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COST AND RETURN STUDY AFFECTING YEAST SUPPLEMENT (SACCHAROMYCES CEREVISIAE) PURCHASE DECISION UNDER TRANSPORTATION STRESS OF TILAPIA FROM AMONG FARMERS WHO RAISED TILAPIA IN MAHARAKHAM PROVINCE

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Abstract

The study investigated costs and returns affecting the decision to purchase Saccharomyces cerevisiae yeast supplements under the stress of tilapia during transportation among farmers in Mahasarakham. Data were collected through interviews with 150 tilapia farmers in Mahasarakham and secondary sources to calculate tilapia farming costs.

Most farmers raised tilapia in 3x3x3-meter earthen ponds. The density rate was three fish/sq.m., a survival rate 70 percent, and average yield 1,775 kg/rai. The average sale price was 55 baht/kg, the average farming time was five months, the costs ranged from 54.92 to 49.41 baht/kg. The variable costs ranged from 94.60 to 93.43 percent and fixed costs 5.40 to 6.57 percent. The average returns ranged from 3.08 to 5.59 baht/kg.

This study revealed that S. cerevisiae yeast supplement of 20 g/kg had the highest survival rate. This experiment proved that yeast supplements of 20 g/kg contributed to the highest survival rate. The findings can help farmers make the decision to purchase Saccharomyces cerevisiae yeast supplements to improve tilapia health under stress from transportation and assess the costs and returns because economic production costs are defined differently from general costs or accounting costs.

Keywords: costs, returns, the decision to purchase, yeast supplement

1. INTRODUCTION

Tilapia is an important economic aquatic animal in Thailand and other countries around the world such as China, Indonesia, Egypt, the Philippines and Israel, etc. It is the first most freshwater aquaculture in Thailand in the past five years.

In 2022, there was a production volume of 189,254 tons per year, worth approximately 9,700 million baht per year, and more than 300,000 farmers were involved in this business. Most of the tilapia produced is used for domestic consumption (Keawalin, 2018). Although the export of tilapia is small, it can be said that Thai tilapia production can meet the needs of both domestic and international markets well. The population in the country increases the demand for tilapia consumption, resulting in the tendency of raising this type of fish as well. The central region raises tilapia the most because it is a region that is flat and has many rivers flowing through. In 2022, the total production was 81,691 tons, followed by Northeast with a total production of 62,241 tons because it is a predominantly flat region, and many rivers are flowing through it.

Tilapia farming is widely popular in the Northeast. The Northeastern region has the largest farming area, but the productivity is less than other sectors. This may be caused by limitations and problems in aquaculture such as the high cost of aquaculture feed due to longer transportation distances than other regions (Office of Agricultural Economics and the Working Group on Fisheries Data Quality Improvement, Ministry of Agriculture and Cooperatives, 2018). Another problem found in the northeastern region is saline soil. More than 11,506,882 rai of saline land is affected by salt (Land Development Department, 2006). The salinity of fish farming water in the saline area may affect the stress of fish, which leads to a decrease in productivity. Suresh and Lin (1992) stated that most tilapia raised in high-salinity waters have disease problems that are related to the stress that occurs. The purpose of this survey was to know the situation of tilapia farming, costs, and rearing returns by surveying commercial tilapia farming in cages and earthen ponds and a survey of the market price of tilapia in Sakon Nakhon Province. The study results provided updated information for production planning as well as finding solutions to problems that arise with tilapia farmers in Mahasarakham Province.

Therefore, it is necessary to study the costs and returns of investment in tilapia farming by adding yeast Saccharomyces cerevisiae in food to promote health within stress, product analysis, costs, and returns of investment per commercial tilapia farming in Mahasarakham Province. In addition, it is necessary to study the effects of Saccharomyces cerevisiae yeast supplement in feeding to promote health within different levels of stress on the growth, and survival rate of tilapia, and the effect of S. cerevisiae yeast supplement in feeding to promote the health of stress indicators of tilapia during transportation (Ref). It will be important information to apply in the promotion and development, that is, to bring the knowledge gained from the present study to reflect the cost-effectiveness of investment that affects production during tilapia farming. This helps me decide to purchase S. cerevisiae yeast supplement to promote tilapia health under the stress of transportation and for those who are interested in raising tilapia as a career for a career change. It can modify farming patterns by supplementing with the yeast of S. cerevisiae to promote tilapia health under transport stress. This generates income and stability in the occupation of tilapia farmers. Government agencies and private sectors can use the information to consider solving problems and making recommendations for planning and policy for the development and promotion of tilapia production both in terms of quantity and the quality of tilapia production, tilapia products from tilapia farming using the S. cerevisiae yeast supplement to promote tilapia health under the stress of transportation to compete in the

provincial, regional, national and global markets. Government agencies and private sectors can use the information to consider under the stress of transportation to compete in the provincial, regional, national and global markets. The production and marketing potential compete under the environmental, social, and economic conditions of Mahasarakham Province that change according to the trend of the demand for tilapia in the region of the country and the world continues to increase at present.

2. OBJECTIVES

1. To study the costs and returns affecting the decision to purchase the Saccharomyces cerevisiae yeast supplement under the stress of tilapia during transportation among tilapia farmers in Mahasarakham Province.

2. To study the general condition of farmers, conditions of tilapia farming, production management and marketing of tilapia, and problems and obstacles of tilapia farmers.

3. To study the effects of the Saccharomyces cerevisiae yeast supplement in different feeds on growth, the survival rate of tilapia, and the effect of the Saccharomyces cerevisiae yeast supplement on indicators of stress during transportation.

3. LITERATURE REVIEW

3.1 Costs and returns for purchase decision of the Saccharomyces cerevisiae yeast supplement to promote tilapia health under stress during transportation

The current situations have rapid changes in the natural environment and the man-made environment, such as flooding, drought, wastewater, fish disease epidemics, water management of dams, and agricultural chemical residues in water sources. There are also economic and social changes, such as higher petrol prices, higher prices of fish feed, lack of academic principles, and lack of fish farming labor. The instability of aquatic animal prices has, directly and indirectly, affected tilapia farming in Mahasarakham Province, namely unstable production, increased production costs, and unstable production prices. As a result, farmers receive returns that are not worth the investment or receive fewer returns from tilapia farming. Therefore, there is a risk of investment resulting in farmers in the area and it cannot upgrade the occupation of tilapia farming to connect with the market effectively, so the occupation of tilapia farming is not sustainable. One way to solve this problem is to use current costs and returns data of tilapia farming investment in the area and current factors affecting productivity, costs of production, and production returns to manage tilapia farming. However, Mahasarakham Province still did not have data on production costs, production costs, returns of tilapia farming, and production costs of the Saccharomyces cerevisiae Yeast Supplement to promote tilapia health under stress during transportation. Explaining the reasons for production costs and returns must use general condition information of farmers, conditions of raising tilapia, conditions of management, production, marketing of tilapia, and current problems and obstacles of tilapia farmers to management for efficiently and effectively raising tilapia and to develop and promote tilapia farming in suitable areas for commercial tilapia farming in Mahasarakham Province. Therefore, a study ofcosts and returns of investment in tilapia farming and the general conditions of farmers, conditions of raising tilapia, conditions of production management, marketing of tilapia, and current problems and obstacles of tilapia farmers for commercial tilapia farming must be studied.

From the study of the cost structure of fish farming, most of the cost structure and returns were studied consisting of fixed costs such as the depreciation of cage, the depreciation of equipment, opportunity cost of fixed investment, and variable costs such as fish breed, fish feed cost, vitamin cost, medicine cost, household labor cost, the cost of catching fish, cage repair cost, and the opportunity cost of a variable investment. In this cost structure, it found that the highest costs of fish farming were fish feed costs followed by the cost of fish breeding. Suparat Chatjareyaves (2001) studied “Cost and return on investment of hormone sex-reversal male tilapia culture in the cage in Mun River, Ubon Ratchathani Province”, 30 cases. It found that the average cost of raising was 1,157.75 baht/ m3 or 26.42 baht/kg. There were 97.4% fixed costs and 2.6% variable costs. The value of fish feed 76.3 % was the most important cost, and the net profit and the return on investment were 376.83 baht/ m3 or 8.58 baht/kg and 40% respectively. Moreover, Kewalin Nooritthi (2013) studied “tilapia farming in cages in Ubon Ratchathani province in 2013 of a group of tilapia farmers in Mun River cages, Warin Chamrap district, Ubon Ratchathani, in Ban Tha Lad Fish Krachan Community Enterprise Group. There are two cage sizes, 3 x 6 x 2.5 meters and 2.5 x 5.5 x 2.5 meters. It showed that the cost of fish farming was 52,755.23baht/cage/generation. The majority of fish feed costs accounted for 76.85 %, followed by fish breeding at 11.37 %, and the other at 11.78 % as the cost per kilogram at 55.83 baht. This is consistent with the research of Chonlada Chalomklang (2009) who studied “A modeling of production cost in the agricultural industry: a case study of management developing project in pig sector of Maejo University”. In-depth interviews were used for data collection with the Director of the project management developing project in the pig sector and administrative staff which is responsible for an accounting system and calculating production costs from formulas from raising pigs to becoming breeders. It showed that the total cost was 5,620.08 baht per breeder, consisting of food costs, and the cost of labor used in raising pigs. Pannipa Rodwanna (2007) studied “the cost analysis in raw milk production of dairy cooperatives in Thailand.” Such costs are classified according to cost behavior, i.e., they are classified into variable costs and fixed costs where the average cost per rai is allocated using the amount of rai as the basis for allocating expenses. From the review of concepts, theories, documents, and related research to create a research conceptual framework as follows:

Hypothesis 1: Costs and returns affecting the decision to purchase the Saccharomyces cerevisiae Yeast Supplement to promote tilapia health under stress during transportation

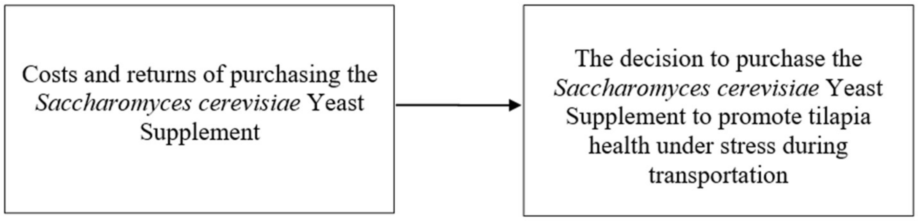

Figure 1 The Conceptual Framework of the First Hypothesis 1

3.2 The Saccharomyces cerevisiae Yeast Supplement promotes tilapia health under stress during transportation

Probiotics are widely used in animal feed which includes the fishing industry (Newaj-Fyzul et al., 2014). Past research has shown that using probiotic-fortified foods can help reduce disease outbreaks in aquatic animals by stimulating the immune system (Kim et al., 2003;Wang and Gu, 2010).

Yeast Saccharomyces cerevisiae is one of the probiotics added to a fish feed that can support the growth and utilization of feed which is increasingly used in Catla Carp (Mohanty et al., 1996), Mrigal Carp (Swain et al., 1996), striped bass hybrid fish (Li and Gatlin, 2003), Japanese flounder (Taoka et al., 2006), Israeli Carp (Noh et al., 1994), and in tilapia (Lara- Flores et al., 2003). The right proportion to supplement feed with yeast can help fish to use more efficiently as reported by Mazurkiewicz et al. (2005), revealed that the yeast supplementation (Saccharomyces cerevisiae) at 0.1% per 1 kg. of feed can increase the feed efficiency, weight growth, and good FCR in common carp (Cyprinus Carpio L.) were the most suitable. This was consistent with the report of Kornthip et al. that supplementation by Brewer's Yeast at 0.1% was found to have good growth suitable for tilapia farming, but supplementation at 0.5% will help in better immune system function, especially regarding phagocytosis activity in tilapia (Kornthip et al. 2011) and gilthead seabream (Sparur aurata L.) (Ortuño et al., 2002). In addition, supplementing fish with yeast at 0.1% per 1 kg. of feed will improve blood biochemistry and can also prevent the development of Aeromonas hydrophila in tilapia. However, the survival rate was highest in the yeast supplement group at 0.5% (Abdel-Tawwab et al., 2008). According to the report, the use of microorganisms is an alternative to the use of antibiotics to prevent infectious diseases in aquatic animals in the future. In addition, Pdp11 probiotic compounds have been shown to reduce density stress by observing lower levels of cortisol in gilt-head bream fish (S. auratus) and also resulting in lower levels of glycogen and triglycerides (Varela et al., 2010). From reviewing concepts, theories, documents, and related research to create a research conceptual framework as follows:

Hypothesis 2: Saccharomyces cerevisiae yeast supplement in different levels on growth, the survival rate of tilapia, and effects S. cerevisiae yeast supplement, effect on indicators of stress during transportation

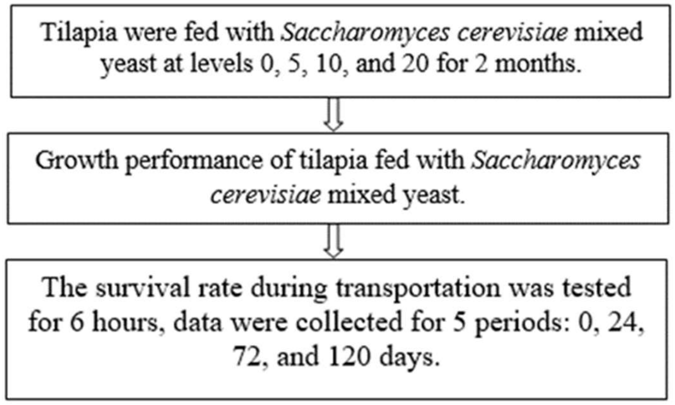

Figure 2. The Conceptual Framework of the Second Hypothesis

4. RESEARCH METHODS

4.1 Population

The study area can be selected, which is an area suitable for aquaculture. Then, population boundaries were determined, consisting of 50 aquaculture farmers in Ban Yang Noi, 50 in Ban Hua Chang, and 50 in Ban Hae Tai, totaling 150 population and samples in Kosum Phisai District, Mahasarakham Province.

4.2 Data collection

Data was collected using a questionnaire with a questionnaire consisting of both open-ended questions and closed-ended questions, and interviews with fish farmers in earthen ponds in Mahasarakham Province. It found that 150 farmers raised tilapia in commercial earthen ponds. Therefore, 150 farmers were interviewed. The areas where data were collected were Ban Yang Noi, Ban Hua Chang, and Ban Hae Tai. In addition, data on tilapia prices were collected in the local market in Mahasarakham Province.

4.3 Research Tools

1. Analysis of costs and returns

Fixed costs consist of the depreciation of earthen pons and equipment per production cycle, the equipment used to account for the cost is regular equipment of Farmer's Farm. Variable Cost consists of seedlings, food, supplementation vitamin, fish medicines, fuel cost, productivity, and labor costs.

2. Data analysis

Data were analyzed according to statistical principles by using Descriptive Statistics, i.e., %age and mean used to describe the characteristics of the studied sample.

3. Experimental method

3.1 Two-month-old tilapia and experimental animals were placed in a fiberglass tank with a water capacity of 1000 liters for 14 days before the start of the experiment to adjust the environment. A total of 360 tilapia were randomly fed 32 % protein pellets until they were full twice a day at 9:00 a.m. and 4:00 p.m. Completely randomized design (CRD) experimental planning to study the effects of tilapia farming in the prescribed recipes by raising fish at 5 % of body weight per day, given twice a day at 9:00 and 16:00, over a period of 2 months.

3.2 Method of food preparation: Commercial pellet feed for tilapia farming was prepared at 32 % protein by modifying the method from Kornthip et al. (2011) by mixing it with yeast, Saccharomyces cerevisiae, at levels of 0, 5, 10, and 20 g. were applied to 1 kg. of fish feed. Then mixed with guar gum to form a paste at 200 g. per kg. of feed and then sprinkled the distilled water over the pellets and mixed well, and coating food pellets with 4% agar powder (Panase, 2018) that improved adhesion to the yeast and the pellets. After that, they were dried in the shade for 1-2 days. Store the feed in a sealed container and stored at 4 °C.

3.3 To study the immune system and survival rate after testing the stress of tilapia during transportation. At the end of the 2-month experiment, each group of tilapias was randomly assigned to stress test by transport for a period of 6 hours, then the biochemical feces of the blood were collected. One random sampling from all experimental groups fainted with 60 ppm clove oil.

4. Analysis of growth rate and survival rate

Before and after the experiment, tilapia was weighed and recorded the amount of food consumed for a period of 10 weeks for using the data to calculate the growth rate, i.e., weight gain %age, specific growth rate, change, meat rate, and survival rate of tilapia.

5. RESEARCH RESULTS

1. General information on commercial tilapia farmers in Mahasarakham Province

The tilapia farmers in the tilapia ponds found that most of them were male and female. Most of them were 41-50 years old and over 50 years old. Income for tilapia farmers was 40,001 – 50,000 baht, and 30,001 – 40,000 baht. They have marital status. Education level is below bachelor’s degree. Their occupations are farmers raising animals, and farmers raising animals and growing crops.

2. Farmers’ decision to purchase tilapia feed: In terms of problem perception, the farmers purchased tilapia feed because it requires convenience and time saving on feeding tilapia; choosing to buy tilapia feed for a business; buying tilapia feed because it matches the needs of the type of tilapia that you raise; buying tilapia feed because it is more convenient than using self-mixed tilapia feed; and buying tilapia feed because the farmer’s tilapia feed has run out. There was finding information from various advertising media such as radio, billboards, flyers, or television. In terms of alternative assessment, it showed that tilapia farmers chose to buy tilapia feed by considering the comparative price of various shops, marketing promotion of tilapia feed plays an important role in their purchasing decision. Choosing to buy tilapia feed by considering quality mark; Choosing fish feed by considering the price that is suitable for the quality and brand of fish feed plays an important role in their purchase decision.

3. General conditions of farmers, conditions of raising tilapia, conditions of production management, marketing of tilapia, and problems and obstacles of tilapia farmers in suitable areas for raising commercial tilapia in Mahasarakham Province

All farmers raise tilapia in earthen ponds with other types of fish (polyculture) is a type of farming according to the management style. It is mainly fed with ready-made food and other complementary foods. When considering the type of farming according to the feeding style, it is a semi-intensive culture commercially (Panu et al., 1996) to sell mainly the produce. Farmers raise fish on a mixed basis because they want to produce a variety of fish species, of which 60.38 % catch fish production gradually to take advantage of selling, consumption, and distribution rather than taking advantage of distribution alone. It indicates that tilapia farming in the earthen ponds of farmers does not have market incentives that will lead to a single type of tilapia farming that will be able to sell large quantities of tilapia production at a time.

All private farmers are male and female, 41 to 60 years old, in late adulthood (Roongarun, 2009). There are learning restrictions due to advancing age and completion of the highest early primary level. However, with 5 to 20 years of experience in raising fish in earthen ponds, 56.60 % of them used knowledge from their previous experience to raise fish in earthen ponds as part of the result that the farming was not academically correct. 82.36% of fish farming in earthen ponds is a secondary occupation to increase family income. Therefore, although 88.68% of farmers are members of the financial groups, namely, savings members of the village and the Bank for Agriculture and Cooperatives, not all farmers borrowed money from the sources of funds to raise tilapia in the earthen ponds.

Farmers raise fish in a pond of 1.07 rai, a farm with a small area of 1 to 10 rai (Aphisit, 1989). 41.50 % of the pond used for fish farming were not intended for direct fish farming in the first place, causing an effect on decrease in the efficiency of fish production. This will cause the fish to have a low survival rate and slow growth; therefore, production and returns are low.

Farmers spent an average of 13.53 months (13 months 16 days) raising fish, with 25.20 % raising more than 12 months. Feeding all three types of food: ready-made food, natural food, and supplementary food, only 15.31 %, which is a small amount resulting in slow fish growth and requires a long-time rearing period to produce 300 to 500 grams of tilapia per fish as required by the market. This will result in increased costs and could not plan to sell during periods of high fish prices resulting in low returns. However, a minority of 20.75% released fish more than the appropriate rate, i.e., 8,001 to 22,400 fish per rai, which could affect higher breeding costs.

In production management of tilapia and other fish species, 85.63 % of the farmers plan to catch them gradually, and 61.23 % of those who used fish for consumption, distribution, and sale when the fish grew unevenly in size and yield less, not worth for a single catch. The farmer catches the fish themselves and sold around the mouth of the pond with retailers, or sold them at the market by the farmer setting the selling prices by themselves. 33.52% of the one-time catches were used for those who used fish for sale.

4. Analysis of productivity, cost, and return on investment during tilapia farming in earthen ponds

Farmers raise tilapia in earthen ponds in a commercial way mainly for the sale of produce. The average price of tilapia was 0.85 baht per fish. The average rearing period was 13.53 months (or 13 months and 16 days). The size of tilapia that the market demanded was 300 to 500 grams per fish. The survival rate was 33.63% and 38.78 baht per kg. The break-even is 33.16 baht per kilogram.

The data obtained in this study revealed that tilapia farming in earthen ponds had the same significant costs, namely, fish feed and fish breeding costs. There is a significant proportion of costs (fish feed and fish breeding) at 93.31 %, which is higher than tilapia farming in earthen ponds with significant costs (fish feed, fish breeding, and household labor costs) at 83.8 %. Therefore, to successfully engage in tilapia farming in these two farming facilities, management to reduce significant costs is necessary to create opportunities for farmers to have high returns worth farming, but raising tilapia in earthen ponds requires higher significant costs.

5. The Saccharomyces cerevisiae Yeast Supplement in various levels on growth, the survival rate of tilapia fish, and the effect of Saccharomyces cerevisiae Yeast Supplement on indicators of stress during transportation

5.1 Growth of tilapia fed with S. cerevisiae yeast supplement for 90 days is shown in Table 1. It showed that tilapia groups fed S. cerevisiae yeast supplement at 20 and 10 g/ kg diet were shown in Table 1:

Table 1. Growth results of tilapia fed with Saccharomyces cerevisiae mixed yeast

Parameters	T1 (control)	T2 (5.0 g kg^{-1} diet)	T3 (10.0 g kg^{-1} diet)	T4 (20.0 g kg^{-1} diet)
Initial body weight (IBW; g)	5.64±0.53	5.44±0.42	5.68±0.36	5.63±0.61
Initial length (IL; cm)	5.46±0.44	5.10±0.18	5.13±0.13	5.27±0.08
Final body weight (FBW; g)	56.54±2.79^{ab}	53.90±1.00^{b}	60.03±1.60^{a}	63.45±4.22^{a}
Final length (FL; cm)	9.41±0.72	10.50±1.11	9.49±0.85	10.53±0.58
Weight gain (WG; g)	50.89±2.69^{bc}	48.46±1.39^{c}	54.34±1.70^{ab}	57.82±4.06^{a}
Length gain (LG; cm)	3.95±0.43	5.40±1.25	4.36±0.79	5.25±0.63
Average daily growth gain (ADG; g day^{-1})	0.56±0.02^{bc}	0.53±0.01^{c}	0.60±0.01^{ab}	0.64±0.04^{a}
Specific growth rate; SGR (% day^{-1})	2.56±0.10	2.54±0.10	2.61±0.08	2.69±0.12
Feed conversion ratio; (FCR)	2.08±0.24^{b}	1.67±0.06^{a}	1.87±0.18^{ab}	1.68±0.11^{a}
Survival rate (%)	84.43±1.96	82.23±6.92	88.90±3.81	85.53±6.92

Data are given as mean ± SD. The mean values in the same row with different superscripts are significant differences ($p<0.05$).

Table 1 revealed that the tilapia group fed with S. cerevisiae yeast supplement at 20 and 10 g/ kg showed the final best weight values (FBW) of 63.45±4.22 and 60.03±1.60 g, which were higher than the S cerevisiae supplemented group at 5 g/ kg diet and the control group (P<0.05) had a weight gain of 53.90 ± 1.00 and 56.54 ± 2.79 g, respectively. The weight gain (WG) showed that the yeast-supplemented 20 g/ kg diet group had the highest weight gain of 57.82 ±4.06 g/kg diet compared to the 5 g/kg diet and control groups at statistically significant (P<0.05), with values of 48.46±1.39 and 50.89±2.69 grams, respectively. The daily growth rate (ADG) value showed that the tilapia group received S. cerevisiae yeast supplement at 20 and 10 g/ kg was found to be ADG of 0.640±0.04 and 0.60±0.01 g/day, respectively, higher than the S. cerevisiae yeast-supplemented group at 5 g/kg diet and the control group (P>0.05) of 0.53±0.01 and 0.56±0.02 g/da at statistically significant differences (P<0.05). In addition, the supplemented fish group in all experimental groups (20 and 5 g/kg) was lower than the 10 g/kg diet supplemented and control groups at statistically significant (P<0.05), with the same FCR values, 1.68±0.11, 1.67±0.06, 1.87±0.18, and 2.08±0.24, respectively. However, there was no statistical difference between all sets of the experiments on length gain (LG), specific growth rate (SGR), and survival rate were shown in Table 2. Moreover, the effect of water quality during tilapia farming with S. cerevisiae yeast supplement in fiberglass tanks over a period of 90 days with various parameters including temperature, dissolved oxygen, pH, and total ammonia values of all experimental groups had mean values of 23±1.80 °C, 6.15±1.3 mg/L, 7.15±1.53 and total ammonia values were 1.10±1.02 mg/L.

5.2 From the survival test after 6 hours of transport

A 90-day experiment was conducted on tilapia farming with an S. cerevisiae yeast supplement. Four tilapia groups were the control group and the tilapia group fed with S. cerevisiae yeast supplement at 5, 10and 20 g/kg diet, respectively. The survival rate after 6 hours transportation stress of the fish was displayed in Table 2.

Table 2. The survival rate of tilapia fed with Saccharomyces cerevisiae yeast supplement during transportation for a period of 6 hours.

Time	Treatments			
	T1 (control)	**T2 (5.0 g kg^{-1} diet)**	**T3 (10.0 g kg^{-1} diet)**	**T4 (20.0 g kg^{-1} diet)**
0 h after transportation	100.00±0.00^{a,A}	100.00±0.00^{a,A}	100.00±0.00^{a,A}	100.00±0.00^{a,A}
24 h after transportation	76.66±5.77^{a,B}	73.33±11.54^{a,B}	83.33±5.77^{a,B}	83.33±5.77^{a,B}
72 h after transportation	66.66±5.77$^{b, C}$	70.00±10.00^{ab,B}	80.00±10.00^{a,B}	83.33±5.77^{a,B}
120 h after transportation	66.66±5.77^{b,C}	70.00±10.00^{ab,B}	80.00±10.00^{ab,B}	83.33±5.77^{a,B}
Mean	77.50±15.73	78.33±14.53	85.83±9.57	87.49±8.33

Data are presented as mean ± SD. Different lowercase letters indicate significant differences between groups at the same time (p<0.05). Uppercase letters indicate significant differences over time for the same group (p<0.05).

The results showed that the survival rate of all four experimental groups was 100 %, which was not statistically different hour after transportation. However, all the experimental fish batches started to die 24 hours after transportation. The survival rates values were 76.66±5.77, 73.33±11.54, 83.33±5.77 and 83.33±5.77 %, respectively, with 72 hours after transportation showing that fish fed with S. cerevisiae 10 and 20 g/kg diet had significant survival rates higher than those of fish fed with T2 and the control group (P< 0.05). After 120 hours, it showed that fish that received the T4 group had the highest survival rate of 83.33± 5.77%, which was higher than the control group (66.66±5.77%).

6. CONCLUSION

For tilapia farming in earthen ponds, farmers raise tilapia in earthen ponds by investing with their budget, all of them have the characteristics of free-fed farming with other fish species (polyculture) in the earthen ponds. According to management characteristics, they were fed with ready-made food and other supplementary foods and produced mainly natural food, classified as a semi-developed culture under the feeding style.

Farmers usually release tilapia and other fish of size 2 to 3 centimeters. The average price of tilapia is 0.72 baht per fish, and the average total fish is 1.82 baht per fish, with an average stocking rate of 100,000 tilapia per rai. The farming period is 3 months, tilapia of the size required by the market was 300 to 500 grams per individual, with a total survival rate of 35.21%, tilapia yield of 192.49 rai/kg per, and total fish yield of 604.1.3 kg/ rai. The average selling price of tilapia was 38.78 baht/ kg, the total fish was 36.04 baht/ kg, and the break-even price of fish was 33.16 baht/ kg. While the total cost of fish was 20,033.68 baht per rai or 33.16 baht per kilogram, the net profit of fish was 1.737.08 baht per rai or 2.88 baht per kilogram. The average profit of fish was 128.39 baht per month per rai, and the payback period was 11.53 % (11 years 6 months, and 11 days). The major total expenditures on fish were ready-made food (43.10%), fish breeds (20.82%), and household labor costs (19.89%).

Problems and obstacles of farmers in raising fish in earthen ponds, most of them were raw material prices, fish farming water sources, capital sources, production and market prices, fish pests and tilapia diseases, followed by quality and seedling prices, respectively.

7. RECOMMENDATIONS

For tilapia farming in earthen ponds, there are important costs of production, which are 42.11 % of fish feed, 21.22 % of fish breeding, and 17.91 % of household labor. A total of 81.71 % is a high proportion. Therefore, this important cost should be managed to reduce increasing the opportunity to get a higher return in raising tilapia in the earthen ponds as follows:

1) Encourage farmers to reduce the amount of ready-made food used and replace it by increasing the amount of other supplementary foods to increase the supplementary food. This supplementary food should be substituted with a protein content that is sufficient for the growth of fish as well as supplementation food by consistently creating natural food.

2) Encourage farmers to feed fish using low-cost supplementary feed, i.e., fed with rice bran and duckweed, rice bran with pellets, and rice bran with chicken droppings.

3) Encourage farmers to buy fish species to release at an appropriate rate of no more than 8,000 per rai and release them at an appropriate rate according to the potential of the area and the farmers by the nursery in the cage before releasing. This will be able to achieve a higher survival rate, which is a cost-effective use of fish breeding costs, and buy from sources that produce quality fish at low prices, such as production farms or fisheries research and development centers located near breeding grounds.

REFERENCES

Abdel-Tawwab, M., A.M. Abdel-Rahman, N.E.M. Ismael. 2008. Evaluation of commercial live baker's yeast, Saccharomyces cerevisiae as a growth and immunity promoter for fry nile tilapia, Oreochromis niloticus (L.) challenged in situ with Aeromonas hydrophila. Aquaculture. 280: 185-189.

Carnevali, O., L. de Vivo, R. Supizio, G. Gioacchini, I. Olivotto, S. Silvi and A. Cresci. 2006. Growth improvement by probiotic in European sea bass juveniles (Dicentrarchus labrax, L.), with particular attention to IGF-I, myostatin and cortisol gene expression. Aquaculture. 258: 430-438.

Chollada chalomklang. (2009) A modeling of production cost in agricultural industry : a case study of management developing project in pig sector of Maejo University. Faculty Maejo University

Dalmin, G., Kathiresan, K., Purushothaman, A., 2001. Effect of Probiotics on Bacterial Population and Health Status of Shrimp in Culture Pond Ecosystem.

Haroun, E., A. Goda and M. Kabir. 2006. Effect of dietary probiotic biogen supplementation as a growth promoter on growth performance and feed utilization of Nile tilapia Oreochromis niloticus (L.). Aquacult Res. 37(14): 1473-1480.

Kim, D.H. and B. Lara-Flores, M., M.A. Olvera-Novoa, B.E. Guzman-Méndez, W. López-Madrid. 2003. Use of the bacteria Streptococcus faecium and Lactobacillus acidophilus and the yeast Saccharomyces cerevisiae as growth promoters in Nile tilapia (Oreochromis niloticus). Aquaculture. 216: 193-201.

Lara-Flores, M., M.A. Olvera-Novoa, B.E. Guzman-Méndez, W. López-Madrid. 2003. Use of the bacteria Streptococcus faecium and Lactobacillus acidophilus and the yeast Saccharomyces cerevisiae as growth promoters in Nile tilapia (Oreochromis niloticus). Aquaculture. 216: 193-201.

Li, P. and D.M. Galtlin III 2003. Evalution of brewer's yeast (Saccharomyces cerevisiae) as a feed supplement for hybrid striped bass (Morone chrysops x M. saxatilis). Aquaculture.219: 681-692.

Mazurkiewicz, J., A. Przybyl, W. Mroczyk. 2005. Supplementing the feed of common carp (Cyprinus carpio L.) Juveniles with the biosaf probiotic. Arch. Pol. Fish. 13(2): 171-180.

Mohanty, S.N., S.K. Swain and S.D. Tripathi. 1996. Rearing of catla (Catla catla Ham) spawn on formulated diets. J. Aquac. Trop. 11: 253-258.

Mohideen, N.M., A. Kader, T.S. Mohan, S.P. Mohamed and M.I.Z. Hussain. 2010. Effect of probiotic bacteria on the growth rate of fresh water fish, Catla catla. Int. J. boil. Tech. 1(2): 113-117.

Mohapatra, S., T. Chakraborty, A.K. Prusty, P. Das, K. Paniprasad and K.N. Mohanta. 2012. Use of probiotics in the diet of roho, Labeo rohita fingerlings: effects on growth nutrient digestibility, retention digestive enzyme activities and intestinal microflra. Aquacult. Nutr. 18: 1-11.

Newaj-Fyzul, A., Al-Harbi A.H., & Austin, B. (2014). Review: developments in the use of probiotic for disease control in aquaculture. Aquaculture, 431, 1-11.

Noh, S.H., K. Han, T.H. Won, Y.J. Choi. 1994. Effect of antibiotics, enzyme, yeast culture and probiotics on the growth performance of Israeli carp. Korean J. Anim. Sci. 36: 480-48.

Ortuño, J., A. Cuesta., A. Rodríguez, M.A. Esteban, J. Meseguer. 2002. Oral administration of yeast, Saccharomyces cerevisiae, enhances the cellular innate immune response of gilthead seabream (Sparur aurata L.). Vet. Immunol. Immunopathol. 85: 41-50.

Ran, C., L. Huang, J. Hu, P. Tacon, S. He, Z. Li, Y. Wang, Z. Liu, L. Xu, Y. Yang and Z. Zhou. 2016.

Effect of dietary live and heat-inactive baker's yeast on growth, gut health, and disease resistance of Nile tilapia under high rearing density. Fish & Shellfish Immunol. 56: 263-271.

Rollo, A., R. Sulpizio. M. Nardi, S. Silvi, C. Orpianesi, M. Caggiano, A. Cresci, O. Carnevali. 2006. Live microbial feed supplement in aquaculture for improvement of stress tolerance. Fish Physiol. Biochem. 32: 167-177.

Soundarapandian, P., V. Ramanan and G.K. Dinakaran. 2010. Effect of probiotics on the growth and survival of Penaeus monodon (Fabricius). Current Research Journal of Social Sciences. 2(2): 51-57.

Suresh, A.V., and C.K. Lin. 1992. Tilapia culture in saline waters: a review. Aquaculture. 106: 201-226.

Supatra Tangvichien1 and Paweena Kongchan. (2013). A Study of Cost Reduction Techniques for Tilapia Feeding Farm In the Case of Fish Farms in Mahasarakham Province. Burapha Journal of Business Management. (51-61)

Suparat Chutjareyaves. (2001) Cost and return on investment of hormone sex-reversal male tilapia culture in cage in Mun river, Ubon Ratchathani province. (220-227). Bankkok: Kasetsart University

Swain S.K., P.V. Rangacharyulu, S. Sarkar and K.M. Das. 1996. Effect of a probiotic supplement on growth, nutrient utilization and carcass composition in mrigal fry. Aquaculture. 4: 29-35.

Taoka, Y., H. Maeda, J.Y. Jo. 2006. Growth, stress tolerance and non-specific immune respone of Japanese flounder Paralichthys olivaceus to probiotics in a closed recirculating system. Fisheries Sci. 72(2): 310-321.

Varela, J.L., I. Ruiz-Jarabo, L. Vargas-Chacoff, S. Arijo, J.M. León-Rubio, I. García-Millán, M.P. Martín del Río, M.A. Moriñigo, J.M. Mancera. 2010. Dietary administration of probiotic Pdp11 promotes growth and improves stress tolerance to high stocking density in gilthead seabream Sparus auratus.

Aquaculture. 309. 265-271.

Wang, Y.B. and Q. Gu. 2010. Effect of probiotic on white shrimp (Penaeus vannamei) growth performance and immune response. Mar. Biol. Res. 6: 327-332.