

Interaction Of Municipal Garbage Waste And Local Microorganisms (LOM) Of Banana Weevil On Soybean Yield

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Abstract – Soybean is the third main food commodity after rice and corn because soybean is a source of protein for Indonesian people. The high use of inorganic fertilizers causes fertile land resources to decrease. The need for soybeans increases with the increase in population. Reduced availability of soybean supply so efforts are needed to increase soybean production. Utilization of municipal waste as an effort to reduce the use of inorganic fertilizers. The study aimed to determine the effect of the interaction between municipal solid waste and local microorganisms on banana weevils on soybean yields. The research was conducted in Tember Village Tompas District Minahasa Regency from May to October 2021. The study used a completely randomized factorial design. The treatment consists of, Factor I (A) = city waste compost. A0=without municipal waste compost, A1=10 tonnes/ha municipal waste compost, A2=20 tonnes/ha municipal waste compost. Factor II (B) = dosage of banana weevil local microorganisms. B0=without local microorganisms; B1= 50 ml of banana weevil local microorganisms/1 liter of water; B2=100 ml of banana weevil local microorganisms/1 liter of water, B3= 150 ml of banana weevil local microorganisms/1 liter of water. Each treatment was repeated three times to obtain 36 trial pots. The results showed that the concentration of 150 ml of local microorganisms (LOM) on banana weevil at 20 tonnes/ha of municipal waste compost increased the number of soybean seeds by 532 and the weight of soybean seeds per plant was 107 grams.

Keywords – banana weevil local microorganisms; municipal waste compost; soybean yield

I. INTRODUCTION

Soybean is a plant source of protein that is cheap and widely consumed by Indonesian people in the form of tempeh, tofu, and other menus. Soybeans are needed as industrial raw materials such as cooking oil and beverages. Therefore the availability of soybeans is very important. Increased soybean production ensures the availability of soybeans to meet demand. Soybean production is determined by the availability of nutrients in the soil. Many agricultural lands have experienced a decline in fertility due to the frequent use of chemical fertilizers. The soil becomes dense and plant roots do not develop properly causing nutrient uptake to not be optimal so the use of organic fertilizers becomes necessary.

Organic fertilizers can improve soil physical properties through the formation of stable soil structures and aggregates and are closely related to the soil's ability to bind water, water infiltration, reduce the risk of erosion, increase ion exchange capacity and regulate soil temperature, all of which have a good effect on plant growth [1]. Compost is the result of partial or incomplete decomposition of a mixture of organic materials which is accelerated artificially by a population of various kinds of microbes in warm, humid, and aerobic or anaerobic environmental conditions [2]. The use of decomposers in the composting process has the function of accelerating the degradation of organic matter, thereby accelerating the time when compost is formed with the expected criteria. The research results using 40 tons/ha of municipal waste compost and 200 kg of urea/ha can increase the fresh weight of pakchoi and increase production per plot up to 25.23 tons/ha [3].

Local microorganisms banana weevil contains nitrogen=0.06%, phosphorus=0.48%, and potassium = 0.21% [4]. Local microorganisms of banana weevil contain growth regulators gibberellins and cytokinins and microorganisms that are very useful

for plants [5]. Banana weevils are underused by farmers and left to rot naturally, even though banana weevils can be used as decomposer microorganisms. In 100 g of the dry hump, there are 66.2 g of carbohydrates, which also contain protein and important minerals [6]. Local microorganisms function as bio activators and have been identified as supplying nutrients through the exudate mechanism, controlling microbes according to plant needs, maintaining the stability of soil conditions to ideal conditions for plant growth, and even controlling plant disease attacks [7].

Local microorganisms as liquid organic fertilizers do not damage the soil and plants, even though they are used as often as possible, they also have a binder that functions as a fertilizer solution that can be directly utilized by plants [8]. Banana weevil as a basic ingredient for making local microorganisms is very good because it contains microbes that decompose organic matter. The decomposer microbes are located on the outer and inner banana weevils. Types of microbes that have been identified in banana weevils include *Bacillus sp*, *Aeromonas sp*, and *Aspergillus niger*. Banana weevil microbes act as decomposers of composted organic matter [9].

Municipal waste derived from organic matter can be processed into compost which plays a role in improving the physical, biological and chemical properties of the soil. Maintain and increase soil fertility, and reduce dependence on inorganic or chemical fertilizers. Banana weevil local microorganisms can act as decomposers which accelerates the composting process of municipal waste so that it is available in good quality. Good quality compost will provide the best soybean production. The study aimed to determine the effect of the interaction between municipal solid waste and local microorganisms on banana weevils on soybean yields.

II. METHOD

The research was conducted in Tember Village Tompaso District Minahasa Regency from May to October 2021. The study used a completely randomized factorial design. The treatment consists of, factor I (A) = city waste compost. A0=without municipal waste compost, A1=10 tonnes/ha municipal waste compost, A2=20 tonnes/ha municipal waste compost. Factor II (B) = dosage of banana weevil local microorganisms. B0=without local microorganisms; B1= 50 ml of banana weevil local microorganisms/1 liter of water; B2=100 ml of banana weevil local microorganisms/1 liter of water, B3= 150 ml of banana weevil local microorganisms/1 liter of water. Each treatment was repeated three times to obtain 36 trial pots.

The materials and tools used were soybean seeds of the Anjosmoro variety, municipal waste (organic), husks, bran, sugar, compound nitrogen phosphorus fertilizer, banana cobs, brown sugar, coconut water, tape measure, scales, oven, land preparation tools, and tools write. Analysis of the contents of pH, nitrogen, phosphorus, potassium, and C-organic city waste compost in the Manado Palmae Crops Research Institute laboratory. Analysis of nitrogen, phosphorus, potassium, and local microorganism pH of banana weevil at Manado Industrial Research and Standardization Center. The data were analyzed using analysis of variance and if there were differences, it was continued with the *Least Significant Difference (LSD)* test at the level of 5%.

III. RESULT AND DISCUSSION

3.1. Seeds per Plant

The interaction between municipal waste compost and weevil banana local microorganism has a significant effect on the number of soybean seeds per plant. The effect of interaction can be seen in Figure 1.

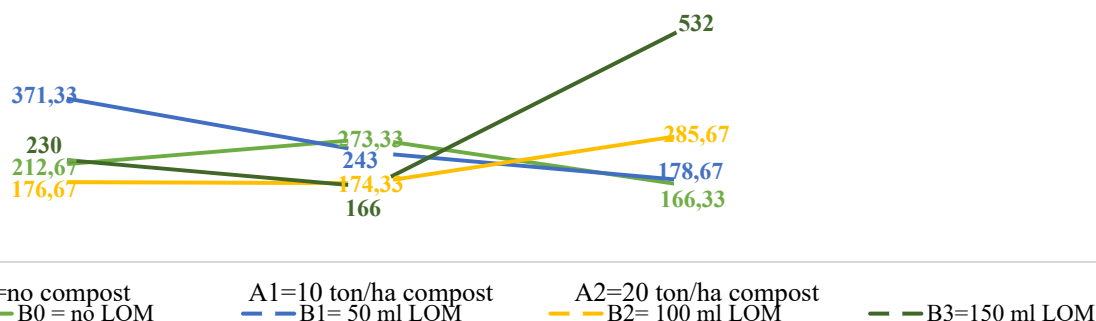


Figure 1. The Effect of Interaction between City Garbage Compost and Local Microorganisms (LOM) of Banana Weevil on the Number of Soybean Seeds

3.2. Weight of Soybean Seeds per Plant

The effect of interaction between municipal waste compost and local banana weevil microorganisms was significant on soybean seed production per plant. The effect of interaction can be seen in Figure 2.

The concentration of 150 ml of local microorganisms banana weevil at 20 tonnes/ha of municipal waste compost increased the number of soybean seeds by 532 seeds (Figure 1) and the weight of soybean seeds per plant weighing 107 grams (Figure 2). Applying municipal waste compost can add organic matter, where organic matter can improve the condition of the physical and chemical properties of the soil. Municipal solid waste interacted with local banana weevil microorganisms with a C/N compost of 24% and met the standard C/N value of compost around 17-25. The C/N ratio is an indicator of the quality and maturity level of the compost material [10].

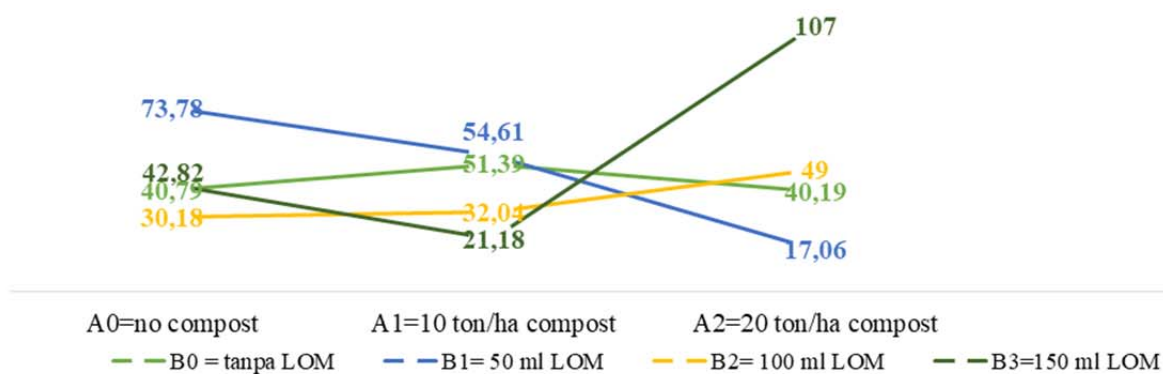


Figure 2. Effect of Interaction between City Garbage Compost and Local Microorganisms (LOM) of Banana Weevil on Soybean Seed Weight

Nitrogen, phosphorus, and potassium nutrient content in municipal waste compost and local microorganisms in banana weevils complement each other in the nutrients needed by soybeans during the formation of pods, seeds, and seed filling (Table 1). The availability of nitrogen is in a balanced condition resulting in the formation of amino acids and proteins increasing in the formation of seeds so that the pods are filled. An increase in plant nitrogen will affect the rate of phosphorus uptake, and affect the rate of seed filling, where plants need nitrogen and phosphorus nutrients for seed formation [11].

The element phosphorus plays an important role in the synthesis of Adenosine Triphosphate (ATP) and NADPH as an energy supply in the formation of root nodules and the operation of the N₂ fixing process by *Rhizobium*. In addition to the important role of the elements nitrogen and phosphorus, potassium is very important in plant metabolic processes, namely in the synthesis of amino acids and proteins from ammonium ions. The functions of potassium include helping the process of protein formation, increasing plant resistance to disease, and stimulating seed filling. Interactions between local microorganisms banana weevil contain growth regulators gibberellin and cytokinins and microorganisms which are very useful for plants [12]. Microorganisms play an important role as regulators of various nutrient cycles, especially nitrogen, phosphorus, and potassium in the soil, and increase the efficiency of absorption of nutrients. The advantages of this local microorganism are that it contains cytokinins growth regulators which help accelerate cell division, contains more microbes, is easy to obtain because it is often not used after the fruit is taken, is inexpensive, and has a non-rotten odor [13].

Table 1. Laboratory Test Results for Municipal Waste Compost and Local Microorganisms (MOL) for Banana Weevil

Test Parameters	Total	Unit	Test Method
<i>Municipal Garbage Compost</i>			
pH	7.48		
C-organic	27.28	%	
N-total	1.1	%	K-Jeldal Tritimetry
N	0.93	%	AAS
K	0.44	%	Spectrophotometer

C/N ratio 24.00 %

Source: Manado Palmae Crops Research Institute Laboratory, 2021 ISO 17025 accreditation

Test Parameters	Total	Unit	Test Method
<i>Banana Weevil Local Microorganisms (LOM)</i>			
pH	3.99		SNI 01-2891-1992 point 16
Nitrogen (N)	0.04	%	SNI 01-2891-1992 point 7.1
Phosphorus (P)	0.06	%	SNI 2803-2012
Potassium (K)	0.40	%	SNI 7763-2018

Source: Manado Industrial Research and Standardization Center, 2021

IV. CONCLUSIONS

The results showed that the concentration of 150 ml of local microorganisms (LOM) on banana weevil at 20 tonnes/ha of municipal waste compost increased the number of soybean seeds by 532 and the weight of soybean seeds per plant was 107 grams. To reduce the use of inorganic fertilizers, the use of local banana weevil microorganisms in city waste compost can be done. Beneficial for increasing yields and useful for maintaining soil fertility and health.

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