Utilization of Cocopeat And Goat of Dirt In Marking of Solid Organic Fertilizer To Quality Macro Nutrient (NPK)

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Abstract. Fertilizer is a material that can provide nutrients for plants. Organic fertilizers are fertilizers composed of living creatures that are processed through decomposition by decomposers, such as weathering the remains of plants, animals, and humans. The purpose of this research is to see the effect of fermentation time and influence of EM4 composition on nutrient quality in solid organic fertilizer. The results obtained based on the length of time of fermentation and Volume Effectve Microorganism 4 EM4 then obtained the best results at 60 ml EM4 volume and 16th days fermentation time with 0.90% nitrogen content, 0.93% phosphorus, and potassium levels of 1.48%. The longer and more EM4 volume the more nutrients it gets.

1. Introduction

Fertilizer is a material that can provide nutrients for plants, if plants lack even do not have one nutrient element, the growth of these plants will not grow optimally. The availability of nutrients in the soil is not always enough to meet the needs of plants. N, P and K elements are primary nutrients, elements Ca, Mg and S are secondary nutrients. In addition, plants need micro nutrients, namely other important elements needed in small amounts, but determine the development of plants, namely boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn).

Fertilizer is a material that is added to the planting media or plants to meet the nutrient needs needed by plants so that they are able to produce well. Fertilizer material can be either organic or non-organic (mineral) materials. Fertilizers containing raw materials that are needed for plant growth and development in the provision of fertilizers need to be considered for the needs of these plants, so that plants do not get too many nutrients. Too little or too many nutrients can be harmful to plants. Fertilizers can be given through the soil or sprayed on the leaves. One type of fertilizer that became an alternative and began to be popular again after a long time has never been used in the development of organic agriculture, namely organic fertilizer.

Organic fertilizer is a fertilizer composed of living matter which is processed through decomposition by decomposing bacteria, such as weathering of plant, animal and human remains [9]. According to [15], the planting medium serves as a place for plants to lay their roots, a source of nutrients for plants that must be supported by good funding drainage. Planting media provide nutrients and provide moisture for plants that function for growth. Plants will grow well when placed on fertile planting media. Fertility of growing media can be seen from physical aspects which include texture, funderation structure.

Organic fertilizers are fertilizers that are composed of material living things that are processed through a process of decay (decomposition) by decomposing bacteria, such as weathering the remains of plants, animals and humans. Organic fertilizers can be either solid or liquid which is used to improve the physical, chemical and biological properties of the soil. Organic fertilizers will provide many benefits because the basic ingredients of organic fertilizers come from agricultural waste, such as: straw, and rice husks, peanut shells, bagasse, cuttlefish, corn stalks, and other forage materials. Whereas livestock manure that is widely used is cow dung, buffalo, goats, chickens, ducks and pigs. Besides that, with the development of settlements, cities and industries, the basic ingredients of compost are
increasingly diverse. Materials that are widely used include: feces, liquid waste, municipal waste and settlements. Organic fertilizers are the best soil enhancers compared to other enhancers.

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According to [5] cocopeat contains macro and micro nutrients needed by plants including potassium, phosphorus, calcium, magnesium and sodium. In addition, cocopeat can hold water and chemical elements of fertilizer and neutralize soil acidity. Physically, cocopeat has a structure that can maintain the balance of aeration and is crumb so that water and air can easily enter.

One of the planting media that is often used for ornamental plants is cocopeat. Cocopeat has several advantages including:

1. Can store oxygen up to 50%, while soil media can only store oxygen 2-3%. The availability of oxygen in the growing media is needed for root growth.
2. Cocopeat can withstand the water content and chemical elements of fertilizer.
3. Can neutralize soil acidity (acidity of cocopeat fiber 5.8 - 6).
4. Macro and micro nutrients contained in coconut fiber include (K) Potassium, (P) Phosphorus, (Ca) Calcium, (Mg) Magnesium, (Na) Sodium and several other minerals. But of the many nutrient content that is owned by cocopeat, it turns out that the most abundant amount is the element K.

Dolomite is a type of limestone that can also benefit plants and soil. These benefits include:

1. Member of nutrition for plants
2. Helps change the pH of the soil
3. Neutralizing harmful substances that can poison the soil and plants (Al, Fe and Cu)
4. Increasing the effectiveness and efficiency of the soil against absorption of nutrients in it.
5. Maintain the availability of nutrients in the soil.
6. Improve soil structure.
7. Stimulates the formation of fatty substances, carbohydrates and various other nutrients in plants.
8. Helping phosphorus distribution in plants.
9. Helps perfect chlorophyll formation in plants.

The advantage of EM4 is that it can be produced in a faster time than natural methods. EM4 contains yeast, photosynthetic bacteria, fungus and lactobacilus sp. EM4 is an agricultural cultivation technology to improve the health and fertility of soil and plants by using beneficial microorganisms for plant growth. While harmful microorganisms that can cause disease can be suppressed. EM4 is able to process or decompose organic materials quickly by fermenting into compost so that it does not cause foul odor but causes fresh aroma.

The quality of bokashi from goat manure will be better if mixing goat manure before the fermentation process begins. Increasing the macro or micro nutrient content will increase and be more complex thanks to the mix of cow manure and goat manure. As a table of composition of macro and micro chemical content between cow and goat manure has advantages in macro elements Nitrogen (N), Potassium (K) and calcium (Ca). However, all that depends on what kind of plants will be fertilized using bokashi made from a mixture of cow and goat manure. in addition to solid goat manure, goat's urine also has very good nutrients to be used as organic fertilizer.

Goat manure is added in cocopeat to add cocopeat nutrition for more decomposition so that it is good for plant nutrition. The selection of goat manure for additional nutrition in cocopeat production because goat manure is harder and denser so that the water content is less and the nitrogen content is greater because the nitrogen element is needed by plants for its growth.

Benefits of goat manure:
1. Increase the nutrient content needed by plants
2. Increasing crop productivity
3. Stimulates the growth of roots, stems, and leaves
4. Spout and fertilize the soil
5. Provision of macro nutrients (nitrogen, phosphorus, potassium, calcium, magnesium and sulfur) and microstructure such as zinc, copper, cobalt, barium, manganese, and iron, although the numbers are relatively small.
6. Increase soil cation exchange capacity (CEC).
7. Form complex compounds with metal ions which poison plants such as aluminum and iron.

The benefits of solid organic fertilizers include, increasing plant fertility, improving soil chemical conditions, improving soil biological conditions, improving soil physical conditions, safe use for humans, not polluting the environment. There are three macro nutrients in organic fertilizer, namely nitrogen, phosphorus and potassium. The uses of nitrogen are to increase plant growth, protein levels in the soil, vegetable plants produced by the leaves, the activity of organisms in the soil and helps process the synthesis of amino acids and proteins in plants. The benefits of phosphorus for plants are helps respiration and photosynthesis in plants, helps form nucleic acids, helps the formation of plant seeds and fruit formation, stimulates the development of plant roots so that plants are more resistant to drought and speed up crop harvest time. The content of potassium plays a major role in the process of plant growth, including form and transport carbohydrates in the plant's body, useful as a catalyst in the process of protein formation, regulate various types of activities from mineral elements in plants, neutralize the reactions that are in the cell, especially the reaction of organic amino acids, increase the growth of meristem tissue, adjust the movement of the stomata, increasing the robustness of the plant stem so that it does not easily collapse, increase the level of carbohydrates and also sugar in the fruit so that the fruit has a sweet taste to make the seeds of the plant fuller and denser so that it can be used as superior seeds, improve fruit quality in plants, increase plant resistance from pests and diseases, and improve the development of plant roots.

Organic fertilizers are also called complete fertilizers because they have a complete composition of nutrients, but the amount of each nutrient is relatively low, so it is needed in large quantities. The main advantage of using organic fertilizer is that it can improve the fertility of the chemical, physical and biological soil, in addition to nutrients for plants. Organic fertilizers can spur and increase the microbial population in the soil, far greater than just providing chemical fertilizers. Organic fertilizers are also able to fix the structure and fertility of the soil. No wonder if organic fertilizer can prevent soil erosion. Because the nitrogen content and nutrient content released by organic matter will slowly undergo a process of mineralization. If given continuously, it can help build soil fertility.

Organic fertilizers have several advantages including, increasing water content and can withstand water for sandy conditions, increase resistance to erosion, increase air exchange, the number of pores and the nature of water infiltration for clay conditions, reduce the level of soil surface hardness, contain elements complete macro micro nutrients, safe (environmentally friendly), effective and economical (cheap/easy to get) and eliminate chemical residu [14]. While, organic fertilizers also have disadvantages, including, it requires in very large quantities to meet the nutrient requirements of a crop, nutrients contained for similar materials vary widely and are good, both in transportation and use in the field. Similar effect of sewage sludge on the levels of soil acidity was demonstrated by [7] who investigated the effect of fertilization with manure and sewage sludge on soil properties. Others point to the acidifying tendencies of sewage sludge after its introduction to the soil fertilized with it [13] This causes the necessity of further investigations of wastewater and sludge in terms of chemical composition.

Fermentation is the process of producing energy in cells in an anaerobic (without oxygen) state. In general, fermentation is a form of anaerobic respiration. Fermentation is the process of decomposition or alteration of organic matter carried out under certain conditions by fermentative microorganisms. The principle of fermentation is that organic waste material is destroyed by microbes in a range of temperatures and certain conditions, namely fermentation. Fermentation can occur due to the activity of
microorganisms found in suitable organic matter, this can cause changes in compounds. Fermentation is also a process of breaking down organic compounds into simple compounds involving microorganisms. Fermentation can occur due to microbial activity due to fermentation on suitable organic substrates.

Fermentation is the process of solving organic compounds into simple compounds involving microorganisms. Fermentation can occur due to microbial activity that causes fermentation on an appropriate organic substrate. The occurrence of fermentation can cause changes in the nature of food as a result of the breakdown of the components of the material. To avoid a competition with food industry, cheap by-products and waste substrates are recommended generally for fermentative production of chemicals [10].

Bio-fermentation is a bioengineering technology that utilizes the metabolism of microorganisms for the production of chemical raw materials. The continuous regulation of the technological parameters of bio-fermentation is the most important means of maintaining biological production of chemical raw materials [2].

The essential factors for the growth of microorganisms are temperature, water, nutrients, pH value, etc. Since the bio-fermentation involves many aspects as physics, chemistry and biology, etc, and it is a typical nonlinear and time-varying reaction process, the existing technologies have many shortcomings in the online monitoring of related metabolic indexes (such as biological concentration, growth rate and metabolic rate) of microorganisms. Currently, the most commonly used method is to manually sample the bio-fermentation and perform offline analysis, however, this method has larger sampling amount and the analysis result is lagging, which severely constrains the development of bio-fermentation technology [11]. In addition, extensive bacterial growth achieved during fermentation of the stillage could bring additional value to the process through utilization of the spent media for animal feed formulae enriched in lactic acid bacteria [1].

The purpose of this study is to see the effect of bio-fermentation time and the effect of EM4 composition on nutrient quality in solid organic fertilizer.

Factors Affecting Fermentation:
1. Microorganisms
2. pH (acidity)
3. Temperature
4. Humidity
5. Number of Microorganisms
6. Material Size

Factors that influence the growth of microorganisms:
1. Supply of Nutrition
2. Time
3. Temperature
4. pH value

2. Materials and Methods

The materials used in this research are cocopeats, goat of dirt, dolomite, EM4 and water. And the tools used in this study are blender, buckets, scales, gloves, plastic bag, knife and fertilizer mold. Cocopeats are dried in the sun and sifted with a 10 mesh sieve called dust. The following are the stages carried out in this study:
1. Prepared goat samples are then stacked and placed on a place that is not inundated
2. Refined dirt samples
3. Samples of cocopeat as much as 100 grams are taken into the bucket.
4. Added 5 grams of dolomite while watering enough water for moisture then added EM4 of 20.40, and 60 ml.
5. Take the cocopeat which has been inserted into the mold.
6. Then 5 grams of goat manure is taken and put in a mold that has been filled with cocopeat, then closed again using a mixture that has been mixed.
7. Insert the mold that has filled the fertilizer into the plastic so that no air enters.
8. Leave it for 8, 12 and 16th days.
9. After finishing the fermentation, the fertilizer is ready to be used.

As for the nitrogen testing method with the Kjeldahl method, phosphorus by spectrophotometry and potassium by the Atomic Absorbsion Spectrophotometry (AAS).

3. Results and Discussion

| Table 1. Nitrogen Content Analysis Results Data (%) |
|-----------------------------------------------|
| Time of Fermentation of                      |
| Solid Organic Fertilizers (Day)              |
| Volume EM4(ml) | 20,0 | 40,0 | 60,0 |
| 8         | 0,54 | 0,63 | 0,76 |
| 12        | 0,64 | 0,72 | 0,82 |
| 16        | 0,71 | 0,82 | 0,90 |

The effect of fermentation time on nitrogen content by varying the use of EM4 as a bioactivator for the fermentation process carried out. The lowest Nitrogen content was obtained at 8th day fermentation with 20 ml of EM4 amounting to 0.54%. This is because in the 8th day fermentation period the growth of the initial phase microorganisms is a phase of adjustment between decomposing microorganisms and the substrate described so that there has not been a change in the number of cells that are too significant. This can affect the NPK obtained in fertilizers, because the quality of nutrients in solid fertilizers is influenced by the rate of extraction by microbes, NPK levels will increase with the increasing number of microorganisms where the more microbes that develop, the more substrate described so that the quality of organic fertilizer will be even better [14].

This is because in the 8th day fermentation period the growth of the early phase microorganisms is an adjustment phase between decomposing microorganisms and the substrate described so that there is no significant change in cell number. The best results were obtained on the 16th day with an EM4 volume of 60 ml which was 0.90%. The Nitrogen level has met the quality standards of solid fertilizer, which is at least 0.4%. At 12th and 16th day fermentation, the Nitrogen levels were 0.64%, and 0.71%, with the same EM4 amount of 20 ml, the Nitrogen levels were increasing, so did the same day with different EM4 volumes of 40 ml, and 60 ml of Nitrogen levels also increase. This is because the existing microorganisms experience an exponential phase which is very rapid cell division [3]. This is because in the 8th day fermentation period the growth of the early phase microorganisms is an adjustment phase between decomposing microorganisms and the substrate described so that there is no significant change in cell number. The effect of application of organic fertilizers on soil reaction and other properties of sorption complex are also essential [4].

| Table 2. Phosphor Content Analysis Results Data (%) |
|-----------------------------------------------|
| Time of Fermentation of                      |
| Solid Organic Fertilizers (Day)              |
| Volume EM4(ml) | 20,0 | 40,0 | 60,0 |
| 8         | 0,63 | 0,74 | 0,84 |
| 12        | 0,66 | 0,79 | 0,87 |
| 16        | 0,71 | 0,82 | 0,93 |

Phosphorus levels obtained are increasing. The phosphorus content obtained is strongly influenced by the length of fermentation time and the volume of EM4 that is varied. The lowest phosphorus content obtained at 20 ml EM4 volume on the 8th day is 0.63%, this is due to the growth of microorganisms in
the initial phase which is the adaptation period, since the inoculation of the medium is carried out during the initial phase where the cell mass can change without changes in cell numbers. Phosphorus in plants plays a role in the formation of flowers, fruits and seeds and plays a role in the transfer of energy in plant cells which cannot be replaced by other elements. The best results were obtained on the 16th day with an EM4 volume of 60 ml which was 0.93%.

This is because in fermentation the growth of microorganisms in the initial phase is a period of adaptation that is since the inoculation of the medium is carried out during the initial phase where the cell mass can change without changes in the number of cells. After the mass change then microorganisms grow into the exponential phase, namely at the volume of EM4 40 ml with a fermentation time of 12th day, where the existing microorganisms develop optimally to the number of cells produced so that the phosphorus content obtained is also increasing. From the Phosphorus level it shows that the phosphorus level has met the standard, which is > 0.10%. The content of Nitrogen in the substrate, the greater the multiplication of microorganisms that overhaul phosphorus will increase, so that the phosphorus content in fertilizers also increases [18].

| Table 3. Potassium Content Analysis Results Data (%) |
|-----------------------------------------------|
| Time of Fermentation of Solid Organic Fertilizers | Volume EM4(ml) |
| (Day) | 20,0 | 40,0 | 60,0 |
| 8 | 0.75 | 0.92 | 1.36 |
| 12 | 0.79 | 1.15 | 1.42 |
| 16 | 0.83 | 1.24 | 1.48 |

The lowest results were obtained at 20 ml EM4 volume with 8th day fermentation time of 0.75%. This is because in fermentation the growth of microorganisms occurs in the initial phase which is a stage of adjustment between microbes and substrate to be described. During the initial phase, cell mass can change without changes in cell number. After the next mass change microorganisms grow into an exponential phase where the existing microorganisms develop optimally against the number of cells produced by microorganisms so that the levels of phosphorus obtained increase. The best results were obtained on the 16th day and 60 ml EM4 volume of 1.48%. From these levels showed potassium solid organic fertilizer has met potassium standards, namely > 0.20%. The best results were obtained on the 16th day and the volume of EM4 as much as 60 ml which is 1.48%. From these levels indicate potassium solid organic fertilizer has met the standard potassium is > 0.20%. the results obtained were higher compared to the fermentation time and other EM4 volumes. Potassium is used by microorganisms in the substrate material as a catalyst, with the presence of bacteria and its activity will greatly influence the increase in potassium.

4. Conclusions

From the research that has been done it can be taken several conclusions which are:
1. Solid waste of goat and coconut husk waste can be used as a raw material for solid organic fertilizers with the addition of some other ingredients.
2. The content of macro nutrients (N, P, K) in solid organic fertilizer was best at 16th day fermentation with EM4 volume of 60 ml that is 0.90% N, 0.93% P and 1.48% K.
3. The contents of macro nutrients (N, P, K) are directly proportional to EM4 volume and fermentation time.
4. EM4 volume and fermentation time have an effect on the macro nutrient content (N, P, K).

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