
Analysis of Droplet Transport from Agricultural Spray

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Abstract

Pesticide application for agricultural crops is always associated with off-target losses in terms of soil surface contamination and airborne spray drift.

New development of field sprayers is using on/off sprayer nozzles. The purpose is to target the intended plant surface area only without contamination of the surroundings.

The objective of this paper is to quantify the precision in targeting the plants and to quantify the off-target loss. The work includes experimental as well as numerical analyses.

A selection of 3 conventional sprayer nozzles were included in the study.

The experimental work includes droplet size measurement and wind tunnel test (NIAB, the Silsoe Spray Application Unit, Bedford, England). The droplet size and -velocity distribution was analyzed by use of Phase Doppler Anemometry (PDA). The measurement was conducted by scanning the spray in 3 different horizontal planes, respectively 300, 400 and 500 mm from the nozzle tip. The wind tunnel measurement includes on-target deposition beneath the sprayer nozzle and off-target spray drift in different distances from the nozzle, both airborne and sedimentation. The measurement was conducted in a cross flow as the nozzle was mounted on a sliding track perpendicular to the air flow direction.

The numerical work includes a CFD analysis of the spray and droplet transport by a Discrete Phase Model (DFM), where the droplet is tracked in a Lagrangian reference frame with one-way coupling to the continuous phase. The continuous phase is modeled using a turbulent k-eps model. A mesh independent study is included in the study.

The numerical results are verified and validated against experimental results.

Keywords: Droplet transport, CFD, Wind tunnel, PDA droplet analyser

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