*Proposal for an internship with the Plant Science, Interactions and Innovation (PSII) lab of Avignon.*

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Period : February – July

**Title**

Effects of flashes of UV-C light on the tolerance mechanisms of pepper and grapevine against water stress. A case study of photosynthesis and its components.

**Context**

Extreme climatic events, including drought, are predicted to increase in intensity, frequency, and geographic extent as a consequence of global climate change. To maintain high crop performance under conditions of limited water availability, there will be the need to design and use innovative cropping strategies. Breeding has a lot of potential but other approaches could also help. Some chemical and biological biostimulants look very promising for having been found to maintain crop performance under various stress conditions (Rouphael and Colla 2020). There is far less literature available about physical factors that could also play a role as stimulants of crop tolerance in the field. Then there is some new evidence that UV-C light can be used as a mean of seed priming to improve crop performance under high salinity (Fgaïer et al. 2021). The latter is very similar to water stress. And it seems now also very tempting to test the hypothesis that flashes of UV-C light applied to growing plants can stimulate their tolerance against drought. It is well-established that flashes of UV-C light strongly stimulate plant defenses against a very large range of diseases and there is increasing evidence that the positive effects of UV-C light on plants are attributable to the stimulation of the salicylic acid (SA) pathway (Fgaïer et al. 2021, Luc Bidel, personal communication). The latter is not only instrumental in plant defenses but also in tolerance towards abiotic stresses (Khan et al. 2015).

**Objective and strategy**

The major objective of this study is to test the hypothesis that flashes of UV-C light can be used to stimulate plant tolerance against water stress. Crop performance being conditioned by net photosynthesis, we shall analyze the effect of flashes of UV-C light on the latter and its components. In addition we may also analyze leaf concentration in SA and potentially other hormones like abscisic acid and cytokinins.

**Materials and methods**

Pepper and grapevine plants will be grown in pots in the greenhouse of Avignon Université.

All plants will be exposed to single flashes of UV-C light, three times at ca. 10-day intervals prior to drought treatments. Some plants will serve as controls whereas others will be submitted to mild or severe water stress assessed from measurements of leaf stomatal conductance (gs). n = 10. Four types of measurements will be performed on plants:

1. Leaf net assimilation rate (Anet), total photosynthetic electron transport, gs, photosynthetic Water Use Efficiency… + mitochondrial respiration.
2. Photosynthetic capacity derived from so-called A-Ci curves, or Amax as a more easy alternative.
3. Parameters of energy use efficiency derived from induction curves of maximal chlorophyll fluorescence (ChlF).
4. Growth parameters such as leaf size and number, dry and fresh matter.

Leaf gas exchanges will be measured using a Licor 6800, and ChlF using the Pocket PEA of Hansatech. Leaves may be collected for hormone analysis by the Metabolomics facility (n = 8 x 3).

What we expect from the successful applicant:

1. A true interest for agronomy and ecophysiology
2. The will for taking charge of demanding protocols and tools
3. Commitment to the goal
4. Some appetite for data processing and mining
5. Writing skills.

**Some references**

Fgaïer, S., Lizzi, Y., Lauri, F., Aarrouf, J. & Urban, L.(2021). Seed priming by UV-C light mitigates the negative effects of high salinity on photosynthesis and growth of lettuce plants. Soumis à *Scientia Horticulturae*.

Khan, M. I. R., Fatma, M., Per, T. S., Anjum, N. A., & Khan, N. A. (2015). Salicylic acid-induced abiotic stress tolerance and underlying mechanisms in plants. *Frontiers in plant science*, *6*, 462.

Rouphael, Y., & Colla, G. (2020). Biostimulants in agriculture. *Frontiers in plant science*, *11*, 40.