THE ULTRAVIOLET RADIATION EFFECT IN LEAF AREA AND PLANT HEIGHT OF *Phaseolus vulgaris* L.

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INTRODUCTION

Nowadays the situation that our planet confronts is quite alarming. Many people wonder if summers are hotter or if it rains less or more than last year. But, what is behind those changes that people feel? What is happening with the atmosphere? And even more, what is the impact that all these changes are producing? The global climate change has been defined as that which produce the transformation of the atmosphere composition. This change produces an increase in the concentration of carbon dioxide (CO_2) and methane as well as the destruction of the ozone layer in the stratosphere. The destruction of this layer brings as a consequence an increment in the incidence of the ultraviolet radiation (UV) producing a significant effect upon the biological diversity (Jaramillo, 1994). Among these effects we can name the damage of the nucleic acids, damage to eyes, skin cancer and deficiency in the immune system. The ultraviolet radiation also has an ecological importance since it modified the competence balance among the vegetal population components due to differential changes in growth among the species (Caldwell and Flint, 1994). The exposure to ultraviolet radiation produce changes in the morphological plant characteristics and a reduction in the assimilation rate (Teramura, 1983). Based in this information the objective of this study was to determine the effect of the ultraviolet radiation (UV-B) in the leaf area and height of two bean cultivars: G4523 and Cacahuate 72.

MATERIAL AND METHODS

Seeds of *Phaseolus vulgaris* L. c.v G4523 and Cacahuate 72 were sown in plastic bags (5.0 L volume) and filled with sterile mountain soil. The plastic pots were transferred to a growth chamber with a temperature of 25°C, 18 h photoperiod and an average of 480 $\mu mol\ m^{-2}s^{-1}$ photosynthetic photon flux density. Plants were watered every day with distilled water and after emergence a Hoagland modified nutrient solution was apply twice a week. Two growth chambers were used. In the first one the control experiment was set and the plants grown as establish before. In the second chamber a set of ultraviolet lamps was fixed. The level of irradiance of UV-B used was set taking the maximum levels of ultraviolet radiation with a wavelength of 310 nm registered in a sunny day of July 1999 in the State of Texcoco, Mexico. The level of irradiance applied was adjusted with the PAR that we measured in the growth chambers, having a total irradiance of 400 $\mu W\ cm^{-2}$. The radiation treatment was applied as follow: In the first two days after emergence, seedlings were exposed to radiation for 2 h at midday. After that, seedlings were left without radiation during fifteen days. Then, the radiation treatment was restored, and plants were radiated every third day during half an hour until the sampling day (23 days after emergence). The leaf area was measured with a leaf area meter (Li-cor, Li-3100, U.S.A.). The length of the central leaflet of all leaves produced was measured every day with a flexible ruler.

RESULTS AND DISCUSSION

An important change in the architecture of the radiated plants was evident. Plants of the cv. Cacahuate 72 exposed to radiation shown a great branching production. While the control plants had a single stem development. The same happened with the radiated G 4523 plants. However, in this case the branching was not as abundant as in the Cacahuate 72 plants that presented up to

3 leaves per node. A great difference in plant height was evident after 23 days of emergence. The no radiated plants were much higher than the plants exposed to radiation. Even though the control plants of Cacahuate 72 grew slowly than G4523, they were 34% higher than the radiated plants of both cultivars (Figure 1).

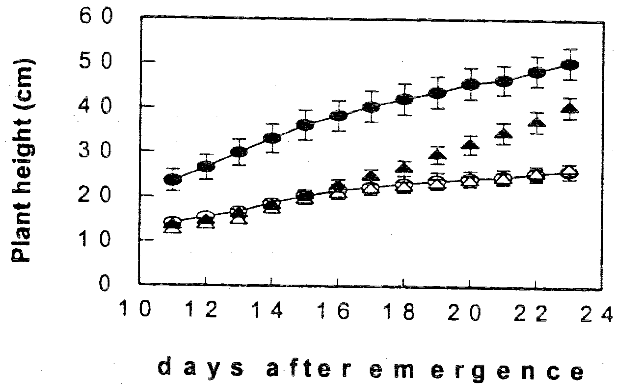

Figure 1. Height of *Phaseolus vulgaris* L. plants cv. G4523 (•) y Cacahuate 72 (▲). The white symbols show the UV radiation treatment. Each symbol represents the mean of 15 measurements ± s.e.

CULTIVAR	Leaf length (cm)	Leaf area (cm^2)
G4523 control	12.2 ± 0.29	305.2 ± 21.24
G4523 UV-B	7.5 ± 0.61	275.5 ± 22.76
Cacahuate 72 control	11.9 ± 0.23	334.6 ± 36.65
Cacahuate 72 UV-B	8.5 ± 0.32	235.7 ± 9.03

Table 1. Leaf length of the youngest fully expanded central leaflet and total leaf area of *Phaseolus vulgaris* L. after 23 days of emergence. Measurements are the mean of 15 replicates ± s.e.

Leaves of the control plants of the two studied cultivars grew bigger (about 30%) than the plants exposed to ultraviolet radiation. A similar trend was found with the total leaf area (Table 1). In this case Cacahuate 72 had a difference of almost 30% more in the leaf area production than the radiated treatment. It was also observed that leaf senescence was reached before in the radiated plants. These results are similar to those reported by Teramura (1983). However, further experiments have to be performed in order to determine the radiation effect in the flowering and seed production.

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