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# Application of Bioamelioran with Local Raw Materials to The Yield of Some Varieties Sweet Corn

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**Abstract:- Sweet corn farmers in Midang Village, Gunung Sari District, West Lombok Regency are currently still cultivating sweet corn using conventional cultivation technology with a relatively high input of inorganic fertilizers. This, if viewed from an economic point of view, is a waste and from an environmental point of view it is not environmentally friendly. Another problem is the production of sweet corn which is still low, not fresh and of low quality. Therefore, community service activities (CSA) on "Application of Bioameliorants Made from Local Raw Materials in Sweet Corn Plants"were tried to provide solutions to problems faced by farmers. The purpose of this CSA is to find out the yield of technology transfer for the use of bioameliorants made from local raw materials from the Faculty of Agriculture University of Mataram Team to the Farmers Group "Gapoktan Karya Usaha Bersama" in increasing knowledge about the use of bioameliorants and increasing sweet corn yields. The method used in implementing this CSA is the training method followed by practical work in the field by conducting demonstrations and active participatory action research. The demonstration plot method was carried out using a randomized block design using four varieties of sweet corn, namely V1: Bonanza variety, V2: Ganebo variety, V3: Golden Boy variety, and V4: Exotic Pertiwi variety. The result of the demonstration plot of the application of bioameliorants made from local raw materials at a dose of 25 t ha$^{-1}$ on the Golden Boy variety gave the highest plant height and number of leaves. Meanwhile, the concentration of total N, soil available P, plant N and P nutrient uptake, number of spores and percentage of mycorrhizal colonization and the highest cob weight and wet biomass were obtained in the Bonanza F1 variety. With agricultural extension activities and discussions, farmers' understanding of the application of bioameliorants plus mycorrhizal biofertilizers in sweet corn cultivation increased by 90%.**

***Keywords:*** *Bioameliorant, Sweet Corn, Mycorrhizal.*

## I. INTRODUCTION

Gapoktan Farmer Group "Karya Usaha Bersama" is a farmer group that cultivates sweet corn. This sweet corn is grown in intercropping with other crops or monoculture. Farmers usually plant after the rice crop is harvested which is around May and harvested in mid-July. The reason farmers cultivate sweet corn is to adjust to the climatic conditions and the available water in the field. In addition, the selling price and economic value of sweet corn are considered quite good according to farmers, because it can be processed into various foods such as roasted corn, boiled corn, sweet corn milk, and various foods made from sweet corn such as capcay, salad and so on.

However, the main problem found by sweet corn farmer groups is the low production of the resulting crop. Whereas on the other hand, consumer demand for sweet corn culinary is always increasing every day. Production yield are quickly damaged due to the lack of post-harvest handling and are not packaged properly so that sometimes they are not attractive to consumers. If this problem can be handled, it may be that sweet corn products that are marketed can be stored longer by post-harvest handling, hygienic, clean and with attractive labels that will attract consumers to buy them at high prices.

On the other hand, the sweet corn cultivation technology applied is still conventional which demands high energy in the form of inorganic fertilizers and artificial pesticides. From an economic point of view, this technology requires high costs, while on the other hand the level of capital for farmers is very low. In addition, the unwise use of artificial fertilizers and pesticides which are usually applied by local farmers per unit area tends to increase. This turned out to have a negative impact on the environment. Likewise, the increasing use of pesticides, besides being a waste, can also disrupt the environmental balance such as the death of natural enemies and other non-target bodies, resurgence and resistance to pests and pathogens, also causes environmental pollution, reduces soil fertility due to pesticide residues and inorganic fertilizers. in soil, water, plants and possibly the human body. Based on this situation, it is necessary to have a new concept in an effort to increase sweet corn production which is not only based on the economy, but also needs to be environmentally sound, health so as to create an environmentally friendly and sustainable agricultural pattern.

One of the new concepts that will be applied is the application of bioameliorant which is a combination of biological resources (biological fertilizers, biological agents) with soil enhancers, especially organic fertilizers (compost, manure, biochar) enriched with organic extracts and nutrients to improve soil health and soil fertility continuously [1]; [2]; [3]. This bioameliorant can be made from local raw materials that have not been used properly by farmer groups in the form of cattle manure, rice straw and rice husk [4]. Whereas these materials can be processed into mature manure, both for plants, straw for compost and rice husks can be processed into biochar as a bioameliorant raw material. The addition of bioameliorant which contains a lot of organic matter plus enriched with mycorrhizal biofertilizer MAA-001 can help increase fertilization efficiency through its role in improving the physical, chemical and biological properties of the soil [5]; [6]., a follow-up study was carried out on "Application of Bioameliorant Made from Local Raw Materials on the Yield of Several Sweet Corn Varieties" to improve fertilization efficiency, soil fertility and increase sweet corn crop yields which at the same time can increase farmers' income.

## II. MATERIALS AND METHOD

### *A. Activity in Method CSA*

The method of activity used in the implementation of this CSA is through training and practice using the Andragogy Method or the Adult Education Method. The training is in the form of sweet corn cultivation material with the addition of plant nutrition with a portion of 20% theory (counseling, lectures and discussions). Practice in the field with demonstrations and active participatory action studies on sweet corn cultivation with a portion of 80% practice in the field (practices of making bioameliorants plus mycorrhizal biofertilizers, sweet corn cultivation and evaluation. The demonstration plot method was carried out using a randomized block design using four varieties of sweet corn, namely: V1: Bonanza F1, V2: Ganebo, V3: Golden Boy and V4: Exsotic Pertiwi with four replications, so that sixteen plot plots were obtained.

### *B. Training on Making Bioameliorants*

The training was conducted by providing material on corn cultivation with the addition of bioameliorants containing mycorrhizal biofertilizers in order to obtain organic sweet corn products that have a high selling value. Practical training on making bioameliorant plus mycorrhizal biofertilizer is carried out by first preparing mycorrhizal inoculum using corn as its host with a mixture of soil and 10 kg of sterile cattle manure as a medium with a ratio of 1: 1. Before planting, corn seeds are germinated first, afterindigenous mycorrhizal isolates$_{AA}$ from the collection. Inoculation was carried out with a mixture of soil, roots, spores and hyphae of indigenous $M_{AA}$ from the collection. Inoculation was carried out using the funnel method, isolate MAA-001 was placed and the host plant was placed on the filter paper. The filter paper is then covered with soil and the plants are allowed to grow [7]. After three months, the soil in the culture pot was harvested by cutting the roots and then blending it and then mixing it together with the soil in the culture pot media. The form of inoculum made is powder with a moisture content of 10-15%, then filtered through a 50 mesh sieve. The mycorrhizal inoculants were then mixed with cattle manure, rice husk charcoal and compost with a percentage ratio of 25%: 25%: 25%: 25%. The result of this mix then air-dried under the sun until the water content reaches 10-15%. This formulation mixture is then sieved to produce a clean substrate. The yield of the sieve that have been clean, smooth and in powder form, are then weighed, then put into a 5 kg plastic bag.

### *C. Sweet Corn Plot Demonstration with Bioameliorant*

Land to be used in this service is ± 400 $m^2$. Tillage is done by hoeing twice. In the first plowing, the clod of soil is left in the wind for 2 days, while the second plowing is carried out at the same time as leveling the soil, fertilizing, loosening and cleaning the soil from the remnants of the roots. After that, 4 plots of demonstration plots were made and each demonstration plot measuring 3 mx 2.5 m and the experimental plot height was 50 cm, with a channel with a width and depth of 30 cm for every 4 m.

The application of bioameliorant was carried out at the time of planting by spreading it evenly to form a layer under the corn seeds. The bioameliorant used was a mixture of mycorrhizal inoculum, cattle manure, rice husk charcoal and compost that had been previously prepared in powder form at a dose of 25 ton per haor the equivalent of 40 g of bioameliorant per plant.

Planting sweet corn seeds is done by inserting two seeds into the soil as deep as 3 cm with a spacing of 60 x 40 cm on plots measuring 3 cm. mx 2.5m with a test plot height of 30 cm and a water channel width of 40 cm. Furthermore, the experimental plots were watered with “gembor” until they were evenly wet.

Fertilization is done by giving inorganic fertilizers for sweet corn with urea and phonska fertilizers at a dose of 350 kg per ha and 250 kg per ha. Inorganic fertilizers were given 1/3 dose at the age of 10 days after planting (DAP) and the remaining 2/3 were given at 28 days after planting by placing them in the soil at a depth of ± 5 cm next to the stem at a distance of 7 cm. Irrigation is sourced from rain and if there is no rain, irrigation is carried out by watering using a gembor evenly until it reaches field capacity which is carried out every three days. Weeding is done by pulling weeds around the plant, weeding is done every 3 days. Meanwhile, pest and disease control was carried out with the organic pesticide Azadirachtin which is a neem leaf extract with the trade name OrgaNeem with a concentration of 5 ml per liter of water with a spraying interval of 3 days.

### *D. CSA Evaluation Result*

To see the effect of treatment on plant yields, an evaluation of height parameters plants at 28 and 56 DAP (cm), number of leaves at 28 and 56 DAP (cm), soil nutrient concentration and plant nutrient uptake (N and P) at 42 DAP, and the number of spores and percentage of root infection at 42 DAP, weight shoot wetness, cob weight per plant (g per plant), shoot wet weight and cob weight per plot (kg per plot) aged 70 days after planting. The data obtained were analyzed using analysis of variance and if there was a significant difference, it was continued using the Honest Significant Difference (HSD) test at the 5% level. Meanwhile, to find out the increase in farmers' understanding of the extension material, it was done using a list of questions.

## III. RESULTS AND DISCUSSION

*A. Participation of farmers in the extension*

The participation of farmers in participating in agricultural extension is very enthusiastic, which makes farmers understand, those who initially do not understand become understanding. In CSA activities farmers actively participate, this can be seen from the questions asked in the discussion sessions which are very relevant and related to the material presented during the extension (Figure 1).

Fig 1:**-** Farmers' participation in extension activities while following the explanation of extension materials by the extension team from the Faculty of Agriculture University of Mataram

*B. Sweet corn cultivation techniques*

The demonstration plot for sweet corn cultivation with the addition of bioameliorants plus mycorrhizae was very successful. This demonstration plot was carried out by the Farmers Group with technical guidance from the Extension Team of the Faculty of Agriculture, University of Mataram (Figure 2).

Fig 2:**-** Demonstration of cultivation of four varieties of sweet corn with the application of bioameliorant plus mycorrhizae

After sweet corn is harvested, it is packaged and weighed and then labeled using an attractive design and packaging (Figure 3). The design shows Pearson's contact to make it easier to order online. This sweet corn after being packaged and labeled looks neat and attractive so that it attracts consumers to buy. After the labeling is complete, sweet corn is sold on Sunday during car free day on Udayana Street which is very popular with consumers, especially mothers and sold out in a short time

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Fig 3:-. Packaging of sweet corn and bioameliorant products plus mycorrhizae from CSA

*C. Height and number of plant leaves*

The results of the analysis of diversity showed significant differences. The application of bioameliorant plus mycorrhizal biofertilizer 25 t $ha^{-1}$ on the Golden Boy variety obtained the highest yields on the parameters of plant height and number of leaves at the age of 28 and 56 days after planting (Figure 4 and Figure 5).

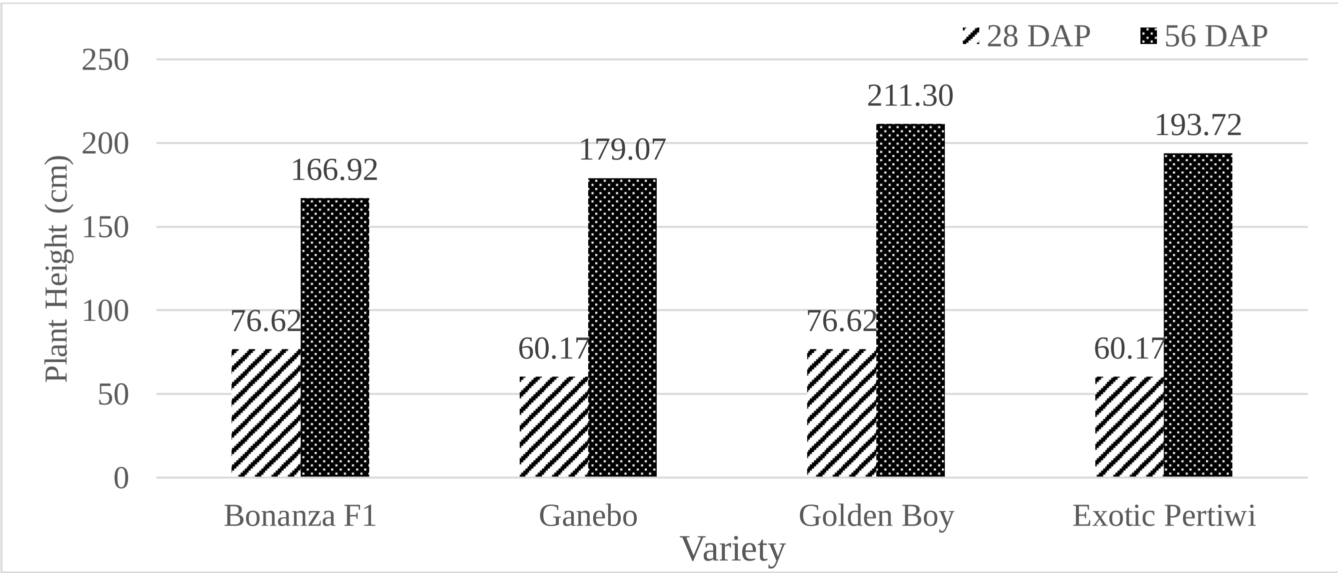


Fig 4:- Average plant height at 28 and 56 DAP for each variety (cm)

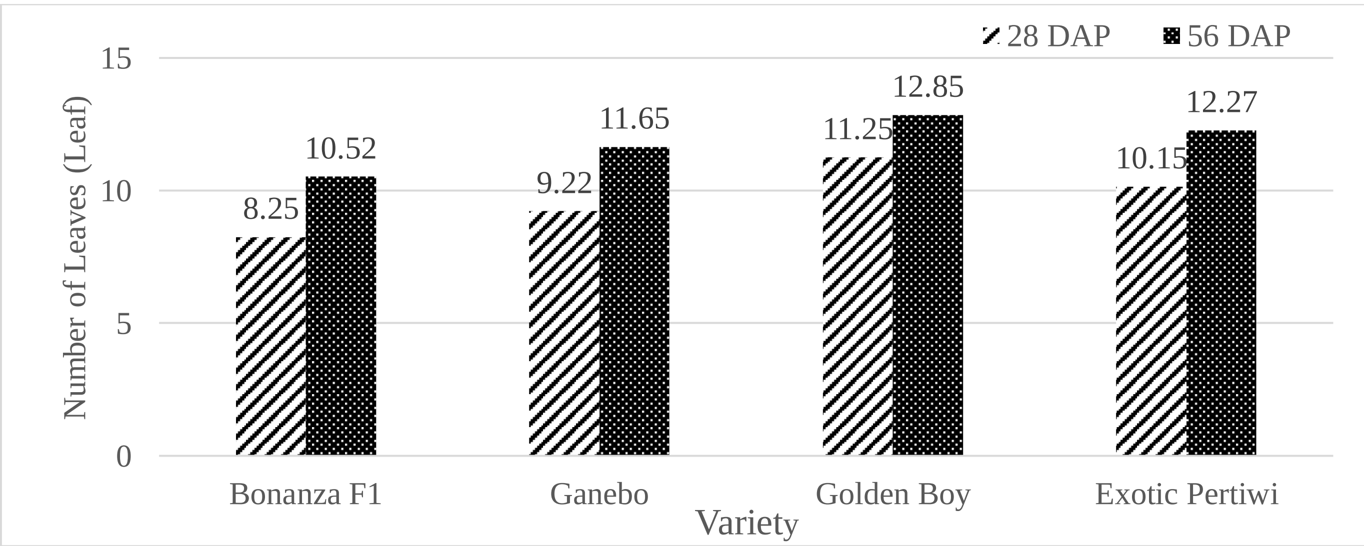


Fig 5:- Average number of leaves at 28 and 56 DAP for each variety

Treatment of the use of the Golden Boy variety by giving bioameliorant containing mycorrhizae with a dose of 25 t $ha^{-1}$ can increase the height and number of leaves of sweet corn plants. This can be seen from the response of the Golden Boy variety to the dose of bioameliorant which showed the highest and significantly different height and number of plant leaves. This is due to the response of the Golden Boy variety to the application of bioameliorants containing mycorrhizae which can increase the height and number of leaves of sweet corn plants. Plants that were given bioameliorants containing mycorrhizae grew better than plants without mycorrhizae. The main cause is that mycorrhizae can effectively increase the absorption of nutrients, both macro and micro nutrients. In addition, mycorrhizal roots can absorb nutrients in bound form and which are not available to plants [8].

The above indications show the importance of giving bioameliorants to sweet corn plants that function as "soil enhancers" that can improve the root environment to support plant growth. Golden Boy variety with added bioameliorant 25 t $ha^{-1}$ seems to be growing and normal. The results of this study are in line with the results of research by which used an optimal dose of ameliorant in the form of chicken manure for peat soils of 20 tons $ha^{-1}$ [9].

*D. Soil nutrient concentration and plant nutrient uptake*

The results of the diversity analysis showed that the Bonanza F1 variety given 25 t $ha^{-1}$ gave a significant effect compared to other varieties on changes in soil nutrient concentration and nutrient uptake by plants (Table 1). The results of the HSD test at the 5% level showed that the use of the Bonanza F1 variety accompanied by the administration of 25 t $ha^{-1}$ could increase total N and available P. The highest increase was obtained with the use of the Bonanza F1 variety.

The results of the analysis of diversity showed that the use of the Bonanza F1 variety given 25 t $ha^{-1}$ also had a significant effect on increasing N and P uptake in plants. Table 1 shows that the Bonanza F1 variety given 25 t $ha^{-1}$ gave a significantly different effect on plant N and P uptake. Table 2 also shows that the use of the Bonanza F1 variety provided the highest plant N and P uptake compared to other varieties.

| Varieties | Soil nutrient concentration | | Plant nutrient uptake | |
|---|---|---|---|---|
| | N Total (g.$kg^{-1}$) | Available P (mg.$kg^{-1}$) | N uptake (g $kg^{-1}$) | P Absorption (g $kg^{-1}$) |
| V1: Bonanza F1 | 1.501$^a$ | 63.770$^a$ | 36.195$^a$ | 3.830$^a$ |
| V2: Ganebo | 1.168$^c$ | 48.850$^b$ | 32.755$^b$ | 3.112$^b$ |
| V3: Golden Boy | 1.501$^a$ | 36.920$^c$ | 31.958$^c$ | 2.647$^c$ |
| V4: Exotic Pertiwi | 1.183$^b$ | 25.092$^d$ | 23.595$^d$ | 2.435$^d$ |
| HSD 5% | 0.007 | 1.398 | 0.0091 | 0.0140 |

Table 1. Average concentration of nutrients and uptake of N and P in each variety aged 42 DAP
Note: The mean value followed by the same letter in the same column is not significantly different according to the HSD 5% test

*E. Mycorrhizal development*

The results of the analysis of the diversity of the effects of using the Bonanza F1 variety given 25 t $ha^{-1}$ showed a significant difference in the 5% HSD test. compared with other varieties on the parameters of the number of mycorrhizal spores and the percentage of root colonization at 42 DAP and 70 DAP (Table 2). The value of the number of spores and the highest percentage of colonization were found in the treatment of the Bonanza F1 variety, namely 1417 and 1603 spores/50 g soil and 82 and 87 percent colonization at 42 and 70 DAP. The value of the number of spores and the lowest percentage of colonization were found in the treatment of Exotic Pertiwi varieties, namely 304 and 869 spores/50 g of soil and 67 and 68 percent of colonization at 42 and 70 DAP.

| Treatment | Number of Spores | | Colonization | |
|---|---|---|---|---|
| | 42 DAP | 70 DAP | 42 DAP | 70 DAP |
| V1: Bonanza F1 | 1417.01$^a$ | 1603.76$^a$ | 82.4$^a$ | 87.6$^a$ |
| V2: Ganebo | 1052.51$^b$ | 1255.76$^b$ | 77.4$^b$ | 77.6$^b$ |
| V3: Golden Boy | 851.51$^c$ | 1025.76$^c$ | 72.4$^c$ | 72.6$^c$ |
| V4: Exsotic Pertiwi | 304.76$^d$ | 869.76$^d$ | 67.1$^d$ | 68.6$^d$ |
| HSD 5% | 87.01 | 87.01 | 1.98 | 3.90 |

Table 2:- Average number of spores (spores per 50 g of soil) and value of colonization (%-colonization) at 42 DAP and 70 DAP for each variety
Note: The mean value followed by the same letter in the same column is not significantly different according to the test HSD 5%

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*F. Biomass weight and crop yield*

Application of bioameliorant plus mycorrhizal biofertilizer 25 t $ha^{-1}$ on several sweet corn varieties showed significant differences in plant biomass weight and cob weight. It appears that the Bonanza F1 variety gave the highest yield of wet and cob biomass weights per plant and per plot compared to other varieties (Figure 6 and Figure 7).

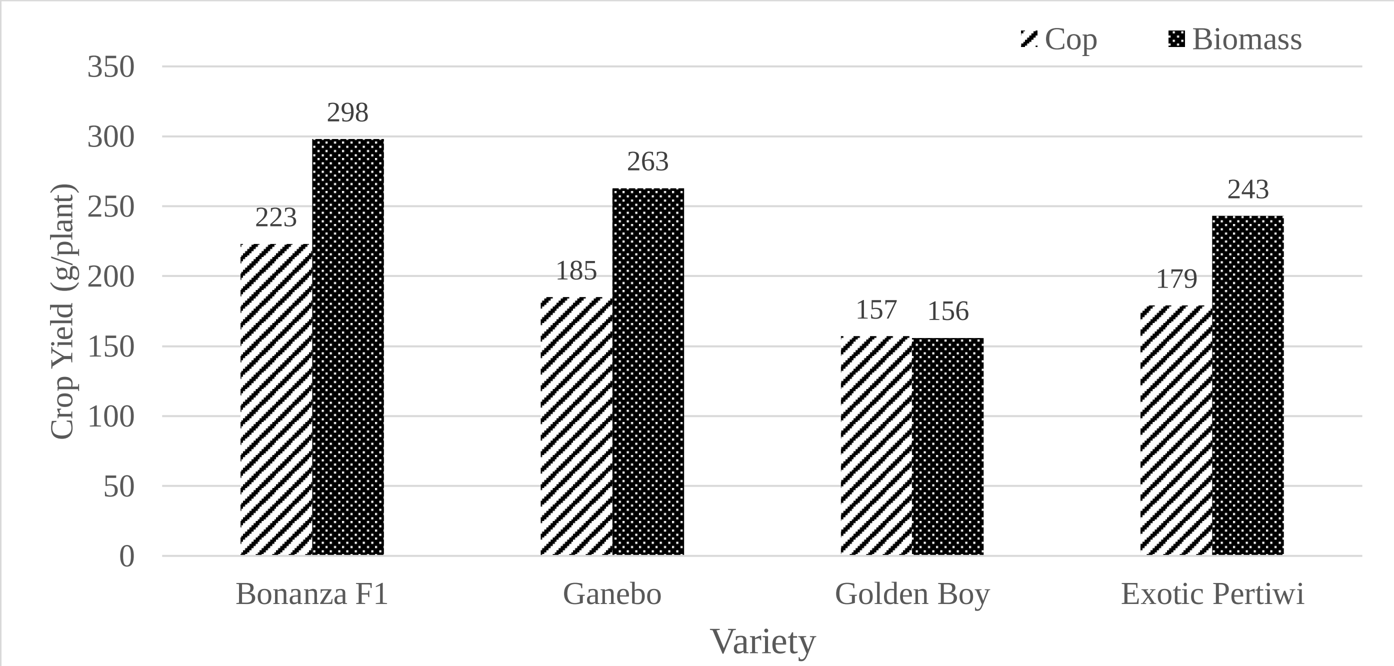


Fig 6- Average cob weight and wet biomass weight in each variety (g per plant)

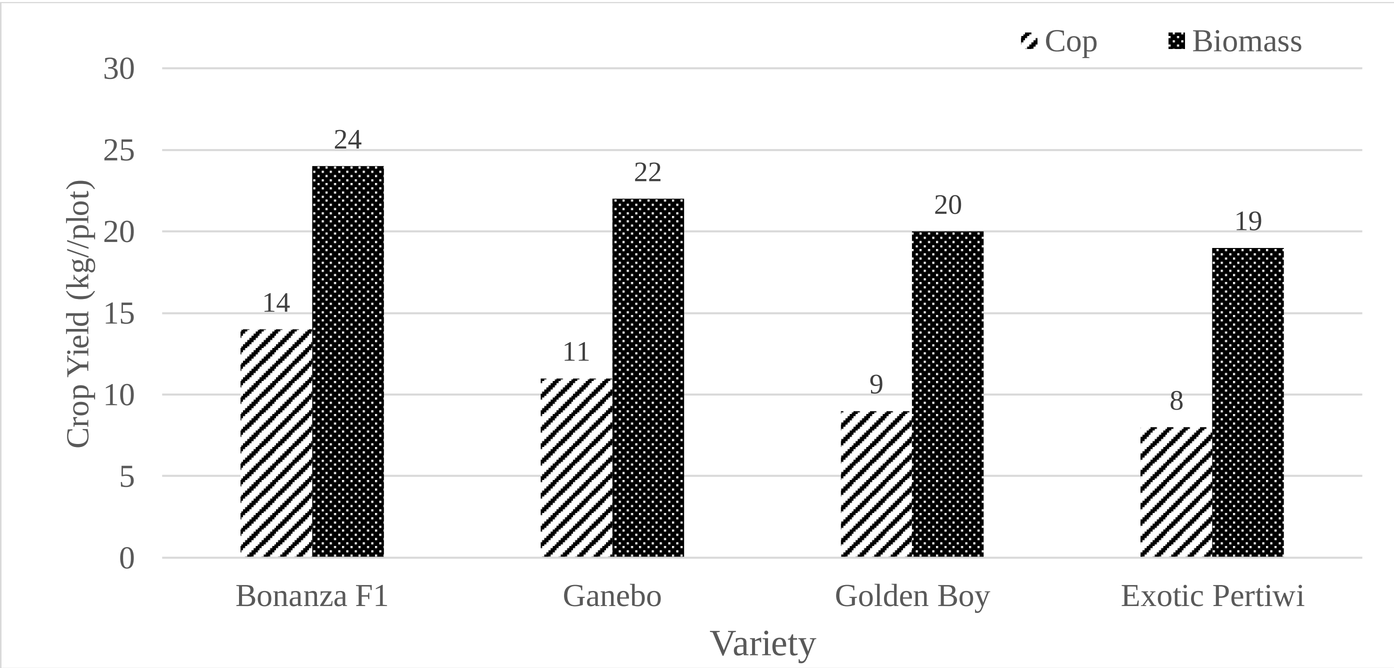


Fig 7:- Average cob weight and wet biomass weight in each variety (kg per plot)

Giving bioameliorant as much as 25 t $ha^{-1}$ for varieties sweet corn Bonanza F1 can significantly increase the concentration of nutrients and uptake of N and P when compared to other varieties. This shows that of the four varieties tested with bioameliorant application, Bonanza F1 variety gave the best response. Increased N and P uptake in the Bonanza F1 variety resulted in an increase in N and P concentrations in plant tissues. Changes that occur in the values of N and P uptake in other varieties are strongly suspected to be related to differences in the ability of each sweet corn variety to increase N and P availability. on the absorption of nutrients in the soil and the most dominant is influenced by genetic factors of the plant varieties used [10]. Giving organic bioameliorant material from pruning gamal (*Gliricidia sepium*) 15 t $ha^{-1}$ can increase plant P uptake [11]. Administration of organic bioameliorants containing mycorrhizae can increase plant P uptake [12]; [13]. The main role of mycorrhizae is to increase plant P uptake [14]. This is due to the increase in the amount of absorption caused by a wider absorption surface area due to the presence of external hyphae [15]. These hyphae function to expand the cruising range of the root surface in addition to the area explored by root hairs [16]. Compared to non-mycorrhizal roots, mycorrhizal roots were better able to absorb P in soils with low P content [17]. Provision of compost with a high C/N ratio will reduce sweet corn production, due to the inhibition of nutrient supply [18]. The application of bioameliorants to corn plants is generally intolerant of high soil acidity [19]. Correcting the pH will balance the nutrients in the soil. In addition, the application of bioameliorants with the formulation of 20% chicken manure + 20% agricultural weeds + 20% rat purun + 20% dolomite + 20% mineral soil was able to provide NPK in sufficient proportion to support plant growth [20]. Bioameliorantscan also be applied to improve soil health and crop productivity [21]. Sweet corn of Bonanza F1 variety had the highest cob weight and wet biomass in the application of bioameliorant plus mycorrhizal biofertilizer 25 t $ha^{-1}$. This is due to the plant's need for nutrients, especially the element N which is important to increase the weight of plant biomass, which was met and responded well by the Bonanza F1 variety. This causes the nitrogen requirement in the vegetative phase of the plant to be fulfilled, thereby increasing the wet biomass of the plant [22]; [23]. The high weight of wet biomass is closely related to the availability of high N content. If the N content is high, the growth process of plant organs is also large. The higher the N element that is absorbed by the plant, the higher the wet weight of the plant will be [24].

## IV. CONCLUSION AND SUGGESTIONS

The result of the demonstration plot of the application of bioameliorants made from local raw materials at a dose of 25 t $ha^{-1}$ on the Golden Boy variety gave the highest plant height and number of leaves. Meanwhile, the concentration of total N, soil available P, plant N and P nutrient uptake, number of spores and percentage of mycorrhizal colonization and the highest cob weight and wet biomass were obtained in the Bonanza F1 variety. With agricultural extension activities and discussions, farmers' understanding of the application of bioameliorants plus mycorrhizal biofertilizers in sweet corn cultivation increased by 90%.

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