TILAPIA-SHRIMP POLYCULTURE AT LOW SALINITY WATER: STOCKING DENSITIES OF NILE TILAPIA AND FEEDING STRATEGIES

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Introduction (1)

- Coastal shrimp culture
  - One of the major problems is the disease outbreak such as white spot
  - Causes the failure of marine shrimp production
  - Abandoned shrimp ponds
- Inland shrimp culture
  - Rapid expansion of shrimp culture into many inland areas
- Sustainable shrimp culture
  - The polyculture of shrimp-tilapia at relative low stocking density may provide an opportunity to develop a sustainable aquaculture system
  - To best utilize abandoned shrimp ponds in coastal areas and low-salinity shrimp ponds in inland areas.

Objective

- To determine optimal stocking density of Nile tilapia in a tilapia-shrimp polyculture system at low salinity.

Experimental Design

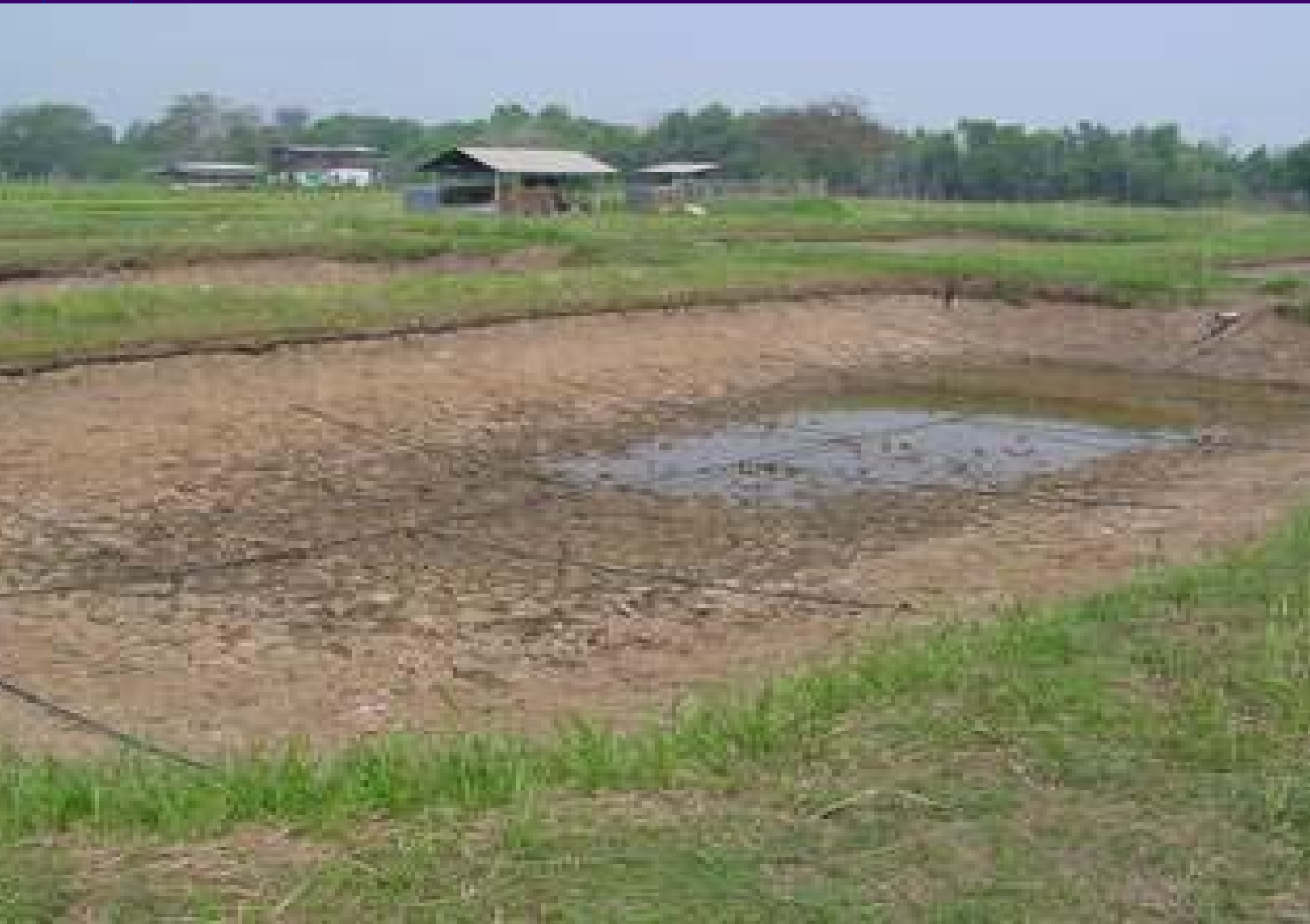
- Treatment 1 (shrimp monoculture):
  - Shrimp (*Penaeus monodon*)
  - Density: 30 pcs/m^2
- Treatment 2 (Low tilapia density polyculture):
  - Shrimp plus Nile tilapia
  - Tilapia density: 0.25 fish/m^2
- Treatment 3 (Low tilapia density polyculture):
  - Shrimp plus Nile tilapia
  - Tilapia density: 0.5 fish/m^2

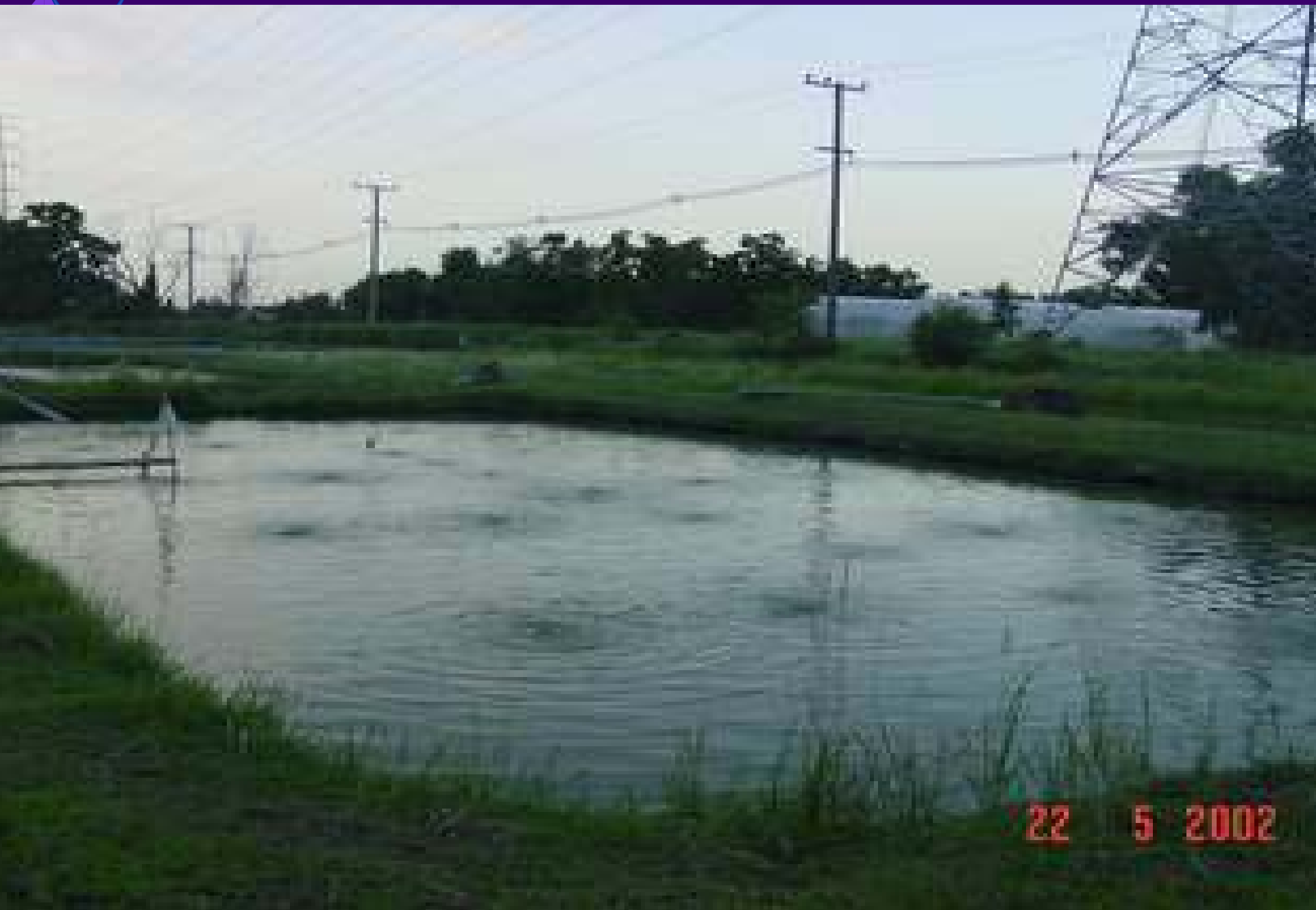
Two Experiments

- Experiment 1
  - Varied feed ration in individual ponds
  - Determined by feeding tray method
- Experiment 2
  - Fixed feed ration in all ponds
  - Determined by a feeding table

Experimental Conditions

- Nine 200-m^2 earthen ponds
- Shrimp PL60 (0.4-1.2 g)
- Tilapia (5-8 g) stocked 1 week after shrimp stocking
- Pond fertilization once before stocking
- Shrimp feed (36% CP), fed at 0600, 1200 1800, 0000
- Initial salinity 5 ppt, then no more saline water added
- Diffusing aeration system, 24 hrs daily
- No water exchange
- No chemical/drug use

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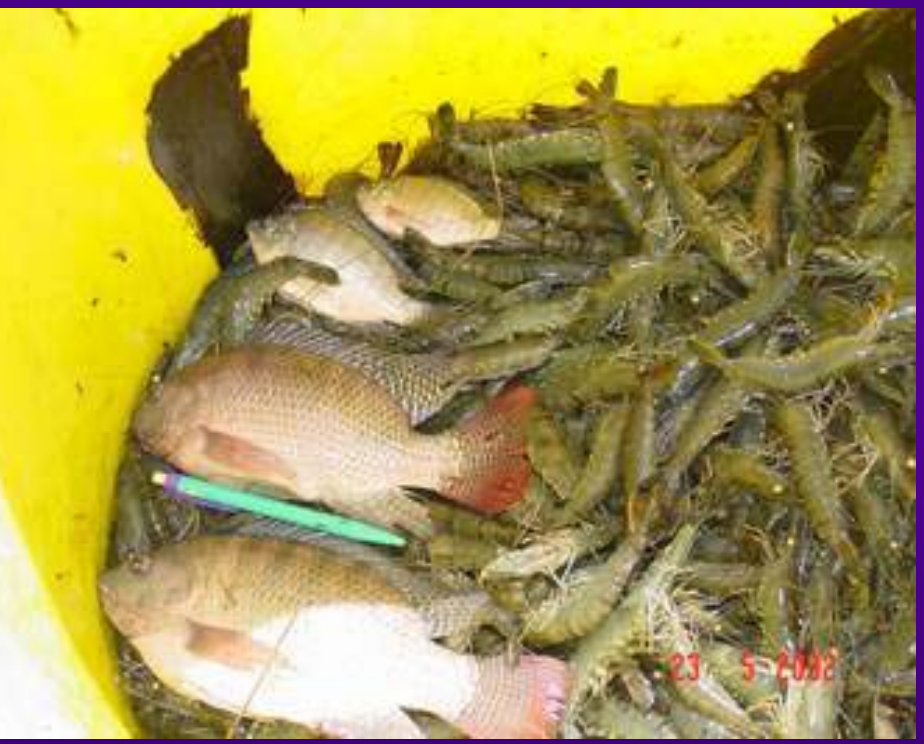
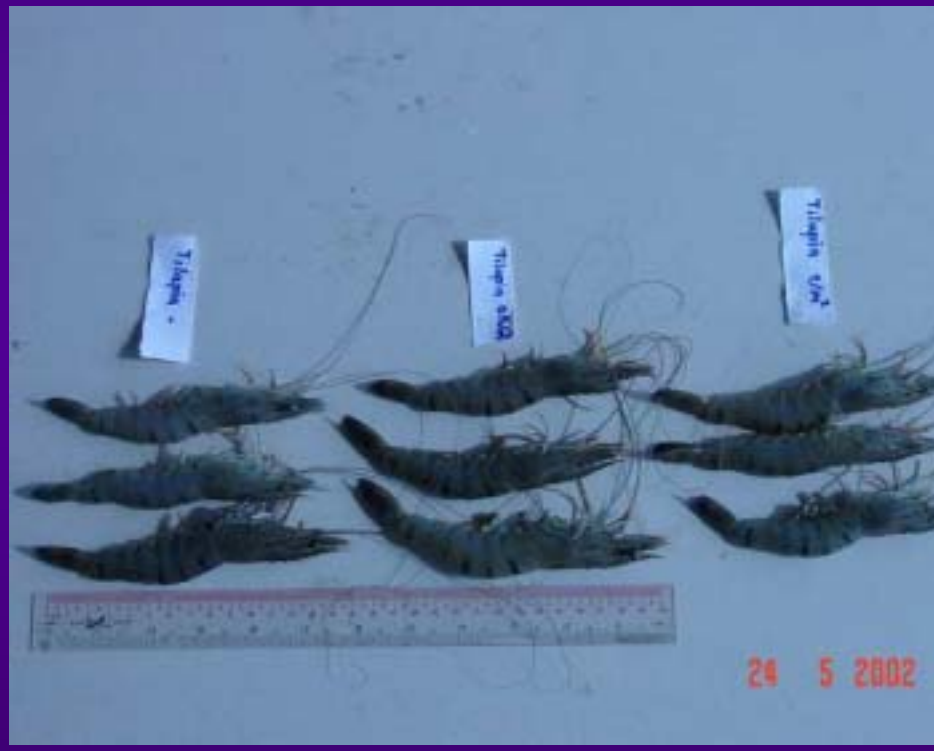
Harvested shrimp and tilapia





Experiment 1. Shrimp performance

Parameter	Unit	Treatments		
		Monoculture	Polyculture	
			Low density	High density
Stocking				
Mean weight	g/pieces	1.2±0	1.2±0	1.2±0
Total weight	kg/pond	7.3±0	7.3±0	7.3±0
Harvest				
Mean weight	g/piece	16.3±0.98	16.6±1.05	15.4±0.66
Total weight	kg/pond	61.8±2.14	59.1±5.58	63.6±1.78
Survival rate	%	64.00 ± 1.78^{ab}	59.00 ± 2.73^{b}	69.00 ± 1.73^{a}
Net yield	t/ha/crop	4.19 ± 0.16	3.98 ± 0.43	4.33 ± 0.14
Gross yield	t/ha/crop	4.75 ± 0.16	4.55 ± 0.43	4.89 ± 0.14
Feed input	kg/pond/crop	87.7 ± 2.79^{a}	108.9 ± 1.78^{b}	112.2 ± 0.26^{b}
Apparent FCR		1.62 ± 0.11	2.14 ± 0.20	2.00 ± 0.06

Experiment 1. Tilapia performance

Parameter	Unit	Treatments	
		Low tilapia density polyculture	High tilapia density polyculture
Stocking			
Mean weight	g/fish	5.5 ± 0	5.5 ± 0
Total weight	kg/pond	0.3 ± 0[a]	0.6 ± 0[b]
Harvest			
Mean weight	g/fish	263.9 ± 7.73	267.8 ± 15.88
Total weight	kg/pond	11.6 ± 1.28[a]	26.0 ± 1.34[b]
Survival rate	%	82.67 ± 8.19	88.00 ± 2.06
Daily weight gain	g/fish/day	3.98 ± 0.00	4.04 ± 0.24
Net yield	t/ha/crop	0.87 ± 0.10[a]	1.96 ± 0.10[b]
Gross yield	t/ha/crop	0.89 ± 0.10[a]	2.00 ± 0.10[b]

Experiment 1: Partial budget analysis (based on 200-m^2 ponds for 65 days, US$/200$m^2$/crop)

Items	Monoculture	Low tilapia density polyculture	High tilapia density polyculture
Gross revenue			
Shrimp	264.91	253.50	272.63
Tilapia	-	4.16	9.35
Total	264.91	257.66	281.98
Total variable cost	144.03	162.79	167.42
Net return	120.88	94.87	114.56
Added cost	-	18.76	23.39
Added return	-	-7.25	17.07
Added return/added cost	-	-0.39	0.73

Experiment 1: Conclusion

Tilapia-shrimp polyculture is:

- Technically feasible
- Environmentally not sure
- Economically not attractive

Further research:

- Adjust feeding strategy

Experiment 2. Shrimp performance

Parameter	Unit	Treatments		
		Monoculture	Polyculture	
			Low density	High density
Stocking				
Mean weight	g/pieces	0.4±0.00	0.4±0.00	0.4±0.00
Total weight	kg/pond	2.6±0.00	2.6±0.00	2.6±0.00
Harvest				
Mean weight	g/piece	12.7±0.37	12.8±0.33	12.3±0.28
Total weight	kg/pond	50.6±1.18^{b}	60.6±2.90^{a}	52.1±2.30^{b}
Survival rate	%	66.70±3.60	79.50±5.61	70.70±1.86
Net yield	t/ha/crop	2.40±0.06^{b}	2.90±0.15^{a}	2.47±0.12^{b}
Gross yield	t/ha/crop	2.53±0.06^{b}	3.03±0.15^{a}	2.6±0.12^{b}
Feed input	kg/pond/crop	83.1	83.1	83.1
Apparent FCR		1.70±0.04^{b}	1.44±0.07^{a}	1.69±0.08^{b}

Experiment 2. Tilapia performance

rameter	Unit	Polyculture treatments	
		Low tilapia density	High tilapia density
ocking			
Mean weight	g/fish	8.0±0.28[a]	6.6±0.12[b]
Total weight	kg/pond	0.40±0.02[a]	0.67±0.01[b]
arvest			
Mean weight	g/fish	323.5±8.19	326.4±16.36
Total weight	kg/pond	15.7±0.31[a]	30.5±1.87[b]
Survival rate	%	97.33±0.67[a]	93.33±1.20[b]
aily weight gain	g/fish/day	4.64±0.12	4.70±0.24
et yield	t/ha/crop	0.77±0.02[a]	1.49±0.09[b]
ross yield	t/ha/crop	0.79±0.02[a]	1.53±0.09[b]

Experiment 2: Partial budget analysis (based on 200-m^2 ponds for 65 days, US$/200$m^2$/crop)

Items	Monoculture	Low tilapia density	High tilapia density
ross revenue			
Shrimp	192.94	230.77	198.46
Tilapia	-	7.56	14.64
Total	192.94	238.33	213.10
otal variable cost	144.39	146.39	148.39
et return	48.54	91.93	64.71
dded cost	-	2	4
dded return	-	45.39	20.16
dded return/added cost	-	22.69	5.04

Experiment 2: Conclusion

Tilapia-shrimp polyculture is:

- Technically feasible
- Environmentally friendly
- Economically attractive

Further research:

- Optimize feeding regime

General Conclusions

- Tilapia-shrimp polyculture is:
  - Technically feasible

  Under appropriate feeding strategy
  - Environmentally friendly
  - Economically attractive

- Use of cost effective diets and optimization of feeding inputs is therefore vital in sustainable shrimp farming and can make the shrimp-tilapia polyculture more attractive to shrimp farmers :

- The addition of Nile tilapia into shrimp ponds can improve feed utilization efficiency, resulting in better economic returns and less environmental pollution


THANK YOU