The impact of ridge direction and latex on the yield of potato (Solanum tuberosum l.) in Typic Hapludands, Pangalengan, West Java

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Abstract. The objective of this experiment was to find out the effect of ridge direction and latex soil conditioner on potatoes yields on Typic Hapludands from Pangalengan. The experiment was conducted in Pangalengan, with elevation 1,600 meters above sea level and 30% of slope steepness. The experiment used a split plot design with 12 treatments and three replications. The main plot ridge direction consists of: in line with slope direction, in line with contour, and diagonal. The sub plot was latex concentration level as follow: 0%, 0.6%, 1.2% and 1.8%. The result of the experiment showed that there was no interaction effect between ridge direction and latex soil conditioner. The independent effect of latex just influenced potatoes yields. Potatoes yield of latex 0%, 0.6%, 1.2% and 1.8% was 72.97 kg, 74.47 kg, 75.14 kg and 76.48 kg, respectively.

1. Introduction
Andisols are generally formed from andesitic and basaltic parent material, therefore it is considered a fertile soil [1]. The distribution of Andisols is around 5.39 million hectares, or around 2.9% of Indonesia's land area. The Andisols soil structure is still in the stage of development, and geographically it is located on a sloped area with high rainfall, which causes erosion easily [2]. Therefore, agricultural practice on Andisols must be followed by conservation techniques.

Ridge is one of the land processing technologies that are already well-known by the farmers. Ridge as development media, inhibit surface runoff and accommodate and channel flow. Ridges in line with the contour result in a lower surface runoff and erosion rate than the diagonal one. The direction of the crop and ridge is very significant in terms of controlling surface runoff and erosion [3].

Land management in the highlands, such as potatoes with high rainfall is very risky for erosion. the danger of erosion is increasingly supported by a large number of sloping and steep terrain [4]. Farmers in the Garut and Pangalengan areas already know that planting potatoes in the direction of slopes has a high risk of erosion, but farmers assume that ridge in contour directions increase soil moisture, so that the development of infectious plant diseases in the soil can increase, meaning it can cause crop failure.

One effort to control erosion is the implementation of soil stabilizers. Soil stabilizers may improve the physical properties of soils such as aggregate structure and stability. Latex (natural rubber) as a soil-stabilizing material may create large aggregates of soil and stabilize large pores so as to increase the infiltration rate and ultimately reduce soil moisture [5].
The results of the [6] were estimated by using a 0.6% latex soil stabilizer and 0.75% polymer acrylnitril monomeric (PAM) soil in the Podsolik Merah Putih soil from Bengkulu, which could save the topsoil from loss due to surface erosion by 12.78 tons ha\(^{-1}\) year\(^{-1}\), 22.50 tons ha\(^{-1}\) year\(^{-1}\), 40.65 tons ha\(^{-1}\) year\(^{-1}\) and 49.49 tons ha\(^{-1}\) year\(^{-1}\) respectively for 3% slope, 8%, 15% and 30%.

2. Materials and Methods

2.1. Materials
This study was conducted in the area of Pangalengan potato center, Bandung Regency, West Java, with altitude 1,600 m below sea level on Andisols. The amount of rainfall (1998-2002) ranged from 1,750-2,800 mm yr\(^{-1}\) with climate type C2 [7].

2.2. Method
The treatment consisted of the main plot and subplots i.e. the direction of the ridge (G) and the latex dose (L). The types of the two plots are as follows:

1.) Ridge (G) as the main plot consists of three levels, as follow:
   - \(g_1\) = Ridge in line with the direction of the slope
   - \(g_2\) = Ridge in line with the contour
   - \(g_3\) = diagonal ridge (between the slope and contour direction)

2.) Latex Concentration Plots (L) consist of four levels, as follow:
   - \(l_0\) = 0 (without latex)
   - \(l_1\) = 0.6% latex
   - \(l_2\) = 1.2% latex
   - \(l_3\) = 1.8% latex

The experiment was arranged in a split plot design (RPT) which included 12 treatments with 3 replications, so that there were a total of 36 experimental plot units.

3. Results and Discussions
Statistical analysis showed no interaction between latex and direction of the ridge on the yield of potato. The results of additional latex in various directions of the ridge on the yield of potato are presented in Table 1.

| Table 1. Average Potato Yield per pot at Various Latex Stages and Ridge Direction |
|-----------------------------------|---------------------------------|
| Treatment                         | Yield (kg plot\(^{-1}\))        |
|                                  |                                 |
| I. Ridge direction                |                                 |
| In line with slope (\(g_1\))      | 76.58 a                         |
| In line with contour (\(g_2\))    | 73.27 a                         |
| Diagonal (\(g_3\))                | 76.84 a                         |
| II. Lateks                        |                                 |
| Without Lateks (\(l_0\))         | 72.97 a                         |
| Lateks 0.6 % (\(l_1\))           | 74.47 a                         |
| Lateks 1.2 % (\(l_2\))           | 75.14 ab                        |
| Lateks 1.8 % (\(l_3\))           | 76.84 b                         |

Remark: All numbers which are followed by the same letter are not significantly different based on 5% level of confidence of variance analysis.

Statistical analysis in Table. Fig. 5 shows that the independent effect of the ridge direction is not significantly different from the results of Lateks. This shows that although planting is done by cutting the slope, moisture is maintained by the existence of a drainage channel. [8]. This is supported by visual observation data which only a few attacked by bacterial.
The treatment of latex concentration of 1.8% gave higher results than the treatment of latex concentration of 1.2%, 0.6% and control. Without treatment of latex, the yields are noted 72.97 kg plot-1 or equivalent to 35.47 tons ha-1 in plant populations of 35,000 per hectare. Provision of latex at 1.2% level was able to increase potato yield by 0.3% and latex level 1.8% increased the yield by 5.3% compared to controls.

The increase in yield is due to the higher latex treatment which causes more stable aggregate stability. Hence, it able to combat erosion [9, 10]. Erosion reduces nutrient losses so that crop is supported by this condition [11]. This increment can also due to the increase in the content of organic matter from latex addition. Latex is assumed as carbohydrates source, so that organic material is more available.

4. Conclusions
There is no interaction between the latex soil stabilizer and the direction of the mounds on the potato yield. The direction of mounds does not significantly affect the yield of potatoes. Additional Latex administration has a significant effect on potato yield. The latex concentration of 1.8% was able to increase the yield of 76.84 kg greater than 5.3% compared to without latex which was 72.97 kg plot-1.

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