

Silkworm (*Tubifer* sp) Business Development Through a Combination Model of Flowing Water Circulation and Vegetables

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Abstract. Single Parent women in Pudak Village high, namely around 200 people. Being a Single Parent Woman is of course required to be independent so that they can make their children successful and have a better life. One solution that can be done is to empower single parent women to become strong women so they can prosper in their families, through cultivation activities for the development of silkworm (*Tubifer* sp) cultivation as freshwater fish seed feed, because currently there are quite large marketing opportunities, and there are still unable to meet market demand. To achieve the objective of the activity, technology transfer was carried out, through the implementation of the silkworm cultivation model using a running water system with vegetable feed ingredients such as carrots, mustard greens, tomatoes, and carrots which are market waste that is no longer utilized. The form of technology transfer that is applied through the Learning by doing model. The results obtained show that single-parent women can cultivate silkworms and understand the use of market waste in the form of waste vegetables (mustard), and fruits (tomatoes, papayas, oranges, banana peels).

Keyword: Silkworm (*Tubifex* sp), Single Parent, Biomass, Natural Food, Fermentation

Abstrak. Perempuan single parent di Desa Pudak termasuk tinggi yakni sekitar 200 orang. Menjadi Perempuan single parent tentu saja dituntut untuk bisa mandiri agar bisa menjadikan anak-anak mereka berhasil dan mempunyai kehidupan yang lebih baik. Salah satu solusi yang dapat dilakukan adalah melakukan pemberdayaan Perempuan single parent menjadi perempuan yang tangguh sehingga dapat mensejahterakan keluarga mereka, melalui kegiatan budidaya pengembangan budidaya Cacing sutra sebagai pakan benih ikan air tawar, karena saat ini peluang pemasaran cukup besar, dan masih belum bisa memenuhi permintaan pasar. Untuk mencapai tujuan kegiatan maka dilakukan alih teknologi, melalui implementasi model budidaya cacing sutra dengan menggunakan sistem air mengalir dengan bahan pakan sayuran seperti wortel, sawi, tomat dan wortel yang merupakan limbah pasar yang tidak termanfaatkan lagi. Bentuk alih teknologi yang diaplikasikan melalui model Learning by doing. Hasil yang diperoleh menunjukkan bahwa perempuan single parent mampu membudidayakan cacing sutra serta memahami bahwa pemanfaatan limbah pasar berupa limbah sayur (Sawi), dan buah-buahan (tomat, pepaya, jeruk, labu madu afkir) dan kulit pisang serta mentimun dapat diberikan sebagai pakan cacing sutra dan pakan terbaik untuk menghasilkan produksi biomassa cacing sutra adalah sawi yang difermentasi, pepaya dan kulit pisang.

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1. Introduction

Pudak Village is an Integrated Laboratory Village (DLT), a fostered village of Jambi University. This village is an Integrated Food Village because the businesses carried out by the community are agriculture, animal husbandry, and fisheries. This village is innovative because it wants to accept innovations so that the community is always advancing. As a freshwater fisheries center, there are 1,500 ponds consisting of grow-out and nursery ponds. This potential has quite a big opportunity to open a silkworm (*Tubifer Sp*) business because it is very much needed as freshwater fish seed feed. Seeing the great potential of developing freshwater fish, the silkworm business opportunity is quite promising as a business for Single Parent rural women.

Training for single-parent rural women aims to increase their household income in the hope that the children they care for will have a better life. From Pudak village data in 2021, there are quite a lot of single-parent rural women, reaching 200 people. Therefore it is necessary to empower this group which is affiliated with the Sibermas Mandiri women farmer group.

The Covid 19 pandemic has greatly affected the community's economy, especially single-parent women. The difficulties faced in the household greatly affect the lives of single-parent women, because they are the backbone of the family who must raise children to be healthy children. One thing that can be done is to provide a business that can be a source of income. One of them is cultivating silkworms, because as previously stated Pudak village is a fishing center and needs a supply of silkworms. The model to be implemented is a simple model without using an apartment system. The natural life of the silkworm is applied in the flowing water system model. And the feed given is very simple in the form of waste vegetables which are scraps from sales. Using a simple model makes it very easy for single-parent women to adopt science and technology provided by universities.

The use of the flowing water method is very simple, using catfish mud as a medium because this mud is a good medium because it will become nutrition and food for silkworms and contains organic matter that comes from leftover feed and feces from catfish ponds. Silkworms eat organic matter found in water and consume substrate-breaking bacteria [1].

Through this activity, it is hoped that it will become a business for single-parent rural women's groups. After all, it has a high enough opportunity as an additional business because it is very much needed by fish farmers around Pudak village who are currently still lacking in the supply of silkworms for the seed feed they cultivate. The development of silkworms through groups is expected to develop and they become independent women. The target to be achieved from this

activity is how to increase the income of single-parent rural women's groups so that they become independent and resilient women facing life as single parent.

2. Method

Program implementation activities refer to the stages in planning management in general, namely identification to obtain potential activities, preparation and analysis for feasibility studies from various aspects, and preparing plans for implementing selected activities, assessment for assessment and reassessment of the benefits of an activity and its implementation in the form of carrying out activities according to a realistic and flexible plan and evaluation as the final stage for systematic identification of various driving and inhibiting factors for program achievement. The activities implemented consist of various activities including:

a. Activity Preparation

- 1) Field Survey
- 2) Determination of partner groups (single-parent women)
- 3) Training Preparation

b. Implementation

- 1) Outreach about the cultivation of silkworms
- 2) Making silkworm houses
- 3) Training of participants with materials
 - 3.1) Pool media filling
 - 3.2) Spread seeds
 - 3.3) Feeding silkworms
 - 3.4) Harvesting technique

c. Activity Monitoring

d. Activity Evaluation

The method of transferring technology to single-parent women is carried out in learning by doing manner based on activities that have been prepared. With this method the activity participants will immediately carry out cultivation activities so that they understand more about the cultivation of silkworms, then for the type of feed provided, activity participants are given an understanding of vegetable and fruit waste which can be used as silkworm feed, and tests are carried out to see which types of feed the silk worms like most, this activity was carried out with students to study the best feed ingredients that can be given and preferred by silkworms.

With various activities that have been planned to broaden the horizons of single-parent women with the learning-by-doing method, it is hoped that this will increase innovation for single-parent women through silkworm cultivation. Through studies involving students, results will be obtained that will be used by single-parent women, especially in the type of feed that can be given through

the utilization of vegetable and fruit waste, so that it will make it easier for single-parent women to provide feed for silkworms.

3. Results and Discussion

3.1 Silkworms as Natural Feed for Freshwater Fish Larvae

Silkworms are a type of natural food that has the potential to be developed because it has high market demand, especially demand from fish cultivators because silkworms contain nutrients that are high enough for the growth of fish larvae. In general, silkworms are found in tropical areas with muddy water conditions and contain organic matter, where the organic matter that has decomposed and settles to the bottom of the waters is the main food for these silkworms. The best growth of silkworms is in an environment with temperatures between 12 – 17°C, pH: 6.0 – 8.0 with a survival rate of 24 – 96% [2]. Silkworms have a high nutritional content with protein (57%), fat (13.3%), crude fiber (2.04%), ash content (3.6 %) and water (87.7%) where the nutrient content is needed by fish seeds for the growth process [2]. A silkworm house was shown in Figure 1.

In the development of silkworms, a silkworm house was built with the medium used catfish mud. The cultivation of silkworms requires media with a high organic matter content. Fish farming waste contains lots of organic particles and abundant bacteria that come from leftover feed that accumulates in the pond during maintenance, especially in intensive cultivation systems [3]. The waste generated from the catfish farming process contains abundant organic particles. This high organic matter content may be utilized to produce silkworms as a natural feed for fish larvae. Optimalization of silkworm biomass production can be done by adjusting the media and optimal immunity as well [4].



Figure 1. Silkworm House

3.2 Distribution of Silkworm Seeds and Water Quality

3.2.1 Distribution of silkworm seeds

After finishing making the silkworm media, we will be followed by spreading the silkworm seeds. Silkworm seeds were imported from Kerinci Regency for stocking. To fulfill the stocking of seeds, 6 kg were sown which were divided into each box of silkworms. The purpose of silkworms

stocking is to grow silkworms to increase the good productivity of natural feed silkworms' production. In stocking the silkworm seeds, each box of worms is evenly spread into the box. In this activity, 1 kg is given for each box. After the seeds were spread, it was seen that the silkworms spread to form colonies of silkworm colonies.

3.2.2. Water quality

To increase the number of silkworms, the flow of water is immediately maintained by recirculating water in the pond. Because the most crucial thing for the cultivation of silkworms is the condition of the water. Comfortable water temperature for silk worms ranges from 24-27°C. After stocking, it is left for one week because of the presence of organic sludge [5]. From the results of observing the temperature of the water obtained from each box which was given different feed, it has the same relative temperature from 28.33°C (cucumbers, tomatoes, rejected pumpkins, banana peels, oranges) to 29.70 °C (fermented mustard greens). The condition of the water temperature based on the type of food is in line with the results obtained by Febrianti et al. [6], who obtained a water temperature of 25 °C to 29 °C. The spreading of silkworm seeds is presented in Figure 2.



Figure 2. Spreading of Silkworm Seeds (*Tubifex* sp)

As previously stated, the water temperature for silkworms, based on the provision of different types of feed, obtained water temperatures ranging from 29 °C to 31,67 °C. The pH of the water obtained was 6.0 for all types of food given. The temperature and pH of the water from the observation activities carried out are presented in Figure 3.

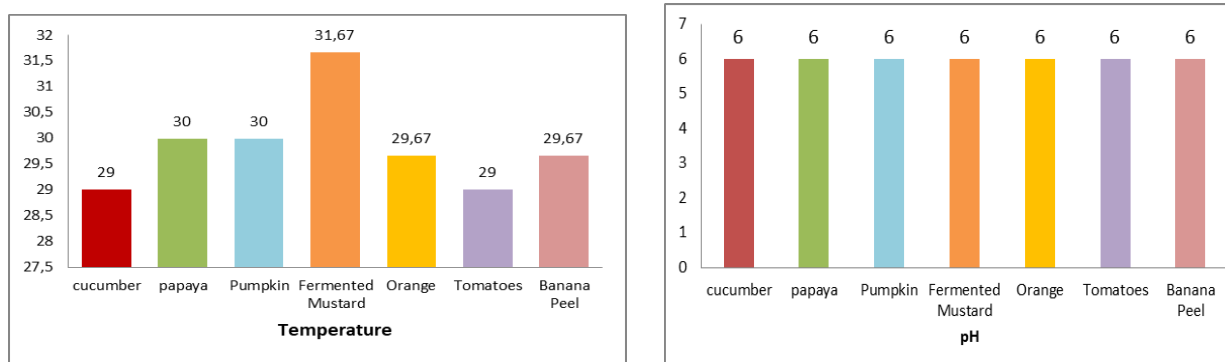


Figure 3. Temperature and pH of Silkworm Water

From Figure 3, the fermented mustard greens have a fairly high temperature compared to the water temperature of the silkworms. For boxes containing various vegetable and fruit feed wastes, the range is $\pm 28^{\circ}\text{C}$. The temperature variation is caused by the ambient temperature because the fermented mustard greens are directly affected by the sun so it often causes fluctuations in the temperature of the water in the rearing medium caused by heat and rain. The temperature feasibility of the maintenance media for silkworm ranges from $24\text{--}32^{\circ}\text{C}$ [7]. The pH of silkworm water for all types of feed given to silkworms reached 6.0. This pH is the recommended pH in the cultivation of silkworms. Good water pH for the growth of silkworm was 6-7 [8].

3.3 Silkworm Biomass Production

Table 1 shown the amount of biomass from feeding with various types of vegetables and fruits. The highest biomass production was obtained from silkworms fed by papaya fruits (140.33 g) and banana peels (132 g). The use of vegetable and fruit waste as silkworm feed can increase silkworm biomass. The use of catfish sludge containing organic matter accompanied by the provision of vegetable and fruit feed is the best feed combination. Vegetable waste can increase the nutrient content of silkworms [6]. Silkworm biomass production is presented in Figure 4.

Table 1. Biomass production from Silkworms from various types of feed

Replication	P0 Cucumber (g)	P1 Papaya (g)	P2 Pumpkin (g)	P3 Fermented Mustard (g)	P4 Orange (g)	P5 Tomatoes (g)	P6 Banana peel (g)
1	59	137	99	98	79	103	147
2	66	128	96	121	80	98	130
3	60	156	107	104	80	108	119
Means	61,7	140,33	100,67	107,67	79,67	103	132



Figure 4. Production of Biomass from Silk Worms

3.4 Innovation Development of Silkworm Cultivation in Single-Parent Women

Innovation for the development of silkworm cultivation through a combination of flowing air circulation models and vegetables for single-parent women, increasing the ability of single-parent women to carry out cultivation activities Silkworms provided. They have been able to do the stages of cultivation well. Likewise, the students who took part in the activity have been able to produce several studies, with results that can be used by single-parent women. The training

method using learning by doing is very effective for transferring innovation to single-parent women because of their direct involvement with the innovations provided.

4. Conclusion

Utilization of vegetable and fruit waste can be used as feed for silkworms, especially papaya and banana peels and fermented mustard greens. The use of catfish mud as a medium for silkworms can be applied because catfish mud still contains the organic matter needed by silkworms. The resulting temperature and pH with a value of 28-29°C are suitable for cultivated silkworms. The highest silkworm biomass production was obtained from the feeding of rejected papaya, followed by banana peels and saw-fermentation. The innovations provided through the application of the learning-by-doing method were responded to well by single-parent women.

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