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PERFORMANCE OF SILVER CARP (HYPOPHTHALMICHTHYS MOLITRIX) AS AFFECTED BY LEVEL OF DUCK MANURE AND STOCKING DENSITY

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Abstract

This study was carried out to investigatigate the effect of duck manure level and stocking density on growth performance of silver carp. The experiment was conducted at the Central Laboratory for Aquaculture, Abbassa, Abou-Hammad, Sharkia, Agricultural Research Center. Six rectangle earthen ponds each of total area of total area of 0.25 Feddan (50x20 m) representing six treatments (3 levels of duck manure 150, 300, 450 kg/fed within each two stocking density 3200 and 4800/fed within each two stocking density 3200 and 4800/fed). The experimental period expanded 20 weeks. The statistical evaluation of results showed the differences in body weight and length at the successive growth were significantly ($P<0.05$) for the favour of higher manuring level (450 kg/Fed). Regardless of level of manuring, averages body weight of silver carp decreased significantly ($P<0.05$) with increasing stocking denstiy from 3200 fish/fed to 4800 fish/fed during all experimental period. Relative growth rate increased with decreasing stocking density and improved with increasing the rate of manure.Level of manure and stocking density had no influeuce on condition factor. Total yield increased in a linear manner with each increase in manuring level and stocking density.

INTRODUCTION

It has often been suggested that aquaculture will expand to conpensate for short falls from catches. The continuing rise in production from aquaculture is paralleled by a diversification of the fisheries sector with more species entering culture systems. In recent years, Chinese carp, have been introduced to many countries. In recent years, Chinese carp, have been introduced to many countries. In Egypt, it was introduced to be used in artificial hatcheries and fish production.

Semi-intensive pond aquaculture produces little nutrient pollution on a routine basis, and the nutrients discharged at harvest can be captured effectively using simple setting ponds. The main sources of fertilizers used in semi-intensive aquaculture systems are livestock manure, human sewage and chemical fertilizer. Animal

manure is considered to be better than inorganic fertilizer in promoting the growth of planktonic and benthic food organisms in fresh-and brackish-water ponds (Pillay 1990). Duck manure is rich in nitrogen and phosphorus, and of low price and ready available in the local market in Egypt.

Pullin and Shehadeh (1980) reported that, each duck produces about 7 kg fresh manure over a 36 - days period, and 500 ducks therefore, produce about 3 to 3.5 ton in the same period. They added that, there is an European indirect yield increase of about 50 kg/ha higher carp stocking, as this allows recycling of fish faeces and fall utiliztion of any remnants of duck feed. They found that the fish yield 4323kg/ ha/year from the duck-fish experiment without the use of any supplemental feed or inorganic fertilizers.

Bardach *et al.* (1973) reported that, silver carp feed on phytoplankton in mid-water, and are the most commonly stocked phytoplankton feeds. They added that silver carp can also accept grain and flower and consume some higher plants. According to Woynarovich (1975), silver carp fish of 250 g body weight can strain 32 liters of water per day through its gills. Cremer and Smitherman (1980) observed that, combined intestinal contents of silver carp are almost phytoplankton with zooplankton. Hepher and Purginin (1981) cleared that, the silver carp feed mainly on phytoplankton as small as 30-40 mm. Horvath (1984) reported that, silver carp is herbivorous similar to grass carp, but the main protein of its diet consists of unicellular algae.

This study was conducted to evaluate the effect of duck manure level, as well as, stocking density on performance of silver carp (*Hypophthalmichthys molitrix*)

MATERIALS AND METHODS

This work was carried out at Abbassa Farm, Abou-Hammad district, Sharkia. The farm belongs to Central Laboratory For Aquaculture, Agricultural Research Centre. Six rectangle earthen ponds each of total area 0.25 feddan (50 x 20m) were used. All ponds were filled with fresh water to depth of 1m. The ponds were randomly assigned to six treatments (3 levels of duck manure 150, 300 and 450 kg/fed within each two stocking densities 3200 and 4800 fish/fed).

The experimental fish used was silver carp (*Hypophthalmichthys molitrix*) with an average body weight of 73.3g at the start of the experiment. Random sample of fish (60 fish/pond) were taken every two weeks in order to collect data on body

weight (g) and body length (cm). The experimental period was 20 weeks (May 15 till October 15/1994).

Based on data of body weight and length, the following parameters were estimated:

$$\text{1- daily gain} = \frac{W2-W1}{T}$$

Where:
W1= initial body weight
W2 = final body weight
T = period in days

$$\text{2. specific growth rate (SGR)} = \frac{\ln w2-\ln w1}{T}$$

Where:
ln = antilog

$$\text{3. Condition factor (k)} = \frac{W \times 100}{L3}$$

according to **Lagler (1959)**
Where:
W = body weigh
L = body length

$$\text{4. Relative growth rate (RGR)} = \frac{W2 - W1 \times 100}{W1}$$

At the end of the experimental period, ponds were drained from water and fish were harvested by seining. Statistical analysis was applied by adopting two ways analysis was applied by adopting two ways analysis of variance. Differences between means were tested according to Duncan's multiple Range test 1995.

RESULTS AND DISCUSSION

Body weight

A verages of body weight of silver carp for treatment MISDI (150 kg duck

manure and 3200 fish/fed), MISD2 (150 kg manure and 4800 fish/fed), M2 SD1(300kg duck manure and 3200 fish/fed), M2SD2 (300 kg duck manure and 4800 fish 1/fed) and M3SD1 (450 kg duck manure and 4800 fish/fed) and M3SD2 (450 kg duck manure and 3200 fish/fed) are presented in Table1. The statistical evaluation of the results showed that, differences in body weight among the experimental groups were significant ($P<0.05$) for all treatments with the favour of higher manuring levels at lower stocking density (M3 SDI) (Table 1). The results showed that, group M3 SDI had significantly ($P<0.05$) the highest final weights as compared to the other groups, followed in decreasing order by M2SD1, M3SD2, M1SD1, M2SD2 and M1SD2, respectively (Table 1).

These results may lead to recommend applying the duck manure for silver carp ponds at a level of 450 kg/fed/every two weeks in order to improve the growth performance of silver carp fish. These results are in partial agreement with the finding of Hickling (1962) and Pullin and Shehadeh (1980) who reported that, increasing the rate of manure application enhanced the growth rate of fish.

Six weeks after the experiment had started, average weights were found to be 102, 93.9, 110.4, 121.4, and 110.4, 110.4 for treatments MISD1, MISD2, M2SD1, M2SD2, M3SD1 and M3SD2, respectively. The analysis of variance showed that, differences in body weights at this period among the treatments were not significant.

Eight weeks after the experiment had started, average weights were significantly ($P<0.05$) different for the favour of higher manuring levels at lower densities (Table 1). After 10 weeks, average body weights of the experimental groups were significantly ($P<0.05$) different (Table 1).

Average body weights of the experimental groups at 12 weeks showed that, M1SD2 group had significant ($P<0.05$) lowest body weight as compared to the other groups. However, differences among groups M1SD1, M2SD2, and M3SD2 were insignificant. In general, results of body weight 12 week after the experiment had started indicated that, body weight increased as the stocking density decreased within each manuring level. Also, these results showed that, body weight increased with each inrease in manuring level (Table 1).

As presented in table 1, average of body weights after 14 weeks revealed that, group M3SD1 had significant ($P<0.05$) heavier body weight as compared to the other groups, followed in a decreasing order by M2SD2, M3SD2, M1SD1 and M1SD2, respectively. These results indicated that, increasing the manuring levels from 150 kg/fed to 450 kg/fed increased significantly ($P<0.05$) average body

Table 1. Effect of level of duck manuring and stocking density on body weight development of silver carp.

Treatment	Start Mean ± S.E.	2/w Mean ± S.E.	4/w Mean ± S.E.	6/w Mean ± S.E.	8/w Mean ± S.E.	10/w Mean ± S.E.	12/w Mean ± S.E.	14/w Mean ± S.E.	16/w Mean ± S.E.	18/w Mean ± S.E.	20/w Mean ± S.E.
M1 SDI	73.6±0.7^{a}	79.2±4.2^{b}	88.6±1.9^{cd}	102.0±4.1^{bc}	124.5±1.3^{d}	152.5±1.3^{d}	185.7±1.4^{c}	223.0±1.4^{d}	225.0±1.6^{d}	284.6±1.6^{d}	308.6±1.6^{d}
M1 SD2	73.6±0.7^{a}	78.2±4.2^{b}	83.7±1.9^{d}	93.9±4.1^{c}	101.5±1.3^{f}	121.1±1.3^{f}	147.1±1.4^{f}	175.6±1.4^{f}	201.2±1.6^{f}	221.9±1.6^{f}	241.9±1.6^{f}
M2 SDI	73.6±0.7^{a}	86.8±4.2^{b}	94.6±1.9^{ab}	110.4±4.1^{ab}	139.1±1.3^{b}	175.5±1.3^{b}	217.5±1.4^{b}	263.5±1.4^{b}	306.7±1.6^{b}	347.3±1.6^{b}	377.6±1.6^{b}
M2 SD2	73.6±0.7^{a}	79.1±4.2^{b}	91.6±1.9^{b}	110.4±4.1^{ab}	118.7±1.3^{e}	145.2±1.3^{e}	173.3±1.4^{e}	206.1±1.4^{e}	236.0±1.6^{e}	265.5±1.6^{e}	287.0±1.6^{e}
M3 SDI	73.6±0.7^{a}	95.8±4.2^{b}	99.8±1.9^{a}	121.4±4.1^{a}	150.8±1.3^{a}	191.7±1.3^{a}	238.7±1.4^{a}	288.1±1.4^{a}	338.3±1.6^{a}	383.4±1.6^{a}	422.4±1.6^{a}
M3 SD2	73.6±0.7^{a}	82.7±4.2^{b}	94.3±1.9^{abc}	110.4±4.1^{ab}	130.2±1.3^{c}	155.0±1.3^{c}	185.3±1.4^{d}	224.7±1.4^{c}	256.5±1.6^{c}	285.6±1.6^{c}	309.8±1.6^{c}

Values in the same column having the same superscript letters are not significantly different (P>0.05).

weights when applied at lower stocking density. The same trend was also observed at periods 16 and 18 weeks.

At the end of the experimental period, i.e. 20 weeks after the experiment had started, average of final weights for the same groups cited before were found to be 308.6, 241.9, 377.6, 287.0, 422.4 and 309.8 g, respectively (Table 1). The statistical analysis of the results showed that, group M3SD1 had significantly ($P<0.05$) the highest average body weights as compared to the other groups in a decreasing order of M2SD1, M3SD2, M1SD1, M2SD2, and M1SD2, respectively.

The results indicated that, final body weight of silver carp increased within each increase in manuring level as the stocking density decreased, and the increase in the this trait was more pronounced at higher manuring levels. These results are in partial agreement with the finding of Hickling (1962) who reported that, increasing the rate of manure application of cow dung enhanced the growth rate of fish. The same author added that, better growth of fish was observed with higher rate of manure application. The results presented also are in accordance with those obtained by Pullin and Shehadeh (1980) who reported that, application of duck manure to common carp ponds cultured in monoculture system increased the fish production. In this respect, Abdel-Hakim and Hafez (1995) reported that, average body weights (g) for the three poultry manure (500, 750 and 1000 kg/ha) were 20.21, 50.84 and 57.21, respectively. They added that increasing poultry manure levels increased significantly ($P<0.05$) growth performance of silver carp in the form of body weight and length.

Body length

As presented in Table 2, averages of body length (cm) at the experimental start was found to be 19.2 cm for all groups indicating the compete homogenicity of the experimental groups at start. Two weeks later, averages of body length have ranged between 19.5 and 20.1, and differences among the experimental groups were not significant (Table 2). At four and six weeks after experimental start, averages body length were insignificant between M1SD1, M1SD2 and M2SD2 on one hand, and between M2SD2, M2SD1 and M3SD1 on the other hand, while, they were significantly different ($P<0.05$) between the two groups above (Table 2).

As presented in Table 2, averages body length at eight weeks after experimental start were found significantly ($P<0.05$) different with the favour of M3SD1, followed by M3SD2 groups. The same trend was observed at 10, 12, 14, 16 and 18 weeks after experimental start. Thus, body length of the M3SD1 group was significantly ($P<0.05$) superior to the other groups, indicating that higher manuring level

Table 2. Effect of manuring level and stocking density on body length development of silver carp.

Treatment	Start Mean ± S.E.	2/w Mean ± S.E.	4/w Mean ± S.E.	6/w Mean ± S.E.	8/w Mean ± S.E.	10/w Mean ± S.E.	12/w Mean ± S.E.	14/w Mean ± S.E.	16/w Mean ± S.E.	18/w Mean ± S.E.	20/w Mean ± S.E.
M1 SDI	19.2±0.2 a	19.9±0.2 a	20.2±0.2 b	21.8±0.1 b	23.3±0.1 d	25.1±0.1 b	27.0±0.1 d	28.0±0.1 c	29.1±0.1 d	29.1±0.1 d	29.3±0.1 d
M1 SD2	19.2±0.2 a	19.5±0.2 a	19.6±0.2 b	21.2±0.1 b	21.8±0.1 e	22.9±0.1 d	24.7±0.1 f	25.8±0.1 f	26.8±0.1 f	27.4±0.1 e	28.3±0.1 f
M2 SDI	19.2±0.2 a	20.1±0.2 a	21.4±0.2 b	22.6±0.1 a	24.3±0.1 b	24.85±0.1 c	27.8±0.1 b	28.3±0.1 b	30.7±0.1 b	31.4±0.1 b	32.9±0.1 b
M2 SD2	19.2±0.2 a	19.6±0.2 a	20.0±0.2 b	21.7±0.1 b	24.6±0.1 d	24.5±0.1 c	24.9±0.1 e	26.9±0.1 e	28.5±0.1 e	31.0±0.1 c	29.2±0.1 e
M3 SDI	19.2±0.2 a	19.6±0.2 a	21.6±0.2 b	22.7±0.1 a	26.7±0.1 a	26.7±0.1 a	28.9±0.1 a	30.2±0.1 a	31.6±0.1 a	32.6±0.1 a	34.0±0.1 a
M3 SD2	19.2±0.2 a	19.9±0.2 a	21.6±0.2 b	22.6±0.1 a	25.2±0.1 c	25.2±0.1 b	26.6±0.1 c	28.4±0.1 d	29.1±0.1 c	29.1±0.1 d	30.3±0.1 c

Values in the same column having the same superscript letters are not significantly different (P>0.05).

at the lower stocking density leads to a significant improvement in body length development.

Regardless of stocking density, averages of body length as affected by manuring level did not differ significantly among the manuring level at the experimental start and two weeks thereafter. Averages body length at periods 4, 6, and 8 weeks as affected by level of manuring increased significantly ($P<0.05$) with each increase in the level of duck manure application. After ten weeks, body length 150, 300 and 450 kg/fed regardless of stocking density were found 24.1, 24.1 and 26.0 cm, respectively.

At periods 12, 14, 16 and 18 weeks after experimental start, averages body length increased significantly ($P<0.05$) with each increase in manuring level regardless of stocking density. At the end of the experiment (20 weeks after experimental start), averages body length revealed that, silver carp fish increased significantly ($P<0.05$) with each increase in level of manuring level, regardless of stocking density.

These results may lead us to conclude that, manuring the silver carp ponds with duck manure at higher rates increased significantly ($P<0.05$) the growth performance in general, and specifically, body length, and the increase in body length was more markedly at higher level of duck manure application.

Regardless of level of manure, averages body length at two weeks affected by stocking density were found to be insignificant (Table 2). During the following periods (i.e. 4, 6, 8, 10, 12,14,16,18 and 20 weeks after experimental start, fish stocked at lower density (3200 fish/fed) showed significantly ($P<0.05$) higher body length compared to those stocked at higher density (4800) fish/fed), regardless of manuring level.

Table 2 showed averages body length of silver carp for groups M1SD2, M2SD1, M2SD2, M3SD1 and M3SD2 at the successive growth periods. The analysis of variance for this trend indicated that, M3 SD1 group had significance by ($P<0.05$) superior body length compared to the other groups. Results of body length as affected with level of manure and stocking density behaved parallel to those of body weight. These results may lead to conclude that, manuring the silver çarp ponds with duck manure at higher rates (450 kg/Fed) increased significantly ($P<0.05$) growth performance (body weight and length). Fish stocked at lower density (3200 fish/fed) showed significantly ($P<0.05$) higher growth performance (body weight and length (Table 1 and 2). In this connection, Swingle (1966) noted that, the rate of stocking of fish is an extremely important factor at all levels of fish production. The

same author added that, if few fish were stocked, the results were large fish with low yield, however, at very high stocking densities, the results may be high yield with fish of small size.

Daily gain

Table 3 showed that, averages daily gain in gramme of silver carp increase was more pronounced at lower stocking density. It was found that, averages daily gain were 0.37, 0.31, 0.88, 0.36, 1.47 and 0.6 for the groups M1SD1, M1SD 2, M2SD1, M2SD2, M3SD1 and M3SD2 after two weeks of the experimental start, respectively. Four weeks after the experimental start, daily gains were found the highest for M2SD2, followed by the other groups. At the 6 weeks, the highest daily gain was obtained by the M3SD1 group, followed in a decreasing order by the M2SD2, M3SD1, M2SD1 and M1SD2, respectively (Table 3).

At periods 8,10, 12, 14, 16, 18 and 20 weeks, the M3SD1 group was superior in daily gain as compared with the other groups (Table 3). These results indicated that, daily gain of silver carp increased with each increase in the level of manuring, and the increase was more pronounced at lower stocking density.

Regardless of stocking density, daily gains of silver carp as affected by the level of manuring during all experimental periods were the highest for the groups of the highest manuring rate (450/kg/fed), followed in a decreasing order by those that received 300 kg/fed as 150 kg/fed, respectively (Figure 1).

Specific growth rate (SGR)

Averages of specific growth rate (SGR) during the experimental period, 4, 6, 8, 10, 12, 14, 16, 18 and 20 weeks after the start the start of the experiment for the experimental groups MISD1, M2SD2, M3SD1, and M3D2 are presented in Table 4. The averages of SGR during the whole experimental period for the same groups cited before were 0.96, 0.79, 1.09, 1.17 and 0.96, respectively. These results indicated in general that, SGR increased linearly with each increase in the level of manuring, however, the increase was more pronounced at lower stocking densities. (Table 4).

The averages of SGR during the whole experimental period as affected by level of manure were found to be 0.88, 1.0 and 1.07 for levels of manure 150,300 and 450, respectively. Averages of SGR as affected by stocking density were 1.08 and 0.89 for stocking density 3200 and 4800 fish/fed, respectively. These results indicated that, increasing the manuring levels and decreasing stocking density resulted in an improvement in SGR (Tables 4a and 4b).

Table 3. Effect of duck manuring and stocking density on body length development of silver carp.

Treatment	2/w	4/w	6/w	8/w	10/w	12/w	14/w	16/w	18/w	20/w	Average
M1 SDI	0.37	0.63	0.89	1.5	1.87	2.2	2.49	2.17	1.92	1.6	1.56
M1 SD2	0.31	0.36	0.68	0.5	1.31	1.73	1.89	1.7	1.37	1.31	1.11
M2 SDI	0.88	0.52	1.05	1.9	2.43	2.8	3.06	2.87	2.71	2.1	2.02
M2 SD2	0.36	0.83	1.25	0.54	1.77	1.87	2.18	1.99	1.94	1.45	1.42
M3 SDI	1.47	0.27	1.4	1.95	2.72	3.13	3.29	3.34	3	2.5	2.32
M3 SD2	0.6	0.78	1.07	1.32	1.65	2.01	2.62	2.12	1.94	1.6	1.57

Table 4. Effect of levels of duck manuring and stocking density on body length development of silver carp.

Treatment	2/w	4/w	6/w	8/w	10/w	12/w	14/w	16/w	18/w	20/w	Average
M1 SDI	0.54	0.76	0.96	1.33	1.38	1.36	1.11	0.93	0.74	0.54	0.96
M1 SD2	0.46	0.44	0.81	0.46	1.2	1.33	1.13	0.93	0.66	0.58	0.79
M2 SDI	1.15	0.6	1	1.35	1.35	1.46	1.26	1	0.86	0.53	1.09
M2 SD2	0.54	0.93	1.26	0.46	1.33	1.2	1.13	0.93	0.8	0.52	0.91
M3 SDI	1.81	0.28	1.33	1.4	1.6	1.46	1.26	1.06	0.8	0.66	1.17
M3 SD2	0.83	0.86	1.06	1.06	1.2	1.2	1.2	0.86	0.73	0.53	0.96

Table 4a. Effect of duck manuring on specifc growth rate regardless of stocking of silver carp.

Treatment	2/w	4/w	6/w	8/w	10/w	12/w	14/w	16/w	18/w	20/w	Average
M1	0.46	0.6	0.86	0.93	1.26	1.33	1.23	0.93	0.66	0.53	0.88
M2	0.8	0.8	1.16	1	1.46	1.33	1.2	1	0.8	0.53	1
M3	1.33	0.53	1.2	1.26	1.4	1.33	1.26	1	0.8	0.6	1.07

Table 4b. Effect of stocking density specifc growth rate regardless of levels of manuring of silver carp.

Treatment	2/w	4/w	6/w	8/w	10/w	12/w	14/w	16/w	18/w	20/w	Average
SD1	1.07	0.53	1.13	1.4	1.53	1.4	1.2	1	0.8	0.6	1.08
SD2	0.6	0.73	1.06	0.73	1.2	1.2	1.2	0.93	0.73	0.53	0.89

Relative growth rate (RGR)

Averages RGR for all experimental groups are given in Table 5. Results present in this table indicated that, the highest RGR values for almost all the experimental groups were obtained during the period from 16 of June to 30th of August of the season, i.e. 14 weeks (Table 5). Averages of RGR during the whole experimental period, revealed that, RGR within each manuring level increased with decreasing socking density, and improved with each increase in manuring level (Table 5).

Results presented in Table 5 are in agreement with the finding of Refstie and Kittelsen (1976) working with atlantic salmon (Salmo salar). They reported that, high stocking density of fish depressed the growth rate, and that compensatory growth curved where the densities were standardized. Also, results obtained that, growth rate of rainbow trout was depressed when the stocking density increased from 15 to 30 kg/fish/m3 in the rearing tanks.

Condition Factor (k)

Average K values for the experimental groups at all stages studied are given in Table 6. These results may indicate that, level of manuring and stocking density seemed to have no influence on condition factor, indicating that, both factors influence both body weight and body length together and not one independent from the other. Results of K factor as affected by manuring level indicated that, level of manuring seemed to have no influence on this trait. In this connection, Bishara (1978) reported that, condition factor values obtained by grey mullet (*Mugil cephalus*) received chemical fertilization (superphosphate + ammonium nitrate) were nearly double that received only superphosphate alone or artificial feeding. Also, Stickney *et al.* (1979) reported that, growth of tilapia was most rapid in ponds that had a history of high manuring rate. They added that condition factor was parallel to fish growth.

Table 5. Effect of duck manuring and stocking density on relative growth rate of silver carp.

Treatment	2/w	4/w	6/w	8/w	10/w	12/w	14/w	16/w	18/w	20/w	Average
M1 SDI	7.5	11.9	15.1	22.0	22.5	21.5	20.0	14.6	11.2	8.4	319.3
M1 SD2	6.3	6.9	12.1	7.9	19.4	21.4	19.3	14.5	10.2	8.8	228.2
M2 SDI	17.9	8.9	16.7	25.9	26.2	23.9	21.0	16.3	13.4	8.7	413.0
M2 SD2	7.4	15.8	20.5	7.4	22.4	19.3	18.9	14.5	12.3	8.2	289.9
M3 SDI	30.0	4.2	21.6	24.2	27.1	24.6	20.6	17.4	13.3	11.2	373.8
M3 SD2	12.2	14.1	17.0	17.9	19.0	19.5	21.2	14.1	11.3	8.4	320.8

Table 6. Effect of levels of duck manuring and stocking density on condition factor of silver carp.

Treatment	2/w	4/w	6/w	8/w	10/w	12/w	14/w	16/w	18/w	20/w
M1 SD^1	1.03	0.99	0.97	1.05	0.95	0.94	1.01	1.01	1.02	1.21
M1 SD^2	1.03	1.04	0.96	0.6	1	0.97	1.02	1.05	1.08	1.06
M2 SD^1	1.03	1.01	0.95	0.96	1.14	1.01	1.15	1.06	1.11	1.05
M2 SD^2	1.03	1.05	0.97	0.94	0.98	1.12	1.06	1.02	0.88	1.14
M3 SD^1	1.03	1.13	1.02	0.95	1	0.98	1.04	1.07	1.1	1.06
M3 SD^2	1.03	1.04	0.94	0.96	0.97	1	0.98	1.04	1.14	1.09

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تأثير استخدام معدلات مختلفة من زرق البط على أداء أسماك المبروك الفضى تحت كثافتين

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أجريت الدراسة بغرض تأثير استخدام معدلات مختلفة من زرق البط على أسماك المبروك الفضى تحت كثافتين مختلفين. ثم اجراء التجربة فى أحواض التجارب التابعة للمعمل المركزى لبحوث الاسماك بالعباسة فى ٦ أحواض ترابية مساحة الحوض الواحد ١/٤ فدان (٥٠ × ٢٠) والمعاملات المستخدمة ثلاث معدلات سماد زرق البط ١٥٠ ، ٣٠٠ ، ٤٥٠ كجم/فدان وكل معدل سماد استخدمت كثافتين من الأسماك ٣٢٠٠ ، ٤٨٠٠ سمكة / للفدان.

أظهرت النتائج زيادة أوزان وأطوال اسماك المبروك الفضى بزيادة معدلات التسميد وانخفاض معدل الكثافة فى الاحواض. الاختلافات كانت معنوية. كذلك زيادة معدل النمو النسبى مع انخفاض الكثافة زيادة الانتاج الكلى بزيادة معدلات التسميد والكثافة.