EFFECT OF LOW FREQUENCY ELECTROMAGNETIC RADIATION ON HUMIDITY AND WEIGHT CHARACTERISTIC OF CORN AND SUNFLOWER SEEDS

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Abstract *Radiations cause diverse morphological and physiological responses in plants, but the underlying mechanisms governing these integrated responses are unknown. It is known that electromagnetic radiation act on the water structure in cells, with beneficial effects on both germination and plants in vegetation. 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. In this paper we present the effect of 7 frequencies with wave lengths between 0-100 Hz on humidity and weight characteristics of corn and sunflower seeds comparative to the control. The duration of treatment 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. Measurements concerned the humidity and weight characteristics of corn and sunflower seeds were carried out in the laboratory of „Agricultural produce quality Analysis" of the Department of Agricultural Technologies, Faculty of Agriculture of the Banat University of Agricultural Science and Veterinary Medicine "King Michael the I-st of Romania" from Timişoara, In the experiment, we used as genetic material the corn hybrids P9175, P9528, PR36V52, PR37N01, P9241, and sunflower hybrids P64LE19, P64LE25, P64LE20, ES Aramis, NK Adagio and in the treatment of the seeds we used the generator of electromagnetic radiations of the Faculty of Agriculture of Novi Sad. The improvement of the evaluated functional variables suggests that the seeds may perform better with an electromagnetic field treatment.*

Keywords: *corn, sunflower, radiation, frequency, treatment*

INTRODUCTION

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.

Through electromagnetic stimulation, one can enhance microbiological activity in the soil and the quantitative and qualitative features of the 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.

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

MATERIALS 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.

The study present the effect of 7 frequencies with wave lengths between 0-20 Hz on humidity and weight characteristics of corn and sunflower seeds. The experiment was conducted in field, in vegetation vessels.

The duration of the treatment was 10 minutes and it was used the generator of electromagnetic radiations of the Faculty of Agriculture of Novi Sad.

Biological material used in research was represented by five corn hybrids currently used on the largest area in the west of the country, namely: P9175, P9528, PR36V52, PR37N01, P9241 and five sunflower hybrids: P64LE19, P64LE25, P64LE20, ES Aramis and NK Adagio.

RESULTS AND DISCUSSIONS

To characterize the specific climatic conditions for agricultural years 2013-2014, were used data recorded by OSPA Timisoara at Sanandrei Experimental Center (located on Route 56 Timisoara-Arad, Km 15.4) .

Regarding the rainfall, it may be noted that compared to the annual average was a deficit of 36.1 mm (tab 1).

Table 1

Monthly rainfall average, annual (2011-2013), at Center of Experimental Sanandrei and multiannual rainfall from 1931-2012 range (mm), Timisoara Weather Station

Agricultural year	Montly												
	IX	**X**	**XI**	**XII**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	Annual
13—14	41,5	42,0	37,5	0,0	25,5	27,5	10,0	21,5	124,8	27,5	169,0	67,0	593,8
normal	**46,1**	**54,8**	**48,6**	**47,8**	**40,9**	**40,2**	**41,6**	**50,0**	**66,7**	**81,1**	**59,9**	**52,2**	**629,9**
Differences	- 4,6	-12,8	-11,1	- 47,8	-15,4	-12,7	-31,6	-28,5	+58,1	- 53,6	+109,0	+14,8	- 36,1

To assess the impact of weather conditions on land productivity in the two stationary, the data were compared with significance of rainfall (reference limits in relation to the requirements of agriculture, (tab. 2) using data from agro-climatic resources of Timis County.

Table 2

The significance of rainfall (reference limits in relation to the requirements of agriculture)

Interval	Significance of rainfall				
	Very dry	Dry	Satisfactory	Optimum	Excedentary
September-October	Under 40	41-60	61-80	81-150	Over 150
November-March	Under 100	101-150	151-200	201-300	Over 300
April	Under 20	21-30	31-40	41-70	Over 70
May-July	Under 100	101-150	151-200	201-300	Over 300
Annual	Under 350	351-450	451-600	601-700	Over 700

Referring to the amount of rainfall in the high plain in agricultural year 2013-2014 it should be noted that they have optimal values in September-October, followed by a dry period during the winter (November - March) and in April and between May and July they present an excedentary aspect. Agricultural year 2013-2014 is characterized by values of rainfall within

the overall optimum and satisfactory characteristic, periods during which moisture deficit was offset by accumulated water reserves in the soil (tab 3).

Table 3

The significance of precipitation in relation to the requirements of agriculture, the 2013-2014 agricultural years, at Experimental Center Sanandrei

Characteristic periods										
Agricultural year	IX-X	Semnif.	XI-III	Semnif.	IV	Semnif.	V-VII	Semnif.	Annual	Semnif.
13-14	83,5	optimum	100,5	dry	21,5	dry	321,3	excedentary	593,8	satisfactory

At Sanandrei the experiences are placed on a haplic luvisol, medium clay loamy / medium clay loamy predominates in the Vinga Plain and representative of a significant surface in Banato-Crisana plain (Table 4).

Table 4

The physical and chemical properties of the haplic luvisol from Sanandrei

Analitical indices	Depth (cm)							
	0-17	17-30	30-47	47-65	65-90	90-120	120-150	150-200
Coarse sand (2.0 – 0.2 mm)	0.6	0.7	0.5	0.7	0.7	1.3	1.2	1.1
Fine sand (0.2 – 0.02)	36.9	36.9	34.9	36.0	37.3	34.7	34.2	35.1
Silt (I + II) (0.02-0.002 mm)	27.9	25.2	25.2	25.6	25.0	23.9	21.2	21.7
Coloidal clay (sub 0.002)	34.6	34.5	39.4	37.7	37.0	40.1	43.4	42.1
Phisical clay (praf II +arg col)	46.5	47.5	50.7	49.8	49.5	52.3	51.3	52.0
TEXTURE	TT	TT	TT	TT	TT	TT	TT	TT
Specific Density (Ds)	2.56	2.57	2.59	2.59	2.60			
Aparent density (Da)	1.45	1.64	1.61	1.59	1.66			
Total phorosity (PT)	43.36	36.19	37.84	38.61	36.15			
Aeration phorosity (Pa)	9.47	-2.12	-0.27	1.15	-2.89			
Higroscopical coefficient(CH)	14.38	28.51	26.51	24.52	29.16			
Fadind coefficient (CO)	8.11	8.09	8.23	8.83	8.67			
Field capacity (CC)	12.16	12.13	13.84	13.25	13.00			
Total capacity (CT)	23.37	23.36	23.67	23.56	23.52			
Utile water capacity (CU)	11.21	11.23	9.83	10.31	10.52			
pH in water	5.46	5.87	6.15	6.77	6.95	8.13	8.22	8.16
Carbonates ($CaCO_3$)						5.67	6.09	3.57
Humus	2.28	1.59	1.41	0.42				
Humus reserve t/ha	56.20	33.90	38.59	2.00	**130.69**			
Mobile phosphorous (ppm)	15.0	13.4	12.0	10.9				
Mobile potasium (ppm)	131.8	87.8	74.7	72.9				

Grain moisture at harvest and seed weight characteristics are influenced in a greater or lesser depending on agro-technical factors, climatic, etc. Also in agricultural practice, high values of these indicators show that regarding germination, seeds have germs well developed resulting vigorous plants, and in terms of technology, higher yield of flour extraction.

Moisture at harvest, depending on the wavelength used, is shown in Figure 1, 2. Although in terms of climate and humidity in particular, this year were recorded values below the annual average, the genetic of hybrids used in experiments stimulation produced by means of low-frequency electromagnetic waves are determined at the time of harvesting, moisture content as to allow the harvesting of grain.

The corn values of moisture at harvest ranged from 14.8% in variant V1 hybrid P9175 and 17.7%, the hybrid PR37N01, version V2. (Fig. 1) Seeds treated in variants V3 and V7

recorded humidity values below the control seed, emphasizing the beneficial effect of used wavelength.

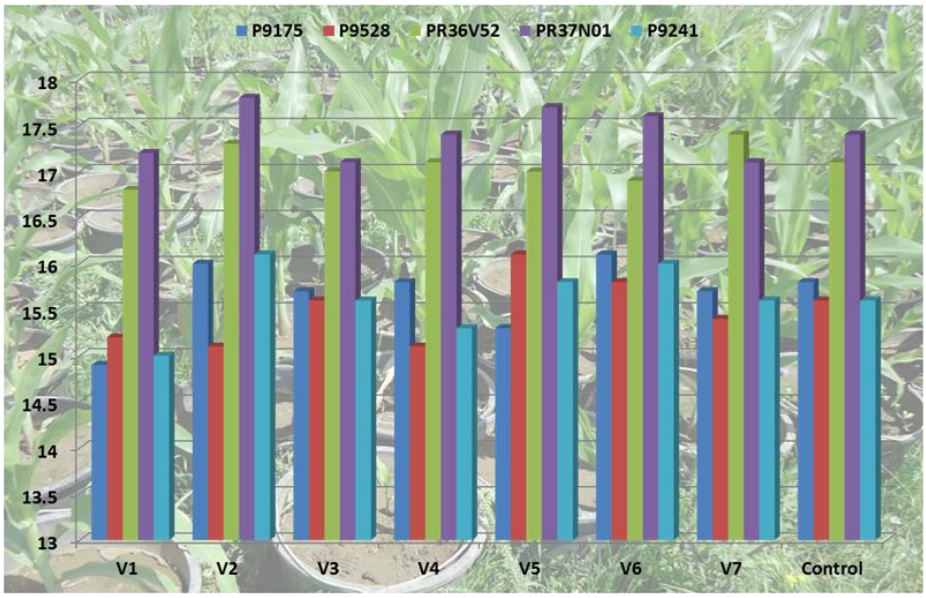

Fig.1 Corn seeds moisture (%)

At sunflower, grain moisture at harvest values ranged from 7.3% in variant V7, hybrid P64LE25 and 8.3%, the hybrid P64LE20 in the variant V5 (Fig. 2). The treated seeds from V4 and V5 have higher values than the control, other variants having a positive effect on moisture at harvest.

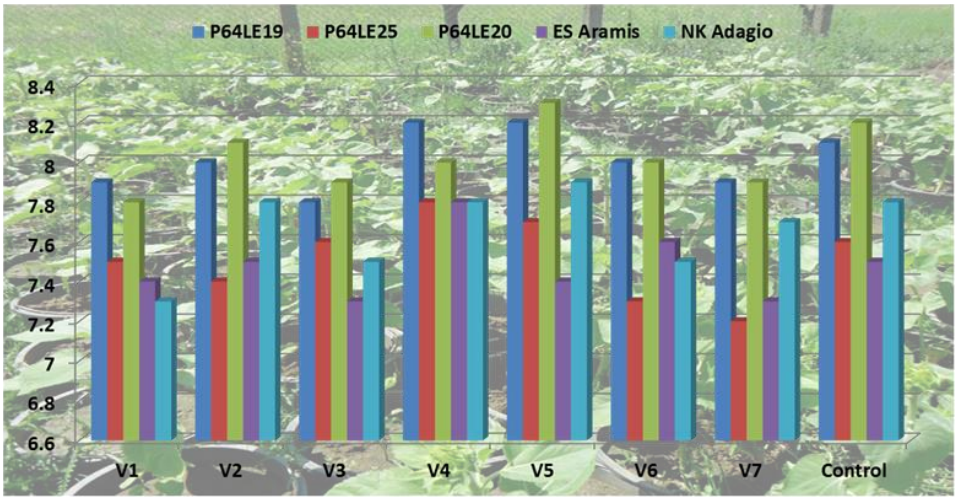

Fig.2 Sunflower seeds moisture (%)

Weight of 1000 grains determined by the wavelength of the experiment is shown in Figures 3 and 4. The analysis of the data, at corn, it is noted that corn compared to control untreated, the recorded values were between 315-400 g, by stimulating with electromagnetic radiation mass of 1000 grains values ranged from 296 g at the variant V2 , P9528 hybrid, to 410 g at V5 variant, the hybrid PR37N01 (Fig 3).

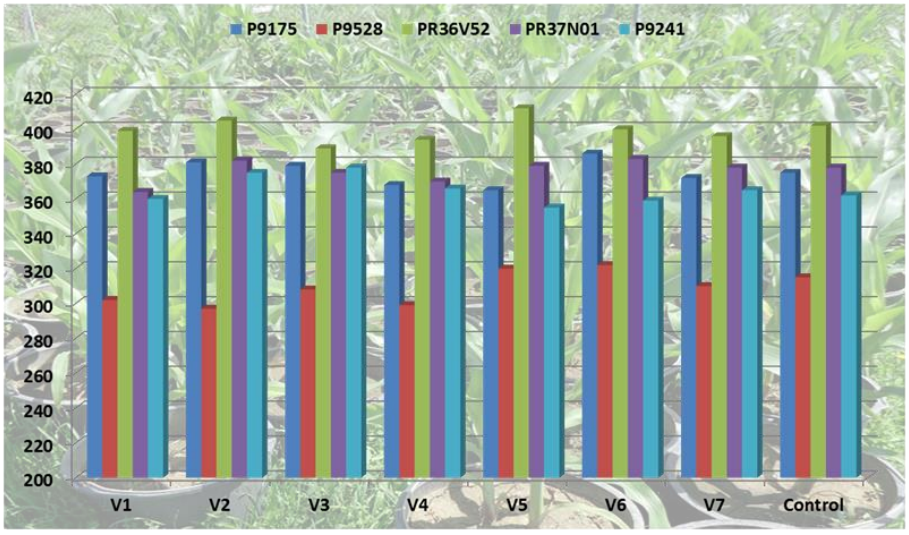

Fig. 3 Corn Mass of 1000 grains (g)

In sunflower, depending on the experienced wavelength, the value of mass of 1000 grains was influenced positively, being comprised between 54 g version V2, the hybrid NK Adagio and 68 g V5 version, the hybrid P64LE25. Mass of 1000 grains compared to the control value have higher values, between 4 g version V5 hybrid P64LE19 and 2 g P64LE25 hybrid version V5 (Fig. 4).

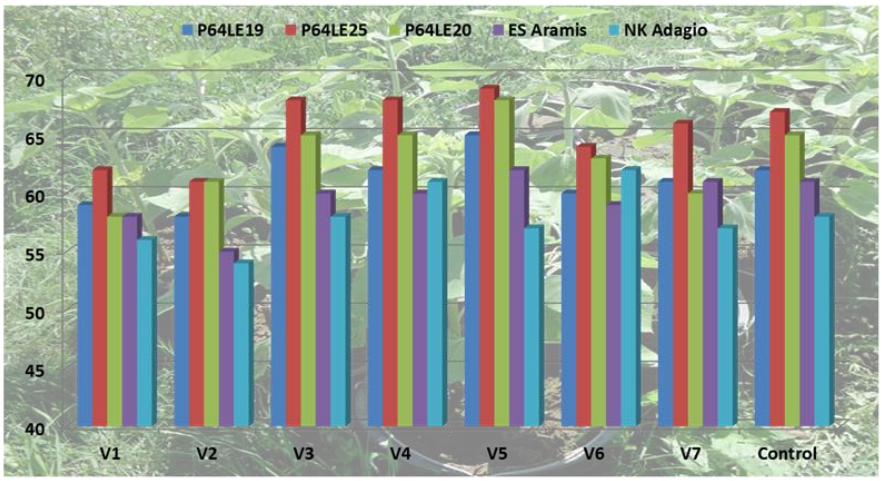

Fig. 4 Sunflower Mass of 1000 grains (g)

CONCLUSIONS

Analysing the impact of electromagnetic waves on seeds moisture and of the mass of 1,000 grains shows the positive impact of this type of stimulus on plants, an impact resulting in yield and quality increase.

Stimulation of agricultural crops using low frequency electromagnetic radiation causes some gains in terms of analyzed parameters. It should be borne in mind that not all wavelengths influence positively, for which, in the future should be tested more treatment options in order to choose the best solutions.

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