Esxon Publishers

International Journal of Applied Research and Technology
ISSN 2277-0585

Publication details, including instructions for authors and subscription information:
http://www.esxpublishers.com

Effects of Two Basal Application Rates of Mono-ammonium Phosphate and Different Stocking Densities on Milkfish (*Chanos chanos* Forskal) Production in Brackishwater Ponds.

Nwachukwu, A. N.

Abia State University, Umuahia, Abia State, Nigeria

Available online: January 31, 2014

International Journal of Applied Research and Technology
Vol. 3, No. 1, January 2014. 57 – 64.

Esxon Publishers

Effects of Two Basal Application Rates of Mono-ammonium Phosphate and Different Stocking Densities on Milkfish (*Chanos chanos* Forskal) Production in Brackishwater Ponds.

Nwachukwu, A. N.

Abia State University, Umuahia, Abia State, Nigeria

(Received: 16 January 2014 / Accepted: 27 January 2014 / Published: 31 January 2014)

Abstract

This study investigated the effects of two basal application rates of monoammonium phosphate (MAP) fertilizer and three different stocking densities on Milkfish (*Chanos chanos)* production, using six treatments in a 2 x 3 factorial experiment in a completely randomized design was studied in brackishwater ponds at the University of the Philippines Brackishwater Aquaculture Centre, Leganes, Iloilo. Treatment, T_1 (50kg MAP/ha basal and 3,000/ha stocking density) gave the highest net fish production of 663.11kg/ha, followed by T_3 (50kg MAP/ha basal and 6,000/ha stocking density) with a mean net production of 559.16kg/ha. T_4 (75kg MAP/ha basal and 3,000/ha stocking density) had the lowest net production of 304.09 kg/ha. Generally, treatments with 50kg MAP/ha basal application had higher net fish production than treatments with 75kg MAP/ha basal application. It is therefore recommended that farmers use any of the stocking densities of 3000, 4,500 and 6,000 at basal application rate of 50kg MAP/ha at the reduced bi-weekly dressing application rate of 30kg MAP/ha for better milkfish yield.

Keywords: *Chanos chanos*, Basal, Monoammonium Phosphate, Fertilizer, Application.

For corresponding author:
E-mail: *info@esxpublishers.com*
Subject: *0114-0218*

Introduction

Herbivorous fish species are low in the food chain, very close to the primary producers (Nwachukwu, 2006). As a result, they are economic to culture due to their food habit. In the semi-intensive farming system (SIFS) where pond fertilization is needed to enhance growth of the primary producers, what it takes to successfully rear these fish species are efficient pond fertilization and appropriate stocking density. Milkfish (*Chanos chanos*) a dominant fish in the Philippine fish culture industry, is one of such fish low in the food chain and dependent on the primary producers as food source. Success in the Philippine milkfish culture is heavily dependent on the growth of various algae since direct supplementary feeding is not widely practised (Chong *et al*, 1982). The microscopic algae in combination with microscopic animals form a complex mixture generally known as lab-lab in the Philippines and this forms the natural food of milkfish. The growth of lab-lab is enhanced by fertilization (Rabanal, 1949).

Farmers in the Philippines use various types of inorganic fertilizers to enhance growth of these fish food organisms. However, they show some preference to monoammonium phosphate (16-20-0) fertilizer. The fertilizer is presently being applied as recommended by Inland Fisheries Project (IFP, 1980); a single basal rate of 50kg/ha broadcast evenly on the pond bottom during pond preparation for a stocking density of 3,000/ha. The same quantity of fertilizer is applied bi-weekly throughout the culture period (IFP, 1980). Some farmers believe that this rate of fertilizer application and stocking density leave a lot of fish food organisms in the pond unconsumed at the end of the culture period; thus making this system uneconomical and as such a waste.

This study was conducted to evaluate the effect of two different basal application rates of monoammonium phosphate (16-20-0) fertilizer and three different stocking densities on milkfish production.

Materials and Methods

The experiment was conducted in eighteen (18) 100m^2 ponds measuring 11.5m x 8.7m of the E-1B series, at the University of the Philippines in the Visayas Brackishwater Aquaculture Center (UPV-BAC), Leganes, Iloilo City. These ponds were previously used in feeding experiment with *Tilapia*. Each pond (Figure 1) had a separate 10cm diameter polyvinyl (PVC) stand-pipe with an elbow joint, connected with a rubber tube of a minicar. The horizontal part of the stand-pipe led into the diversion canals and projected into the ponds at the other end where they stand on bamboo supports. They served for both water inlet and drainage by lowering or lifting the elbow, at high and low tides, respectively, till the required water level was realized in the ponds. Each pond had a separate 10 cm diameter polyvinyl (PVC) stand-pipe with an elbow joint, connected with a rubber tube of a minicar. The horizontal part of the stand-pipe led into the diversion canals and projected into the ponds at the other end where they stand on bamboo supports. They served for both water inlet and drainage by lowering or lifting the elbow at high and low tides, respectively, till the required water level was realized in the ponds.

Prior to pond preparation, five random soil samples were collected from each pond at a depth of 10cm for initial soil analysis. The ponds were totally drained to enable effective repair of dikes, canals and water inlet/drainage stand-pipes. The projecting ends of the stand-pipes were properly screened with a fine mesh (1mm) nylon net to prevent the entry of predators and the escape of stocked fish during flooding or draining. The wooden gates of the diversion canals were provided with wooden slabs and closed with mud blocks for effective soil-sealing to retain water in the canals. These gates were also provided with semicircular nylon screens of fine mesh size (1mm) at their inner sides to further preclude the entry of extraneous species into the experimental ponds. Pond bottoms were levelled and allowed to dry to cracking for six (6) days. This was to eradicate all predators in the pond bottom mud. By the 7th day of cracking, the ponds were saturated with sea water to about 3cm depth and once more allowed to dry before liming. Agricultural lime ($CaCO_3$) was applied by broadcasting to each pond at the rate of 500kg/ha as pre-treatment for disease-causing organisms, et cetera and not for correcting acidity since the soil was not acidic.

Two days later, water was admitted into the ponds to moisten the pond bottom and tobacco dusts were applied by broadcasting at the rate of 400kg/ha to further eradicate pests. Five (5) days later, the ponds were again flooded to 2cm depth and dried chicken manure was applied evenly by broadcasting on the pond bottom at 2 tons/ha (PCAR, 1976). The depth gauges were installed in each pond and the ponds were flooded to initial depth of 5cm, five (5) days after application of chicken manure. Urea was later applied at the rate of 25kg/ha in all ponds to hasten the decomposition of chicken manure. Three (3) days after urea application, the two basal application rates of 50kg/ha and 75kg/ha of monoammonium phosphate (MAP) fertilizer were each applied as treatments (T_1, T_2, T_3) and (T_4, T_5, T_6), respectively. Water level in the ponds was gradually increased from 5cm to 30cm and maintained at 30cm level throughout the culture period of 90 days.

A 2x3 factorial experiment was conducted using two levels of basal fertilizer application of monoammonium phosphate (50 and 75kg/ha) and three stocking densities (3,000, 4,500 and 6000/ha). There were six (6) treatments in all.

Treatment (T_1) 50kg/ha basal fertilizer application at a stocking density of 3,000/ha.
Treatment (T_2) 50kg/ha basal fertilizer application at a stocking density of 4,500/ha.
Treatment (T_3) 50kg/ha basal fertilizer application at a stocking density of 6,000/ha.
Treatment (T_4) 75kg/ha basal fertilizer application at a stocking density of 3,000/ha.
Treatment (T_5) 75kg/ha basal fertilizer application at a stocking density of 4,500/ha.
Treatment (T_6) 75kg/ha basal fertilizer application at a stocking density of 6000/ha.

Each treatment was replicated three (3) times and randomly assigned to the experimental ponds. Subsequent dressing application of monoammonium phosphate (16-20-0) at the rate of 30kg/ha was done bi-weekly throughout the 90 days culture period. Milkfish (*Chanos chanos*) fingerlings with an average weight and length of 2.54g and 6.26cm, respectively, were used in the study. These were seined from the adjacent UPV-BAC nursery ponds, sorted and counted randomly into plastic bags containing seawater. Since the nursery ponds and the experimental ponds had a salinity difference of only 2 ppt, the fingerlings were not acclimatized, but directly stocked into the experimental ponds according to the stocking densities of 3,000/ha, 4,500/ha and 6,000/ha. Fifty (50) fingerlings were taken randomly from the whole batch for individual weight and length measurements.

A water level of 30cm was maintained in all the ponds throughout the culture period. Water was replenished at every available high tide or by pumping. A day before each subsequent fertilizer application, 50% of water volume in each pond was drained and replenished with the next high tide or by pumping. Loss of water through evaporation, seepage and percolation was replenished by either tidal movement or pumping. Soil samples were collected from each pond before pond preparation and after fish harvest at five (5) stations from a depth of 10cm, using soil auger. The stations were taken along an s-shaped path within each pond. The wet soil samples were properly mixed and wet pH taken by the potentiometric method using the glass electrode pH meter Model 161OA (Black, 1965). The remaining soil samples were air-dried, pulverized and passed through standard sieve No.60 and analyzed for dry pH by the potentiometric method (1:1 ratio soil: water) using the glass electrode pH meter. Organic matter was determined by the Walkley wet oxidation method (Walkley, 1947); available phosphorus by the sodium bicarbonate extraction method (Olsen, *et al.*, 1954) and total nitrogen by Marco- Kjedahl's digestion method (Dewis and Freitas, 1970).

Selected physical and chemical properties of the pond water such as salinity, temperature and dissolved oxygen were measured in-situ in the field once every week between 0600 and 0700hrs. Salinity was measured few minutes before dissolved oxygen measurement using Goldberg's T/C refractometer. Water samples were collected once a week between 0800 and 0900 hours and analyzed for pH , using portable Corning's glass electrode pH meter Model 1610A; reactive phosphorus, using the method described by Strickland and Parson (1972). The primary productivity of the ponds were estimated using the simplified diel oxygen (open method) by Lind (1979) and McConnel *et al.* (1977). Three in-situ dissolved oxygen concentrations were taken at 10cm depth on two successive evenings and the interim morning using YSL 51-B D.O. meter. The fish at the end of the culture period of 90 days were initially and partly harvested by seining. The ponds were later completely drained and remaining fish hand-picked to ensure 100% recovery. Fish in each treatment group were counted and weighed using a 20kg Ohaus triple beam balance. Net production was obtained by subtracting weight of fish at stocking from the weight of fish at harvest.

The effect of the different treatments on the milkfish production was determined using the two-way analysis of variance (ANOVA). Test of significant difference was made using Duncan's Multiple Range Test (Gomez and Gomez, 1981; Walpole, 1974).

Results and Discussion

Mean weight gain and net production of milkfish at the two basal rates of application of monoammonium phosphate (16-20-0) fertilizer and three stocking densities are presented in Tables 2 and 3, respectively. Treatment (T_1) (50kg MAP/ha basal and 3,000/ha stocking density) had the highest mean weight gain of 221.04g, followed by T_4 (75kg MAP/ha basal and 3,000/ha stocking density) with a mean weight gain of 109.95g. T_6 (75kg MAP/ha basal and 6,000/ha stocking density) gave the lowest mean weight gain of 64.96g. Statistical analysis showed that T_1 was significantly higher than all other treatments (Table2). Factorial analyses showed significant differences between the two basal application of monoammonium phosphate and the three stocking densities used. Significant higher mean weight gain was obtained at 50kg MAP/ha basal application (136.39g). Similarly, significantly higher mean weight gain was obtained at a stocking density of 3,000/ha (165.50g) than at stocking densities of 4,500/ha (80.64g) and 6000/ha (81.32g). Differences in mean weight at stocking densities of 4,500 and 6,000 per hectare were not significant.

In terms of net fish production, (Table 3), T_1 gave the highest net fish yield of 663.11kg/ha, followed by T_3 with a net fish yield of 559.16kg/ha. T_4 gave the lowest yield of 304.09 kg/ha. Duncan's Multiple Range Test showed that mean net production in T_1 was significantly different from T_4, T_5, and T_6 but not significantly different from T_2 and T_3. Factorial analysis showed significant differences between the two basal application of monoammonium phosphate and the three stocking densities used.

The significantly higher net fish yield obtained in treatments with 50kg/ha basal compared with those of 75kg/ha basal application could be attributed to 100% survival and net fish yield among replicates. Differences could also be attributed to constantly higher phosphorus content of the pond water. Two most important nutrients in pond aquaculture are nitrogen and phosphorus because these two often are in short supply and limit phytoplankton growth (Boyd *et al*,2002). The monoammonium phosphate added to the experimental ponds provided enough phosphorus for good growth of phytoplankton at that level, hence higher net fish yield in T_1-T_3. There was no supplementary feeding in all the ponds, except pond fertilization. Boyd *et al* (2002) further explained that phytoplankton can rapidly remove phosphate from water and phosphorus in phytoplankton may enter the food web culminating in fish or shrimp production. Reham, *et al* (2007) asserted that phosphorus availability in pond water influences water quality and the accumulation of nutrients in phytoplankton, zooplankton, benthos and culture animal. Thus, they asserted that more nutrients passing through plankton and benthos increased the availability of natural food and stimulating fish production. These findings agree with the higher primary production in T_1-T_3 compared with T_4 –T_6 (Table 4).

Water pH in these experimental ponds falls within the range of 7.5 to 8.0 reported by Guerrero (1981) as optimum for good algal growth in fish ponds. They also fall within the ranges of 7.0 to 8.0, 6.9 to 9.0, 6.5 to 9.0 and 8.0 to 10.0 reported by Huet (1975), Champ *et al* (1973), Boyd and Lichtkoppler (1979) and IFP Technical Report (1980), respectively, as good for fish pond culture. These values are non-toxic to fish and they are kept so low by the presence of carbondioxide which destabilizes undissociated ammonium hydroxide in solution (Champ *et al*, 1973). The mean salinity ranged from 22.02 ppt in T_1 to 23. 30ppt in T_6 (Table 4). Guerrero (1981) reported that an optimum salinity of 25.0ppt and above was needed for good algal growth. The milkfish (*Chanos chanos*) is known to tolerate large changes in salinity such that it can live in salt pans where salinity was 65.0ppt (Dwivedi and Reddi, 1977). The salinity range in this experiment was therefore within the tolerance limit for milkfish. Mean temperatures ranged from 22.9^{0}C in T_1 to 23.4^{0}C in T4 in the morning (0600-0700hrs), while mean afternoon (1400-500hrs) temperature ranged from 29.6^{0}C in T_6 to 30.1^{0}C in T_2 and T_5 (Table 4). Ranges in temperatures measured in this experiment are within the optimum range of 20^{0}C to 27^{0}C found good for algal growth (Villegas, 1981; Ikotun, 1981) and within the wide tolerance zone of 8.5^{0}c to 42.7^{0}C (Gerochi *et al*, 1987; Fortes *et al*, 1991) necessary for milkfish survival.

Correlation analysis showed highly significant correlation co-efficient (r=0.89) between net fish yield and reactive phosphorus (Table 5). A high positive but not significant correlation (r=0.71) was obtained between net fish yield and primary productivity measured by Mc Connell's Three-Point Method. Net fish yield was also correlated with pH of the pond water with a correlation co-efficient (r=0.75). Results of correlation analyses obtained in this study were similar to those obtained by other workers (Almazan and Boyd, 1978; Ikotun 1981; Liang *et al*, 1981 and Okoye, 1982).

Conclusion and Recommendations

Generally, treatments with 50kg MAP/ha basal application had higher net fish production than treatments with 75kg MAP/ha basal application, irrespective of stocking density. It is therefore recommended that farmers now use any of the stocking densities of 3,000, 4,500 and 6,000 at basal application rate of 50kg MAP/ha at the reduced bi-weekly dressing application rate of 30kg MAP/ha for better milkfish yield.

References

Almazan, G. and Boyd, C.E (1978). Plankton production and *Tilapia* yield in ponds. Aquaculture 15:75-77.

Black, C.A. (1965). Methods of Soil Analysis, Part II. American Soc. of Agronomy and American Soc. for Testing and Materials. Agronomy 9:771-1572.Wisconsin, U.S.A

Boyd, C.E and Lichtkopper, F (1979). Water quality management in pond fish culture. Research and Development Series No. 22.International Centre for Aquaculture, Agricultural Experiment Station, Auburn University, Auburn, Alabama, U.S.A., 30pp.

Boyd, Claude E., Wood, C. and Thunjai, Taworn (2002). Aquaculture Pond Bottom Soil Quality Management. Pond Dynamics/Aquaculture Collaborative Research Support Program. Oregon State University, Corvallis, Oregon 97331-1641.41 pp.

Champ. M.A., Lock J.T., Bjork and Klusmann, W.G. (1973). Effects of anhydrous ammonia on a Central Texas pond, and a review of previous research with ammonia

Chong, K.C., Smith, I.R. and Lizarondo, M.S. (1982) Economics of the Philippine Milkfish Resource System. The United Nations University, Shibuy-Ku, Tokyo 150, Japan.

Dewis, J. and Freitas, F.(1970). Physical and Chemical Methods of Soil and Water Analysis. FAO Soil Bull. 10,275pp.

Dwivedi, S.N. and Reddi, D.V. (1977). Brackishwater fish and prawn culture in India. Fish Farming International. 4(1).

Fortes, R.D., Fortes,N.R. and Pahila, I.G. (1991). Effect of Varying Levels of Sulfate Concentration In Saline Waters On Fish Yield. Aquaculture and Schistosomiasis. Proceedings of a network meeting held in Manila, Philippines, August 6-10,1991. pp88-101.

Gerochi, D.D., Padlan, P.G., Buenconsejo, I.D., Paw,J.N. and Rodriguez, E.M.(1978). Minimum dissolved oxygen tolerance for four different sizes of milkfish. SEAFDEC Quarterly Research Report, 4th Quarter (Oct-Dec), 1978. II, No4: 7-10.

Guerrero III, R.D. (1981). Introduction to Fish Culture In The Philippines. Philippine Education Co., Inc. Quezon City, Metro Manila, 70pp.

Gomez, K.A and Gomez, A.A. (1981). Statistical Procedure for Agricultural Research Institute, Los Banos, Laguna, Manila, Philippines. 294pp.

Huet, M. (1975). Textbook of fish culture: Breeding and cultivation of fish. Fish News (Books) Ltd. Surrey, England,436pp.

Ikotun, S.J. (1981). Frequency of inorganic fertilizer application and its effects on Milkfish (*Chanos chanos* Forskal) production in brackishwater ponds. Unpublished M.S. Thesis, University of the Philippines in the Visayas, Iloilo City, 86pp. Inland Fisheries Project (IFP) (1980). Fish pond fertilizers and fertilization. Fish culture leaflet No.1. National Science Development Board, Manila, Philippines

Liang, Y., Melack, J.M. and Wang, J. (1981). Primary production and fish yields in Chinese lakes and ponds. Tr. Am. Fish Soc. (3): 346-350.

Lind, O.T. (1979). Handbook of Common Methods in Limnology. The C.V. Mosby Company, St. Louis 199pp.

McConnell, N.J., Steven, L.and Olson, J.E. (1977). Gross photosynthesis as an estimator of fish production. Tr. Am. Fish Soc., 106:417-423.

Nwachukwu, A.N. (2006). Fish Farming: An Aspect of Aquaculture. WillyRose and Appleseed Publishing Coy. #3 Gilbert Street, Kpirikpiri, Abakiliki, Ebonyi State, Nigeria 111pp.

Okoye, F.C. (1982). The effect of various rates of monoammonium phosphate (16-20-0) fertilizer application on milkfish production in brakishwater fish ponds. Unpublished M.S. Thesis., University of the Philippines in the Visayas,Iloilo City, 94pp.

Olsen, S.R., Cole, C.V., Watanabe, F.S. and Dean, L.A (1954). Estimation of available phosphorus in soils by extraction with $NaHC0_3$. In: Methods of Soil Analysis, Part II. American Soc. of Agronomy and American Soc. of Testing and Materials. Agronomy 9:1044-1047. Philippine Council for Agricultural Research (PCAR) (1976). The Philippines Recommends for Bangus. Los Banos, Laguna, Philippines.

Rabanal, H.R. (1949). The culture of lab-lab, the natural food of Milkfish or Bangus (*Chanos chanos* Forskal) fry and fingerhings under cultivation.Dept. of Agric and Nat. Res. (DANR) Manila, Philippines. Tech. Bull. .18:3-9.

Raham, M.M., Verdegen, M., Nagelkerke, L.,Wahab, Md. A., Milstein, A. and Verreth, J. (2007). Effects of common carp *Cyprinus carpio* (L.) and feed addition in rohu *Labeo rohita* (Hamilton) ponds on nutrient partitioning among fish, plankton and benthos. Aquaculture Research. Vol. 39 (1): 85-95.

Strickland, J.D. and Parsons, T.R. (1972). A practical handbook of seawater analysis (2nd Ed). Fisheries Research Board, Ottawa, Bull., 67, 310pp

Villegas, C.T. (1981) Maintenance and culture of selected food organisms. Paper delivered by. Cesar T. Villegas on September 17, 1981. for the International Training on Small-Scale Prawn Hatchery Management; September 14-November 13,1981, at SEAFDEC Aquaculture Department, Tigbauan, Iloilo City, Philippines.

Walkley, A. (1947). A Critical Examination of Rapid Method of Determining Organic Carbon in Soils. Effect of Variations in Digestion Conditions In Organic Soil Constituents. Soil Sc. 63: 251-264.

Walpole, R.E. (1974). Introduction to Statistics. Macmillan Publishing CO., New York, 340pp

Tables

Table 1: Schedule and Rates of Application of (16-20-0) Fertilizer in the Experimental Ponds.

Fertilizer Application (kg/ha)	**Treatments**					
	T_1	**T_2**	**T_3**	**T_4**	**T_5**	**T_6**
Initial (Basal)	50	50	50	75	75	75
Bi- weekly (1st Subsequent)	30	30	30	30	30	30
Bi-weekly (2nd Subsequent)	30	30	30	30	30	30
Bi-weekly (3rd Subsequent)	30	30	30	30	30	30
Bi-weekly (4th Subsequent)	30	30	30	30	30	30
Bi-weekly (5th Subsequent)	30	30	30	30	30	30
Bi-weekly (6th Subsequent)	30	30	30	30	30	30
TOTAL (kg/ha)	230	230	230	255	255	255

Table 2: Mean Weight Gain (g) of Milkfish at The Two Basal Application of Monoammonium Phosphate and Three Stocking Densities after 90 Days of Culture Period.

Basal Fertilizer Application	Stocking Density/ha				
Rate (Kg/Ha)	3,000	4,500	6,000	Total	Mean
50	221.04^{a} (T_1)	90.44^{b} (T_2)	97.69^{b} (T_3)	409.17	136.39^{a}
75	109.95^{b} (T_4)	70.85^{b} (T_5)	64.96^{b} (T_6)	245.76	81.92^{b}
Total	330.99	161.29	162.65	654.93	
Mean	165.50^{a}	80.65^{b}	81.32^{b}		109.16

ab: Any two means in a column with different superscripts are significantly different (P<0.05)

Table 3: Net Fish Production (Kg/ha) at The Two Basal Application of Monoammonium Phosphate and Three Stocking Densities after 90 Days Culture Period.

Basal Fertilizer Application	Stocking Density /ha				
Rate (kg/Ha)	3,000	4,500	6,000	Total	Mean
50	663.11^{a} (T_1)	397.72^{ab} (T_2)	559.16^{ab} (T_3)	1,619.99	540.0^{a}
75	304.09^{b} (T_4)	308.98^{b} (T_5)	357.70^{b} (T_6)	970.77	323.59^{b}
Total	967.20	916.86	916.86		
Mean	483.60^{a}	458.43^{ab}	458.43^{ab}	2,590.76	431.79

aabb: Treatment means with same superscripts in a column are not significantly different (P>0.05).

Table 4: Mean Percent Fish Survival, Primary Productivity and Some Physico-Chemical Parameters of The Experimental Pond Water.

Treatments	Parameters							
	% Fish Survival	Primary Productivity (ppm)	Reactive Phosphorus (ppm)	Ammonia-Nitrogen (ppm)	Temperature ^{0}C		Salinity (ppt)	pH
					Morning	Afternoon		
T_1	100.0	18.6	0.73	0.06	22.9	29.8	22.02	7.9
T_2	97.8	18.7	0.59	0.04	23.0	30.1	22.30	7.5
T_3	95.0	18.4	0.76	0.10	23.0	29.9	22.98	7.6
T_4	88.9	15.4	0.32	0.08	23.4	29.7	22.20	6.8
T_5	95.6	17.3	0.25	0.06	23.0	30.1	22.78	7.4
T_6	90.6	16.8	0.24	0.07	23.1	29.6	23.30	7.5

Table 5: Correlation Co-efficient (r) Between Net Fish Yield and Reactive Phosphorus and Other Parameters

Parameter	Correlation Co-efficient (r)	Remarks (*)
Reactive Phosphorus	0.89	Significant
Primary Productivity	0.71	Not significant
pH (Water)	0.75	Not Significant

(*) Significance test is at 5% level of probability.