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

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Abstract
Performance of axial flow blower in air assisted orchard sprayer was assessed in lab. The testing of blower was carried out for observing impact of blade angle on blower speed and air velocity. The maximum blower speed obtained as 1867.2 rpm at blade angle 25^0 and the minimum blower speed obtained as 1821.5 at blade angle 40˚. Maximum air velocity obtained as 31.3 m/s at blade angle 40˚ whereas minimum air velocity obtained as 23.4m/s at blade angle 25^0.

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

Introduction
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. The Indian farmers usually control them 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. The conventional methods of spraying orchard and tree crops involve low initial cost but manifest serious drawbacks and limitations in spraying orchards and trees. In India, although air-assisted spraying technique has been employed in some of the hand operated and boom sprayers, air-carrier sprayers capable of spraying vast orchard and tree crops are still aliens to Indian agriculture. 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
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 angle (25˚, 30˚, 35˚, 40˚) (A1, A2, A3, A4)
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. In existing blower four blade angles 25˚. 30˚, 35˚, 40˚ were used. The blower rpm was recorded by using tachometer at each blade angle. The experiment at all combination was repeated three times

Air velocity

At each blade angle, air velocity was recorded by using anemometer at two positions i.e. at outer canopy and inner canopy. The experiment at all combination was repeated three times.

Results and Discussion

Effect of blade angle

a) Blower speed

The table 1 revealed that the blower speed goes on decreasing with increase in blade angle from 25˚ to 40˚.This might be due to the fact that as the angle increases, it encounters maximum air resistance. The minimum value of blower speed was observed at blade angle 40˚ while the maximum value was observed at blade angle 25˚. The statistical analysis shows non significant effect of blade angle on blower speed.

Table 1: Effect of blade angle on blower speed

Sr. No.	Blade angle, degree	Blower speed, (rpm)
1	25	1867.2
2	30	1850.1
3	35	1837.6
4	40	1821.5
	F Test	**NS**
	SE (m) ±	24.0
	CD at 5%	-

The fig.1 shows the decreasing trend for the values of blower speed and observed 0.9% decrease when the blade angle was increased from 25˚ to 30˚and further decreased by 0.7% and 0.8% when the blade angle was increased from 30˚ to 35˚ and from 35˚ to 40˚ respectively. On an average there was decrease in blower speed by 0.8% with increase in blade angle by every 5 degree from 25˚ to 40˚.

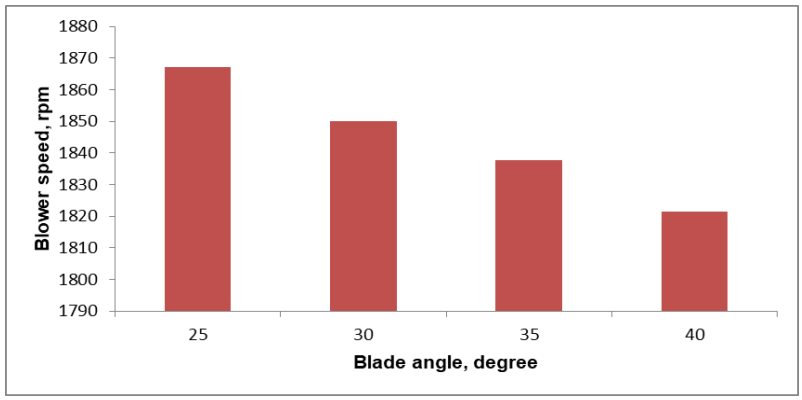

Fig 1: Effect of blade angle on blower speed

b) Air Velocity

Table 2: Effect of blade angle on air velocity

Sr. No.	Blade angle, degree	Air velocity, m/s	
		Outer canopy	Inner canopy
1	25	23.4	3.4
2	30	26.1	5.0
3	35	29.0	6.7
4	40	31.3	8.0
	F Test	Sig.	Sig.
	SE (m) ±	0.2	0.06
	CD at 5%	0.7	0.1

The table 2 represents an effect of blade angles, 25˚, 30˚, 35˚, and 40˚ on air velocity and found significant on outer and inner canopy. The minimum value of air velocity 23.4 m/s and 3.4 m/s was recorded on outer canopy and inner canopy respectively at blade angle 25˚ while the maximum value 31.3 m/s and 8.0 m/s at same positions was observed at blade angle 40˚.

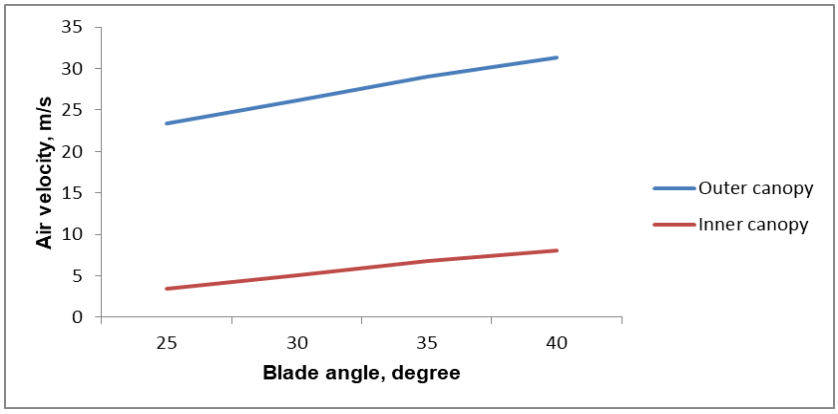

Fig 2: Effect of blade angle on air velocity

The fig. 2 shows the increasing trend in the values of air velocity at every selected blade angle on outer and inner canopy. This might be due to the fact that as the angle increases air easily passes outside the blower. On outer canopy the air velocity increased by 11.4%, 11.1% and 7.8% and on the inner canopy the values of air velocity was increased by 45.8%, 34.2%, and 18.3% when the blade angle was increased to 30˚, 35˚ and 40˚ respectively.

Conclusions

1. The effect of blade angle has significant difference in the value of air velocity while it shows non significant difference in blower speed.
2. Blower speed decreases as blade angle increases while air velocity increases with increase in blade angle.

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References

1. Derksen RC, Gray RL. Deposition and air speed patterns of air-carrier apple orchard sprayers. ASAE Paper, 1994, 93-1543.
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.