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INFLUENCE OF ILLUMINATION WITH LEDs ON GROWTH AND DEVELOPMENT OF LETTUCE SEEDLINGS

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Abstract

The paper aimed to present the evolution of lettuce (Lactuca sativa L.) grown in different light conditions. Plants were grown in a climate chamber of the Faculty of Horticulture-UASVM Bucharest, using as light sources LED and neon. There have used two varieties of lettuce namely 'Lollo Rosa' and 'Lollo Bionda'. Both of varieties have better development (eg germination period, number of leaves) in the case of LED luminaries compared with those developed under neon light. Thus, masses obtained after 30 days of growth were 30.8% higher in case of the variety 'Lollo Rosa' and 29.8 for variety 'Lollo Bionda'. As a general conclusion it can be say that use of LED light has a lot of advantages against neon light being ecological and offering a reduced energy consumption which determine a lower greenhouse warming phenomenon compared to overheating caused by neon lighting. In addition, it is important that to pursue the studies by assessing the behavior of plants at different radiation emitted by the LED.

Key words*: lettuce, LED illumination, growth characteristics.*

INTRODUCTION

Lettuce (*Lactuca sativa* L.) is a species commonly cultivated in protected areas especially during the autumn-winter-spring.
For some varieties of lettuce external factors such as light and temperature can influence the quality leaves or heads. For example Piroga lettuce varieties (var. Crispa) and Paris White (var. Romanian) under short-day conditions with increased cloudiness and low temperature (2-4°C) leaves occurring embossed, coarser, crunchy, stained, without commercial aspect. To these varieties leaf tenderness may return only when the temperature rises above 7°C and light conditions are improved (Draghici, 2014).
Light is one of the most important environmental factors that exerts different influences on plants, it is not only a source of energy in photosynthesis, but also the promoter of germination, growth and development of plant organisms. The reaction of plants to light, counts both the quantity and quality of radiation incidents as well as length of the lighting period, respectively photoperiod.
As stated Tikhomirov (1994), spectral changes of light determines the recording - to the green organs of each plant – of morphogenetic and different photosynthetic reactions with intra- and interspecific variations or even intra-individuals.
LEDs are widely used in various fields of activity. In the last years, there were indoor plant growers who use LED light to grow plants used for their own food (Yeh and Chung, 2009). Light-emitting diodes (LEDs) have long been recognized for their benefits, long life, energy efficiency and flexibility.
In the last decade LED technology evolution has been outstanding, the market being rising significantly in recent years. However, in comparison with the rest of the lighting industry, the introduction of LEDs in horticultural cultivation techniques is more recent being materialized only in recent years. Introducing of LEDs on the horticultural market in is largely due to significant advances in technology (Matioc, 2012).
In recent years, studies have shown that plants are more sensitive to certain wavelengths of

light to increase the absorption of chlorophyll and photosynthesis standing out exposure to red (~ 640-660 nm) and blue (~ 450 nm) light. These studies showed that the peaks of the spectral light absorption for the *chlorophyll a* is within the ranges of 400 to 500 nm and 600 to 700 nm. The use of additional lighting using lamps helps to produce greenhouse vegetable salad and their use has skyrocketed over the past 15 years in the Netherlands. The main reasons for using additional lighting are ensuring high yields throughout the year and the level of quality that meets market demand (Marcelis et al., 2002).

In the Netherlands, in 1999 additional illuminated surfaces in greenhouses increased by about 13% compared to 1994 (Bakker et al., 2000). Until 2002 about 22% of the Dutch greenhouse made use of supplementary lighting, the digit having increased by 1.7 percent annually compared to 1994 (Knijff and Benning, 2003).

The study aimed to identify the best light spectrum to produce seedlings of lettuce.

MATERIALS AND METHODS

The experiment was conducted in the Department of Bioengineering Hortiviticultural Systems, Faculty of Horticulture Bucharest, during the period 2013-2014.

The study was conducted in the climate chamber, under controlled environment, ensuring a temperature of 22 °C day and 20 °C night, a constant atmospheric humidity of 65%. The duration of lighting was 16 hours / day light and 8 hours dark.

Have been sown seeds of lettuce varieties Lollo Bionda and Lollo Rosa, 150 seeds for each varieties, in three repetitions.

Determinations were carried out on emergence, the growth of salad plants, dynamics of leaves formation, the seedlings mass. It used one type of LEDs.

RESULTS AND DISCUSSIONS

It was found that after three days from sowing that the highest percentage of emergence was recorded at Lollo Bionda variety (20%), the variant exposed to light LED.

At the all variants, the emergence of plants was higher for all cultivars exposed to LED light (figure 1).

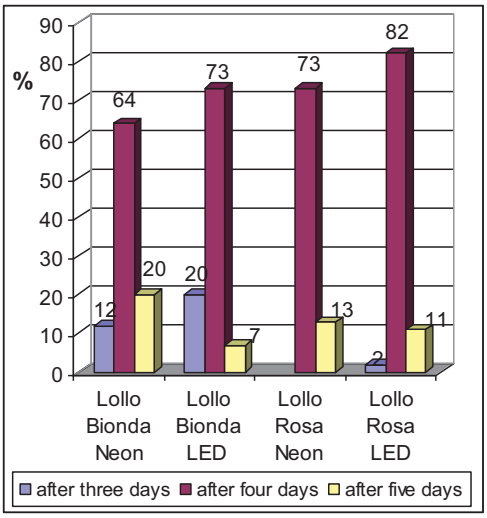

Figure 1. The duration and the percentage of the plants emergence.

Notice that the highest percentage of emergence was Lollo Bionda variety of 100% followed by 95% variety Lollo Rosa to variants lighting by LED, figure 2.

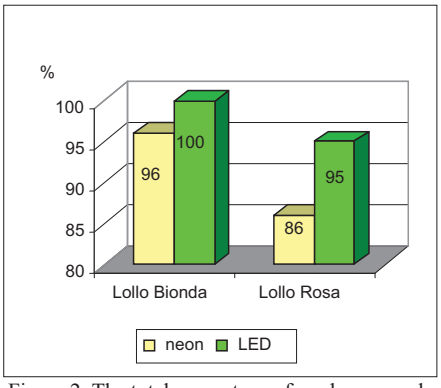

Figure 2. The total percentage of seeds emerged

Observations on the dynamics of lettuce leaves, Lollo Bionda and Lollo Rosa varieties, showed that for both varieties has been formed a greater number of leaves when seedlings growth under LED lighting (figure 3 and figure 4).

Likewise, following the plant masses after 30 days it can see that these have the same aspect. Namely, the salad masses after 30 days of development is higher at both varieties by about 30% (30.8% Lollo Rosa and 29.8% for

Lollo Bionda) to plants grown under illumination provided by LED compared to those grown under neon lighting.

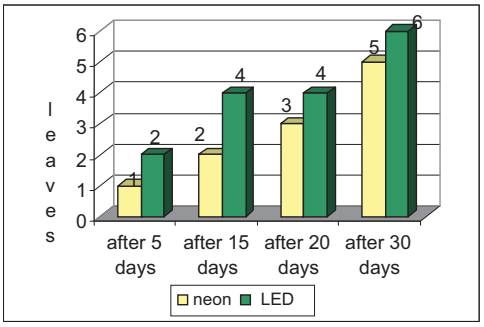

Figure 3. The dynamics of formation of leaves for the variety Lollo Bionda.

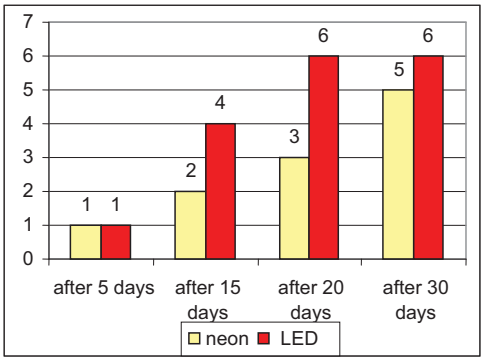

Figure 4. The dynamics of formation of leaves for the variety Lollo Rosa

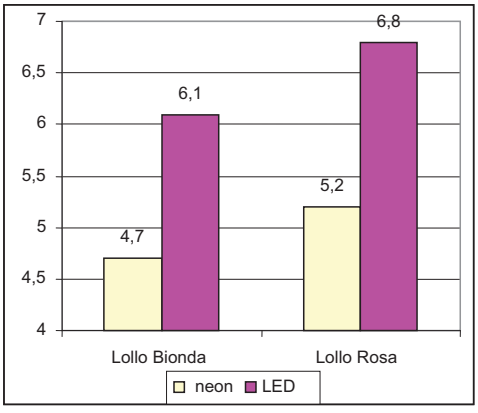

Figure 5. The mass of seedlings after 30 days

CONCLUSIONS

The results obtained clearly confirmed by the fact that they were very close to rehearsals conducted under the same conditions (3 repetitions for the same conditions) shows the obvious advantage of using LED luminaries.
Important is that they are ecological and of reduced energy consumption point of view which determine a lower greenhouse warming phenomenon compared to overheating caused by neon lighting.

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