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STUDY OF GROWTH YIELD AND SEED QUALITY OF CUCUMBER (*Cucumis sativus* L.) ON BIOFERTILIZER AND LIQUID SMOKE FERTILIZER

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ABSTRACT

The application of biofertilizer and liquid smoke fertilizer is either method to increase the production of cucumber according to the environmentally friendly because it's made from organic materials. The purpose of this research is to get the biofertilizer dose and the best concentration of the liquid smoke fertilizer to increase the growth and yield of fruit as well as the quality of seed cucumber. This research method is a field experiment that arranged by Completely Randomized Group Design (RAKL). The first factor is biofertilizer dose (P) that consist of 3 levels, that is: 5 ml/plant, 10 ml/plant and 15 ml/plant. The second factor is the concentration of the liquid smoke fertilizer (O) that consist of 3 levels that is: 1%, 2% and 3%. The control crops were fertilized according to the farmer's habit of using NPK without biofertilizer and liquid smoke fertilizer treatment. The obtained data were analyzed by diversity analysis level 5%. To find out the significant differences between the control and the treatment, we did Contras Orthogonal Test level 5% and Duncan Multiple Distance Test level 5%. The result showed that the combination of treatment was significantly better than the control. There is an interaction between the dose of biofertilizer and concentration of liquid smoke on the vigor index parameter. The combination of P2O2 (biofertilizer 10 mL/plant and liquid smoke 2%) treatment is the best treatment on vigor index parameter. The best P2 (dose of biofertilizer 10 mL/plant) treatment was on the parameter of fruit weight per plant. O2 (concentration of liquid smoke 2%) treatment was best on the parameters of fruit weight per swath.

***Keyword**: cucumber, dose of biofertilizer, concentration of liquid smoke fertilizer, seed quality.*

INTRODUCTION

Cucumber (*Cucumis sativus* L.) belongs to the vines which is a type of vegetable from the *Cucurbitaceae*. Cucumber cultivation extends throughout the world, both in hot (tropical) and temperate (sub-tropical) climates. In Indonesia, cucumber plants are widely grown in the lowlands (Wijoyo, 2012).

The need for cucumbers continues to increase along with the increase in population, this is because the cucumber plant has many benefits in life. Cucumbers

have a fairly short harvest life and can be harvested many times so that with proper handling and cultivation treatment the productivity of cucumbers can be increased. According to BPS data (2019), national cucumber production has fluctuated from year to year for the last 5 years. Data from 2014 to 2018 shows that cucumber production in Indonesia decreased from 477,976 tons in 2014 to 433,923 tons in 2018.

The availability of cucumber seeds is one of the factors causing the decline in cucumber production. In addition, the use of hybrid seeds used by farmers makes production costs increase because the results of hybrid fruit seeds cannot be used as seed again. Planting non-hybrid cucumbers is also aimed at obtaining seeds that can be replanted in the next season so as to reduce costs incurred by farmers. Non-hybrid cucumber yield can be increased by using fertilizer as biofertilizers and Liquid smoke fertilizers

Biofertilizers are defined as substances that contain live microorganisms and when applied to seeds, plant surfaces, or soil, can colonize with the rhizosphere or other parts of the plant. in plants and promote plant growth by increasing the supply or availability of key nutrients to host plants. According to Sinha et al., (2014) *in* Kartikawati, et al. (2017), biofertilizers provide benefits for plant growth and increase crop yields. Biofertilizers play a role in maintaining the soil environment through N fixation in soils rich in micro and macro-nutrients, dissolving phosphorus and potassium or mineralization, releasing plant growth regulators, and producing antibiotics and biodegradation of organic matter.

Liquid smoke fertilizers (*wood vinegar, liquid smoke*) is a result of condensation or condensation of steam resulting from direct or indirect combustion of materials that contain lots of lignin, cellulose, hemicellulose and other carbon compounds. In agriculture, liquid smoke is used to improve soil quality and neutralize soil acid, kill plant pests and control plant growth, repel insects, accelerate growth in roots, stems, tubers, leaves, flowers, and fruits (Basri, 2010). According to Yatagai (2002) *in* Komarayati.dkk (2011), chemical components of wood vinegar such as acetic acid function to accelerate plant growth and prevent plant diseases. Methanol functions to accelerate plant growth, while phenol and its derivatives function to prevent pests and plant diseases. The aim of the study was to obtain the best dose of biofertilizer and concentration of liquid smoke in increasing growth and yield and quality of cucumber seeds.

RESEARCH METHODS

The research was carried out at Pudak, Terbah, Patuk, Gunungkidul Regency. The research started from April to July 2020. The materials used were non-hybrid Vanesa variety cucumber seeds, basic fertilizers (manure/compost, TSP, KCl, ZA, NPK), biological fertilizers, liquid smoke fertilizers and pesticides/fungicides if

needed. needed. The tools used are stationery, labels, nameplate, sickle, caliper, camera, meter, ruler, scales, gembor, hoe, stake, raffia rope, black silver plastic mulch, mulch clamp, mulch hole, *handsprayer and Grain Moisture Meter.*

The study was structured using a field experiment with a Completely Randomized Block Design (RAKL) environment design with 2 factors, namely the dose of biological fertilizer and the concentration of liquid smoke fertilizer. The dose of biological fertilizers consisted of 3 levels including P1= 5 mL/plant, P2= 10 mL/plant, and P3= 15 mL/plant. While the concentration of liquid smoke fertilizer also consists of 3 levels, namely O1 = 1%, O2 = 2%, and O3 = 3%. There were 9 treatment combinations plus 1 control, each repeated 3 times.

The observed parameters consisted of growth components including the number of leaves (strands) and the number of female flowers (buds). Yield components included fruit weight per plant and fruit weight per plot (kg). While the components of seed germination (%) and vigor index (%). Data were analyzed using analysis of variance (Anova) at the 5% level. To find out there is a significant difference between the control and the treatment, the *Orthogonal Contras* 5% level. Meanwhile, to find out the differences between treatments, *Duncan's Multiple Test* (DMRT) was used.

RESULTS AND DISCUSSION

Table 1. Average Number of Leaves of Plants Age 14, 21 and 28 Days (strands)

Treatment		Number of Leaves (strands)		
		14 Days	21 Days	28 Days
Biofertilizer	5 mL (P1)	4.70 a	11.81 a	24.59 a
	10 mL (P2)	4.74 a	12.11 a	26.07 a
	15 mL (P3)	4.74 a	11.63 a	25.15 a
Average		4.72 (x)	11.85 (x)	25.27 (x)
Liquid Smoke	1% (O1)	4.63 p	11.74 p	24.59 p
	2% (O2)	4.82 p	12.19 p	26.44 p
	3% (O3)	4.74 p	11.63 p	24.78 p
Average		4.73 (x)	11.85 (x)	25.27 (x)
Control		4.00 (y)	9.56 (y)	21.56 (y)
Interaction		(-)	(-)	(-)

Note: The average of treatment followed by letters in the same column (p) and (a) shows no significant difference. The letters (x) and (y) indicate that there is a significant difference between the control and treatment. The sign (-) indicates no interaction.

Observations on the vegetative phase of the number of leaves showed that there was a significant difference between the control and the treatment but there was no interaction between the treatment combinations. This is because the microbes present in biological fertilizers applied to plants are able to bind nitrogen from the air and in the soil, break down complex organic compounds into simpler compounds, and stimulate plant growth (Suwahyono, 2011). According to Basri (2010), liquid smoke has a positive effect on plants, namely improving soil quality, warding off pests and plant pathogens, as a stimulant for plant growth in roots, stems, tubers, leaves, flowers and fruit.

Table 2. Average Number of Female Flowers Age 21, 28 and 35 Days (buds)

Treatment		Number of Female Flowers (buds)		
		21 Days	28 Days	35 Days
Biofertilizer	5 mL (P1)	1.11 a	3.41 a	3.41 a
	10 mL (P2)	1.33 a	4.07 a	4.07 a
	15 mL (P3)	1.19 a	3.67 a	3.52 a
Average		1.21 (x)	3.71 (x)	3.67 (x)
Liquid Smoke	1% (O1)	1.15 p	3.89 p	3.33 p
	2% (O2)	1.22 p	3.89 p	4.04 p
	3% (O3)	1.26 p	3.37 p	3.63 p
Average		1.21 (x)	3.72 (x)	3.67 (x)
Control		1.00(x)	2.22 (y)	2.44 (y)
Interaction		(-)	(-)	(-)

Note: The average of treatment followed by letters in the same column (p) and (a) shows no significant difference. Letters (x) and (x) indicate there is no significant difference, letters (x) and (y) indicate there is a significant difference between control and treatment. The sign (-) indicates no interaction.

Observations on the parameters of the number of female flowers aged 28 and 35 days showed a significant difference with the control. The availability of phosphate elements is very important during the flowering phase of plants. The age of 21 days is the beginning of flower formation, all plants can get Phosphate so that flowering can be evenly distributed in both treatment and control. However, in the control, phosphate was only obtained from the application of NPK fertilizer and there was no continuous addition. Meanwhile, the microbes in the released biological fertilizers will develop in the soil (plant roots) and continue to provide phosphate for plants, so that the formation of female flowers is not hampered. According to Suwahyono (2011), the microbes present in biological fertilizers that are applied to plants are able to dissolve phosphate bound in the soil. Phosphate

element plays a role in the formation of flowers in plants. Royani, (2014) revealed that the phosphate content in biological fertilizers also stimulates flowering in plants. Phosphate functions to accelerate and strengthen the growth of young plants into mature plants and increase the percentage of flowers.

Table 3. Average Fruit Weight Per Plant (kg)

Dose of Biofertilizer	Concentration of Liquid Smoked Fertilizer			Average
	1% (O1)	2% (O2)	3% (O3)	
5 mL/plant (P1)	1.53	1.38	1.42	1.44 b
10 mL/plant (P2)	1.65	1.76	1.43	1.61 a
15 mL/plant (P3)	1.66	1.49	1.58	1.58 ab
Average	1.62 p	1.54 p	1.47 p	1.54 (x)
Control (NPK)				1.17(y)
Interaction				(-)

Note: The average of treatment followed by letters in the same row (p) or column (a, b) shows no significant difference. Letters (x) and (y) indicate that there is a significant difference between the control and treatment. The sign (-) indicates no interaction.

Observation of the average fruit weight per plant showed that the dose of P2 (10 mL/plant) was significantly higher than the other treatments. According to Simanungkalit *et al.,* (2006) giving excessive doses of biological fertilizers will cause competition between microbes in obtaining food so that it will affect the nutritional needs of microbes, as a result the microbes will work less than optimally in providing nutrients for plants. On the other hand, if too little is possible, the released microbes can die because they are unable to adapt to soil conditions in the plant root area. A dose of 10 mL/plant allows competition between microbes to be suppressed but also microbes can still survive and thrive in plant roots to supply nutrients.

Table 4. Average Fruit Weight Per Plot (kg)

Dose of Biofertilizer	Concentration of Liquid Smoked Fertilizer			Average
	1% (O1)	2% (O2)	3% (O3)	
5 mL/plant (P1)	4.73	5.40	5.93	5.36 a
10 mL/plant (P2)	5.85	6.22	5.45	5.84 a
15 mL/plant (P3)	5.25	5.72	5.30	5.43 a
Average	5.28 q	5.78 p	5.56 pq	5.54 (x)
Control (NPK)				4.25(y)
Interaction				(-)

Note: The average of treatment followed by letters in the same row (p, q) or column (a) shows no significant difference. Letters (x) and (y) indicate that there is a significant difference between the control and treatment. The sign (-) indicates no interaction.

Observations on the parameters of fruit weight per plot, giving a liquid smoke concentration of 2% (O2) was better than 1% (O1) and 3% (O3). This can be caused by several factors, one of which is pH. Plants in a growing environment that is too alkaline or too acidic will experience problems with nutrient absorption. The concentration of 2% liquid smoke is thought to not significantly affect the environment of cucumber plants so that the nutrients in fertilizers can still be absorbed and utilized by plants.

Table 5. Average Seed Germination Moisture Content 7% (%)

Dose of Biofertilizer	Concentration of Liquid Smoked Fertilizer			Average
	1% (O1)	2% (O2)	3% (O3)	
5 mL/plant (P1)	100.00	98.33	98.33	100.00 a
10 mL/plant (P2)	98.33	100.00	98.33	99.44 a
15 mL/plant (P3)	96.67	98.33	100.00	99.44 a
Average	100.00 p	99.44 p	99.44 p	99.63 (x)
Control (NPK)				96.67(x)
Interaction				(-)

Note: The average of treatment followed by letters in the same row (p) or column (a) shows no significant difference. The letters (x) and (x) indicate that there is no significant difference between the control and treatment. The sign (-) indicates no interaction.

Observations on the percentage of germination in all treatments and controls were not significantly different. Protein is one of the main food reserves so it is important to be stacked in large quantities during seed development. Protein as a food reserve is used by the embryo during the germination process. In seed development, proteins are involved in the metabolism of sugars that provide a carbon source, as well as in various biochemical activities of seeds (Li *et* al, 2012). The germination of all seeds is high with a percentage above 80% so that they are suitable for replanting.

Table 6. Average Seed Vigor Index Moisture Content 7% (%)

Dose of Biofertilizer	Liquid Smoke Fertilizer Concentration			Average
	1% (O1)	2% (O2)	3% (O3)	
5 mL/plant (P1)	91.67 a p	90.00 a q	90.00 a q	90.56
10 mL/plants (P2)	91.67 b p	96.67 a p	91.67 b q	93.33
15 mL/plant (P3)	85.00 b q	81.67 b r	95.00 a p	87.22
Average	89.44	91.20	90.83	(x)
Control (NPK)				63.33(y)
Interaction				(+)

Note: The average of treatment followed by letters in the same row (a, b) or column (p, q, r) shows no significant difference. The letters (x) and (y) indicate that there is a significant difference between the control and treatment. The sign (+) indicates there is an interaction

Observations on the vigor index parameter showed that there was a significant difference between the treatment and the control. The formation of quality cucumber seeds / seeds cannot be separated from the quality of the fruit. Good fruit will have a positive correlation with the seeds produced. The role of microbes in biological fertilizers, which are able to provide phosphate for plants, has been shown to have a positive effect on the fruit and seeds produced by cucumber plants. According to Royani, (2014), phosphate serves to increase the percentage of flowers into fruit/seeds, helps assimilation and respiration while accelerating flowering and ripening of fruit, seeds or grain.

CONCLUSION

1. The combination of treatment dose of biological fertilizer and concentration of liquid smoke fertilizer was significantly better than the control on all observed parameters except for the parameters of the number of female flowers aged 21 days and germination.
2. The dose treatment of biological fertilizers and liquid smoke concentration showed an interaction with the vigor index parameter of the seed moisture content of 7%. Seed vigor index moisture content of 7% combination of P2O2 treatment (10 mL dose of biological fertilizer/plant with 2% liquid smoke fertilizer concentration) was significantly better than other treatments.
3. The dose of biological fertilizer P2 (10 mL/plant) was significantly better than the P1 (5 mL/plant) and P3 (15 mL/plant) treatments on the parameter of fruit weight per plant
4. Treatment with concentration of liquid smoke fertilizer O2 (2%) was significantly better than treatment O1 (1%) and O3 (3%) in the parameter of fruit weight per plot.

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