A CORRELATION STUDY BETWEEN THE APPLICATION OF PHYTOSANITARY TREATMENTS AND THE EFFECTS OF ELECTROMAGNETIC FIELD, AT *PHASEOLUS VULGARIS* L., IN GREENHOUSE CONDITIONS

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Abstract. *The objective of this research was to correlate the effect of electromagnetic field on Phaseolus vulgaris L. var. nanus plants, in the greenhouse conditions and the action of conventional and unconventional phytosanitary treatments. The study was carried out at the University of Agricultural Sciences and Veterinary Medicine Cluj – Napoca, in the spring of 2016. The system for generating the electromagnetic field on the plants in the greenhouse experiments consists in a microwave generator and an open dipole antenna, of total length 7.3 m, located at a distance of 50 cm above the pots with plants. The experiments aim the use of foliar treatments with Bio Flama (unconventional treatment) and Captan 80WDG (conventional treatment). For processing the data, STATISTICA v.8.0 for Windows was used. The simple correlations were obtained by using the " Basic statistics" facility from the statistical program. Under greenhose conditions, multiple correlations of low intensity were identified in the absence of phytosanitary treatments and when applying phytosanitary treatments, weak (and medium to strong correlation were recorded on the electromagnetic field. In the absence of irradiation and phytosanitary treatments a multiple average correlation was reported, while when applying Captan 80WDG and Bio Flama, the correlations were medium.*

Key words: *Phaseolus vulgaris L., electromagnetic field, irradiation, greenhouse, phytosanitary treatments*

INTRODUCTION

Due to the accelerated growth and the emancipation of human population and its requirements, especially for food, nature becomes increasingly powerless. Following the rush for profit, agriculture become more distant to nature, while human creations were developing - mechanization, chemisation, irrigation and, more recently, genetic engineering. The industrialization and modernization of all social life's aspects has caused a strong environmental pollution (ALADJADJIYAN A., 2007). Chemical compounds are largely used for improving the plant protection against plant diseases and pests (OROIAN ET AL., 2003). Uncontrolled use of chemicals is hazardous for the contamination of raw materials for food production with different couponds dangerous for the health of consumers (ODAGIU ET AL. , 2003).

The substitution of chemical treatments with physical factors for controlling influence on biological behaviour during development, is a modern trend in combining the intensification of plant technologies with the ecological requirements. It could be important for biological and organic agriculture.The effect of weak electromagnetic field on biological systems became more and more interesting for researchers. Lots of studies demonstrate that this field have positive influence on seeds germination (increase the germination velocity, and uniformity of growing velocity), roots and stem growth, leaves area, dry matter content, and

plant yields, in different crops, as wheat, barley, lentils, lettuce, tomato, common bean, etc. (PIRUZYAN ET AL., 2004; DE SOUZA ET AL., 2006; ESITKEN, 2003; IJAZ ET AL., 2012).

The objective of this study was to investigate the dynamics of the developments of *Phaseolus vulgaris* L., from germination to the production of pods and beans in greenhouse environment, under the action of conventional and unconventional phytosanitary treatments, correlated with the irradiation conditions. The climatic parameters, represented by ambient temperature and air humidity were monitored. For processing the statistical data, STATISTICA v.8.0 for Windows was used. The simple correlations were obtained by using the "Basic statistics" facility from the portfolio of the above mentioned statistical programme.

MATERIAL AND METHODS

The study was done under greenhouse conditions at the University of Agricultural Science and Veterinary Medicine Cluj – Napoca, in the spring of 2016. The biological material consists in the dwarf bean, *Phaseolus vulgaris* L. var *nanus* respectively, Ardeleanca stain.

The system for generating the electromagnetic field on the plants in the greenhouse experiments it was composed of a microwave generator (1) a open dipole antenna (2), of total length 7.3 m boosted in the middle, located at a distance of 50 cm above the pots with plants (3). Electromagnetic field distribution was measured at ground level from the pots with a spectrum analyser Aaronia HS-6060. The pots were placed only in the field regions having a density of less than 3mW/m^2.

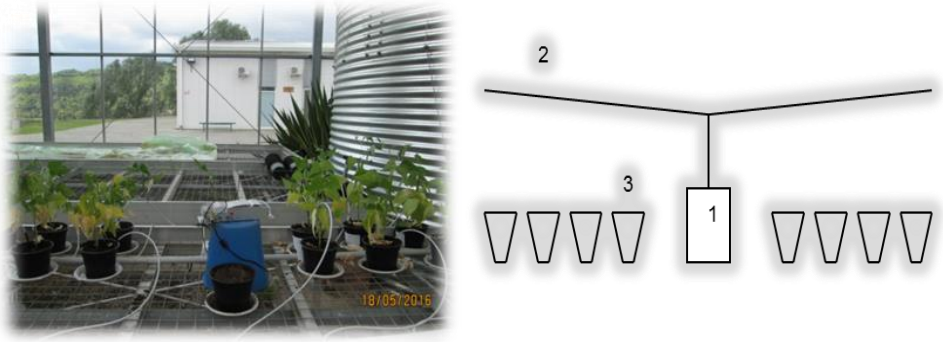

Fig. 1. The greenhouse setup (microwave generator (1) , a dipole antenna (2), pots with plants (3))

Plant protection plays an extremely important role in increasing the production of agricultural crops and in protecting them. In our experiment products for foliar application namely Bio Flama (Holland Farming) - unconventional treatment, and Captan 80 WDG (Arysta LifeScience) - conventional treatment, were used.

RESULTS AND DISCUSSION

The process of growing of beans plants, under greenhouse conditions, shows a statistically higher development, at different thresholds of significance, with all phytosanitary treatments, including the control, where plants are placed in the electromagnetic field.

The correlations between parameters of physiological development of comon bean plants, under greenhouse conditions, in the absence of the electromagnetic field and phytosanitary treatments, emphasizes that the dry matter of bean plants is positively correlated with a medium intensity, by the length of stems (R = + 0.570), the number of pods (R = +0.598) and the amount of production of grain (R = +0.489) (Table 1). In the same conditions, the analysis of the interrelation between the length of stems, pods production on bean plants, shows a positive medium multiple correlation (R = +0.467).

In the same environment, positive correlation (R = +0.540) between the weight of the beans and the number of pods is recorded. Length of stems, however, are weak positively correlated (R = +0.335) with the production of pods, while the correlation of stems length with beans weight is weak, and negative correlated, as evidenced by the correlation coefficient of (R = - 0.258) (Table 1).

Table 1

The matrix of correlations between the stem length and quantitative and qualitative traits of *Phaseolus vulgaris* L. var. *nanus* productions in greenhouse, in conditions of lack and presence of irradiation in no treated plants

Issue	Stem length (cm)	Pods production (g)	Beans production (g)	Dry matter (%)
Not irradiated				
Stem length (cm)	-	+0.335	-0.258	+0.570
Pods production (g)	-	-	+0.540	+0.598
Beans production (g)	-	-	-	+0.489
Irradiated				
Stem length (cm)	-	-0. 895	-0.183	+0.100
Pods production (g)	-	-	+0.251	-0.255
Beans production (g)	-	-	-	-0.978

Regarding the interrelationship between the physiological development parameters of bean plants treated with Bio Flama - unconventional product, in the absence of the electromagnetic fields, and specific microclimate, this study shows that the dry matter of bean plants is positively correlated, with a low intensity, with stems length (R = +0.113) and the average number of pods (R = +0.431), while the quantity of grain is strong correlated with the production, but negatively (R = -0.817).

Production of beans is, under these experimental conditions, positively correlated, but very weak, with the production of pods (R =+0,040), but negative with the average of stems length (R = -0.440). In terms of production of pods, the correlation it is weakly negative correlated (R = -0.172) with length stems (Table 2).

The dry matter is negatively strong correlated with the number of pods (R = -0.840), but positive (R = +0.634) with the weight of the beans (R = -0.978). A medium positive correlation (R = +0.682), is noted also, between stems length and beans production, while between pods production and beans production, the negative correlation (R = -0.430) falls into the medium category (Table 2).

Taking into discusion the biometric traits of bean plants, irradiated, under greenhouse conditions, which are phytosanitary treated with Captan 80WDG - conventional product, one may find that the dry matter of bean plants is positively correlated with the production of beans in a strong manner (R = 0.828), and with the production of pods in a weak to medium manner (R = +0.311), but negtative weakly with stems length (R = -0.190). Pods production is weakly positive correlated with stems length (R = +0.277). Also a negative correlation, with a low intensity, is established between stems lenght and pods production (R = -0.287). In the same experimental conditions, in the absence of irradiation, there is a negative influence of dry matter content on the beans and pods production and stems length. If the first interrelation is strong (R = -0.915), the other two are with a low intensity (R = -0.316 and R =-0.222) (Table 3).

Table 2

The matrix of correlations between the stem length and quantitative and qualitative traits of *Phaseolus vulgaris* L. var. *nanus* productions in greenhouse, in conditions of lack and presence of irradiation in plants unconventionally treated with Bio Flama

Issue	Stem length (cm)	Pods production (g)	Beans production (g)	Dry matter (%)
Not irradiated				
Stem length (cm)	-	-0.172	-0.441	+0.113
Pods production (g)	-	-	+0.040	+0.431
Beans production (g)	-	-	-	-0.817
Irradiated				
Stem length (cm)	-	+0.263	+0.682	-0.128
Shucks production (g)	-	-	-0.430	-0.846
Beans production (g)	-	-	-	+0.634

Table 3

The matrix of correlations between the stem length and quantitative and qualitative traits of *Phaseolus vulgaris* L. var. *nanus* productions in greenhouse, in conditions of lack and presence of irradiation in plants unconventionally treated with Captan 80WDG

Issue	Stem length (cm)	Pods production (g)	Beans production (g)	Dry matter (%)
Not irradiated				
Stem length (cm)	-	-0.285	+0.546	-0.222
Pods production (g)	-	-	+0.100	-0.316
Beans production (g)	-	-	-	-0.915
Irradiated				
Stem length (cm)	-	-0.287	+0.277	-0.190
Shucks production (g)	-	-	-0.148	+0.311
Beans production (g)	-	-	-	+0.828

In the same experimental conditions, but in the absence of electromagnetic field, the content of dry matter increased in the detrimental way of other parameters analyzed, however, with the most important influence, on beans production. Bean production is stimulated in a reduced manner of the pods production, but in a medium maner of a stems length. The latest one, being negatively affected, even on a smaler maner by increasing the pods number (Table 3).

CONCLUSIONS

The output resulting from the complex of correlations represents an important database issued from the experiment that was carried out following a complex experimental design. The results consist in an important theoretical and experimental basis, leading to significant recommendations that can be useful for the development of scientifical research in the field, and especially for those approaching this topic in practical terms.

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