International Journal of Agricultural Engineering, Vol. 3 No. 2 (October, 2010) : 236 -242

Research Paper :

Performance evaluation of rotary nozzles for air assisted sprayers for cotton crop

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Accepted : *July, 2010*

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ABSTRACT

A study was undertaken at ASPEE Research Institute, Mumbai to evaluate performance of cone type rotary nozzle (N1) of tractor mounted sprayer (TMS) and cage type (N2) and disc type (N3) rotary nozzles of engine operated sprayer (EOS) for their spray spectrum producing characteristics. The performance was evaluated at different blower speeds and discharge rates (for TMS 1250, 1500, 1750 and 2000 rpm and 3400, 2600, 2000 and 850 ml/min discharge rates at 2.81 kg/cm^2 system pressure and for EOS; 2500, 2700, 2800 and 3000 rpm blower speeds at variable discharge rates with respect to engine speed) at 6, 9, 12 and 15 m distance from outlet. In EOS, the discharge rate varied according to the blower / engine speed as the rotary feed pump was mounted on the shaft of the blower. Atomization of spray fluid was obtained in the required range at lower discharge rate of 850 ml/min and higher blower speed of 2000 rpm with cone type rotary nozzle in open space and in cotton field compared with engine operated sprayer with both the nozzles. It showed the better penetration of spray on the upper surface of leaves with larger droplet and higher densities compared to lower surface of leaves in front of plant canopy and reverse phenomenon on the backside of plant canopy.

Key words : Rotary nozzle, Spray spectrum, Discharge rate, Blower speed

In India Cotton is the king of cash crops. In many developed country like India, even with small farms, the pest control program is increasingly dependant on the chemical control and about 60% of annual production of pesticides is being used for cotton crop only (Khatua, 1997). As cotton is a bushy crop; the distribution, coverage and penetration of chemicals are quite difficult. Mostly, the farmers use conventional hydraulic sprayer and nozzles for the pest control. However, complete control on insects with this conventional method of spraying is very difficult because of poor penetration of spray and improper coverage. This method is beneficial provided that the recommend pesticide dose and volume are used. But, in practice actual dose requirement are more than theoretical (Mathews and Hilsop, 1993).

In the efforts to overcome the drawback of clogging and wide droplet producing characteristic of the hydraulic nozzle, in the late 1930, European engineers discovered that for very low chemical rates, rotary disc atomizers produced a more definable range of droplet sizes than hydraulic nozzles. To overcome this drawback of hydraulic nozzle, rotary nozzle with air assisted spraying came in existence. Also, rotary nozzles can be used in air assisted spraying without any additional power source to drive it as air velocity can be used by mounting disc or cup on a propeller fan in air trajectory. A certain minimum air velocity is needed to deflect foliage and to convey and cause impingement of droplets on the target. Hence, present study was conducted to evaluate the performance of rotary nozzles for air-assisted sprayer for cotton crop.

METHODOLOGY

Two types of air assisted sprayers *i.e.* tractor mounted air assisted sprayer (TMS) (Fig. 1) with cone type rotary nozzle (N1) (Fig. 2) and engine operated air assisted spryer (EOS) (Fig. 3) with cage type (N2) (Fig 4) and disc type (N3) (Fig. 5) rotary nozzles were used for the study. The major components of sprayer were spray pump, control panel assembly, pesticide tank, blower, impeller, casing, prime mover etc.

The performance of sprayer for air velocity trajectories and the spray spectrum producing characteristics were tested in the open space at distances of 6, 9, 12 and 15 m from outlet of the sprayer. TMS was operated at the blower speeds of 1250, 1500, 1750 and 2000 rpm (Agey, 1997). As the blower in TMS was PTO operated, its speed was controlled with tractor governor. The discharge rates were 3400, 2600, 2000 and 850 ml/min at 2.81 kg/cm^2 system pressure. Though the spray pump of the TMS was dependent on the PTO speed, but it was possible to fix some discharge rate and pressure at different PTO speed using control panel and orifice plates.