The role of dolomite and vermicompost in nutrient uptake and production of sweet potato (*Ipomoea batatas* L) on acid soil

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Abstract. Sweet potato production is limited where it is caused by the lack of nutrients needed by the plant, where most of the sweet potato is planted on acid dry land where liming on the soil is an important activity that is sometimes neglected by farmers, so that the need for the nutrients needed is not fulfilled, so that the production of sweet potatoes is lo, by giving Dolomite and Bio-Vermi can help to increase nutrient uptake and plant production. The purpose of this study was to determine the effectiveness of dolomite and Bio-Vermi in optimizing nutrient absorption in the growth and production of sweet potato (*Ipomoea batatas* L.). The research was conducted in Aras Kabu Village, Beringi District, Deli Serdang Regency, North Sumatra using a randomized block design (RAK) with two factors and three replications. The first factor is the provision of Dolomite with 3 levels, namely D0 (without dolomite), D1 (1.5 ton/ha) and D2 (3 ton/ha). The second factor is the application of Bio-vermi with 4 levels, namely P0 (without Bio-vermi), P1 (100g/plant), P2 (150g/plant), P3 (200g/plant). The results showed that the application of dolomite and bio-vermi could increase soil pH, plant length growth and the number of yams planted. The highest increase in pH was found in D1 (1.5 ton/ha) of 5.57 and P2 (150g/plant) of 5.53, the longest plant length in P3 treatment (200g/plant) along 64.31 and D2 (3 ton/ha) along 64.27, the highest number of planted yams in treatment P1 (100g/plant) was 5.62. There is a significant interaction with dolomite and biovermi in increasing plant growth and nutrient uptake, with the provision of D1 (1.5 ton/ha) can increase soil pH and organic matter by 1% in acid soils, so that the longest plant length in treatment D1P3 is 69.33 this proves that by giving Dolomite and Bio-vermi can help nutrient uptake and growth and production of sweet potato in acid soils.

1. Introduction
Sweet potato (*Ipomoea batatas* L.) is a source of carbohydrates and a high source of calories (energy). The carbohydrate content of sweet potatoes is in fourth place after rice, corn and cassava. Sweet potato is also a source of vitamins and minerals so it is good enough to meet nutrition and public health [1].

Sweet potato is mostly cultivated in dry land and only a small part is planted in paddy fields with a wide adaptability of sweet potato to the environment and various land fertility, which is a potential for development on dry land which is dominated by acidic, nutrient-poor land. easily eroded [2]. Besides having a direct effect on the level of production food crops, climate change also has an indirect effect that can reduce the productivity of food plants by increasing the attack of pests and diseases [3].
With the application of dolomite to acidic soils, the absorption of the elements Mo, P and Mg will increase at the same time which will significantly reduce the concentration of Fe, Al and Mn which in an acidic state these elements can reach concentrations that are toxic to plants [4].

Bio-vermicompost is a biological fertilizer made using vermicompost as a carrier. Biovermi fertilizers have 6 probiotic microbes which are known to have a positive effect on plant growth. Where the advantages of using vermicompost are the fast process and the resulting compost (vermicompost) contains high nutrients [5]. Organic material that is eaten by earthworms will undergo a change in their digestive tract so that it becomes smooth and after being digested the rest will be secreted into dirt or casting. Casting contains dissolved nutrients N, P, K and Mg and Ca which can be exchanged in a form available to plants [6].

Based on the description above, this research was carried out in order to determine the effect of climate change and the provision of dolomite and the provision of bio-vermi on nutrient uptake and sweet potato production in acid soils.

2. Materials and methods
The research was conducted in Aras Kabu Village, Beringi District, Deli Serdang, North Sumatra. Starting from October 2020 - February 2021. Using a randomized block design (RBD) with 2 factors and 3 replications. The first factor is the levels of Dolomite 3, D0 (without dolomite), D1 (1.5ton/ha) and D2 (3 ton/ha). The second factor is the levels of Vermicompost 4, P0 (without vermicompost), P1 (100g/plant), P2 (150g/plant), P3 (200g/plant). Each experimental unit is repeated three times to get 36 experimental units.

2.1 Planting and fertilizing
Planting is carried out after 2 weeks of dolomite application, shoot cuttings are taken from the seedlings from the sprouting tubers that have been selected previously. It is about 20 days old. Shoot cuttings are taken from plants with 2-4 leaves. Dolomite fertilization is carried out before planting. Dolomite is given according to the dose of Treatments, giving bio-vermi is given when the plants enter the age of 4 weeks after planting.

2.2 Plant maintenance
Maintenance includes watering, weeding at 2 weeks after planting, NPK fertilization is given when the plants are 6 weeks after planting. Pest and disease control is adjusted to the intensity of pests and diseases.

2.3 Data analysis
Data processing used the SPSS statistical program (ver. 17). The data obtained were analyzed using variance at the level of α = 5%. If there is a significant effect between the test treatments, continue with the Duncan Multiple Range Test (DMRT) [7].

3. Results and discussion
3.1 Soil pH
The application of Dolomite and Bio-vermi had a significant effect on the increase in soil pH and their interaction had a significant effect on soil pH. The highest increase in pH was found at D2 (1.5 ton/ha) pH 5.57 and P2 (150 g/plant) pH 5.53 and the second interaction was found in D1P1 treatment with a pH increase of 6.00 pH. The lowest soil pH was in the D0 treatment (without dolomite) with a pH of 5.33 and P0 (without Bio-Vermi) with a pH of 5.34. Data The results of observations of soil pH on dolomite treatment and application of biological fertilizers can be seen in Table 1.

In Table 1, it can be seen that the increase in soil pH had a significant effect on both treatments. This is presumably because the application of vermicompost and dolomite has an effect on soil physical properties, soil chemistry and soil biology, where vermicompost application can increase the growth of...
setaria plants [8] and dolomite application is thought to be caused by an increase in organic compounds produced by further weathering of the type of material. organic matter becomes humus from the interaction between vermicompost and given dolomite. the administration of ameliorant (dolomite) with various levels of different doses gave a tendency to increase in phosphate. This increase occurred due to the influence of decomposition of organic matter and the possibility of microorganism activity, both fungi and bacteria. Comparing the application technique of earthworms and microbes, various types of microbes and their interactions have a very real effect. The presence of earthworms can increase the microbial population that populates bio-vermines. In addition, the decomposition process of organic matter is faster in the presence of earthworms because the organic matter decomposes more quickly [9].

Table 1. Effect of Dolomite and Bio-vermite on the increase in soil pH.

| Treatment | Dolomit Amount | Average |  
|-----------|----------------|---------|
|           | D0  | D1  | D2  |  |  |
| P0        | 5.06 | 5.49 | 5.48 | 16.03 | 5.34a |
| P1        | 5.50 | 6.00 | 5.09 | 16.59 | 5.53a |
| P2        | 5.66 | 5.43 | 5.51 | 16.59 | 5.53b |
| P3        | 5.09 | 5.37 | 5.66 | 16.12 | 5.37b |
| Amount    | 21.31a | 22.29b | 21.74a | 65.33 | 21.78 |
| Average   | 5.33 | 5.57 | 5.43 | 16.33 | 5.44 |

Note: The numbers followed by different letters show a significant difference according to Duncan's Multiple Range Test at the level of α = 5%.

3.2 Plant length
Giving Dolomite and Bio-vermi had a significant effect on the length of the sweet potato plant and the interaction of the two had no significant effect on the length of the sweet potato plant. The length of the longest plant was treated with D2 (3 ton/ha) along 64.27 cm and P3 (200 g/plant) along 64.31 cm, compared to without dolomite and bio-vermi treatment, where the shortest plant length was in D0 treatment (without dolomite) along 53.42 cm and P0 (without Bio-vermi) along 55.58 cm. Data The results of observations of soil plant length on dolomite treatment and application of biological fertilizers can be seen in Table 2.

In Table 2 it can be seen that the increase in soil pH had a significant effect on both treatments. This proves that the provision of dolomite and bio-vermi as much as 3ton / ha and 200g / plant can increase the length growth of sweet potato plants. Where the increase in plant length is due to the occurrence of cell division and cell extension which is dominated by the shoots, so that the length of the plant increases due to the provision of dolomite which can increase Mg nutrient uptake which is useful for plant photosynthesis. As well as with the provision of vermicompost, it is suspected that its application affects the physical properties of the soil, soil biology and soil chemistry, so that the requirements for plant growth can be fulfilled so that the plant grows long [10].

It turns out that the effects of biological fertilizers that use vermicompost as the default material have the same effect as vermicompost applications without microbial inoculation. Vermicompost in plants is not only caused by the quality of mineral nutrients provided but also for other growth regulating components such as plant growth hormones and humic acid [11].
Table 2. Effect of dolomite and bio-vermi on the length of 8MST (cm) sweet potato plants.

| Treatment | Dolomit Amount | Average |
|-----------|----------------|---------|
|           | $D_0$ | $D_1$ | $D_2$ |               |         |
| $P_0$     | 51.67 | 51.25 | 63.83 | 166.75        | 55.58b  |
| $P_1$     | 51.50 | 67.50 | 63.58 | 182.58        | 60.86a  |
| $P_2$     | 53.42 | 65.50 | 63.17 | 182.08        | 60.69a  |
| $P_3$     | 57.08 | 69.33 | 66.50 | 192.92        | 64.31a  |
| Amount    | 213.67b| 253.58a| 257.08a| 724.33        | 241.44  |
| Average   | 53.42 | 63.40 | 64.27 | 181.08        | 60.36   |

Note: The numbers followed by different letters show a significant difference according to Duncan's Multiple Range Test at the level of $\alpha = 5\%$.

3.3 Number of sweet potatoes per plant

The administration of Dolomite had no significant effect on the amount of sweet potato per plant, but had a significant effect on the provision of bio-vermi on the number of sweet potatoes in the plant and the interaction between the two had no significant effect on the number of sweet potatoes per plant. The highest number of sweet potatoes in treatment $P_1$ (100 g/plant) was 5.62 sweet potatoes, compared to without treatment $P_0$ (without Bio-vermi) of 5.03 sweet potatoes. Data Observation results the number of sweet potatoes planted to dolomite treatment and application of biological fertilizers can be seen in Table 3.

Table 3. Effect of dolomite and bio-vermit on the number of yams per plant.

| Treatment | Dolomit Amount | Average |
|-----------|----------------|---------|
|           | $D_0$ | $D_1$ | $D_2$ |               |         |
| $P_0$     | 4.77  | 4.73  | 5.60  | 15.10         | 5.03b   |
| $P_1$     | 5.50  | 5.97  | 5.40  | 16.87         | 5.62a   |
| $P_2$     | 5.27  | 5.53  | 5.47  | 16.27         | 5.42ab  |
| $P_3$     | 5.37  | 4.63  | 5.37  | 15.37         | 5.12b   |
| Amount    | 20.90 | 20.87 | 21.83 | 63.60         | 21.20   |
| Average   | 5.23  | 5.22  | 5.46  | 15.90         | 5.30    |

Note: The numbers followed by different letters show a significant difference according to Duncan's Multiple Range Test at the level of $\alpha = 5\%$.

In Table 3 it can be seen that the increase in soil pH had a significant effect on the treatment of bio-vermi fertilizer application. This proves that the provision of bio-vermi is able to increase the number of yams in sweet potato plants, because bio-verbs which contain several soil microbes and sweet potato vermicompost fertilized by vermicompost 100-200 grams per hectare produce more tubers. Organic plant production is controlled by essential macro and micro nutrients and other growth substances present in promoting their growth medium. Application of organic matter and organic fertilizers can increase the yield of sweet potato tubers. Earthworms that are processed into vermicompost which can be used to supply nutrients and soil stimulants for plants and improve soil quality. Plant growth and quality can be improved through improving soil quality. This is because the provision of bio-vermi in plants can help root development which has a relationship with the dry weight of the canopy, the better
the root development of the plant, the increasing the number of yams. At the time of the study in November, there was high rainfall so that the formation of sweet potatoes was not perfect and resulted in the sweet potato plant only growing leaves and roots, because the amount of water that entered the soil was more than the absorption capacity of the soil in the research area where the soil structure used had sandy loam structure.

4. Conclusion
Dolomite application had a significant effect on soil pH and plant length. And the application of Bio-vermi biofertilizer had a significant effect on plant length, soil pH and the number of sweet potatoes per plant. This proves that the application of bio-vermi fertilizer can increase plant growth and help plant resistance to climate change.

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