



Application of Cow Manure and *Trichoderma* sp. on Ex-mining Land to Improve Soil Chemical Properties and Fragrant Lemongrass (*Cymbopogon nardus* L.) Growth

Santi Diana Putri,¹ Giska Oktabrina¹

¹ Department of Agrotechnology, STIPER Sawahlunto Sijunjung, Sijunjung, 27511, Indonesia

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CORRESPONDENCE

Phone: +6281374147373
E-mail: giskaoktabriana@gmail.com

A B S T R A C T

Ex-mining land has low productivity due to poor soil quality. One way to improve the quality of the soil is by providing organic materials, soil microbes, and plants that are known to be adaptive, such as fragrant lemongrass. The study aimed to determine the effect of the use of manure and *Trichoderma* sp. in improving soil chemical properties on ex-mining land. This research was conducted in Nagari Pala Luar, Koto Tujuh District, Sijunjung, and the Soil Laboratory, Agriculture Faculty, Universitas Andalas. The design used was Randomized Block Design (RBD) with 5 treatments (A = control / without cow manure and *Trichoderma*, B = 144 g cow manure + 14.4 gr *Trichoderma* sp. / planting hole, C = 288 g cow manure + 28, 8 gr *Trichoderma* sp. / planting hole, D = 432 g cow manure + 43.2 gr *Trichoderma* sp. / planting hole, E = 576 g cow manure + 57.6 gr *Trichoderma* sp. / planting hole) and 3 replications. The results showed the use of cow manure and *Trichoderma* sp. able to increase nutrient content and of fragrant lemongrass growth in ex-mining land by giving 432 g cow manure + 43.2 gr *Trichoderma* sp. / planting hole.

INTRODUCTION

In West Sumatra Province, there are potential mineral resources such as gold and mangani. According to a report from the West Sumatra Province Mining and Energy Office (2004) *cit* Refles (2012), gold is found in the regions of Sijunjung, 50 Kota, Pasaman, and Pesisir Selatan Regency. In the area of Sijunjung Regency, gold deposits are estimated to occur in several locations such as; Bukit Kabun, Batu Manjular, Silokek, Tanjung Ampalu, Palangki, Mundam Sakti, Muaro Sijunjung and Lubuk Karia. In sites that have gold content, traditionally, it has been exploited by the community for a long time using a straightforward method and a technique known as gold panning. In its development, community gold mining is no longer only done in the river flow in Sijunjung Regency, but has also been carried out on the edge/river bank, continued to <https://doi.org/10.25077/jfmp.1.1.16-19.2020>

other locations, including the area of rice fields, gardens, and even yards. Panning has changed to mining using mechanical excavation and screening/sifting. The excavation has been carried out by using a heavy tractor or an excavator.

The problem faced in this former mining land is low productivity due to poor physical and chemical properties of the soil such as little water holding capacity, large porosity, low soil fertility such as acid soils, N-Total, P-available, cation exchange capacity (CEC) and weak base bases (K, Ca, Mg and Na) and also Al which is dissolved in the soil is very high and even high content of heavy metals and toxic compounds that can damage the environment.

One alternative that can be used for degraded land is by utilizing ameliorant soils such as organic matter, soil microbes, and growing plants that are adaptive to sandy

ground such as lemongrass. In line with this, it is necessary to first improve the soil through the provision of organic materials such as manure, such as cow manure.

Lemongrass is known to be resistant to a small number of nutrients so that it can be used on minimal gold mined soil in the presence of nutrients and has high economic value. Cow manure usually consists of a mixture of 0.5% N; 0.25% P₂O₅ and 0.5% K₂O. Solid cow manure with 85% water content contains 0.40% N; 0.20% p₂O₅ and 0.1% K₂O, and those that are liquid with 95% water content include 1% N; 0.2% P₂O₅ and 1.35% K₂O (Tawakkal, 2009). *Trichoderma* sp., besides being a decomposing organism, it can also function as a biological agent. The purpose of this study was to determine the effect of the use of manure and *Trichoderma* sp. in improving soil chemical properties on ex-mining land.

METHODS

The study was conducted for five months in the land of a former gold mine in Nagari Palaluar, Koto VII District, Sijunjung Regency, and continued with soil analysis at the Andalas University Laboratory in Padang. The design used in this study was a randomized block design (RBD) with five treatments and three replications. The treatments were as follows:

- A = control (without the use of cow manure and *Trichoderma*)
- B = 144 g cow manure + 14.4 g *Trichoderma* sp./ planting hole
- C = 288 g cow manure + 28.8 gr *Trichoderma* sp./ planting hole
- D = 432 g cow manure + 43.2 g *Trichoderma* sp./ planting hole
- E = 576 g cow manure + 57.6 g *Trichoderma* sp./ planting hole

Data were analyzed using analysis of variance of 5%, if there are significant differences, then further tests of Honest Significant Difference (BNJ) were conducted at the 5% level.

Propagation of *Trichoderma* sp.

Pure culture of *Trichoderma* sp. in the test tube is crushed then mixed with rice bran and then homogenized with the addition of sterile distilled water and added enough rice flour so that the mixture is smooth. This mixture is then incubated at room temperature in a sterile state for 4-5

days to grow mold spores that meet the media of rice bran added rice flour. This mixture is then air-dried to powder. The resulting powder is called a starter *Trichoderma* sp.

Land preparation, treatment, and planting

Land preparation was done by clearing the land from weeds, then planting holes were made with a size of 30 x 30 x 20 (cm³), with the distance between the holes was 1 x 1 m². The treatment is given based on the dose of each treatment to the planting hole and incubated for one week.

Maintenance

Maintenance carried out during the study included watering, weeding from weeds. Watering was done every day (1 time a day) if it was not raining. Weeding is done by pulling every grass that grows.

Observation

Observations made are observation of soil and plants. Soil observation includes analysis of soil chemical properties such as pH, N-total, P-available, K-dd, and C-organic. Plant observations were plant height, number of tillers, and the percentage of living plants (%).

RESULTS AND DISCUSSION

The results of the analysis of the chemical properties of ex-mining land before giving *Trichoderma* sp. and cow manure showed in Table 1.

Table 1. The analysis of some chemical properties before giving cow manure and *Trichoderma* sp.

The chemical properties of soil	Score	Criteria *)
pH H ₂ O	5,31	Acid
N-total (%)	0,13	Low
P-available (ppm)	0,20	Very low
K-dd (me/100 g)	0,15	Low
C-organic (%)	0,48	Very low

*) Staff of the Soil Research Center (1983 cit (Hardjowigeno, 2003)

Table 2. Effect of cow manure and *Trichoderma* sp. on some of soil chemical properties.

Treatments	The chemical properties of soil									
	pH	Criteria	N-total (%)	Criteria	P-available (ppm)	Criteria	K-dd (me/100g)	Criteria	C-organic (%)	Criteria
A	5,46	Acid	0,15	Low	0,25	Very low	0,27	Low	0,47	Very low
B	5,77	Slightly acid	0,17	Low	0,28	Very low	0,31	Moderate	0,53	Very low
C	5,79	Acid	0,21	Moderate	0,21	Very low	0,37	Moderate	0,75	Very low
D	5,93	Slightly acid	0,23	Moderate	0,26	Very low	0,43	Moderate	1,07	Low
E	5,65	Slightly acid	0,22	Moderate	0,25	Very low	0,41	Moderate	1,41	Low

Results of analysis of soil pH and P-available after administration of cow manure and *Trichoderma* sp. are showed in Table 2. From the results of the analysis of variance, there was no significant difference between treatments.

From Table 2, it can be seen that in general, the soil pH on this ex-mining land after treatment is still classified as acidic to slightly acidic, but there has been an increase in pH from the initial soil (before being treated). The increase in soil pH value by number in the ground is in line with the rise of base cations such as K.

The P-available content in ex-gold mining land after being given organic matter has increased from very low to low criteria. This increase is due to the addition of organic matter, which can contribute to the P element in the soil. According to Nyakpa *et al.* (1988), the addition of organic matter to the soil causes a reduction in P binding, which means an increase in the available P-soil. Besides that, the increase in P is also influenced by the P content contained in the organic material.

From Table 2, it can also be seen that the C-organic nutrient content is still classified as very low to low after being given cow manure and *Trichoderma* sp. The low content of C-Organic is caused by *Trichoderma* sp. in its growth and development, still taking energy from the given manure, so the C-organic content is still relatively low. This is consistent with the opinion of Wong *et al.* (2004), which states that the availability of C will decrease in line with the decomposition process and that C is a source of substrate for soil microbes.

The N content in the soil after being given manure and *Trichoderma* sp. is classified as low to moderate criteria. The increase in N content in the soil is due to the addition of cow manure and *Trichoderma* sp. The primary source of N is also organic matter, which will then undergo the

process of mineralization, namely the conversion of N by microbes from N-organic to N-inorganic. Therefore, the application of manure can increase the decomposition process by microbes, which in turn will increase the N content in the soil (Douds *et al.*, 1997).

The content of K-dd after being given manure and *Trichoderma* sp. has increased, which is included in the criteria Moderate. The increase in K-dd is due to the addition of cow manure into the soil, where this manure will contribute the K element to the soil.

Table 3. Effect of cow manure and *Trichoderma* sp. on ex-mining land on the height, to the number of tillers, and percentage of living plants of fragrant lemongrass

Treatments	The height of plants (cm)	Number of tillers (stems)	Percentage of living plants (%)
A	70,27	10,33	63,33
B	78,60	19,44	71,66
C	84,55	19,33	68,33
D	86,94	24,10	73,33
E	75,83	19,44	71,66
*CV (%)	8,49	29,29	18,08

*Coefficient of variance

In Table 3, it can be seen that the increase in plant height and number of tillers is more significant and more numerous in the treatment of cow manure and *Trichoderma* sp. This is because the treatment will increase nutrients in the soil such as N, P, and K. Provision of cow manure compost with a balanced level can improve the nutrients needed by plants sufficient for vegetative growth, to stimulate growth in plant height and several tillers. Syukur and Indah (2006) state that organic fertilizer mixed with the soil will undergo decomposition and be able to provide nutrients for plants. Nutrients needed for plant height are N elements required by plants

for the formation of chlorophyll, and chlorophyll itself is an acceptor in the absorption of sunlight that plants need in the process of photosynthesis to produce photosynthates required by plants to carry out growth and development. Nitrogen in plants functions as a constituent of protoplasts, chlorophyll molecules, nucleic acids, and amino acids which are constituents of proteins, if nitrogen deficiency occurs, it can cause vegetative or generative growth of plants to be disrupted. Plant height growth takes place in the vegetative growth phase. The vegetative growth phase of plants is related to three essential processes, namely cell division, cell elongation, and the first stage of cell differentiation. All three of these processes require carbohydrates because the carbohydrates that are formed will be compounded with nitrogen compounds to form protoplasm at growing points, which will affect plant height increase. The availability of carbohydrates concentration formed in plants is influenced by the nitrogen fertilization rate (Braun et al., 2016).

From Table 3, it can also be seen that the percentage of plant life is higher in the treatment of cow manure and *Trichoderma* sp. compared to control. It is strongly influenced by the state of the soil and the growth media with the state of the soil. Despite poor soil conditions, fragrant lemongrass can still survive, which ranges from 63.33 to 73.33%. It does not affect the fact that giving cow manure compost to the percentage of plants is due to environmental conditions and growing media because it is carried out on ex-mining land that is poor in nutrients with arid soil conditions, the soil horizon changes due to excavation. After all, there are not many types of plants that live on it. Post gold mining land is dominated by sandy soil where the ability of the soil to bind water is deficient, the light intensity is very high due to open area so that the surface temperature is very high, the topsoil layer is almost non-existent, and at the time of the study, an extended drought occurred causing the plants many died.

CONCLUSIONS

The results showed that the use of cow manure and *Trichoderma* sp. was able to increase nutrient content and growth of fragrant lemongrass plants in ex-mining land by giving 432 g cow manure + 43.2 gr *Trichoderma* sp. / planting hole.

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