Economic Analysis of Two Zero Exchange Biofloc Dominated Super-Intensive Shrimp Production Systems for the Pacific White Shrimp

Terry Hanson, Tzachi Samocha
Dariano Krummenauer, Rodrigo Schveitzer
and Timothy Morris

Auburn University
Department of Fisheries and Allied Aquacultures

AgriLIFE RESEARCH
Texas A&M System

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Introduction

- Indoor super-intensive recirculating systems continues to attract attention
  - High quality shrimp
  - Produced under controlled conditions
- Drawbacks
  - High initial investment
  - Volatile shrimp prices
- Economic analyses performed on:
  - Two trials in different production systems
  - Conducted at the Texas AgriLife Research Mariculture Lab at Flour Bluff, Corpus Christi, Texas

Presentation

- Two 2011 Studies
  - Summary of Production Results
  - Economic Analysis Summary
    - Cost of Production, Net Returns, Net Present Value, Internal Rate of Return, Payback Period
- Summary and Conclusions

2007 Study Findings

- Many factors affect the COP and financial viability
- Some are more controllable than others
  - More controllable
    - Location choice & its impact on investment, inputs & costs
    - Increasing stocking density
    - Nursery and growout survival
    - FCR
    - Source of investment and start-up operating capital
  - Less controllable
    - Growout and juvenile feed cost
    - Increase in growth rate
    - Shrimp selling price

Economic Analysis

- Trial A
  - Conducted in five 40 m^3 (68.5 m^2) RWs using juveniles from a fast growth line; no water exchange
- Trial B
  - Conducted in two 100 m^3 (100 m^2) RWs using Taura resistant juveniles ("slow growth" line); no water exchange
- Economic analysis for:
  - Trials A and B
  - Hypothetical scenario C
  - Comparison to 2007 factor analysis

Trial A 2011 Study Results

“Fast” Growth Line

RW	Stocking (Juv/m^3)	Stock (g)	Harvest (g)	Days	Growth (g/wk)	SGR (g/d)	Sur (%)	Yield (Kg/m^3)	FCR	Water Use L/1 kg	Sal (ppt)
1	500	1.9	22.16	81	1.75	0.25	87.6	9.66	1.39	169.0	18
2	500	1.9	23.63	82	1.86	0.27	81.5	9.59	1.44	160.8	18
3	500	1.9	23.36	82	1.83	0.26	80.7	9.40	1.45	149.0	18
4	500	1.9	23.79	83	1.85	0.26	79.3	9.39	1.45	161.0	18
5	500	1.4	25.12	85	1.95	0.28	78.9	9.87	1.44	148.2	30
Av.			**23.61**		**1.85**	**0.26**	**81.6**	**9.58**	**1.43**	**157.6**	
SD			0.9 4		0.06	0.01	0.3	0.18	0.02	7.9	

Trial B 2011 Study Results

Taura Resistant Line – “Slow” Growth Line

RW	Stocking (Juv/m^3)	Stocking (g)	Harvest (g)	Growth (g/wk)	Sur. (%)	Yield (kg/m^3)	FCR	Water Use (L/1 kg)
1	390	3.14	25.14	1.45	79.7	8.04	1.83	166.6
2	390	3.14	25.39	1.47	86.3	8.69	1.70	149.7
Av.	**390**	**3.14**	**25.26**	**1.46**	**83.0**	**8.36**	**1.77**	**158.1**
SD			0.18	0.01	3.3	0.32	0.06	8.5

Production results from two experiments (A, B) and expected (C) compared to 2007 levels

Treatment	2007	A	B	C
Stocking density (Juvenile/m^3)	500	500	390	500
Survival rate (%)	70	81.6	83.0	83.0
Growth rate (g/wk)	1.5	1.85	1.46	1.85
Stocking size (g)	1.0	1.8	3.14	1.8
Desired harvest size (g)	20.0	23.6	25.3	23.6
FCR	2.0	1.43	1.77	1.43
Length of crop period (day/crop)	86	83	106	83
Production (kg/m^3)	7.0	9.58	8.36	9.79

Production results from two experiments (A, B) and expected (C) compared to 2007 levels

Treatment	2007	A	B	C
Stocking density (Juvenile/m^3)	500	500	390	500
Survival rate (%) +16 to 19%	**70**	**81.6**	**83.0**	83.0
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Survival rate (%) **+16 to 19%**	70	81.6	83.0	83.0
Growth rate (g/wk) 0 to +23%	**1.5**	**1.85**	**1.46**	1.85
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Stocking size (g)	1.0	1.8	3.14	1.8
Desired harvest size (g)	20.0	23.6	25.3	23.6
FCR +12 to +29% decrease	**2.0**	**1.43**	**1.77**	1.43
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Production(kg/m^3) +19 to +37%	**7.0**	**9.58**	**8.36**	9.79

Economic Analysis

- Performed a 10-year cash flow analysis to estimate:
  - Cost of production, Net returns to land, Net present value, Internal rate of return, and Payback period
- Prices/Costs used in analysis
  - Shrimp sales price: averaged $3.27/lb
  - Grow-out feed: $0.8722/lb or $1744/ton
    - Zeigler Bros. Hyper Intensive 35
  - Juveniles production cost: $19.43/1,000
  - Interest rate for loans: 8%
- Initial investment = $991,997

Economic Analysis

- Study results extrapolated to:
  - One greenhouse system (GH)
  - Each GH consists of eight 500 m^3/m^2 grow-out tanks and two 500 m^3/m^2 nursery tanks
- Budget results are based on production figures (2007, A and B) and combination of best results obtained in Samocha's trial results (C)

Summary of Enterprise Budgets and Financial Indicators of Profitability for Super-intensive Recirculating Shrimp Production Systems (A, B) and Expected Future Results (C), in $/lb

	2007	A	B	C
Gross Receipts	3.27	3.27	3.27	3.27
Variable Costs	2.98	2.44	3.22	2.41
Income Above Variable Cost	0.28	0.83	0.05	0.86
Fixed Cost	0.38	0.27	0.40	0.26
Total of All Specified Expenses	3.36	2.71	3.62	2.67
Net Returns Above All Costs	(0.09)	0.56	(0.35)	0.60
Payback period, years	9.1	2.9	21.3	2.7
Net present value ($ mil.)	(0.3)	1.0	(0.7)	1.1
Internal Rate of Return (%)	1.54	31.3	(9.9)	33.8

Summary of Enterprise Budgets and Financial Indicators of Profitability for Super-intensive Recirculating Shrimp Production Systems (A, B) and Expected Future Results (C), in $/kg

	2007	A	B	C
Gross Receipts	7.20	7.20	7.20	7.20
Variable Costs	6.58	5.38	7.10	5.31
Income Above Variable Cost	0.63	1.82	0.10	1.89
Fixed Cost	0.83	0.59	0.88	0.57
Total of All Specified Expenses	7.40	5.97	7.98	5.88
Net Returns Above All Costs	(0.20)	1.23	(0.78)	1.32
Payback period, years	9.1	2.9	21.3	2.7
Net present value ($ mil.)	(0.3)	1.0	(0.7)	1.1
Internal Rate of Return (%)	1.54	31.3	(9.9)	33.8

Opportunities for the Future

- Tough times due to increasing input costs
  - GO feed price: $800 to $1,744; +118%
- Improved technology continues to:
  - Increase growth rate
  - Improve FCR
  - Increase survival
  - Increase yield
- Can technological improvements decrease COP to overcome increases in input (feed) costs?
  - Without tech advances net return would be negative
- Financial analyses are focusing research to sharpen competitiveness

Beginning or End!? Questions?