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Using Computational Fluid Dynamics to Model and Design a Preventative Application for Strong Wind

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Abstract : Typhoons are one of the major types of disasters that affect Taiwan each year and that cause severe damage to agriculture. Indeed, the damage exacted during a typical typhoon season can be up to $1 billion, and is responsible for nearly 75% of yearly agricultural losses. However, there is no consensus on how to reduce the damage caused by the strong winds and heavy precipitation engendered by typhoons. One suggestion is the use of windbreak nets, which are a low-cost and easy-to-use disaster mitigation strategy for crop production. In the present study, we conducted an evaluation to determine the optimal conditions of a windbreak net by using a computational fluid dynamics (CFD) model. This model may be used as a reference for crop protection. The results showed that CFD simulation validated windbreak nets of different mesh sizes and heights in the experimental area; thus, CFD is an efficient tool for evaluating the effectiveness of windbreak nets. Specifically, the effective wind protection length and height were found to be 6 and 1.3 times the length and height of the windbreak net, respectively. During a real typhoon, maximum wind gusts of 18 m s-1 can be reduced to 4 m s-1 by using a windbreak net that has a 70% blocking rate. In short, windbreak nets are significantly effective in protecting typhoon-affected areas.

Keywords : computational fluid dynamics, disaster, typhoon, windbreak net
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