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STUDIES ON THE INFLUENCE OF LIGHT ON THE DEVELOPMENT OF WHEAT

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Abstract: Plant development and physiology are strongly influenced by the light spectrum of the growth environment among which blue light is involved in a wide range of plant processes such as phototropism, photo-morphogenesis, stomatal opening, and leaf photosynthetic functioning. This paper presents the influence of light on plant development. Also presenting the effects of red and blue light on wheat. A comparative analysis of germination and wheat growth is performed, depending on the color of the light. The purpose of the present research was to conduct studies on the influence of light color-coded pet-colored crops on seed germination and plant growth from their embryos. Studies have as their starting point the seed stage and have considered the response of each organ plant growth during plant growth, for each species under study.
Keywords: Influence of light, red light, blue light, development of wheat

1. INTRODUCTION

The structure and physiology of plants are particularly regulated by light signals from the environment, as the primary response of plants during photosynthesis completely depends on light conditions, [2].

Plant growth and productivity depends on the light conditions and photosynthetic metabolism is detrimentally affected by light intensity, (Bercea V., 2008).

Plants have developed a sophisticated mechanism to adapt their structure and physiology to the light environment, (Bercea V., 2008).

Light is an energy source for plant life is known to effect plants dually. Light affects photosynthetic rate and assimilate accumulation, thereby playing a substrate role and also controls plant growth and development, (Avercheva et al, 2009; Samuoliene et el, 2010).

Plants use light as an energy source for photosynthesis and as an environmental signal, and respond to its intensity, wavelength, and direction. Light is perceived by plant photoreceptors that include phytochromes, cryptochromes and phototropins and plants generate a wide range of specific physiological responses through these receptors, (Bercea V., 2008; Shewry, 2009; Samuoliene et el, 2010).

Plant development and physiology are strongly influenced by the light spectrum of the growth environment among which blue light is involved in a wide range of plant processes such as phototropism, photo-morphogenesis, stomatal opening, and leaf photosynthetic functioning, (Bercea V., 2008; Kroeze D., 2005).

Plants are sensitive to red light spectrum, the plant having a red light photoreceptor. The receptor is a blue-green pigment termed a phytochrome present in the cells of a plant. Red light impacts a plant in many ways. The plants that are grown in red light are often large and tall with plenty of branches, Cachiţă C.D., Ardelean A. (2009) If the photoreceptor picks up a large quantity of natural red light, for example in the summer when there's plenty of natural red light, production of a plant hormone (meta-topolin) is increased. This hormone prevents the chlorophyll in the plant being broken down, so that it stays green in the spring and summer Cachiţă C.D., Ardelean A. (2009)

If there is plenty of blue light, as in nature during the autumn and winter, this receptor dampens the operation of a plant hormone called auxin, Cachiţă C.D., Ardelean A. (2009)

This hormone is responsible for the plant's stem growth. Auxin is also responsible for what is referred to as 'apical dominance', the phenomenon whereby growth points ensure that buds do not get entwined and create subsidiary branches. This causes the plant to create more side stems when exposed to bluish light and the plant stays a little shorter, Cachiţă C.D., Ardelean A. (2009)

The blue light is also responsible for directing leaves and growth points toward the light. Blue light also avoids the multiplication of leaves around the fruits and fertilised plants give more seeds (if applicable to the crop – more female seeds), Cachiţă C.D., Ardelean A. (2009)

Wheat (Triticum aestivum L) is the most extensively grown cereal crop in the world, covering about 237 million hectares annually, accounting for a total of 420 million tonnes and for at least one-fifth of man's calorie intake, is counted among the 'big three' cereal crops, with over 600 million tonnes being harvested annually, (Dobrotă C., Yamashita M., 1999).

The quality of agricultural seedlings is important to crop growth and yield and the quality seedlings exhibit characteristics such as thick stems, thick leaves, dark green leaves, and large white roots. The plant development and physiology are strongly influenced by the light spectrum, which affects seedling structure, (Bercea V., 2008).
Raising seedlings irradiated with blue light has been shown to increase crop yield after planting because of the high accumulation of phenolic compounds, (Bercea V., 2008).
Although most studies with blue light only or blue mixed with red light have indicated that blue light-containing irradiation produces higher plant biomass, recent research has suggested that yield and crop quality could be improved by controlling light quality, (Bercea V., 2008).

2. MATERIAL AND METHOD

The aim of this study was to investigate the effect of red, blue and natural light on the development of wheat over a seven-day period.
The biological material used consisted of seeds, or the plants from their embryos - with which we studied the germination and growth process in the colored light produced by the colored glasses in which the plants stood.
The method used to grain wheat was by using a piece of wet cotton. Deep glasses were used, the bottom was padded with a piece of cotton wool soaked in water, and wheat was placed on top. It was watered daily and kept in a bright place, more precisely beside the window sill.
Wheat requires a moist, warm and bright environment to germinate.
We used the wheat plant to determine how it influences its growth. For this study we used three plastic glasses: a transparent one, a red one and a blue one. In each glass, fifty grains of wheat were placed over a piece of cotton.
The natural light should give the wheat a normal increase, while the red light will give it a sharp increase in height. Blue light will also provide faster growth but not as dramatic as the red one.
The plants that are grown in red light are large and tall with plenty of branches. The blue light causes the plant to create more side stems and the plant will stay a little shorter in length.
All plants were watered with the same source of water, they were left in the same place and received the same amount of natural light. No fertilizers were used during the study.
Figure 1 shows the red glass, the transparent one and the blue one.

Figure 1 - Wheat seeds in plastic glasses

3. RESULTS

On the second day we can see how wheat germinated (Figure 2- a red glass, b the transparent, c blue).

a) b) c)

Figure 2 - Wheat seeds in plastic glasses

Four days after planting the wheat, we can see a difference in growth. The wheat found in the red glass developed much faster than the one in the transparent glass. In figure 3 we can see that wheat in the middle has reached a much larger size than the other two, and the wheat from the transparent glass seems to develop just like the one in the blue glass. The one from the red cup it's larger and has several branches.

Figure 3 - Wheat – four days after planting

On the seventh day it can be very clear that wheat in the red glass grew about 20 percent more than the wheat in the transparent or blue glass (figure 4).
Instead, there is not a big difference between the blue and the transparent glass (the two glasses look almost the same). A slight difference can be seen in the flower pigment.
The plant from the blue glass is slightly more pigmented than the one in the transparent glass that is more discolored.
Following this study we can say that red light is much better in terms of plant development.

Figure 4 - Day 7 - the final day of the study

4. CONCLUSIONS

Plant growth and productivity depends on the light conditions but also of the color. Many plants grown under only red light, have a stretched, elongated appearance; the leaves are thin and large and plants become tall. Red light is among the best colors of light to stimulate plant growth.
The wheat found in the red glass developed much faster and it's large and tall with plenty of branches.
The study presents the effects of red and far-red lights on germination, aerial architectural development and plant nutrition.

Note:
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