Effect of water stress on physiological parameters of sweet pepper

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Introduction

Drought is defined as one of the major constraints limiting crop production worldwide. In fact, globally, almost one third of farmland suffers from a water deficit that limits the yields of crops (Le Gall, 2015). Sweet pepper has been reported to be the most susceptible horticultural plant to drought stress because of its high stomatal conductance (Sayari and Ghanbari, 2012). Several authors have been interested about the effect of drought stress on photosynthesis. It has been proved as an inhibitor of photosynthetic activity (Valimunzigha, 2005). Thus, the reduction of photosynthesis is related to a series of limitations. Firstly, the limitation of photosynthetic activity resulting from the reduction of the supply of CO2 into sites of the decarboxylation in chloroplasts. This limitation occurs at the early perception of water deficit and is considered as the consequence of stomatal closure in response to the early signals. The second process is a degradation of the activity of photosynthetic enzymes (ribulose 1.5 bisphosphate (RuBP)). Indeed, the decline of enzyme activity results from the degradation of the water status in the cells (Mouellef, 2010).

Materials and methods

The experiment was carried out at the Research Institute of SZIU at the Vegetable Growing Division. Rooted (*SV9702* F1) and grafted (*SV9702* F1 grafted on *Snooker* F1) sweet pepper transplants were nursed in optimum and stressed conditions. For all treatment combination we selected 8 transplants based on the photosynthetic activity (Zero day) in order to have homogeneous plants. The optimum nursed transplants got water on-demand and once a week nutrition solution, however the stressed ones got water and nutrition solution once a week. After three weeks of treatment the photosynthetic activity, transpiration activity and stomatal conductance of the transplants were measured by LCI Portable Photosynthesis System. Multivariate general linear model were applied and the multiple comparison of means is made by Sidak test at 5% and 1% level. All statistical analyses were carried out using IBM SPSS Statistics 20.

Results and discussion

Figure 1 shows that the optimal plants has a higher transpiration activity (2.44 mmol $m^{-2}s^{-1}$, 2.62 mmol $m^{-2}s^{-1}$) than the stressed plants (0.93 mmol $m^{-2}s^{-1}$, 1.93 mmol $m^{-2}s^{-1}$) in rooted and grafted plants, respectively. The same results were shown in stomatal conductance (Figure 2). In this context, the Figure 3 shows that the optimal plants have a higher photosynthetic activity (11.23 µmol $m^{-2}s^{-1}$, 9.6 µmol $m^{-2}s^{-1}$) than the stressed plants (4.36 µmol $m^{-2}s^{-1}$, 7.7 µmol $m^{-2}s^{-1}$) in rooted and grafted plants, respectively.

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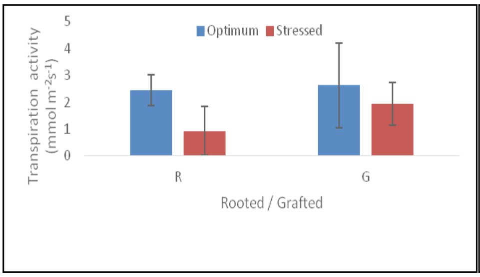

Figure 1: Variation of transpiration activity

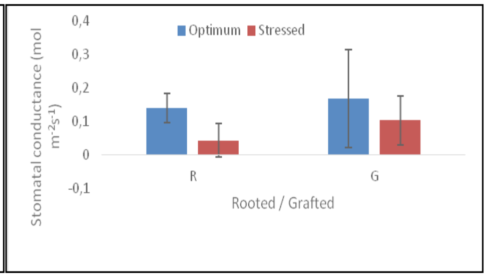

Figure 2: Variation of stomatal conductance

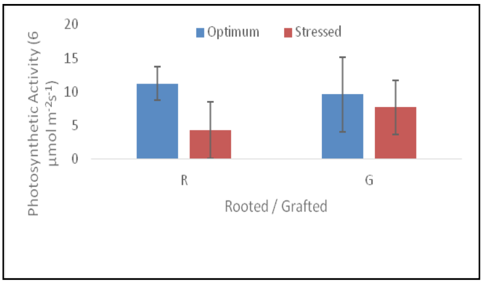

Figure 3: Variation of photosynthetic activity

Conclusions

The plants under optimum conditions showed better transpiration and photosynthetic activity, as well as better stomatal conductance than plants summed to water stress conditions, we can deduce that drought is an inhibitorty of the photosynthetic and transpiration activity. In addition, we can deduce, on the basis of the non significance effect of the technological treatment (rooted/grafted) for the physiological parameters measured that grafting didn't help to resist under the drougth stress conditions.

Acknowledgement

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References

Le Gall, H., Florian, P., Jean-Marc, D., Gillet, F., Pelloux, J., Rayon, C. (2015): Cell Wall Metabolism in Response to Abiotic Stress. Plant 4, 112-166. https://doi.org/10.3390/plants4010112

Mouallef, A. (2010) : Caractères physiologiques et biochimiques de tolérance du blé dur (*Triticum durum* Desf). Au stress hydraulique. Mémoire, Biotechnologie Végétale, Université Mentouri, Constantine, Algérie.

Sayyari, M., Ghanbari, F. (2012): Effects of Super Absorbent Polymer A 200 on the Growth, Yield and Some Physiological Responses in Sweet Pepper (*Capsicum Annuum* L.) Under Various Irrigation Regimes. Dep. of Horticultural Science, Faculty of Agriculture, Ilam University, Iran. International Journal of Agricultural and Food Research ISSN 1929-0969 | 1: 1, 1-11. https://doi.org/10.24102/ijafr.v1i1.123

Valimunzigha, C. K. (2005): Etude du comportement physiologique et agronomique de tomate. CIACO, Belgique: 20-15.