56th Annual Technical Meeting of the Society of Engineering Science (SES2019)
October 13 - 15, 2019, Washington University, St. Louis, MO, U.S.A.

Effect of wind on morphology and mechanical properties of Arabidopsis thaliana

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Interaction of plants with wind is unavoidable in the natural environment and can have beneficial or detrimental effects on the plants. While low wind speeds influence water evaporation, rate of photosynthesis, etc., higher wind speeds can damage or even destroy plants [1]. Since plants cannot shelter themselves from wind, they must adapt to their local conditions in order to survive. This leads to changes in their morphology, structure and mechanical properties [2]. These changes are important for a better understanding of plants biomechanics and for breeding plants that can survive in challenging wind environments.

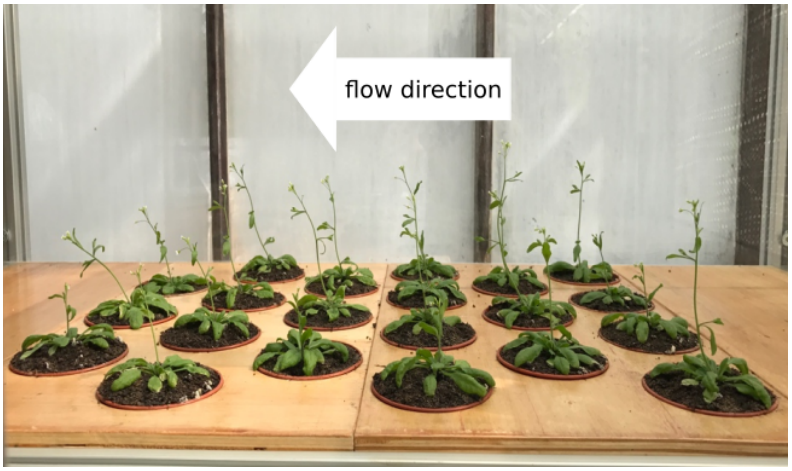

Figure 1. Arabidopsis in the test section of the specialised wind tunnel subjected to a constant flow.

The response of plants to wind is investigated experimentally using a model plant *Arabidopsis thaliana.* The plants are grown subjected to a constant wind in a purpose-built wind tunnel placed inside a glasshouse. The control group is subjected to the same conditions but without wind treatment. Throughout duration of the experiment number of stems, branches and length of the primary inflorescence stem are recorded in both groups. To study changes in the mechanical properties of Arabidopsis, a new dynamic testing approach based on multiple resonant frequencies was developed and validated against static three-point bending tests. Using this method mechanical characterisation of the top and bottom parts of plant stems from both groups was conducted to quantify the changes in their modulus of elasticity.

In this paper an overview of the developed dynamic testing method is given together with the results of mechanical characterisation of different parts of Arabidopsis stems grown under constant flow of 5 m/s and those of the control group. In addition, the results of plants phenotyping that show changes in Arabidopsis plant structure will be presented.

References

[1] De Langre E. Effects of Wind on Plants. *Annu. Rev. Fluid Mech.* 2008;40:141-168.

[2] Gardiner B, Berry P, Moulia B. Review: Wind impacts on plant growth, mechanics and damage. *Plant Science* 2016;245:94-118.