Dragon fruit agriculture on soil geomorphology perspective

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Abstract. This study aims to describe the land horizon of soil texture that is influenced by soil moisture, soil pH, soil organic matter and soil color in dragon fruit gardens in the Kemuning Lor village, Arjasa Subdistrict, Jember Regency. The type of research used includes qualitative research using the survey method. The object of this research can be obtained and reviewed from the Geomorphological and Geological Map of the Arjasa Subdistrict, Kabupaten Jember, East Java Province on a scale of 1: 25,000 (Indonesian Digital topographic map), which is on the condition of the land horizon. Point samples are determined by the area of the dragon fruit orchard selected to be used as five sample points by means of tools, namely, google earth, GPS, pH and humidity measuring devices, geological maps, and geomorphological maps. The results showed that the 5 points taken at the dragon fruit garden had an average pH that was neutral, the soil moisture was high, the soil was of average dark brown and blackish brown, brown in such a way that the condition of organic matter was present in O horizon or the uppermost layer itself has a fairly high level of soil fertility, the soil structure that is there contains quite a lot of sand and clay. These conditions influenced by old volcanic landform, aluvial plain, and quarter volcanic landform

1. Introduction
Jember Regency is one of the regencies located in the area of East Java Province. Land surface conditions in the city of Jember especially Arjasa Subdistrict Kemuning Lor Village is quite bumpy, because most of it is hilly. The land in the village of Kemuning Lor was formed by latosol and regosol soil types, as evidenced by the color of the soil there with yellowish brown color. This condition determines the level of fertility and effective depth of soil, where the level of fertility is around 90 cm. The climate in the city of Jember itself is included in the tropical climate and rainfall conditions are quite a lot so that it is possible if the land in the Kemuning Lor area is very fertile overgrown with dragon fruit. Geographically, the position of Jember Regency is between the horseshoe area which is surrounded by other districts such as Lumajang Regency, Situbondo Regency, Bondowoso Regency and Banyuwangi Regency [15]. Jember Regency is divided into four regions that surround it including: the southern lowlands, the slopes of Mount Raung, the Slopes of Mount Argopuro, and the hills in the southeast. Jember Regency is on the slopes of the Hyang Mountains, Mount Argopuro in the north, and Mount Raung in the northeast [18].

The village of Kemuning Lor district, when viewed from the river flow, can see the hydrological conditions there. Hydrology in Kemuning Lor is influenced by shallow surface water, springs and streams that pass through it. Kemunging Lor Village, Arjasa Subdistrict, Jember Regency, has a land that is good enough to be used as a farming area, as evidenced by the geomorphological map of Arjasa District which is found in yellow. From the map symbol on the right, the geomorphological map of the yellow symbol indicates the number of farms
Geologically, the area of Jember Regency is characterized by the formation of the dune which is estimated to have originated from the eruption of Raung Volcano in ancient times around 1700-1800 years ago. The existence of the dune has provided a unique landscape and is quite rare in other regions in Indonesia, especially in the village area of Kemuning Lor, Arjasa District. Apart from being part of the landscape, there are still many dunes to be utilized to meet several interests such as tourism. Seen from a stratigraphic angle, these spurs belong to young volcanic formations. The young volcanic formations in Arjasa sub-district include the Sukowono volcanic unit, including the formation of the other dumplings. The dune is from rocks, lapilli, and pumice.

In the geological map of topographic features, it can be seen that the area of the presence of the dunes is part of the formation of young quarterly volcanoes. Some researchers [20] state that Mount Raung (young volcanic formation) belongs to the Strato volcano. Therefore the cone is composed of layers of lava rock, volcanic ash, volcanic sand, lapilli, lava deposits and other volcanic rocks which are irregular in composition. Mount Raung produces lava, lapilli ash (sand and dust) and volcanic gas [12]. Kemuning Lor Village Arjasa Subdistrict is a Subdistrict that has the least amount of dune compared to other districts, this is because many of the dams have been mined in this area, so the amount of dune is decreasing and thinning. The rock formations in this region are the Bogor Formation, Argopuro Breccia, and Argopuro Tuff rock formations.

Dragon fruit or better known as dragon fruit is a plant that is still not long known and cultivated by the people of Indonesia. Dragon fruit plant is a plant that is red and has an outer skin similar to green scales. Of course for the people of Indonesia, especially in the world of agriculture is a fruit that is classified as a newcomer. However, for now cultivating dragon fruit is a promising business opportunity because the growth of dragon fruit is suitable if it is developed in tropical Indonesia. And also those who are interested in dragon fruit in Indonesia are pretty much fond of this fruit. It is noted that enthusiasts or the need for dragon fruit in Indonesia reach around 200-400 tons per year, but the fulfillment of the dragon fruit is still less than 50% [1]. In areas with a good environment, it will improve the welfare of the community [6]. That will also happen in the dragon fruit plantation area. However, if without good management, the area also has the potential for landslides [7].

There are many known benefits of dragon fruit for the body if consuming dragon fruit regularly can reduce cholesterol. One area that cultivates dragon fruit is in the village of Kemuning Lor, Arjasa District, Jember Regency. Dragon fruit in the village of Kemuning Lor is known for its sweet fruit taste because the planting uses organic fertilizer so that the fruit is different from the dragon fruit that is usually sold by traders on the roadside. However, there is a problem with the dragon fruit garden that is there, namely the large number of potholes that are there and a large number of wild grasses are found. The lack of care for the dragon fruit is not comparable to the yields that produce dragon fruit with a sweet taste. And also with the presence of wild grasses will greatly interfere with the organic material content in the dragon fruit plant so that its growth will eventually be hampered and the fruit produced will not be as good as before. One of the factors that can influence the dragon fruit yield is organic fertilizer because by giving fertilizer it will improve the nutrients contained in the soil [19].

2. Methods
This research is a qualitative type of research using survey methods. The purpose of this research is to describe the soil horizon about soil texture which is influenced by soil moisture, soil pH, soil organic matter and soil color. Land horizon variations have occurred in the past, and currently represent the condition of past topographic functions. This happen
because, the process of land formation has occurred centuries ago until this century. At each variation of the soil horizon determined by the determinant location point that affects it. We can choose the land horizon on a land that is rarely or without vegetation or plants with many roots on the soil. The object of this study can be obtained and reviewed from the Geomorphological and Geological Maps of the Arjasa Subdistrict, Jember Regency, East Java Province on a scale of 1: 25,000 (Indonesian Digital Rupabumi Map), namely on the soil horizon conditions. The location of this research is on the horizon of the dragon fruit garden in the village of Kemuning Lor, Arjasa District, Jember Regency. The sample point is determined by the area of the dragon fruit garden chosen to be made into five sample points with aids namely, google earth, GPS, pH and humidity gauges, geological maps, and geomorphological maps. The sample point is made in the form of a table which shows the seven indicators that must be analyzed can be seen in the table below:

**Table 1.** Point location instrument for finding seven land horizons from the study site

| Location Point | Coordinate | Elevation Angle | Soil moisture | Soil pH | Organic Ingredients | Soil Texture | Land Color       |
|----------------|------------|----------------|---------------|---------|---------------------|--------------|------------------|
| 1.             | S 08° 04’ 50. 90″ | 535 m     | 10            | 7       | high                | Sandy (30%)  | Blackish Brown |
|                | £ 113° 41’ 24. 32″ |          |               |         |                     |              |                  |
| 2.             | S 08° 04’ 54. 12″ | 541 m     | 10            | 7       | medium              | Sandy (30%)  | Dark brown      |
|                | £ 113° 41’ 23. 99″ |          |               |         |                     |              |                  |
| 3.             | S 08° 04’ 55. 63″ | 543 m     | 8.5           | 6       | medium              | Sandy (30%)  | Dark brown      |
|                | £ 133° 41’ 23. 19″ |          |               |         |                     |              |                  |
| 4.             | S 08° 04’ 54. 70″ | 535 m     | 8,9           | 7       | high                | Sandy (30%)  | Blackish Brown |
|                | £ 113° 41’ 23. 19″ |          |               |         |                     |              |                  |
| 5.             | S 08° 04’ 54. 29″ | 533 m     | 7             | 6       | Medium              | Middle sandy (15%) | Dark brown |                  |
|                | £ 113° 41’ 21. 04″ |          |               |         |                     |              |                  |

Observation test uses assistive devices and then analyzes one another to determine the nature of the soil horizon. The nature of the soil horizon itself consists of: moisture, pH, organic matter, texture and color of the soil to analyze and will be discussed in order to obtain research results. From the results of the study it can be seen that the condition of the
soil horizon that affects the dragon fruit is quite fertile to be planted in the village area of Kemuning Lor.

3. **Results and Discussion**

In general, each soil depth from the sample we obtained has the same physical properties from the five sample locations.

**Table 2. Results of observation**

| Location Point | Coordinate | Sudut Elevation | Soil moisture | Soil pH | Organic Ingredients | Soil Texture | Land Color |
|----------------|------------|------------------|---------------|---------|---------------------|--------------|------------|
| 1              | S 08° 04’ 50. 90” | 535 m           | 10            | 7       | High                | sandy (30%)  | Blackish Brown |
|                | £ 113° 41’ 24. 32” |                 |               |         |                     |              |            |
| 2              | S 08° 04’ 54. 12” | 541 m           | 10            | 7       | moderate            | sandy (30%)  | Dark brown |
|                | £ 113° 41’ 23. 99” |                 |               |         |                     |              |            |
| 3              | S 08° 04’ 55. 63” | 543 m           | 8.5           | 6       | Moderate            | sandy (30%)  | Dark brown |
|                | £ 133° 41’ 23. 19” |                 |               |         |                     |              |            |
| 4              | S 08° 04’ 54. 70” | 535 m           | 8.9           | 7       | High                | sandy (30%)  | Blackish Brown |
|                | £ 113° 41’ 23. 19” |                 |               |         |                     |              |            |
| 5              | S 08° 04’ 54. 29” | 533 m           | 7             | 6       | moderate            | middle (15%) | Dark brown |
|                | £ 113° 41’ 21. 04” |                 |               |         |                     |              |            |

Moisture properties in the soil are quite unique because, the more the soil is found in sand texture, the easier the permeability level will be, because the pore or texture in the soil greatly affects the soil permeability, and vice versa if, the pore in the soil is small and dense, the level of permeability is relatively low. High soil moisture will result in the condition or state of water in the soil. Because of the ideal soil moisture, it certainly has good water storage. In soil moisture there is evaporation through the soil surface, transpiration and percolation. The level of ideality of soil moisture can be attributed to the soil texture in the Kemuning Lor village orchard, as evidenced at the five points of the observation site we found, through our observation and analysis of the textures which contained a large amount of sand which was large enough for grains - the grains of sand. Soil moisture is where the condition of the water that fills some or all of the soil pores above the term water table [15].
Can be seen in the table above the average soil moisture ranges above seven. The range of this figure indicates that the land of dragon fruit plantation in Kemuning lor village is quite high from the humidity indicator. The higher the soil moisture level, the better the soil quality and it is not surprising that every land in the village is found in abundant fertile and dense dragon fruit plants. Its influenced by old volcanic landform, aluvial plain, and quarter volcanic landform.

Soil pH is soil content in the soil where acidity or wetness occurs, with measurements using a pH scale between 0 to 14. An object can be said to be acidic if the pH scale number is less than 7 and is called alkaline if the pH scale is more than 7. At when measuring on areas of land that have a pH scale of 7, it can be said that the soil is neutral, not acidic or not alkaline. So that in areas that have a neutral soil pH will contain lots of nutrients for the sake of sustainable plant growth, in order to produce maximum fruit. Can be seen from the pH measurement table in the Dragon Fruit garden that occurs at the five measurement points above. So that it can be described that the first and fourth observation points have a soil pH scale of 7, which means that the blood is a neutral region that is neither acidic nor basic. The fields can produce nutrients properly so that they can enlarge the fruit quickly and optimally. When the pH of the soil changes in a neutral direction it will be beneficial to provide nutrients in the soil. There is an optimal availability of nutrients and certain nutrients that can poison the settling plants. Liberation from soil organic matter is related to soil pH. Calcification increases organic mineralization.

In the second, third, and fifth regions, the pH has a scale of 6, which means that the soil is on an acid scale. Acidic soil is indicated that the soil is deficient in phosphorus, calcium, magnesium and molybdenum. These elements are chemically bound and cannot be absorbed by plants. Such conditions can cause aluminum and manganese elements that are toxic and can harm plants that will develop. Impacts that will be experienced by plants are abnormal growth, low productivity and deteriorating quality. Soil like this can be improved soil or land by providing dolomite or agricultural lime at the appropriate dose.

In this case soil pH can be beneficial for the sustainability of soil fertility, namely:
1. As a place to live micro-organisms. At pH 5-5.7 bacteria and fungi break down organic matter to develop properly. If the pH is too acidic, soil microorganisms will die.
2. As an indicator of poison. Soil with a pH that is too acidic will increase levels of Al, Fe, and Mn which if the content is excessive will be toxic to plants. Conversely, if the pH is too alkaline it will increase levels of Na, and Mo which are toxic to plants.
3. Nutrition Absorption. Absorption of nutrients both macro or micro will be optimal in neutral soil pH conditions.
4. Monitoring of agricultural land, soil pH measurement can also be used to monitor the cultivation of agricultural land against the use of chemicals and their impact on the environment.

The acidity of the soil (pH) is clearly positively correlated to the height of a place, i.e. the pH value will tend to increase with increasing altitude from that place. One of the factors is the higher organic matter content in the soil. Organic matter contained in soil can increase soil pH whose value is highly dependent on the quality of organic matter [9].

An increase in pH is caused by the presence of a decomposition process of various organic materials so that it makes the cation base. The final results obtained are simple from the overhaul of the organic material, which among others in the form of base cations, such as Mg, Ca, Na, and K [13]. the release of alkaline action into a solution in the ground causes the
soil to saturate with the cation so that it can eventually increase the pH of the soil. The main source of organic material is humus / litter which comes from dragon fruit stems or other plants which are quite numerous. Lower temperatures and high rainfall in mountainous areas can increase the amount of humus / litter which is the main source of organic material [13].

Soil organic material in the dragon fruit garden in the village of Kemuning Lor signifies good, because it can be seen from the color of the soil that is on the land. Of the five locations in the dragon fruit garden, the average color is dark brown and blackish brown, such a brown color indicates that the condition of organic matter in horion O or the top layer itself has a high level of soil fertility other than that with pH a neutral average means that it contains a lot of nutrients produced more abundantly such as phosphorus, nitrogen, magnesium, food, etc. The presence of these nutritional contents causes the organic material in the land to be sufficiently nourished and well-developed and more worms are found. The presence of worms helps the process of soil enrichment, so that plants that are on the ground can flourish and have better quality.

Soil organic matter is the result of the process of decomposition of living organisms which is composed of a mixture of lignin, protein, polysaccharides and other organic materials derived from mineral rocks present in the soil [4]. The secondary source of organic matter from the soil is fauna. Fauna first uses a plant organic material which after that supplies organic material. In general, in animal tissue will be more quickly destroyed compared to plant tissue. These animal tissues are mostly composed of water, solid parts including charcoal, protein, fat, oxygen, hydrogen, and ash. The composition of the ash itself consists of all nutrients absorbed and needed by plants except carbon, hydrogen and oxygen [1].

The texture of the soil shows the smoothness of a surface. Coarse-textured soil will cause higher or faster permeability levels and easy to pass water, but if fine-textured soil causes the level of soil permeability is low or slow in the process of passing water through it. The presence of soil texture also greatly affects the rate of plant growth through the infiltration process. In soil conservation, infiltration is an important element that must be really considered because, basically infiltration is closely related to rainfall intensity and infiltration capacity itself and to regulate ground surface runoff [3]. Ground surface flow can only be regulated by increasing the ability of the soil to store water, the main road can be reached by using repairs or increasing infiltration capacity. The infiltration capacity itself is the maximum rate of water that can enter the soil at any time. If the soil is found in many fine textures so that the level of permeability is slow and then the ability of the soil to store water is also low, as a result the process of infiltration in the soil will also be hampered, if this event is continually ignored then the occurrence of erosion will be faster if there is a height steep slope.

In the table above, it can be seen that the texture of the soil in the village of Kemuning Lor, that on average many locations were found to have a rough texture, means that the soil conditions in Desa Kemuning Lor are very good for planting different types of plants and dragon fruit plants. The dragon fruit in Kemung lor Village is red-red and large-sized all indicate that the soil conditions there are very good despite the disturbing vegetation and lack of care from the owner of the garden. Moreover, Jember is a drought-prone region due to the mixing of two volcanic bedrock with young and old age, so this will also affect the characteristics of dragon fruit farming [21].

The color of the soil indicates the condition of soil organic matter in the dragon fruit field. Proven in the table above the average soil color is blackish brown which means that it is very good and quality in soil fertility. The color of the soil is not yellowish brown and is
not of good quality to be used as a plantation. The existence of soil color can provide an information for us to find out some soil sifs. Soil color generally occurs because of a difference in organic content in the soil. The more organic soil content, the darker the soil color [10].

4. Conclusion

Dragon fruit plants are very suitable to be planted in areas that have high topography because they contain sufficient hydrology. The color of the soil indicates the condition of soil organic matter in dragon fruit fields. Dragon fruit, or better known as dragon fruit, is a plant that is still not long known and is cultivated by the people of Indonesia. Dragon fruit plant is a plant that is red and has an outer skin similar to green scales. Of course for the people of Indonesia, especially in the world of agriculture is a fruit that is classified as a newcomer. But for now cultivating dragon fruit is a promising business opportunity because the growth of dragon fruit is suitable if it is developed in tropical Indonesia. Proven in the table above the average soil color is blackish brown which means that it is very good and quality in soil fertility. The color of soil mud can also be classified in several groups, namely sandy soil, clay soil and sandy soil.

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