Jurnal Ilmiah Multidisiplin Indonesia (JIM-ID)
Volume 2, Number 02, Juli 2023
doi.org/10.58471/esaprom
E.SSN 2828-9463 (Online)

The Effectiveness Of Spraying Nano Bone Ash And Oil Palm Emty Fruit Bunch Ash On Leaf Character Appearance Of Rice Mandel Variety

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ABSTRACT

This study aims to determine the effectiveness of spraying nano bone ash and palm oil emty fruit bunnch ash on leaf character appearance of rice Mandel variety. This research was carried out in the Agricultural Experiment Grenn House of the Muhammadiyah University of Yogyakarta in January to June2021. This study uses a single factor design arranged in a Complete Randomized Design (CRD), there are 4 treatm ents. Each tratments consisted of 6 plant samples with 3 replications namely: P. Urea 250 kg/hectare + SP-36 100 kg/hectare + KCl 100 kg/hectare, Q.Urea 250 kg/hectare + SP-36 50 kg/hectare + KCl 100 kg/hectare + Nano Bone Ash concentration 0,2 %, R. Urea 250 kg/hectare + SP-36 100 kg/hectare + KCl 50 kg/hectare + Nano OPEFB Ash concentration 0,3 %, S.Urea 250 kg/hectare + SP-36 50 kg/hectare + KCl 50 kg/hectare + Nano Bone Ash concentration 0,2 % and Nano OPEFB Ash concentration 0,3 %. The results showed that the application of Urea 250 kg/hectare + SP-36 50 kg/hectare + KCl 50 kg/hectare + 0.2% Nano Bone Ash Concentration and 0.3% OPEFB Nano Ash concentration gave a significant effect on the character.sheat of leaf color, blade of leaf, chlorophyll content, length and width of stomata.

Keywords:
Nano Bone Ash, Oil Palm Emty Oil Palm Emty, Rice Mandel Variety

INTRODUCTION

In the practice of rice cultivation in dry land, a lot of inorganic fertilizers are used for phosphorus and potassium. Phosphorus (P) is one of the most important elements that significantly contributes to agricultural and industrial development. Around 90% of global demand of rock phosphate is for food production [1]. Various sources of organic matter have been used as an alternative to inorganic fertilizers as fertilizers such as bone ash and oil palm empty fruit bunch ash [2]. Raw bone and empty fruit bunches of oil palm must be converted to ash by burning at a temperature of 250oC or higher to remove the organic matrix so that fertilizer can be produced [3]. Beef bones contain 37% Calcium and 18.5% Phosphorus by weight of bovine bones. Bone ash generally contains 53% calcium oxide and 42% diphosphorus pentoxide [4]. Bone ash contains a higher concentration of phosphorus than commercial fertilizers from phosphate rock. Commercial inorganic fertilizers only contain 36% diphosphorous pentoxide. Based on this composition, cow bone can be used as a source of phosphorus for plants in the form of cow bone ash. Cow bone ash is still complex and has a relatively large particle size, so if it is applied through the leaves it is less efficient. To increase the efficiency of fertilization through cow bone ash leaves, it can be done by reducing the particle size in the form of nano size.

Oil palm empty fruit bunches are a source of organic matter rich in N, P, K, and Mg elements. The number of empty oil palm fruit bunches is estimated at 23% of the total processed fresh

bunches. In each tonne of oil palm bunches it contains 1.5% N, 0.5% P, 7.3% K and 0.9% Mg which can be used as a substitute for oil palm plants [5]. For this reason, oil palm bunches can be used as an alternative to potassium fertilizer, because the K2O content is 30-40%.

Fertilizers that are high in phosphorus in bone ash and potassium in oil palm fruit bunch ash are wasted when applied to soils because of the strong bonds between phosphorus and aluminum and iron in acid soils and similar bonds with calcium and magnesium in alkaline soils [6] . Generally, phosphorus fertilizers only have an effectiveness of 10-25% [6]. To increase the effectiveness of fertilization, various technologies have been introduced, one of which is foliar spray application. Leaf spray application requires particles whose size must be smaller than the size of the stomata. Therefore, ball mill machines are recommended to be used to reduce particle size and are commonly used in nanotechnology. The smallest stomata size is Rhus copallium with a size of 25 m, and the largest is Horneophyton lignieri with a size of 20,700 m [7]. Therefore, the application of nano bone ash and nano oil palm bunch ash has been able to affect the appearance of rice leaf characters.

producing a product[1]. In the face of rapidly developing technological developments, especiallyin the field of machinery. To get a good product, special skills are needed and must also pay attention to economic aspects so that maximum results are obtained and also save production costs. If these things are not owned then the goods produced cannot be marketed, and if they arestill marketed, the sales results are not satisfactory because market demand must meet good quality standards.[2].

One of the characteristics of good machining results is the cylindrical process that is closeto perfect.[3] Cylindrical process results are one of the deviations caused by the cutting conditions of the machining process, so the machining process must be planned properly[4]. Starting fromthis, of course, it is necessary to know the cutting parameters, namely the feeding and spindle rotation used to turn the material, because with the right feed and spindle rotation the results ofturning will be good and the cylindrical level will be close to perfect.[5].

The cutting edge angle is also one of the parameters in the machining process that is usefulin cutting[6]. Parameters in the machining process are very useful in determining the final result of a product, and the main cutting angle is one of the useful parameters, and also affects roundness/cylindricity. By changing the main cutting angle, the roundness/cylindricity of the workpiece will also be different[7].

Components with ideal roundness are very difficult to make, thus we must tolerate the existence of non-roundness within certain limits according to the purpose/function of the component. Roundness plays an important role in terms of: dividing the load evenly, facilitating lubrication, determining rotation accuracy, determining component life and determining adjustment conditions.[8]. The products produced from the machining process are very diverse,and one of them is the shaft[9]. The material used to turn this shaft is ST 37 and use HSS chisels,then vary the cutting parameters, namely the main cutting angle and feed motion.[10].

METHOD

The experiment was conducted at the Greenhouse of Faculty of Agriculture, University Muhammadiyah Yogyakarta from January to june 2021. The research was arranged in completely randomized design consisted of four treatments : : P. Urea 250 kg/hectare + SP-36 100 kg/hectare + KCl 100 kg/hectare, Q.Urea 250 kg/hectare + SP-36 50 kg/hectare + KCl 100 kg/hectare + Nano Bone Ash concentration 0,2 %, R. Urea 250 kg/hectare + SP-36 100 kg/hectare + KCl 50 kg/hectare + Nano OPEFB Ash concentration 0,3 %, S.Urea 250 kg/hectare + SP-36 50 kg/hectare + KCl 50 kg/hectare + Nano Bone Ash concentration 0,2 % and Nano OPEFB Ash concentration

0,3 %. : All treatments were planted on 72 polybags with 10 kg absolute dry weight of soil for each polybag.

Preparation of the nano bone ash and nano oil palm empty fruit bunch ash

The bone ash and oil palm empty fruit bunch was made by modifying the technique used by Bahrololoom *et al.*. The fat, the meat, and other organic components were burned by applying direct flame. After that, the bone and oil palm empty fruit bunch was placed in the muffin furnace with 800^{o}C for five hours to create a white granular bone ash. Afterward, granular bone ash placed on hammer mill to created white ash powder. White ash powder is placed in a ball mill with the addition of water and small iron ball with ratio 2:1:5. The water was removed using an oven at 300^{o}C. The size of the particle was analyzed using Scanning Electron Microscopy (SEM), while Energy dispersive X Ray Spectroscopy (EDXS) was used to analyze the distribution of particle. Samples were placed to a sample stage with carbon tape that can transmit electric flow. Images were taken at 1500x magnification. The X-rays were and captured at an angle of 35.73^{0} for 30 seconds.

Application of the nano bone ash and nano oil palm empty fruit bunch ash

The foliar application is applied by diluting nano bone ash on concentration 0,2 % and nano oil palm empty fruit bunc ash concentration 0,3 %. The sprayed is three times in vegetative phase (3, 6, and 10 weeks after planting). The data were observed on growth parameter such as morphological qualitative characters, morphological quantitative character, and fisiological charakter

RESULTS AND DISCUSSION

Particle size is one of the conditions for successful application through leaves. Particles must have a smaller size than the stomata opening [8]. Based on SEM analysis, the size of bone ash which was resized using a ball mill was 0.118 m, while the largest size was 39.4 m. However 50.98% was dominated by particles measuring below 1.2 m (Fig. 1). The test results on nano bone ash fertilizer showed the presence of N, P, K, Ca, Si, Mg and O contents, respectively; 27.01%; 16.85%; 42.80%; 0.5% , 0.71% and 38.55%. While the average particle size in nano bone ash fertilizer is 283.16 nm. The particle diameter below 100 nm is 43.57%, while above 100 nm is 50.98%.

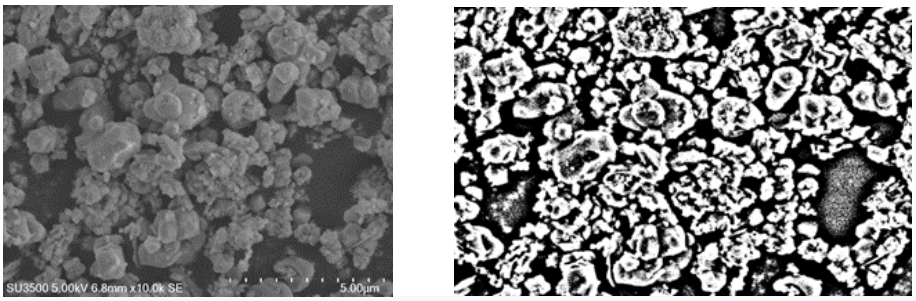


Figure 1. The results of the cross-sectional size of nano particles bone ash with a magnification of 5 micrometers using imageJ software

Nano fertilizer ash of oil palm empty fruit bunches contains P, K, Ca, Si, Mg and O respectively 3.09%; 27.01%; 6.65%; 14.24%; 3.5% and 45.5%. Meanwhile, the average particle size of potassium nano fertilizer in oil palm empty fruit bunches is 283.16 nm. The particle diameter below 100 nm is 43.57%, while above 100 nm is 50.98%. (Figure 2.)

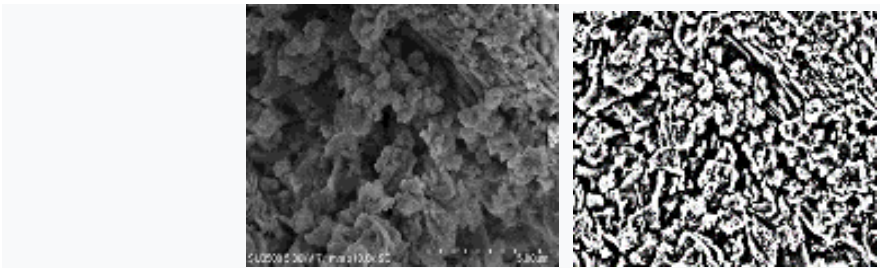


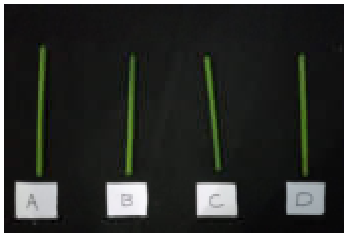
Figure 2. The results of the cross-sectional size of nano particles of oil palm empty fruit bunch ash with a magnification of 5 micrometers using imageJ software

Leaf color character appearance

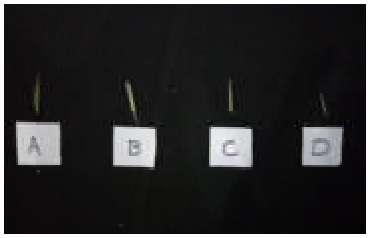
The appearance of plant characters is strongly influenced by environmental conditions. The application of bone ash nano fertilizer and nano oil palm empty fruit bunch ash can induce the appearance of the leaf color character of Mandel variety rice. Visual observation of the leaf color of the Mandel variety rice showed that the application of nano bone ash containing high calcium and phosphorus and oil palm empty fruit bunch ash containing high potassium had an effect on the appearance of the color character of the parts of the Mandel variety rice leaf. Based on color (leaf midrib, leaf tongue, leaf neck and leaf blade). showed that there was diversity in the color of the leaf midrib and leaf blade, but the color of the leaf tongue and leaf neck did not have diversity (table 1).

Table 1. Effect of spraying bone ash nano fertilizer and nano oil palm empty fruit bunch ash on color appearance on sheath of leaf, tongue of leaf, neck of leaf, blade of leaf.

	Observation			
Treatment	**Sheath of Leaf**	**Tongue of Leaf**	**Neck of Leaf**	**Blade of leaf**
P	Pale Green	White	Pale Green	Pale Green
Q	Green	White	Pale Green	Pale Green
R	Green	White	Pale Green	Pale Green
S	Dark Green	White	Pale Green	Green

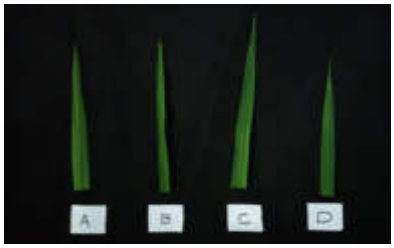


(a) Sheath of Leaf



(b) Tongue of Leaf

(c) Neckof Leaf



(d) Blade of Leaf

Figure 3. Color appearance on sheath of leaf, tongue of leaf, neck of leaf, blade of leaf. Character appearance of leaf area, amount of chlorophyll, length and width of stomata

The appearance of the character of the leaves of rice plants is very influential on the production process. The photosynthetic ability of plants is strongly influenced by leaf area, amount of chlorophyll, and stomata size. The effect of application of bone ash nano fertilizer and oil palm empty fruit bunch ash on leaf area, amount of chlorophyll, stomata length, and stomata width is shown in table 2.

Table 2. Effect of spraying bone ash nanofertilizer and oil palm empty fruit bunch ash on leaf area, chlorophyll count, stomata length, stomata width.

Treatment	Leaves Area (dm^2)	Amount of Chlorophylll (ml)	Stomata Length (µm)	Stomata Width (µm)
P	1427,73 a	41,00 a	145,33 b	79,67 b
Q	1365,73 a	29,67 a	183,67 a	88,67 a
R	1431,02 a	37,67 a	178,67 a	86,33 a
S	1631,34 a	45,33 a	188,00 a	88,67 a
CV	19.05	11.73	25.52	4.66

Mean values within a column followed by the same letter stomata widths indicated non significantly different as determined by DMRT at α = 5%.

The treatment of nano particle bone ash, nano particle oil palm empty fruit bunches, and the treatment of a mixture of nano particle bone ash and nano particle oil palm empty fruit bunches had the sam e effect as the control for leaves area and amount of chlorophyll but are not significantly for stomata length and stomata width. This shows that nano spraying of 38.40% cow bone ash can replace SP-36 fertilizer by 50% and nano spraying of 38.400% empty bunches of ash can replace KCl fertilizer by 50%. . This is presumably because nano-fertilization that is sprayed directly on plant leaves will be more effective if fertilization is carried out through the soil. The addition of nanofertilizers will increase the availability of nutrients in the soil, so that uptake will increase and nutrient levels in plant tissues will increase.

The nano treatment of cow bone ash, nano ash of oil palm empty fruit bunches, and the treatment of a mixture of nano cow bone ash and oil palm empty fruit bunches had the same effect as the control. This shows that nano spraying of 38.400% cow bone ash can replace SP-36 fertilizer by 50% and nano spraying of 38.400% empty bunches of ash can replace KCl fertilizer by 50%. High P nutrients in the soil and added with nano cow bone ash affect the weight of upland rice grains because the fulfillment of the nutrients needed in filling rice grains needed by plants is P element.

The application of nano particle bone ash through leaves with a concentration of 0.2% and nano oil palm empty fruit bunch ash with a concentration of 0.3% can increase length and width stomata, describesle photosynthetic capacity, while net assimilation rate describes photosynthetic efficiency. Calcium contained in bovine bone ash can increase photosynthesis by modulating ATP-ADP activity and also regulating chloroplast NAD+ [9]. Phosphorus plays an important role in the structure of the ATP-ADP enzyme.

The method for calculating the total chlorophyll content is the Arnon method, which is calculating the chlorophyll content using 85% acetone solvent and measuring the absorbance value (A) of the chlorophyll solution at wavelengths (λ) = 663 nm and 645 nm [9]. Based on the results of the variance, it showed that there was no significant difference between fertilizer treatments. This is presumably because there is an influence from environmental stresses such as the lack of absorption of sunlight on the leaves so that this factor can affect the results of the chlorophyll content in rice plants, the more difficult the plants to absorb sunlight, the less chlorophyll content will be produced by plants.

Stomata are small oval-shaped holes surrounded by two special epidermal cells called guard cells where the guard cells are epidermal cells that have undergone events or changes in shape and function that can regulate the size of the holes Among other things, by changing their shape, the guard cells regulate the widening and narrowing of the gap. Stomata are usually found on plant parts that are in contact with air. The number of stomata varies in the leaves of the same plant and also in the same leaf area.

The size of the stomata diameter is closely related to the size of the stomata pore, the larger the stomata size, the larger the stomata pore. This results in a high rate of transpiration because more water comes out so that it will increase the absorption of nutrients from the soil. The absorbed nutrients will be used for the photosynthesis process which causes an increase in the rate of photosynthesis which will affect the increase in plant growth and development. The picture of observing the diameter of the stomata opening in various treatments can be seen in Figure 4.

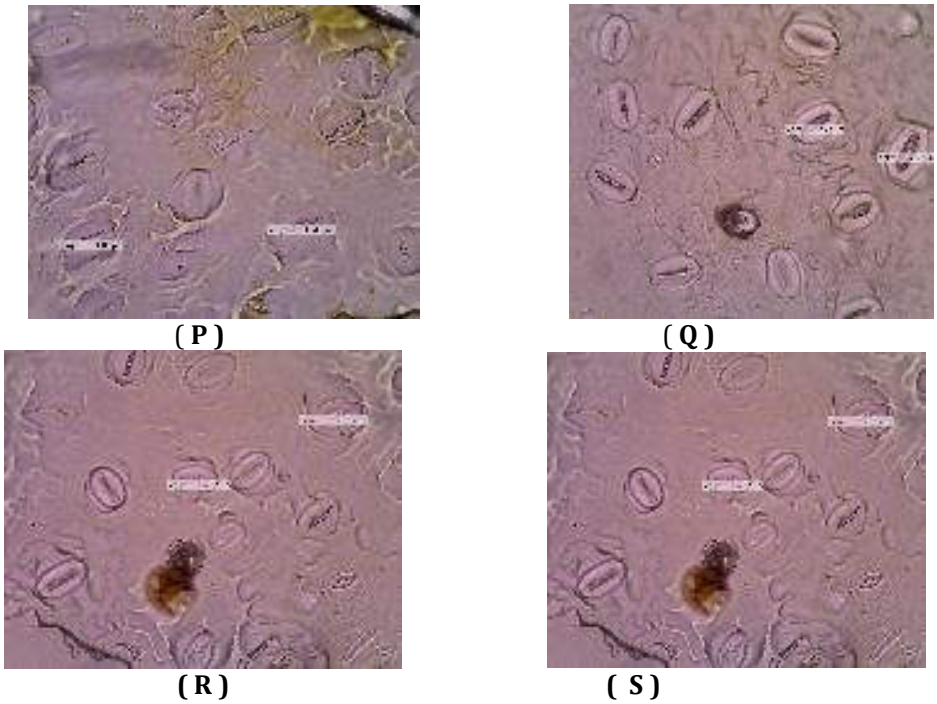


Figure 4. Observation of Stomata Opening Diameter in Various Treatments

Based on Figure 4. The size of the diameter of the stomata openings of rice plants is significantly. [10] Plants exposed to high-intensity light have smaller stomata daimeters and larger numbers than those grown in shaded and humid areas. This is in line with [11] which states that the stomata will be large if the plant is growing in an area with low sunlight intensity (shade). [12] Variations in the size of the stomata diameter are affected by the thickening of guard cells in response to light, CO2, and water conservation. Plants that grow in shaded and unshaded environments, stomata size and number of stomata are important factors in transpiration (evaporation).

CONCLUSION

The spraying of nano bone ash and oil palm empty fruit bunches ash affects the appearance of the leaves of the Mandel variety rice plant on sheath of leaf color, blade of leaf color, stomata length, stomata width, and stomata opening width.

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