ASPECTS REGARDING THE BEHAVIOUR OF THE *CAPSICUM ANNUUM* L. SPECIES TO THE ULTRASOUND TREATMENT

Anişoara STRATU [1], Mihai PEPTANARIU [2], Violeta SÂRGHI [1], Naela COSTICĂ [1]

[1] „Al. I. Cuza" University of Iaşi
[2] National Research and Development Institute for Technical Physics Iaşi

Abstract

The paper presents the results of a study referring to the behaviour of the *Capsicum annuum L* species to the ultrasound treatment during the germination process and in the incipient phases of seedling growth (at Little Wonder variety) repectively of plant growth (at Splendid variety).
The results obtained emphasize specific values of the analyzed indicators (the percentage of germinated seeds, the water and dry substance content of the seedling / plants, fresh weight of the seedling / plants, the length of vegetative organs of the seedling / plants, the content of assimilatory pigments) according to the experimental conditions.
The percentage of germinated seeds progressively increases during the analyzed period. The germination is epigeous; is made easier on paper filter than in soil. At the end of the experiment (at 22/21 day) on constate: a high degree of hydration of the seedlings /plants in all the experimental variants; high values of the length of vegetative organs and of the assimilatory pigments content at variants with a short exposure time of ultrasounds.

Key words*:* ultrasounds, physiological and morphological indicators.

The researches carried out by a series of authors (Albu, E. et al., 1969; Dăbală, I., Auslander, D.,1970; Raianu, O., Zanvetor, Fr., 1969; Dimitriu, E. et al., 1990) have emphasized the stimulating effect of ultrasounds on the germination, growth and development of plants and on the vegetal production as well.

This paper continues our research on the influence of ultrasounds on species with food value (parsnips, cucumbers, spinach) made in previous years (Stratu, et al., 2005; 2009).

The paper presents results of a study on the influence of ultrasounds applied to seeds and plant from two varieties of pepper *(Capsicum annuum* L.).

MATERIAL AND METHOD

For the experiments, we used biological material from two varieties of pepper-seeds from the variety – Little wonder (pot red pepper), acquired from the Sem Luca company and plants of red pepper-Splendid variety, aged 52 days old.

The seeds/ plants were subjected to the action of an ultrasonic field, with the frequency of 48 and 36 kHz, electrical power of 60 and 30 V.A., at different time intervals: 1, 2, 4 minutes(for seeds) and 1.2 minutes (for plants).

For ultrasounding the seeds we used two ultrasound beats which distinguish themselves through the frequency and electrical power properties. After the ultrasounding, the seeds were inserted into water for drenching, for 24 hours in laboratory conditions. Afterwards, the seeds were placed in pots with soil that present the following characteristics: pH comprised between 5,5 - 6,5 ; water content of 60 - 70 %, azote - 410 ppm, phosphorus – 192 ppm, potassium 1350 ppm.For each category of vegetal material used, we achieved 5 experimental variants: a control variant and 4 treatment variants – where the seeds/ plants were treated with ultrasounds.Table 1 presents data on experimental variants for seeds.

Were used 100 seeds/ variants for germination in Petri plates and 20 seeds / variants for germination in soil. We analyzed the following indicators : the percentage of germinated seeds (we considered it equivalent with the percentage of seedlings emergence); the water and dry substance content of seedlings (Dimitriu E. et al., 1990) the fresh mass and the length of vegetative organs of seedlings at 22 days since the experiment beginning.Table 2 presents data on experimental variants for plants.

After ultrasonic treatment, plants (each four plants/ variant), they were planted in pots with soil with a pH between 5.5 to 6.5.

At the end of the experiment (at 21 days) we analyzed the following indicators: the water and dry matter content, the content of assimilating pigments, the average length of plant, the average number of leaves.

Table 1

The experimental variants- seeds

Experimental variants	Exposal time[minute]	Acoustic parameters	
		Frequency (kHz)	Electric power (W)
M	-	-	-
V1	1	48	60
V2	2	48	60
V3	2	36	30
V4	4	36	30

Table 2

The experimental variants- plants

Experimental variants	Exposal time[minute]	Acoustic parameters	
		Frequency (kHz)	Electric power (W)
M		-	-
V1	1	36	30
V2	2	36	30
V3	1	48	60
V4	2	48	60

RESULTS AND DISCUSSIONS

The results obtained emphasize specific value variations of the indicators analyzed according to the ontogenetic stage and the experimental conditions. We notice the fact that the seeds germinate easier in the boards than in the soil. The germination is epigeous.

In experimental variants - Petri plates, after 9 days since the experiment beginning, the percentage of germinated seeds varies between 15.71 % and 40%. In the control, the percentage of germinated seeds has an intermediary value (30%) to those registered in the treatment variants (*fig.1*).

During the period analyzed, the percentage of germinated seeds progressively grows; after 22 days since the experiment beginning, we register values comprised between 81.42% and 94.28 %. Compared with the witness, in the treatment variants we register a growth of the germinated seeds percentage with 3.16 % and respectively 4.75% in the variants with high frequency of the ultrasounds (VI, V2).

In experimental variants- in the soil, after 9 days since the experiment beginning, the percentage of germinated seeds varies between 10 and 20%. At the end of the experiment, this indicator has values between 70-90% (*fig.2*).

Compared with the control, we register a value growth of the percentage of germinated seeds with 14.28 % and 28.57% in the variants with high frequency of the ultrasounds (V1, V2)/ small frequency and small exposal time to the ultrasounds (V3.) In the seedlings grown in the soil, after 22 days since the experiment beginning, the water content has values comprised between 94.60 g % and 96.88 g %/ We ascertain small value variations between the control and the treatment variants (*fig.3*).The seedlings are hairy, the leaves are ovate-lanceolate. The epicotyl is little developed. The root is pivoting. The average length of seedlings has values between 8.61 cm and 9.04 cm.The average length of vegetative organs has values between: 4.33 cm - 4.98 cm for root, and 4.12 cm - 4.32 cm for hypocotyl (*fig.4*).

Compared with the control, in the treatment variants we register inferior values for the seedling and hypocotyl length. Fresh weight of seedlings has average values between 0.108 g and 0.141 g. Compared with the control (0.108 g), in the treatment variants, the average fresh weight of the seedlings (0.110 g and 0.141 g) has superior values.We notice the fact that, in the treatment variants with high exposal time, the average fresh mass of the seedlings has higher values than the control with 20.93% (at V2) and respectively 30.55 (at V4).

In the ultrasounded plants, at the experiment end, the water and dry substance content varies according to the organ analyzed and the ultrasounding parameters. Degree of hydration of vegetative organs is high. Water content has values between 89.56 g% - 93.95 g% for root, 86.61 g% - 89.39 g for stem; 86,98 g % - 89.02 g% for leaf (*fig.5*).Content of total assimilating pigments register, compared to the control, a value increase in the V1 variant (with 10.08%) and a value decrease in the other variants, more obvious in the V4 variant (with 18.62 %)(*fig.6*).The cl*a*/cl*b* ratio has values comprised between 2.5307 and 2.6742, which indicates a specific rhythms of biosynthesis for each of the two types of chlorophylls in the created experimental conditions. The plants in the variants M, V1, V2 had on the stem at the end of the experiment (21 days) a number of 10 leaves, and those from the variants V3 and V4- 9 leaves.

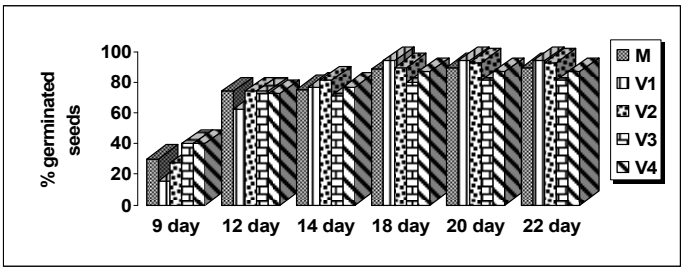

Figure 1 **The percentaje of germinated seeds : Petri plates**

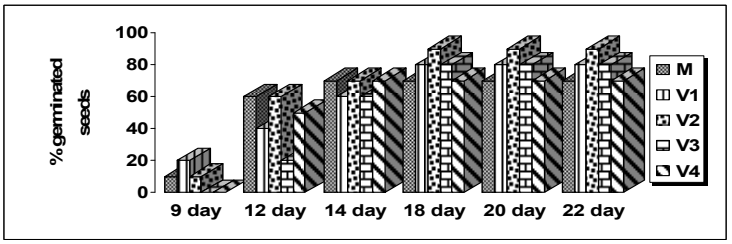

Figure 2 **The percentaje of germinated seeds: soil**

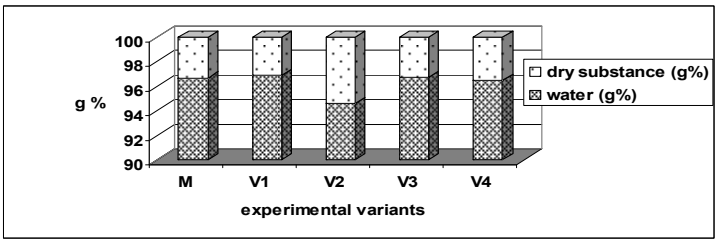

Figure 3 **The water and dry substance content of seedlings**

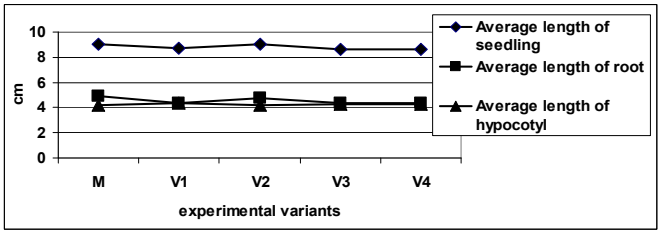

Figure 4 **The length of vegetative organs of seedlings**

In addition, we ascertained the fact that, at the end of the experiment (after 21 days – age of seedlings – 73 days) in all the experimental variants floral buttons were formed. In the control variant, 2 plants had floral buttons and in the variants of ultrasound treatment 3 of the 4 analyzed plants had floral buttons.

The average length of the plant_registered values comprised between 14.2 cm and 16.55 cm (*fig.7*). Compared with the control (16.55 cm), in the treatment variants, the average length of the plant has lower values, the value decrease being more obvious in the variants with long exposal time to ultrasounds.

According to the specialty literature, the biological action of the ultrasounds would be mainly due to the mechanical phenomena that determine modifications of the seeds (corrosion of the tegument, increasing of the water absorption capacity, stimulation of the enzymatic activity, modification of the cellular permeability).

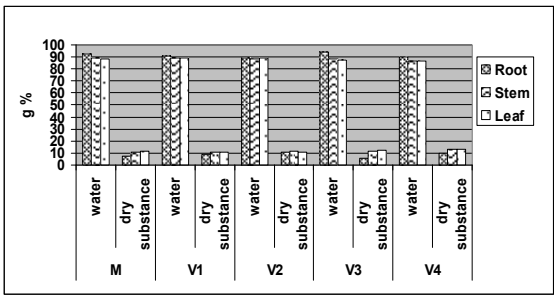

Figure 5 **The water and dry substance content at plants**

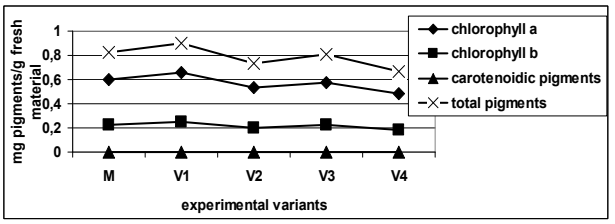

Figure 6 **The content of the assimilating pigments at plants**

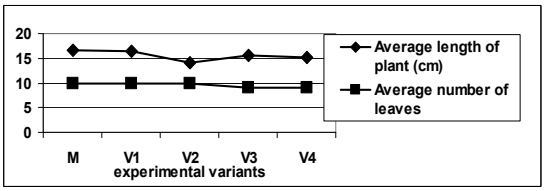

Figure 7 **Average length of plant / number of leaves**
ultrasounded plants

CONCLUSIONS

The ultrasound treatment influences specifically the seeds germination, the growth and development of plants. The treatment effects depend on the frequency of ultrasounds and the exposal time. The ultrasounds with high frequency stimulate the germination of seeds. The high exposal time to ultrasounds determines a fresh biomass growth in the seedlings. The long exposal time of plants to ultrasounds affects the degree of hydration of the vegetative organs, the biosynthesis of assimilating pigments and the growth in length of plants.

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