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# Effect of Speed of Operation on Blower Speed, and Air Velocity of Axial Flow Blower in Air Assisted Orchard Sprayer

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***Abstract:*** *As the name implies, an air-assisted sprayer utilizes an air stream to carry the spray droplets onto the target It employs a blower (which is basically a fan) to produce and deliver an air stream of sufficient discharge, velocity and pressure, and introduces the spray fluid into this air stream in the form of fine droplets at high pressures (from a reciprocating pump) at the air outlet The turbulence of the air stream causes thorough mixing of air and liquid, and this spray laden air proceeds from the sprayer to displace the original air inside the canopy. The turbulent air stream along with the suspended pesticide solution in it causes ruffling action of the foliage and effect impingement of spray droplets on both sides of the leaves, including those in the inner most parts in the canopy. The study has been carried out on the parameter viz. speed of operation which was affecting the air velocity and blower rpm of axial flow blower. For this study three speed of operation selected (2.5 km/h, 3 km/h, 3.5 km/h).The laboratory testing was carried out at the workshop of ASPEE Agriculture Research Foundation, Mumbai. The maximum blower speed was obtained as 2108.1 rpm at the speed of operation 3.5 km/h while the minimum blower speed was obtained as 1594.1 rpm at the speed of operation 2.5 km/h. The maximum air velocity was obtained as 32 m/s at position one and 7.2 m/s at position two at the speed of operation 3.5 km/h while the minimum air velocity was obtained as 22.7 m/s at position one and 4.3 m/s at the speed of operation 2.5 km/h.*

***Keywords:*** *Air assisted sprayer, axial flow blower, speed of operation, blower rpm, and air velocity.*

## INTRODUCTION

Now days, farmers all over the world are making utmost efforts to increase food production to hitherto unreached levels in order to feed the millions utilizing most modern equipment and farming systems. Farmers are employing high yielding varieties of seeds, applying fertilizers and irrigation, and adopting proper plant protection measures for this purpose.

India is no exception to this. However, Indian agriculture is characterized not only by its regular annual crops but also to a large extent, by its orchard and tree crops. Like any other crop, these plantation crops are susceptible to attack of pests and diseases. Control of pest and disease in orchard is a major problem confronting Indian farmer. This is because of the non-availability of a suitable sprayer. Conventional methods presently under use are foot operated, rocking type and power hydraulic type sprayers. They have many bottlenecks as far as orchard spraying is concerned. Requirement of large quantity of water in the conventional method, may limit the spraying area. Also more water requirement unnecessarily increases weight of the sprayer. In addition to this, non- uniform and excessive spraying, slow operation, loss of pesticides, unwanted environmental contamination etc., are the other factors that make conventional system of spraying totally uneconomical and unattractive. In such adverse situation air assisted spraying system is found to be a viable solution for orchard spraying.

It uses air blast as a vehicle to carry finely atomized droplets to distant tree targets. To produce blast of air it employs a blower. For efficient spraying of pesticide, blower develops air blast of

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required discharge, velocity and pressure as per need of crop for which it is designed. Air velocity is used to cause sufficient ruffling action of the leaves which alternatively expose the under and overleaf portion to the spray droplets.

For satisfactory spraying of orchards using air assisted sprayer, air discharge is the most crucial factor. Out of the two common type of blower prevalent, axial flow blower is able to produce a higher discharge compared to a centrifugal blower for the same input power. An axial flow blower can be preferred over a centrifugal blower for orchard spraying. A new axial flower was developed at ASPEE agricultural research and Development Foundation Mumbai and tested its performance in the lab

## MATERIAL AND METHODS

With the help of study on existing blower a new blower was developed which is suitable for small hp tractor.

Components of blower:

1. Blower casing
2. Blower hub (boss)
3. Blade
4. Gear box
5. Back plate

### Laboratory Testing of Newly Developed Blower

The developed blower was calibrated and tested with test set up as shown in plate 1 .In the trial, power source that was used as 18 hp tractor and blower fitted behind the tractor which was operated by tractor PTO. The speed of operation maintained by using tractor accelerator.

#### *Blower speed (rpm)*

The speed of operation of air assisted orchard sprayer should be below 4km/h, so speed of operation for testing 2.5, 3, 3.5 km/hr was selected. To find out the effect of speed of operation on blower speed at each speed of operation of tractor blower speed was recorded by using tachometer. These all combinations repeated three times.

#### *Air velocity (m/s)*

At each speed of operation air velocity recorded by using anemometer at two positions i.e. position 1 and position 2 at blower outlet and 3 meter from blower outlet respectively. These all combinations repeated three times.

Following independent and dependent variables were used for the evaluation.

#### *Independent Variable*

1. Speed of operation (2.5 km/h, 3 km/h, 3.5 km/h)


**Plate 1: Measurement of blower speed and air velocity**

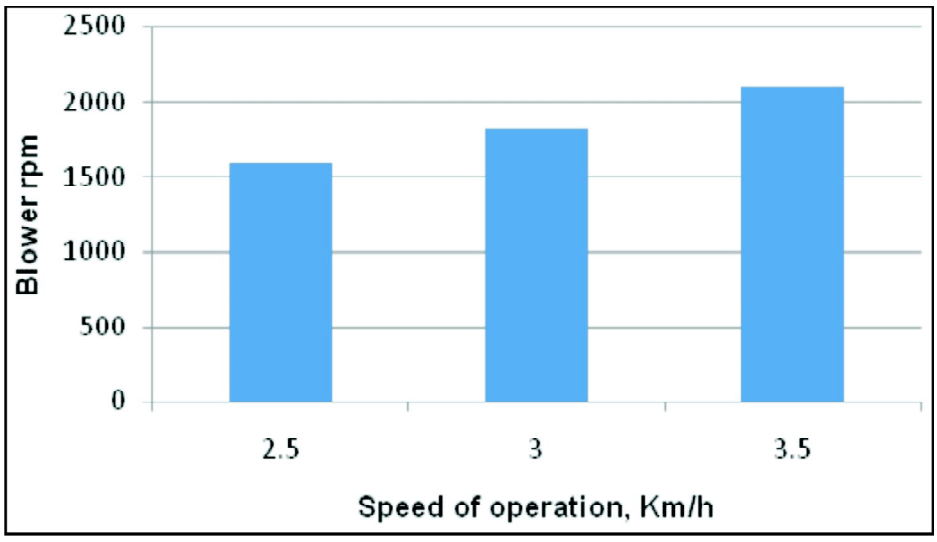


**Figure 1: Effect of speed of operation on blower speed**

***Dependent Variable***

1. Blower speed (rpm)
2. Air velocity (m/s)

***Instruments used for Laboratory evaluation of axial flow blower***

1. Anemometer
2. Tachometer
3. Ammeter

***Statistical Analysis/Mathematical tool to be used***

Completely Randomized Design was used for the laboratory statistical analysis.

## RESULTS AND DISCUSSION

The results are explained as follows:

**Table 1**
**Effect of speed of operation on blower speed**

| *Sr. No.* | *Speed of operation, km/h* | *Blower speed, rpm* |
|---|---|---|
| 1. | 2.5 | 1594.1 |
| 2. | 3.0 | 1830.1 |
| 3. | 3.5 | 2108.1 |
| | F Test | S |
| | SE(m) | 20.7 |
| | CD (5%) | 59.1 |

The table 1 revealed that the effect of speed of operation 2.5 km/h, 3 km/h, 3.5 km/h on blower speed was found significant. The minimum value (1594.1 rpm) of blower speed was observed at speed 2.5 Km/h while the maximum (2108.1 rpm) value was observed at speed 3.5 km/h.

The Figure 1 shows the increasing trend for the values of blower speed with increase in speed of operation. The blower speed increased by 14.8% when the speed was increased from 2.5 km/h to 3 km/h it further increased by 15.19% when the speed was increased from 3 km/h to 3.5 km/h.

**Table 2**
**Effect of speed of operation on air velocity**

| *Sr. No.* | *Speed of operation, Km/h* | *Air velocity, m/s* | |
|---|---|---|---|
| | | $P_1$ | $P_2$ |
| 1. | 2.5 | 22.7 | 4.3 |
| 2. | 3.0 | 27.6 | 5.7 |
| 3. | 3.5 | 32.0 | 7.2 |
| | F Test | S | S |
| | SE(m) | 0.24 | 0.05 |
| | CD (5%) | 0.69 | 0.10 |

The table 2 shows that the effect of speed of operation 2.5 km/h, 3 km/h, 3.5 km/h on air velocity. The minimum value of air velocity at both positions was observed at speed of operation 2.5 km/h while the maximum value at both the positions was observed at speed of operation 3.5 km/h. There was a significant difference between men values of air velocity at each speed of operation on both positions.

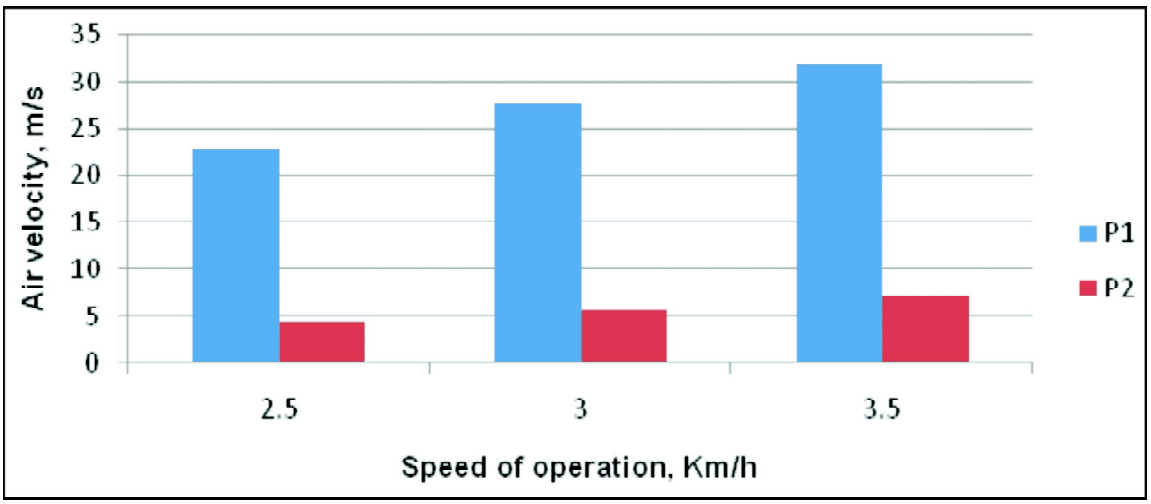


**Figure 2: Effect of speed of operation on air velocity**

The Figure 2 shows the increasing trend for the values of air velocity at each speed of operation at both the positions. At position 1 the air velocity increased by 21.6% and 15.5% when the speed of operation was increased from 2.5 km/h to 3 km/h and 3 km/h to 3.5 km/h respectively.

At position 2 when the speed of operation was increased from 2.5 km/h to 3 km/h and 3 km/h to 3.5 km/h then the air velocity increased by 31.4% and 25.8% respectively.

## CONCLUSION

According to the various treatments the following conclusion are resulted from the evaluation of axial flow blower.

1. Blower speed and air velocity increases as the speed of operation increased.
2. The required air volume was achieved at the speed of operation 3 and 3.5 km/h.
3. The maximum blower speed was observed as 2108.1 rpm at speed of operation 3.5 km/h while the minimum blower speed was observed as 1594.1 rpm at speed of operation 3.5 km/h.
4. The maximum air velocity at position 1was obtained as 32.0 m/s at speed of operation 3.5 km/h and at position 2 it was found 7.2 m/s at 3.5 km/h. The minimum air velocity at position 1was obtained as 22.7 m/s at speed of operation 2.5 km/h and at position 2 it was found 4.3 m/s at 2.5 km/h.
5. The statistical analysis shows that significant difference between mean values of blower speed and air velocity at every speed of operation.

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