STOCKING DENSITIES AND FERTILIZATION REGIMES FOR NILE TILAPIA (*Oreochromis niloticus*) PRODUCTION IN PONDS WITH SUPPLEMENTAL FEEDING

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INTRODUCTION

- Semi-intensive culture:

- Fertilization and supplemental feeding

- Roles of supplemental feed in fertilized pond
  - Increase in fish growth and carrying capacity
  - Limitation on feeding and increasing stocking density
  - Poor water quality
  - Concomitant fertilization might helped maintain reasonable water quality
- Stocking density

OBJECTIVE

To determine the upper limits to Nile tilapia production utilizing supplemental feeds

MATERIALS AND METHODS

Location: Ayutthaya Freshwater Fisheries Station

Pond facilities: 9 earthen ponds of 280- m^2 in surface area

Culture periods: 155 days (Experiment 1);
194 days (Experiment 2)

Test species: Nile tilapia (*Oreochromis niloticus*)

Stocking density: 3, 6 or 9 fish·m^{-2}

Stocking size: 18.7 ± 0.2 (Experiment 1),
15.5 ± 0.2 (Experiment 2)

Feeding: 50 % satiation rate using floating pelleted feed (30% crude protein)

Fertilization:
Experiment (1)- Urea 28 kg $N \cdot ha^{-1} \cdot wk^{-1}$,
TSP 7 kg $P \cdot ha^{-1} \cdot wk^{-1}$

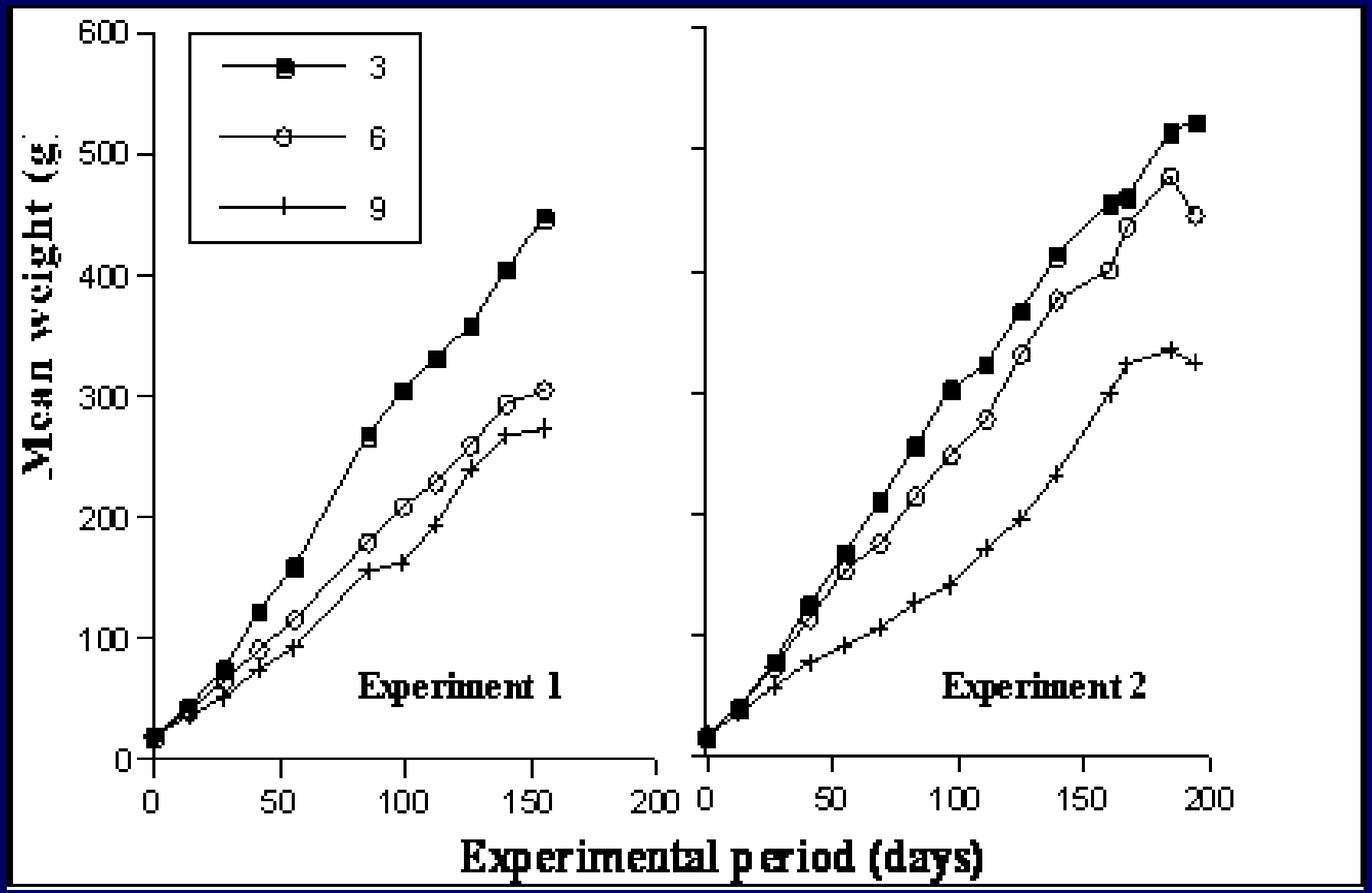
Experiment (2)- fertilizer·fish waste balanced input
(Approx. 14 kg $N \cdot ha^{-1} \cdot wk^{-1}$ and 6 kg $P \cdot ha^{-1} \cdot wk^{-1}$)

RESULTS AND DISSCUSSION

The biomass (kg), number, and mean size (g) of Nile tilapia stocked and harvested in each experimental pond for two experiments

Pond	At stocking			At harvest		
	Number (fish/pond)	Biomass (kg/pond)	Mean size (g/fish)	Number (fish/pond)	Biomass (kg/pond)	Mean size (g/fish)
Experiment 1						
A1	840	15.4	18.3	737	307.0	416.6
A2	840	15.5	18.5	744	345.5	464.4
A3	840	15.0	17.9	745	342.9	460.3
B1	1680	30.2	18.0	1,355	426.3	314.6
B2	1,680	31.8	18.9	1,248	395.5	316.9
B3	1,680	33.0	19.6	1,103	308.5	279.7
C1	2,520	47.9	19.0	1,471	381.4	259.3
C2	2,520	48.0	19.1	1,782	526.3	295.3
C3	2,520	48.7	19.3	1,723	450.3	261.4
Experiment 2						
A1	840	12.8	15.2	678	335.2	494.4
A2	840	12.8	15.2	735	445.1	605.6
A3	840	15.0	14.5	669	313.9	469.2
B1	1,680	26.3	15.6	1,155	502.5	435.1
B2	1,680	26.6	15.8	1,357	652.8	481.1
B3	1,680	26.4	15.7	1,351	567.6	420.1
C1	2,520	38.1	15.1	1,352	417.4	315.0
C2	2,520	40.3	16.0	1,382	452.5	327.4
C3	2,520	41.1	16.3	1,634	533.5	326.5

Mean weights of Nile tilapia during the experiment 1 and 2.



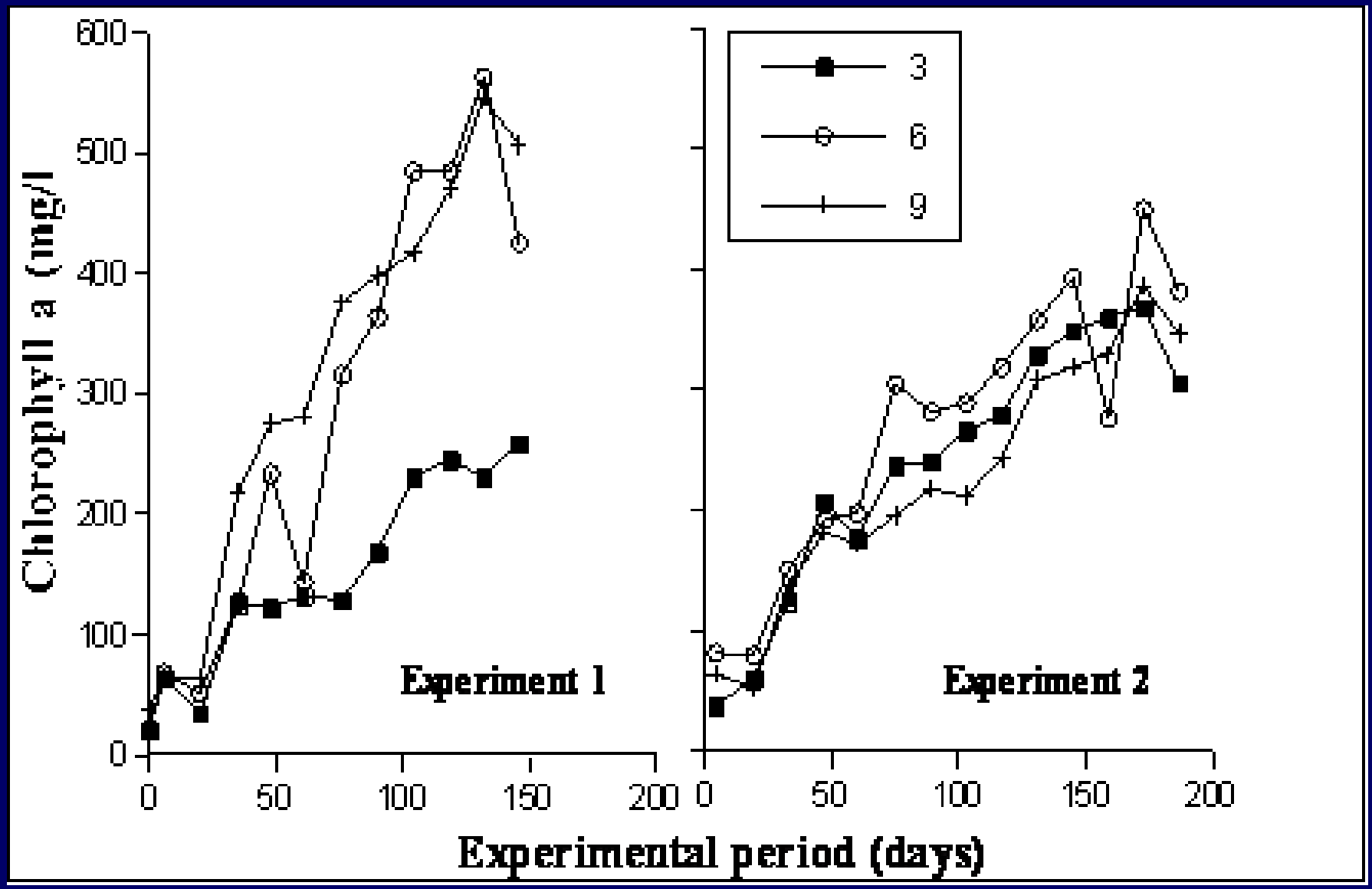
Growth performance of Nile tilapia in each pond in experiment 1 and 2.

Pond	Growth (g?fish^{-1}?day^{-1})	Survival (%)	Net yield (kg/pond)	Feed applied (kg/pond)	FCR	Annual net yield (kg?ha^{-1}?year^{-1})
Experiment 1						
A1	2.57	87.7	291.6	304	1.04	24,524
A2	2.88	88.6	330.0	332	1.01	27,753
A3	2.86	88.7	327.9	328	1.00	27,577
B1	1.91	80.7	396.1	399	1.01	33,313
B2	1.92	74.3	363.7	410	1.13	30,588
B3	1.68	65.7	275.5	393	1.42	23,170
C1	1.55	58.4	333.5	533	1.60	28,048
C2	1.78	70.7	478.3	566	1.18	40,226
C3	1.56	68.4	401.6	512	1.27	33,775
Experiment 2						
A1	2.47	80.7	322.4	463	1.44	21,663
A2	3.04	87.5	432.3	505	1.17	29,048
A3	2.34	79.6	301.7	458	1.52	20,273
B1	2.16	68.8	476.2	624	1.31	32,001
B2	2.40	80.8	626.2	783	1.25	42,080
B3	2.08	80.4	541.2	712	1.32	36,369
C1	1.55	52.6	379.3	590	1.55	25,490
C2	1.61	54.8	412.1	660	1.60	27,701
C3	1.60	64.8	492.4	689	1.40	33,090

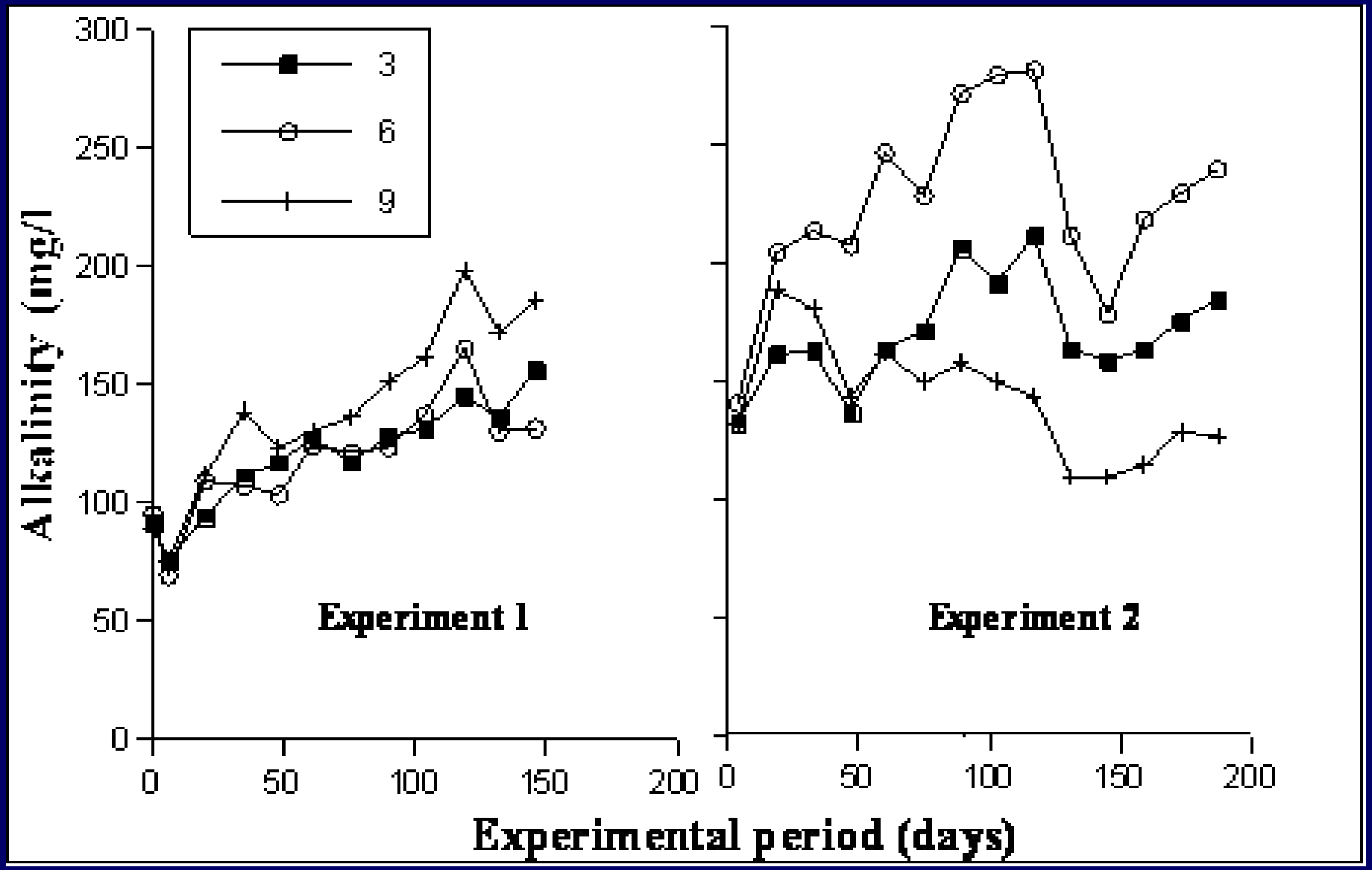
Multiple regression results for main effects (density) related to fish growth ($g \cdot day^{-1}$), survival (%), and yield (kg).

Variable	Coefficient	*P*
Experiment 1		
	Growth Rate ($r^2 = 0.811$, $P < 0.001$)	
Constant	3.42	0.001
Density	-0.210	0.001
	Survival ($r^2 = 0.739$, $P < 0.001$)	
Constant	0.984	0.001
Density	-0.038	0.002
	Yield ($r^2 = 0.281$, $P > 0.05$)	
Constant	267.39	0.001
Density	14.66	0.082
Experiment 2		
	Growth Rate ($r^2 = 0.789$, $P < 0.001$)	
Constant	3.169	0.001
Density	-0.172	0.001
	Survival ($r^2 = 0.736$, $P < 0.001$)	
Constant	0.978	0.001
Density	-0.042	0.002
	Yield ($r^2 = 0.281$, $P > 0.05$)	
Constant	366.78	0.006
Density	12.61	0.408

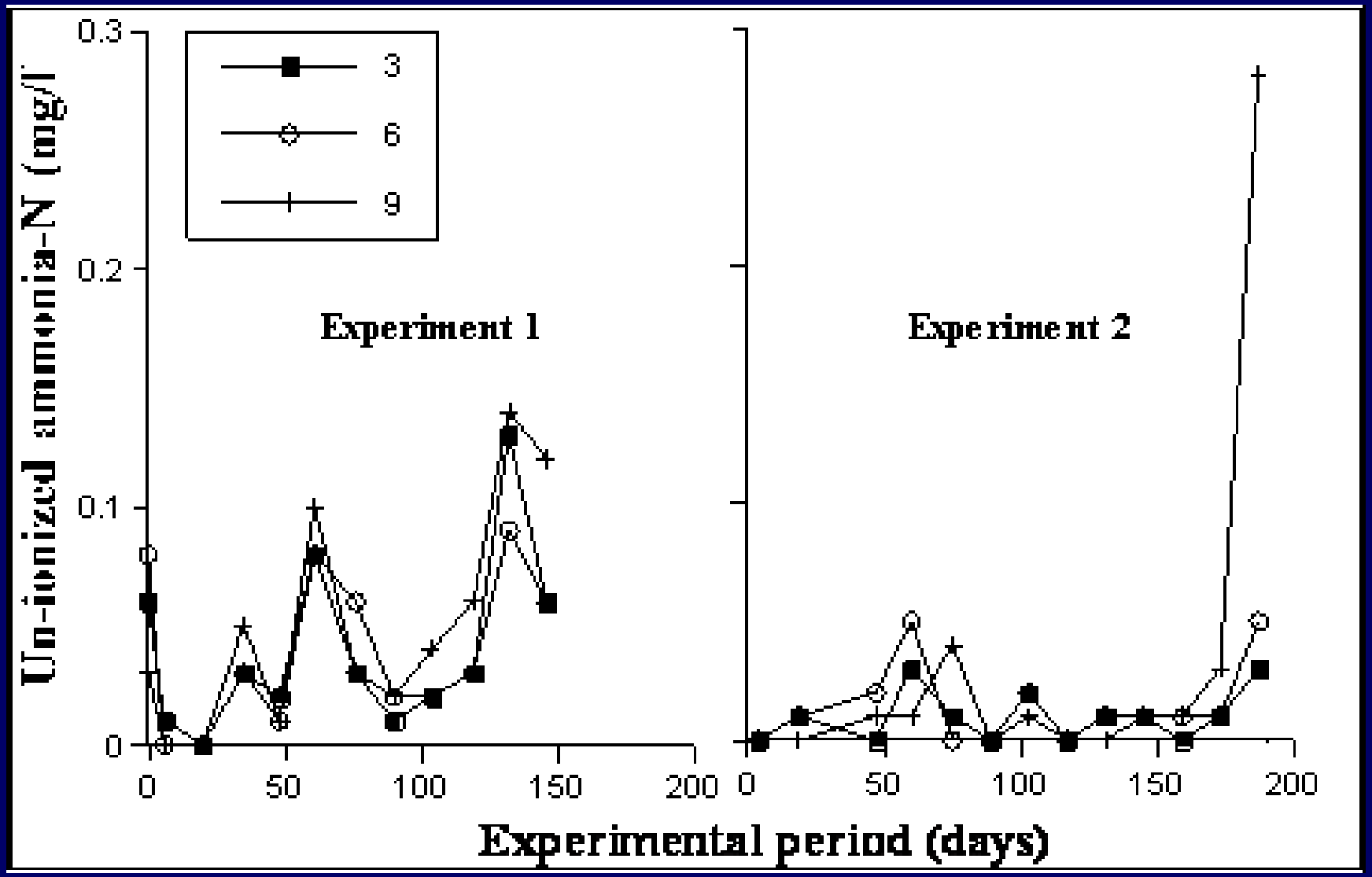
Changes of Chlorophyll-*a* content in pond water during the experiment 1 and 2.



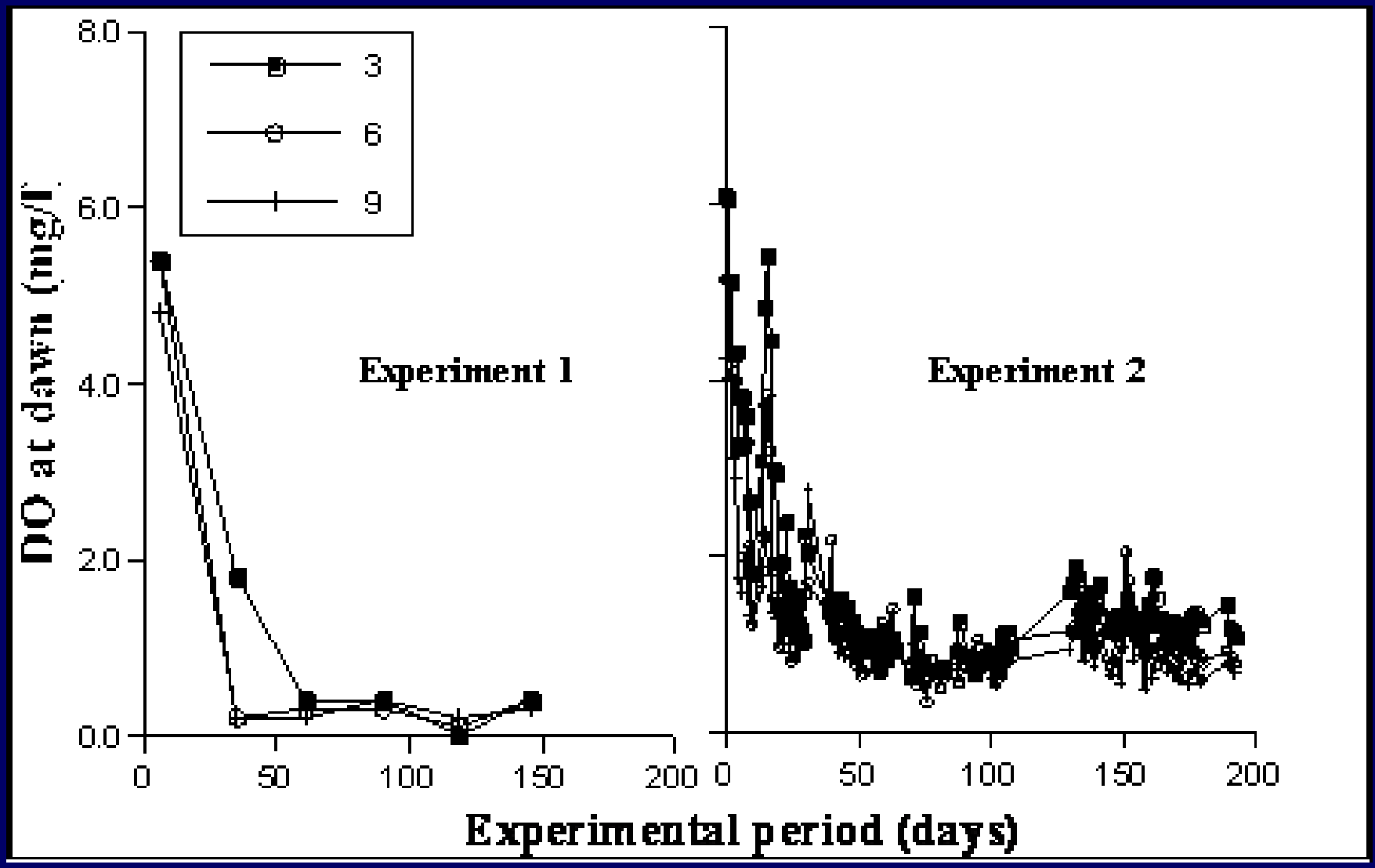
Changes in alkalinity content of pond water during experiments 1 and 2.



Changes in un-ionized ammonia nitrogen content during experiments 1 and 2.



Changes in dissolved oxygen content of pond water at dawn during experiments 1 and 2.



Calculation of annual profit for each stocking density in both experiments.

Density (fish?m^{-2})	Fry (number)	Urea (kg)	TSP (kg)	Feed (kg)	Gross yield (kg)	Fish size (g)	Profit ($)
Experiment 1							
3	70,645	3,129	1,825	27,037	24,508	447	1,180
6	141,290	3,129	1,825	33,704	38,590	304	- 520
9	211,935	3,129	1,825	45,079	31,434	272	- 7,581
Experiment 2							
3	56,443	1,606	1,507	31,999	24,508	523	2,171
6	112,887	1,493	1,197	47,509	38,590	445	- 2,406
9	169,330	1,869	1,584	43,386	31,434	323	- 5,375

CONCULATIONS

- The optimal feeding system, most rapid growth, highest survival and positive economic return occurred at the lowest density, 3 fish m^{-2}.

- The fertilizer and fish waste balancing of nutrient inputs successfully controlled nutrient addition and maintained high water quality.

- HOWEVER, the reduced fertilization rates probably could not produce adequate natural foods for tilapia.

- Further fine-tuning of fertilizer balance may be necessary at each stocking and feeding level.