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UTILIZATION OF SOLID ORGANIC FERTILIZER FROM SQUID AND QUICK WASTE ON NECTAR PRODUCTION AND PALM POLLEN MORPHOLOGY AS BEES FEED

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ABSTRACT
Objective of the study is to determine the effect of the use of solid organic fertilizer from quail waste and squid waste on nectar production and pollen morphology of mustard plants as bee feed. The research method used in this study was a Completely Randomized Design (CRD) experiment consisting of 6 treatments and 4 replications, and if there were differences, it was continued with Duncan's Multiple Real Test (DMRT). The results showed that the variation in the ratio of giving planting media in the form of solid organic fertilizer from squid waste and quail waste had a very significant effect (P<0.01) on mustard pollen morphology, such as: pollen shape, polar diameter and equatorial diameter. The conclusion of this study is the use of solid organic fertilizer on quail waste and squid waste with a ratio of 50% quail + 50% squid (P3) gives the best results on the morphology of mustard pollen as bee feed and can have a fairly positive effect on generative and vegetative growth. mustard greens from the nectar produced.

KEY WORDS
Form of mustard pollen, equatorial diameter, polar diameter, solid organic fertilizer, mustard plant, nectar, quail waste, squid waste.

Animal husbandry and fishery waste in Indonesia has increased from year to year. This is due to the increasing consumption of the main product from livestock and the lack of processing the waste into a more useful product, such as processing it into materials for making bio gas and plant fertilizers. The export values of fishery products such as squid in 2018 according to Sholeh, K (2018) increased by 11.06% from 2017 to 2018. Junus and Novianti (2020) said that in 2018 there was around 89 tons of livestock waste in the area. East Java. So much waste, if it is processed into more useful products such as being processed into bio gas, will have a positive impact on the agriculture and livestock sectors. Junus (2015) said that LOUGBP (Solid Bio Gas Unit Organic Mud) and LOUGBC (Liquid Bio Gas Unit Organic Mud) in it contain many organic substances and nutrients that can be used as fertilizer for green mustard plants. Important elements needed by plants found in LOUGBP and LOUGBC include Nitrogen content of 0.061-3.19%, Phosphorus (P) of 0.209-1.37% and containing K2O of 3.133% (Agustin, et al. 2017). The content serves to accelerate and stimulate the vegetative and generative growth of plants, so that plants can flower quickly.

Mustard is a vegetable commodity that has a fairly high Commercial Value and good prospects in Indonesia. According to data from the Central Statistics Agency in 2020, farmers in Indonesia managed to produce 667,473 tons of mustard greens. Green mustard is a plant that is widely cultivated by farmers in Indonesia. This is due to the nutritional content of mustard greens such as vitamins A, B, C, protein, carbohydrates, phosphorus, potassium and fat needed by the human body. Fertilization is needed to optimize the productivity of green mustard, where in the fertilizer there are elements needed by plants to grow such as N, P and K (Alfandi, et al. 2017). Junus (2017) strengthens this opinion by saying that fertilizers come from animal and plant parts which contain organic materials, such as protein, carbohydrates, fats and other mineral elements, where fractions of these materials are important components that are absorbed by plants for growth and development. The elements in the fertilizer are important for plants to strengthen the leaves

so they don't fall off easily, increase the width and width of the leaves and are used by plants to accelerate flower growth in mustard plants.

Mustard plants that grow healthy will produce flowers. Flowers on mustard plants contain nectar and pollen, which can be used as additional feed ingredients for animals, one of which is beekeeping (Istarofah and Salamah, 2017). Honey bees are plant pollinators insects, meaning that honey bees are plant pollinating agents so it can be said that the relationship between honey bees and flowering plants is a symbiotic mutualism or mutual benefit (Agussalim, et al. 2017). Bees get nectar as food for their colonies, while flowers are pollinated in return. There are two types of nectar, namely floral and extra floral nectar. Floral nectar is produced from nectar glands.

While extra floral nectar is produced by plant parts other than flowers. Flowering mustard plants will provide nectar and pollen for bee feed and bees will be pollinators for these plants. The form of pollen in each plant has a variety of forms; this is influenced by genetic and environmental factors. Genetic factors such as the type of plant used and environmental factors such as water availability, temperature, humidity, light intensity and mineral nutrients for mustard plants.

Pollen in mustard greens is very important for bee colonies because bees with adequate nutritional needs will produce honey, pollen and royal jelly in abundance so that it is profitable for beekeepers. In erratic seasons, sometimes rain and sometimes dryness will cause the flowering cycle of mustard greens to be disrupted, so that it will result in reduced bee feed availability, this can cause bee production to decrease in addition to bees will be susceptible to disease and what is more severe is the number of bees. The bee population decreases due to death and also leaving the hive. So that the processing of residual bio gas production from LTP and LG adsorbents in the form of LOUGBP and LOUGBC as green mustard fertilizer is very important to accelerate and stimulate vegetative and generative growth. The pollen produced in mustard flowers was analyzed for production to determine the effectiveness of LOUGBC and LOUGBP fertilizers and could affect the level of nectar production in mustard greens, so that production can be used as additional feed ingredients for bees, so that the productivity of bees remains high and profitable for beekeepers.

MATERIALS AND METHODS OF RESEARCH

This research consists of two parts, namely field research and laboratory analysis conducted in several places in Malang with details:

1. Field research was conducted to process the residual bio gas production as an ingredient for making fertilizer, namely organic solid bio gas unit sludge (LOUGBP) and to plant mustard greens until flowers appear. The research in the form of processing the residual bio gas into solid organic fertilizer was carried out on 16-20 September 2021 at the Sumber Sekar Field Laboratory, Faculty of Animal Husbandry, Brawijaya University, Malang, while the research in the form of planting green mustard until the flowering phase was carried out on 11 October to 15 December 2021 in Karangploso area;

2. Laboratory analysis research was conducted to determine the morphology of the green mustard plant pollen after being treated with quail livestock waste (LTP) and squid waste (LC) fertilizers. The research was carried out on 22-26 December 2021 at the PT. Joyo Sriwijaya Flower, Malang.

The research material used was 24 green mustard plants that were grown from seed to flower so as to produce plant pollen that would be observed for bee feed. Mustard planting media is divided into two, namely with pottray media and polybags. The use of these two media is intended to maximize the growth and development of mustard greens.

This study used a completely randomized design (CRD) experimental model. The linear model according to Asri et al (2019).

Observation Variables:

a. Diameter of Mustard Pollen Polar. The polar diameter of the pollen is a line connecting the proximal pole to the distal pole, so the way to measure the polar diameter of

the pollen is to draw a measuring line from the proximal pole to the distal pole using a binocular microscope and a digital microscope camera with units of m.

b. Diameter of Equator Pollen Mustard. The diameter of the equator is a line in the middle of the pollen that is perpendicular to the polar line or can be said to be a line that separates the proximal pole and the distal pole. Measurement of the equator diameter on mustard pollen was done by drawing a measuring line perpendicular to the polar line using a binocular microscope and a digital microscope camera with units of m.

c. Mustard Pollen Form. The shape of the mustard plant pollen was observed using a binocular microscope and a digital microscope camera, then the shape was recorded and analyzed. Observation of the shape of mustard pollen was done by dividing the shape of the pollen into 2 forms, namely 50% round and 50% oval.

d. Green Mustard Nectar Production. Measurements were taken every morning between 6 a.m. and 8 a.m. when the flowers had grown simultaneously. This is done so that the number of samples is still optimal and has not been taken by pollinators. The measurement of green mustard nectar production was carried out using the filter paper wicks nectar sampling method (McKenna and Thomson (1988) in Morrant, et al. (2009). The formula used for calculating nectar per cumulative flower (Sari, et al. 2014):

Weight of Nectar per Cumulative Flower = (BAT 1 – BaT 1) + (BAT 2 – BaT 2) + …. + (BAT 4 – BaT 4)

Where: BaT= Initial Weight of Tissue; BAT= Final Weight of Tissue.

e. Nectar Productivity. Based on observations on nectar production, number of flowers and flower weight. Then the nectar productivity can be obtained with the productivity measurement formula based on the output per input ratio approach (Sarjono, 2001).

RESULTS AND DISCUSSION

Mustard Pollen Form. The shape of the pollen of each plant is different; this is influenced by several factors including environmental temperature, pollen maturity and genetics of the plant. The various forms of pollen from the mustard greens in the study can be seen in Figure 1.

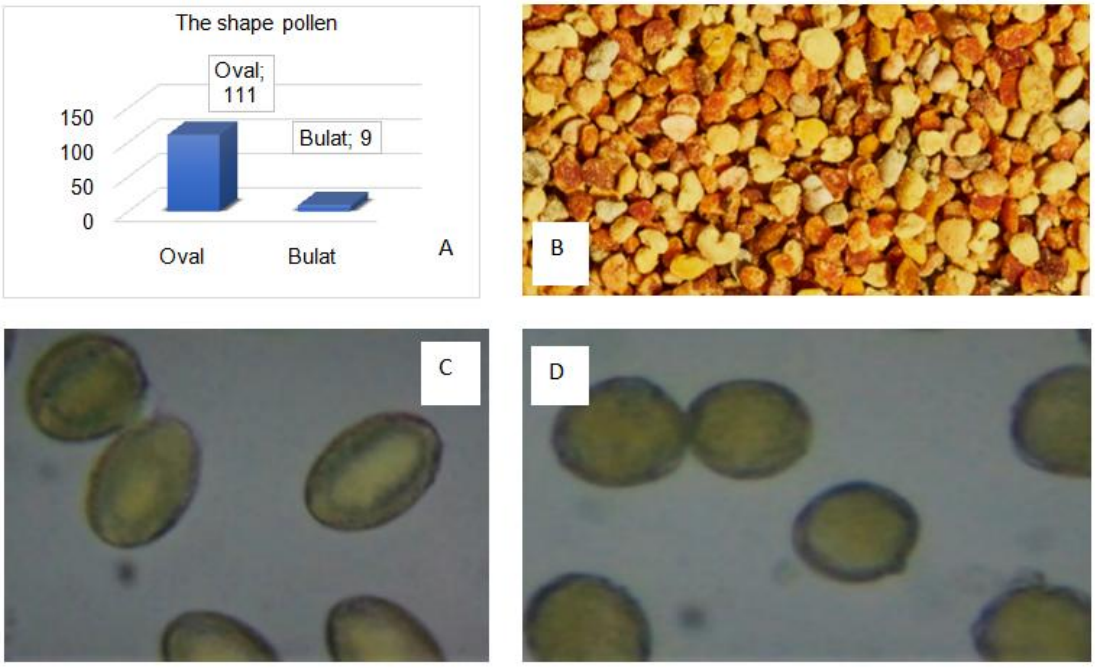

Figure 1 – The shape of the green mustard plant pollen cell: (a) Comparison of round and oval shapes in mustard pollen; (b) Oval shape of mustard plant pollen (400x); (c) Round shape of mustard plant pollen (400x); (d) Collection of plant pollen cell forms (Dubno, 2018)

Based on the research data that can be seen in Figure 1 (a) shows that the shape of the mustard plant pollen is as much as 111 oval-shaped pollen and as many as 9 round-shaped pollen, or about 92.50% oval and 7.50% round. Observations on the shape of the mustard plant pollen were carried out by direct observation under a binocular microscope connected to a laptop to facilitate observation of the shape of the mustard plant pollen. Figure 1 (b) is an oval cross-sectional image of mustard plant pollen and Figure 1 (c) is a circular cross-section of mustard plant pollen. The collection of forms of collected plant pollen cells can be seen in Figure 1 (d).

Pollen or pollen has various shapes, such as round, oval, oval, triangular and has a rough and smooth surface. The outer wall layer of pollen, called exin, protects the outer part of the pollen grain from chemical and physical stresses from the outside which have various sizes. The exin layer is also what distinguishes the form of one plant pollen from another. Fakhrizal (2005) in Sanjaya, Kriswiyanti and Darmadi (2020) said that the level of pollen maturity is also the cause of different pollen forms. Figure 2 is the flowering time of the plant mustard greens for each treatment (P0, P1, P2, P3, P4 and P5) which determines the level of pollen maturity of the mustard greens.

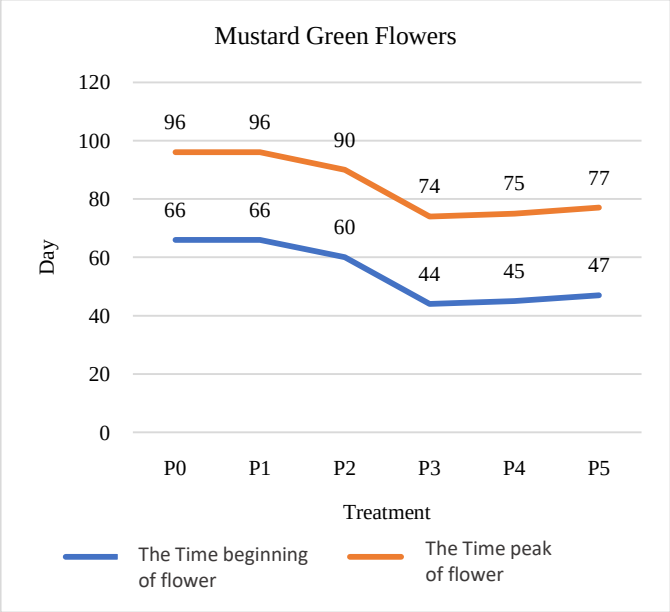

Figure 2 – The time from the beginning of the emergence of flowers to the peak of the mustard flower

The study was conducted for 5 days starting from the 66th day to 70th day. From Figure 2 it can be seen that P0 and P1 experienced a generative period or flowering phase on day 66 which caused the age of the flowers and pollen used in the study to be young and did not have many choices. In contrast to P3, P4 and P5 which flowered on days 44, 45 and 47 where at the age of 40 the plants were still relatively young and had time to ripen the mustard plant pollen until the 66th day, some are round and oval, which is due to the selection of immature flowers or pollen.

Differences in the shape and size of pollen are also influenced by internal and external factors. Internal factors include genetics from plants and external factors such as water availability, nutrients in the growing media, temperature, light intensity and altitude also affect the morphology of plant pollen (Jayuli, Junus and Nursita, 2018). The nutrients contained in the growing media in each treatment had different contents. In the P0 treatment, flowers bloomed on the 66th day because the planting medium used was 100% soil without a mixture of solid organic fertilizers, so that minimal nutrients caused disruption of the growth process and development of mustard plants. The P3 treatment experienced a generative phase or inflorescence at a faster age (44 days) compared to other treatments because the content in the P3 planting medium was the best and ideal compared to other

treatments. P3 planting media is a mixed planting medium between soil and solid organic fertilizer from quail and squid waste. P3 treatment with a combination of soil in the form of 50% quail waste and squid waste made nutrients and soil characteristics suitable for the growth of mustard greens, causing plants to thrive in the planting medium with P3 treatment. Agustin, Pinandoyo and Herawati (2017) said that quail manure contains nitrogen levels of 0.061-3.19%; Phosphorus is 0.209-1.37% and K2O content is 3.133%, while fish waste contains nitrogen nutrients of 2.26%, Phosphorus is 1.44% and Potassium is 0.95%. The nutrient content of the two wastes makes mustard plants in polybags experience maximum vegetative and generative growth (Abror and Harjo, 2018). The P4 and P5 treatments were less good than P3 treatments, because the nutrients present in P4 (25% quail waste + 75% squid waste) and P5 (100% squid waste) were less than those in P3 treatment, although the soil porosity both treatments can be said to be good. However, for the growth and development of mustard greens, not only requires soil characteristics, but the nutrients in it are also important.

Provision of nutrients or minerals in fertilizers that are in accordance with plant needs will provide many benefits to plants. This is reinforced by the statement of Kresnatita, Koesriharti and Santoso (2013) who say that the application of organic fertilizers can improve soil quality physically, chemically and biologically, so that plants can grow and develop optimally.

Diameter of mustard pollen. The results of the analysis showed that the treatment of giving solid organic fertilizer to quail waste and squid waste gave a very significant difference (P<0.01) to the size of the polar diameter of mustard greens. The average value of the polar diameter of the mustard greens can be seen in Table 1.

Table 1 – The average value of the size of the polar diameter of the mustard green pollen (µm)

Treatment	Average
P0	$48,50 \pm 2,13^{a}$
P1	$49,17 \pm 2,33^{a}$
P2	$50,67 \pm 2,11^{a}$
P3	$57,33 \pm 1,89^{b}$
P4	$53,33 \pm 1,39^{a}$
P5	$50,83 \pm 0,64^{a}$

Description: Superscript a,b without any difference in notation in the polar diameter of mustard greens showed a very significant difference (P<0.01).

Table 1 show that the application of solid organic fertilizer from quail and squid waste has a very significant effect on the size of the polar diameter of mustard greens. The size of the largest polar diameter of mustard pollen can be seen in table 2, namely P3 with an average value of 57.33 ± 1.89b using a mixture of 50% quail and 50% squid. The application of fertilizer with a mixture of 50% quail and 50% squid is considered to give the best results for the size of the polar diameter of mustard greens. There are several factors that affect the size of the polar diameter in mustard greens. According to Erdtman (1954) in Priambudi, et al. (2021) said that one of the factors that influence the size and shape of plant pollen is the level of maturity of the pollen itself. Newly emerged flowers have immature pollen. The process of maturation of plant pollen takes time for the pollen to ripen perfectly. This is reinforced by the statement of Sudarmono and Sahromi (2012) who said that the pollen maturation stage occurs through several stages that occur in the anthers or anthers. Anthera will occur in the process of forming microspores by meiosis called the process of microsporogenesis, which is followed by mitotic division (microganetosis) which aims to form male gametophytes. In the process of maturation of plant pollen, microspore grains will develop into pollen grains that have two-layered cell walls (exins on the outside and intin on the inside). Exin has a wall pattern that is unique to the species in question and it is this layer that distinguishes one species from another. At the time of maturity or maturity, the entire anther will be filled with microspores or pollen, so that the two cavities in each theca then unite into a large pollen sac. Pollen exits from the anther through a slit or pore at the end of

the anther. There are 4 anthers in an anther paired pollen sacs in 2 theca (pollen chambers) connected by a nectivum (connecting anthers). The anther wall is composed of several layers of cells, namely the tapetum layer which is the deepest layer in the anther which serves as a source of pollen nutrition while it is developing and the endothelium layer, which is a layer of cells with a distinctive structure that forms a thickening of the wall that plays a role in the mechanism of theca cleft formation at the time of pollen release. The epidermis is the middle layer between the endothelium and the tapetum.

Fakhrizal (2005) in Zahrina, Hasanuddin and Wardiah (2017) says that the variation of pollen size is influenced by several factors, such as internal factors in the form of chromosome number or genetics of plants and the character of flowers, and external factors, namely temperature, minerals or nutrients. on plant growing media and water supply in the soil where plants grow. Plants with treatment 3 (P3) were a mixture of 50% quail manure and 50% squid waste. The mixture of the two wastes with a ratio of 50:50 produces the most ideal soil for vegetative and generative growth of mustard greens. Figure 3 shows the vegetative growth of the mustard plant in the form of plant height in each treatment.

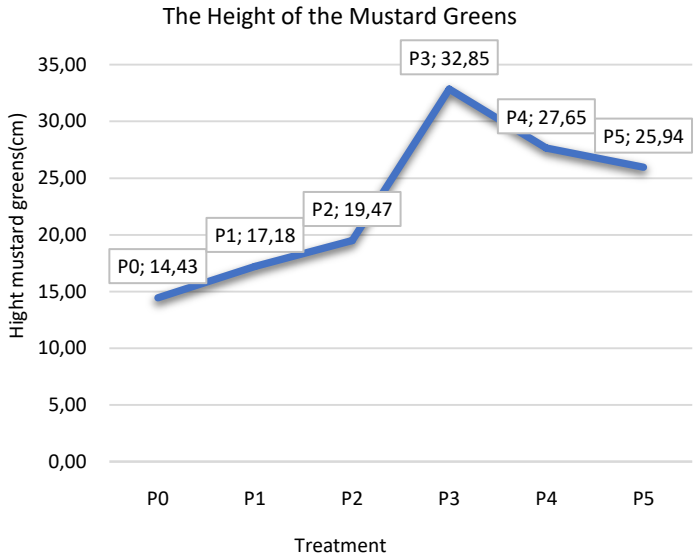

Figure 3 – The height of the mustard greens

Soil at P3 is said to be ideal because it has characteristics such as a high mineral count which is ideal for plant growth and development, has a pH between 6-6.5, is loose and in the form of crumbs, has good aeration and good drainage so as to minimize the occurrence of puddles in the media. This also caused the P3 plant height growth to be the highest compared to other treatments. This is reinforced by the statement of Rukmana (2003) in Hidayati, Nurlina and Purwanti (2021) which says that the ideal condition for mustard plants to grow is soil as a fertile planting medium, loose, contains lots of organic matter, not easy to cause puddles, air conditioning or aeration in the soil goes well and has a soil pH between 6-7, unlike the case with plants with P0 growing media. Treatment 0 (control) was a planting medium containing 100% soil without any fertilizer mixture, causing the soil to be hard, lacking in nutrients or minerals, having a low pH, poor drainage and aeration so that it was easily flooded by water. This causes the pollen size of the mustard plant P0 to be a large size the smallest was 48.50 ± 2.13a and had the shortest growth compared to other treatments.

Quail manure contains minerals needed by plants such as Nitrogen content of 0.061-3.19%; Phosphorus is 0.209-1.37% and K2O content is 3.133%, while fish waste contains nitrogen nutrients of 2.26%, Phosphorus is 1.44% and Potassium is 0.95%. Nitrogen element is the element most needed by plants during growth, which has benefits such as; increase plant growth (number of leaves, leaf height, leaf length and leaf width), increase

protein synthesis in plants, increase the process of chlorophyll formation which causes the leaf color to become greener and increase the root shoot ratio (Sarif, Hadid and Wahyudi, 2015). Alfandi (2011) in Permadi and Haryati (2015) said that phosphate elements are beneficial for plants for cell growth in plants, root formation, root hairs and stimulate root growth, helping to produce photosynthate which will be translocated to pods. While potassium fertilizer is useful for plants for the formation of protein and fat, strengthens plants, roots, leaves, flowers, and fruits do not fall off easily, as well as a source of strength for plants to face drought and disease.

Diameter of Mustard Pollen Equator. The results of the analysis showed that the treatment of giving solid organic fertilizer of quail waste and squid waste gave a very significant difference (P<0.01) to the size of the equator diameter of mustard greens. The average value of the size of the equator diameter of mustard greens can be seen in Table 2.

Table 2 – The average value of the equator diameter of green mustard pollen (µm)

Treatment	Average
P0	$40,17 \pm 0,84^{a}$
P1	$41,67 \pm 3,94^{ab}$
P2	$44,33 \pm 1,28^{b}$
P3	$48,33 \pm 1,39^{b}$
P4	$46,00 \pm 1,22^{b}$
P5	$45,17 \pm 0,64^{b}$

Description: Superscript a, b without any difference in notation in the column size of the equator diameter of mustard greens showed a very significant difference (P<0.01).

Table 2 shows that the size of the polar diameter of the mustard greens has a very significant effect, this is caused by internal factors and external factors of the mustard plant. Erdtman (1954) in Zahrina, et al. (2017) strengthens this statement by saying that the factors that influence the morphology of mustard pollen are internal factors such as genetics and external factors such as temperature, mineral elements and water supplies that exist in the planting medium where the mustard greens grow. Mustard plant is a plant that can grow in hot or cold conditions so it doesn't matter if it is planted in the rainy or dry season. The quality of growth and development of the mustard plant is influenced by the nutrients present in the mustard plant growing medium. Ngantung, Rondonuwu and Kawulusan (2018) said that the ideal soil conditions for mustard plants are loose soil, rich in nutrients, fertile, good drainage, optimum soil acidity (pH) for growth, namely pH between 6 to 7.

P0 treatment is a treatment with soil conditions with a combination of 100% soil without a mixture of organic fertilizers. Soil conditions at P0 (100% soil) give the soil conditions in the form of hard, poor drainage and aeration causing the planting medium to be flooded with water, low pH in the soil and the lack of minerals needed by plants to grow and develop, making plants at P0 experience growth disturbances when compared to other treatments. This is in line with the statement of Lakitan (2007) in Fitrah and Amir (2015) which says that the lack of availability of minerals or nutrients in plant growing media will cause plants to be disturbed in the metabolic process, so that plant growth will be hampered by roots, stems and leaves. This inhibition of plant growth will cause stunted plants so that it is detrimental to farmers. Nitrogen deficiency in plants will affect vegetative growth in plants such as leaf color that becomes pale, plant stems become weak and grow elongated. On old leaves will appear on the underside of the yellow color and fall prematurely. In addition, plant growth will be stunted, stem color is reddish, pod growth is inhibited, leaves shrink and have thick walls so that the leaves become hard or rough and fibrous. Phosphate deficiency in plants will cause several things, such as: causing old leaves on plants to turn dark and turn yellow and fall prematurely. The stem turns purple, due to the accumulation of anthocyanins. In addition, it inhibits the formation of root nodules (nodules), the development of roots, pods and seeds. While the lack of potassium in plants will cause chlorosis between the leaf bones or leaf edges. In severe conditions, the chlorosis will extend to the base of the leaf and only leave a green color on the leaf veins on the plant, at the next level necrosis will occur at the edges of

the old leaves so that it will turn yellow, the leaves roll up and then the plant will dry out (Permadi and Haryati, 2015).

The difference in the concentration of these nutrients is divided into 2, namely macro nutrients and micro nutrients. Macro nutrients are nutrients needed by plants in large amounts (more than 0.1% dry weight of plants), while for micro elements are elements needed by plants in small amounts (less than 0.1% or < 100ppm of plant weight). The existence of standard concentrations of macro and micro nutrients is because if the amount of these nutrients is excessive in plants, it will cause toxicity conditions in plants. As stated by Mulyadi (2012) in Permadi and Haryati (2015) who said that excess nitrogen in plants will cause negative effects on plant growth, due to the administration of excessive nitrogen elements. Nitrates have the ability to negate changes in the shape of root hairs required for entry for bacteria, thereby reducing the number of nodules and affecting the activity of the nodules that have been formed by reducing the volume of bacterial tissue and in the presence of interference with these fixation activities will affect the balance between carbohydrates and nitrogen in plants.

The P3 treatment gave the largest equator diameter with an average of 48.33 ± 1.39b. The second largest equator diameter size is P4 with an average of 46.00 ± 1.22b and the smallest size is P0 treatment with an average of 40.17 ± 0.84a. The difference in the size of the equator diameter of mustard greens is influenced by the nutrients of the growing media. The planting medium in P3 was a mixture of 50% quail waste and 50% squid waste. The mixture of these two wastes produces organic fertilizer with the characteristics of loose soil, in the form of crumbs, pH between 6-7, good drainage and aeration so that the planting media is not easily flooded by water.

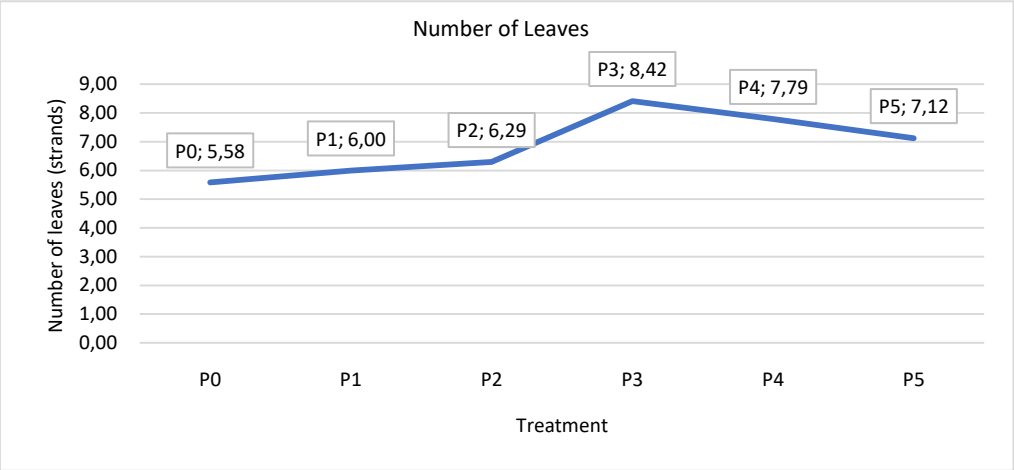

Figure 4 – Number of leaves of mustard greens

The P0 treatment contained 100% soil without the addition of solid organic fertilizers. P0 treatment has poor characteristics for plant growth and development, because mustard plants require loose soil, normal pH between 6-7, good aeration and drainage and soil is not easily flooded so that plants grow healthily. This causes the number of leaves at P0 to be the least and P3 is the treatment that produces the highest number of leaves due to ideal conditions for plants to grow and develop.

Green Mustard Nectar Production. The results of the analysis of variance showed that the treatment of using organic fertilizer from solid sludge biogas waste from squid and quail did not give a significant difference (P>0.05) on the production of nectar in mustard greens. The average value of green mustard nectar production can be seen in Table 3.

Analysis of variance carried out on data from observations of green mustard nectar production showed that the application of organic fertilizer from solid sludge biogas from squid and quail waste to mustard greens did not have a significant effect (P>0.05) on the production of green mustard nectar. It is estimated that these results can be obtained

because there are many factors that affect the production of nectar in a plant other than the planting medium. Pena, et al (2016) explained that the diversity of sugar composition, the amount of nectar volume and sugar concentration in nectar is influenced by environmental factors where the plant is located, the evolution of the plant itself because some researchers think that producing nectar is enough to consume energy for plants, and The physiology of pollinating insects also has a role in the volume of nectar produced. This opinion is also supported by Scogin (1982) that the volume of nectar per flower is also influenced by environmental factors such as humidity, environmental temperature, and mineral substrates that support plant growth. During the research process, the research location was also experiencing the rainy season. The intensity of rainfall has an influence also on the production of nectar in a plant.

Table 3 – Average value of nectar production

Treatment	Average Nectar Production (Milligrams per 4 Buds per plant)
P_0	9,45 ± 3,202[a]
P_1	11,10 ± 3,550[a]
P_2	12,60 ± 4,448[a]
P_3	12,70 ± 1,352[a]
P_4	10,95 ± 0,823[a]
P_5	11,05 ± 2,705[a]

Note: Superscript a, b without the difference in notation in the mean column of green mustard nectar production showed no significant difference (P>0.05).

It is known from Table 4. that the average result shows the highest nectar volume obtained in treatment P3 (12.70 ± 1.3515) which is the treatment with concentration (50% quail waste and 50% squid waste). Treatment P3 did not show a significant difference to P1 (11.10 ± 3.5496), P2 (12.70 ± 1.3515), P4 (10.95 ± 0.8226), P5 (11.05 ± 2.7049).

Treatment P0 (9.45 ± 3.2016a) showed the lowest mean. The P0 treatment was a control treatment without a mixture of quail and squid waste.

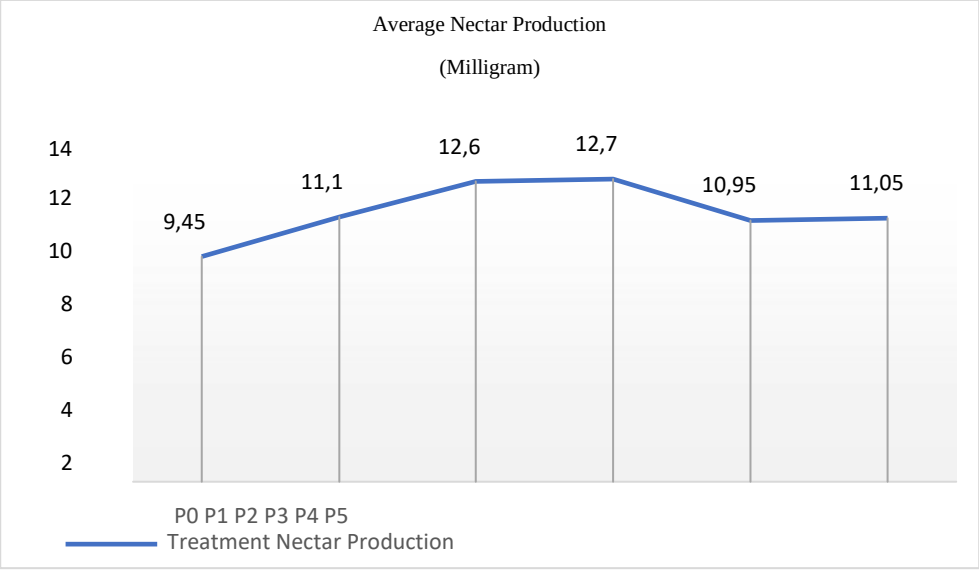

Figure 5 – Diagram of Average Production Volume

The figure above shows that the average mustard green nectar obtained for 5 days varied but the difference was only slightly between one treatment and another. The volume of nectar production tends to experience the lowest point at P0 and the highest point at P3 treatment. The higher the line chart shown, the more volume of nectar produced.

Nectar Productivity. The results of the analysis of variance showed that the treatment using organic fertilizer from solid sludge biogas waste from squid and quail did not give a significant difference (P>0.05) to the percentage of green mustard nectar productivity.

Table 4 – Average value of nectar productivity

Treatment	Average Nectar Production (%)
P_0	42,385 ± 14,108[a]
P_1	48,823 ± 15,937[a]
P_2	53,523 ± 18,322[a]
P_3	53,651 ± 7,022[a]
P_4	45,702 ± 3,505[a]
P_5	48,967 ± 10,837[a]

Note: Superscripts a, b with no difference in notation in the column mean weight of mustard greens showed no significant difference (P>0.05).

It is known from Table 8. that the data results show the highest flower nectar productivity obtained in the P3 treatment (53.651 ± 7,022) which is a treatment with a concentration (50% Quail Waste and 50% Squid Waste). Treatment P0 (42,385 ± 14,108) showed the lowest mean. P0 treatment is a treatment with a concentration (100% soil). This can be presumably because P3 has the most data on the amount of nectar production and the number of flowers, while P0 is the opposite. This is in accordance with the opinion of Alekseyeva and Bureyko (2000) that the nectar productivity of a cultivated plant variety is influenced by the number of plants, the number of flowers and the sugar content in the flower of the plant, nectar productivity also depends on weather conditions during vegetative to generative growth of a plant. The growth of flowers on a plant also cannot be separated from the nutritional factors in the planting medium. Nutrients N, P and K are nutrients that are absolutely needed by plants, the combination of these elements with relatively dilute sludge with cement as a nutrient enhancer produces relatively better growth. Junus et al (2007).

CONCLUSION AND SUGGESTIONS

Efforts to utilize solid organic fertilizer from quail waste and squid waste on pollen morphology and nectar production of green mustard plants can be done by using a planting media ratio of 50% quail and 50% squid (P3). The use of solid organic fertilizer of quail waste and squid waste with a ratio of 50% quail and 50% squid (P3) gave the best results on the morphology of the green mustard plant pollen as bee feed, followed by 25% quail and 75% squid (P4), 100% squid (P5) and 75% quail and 25% squid (P2). Treatment 1 (P1), which is a planting medium with 100% quail, is not recommended for the utilization of pollen morphology and nectar production of green mustard plants because the characteristics of the growing media are not in accordance with the growth requirements of mustard plants.

It is necessary to observe the pollen morphology of the mustard plant for a longer time, due to its relationship with the level of pollen maturity which affects the pollen morphology of the mustard greens. The use of more advanced observation methods (more thorough and advanced), such as using the acetolysis method when observing the morphology of green mustard pollen, so as to obtain clearer research data.

REFERENCES

1. Agussalim., A. Agus., N. Umami and I. G. S. Budisatria. 2017. Variasi Jenis Tanaman Pakan Lebah Madu Sumber Nektar and Polen Berdasarkan Ketinggian Tempat di Yogyakarta. Buletin Peternakan. 41(4): 448-460.
2. Agustin, S. R., Pinandoyo and V. E. Herawati. 2017. Pengaruh Waktu Fermentasi Limbah Bahan Organik Kotoran Burung Puyuh, Roti Afkir and Ampas Tahu) sebagai

Pupuk untuk Pertumbuhan and Kandungan Lemak Daphnia SP. e-Jurnal Rekayasa and Teknologi Budidaya Perairan. 6(1): 653-668.
3. Agustin, S. R., Pinandoyo and V. E. Herawati. 2017. Pengaruh Waktu Fermentasi Limbah Bahan Organik (Kotoran Burung Puyuh, Roti Afkir and Ampas Tahu) sebagai Pupuk untuk Pertumbuhan and Kandungan Lemak Daphnia SP. e-Jurnal Rekayasa and Teknologi Budidaya Perairan. 6(1): 653-668.
4. Alekseyeva, E.S and A.L. Bureyko. 2000. Bee Visitation, Nectar Productivity and Pollen Efficiency of Common Buckwheat. Fagopyrum. Vol 17:77-80.
5. Alfandi., D. Budirahman and Z. Hasikin. 2017. Pengaruh Kombinasi Jarak Tanam and Umur Bibit terhadap Pertumbuhan and Hasil Tanaman Pakcoy (Brassica campestris L.). Agroswagati Jurnal Agronomi, 5(2): 611-619.
6. Dubno, Z. 2018. Local Bee Pollen is the Only Thing That Cured My Seasonal Allergies. Diakses 14 Februari 2022. <https://www.bonappetit.com/story /local-bee-pollen>.
7. Fitrah, A and N. Amir. 2015. Pengaruh Jenis Pupuk Organik Padat and Cair terhadap Pertumbuhan and Produksi Tanaman Seledri (Apium Graveolens L.) di Polybag. Klorofil. 10(1): 43-48.
8. Hidayati, S., Nurlina and S. Purwanti. 2021. Uji Pertumbuhan and Hasil Tanaman Sawi dengan Pemberian Macam Pupuk Organik and Pupuk Nitrogen. Jurnal Pertanian Cemara. 18(2): 81-89.
9. Istarofah and Z. Salamah. 2017. Pertumbuhan Tanaman Sawi Hijau (Brassica juncea L.) dengan Pemberian Kompos Berbahan Dasar Daun Paitan (Thitonia diversifolia). BIO-SITE Biologi and Sains Terapan. 3(1): 39-46.
10. Jayuli, M., M. Junus and I. W. Nursita. 2018. Pengaruh Ketingian Terhadap Diameter Polen Lebah Madu (Apis Cerana) di Kabupaten Malang. Ternak Tropika Journal of Tropical Animal Production. 19(1): 9-21.
11. Junus, M., B. Satata and S. Arifin. 2007. Pengaruh Limbah Pupuk Cair Biogas yang Dipekatkan Terhadap Pertumbuhan Cabai. Jurnal Ternak Tropika. Vol 6(2):88-100.
12. Junus, M. 2015. Pengaruh Cairan Lumpur Organik Unit Gas Bio terhadap Persentase Kandungan Bahan Organik and Protein Kasar Padatan Lumpur Organik Unit Gas Bio. Jurnal Ilmu-Ilmu Peternakan (Indonesian Journal of Animal Science). 25(1): 35- 41.
13. Junus, M. 2017. Produk- produk Lebah Madu and Hasil Olahannya. Malang: UB Press.
14. Junus, M., & I. Novianti. 2020. Accelerating Animal Husbandry Development through a Biogas Unit. EurAsian Journal of BioSciences. 14(2): 7705- 7711.
15. Kresnatita, S., Koesriharti and M. Santoso. 2013. Pengaruh Rabuk Organik terhadap Pertumbuhan and Hasil Tanaman Jagung Manis. The Indonesian Green Technology Journal. 2(1): 8-17.
16. Mengel, K and E. A. Kirkby. 2012. Principles of plant nutrition. Springer Science & Business Media.
17. Ngantung, J. A. B., J. J. Rondonuwu and R. I. Kawulusan. 2018. Respon Tanaman Sawi Hijau (Brassica juncea L.) terhadap Pemberian Pupuk Organik and Anorganik di Kelurahan Rurukan Kecamatan Tomohon Timur. Eugenia. 24(1): 44-52.
18. Permadi, K and Y. Haryati. 2015. Pemberian Pupuk N, P, and K Berdasarkan Pengelolaan Hara Spesifik Lokasi untuk Meningkatkan Produktivitas Kedelai. Agrotrop: Journal on Agriculture Science. 5(1): 1-8.
19. Permadi, K and Y. Haryati. 2015. Pemberian Pupuk N, P, and K Berdasarkan Pengelolaan Hara Spesifik Lokasi untuk Meningkatkan Produktivitas Kedelai. Agrotrop: Journal on Agriculture Science. 5(1): 1-8.
20. Permadi, K and Y. Haryati. 2015. Pemberian Pupuk N, P, and K Berdasarkan Pengelolaan Hara Spesifik Lokasi untuk Meningkatkan Produktivitas Kedelai. Agrotrop: Journal on Agriculture Science. 5(1): 1-8.
21. Priambudi, A. S., R. Rika and N. R. Djuita. 2021. Identifikasi Tumbuhan Sumber Polen pada Madu Lebah Heterotrigona itama and Tetragonula laeviceps di Belitung. Jurnal Sumberdaya Hayati. 7(1): 25-35.
22. Roidah, I. S. 2013. Manfaat Penggunaan Pupuk Organik untuk Kesuburan Tanah. Jurnal Bonorowo. 1(1), 30- 42.

23. Sanjaya, I. K. A. A., E. Kriswiyanti and A. A. K. Darmadi. 2020. Karakteristik and Viabilitas Serbuk Sari 38 Ragam Tanaman Kamboja (Plumeria spp.) Di Bali. Journal of Biological Sciences. 7(1): 40-47.
24. Sarif, P., A. Hadid and I. Wahyudi. 2015. Pertumbuhan and Hasil Tanaman Sawi (Brassica juncea L.) akibat Pemberian berbagai Dosis Pupuk Urea. Jurnal Agrotekbis. 3(5): 585- 591.
25. Sholeh, K. 2018. Kinerja Ekspor Produk Perikanan Indonesia Tahun 2018. Diakses 15 Maret 2022. < https://kkp.go.id/djpdspkp/artikel/7 947-kinerja- ekspor->.
26. Sudarmono and Sahromi. 2012. Pollen atau serbuk sari: Aspek Morfologi, Sistematika and Aplikasinya pada Tumbuhan Keluarga Mentol. Jurnal Sains Natural. 2(1): 12-16.
27. Zahrina., Hasanuddin and Wardiah. 2017. Studi Morfologi Serbuk Sari Enam Anggota Familia Rubiaceae. Jurnal Ilmiah Mahasiswa Pendidikan Biologi. 2(1): 114-123.
28. Zahrina., Hasanuddin and Wardiah. 2017. Studi Morfologi Serbuk Sari Enam Anggota Familia Rubiaceae. Jurnal Ilmiah Mahasiswa Pendidikan Biologi. 2(1): 114-123.