

EX VITRO STUDY ON TESTING THE TREATMENT WITH A STIMULATING EFFECT ON THE SEED GERMINATION RATE OF *OCIMUM BASILICUM* L.

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Abstract

The stimulation of the seed germination rate may be one of the ways to prevent environmental attacks of biotik or abiotik agents on the quality of seedlings. One of the factors involved in stimulating the germination rate of seeds is red light illumination. Currently, the source for generating red light that consumes the smallest amount of energy is atermic laser.

Ocimum basilicum L. is one of the plant species that have been used by man since ancient times in culinary, medicinal, decorative and spiritual activities.

Therefore, this paper presents experimental data obtained by testing the treatments based on the use of a laser light field, with a stimulating effect on the rate of seed germination on Marseille and Red Rubin basil (*Ocimum basilicum* L.) varieties.

The experimental data obtained recommends the application of field laser light treatments for 30' in order to stimulate the germination rate of seeds and in order to obtain seedlings for each of the two varieties of basil (*Ocimum basilicum* L.) under study.

Keywords: *Ocimum basilicum* L., seed germination rate, laser light field

1. INTRODUCTION

The interest in the exploitation possibilities of basil (*Ocimum basilicum* L.) has attracted the attention of the scientific world, too, who has made many experiments resulting in a series of papers that have a wide range of targets [1, 6]. There are many scientific papers concerned about capitalizing basil plants (*Ocimum basilicum* L.), or only about some of the substances biosynthesised by them. But, scientific work referring to the possibilities of prevention and protection of basil (*Ocimum basilicum* L.), otherwise known for its antiseptic properties, is at a much lower level than the negative action of biotic and abiotic factors.

Considering the actual socio-economic situation, when the principles of ecology are beginning to prevail at the expense of abundant and unsustainable crops, basil (*Ocimum basilicum* L.) needs finding and providing solutions to ensure prevention and protection against the negative actions of the biotik and abiotik factors. Among the solutions offered by modern science to help protecting plants by organic methods, laser light field method should be mentioned.

It is also well known that, under the influence of abiotik environmental factors, there is a direct correlation between the seed germination time and the moment when various stages of growth and development of certain biotik phytopathogenic factors begin.

Therefore, the purpose of our research was an *ex vitro* study about testing treatments based on the use of a laser light field, with a stimulating effect on the basil (*Ocimum basilicum* L.) seeds germination rate, of the Marseille and Red Rubin varieties.

2. MATERIAL AND METHOD

The biological material consisted of basil seeds (*Ocimum basilicum* L.) of *Marseille* and *Red Rubin* varieties – with food and ornamental value - obtained by conventional horticultural methods and in their dormant phase. *Marseille* variety is characterized by green foliage – medium, while the *Ruby Red* variety is characterized by red foliage – ruby.

The experimental device [2, 3, 4, 5], used for testing the treatments based on the use of a laser light field, with a stimulating effect on the seed germination rate of *Marseille* and *Red Rubin* basil (*Ocimum basilicum* L.) varieties.

Laser diodes are somewhat similar to the LEDs, but different by the fact that light is generated by stimulated emission and not by spontaneous emission, leading to a better efficiency and different properties of the emitted beam.

In **Table 1** is given information regarding the irradiation exposure time and doses with 20 red coloured laser diodes, having a total strength of 100mW on a surface of 20 x 10 cm².

The experimental device that is used consists of a “mobile arm” system which allows to adjust the distance between the system of laser diodes and the exposure surface and a laser head that consists of system with 20 laser diodes aligned in a cylinder so that the emitted light can be equally superposed on the exposure surface.

Table 1. Irradiation doses values versus exposure time

T(min.)	D (J/cm ²)
10	0.6
20	1.2
30	1.8

The device is independent and it can be placed on a surface that allows the recipients with the seeds or the plants that must be irradiated to be exposed. In our experiments, on the exposure surface were placed 3 Petri recipients containing 30 seeds of every species each. The light emitted by the laser diodes is assigned on a 200 cm² surface. The aim is to make the illumination as even as possible on the entire surface so that the seeds can be irradiated at the same dose. The Petri recipients with the seeds which represented the control sample were not exposed to the supplementary illumination with red coloured laser diodes.

The experimental scheme [5], used for testing the treatments based on the use of a laser light field, with a stimulating effect on the seed germination rate of *Marseille* and *Red Rubin* basil (*Ocimum basilicum* L.) varieties.

The seeds were placed on sterile wet filter paper, at room temperature 17-20°C and air relative humidity of 35-40% suitable to the ambient medium. These were placed in one time use plastic Petri recipients (9 cm diameter and 2 cm high).

Experiments were developed for each varieties in the same time (*Ocimum basilicum* L. var. *Marseille* and *Ocimum basilicum* L. var. *Red Rubin*), for 3 repetitions, in the same controlled working and culture conditions in Laboratory of Vegetable Biotechnology from Biotechnology Faculty, USAMVB.

Daily, the seeds were supplementary illuminated by the red light emitted by laser diodes in different exposure times corresponding the following experimental scheme:

- V_C – experimental control variant non-illuminated;
- V₁ – experimental variant illuminated for 10 minutes;
- V₂ – experimental variant illuminated for 20 minutes;
- V₃ – experimental variant illuminated for 30 minutes.

After applying the treatment all the seeds were preserved at a photoperiod of 8 hours dark/ 16 hour day at artificial white light (Phillips neon - 40W).

3. RESULTS AND DISCUSSIONS

Experimental results obtained for *ex vitro* testing of treatments based on the use of a laser light field, with a stimulating effect on the seed germination rate of *Ocimum basilicum* L. *Marseille* var. In the case of the test samples on which the treatments based on using a laser light field for 30' were tested the largest experimental values for *Ocimum basilicum* L. *Marseille* var. were recorded, in terms of the average number of germinated seeds (Figure 1), the average length of the radicle (Figure 2), and the average length of the primary stem (Figure 3).

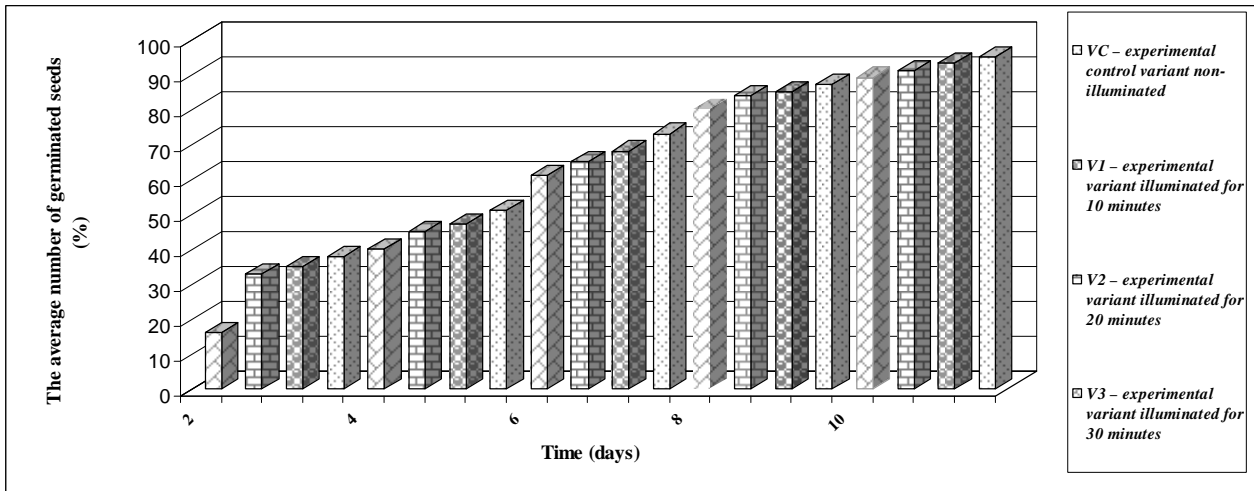


Figure 1. The average number of germinated seeds for *Ocimum basilicum* L. *Marseille* variety

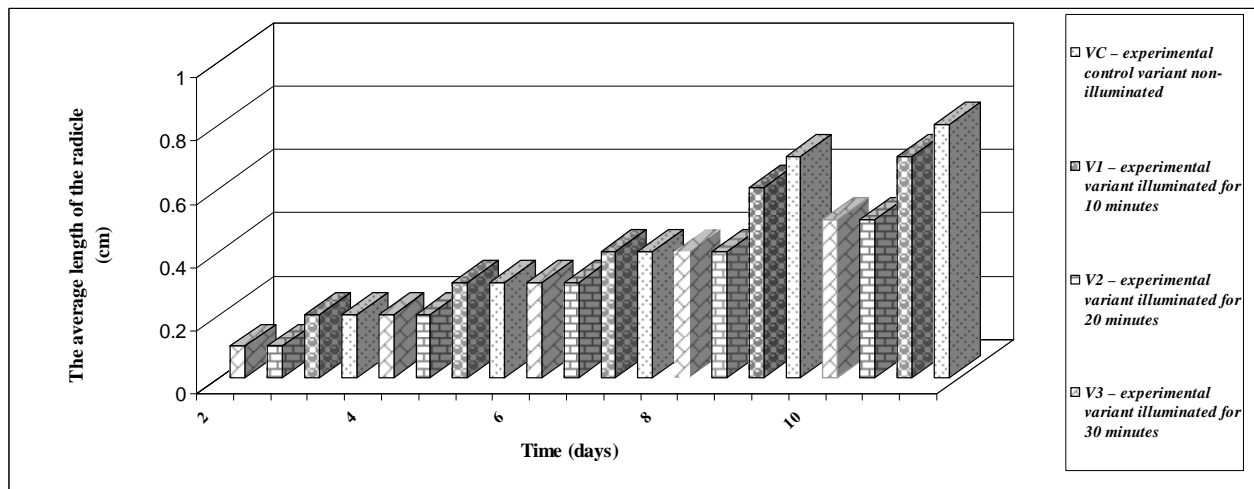


Figure 2. The average length of the radicle (cm) for *Ocimum basilicum* L. *Marseille* variety

The test samples on which laser light field treatments, for 20', where tested have generated better experimental values than those test samples on which laser light field treatments, for 10', where tested for *Ocimum basilicum* L. *Marseille* var., in terms of average number of germinated seeds (Figure 1), the average length of the radicle (Figure 2), and the average length of the primary stem (Figure 3).

While the test samples on which laser light field treatments, for 10', where tested have generated close experimental values to those of the test sample with a controlling role for *Ocimum basilicum* L. *Marseille* var., in terms of average number of germinated seeds (Figure 1), the average length of the radicle (Figure 2), and the average length of the primary stem (Figure 3).

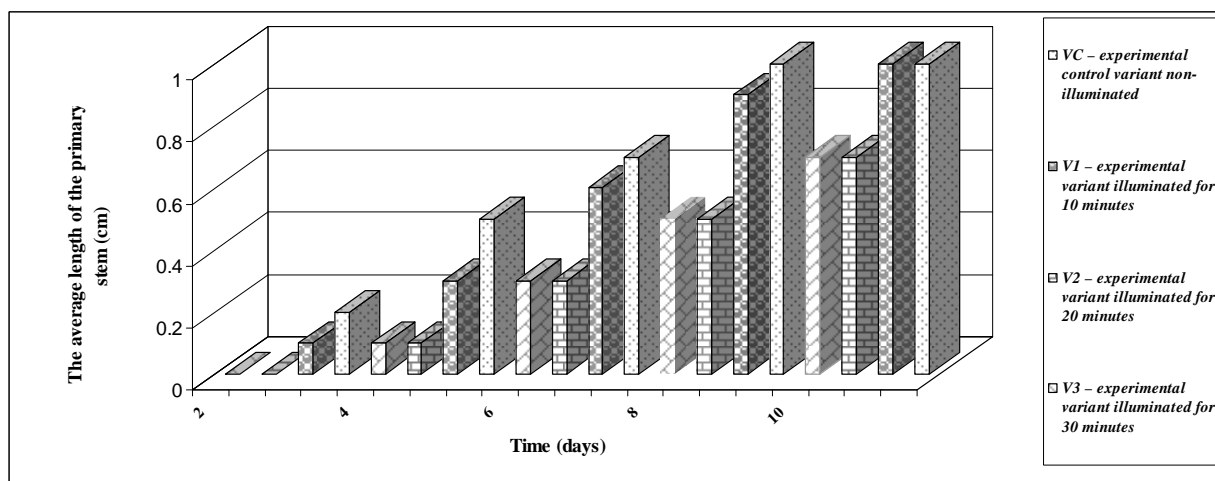


Figure 3. The average length of the primary stem (cm) for *Ocimum basilicum* L. Marseille variety

Experimental results obtained for ex vitro testing of treatments based on the use of a laser light field, with a stimulating effect on the seed germination rate of *Ocimum basilicum* L. Red Rubin var. The test samples on which laser light field treatments, for 30', were tested have recorded the largest experimental values for *Ocimum basilicum* L. Red Rubin var., in terms of average number of germinated seeds (Figure 4), the average length of the radicle (Figure 5), and the average length of the primary stem (Figure 6).

In the case of the test samples on which laser light field treatments, for 20', were tested, better experimental values were recorded than those of the test samples on which laser light field treatments, for 10', were tested for *Ocimum basilicum* L. Red Rubin var., in terms of average number of germinated seeds (Figure 4), the average length of the radicle (Figure 5), and the average length of the primary stem (Figure 6).

While variants have been tested experimental treatments based on using a laser light field for 10' were recorded close to the experimental values of the experimental variants with a controlling role for *Ocimum basilicum* L. from var. Red Rubin, in terms in terms of average number of germinated seeds (Figure 4), the average length of radicle (Figure 5), and the average length of the primary stem (Figure 6).

While the test samples on which laser light field treatments, for 10', where tested have generated close experimental values to those of the test sample with a controlling role for *Ocimum basilicum* L. Red Rubin var., in terms of average number of germinated seeds (Figure 4), the average length of the radicle (Figure 5), and the average length of the primary stem (Figure 6).

The correlation of the experimental data recorded by ex vitro testing of treatments with a stimulating effect on the rate of *Ocimum basilicum* L. Marseille and Red Rubin seed germination show that there is a relationship between the time of the laser light field application (10', 20' or 30'), and the reaction of the experimental parameters followed (the average number of germinated, seeds the average length of the radicle and average length of the primary stem) to its action.

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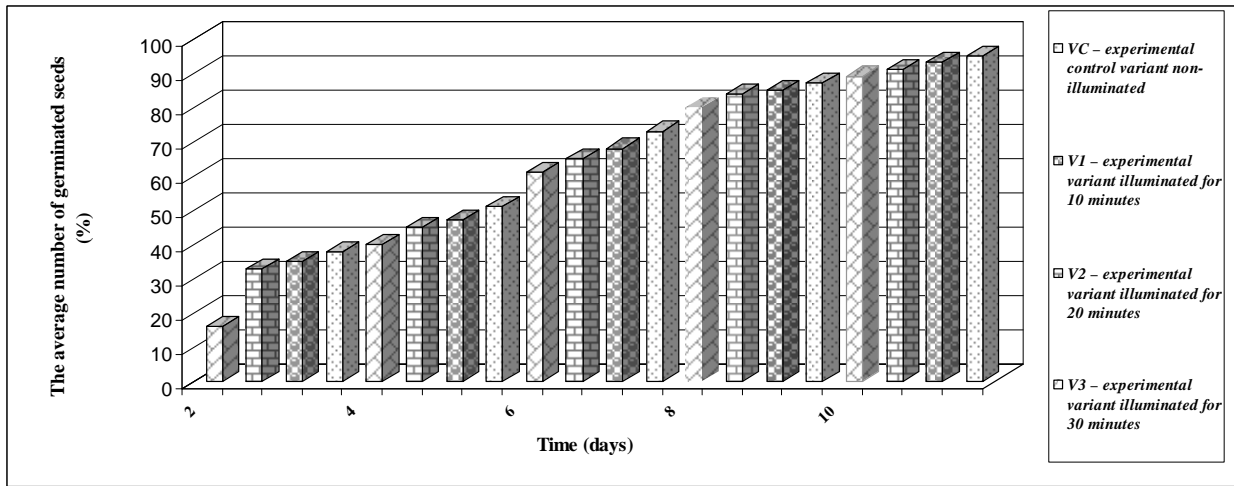


Figure 4. The average number of germinated seeds for *Ocimum basilicum* L. Red Rubin variety

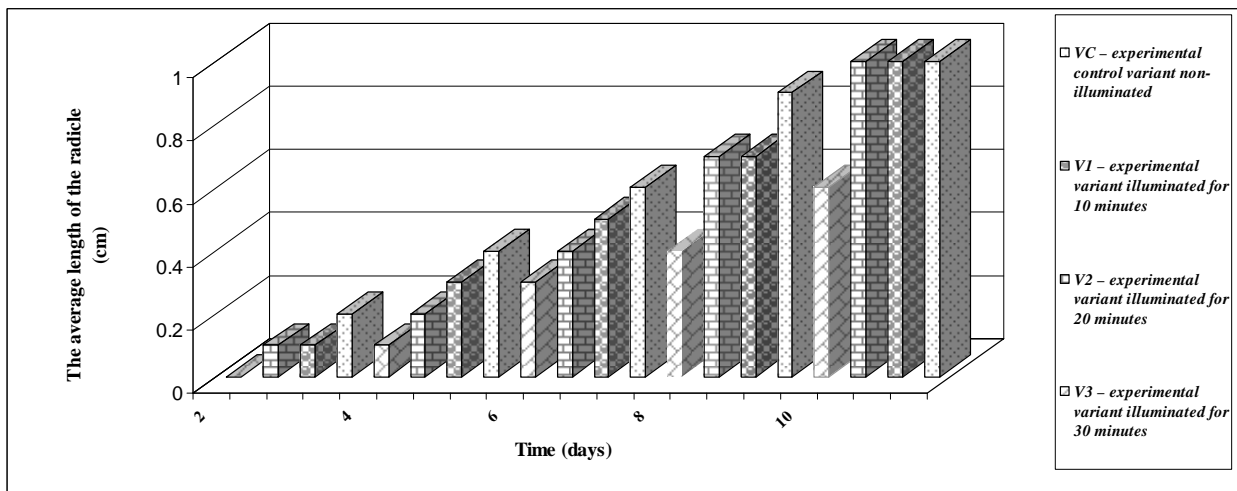


Figure 5. The average length of the radicle (cm) for *Ocimum basilicum* L. Red Rubin variety

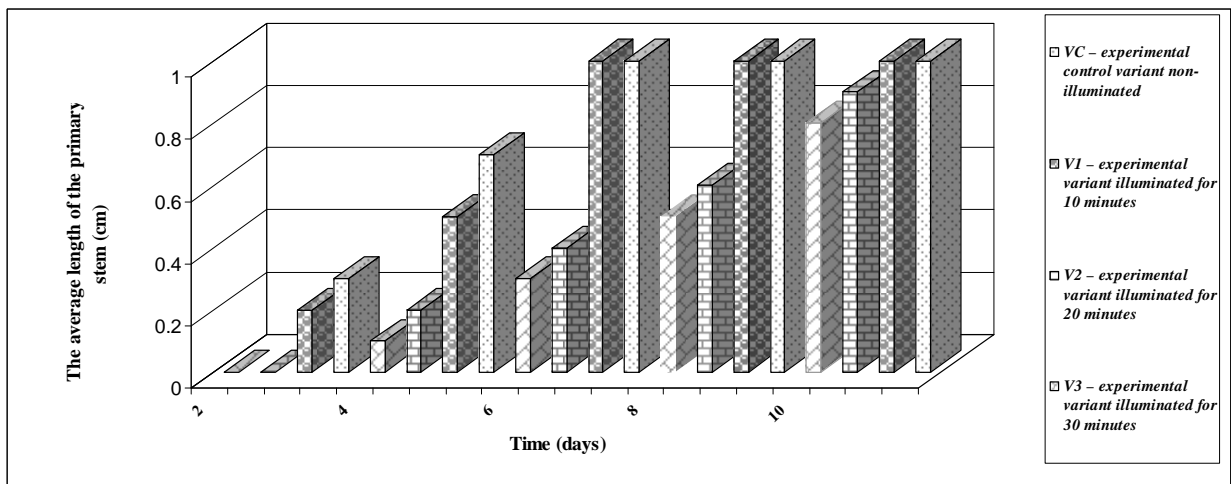


Figure 6. The average length of the primary stem (cm) for *Ocimum basilicum* L. Red Rubin variety

4. CONCLUSIONS

The research carried out for the *ex vitro* study, concerning the testing of treatments with stimulating effect on the rate of seed germination of *Ocimum basilicum* L. Marseille and Red Rubin varieties, have led to experimental results that issued the following conclusions:

- in the case of test samples on which laser light field treatments, for 30', were tested the biggest experimental results were recorded, both for *Ocimum basilicum* L. *Marseille* variety and *Ocimum basilicum* *Red Rubin* variety, in what concerns the average number of seeds germinated, the average length of the radicle and the average length of the primary stem;
- in the case of the test samples on which laser light field treatments, for 20', were tested better results were recorded than those recorded for the test samples on which laser light field treatments, for 10', were tested, both for *Ocimum basilicum* L. *Marseille* variety and *Ocimum basilicum* L. *Red Rubin* variety, in what concerns the average number of germinated seeds, the average length of the radicle and the average length of the primary stem;
- in the case of the test samples on which laser light field treatments, for 10', were tested, close experimental results were recorded to those of the control test samples, both for *Ocimum basilicum* L. *Marseille* variety and *Ocimum basilicum* L. *Red Rubin* variety, in what concerns the average number of germinated seeds, the average length of the radicle and the average length of the primary stem.

The experimental results for the *ex vitro* study, concerning the testing of treatments with stimulating effect on the rate of seed germination for *Ocimum basilicum* L. *Marseille* and *Red Rubin* varieties, recommend the application of a laser light field treatment, for 30', in order to stimulate the seed germination and the seedlings obtaining process, for each of the two basil (*Ocimum basilicum* L.) varieties under study.

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