TECHNICAL APPROACHES AND AQUACULTURE DEVELOPMENT ALTERNATIVES

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ABSTRACT

Tam Giang - Cau Hai lagoon systems covered over 22.000 ha, along coastal region from North to South of Thua Thien Hue with 70 km and more than 400.000 inhabitants are living around in lagoon systems. There are many livelihood activities as fishing, aquaculture and farming. Aquaculture systems are diversified: pond, net-closure in high and low tide systems and farmers and communities had to choose and select proper species and models for adaptation of the regions but they still have not successful, even they lost investment money and capital by environmental problems and uncorrected carrying capacity leading to diseases and low productions. Research results were showed the different technical approaches and aquaculture system alternatives for property aquaculture models in the regions. More than 267 aquaculture households of 15 communes in 5 districts that related to Tam Giang - Cau Hai lagoon were investigated and shown the figures on over 4000 ha of aquaculture water area of 33 communes: high/low tides of pond systems; cage culture in low tide systems; sandy shrimp culture system; integrated poly-culture and monoculture, while P. monodon was main species in all of systems and models. Efficiency of different alternatives were conducted in intensive of high tide was highest income, net income 100 - 700 mil. VND; semi-intensive of high tide-mono, 10 - 25 mil.; semi-intensive high tide-integrated poly-culture, 20 -40 mil.; semi-intensive-low tide-mono, 3 - 10 mil.; extensive-low tide-poly, 30 -50 mil.; marine water cage culture-poly, 25 - 35 mil., respectively. Effect of different species alternatives were on 267 households in differences, 26.99; 90.22; 221.13; 48.21, $P < 0.01$. The stock density and composition was conducted in differences of income and benefit for farmers, $P < 0.05$. Water control and management, dietary composition and feed processing, animal health management were effected on the income and benefit of aquaculture models, $P < 0.01$ and 0.001.

INTRODUCTION

Tam Giang - Cau Hai lagoon systems covered over 22.000 ha, along coastal region from North to South of Thua Thien Hue with 70 km and more than 380.000 inhabitants are living around the lagoon. There are many livelihood activities as fishing, aquaculture and farming, which are active on the lagoon systems and buffer zones. Aquaculture systems are diversified: pond, net-closure in high and low tide systems [5]. Although, local authorities and communities have been discussed many times to choose and select proper species, aquaculture techniques and production models by themselves for the regions and ecosystems but they have not successful in aquaculture systems, as conducted some pictures from other countries [2], [3], many farmers and communities lost investments and capital by environmental problems and uncorrected carrying capacity leading to diseases and a low production. The research aims in alternatives of different aquaculture technical approaches on different ecosystems and how to reduce risks and increase farmer income, simultaneously increasing capacity building for lagoon community and researchers in university, especially system analysis and fisheries management.

METHODS AND MATERIALS

Research site

The research conducted on 267 households with their aquaculture production systems in Tam Giang – Cau Hai lagoon systems.

Table 1. **Setting –up the householder investigations on Tam Giang – Cau Hai lagoon**

No.	Name of communes	H.tide pond	L.tide pond	Poly culture	E.Net lowtide	Sandy S.farms	Fish pond	Fish cage	Total
1	L. Dien	5	20						**25**
2	L. Co	10	7					5	**22**
3	V.Hung	15	15						**30**
4	V.Xuan	10	5	5					**20**
5	P. Xuan	15	5	5	15				**40**
6	T. An	5	5	5	15			5	**35**
7	H. Duong	5	5	5				13	**28**
8	Q. An		14	10					**24**
9	Q. An	5							**5**
10	Đ. Hai	5					3		**8**
11	Q. Thai						5	15	**20**
12	Đ. Loc					3			**3**
13	Đ. Huong					3			**3**
14	P. Hai					2			**2**
15	V. An					2			**2**
15 Communes									**267**

In table 1 conducted that there were 267 shrimp farms in different ecosystems, with different technical approaches to different ecosystems of aquaculture production systems as indication that: The total of 19.531 householder aquaculture farming systems in 5 districts of Thua Thien Hue province on Tam Giang – Cau Hai lagoon.

Table 2. Distribution of shrimp farming households in 5 districts

No	District	n (h.h)	n(h.h) selected
1	Phu Loc	4545	45 (5 sandy shrimp farms)
2	Phu Vang	6274	96
3	Quang Dien	3121	45
4	Huong Tra	2576	32
5	Phong Dien	3015	49 (5 sandy shrimp farms)
	Total	**19.531**	**267**

Variables

Householder characteristics; 6 input variables; 3 output variables; Different effects of techical approaches for different aquaculture systems

Research methods

Different tools were used for data and information collection by experimental designs and casetudies.
All of variables were quantified and analysed by statistical models [4] as:
$Y = \mu + \alpha 1, 2, 3 + \beta 1,2,3 + \Sigma in = 1\text{-}2\ X1 + X2 + \ldots + Xn + eijk$
Y = variables as Performance; health/infections; environmental
Data were managed on Excel and calculated on SPSS v16 on LMS for relationships, parameters with $P < 0.05$

RESULT AND DISCUSSIONS

Different aquaculture systems and cropping cycles

Research results were showed that the technical approaches and aquaculture system alternatives for property aquaculture models in the regions. More than 267 aquaculture households of 15 communes in 5 districts that related to Tam Giang - Cau Hai lagoon were investigated and shown the figures on over 4000 ha of aquaculture water area of 33 communes: high/low tides of pond systems; cage culture in low tide systems; sandy shrimp culture system; integrated poly-culture and monoculture, while *P. monodon* was main species in all of systems and models.

Table 3. Shrimp culture and polyculture systems in Tam Giang - Cau Hai

Feeding systems	Ecosystem	Culture types	Allocation	Rate (%)	Crops
Intensive	Pond	Monoculture	Sandy area	5	3; 45 %& 2;55%
Semi-intensive	Pond	Monoculture	High-tide	15.5	1;40% & 2;60%
Semi-intensive	Pond	Polyculture	High-tide	9.05	1;70% & 2;30%
Semi-intensive	Pond	Monoculture	Low-tide	25.2	1; 60% & 2; 40%
Ext. improved	Pond	Polyculture	Low-tide	12.7	1; 100%
Ext-improved	Enlosure – net	Polyculture	Low-tide	27.8	1; 100%
Intensive	Cages and float	Monoculture	Marine	4.75	1; 100%

Influence of different feeding levels on shrimp culture efficiencies

Efficiency of different aquaculture system alternatives were conducted in intensive of high tide was highest income, net income 100 - 700 mil. VND; semi-intensive of high tide-mono, 10 - 25 mil.; semi-intensive high tide-integrated poly-culture, 20 -40 mil.; semi-intensive-low tide-mono, 3 - 10 mil.; extensive-low tide-poly, 30 -50 mil.; marine water cage culture-poly, 25 - 35 mil., respectively.

Table 3. Influence of feeding alternatives to farmer's income on shrimp culture (VND. Mil)

Ecosystems	n	Income (VND)
1	12	$31.75^{a} \pm 5.81$
2	123	$48.41^{b} \pm 5.12$
3	60	$56.73^{c} \pm 5.51$
4	30	$58.43^{c} \pm 7.47$
5	42	$38.47^{a} \pm 3.75$
Average	267	**48.21 ± 16.97**

$a \neq b \neq c$ in the same column, $P < 0.05$

Effects of different stocking density on shrimp culture income

There were many stocking density that managed by farmers, they can select and alternative for a level what they set-up for their pond and systems. With level of 3 heads/m^2 in extensive system had more efficiencies, compared with other stocking density, while semi- intensive system with level of 12 heads/m^2 and in intensive system, with 120 heads/m^2.

Table 4. Different stocking density and income from shrimp culture

Stocking density (heads/m^2))	Mean	No.	Std. Deviation
2	10.00	5	3.937
3	24.00	1	.
3	**38.25**	**4**	**4.945**
3	44.00	44	4.7829
4	35.00	6	5.289
5	34.42	21	8.789
6	60.18	40	5.663
7	55.81	32	2.323
8	62.14	7	3.041
9	60.00	1	.
10	61.88	32	9.365
11	8.00	1	Disease infection
12	**138.67**	**35**	**9.877**
13	37.50	2	3.820
14	56.00	8	4.200
15	52.67	6	5.492
16	60.50	2	7.004
18	37.60	5	4.956
20	53.26	31	2.405
22	78.00	1	.
24	72.33	3	3.524
25	79.33	11	4.550
26	87.00	1	.
30	54.00	3	6.776
33	17.00	1	.
34	37.00	1	.
35	47.67	3	8.009
40	16.00	1	.
80	42.00	1	.
100	44.00	1	.
120	**255.50**	**9**	**14.849**
Average	48.21	267	6.974

Influence of species on ecosystem alternatives in shrimp culture

In 2007, there were 3856.75 ha water areas for aquaculture, 921.78 ha of shrimp farming in high tide and 1814.40 low tide systems; 0.5 ha fish culture in high tide and 14.15 ha low tide systems, while poly-culture of shrimp, crabs, fish and mollusk 12.83 ha of high tide and 306.35 ha of low

tide, beside in this, there were 1.5 ha of shrimp monoculture and 780.80 ha of poly-culture in enclosure net systems. In addition, there were 421 ha of fish culture and 75 ha of mollusk culture. The research was conducted on 265 aquaculture households of 31 communes in Tam Giang – Cau Hai lagoon systems, with different feeding system approaches to different eco-aquaculture systems, that conducted that changed feeding systems from intensive and semi-intensive to extensive aquaculture in lagoon systems, 450 ha of low rice land area by side and buffer zone of the lagoon converted into shrimp culture in high-tide. Effect of different species alternatives on aquaculture and householder income in differences, $P < 0.01$ (table 1) for 1, 2 and 3 species combination, when consideration in different feeding system approaches on aquaculture income in table 4., that conducted in significant differences, $P < 0.05$ for intensive–high tide; semi-intensive high tide mono; semi-intensive high tide poly-culture; semi-intensive low-tide-poly and extensive-lowtide-mono.

Table 5. Effect of different species on aquaculture income

Species	n	Income (VND)
1	180	$26.99^{a} \pm 17.55$
2	60	$90.22^{b} \pm 26.47$
3	8	$221.53^{c} \pm 59.83$
Average	267	48.21 ± 16.97

$a \neq b \neq c$ in the same column, $P < 0.01$

Table 6. Effect of ecosystems to aquaculture income

Ecosystems	n	Income (VND)
1	12	$31.75^{a} \pm 5.81$
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5	42	$38.47^{a} \pm 3.75$
Average	267	48.21 ± 16.97

$a \neq b \neq c$ in the same column, $P < 0.05$

Effect of different species alternatives were on 252 households in differences, 26.99; 90.22; 221.13; 48.21, $P < 0.01$. The feeding system and strategies was conducted in differences of income and benefit for farmers, $P < 0.05$. Water control and management, dietary composition and feed processing, animal health management were effected on the income and benefit of aquaculture models, $P < 0.01$ and 0.001.

Table 7. Influence of quarantine on shrimp culture income, mil. VND

Quarantine	Mean	No.	SD		
1	71.60	121	51.732		
2	26.60	146	28.462		
Total	**48.21**	**267**	**46.974**		
SS		Df	Mean	F	Sig.
Between groups	127375.536	1	127375.536	74.670	.000
Within groups	426460.317	266	1705.841		
Total	553835.853	267			

The technical quarantine for breeding and post-larvae for shrimp culture, with (1) farmers have brought their post-larvae for PCR test in different laboratories to know how their post-larvae strong and infected or not. Hence, they can decide to delivery the post-larvae or not, while (2)

farmers did not concentrate on the PCR test, they can buy from hatchery and brought direct to pond and shrimp farming systems. Compared between two groups, there was a higher income for group of farmers with post-larvae test, $P < 0.001$.

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