INFLUENCE OF LOW FREQUENCY ELECTROMAGNETIC RADIATION ON SUNFLOWER SEEDS GERMINATION

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Abstract. *The goal of the paper is to valorise the benefic effect of this type of electromagnetic radiations on seed germination and, later on, on plant growth and, last but not least, on the environment, through pollution decrease. The importance of the study comes from the fact that at present, in many countries of the world, there are researches being carried on that present the beneficial effect of these radiations on numerous field crops, and in the field of plant microbiology and physiology. Research was carried out in the laboratory of „Agricultural produces quality analysis" of the Department of Agricultural technologies of the Faculty of Agriculture. The working method used in the experiment is specific to determining germinative capacity, while in the treatment of the seeds we used the generator of electromagnetic radiations. The frequencies used in the seed treatment are those in the lower frequency range of wavelength between 0 and 100 Hz. The duration was 10 minutes and sowing seeds treated realizing immediately after treatment, knowing that such treated seeds must be sown in maximum 7-10 days after making it. We monitored the effect of 7 different wave lengths on 5 sunflower hybrids compared to the control with the following measurements: germinating energy (%),4 days after treatment, germinating capacity (%) 7 days after treatment, root weight (mg) 7 days after treatment, root length (cm), 7 days after treatment, fresh root volume (g), days after treatment, length of aerial part (cm), 7 days after treatment, weight of aerial part (g), 7 days after treatment. Depending on the magnetic field of the experimental area, a certain wave length can produce a positive or negative effect, which determines the necessity of very laborious studies in order to establish wave lengths for each species (cultivar, hybrid) and the area.*

Key words: *electromagnetic, waves, sunflower, radiation, effect,*

INTRODUCTION

The electromagnetic stimulation can increase soil microbiological activity and quantitative and qualitative properties of crops. The positive effect of electromagnetic pulses to stimulate germination and plant growth is not only caused by the induced current, but probably explained by resonance. So, is explained the effects obtained at plants by interaction of cellular systems stimulate with electromagnetic pulses that occur at the level of intracellular signals.

Usually, the influence of the electromagnetic field on the plants is aimed at the frequencies in the range between 10 MHz and 1 KHz.

According to some authors, stimulation of electromagnetic pulses act on structural change of water in the cell, which has a beneficial role on plants. The presence of electromagnetic field stimulates plant growth and development but at the same time, can act and repressive.

MATERIAL AND METHODS

The research was conducted in multidisciplinary research platform ,,Sustainable agriculture and food security", Laboratory "Testing quality of seeds and plant" from the USAMVB Timişoara, Faculty of Agriculture, using existing infrastructure: trays for plant germination, seed counter SC2 model and analytical balance to determine the mass of roots and aerial parts of the plants.

Biological material used in research was represented by five sunflower hybrids currently used on the largest area in the west of the country, namely: P64LE19, P64LE25, P64LE20, ES Aramis and NK Adagio, to determine the frequency that stimulates better the growth of plants.

Frequency codification under study was done randomly, without observing the increase scale of the determined parameters. Studied frequencies ranged within low-wave frequency, i.e. between 0 and 100 Hz.

The duration of the treatment was 10 minutes. Sowing treated seeds was done right after the treatment was applied, knowing from previous research that seeds thus treated should be sown maximum 7-10 days after the treatment.

Sowing was done in boxes 30 x 20 cm. In a box we sowed 40 treated seeds, and each variant was sown in three replications. The support on which seeds were sown was quartz sand, and watering the seeds was done with distilled water.

We monitored the effect of 7 different wave lengths compared to the control with the following measurements: germinating energy (%) at 4 days after treatment, germinating capacity (%) 7 days after treatment, root volume (mg) 7 days after treatment, root length (cm), 7 days after treatment, fresh root volume (g), 7 days after treatment, length of aerial part (cm), 7 days after treatment, dry aerial plant part volume (g), 7 days after treatment.

RESULTS AND DISCUSSIONS

Seed germination energy is expressed as the percentage of germinated seeds normally in 1/3 - 1/2 of the time set for the determination of germination.

Figure 1 shows the germination energy (%), determined at 4 days after treatment according to the hybrid. As for hybrids and variant of treatment, the highest germination energy is at P64LE20 hybrid registered in variant V5 (78%) and lowest in the P64LE25 hybrid in the V2 version. On average across the five variants treatment versus untreated control, the highest percentage of germination energy was in the version V4 and V5.

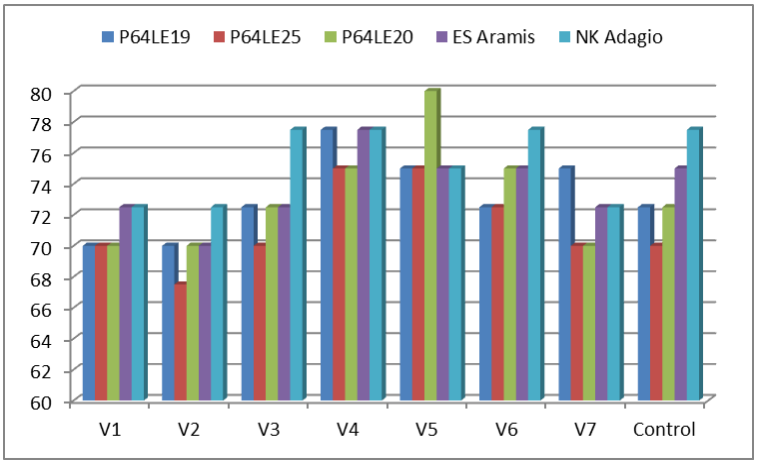

Figure 1. Germination energy (%) based on hybrid and applied treatment

Germination capacity of seeds is expressed as the numeric percentage of seeds normal germinated in optimally conditions, in a set time for each species. Germination is influenced by culture conditions, stage of harvesting, drying and storage mode seed.

The highest percentage of germination was recorded is at P64LE20 and P64LE25 hybrids registered in variant V4 (100%) and lowest in the ES Aramis and NK Adagio, the V1 version. On average across the five variants treatment versus untreated control, the highest percentage of germination energy was in the version V4 and V5.

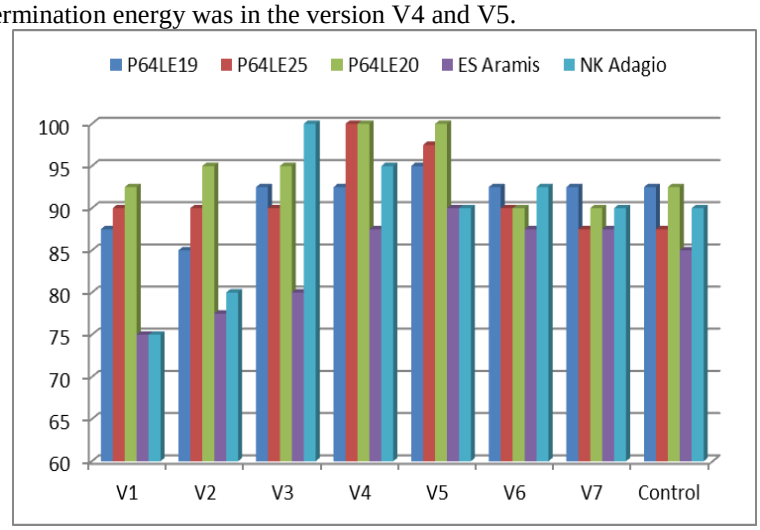

Figure 2. Germination capacity based on hybrid and applied treatment

Root volume was calculated after 7 days, and the results are shown in Figure 3. The data analysis reveals that the largest amount was recorded in the hybrid NK Adagio, V3 version (0.95 cm^3). About the volume depending of treatment comparing with the untreated

control, the largest volume was recorded in treatment option V3 (0.95 cm^3), followed by V4 (0.91 cm^3), hybrid NK Adagio, the difference from the control being 0,17 cm^3 and 0.12 cm^3.

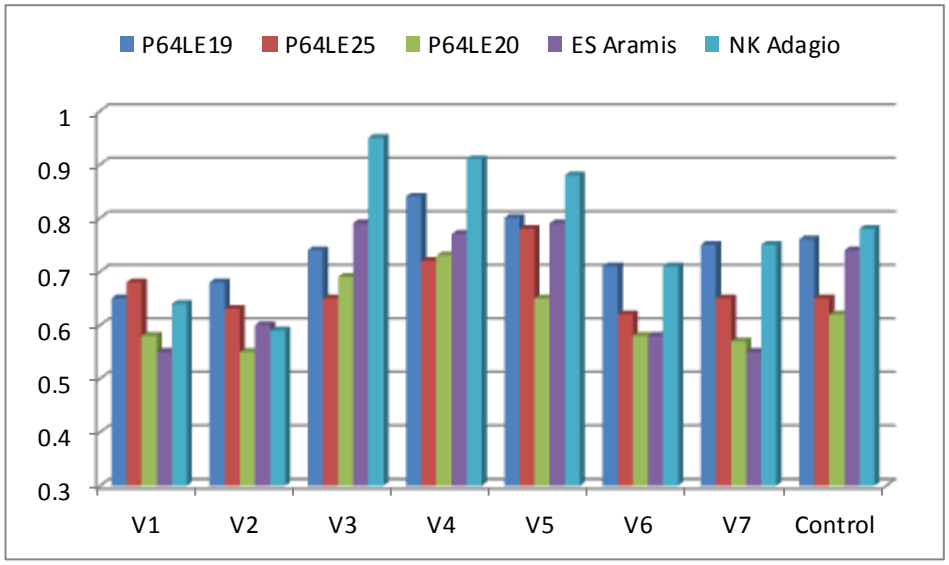

Figure 3. Root volume (cm^3), based on hybrid and applied treatment

Root length (cm), is shown in Figure 4. From the data analysis, we observed that the highest root length was recorded in the hybrid NK Adagio, version V4 (11.3 cm), and the lowest root length at hybrid ES Aramis in version V2 (6.2 cm). Compared to the control variant, in five experimental variants V3, V4, and V5, the root length was greater. In the other version , the electromagnetic stimulation treatment inhibited the growth of the roots, the roots were thus smaller average (fig. 4).

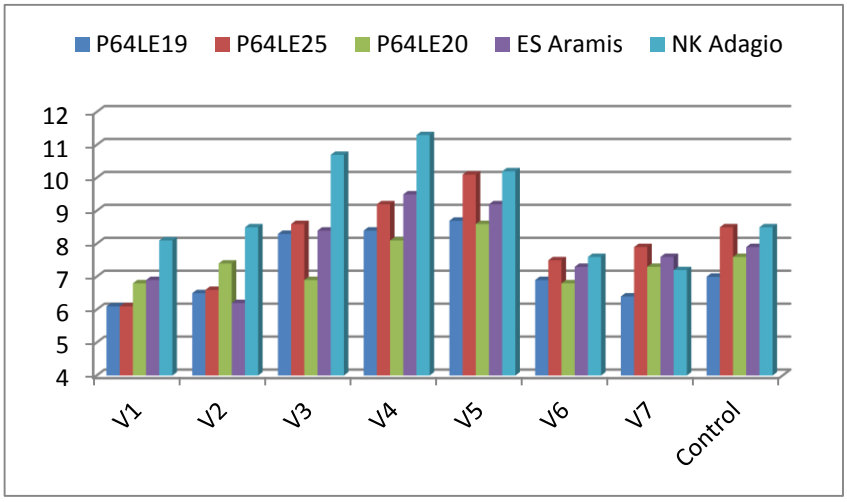

Figure 4. Root lenght (cm), based on hybrid and applied treatment

Another observed indicator was fresh root weight (g), calculated after 7 days. Comparing how the experimental variants influencing fresh root mass, is observed that the highest fresh weight was recorded in V5 version (1.65 g), hybrid P9528, and the smallest in variant V2 (0.41 g) at hybrid P9241. Analyzing variants stimulation compared to control untreated V5 version, root fresh weight increased by 0.61 g and V7 version, the increase was 0.54 g (fig. 5).

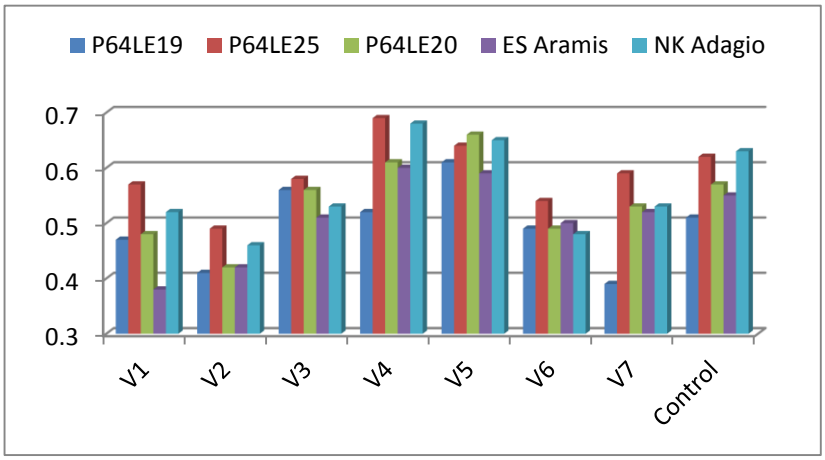

Figure 5. Fresh root weight (g), based on hybrid and applied treatment

Results of the length of the aerial part (cm), as determined after 7 days, are shown in Figure 6. The greatest length of the aerial part was recorded in version V 4, 12.4 cm, registered at P64LE25 hybrid and the smallest length of the aerial part was recorded in version V 1, 7,8

cm, registered at ES Aramis hybrid. On average, in V4 and V5 versions, the values were higher than the average control.

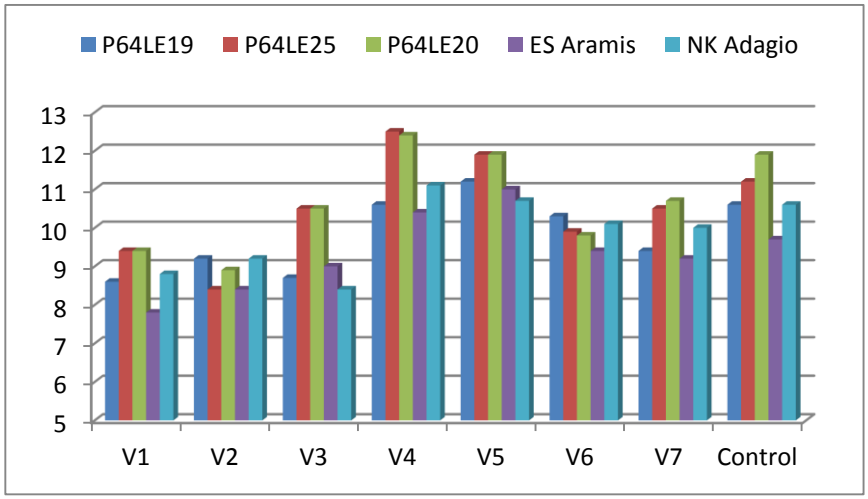

Figure 6. Length of the aerial part (cm), based on hybrid and applied treatment

The results of the aerial part mass (g) determined after 7 days are shown in Figure 7. The greatest mass of aerial part was recorded in version V 5, 1.24 g, registered at P64LE25 and ES Aramis hybrids and the smallest values was registered at V2 at P64 LE 19 hybrid of 0.48 g. On average, 2 of the 7 variants values were higher than the average control.

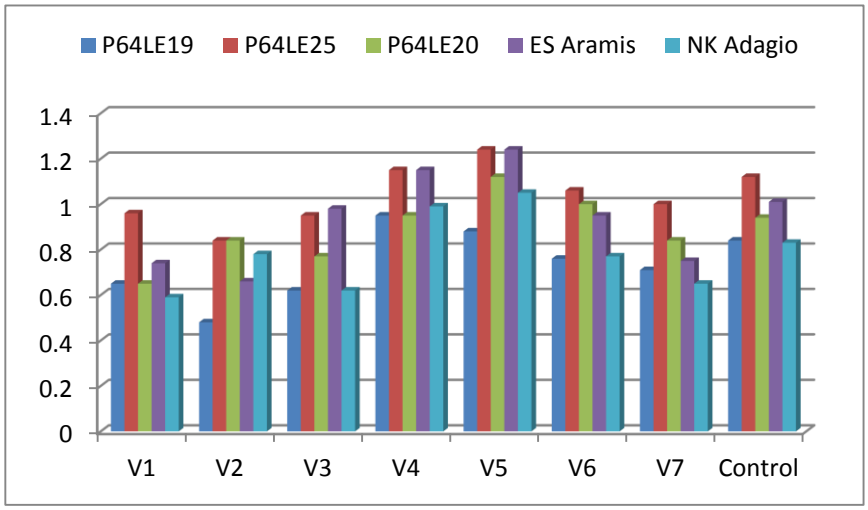

Figure 7. Aerial part mass (g) based on hybrid and applied treatment

CONCLUSIONS

Stimulating agricultural crops using low frequency electromagnetic radiation causes some gains in terms of analyzed parameters. Not all wave lengths influence positively, for which, in the future should be tested more treatment options in order to choose optimal variants. Also, as seen from the research, and in terms of the behavior of hybrids, are clear differences. Thus, the wave length positively influence the germination of a hybrid, root length, etc., and in the case of other hybrid inhibits these parameters.

Following the mode of transmission of the positive effect on germination and plant growth was succeeded on the same conditions of vegetation, which is not always the most favorable for plant growth and development, using electromagnetic stimulation, encourage a better rooting plants, so that in only 7 days after treatment, the root length was 11cm high, the root volume has also increased to 0.15 cm^3, and the fresh weight of the roots increased by 0.10 g.

Incentive effect resulting from the treatment of maize seed with different electromagnetic frequency radiation observed on the length of the aerial part and fresh mass of the aerial part. Experimentation of new technologies of cultivation of maize is an important step to optimize production capacity of corn hybrids to be introduced into the culture.

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