The Effect of Sunlight in Parenchyma Pith Cells Diameter of *Manihot esculenta*

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**Abstract.** Sunlight is one of the factors that effect on the grow of a plant. *Manihot esculenta* is one of the plants that easily found in Indonesia because its role as staple food. The aim of this research is to know the correlation between sunlight the grow of parenchyma pith cells diameter of *Manihot esculenta*. Independent variable in this research is sunlight, and dependent variable is the parenchyma pith cells diameter of *Manihot esculenta*. Data was collected is in qualitative and quantitative form. Qualitative data gotten gained by morphology observation. The parenchyma pith cells of *Manihot esculenta* that is affected by sunlight in 1310 x 10 Lux, morphologically has hexagon, cell walls thick, solid state, and regular composition. Meanwhile, the parenchyma pith cells that has less sunlight (363 x 10 Lux) has a hexagon shape, thin cell walls thin, soft state, and irregular composition. Qualitative data suported by quantitative data. The size of parenchyma pith cells diameter that is affected by sunlight in 1310 x 10 Lux 96.4 µm. While, the stem parenchyma pith cells diameter empulur that has less sunlight (363 x 10 Lux) is 129.8 µm.

1. **Introduction**
Cassava (*Manihot esculenta*) is one of the few cultigens in the family Euphorbiaceae. Cassava (*Manihot esculenta*) is one of the plants that easily found in Indonesia because its role as staple food. Cassava (*Manihot esculenta*) is widely cultivated for its starchy storage roots and is a staple food and animal feed in tropical and sub-tropical areas. Cassava is a typical tropical crop adapted to warm climates. Under normal conditions, 3-month-old cassava (TMS60444) plants have vigorous apical buds and fully expanded mature leaves with upward leaf fingers. When a low-temperature treatment is applied to cassava at 7°C under weak light for 4 h, the plants displayed visible morphological changes, including weak dehydration and wilting of the apical buds and leaves, especially in the buds, as well as downward leaf fingers [1].

Being sessile, plants mainly depend on physiological and metabolic adaptations to obtain the phenotypic flexibility required to withstand the adverse biotic and abiotic growth conditions [2], such as drought, low temperature, and salinity. Low temperature has a great impact on plant productivity, mostly because it significantly alters plant metabolism and physiology [3]. Cassava (*Manihot esculenta*) is a staple food for more than 800 million people in the world [4]. As a tropical root crop, cassava is sensitive to low temperature [5]. It can modify its metabolism and growth to adapt to cold
stress by reprogramming gene expression to increase the ability to withstand oxidative stress and synthesis of cold induced proteins during cold acclimation [6].

The tissues formed by the transition of the primary meristems into the permanent state where cell-division ceases are known as the primary permanent tissues in contradistinction to those that are the product of cambium cells, which are called secondary permanent tissues. The cells of the permanent tissues may be grouped in two classes according to their forms: Prosenchymatous cells are fibrous in form, and parenchymatous cells are the non-fibrous, boxlike forms. A tissue composed of the former class of cells is called prosenchyma, and of the latter class parenchyma. Beginning at the outside, the primary permanent tissues in Dicotyledons are grouped on anatomical and topographical grounds into the following main divisions: Epidermis, primary cortex, pericycle, phloem part of the vascular bundle, xylem part of the vascular bundle, medullary ray, pith. Light plays a key role in plant life, determining their photo-morphogenesis and photosynthesis rate [7]. Sunlight is one of the factors that effect the grow of a plant. *Manihot esculenta* is one of the plants that easily found in Indonesia because its role as staple food. The aim of this research is to know the correlation between sunlight to the grow of parenkim cell diameter of *Manihot esculenta*.

### 2. Material And Method

The focus of research is on the stem parenchyma pith cells diameter *Manihot esculenta*. *Manihot esculenta* plants used are taken from two places with different light intensities. The research design used is descriptive research. Qualitative and quantitative data are used to describe the effect of light on the parenchyma cells. The tools used to conduct the research are light meter, electric microscope, stage micrometer scale, scale ocular lens, object glass, cover glass, pipette, razor blades, rulers, scissors and needle. Materials used in this research are stem of *Manihot esculenta*, and reagents distilled water. This research was conducted at the Laboratory of Plant Structures FPMIPA Indonesia University of Education. In the implementation of the research, conducted the identification and analysis of morphological and anatomical differences in the size of the diameter of the parenchyma pith cells in six *Manihot esculenta* plants which grow in two places with different light intensities. Anatomical observations carried out on transverse incision. Preparation rod is made at a distance of 10 cm measured from the top.

### 3. Results and Discussion

Parenchyma pith cells *Manihot esculenta* that grow in light intensity of 363 x 10 Lux with a magnification of 400x are hexagon-shaped parenchyma pith cells, the cell walls are thin, soft and irregular cell size. While on the stem parenchyma pith cells *Manihot esculenta* that grow in light intensity of 1310 x 10 Lux are hexagon-shaped pith parenchyma cells, the cell walls are thick, hard, and regular cell size (Table 1).
Table 1. Comparison of parenchymal cells at different light intensities.

| Parenchyma Pith Cells on Light Intensity of 363 x 10 Lux (µm) | Parenchyma Pith Cells on Light Intensity of 1310 x 10 Lux (µm) |
|-------------------------------------------------------------|-------------------------------------------------------------|
| A | A |
| ![Image A](image1.png) | ![Image A](image2.png) |
| 142.8 µm | 97.2 µm |
| B | B |
| ![Image B](image3.png) | ![Image B](image4.png) |
| 125.3 µm | 102.8 µm |
Table 1. Cont.

The measurement results of the parenchyma diameter resulting differences in the diameter size of the stem parenchyma pith cells *Manihot esculenta* in the light intensity of 363 x 10 x 10 Lux and 1310 Lux. Quantitative data of parenchyma pith cells *Manihot esculenta* which grow in the light intensity of 363 x 10 Lux at stem A with diameter of 142.8 μm parenchyma pith cells, at stem B with diameter of 125.3 μm parenchyma pith cells, and the stem C parenchyma pith cells with diameter of 121.3 μm. From the three stems obtained an average diameter of parenchyma pith cells that is 129.8 μm. In the stem parenchyma pith cells *Manihot esculenta* that grow in the light intensity of 1310 x 10 Lux at stem A with diameter of 97.2 μm parenchyma pith cells, at stem B with the diameter of 102.8 μm parenchyma pith cells, and at stem C with diameter of 89.2 μm parenchyma pith cells. From the three stems obtained an average diameter of parenchyma pith cells that is 96.4 μm (Table 1).

| Stem of Manihot esculenta | Diameter of Parenchyma Pith Cells in light intensity of 363 x 10 Lux (μm) | Diameter of Parenchyma Pith Cells in light intensity of 1310 x 10 Lux (μm) |
|---------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------|
| A                         | 142.8                                                                  | 97.2                                                                   |
| B                         | 125.3                                                                  | 102.8                                                                  |
| C                         | 121.3                                                                  | 89.2                                                                   |
| Rata-rata                 | 129.8                                                                  | 96.4                                                                   |

Based on the quantitative data, the diameter size of the stem parenchyma pith cells *Manihot esculenta* that grow in less sunlight (363 x 10 Lux) is larger than the diameter of the stem parenchyma pith cells *Manihot esculenta* that grow in light intensity of 1310 x 10 Lux. In this research, the light is one of the factors that influence the diameter size of the stem parenchyma pith cells.
4. Conclusions
Based on the results of observation and discussion, obtained difference diameter of parenchyma pith cells *Manihot esculenta*. The diameter size of the stem parenchyma pith cells *Manihot esculenta* that grow in less sunlight (363 x 10 Lux) is larger than the diameter of the stem parenchyma pith cells *Manihot esculenta* that grow in light intensity of 1310 x 10 Lux. It is concluded that the light affect on the diameter size of the stem parenchyma pith of *Manihot esculenta*.

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