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DIFFERENT TYPES OF LIGHT IN THE PRODUCTION OF CORIANDER SEEDLINGS

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Abstract: The objective of this work was to evaluate different types of light in the production of coriander seedlings cultivar Verdão. The seeds were sown in trays containing Carolina Soil® vegetal substrate and maintained in a growth chamber with a 16-hour photoperiod and a light intensity of 25 μmol m^{-2} s^{-1}. The treatments were blue LEDs, green LEDs, red LEDs and a control consisting of no artificial light. The experimental design used was entirely randomized with ten repetitions. After 30 days, plant height, number of leaves, root length, and fresh mass of the aerial and root parts were evaluated. The data obtained were submitted to variance analysis, and the means were compared using the Tukey test at 5% probability of error. The seedlings grown under the blue LEDs showed a greater number of leaves (24 leaves) than those kept under green LEDs. The greatest root length (10.65 cm) was obtained under the blue LEDS, followed by the red LED (8.45 cm). Regarding the fresh mass of the aerial part, the highest averages were obtained under the blue LEDs and red LEDs, which did not differ from each other. As for the root fresh mass variable, the highest averages were obtained under the blue LED and the red LED. The height of the coriander seedlings was not influenced by the type of light.
Keywords: *Coriandrum sativum*, light quality, light photons, LED's

INTRODUCTION

Coriander (Coriandrum sativum L.), is a plant species belonging to the Apiaceae family, it is a herbaceous and annual plant. It is a seasoning plant widely used in Brazil, mainly as seasoning for fish, meat, sauces and salads (COSTA, 2002).

This species comes from southern Europe and the Middle East, and this culture adapts well to hot climate regions and is intolerant of low temperatures, presenting good precocity in the cycle, from 45 to 60 days (FILGUEIRA, 2003).

According to Carmello (1995), one of the most important stages of the productive system, mainly in olericulture, is the production of seedlings, considering that the final performance of the plants in the production beds depends on them, being therefore an indispensable input for the success of the process. producer.

Currently, the cultivation of coriander is widespread in several countries, due to its use in cooking and also as adornments in the presentation of dishes. In Brazil, especially in the North and Northeast regions, it is used as a medicinal plant and seasoning for different types of dishes. Its seeds have essential oils that are used in the manufacture of liqueurs, spices, sweets and perfumes (LINHARES et al., 2015; RESENDE et al., 2015).

Among the coriander cultivars available on the market, Verdão stands out, which is considered the leader throughout Brazil, in addition to having an early cycle, which fluctuates around 30 to 40 days, depending on the time of year and the season. region. This cultivar is quite vigorous, with dark green leaves, excellent hardiness and good resistance to pests and diseases (SOUSA et al., 2011).

Light quality can be understood as photoperiod, light intensity, specific wavelength. The different radiation sources have been the center of several researches over the years, especially regarding the effects of red and far red light spectrum on plant development and physiology (DEMOTES-MAINARD et al., 2016).

Radiation in the blue light spectrum is also considered of great importance, as it influences photomorphogenesis, stomata opening and photosynthetic functioning of leaves (WHITELAM & HALLIDAY, 2007). In addition, it can act on stem and

leaf elongation (HOENECKE et al., 1992). The blue light spectrum is involved in several plant physiological processes, such as phototropism and morphogenesis. It is known that red light generally emits a spectrum close to the maximum absorption of chlorophylls and phytochromes, being important for the development of the photosynthetic apparatus and for the accumulation of starch (SAEBO et al., 1995). Green light is absorbed by phytochromes and cryptochromes, which possibly influence light-induced events (FOLTA, 2004).

Currently, the use of fluorescent lamps has not been considered as the most appropriate source, as this type of lamp has a higher consumption of electrical energy and a shorter useful life, when compared to light emitting diodes (Light emitting Diode-LED). In addition, fluorescent lamps also produce more heat (GUPTA & JATOTHU, 2013). According to Nhut et al. (2003), the quality of the photon flux, wavelength and density may contribute to the increase of photosynthetic pigments, length of shoot and root system.

The first LEDs were developed over a hundred years ago by Russian researcher Oleg Losev. However, it was only at the end of the nineties with the generation of high-brightness LEDs that the greatest commercial interest began. LEDs are more efficient in transforming electrical energy into light energy than traditional light sources, in addition to having a longer useful life; they do not contain toxic substances such as mercury; did not generate heat; they have specific wavelengths; does not emit ultraviolet radiation; allow the control of the luminous flux in different cultivation environments, in and ex vitro conditions (ZHELUDEV, 2007).

Studies with LEDs in recent years as a source of radiation have aroused great interest, as they have a vast potential for application in different cropping systems (ROCHA et al., 2016). According to Nhut et al. (2003), this type of light can contribute to increased productivity.

In light of the above, the objective of this work was to evaluate different types of light on the production and quality of coriander seedlings cultivated very green.

MATERIAL AND METHODS

To theconducting the experiment to evaluate the production of coriander seedlings under different types of LED light, seeds of the verdão cultivar were used. Sowing was carried out in an expanded polystyrene tray with 200 cells. Six seeds were sown for each cell of the tray containing commercial plant substrate Carolina Soil®. After sowing, the trays containing the seeds were kept in a dark environment until the coriander seedlings emerged. Then the trays were transferred to a growth chamber with a photoperiod of 16 hours and light intensity of 25 μmol m^{-2} s^{-1} and placed on benches at a distance of 65 cm from the light emitting diodes (LED's).

The treatments consisted of different light sources, provided by EDER 3LA3 630nm red LED's, EDEB-3LA1 470nm blue LED's, 3LA1 530nm green LED's, with the control treatment being the absence of artificial light (Figure 1).

Figure 1- Visual aspect of coriander seedlings (Coriandrum sativum L.), cultivar Verdão under green LEDs3LA1 530nm.

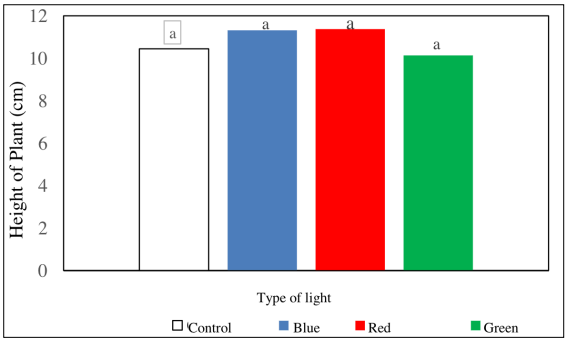
Coriander seedlings were watered daily in order to meet the water needs of the plants and once a week they were watered with the nutrient solution by Hoagland & Arnon (1952).

The experimental design used was completely randomized with ten replications per treatment. After 30 days of sowing, plant height (cm), number of leaves, root length (cm), fresh mass of shoots, fresh mass of roots (g) and visual appearance of seedlings were evaluated.

Data from leaf number variables were transformed into $(x + 0.5)^{½}$. Plant height, root length, shoot fresh mass and root fresh mass were not transformed. The data obtained were subjected to analysis of variance, with the averages compared by Tukey's test at a 5% error probability level using the statistical program Saneste.

RESULTS AND DISCUSSION

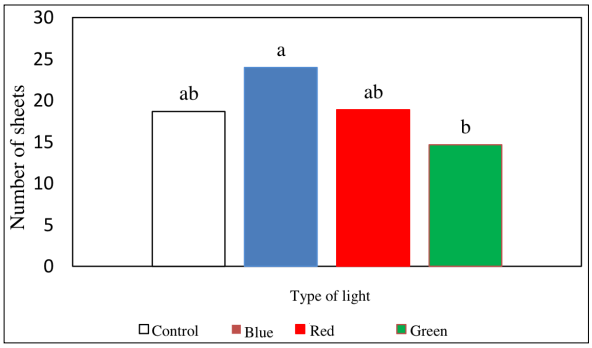
According to the analysis of variance, there was a significant effect of the type of light for all the variables analyzed in the experiment (number of leaves, root length, fresh mass of shoots and roots), except for seedling height. It can be observed in figure 2 that the height of the plants did not differ between the different types of light.



*Means followed by distinct letters differ by Tukey's test at the 5% error probability level.

Figure 2 - Height of coriander seedlings (Coriandrum sativum L.), cultivar Verdão, after 30 days of cultivation under different light sources.

The coriander seedlings cultivated under EDEB-3LA1 470nm blue LED's showed a higher number of leaves (24 leaves) than those grown under green 3LA1 530nm LED's (15 leaves), but did not differ from those grown under red 3LA3 630nm LED's (19 leaves) and control treatment (19 leaves). These results differ from those obtained by Johkan et al. (2010), who, evaluating different types of light in dealface plants (Lactuca sativaL.), found no difference in the number of leaves formed per plant after 45 days of cultivation. Although the quality of light (wavelength) influences the growth and development of plants, the effect triggered by light may be related to the species.



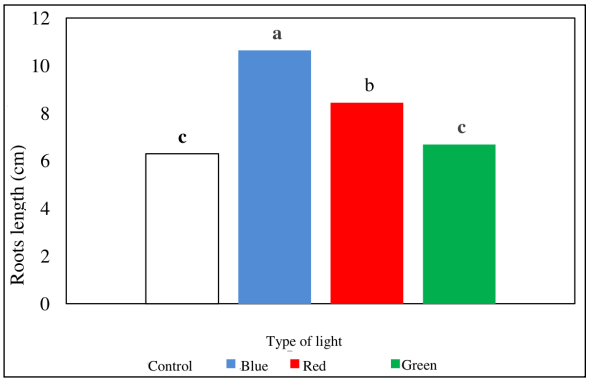
*Means followed by distinct letters differ by Tukey's test at the 5% error probability level.

Figure 3 - Number of leaves of coriander seedlings (Coriandrum sativum L.), cultivar verdão, after 30 days of cultivation under different light sources.

Regarding the root length variable (Figures 4 and 5), the highest average was observed in the seedlings cultivated under the LED'sazuis EDEB-3LA1 470nm (10.65 cm). As for the length of the roots in the seedlings grown under the red LED's EDER 3LA3 630nm (8.45 cm), this was greater than those observed in the seedlings produced under the green LED's 3LA1 530nm (6.7 cm) and control treatment (6.3 cm). Additionally, it can be seen in figure 4 that visually the seedlings from the control treatment and green LED's 3LA1 530nm showed a smaller volume of roots formed

in relation to the seedlings cultivated under blue LED's EDEB-3LA1 470nm and red LED's EDER 3LA3 630nm. Evaluating light quality during rooting of Gerbera jamesonii, Pawtowska et al. (2018) observed that plants grown under blue LEDs had greater length (6,

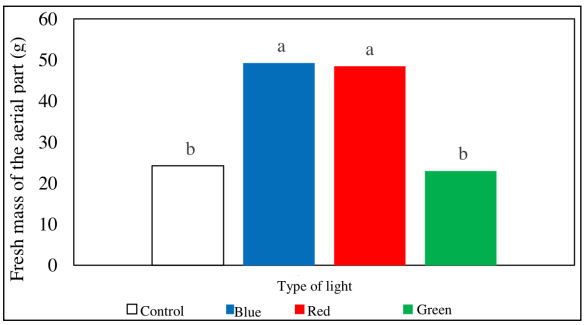
Figure 4 - Visual appearanceof the root system of coriander seedlings (Coriandrum sativum L.) cultivar Verdão, after 30 days of cultivation under different light sources, from left to right (blue LED's EDEB-3LA1 470nm, red LED's EDER 3LA3 630nm, green LED's 3LA1 530nm and control treatment).



*Means followed by distinct letters differ by Tukey's test at the 5% error probability level.

Figure 5 - Root length of coriander seedlings (Coriandrum sativum L.) cultivar Verdão, after 30 days of cultivation under different light sources.

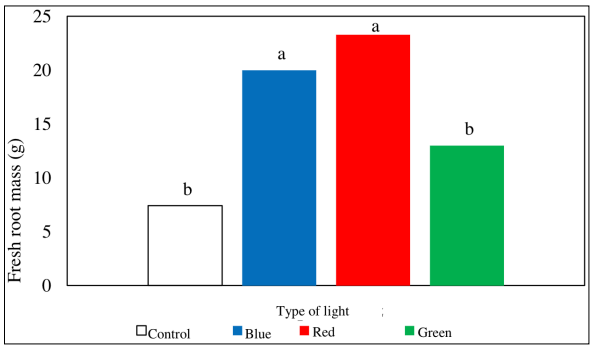
As for the fresh mass of the aerial part, it can be observed that the highest averages were obtained from the seedlings kept under the blue LED's EDEB-3LA1 470nm (49 g) and red LED's EDER 3LA3 630nm (48.5 g), which did not differ each other. On the other hand, there was no statistical difference between the results obtained under the 530nm 3LA1 green LEDs (23 g) and the control treatment (24.2 g) (Figure 6). According to Chen et al. (2016); Johkan et al. (2010), blue light stimulates leaf expansion, chlorophyll synthesis, chloroplast development, accumulation of anthocyanins and flavonoids.



*Means followed by distinct letters differ by Tukey's test at the 5% error probability level.

Figure 6 - Fresh mass of the aerial part of coriander seedlings (Coriandrum sativum L.) cultivar Verdão, after 30 days of cultivation under different light sources.

Regarding the variable fresh root mass of the coriander seedlings, it can be observed that the highest averages were obtained from the seedlings produced under the red LED's EDER 3LA3 630nm (23.3 g) and blue LED's EDEB-3LA1 470nm (20 g), which did not differ from each other. The smallest amounts of fresh mass of the roots were obtained from seedlings grown under green LEDs3LA1 530nm (13 g) and control treatment (7.4 g) (Figure 7). These results differ from those observed by Li et al. (2012), who evaluated different types of light in the growth of Brassica campestri and obtained a greater amount of fresh mass of roots under red LEDs than in plants grown under blue LEDs. This demonstrates that the quality of light exerts a strong influence on cultivated plants. According to Yeh and Chung (2009),



*Means followed by distinct letters differ by Tukey's test at the 5% error probability level.

Figure 7 - Fresh mass of the roots of coriander seedlings (Coriandrum sativum L.) cultivar Verdão, after 30 days of cultivation under different light sources.

CONCLUSION

For the conditions in which the experiment was conducted, it can be stated that the quality of light has an effect on the quality of the coriander seedling.

The height of coriander seedlings was not influenced by light quality;

The blue LED'sEDEB-3LA1 470nmpromote the highest growth of seedling roots.

The ones with blue LED'sEDEB-3LA1 470nm and EDER 3LA3 630nm red LED's contribute to obtaining coriander seedlings with greater fresh mass of shoots and roots.

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