Pla Duk Dan Culture in Circular Concrete Ponds with Water Recirculating System

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ABSTRACT

A study was conducted in circular concrete ponds with water recirculating system at the Kasetsart University Aquaculture Department to evaluate the effects of different stocking levels on fish survival, growth, production, feed conversion, and economic returns. On 16 June 1981, pla duk dan fry averaging 0.1 g each were stocked in six 15-m^3 ponds at the following rates : 5,000 fish per pond, 2 ponds; 7,500 fish per pond, 2 ponds; and 10,000 fish per pond, 2 ponds. The fish were fed floating pellet until September 15. Results indicated that average fish survival (%), absolute growth (g), production (kg), feed conversion, and economic returns (%), respectively, were as follows : the low stocking level treatment, 79.53, 96.07, 381.49, 1.40, 44.38; the medium stocking level treatment, 91.06, 89, 607.32, 1.49, 53.62; and the high stocking level treatment, 90.73, 85.51, 775.04, 1.27, 80.93. The economic feasibility for small scale culture of this fish was also estimated.

INTRODUCTION

Though pla duk dan, *Clarias batrachus* (Linnaeus), has been cultured in ponds in Thailand for some 20 years, culture of this fish is presently not widely operated. Such unprogressive operation has been resulted mainly from a lack of reliable information on suitable culture systems.

It has been established that fish production can be increased through high density of stocking and feeding, and that the production level that can be increased varies with the species and the culture environment. For pla duk dan which can be densely stocked due to its high tolerance to poor water quality, its yield per unit area in properly managed culture systems with efficiently controlled environment can be expected by several times over that obtained from conventional pond culture system.

Improvement of fish production efficiency in circular ponds with water circulating system has been successfully demonstrated in recent years by many investigators. Thus far, the majority of the work conducted in such controlled environmental system has been done with trout and nile tilapia (Huet, 1970; Bardach, 1972; Balarin, 1981; Wilson and Hilton, 1981). There has been virtually no such efficiently, advanced technological work on pla duk dan reported in the literature.

This study was, therefore, designed to provide information on the optimum stocking level of pla duk dan grown in circular concrete ponds with water recirculating system. Specific objectives were to (1) determine survival, growth, in the concrete ponds receiving the same supplemental feed, and (2) estimate the economic feasibility for culture of this fish under a small scale basis. Such information can be useful in management aimed at the improvement of production efficiency for pla duk dan in controlled environmental culture systems.

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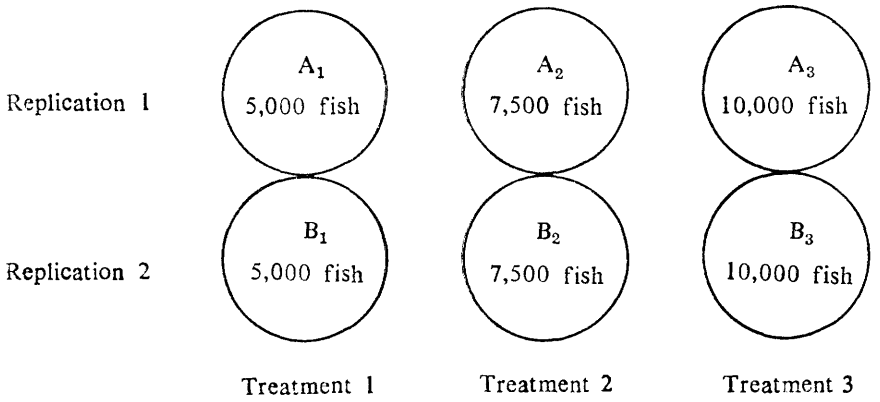
MATERIALS AND METHODS

Six 5-m diameter concrete ponds with a water capacity of 15 cubicmeter each at the Kasetsart University Aquaculture Department, Bangkhen, Bangkok were used in this experiment. The six concrete ponds were equipped with a 2-in.pipe (0.5 HP) submersible pump (Fig. 1 and Fig. 2) making water to recirculate from a 10-rai (4-acre) pond through all the experimental units until the feeding trial was terminated. On June 16, 1981, these ponds were stocked with pla duk dan fry averaging 0.1 g each at the following rates : 5,000 fish per pond; 7,500 fish per pond; 10,000 fish per pond. Each stocking rate was replicated two times. The experiment was sketchily designed as below :



The fish were fed a commercial floating fish pelleted feed containing 30% protein for the first 45 days, then for the rest of the feeding period the feed used was changed to a 25% protein diet. Estimates for fish growth were made every week.

A measurement for total final weight and a count for total number of the fish from each pond was done on September 15, 1981. Fish were grouped as market size, under market size, and abnormal, and their respective total weights were determined. Fish survival, absolute growth and production, feed conversion, and economic returns were then calculated and compared. Based on the data obtained the economic feasibility for small scale culture of this fish was estimated.

RESULTS

Average weights of pla duk dan stocked at various levels in the experimental ponds for 12 weeks are shown in Table 1 and Figure 3. At the end of experiment, fish stocked at 5,000 tails, 7,500 tails, and 10,000 tails per pond attained 96.07 g, 89 g, and 85.51 g in body weight, respectively.

Table 2 represents average total weights of pla duk dan in each experimental pond at harvest. Average total weights (per pond) of the fish stocked at 5,000 tails, 7,500 tails, and 10,000 tails per pond were 381.49 kg, 607.32 kg, and 775.04 kg, respectively. Of the lowest weight produced, 218 kg, (57.17 %) was obtained from maket size fish, 156.27 kg (40.96 %) from under market size fish, and 7.17 kg (1.88 %) from abnormal fish, whereas for the highest weight produced group, 308.35 kg (39.65 %) came from market size fish, 453.88 kg (58.75 %) from under market size fish, and 12.8 kg (1.6 %) from abnormal fish. For fish produced medium weight, market size fish, under market size fish, and abnormal fish contributed 241.16 kg (39.72 %), 361.19 kg (59.46 %), and 5.53

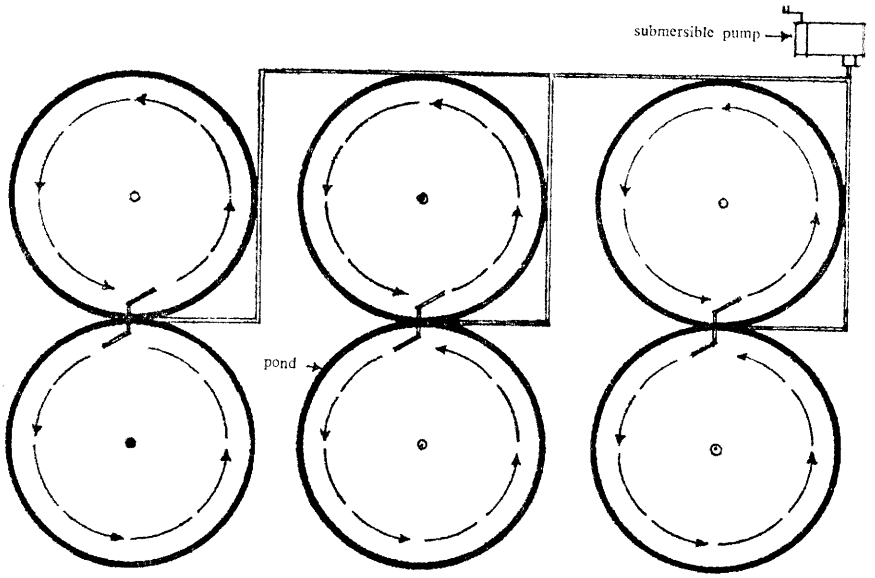


Figure 1 Diagram (Top View) Showing Water Circulating Direction

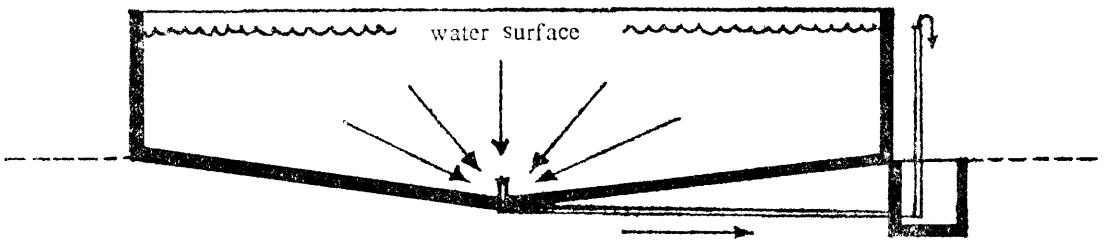


Figure 2 Diagram (Side View) Showing Water Circulating Direction

kg (0.91 %), respectively (Fig. 4).

Survival rates of the fish in all experimental ponds are given in Table 3 and Figure 4. Average survival values of the fish stocked at 5,000 tails, 7,500 tails, and 10,000 tails per pond were 79.53%, 91.06%, and 90.73%, respectively.

Table 3 also shows weight gains, amounts of feed consumed, and feed conversion ratios by pla duk dan stocked at various levels. Average feed conversion value was lowest (1.27) for fish stocked at 10,000 tails per pond and highest (1.49) for fish stocked at 7,500 tails per pond. Fish stocked at 5,000 tails per pond gave an average feed conversion value of 1.4.

Average cost and income resulting from a 90-day rearing period for pla duk dan stocked at low level were estimated at 13,211.13 baht (23 baht = 1 US $) for cost and 19,074.50 baht for income with 44.38 % profit, while fish stocked at high level showed 21, 418.01 baht for cost and 38,751.75 baht for income with 80.93 % profit. Fish stocked at medium level gave 53.62 % benefit with 30,365.75 baht for income and 19,766.65 baht for cost (Table 4).

Based on the data obtained, attempts were made to estimate the economic feasibility for a small scale (family size) culture of pla duk dan in this system. Details for such estimation are shown in Table 5.

Table 1 Average weight (g) of *Clarias batrachus* stocked at various levels in circular concrete ponds with water recirculating system for 12 weeks

Stocking level	Pond	Week												
tail/pond	No.	0	1	2	3	4	5	6	7	8	9	10	11	12
5,000	A_1	1	1.77	5.10	7.65	17.19	22.27	25.59	33.71	40.13	52.13	53.44	78.70	99.03
	B_1	1	2.18	4.40	10.12	16.19	19.45	25.20	33.75	39.18	55.21	59.52	67.90	93.10
	Ave	1	1.98	4.75	8.89	16.69	20.86	25.40	33.73	39.66	53.67	56.48	73.30	96.07
7,500	A_2	1	2.45	4.43	7.73	13.24	15.92	21.96	30.84	47.33	54.05	57.14	67.10	85.94
	B_2	1	2.16	3.40	6.64	15.22	16.74	24.93	30.32	50.56	52.40	62.72	66.10	92.05
	Ave	1	2.31	3.92	7.19	14.23	16.33	23.45	30.58	48.95	53.23	59.93	66.60	89.00
10,000	A_3	1	1.50	4.10	7.36	16.34	21.32	22.96	29.75	48.31	53.85	62.50	70.06	79.68
	B_3	1	3.40	6.25	10.90	20.34	22.65	25.69	32.18	41.19	51.07	54.05	65.00	91.34
	Ave	1	2.45	5.18	9.13	18.34	21.98	24.33	30.97	44.75	52.46	58.28	67.53	85.51

Table 2 Average total weight (per pond) of *Clarias batrachus* stocked at various levels for 12 weeks, as grouped by wieght and percentage for market size, under market size and abnormal

Stocking levels		Total W.	Market size		Under market size		Abnormal	
tail/pond	Pond No.	(kg)	kg	%	kg	%	kg	%
5,000	A_1	376.91	216.08	57.33	152.12	40.36	8.71	2.31
	B_1	386.07	220.05	57.00	160.41	41.55	5.60	1.45
	Ave.	381.49	218.06	57.17	156.27	40.96	7.17	1.88
7,500	A_2	599.83	243.29	40.56	353.06	58.86	4.56	0.76
	B_2	614.80	239.03	38.88	369.31	60.07	6.46	1.05
	Ave.	607.32	241.16	39.72	361.19	59.46	5.53	0.91
10,000	A_3	733.47	272.34	37.13	456.51	62.24	4.62	0.63
	B_3	816.60	344.36	42.17	451.25	55.26	20.99	2.57
	Ave.	775.04	308.35	39.65	453.88	58.75	12.80	1.60

Note : Market size – 10 tails/kg

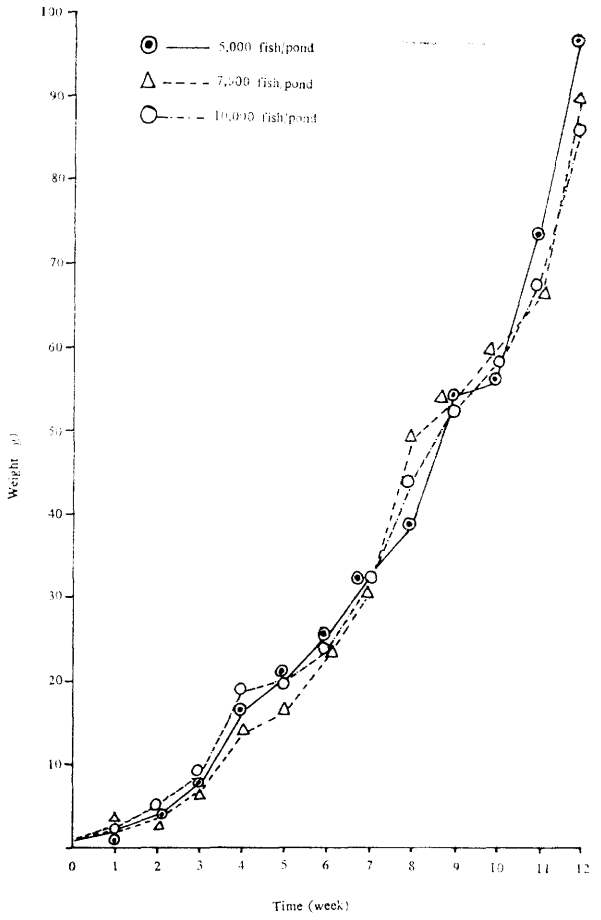


Figure 3 Average weight of Pla Duk Dan stocked at various levels in 15-m^3 circular concrete ponds with water recirculating system for 12 weeks.

Table 3 Average survival, weight gain, feed consumed and feed conversion of *Clarias batrachus* stocked at various levels for 12 weeks.

Stocking level tail/pond	Pond No.	Survival tail	Survival %	Weight gain (kg)	Feed consumed (kg)	Feed conversion
5,000	A_1	3,806	76.12	371.91	508.73	1.37
	B_1	4,147	82.94	387.07	554.65	1.46
	Ave.	3,976.5	79.53	379.49	531.69	1.40
7,500	A_2	6,980	93.07	592.33	843.96	1.42
	B_2	6,679	89.05	607.30	945.11	1.56
	Ave.	6,829.5	91.06	599.82	894.54	1.49
10,000	A_3	9,205	92.05	723.47	847.36	1.17
	B_3	8,940	89.40	806.60	1,054.38	1.36
	Ave.	9,072.5	90.73	765.04	950.87	1.27

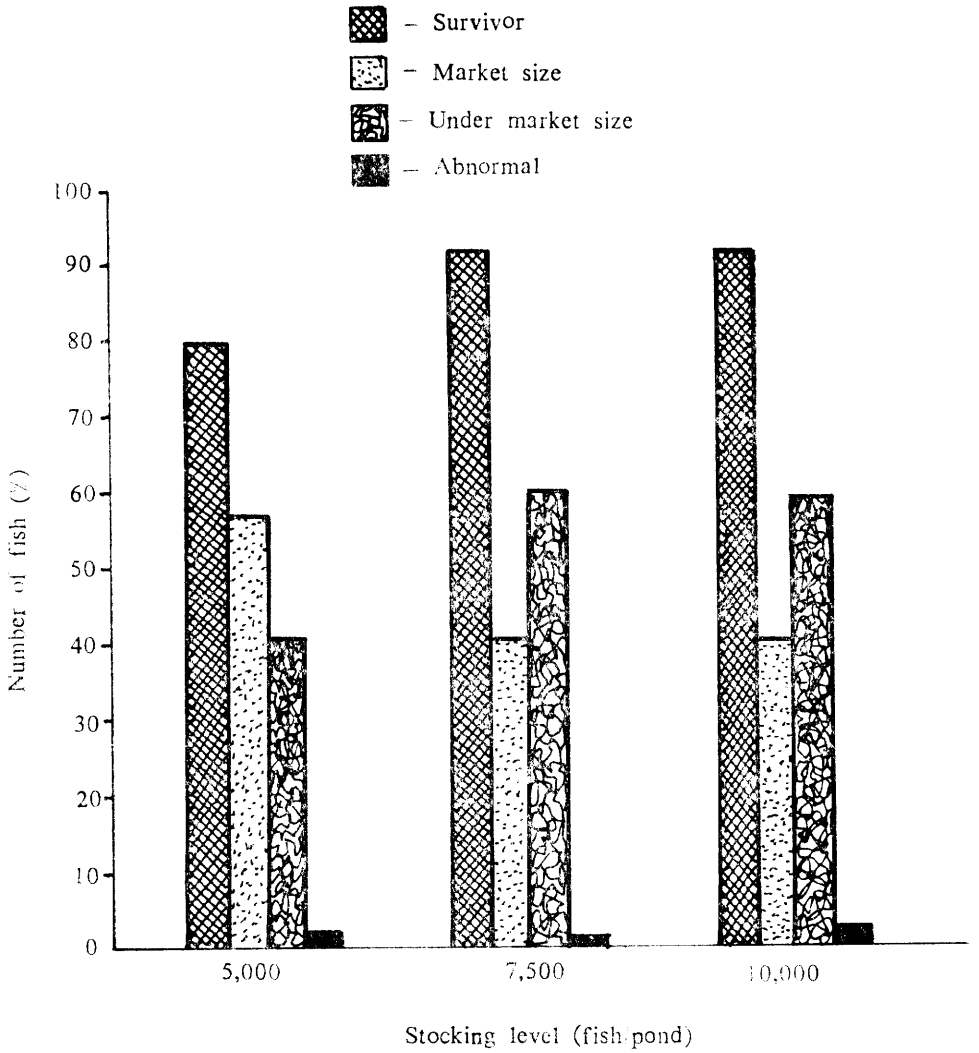


Figure 4 Number of fish as determined by average percentages of survivor, market size, under market size and abnormal from rearing Pla Duk Dan in 15–m^3 circular concrete ponds at different stocking levels for 12 weeks

Table 4 Estimated cost and income resulting from a 90-day rearing period for *Clarias batrachus* stocked at different levels in circular concrete ponds with water recirculating system

Item	Stocking levels		
	5,000	7,500	10,000
Fixed costs (depreciation)*			
Concrete ponds (baht)	500.00	500.00	500.00
Submersible pump (baht)	100.00	100.00	100.00
Containers (baht)	30.41	30.41	30.41
Variable costs			
Fish fry (0.15 baht/tail)	1,500.00	2,250.00	3,000.00
Feed (8 baht/kg)	8,507.04	14,312.56	15,213.92
Chemical & drugs	233.33	233.33	233.33
Electricity (baht)	510.35	510.35	510.35
Labour (baht)	1,830.00	1,830.00	1,830.00
Total cost (baht)	13,211.13	19,766.65	21,418.01
Income (baht)**	19,074.50	30,365.75	38,751.75
Economic returns (%)	44.38	53.62	80.93

* Based on life span : ponds, 10 years; pump, 3 years; containers, 3 years.

** 25 baht/kg basis and assumed that all fish can be sold.

Table 5 The feasibility for small scale culture of *Clarias batrachus* in circular concrete ponds (19.6 sq.m., $15m^3$) with water recirculating system, estimation made is based on actual data acquired at the experiment (Pond A_3, B_3) shown in Table 2

Item	Year 1			
	1 unit (2 ponds)			
	Cycle 1	Cycle 2	Cycle 3	Cycle 4
Fixed Costs (depreciation)[1]				
concrete ponds (baht)	500.00	500.00	500.00	500.00
submersible pump (baht)	300.00	300.00	300.00	300.00
fish containers (baht)	75.00	75.00	75.00	75.00
feed containers (baht)	10.83	10.83	10.83	10.83
opportunity cost (15% = baht)[2]	4,030.69	4,030.69	4,030.69	4,030.69
Variable Costs				
labour-daily (baht)[3]	5,490.00	5,490.00	5,490.00	5,490.00
labour-harvesting (baht)[3]	122.00	122.00	122.00	122.00
fish fry (baht)[4]	4,000.00	4,000.00	4,000.00	4,000.00
feed (baht)[5]	15,213.92	15,213.92	15,213.92	15,213.92
chemicals and drugs (baht)	933.33	933.33	933.33	933.33
power cost for pumping (baht)	1,531.05	1,531.05	1,531.05	1,531.05
maintenance	–	–	–	–
Total Costs (baht)	32,206.82	32,206.82	32,206.82	32,206.82
Income (less 10% = baht)[6]	31,388.91	31,388.91	31,388.91	31,388.91
Returns to management (net income-baht)	-817.91	-817.91	-817.91	-817.91

Notes :

1. Depreciation schedule of 10 years for pond, 3 years for submersible pump, fish and feed containers. Straight-line depreciation used
2. includes interest on investment and interest on working capital
3. 61 baht/day
4. 20 baht/100 tails
5. 8 baht/kg
6. selling price : 25 baht/kg basis

Table 5 (cont.)

Item	Year 1					
	2 units, 4 cycles	3 units, 4 cycles	4 units, 4 cycles	5 units, 4 cycles	6 units, 4 cycles	7 units, 4 cycles
Fixed Costs (depreciation)[1]						
concrete pond (baht)	4,000.00	6,000.00	8,000.00	10,000.00	12,000.00	14,000.00
submersible pump (baht)	1,200.00	1,200.00	1,200.00	1,200.00	2,400.00	2,400.00
fish containers (baht)	300.00	300.00	300.00	300.00	300.00	300.00
feed containers (baht)	86.66	130.00	173.33	216.66	216.66	216.66
opportunity cost (15% = baht)[2]	29,286.45	42,855.30	54,216.30	66,559.65	80,076.15	92,494.05
Variable Costs						
labour-daily (baht)[3]	21,960.00	21,960.00	21,960.00	21,960.00	21,960.00	21,960.00
labour-harvesting (baht)[3]	244.00	366.00	488.00	610.00	732.00	854.00
fish fry (baht)[4]	32,000.00	48,000.00	64,000.00	80,000.00	96,000.00	112,000.00
feed (baht)[5]	121,711.36	182,567.04	243,422.72	304,278.40	365,134.08	425,989.76
chemicals and drugs (baht)	7,466.64	11,199.96	14,933.28	18,666.66	22,399.92	26,133.24
power cost for pumping (baht)	6,124.20	6,124.20	6,124.20	6,124.20	12,248.40	12,248.40
maintenance	–	–	–	–	–	–
Total Costs (baht)	224,379.31	320,702.50	414,817.83	509,915.57	613,467.21	708,596.11
Income (less 10% = baht)[6]	279,012.60	409,518.90	558,025.20	697,531.50	837,037.80	976,544.10
Returns to management (net income-baht)	54,633.29	88,816.40	143,207.37	187,615.93	223,570.59	267,947.99

Notes :

1. Depreciation schedule of 10 years for ponds, 3 years for submersible pump, fish and feed containers. Straight-line depreciation used
2. includes interest on investment and interest on working capital
3. 61 baht/day
4. 20 baht/100 tails
5. 8 baht/kg
6. selling price : 25 baht/kg basis

Table 5 (cont.)

Item	Year 1			Year 2	Year 3
	8 units, 4 cycles	9 units, 4 cycles	10 units, 4 cycles	10 units, 4 cycles	10 units, 4 cycles
Fixed Cost (depreciation)[1]					
concrete ponds (baht)	16,000.00	18,000.00	20,000.00	20,000.00	20,000.00
submersible pump (baht)	2,400.00	2,400.00	2,400 00	2,400.00	2,400.00
fish containers (baht)	300.00	300.00	300.00	300.00	300.00
feed containers (baht)	216.66	216.66	216.66	216.66	216.66
opportunity cost (15% = baht)[2]	104,911.95	117,329.85	131,394.75	131,394.75	131,394.75
Variable Costs					
labour-daily (baht)[3]	21,960.00	21,960.00	21,960.00	22,800.00	24,000.00
labour-harvesting (baht)[3]	976.00	1,098.00	1,220.00	1,220.00	1,220.00
fish fry (baht)[4]	128,000.00	144,000.00	160,000.00	160,000.00	160,000.00
feed (baht)[5]	486,845.44	547,701.12	608,556.80	608,556.80	608,556.80
chemicals and drugs (baht)	29,866.56	33,599.88	37,333.20	37,333.20	37,333.20
power cost for pumping (baht)	12,248.40	12,248.40	12,248.40	12,248.40	12,248.40
maintenance	–	–	–	–	10,000.00
Total Costs (baht)	803,725.01	898,853.91	995,629.81	996,469.81	1,007,669.81
Income (less 10 % = baht)[6]	1,116,050.40	1,255,556.70	1,395,063.00	1,395,063.00	1,395,063.00
Returns to management (net income-baht)	312,325.39	356,702.79	399,433.19	398,593.19	387,393.19

Notes :

1. Depreciation schedule of 10 years for ponds, 3 years for submersible pump, fish and feed containers. Straight-Line depreciation used
2. includes interest on investment and interest on working capital
3. 61 baht/day
4. 20 baht/100 tails
5. 8 baht/kg
6. selling price : 25 baht/kg basis

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