Economic Analysis of Two Feeds in Biofloc-Dominated Super-Intensive Shrimp Production Systems for the Pacific White Shrimp, 2012

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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:
  - Effect of two commercial diets on shrimp performance
  - Conducted at the Texas AgriLife Research Mariculture Lab at Flour Bluff, Corpus Christi, Texas

Presentation

- Two 2012 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

Earlier 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 and juvenile size
    - Reducing crop duration => more crops per year
    - Nursery and growout survival
    - FCR
    - Water usage
  - Less controllable
    - Growout and juvenile feed cost
    - Year round supply of PLs
    - Shrimp selling price

Economic Analysis

- Study 1
  - Two diets (Zeigler Brothers); three replicates
    - Semi-Intensive (SI-35) 35% protein: $ 0.99/kg or $ 0.452/lb
    - Hyper-Intensive (HI-35) 35% protein: $ 1.75/kg or $ 0.795/lb
  - Each treatment conducted in three 40 m^3 (68.5 m^2) RWs
  - Juveniles from a cross between Taura resistant and fast-growth genetic lines developed by Shrimp Improvement Systems (Islamorada FL)
  - No water exchange

Economic Analysis

- Study 2
  - Only HI-35 diet
  - Conducted in two 100 m^3 (100 m^2) RWs using same strain; no water exchange

Trial A 2011 Study Results

“Fast” Growth Line with HI-35

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**	**83**	**1.85**	**0.26**	**81.6**	**9.58**	**1.43**	**157.6**	
SD			0.94		0.06	0.01	0.3	0.18	0.02	7.9	

Two Diet Study: HI-35 v SI-35

Cross between Taura resistant and fast-growth genetic line

RW	Stocking (Juv/m^3)	(g)	Harvest Size (g)	Days	Growth (g/wk)	Sur (%)	Yield (Kg/m^3)	FCR	Water Use (L/kg)
HI-35, 40 m^3 RW									
1	500	2.66	22.26	67	2.02	87.20	9.70	1.24	23.2
3	500	2.66	22.29	67	2.02	87.85	9.79	1.25	17.9
5	500	2.66	22.45	67	2.04	86.76	9.74	1.26	28.3
Average	**500**	**2.66**	**22.33**	**67**	**2.03**	**87.27**	**9.74**	**1.25**	**23.1**
SI-35, 40 m^3 RW									
2	500	2.66	19.06	67	1.69	93.04	8.87	1.4	21.1
4	500	2.66	20.81	67	1.87	84.78	8.82	1.41	25.5
6	500	2.66	19.49	67	1.73	86.71	8.45	1.48	22.7
Average	**500**	**2.66**	**19.79**	**67**	**1.76**	**88.18**	**8.71**	**1.43**	**23.1**

Study 2 - HI-35 Diet Conducted in Two 100 m^3 (100 m^2) RWs

Using Same Strain; No Water Exchange

RW	Stocking (Juv/m^3)	Stocking (g)	Harvest Size (g)	Days	Growth (g/wk)	Yield (Kg/m^3)	FCR	Water Use (L/kg)
HI-35, 100 m^2 RW								
B1	500	3.6	22.76	63	2.13	9.2	1.43	38.59
B2	500	3.6	22.67	63	2.12	8.86	1.53	44.00
Average	**500**	**3.6**	**22.72**	**63**	**2.13**	**9.03**	**1.48**	**41.30**

Comparison of Production Results From 2011 to 2012

Treatment	2011 A	HI-35 40m^3	SI-35 40m^3	HI-35 100m^3
Stocking density (Juvenile/m^3)	500	500	500	500
Survival rate (%)	81.6	87.3	88.2	79.5
Growth rate (g/wk)	1.85	2.03	1.76	2.13
Stocking size (g)	1.8	2.7	2.7	3.6
Harvest size (g)	23.6	22.3	19.8	22.7
FCR	1.43	1.25	1.43	1.48
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FCR -12.6%, 0%, +3.5%	4.4 crops /yr	1.25	1.43	1.48
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4.4 crops /yr

5.5 crops /yr +25%

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FCR -12.6%, 0%, +3.5%		1.25	1.43	
Crop length (days)**-19.3%, -19.3%, -24.1%**		67	67	
Production (kg/m^3)	9.58	9.74	8.71	9.03

4.4 crops /yr

5.8 crops /yr +32%

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Crop length (days)-19.3%, -19.3%, -24.1%	83	67	67	63
Production (kg/m^3) **+1.7%, -9.1%, -5.7%**	9.58	9.74	8.71	9.03

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 $7.20/kg ($3.27/lb)
  - Grow-out feed: Zeigler Brothers
    - Semi-Intensive (SI-35): $0.99/kg = $ 990/MT or $0.452/lb = $ 904/ton
    - Hyper-Intensive (HI-35): $1.75/kg = $1,750/MT or $0.795/lb = $1,590/ton
  - Juveniles production cost: $20.00/1,000
  - 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

Summary of Production and Sales for Super-intensive Recirculating Shrimp Production Systems 2011 Compared to 2012 Trials

Metric Units

	2011	HI-35 40m^3	SI-35 40m^3	HI-35 100m^3
Production, kg/crop	38,320	38,960	34,840	36,120
Crops per year	4.4	5.5	5.5	5.8
Production, kg/year	168,608	214,280	191,620	209,496
Production MT/year	169	214	192	209
Selling price, $/kg	7.20	7.20	7.20	7.20
Total Sales per year, $	1,213,978	1,542,816	1,379,664	1,508,371

Summary of Enterprise Budgets for Super-intensive Recirculating Shrimp Production Systems 2011 Compared to 2012 Trials

$/kg

	2011	HI-35 40m^3	SI-35 40m^3	HI-35 100m^3
Gross Receipts	7.20	7.20	7.20	7.20
Variable Costs	5.38	4.06	4.54	4.31
Income Above Variable Cost	1.82	3.14	2.66	2.89
Fixed Cost	0.59	0.47	0.53	0.48
Total of All Specified Expenses	5.97	4.53	5.07	4.79
Net Returns Above All Costs	1.23	2.67	2.13	2.41
Payback period, years	2.9	1.4	1.9	1.6
Net present value ($ mil.)	1.0	2.9	2.0	2.6
Internal Rate of Return (%)	31.3	66.6	50.1	60.6

Opportunities for the Future

- Improved technology & experience continues to:
  - Increase growth rate
  - Improve FCR
  - Increase survival
  - Increase yield
- BIG CAVEATS REMAIN !!!
  - 1. Must have year-round PL supply!
  - 2. Research must show back-to-back-to-back… production is possible
- Financial analyses are focusing research to sharpen competitiveness

Beginning or End!? Questions?

Summary of Production and Sales for Super-intensive Recirculating Shrimp Production Systems 2011 Compared to 2012 Trials

English Units

	2011	HI-35 40m^3	SI-35 40m^3	HI-35 100m^3
Production, lb/crop	84,496	85,907	76,822	79,645
Crops per year	4.4	5.5	5.5	5.8
Production, lb/year	371,781	472,487	422,522	461,939
Production ton/year	186	236	211	231
Selling price, $/lb	3.27	3.27	3.27	3.27
Total Sales per year, $	1,215,723	1,545,034	1,381,647	1,510,539

Summary of Enterprise Budgets for Super-intensive Recirculating Shrimp Production Systems 2011 Compared to 2012 Trials

$/lb

	2011	HI-35 40m^3	SI-35 40m^3	HI-35 100m^3
Gross Receipts	3.27	3.27	3.27	3.27
Variable Costs	2.44	1.84	2.06	1.96
Income Above Variable Cost	0.83	1.43	1.21	1.31
Fixed Cost	0.27	0.21	0.24	0.22
Total of All Specified Expenses	2.71	2.05	2.30	2.17
Net Return Above All Costs	0.56	1.21	0.97	1.09
Payback period, years	2.9	1.4	1.9	1.6
Net present value ($ mil.)	1.0	2.9	2.0	2.6
Internal Rate of Return (%)	31.3	66.7	50.1	60.6