Determining Water Quantity from Sprayer Nozzle Using Particle Image Velocimetry (PIV) and Image Processing Techniques

Authors : M. Nadeem, Y. K. Chang, C. Diallo, U. Venkatadri, P. Havard, T. Nguyen-Quang

Abstract : Uniform distribution of agro-chemicals is highly important because there is a significant loss of agro-chemicals, for example from pesticide, during spraying due to non-uniformity of droplet and off-target drift. Improving the efficiency of spray pattern for different cropping systems would reduce energy, costs and to minimize environmental pollution. In this paper, we examine the water jet patterns in order to study the performance and uniformity of water distribution during the spraying process. We present a method to quantify the water amount from a sprayer jet by using the Particle Image Velocimetry (PIV) system. The results of the study will be used to optimize sprayer or nozzles design for chemical application. For this study, ten sets of images were acquired by using the following PIV system settings: double frame mode, trigger rate is 4 Hz, and time between pulsed signals is 500 µs. Each set of images contained different numbers of double-framed images: 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 at eight different pressures 25, 50, 75, 100, 125, 150, 175 and 200 kPa. The PIV images obtained were analysed using custom-made image processing software for droplets and volume calculations. The results showed good agreement of both manual and PIV measurements and suggested that the PIV technique coupled with image processing can be used for a precise quantification of flow through nozzles. The results also revealed that the method of measuring fluid flow through PIV is reliable and accurate for sprayer patterns.

Keywords : image processing, PIV, quantifying the water volume from nozzle, spraying pattern

Conference Title : ICSATNR 2017 : International Conference on Sustainable Agriculture Techniques and Natural Resources **Conference Location :** Toronto, Canada

Conference Dates : June 15-16, 2017

1