

Original Research Article

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Utilization of Biogas Reactor Waste (Bio-slurry) to Control of Club Root Disease on Cabbage Plants (*Brassica oleracea* L.)

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ABSTRACT

Cabbage is a plant that has important economic value for farmers, and a source of nutrition for the community. But lately cabbage plants often find it difficult to cultivate, due to the presence of clubroot. This clubroot is caused by the pathogen *Plasmodiophora brassicae*. Various ways of controlling have been carried out to control this disease both physically and chemically have not provided good results. Utilization of biogas reactor waste (bioslurry), needs to be further investigated in addition to fertilizing plants, it can also be used as a biological control agent for pathogenic plants. Biogas reactor waste (bioslurry), both liquid and solid, is rich in microorganisms, perhaps some of which are antagonistic microbes or natural enemies of clubroot root pathogens. From the results of the study it turned out that Bioslurry was able to increase plant growth, and reduce the clubroot infection. Organic fertilizer from biogas reactor waste is good enough to increase the growth of cabbage compared to organic fertilizer used by farmers. Bioslurry from cow manure is very good to increase the growth of cabbage plants, both plant height, number of leaves and amount of leaf chlorophyll when compared with bioslurry from chicken, pork and goat manure. Bioslurry from goat manure has the lowest ability to increase the growth of cabbage. In order to protect cabbage from clubroot infection, the results of the study showed that organic fertilizer from biogas reactor waste, namely Bioslurry from Cattle could suppress clubroot infection up to 20.83%, while control of clubroot root infection rates reached 85%, while bioslurry from Goats only can reduce root disease only 65%, so it is not good to use as a control device for clubroot.

Keywords

Cabbage plants,
Biogas reactors,
Bioslurry,
*Plasmodiophora
brassicae*,
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Introduction

Clubroot disease is one of the most important diseases in cabbage plants (*Brassica* spp.) (Karling, 1968; Voorrips, 1995). This disease is also called swollen root disease (Djatnika, 1989) caused by the *Plasmodiophora brassicae* Wor. In Indonesia, this disease causing loss of cabbage crops around 88.60%

(Widodo and Suheri, 1995) and caisin plants around 5.42–64.81% (Hanudin and Marwoto, 2003). Swelling of the root tissue can interfere with root functions such as translocation of water and nutrients from the soil to the leaves. This situation causes plants to wither, stunt, dry and eventually die (Cicu, 2006). If the soil has been infested by *P. brassicae*, the pathogen will always be a limiting factor in

cultivating the plant of the Brassicaceae family on the land, because this pathogen has a high resistance to environmental changes in the soil. This is because these pathogens can live in the soil by utilizing organic matter in the soil so that the cabbage is no longer suitable to be cultivated on the land (Agrios, 2005).

In Bali various ways of controlling clubroot disease have been done, but have not been successful. According to farmers in Kembangmerta village, Baturiti Subdistrict, Tabanan Regency, various ways of control have been carried out by farmers. Some of these efforts are by giving dolomite lime, the application of several types of synthetic fungicides, and the use of several varieties of cabbage seeds imported from Japan such as YCR-Anju and YCR-Tae which are resistant to clubroot root (Arya *et al.*, 2000 in Hendriani *et al.*, 2012), but the results have not shown satisfactory.

Utilization of biogas reactor waste (bioslurry), needs to be further investigated in addition to fertilizing plants can also be used as biological control agents for plant pathogens (Klinton *et al.*, 2017). Biogas reactor waste (bioslurry), both liquid and solid forms, rich in microorganisms, maybe some of them are antagonistic microbes or natural enemies of clubroot root pathogens.

Bio-slurry

Bio-slurry or biogas waste is a product of biogas processing made from livestock manure and water through an anaerobic fermentation process in a closed tank. Waste coming out of outlet holes, called bio-slurry in liquid form tends to be solid, light brown or green and tends to darken, little or no gas bubbles, odorless and does not invite insects. When it has solidified and dried, the bio-slurry color turns to dark brown. Drying Bio-slurry is sticky, tough and not shiny, and has the ability

to bind good water. According to Risnawaty (2015), bioslurry contains many microbes and some of them can be natural enemies of plant pathogens

Materials and Methods

Preparation of organic bio-slurry fertilizer

Bio-slurry fertilizers used are bio-slurry from cow manure, pig manure, chicken manure and goat manure. Cow manure bio-slurry is taken directly from Simantri in Bali which runs Biogas Reactors to produce fuel gas from cow manure, while bio-slurry, pig, chicken or goat manure is taken directly on pig, chicken or goat farms that run biogas reactors.

Treatment

- A. Chicken manure Bioslurry organic fertilizer
- B. Pig manure Bioslurry organic fertilizer
- C. Goat manure Bioslurry organic Fertilizer
- D. Cow manure Bioslurry organic Fertilizer
- E. Plants not given Bioslurry organic fertilizer
- F. Control, plants are treated with fertilizer according to the habits of farmers

Planting and observation

Before planting, the soil is processed until it is ready to be planted and treatment plots 1 x 2 m in size, seedlings that have been sown in nursery beds and aged 21 days are moved to experimental plots.

Experimental plots that have been given basic fertilizer, namely solid Bioslurry fertilizer in accordance with the treatment dose of 20 tons / Ha, then every month additional fertilizer is given, namely liquid Bioslurry which is the type according to treatment, by pouring near the roots of each plant in the experimental plot with a dose of 250 ml per tree, but before application the Bioslurry must be diluted by

adding water 1: 1, the distance of the plant per plot is 20 X 20 cm

This study uses a completely randomized design using 4 replications with 6 treatments and the plants are well maintained until the harvest is observed;

1. Plant height
2. Number of leaves, cabbage plants,
3. Chlorophyll content in cabbage leaves
4. Percentage of clubroot disease by calculating plant symptom of clubroot which is the growth of dwarf or withered plants

$$P = \frac{n}{N} \times 100$$

P = percentage of clubroot disease

n = number of infected plants

N = total number of plants

5. When harvesting, the symptoms of clubroot on the the plant roots are also weighed
6. Weight of cabbage plants
7. Crop harvest weight produced

Results and Discussion

Effect of bio slurry on vegetative growth of cabbage plants

After cabbage plants are given Biogas waste, namely bioslurry from chicken manure (A), Pig manure (B), Goat manure (C) and Cow manure (D), do not use bioslurry (E) and Fertilization which is usually not used by farmers on cabbage, (F), then the vegetative growth produced on cabbage can be seen in Table 1

In table 1, it appears that the higher the plant, the more number of leaves produced as well as the amount of chlorophyll produced more this can be shown in the treatment of use of Cow bioslurry, which results in plant height,

number of leaves and the highest amount of chlorophyll and different treatment others. Then followed by bioslurry chicken manure, pig and goat. With the large number of leaves, more and more carbohydrate is produced so that more energy is produced for the purposes of metabolism in plant cells to produce compounds that are beneficial for plant growth and production and increase plant resistance to pests and plant diseases.

Here it is clear that the use of Bioslurry fertilizer can significantly increase the growth of cabbage compared to plants without bioslurry use, treatment E and F. However, among bioslurry, it turns out that bioslurry from goat manure is not good for fertilizer as cabbage.

The effect of bio slurry on generative growth and the rate infection of clubroot on cabbage plants pada

After the cabbage plants were treated with biogas waste, namely bioslurry as organic fertilizer, the generative growth and the rate of clubroot disease infection in cabbage can be seen in Table 2.

In Table 2, it appears that bioslurry cow manure can suppress clubroot infection compared to other treatments with an infection percentage of 20.83%. This is because vegetative growth after cabbage is given bioslurry cow manure is quite good, because the amount of chlorophyll produced by the leaves is the most compared to other treatments, so carbohydrates are produced, which can be metabolized to energy for plant. Then this energy will be used for metabolism to produce compounds that can inhibit the growth of clubroot root pathogens. With the reduction of clubroot disease, the number of plants that produce more crops and the weight of each crop are heavier so that the highest crop production compared to other treatments.

From the table above it can be seen that bioslurry of cow manure is best used to control clubroot root disease in cabbage plants and increase the production of cabbage plants. So to develop organic agriculture in cabbage can use bioslurry fertilizer cow manure and using biopesticides with active ingredients of plant extract has the potential to inhibit the growth of pathogens or biopesticides with active ingredients of microbial antagonists.

From Table 2 it also appears that fertilization using bioslurry from livestock manure is able

to control clubroot disease and increase crop production compared to the treatment of plants without fertilizer with bioslurry. From the research results of Boteroa *et al.*, (2019) Clubroot disease in Latin America can be controlled properly using microbial antagonists *Trichoderma koningiopsis* and *Trichoderma harzianum* even though in Latin America it has air humidity and extreme temperatures. Possibly the bioslurry of cattle manure used in this study contained a lot of trichoderma (Fig. 1–5).

Table.1 Effect of use of bio slurry on vegetative growth of cabbage plants

Bioslurry Fertilizer From livestock manure	Vegetative growth of cabbage plants after being given Bioslurry Fertilizer		
	Plant height (Cm)	Number of Leaves (Sheet)	Total Chlorophyll (SPAD)
A (Chicken)	32.06ab	14.37bc	57.39b
B (Pig)	34.52a	15.33ab	57.21b
C (Goat)	30.16bc	13.04cd	56.04bc
D (Cow)	35.63a	16.21a	62.91a
E (without Bioslurry)	26.4d	12.08d	51.81c
F (the habits Of farmers)	27.17cd	11.75d	55.27bc

The same letter in the same column shows no significant difference in DMRT 5%

Table.2 Effect of bio slurry application on generative growth and infection of clubroot on cabbage plants

Bioslurry fertilizer from livestock manure	Generative Growth of Cabbage Plants				
	Number of Club root (pieces)	Weight / Crop (Gram)	Plant Weight (Gram)	Root weight (Gram)	Percentage of clubroot infection (%)
A (Chicken)	3.13bc	810.83ab	761.83a	84.91ab	66.67c
B (Pig)	3.70b	746.37ab	856.79a	110.42a	45.83c
C (Goat)	3.87b	620.29b	696.54a	85.91ab	50.00c
D (Cow)	1.87c	1040.12a	759.96a	83.08ab	20.83d
E (without Bioslurry)	7.87a	150.70c	53.71c	53.70b	87.50a
F (the habits of farmers)	7.54a	291.95c	406.88b	86.25ab	70.83b

The same letter in the same column shows no significant difference in DMRT 5%

Plants research in the field



Figure.1 Bioslurry cow manure



Figure.2 Bioslurry goat manure



Figure.3 Bioslurry chicken manure



Figure.4 Bioslurry pig manure



Figure.5 Control, without bioslurry and without fertilizer

Conclusions and Suggestion

The results of this study concluded that;

Organic fertilizer from waste of biogas reactor is quite good to be used to increase the growth of cabbage compared to organic fertilizer used by farmers. Namely bioslurry from Chicken manure (A), Pigs (B), Goat (C) and Cows (D),

Bioslurry from cow manure is very good to increase cabbage plant growth, both from plant height, number of leaves and number of leaf chlorophyll when compared to other bioslurry.

Bioslurry from goat manure is low in ability to increase the growth of cabbage.

In the case of protecting cabbage from infection by clubroot, use, Bioslurry organic fertilizers from cows can reduce the infection of clubroot, disease by 20.83%, while control without using bioslurry the infection rate of club root disease reaches 70.33% to 87.50%, while bioslurry from goat only able to reduce clubroot disease by only 50%, so it is not good to be used as a controlling agent for clubroot.

Suggestion

To control clubroot in cabbage plants should use integrated control that is using organic fertilizer bioslurry from cow manure combined with *Trichoderma* biopesticides, using balanced fertilizing and good cropping

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