PRODUCTION TECHNIQUES AND ENVIRONMENTAL MANAGEMENT IN FROG FARMING IN DONG THAP PROVINCE

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Article history

Received: 10/3/2022; Received in revised form: 20/5/2022.; Accepted: 26/5/2022

Abstract

This study surveyed 40 farmers on their production techniques and environmental management in frog farming in Cao Lanh and Thap Muoi district, Dong Thap province, and the results showed that frogs were cultured in tarpaulin tanks (82.5%), hapas in an earth pond (35%), and earth ponds (2.5%). Most of the farmers (82.5%) had a combination of breeding frogs and production frogs to be self-sufficient froglet. Stocking density is high with 146.3±92.3 individuals/m^2 for production frogs and 51.6±35.7 individuals/m^2 for breeding frogs. The culture duration of froglet was an average of 33.6±8.8 days/crop (9.3±2.4 crops/year) and production frogs was 64.7±9.7 days/crop (5.1±0.6 crops/year). Frogs were raised with a commercial pellet feed of many brands. The diseases occurred in tadpole and froglet phase (2-30 days), including septicemia diseases (57.5%), red thighs (45%), white bodies (35%), blindness (35%), digestive disorders (20%), and flatulence (15%). The disease causes were mainly due to poor water quality, weather change, feed, and high stocking density. However, few farmers had treated farming system (37.5%), supplemental water (27.5%), and monitored and controlled water quality. There were 60% of households to discharge wastewater directly into rivers and canals. Some farmers have used nutrient for wastewater from frogs with combining frog with fish (27.5%), or discharging wastewater into ditches gardens, fields (7.5%), settling pond (5%), which have helped to increase income and protect the environment. Therefore, farmers need to be supported with knowledge of farming technique and environmental management from the local government.

Keywords: *Thai frog (Rana tigerina), farming technique, environmental management.*

DOI: https://doi.org/10.52714/dthu.12.5.2023.1074

Cite: Le, D. K., Dang, T. A. T., & Pham, Q. N. (2023). Production techniques and environmental management in frog farming in Dong Thap province. *Dong Thap University Journal of Science, 12*(5), 71-77. https://doi.org/10.52714/dthu.12.5.2023.1074.

KỸ THUẬT NUÔI VÀ QUẢN LÝ MÔI TRƯỜNG TRONG NUÔI ẾCH Ở TỈNH ĐỒNG THÁP

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Lịch sử bài báo

Ngày nhận: 10/3/2022; Ngày nhận chỉnh sửa: 20/5/2022; Ngày duyệt đăng: 26/5/2022

Tóm tắt

Nghiên cứu về kỹ thuật nuôi và quản lý môi trường trong nuôi ếch được khảo sát trên 40 hộ nông dân ở các huyện Cao Lãnh và Tháp Mười, tỉnh Đồng Tháp, kết quả cho thấy ếch được nuôi trong bể bạt (82,5%), vèo trong ao đất (35%) và ao đất (2,5%). Hầu hết nông hộ (82,5%) đã kết hợp nuôi ếch giống và ếch thịt để tự chủ về con giống. Mật độ nuôi ếch cao với 146,3±92,3 con/m^2 đối với ếch thịt và 51,6±35,7 con/m^2 đối với ếch giống. Thời gian nuôi của ếch con trung bình là 33,6±8,8 ngày/vụ (9,3±2,4 vụ/năm) và ếch thịt là 64,7±9,7 ngày/vụ (5,1±0,6 vụ/năm). Ếch được nuôi bằng thức ăn viên công nghiệp của nhiều thương hiệu. Các bệnh thường xuất hiện ở giai đoạn nòng nọc và ếch con (2-30 ngày) bao gồm bệnh tụ huyết trùng (57,5%), đỏ đùi (45%), thân trắng (35%), mù mắt (35%), rối loạn tiêu hóa (20%), đầy hơi (15%). Nguyên nhân của dịch bệnh chủ yếu do chất lượng nước kém, thời tiết thay đổi, thức ăn và mật độ nuôi cao. Tuy nhiên, rất ít hộ dân xử lý hệ thống nuôi và nước trước khi thả giống (37,5%), xử lý nước bổ sung (27,5%) và giám sát, kiểm soát chất lượng nước. Có đến 60% số hộ xả nước thải trực tiếp ra sông, kênh, rạch. Một số nông dân đã tận dụng chất dinh dưỡng từ nước thải nuôi ếch bằng cách kết hợp nuôi ếch với cá (27,5%), hoặc xả nước thải ra mương vườn, ruộng (7,5%), ao lắng (5%) vừa giúp tăng thu nhập vừa bảo vệ môi trường. Vì vậy, nông dân cần được chính quyền địa phương hỗ trợ kiến thức về kỹ thuật nuôi và quản lý môi trường.

Từ khóa: *Ếch Thái Lan (Rana tigerina), kỹ thuật nuôi, quản lý môi trường.*

1. Introduction

The Mekong Delta is one of the important aquaculture areas in Vietnam. There are not only economic freshwater aquatic species such as striped catfish, basa fish, snakehead, freshwater shrimp, but some farmers also culture eels, frogs, and turtles. Thai Frog (*Rana tigerina*) was experimentally cultured in Nong Lam University and spread over the Mekong Delta (Le, 2012). Frog meat is of low lipid percentage and high quality of proteins and amino acids (Oliveira et al., 2017) and Thai frogs have the ability to grow in 6‰ salinity environment (Nguyễn, 2018). Moreover, the profit by raising Thai frogs is higher than that of Vietnamese frog (*Rana rugulosa*), so this frog has quickly expanded and popular in the Mekong Delta (Lê et al., 2013), especially in Dong Thap and Tien Giang provinces (Le, 2012). In the first 6 months of 2017, the harvested frog production of Dong Thap province was more than 2,600 tons, which increased over 84% that at the same time in 2016 (Dong Thap Aquatic Product Department, 2017). In 2020, the number of frogs stocked was about 60 million individuals/ year, the farming area was about 68 hectares in Thap Muoi district, which increased 03 hectares compared to 2016 (Thap Muoi District People's Committee, 2020). However, the local farming frog is mainly small and self-established, and the raising techniques and environmental management have not been taken enough care. This study was conducted to identify production techniques and environmental management of frog farming in Dong Thap province to have a basis for orientation in the study of effective farming models and for successful and sustainable frog production.

2. Research methods

2.1. Methods of data collection

The study was performed by interviewing farmers culturing the Thai frog in Cao Lanh (17 farms) and Thap Muoi districts (23 farms), Dong Thap province, from December 2020 to May 2021. Data was collected through direct individual questionnaire interviews with personal contact. The questionnaires contained open-ended culture techniques and environmental management of farming. The questionnaires contained (1) poud design characteristic, water level, technical aspects (stocking density, feed use, harvesting, disease status in frog etc.), (2) pond management (pond preparation, water quality monitoring method, frequency of water change and wastewater treatment, (3) farming experience and local government support.

2.2. Data processing methods

Collected data were analyzed by descriptive statistics, including average, min, max, and frequency using the IBM SPSS statistics software for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA).

3. Results and discussion

3.1. General information of frog farming

The survey results showed that the average age of respondents was 44.2±10.2 years old (range 27-64) years old. However, the experience of farmers was average of 5.2±3.5 years (range 1-14 years), and 45% of farmers had 1-3 years of experience. In addition, 27.5% of surveyed farmers completed primary education, 42.5% secondary education, only 25% tertiary education and 5% college degrees.

Production techniques were mainly earned by experience and learning among the local farmers, and only 20% farmers were only trained 1-2 times per year. The information showed that the local frog farming model is quite developed in recent times, but there are also many difficulties for sustainable development.

3.2. Characteristics of ponds

The cultivated area ranged from 256 to 8000 m^2 with a mean of 1775.3±1913.9 m^2/household, which was mainly converted from garden land (60%) and field land (27.5%) or from other aquatic species (7.5%). Therefore, the profit from culturing frog was higher than that of growing rice and gardening. This species was reared in many different models such as tarpaulin tanks (70% of farmers), hapas (25%), earthen ponds (2.5%) and tarpaulin tanks combine with hapas (10%) or earthen pond (2.5%). The tarpaulin tank was designed with an average area of 38.2±9.1 m^2 which was similar to the hapas (41±6.8 m^2), and mean of depth water was 40.3±11.3 cm (Table 1). There were 36.62±29.4 tarpaulin tanks or 21.1±14.2 hanas in the household (Table 1). Tarpaulin tanks are becoming more popular and nearly replacing cement tanks because of its lower investment costs and easier portability. Floating floor materials were mostly mesh

and plastic pipes (92.5%) because these materials are easy to clean and transport, in which some households combined it with bamboo (25%), bitite (5%), very few households only chose bitite (7.5%).

Table 1. Technical characteristics of the frog farm in Dong Thap province

Pond	Ratio farmers (%)	Numbers tanks/farm	Tanks area (m^2/tank)
Tarpaulin tanks	82.5	36.62±29.4	38.2±9.1
Hapas in earthen pond	35	21.1±14.2	41±6.8

3.3. Frog farming techniques

3.3.1. Technical characteristics of culture frogs

The surveyed farmers used artificial froglet and most of them (82.5%) self-sufficient in froglet sources to culture production frogs; other farmers (17.5%) bought froglet from local farms. This helps farmers to be proactive about froglet sources, decrease investment costs and limit the negative impacts on the survival rate of frogs due to the transportation process and changing environment. However, the quality of seed will not be assessed and certified (Table 2).

Table 2. Time and stocking density of culturing frogs

Farming	Ratio farm (%)	Time of crop (days/crop)	Number of crops/ year	Stocking density (frog/m^2)
Froglet	82.5	33.6 ± 8.8	9.3±2.4	146.3±92.3
Production	100	64.7±9.7	5.1±0.6	51.6±35.7

The local farmers responded that a culture froglet was 33.6 ± 8.8 days because the period tadpole of Thai frog was about 28-30 days (Trần Trường Giang, 2006). This frog can reproduce throughout the year in Viet Nam, so the number of rearing crops of surveyed households was 9.3±2.4 crops/year. The time of rearing production frog was 64.7±9.7 days/ crop corresponding to 5.1±0.6 crops/year (Table 2). The time of the crop also depends on market demand, if the market demand is high, frames will harvest soon. The average size of froglet at harvest was 6.1±1.0 g/individual, production frogs were average of 5.4±1.3 individuals/kg.

3.3.2. Stocking density

For most respondents (87.5%), the strong froglet need to have dark colors such as yellow (7.5%) and green (2.5%). For breeding frogs, farmers must select on the weight standard with 4-5 frogs/kg for male and 3 frogs/kg for female.

The stocking density of production frogs is 146.3±92.3 individuals/m^2 (Table 2), similar to the recommendation in the early stages of Nguyễn (2012) (150-200 frogs/m^2) & Nguyen & Tran (2021) with 198±23 (150-250 frogs/m^2); other farmers (7.5%) also began cropping by eggs with a stocking density of 0.2±0.06 kg egg/m^2. The density of breeding frogs was 51.6±35.7 individuals/m^2 (Table 2) which was lower than productivity frog, but it was higher than the recommended (17-25 frogs/m^2) of the study by Lê Trần Trí Thức et al. (2013). To increase the fertility of eggs, the number of males is usually higher than females with a male/female ratio of 1.2±0.3. The time to release frogs in ponds is mainly in the afternoon (67.5%), morning (7.5%), morning and afternoon (15%). Some households must buy froglet, so they release frogs after receiving without attention to the time of day. Release in the afternoon and morning is the most suitable time because the weather is good for survival rate in the out-growing stage.

3.3.3. Feed

A feed is an important factor to the success of culture, 100% of households used industrial feeds with stable nutritional composition and less water pollution. There are 17 brands of industrial feed to purchase such as Cargill (17.5%), Lai Thieu (15%), EWOS (10%), Dachan and The Heart (7.5%). Frogs were fed 30-40% crude protein in froglet stage and 27-32% crude protein in production stage. Since reducing the protein content of the feed from 35% to

27% in 50 days, it has helped increase the survival rate, yield, and profit (Lê & Thảo, 2016). In addition to the change in protein content, the size of the feed increased following the age of the frog from powder to 10 mm pellets.

3.3.4. Frog disease occurrence

Also from the surveyed farmers, there were a lot of diseases in frogs such as septicemia disease, which named hemorrhage by the farmer (57.5%), skin disease (white body - 35%, red thighs - 45%), digestive tract problems (flatulence - 15%, abdominal intestine - 20%), blindness (35%), liver (10.0%), lung (7.5%), kidney (5%), swelling of pharynx (5%), swelling of body (5%) and crooked neck (2.0%) (Fig. 1). Farmers can identify sick frogs through symptoms such as erratic swimming, changing color, and eating less. Frogs are often got diseases on the stage of froglets from 3-4 days (29.1%), 20-30 days (67.7%) and 40 days old (3.2%), so farmers need to regularly monitor the frog's activities and manage the environmental quality of the tank at this stage. Skin diseases were common diseases in frog culture because the amphibian skin is a mucosal surface in direct and continuous contact with a microbially abundant aquatic and terrestrial environment (Varga et al., 2019). In addition, stocking frogs was at high density, frogs started to appear some bacterial diseases such as frog ulcers caused by *Aeromonas hydrophila* (Trần, 2007).

In addition, the main cause of the frog disease was the erratic changing weather and dirty water (100%), quality and changing the size or amount of feed (12.5%) and antibiotics (7.5%), but farmers never noticed about high stocking density. Therefore, the diseases may result from changing weather, high stocking density, poor preparation of ponds, and inappropriate feeding method (Nguyễn, 2007). The households used to treat and prevent diseases by specific drugs and antibiotics (52.5%), supplemented nutrition and probiotics (7.5%), garlic and probiotics (2.5%). The antibiotics will give quick effect, but it can lead to resistance and antibiotic residues in meat of frogs.

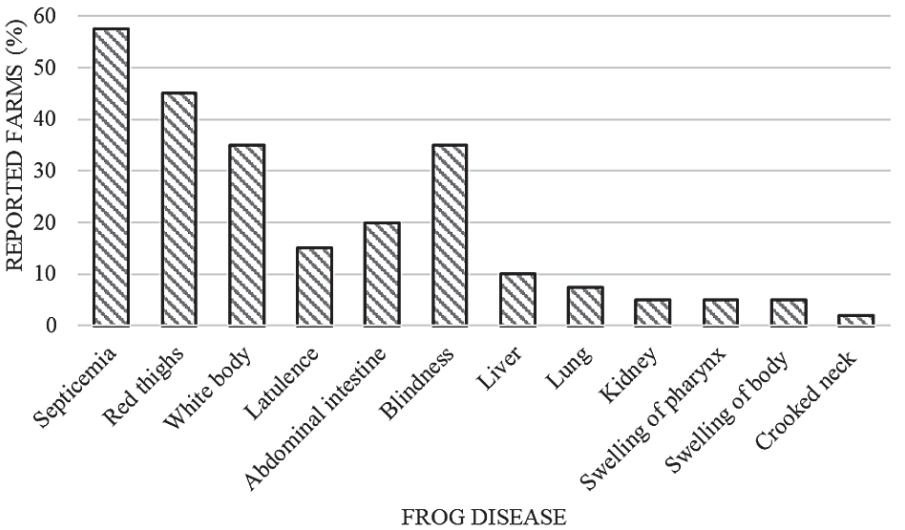

Fig 1. Common diseases reported by frog culture farmers

3.4. Environmental management

3.4.1. Preparation of the culture systems

The survey results (Table 2) show that most farmers prepared the aquaculture systems before crop (72.5% of farm) (Table 3) such as treating with lime and potassium permanganate (30%), bactericides (5,5%), probiotic (2.5%), pump mud and dry floating tool (2.5%), zuca drug and dry floating tool (2.5%). However, 37.5% farmers treated water before stocking with iodine (17.5%) or zuca (10%). It may be one of the causes of the frog disease. Treatment system and water before stocking are very important because it will be a good for growing and developing and limiting diseases of frogs, especially in the tadpole and froglet stage.

Table 3. Environmental management activitie

Environmental management activities	Ratio of household applied (%)	Ratio of household no applied (%)
Preparation of the culture systems	72.5	27.5
Treat culture systems before stocking	27.5	72.5
Treat water before stocking	37.5	62.5
Treat additional water	0	100
Sensory water quality monitoring	75	25
Measure the pH indicators of water	5	95
Treat wastewater	40	60
Check water quality before discharging into the environment	0	100

3.4.2. Water quality management

All surveyed households checked the water supply system and protection net, but only 27.5% treated by using settling ponds (22.5%) or iodine, zuca (5%). During the culturing, 75% monitored water colorants (Table 3) to assess the growth of algae, determine the time to change water (60%) or estimate the pH of the water (2.5%). Only 5% tested the pH of the water with rapid measuring instruments. These results showed that the farmers were also very concerned about the water quality of the rearing system; however, the assessment was mainly based on the senses without using equipment to accurately quantify water quality. In addition, the source of water was supplied directly from the river and was not applied any water treatments, which was similar to the report by Nguyen Quoc Thinh and Tran Minh Phu (2021).

3.4.3. Wastewater management

Most of the households (97.5%) changed the cycle and method of water exchange according to the growth stage of frogs, because the amount of food and waste increased with the frog growth. At the froglet stage, the systems were mainly added water, and then these systems were exchanged regularly on average 2.4±1.8 times/week with an average 60.5±15.4% of the total water. The water change cycle and the amount of supplemental water were mainly based on their own experience and learning from local farms.

They informed that wastewater from 60% frog farming system was not treated which was discharged directly into the river to risk causing negative environmental impacts (Table 3). However, some households used nutrient in wastewater by combining frog with catfish farming (15%), pangasius (7.5%), snakehead fish (2.5%), or mix pangasius, giant catfish, red snapper (2.5%); or discharged into garden ditches, rice fields (7.5%), settling ponds (5%).

Currently, farmers have not assessed the quality of wastewater before discharging into the receiving water, so 95% households design have a separate drainage system for collecting and discharging water at opposite ends of the pond in order to limit the impact of wastewater to the supplyment water quality. In addition, most households (95%) chose a farming location near the river to have a clean water supply and discharge wastewater and transport conveniently. Protecting the aquatic environment is the important way forward to successful and sustainable frog production. Given the problems of technical and environmental management, it is necessary to support farmers in knowledge on technology and environmental management from the local government.

4. Conclusions and recommendations

The survey results of 40 households in Cao Lanh and Thap Muoi districts showed that:

Frogs were mainly cultured in tarpaulin tanks and hanas in commercial pellet feed. Households self-produced froglet by combining breeding

and production frogs. Time of froglet culturing was 33.6±8.8 days/crop (9.3±2.4 crops/year) and production frogs was 64.7±9.7 days/crop (5.1±0.6 crops/year).

The stocking density was high such as 146.3±92.3 individuals/m^2 for production frogs, and 51.6±35.7 individuals/m^2 for breeding frogs.

Common diseases in frogs are mainly intestinal blood fever, white body, red thighs, blindness, bloating, digestive disorders. The main reasons were water quality, weather changes, feed and high stocking density.

Most of the farms did not treat or assess water supply and wastewater. Some households combined frog with fish farming (27.5%); or discharged wastewater into garden ditches, fields (7.5%), settling ponds (5%).

Farmers need to be supported with knowledge of farming techniques and environmental management from the local government./.

Acknowledgments: This research is supportsed by the project SPD2021.01.40, Dong Thap University.

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