Vet.Med.J.,Giza. Vol.50, No.2. (2002) 221-237.

EFFECT OF FERTILIZERS AND ARTIFICIAL FEEDING ON WATER PARAMETERS IN TILAPIA EARTHEN PONDS.

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Received: 22- 9-2001
Accepted: 5-12-2001

SUMMARY

Eighteen earthen ponds (each pond 0.25 fed) representing six treatments with three replicates was carried out in this study. Control was fed diet containing 25% crude protein. Feed was applied six days per week at a rate of 7% for the first 2 weeks, then it was 5% for the next 2 weeks and finally at a rate of 3%, Oreochromis niloticus biomass. Treatment (A), poultry litter was added at a rate of 100 kg/pond weekly for the first 60 days followed by feed at a rate of 3% of fish biomass. Treatment (B), poultry litter was added at a rate of 50 kg/pond weekly plus feeding artificial diet at rate of 1.5% of tilapia biomass. Treatment (C) poultry litter was used at a rate of 50 kg/pond weekly. Treatment (D), cow manure was applied at a rate of 100kg/pond. Treatment (E), urea and triple superphosphate was applied at a rate of 3.21 kg and 6.57 kg/pond. The experimental period was 5 months. Results showed that the highest water temperature was highest at August. Water temperature ranged between 26.1-29.9°C. The highest dissolved oxygen value was recorded for treatment E (5.2 mg/l), while the lowest was for treatment A (2.9 mg/l). The highest pH value was in-group E with an average of 9.3 during the study period. The total alkalinity increased in-group A to 424.9 mg/l than the other treatments. The average concentration of total phosphorus and orthophosphate increased to 1.90 and 0.83 mg/l respectively, in group A. The highest concentration of chlorophyll"a" was recorded in group A (230M/l) and the lowest concentration

was in the control group (83 M/l).

The water quality measurements were found to be within the normal range of tolerance and well being of tilapia (Oreochromis niloticus). The growth of different varieties or species of phytoplankton and zooplankton were highest of group A and lowest for control group. The highest daily gain of tilapia was of treatment A (1.62 g) and the lowest value for group E (0.73 g).

INTRODUCTION

Ponds water temperature (°C) is related to air temperature and closely follows it, within a range of 5 to 35°C. A temperature increase of 10°C often doubles the rate of decomposition and consumption of organic substances (Boyd, 1990). Water temperature is, perhaps, the single most important factor determining tilapia production in ponds. Tilapia stops growing between 15-20°C, while it do the best when temperature is between 25-30°C. Edwards et al., (1994) reported that dawn dissolved oxygen (DO) declined with an increase in manure loading rate, so at 60 kg dry matter of manure/ha/day plus rice bran, DO was frequently zero or close to zero. The adverse DO regime in buffalo-manured ponds was probably due to the respiration demand of bacterial activity caused by high loading of buffalo manure. The DO depletion rate depends on biological density of living organisms (Boyd, 1990). Maintaining alga biomass between 150-350 mg/m3 chlorophyll "a", could provide an extra 8-10 mg/m3 of oxygen per day (Smith and Piedrahita, 1988). The effect of inorganic nutrient loading on chlorophyll"a" concentration is obvious, a 55% increase in the amount of inorganic nutrients produced a 20% increase in the average of chlorophyll ìaî concentration (Zhu et al., 1990). The relationship of photosynthesis and respiration to pond pH has been well-documented (Tucker and Boyd, 1985). Boyd (1990) reported that total phosphorus is a key metabolic nutrient, and the supply of this element often regulates the productivity of natural waters. Soluble orthophosphate ions, which may be considered as ionization products of orthophosphoric acid (H3PO4) are simple forms of phosphorus that the phytoplankton utilize (Boyd, 1990). The same author demonstrated that in fresh water phosphorus usually is more important than nitrogen, but both phosphorus and nitrogen normally are limiting factors in seawater.

Fish need protein, minerals, vitamins and energy sources. In wild, they seldom show sings of nutrient deficiency because natural foods are relatively well balanced nutritionally and growth rate is proportional to quantity, where natural food is limited or completely absent, such as in closed systems, nutritional requirements of fish become critical and therefore, their formulated feed must be nutritionally complete (Lovell, 1989 and Ensminger et al., 1990).

The present study was conducted to investigate the effect of fertilizers and artificial feeding on water quality parameters in tilapia ponds.

MATERIALS AND METHODS

The experiment was applied in Abbassa farm belongs to Central Laboratory for Aquaculture Research, Abou-Hammad, Sharkia, Agriculture Research Center. The experimental design of this study are presented in table (1). using eighteen rectangle earthen ponds, representing six treatments with three replicates per each. The individual pond area was 0.25 feddan (1000 m2, as 20 X 50 m) and 130 cm depth. The experimental fish was, Oreochromis niloticus. Nile tilapia fingerlings were obtained from the production ponds at Abbassa farm with an average weight of 30.72 g. All experimental ponds were stocked by 1050 of Nile tilapia fingerlings. All experimental ponds were fertilized initially using organic fertilizer (50 kg poultry litter/pond), thereafter they were filled with fresh water for no longer than two weeks before they were stocked with fish. Random samples of fish (50 fish /pond) were taken at start and every two weeks during the whole experimental period (5 months) to recording the measurements of individual body weight and length. The experimental period begin from 15th May and finished on 15th October 1998.

Quality of pond water was checked once per month to determine temperature, dissolved oxygen (DO), secchi disk visibility (SD), hydrogen ions (pH), ammonia (NH3), nitrite-nitrogen (NO2-N), nitrate-nitrogen (NO3-N), total alkalinity (T. alk), total phosphorus (T.P), orthophosphate (OP) and chlorophyll "a" (Chl. a). All measurements were carried out according to the standard methods of American Public Health Association (APHA) (1985) and Boyd (1992). Temperature and dissolved oxygen were measured using Yellow Spring Instrument (YSI model 57) dissolved oxygen meter.

RESULTS AND DISCUSSION

Effect of fertilizers and artificial feeding on water quality parameters:

Results of water quality parameters including water temperature (°C), dissolved oxygen (DO), secchi disk (SD), pH, total alkalinity (T. alk), unionized ammonia (NH3), nitrite (NO2), nitrate (NO3), total phosphorus (T.P), orthophosphate (O.P) and chlorophyll "a" are presented in Tables 3 - 12.

Chemical parameters.

Water temperatures at 7 A.M. ranged from 26.1 to 29.9°C in all treatments during the study. Temperature of water in the experimental ponds ranged from 26.1 to 29.9°C being adequate for the growth of fishes (Table 3). This temperature is suitable for all chemical, physical, and biological processes in ponds as cited by Boyd (1979). In this respect Boyd (1990) reported that warm water species which were native to temperate climates and best semitropical grow at temperatures raged between 20 and 28°C.

Concerning dissolved oxygen (DO) contents of water, the averages values of DO were 3.2, 2.9, 3.9, 4.12, 3.0 and 5.2 mg/l for control, A, B, C, D and E, groups, respectively (Table 4). These results indicated that the highest concentration of DO was in treatment E and the lowest with treatment A. It is noticed from the data that the highest values of DO were in May in all groups (Table 4). This may be due to the decrease of phytoplankton consumed by fish which leads to increase of phytoplankton and consequently increased DO, while the lowest values were observed in July and October. It is proved that percentage of oxygen at sunrise can serve as an index of oxygen consuming organisms in the pond. Increased biomass of zooplankton and fish as well as heavy organic load with C and control treatments led to increase community respiration during the dark period and consequently decreased dissolved levels in dawn these treatments. In this respect Boyd (1990) stated that decomposition of organic matter by bacteria is normally an important drain for oxygen supplies in ponds.

Secchi disk visibility gradually decreased from the beginning of the season 10.5 - 19.72 reach 7.56 - 13.71 cm (Table 5). At the middle of the

Table (1): Experimental design

Group No.	Dietary treatments
(Control)	Fish in control group was fed on artificial feed diet (2mm in diameter and contained 25% CP) six days a week. The fish diet was offered at a rate of 7% of tilapia biomass in each pond for the first 2 week. Then it was 5 % for the next 2 weeks and finally 3% of tilapia biomass for the reat of experimental study.
(A)	Poultry meanure was added at a rate of 400 kg/feddan (which was represented 100kg/pond) weekly for the first 60 days of the experimental period followed by feeding Tilapia on artificial feed (3% Tilapia biomass / day)
(B)	Poultry manure was used at a rate of 200 kg/feddan (50kg/pond) weekly plus artificial feed as 1.5 % of tilapia biomass throughout the experimental period.
(C)	Poultry manure was added at 200 kg/feddan weekly (50 kg/pond)
(D)	Cow manure was used at the rate of 400 kg/feddan weekly (100kg/pond)
(E)	Inorganic fertilizer (chemical fertilizer) was concluded 2 inorganic fertilizer a urea at 12.86 kg/feddan/weekly (3.21 kg/pond), plus triplesuperphosphat at 26.30 kg/feddan/weekly (6.57 kg/pond).

experimental period this expected to happen because rates of phytoplankton production was higher than rates of its consumption by fish and zooplankton. From the middle of season to the end, the size and biomass of fish and zooplankton consequently increased the grazing on phytoplankton population. Secchi disk reading increased with time and reached 12.5 - 22.1 cm at the end of the experiment. The range of secchi disk visibility was 11.3 - 17.2 cm for all experimental ponds and it was within the acceptable limits (Boyd, 1979).

As presented in Table 6 values of pH values for control, A, B, C, D, and E groups were 8.3, 8.8, 9.0, 8.3, 8.5 and 9.3, respectively. These results indicate that the highest pH value was in E group (9.3) compared to the other groups studied. This may be due to higher photosynthesis activity in the E treatment. However, pH values were different between organic and inorganic fertilized ponds. In this study pH value never reached the critical high or low levels denoted by Boyd (1979 and 1990).

Table (2): Chemical analysis of poultry manure, cow manure and supplementary feed on dry basis:

Item	Poultry manure	Cow manure	Supplementary feed
Dry matter (DM%)	92.37	91.11	90
Organic matter (OM%)	67.5	81.66	89.5
Crud protein (CP%)	18.19	14.2	25
Ether extract (EE%)	1.92	1.20	6
Crud fiber (CF%)	12.57	9.17	7
Nitrogen free extract (NFE %)	34.82	57.09	50.93
Ash %	32.5	18.34	11.07
Gross energy	310.38	356.55	429.34

Table (3): Effect of different treatments on water temperature °C during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	27.00	26.50	26.20	26.10	26.60	26.43
June	28.60	28.10	28.20	28.15	28.30	28.20
July	29.20	29.20	29.70	29.55	29.70	29.60
August	29.90	29.40	29.70	29.55	29.80	29.63
September	29.20	29.70	29.40	29.45	29.70	29.53
October	28.50	29.40	28.60	28.50	28.50	28.50
Average	28.70	28.50	28.60	28.55	28.80	28.65

Table (4): Effect of different treatments on dissolved oxygen (mg/1) concentrations during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	7.40	7.20	12.40	11.78	8.56	14.90
June	2.28	1.20	1.65	4.11	2.59	5.20
July	3.50	1.40	1.10	1.34	1.38	1.70
August	3.50	1.50	1.60	2.35	1.84	3.20
September	1.20	3.40	3.60	2.61	1.91	3.30
October	1.10	3.10	2.80	2.37	1.72	3.00
Average	3.20	2.90	3.90	4.12	3.00	5.20

Table (5): Effect of different treatments on Secchi disk reading (cm) during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	19.35	10.50	15.60	14.59	16.19	19.72
June	19.35	10.50	13.40	11.45	12.95	15.88
July	12.36	10.50	10.40	9.72	11.57	13.7
August	11.56	12.00	8.90	7.56	10.99	13.71
September	18.27	12.50	10.40	17.72	18.10	15.34
October	22.10	12.50	14.60	19.45	18.63	17.64
Average	17.20	11.30	12.20	13.41	14.74	16.00

Table (6): Effect of different treatments on pH values during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	8.68	8.50	9.10	8.10	8.50	9.10
June	8.20	8.60	9.20	8.27	8.68	9.80
July	7.82	8.80	8.50	8.45	8.68	9.20
August	8.11	9.00	9.20	8.45	8.50	9.00
September	9.20	9.00	9.20	8.27	8.31	9.10
October	8.68	9.00	9.10	8.27	8.31	9.40
Average	8.30	8.80	9.00	8.30	8.50	9.30

Table (7): Effect of different treatments on total alkalinity during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	298.60	306.0	299.60	349.0	448.0	190.0
June	396.0	404.0	406.10	386.0	410.0	201.0
July	395.0	455.0	260.0	254.0	293.0	290.0
August	486.0	509.10	546.0	301.0	402.0	294.0
September	506.0	496.0	512.20	330.0	423.0	299.0
October	382.40	370.0	326.0	336.0	421.0	231.0
Average	411.00	424.90	391.70	329.33	399.50	260.83

Table (8): Effect of different treatments on concentrations of ammonia (rag/1NH3) during the experimental period un-ionized.

Months	Treatments					
	Control	A	B	C	D	E
May	0.37	0.20	0.64	0.02	0.10	0.17
June	0.58	0.49	0.59	0.06	0.18	1.95
July	0.08	0.52	0.04	0.14	0.19	1.01
August	0.23	0.74	0.81	0.14	0.19	0.59
September	0.48	1.05	0.89	0.14	0.19	0.68
October	0.64	0.82	0.76	0.14	0.15	0.77
Average	0.39	0.64	0.60	0.12	0.17	0.69

Table (9): Effect of different treatments on nitrite concentrations (mg/l NO_2) during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	0.00	0.00	0.01	0.01	0.01	0.00
June	0.01	0.05	0.01	0.02	0.04	0.02
July	0.01	0.02	0.01	0.02	0.03	0.05
August	0.01	0.05	0.02	0.02	0.03	0.03
September	0.01	0.01	0.03	0.02	0.00	0.02
October	0.00	0.01	0.03	0.01	0.00	0.03
Average	0.00	0.02	0.02	0.02	0.02	0.03

Table (10): Effect of different treatments on nitrate concentrations (mg/l NO_3) during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	0.20	0.15	0.21	0.02	0.19	0.25
June	0.15	0.14	0.09	0.10	0.24	0.22
July	0.20	0.22	0.14	0.01	0.16	0.23
August	0.16	0.21	0.03	0.13	0.13	0.22
September	0.20	0.26	0.40	0.10	0.09	0.40
October	0.22	0.21	0.27	0.11	0.08	0.26
Average	0.19	0.19	0.19	0.10	0.15	0.26

Table (11): Effect of different treatments on total phosphorus (mg/l) during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	0.46	1.30	0.80	0.52	0.37	1.05
June	0.59	2.36	1.51	0.98	0.69	1.91
July	0.55	3.77	1.88	1.21	0.86	1.02
August	0.49	2.43	1.98	1.28	0.91	1.16
September	0.68	1.00	1.51	0.98	0.69	1.54
October	0.61	0.63	1.34	0.87	0.62	1.48
Average	0.56	1.90	1.50	0.97	0.69	1.36

Table (12): Effect of different treatments on concentartions of orthophosphate (mg/l) during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	0.14	0.57	0.36	0.27	0.20	0.15
June	0.23	1.16	0.60	0.44	0.34	0.43
July	0.23	1.57	0.75	0.56	0.43	0.31
August	0.19	0.94	0.67	0.50	0.38	0.29
September	0.23	0.46	0.57	0.42	0.32	0.28
October	0.17	0.29	0.51	0.38	0.29	0.24
Average	0.20	0.83	0.58	0.43	0.33	0.28

Table (13): Effect of different treatments on concentrationsof chlorophyll "a" (μg/l) during the experimental period.

Months	Treatments					
	Control	A	B	C	D	E
May	42.[illegible]0	353.0	141.40	118.0	100.0	45.60
June	96.40	489.0	184.00	153.0	130.0	144.0
July	85.00	266.0	197.00	164.0	139.0	125.0
August	94.20	136.0	208.00	174.0	146.0	131.0
September	113.65	97.33	188.00	157.0	132.0	157.0
October	66.60	39.0	164.00	137.0	115.0	94.0
Average	83.00	230.0	180.40	150.50	127.0	116.10

Table (14): Effect of different treatments on concentrations of phytoplankton (organism/l) during the experimental period.

Period	Treatments														
	Control					A					B				
	Green	B.gr.	Eug.	Di.	Total	Green	B.gr.	Eug.	Di.	Total	Green	B.gr.	Eug.	Di.	Total
May	45	29	22	11	107	219	98	46	18	381	190	61	8	4	263
June	81	42	17	5	145	386	124	56	35	601	264	127	27	17	435
July	137	106	33	5	281	437	346	74	20	877	220	155	42	7	439
August	154	137	73	12	376	272	193	40	26	541	222	199	31	13	465
September	133	85	9	1	228	129	90	20	4	243	245	176	31	12	454
October	136	82	4	1	223	84	58	11	4	157	200	180	36	2	418
Average	115	80	26	6	227	255	151	43	18	467	222	152	29	9	412

Period	Treatments														
	Control					A					B				
	Green	B.gr.	Eug.	Di.	Total	Green	B.gr.	Eug.	Di.	Total	Green	B.gr.	Eug.	Di.	Total
May	45	29	22	11	107	219	98	46	18	381	190	61	8	4	263
June	81	42	17	5	145	386	124	56	35	601	264	127	27	17	435
July	137	106	33	5	281	437	346	74	20	877	220	155	42	7	439
August	154	137	73	12	376	272	193	40	26	541	222	199	31	13	465
September	133	85	9	1	228	129	90	20	4	243	245	176	31	12	454
October	136	82	4	1	223	84	58	11	4	157	200	180	36	2	418
Average	115	80	26	6	227	255	151	43	18	467	222	152	29	9	412

Green. .... Green algae.
B.gr. ....Blue green algae.
Eug. .... Euglena.
Di. .... Diatom.

Table (15): Effect of different treatments on concentrations of zooplankton (organism/l) during the experimental period.

Period	Treatments														
	Control					A					B				
	Cop.	Rot.	Cla.	Ost.	Total	Cop.	Rot.	Cla.	Ost.	Total	Cop.	Rot.	Cla.	Ost.	Total
May	39	10	3	3	55	85	30	24	16	155	50	15	12	11	88
June	153	18	29	13	213	420	90	38	33	581	216	48	22	16	302
July	150	37	18	11	216	535	92	59	28	714	314	51	37	17	419
August	160	36	20	13	229	159	49	27	16	251	331	57	41	20	449
September	155	34	19	12	220	118	33	35	19	205	327	51	33	17	428
October	132	10	18	12	172	117	18	31	18	184	314	33	27	13	387
Average	131	24	18	11	184	239	52	36	22	249	259	42	29	16	346

Period	Treatments														
	Control					A					B				
	Cop.	Rot.	Cla.	Ost.	Total	Cop.	Rot.	Cla.	Ost.	Total	Cop.	Rot.	Cla.	Ost.	Total
May	42	12	10	10	74	35	11	9	8	63	21	7	5	4	37
June	180	40	18	13	251	153	34	16	11	214	104	25	11	5	145
July	261	43	30	14	348	222	36	26	12	296	122	25	9	5	161
August	277	48	34	17	376	232	40	29	15	316	131	28	11	5	175
September	273	42	28	14	357	229	36	24	12	301	127	26	10	5	168
October	262	28	23	11	324	221	23	19	9	272	106	7	5	4	122
Average	216	36	24	13	289	183	30	20	11	244	102	20	8	5	135

Cop. .... Green algae.
Rot. ....Rotifera.
Eug. .... Cladocera.
Di. .... Ostracoda.

Averages of total alkalinity (T. alk./l as $CaCo_3$) were found to be 411.0, 424.9, 391.7, 329.3, 399.5 and 260.8 mg/l for the control, A, B, C, D and E treatments, respectively (Table 7). These results indicate that the highest concentration of T. alk. was in A group (424.9 mg/l) and the lowest was in E group (260.8 mg/l). Decreased total alkalinity and increased pH value (Table 7 & 6) characterized the chemical fertilizer treatments. This may be contribated to three factors: 1. The negative effect between organic manure and feed versus chemical fertilizer on pH value. 2. The increase in pH value in water with high photosynthetic rate due to depletion of carbon dioxide.

3. The hydrolysis of bicarbonate ions at higher pH values reducing the total alkalinity.

There was a gradual increase in the total alkalinity during the experiment, which ranged from (-190.0

- 448.0 mg/l), at the start of and reached (231.0 - 421.0 mg/l) at the end of the experiment. Boyd (1979) reported that autotrophic activity increased pH through CO_2 absorption, while heterotrophic activity decreases pH through respiration. Since autotrophic and heterotrophic processes affect the measure variable in the opposite ways.

Results in Table 8 showed the averages of ammonia values (NH_3) concentration for the groups studied. Results indicated that the highest concentration was in E group (0.69 mg/l) and the lowest with C group (0.12 mg/l). Boyd (1990) stated that un-ionized ammonia is extremely toxic to aquatic animals and it is capable of inhibiting growth, and can also produce an increase susceptibility to other unfavorable disease conditions of the culture systems.

The results in Table 9 indicate that the highest NO_2 value was found in group E (0.03 mg/l), compared to the other groups. This may be due to ammonium change to nitrite by oxidation reaction. The increase in ammonia content in the E treatment led to enhanced level of nitrite (0.03 mg/l). Nitrite concentration in water of all experimental ponds was lower than the critical limit that effects growth. Colt and Armstrong (1981) found that growth of juvenile catfish (Ictalurus punctatus) was reduced by nitrite level of 1.6 mg/l and the mortality increased at 3.7 mg/l and above.

As shown in Table 10, the concentrations of NO_3 ranged between 0.15-0.22, 0.14-0.26, 0.03-0.27, 0.01-0.13, 0.08-0.24 and 0.22-0.40 mg/l for control, A, B, C, D and E groups, respectively. The average concentrations of NO_3 in all treatments during the entire experiment ranged between 0.10 and 0,26 mg/l. Data indicated that the highest concentration of NO_3 was in E treatment compared with the other treatments. The weekly application of urea (12.86 kg/fed) in the E treatment led to this increase, since urea is transferred to ammonia and ammonium, then nitrite to nitrate under both aerobic and anaerobic conditions. The present results are in agreement with those obtained by Green et al., (1995) who reported that the concentration of NO_2, NO_3 and total nitrogen increased with increasing of organic and inorganic fertilizers.

Results in Table 11 showed that total phosphorus concentration increased from May to August and gradually decreased from September till the end of the experiment. The results indicated that the highest total phosphorus concentration was in group A (1.9 mg/l) and the lowest with the control group (0.56 mg/l). The increase in total phosphorus concentration in poultry litter treatment may be due to: 1. Phosphorus released from chicken litter after degradation (main source); 2. Phosphorus released very quickly by microbial degradation from the dead cells of phytoplankton (De-Pinto et al., 1986). Knud-Hansen et al., (1993) stated that in calculation loading rates, it was assumed that chicken manure release through leaching and decomposition about 20% of total phosphorus for phytoplankton.

Results showed that orthophosphorus concentration increased from May to August and gradually decreased from September till the end of the experiment. Also, there was an accumulation of SRP (soluble reactive phosphorus) in the A treatment. Mean orthophosphate level in water was higher than optimum in the A group (0.83 mg/l) and C (o.58 mg/l) treatment (Table 12). In this respect, Mims et al., (1991) reported that the total filterable orthophosphate (which ranged from 1.5 to 6.8 mg/l) was within the acceptable limits.

Results in Table 13 indicate that the highest chlorophyllîaî concentration was in A and B groups compared to the other groups. Also, this result indicates that organic fertilizers had a direct effect on growth rate of algae. The addition of organic and inorganic fertilizers caused fast development of phytoplankton blooms. Teichert-Coddington and Green (1993) found that mean chlorophyll ìaî concentration ranged from 104Mg/l in the beginning of the experiment to 279 Mg/l at the end of the experiment.

These results are in good agreement with the data presented by Hollerman and Boyd (1985) who reported that supplemental organic and inorganic fertilized ponds gave a higher content of total nitrogen, total orthophosphate, chlorophyll ìaî primary productivity and fish production than organic fertilizer or chemical fertilizer only.

Biological parameters:

Plankton is comprised of all the microscopic organisms which are suspended in water and include small plants (phytoplankton), small animals (zooplankton), and bacteria. The plankton uses inorganic minerals salts carbon dioxide, water and sunlight to produce its own food. The zooplankton feeds on living or dead plankton and other particles of organic matter in the water.

Total number of phytoplankton count (organisms/l) during May, June, July, August, September and October for all the experimental ponds are presented in Table 14. The highest count of phytoplankton during May was obtained by the treatment A followed in a decreasing order by B, C, D, E and control treatments, respectively. The same trend was observed during June, however the phytoplankton count was higher in all treatments compared to that in May.

All ponds recorded the highest phytoplankton concentration during August where the A group showed the highest concentration compared to the other treatments. The high phytoplankton bloom due to high water temperature during this month At the end of the experimental period at (October) total number of phytoplankton count of B treatment was the highest followed by C, D, E, control and A treatments, respectively.

The regression equation obtained in the present study of the phytoplankton abundance/ml and chlorophyll ìaî ($r2 = 0.990$) was:

$$Y = 0.604 X + 4.5$$

Where:

Y = chlorophyll "a" (M/l)

X = phytoplankton (number/ml)

4.5= statistical constant

From the above equation, it could be calculate phytoplankton from chlorophyll ìaî in the same condition of this investigation. Phytoplankton density estimated by Secchi disk visibility and chlorophyll "a" concentration. However, all pond fertilizers increased plankton abundance by estimated turbidity measurements and Secchi disk. Generally, fish yield was well correlated with phytoplankton productivity. These results are in agreement with those reported Teichert-Coddington et al., (1992) who reported that the relationship between net daily fish yield, chlorophyll ìaî, and primary productivity are unique, because they were developed from monoculture of tilapia stocked at one rate and cultivated under varying fertility levels during different seasons in different geographical regions.

Boyd (1990) reported that the organic fertilizer might serve as a direct source of food for invertebrates, food organisms and fish.

Regarding to zooplankton, data in Table 15 showed that the lowest numbers of zooplankton were in May and gradually increased with time until August and then decreased in September and October.

Total number of zooplankton in A group were higher compared to the other treatments. Zooplankton increased in control, A, B, C, D and E treatments with advancing time but in A group increased in May and July then decreased from July till October (Table 15). This decreased due to stopping fertilization.

It is noticed also that the highest numbers of plankton were obtained in A and B treatments and the lowest number were in control group due to the decrease of macro nutrients. Also, data indicated that the highest number of phytoplankton in green algae in all treatments during the experimental period. The highest number of zooplankton mans was in copepoda and rotifera in all treatments. Overall zooplankton increased with the time. El-Nagdy et al., (1997) reported that copepoda was the main species in all ponds, while green algae was the main species in all ponds with variable percentages.

Ponds fertilized with poultry litter followed by feed supported the fastest growing of zooplankton density during the early part of the cultured period. In this respect, Orachunwong et al., (1988) reported that, Oreochromis niloticus is known to feed on the grazing zooplankton as well as plant materials.

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