Abbassa International Journal for Aquaculture

Volume (3) Number (1), 2010

ISSN 1687-7638

Egyptian Society for Water, Aquaculture and Environment

Abbassa, Abou Hammad, Sharki, EGYPT

Abbassa Int. J. Aqua., V0l.3 No.(1) 2010. *118-145*

FERMENTED COMPOST APPLICATION IN EARTHEN PONDS AND THE RESULTED EFFECT ON WATER-QUALITY, PHYTOPLANKTON POPULATION AND FISH YIELD

Amr M. Alnagaawy[1] and **Ayman A. Ammar**[2]

1- Limnology Dept. 2- Fish production and aquaculture systems Dept., Central Lab for Aquaculture Research (CLAR), ARC.

Received 25/ 2/ 2010 Accepted 1/ 4/ 2010

Abstract

Compost had been used as initiating dose in earthen fish-ponds. Different compost application techniques had been tested for the optimum one as reflected on water quality as well as phytoplankton production. Six different techniques of compost were applied as follow: without compost, compost without fermentation, compost fermented for one month outside the pond, compost fermented for two months outside the pond, compost fermented for one month inside the pond and compost fermented for two months inside the pond. Highest electric conductivity, salinity and total dissolved solids were obtained in compost fermented for 2 months outside the pond treatment (2 O). Highest orthophosphate, chlorophyll "a" concentrations as well as total phytoplankton count were detected in two months inside pond fermented compost treatment and then in compost without fermentation treatment. Lowest total alkalinity and total hardness were recorded in 2 months inside the pond (2 IN) treatment. In spite of the highest fish yield was obtained in 1 month outside the pond (1 O) treatment, but the highest percentage of the sum. of super&1st grades of fish size was obtained in 2 IN treatment. An initial single dose of fermented compost highly recommended, when compost was fermented for 2 months inside the pond.

INTRODUCTION

The use of terrestrial and aquatic macrophytes for aquaculture is a very broad topic, which includes direct feeding on freshly cut plant material and the composting of plants both in and outside the pond (Edwards, 1987). Composted plant materials provide a pond with decomposed particulate matter, and release soluble algal nutrients and dissolved organic matter during decomposition (Biddlestone and Gray, 1987). Management strategies in the lower levels of intensification involve the use of fertilizer to encourage natural productivity and to improve the levels of dissolved oxygen. Fish yields from such techniques have been found to be higher than those from natural unfertilized systems (Hickling, 1962; Hepher, 1963 and Green, 1992).

In fish culture ponds, fertilizers are added to pond water to increase nutrient concentrations necessary for phytoplankton growth. Addition of fertilizers would not only increase nutrient concentrations, but also affect directly or indirectly other aspects of pond environment. It is important to understand the dominance shift of phytoplankton as a result of organic fertilization in order to develop appropriate management procedures Osuji, *et al* (2004). Fertilizer (inorganic and organic) application among other things has been used to achieve an increase in the productivity of pond. Biological productivity in any given aquatic body is a function of nutrients in it (Davies, *et al*. 2006). According to Bhakta *et al*. (2004), optimal fertilization rates are the amount of organic matter that may be cost-effective and utilized in a pond ecosystem without any harmful effects on water quality and fish growth. Compost (or manure) is added to the pond as an indirect feed for fish. It accelerates the plankton growth in the water. Many fish species, of which some tilapias and carps feed on plankton. In general fish respond well to the addition of fertilizer and their numbers may rise considerably (Inckel, *et al*. 2005).

This study was conducted to compare the effect of different application techniques of compost as reflected on fish-earthen pond water-quality, phytoplankton population and fish yield.

MATERIAL AND METHODS

The present experiment was carried out in a private fish farm at Wady El-Rayan, Fayoum Governorate and lasted from 15/04 to 11/11/ 2008.

Experimental ponds:

Twelve earthen ponds, each of 8400 m^2 surface area and 1.5 meter water depth were used. They were dried completely and exposed to sunrays for about 4 weeks for complete drying, then filled with water from the first El Wady drainage canal.

Experimental fish:

Nile tilapia monosex fingerlings (8 ± 1 g) produced by hormonal treating were purchased from a privet tilapia hatchery.

Experimental diet:

All experimental fish were fed on a commercial artificial feed containing 27% crude protein and 3750 kcal/gross energy/kg. The fish were fed at a rate of 3% of their biomass three times daily at. 8^{00}; 12^{00} and 16^{00} o'clock.

Experimental design:

Ponds were divided into 6 treatments with 2 replicates for each. Different treatments and their notations are summarized in Table 1.

Table 1: different treatments and their notations.

Notation	Description
W Comp. (without compost)	Where no compost was added as initial single dose
W F (without fermentation)	Where the single initial dose of compost was added to ponds without previous fermentation
1 O (1 month outside the pond)	Where the single initial dose of compost was previously fermented for one month outside the pond before adding fish..
1 IN (1 month inside the pond)	Where the single initial dose of compost was previously fermented for one month inside the pond before adding fish.
2 O (2 months outside the pond)	Where the single initial dose of compost was previously fermented for two months outside the pond before adding fish.
2 IN (2 months inside the pond)	Where the single initial dose of compost was previously fermented for two months inside the pond before adding fish.

Fertilization strategy:

All ponds received the same amount of compost as a single initial dose (250 kg/feddan) except W Comp. treatment. Chicken manure was applied with the rate of 1.5 m^3 / feddan to all ponds, except W Comp. treatment which received 2 m^3 / feddan as shown in Table 2. Physical and chemical analysis of the investigated compost is shown in Table 3.

Table 2: Fertilization strategy

Treatment	Compost amount (kg /feddan as a single initial dose)	Chicken manure amount (m^3 /feddan)
W Comp.	0	2
W F	250	1.5
1 O	250	1.5
1 IN	250	1.5
2 O	250	1.5
2 IN	250	1.5

Table 3: physical and chemical analysis of the investigated fresh (un fermented) compost

Cubic meter wt. weight	585 kg/M^3
Cubic meter dry weight	380 kg/M^3
humidity	35.3 %
pH (1:10)	8.5
EC (1:10)	4.15 ds/m^2
NH4-N	87 ppm
NO3-N	60 ppm
Organic carbon	24.4 %
ash	58 %
C:N ratio	17.4 : 1
Total phosphorous	0.4 %
Total potassium	1.1 %
nimatoda	Absent

Analytical procedures:

Water quality measurements:

Different physical and chemical properties were carried out biweekly.

Outdoor measurements:

Water quality measurements taken outdoor: Temperature and dissolved oxygen (DO) using Yellow Spring Instrument (YSI model 57) oxygen meter. Salinity, electrical conductivity and total dissolved solids were measured using a salinity-conductivity meter (model: YSI EC300). pH values using pH meter (model Corning 345). Water visibility using Secchi disk (SD).

Laboratory analysis:

5 liters water collected from signed sites in each pond, was mixed and transferred to the laboratory for the following measurements: Total alkalinity and total hardness were determined by titration as $CaCO_3$ according to APHA (1985). Nitrate-nitrogen was measured by phenoldisulphonic acid method while nitrite-nitrogen was measured by diazotyzing method using spectrophotometer (model, WPA Linton Cambridge UK) as desribed in APHA (1985). Filterable orthophosphate was measured by ascorbic acid method and measured by spectrophotometer (WPA Linton Cambridge UK) according to APHA (1985).

Biological examinations:

Chlorophyll "a".

Chlorophyll “a” was determined using spectrophotometer (WPA Linton Cambridge UK) as previously described by Vollenweider (1969).

Phytoplankton assessment.

Phytoplankton was concentrated by settling 500 ml water sample in a volumetric cylinder for 24 hours after being preserved in lugol's solution, at a ratio of 0.3 ml to 100 ml sediment (APHA, 1985). The surface water was siphoned and the sediment was examined. Phytoplankton cells were identified to four divisions: Green algae (Chlorophyceae), Blue-green algae (Cyanophyceae), Diatoms (Bacillariophyceae), and Euglena (Dinophyceae). Phytoplankton cells were counted microscopically in a special counting chamber using a micrometer eye lens.

Net fish yield and feed conversion ratio:

Fish Samples from each pond were collected monthly, weighed to adjust feed quantities, then immediately returned to the water of the same pond. At the end of the experiment, all fish were harvested, weighted and counted. The feed conversion ratio (FCR) was calculated by the following equation:

FCR = Weight of feed added/increase in wet fish weight

Statistical analysis:

Results statistics were carried out by using SAS program (SAS Institute, 1990).

RESULTS AND DISCUSSION

Water temperature

Data obtained alongside the study period concerning water temperature as represented in Table 4**.** showed that there were no significant differences (P< 0.05) among different treatments. Average Means of water temp. among different treatments were between 24.7 and 24.8 ˚C. which lies within the optimum range of tilapia tolerance (24 -32 °C) mentioned by El-Sayed and Kawanna (2008).

Table 4: Means ± SE of different investigated water quality parameters.

	WComp.	WF	1 O	1 In	2 O	2 In
Temp. (°C)	24.8 ± 3.22 [a]	24.7 ± 2.25 [a]	24.7 ± 1.95 [a]	24.8 ± 3.18 [a]	24.7 ± 1.57 [a]	24.7 ± 2.25 [a]
DO (mg/l)	4.483 ± 0.73 [c]	5.00 ± 0.950 [a]	4.267 ± 0.700 [cd]	4.600 ± 0.83 [b]	4.083 ± 0.79 [d]	4.383 ± 0.88 [c]
EC (mlmhos/cm)	3.472 ± 0.08 [b]	3.54 ± 0.08 [b]	3.38 ± 0.10 [b]	3.37 ± 0.09 [b]	3.92 ± 0.11 [a]	3.04 ± 0.24 [c]
Sal. (g/l)	1.93 ± 0.11 [b]	1.97 ± 0.06 [b]	1.83 ± 0.06 [bc]	1.87 ± 0.09 [bc]	2.23 ± 0.13 [a]	1.6 ± 0.070 [c]
TDS (g/l)	2.41 ± 0.15A [b]	2.46 ± 0.1A [b]	2.28 ± 0.03 [bc]	2.33 ± 0.14 [ab]	2.74 ± 0.13 [a]	1.97 ± 0.18 [c]
pH	7.975 ± 0.01 [b]	8.32 ± 0.08 [a]	8.01 ± 0.14 [b]	8.15 ± 0.07 [ab]	7.99 ± 0.05 [b]	8.33 ± 0.09 [a]
SD (cm)	25.00 ± 2.25 [a]	20.80 ± 2.40 [c]	24.50 ± 1.99 [a]	20.80 ± 2.25 [c]	23.30 ± 1.15 [b]	21.00 ± 2.30 [c]
T. Alk (mg/l as $CaCO_3$)	353.33 ± 35.55 [a]	302.5 ± 45.75 [c]	322.5 ± 28.25 [b]	318.33 ± 33.28 [b]	336.67 ± 28.92 [ab]	300 ± 51.69 [c]
T. H (mg/l as $CaCO_3$)	578.33 ± 66.98 [a]	501.67 ± 75.00 [b]	506.67 ± 62.75 [b]	496.67 ± 48.75 [b]	580.33 ± 73.29 [a]	410.83 ± 48.48 [c]
OP (mg/l)	0.018 ± 0.003 [d]	0.074 ± 0.009 [b]	0.014 ± 0.002 [d]	0.028 ± 0.003 [cd]	0.041 ± 0.003 [c]	0.107± 0.009 [a]
NO_3 (mg/l)	0.0376 ± 0.004 [c]	0.233 ± 0.009 [b]	0.1523 ± 0.016 [b]	0.8897 ± 0.058 [a]	0.201 ± 0.015 [b]	0.8407 ± 0.049 [a]
NO_2 (mg/l)	0.0173 ± 0.002 [d]	0.04 ± 0.002 [a]	0.0083 ± 0.008 [e]	0.0327 ± 0.003 [bc]	0.0267 ± 0.002 [c]	0.0338 ± 0.003 [ab]
Chlorophyll a (ug/l)	37.32 ± 4.04[c]	99.575 ± 7.51 [b]	65.605 ± 5.4 [c]	107.188 ± 9.63 [b]	49.056 ± 3.77 [c]	243.148 ± 17.33 [a]

*Means followed by different letters are significantly different (Duncan, s Multiple Range Test, 1955, P< 0.05).

Dissolved oxygen.

The averages of dissolved oxygen concentrations obtained alongside the present work ranged between 4.08 and 5 mg/l. Davies, *et al*. (2006) recorded levels of dissolved oxygen ranged between 3 and 5.9 mg/l which obtained after fertilization with different organic and in organic fertilizers. They mentioned that these levels were desirable for phytoplankton growth and also for fish production.

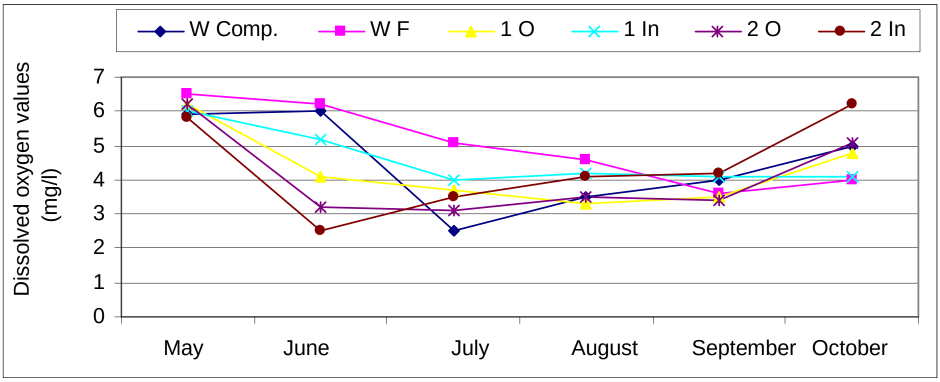

Figure 1. Water dissolved oxygen values (mg/l) of different treatments alongside the study period.

Salinity, electrical conductivity and total dissolved solids.

The lowest average of salinity (1.6±0.07 ppt), electrical conductivity (3.038±0.24 mlmhos/cm), and total dissolved solids (1.968±0.18 g/l) were recorded in 2 IN treatment. The obtained result could be attributed to the increased growth of phytoplankton, as indicated by the highest average of chlorophyll a with the treatment 2 In, which consumed more dissolved solids in the form of nutrients. Stickney (1986), mentioned the range 0-10 ‰ as an optimum salinity range for *O. niloticus*.

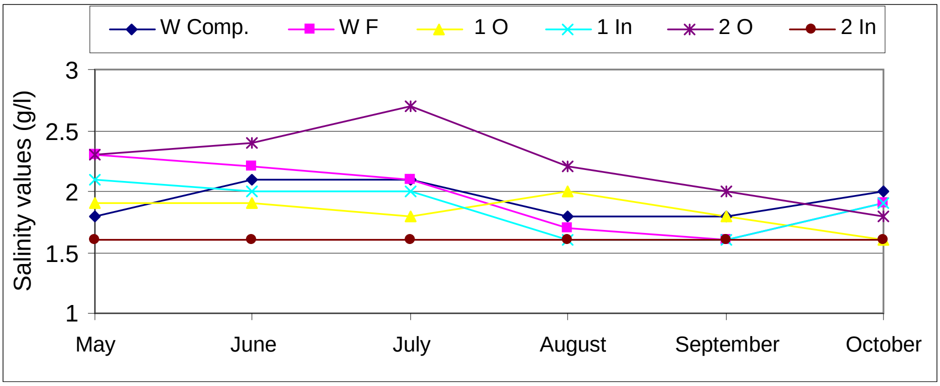

Figure 2. Salinity (g/l) in different treatments alongside the study period.

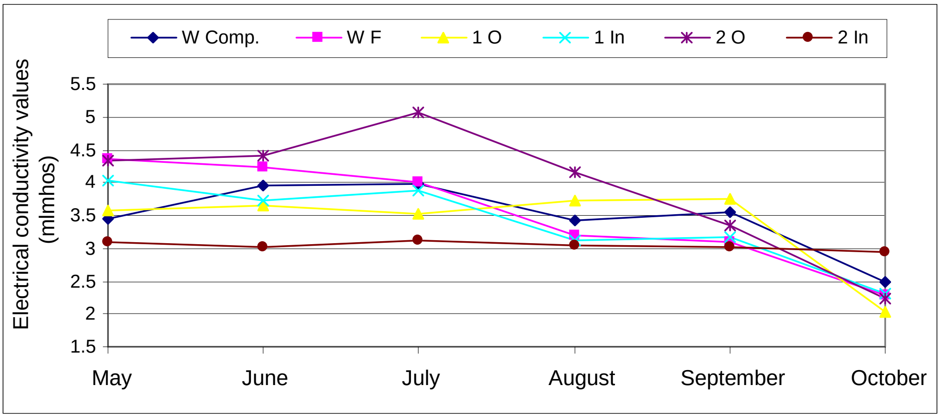

Figure 3. Electrical conductivity (mlmhos) in different treatments alongside the study period.

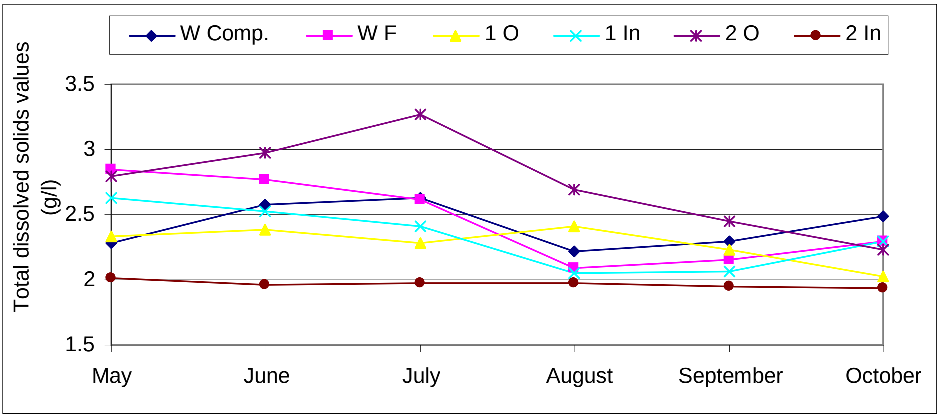

Figure 4. Total dissolved solids (g/l) in different treatments alongside the study period.

pH :

The observed pH values obtained alongside the present work which ranged between 7.98 and 8.33, were suitable for the healthy growth of phytoplankton (Adeniyi and Ovie, 1982; Boney, 1983; Kemdirim, 2001). Chen and Durbin (1994) reported that pH ranged between 7.9 and 8.2 resulted in maximum carbon uptake, which indicates optimum growth of phytoplankton.

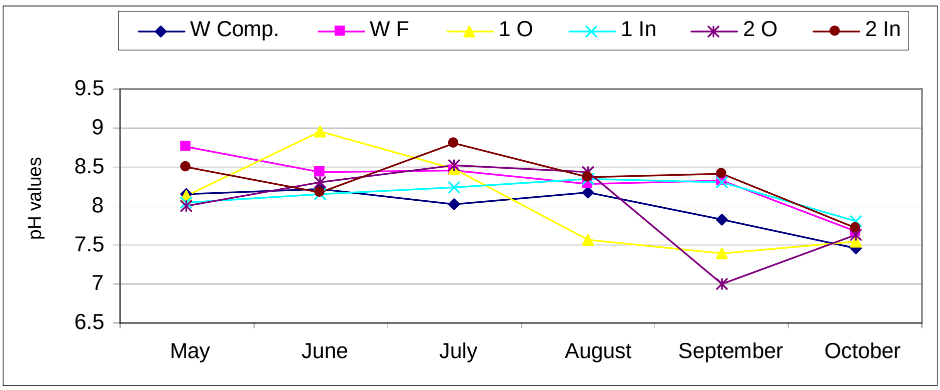

Figure 5. pH values of different treatments alongside the study period.

Water visibility:

Lowest Secchi disk (SD) readings (20.8, 20.8 and 21 cm) were observed in treatments: WF, 1 In and 2 In, respectively. This result could be attributed to the increased abundance of phytoplankton in these treatments. Similar results were mentioned by El-Naggar *et al* (2008) who reported that the increased phytoplankton abundance decreases Secchi disk reading in fertilized earthen ponds**.**

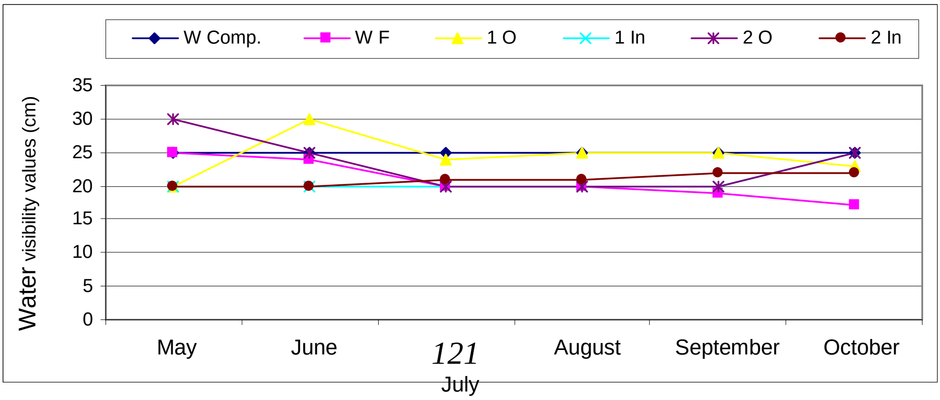

Figure 6. Water visibility values (cm) of different treatments alongside the study period.

Total alkalinity and total hardness:

Highest average of total alkalinity value (353.33 ± 11.55 mg/l as $CaCO_3$) was recorded in W Comp. treatment while the lowest values (300 ± 11.55 and 302.5 ± 17.32 mg/l as $CaCo_3$) were recorded in treatments 2 IN and WF respectively. Decreased values of total alkalinity observed in these treatments could be attributed to the relatively increased growth of algae in these treatments, which resulted in increased consumption of HCO_3^-, which in turn resulted in a significant decrease in total alkalinity values. Boston *et al*. (1989) reported that a decrease in pond water alkalinity can occur, however, when HCO3 - is removed by algae, as might occur during periods of high photosynthetic activity**.** Total hardness values recorded alongside the study period had the same trend as total alkalinity. Highest average of total hardness (578.33 ± 17.32 mg/l as $CaCo_3$) was recorded in W Comp. treatment, while the lowest value (410.83 ± 15.92 mg/l as $CaCo_3$) was recorded in 2 IN. treatment. Both total hardness and alkalinity will decrease in ponds as a result of increased phytoplanktonic growth as mentioned by Knud-Hansen (1998) who reported that high algal productivity can result in the precipitation of $CaCO^{3-}$, and consequently the reduction of both total alkalinity and total hardness**.**

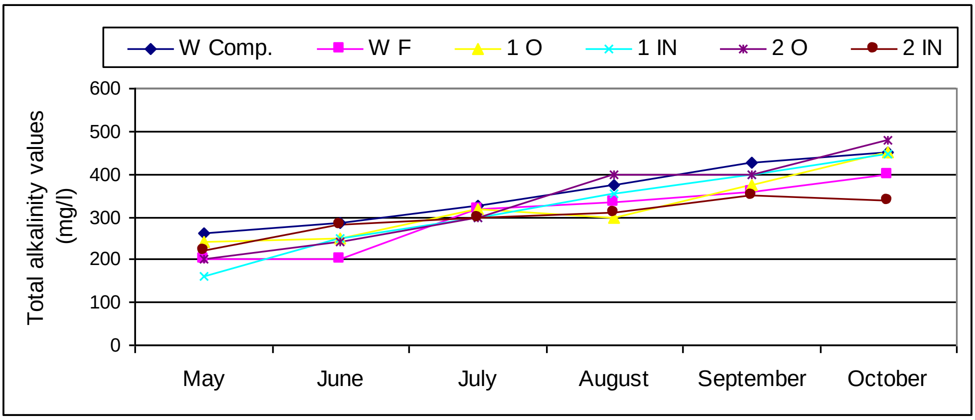

Figure 7. Water total alkalinity values (mg/l as $CaCO_3$) of different treatments alongside the study period.

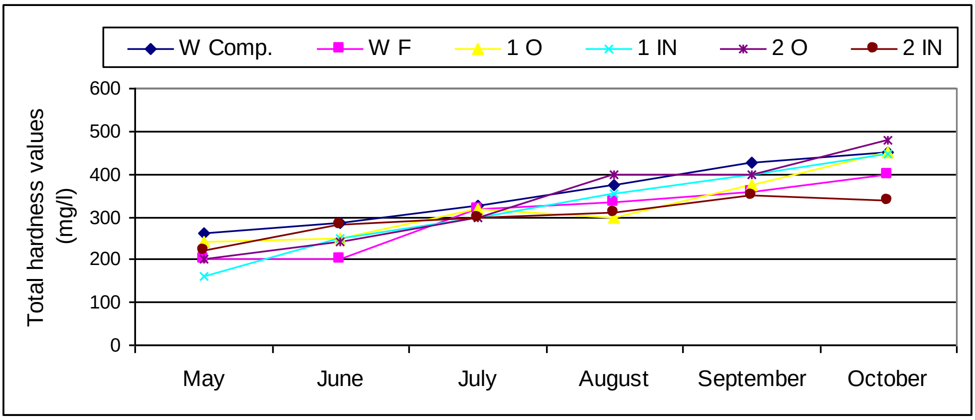

Figure 8. Water total hardness values (mg/l as $CaCO_3$) of different treatments alongside the study period.

Nutrients ($PO4^-$ & NO_3-N):

Knud-Hansen (1998) mentioned that Whether plants decompose in composting bins or directly in the pond, the decomposition processes are the same and the amount of nutrients eventually released from the plants should be reasonably similar, with the exception that placing compost bins outside the pond can cause some of the released ammonia and carbon dioxide to be lost to the atmosphere through volatilization, so nutrients being lower in case composting outside the pond. Orthophosphate average concentrations obtained alongside the present work ranged between 0.014 and 0.107 mg/l, while the average concentrations of nitrate during this study ranged between 0.037 and 0.889 mg/l. Highest orthophosphate (OP) and nitrate concentrations were recorded in treatments: (2 In) and (1 In) respectively, where compost was fermented inside the pond. It is observed that nitrates and orthophosphates concentrations started to increase gradually and then decreased until the end of the study, which could be explained as previously reported by Mallin and Wheeler (2000), that nutrient concentrations increased as decaying process of organic by-products proceeding. Both nitrate and orthophosphates consumed for phytoplankton flourish. Bush and Austin,

(2001) mentioned that phosphorus is responsible for algal blooms in surface waters and can cause eutrophication at levels as low as 0.01 to 0.035 mg/l.

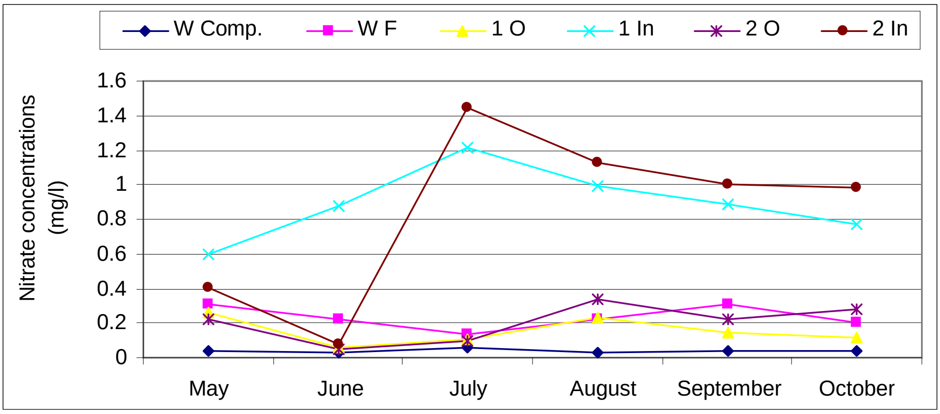

Figure 9. Nitrate concentrations (mg/l) in different treatments alongside the study period.

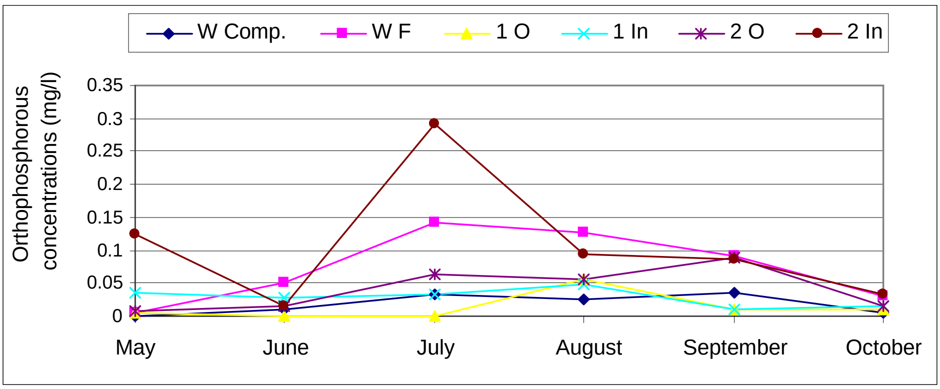

Figure 10. Orthophosphorous concentrations (mg/l) in different treatments alongside the study period.

Nitrite (NO_2-N):

Nitrite concentrations obtained alongside the study period were between 0.008 and 0.033 mg/l. This range is much lower than the maximum acceptable limit (<0.3 mg/l) mentioned by Boyd (1998).

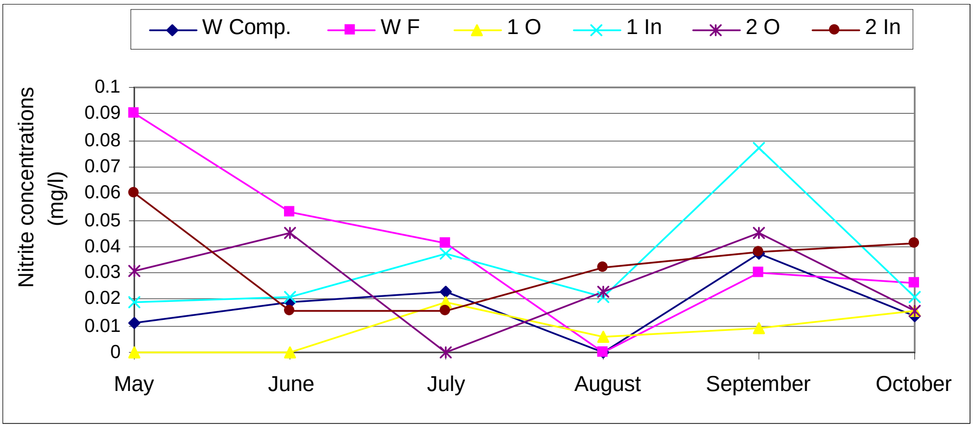

Figure 11. Nitrite concentrations (mg/l) in different treatments alongside the study period.

Chlorophyll "a":

Significantly highest chlorophyll "a" concentration obtained alongside the present work was in treatment: 2 In, and then in treatments 1 In and WF with values of 243.15, 107.19 and 99.58 ug/l respectively. The increased concentrations of chlorophyll "a" in these treatments attributed to the increased nutrients, which resulted in the increasing of phytoplankton density. Concentrations of chlorophyll *a*, the primary pigment used by algae for the capture of light energy for photosynthesis, are often used to estimate algal biomass in water (Wetzel and Likens, 1979; APHA, 1985).

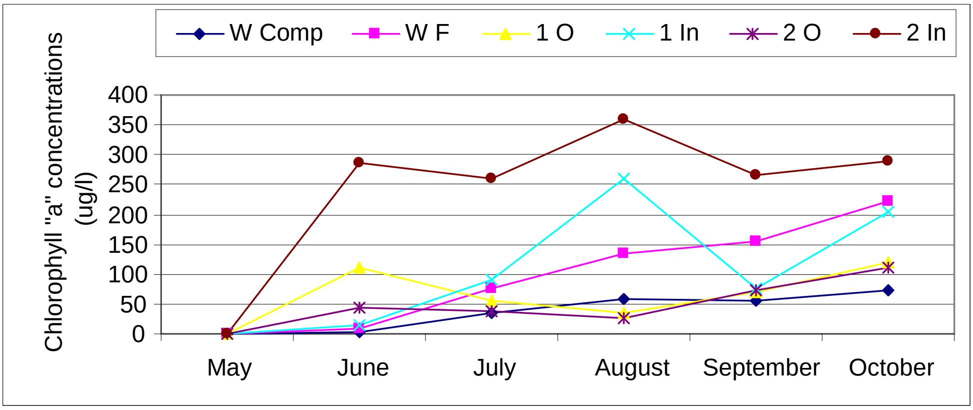

Figure 12. Chlorophyll "a" concentrations (ug/l) in different treatments alongside the study period.

Phytoplankton density and community:

Highest average of total phytoplankton count, as represented in Table 5 (46.44 million org/l) were observed in (2 In) treatment, where compost fermented for two months inside the pond, followed by (W F) treatment (35.37 million org/l), where compost was applied without fermentation. As previously mentioned chlorophyll "a" as well as orthophosphate, nitrite and nitrate concentrations had highest values in these two treatments. The quantity of nutrients in a pond plays a major role in determining the amount and quality of plankton (Pearson *et al*., 1984). The relative availability of nutrients in aquatic environments is believed to play an important role in the structuring of phytoplanktonic communities (Harris, 1986). Green algae, as represented in Fig. 14, had been dominated the other divisions in all treatments. Green algae percentages were 60.6, 74.6, 65.3, 53.09, 62.6 and 56.77 of the all community in treatments W Comp., W F, 1 O, 2 O, 1 IN and 2 IN respectively. Osuji *et al* (2004) previously reported that as the nutrient level increased, phytoplankton dominance generally shifted to green algae. Cyanobacteria came in the second order of dominance before diatoms in treatments W Comp. W F and 1 IN treatments, while diatoms came in the second order of dominance before cyanobacteria in treatments 1 O, 2 O and 2 IN. Other researchers have also reported the development of cyanobacterial bloom to be favored under conditions of high nutrient loading (Paerl and Tucker, 1995; Akpan and Okafor, 1997).

Table 5. Average all means of total phytoplankton count (10^6 org/l).

WComp	12.065
WF	35.369
1O	15.884
1IN	23.886
2O	30.415
2IN	46.436

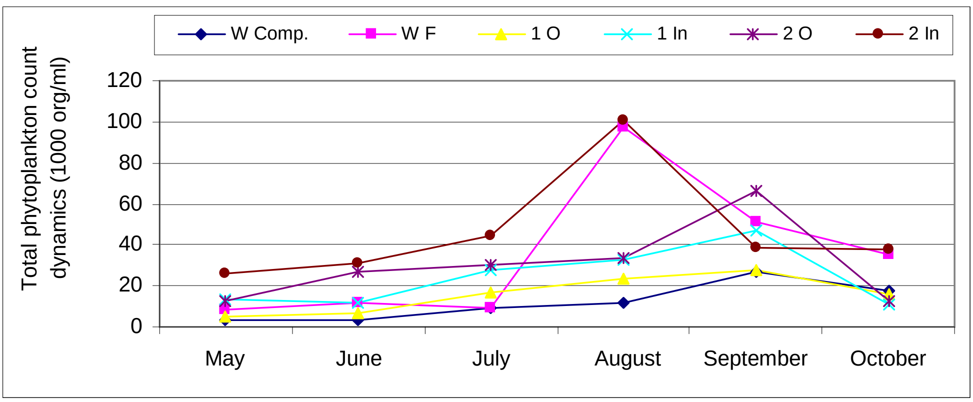

Figure 13. Total phytoplankton count dynamics (10^6 org/l) in different treatments alongside the study period.

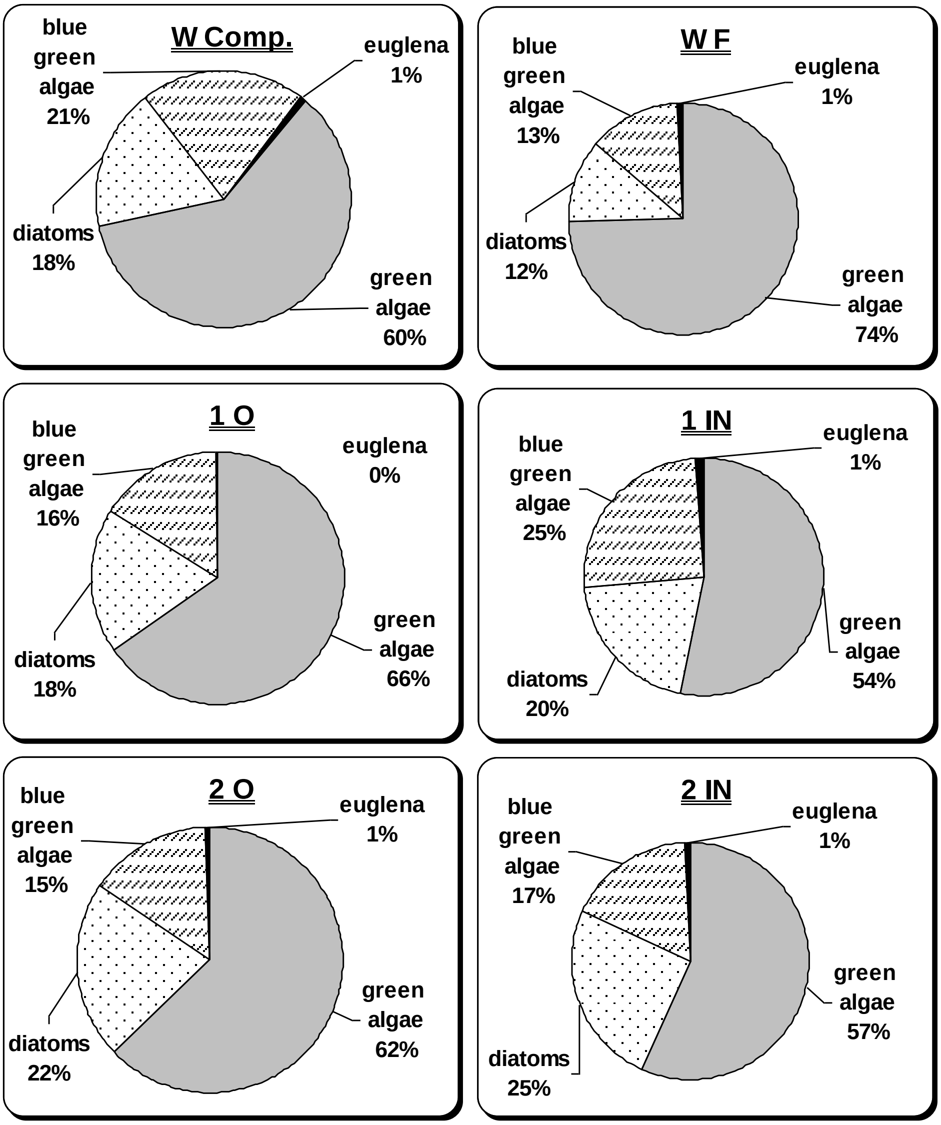

Figure 14. Percentages of different phytoplankton divisions in different investigated treatments.

Net fish yield (NFY) and feed conversion ratio (FCR).

Data obtained at the end of the study and shown in Table 6. indicated that treatment 1 O had the highest ($P < 0.05$) net fish yield which was 4530.5 ± 144.34 kg, followed by W Comp. and 2 O treatments with a NFY of 4428 ± 57.87 and 4191.5 ± 144.34 kg respectively. In spite of the importance of the NFY value, but FCR also has a significant important. The lowest (better) FCR (1.64 ± 0.02) was recorded in (2 O) treatment. Although, principally herbivorous in nature (Moriarty, 1973; Moriarty and Moriarty, 1973), *O. niloticus* can feed on a wide variety of natural food organisms found in organically fertilized ponds (Bowen, 1982) as well as on artificial feeds. Feeding represents over 50% of the operational costs of aquaculture (El-Sayed, 1999), so the reduced FCR value is highly appreciated where lower amounts of supplementary feed required for obtaining the same harvested fish yield.As shown in Figure 16, the highest percentages of the sum. of super & 1st grades were in treatments 2 IN and WF. This result could be explained by the increased total phytoplankton count in these treatments, especially, green algae. Abdel-Tawwab (2003) indicated that phytoplankton contribution in stomach content of *Oreochromis niloticus* increase as fish size increase. He reported also that chlorophyta represented the main phytoplanktonic division at large fish size. Consequently, it could be concluded that an initial single dose of fermented compost before introducing fingerlings highly recommended.

Table 6. Mean ± st. error of net fish yield (kg/feddan) and feed conversion ratio of different investigated treatments.

Treatment	Net fish yield(kg)	FCR
W Comp.	4428 ± 57.87 [a]	1.74
W F	3564.5 ± 86.61 [c]	1.89
1 O	4530.5 ± 144.34 [a]	1.86
1 IN	4050.5 ± 115.47 [b]	1.8
2 O	4191.5 ± 144.34 [ab]	1.64
2 IN	3960 ± 115.47 [b]	1.86

* Means followed by different letters are significantly different (Duncan, s Multiple Range Test, 1955, $P < 0.05$).

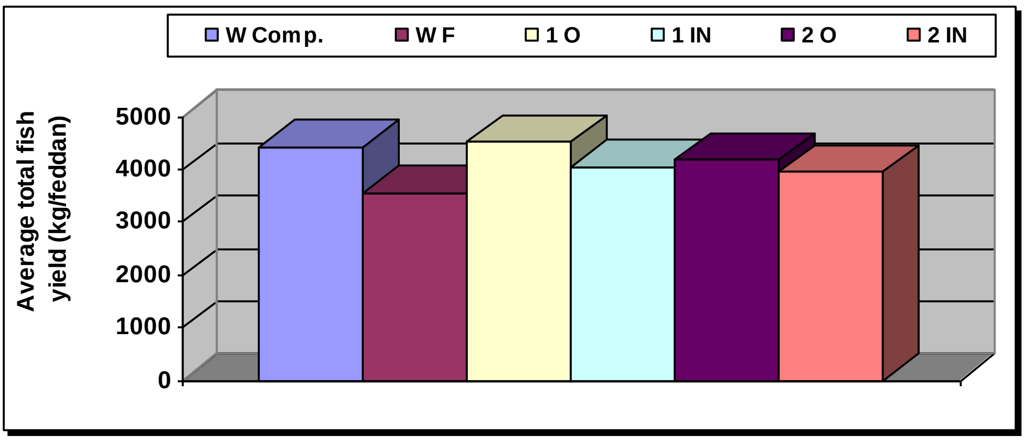

Figure 15: Average total fish yield (Kg) of different treatments

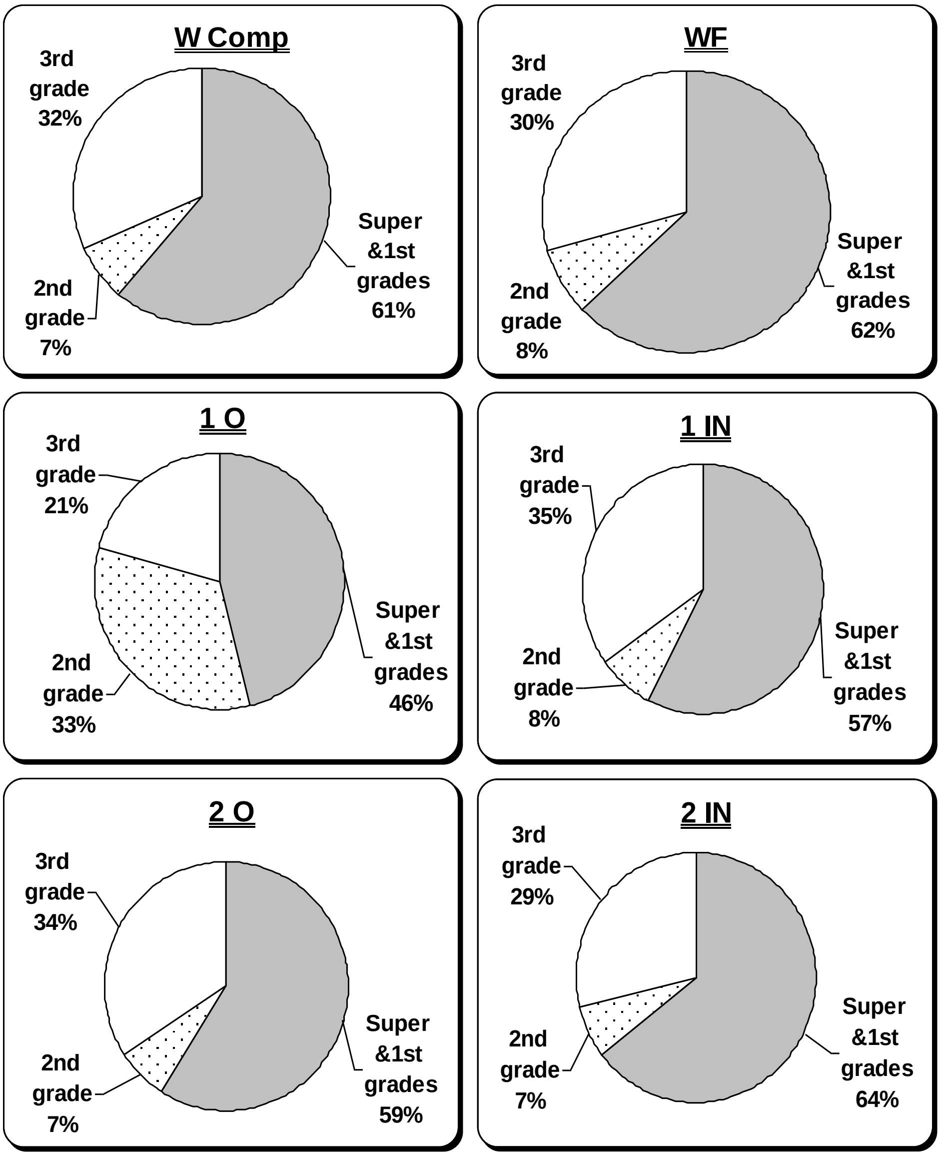

Figure 16. Fish size grades of different investigated treatments.

REFERENCES

Abdel-Tawwab, M. 2003. Occurrence Of Phytoplankton In Stomach Content And Its Selectivity By Nile Tilapia (Oreochromis Niloticus L.) Cultured In Fertilized Earthen Ponds. Qatar Univ. J., 23: 153-166.

Adeniyi, H.A. and S.I. Ovie, 1982. Study and appraisal for the water quality of the Asa Lake and Niger Rivers. NIFFR Annual report, pp 15 – 20.

Akpan, F.R. and N. Okafor. 1997. On organic fertilization and plankton development in two experiernental freshwater ponds of Nigeria. .1 Aqua. Trop., 12: 147 - 154.

APHA, 1985. Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition. American Public Health Association, American Water Works Association, and Water Pollution Control Federation, Washington, D.C., 1268 pp.

Bhakta, J.N.; D. Sankar; Jana, S. and Jana, B.B. 2004. Optimizing fertilizer dose for rearing stage production of carps under polyculture. Aquacult., 239:125-139.

Biddlestone, A.J. and K.R. Gray. 1987. Production of organic fertilizers by composting. In: D.W.J. Moriarty and R.S.V. Pullin, Detritus and Microbial Ecology in Aquaculture. ICLARM Conference Proceedings 14. Internat. Center for Living Aquatic Resources Management, Manila, Philippines, pp. 151-180.

Boney, A.D. 1983. Phytoplankton. The Institute of Biology’s Studies in Biology no 52. Edward Arnold Publishers Limited, London, U. K. 15pp.

Boston, H. L.; M.S. Adams and J.D. Madsen. 1989. Photosynthetic strategies and productivity in aquatic systems. Aquat. Bot., 34: 27-57.

Bowen, S.H., 1982. Feeding, digestion and growth - qualitative considerations. In: Pullin, R.S.V., Lowe-McConnell, R.H. (Eds.), The Biology and Culture of Tilapias. ICLARM Conference Proceedings 7, pp. 141-156.

Boyd, C.E. 1998. Water Quality for Pond Aquaculture. Research and Development Series No. 43 International Center for Aquaculture and Aquatic Environments, Alabama Agricultural Experiment Station, Auburn University, Alabama.

Bush, B.J., and N.R. Austin. 2001. Timing of phosphorus fertilizer application within an irrigation cycle for perennial pasture. J. Environ. Qual. 30:939– 946.

Chen, C.Y. and E.G**.** Durbin. 1994. Effects of pH on the growth and carbon uptake of marine phytoplankton Marine Ecology Progress Series (109) 83-94.

Davies, O.A.; J.F. Alfred-Ockiya and A. Asele. 2006. Induced growth of phytoplankton using two fertilizers (NPK and agrolyser) under laboratory conditions. African Journal of Biotech., 5 (4): 373-377.

Duncan, D.B. (1955): Multiple range and multiple F-test. Biometrics, 11: 1-42.

Edwards, P. 1987. Use of terrestrial vegetation and aquatic macrophytes in aquaculture. In: D.W.J. Moriarty and R.S.V. Pullin (Editors), Detritus and Microbial Ecology in Aquaculture. ICLARM Conference Proceedings 14. International Center for Living Aquatic Resources Management, Manila, Philippines, pp. 311-335.

El Naggar, G.O.; N.A. Ibrahim And M.Y. Abou Zead. 2008. Influence Of Fertilizers' Types And Stocking Density On Water Quality And Growth Performance Of Nile Tilapia- African Catfish In Polyculture System. 8th International Symposium on Tilapia in Aquaculture.

El-Sayed, A.E.M. 1999. Alternative dietary protein sources for farmed tilapia, Oreochromis spp**.** Aquaculture 179 (1-4): 149-168.

El-Sayed, A.E.M. and M. Kawanna. (2008). Optimum water temperature boosts the growth performance of Nile tilapia (Oreochromis niloticus) fry reared in a recycling system. Aquaculture Research, (39) 670-672.

Green, B.W. 1992. Substitution of organic manure for pelleted feed in Tilapia production. Aquaculture, 101: 213-222.

Harris, G.P. 1986. Phytoplankton Ecology, Structure, Function and Fluctuation Chapman and Hall, London, U. K. 260 pp.

Hepher, B. 1963. Ten years of research in fish pond fertilization in Israel,11 fertilization dose and frequency of fertilization. Bamidgeh, 15: 78-92.

Hickling, C.F. 1962. Ed. Fish culture. First published in memlxii by Faber and Faber Limited, 24 Russell square London W.C.1., 295pp.

Inckel, M.; P. Smet; T. Tersmette and T. Veldkamp, 2005. The preparation and use of compost. Agromisa Foundation, Wageningen.

Kemdirim, E.C. 2001. Checklist of phytoplankton of Shendam Reservoir in Plateau State, Nigeria. J. Aquatic. Sci., 16: 61 – 63.

Knud-Hansen, C.F. 1998. Pond fertilization: Ecological a pproach and p ractical a pplication. Pond Dynamics/Aquaculture Collaborative

Research Support Program. Oregon State University, Corvallis, Oregon.

Mallin, M.A., and T.L. Wheeler. 2000. Nutrient and fecal coliform discharge from costal North Carolina golf courses. J. Environ. Qual. 29: 979–986.

Moriarty, D.J.W. 1973. The physiology of digestion of blue-green algae in the cichlid fish, Tilapia nilotica. J. Zool. (Lond.), 171: 25-39.

Moriarty, D.J.W. and C.M. Moriarty. 1973. The assimilation of carbon from phytoplankton by two herbivorous fishes, Tilapia nilotica and Haplochromis nigripinnus. J. Zool. (Lond.), 171: 41-55.

Osuji, C.N.; Alfred-Ockya, A.J. and Chindah, A.C. 2004. Dominance shift of phytoplankton in relation to different organic fertilizer treatments in Clarias gariepinus culture. In: 18th Annual Conference of the Fisheries Society of Nigeria (FISON), 8-12 December, 2003 , Owerri, Nigeria.

Paerl, H.W. and C.S. Tucker. 1995. Ecology of blue green algae in aguaculture ponds, Journal of the Worid Aquaculture Society Vol. 26 (2): 109-131.

Pearson, T.R.; M. Takahashi and B. Hargrare., 1984. Biological oceanographic 3rd edition 380 pp.

SAS, 1990. SAS user’s guide statistics, version 6, SAS Institute Inc., N.C., USA.

Stickney, R.R. 1986. "Tilapia Tolerance of Saline Waters: A Review." Progressive Fish Culturist, 48: 161-7.

Vollenweider, R.A. 1969. A manual on methods for measuring primary production in aquatic environments. *IBP Handb. No. 12*, Blackwell Sci. Publ., Oxford. 213 pp.

Wetzel, R.G. and G.E. Likens. 1979. Limnological Analyses. W.B. Saunders, Co., Philadelphia, Pennsylvania, 357 pp.

استخدام الكمبوست المخمر في الأحواض الترابية والأثر الناتج علي جودة المياه ونمو الطحالب والإنتاج السمكي

د./ عمرو محمد محمد النجعاوي[1] ، د./ أيمن أنور عمار[2]

١ – قسم الليمنولوجي – المعمل المركزي لبحوث الثروة السمكية – مركز البحوث الزراعية

٢ – قسم الإنتاج السمكي ونظم الإستزراع – المعمل المركزي لبحوث الثروة السمكية – مركز البحوث الزراعية

تم إستخدام الكمبوست كجرعة بادئة لمرة واحدة في أحواض إستزراع الأسماك بأحد المزارع الخاصة بمنطقة وادي الريان وكان معدل الإضافة ٢٥٠ كجم/فدان. وقد تم تقسيم أحواض إستزراع إصبعيات البلطي النيلي (٨ جم) وحيد الجنس إلي ستة معاملات بتكرارين كما يلي:

- مجموعة ضابطة بدون إضافة أي كمبوست.
- مجموعة تمت فيها إضافة الكمبوست بدون تخمير.
- مجموعة تم فيها تخمير الكمبوست لمدة شهر خارج الحوض.
- مجموعة تم فيها تخمير الكمبوست لمدة شهر داخل الحوض.
- مجموعة تم فيها تخمير الكمبوست لمدة شهران خارج الحوض.
- مجموعة تم فيها تخمير الكمبوست لمدة شهران داخل الحوض.

وقد كانت نتائج الدراسة كالتالي:

قيم كل من درجة حرارة المياه والأكسجين الذائب في الحدود المثلي لإستزراع أسماك البلطي.

قيم الملوحة والتوصيل الكهربي والأملاح الكلية المذابة والقلوية الكلية والعسر الكلي المسجلة في معاملة الكمبوست المخمر لمدة شهرين داخل الحوض كانت أقل القيم بالمقارنة

بباقي المعاملات بينما سجلت هذه المعاملة أعلي القيم بالنسبة لتركيز أيون الهيدروجين وتركيز أملاح النترات والفوسفور الذائب والكلوروفيل.

أعلي متوسط لقيم الهائمات النباتية في معاملة الكمبوست المخمر لمدة شهرين داخل الحوض وكانت الطحالب الخضراء هي السائدة في كل المعاملات.

سجلت معاملة الكمبوست المخمر لمدة شهر خارج الحوض أكبر متوسط إنتاج كلي للأسماك بينما كان أقل (أفضل) معدل لتحول الغذاء في معاملة الكمبوست المخمر لمدة شهرين خارج الحوض. بالنسبة للأحجام النهائية التي تم صيدها، كانت أفضل نسبة مئوية لمجموع الدرجتين السوبر والأولي في معاملة الكمبوست المخمر لمدة شهرين داخل الحوض والكمبوست الغير مخمر.

توصي هذه الدراسة بإضافة الكمبوست المتخمر لمدة شهرين داخل أحواض الأسماك الترابية قبل إضافة الإصبعيات كجرعة بادئة لمرة واحدة.