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The Influence of Change of Brightness Intensity on Change of Temperature and Humidity in Ranoyapo Area, South Minahasa

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Abstract— Inroduction*: Temperature and humidity are physical parameters that play an important role for the survival of the production forest. Temperature and humidity affect the amount of litter fall. Forest litter production in the form of leaves, twigs and other biomass sources that fall into eating biota and nutrients that determine the productivity of forest cloves.*
Purpose*: Based on the background above, this study examined the influence of Light Intensity on Temperature and Humidity in Ranoyapo area, South Minahasa*
Material and Methods*: In this study using inferential analysis to examine the effect of light intensity on the air temperature and air humidity and test the hypotheses that have been formulated*
Finding: There is a significant direct effect between light intensity (I) of the Air Temperature (T), There is a significant direct effect between light intensity (I) of the Air humidity (H) and the data is likely to form a quadratic pattern so that it can be said that the quadratic model more good

Keywords— *Light intensity, air temperature, air humidity, inferential analysis*.

I. INTRODUCTION

Clove (Eugenia aromatica O.K) is one of agricultural commodities which have high economic value. Clover is often used in industry to make cigarette. Clove can also be used in cosmetics industry. Clover oil is even used to complement life necessities. Laboratory clarifies prepare seen under microscope. As the population grows, the demands for products made of clover will also increase. Indonesia imports clover, so the price of clover from farmers is cheap. In 1996, Indonesia successfully didn't import clover, while 1999 was the peak of clover import of Indonesia.

Clover is one of seasonal plantation commodities which have an important role in food and non-food sectors. Most clover production is used by the cigarette industry, beside for medicines, cosmetics, and perfumes. Therefore, to maintain the quality of clover, it is dried to last in storage and give additional value. Greenhouse effect drying is an alternative because it's cheaper, easy to operate, environmentally friendly and easy to make. In Indonesia, clover is one of the leading plantation products. It's because Indonesia produces quite a high amount of clover and because the price of clover is high. However, because the climate condition in Indonesia is often cloudy and raining, especially in the rainy season, clover drying is very disturbed.

Climate change on earth is always influenced by heat balanced on earth. Heat flow in climate system can work because of radiation from the sun. Before reaching the earth surface, some solar radiation is absorbed by particles n the atmosphere while the rest reaches the earth surface. Heat which reaches the earth surface is partially reflected to the atmosphere by the earth and partially absorbed by the earth. The reflected radiation is captured by particles in the atmosphere. The reflection occurs due to cloud and a particle called aerosol. Snow, ice and desert play an important role in reflecting back solar radiation which reaches the earth surface. The heat absorbed by the earth is transformed into latent heat, sensible heat, and other heats. To maintain heat balance, the earth emits heat, which is absorbed as short wave radiation (visible wave).

Temperature and humidity are physical parameters which play an important role in the survival of production forest. Temperature and humidity influence the amount of brown waste. The brown waste of production forest is leaves, twigs and other biomasses, which fell and is eaten by biota and nutrients which strongly determine the productivity of clver forest. Chen et al., (1999) state that the influence of micro climate of soil of the activities of biota in the group also influences the decomposition, depending on combination of temperature and humidity.

Temperature is heat in the air due to solar thermal. Factors influencing the amount of solar thermal received by the earth are cloud condition, surface condition, incoming angle of light, and the duration of sun shining. Humidity is water vapor concentration in the air. The concentration level can be expressed as absolute humidity, specific humidity, or relative humidity. The instrument to measure humidity is called hygrometer. A humidistat is used to regulate humidity level in a building using a dehumidifier. It's similar to thermometer and thermostat for temperature. Pressure change of some water vapor in the air is related to temperature change. Water concentration in the air at sea level can reach 3% at 30 °C (86 °F), and not over 0,5% at 0 °C (Handoko, 1994).

Humidity illustrates water vapor content in the air, which can be stated as absolute humidity, relative humidity or water vapor pressure deficit. Absolute humidity is water vapor content (can be stated as water vapor mass or the pressure) per volume unit. Relative humidity compares actual water vapor content/pressure and the saturation or at air capacity to contain water vapor. Air capacity to contain the water vapor (when saturated) is determined by temperature. While water vapor pressure deficit is the difference between saturated vapor pressure and actual vapor pressure. Each humidity has certain

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significance and function related to the problem to be discussed(Handoko,1994).

Climate, clover demands hot climate with even rainfall because the plant can't stand long draught. Strong wind can damage plant canopy. Optimal rainfall for clover is 1500-4500 mm per year. Clover requires sunlight at least 8 hours per day. Optimal temperature for this plant is 220 C - 300 C and 60%-80% humidity (Erland Arfandi Rukka, 2010). The growth of clover forest in Ranoyapo area, South Minahasa is good because it's supported by fertile soil structure suitable for perennial crop. Fruiting season starts from flowering to near harvest, at six to eight months, fruit changes drastically inflicting loss, the amount of fallen clover fruit is significant at 60 % to 80 %. The condition is interesting to study considering the climate of the area is different from other areas. In the morning from 06.00 to 09.30, the location is covered by thick dew (attached picture). The condition changes drastically (time lag) at around 10.00, because temperature and direct sunlight covers clover canopy, so there may be significant changes of temperature, humidity, and soil temperature to change clover. Originality for this paper shows: (1) the influence of change of brightness intensity on change of temperature and humidity in ranoyapo area, (2) location of in plantation area cloves Ranoyapo South Minahasa regency in North Sulawesi, Indonesia.. Based on the background above, this study examined the influence of Light Intensity on Temperature and Humidity in Ranoyapo area, South Minahasa.

II. LITERATUR REVIEW

One of the common plantation crops Indonesia is clover (syzigium aromaticum). Clover is a plantation/industrial crop from Myrtaceae family. The origin of this plant is unclear. Many thinks that clover comes from North Maluku (Maluku islands), Philippines, or Irian. The oldest clover in the world is found in Maluku islands and the area is one of the largest clover producers in the world.

Living things and nature depend on heat transfer, mass (such as CO2, O2, and water vapor), and momentum in air medium. The intensity of solar radiation is defined as the amount of energy from sunlight received by the earth at certain area and certain time period. Radiation is defined as transfer of heat without medium. Daily change of micro climate of forest (including clover forest) is a series of physical processes starting from sunlight, absorption of light energy by components of forest ecosystem and environment, change of light energy into latent heat and sensible heat, thermal emission, and thermal diffusion between components of ecosystem and between environment and forest ecosystem. The sun as a source of energy radiates energy as a very wife electromagnetic spectrum, from gamma ray spectrum (the shortest wavelength, the highest frequency) to radio wave (the longest wavelength, the lowest frequency).

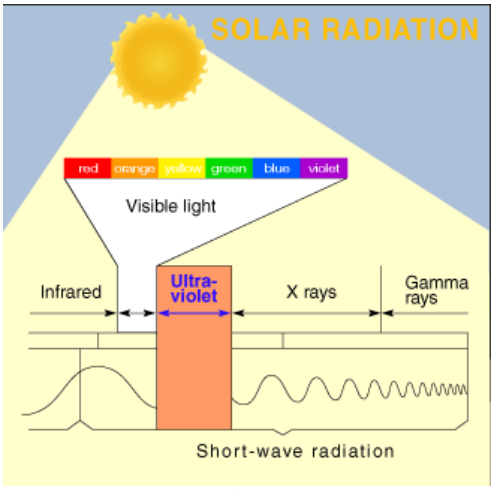

Fig. 2.1. Spectrum of electromagnetic waves.

Heat in this process is radiated as heat carrying electromagnetic wave (infrared ray). This is radiation of heat from the sun to the earth. The sun is the source of energy on earth. Electromagnetic radiation is energy from vibrations of magnetic and electrical fields, one of the energies which can transmit through the vacuum at c = 3 x 108 ms-1.

Gehlhausen et al., (2000) quoting Matlack (1993), states that sunlight is the driving force of other micro climates, such as temperature, humidity and soil humidity. Both sea and land are heated by the sun through a process called insolation. The heat isn't the same in regions in different latitudes. Tropical regions receive more sunlight than subtropical and polar regions. Micro climate is strongly influence by sun intensity, humidity, temperature and wind velocity. According to Moore et al., (2005) at ecosystem boundary, variables of micro climate: radiation intensity, temperature, humidity, wind velocity, will reach an (temporary) equilibrium where there is no energy transfer past the boundary. Moore et al., (2005) formulate temperature gradient as dT/dx = 0, where T is temperature, and x is distance from boundary to ecosystem. Moore et al., (2005) state that temperature equilibrium (air and water) at ecosystem boundary can be developed because the condition of boundary can change depending on place (position) and time. At every point above ground, temperature depends on the amount of heat received or lost on the earth surface or any other surface where air comes in contact with it. Heat exchange at the earth surface varies during day and night, depending on season. Spittlehouse et al., (2004) state that when the sun shines brightly, temperature in forest near the ground is 2-4 0C cooler than open land, while at night soil temperature is the same. A study byDavies Colley et al., (2000) shows that temperature and humidity are stable at the beginning of the evening and contrast between forest and open land (pasture).

There is always water vapor in the atmosphere. Water vapor level in air is called humidity. This level keeps changing depending on local temperature. Humidity is percentage/concentration of water vapor content in air. Mass of moist air is total mass of all atmospheric gases, including

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water vapor. If mass of water vapor isn't included, it's called mass of dry air.

III. Methodology

Research conducted in the area clove tree plantations Ranoyapo South Minahasa regency, North Sulawesi. This study was conducted in two conditions seasons, rainy and dry seasons. Each of these conditions through three stages: pre-field work, field work stage and post-fieldwork.

In this study, the data will be measured data on humidity, temperature data, the data light intensity of solar radiation. In this study using inferential analysis to examine the effect of light intensity on the air temperature and air humidity and test the hypotheses that have been formulated. The analysis model used is a simple linear regression (2 models) with the help of computer software (software) program SPSS (Statistical Product and Service Solutions) version 18.0 for Windows

IV. Results and Discussion

OInInetnsity4.1. Simple Linear Regression To The Effect of Light Intensity (X) on Air Temperature (Y)

Table I is a result of calculation of the multiple linear regression model of the effect of light intensity (X) of the Air Conditioning (Y), with SPSS version 21.

TABLE I. Simple linear regression test results.

Variable	Coefficient	Beta	T	Sig t	Information
Constants	24.436		57.015	0.000	
Light Intensity (X)	0.001	0.636	9.146	0.000	Significant
R *Square*	= 0.405				

Source: Research Data Processed in 2016

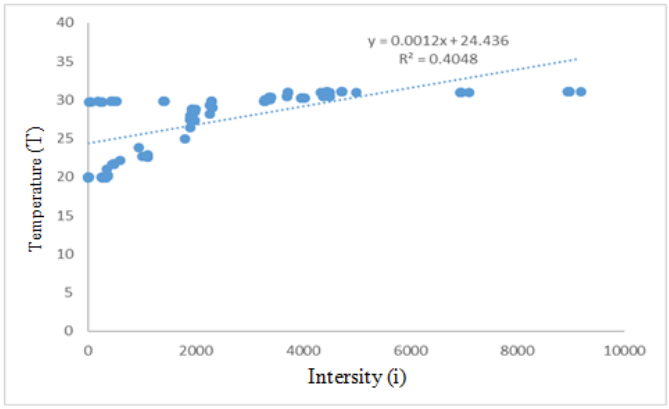

Fig. 1. Regression analysis.

The coefficient of determination R Square showed a value of 0405, or 40.5%. This means that the variable air temperature of 40.5% influenced by light intensity (X) while the remaining 59.5% is influenced by other variables outside of two independent variables were examined in this study.

Hypothesis test used t test for the influence of independent variables of the dependent variable. Variable Light Intensity produces tcount of 9146 with t significance of 0,000. Because tcount is bigger than TTable (9146> 1979) or t significance is smaller than 5% (0.000 <0.05), Light Intensity variable (X) Significantly Temperature influences variable (Y). Based on regression coefficient value of 0.001, Increased light intensity by 1 unit will cause Increased Temperature by 0,001 units.

4.2. Quadratic Regression for the Influence of Light Intensity (X) on Temperature (Y)

Based on Table II, R Square determination coefficient produces a value of 0.529 or 52.9%. So variable Temperature is influenced by 52.9% by Light Intensity (X) and the Square of Light Intensity (X2) while the remaining 47.1% is influenced by other variables other than the two independent variables examined in this study.

TABLE II. Results of quadratic regression testing.

Variable	Coefficient	Beta	T	Sig t	Information
Constants	22.889		48.723	0.000	
Light Intensity (X)	0.003	1.536	9.028	0.000	Significant
Squares of Light Intensity (X2)	-2.284×10^{-7}	-0.966	-5.679	0.000	Significant
R *Square*	= 0.529				

Source: Research Data Processed in 2016

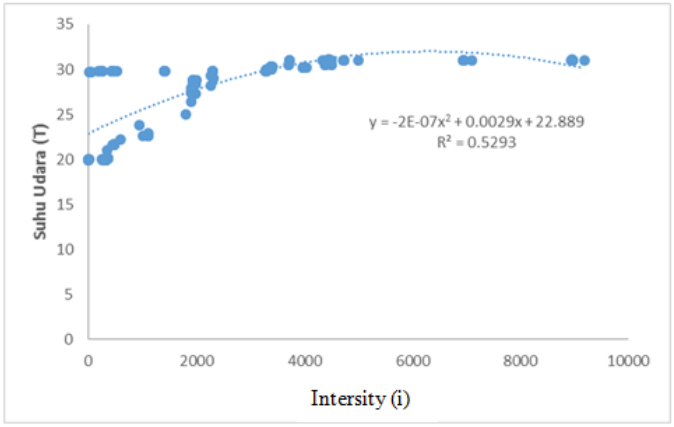

Fig. 2. Regression Analysis.

Variable Light Intensity produces tcount of 9.028 with t significance of 0.000. Because tcount is bigger than ttable (9.028>1.980) or t significance is smaller than 5% (0.000<0.05), variable Light Intensity (X) partially had significant influence on variable Temperature (Y). Based on regression coefficient value of 0.003, increased Light Intensity (X) by one unit will increase Temperature (Y) by 0.003 unit.

Variable Square of Light Intensity produces tcount of 5.679 with t significance of 0.000. Because tcount is bigger than ttable (5.679>1.980) or t significance is smaller than 5% (0.000<0.05), variable Square of Light Intensity (X2) partially had significant influence on variable Temperature (Y). Regression coefficient value is -2.284x10-7, meaning increased Square of Light Intensity (X2) by one unit will decrease Temperature (Y) by 2.284x10-7 unit.

Based on the results of multiple regression analysis and regression polynomial of degree two (quadratic regression) R-square values obtained in the quadratic regression model (52.9%) higher than the R-square value of a simple linear regression (40.5%). In addition, if you view the pattern of scattered data based on Figure 1 and Figure 2 shows that the data patterns tend to form quadratic pattern so that it can be

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said that the quadratic model is better used to test the effect of light intensity on the temperature than the simple linear regression model.

4.3. Simple Linear Regression To The Effect of Light Intensity (X) to Humidity (Y)

Table III is the result of calculation of the multiple linear regression model of the effect of light intensity (X) of the air humidity (Y), with SPSS version 21

TABLE III. Simple linear regression test results.

Variable	Coefficient	Beta	T	Sig t	Information
Constants	62.549		57.015	0.000	
Light Intensity (X)	-0.001	-0.635	-9.119	0.000	Significant
R *Square*	= 0.403				

Source: Research Data Processed in 2016

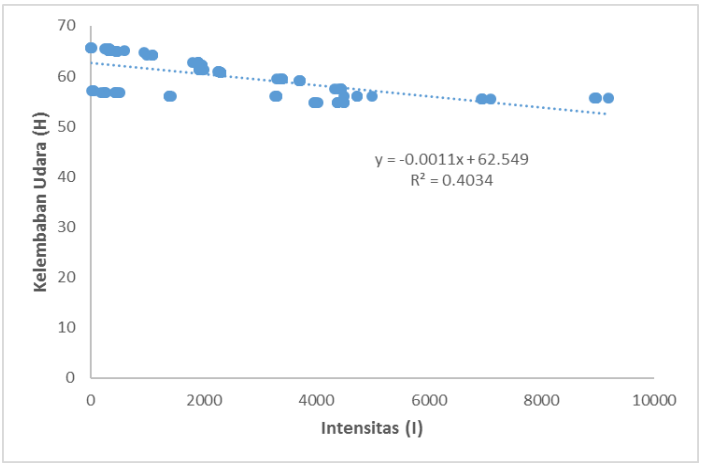

Fig. 3. Regression analysis.

The coefficient of determination R Square showed a value of 0.403 or 40.3%. This means that the variable air humidity of 40.3% influenced by light intensity (X) while the remaining 59.7% is influenced by other variables outside of two independent variables were examined in this study.

Testing the hypothesis in this penleitiani using t-test, namely to influence the independent variable on the dependent variable. In the variable light intensity values obtained tcount of 9119 with a significance t of 0000. Because thitung greater ttable (9119> 1979) or t significance is less than 5% (0.000 <0.05), it can be said variable light intensity (X) significantly affects the air humidity variable (Y). Based on the value of regression coefficient of -0001 indicate that the increase of 1 unit of light intensity will cause a decrease in air humidity of 0001 units.

4.4. Quadratic Regression To The Effect of Light Intensity (X) to Humidity (Y)

Based on Table IV, the value of the coefficient of determination R Square showed a value of 0435, or 43.5%. This means that the variable air humidity of 43.5% influenced by light intensity (X) and the square of light intensity (X2) while the remaining 56.5% is influenced by other variables outside of two independent variables were examined in this study.

TABLE IV. Hasil Uji Regresi Kudratik.

Variable	Coefficient	Beta	T	Sig t	Information
Constants	63.260		134.482	0.000	
Light Intensity (X)	-0.002	-1.087	-5.834	0.000	Significant
Squares of Light Intensity (X2)	$1.049x10^{-7}$	0.486	2.606	0.010	Significant
R *Square*	= 0.435				

Source: Research Data Processed in 2016

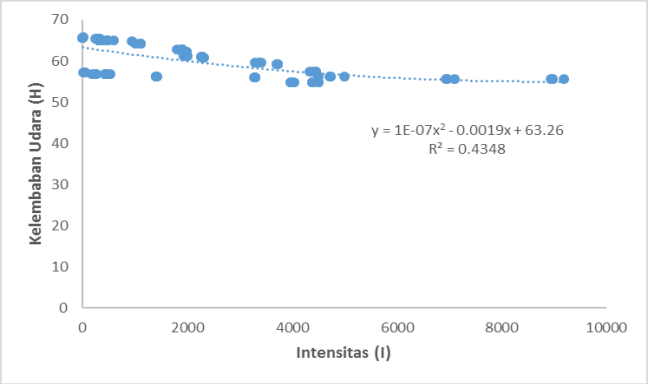

Fig. 4. Regression analysis.

In the variable light intensity values obtained tcount of 5.834 with a significance t of 0000. Because thitung greater ttable (5.834> 1.980) or t significance is less than 5% (0.000 <0.05), then the partial variable light intensity (X) significantly affects the air humidity variable (Y). Based on the value of regression coefficient of -0002. This means that the increase in light intensity (X) of the unit, will reduce air humidity (Y) amounted to 0002 units.

On the square of the variable light intensity obtained tcount amounted to 2,606 with significance t of 0000. Because larger tcount ttable (2,606> 1,980) or t significance is less than 5% (0.000 <0.05), then in partial square of light intensity (X2) significantly affects the air humidity variable (Y). Based on the value of regression coefficient of 1.049x10-7. This means that an increase in square of light intensity (X2) as one unit, will increase air humidity (Y) of 1.049x10-7 unit.

Based on the results of simple linear regression analysis and regression polynomial of degree two (quadratic regression) R-square values obtained in the quadratic regression model (43.5%) higher than the R-square value of a simple linear regression (40.3%). In addition, if you view the pattern of scattered data based on Figure 3 and Figure 4 shows that the data patterns tend to form quadratic pattern so that it can be said that the quadratic model is better used to test the effect of light intensity on the air humidity than the simple linear regression model.

V. CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the research result and discussion, the following conclusions are drawn:

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1. There is direct significant influence of Light Intensity (I) on Temperature (T). Considering the regression coefficient is positive, the relation is positive. It means the higher the Light Intensity (I), the higher the Temperature (T).
2. There is direct significant influence of Light Intensity (I) on Humidity (H). Considering the regression coefficient is negative, the relation is inversely proportional. It means the higher the Light Intensity (I), the lower the Humidity (H).
3. The data tends to make quadratic pattern, so quadratic model is better to be used than simple linear regression model to test the influence of light intensity on temperature and humidity.

Suggestions

Several suggestions as the recommendation from this research are as follows:

1. In developing the model study, the researchers suggested further to expand the scope of factors other than changes in air temperature and humidity.
2. The further researches can be done in addition to the clove plant plantation area Ranoyapo South Minahasa regency in North Sulawesi in order to do a comparison.

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