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Analysis of spray retention on a 3D black-grass plant model as a function of spray nozzle and formulation using a process-driven approach

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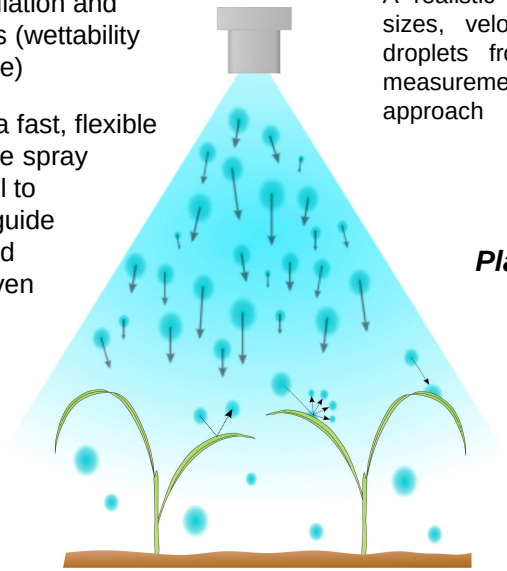
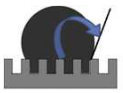
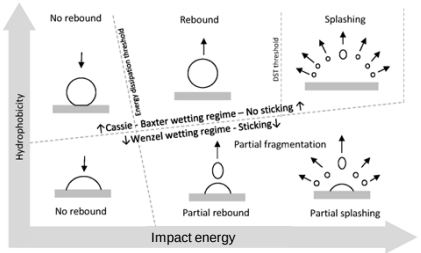
Introduction

Spraying efficacy results from the interactions between spray droplets, formulation and plant properties (wettability and architecture)

Aim: Develop a fast, flexible and inexpensive spray retention model to complete and guide field trials based on process-driven approach







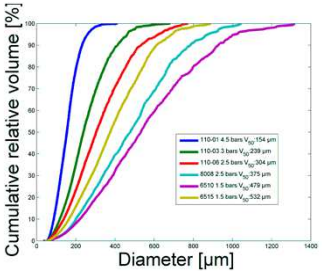
$$Weber\ number\text{: } We = \frac{\rho V^2 d}{\sigma}$$

Indicates the relative importance of the fluid's inertia compared to its surface tension

Materials and methods

Virtual nozzle

A realistic estimate of the number, sizes, velocities and directions of droplets from spray characteristics measurements using a probabilistic approach



Plant phenotyping

Structured light 3D scanner

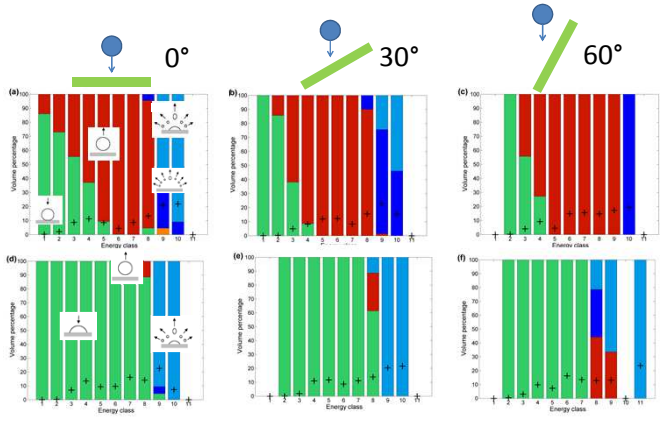
Turntable

3D triangular mesh

Collision algorithm and retention model

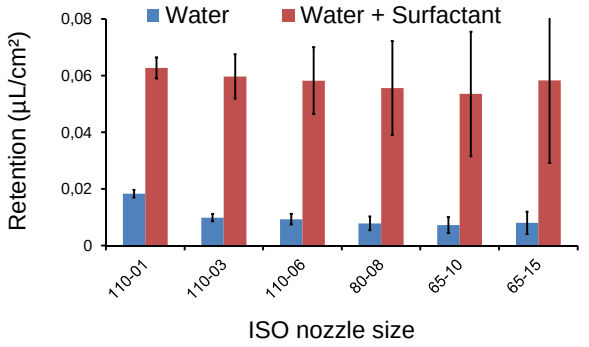
Tap Water

Tap Water + 0,1%v/v of organo-modified trisiloxane surfactant (non-ionic)



Simulation results

100 L.ha^{-1} spray application



Conclusions

The process-driven spray retention model allows to:

- Determine spray retention on a single plant
- Highlight the variability of deposits
- Discriminate between mixture surface tensions and nozzle types (droplet sizes, velocities and directions)

Suited for optimizing spray applications depending on the formulation and the target (species and growth stage) using sensitivity analysis

References

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