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Impact of blade type on blower speed, and air velocity of axial flow blower in air assisted orchard sprayer

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Abstract
Impact of blade type assessed in lab. The testing of blower was carried out for observing impact of blade type on blower speed and air velocity. The maximum blower speed obtained as 1848.5rpm at blade type 1 and the minimum blower speed obtained as 1839.7at blade type 2. Maximum air velocity obtained as 30.5 m/s at blade type 2 whereas minimum air velocity obtained as 24.4m/s at blade type 1.

Keywords: Air assisted sprayer, air velocity, axial flow blower, blade type

Introduction
It is reported that around 40 per cent yield is reduced due to attack of pest and diseases and may increase if not controlled in time. The Indian farmers usually control pest and diseases using conventional methods and appliances which include spraying of pesticides to the affected crops up to the point of runoff with manually operated or power operated hydraulic sprayers, such as rocking sprayer, foot sprayer and reciprocating pump supplying pressurized liquid to the spray guns. Uniform distribution and deposition of chemical from top to bottom of plant canopy and on the undersides of leaves is of utmost importance for effective pest control. 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. Axial flow blower is able to produce a higher discharge compared to a centrifugal blower for the same input power. Axial flow blower can be preferred over a centrifugal blower for orchard spraying.

Material and Methods
Blade design
Different types of airfoils (blades) have been developed for different purposes. For the said research work medium to high discharge and medium air pressure was required. In order to suit for the axial flow blower to be used for air assisted orchard type agricultural sprayer, aerofoil blade was selected for the development of blower. In case of aerofoil type of blade, the leading edge was rounded and thick whereas, the trailing edge was thin and sharp. That type of blades was fabricated with two different lengths (blade1- 160 mm and blade2- 190 mm) and material used was nylon. For the fabrication of blade, die of the blade was fabricated. The performance of blower with these blades was evaluated. The detail dimensions of blades as shown in plate 1and fig 1.

Plate 1: Blades used in blower

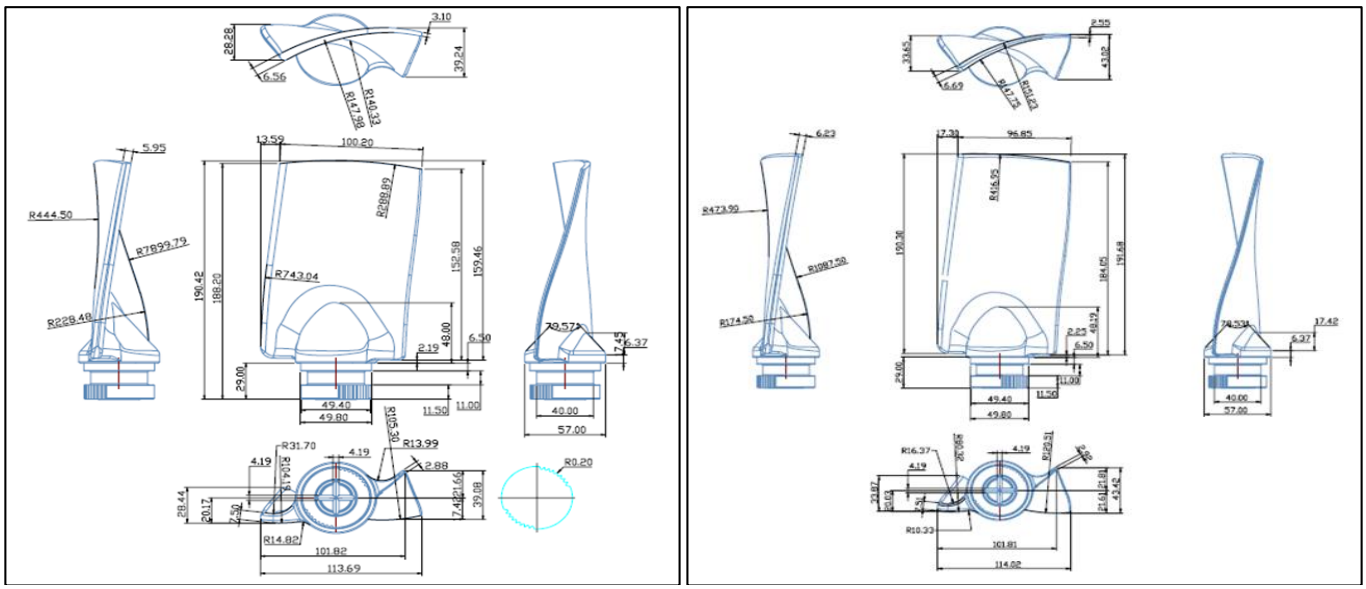

Fig 1: Detail dimensions of blade

The experiment was carried out at ASPEE, Agricultural Research Foundation, Tansa, Tal- Wada, Dist.- Palghar. Season of the laboratory evaluation of developed blower was October, November 2015. Different variables selected for the study are described herewith as follows.

Independent variables:
Blade type (1, 2) (B_1, B_2)
Dependent variables: 1) Blower speed, rpm
2) Air velocity, m/s

Blower speed
The blower was provided with adjustable fan blades and changing the blade angle increases or decreases the air velocity or air volume. The blower rpm was recorded at both blade types (B1 and B2) by using tachometer at each blade angle (Plate 2). The experiment at all combination was repeated three times

Air velocity
At both blade types (B1 and B2), air velocity was recorded by using anemometer at two positions i.e. at outer canopy and inner canopy (Plate 3). The experiment at all combination was repeated three times.

Plate 2: Measurement of blower speed

Plate 3: Measurement of air velocity

Results and Discussion

Effect of blade type

a) Blower speed

Table 1: Effect of blade type on blower speed

Sr. No.	Blade type	Blower speed, rpm
1	1	1848.5
2	2	1839.7
	F Test	NS
	SE (m) ±	16.9
	CD at 5%	-

Table 1 revealed the effect of blade type on blower speed. It was observed that the blower speed decreased from blade type 1 to blade type 2. This might be due to the fact that with increase in blade length, the load on the blower increases which directly results in the decrease of blower speed. The minimum value 1839.7 rpm was observed at blade type 2 while the maximum value 1848.5 was observed at blade type 1. However, the statistical analysis shows no significant difference between the mean values of blower speed as an effect of blade type.

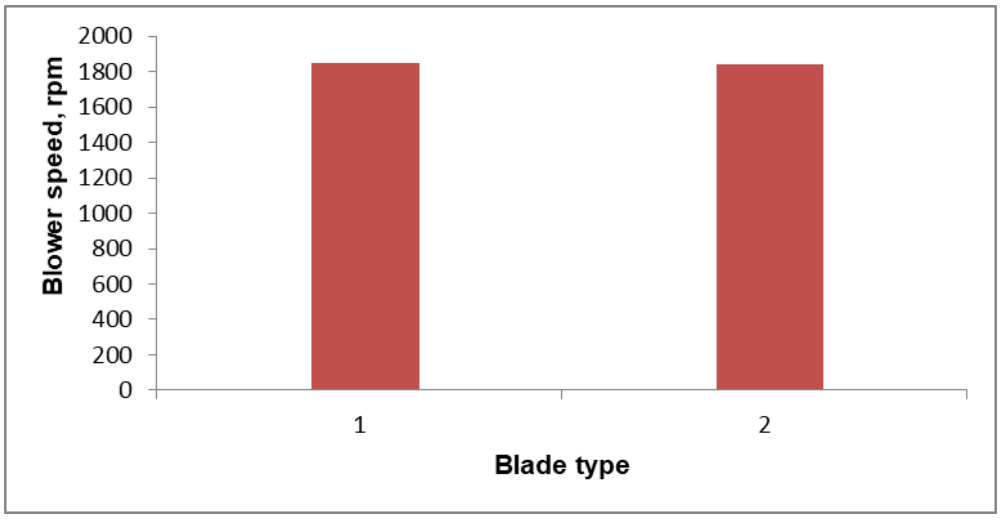

Fig 2: Effect of blade type on blower speed

The fig.2 shows the decreasing trend in the values of blower speed and recorded 0.4% decrease when the blade was changed from blade type 1 to blade type 2.

b) Air velocity

Table 2: Effect of blade type on air velocity

Sr. No.	Blade type	Air velocity, m/s	
		Outer canopy	Inner canopy
1	1	24.4	4.9
2	2	30.5	6.7
	F Test	Sig.	Sig.
	SE (m) ±	0.1	0.04
	CD at 5%	0.5	0.1

The table 2 revealed the effect of blade type on air velocity. The minimum value of air velocity on outer canopy and inner canopy was observed at blade type 1 while the maximum value was observed at blade type 2. The statistical analysis shows significant difference in values of air velocity as an effect of blade type.

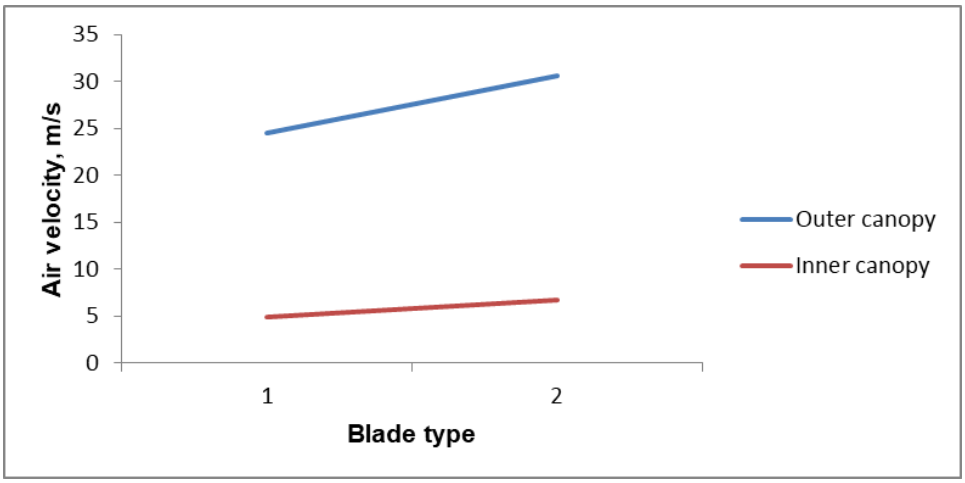

Fig 3: Effect of blade type on air Velocity

The fig.3 shows the increasing trend in the values of air velocity as an effect of length of blade on both positions i.e. outer and inner canopy. On outer canopy and inner canopy the air velocity increased by 24.9% and 37.2% when the blade was changed from blade type 1 to 2 respectively.

Conclusions

1. The effect of blade type shows significant difference amongst the mean values of blower speed, air velocity.
2. Blower speed decreases while air velocity increases when blade changes from blade type 1 to blade type 2.

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References

1. Derksen RC, Gray RL. Deposition and air speed patterns of air-carrier apple orchard sprayers. ASAE Paper No.93-1543, 1994.

2. Das SK. Performance evaluation and optimization of parameters of axial flow blower. Unpublished Thesis, M.Tech. IIT, Kharagpur, 1997.
3. Dhande KG. Design and performance evaluation of air carrier sprayer for Mango orchard. Unpublished Thesis, M. Tech. IIT, Kharagpur, 1991.
4. Fox RD, Derksen RC, Zhu H, Brazee RD, Svensson SA. A history of Air blast sprayer: Development and future prospects. Trans. of the ASABE. 2008; 51:405-410.
5. Gu J, Zhu H, Ding W. Unimpeded air velocity profile of an air-assisted five port sprayer. Trans. of ASABE. 2012; 55(5):1659-1666.
6. Singh SK, Singh S, Sharda V. Effect of Air assistance on spray deposition under laboratory conditions. IE (I) Journal-AG. 2007; 88:3-8.