POLYCULTURE OF GRASS CARP AND NILE TILAPIA WITH NAPIER GRASS AS THE SOLE NUTRIENT INPUT IN THE SUBTROPICAL CLIMATE OF NEPAL

Narayan P. Pandit, Madhav K. Shrestha* (IAAS, Nepal)
Yang Yi (AIT, Thailand)
James S. Diana (UM, USA)



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INTRODUCTION

- Low-cost input in naturally balanced pond environment based semi-intensive aquaculture is the preferred systems for the small-scale fish farmers of the developing countries.
- Grass carp based polyculture is a traditionally practiced system where grass carp consume low valued grasses and increase natural food production in the pond by nutrient recycling and fecal production.
- Several species of filter feeder and detritivorus fish are stocked to utilize the natural food production in pond.
- A single species Nile tilapia might be feasible to replace several species carps in grass carp based polyculture to simplify and minimize polyculture and to utilize feeding 'niche" of pond ecosystem with maintaining natural balance of pond environment.

OBJECTIVES

- To evaluate the growth of grass carp and Nile tilapia fed with napier grass in polyculture.
- To evaluate water quality regimes of pond water.
- To determine the compositions of foods consumed by Nile tilapia.
- To determine the optimal ratio of grass carp to Nile tilapia in polyculture.

MATERIALS AND METHODS

- Pond input:
  - Napier grass (*Pennisetum purpureum*)
    - A perennial tropical / subtropical fodder grass
    - Easily cultivable in pond dikes, slope areas and in underneath of large trees
    - Needs minimum management practice
- Fish species:
  1. Grass carp (*Ctenopharyngodon idella*)
     - For grass feeding
  2. Nile tilapia (*Oreochromis niloticus*)
     - For natural food utilization of pond ecosystem

MATERIALS AND METHODS (Cont'd)

- Treatment combinations:

T_1: Monoculture of:
grass carp @ 0.5/m^2

T_2: Polyculture of:
grass carp @ 0.5/m^2
Nile tilapia @ 0.25/m^2

T_3: Polyculture of:
grass carp @ 0.5/m^2
Nile tilapia @ 0.5/m^2

T_4: Polyculture of:
grass carp @ 0.5/m^2
Nile tilapia @ 1.0/m^2

T_5: Polyculture of:
grass carp @ 0.5/m^2
Nile tilapia @ 2.0/m^2

MATERIALS AND METHODS (Cont'd)

Culture system:

- Cemented tank of 24 m^2.
- Stagnant water system with weekly water added to maintain 1.5 m deep.
- Feeding of chopped fresh napier grass leaves at *ad libitum* everyday as a sole input.
- Culture period: 188 days for grass carp and 182 days for Nile tilapia.
- Experimental period: May 26 – Nov 30, 2002.
- Experimental design: Completely randomized design (CRD)

RESULTS

Mean stocking and harvest size, survival, growth and net fish yield of grass carp in monoculture and polyculture tanks.

Item	T1	T2	T3	T4	T5
Initial wt (g)	39.3	44.2^{a}	44.2^{a}	45.3^{ab}	46.6^{b}
Final wt (g)	--	471^{a}	635^{b}	490^{a}	453^{a}
Survival (%)	0	80.6	80.6	83.3	91.7
Weight gain (g/d)	--	2.3^{a}	3.1^{b}	2.4^{a}	2.2^{a}
NFY (kg/ha/d)	--	9.0^{a}	12.6^{b}	9.8^{ab}	10.0^{ab}
GFY (kg/ha/d)	--	10.2^{a}	13.8^{b}	11.0^{ab}	11.2^{ab}

RESULTS (Cont'd)

Mean stocking and harvest size, survival, growth and net fish yield of adult Nile tilapia in polyculture tanks.

Item	T2	T3	T4	T5
Initial wt (g)	9.4	10.0	9.3	9.0
Final wt (g)	91.4^{a}	82.1^{a}	56.1^{b}	44.0^{c}
Survival (%)	100	100	100	100
Weight gain (g/d)	0.46^{a}	0.40^{a}	0.26^{b}	0.19^{c}
NFY (kg/ha/d)	1.15^{a}	2.02^{b}	2.62^{c}	3.92^{d}
GFY (kg/ha/d)	1.28^{a}	2.30^{b}	3.15^{c}	4.93^{d}

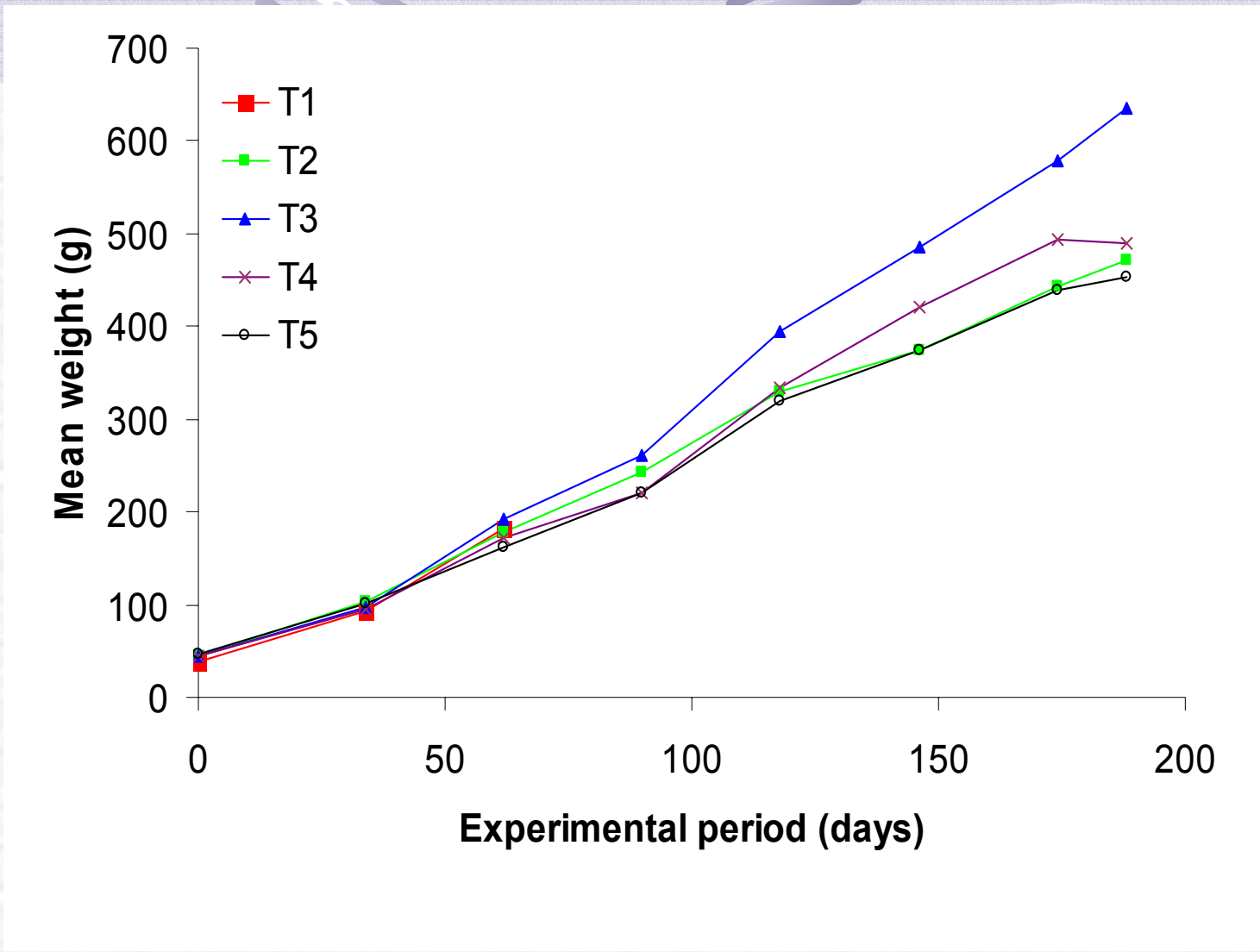


Figure 1. Mean weight of grass carp in different treatments during experimental period. All fish died in T1 during 81 days of culture period.

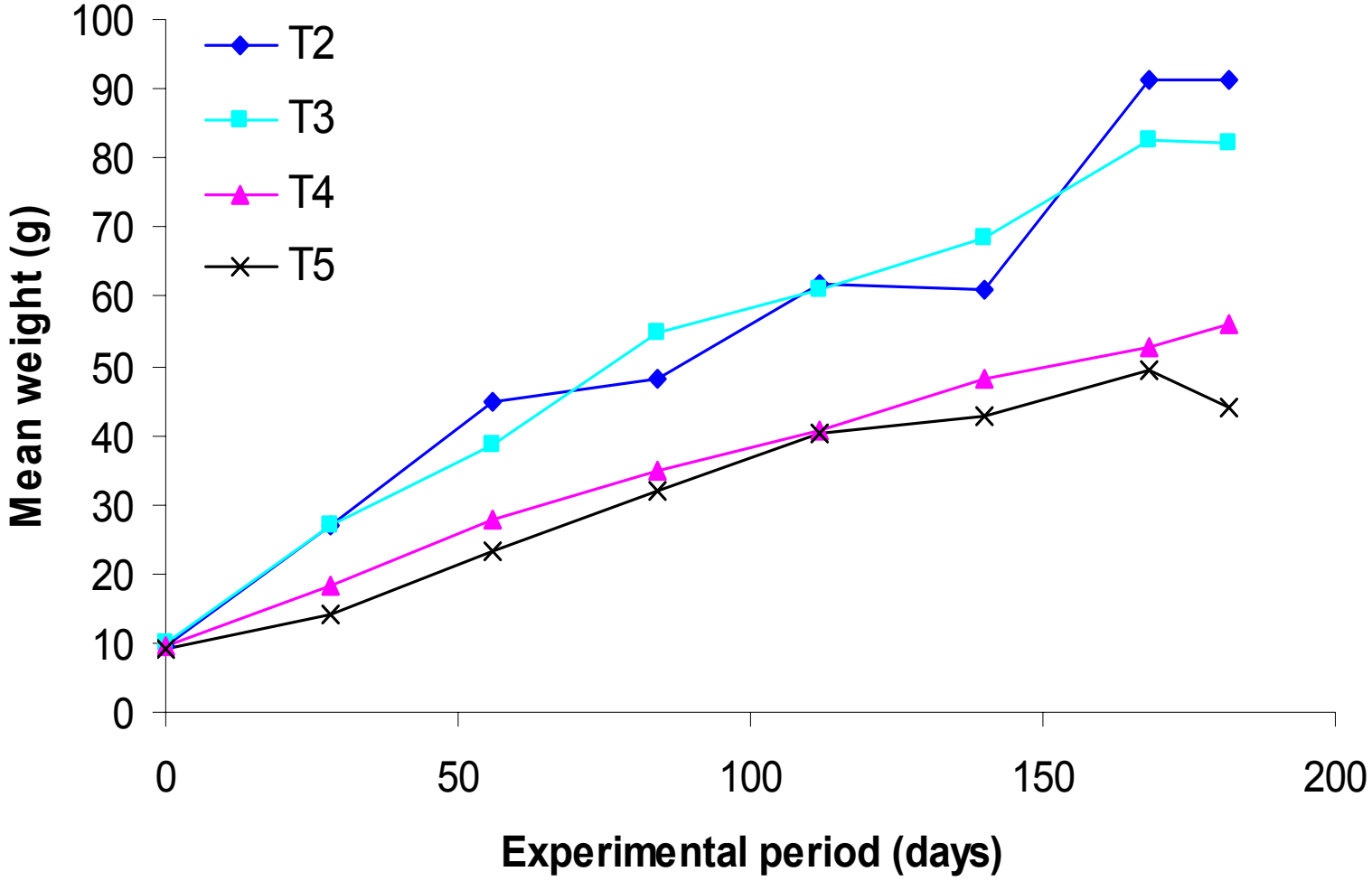


Figure 2. Mean weight of Nile tilapia in different treatment during experimental period.

RESULTS (Cont'd)

Mean Combined NFY and GFY of grass carp and Nile tilapia in polyculture tanks.

Item	T2	T3	T4	T5
NFY (kg/ha/d)	10.98	14.62	12.40	13.91
GFY (kg/ha/d)	12.31	16.10	14.15	16.18

RESULTS (Cont'd)

Mean Nile tilapia recruits and mean total yield including recruits in polyculture tanks.

Item	T2	T3	T4	T5
Nile tilapia Recruits				
Mean number	248	524	353	332
Mean weight (g)	13.4[a]	6.5[b]	7.1[b]	6.2[b]
Yield (kg/ha/d)	7.68	8.09	5.50	4.76
Total NFY (kg/ha/d)	17.5	22.7	17.9	18.7
Total GFY (kg/ha/d)	18.8	24.2	19.6	20.9

RESULTS (Cont'd)

Proximate composition (%) of fresh napier grass and fresh feces of grass carp in dry weight basis.

Constituents	Grass	Feces
Dry matter (DM)	18.6±1.5	6.3±0.2
Crude protein (CP)	9.2±0.4	5.2±0.4
Ether extract (EE)	2.0±0.3	1.4±0.4
Crude fiber (CF)	28.6±0.4	36.0±0.6
Total ash (TA)	10.0±0.2	8.2±0.4
Nitrogen free extract (NFE)	50.2±0.7	49.2±0.4

RESULTS (Cont'd)

Mean FCR of napier grass for grass carp (GC), grass carp + adult tilapia (GC+AT), and grass carp + adult tilapia + recruits (GC+AT+R) on FW and DW basis.

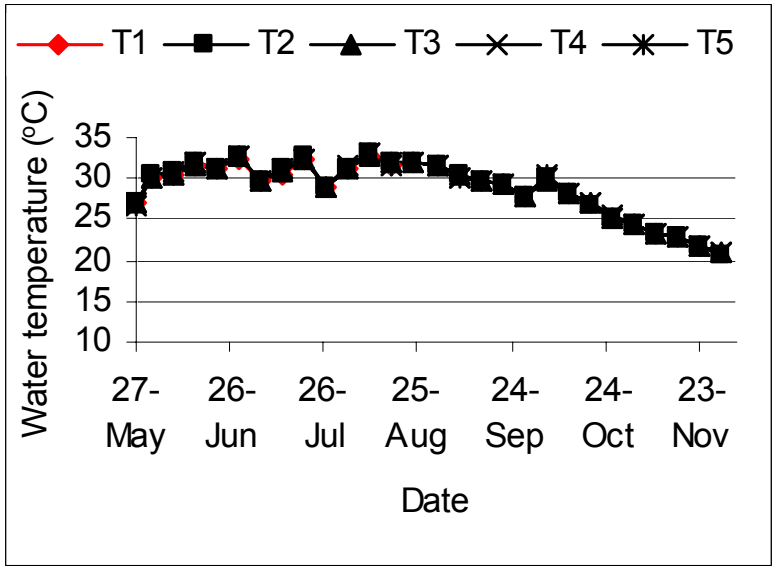
Group	T2	T3	T4	T5
GC (FW)	38	31	39	36
GC (DW)	7.2	5.8	7.4	6.8
GC+AT (FW)	31	26	31	26
GC+AT (DW)	5.9	5.0	5.9	4.9
GC+AT+R (FW)	20	17	21	19
GC+AT+R (DW)	3.7	3.3	4.1	3.7

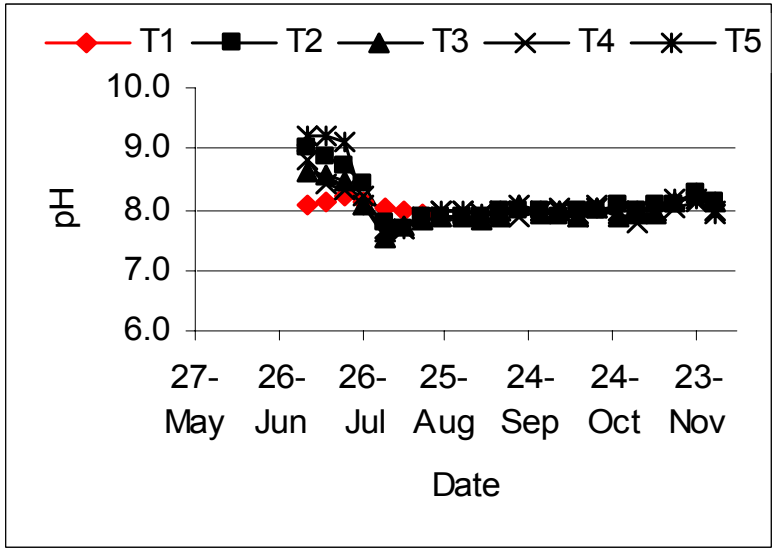
RESULTS (Cont'd)

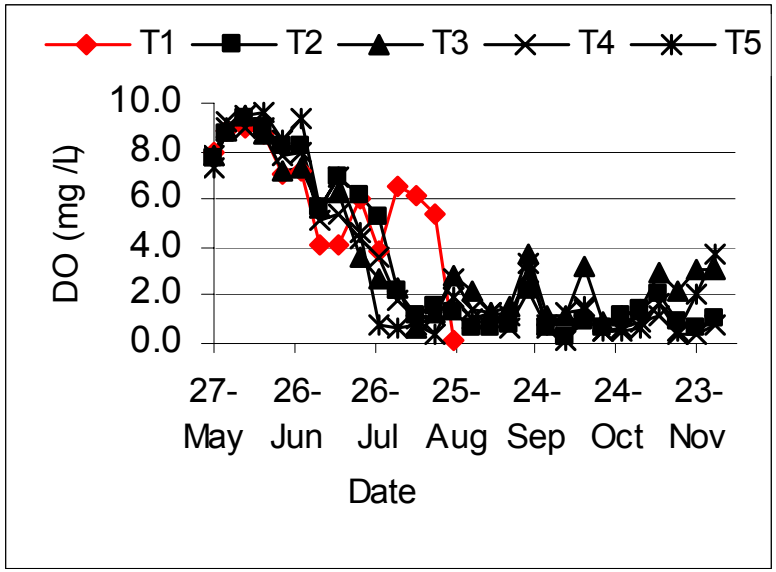
Gut contents of grass carp and Nile tilapia of this culture system.

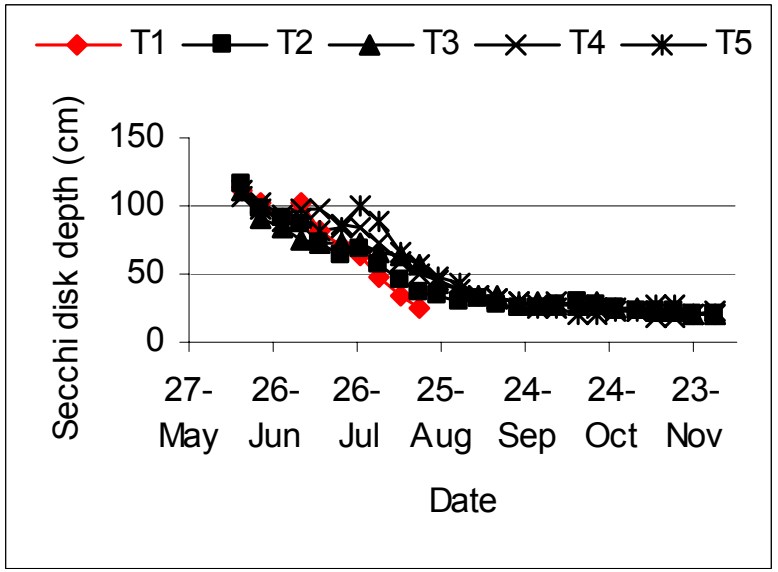
Species	Gut contents	Frequency
Grass carp	Napier grass	All
Nile tilapia	*Anabaena*, *Oscillatoria*, Detritus, grass / Grass carp feces	Common
	Cosmarium, Euglena, Brachionus	Frequent
	Moina, Daphnia, Cyclops	Rear

Temperature, pH, DO and Secchi disk depth

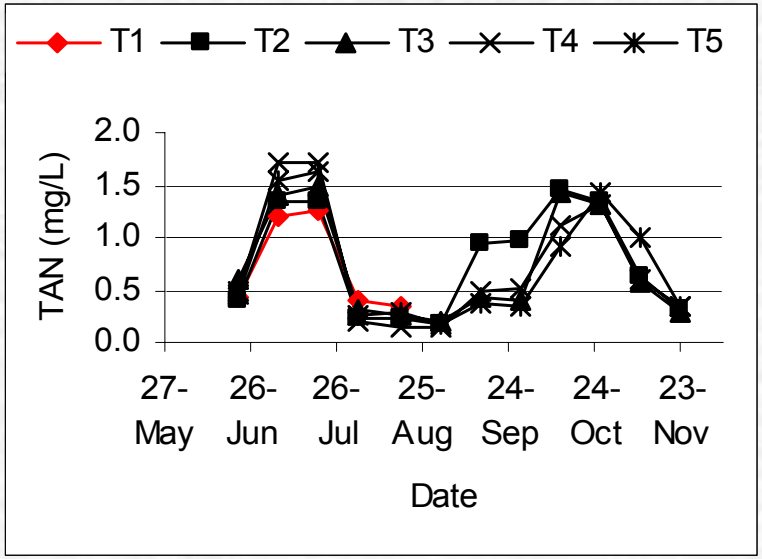


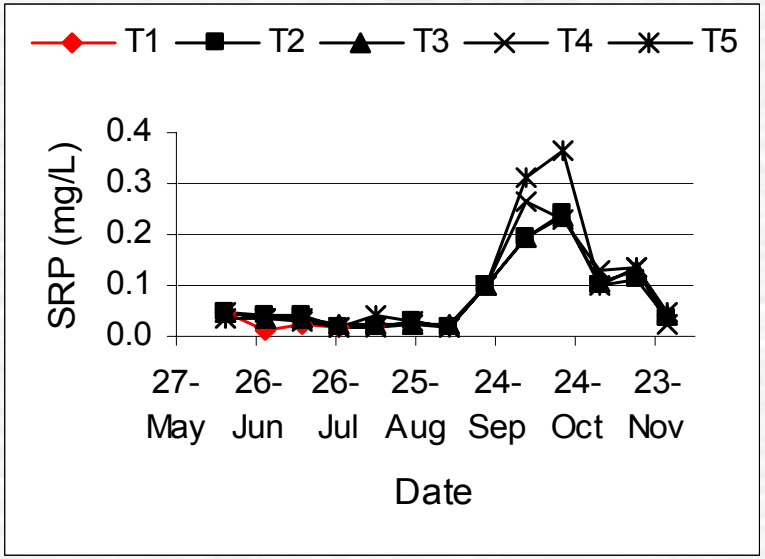


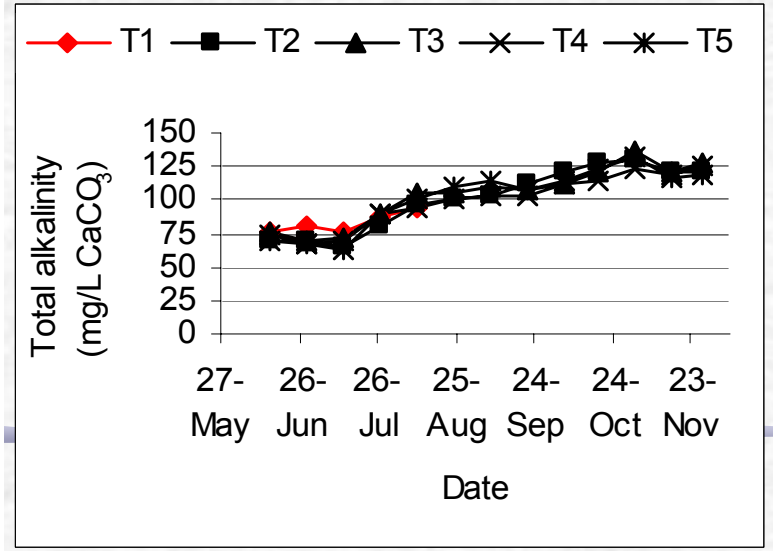


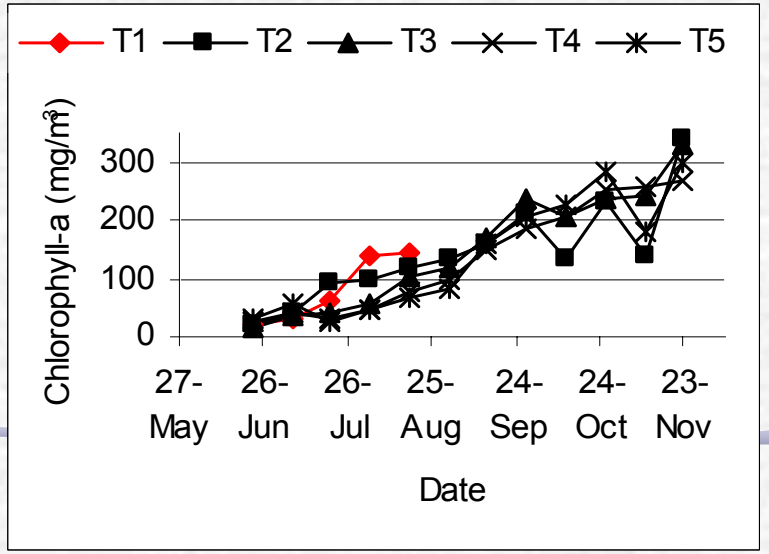


TAN, SRP, Total alkalinity and Chlorophyll_a

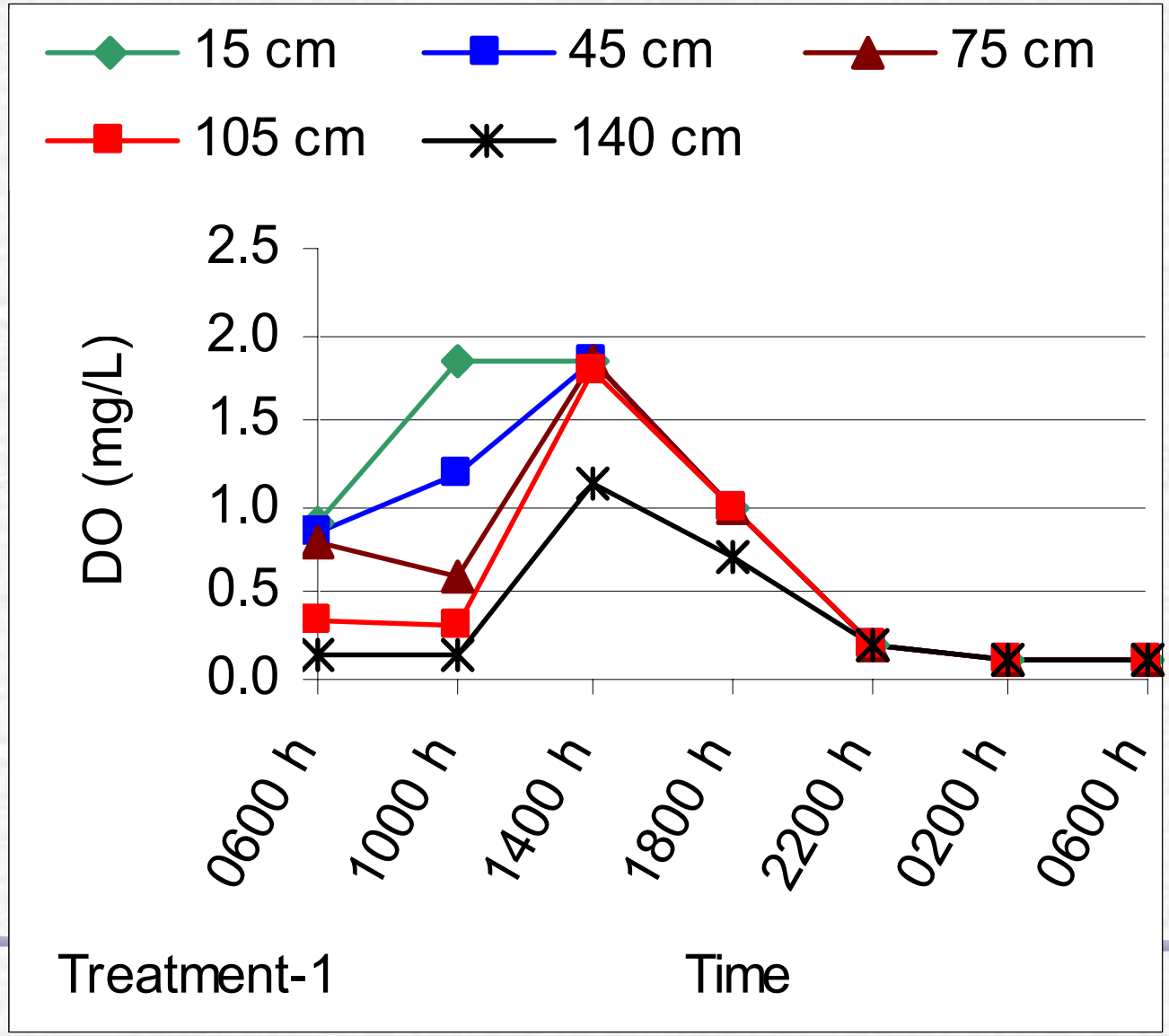








Diel oxygen fluctuation of Grass carp monoculture treatment on Aug 20, 2002.



CONCLUSIONS

- Monoculture of grass carp feeding with napier grass in stagnant system is risky.
- Optimal ratio of grass carp to Nile tilapia in polyculture fed with napier grass is 1:1 in this present study.
- Addition of Nile tilapia to the grass carp tanks fed napier grass as a sole nutrient input in stagnant water system can efficiently utilize available resources, reuse waste derived from grass carp, enhance total fish yield and also maintains natural balance of pond environment.
- Grass carp-Nile tilapia polyculture fed napier grass is a low-cost alternative aquaculture system for small-scale poor farmers which can yield about 4.5 to 5.0 t/ha annually.


Thank You