

Design and development of an indoor testing facility for downwash and spray distribution evaluations of agricultural UAV

ABSTRACT

The usage of UAV as a pesticide application technology is becoming a common practice in South East Asia with a very significant proportion of agricultural areas have now being treated using such method. Up to date, about more than 169 of various designs and configurations of UAV have been produced to cater the demand, however it is in doubt whether all these available models were optimally integrated with the spray systems to give the required spraying qualities. Despite of each UAV configuration has their own unique aerodynamic effects, it is crucial to determine their downwash airflow patterns, the spray distributions and the effective application parameters that could give high spraying quality. This research outlines the development of an indoor testing facility and its standardised testing procedure for evaluating the spraying performances of any model UAVs that are used in agricultural applications. The testing facility was developed to imitate the UAV in the actual field spraying operation. With 23 m travel length, the developed testing facility was designed to carry the test UAV up to 100 kg, adjust the test UAV at three levels of spraying heights (1.5, 2.5, and 3.5 m), and moves the test UAV up to a maximum travelling speed of 10 m/s. The 6x6 m sampling platform structure for the pressure sensors and water sensitive papers was built underneath the rail support structure to measure and collect data for spraying distributions and downwash 3D profile spectrum. With the availability of this indoor UAV Testing Facility, it is expected that any efforts to increase the spraying efficiency using UAV could be tested repeatedly with same standard protocols, so that proper recommendations could be made on the flying requirements of the UAV in order to achieve an efficient agricultural chemical spraying operation.

Keyword: Aerial spraying; Unmanned aerial vehicle; Agricultural chemical spraying; Test rig; Downwash air flow profile; Spray distribution