IMPACT OF ELECTROMAGNETIC WAVES ON BIOLOGICAL FEATURES IN MAIZE

Florin IMBREA, Branko MARINCOVIC, Valeriu TABĂRĂ, Paul PÎRŞAN, Gheorghe DAVID,Lucian BOTOS,

Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Agricultural Sciences, Timisoara, Aradului Street, no. 119, RO-300645, Romania, imbrea_fl@yahoo.ca

Abstract.*The 20th century is to be noticed, among other things, for the technical and technological revolution in all the fields of activity. Bernard C. said that biology "should take over from physics and chemistry the experimental method while preserving its own phenomena and laws". At present, at international level, it is known that electromagnetic waves act on the water structure in cells, with beneficial effects on both germination and plants in vegetation. In this paper we present the positive effect of 5 frequencies whose wave lenghts is between 0-100 Hz on maize plants growth comparative to the control. Measurements concerned the fresh weight of the root (mg), the dried weight of the root (mg), the volume of the root (ml), the fresh weight of the aerial part (mg), the dried weight of the aerial part (mg), the length of the aerial part (mg), and the length of the root (cm). these measurements were made 30 days after plant sprouting. Research was carried out in the laboratory of „Agricultural produce quality analysis" of the Department of Agricultural technologies of the Faculty of Agriculture of the Banat University of Agricultural Science and Veterinary Medicine in Timişoara, using 1/1 boxes; the nutritious solution was used after the Jork method that best renders soil conditions. In the experiment, we used as genetic material the maize hybrid PR37D25 developed by the Pioneer Hi Bred Seed Co., and in the treatment of the seeds we used the generator of electromagnetic radiations of the Faculty of Agriculture of Novi Sad thanks to Professor Branko Marinkovic, a member of the research contract that finances the present study. The results of the present study are part of a research project PN II IDEI Contract nr. 1076/2009, topic code ID_864, financed by the Ministry of Education, Research, Youth and Sport, through the National Council of Scientific Research in Higher Education. The topic of the project is „Study concerning low-frequency electromagnetic waves effect on crop and quality in maize".*

Key words**:** *words, electromagnetic waves, biological features, irradiation*

INTRODUCTION

These last years, because of the high drought in spring and because of the improper preparation of the germination bed, maize cultivators in the area have been confronted with serious problems from the point of view of even sprouting of maize crops. Literature mentions that low-frequency electromagnetic waves act on the structure change in the cell which has a beneficial role on plants.

MATERIAL AND METHODS

We have studied the maize hybrid PR37D25 developed by Pioneer Hi Bred Seed, which is being cultivated on the largest areas in Western Romania.

We monitored the effect of 5 frequencies compared to the control variant (not treated) and we made the following measurements:

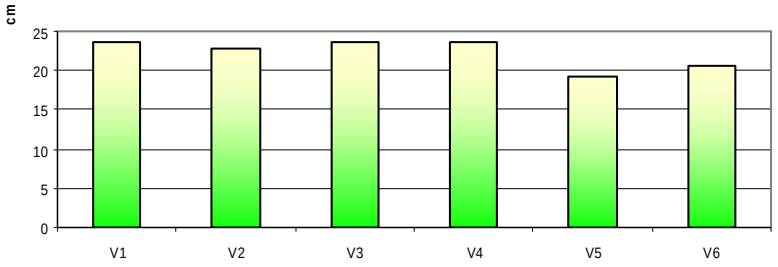
- maize root length (cm) after 30 days;
- maize aerial part length (cm) after 30 days;
- fresh maize root weight (g) after 30 days;
- dry maize root weight (g) after 30 days;
- fresh maize aerial part weight (g) after 30 days;
- dry maize aerial part weight (g) after 30 days.

After germination, the plantlets were transplanted into boxes measuring 10 x 10 cm, and the nutritious solution we used to feed the plants was after the Jork method.

Dry maize root weight and dry aerial part weight were determined at the Seed quality testing laboratory of the Department of Plant cultivation technology, using a Thermo-balance.

RESULT AND DISCUSSION

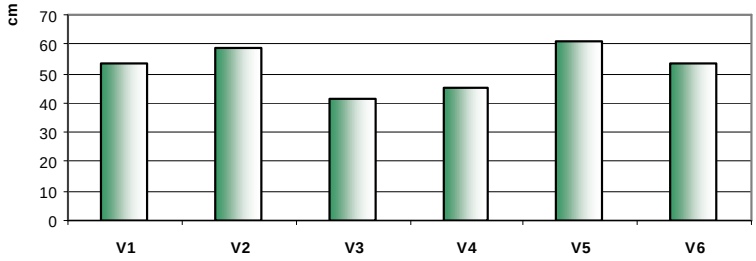
Figure 1 presents the results we obtained depending on the treatment from the point of view of maize root length, measurements made 30 days after treatment. We can see that, compared to the control variant (not treated), when treating with three different wave lengths (V1, V3 and V4), the stimulating effect was positive, maize root length being 2.8-2.9 cm longer than that of the control variant (not treated). In a single case, the stimulating effect was negative, maize roots being 1.4 cm shorter than the control variant (not treated). In the variant V2, maize root length was 2.16 cm longer than that of the control variant (not treated).



Mean	23,68	22,86	23,54	23,6	19,3	20,7
%	114	110	114	114	93	100
Difference	2,98	2,16	2,84	2,9	-1,4	
DL5%=1,5; DL 1%=2,13; Dl 0,1%= 3,08.						

Fig.1 Maize root length (cm)

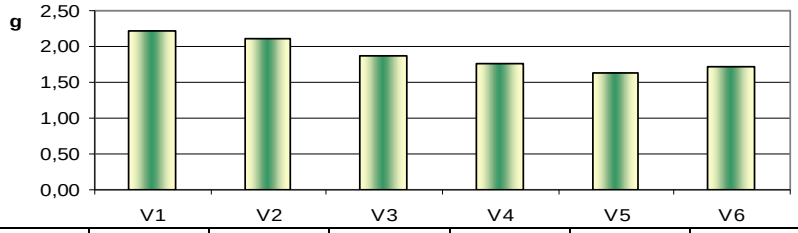
The impact produced by electromagnetic stimulation on maize plant growth is presented in Figure 2. We can notice that, compared to the control variant (not treated), in the variant V5 there was the highest growth of the aerial part, i.e. 7.68 cm longer. To also note that in the variant V5 the roots were the shortest.



Mean	53,68	58,8	41,28	44,94	61,08	53,4
%	101	110	77	84	114	100
Difference	0,28	5,4	-12,12	-8,46	7,68	
DL5%=1,5; DL 1%=2,13; Dl 0,1%= 3,08.						

Fig. 2 Maize aerial part length (cm)

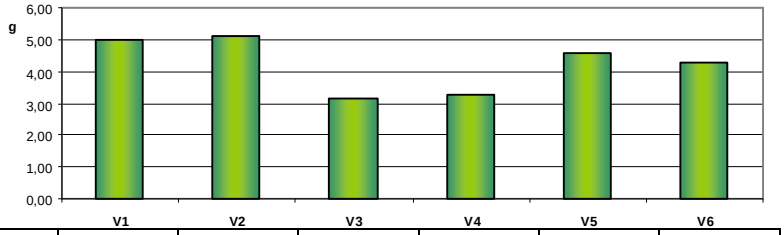
Figure 3 presents the results we obtained related to the fresh maize root weight measured 30 days after treatment. As expected, in the variants with the longest root lengths, there were also the highest values of the maize fresh weight. The differences were between 0.17 g in the variant V3, 0.39 g in the variant V2, and 0.52 g in the variant V1. The variant V5 of stimulation, we measured a fresh maize root weight 0.09 g smaller than that of the control Variant (not treated).



Mean	2,23	2,1	1,88	1,76	1,62	1,71
%	130	123	110	103	95	100
Difference	0,52	0,39	0,17	0,05	-0,09	
DL5%=0,24; DL 1%=0,34; Dl 0,1%= 0,49.						

Fig. 3 Fresh maize root weight (g)

Figure 4 presents the results concerning the fresh maize aerial part weight depending on the five wave lengths compared to the control variant (not-treated), measurements made 30 days after applying the seed treatment. To note that, though the highest increase of the maize aerial part was in the variant V5 compared to the control variant (not treated) – a difference of 7.68 cm – from the point of view of the maize aerial part weight the highest values were in the variants V1 (5.00 g) and V2 (5.10 g). Through electromagnetic stimulation, the longest lengths of the maize root and the highest fresh maize weight are produced, which can be explained by the vigour of the plants treated.

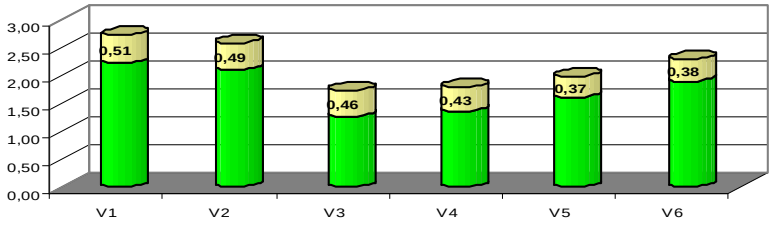


Mean	5	5,1	3,12	3,26	4,55	4,25
%	118	120	73	77	107	100
Difference	0,75	0,85	-1,13	-0,99	0,3	
DL5%=0,28; DL 1%=0,41; Dl 0,1%= 0,58.						

Fig. 4 Fresh maize aerial part weight (g)

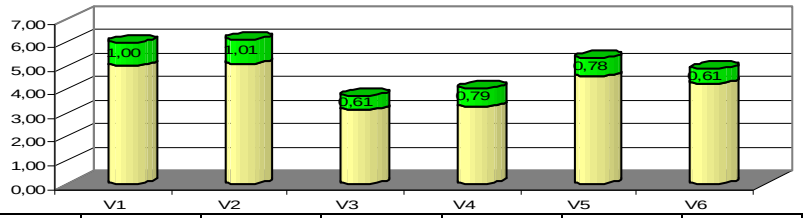
Dry maize root weight measured 30 days after treatment show that the highest values were in the variants V1 (0.51 g), followed by the variant V2 (0.49 g), with differences compared to the control variant (not treated) of 0.03 g in the variant V1 and 0.01 g in the variant V2 (Figure 5).

Results concerning the dry maize aerial part weight are presented in Figure 6. In the case of this indicator too, there are the highest values in the variants V1 and V2, the differences compared to the control variant (not treated) being 0.39 g and 0.40 g, respectively.



Mean	0,51	0,49	0,46	0,43	0,37	0,48
%	106	102	96	90	77	100
Difference	0,03	0,01	-0,02	-0,05	-0,11	
DL5%=0,11; DL 1%=0,20; Dl 0,1%= 0,31.						

Fig. 5 Dry maize root weight (g)



Mean	1,00	1,01	0,61	0,79	0,78	0,61
%	164	166	100	130	128	100
Difference	0,39	0,4	0	0,18	0,17	
DL5%=0,18; DL 1%=0,26; Dl 0,1%= 0,35.						

Fig. 6 Dry maize aerial part weight (g)

CONCLUSSION

1. Stimulating maize seeds with low-frequency electromagnetic radiations has a positive effect on plant growth from both the point of view of maize root length – which resulted in a better resistance to drought during the first phases of vegetation – and of absorption of nutrients. Maize root length depending on wave length was 2-3 cm longer than that of the control variant (not treated). A single wave length of the five experimental ones had a negative impact on root growth.

2. Through electromagnetic stimulation, there is better root growth during the first vegetation phases, and later, through better absorption and resistance to stress factors – particularly drought – the crops get to yield more.

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