





An Observation of Soil pH, Temperature and Moisture of Siamese Orange Farm at Kerta Village, Payangan, Gianyar, Bali

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Abstract: We conduct this research to observe soil pH, temperature and moisture in Siamese orange farm located at Kerta Village, Payangan District, Gianyar Regency, Bali using Takemura DM-15 Moisture Meter and Soil pH to measure soil pH and moisture. Beside that, we use the HT-02 Thermal Imager Camera to measure soil temperature. Meanwhile to determine the environmental temperature and humidity conditions, the MiSol DS102 Temperature Humidity Data Logger is used. We collect the data at 9 points and group the data into three groups, namely group 1 for location of L1-L3, group 2 for location of L4-L6, group 3 for location of L7-L9. The data is collected every 2 days from June to August 2021 for forty-one times. This research concludes that the ideal pH range for orange farm from 5 to 6 is obtained under conditions of soil temperature from 27.7°C to 29.9°C and soil moisture from 35.3% to 42.2%.

1 INTRODUCTION

Siamese orange is part of tangerine originating from Siam (Muangthai) which was originally widely cultivated outside Bali, namely West Kalimantan and is now widely cultivated in the Bali area, especially in Bangli and Gianyar regencies (Supartha, Kesumadewi, Susila, Gunadi, & Suardi, 2015).


The agricultural sector in Kerta Village is dominated by fruit crops. One of the fruit commodities developed in Kerta Village is orange fruit. The type of orange grown in Kerta Village is the Siamese Lumajang orange plant which has been developed by the community here since 2003. The area of land that can be utilized by orange farmers in Kerta Village is 72 hectares with a production yield of 2.90 tons/Ha (Januwia, Dunia, & Indrayani, 2014).


Siamese orange plants can be grown and cultivated in the lowlands to highlands (0 to 1,500 masl), but optimally below 1,000 masl. Siamese orange requires 6-9 wet months (rainy season) and


3-6 dry months (dry season) and need sufficient water, especially in July-August (dry season). High rainfall occurred throughout 2010 causing phenological chaos. Previously, orange plants flowered 1 to 3 times a year to 4 to 6 times a year but these flowers did not turn into fruit (there was a drop in the nipple) and resulted in the failure of orange harvests in 2010 and 2011 (Ashari, Hanif, & Supriyanto, 2014).


The intercropping pattern of Siamese orange with vegetable crops has better soil biological properties than the monoculture cropping pattern. The soil pH value is higher in the intercropping pattern of Siamese orange with several vegetable crops, i.e., 6.72–6.85 compared to the monoculture Siamese orange cropping pattern of 6.38 in Sekaan Village, Kintamani District (Bunada, Kesumadewi, & Atmaja, 2016).

The result of research in 2018 in Lebong Regency shows that around 55.6% of the decrease in soil water content was related to land slope. There was a decrease in water content tends to be 0.38% for every

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1% increase in land slope. In addition, soil pH will also decrease with increasing slope (Banjarnahor, Hindarto, & Fahrurrozi, 2018).

Research on post-mining revegetation land located in East Kalimantan shows that differences in planting age affect microclimate fluctuations, including soil temperature and moisture at different soil depths. The result shows that the highest soil temperature at a depth of 10 cm and 20 cm were 27.7°C and 26.6°C, respectively, at 3 years of revegetation. Meanwhile, the lowest soil temperature was at 7 years old revegetation at a depth of 10 cm and 20 cm, respectively, at 26.1°C and 24.9°C. The highest soil moisture was 87.8% (at a depth of 10 cm) and 88.0% (at a depth of 20 cm) in the 7-year-old revegetation area. The lowest soil moisture at a depth of 10 cm (81.3%) and 20 cm (81.5%) occurred in the 3 year old revegetation area (Karyati, Putri, & Syafrudin, 2018).

Research in guava plantations of crystal varieties (*psidium guajava l.*) in 2017 shows that the value of soil temperature, soil moisture had an effect on the high and low soil pH values at various plant ages (Karamina, Fikrinda, & Murti, 2017).

Orange plants can grow in any type of soil. The degree of soil acidity (pH) required ranges from 5 to 6. In soils that are too acidic, which is less than 5, plant roots cannot develop properly, so they are less able to absorb nutrients. If the plant is able to absorb nutrients, the plant will experience Cu (Copper) poisoning. Soil with pH of more than 6 or alkaline, usually a lot of micro-nutrients are bound, causes less normal plant growth due to nutrient deficiency. In principle, orange plant will grow and bear fruit very well in areas with a rather dry climate type as long as there is enough water ((Nia T, 1993).

Based on previous research studies, in this article we will report about soil pH, temperature and moisture research of Siamese orange farm located at Kerta Village, Payangan District, Gianyar Regency, Bali that has never been done before in this location.

2 RESEARCH METHOD

This observation is conducted in a Siamese orange farm that has experienced several harvests with a plant age of about 10 years. Orange cultivation here has a spacing of 3 meters with cabbage intercropping. The data taken are soil pH, soil moisture and soil temperature. For measuring soil pH and moisture, the DM-15 pH and Moisture Meter made by Takemura is used, while for measuring soil temperature, the HT-02 Thermal Imager Camera is used. To determine

the environmental temperature and humidity conditions, the MiSol DS102 Temperature Humidity Data Logger is used. The data has been collected from June to August 2021. During that time, there is no fertilization conducted in this orange farm. Photos of the equipment are shown in Figures 1-3.



Figure 1: DM-15 pH and soil moisture meter.

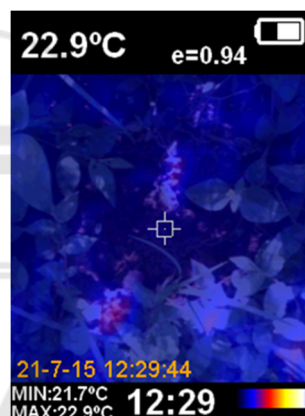


Figure 2: HT-02 thermal imager camera.

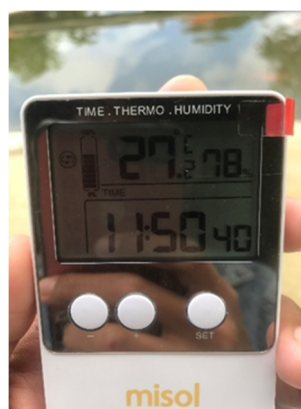


Figure 3: Temperature and humidity data logger.

Data collection of soil pH, humidity and temperature are conducted at nine points at the observation location during the day. The collections at these nine points are grouped into three groups, i.e., group 1 for location of L1, L2 and L3, group 2 for location of L4, L5 and L6, group 3 for location of L7, L8 and L9. As stated before, the data collection is conducted from June to August 2021 every 2 days. Totally, the data has been collected forty-one times. Furthermore, data tabulation and processing, continued with statistical data analysis are conducted to obtain conclusion from the observation.

3 RESULT AND DISCUSSION

3.1 Result

The movement of air temperature and humidity data at the research site are shown in Figure 4. This data indicates that the air temperature is in the range of 24.3°C to 30.1°C, while the humidity is in the range of 68% to 83%. the MiSol DS102 Temperature Humidity Data Logger is used to collect the data at noon time.

Soil pH data at the research site are shown in Figure 5-7. At location of L1, L2 and L3, the soil pH moves from 4.4 to 6.4 as shown in Figure 5. At location of L4, L5 and L6, the soil pH moves from 4.2 to 6.6 as shown in Figure 6. At the same time, the soil pH moves from 4.4 to 6.4 at location of L7, L8 and L9 as shown in Figure 7. The DM-15 pH and soil moisture meter is used to measure the data.

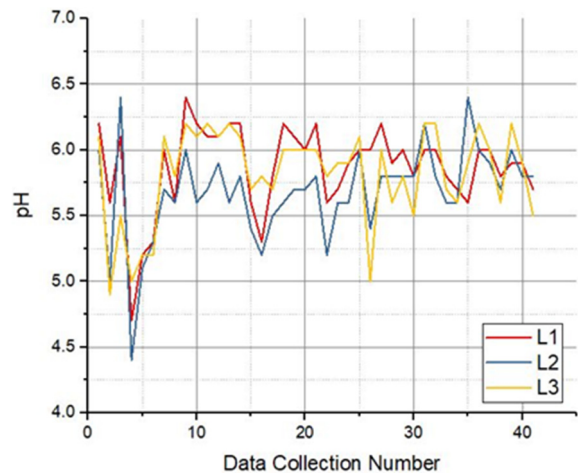


Figure 5: pH data of L1, L2 and L3.

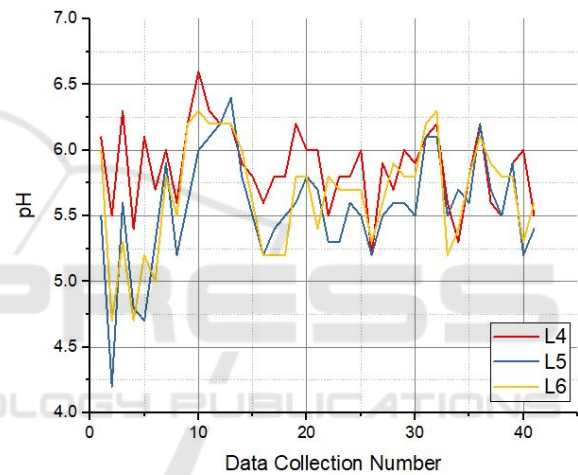


Figure 6: pH data of L4, L5 and L6.

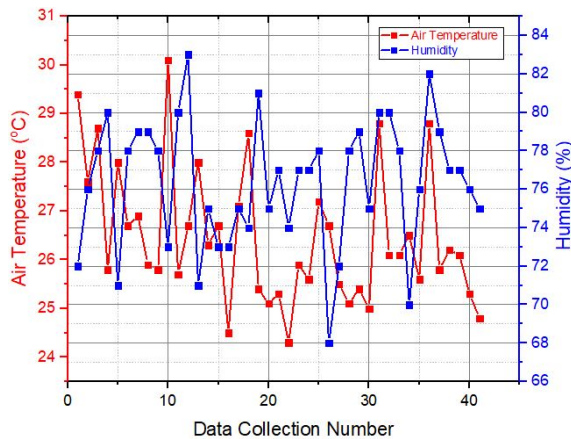


Figure 4: Air temperature and humidity data.

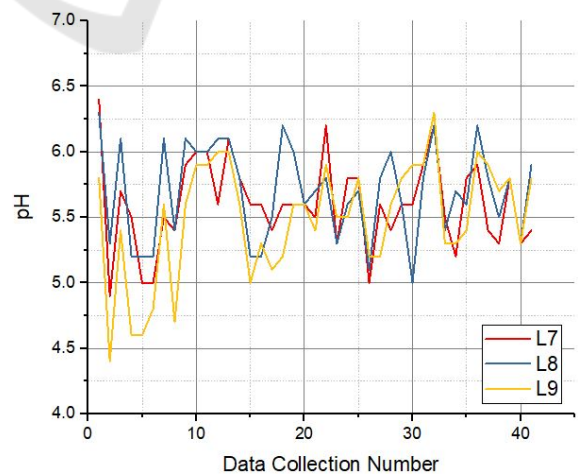


Figure 7: pH data of L7, L8 and L9.

Soil moisture data at the research site are shown in Figure 8-10. The soil moisture at location of L1, L2 and L3 moves from 10% to 76% as shown in Figure 8. At location of L4, L5 and L6, soil moisture fluctuates from 13% to 76% as shown in Figure 9. Meanwhile at location of L7, L8 and L9, the soil moisture changes from 11% to 84% as shown in Figure 10.

Soil temperature data at a depth of 10 cm at the study site are shown in Figure 11-13. At location of L1, L2 and L3, the soil temperature varies from 21.8°C to 37.9°C as shown in Figure 11. Meanwhile at location of L4, L5 and L6, the soil temperature changes from 22.4°C to 38.8°C as shown in Figure 12. At the same time, the soil temperature fluctuates from 22.1°C to 43.1°C at location of L7, L8 and L9 as shown in Figure 13.

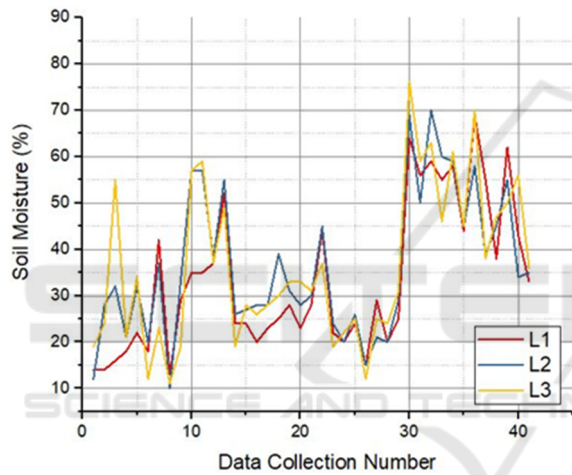


Figure 8: Soil moisture data of L1, L2 and L3.

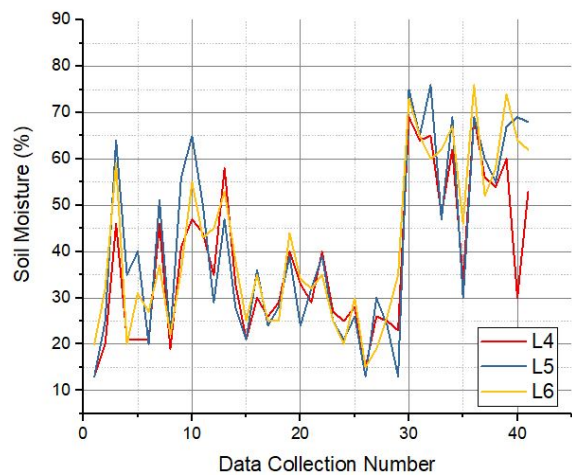


Figure 9: Soil moisture data of L4, L5 and L6.

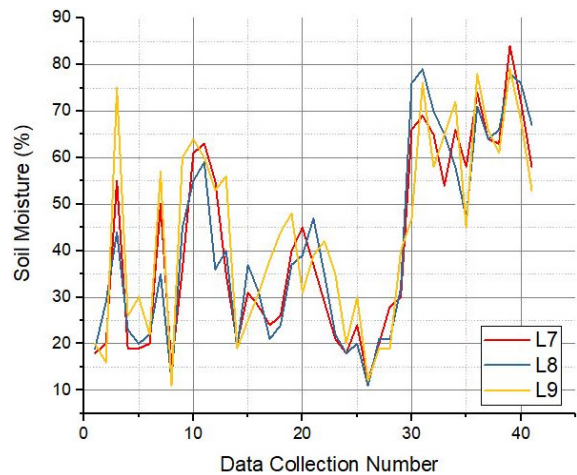


Figure 10: Soil moisture data of L7, L8 and L9.

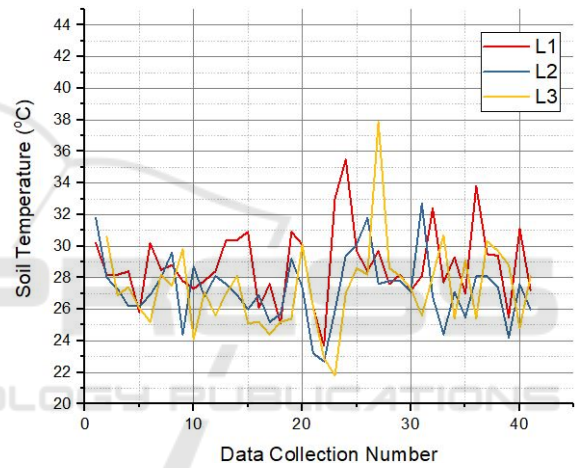


Figure 11: Soil temperature data of L1, L2 and L3.

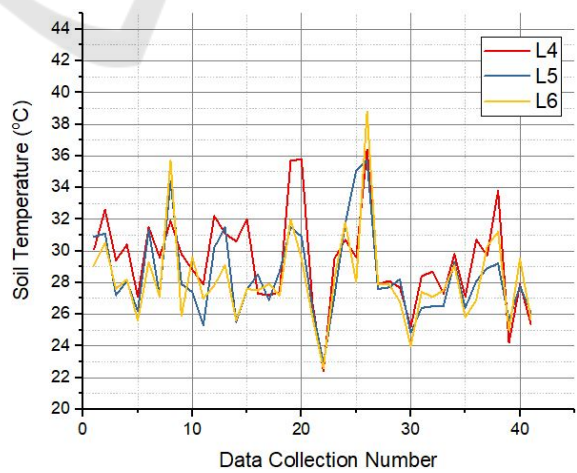


Figure 12: Soil temperature data of L4, L5 and L6.

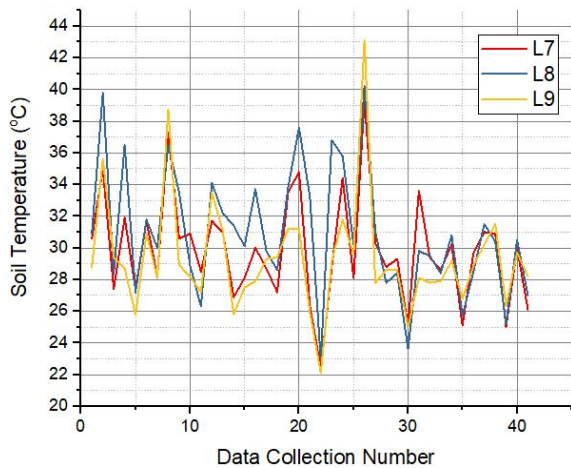


Figure 13: Soil temperature data of L7, L8 and L9.

3.2 Discussion

Based on the results of primary data about air temperature at the research site, Figure 4 shows that the air temperature has met the requirements for growing orange plants, i.e., 19°C to 39°C. Likewise, the humidity in the research location is 68% to 83%. This air humidity value has met the requirement for growing orange plants, i.e., 50% to 90% (Nurmegawati, Hamdan, & Sastro, 2020). At normal air humidity (70% to 80%), orange plant gets smooth fleshy fruit, more fruit juice, fresher taste, and stronger citrus aroma (Hilman, Suciandini, & Rosliani, 2019).

Parameter analysis of pH, moisture and soil temperature are conducted by calculating the average value of these three parameters at locations of L1-L3, L4-L6 and L7-L9. The results of this calculation are shown in Figure 14-16. Referring to a study by Nia T. in 1993 regarding the appropriate pH limit for Siamese orange cultivation, i.e., pH 5 to 6, it can be seen that the average pH in all locations have above or below ideal values.

Figure 14 shows the average pH of L1, L2, and L3. The pH value lower than 5 is obtained at soil temperature of 26.9°C and soil moisture of 20%. Meanwhile the pH value of 5 to 6 is obtained at average soil temperature of 27.7°C and average soil moisture of 35.3%. Furthermore, the pH values higher than 6 is obtained at the average soil temperature of 28.3°C and the average soil moisture of 37.9%.

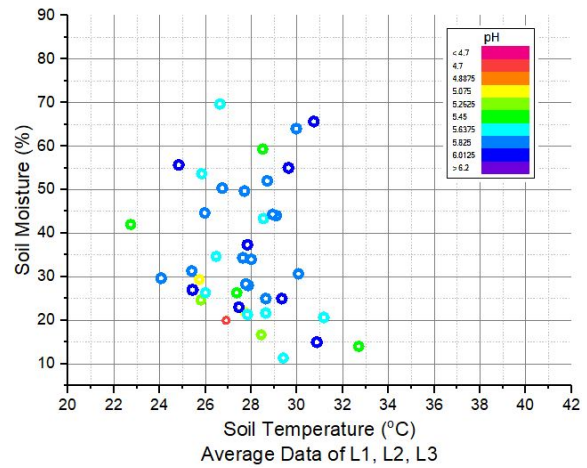


Figure 14: Average soil pH, moisture and temperature of L1, L2, L3.

Figure 15 shows the average pH values of L4, L5, and L6. The pH value of less than 5 is acquired at average temperature of 30.1°C and average soil moisture of 25.5%. Meanwhile the pH value of 5 to 6 is acquired at soil temperature of 28.6°C and soil moisture of 37.6%. Furthermore, pH value of higher than 6 is acquired at average soil temperature of 28.5°C and average soil moisture of 56.2%.

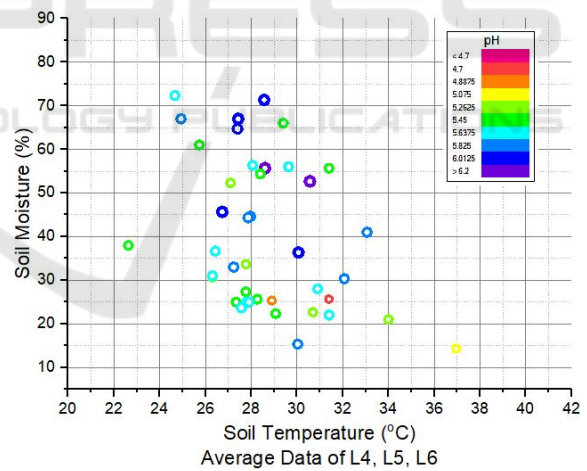


Figure 15: Average soil pH, moisture and temperature of L4, L5, L6.

Figure 16 shows the average pH values of L7, L8, and L9. The pH value of less than 5 is achieved at average temperature of 31.8°C and an average soil moisture of 22.3%. Meanwhile the pH value of 5 to 6 is achieved at soil temperature condition of 29.9°C and soil moisture of 42.4%. Furthermore, pH value of higher than 6 is achieved at average soil temperature of 29.8°C and average soil moisture of 50.3%.

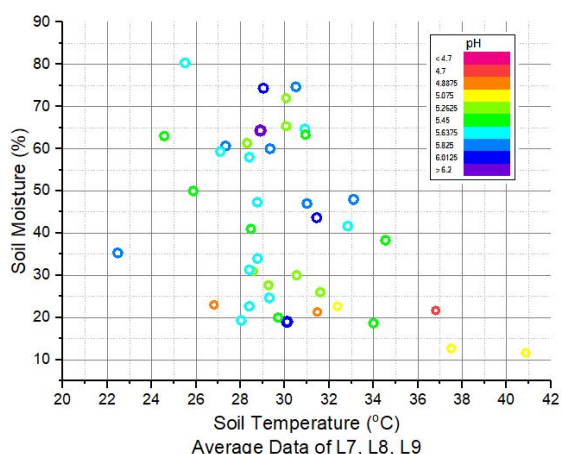


Figure 16: Average soil pH, moisture and temperature of L7, L8, L9.

4 CONCLUSIONS

Observation of the parameter values of pH, and temperature and soil moisture in the Siam Orange Gardens located in Kerta Village, Payangan District, Gianyar, Bali is conducted from June to August 2021 concludes that pH below 5 is obtained at soil temperature from 26.9°C to 31.8°C and soil moisture from 20% to 22.3%. The ideal pH range for orange farm from 5 to 6 is obtained under conditions of soil temperature from 27.7°C to 29.9°C and soil moisture from 35.3% to 42.2%. Meanwhile pH of more than 6 is obtained at soil temperature condition from 28.3°C to 29.8°C and soil moisture from 37.9% to 56.2%.

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