



**Research Article**

## The effect of light on the early growth wheat (*Triticum aestivum* L)

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### ABSTRACT

*Triticum aestivum* L is a cereal plant that grows optimally in a subtropical climate. In tropical climate wheat growth experiences various obstacles such as high air temperature and humidity, and intensity of light. Study of wheat conditions for the growth of this plant in tropical areas such as Indonesia is needed. This study aims to determine the effect of light on the germination, growth, and early development of wheat. This is an experimental research with two treatments, the first group was in normal light and the second was without light. Each treatment was carried out using 30 replications. The analysis was carried out by comparing the average value of plant length and plant morphology from eight days of observation on two kinds of treatments. The results showed that there were differences in plant height in the two treatments. The average plant height on the 8th day in normal light treatment was 9.76 cm, while the average plant height with the treatment without light was 10.1 cm. Observations of growth on the morphology of wheat plants showed that plants with no light treatment experienced a slowdown in the opening of the second leaf, had a paler color and thinner leaf blades, compared to plants grown with light treatment. The absence of light accelerates the germination process and increases the height of wheat plants, but at a later stage it can slow down the development of these plants.

**Keywords:** *triticum aestivum*, light, germination, growth, development.

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### INTRODUCTION

Wheat (*Triticum aestivum*) is a cereal plant from the cereal group that is widely consumed in Indonesia. In addition, there are many uses of wheat products. The most widely used wheat is as flour for various processed foods such as bread and noodle. In addition, wheat can also be used to make health drinks. Wheatgrass juice contains antioxidants, such as vitamin A, C, E, and chlorophyll (Albar, 2015). However, biological factors limit wheat cultivation in Indonesia. Therefore, Indonesia is the largest wheat importer in the world.

Wheat is a plant that grows optimally in subtropical climates. In Indonesia, wheat can grow and produce well at locations >1,000 above sea level, or low land with dry climates and temperatures <25°C, such as parts of NTT province (Balitsereal, 2012; Yen & Yang, 2020). However, most high land is already used for horticultural crop cultivation. Wheat cultivation in high land will compete with horticultural crops. (Balitsereal, 2012). The growth phases of wheat plants are generally the same as the growth phases of other cereal plants (Widowati, 2016) which depends on nutrients, temperature, humidity and height. Andriani (2017) describes the growth phase of wheat plants into ten phases.

Light is an external factor that affects plant growth. All plant organs have different responses to light. Some responses to light include the direction of root growth, leaf width (leaves will try to get more light for photosynthesis), and stem length. Stems exposed to light will have a longer size. Plants placed in the dark will grow faster than those placed in a place exposed to light, but plants will look pale due to lack of chlorophyll (Zažímalová et al., 2014). In conditions without light, the auxin hormone stimulates cells to experience elongation so that they grow longer, while in conditions of a lot of light auxin is damaged so that growth is inhibited. The light causes the damaged auxin to be dispersed to the dark side. This causes the stems to become shorter, and the plant become firm, well-developed and have green leaves. Meanwhile, if the intensity light received by plants is too high, the chlorophyll will be damaged (Zažímalová et al., 2014).

Light is needed by plants for photosynthesis. Photosynthesis is the process of producing food in green plants with the help of light and enzymes. Photosynthesis is carried out by leaves. The ability of plants to absorb light is due to the presence of chlorophyll pigments. Chlorophyll pigments make plants have green color.

Chlorophyll is located inside the chloroplast organelle. Leaves have a layer of cells called mesophyll. In the mesophyll there are half a million chloroplasts in every square millimetres. Light will pass through the epidermal layer, this epidermal layer is a transparent layer to get to the mesophyll, the mesophyll is where most photosynthesis occurs. Light in plants affects vegetative and generative growth (Wiratmaja, 2017). The use of the right light intensity for wheat growth has an impact on optimal wheat product yields. Research on the effect of light intensity on wheat plants has been previously carried out by Pratiwi (2010) in the form of shading treatment. In this study, observations of wheat plant height and development in morphology were carried out. Different treatment was carried out from previous studies, namely using 100% treatment without light.

## METHODS

This research is an experiment with completely randomized design. The number of samples for each treatment was 30 wheat seeds planted on cotton which were always wet at all times. There are two treatments, which is providing light and not providing light (dark). Plant height measurements and morphological observations were carried out every day in the afternoon for eight days. The analysis was carried out by comparing the average value of plant length and plant morphology from eight days of observation on two kinds of treatments.

## RESULTS AND DISCUSSION

Germination of wheat seeds in the light treatment (with light) was slower than the germination of wheat seeds in the dark treatment (Figure 1). On the first day, the seeds in the light treatment did not show any germination, while the seeds in the dark treatment showed germination. On the second day, the seeds with the light treatment showed germination, but the size of the sprouts was smaller than the seeds with the dark treatment (Figure 1). To see the germination of wheat seeds in light and dark, it can be seen in the image below

**Figure 1.** Germination of wheat seeds in light and dark.



Explanation: the first day (a) and second day (b) in the light treatment (with light), and seed germination on the first day (c) and the second day (d) in the dark treatment (without light). Bars = 0.5 cm.

The observation data on wheat plant height from the first day to the eighth day showed differences in the growth of the two treatments (Table 1).

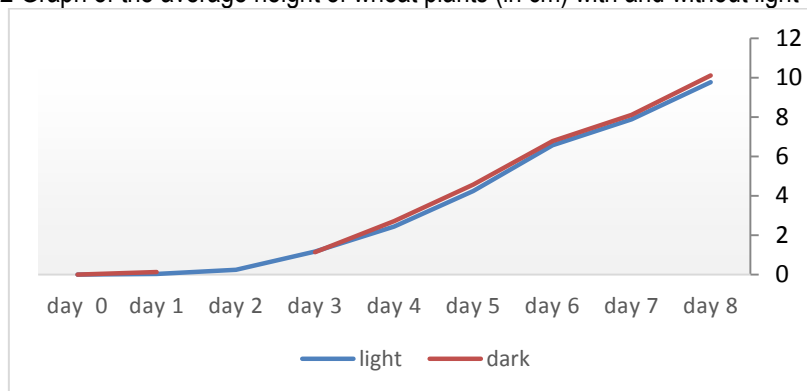
**Table 1.** wheat plant growth differences

Treatment	wheat plant height (cm) on day								
	0	1	2	3	4	5	6	7	8
Lighted	0	0.02	0.23	1.17	2.44	4.23	6.57	7.88	9.76
No light	0	0.13	0.32	1.13	2.71	4.56	6.78	8.1	10.01

The table on the average height of wheat plants above shows that the plants treated with no light (dark) were relatively taller than the plants treated with light (light). The light treatment given can affect the growth of wheat plants.

The graph of the growth of wheat plant height from the first day to the eighth day is shown in Figure 2.

**Figure 2** Graph of the average height of wheat plants (in cm) with and without light treatment.



The results of the graph show that the treatment of plants without light or in dark conditions showed higher plants on almost all observation days compared to plants that were given light treatment. This condition indicated that the stems of wheat plants in the dark treatment were etiolated, so that they were higher than the plants in the light treatment. Light is a key determinant in plant metabolism and photosynthesis. Light is also needed by plants from the seed germination process to maturity (Linda, 2007). Wheat are C3 plants. Pratiwi (2010) stated that C3-type plants can experience a decrease in yield if the intensity of sunlight received by plants is high. Cristian et. al (2021) finds out that sun light enable wheat to grow normally.

There are several growth phases that occur during the eight days of sowing wheat seeds. The initial phase that can be observed is the germination phase, where in this phase a radicle will appear which is then followed by the growth of coleoptiles. The results showed that the germination time of the treatment without light was faster than the light treatment. This happens because in the absence of light, the hormone auxin stimulates the elongation of cells so that they grow longer. On the other hand, in the presence of light, the auxin hormone is damaged so that plant growth is inhibited (Zazimalova et al, 2014). After the appearance of a coleoptile with a length of 2.5 cm, its growth stops and at the end of the coleoptile appears the first leaf that grows at the growing point or called the growing point (Andriani, 2017). The coleoptile serves as the first leaf guard during the process of penetrating the soil surface. The first leaves appeared at the same time, namely on the fourth day in two different treatments. The first leaf in the light treatment had a green color while the first leaf in the no light treatment had a pale yellow color. This shows that light affects the process of photosynthesis.

Plants that are not exposed to light cannot form chlorophyll so that the leaves look pale. Meanwhile, in plants exposed to light auxin is damaged and causes a reduced growth rate, causing the stems to be shorter but stockier. The presence of light causes the leaves to be fully developed and green (Zazimolova at al, 2014). The group of wheat plants that were given showed opening of the second leaf while in the treatment without light the plants were taller but the second leaf was still not open. Observation of growth on the morphology of wheat plants showed that plants with no light treatment experienced a slowdown in the opening of the second leaf, had a paler color and thinner leaf blades than plants grown with light treatment. The absence of light accelerates the germination process and increases the height of wheat plants. However, absence of light at a later stage it can slow down the development of these plants.

## CONCLUSION

The light treatment inhibited the early germination of wheat seeds and plant elongation in the early stages of germination. However, light has a positive effect on the development of wheat seed germination at the time of leaf development. Plant with the presence of light has green color.

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