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Research Paper :

Performance evaluation of centrifugal flow mist blowers in laboratory

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ABSTRACT

Experiments were conducted in laboratory to study the performance of three centrifugal flow mist blowers based on air velocity, air discharge, efficiency and power requirement. These blowers B_1, B_2 and B_3 gave more air velocity, air discharge and efficiency at 2450, 2000 and 1600 rpm, respectively and power required to run these blowers was 28.4 kW, 19.9 kW and 4.4 kW, respectively. The suitable tractors to operate these blowers in the field were 45 hp, 35 hp and 18 hp, respectively.

Key words : Performance evaluation, Centrifugal, Mist blower

It is difficult to spray the pesticide uniformly and efficiently throughout the tree and vines by conventional method of spraying. Air carrier sprayer provides good coverage consuming very less water, time and labour, hence suitable for spraying. The sprayers which uses air as a carrier for spraying chemicals are called as "Mist Blowers". It employs a blower to deliver an air blast of sufficient discharge and velocity. Spray fluid is introduced into this air blast in the form of fine droplets.

Centrifugal and axial flow blowers are used in air carrier spraying system. The centrifugal flow blowers are suitable for small height plants, where as axial flow blowers are suitable for large height plants. Axial blowers gives large air discharge at lower pressures and centrifugal blower gives lower air discharge at greater pressure.

The effectiveness of an air blast sprayer depends upon its ability to displace the air in all parts of the tree with spray-laden air from the machine. Also, the performance of an air carrier sprayer depends upon air flow rate and its velocity, liquid flow rate and its pressure, forward travel speed of sprayer as well as prevailing atmospheric conditions like wind velocity, humidity and temperature.

Experiments were conducted in laboratory to study the performance of three centrifugal flow mist blowers based on air velocity, air discharge, efficiency and power requirement.

METHODOLOGY

The performance evaluation of three blowers namely, B_1, B_2 and B_3 was evaluated in laboratory at different speeds. Constructional details of these blowers are given in Table 1. The optimum speeds of operation of the blowers were determined from these tests.

Experimental design for laboratory Testing
Independent variables

No of blowers:	3
Speeds of rotation:	5
Test section points:	20

Measurements of atmospheric variables:

a. Temperature b. Humidity

Dependent variables:

Static pressure, Dynamic pressure, Air velocity, Air discharge, Blower efficiencies, Power input and Power output.

The laboratory test set-up consisted of blower assembly, frame to support the blower, wind tunnel assembly, prime mover, transmission assembly, pressure, measuring instruments, power measuring instruments, speed measuring instruments, and temperature measuring instruments.

The frame was fabricated by joining the two Mild Steel angles of size 50 x 50 x 5 mm and bolted to heavy Mild Steel plate to resist the vibration while in operation. This Mild Steel plate has number of holes and blower was fitted to these Mild Steel plates by means of nuts and bolts. The wind tunnel assembly was constructed according to AMCA (1985) specifications. It consists of transition section, flow straightner and the tunnel. The details of wind tunnel assembly for different blowers are given in Table 2. The blower was driven by different induction motors by means of chain and sprockets. The details of motors used are given in Table 3.

The static, dynamic and total pressure of the air that was blown by the blower was determined by standard pitot tube in conjunction with U tube manometer and pitot