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Optimized Pond Structure for Catfish Farming as a Permanent Revenue Source of Ahmad Dahlan Muhammadiyah Reformatory

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Abstrak

This community service activity was conducted in accordance with the problems faced by the reformatory, i.e. lack of revenue source to fund its regular activities, and aims to providing catfish farming ponds which can be used for life skill training medium for reformatory students and a permanent source of income for the reformatory. Having had this ponds the reformatory has an additional permanent revenue source, in addition, the ponds was constructed by optimizing the potential mechanical properties of the material being used. The methods used include object observation, interviews with reformatory management, technical guidance, and catfish farming practices. The result of this activity is the availability of three tarpaulin catfish ponds measuring 3 × 2 m^2 each which can be used by the reformatory students as a medium for life skills training. The time for putting baby fish into the three ponds was scheduled in different times so that the harvest time would also be different such that market oversupply can be avoided. During the farming period, the reformatory students were very enthusiastic in feeding and monitoring the condition of the pond water and the growth of the catfish, so that catfish farming could run as expected. The first harvest was partly consumed and the other was sold to the local market.

Keywords*: Catfish, Life Skill, Pond Structure, Reformatory*

1. INTRODUCTION

1.1 Reformatory Situation

The Ahmad Dahlan Muhammadiyah Reformatory of Kokap founded on Juni 16, 2012 was initially located in Tegiri 2 Village of Hargowilis Locality. Since Januari 2020 the reformatory has been moved to a piece of waqf land managed by the Muhammadiyah Branch Management (PCM) of Kokap, located in Ki Josuto Street of Kriyan Village of Hargorejo Locality of Kokap Subdistrict of Kulonprogo Regency. The personnels of the Branch Management have been assigned, which consist of daily management, assistants, and sections. The Chair of the Branch Management who was automatically acting as Head of the Reformatory was sometimes causing technical problems in managing daily activities of the reformatory, thus currently, these two positions are assigned with two different persons. Due to COVID 19 pandemic, in 2021 there were 44 foster children of the reformatory consisting of 15 are boarding (13 female and 2 male), and 29 are non-boarding. There are two guardian taking care of the foster children, one guardian for female foster children and one guardian for male foster children. In addition to participating in reformatory activities, they are also registered as students of the surrounding junior and senior high schools (SMTP and SMTA). Most of them are registered as Muhammadiyah schools' students receiving partial scholarship (tuition fee waivers) from the Muhammadiyah movement, and the rest are registered as students at the surrounding public schools where the reformatory management have to pay for their tuition fees (Iuran Komite Sekolah). Figure 1 shows foster

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children of the reformatory have a chat with Universitas Muhammadiyah Yogyakarta students after introducing the program to the reformatory management dan students.

Figure 1 The Reformatory, female foster children and Universitas Muhammadiyah Yogyakarta students (wearing red coat uniforms) who were doing their Obligatory Community Service (KKN) programs.

Daily expenditure (meals, housing, tuition fee and students' transportations) of the reformatory is funded from the revenue generated from Reformatory business, such as 3-kg LPG distribution, as well as from regular and incidental donors. So far, the main problem of the reformatory management is that the revenue has not been able to cover all the operational reformatory expenditure, so the management has to find any other possible revenue sources. Considering the number of foster children increases from year to year, the management needs to find the solution to overcome this deficit.

When the Community Service Team along with the Universitas Muhammadiyah Yogyakarta students who were doing their KKN program came and overed Catfish Farming program, the reformatory management responded positively and enthusiastically. While the product of the farming can either be used as side dishes for foster children meals or sold to local markets as self-generated revenue, the farming activities can also be a media for their life skill training. Thus, this program aims to optimally construct ponds, such that the material being used can be more effective and efficient. In addition, the catfish farming can help the reformatory management find a permanent revenue source so that the budget deficit can be reduced, or even eliminated.

1.2 Tarpaulin Pond Structure

The schematic illustration of the pond for catfish farming has been presented in Figure 2 above. Considering the ability of local market to accommodate the product of the farming, the total floor area of the fond of 3×6 mm^2 was divided into three smaller fonds of 2×3 m^2 in size. By doing so, the time for sowing the baby fish can be done in three different times, as well as their respective harvest times, so the amount of consumable fish being supplied to the local market can also be controlled. The ponds were made of tarpaulin sheet, *i.e.* combination of polyethylene and polyurethane. Their side walls were strengthened with used bamboo and/or wooden structures, as well as their retaining poles, as can be seen in Figure 2.

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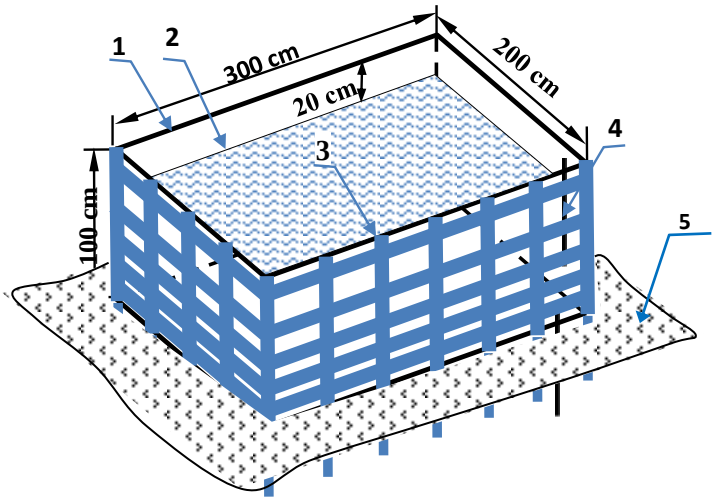

Figure 2 Schematic illustration of tarpaulin pond: 1. Tarpaulin wall, 2. Maximum water level, 3. Retaining poles, 4. Reinforcing bars, 5. Ground surface

The magnitude of water pressure acting at any point in the pond wall depends on its distances measured from the water level [1-2], (Figure 3(a)), such that the closer to the base, the higher the hydrostatic pressure. This condition must be taken into account in designing and arranging the distribution of the reinforcing bars in vertical direction, where the closer to the pond base, the closer the vertical distance between two adjacent horizontal bars, as shown in Figure 2 and Figure 3. If the vertical distribution of the horizontal reinforcing bars was made in evenly pattern, the lower a bar position, the higher the internal mechanical stress generated inside the bar causing earlier broken apart leading to the lower part of the pond wall tend to be more easily to get torn.
The magnitudes of pressure with respect to pole step point at any point in the vertical tarpaulin wall is given in equations (1), and visually presented in Figure 3(a) [4]. Thus, that of bending moment per unit length of strengthening bar is given in equation (2) and illustrated in Figure 3(b).

$$p = \rho g h \quad (\mathrm{N/m^2}) \tag{1}$$

$$M = (1/6)\, \rho g h^2 \quad (\mathrm{N.m}) \tag{2}$$

where: p = hydrostatic pressure (Pa, $\mathrm{N/m^2}$)
ρ = water density ≈ 1 ($\mathrm{kg/m^3}$)
g = gravitational acceleration ($\mathrm{m/s^2}$)
h = distance from water surface (m)
M = bending moment (N.m)

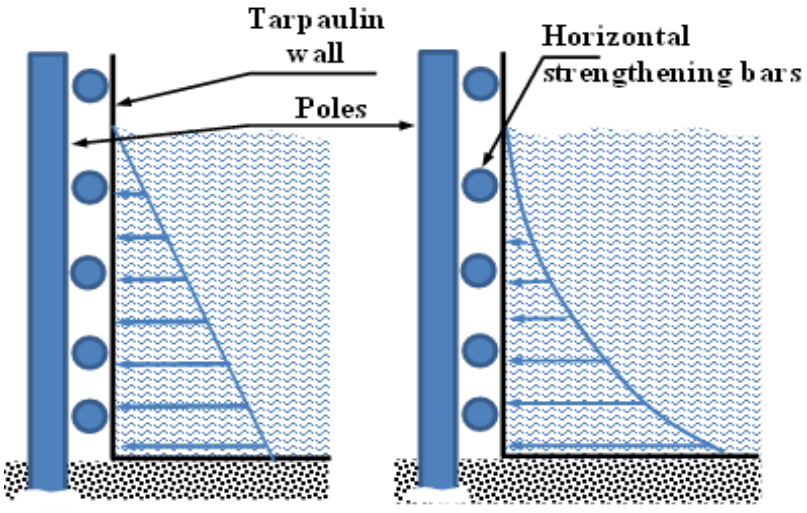

Figure 3 Load distribution pattern along vertical direction
(a) Hydrostatic pressure, (b) Bending mement

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Due to the hydrostatic pressure, the retaining poles will bear a bending moment where the closer to the pond floor, the larger the magnitude of the bending moment [4]. Considering this, the stronger parts, *i.e*. the thicker the wall in the case of bamboo, or the larger the size, of the retaining poles must be installed as the lower parts of the poles, similar to that of the thickness of dam body [5]. Therefore, larger loads would be supported with the stronger parts of the poles.

2. METHOD

This community service program was held in the Ahmad Dahlan Muhammadiyah Reformatory located in Kokap subdistrict of Kulonprogo regency, Special Region of Yogyakarta for four and a half months. The stages for implementing this program are as follows:

2.1 Field Surveying

Prior to setting the program, the team conducted a field survey to collect data giving a complete description of the location including the potential and what is/are needed by the reformatory. By the end of this stage, it was concluded that the reformatory needs a media for life skill practical training for its foster children. In addition, this media should also function as a revenue source to partially support operation cost of the reformatory. Based on the reformatory potential, the Community Service Team and the Reformatory Chair agreed to run a catfish farming using tarpaulin pond technique. Six people were involved in this stage, 2 of them were the lecturers, another two were reformatory management (H. Juremi, S.Pd.I. and Sudamar, S.Pd.), and the other two were senior foster children.

2.2 Coordination and Consultation

Coordination was held between the community service team helped by two Universitas Muhammadiyah Yogyakarta students doing their KKN as one party with the reformatory management as the other party. This coordination was held only once involving six people. Both parties agreed that the community service team provide three ponds of 3×2 m^2 size and baby catfish required, while the reformatory provide fish food, doing pisciculture under supervision of the community service team, and marketing.

In order to ensure that the program be running well as a good fish farming, the community service team also consulted with the Regency Office of Maritime Affairs and Fisheries of Kulonprogo regency, as well as discussing with some catfish practitioners in the surrounding area of the reformatory. Two catfish farmers were visited, and some aspects of catfish farming were discussed. The result of these consultations were then shared with the reformatory manager and the 15 foster children who are bording. The materials collected during this stage were used or implemented during the next stages.

2.3. Program Socialization

Since this program was run during the COVID 19 pandemic period, off-line discussions among the parties involved were held by strictly obeyed the COVID 19 helth protocol. The materials being delivered were the practical aspects of the materials that has been collected during the previous stage, such that the foster children, under supervision of the reformatory guardian, who will be in charge of taking care of the farming in the daily bases could do their task well, and they are hoped to be able to recognize any symptom when something unexpected happened to the catfish.

2.4 Program Implementation

The partner of this program is Ahmad Dahlan Muhammadiyah Reformatory (Panti Asuhan Muhammadiyah Ahmad Dahlan) located in Kokap Sub-district of Kulonprogo Regency, whose detail has been presented in Sub-section 1.1 of this paper. It should be noted

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that the foster children involved in this program were those 15 people who were boarding. During this stage, all activities that have been set were implemented under supervision of the Community Service Team, to ensure that all the activities being agreed are running well as expected. There are five important period of this implementation, *i.e*. pond preparation, catfish sowing, surviving period (during the first two weeks) where the baby fish was fed with F999 pellets, growing period (the next third to ninth weeks) where the fish was fed with 781-2 pellets, and harvesting period (the tenth to twelfth weeks) where the fish was fed with 781-1 pellets. According to Zaidy [6] biofloc farming system using fish culture technology may be applied without any water change. Considering this, during this rearing period, the pond water was replaced or changed every two weeks.

Catfish farming was started with pond preparation for baby fish sowing. The preparation began with filling a pond with water until about 30 cm depth, and left it until the next day. In the second day, 9 cc of prebiotic agent was poured into a 2×3 m^2 floor area at a water depth of about 30 cm. Prior to being poured into the pond, the prebiotic agent was diluted in two liters of water. In the third day, 450 cc of molasses syrup were added into the pond. It was then let as it was for one week to facilitate microbial breeding as natural food provided for the baby catfish at their early sowing. The density of baby catfish (5 cm long) sowing is 500 baby fish/m^3 of water [7]. Considering the total floor area of the ponds is 18 m^2 and the depth of the water at the time of sowing is 30 cm resulting in the total volume of water of 5.4 m^3, maximum number of the baby fish is 2700. Since the length of baby catfish is a bit larger, 6 cm, the number of baby catfish being sowed in this program is 2000. Baby catfish of 6 cm long weigh about 3 kg per 1000 baby fish, thus, for 2000 required baby fish the weight of fish seeds is 6 kgs.

Within the first two weeks, the fish was fed with F999 pellet. The required daily food of catfish is approximately 3% of the fish weight, and given three times a day [8]. The weight growth rate of catfish increases with the increase of their ages meaning that the older the fish the heavier their weight [9]. During the third to ninth weeks, the food was changed into 781-2 pellet where their need for food depended upon their ages. During the ninth up to 12^{th} week, their food was changed again into 781-1 pellet. Beyond 12 weeks, rearing would not be feasible because the cost for their food tends to exceed their weight increase.

2.5 Mentoring and Monitoring

Mentoring and monitoring are intended to ensure that all the programmed activities are running well as being scheduled and agreed among the parties involved in this program. Mentoring was held in the form of visiting in person or via telecommunication media. In the beginning, the visit was done every two weeks, and starting from the third month it was done every month. During the visit, progress was monitored and recorded, and any possible obstacle was discussed to find for solution. Any urgently required solution for any problem, online discussion using telecommunication media was implemented. If there is an extremely urgent problem related to technical matter of catfish farming, the Chair of the Reformatory can directly consult to the officer in the Regency Office of Maritime Affairs and Fisheries of Kulonprogo regency.

3. RESULT AND DISCUSSION

Three catfish ponds made of tarpaulin sheets reinforced with bamboo and/or wooden structures had successfully been made. The total floor area of the ponds is 18 m^2. The height of the side wall is one meter, where the depth of the water was approximately 40 cm at the time of baby fish sowing. The height of the water level was gradually increased up to maximum of 80 cm in the approaching harvest time.

During the fish rearing period, foster students were very enthusiastic in taking care if the fish, periodically fed the fish and changed the pond water. A small problem faced during this farming is small debit of water source causing taking quite long time to fully fill the ponds after being drained for replacing the water. This water changes as well as monitoring

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the growth of the fish were done every two weeks. By periodically checking the growth of the fish, harvest time may be predicted more accurately. The size of the fish when they are harvested has been presented in Figure 4(b).

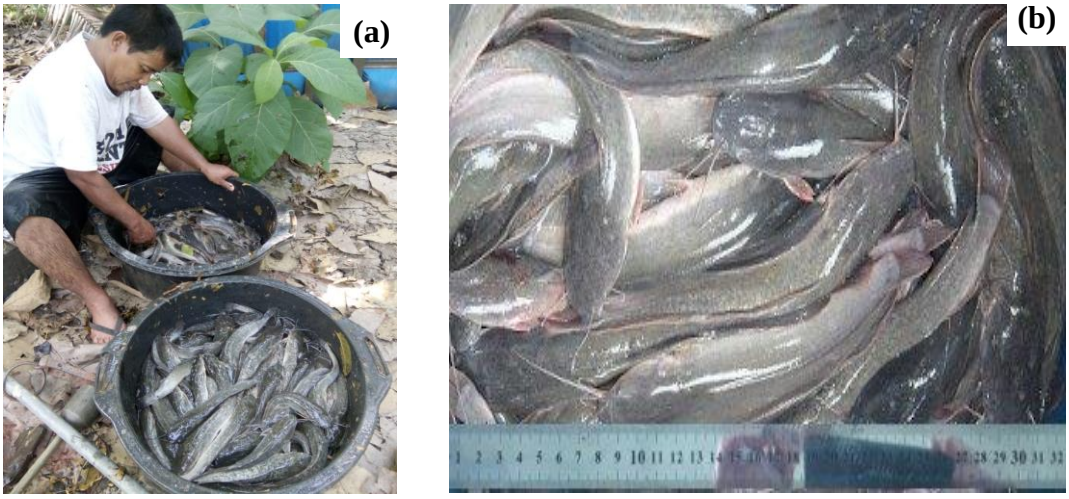

Figure 4 Harvest time: (a) Sorting based on their sizes, (b) Smaller size consumable catfish.

Harvesting began by the end of 10th week, and finished by the end of 12th week when the rearing period was completed. Assuming that approximately 10% of the baby fish was died during the rearing period, there were still 1800 fish can be harvested. This amount is approximately equivalent to 220 kgs, since the weight of the catfish at the harvest time ranges from 8 to 10 fish per kilogram.

Economic Aspect

Expenditure and revenue related to this farming will be discussed in this sub-section. Expenditure consists of: (i) capital depreciation, (ii) food cost, (iii) medicine, and (iv) electricity for water pumping. Please note that labor cost was not included in the expenditure components, while feeding cost is the highest spending among the expenditure components [10]. The detail of these information has been presented in Table 1.

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Table 1 Balance for One Cycle

Items	Amount	Unit price/ cost (Rp)	Total (Rp)
A. Revenue			
Harvested consumable catfish	220 kg	19 000 /kg	**4 180 000**
B. Expenditure			
1. Pond depreciation	3	120.000 ea	360 000
2. Pellet F999	18 kg	12 500 /kg	225 000
3. Pellet 781-2	6 zak	300 000 / zak	1 800 000
4. Pellet 781-1	3 zak	300 000 / zak	900 000
5. Medicine	1 pack	150 000 /pack	150 000
6. Electricity for water pumping			200 000
Sum of B			**3 350 000**
C. Balance: Profit = A - B			**555.000**

For every 2000 baby catfish sowing, the profit being earned here is smaller than that reported by Rusherlistyani et al [11], which is Rp 940.000,00. Rusherlistyani et al [11] did not include capital depreciation in their expenditure resulting in higher profit. Another cause of smaller profit is the increase of pellet for fish feeding during this farming period was not followed by comparable increase of catfish price at the harvest time.

4. CONCLUSION

To obtain an optimum structure, the stronger parts of the retaining poles need to be stepped at their lower sides in accordance with the magnitude distribution of the applied bending moment where the lower the position the larger the magnitude of the applied bending moment. In addition, the horizontal strengthening bars need to be arranged in a pattern where the lower the position of a point in the pond wall, the denser the arrangement of the horizontal strengthening bars. In addition, this community service program has provided three 2×3 m^2 tarpaulin ponds for catfish farming, where the height of the tarpaulin wall is one meter. In addition to being used as catfish farming as an income generation for the reformatory, this program also functioned as a life skill training media for the foster children of the Muhammadiyah Ahmad Dahlan Reformatory at the Kokap subdistrict of Kulonprogo regency. During the program, foster children enthusiastically joined the program.

5. ADVICE FOR FUTURE WORK

A more precise calculation of the profit may be required by including all the cost related to the forming, such as transportation and labor. This is important, especially for a larger scale of catfish farming.

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