (P<0.01) at the different stages of growth studied. In most of these stages, these coefficients ranged from 0.75 to 0.98. This may indicate a strong positive phenotypic association between body weight and body length at different stages from stocking as fingerlings to harvest at 180 days post-stocking.

The magnitude of correlation coefficients between body weight and condition factor of the fish at different stages of growth showed, in general, that there is a negative phenotypic relation between the two traits which ranged from low to moderate. Also, values of the residual phenotypic correlation coefficientts between body length and condition factor of the fish ranged from-0.04 to -0.68 (Table 11).

Significance (P<0.05 or P<0.01) of the relationship between body weight and condition factor (BW-CF) was dectected only at 30, 45, 75 and 120 days post-stocking. These findings which indicated a negative phenotypic association between body length and condition factor was signfican (P<0.01) at 30, 45, 75, 90, 135 and 165 days post-stocking. The negative correlations obtained between either body weight or body length and the condittion factor may be due to the nature of calculating the condition factor [CF=(weight/cubic length) 100].

Fish length at 90 and 180 days post-stocking when included in model of analysis (Model 2) as a covariant, was found to have a significant (P<0.001) effect on body weight at the two stages (Table 12). F-ratios for the factors included in the model of reanalyzing body weight, i.e. when using body length as a covariant showed that body length accounted for the most considerable effect on body weight.

From the partial linear regession coefficients given in Table 13, the prediction equations for body weight of carp fish of the study at 90 and 180 days post-stocking adjusted for the factors in model 2, were calculated.

This may indicate a strong positive phynotypic association between body weight and length at different stages from stocking as fingerlings to harvest. Also, fish length at 90 and 180 days was found to have a significant (P<0.001) effect on body weight at the two stages.

Table 2 showed the effect of manuring levels on water quality parameters. Non of the values for the above mentioned parameters in the table was found to be outside the normal range of tolerance for common carp.

Table 2. Average of water quality traits at different stages of the study for pends under different manuring levels.

Water quality traits		Duck manure level per 1050 m2			
		500 kg	750 kg	1250 kg	zero kg
Dissolved oxygen	Mean ± SE	4.82 ± 0.22	0.70 ± 0.22	4.81 ± 0.22	3.86 ± 0.22
(mg/L)	Range	1.2 - 8.2	2.3 - 7.5	1.5 - 7.9	0.6 - 6.4
	Mean ± SE	8.56 ± 0.04	8.75 ± 0.04	8.82 ± 0.04	8.48 ± 0.04
pH	Range	8.16 - 9.32	8.1 - 9.62	8.12 - 9.66	7.75 - 9.06
Temperature	Mean ± SE	26.59 ± 0.35	26.49 ± 0.35	26.57 ± 0.35	26.02 ± 0.35
(oC)	Range	22.2 - 29.2	22.8 - 29.5	22.5 - 28.8	22.0 - 28.4
Secchi disk visibility	Mean ± SE	14.94 ± 0.92	14.42 ± 0.92	14.05 ± 0.92	14.02 ± 0.92
(cm)	Range	7.0 - 37.0	8.25 - 33.0	7.5 - 31.0	9.0 - 27.25
Total hardness	Mean ± SE	149.79 ± 4.27	147.79 ± 4.27	164.69 ± 4.27	138.15 ± 4.27
(mg/L)	Range	102.0 - 182.0	102.0 - 192.0	102 - 210	102 - 170
Total alkalinity	Mean ± SE	246.56 ± 9.89	249.15 ± 9.89	263.67 ± 9.89	210.33 ± 9.89
(mg/L)	Range	156 - 395	166.0 - 385.0	186 - 390	140 ± 425
Electric conductivity	Mean ± SE	0.55 ± 0.02	0.56 ± 0.07	0.50 ± 0.02	0.48 ± 0.02
(Ions)	Range	0.4 - 0.8	0.4 - 0.75	0.4 - 0.83	0.4 - 0.62
Salinity	Mean ± SE	0.21 ± 0.01	0.20 ± 0.1	0.22 ± 0.01	0.18 ± 0.01
(ppm)	Range	0.1 - 0.28	0.1 - 0.27	0.1 - 0.32	0.1 - 0.24
Ammonium	Mean ± SE	0.89 ± 0.06	0.92 ± 0.03	1.23 ± 0.06	0.67 ± 0.06
(ppm)	Range	0.5 - 1.5	0.6 - 1.5	0.5 - 2.3	0.8 - 1.0
Ammonia	Mean ± SE	0.45 ± 0.05	0.46 ± 0.05	0.40 ± 0.05	0.29 ± 0.05
(ppm)	Range	0.04 - 1.1	0.06 - 1.0	0.03 - 0.85	0.04 - 0.7
Nitrate	Mean ± SE	0.24 ± 0.02	0.29 ± 0.02	0.33 ± 0.02	0.24 ± 0.02
(ppm)	Range	0.1 - 0.59	0.13 - 0.68	0.14 - 0.63	0.09 - 0.54

Water quality were measured prior to stocking and bieweekly thereafter.

Table 3. Actual means standard deviations and coefficients of variabbility (CV%) for body weight and condition factor of common carp fish at different stages.

Stage	Number	Body weight (gm)			Body weight (gm)			Body weight (gm)		
		Mean	S.D.	C.V.	Mean	S.D.	C.V.	Mean	S.D.	C.V.
At stocking fingerlings	3240	5.88	--	--	6.11	--	--	1.49	--	--
15 days post-stocking	1201	10.09	11.11	108.28	7.6	2.38	30.97	1.9	1.46	75.45
30 days post-stocking	1201	18.64	10.79	48.18	9.53	2.85	27.63	2.1	0.71	33.6
45 days post-stocking	1201	23.86	13.89	44.23	10.86	2.39	16.6	1.7	0.28	14.47
60 days post-stocking	1201	28.36	17.29	45.56	11.55	2.63	15.89	1.85	2.32	124.6
75 days post-stocking	1199	2.86	19.11	38.39	12.17	2.74	14.08	1.71	0.32	16.11
90 days post-stocking	1199	36.67	21.93	35.83	12.75	2.85	13.09	1.84	0.47	27.81
105 days post-stocking	1199	39.97	28.72	53.01	12.97	4.56	29.25	1.09	1.52	84.22
120 days post-stocking	1199	43.38	32.41	51.99	13.39	4.07	23.51	1.85	0.35	20.3
135 days post-stocking	1199	47.49	30.57	31.58	13.79	3.32	12.28	1.32	0.34	20.02
150 days post-stocking	1437	51.77	35.41	37.98	14.06	3.38	13.02	1.67	0.33	79.2
165 days post-stocking	1437	57.73	38.81	28.57	14.74	3.6	11.23	1.68	0.15	8.11
180 days post-stocking	3237	72.50	49.24	37.02	16.06	4.32	17.12	1.55	0.9	57.63

+ C.V. of a given trait was calculated by dividung the square root of the residual mean square by its actual mean

Table 4. F-ratios and tests of significance for factors affecting body weight (Wi) + at different stages under different levels of manuring (Mi)++.

Source of variation	DF	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
Manuring level	3	15.58	179.32	292.78	316.55	519.32	708.54	334.8	423.27	1253.33	1071.56	2171.65	2543.19
Pond within M1	2	0.8	1.33	1.94	0.29	1.34	7.79	2.22	1.57	1.70	1.01	0.72	9.51
Pond within M2	2	0.23	0.48	2.68	2.52	0.16	4.1	0.92	1.37	1.66	2.46	2.62	4.27
Pond within M3	2	1.25	1.33	0.81	2.59	0.12	0.49	1.75	5.25	10.63	4.67	0.46	2.51
Pond within M4	2	0.16	0.06	0.33	0.08	0.13	0.16	0.02	0.45	0.57	0.14	0.15	0.09
Remainder D.F	--	1189	1189	1189.00	1189	1187	1187	1187	1187.00	1187	1189.00	1425	3225.00
Remainder M.S	--	119.32	80.65	111.4	166.9	159.14	172.58	448.86	508.67	24.89	386.59	272.08	720.54
R2		0.04	0.31	0.43	0.45	0.57	0.64	0.46	0.52	0.76	0.69	0.82	0.70

+ W1, W2, W3, W4, W5, W6, W7, W8, W9, W10, W11 and W12 = body weight at 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, 165 and 180 days, respectively

++ M1, M2, M3 and M4 = 500, 750, 1250 and zero kg duck manure per 1050 m2, respectively

* = P<0.05, ** = 0.01, *** = P<0.001

Table 5. Least squares means and standard errors for the effect of level of duck manure on individual body weight (gm) of common carp fish.

Stage	Duck manure level per 1050 m2							
	500 kg		750 kg		1250 kg		zero kg	
	No.	Mean ± SE	No.	Mean ± SE	No.	Mean ± SE	No.	Mean ± SE
15 days post-stocking	301	10.37 ± 0.630	300	10.98 ± 0.681	301	12.41 ± 0.630	299	6.58 ± 0.632
30 days post-stocking	301	16.12 ± 0.518	300	19.02 ± 0.519	301	27.93 ± 0.518	299	11.45 ± 0.519
45 days post-stocking	301	20.33 ± 0.608	300	25.15 ± 0.609	301	37.39 ± 0.608	299	12.51 ± 0.610
60 days post-stocking	301	24.10 ± 0.745	300	29.05 ± 0.746	301	45.96 ± 0.745	299	14.23 ± 0.747
75 days post-stocking	299	26.64 ± 0.70	300	33.96 ± 0.728	300	55.08 ± 0.728	300	15.74 ± 0.728
90 days post-stocking	299	28.56 ± 0.760	300	37.04 ± 0.758	300	64.26 ± 0.758	300	16.78 ± 0.758
105 days post-stocking	299	30.07 ± 1.230	300	41.41 ± 1.22	300	70.33 ± 1.220	300	18.03 ± 1.220
120 days post-stocking	299	31.45 ± 1.300	300	42.05 ± 1.30	300	80.99 ± 1.800	300	18.99 ± 1.300
135 days post-stocking	299	33.81 ± 0.867	300	45.95 ± 0.866	300	90.54 ± 0.866	300	19.60 ± 0.866
150 days post-stocking	358	36.92 ± 1.039	360	50.41 ± 1.036	359	99.30 ± 1.038	360	20.49 ± 1.036
165 days post-stocking	358	39.40 ± 0.872	360	56.14 ± 0.869	359	114060 ± 0.871	360	20.82 ± 0.869
180 days post-stocking	808	51.52 ± 0.944	810	76.63 ± 0.943	809	136.59 ± 0.944	810	25.29 ± 0.943

Table 6. F-ratios and tests of significance for factors affecting body length (Li)+ at different stages under different levels of manuring (Mi)++.

Source of variation	DF	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11
Manuring level	3	10.70	68.74	336.54	416.98	624.28	766.54	18.29	267.09	1130.58	1149.24	1781.42
Pond within M1	2	0.82	3.08	1.57	1.37	1.01	8.45	2.15	3.09	1.82	1.4	0.35
Pond within M2	2	0.44	0.51	6.42	6.76	2.67	4.72	0.002	1.62	3.9	2.22	0.85
Pond within M3	2	0.78	0.23	0.47	2.10	0.49	0.68	0.24	2.77	7.16	2.91	0.38
Pond within M4	2	1.50	0.42	0.61	0.49	0.22	0.98	0.28	0.02	2.52	0.49	0.08
Remainder D.F	--	1189	1189	1189	1189	1187	1187	1187	1187	1187	1425	1425
Remainder M.S	--	5.54	6.93	3.08	3.37	2.93	2.78	14.38	9.91	2.87	3.35	2.74
R2		0.032	0.153	0.464	0.517	0.613	0.662	0.315	0.408	0.742	0.708	0.79

+ L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11 and L12 = body length at 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, 165 and 180 days, respectively

++ M1, M2, M3 and M4 = 500, 750, 1250 and zero kg duck manure per 1050 m2, respectively

Table 7. Least squares means and standard errors for the effect of level of duck manure on individual body length (cm) of common carp fish.

Stage	Duck manure level per 1050 m2							
	500 kg		750 kg		1250 kg		zero kg	
	No.	Mean ± SE	No.	Mean ± SE	No.	Mean ± SE	No.	Mean ± SE
15 days post-stocking	301	7.53 ± 0.136	300	7.65 ± 0.136	301	8.15 ± 0.136	299	7.07 ± 0.136
30 days post-stocking	301	9.32 ± 0.152	300	9.69 ± 0.152	301	11.08 ± 0.152	299	8.02 ± 0.152
45 days post-stocking	301	10.11 ± 0.101	300	11.34 ± 0.101	301	13.17 ± 0.101	299	8.81 ± 0.101
60 days post-stocking	301	10.92 ± 0.106	300	1.85 ± 0.106	301	14.32 ± 0.706	299	9.12 ± 0.106
75 days post-stocking	299	11.36 ± 0.099	300	12.43 ± 0.099	300	15.39 ± 0.099	300	9.48 ± 0.099
90 days post-stocking	299	11.96 ± 0.096	300	12.95 ± 0.096	300	16.21 ± 0.096	300	9.81 ± 0.096
105 days post-stocking	299	12.26 ± 0.219	300	13.12 ± 0.219	300	16.79 ± 0.219	300	9.69 ± 0.219
120 days post-stocking	299	12.54 ± 0.182	300	13.57 ± 0.182	300	17.29 ± 0.182	300	10.14 ± 0.182
135 days post-stocking	299	12.65 ± 0.098	300	14.11 ± 0.098	300	18.12 ± 0.098	300	10.29 ± 0.098
150 days post-stocking	358	13.20 ± 1.107	360	14.31 ± 0.016	359	18.32 ± 0.017	360	10.43 ± 0.106
165 days post-stocking	358	13.67 ± 0.108	360	15.14 ± 0.107	359	19.52 ± 0.107	360	10.66 ± 0.107
180 days post-stocking	808	14.89 ± 0.107	810	17.17 ± 0.107	809	20.66 ± 0.107	810	11.53 ± 0.107

Table 8. F-ratios and tests of significance for factors affecting condition factor (Ki)+ at different stages under different levels of manuring (Mi)++.

Source of variation	DF	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12
Manuring level	3	18.31	7.81	98.44	3.44	113.60	13.43	5.28	47.77	28.63	3.19	149.53	0.86
Pond within M1	2	3.41	0.78	9.68	9.66	12.32	0.21	4.37	0.11	0.24	0.01	0.63	0.11
Pond within M2	2	0.02	0.15	10.42	0.33	16.48	0.52	0.08	1.22	0.81	5.91	5.46	0.01
Pond within M3	2	0.55	0.09	0.13	0.12	0.10	5.10	0.37	0.72	2.40	0.09	1.99	4.20
Pond within M4	2	0.85	0.24	0.08	0.02	1.56	0.47	0.98	0.11	3.01	0.01	8.69	0.39
Remainder D.F	--	1189	1189	1189	1189	1187	1187	1187	1187	1187	1425	1425	3225
Remainder M.S		2.05	0.5	0.06	5.29	0.08	0.21	2.28	0.11	0.11	1.76	0.02	0.80
R2		0.052	0.021	0.221	0.025	0.253	0.043	0.023	0.111	0.077	0.015	0.253	0.004

+ K1, K2, K3, K4, K5, K6, K7, K8, K9, K10, K11 and K12 = condition factors 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, 165 and 180 days, respectively

++ M1, M2, M3 and M4 = 500, 750, 1250 and zero kg duck manure/1050 m2, respectively

Table 9. Least squares means and standard errors for the effect of level of duck manure on the condition factor of common carp fish.

Stage	Duck manure level/1050 m2							
	500 kg		750 kg		1250 kg		zero kg	
	No.	Mean ± SE	No.	Mean ± SE	No.	Mean ± SE	No.	Mean ± SE
15 days post-stocking	301	2.16 ± 0.083	300	2.05 ± 0.083	301	2.00 ± 0.083	299	1.38 ± 0.083
30 days post-stocking	301	2.11 ± 0.041	300	2.06 ± 0.041	301	2.00 ± 0.04	299	2.26 ± 0.041
45 days post-stocking	301	1.92 ± 0.015	300	1.67 ± 0.015	301	1.59 ± 0.015	299	1.79 ± 0.015
60 days post-stocking	301	2.20 ± 0.133	300	1.78 ± 0.133	301	1.57 ± 0.133	299	1.86 ± 0.133
75 days post-stocking	299	1.78 ± 0.016	300	1.77 ± 0.016	300	1.46 ± 0.016	300	1.85 ± 0.160
90 days post-stocking	299	2.61 ± 0.026	300	1.68 ± 0.026	300	1.53 ± 0.026	300	1.75 ± 0.026
105 days post-stocking	299	1.90 ± 0.087	300	1.72 ± 0.087	300	1.55 ± 0.087	300	2.01 ± 0.087
120 days post-stocking	299	1.69 ± 0.019	300	1.61 ± 0.019	300	1.49 ± 0.019	300	1.81 ± 0.019
135 days post-stocking	299	1.62 ± 0.019	300	1.57 ± 0.019	300	1.53 ± 0.019	300	1.76 ± 0.019
150 days post-stocking	358	1.56 ± 0.070	360	1.80 ± 0.070	359	1.58 ± 0.070	360	1.77 ± 0.070
165 days post-stocking	358	1.54 ± 0.007	360	1.57 ± 0.007	359	1.51 ± 0.007	360	1.70 ± 0.007
180 days post-stocking	808	1.54 ± 0.032	810	1.53 ± 0.031	809	1.56 ± 0.031	810	1.59 ± 0.031

Table 10. Calculated specific growth rate % of commom carp fish at different post-stocking stages.

Stage	Duck manure level per 1050 m2					
	Time of the year	500 kg	750 kg	1250 kg	zero kg	Overall mean
15 days post-stocking	June	2.67	2.80	3.13	1.33	2.10
30 days post-stocking	June	1.27	1.60	2.40	1.60	1.78
45 days post-stocking	July	0.67	0.80	0.80	0.27	0.73
60 days post-stocking	July	0.47	0.40	0.60	0.33	0.47
75 days post-stocking	Aug.	0.33	0.47	0.53	0.33	0.47
90 days post-stocking	Aug.	0.2	0.27	0.47	0.33	0.27
105 days post-stocking	Sep.	0.13	0.27	0.27	0.27	0.27
120 days post-stocking	Sep.	0.13	0.07	0.40	0.13	0.27
135 days post-stocking	Oct.	0.2	0.27	0.33	0.07	0.27
150 days post-stocking	Oct.	0.27	0.27	0.27	0.13	0.18
165 days post-stocking	Nov.	0.2	0.33	0.40	0.07	0.40
180 days post-stocking	Dec.	0.67	0.87	0.53	0.53	0.67
Calculated average		0.601	0.702	0.84	0.43	0.66

Table 11. Residual phenotypic correlation coefficient among growth traits (body weight,BW;

Stage	Correlations		
	BW-BL	BW-CF	BL-CF
15 days post-stocking	0.98**	-0.1	-0.13
30 days post-stocking	0.59**	-0.27**	-0.27**
45 days post-stocking	0.94**	-0.46**	-0.68**
60 days post-stocking	0.82**	-0.08	-0.12
75 days post-stocking	0.92**	-0.34**	-0.31**
90 days post-stocking	0.93**	-0.19	-0.28**
105 days post-stocking	0.36**	-0.04	-0.09
120 days post-stocking	0.54**	-0.20*	-0.18
135 days post-stocking	0.87**	-0.15	-0.28**
150 days post-stocking	0.90**	-0.06	-0.10
165 days post-stocking	0.76**	-0.13	-0.40**
180 days post-stocking	0.61**	0.01	-0.04

** = P< 0.01

Table 12. F-ratios and tests of significance for factors affecting individual fish body weight(model 3).

Source of variation	DF	W90+	W180+
Manuring level++	3	60.38	566.18
Pond within M1	2	0.05	4.00
Pond within M2	2	0.40	6.03
Pond within M3	2	0.87	2.04
Pond within M4	2	2.21	0.11
Regression on body length linear	1	7820.50	1886.73
Remainder DF		1186	3224
Remainder MS		22.75	454.68
R2		0.95	0.81

+ W90 and W180= the predicted weight of the fish at 90 and 180 days post-stocking.

++ M1 = 500 kg duck manure/1050 m2, M2 750 kg duck, M3 = 250 kg duck manure/ 1050 m2 and M4 = 0 kg duck manure/1050 m2.

** = P<0.01, *** = P<0.001

Table 13. Tests of significance of linear regression coefficients of body weight on body length and prediction equations of body weight of the fish on its body length at 90 and 180 days post-stocking.

Individual body weight at	Partial regression linear (gm/cm)	Prediction equation
90 days post-stocking	7.348 ± 0.083	W90+ = 36.67 + 7.35 (BL90+ - 12.73)
105 days post-stocking	5.931 ± 0.136	W180+ = 72.50 + 5.93 (BL180+ - 16.06)

+ W90 = the prediction weigth of the fish at 90 days post-stocking.

+ W180 = the prediction weigth of the fish at 180 days post-stocking.

+ BL90 = the observed body length of the fish at 90 days post-stocking.

+ BL180 = the observed body length of the fish at 180 days post-stocking.

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تأثير مستويات زرق البط المجفف على صفات نمو المبروك العادى

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أجريت هذة الدراسة خلال الفترة من ٢٥ مايو إلى أول ديسمبر ١٩٩٣ على اسماك المبروك العادى باستخدام اثنى عشر حوضا خرسانيا ذات أرضية ترابية فى مزرعة العباسة التابعة للمعمل المركزي لبحوث الثروة السمكية بالعباسة - مركز البحوث الزراعية - وزارة الزراعة - جمهورية مصر العربية بهدف بحث صفات النمو فى مراحل مختلفة من فترة التجربة والارتباط بينها عندما عوملت مجموعات أحواض اسماك التجربة بمستويات مختلفة من زرق البط (صفر - ٥٠ - ٧٥ - ١٢٥ كليو جرام من زرق البط لكل ١٠٥٠ متر مربع) وتتلخص النتائج فيما يلى :

- تزايدات متوسطات وزن الجسم وطول السمكة بتقدم مراحل النمو من وقت الاستزراع كاصيعيات حتى نهاية التجربة عند ١٨٠ يوما بعد الاستزراع . بينما أوضحت متوسطات معامل الحالة Condition factor اتجاها عاما بالتناقص بتقدم مراحل النمو (فترة التجربة).

- كان مستوى استخدام زرق البط مصدرا هاما ومعنويا بمستوى ٠,٠٥ و ٠,٠١ و ٠,٠٠١ من مصادر التباين فى وزن الجسم وطول الجسم ومعامل الحالة الجسمية فى جميع أو معظم مراحل النمو بعد الاستزراع كاصبعيات حتى نهاية التجربة .

- تزايد كل من وزن الجسم او طول الجسم للسمكة بزيادة مستوى استخدام زرق البط من صفر الى ١٢٥ كجم من زرق البط لكل ١٠٥٠ متر أ مربعا . هذا وقد أعطت الأسماك للأحواض التى عوملت بأكبر معدل لأستخدام زرق البط اثقل الأوزان أعلى الأطوال .

- لم يشكل اختلاف حوض السمك داخل مستوى استخدام زرق البط أى تأثير معنوى فى أغلب الأحوال على أى من صفات النمو المدرواسة .

- كان معدل النمو االخاص فى أشهر الصيف أعلى من نظيره فى أشهر الخريف بصفه عامة .

- وجود أرتباط مظهرى موجب قوى ومعنوى بين وزن السمكة وطولها فى معظم

مراحل النمو المدروسة من وقت الاستزراع حتى نهاية التجربة (معامل الأرتباط عندهذه المراحل تروح بين ٧٦,٠ & ٩٨,٠) .

– وجود ارتباط سالب بين معامل الحاله للسمكة وكل من وزن الجسم وطول الجسم فى أغلب الأحوال .