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STUDY OF THE INFLUENCE OF A BIOSTIMULATOR USED IN THE TREATMENT SEED OF FAMILY *APIACEAE* BY ULTRASOUND

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Abstract

Root vegetables - carrot, parsley and celery are crops of great economic importance due to their high nutritional and biological value. The article explores the effect of biostimulator and the different duration of ultrasound treatment on the sowing quality of carrot, parsley and celery seeds. From the studies done, it was found that the biostimulator effect differs for the three cultures and depends on the duration of the ultrasound treatment.

Key words: *biostimulator, rood vegetables, seeds, ultrasound.*

INTRODUCTION

Root vegetables - carrot, parsley and celery are very important crops for economic and nutritional reason.

Carrots (*Daucus carota*), which are the main root crop, are used both for fresh and canned consumption (Cholakov, 2009). They refer to polyvitamins vegetables containing vitamins B_1, B_2 and C. The content of carotene is between 5-15 mg per cent. Besides food, carrots are used in pharmacy and perfumery industry.

The harvest of early production occurs during the spring and summer months and is consumed exclusively in a fresh state. The late Polish production, which is essential for our country, has the task of satisfying the needs of the canning industry and the population during the winter months.

With the content of nutrients and especially of essential oils, celery takes one of the first places among vegetable cultures used as seasonings. The importance of celery stands out particularly well given the fact that root crops are excellent and can be used fresh during the winter and spring months. (Liu et al., 2003)

The aim is investigating the impact of the biostimulator used in seed treatment by ultrasound (Istomina et al., 1936; Esfandiar et al., 2012; Gordon et al., 1963) on the seed qualities of carrot, parsley and celery.

MATERIALS AND METHODS

The survey was conducted in the period 2016-2017 in the Department of Mechanization and in the Department of Gardening at the Agricultural University of Plovdiv. The subject of the study was the carrot, parsley and celery seeds. An ultrasonic bath is used to perform the study (Figure 1)..

Figure 1. BRAND CT-405

The bathtub works on the principle of intense sound pressure, created by an ultrasound source, filled in a limited volume of liquid - a number of microscopic bubbles are formed that shrink and expand in sync with the frequency at which they hit the surface of the objects placed in the liquid.

Two exposures of ultrasound treatment were tested at 6 and 12 minutes at a frequency of 43-45 kHz. Two different liquids were used to

perform the ultrasound treatment. The first one was distilled water, and the second in the distilled water was added a Winner biostimulator at a concentration of 1: 1000.

The biostimulator Winner has the following composition: nitrogen 125 g/l, phosphorus 75.2g / l, potassium 54.5 g/l, calcium 0.5 g/l, magnesium 7.5 g/l, iron 0, 5 g/l. It also contains manganese, copper, zinc, sulphur, pine and molybdenum. It is rich in organic substances - amino acids, hormones, vitamins - 57.2%. It is applied to foliage and soil, but it also serves to treat seeds in different concentrations depending on the species.

Non-treated seeds of the indicated crops planted for germination in petri dishes were used for the control. Depending on the duration of the seed treatment and the used liquid, the following variants were tested when loading the ultrasonic bath:

Carrot:

1. Control;
2. Exposure 6 min. + Winner;
3. Exposure 12 min. + Winner;

Parsley:

1. Control;
2. Exposure 6 min. + Winner;
3. Exposure 12 min. + Winner;

Celery:

1. Control;
2. Exposure 6 min. + Winner;
3. Exposure 12 min. + Winner.

The experiment was set in 3 replicates and the number of seeded counts in each iteraction was 100. After the treatment, the seeds were placed in a thermostat at 24°C, with the number of seed germinated daily. The counting continued until the 14th day for carrot, 21 for celery and 28 for parsley.

Two parameters were tested - laboratory germination (%) and germinating energy (%). As a result of day-to-day readings, the speed and cooperativity of seed germination were determined.

Laboratory germination, showing % normal germinated pure seeds under optimum conditions for a specified period of time, was determined by counting the number of germinated seeds according to the accepted BDS standards (601 84) as follows:

1) On the 14th day for carrot;
2) On the 28th day for parsley;
3) On the 21st day for celery.

The germinating energy, expressing the percentage of normally germinated seeds under optimal conditions, but for a shorter period of time, was reported to:

1) 7th day for carrots (under BDS);
2) 10th for parsley (under BDS);
3) 10th for celery (under BDS).

RESULTS AND DISCUSSIONS

1. Germination energy (%)

The results of the performed studies show an increase in exposure and with the addition of a biostimulator, the percentage of germinating energy increases.

Highest test values were recorded in the 12 minutes seed treatment scenarios where the germinating energy reaches 100% and the excess over the control was 233.3%. At 6 minutes exposure, the germinating energy increased to 85%.

The lowest values were recorded in the control - 30% sparying energy (Figure 2).

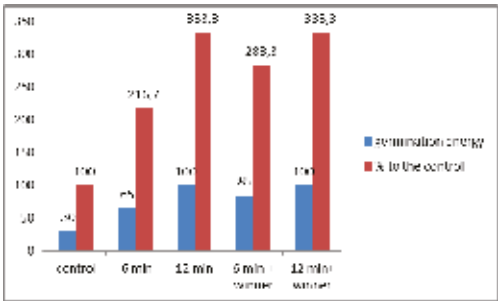

Figure 2. Germinating energy (%) of carrot seed, average for the period 2016-2017

While the germinating energy increases in carrots with the addition of biostimulants, the effect of the studied effects is less pronounced in parsley and celery.

The germinating energy recorded in parsley (Figure 3) increases, although slightly less than 20% (seen in the control) and reaches 30% when the biostimulator is added.

Exceedance of the control for this option is 50%.

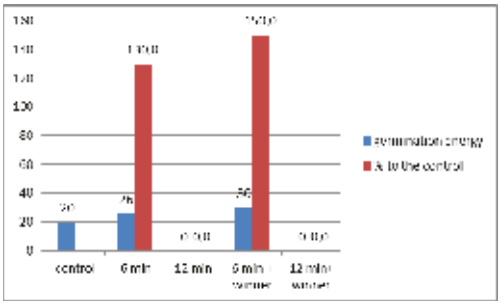

Figure 3. Germination energy (%) of parsley seeds averaged over the period 2016-2017

The treatment of celery seeds with ultrasound (Figure 4) affects germination energy only when its duration is 12 minutes.
Within this exposure, the measured values of the test item do not differ significantly between each other and the difference between the two tested media is only 5%, with the biostimulator variant being 19%.
In the other variants, including the control, 0% of germinating energy was reported.

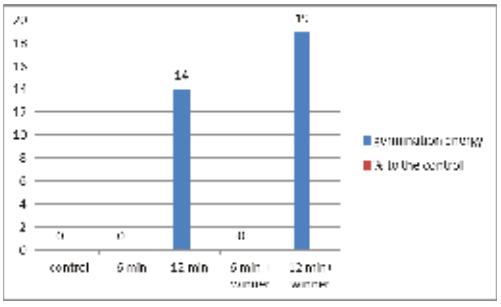

Figure 4. Germination energy (%) of celery seeds, averaged over the period 2016-2017

2. Laboratory germination (%)

Germination is a very important indicator of a biological aspect that provides information on the viability of the seeds, their suitability and the determination of the seed norm (Murtazov, 1984).

And with this main indicator, the trend found in carrots to enhance the effect of adding a biostimulator is retained (Figure 5).
The reported germination exceeds that of the control by 58.7%. Within 6 minutes exposure, germination reached 95%, and the over-control was 50.8%. Significantly lower than the other variants is germination, reported in the control - 63%.

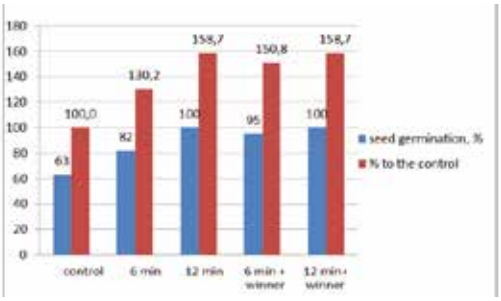

Figure 5. Laboratory germination (%) of carrot seed, averaged over the period 2016-2017

Attention is paid to the results presented in Figure 6, providing information on the speed and suitability of seed germination in carrots. It can be seen from the figure that, with or without biostimulator, in the first 3 days after this phase occurs, the number of germinating seeds depending on the variant is between 55 and 100. For comparison, in the control for the same period of time the number of sprouts is 30.
In the biostimulator variant on Day 4, 60 germinations were reported and the remaining 40 on the 5th day. The biostimulator effect in the 6 minutes exposition was also well-known, whereas on day 6 (3 days after start of germination) the number of sprouted seeds recorded is 27.3% higher than the other variant with the same treatment duration.

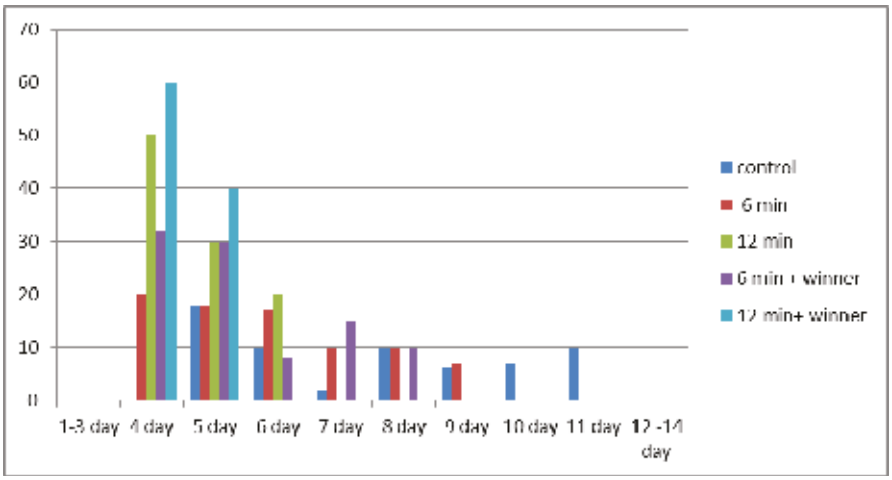

Figure 6. Germination of carrot seeds by day

The most cumbersome and fastest germinating seeds are at 12 minutes exposures, with 60 germination on day 4 and the remaining 40 on day 5.

The biostimulator effect is also well-known in 6 minutes exposure, on the 6th day (3 days after germination) the number of germinated seeds recorded was 27.3% higher than the other variant with the same treatment.

In Figure 7 shows the data on laboratory germination of parsley seeds.

The highest percentage of laboratory germination was reported in the 6 minutes exposition test, with the biostimulator reading being 90%.

The difference between the two 6 minutes exposure variants is 10%. In the control, the germination rate was 60%.

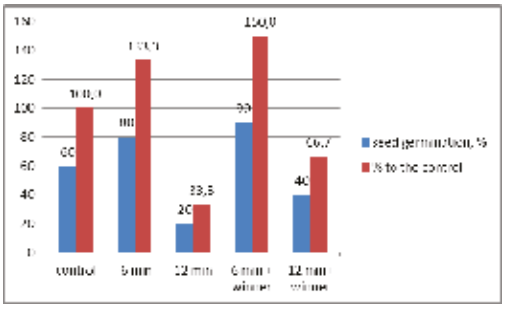

Figure 7. Laboratory germination (%) of parsley seeds averaged over the period 2016-2017

The results of Figure 8 it is noted that seed germination begins from day 6 until day 11, at the earliest 6 minutes biostimulator exposition and at 12 minutes exposure at the latest. The control sprout starts on the 9th and ends on the 14th.

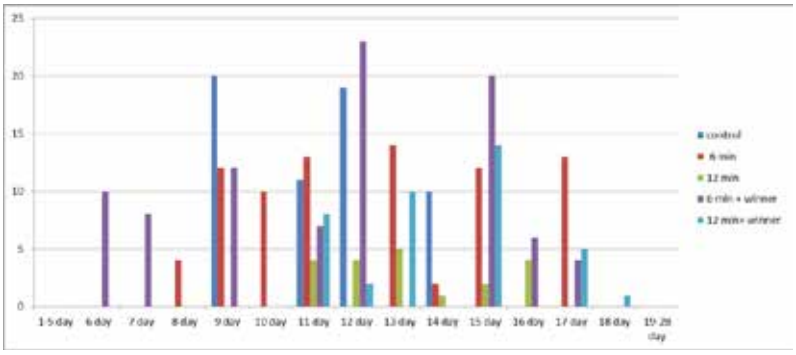

Figure 8. Sprouting seeds of parsley by day for the whole period

In Figure 9 the results for laboratory germination of celery are presented. Under the influence of ultrasound stimulation germination of seeds strongly increases.
At 0% of the control, laboratory germination increases with increasing treatment duration and reaches 70% in the 12 minutes exposure scenario. 6% lower is the germination reported in option 2 (6 minutes).

As far as the biostimulator is concerned, it has a negative effect, because in both embodiments involving this additive there are reported significantly lower results compared to the distilled water variants.
It is noteworthy that even here the tendency to increase germination with an increase in ultrasonic processing is maintained. Although 9% of the benefit is for the 12 minutes option.

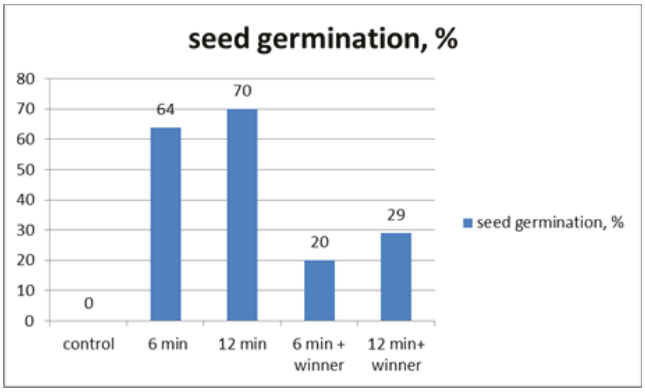

Figure 9. Laboratory germination (%) of celery seeds, average for the period 2016-2017

The germination process (Figure 10) starts at the earliest with 12 minutes exposures - 8th day for variant 3 (12 min.) and 9th day for variant 5 (12 min. + Winner). In the same two variants seed germination ends on day 17 on day one and on day 18 in the second variation.
The first germinated seeds in the 6-minute exposure variants were counted on the 13th day after treatment, with no new germinated seeds being reported for the biostimulator addition until 19th day. Interestingly, the results are reported for option 2. It is clear from the graph that, despite the later onset of germination (on day 13), the number of sprouts at each subsequent counting increases and reaches it's maximum on the 17th day - 35 pieces.
This option is the shortest and the start-end period of germination - 5 days, for which 64 sprouted seeds have been reported. When compared to option 3 (12 minutes), where the highest germination rate was recorded, it is seen that the period is 10 days. Apparently 6 minutes seed treatment with ultrasound helps to seed the seeds more comfortably, and this is essential for obtaining quality and even plants.

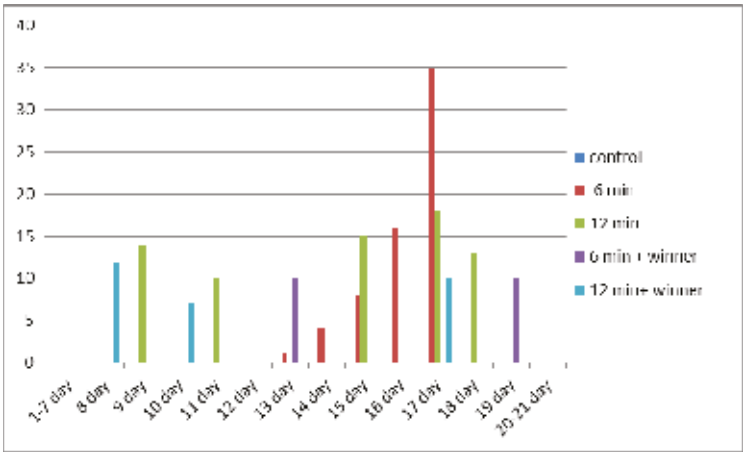

Figure 10. Germination of celery seeds by day for the whole period

CONCLUSIONS

The biostimulator effect is different for the three cultures and depends on the duration of the ultrasound treatment.

In carrots and parsley, the addition of biostimulator increases germination by up to 13% in carrots and by up to 20% in parsley.

It should be borne in mind that adding a biostimulator can also have a negative effect.

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