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DESIGN PLANNING OF THE BLACK SOLDIER FLY (BSF) INSTALLLATION

(Case Study: Midang Village, Gunungsari District, West Lombok Regency, West Nusa Tenggara)

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Abstract

The increasing number of people accompanied by the consumptive nature of society causes an increase in the amount of waste generation in Indonesia. One alternative to overcome this problem can be the implementation of processing organic waste based on Black Soldier Fly (BSF) larvae. One of the 3R TPS in Midang Village, West Nusa Tenggara also applies BSF based organic waste processing to overcome the waste problem. This Research; "Design of Black Soldier Fly (BSF) Installation", aims to; projecting the population in Midang Village from 2020-2039; projecting the amount of waste generation in Midang Village from 2020-2039; projecting the composition of organic waste in Midang Village from 2020-2039; designing the BSF installation based on the existing conditions; and find out whether the supply of organic waste feed from Midang Village is sufficient or not to feed the needs of BSF installation. This research was preceded by field observations to determine the existing condition of the construction of the BSF installation and to obtain data on the size of the BSF installation building. The population calculation is carried out to estimate the estimated waste, the estimated amount of organic waste, so that it can find out whether the feed needs at the BSF installation can be fulfilled optimally. The population projection calculation is carried out to calculate the projected waste generation and projected organic waste composition, so that it can be seen in what year the BSF installation reaches its maximum capacity. The results indicate that the population of Midang village in the next 20 years (2039) is 16062 people with a total waste generation of 1747029 kg, with a composition of 1152340 kg of organic waste. The BSF installation is designed to have 3 units of facilities; Production Room and Warehouse with a length of 500 cm, a width of 700 cm, and a height of 450 cm; a BSF installation building in which there is a BSF fly cage with a length of 300 cm, a width of 300 cm, and a height of 200 cm as well as a BSF biopond with a length of 200 cm, a width of 100, a height of 16 cm, and a slope of the biopond α= 32° and β=57°. Based on the need for BSF feed obtained from organic waste in Midang Village, it is known that the BSF Installation gets a very sufficient supply of organic feed to meet the feed needs of 180675 kg/year. Simple patent registration for the design of the black soldier fly (BSF) larval cultivation installation has been registered with number S-00202205232.

Keywords: Garbage, Organic Waste Management, B lack Soldier F ly Larvae, B lack Soldier Fly Installation Design, Simple.

INTRODUCTION

The high rate of population growth and demographic changes as well as the consumptive nature of the community are the causes of the increasing amount of waste produced. This is a new challenge for waste management. It is known that the amount of daily waste produced in Indonesia reaches 175,000 tons, of which 69% is disposed of in landfills, 10% is stockpiled, 7% is converted into compost or recycled, burned by 5%, and unmanaged by 7% (Nugraha et al., 2018). It is known that the most waste produced is organic waste at the rate of 80% of the total waste. According to article 1 of Law number 18 of 2018, waste is the residue of human

The Seybold Report
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daily activities and / or natural processes in solid form. Sources of waste can come from households, offices, industries, hospitals, markets, agriculture and so on (Chan, 2008)

Addressing environmental pollution and winning the amount of waste generation needs to be developed waste management with the 3R concept (Reduce, Reuse, and Recycle). One of the efforts to reduce non-organic waste, namely by reusing waste that can still be used or recycling waste that allows it to be used as an economical product. As for organic waste, there are several alternatives to rganic waste processing such as incineration, composting, besides that it can also be applied with bioconversion, namely by utilizing black soldier fly larvae / Black Soldier Fly (BSF) or Hermetia Illucens (Diptera: Stratiomyidae). The use of BSF has begun to be widely used in waste management, it is known that BSF larvae can decompose organic waste containing 60%-90% water content. BSF larvae have a high protein content of 40-50% (Chan, 2008). Based on the data that has been described, it can be seen that black soldier fly larvae have many advantages in addition to low cultivation costs, so the choice of processing organic waste with BSF larvae has many advantages and economical.

According to data from the Central Statistics Agency of Lombok Regency in 2021 Figures, West Lombok Regency is located in Lombok Province, consisting of 12 villages/kelurahan located in 10 sub-districts. Astronomically, West Lombok is located at 115° 49.12' 04" - 116° 20'15.62" East Longitude and 8° 24' 33.82" - 8° 55' 19" South Latitude . The total population of West Lombok in 2020 is 721,480 people and the population density is around 685 people / km^2. One of the sub-districts in West Lombok Regency is Gunungsari District which is directly adjacent to North Lombok Regency to the East, Mataram City to the South and Batu District The screen is to the West. Gunungsari Subdistrict has 16 villages, one of which is Midang Village which consists of 8 hamlets with an area of 2 km 2. Midang Village has a TPS Named TPS 3R Midang Village which was built in 2017, TPS 3R Midang Village is the hope of a waste processing site for Midang Village, namun TPS 3R Village Midang experienced problems in processing organic waste and then chose to implement BSF-based organic waste processing which later became the author's research site.

In previous research on Planning Organic Waste Treatment Facilities with the Black Soldier Fly (BSF) Fly Method, it was stated that the waste processing facilities were designed with good and efficient arrangement and layout, consisting of waste management areas, egg hatchery areas, and fly cages (Murdowo et al., 2020). Meanwhile, this p enelitian will discuss the design of the installation design of BSF larvae in Midang Village which is an alternative to waste processing so that zero waste efforts in West Lombok can be achieved and as a source of income for the surrounding community.

The objectives of this study are: (1) Knowing the population projections in Midang Village; (2) Knowing the amount of waste generation in Midang Village; (3) Knowing the composition of organic waste in Midang Village; (4) Design the design of BSF larval cultivation installations based on existing conditions of land availability; (5) Knowing whether the supply of organic waste feed from Midang Village is sufficient or not the feed needs at the Midang Village BSF installation.

The Seybold Report
ISSN 1533-9211
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With this research, it is hoped that it can bring benefits, including the following: This research is expected to be able to become a literature material for the development of science and science in the environmental and social fields of the community regarding the design of optimal and effective BSF larval cultivation installations as organic waste processing to support zero waste efforts in West Lombok Regency. And can be a reference for various regions that will apply the concept of BSF larvae-based organic waste processing and the benefits for the community of the availability of alternative solutions in tackling waste problems.

For the author himself, this research can be a suggestion to increase knowledge and be able to apply the theories obtained during education in lectures, especially in the field of waste processing.

METHOD RESEARCH

The preparation of the methodology in this study was carried out so that the Final Project work could run systematically and purposefully. There are several stages that must be carried out in working on this Final Project, namely conducting field surveys, collecting data, identifying and analyzing is data, and then merancang design of BSF larval cultivation installations in the Village Midang, West Lombok Regency. This research uses quantitative methods, to obtain quantitative data, it is necessary to calculate population projections, projections of waste generation, and projections of the composition of organic waste in Desa Midang. The collected data is then analyzed to obtain a precise, effective, and efficient BSF installation design planning. This research was conducted in Midang Village, Gunungsari District, West Lombok Regency, and West Nusa Tenggara. The study was conducted for 1 month, namely on October 21-November 21 , 2021 by taking very i and taking data di the field.

RESULTS AND DISCUSSION

Overview of the Location of the Midang Village BSF Cultivation Installation

Midang Village is one of 16 villages in Gunungsari District, West Lombok Regency, and West Nusa Tenggara. Midang Village consists of 8 hamlets with a population in 2019 of 9779 people with an area of Midang Village of 2 km 2. The boundaries of Midang Village are as follows:

North : bordered by Taman Sari Village

West : bordering Sesela Village

South : Bordered by Rembig a Sub district

East : bordering Kekeri Village

Midang Village was chosen as the location for the construction of the BSF cultivation installation because the population conditions are not too dense or classified as moderate and the availability of a 3R TPS in Midang Village so that can help maximize the processing of or ganik waste at the TPS with the BSF cultivation installation to be built and the TPS

ISSN 1533-9211

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can be a feed supply for the installation BSF. As for the location of the study presented in **Figure 4.4** below.

Figure 1: Locations for Designing BSF Cultivation Installations in Midang Village

(Source: Google Earth, 2022)

In **Figure above,** the planning location of the BSF cultivation installation has a land area of 192.5 m^2 which is next to Selatan TPS 3R Midang Village. Midang Village has an average humidity known based on BPS data in 2014 of 82.83% with an average temperature of 33.36 °C. Based on field observations along with personal communication to BSF practitioners to BSF breeder practitioners that have been carried out during the research period, data were obtained in the form of existing processing conditions BSF-based waste belonging to TPS 3R Midang Village as well as data on the size of the BSF cultivation installation building to be built, as a matter of participating in:

A. Existing Conditions for the Implementation of BSF Cultivation at TPS 3R Midang Village

BSF cultivation has been implemented at TPS 3R Midang Village since July 20, 2021, BSF-based organic waste processing has many benefits that can be used as compost, fresh maggots, and more effective in reducing organic waste. Based on observations that have been made on the application of BSF cultivation at TPS 3R Midang Village, it is reviewed that the application of BSF cultivation at TPS 3R Midang Village is quite good, where there are several units of supporting facilities, namely in the form of bio ponds, egg breeding grounds, fly cages and production rooms. In **Figure 4. 5** show the existing condition of bio pond installation belonging to TPS 3R Midang Village, based on personal communication to BSF breeder practitioners it is known that there are 8 bio ponds dengan size 100 x 100 cm.

ISSN 1533-9211

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Figure 2: Bio pond Conditions for TPS 3R Installation in Midang Village

The fly cage is divided into 2 places, the first is a dark room and the second is a light room. The dark room serves as a place for the pupa to maximize its phase so that afterwards it can turn into a fly and will naturally enter the bright space. The bright room is a fly cage whose skeleton is made of wood then surrounded by fine nets to maintain air circulation in the cage and is equipped with a roof transparent so that the fly cage gets enough sunlight irradiation and is not damp. The existing conditions of the flyshed can be seen in **Figure 3** below. Adult female flies will mate with flies – adult male flies then female flies will produce eggs and will lay their eggs in containers which is adjacent to the feed source and is considered quite safe. **Figure 4** is an overview of hatching fly eggs

Figure 3: Existing Conditions of Fly Cages

ISSN 1533-9211

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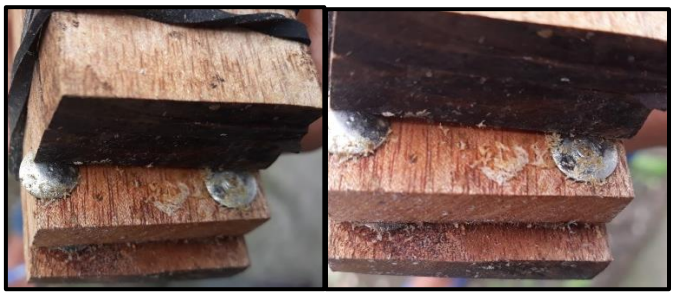

Figure 4: BSF Egg Hatching Container

Then BSF fly eggs will be bred in bioponds with additional wood pulp to maintain friendly temperature conditions for eggs to stay warm as shown in **Figure 5** below. After that, it will be stored in a storage cabinet as shown in **Figure 6**, it can be seen that the egg storage cabinet is protected by fine white webs to avoid insects which can endanger the continuity of the BSF larval egg breeding process.

Figure 5: BSF Larval Egg Breeding Process

Figure 6: Forgingt Breeding Telur BSF

ISSN 1533-9211

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B. BSF Cultivation Installation Under Construction

The BSF installation is under construction, the construction is constrained by unfavorable weather so it takes longer than expected for the cement to dry. The construction stage of the installation starts from land clearing, basic casting of installation, and creation of BSF frame from mild steel, then installation of installation roof, manufacture of bio ponds BSF, and the construction of BSF flytraps.

Figure 7: Stages of BSF Installation Construction

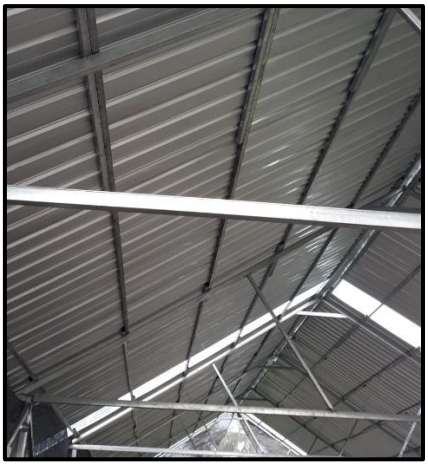

Figure 8: Installation Roof Installation

ISSN 1533-9211

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Figure 9: Biopond Development

Figure 10: Mesh Installation – Fine mesh around the Perimeter of the BSF Installation

Figure 11: Installation of Flyhouse Transparent Roof

Figure 12: BSF Flyhouse Construction Process

The Seybold Report
ISSN 1533-9211
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Midang Village Population Projection

The calculation of the projection of the residents of Midang Village is carried out to determine the amount of waste generation so that they can find out the capacity of feed needs for the Midang Village BSF cultivation installation so that calculations are carried out population projections for Midang Village for the next 20 years.

Midang Village population data obtained from data from the Central Statistics Agency (BPS) taken in the last 6 years, namely 2014-2019, is presented in **Table 1.** As follows:

Table 1: Total population of Midang Village

Year	Total Population (Soul)
2014	8511
2015	8652
2016	9166
2017	9334
2018	9575
2019	9779

(Source: BPS Gunungsari District)

The method used to project the population of Midang Village is Arithmetic, Geometric, Exponential, Least Square, Linear Regression, and Logarithmic methods (**Appendix 1**). Recapitulation of regression values and standard deviations of the projected population of Midang Village can be seen in **Table 4. 7** as follows.

Table 2: Comparison of Midang Village Population Projections

Midang Village, Gunungsari District						
Criterion	Projection Method					
	Arithmetic	Geometric	Exponential	Least Square	Linear Regression	Logarithmic
R^2	0,7336	0.996	0,996	0,227	0,999	0,642
STD	2.131,170	317,054	441,197	3.689,608	611.843,780	1.767,483

The selection of the population projection method is determined based on the value of the deviation mark and the correlation coefficient. Standard deviation provides information about the proximity of data variations to the average value. It is known that the higher the value of the standard deviation, the more varied the data (heterogeneous) and vice versa. (Iii, 2017).

While the correlation coefficient, according to Imam Ghozali:2011, the value of the correlation coefficient that is close to one means, independent variables show almost all the information needed to predict the dependent variables.

Meanwhile, the value of the correlation coefficient that is small or not close to one means that the ability of independent variables is very limited in explaining dependent variables. Based on **Table 4. 7** above, it can be seen that the smallest standard deviation value is found in the geometrick method, which is 317.054 with an R square value of 0.996. Based on this, taking

ISSN 1533-9211

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into account the smallest standard deviation value and the value of the correlation coefficient close to one, the calculation of the geometric method is assumed to be best to use.

Using the selected method, a projection of the population of Midang Village was made with the results of the regression equation formed as follows Y = 316.75x – 630017 (**Figure 13**) meaning each 1-year addition there will be an additional population of 316.7 5 (≈317) inhabitants (**Appendix 1**). The following is a graph of the regression equation for the population of Midang Village as shown in **Figure 13**;

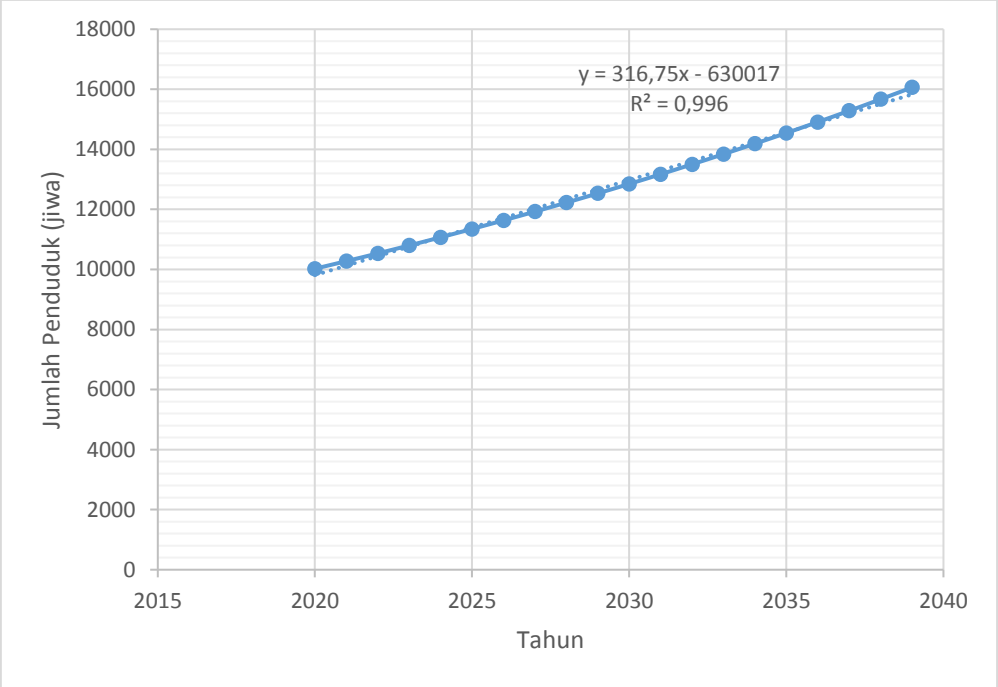

Figure 13: Population Graph of Midang Village (2020-2039)

Based on **Figure above**, it is obtained that R^2 = 0.996 means that there is a very strong relationship or correlation between the addition of years and the increase in the population of Midang Village. Using the regression equation Y = 316.75x – 630017, the projection of the population of Midang Village for the next 20 years is presented in **Table 3.** sa following.

The Seybold Report
ISSN 1533-9211
DOI 10.5281/zenodo.7500895

Table 3: Midang Village Population Projections

Year	Total Population (Soul)
2020	10025
2021	10276
2022	10535
2023	10799
2024	11071
2025	11349
2026	11634
2027	11926
2028	12226
2029	12533
2030	12847
2031	13170
2032	13501
2033	13840
2034	14188
2035	14544
2036	14910
2037	15284
2038	15668
2039	16062

Based on **Table** above, it is known that the projected population of Midang Village in 2039 amounts to 16062 people, which then this data will be used to calculate the projected waste generation in Midang Village.

Projected Number of Waste Generation in Midang Village

Waste generation data is needed in the design of the BSF installation to determine the capacity of waste generation in Midang Village and to estimate the composition of organic waste in Midang Village as a feed supply of BSF larvae. This generation data was obtained from the DLH of West Ombok L Regency, the data to be used is waste / person / day generation data of 0.298 kg / org / day. This waste generation data will then be multiplied by the number of inhabitants per year that was previously projected. The projected data on waste generation in the next 20 years based on the projected population is presented in **Table 4** below.

The Seybold Report
ISSN 1533-9211
DOI 10.5281/zenodo.7500895

Table 4: Midan g Village Waste Generation Projections

Year	Total Population (Soul)	Waste Generation (kg/org/day)	Waste Generation (kg/org/year)
2020	10025	2987	1090381
2021	10276	3062	1117772
2022	10535	3139	1145851
2023	10799	3218	1174635
2024	11071	3299	1204142
2025	11349	3382	1234390
2026	11634	3467	1265399
2027	11926	3554	1297186
2028	12226	3643	1329772
2029	12533	3735	1363176
2030	12847	3829	1397419
2031	13170	3925	1432523
2032	13501	4023	1468508
2033	13840	4124	1505397
2034	14188	4228	1543213
2035	14544	4334	1581979
2036	14910	4443	1621719
2037	15284	4555	1662457
2038	15668	4669	1704219
2039	16062	4786	1747029

Based on **Table 4**, the amount of waste generation has increased along with the increase in population. This is due to an increase in population accompanied by the consumptive nature and behavior of the surrounding community so that the generation of waste produced also increases.

The projected waste generation in Midang Village in 2039 is 1747029 kg / year. To see the relationship between population growth and the amount of waste generation in Midang Village, it is presented in the correlation regression graph in **Figure 14.** As follows.

ISSN 1533-9211

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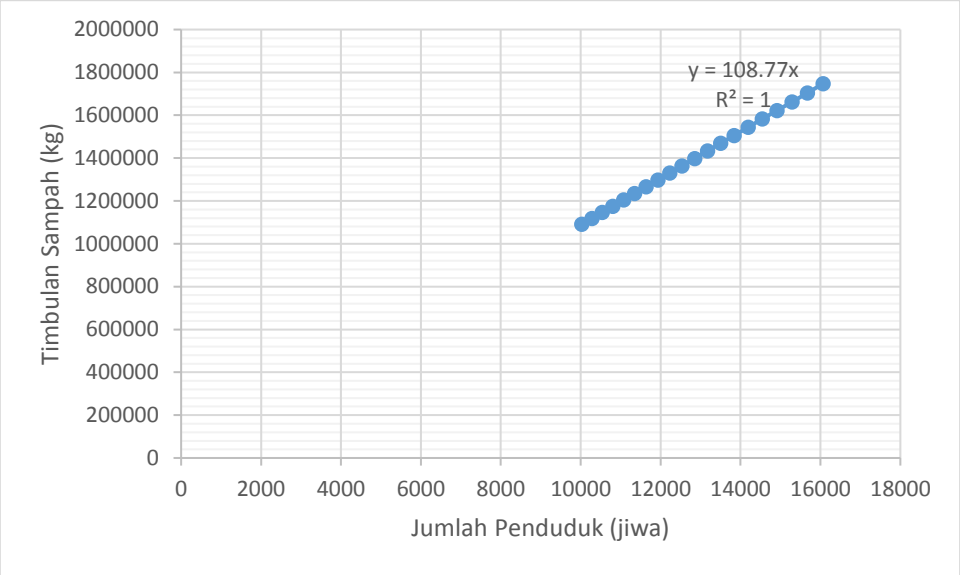

Figure 14: Graphs of the Relationship between Population Growth and the Number of Waste Generation in Midang Village

Based on **Figure 14**, the regression equation formed is Y = 108.77x, meaning that there is an increase in the amount of waste generation by 10 8.77 kg from each addition of the amount residents every yearnya. In the chart above, it is known that nilai $R^2 = 1$, meaning that there is a perfect relationship between the increase in the number of residents of Midang Village and the amount of waste generation in the village Midang.

Projection of the Composition of Organic Waste in Midang Village

The percentage of organik waste composition refers to literature studies due to the unavailability of waste composition data and it is not possible to take sample research. The calculation of waste composition refers to a study entitled "Study of Waste Reduction Potential with 3R System Composition Analysis (Reuse, Reduce, and Recycling) at the Kebon Kongok Landfill, Regency West Lombok" (Tohri, 2019), in this study it was known that the percentage of organic waste composition was 65.96%.

The calculation of the composition of organic waste in Midang Village is calculated by multiplying the percentage value of organic waste , which is 65.96% by the value of waste generation in Midang Village. The calculation of the projected composition of organic waste in the next 20 years in Midang Village based on data on the amount of waste generation that has been projected, is presented in **5.** As follows.

The Seybold Report
ISSN 1533-9211
DOI 10.5281/zenodo.7500895

Table 5: Projected Composition of Midang Village Organic Waste

Year	Total Population (Soul)	Waste Generation (kg/org/year)	Composition of Organic Waste (kg)
2020	10025	1090381	719216
2021	10276	1117772	737282
2022	10535	1145851	755803
2023	10799	1174635	774789
2024	11071	1204142	794252
2025	11349	1234390	814204
2026	11634	1265399	834657
2027	11926	1297186	855624
2028	12226	1329772	877117
2029	12533	1363176	899151
2030	12847	1397419	921738
2031	13170	1432523	944892
2032	13501	1468508	968628
2033	13840	1505397	992960
2034	14188	1543213	1017904
2035	14544	1581979	1043474
2036	14910	1621719	1069686
2037	15284	1662457	1096557
2038	15668	1704219	1124103
2039	16062	1747029	1152340

Based on **Table 5,** the composition of organic waste has increased along with the increase in the amount of waste generation. The projected composition of organic waste in Midang Village in 2039 is 1152340 kg.

To see the relationship between the increase in the amount of waste composition in Midang Village and the increase in the amount of waste generation, a correlation regression graph is presented in **Figure 15** as follows.

ISSN 1533-9211

DOI 10.5281/zenodo.7500895

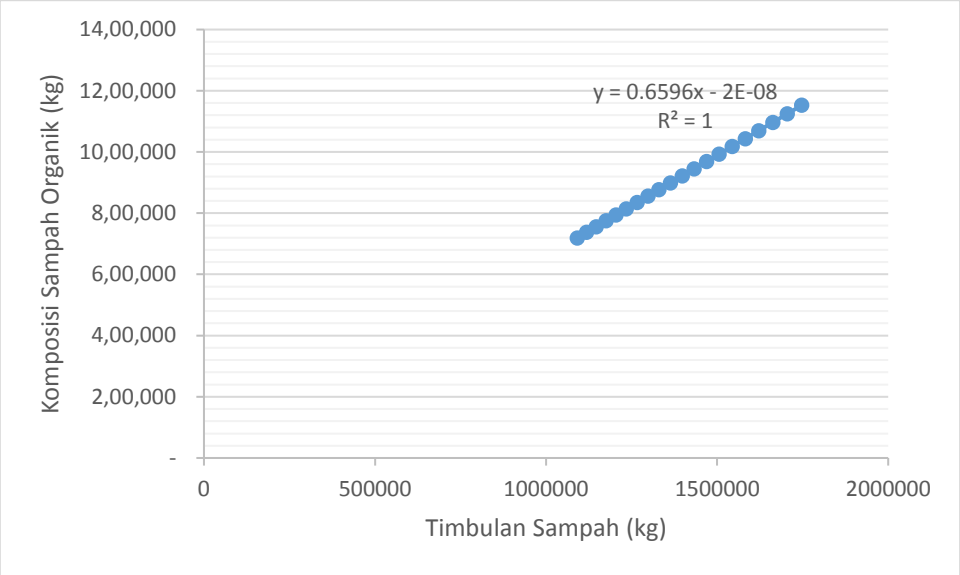

Figure 15: Graphs of the Relationship between the Increase in the Amount of Organic Waste Composition and the Increase in Midang Village Waste Generation

Based on **figure 15**, the regression equation formed is Y = 0.6596 x – 2E-08, meaning that there is an additional volume of organic waste of 0.6596 kg for each addition of the amount of generation rubbish. In the graph above, it is known that the value of $R^2 = 1$ means that there is a perfect relationship or correlation between the increase in the composition of organic waste and the increase in the amount of waste generation Midang Village. This data will be used to determine the feed supply capacity of BSF larvae in BSF installations.

Organic food in Midang Village is not used entirely as BSF feed, the Midang Village BSF cultivation installation only uses organic waste in the form of stale rice, fruits, vegetables, and leftover food as a BSF feed ingredient with the addition of expired snacks obtained from snack factories.

Based on personal communication to BSF installation field practitioners, information was obtained that the percentage of organic waste was in the form of stale rice, fruits, vegetables, and leftover food which is used as BSF feed is 35%, assuming the ratio of BSF feed in the form of leftover food and expired snacks of 1 : 1, then data on the percentage of food is obtained light expiration by 35%, so the required percentage of BSF feed is 70%. The calculation of the projection of organic waste used as BSF feed is presented in **Table 6**, below.

The Seybold Report
ISSN 1533-9211
DOI 10.5281/zenodo.7500895

Table 6: BSF Feed Needs Projection Table

Year	Composition of Organic Waste (kg)	Organic Waste Used as BSF Feed
2020	719216	503451
2021	737282	516098
2022	755803	529062
2023	774789	542352
2024	794252	555976
2025	814204	569943
2026	834657	584260
2027	855624	598937
2028	877117	613982
2029	899151	629406
2030	921738	645216
2031	944892	661424
2032	968628	678040
2033	992960	695072
2034	1017904	712533
2035	1043474	730432
2036	1069686	748780
2037	1096557	767590
2038	1124103	786872
2039	1152340	806638

Based on **Table 6,** it can be seen that the need for BSF feed in 2039 is 806638 kg. The calculation of the composition of organic waste is carried out to determine the feed needs of BSF larvae at the Midang Village BSF cultivation plant. Based on personal communication to BSF breeder practitioners, it is information that the number of bio ponds contained in the Midang Village BSF installation is 66 pieces. The details of the calculation of installation land use and the calculation of the estimated BSF feed needs are as follows:

1. Calculation of installation land use

- Known:

  Land area = 192.5 m^2

  Length = 2500 cm

  Width = 770 cm

ISSN 1533-9211

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- Calculation of the use of a land length of 2500 cm on BSF installations:

Desain a fly cage with a length of 300 cm. Thus, the length of the land of 2500 cm is reduced by the length of the flyshed as follows:

Remaining length = 2500 cm – 300 cm

= 2200 cm

With a remaining land of 2200 cm, it is estimated that a number of bioponds can be made by utilizing the available land optimally, a biopond with a length of 200 cm is designed so that it is available A total of 11 bioponds.

- Calculation of the use of a land width of 770 cm on BSF installations:

The wide design of the fly cage utilizes 300 cm of the installation width then 70 cm for the installation door and there is a remaining 300 cm on the front that can be utilized for BSF feed storage, as for what is presented in **Table 7** below.

Table 7: Front Installation Land Width Details

Kind	Size
Fly Cage	300
Door	70
Remaining Land	300

The bio pond is designed to be 100 cm wide, 10 cm wide pupae migration path, and 70 cm for the road area (as an area for BSF officers to be able to carry out feed and periodic cleaning and pembiakan) so that 3 rows of bio ponds can be obtained in pairs so that in 1 row of bioponds there are 22 bioponds.

2. Calculation of BSF Feed Needs:

In this study, the calculation of feed needs was carried out at the Midang Village BSF installation and it was found that there were three phases of BSF breeding in each phase installation that would occupy as many as 22 biopond. The three phases are calculated based on the period of the feeding day , namely on the first to sixth day; the seventh to the twelfth day; and on the thirteenth to the fifteenth day, the three phases of feeding are counted as following:

A. BSF Feed Needs on days 1-6

1. The need for feed per day

Known:

- Feed requirement per biopond = 2.5 kg
- Number of bioponds = 22 pieces

ISSN 1533-9211

DOI 10.5281/zenodo.7500895

Calculation:

Feed requirement per biopond x number of bioponds	=	2.5 kg x 22 pieces
	=	55 kg/day

2. The need for feed for a year

Known:

- Feed requirement per day	=	55 kg/day

Calculation:

Feed requirement per day x number of days in 1 year	=	55 kg x 365 days
	=	20,075 kg/year

B. BSF Feed Needs on days 7-12

1. The need for feed per day

Known:

- Feed requirement per bioponds	=	5 kg
- Number of bioponds	=	22 pieces

Calculation:

Feed requirement per bioponds x number of bioponds	=	5 kg x 22 pieces
	=	110 kg/day

2. The need for feed for a year

Known:

- Feed requirement per day	=	110 kg/day

Calculation:

Feed requirement per day x number of days in 1 year	=	110 kg x 365 hari
	=	40,150 kg/year

C. BSF Feed Needs on days 13-15

1. The need for feed per day

Known:

- Feed requirement per bioponds	=	15 kg
- Number of bioponds	=	22 pieces

ISSN 1533-9211

DOI 10.5281/zenodo.7500895

Calculation:

Calculation of the Number of Bioponds =

Feed requirement per biopond x number of bioponds	=	15 kg x 22 pieces
	=	330 kg/day

2. The need for feed for a year

Known:

- Feed requirement per day	=	330 kg/day

Calculation:

Feed requirement per day x number of days in 1 year	=	330 kg x 365 days
	=	120,450 kg/year

Based on the calculations above, it is known the amount of feed needs for the three phases of BSF life cycle development as follows:

Daily feed needs	=	55 kg/day + 110 kg/day + 330 kg/day
	=	495 kg/day

Feed needs per year	=	20,075 kg / year + 40,150 kg / year + 120,450 kg / year
	=	180,675 kg/year

Based on the calculation of the amount of feed needs for the three phases of the development of the BSF life cycle above, it is known that the need for feed in one day is 495 kg / day and the need for feed during a year is 180675 kg/year. Referto, that the highest projected BSF feed needs, namely in 2039 as much as 806638 kg, then the BSF feed needs based on the supply of organic waste from Midang Village have been very sufficient for BSF feed needs at the Midang Village BSF cultivation installation and feeding can be given optimally.

CONCLUSIONS

Based on the results of research on the installation design of BSF larvae in Midang Village, the following conclusions can be obtained:

1. The calculation of the projected population of Midang Village for the next 20 years using the geometric method, in 2039 there are 16062 people with the regression equation formed is Y = 316.75x – 630017 meaning that there is an additional population of 317 people per year;
2. The number of sampah generation in Midang Village 20 tahun in the future it is known that in 2039 there will be a waste generation of 1747029 kg and an addition to the average number v waste olume of 108.77 kg per additional population;
3. The composition of organic waste in Midang Village for the next 20 years is known that

The Seybold Report
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in 2039 it will amount to 1152340 kg and there is an addition to the average composition of organic waste of 0.6596 kg any increase in the amount of waste generation;

4. The BSF cultivation installation is designed to have 3 units of facilities, namely production rooms and warehouses, fly cages and BSF bioponds.
   a) The production room and warehouse have dimensions of 500 cm in length, 700 cm in width, and 450 cm in height
   b) BSF installation has dimensions of 2500 cm in length and 770 cm in width and 530 cm in height, has 2 units of facilities:
   - BSF flytrap has dimensions of 300 cm in length, 300 cm in width, and 200 cm in height
   - A BSF biopond has dimensions of 200 cm in length, 1 00 cm in width, 16 cm in height, 10 cm in pupa migration container and a biopond slope of $\alpha = 32°$ and $\beta = 57°$.
5. BSF feed needs based on the supply of organic waste from Midang Village in 2039 as much as 806638 kg. Based on this, it is known that the BSF installation hasa very sufficient supply of organic waste feed from Midang Village to meet feed needs of 180675 kg / year.

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