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Effect of air velocity and pump discharge on spray deposition

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ABSTRACT : An air sleeve boom which can be operated by 5 horse power electric motor was developed for greenhouse pesticide applications. The performance of developed air sleeve boom was evaluated for different air velocities, *viz.*, 9 m/s, 12 m/s, 16 m/s and 20 m/s in combination with different pump discharges, *viz.*, 2.5 l/min, 4.5 l/min, 7 l/min and 9 l/min in the laboratory to assess the effect on spray deposition. The droplet size decreased with increase in air velocity and decrease in pump discharge. Droplet density was found to increase with increase in air velocity and decrease in pump discharge. Droplet size, droplet density and uniformity coefficient had a linear relationship with air velocity and pump discharge. Optimum values of droplet size, droplet density and uniformity coefficient were obtained with 20 m/s air velocity and 2.5 l/min pump discharge. The statistical analysis of the data indicated that air velocity, pump discharge and their interaction had a significant effect on droplet size, droplet density and uniformity co-efficient.

KEY WORDS : Air sleeve boom, Air velocity, Pump discharge, Droplet size, Droplet density, Uniformity coefficient

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Some major challenges to greenhouse production and profitability are insects, diseases and weeds. Chemical control is the popular method adopted for controlling most insects and diseases (Mathews, 1985). Traditional methods of pesticide application have a number of limitations: they are labour intensive, have low application accuracy and require serious safety precautions, since they are highly hazardous for the operator who might be exposed to toxic chemicals by their use in an enclosed environment. Performance depends on skill of operator; manual application often results in an uneven distribution of the pesticide. Air assisted spraying is considered as one of the better pesticide application technique. The air assisted spraying system contributes towards: reduction in spray drift and loss on the ground, an increase in the agrochemical deposits levels and coverage rate of the abaxial surface leaves, improvement in the penetration of the spray droplets into the canopy as well as enabling a reduction in both dosage and in application volume (Raetano, 2005). Incorporation of air assistance in the spraying system improves the deposition uniformity in the entire plant canopy structure, spray deposition on the lower part of the plant leaves, where most pests harbor (Hadar, 1980). Sirohi *et al.* (2008) developed an air-assisted hydraulic sprayer and compared its performance with sprayer without air assistance. Result showed that the air-assisted hydraulic sprayer gave a superior performance in terms of effective spray in all canopies than the sprayer without air assistance. Shahare *et al.* (2010) developed and evaluated tractor mounted air sleeve boom sprayer at different air velocities and spray angles with findings that higher air velocity improves the deposition of pesticide on whole canopy of cotton crop.

In the view of this, an air sleeve boom was developed for greenhouse pesticide applications and its performance was evaluated to study the effect of different air velocity and pump discharge levels on spray deposition at different positions on plant.

METHODOLOGY

Air sleeve boom:

The major components of the sleeve boom spraying system were the blower, sleeve, spraying nozzles and pump. A trolley was fabricated to support whole assembly over it. The blower generated the required volume of air and directed the flow into the sleeve. Air form the blower was conveyed and distributed through two sleeves with multiple orifices to achieve an airflow pattern covering the canopy. The system was developed to obtain the required effective penetration of spray into the crop canopy with an air discharge velocity that