Can Ridge Direction and Latex Change The Soil Organic Matter Content?

Shantosa Yudha Siswanto[1*], Marenda Ishak Sonjaya Sule[1], Muhammad Hilda Rizki Maulana[1], Trananda Pratama Achmad[2], Asep Mulyono[3], Kharistya Amaru[4]

[1]Departement of Soil Science and Land Resources, Faculty of Agriculture, Universitas Padjadjaran.
[*]**Correspondence** : E-mail: shantosa@unpad.ac.id
[2]Directorate of Land Consolidation, Directorate General of Agrarian Arrangement, Ministry of Agrarian Affairs and Spatial Planning/National Land Agency
[3]Environment Research Center and Clean Technology of BRIN
[4]Departement of Agricultural and Biosystem Technique, Faculty of Agricultural Industrial Technology

ABSTRACT

Dry land agricultural systems, including potato cultivation, produce a high potential of critical land due to the exposed area that leads to erosion. Mitigation such as mechanical and biological techniques is required to overcome erosion by increasing soil characteristics. This study is intended to provide information regarding the ridge direction and latex treatment on the soil organic matter (SOM) of Andisols in Pangalengan. This study has implemented a slope gradient of 30% and 1.6 km of altitude. This study conducts a split-plot design, 3 repetitions and 12 treatments. The ridge direction level is as follows: follow the slope direction, follow the contour line, and the diagonal one. Latex concentration act as a subplot consist of 0%, 0.6%, 1.2% and 1.8%. This study shows no interaction impact between ridge direction and latex on organic matter content.

Keywords: *latex, potato, steepness, ridge, organic matter*

INTRODUCTION

Andisols is known as fertile soil due to the content of basaltic and andesitic material (1). The Andisols is prone to erosion since it occupies a step area with a high intensity of rain. This kind of cultivation is not following the land suitability concept. Hence, it emerges a possibility of critical land since suitability plays an important role in the environment point of view (2). Moreover, this type of soil is still in developing process (3). Therefore, the cultivation of Andisols should be accompanied by conservation, such as mechanical and chemical methods. Andisols occupy a quite large area in Indonesia (5.4 million hectares or 2.9% of Indonesia's land area).

Ridge is considered an effective mechanical conservation method for the cultivation activity of farmers. Ridge is normally used as cultivation media. It inhibits the overland flow, directs and accommodates water flow to an unharmful impact. Ridges that follow the contour line lead to a lower erosion and overland flow amount compared to the diagonal method. Ridge implementation decreases heavily the overland flow and erosion (4).

Many cultivation areas of potatoes are commonly found in the steep area. Accompanied by the high intensity of rainfall, it results in a massive erosion possibility. Bad land management characterized by non-conservation implementation results in erosion possibility and it will be aggravated by a steep terrain (5,6,7). Farmers are usually familiar with conservation theories such as a high erosion risk on potatoes cultivation following the direction of the slope. However, they assume that ridge directions against slope direction will increase soil moisture. Hence, it emerges soil infectious plant diseases. This means a possibility of unsuccessful cultivation which lead to a massive loss of cost.

Another method of conservation is soil stabilizers as part of the chemical method. Implementation of soil stabilizers

will enhance the structure and stability of soil aggregate. Latex act as a soil stabilizer component. Implementation of latex will result in strong soil aggregates and stabilize macro pores. Hence, the infiltration rate is increasing and finally reduces runoff and erosion (8). Moreover, the organic matter content of latex will bring a better soil stability aggregate due to the "cementing agent" function on aggregates.

The study conducted by (9) using 0.6 percent of latex and 0.75 percent of polymer acrylnitri monomeric on Podsolik type of soil from Bengkulu shows a reduction of erosion by 13 tons.ha-1.year-1, 23 tons.ha^{-1}.year^{-1}, 41 tons.ha^{-1}.year^{-1} and 50 tons.ha^{-1}.year^{-1} respectively for 3 percent, 8 percent , 15 percent and 30 percent of slope.

MATERIAL AND METHODS

The experiment was implemented on Andisols in Pangalengan potato center, Bandung, West Java, altitude of 1,600 m ASL. The data of rainfall intensity ranged from 1.750-2.800 mm per year with C2 climate type (10). This data was taken during 1998-2002.

36 experimental plot units is designed for this study. It includes 3 replications and 12 treatments on a split plot design. The independent variable consists of the main plot (ridge direction (G)) and subplots (latex dose (L)). Ridge direction (G) levels consist of a ridge following the slope direction (g_1), a ridge following the contour line (g_2) and a diagonal direction (g_3). Meanwhile, latex concentration (L) consists of 0% (l1), 0.6% (l_2), 1.2% (l_3) and 1.8% (l_4).

Observation of bacterial attack was conducted by visual observation of the leaf and stem. The initial symptoms are the wilting condition of some younger leaves and the yellowing color of older leaves. When the wilted plant stems are cut, the color of the vascular will be brown. If the stem is pressed, a grayish mucus will come out.

To see the effect of treatment on the observed variables, statistical analysis was carried out. The experimental design for this experiment is a split-plot design in a factorial randomized group design. The statistical analysis uses the Anova test. If the interaction effect is not existing, then the analysis proceeds with the independent impact of ridge direction and latex concentration factor, using a comparison test of average value with the Least Significance Different (LSD) test.

RESULT

Andisol from Pangalengan of this study is still relatively young or in the developing phase (haploid) so the boundaries of the horizon are not distinct enough. This fact can be obtained from the profile description which shows a diffuse horizon boundary in Bw1, Bw2, Bw3, BC, 2B1, 2BC, and 3AB horizons. The entire horizon is in a humid condition which shows that it never dries out for 90 cumulative days each year.

This soil possesses a high porosity characterized by a sufficient portion of micro and meso pores in each horizon. Soil color in the upper horizon is in the range of 10YR 2/1 to 10YR 4/6. Meanwhile, the lower horizon is in the range of 7.5 YR 4/4 to 7.5 YR 5/8. Soil acidity of the entire horizon is in the range of 5.3-6 which is one of the characteristics of Andisols.

Statistical analysis shows a non-presence interaction between two independent variables (ridge and latex) on the organic content of the soil (SOM). The results of treatment implementation on SOM content are presented in Table 1.

Table 1. SOM content as a result of treatment.

Treatment	Organic matter content (kg.plot^{-1})
I. Ridge direction	
Follow slope direction (g_1)	4.84 a
Follow contour direction(g_2)	4.68 a
Diagonal (g_3)	4.55 a
II. Latex	
Without Latex (l_0)	4.68 a
0,6 % of Latex (l_1)	4.74 a
1,2 % of Latex (l_2)	4.74 a
1,8 % of Latex (l_3)	4.62 a

Remark: The same letter shows a non-significancy (based on variance analysis of 5%)

DISCUSSION

The ridge direction independent impact gave a non-significant difference from the Latex treatment (Table 1). Eventhough the cultivation is conducted against slope direction, the increment of soil water content was avoided by the presence of water outflow path. (11). Thus, the growth of bacterial diseases does not occur. This fact is based on visual observation on the plant, where only few symptoms of a bacterial attack was identified on the plant.

The treatment of all latex concentrations (0 percent, 0.6 percent, 1.2 percent, 1.8 percent) give no significant impact on organic matter content. It shows that the erosion impact on the ridge direction has not impacted organic matter content. Moreover, it is not eroded in the higher value.

The independent effect of latex administration did not show a significant effect on SOM. This shows that the addition of latex is too few, or due to the quick decomposition of latex into nutrients which are then absorbed by plants (12). Therefore, the content of available organic matter becomes small so that there is no significant difference between the levels of organic matter (13), this shows that the higher the concentration of latex, the more intensive decomposition of organic matter. Hence, the remaining content is few.

CONCLUSION

Mechanical method (ridge direction) and chemical method (latex) shows a non-interaction impact on SOM content. Individually, both treatments gave non-significance impact on the SOM content of potato cultivation.

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REFERENCES

1. Yulina H, Devnita R, Harryanto R. The Effect of Steel Slag and Rice Husk Bokashi on Aggregate Stability and Corn Biomass in Andisol, Lembang. Agro Wiralodra, 2018; 1(1), 17-20.
2. Sule, MIS, Siswanto, SY. Feasibility studies of intensively tea plantation on West Java. IOP Conference Series: Earth and Environmental Science. 2019; Vol. 393 No. 1. Pp. 012080
3. Nikmah A, Alibasyah MR, Manfarizah M. Physical Properties of Andisols and Elephant Grass Production Due to Types and Dosages of Organic Fertilizers in Pegasing District, Central Aceh District. Journal of Land Resource Management. 2014; 3(2), 472-479.
4. Sutrisno N, Heryani N. Soil and Water Conservation Technology to Prevent Sloping Agricultural Land Degradation. Journal of Agricultural Research and Development, 2013;

32(3), 122-130.
5. Isjudarto, A. Increase in Soil Erosion on Overburden Piled Slopes Due to Mining Activities in the Clereng Area, Pengasih, Kulon Progo Regency. Proceedings of the 10th ReTII National Seminar. 2015; 196-201.
6. Siswanto, SY, Sule, MIS. The Impact of slope steepness and land use type on soil properties in Cirandu Sub-Sub Catchment, Citarum Watershed. IOP Conference Series: Earth and Environmental Science. 2019; Vol. 393
7. Siswanto, SY, Achmad TP, Sule MIS. The impact of ridge direction and latex on the yield of potato (Solanum tuberosum l.) in typic hapludands, Pengalengan, West Java. IOP Conference Series. Earth and Environmental Science. 2019; Vol. 393. No. 1. IOP Publishing,
8. Ardiansyah R, Banuwa IS, Utomo M. Effect of Tillage Systems and Long-Term Nitrogen Fertilization Residues on Soil Structure, Bulk, Total Pore Space and Soil Hardness in Mung Bean (Vigna radiata L.) Cultivation. Journal of Agrotek Tropika. 2015; 3(2): 283-289.
9. Basri AHH. Study of the Role of Mycorrhiza in Agriculture. Agrica Extension. 2018; 12(2), 74-78.
10. Maru R, Leo MNZ, Rahim S, Basram NF. Oldeman Climate Zoning for Agricultural Areas. Proceedings of ICMSTEA. 2016
11. Yulnafatmawita A, Saidi, Gusnidar, Adrinal, Suyoko. The role of plant forage materials in increasing organic matter and aggregate stability of Ultisol Sweet Limes planted with maize (Zea mays). Solum Journal. 2010; 7(1): 37-48.
12. Anwar H. The effect of additional latex (rubber sap) on the characteristics of normal Laston Ac-Wc. 2020
13. Hidayat C, Rosdiana R, Frasetya B, Hasani S. Improving the Physical Properties of Inceptisols and Sweet Corn Yield Affected by Arbuscular Mycorrhizal Fungi and Manure Application. Knees of Life Sciences. 2017; 158-163.