The growth performance of dwarf banana Cavendish from SE Sulawesi under natural shading

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Abstract: In Indonesia, bananas are an important crop, and demand tends to increase. On the other hand, due to limited land availability, production capacity is limited. The growth of banana as an interplanting plant under the estate forestry plant was the promising solution. The study aimed to identify the tolerant banana cultivar under natural shading. The research was carried out in a field experiment Faculty of Agriculture, University of Halu Oleo. The study used a randomized block design (RBD) with shade treatment consisting of two levels, namely no shade treatment and using natural shade treatment. Plant height, number of leaves, length of leaves and width of leaves were the parameters observed in vegetative growth. It is concluded that shading treatment has no significant effect on the vegetative growth but tend to increase the plant height, leaf length, number of leaves and leaves width of banana cavendish.

1. Introduction
Bananas are a very important commodity and are widespread throughout the world. Bananas are a major source of food in tropical countries [1–3]. Apart from being a source of carbohydrates, bananas are also a source of minerals including potassium, magnesium, phosphorus, iron and calcium [4-7]. The need for bananas increases every year due to increased levels of consumption, population growth and due to technological diversification, so that bananas can be processed into various sources of food [8]

The need for bananas in Indonesia for various uses, both for eating bananas and for processed bananas, reaches 9 million tons annually. Meanwhile, the domestic banana production capacity only reaches 7 million tons. Various attempts have been made to increase production, but have not yet reached the maximum effort.

The main obstacle to increasing banana production in Indonesia is the low level of banana productivity due to the fact that banana cultivation has not been used as the main source of income, but is still limited to a side business. In addition, there is limited land that can be used for banana cultivation. Most of the available land has generally been used for the development of other commodities, be it annuals, annual crops or mixed crops.

Therefore, a strategy is needed to overcome the constraints of limited land in banana cultivation. One of them is by developing banana plants as a secondary crop on existing agricultural land, especially on land developed for plantation or forestry crops [9]. The main obstacle to cultivating
bananas as a secondary plant is the limited availability of light, which can affect the growth and production of bananas. Therefore, it is necessary to develop bananas that are tolerant of lack of light, so that they can be used as insertion plants.

Some research results show that generally plants that lack light or get low light intensity can experience a drastic decrease in production. However, for some tolerant crop commodities, even though light stress can reduce plant growth and production. The decline is not significant so that growth and crop production can still occur. The results of this study were found in some commodities such as in rice [10-15], soybean [16-17] and maize [18-19].

Therefore, various efforts have been made to get shade-tolerant banana cultivars, which can be used as secondary crops for plantation or forestry crops [20]. The aim of the study to determine the effect of differences in light intensity on banana growth during the vegetative period.

2. Materials and methods
The research was conducted in the field laboratory Faculty of Agriculture, Halu Oleo University. The source of germplasm of dwarf Cavendish banana selected from Southeast Sulawesi. The study used a randomized block design (RBD) with shade treatment consisting of 2 levels, namely n1=no shade treatment and n2=using natural shade treatment under the stand plant of *Glyricidia sepium* servations were made on the vegetative parameter include plant height and number of leaves that were measured every month. The leaf characters include leaf length and leaf width, measured from one plant. The observed data was then analysed using variance analysis. To see the impact of different shading on vegetative components, Duncan's Multiple Range Test (DMRT) was performed at a 95 percent confidence level.

3. Results and discussion

3.1. Plant height and leaf length
The results show there were no significant different the plant height and leaf length that grow under natural shade and without any shading (table 1). From the data it indicates that natural shade could increase plant height and leaf length. On the plant height, founded that there were no significant differences on natural shading and without shading treatment. The same condition also found on the leaf length parameter where there were no significant different the leaf length under natural shade and without shading.

| Age (month) | Plant height (cm) | Leaf length (cm) |
|-------------|-------------------|------------------|
|             | No Shade | Natural Shade | No Shade | Natural Shade |
| 1           | 23.76    | 28.90          | 37.68    | 41.77          |
| 2           | 45.40    | 49.09          | 53.78    | 51.79          |
| 3           | 46.51    | 53.03          | 62.12    | 57.68          |
| 4           | 49.83    | 57.56          | 64.18    | 65.35          |
| 5           | 67.22    | 75.81          | 68.95    | 69.32          |
| 6           | 84.84    | 99.87          | 77.93    | 79.91          |
| 7           | 114.63   | 120.33         | 78.72    | 82.29          |
| 8           | 152.89   | 173.44         | 81.23    | 87.63          |

3.2. Number of leaf and leaf width
The results show that there were significant differences on number of leaves and leaves width that grow under natural shade and without shading treatment (table 2). The result showed that the shade treatment in the beginning tend decrease number of leaves, but at the end of the vegetative phase, number of leaves tend to increase on the shading condition. On the other side, on the leaves width
parameter that the natural shade treatment tends to increase leaves width since the beginning the vegetative growth until the end of vegetative phase (table 2).

**Table 2.** The effect of differential shade on number of leaves and leaves width on the plant age up to 8 months after the transfer (MAT).

| Age (month) | Number of leaves | Leaves Width (cm) |
|-------------|------------------|-------------------|
|             | No Shade | Natural Shade | No Shade | Natural Shade |
| 1           | 3.30     | 3.03           | 17.64    | 20.74         |
| 2           | 4.26     | 3.61           | 28.55    | 32.17         |
| 3           | 4.32     | 3.83           | 30.90    | 34.16         |
| 4           | 4.98     | 4.33           | 31.71    | 38.66         |
| 5           | 5.35     | 5.26           | 37.59    | 39.77         |
| 6           | 6.06     | 6.13           | 39.10    | 40.93         |
| 7           | 6.29     | 6.87           | 41.16    | 43.25         |
| 8           | 6.98     | 7.87           | 44.19    | 44.70         |

From the vegetative growth, it appears that the shading treatment tends to increase of plant height, leaf length and leaves width. While on the number leaves parameter, the shading treatment tend to decrease number of leaves but on the last of vegetative growth the shading treatment could increase of leaf number. The shade levels generally have affected the vegetative growth and productivity.

### 4. Conclusion

It could be concluded that shading treatment has no significant on the vegetative growth but tend to increase the plant height, leaf length, number of leaves and leaves width of banana cavendish.

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