



Original Article

Comparative Study on Common Bean Behaviour within Different Germination Conditions

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Abstract

Common bean (*Phaseolus vulgaris* L.) is one of the most important species used for food supply in human nutrition all over the world. It has multiple uses as food in genuine state or as raw material for food industry. The influence of physical factors upon the behaviour of increasing production of different cultures combining with the newest ecological technologies it is important for the agriculture of our century. One interesting approach is that of the influence of electromagnetic field influence on common bean (*Phaseolus vulgaris* L.) developmental process. The aim of this research is to emphasize the correlations between the root and stem increases in non-irradiated and irradiated conditions, in common bean (*Phaseolus vulgaris* L. cv. Ardeleana). Our experiment was developed within Laboratories of the Advanced Research Centre for Environmental Protection and Assessment of Life Quality from USAMV Cluj-Napoca. The duration of this trial was 8 days, taking into account the SR 1634/99 settlements. For plant growth in low microwave field under controlled environment, a special equipment was designed, manufactured and tested at the National Institute for R&D of Isotopic and Molecular Technologies Cluj-Napoca. Both irradiated and non-irradiated conditions of common bean (*Phaseolus vulgaris* L.) led to strong and very strong correlations between root length and stem height. In non-irradiated conditions, strong correlation coefficient is $R = 0.865$ was obtained, while the determination coefficient was $R^2 = 74.80\%$. In irradiated conditions, the correlation coefficient is $R = 0.955$, while the determination coefficient was $R^2 = 91.20\%$. The approach of the separate points of the regression line demonstrate the parametric dependence between variables and suitability of the statistical approach.

Keywords: biometric approach, dry matter, parameter, *Phaseolus vulgaris* L..

1. Introduction

Common bean (*Phaseolus vulgaris* L.) is one of the most important species used for food supply in human nutrition all over the world. conditions *Phaseolus vulgaris* L.

It is well known that common bean (*Phaseolus vulgaris* L.) is one of the most sensitive culture to environmental. It is a thermophile plant that has special temperature needs, its development being best at temperature intervals of 15 - 20°C.

It is also important to know that seed germination is very affected by temperature.

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The seeds germination develops best within temperature interval of 8 - 10°C (and it is noticeable that best temperature for this process is 32°C).

The growing process of common bean is best developed at average temperature of 20°C [9].

If temperature records bigger values than those we mentioned, accompanied by water scarcity, high temperature oscillations along the vegetation period also can lead to decreased germination percentage and decrease the number of plants. If we refer to water, beans have moderate requirements but they differ depending on vegetation phases.

The influence of physical factors upon the behaviour of increasing production of different cultures combining with the newest ecological technologies it is important for the agriculture of our century. One interesting approach is that of the influence of electromagnetic field influence on common bean (*Phaseolus vulgaris* L.) developmental process. According to Racuciu et al. [2] the magnetic exposure to low static magnetic field (50 mT) has stimulatory influence on plants in early ontogenetic stages, especially.

Lots of research [5, 6] developed in Romania and abroad demonstrate the role of the microwave irradiation in order to obtain a higher productions in healthy conditions, avoiding excess of fertilizers and pesticide use. The aim of this research is to emphasize the correlations between the root and stem increases in non-irradiated and irradiated conditions, in common bean (*Phaseolus vulgaris* L. cv. Ardeleana).

2. Material and Method

Our experiment was developed within Laboratories of the Advanced Research Centre for Environmental Protection and Assessment of Life

3. Results and Discussions

The results of our research demonstrates that concerning the correlation between the common bean (*Phaseolus vulgaris* L.) stem height growing in irradiated (V7) and non-irradiated (V5) conditions, a strong correlation was obtained.

The Pearson correlation coefficient is $R = 0.865$, while the determination coefficient was $R^2 = 74.80\%$. The regression line $Y = 1.275 + 0.605 X$ (Fig. 1). The approach of the separate points of the regression line demonstrate the parametric dependence between variables and suitability of the statistical approach.

Quality from USAMV Cluj-Napoca. The duration of this trial was 8 days, taking into account the SR 1634/99 settlements.

For plant growth in low microwave field under controlled environment, a special equipment was designed, manufactured and tested at the National Institute for R&D of Isotopic and Molecular Technologies Cluj-Napoca.

In order to supply the microwave exposure, two identical anechoic chambers were used: reference chamber (R) and an irradiation chamber (I), both with controlled environment (identical humidity, temperature, light intensity and radiofrequency isolation to/from the external environment). The common bean (*Phaseolus vulgaris* L.) was submitted to a microwave generator used for irradiation has been set to GSM900, frequency range 890-915MHz and the power level at the irradiation chamber floor has been set to -20dBm, corresponding to a microwave power density of 1.28mW/m².

The bean seeds were washed with distilled water with the aim of eliminate impurities. A number of 49 seeds were placed on a support plate in the two anechoic chambers with controlled environment, (identical conditions of temperature and relative humidity) inside the reference (R) and irradiation chamber (I), while identical lighting conditions and water were supplied. The seeds were germinated in small glass pots ($\varnothing = 2$ cm and $h = 6$ cm), one seed in each pot, on wet cotton, covered with filter paper. To avoid seeds drying and to maintain humidity of the filter paper for plants growth process, 2 ml of potable water was added in the first day of the experiment and 0.2 ml periodically. No other substances were added in the water and to seeds. Data were statistically processed with STATISTICA v 6.0 for Windows.

The results of our research demonstrates that concerning the correlation between the common bean (*Phaseolus vulgaris* L.) stem root growing in irradiated (V7) and non-irradiated (V5) conditions, a very strong correlation was obtained.

The Pearson correlation coefficient is $R = 0.955$, while the determination coefficient was $R^2 = 91.20\%$. The regression line $Y = 0.652 + 0.748 X$ (Fig. 2).

The approach of the separate points of the regression line demonstrate the parametric dependence between variables and suitability of the statistical approach.

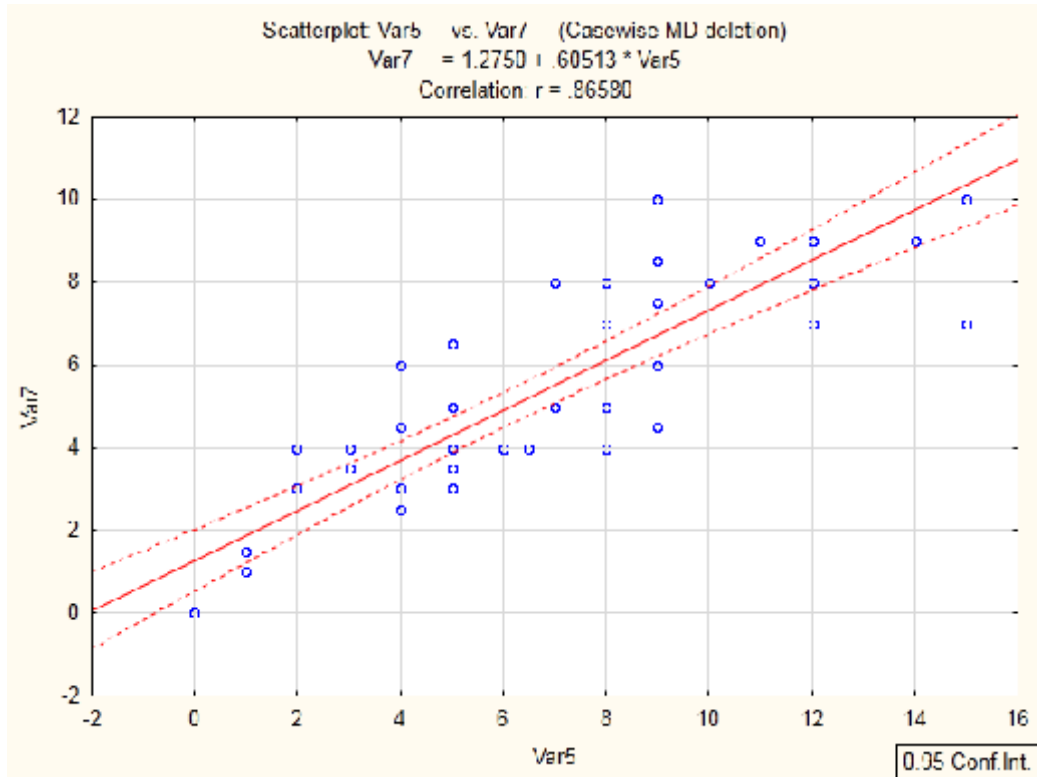


Figure 1. The correlation between the common bean root lengths and stem height within non-irradiated

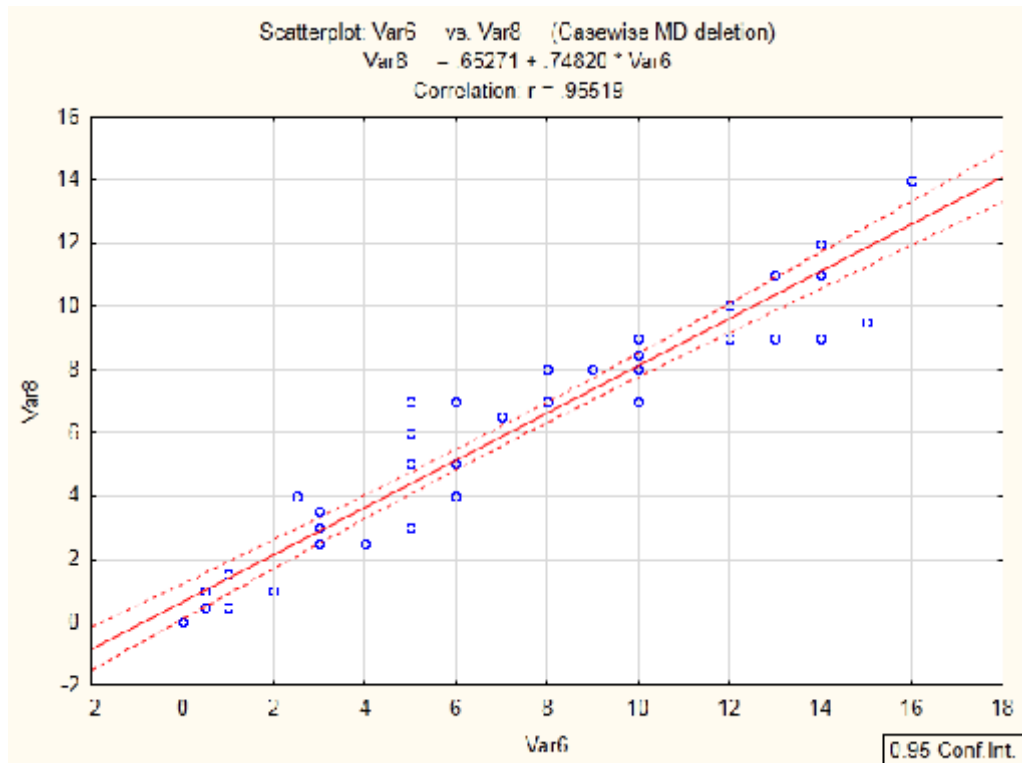


Figure 2. The correlation between the common bean root lengths and stem height within irradiated conditions

4. Conclusions

Both irradiated and non-irradiated conditions of common bean (*Phaseolus vulgaris* L.) led to strong and very strong correlations between root length and stem height.

In non-irradiated conditions, strong correlation coefficient is $R = 0.865$ was obtained, while the determination coefficient was $R^2 = 74.80\%$. In irradiated conditions, the correlation coefficient is $R = 0.955$, while the determination coefficient was $R^2 = 91.20\%$.

The approach of the separate points of the regression line demonstrate the parametric dependence between variables and suitability of the statistical approach.

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