

Advanced mist blower technology for efficient disease management in rubber plantations

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ABSTRACT

Abnormal leaf fall (ALF) caused by Phytophthora spp. is an annually occurring fungal disease in the traditional rubber growing regions in India. Prophylactic ground spraying of copper oxychloride in agriculture spray oil using mist blowers is the conventional practice to manage this disease. Owing to paucity of labourers, the labour intensive ground spraying operations have become less attractive. Therefore, various alternative ground spraying systems were attempted. The blower assembly of the conventional mist blower having 4.5 hp



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capacity was attached to a mini tractor. The power for operating the sprayer was provided by the power take off (PTO) shaft of the tractor. This system was field tested by conducting prophylactic spraying of COC in oil against ALF disease. There was no significant difference with respect to leaf retention between the use of conventional mist blower and that of the tractor mounted mist blower. Therefore, the atomizer, which determines the delivery height of the spray fluid was changed and a modified one was fitted. This system was also field tested and was found to attain comparatively more delivery height than both the conventional mist blower assembly with ordinary atomizer fitted on the tractor and that operated by four persons. Certain defects were also noticed in the system during field operation. The spraying attachment was connected with the PTO by a lengthy shaft due to which a 30 cm gap occurred between PTO and the attachment. This caused frequent slip of propeller shaft frequently while moving on uneven terrain. Moreover, though the power output of the tractor was 18 hp, the capacity of the blower unit was only 4.5 hp. Owing to this incompatibility, the expected discharge height could not be attained. In order to overcome these defects, the spraying attachment was connected directly to the PTO shaft of the tractor using a single gear-wheeled gear box assembly, and a blower assembly having 12 hp capacity was designed and attached. The modified system was tested in the field and was found to attain a delivery height of 26.8 m with a leaf retention of 50% while that with the conventional mist blower was only 30%. The improved mini tractor mounted mist blower was found very effective for the plant protection operations in the rubber plantations of India, owing to less labour requirement and more area covered in unit time.

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Introduction

Crop loss due to pests and diseases in Indian rubber plantations is considered to be high if unprotected by adopting suitable crop protection strategies. Among the diseases, Abnormal Leaf Fall (ALF) disease caused by *Phytophthora* spp.



Fig 1. Conventional spraying

is the most dreadful among the biotic stresses, especially in the traditional rubber growing regions. Rubber plantations are protected from this disease by prophylactic spraying of copper oxychloride in petroleum based mineral oil (Pillay and George, 1973). RRII has developed very efficient systems of ground spraying using various mist blowers. These sprayers become less attractive owing to the high labour requirement vis-a-vis less unit area covered in a day. This necessitated the development of a mini tractor mounted mist blower.

Materials and Methods

At present, mist blowers fitted with four-stroke petrol/ kerosene engine are used for the prophylactic spraying against abnormal leaf fall disease in India. The engine of the sprayer develops a power up to 2.25 kW (4.5 hp) at 3000 rpm. Other essential parts include a tank for spray fluid, a centrifugal pump, intake and delivery hoses, rotary atomizer (nozzle) and blower assembly. These sprayers were suitable for spraying copper oxychloride (COC) oil mixture on trees up to a maximum height of 20 to 23 metre. The mist blower operation is carried out by holding the blower on the shoulders of four workers walking along each row in the plantation (Fig 1). The area usually covered by 4 workers would be a maximum of 6 ha per day.

In order to reduce labour requirement and to increase in area coverage and delivery height, following modifications were made to improve the present ground spraying technology.

- i). Conventional mist blower has been mounted on a mini tractor.
- ii). Mini tractor mounted conventional mist blower was fitted with modified atomizer.
- iii). Mini tractor was mounted with large capacity



Fig 2. Conventional mist blower mounted on a mini tractor

blower with single gear-wheeled gear box assembly.

1. Conventional mist blower mounted on a mini tractor

The blower assembly of the mist blower was attached to a mini tractor. This mini tractor with a 3 cylinder 4 stroke engine, having a width of 1.025 m, height 1.475 m and length 2.565 m has 6 speed forward gear and 2 speed reverse gear, with a 3 speed power take off. The tractor with a travelling speed of 1.2 kmph was suitable for operating along the space in between two rows of rubber trees. The power for operating the sprayer was provided by the power take off shaft (PTO) of the tractor. The blower assembly consisted of a blower case and an impeller mounted vertically inside the case. The blower case is made of bonded plastics. A rotary atomiser having fins with permanent angle was fitted at the top of blower lance. The fungicide pump was used for the delivery of fungicide to the atomizer. Totally 3 flexible rubber hoses attached in the pump were meant for intake (from the tank to pump), agitation (from pump to tank) and delivery (from

pump to atomiser). When the centrifugal impeller rotates due to drive from the tractor, the air current produced by the impeller makes the atomiser run at a high speed (Fig 3). The fungicide is atomised into fine particles and are carried to the target by the air blast from the blower.

This mini tractor mounted mist blower was evaluated in the field for low volume spraying against abnormal leaf fall disease (Fig 2). The experiment was taken up at two locations viz., Pudukkad and Echipara, Trissur, Kerala in clone RRIM 600. This new system was compared with the conventional micron sprayer. Copper oxychloride in agricultural spray oil in the ratio 1:5 was sprayed prophylactically. The operating speed of the spraying system was maintained with 2kmph, so as to obtain a delivery of the spray fluid at the rate of 11 l/min. (40 L/hectare). The result on leaf retention assessment is shown in Table 1.

II. Mini tractor mounted conventional mist blower fitted with modified atomizer

In this type, all features remained the same as mentioned above, except the conventional atomizer. Since the fins of the conventional

rotary atomizer are fitted at a permanent angle and owing to which the rotation (rpm) is constant, the height of the spray fluid is a limiting factor.

Therefore, a modified atomizer with fins adjustable in various angles was fitted to the blower lance



Fig 3. Conventional atomizer



Fig 4. Modified atomizer

Table 1. Leaf retention

Type of spraying	Leaf retention (%)	
	Pudukkad (RRIM 600)	Echilpara (RRIM 600)
Conventional mist blower mounted on mini tractor	28.0	42.5
Conventional mist blower	30.5	38.0

replacing the conventional atomizer to obtain more discharge height (Fig 4).

Multi locational evaluation of the mini tractor mounted mist blower having modified atomizer was carried out at Cheruvally estate, Erumely; Malankara estate, Thodupuzha and Chimony estate, Thrissur. The experiment was conducted in clone PB 260. Copper oxychloride in agricultural spray oil in the ratio 1:5 was sprayed prophylactically. The new system was compared with the conventional mist blower carried by four persons. The optimum delivery time taken to spray one hectare plantation and leaf retention after the disease season was estimated.

The optimum delivery height achievable by the mist blower was estimated by measuring the height at which ≥ 100 spray particles between 80-100 $\mu\text{M}/\text{cm}^2$ were deposited on a leaf in the canopy (Mathews, 1979). In order to measure this height, lengthy rope on which glass slides were fixed horizontally with a gap of 0.3 m was tied vertically on a tree from ground to or above the top of canopy. A minimum of 5 such

slide units were tied in a block under the trial. Each glass slide from the top was examined under microscope after the spraying and the slide having > 100 spray particles $/\text{cm}^2$ was considered as the optimum height at which

the mist blower could deliver the required quantity of spray fluid effectively.

III. Mini tractor was mounted with large capacity blower with single gear wheeled gear box assembly

Certain defects were noted in the previous two spray systems during the operation in the field. The spraying attachment was connected with the PTO by a lengthy shaft. The gap between PTO and attachment unit was 30 cm. This caused slip of propeller shaft frequently from PTO shaft while moving in the uneven terrain. The spraying unit attached to the tractor was also found hitting the ground (Fig 5).

In order to overcome the above defects, the spraying attachment was connected directly to the



Fig 5. Spraying attachment with lengthy shaft



Fig 6. Spraying attachment with lengthy shaft

PTO shaft using a single gear-wheeled gear box assembly.

Moreover, the capacity of the blower unit was only 4.5 hp, while that of the tractor was 18 hp. Owing to this problem, the expected discharge height was not obtained. This incompatibility was rectified

for its efficiency in terms of abnormal leaf fall disease control was carried out at Echipara. Trissur, Kerala on clone RRIM 600. Copper oxychloride (COC) in agricultural spray oil was sprayed prophylactically. The new system was compared with the conventional mist blower. The

by designing large capacity blower having 12 hp. In order to get the efficient discharge of spray fluid, a piston pump (Horizontal Tripple Piston) was also used (Fig 6).

Field testing of this spraying system was carried out at RRS, Dapchari, for discharge height and number of spray particles in unit area.

Field assessment

Table 2. Delivery height (≥ 100 spray particles/cm²)

Sprayer type	Height (Meter)		
	Cheruvally, Erumely	Malankara, Thodupuzha	Echippara, Thrissur
Mini tractor with MA*	17.1	21	23.5
Mini tractor with CA**	16.8	19.5	21.3
Conventional mist blower	15.2	18.3	19.8

MA*- Modified Atomizer; CA**- Conventional Atomizer

Table 3. Leaf fall observation

Type of spraying	Leaf fall (%)		
	Trichur	Cheruvally	Malankara
Mini tractor mounted with conventional mist blower	< 5% leaf fall		
Conventional mist blower	< 5% leaf fall		

observation on leaf retention was recorded after the disease season.

Results and Discussion

I. Conventional mist blower mounted on a mini tractor

The result (Table 1) on leaf retention in the experiments indicated that there were no significant difference in the case of leaf retention between the conventional mist blower and tractor mounted mist blowers. Moreover, the results on leaf retention were not encouraging. This may

the influence of wind in those locations. The leaf fall (Table 3) in both the plots was more or less same (< 5% leaf fall). However, considering the labour consumption and coverage of area sprayed, mini tractor mounted with conventional mist blower having modified atomizer was promising and encouraging.

III. Mini tractor was mounted with large capacity blower with single gear -wheeled gear box assembly

The results on delivery height revealed that mini

Table 4a. Delivery height (≥ 100 spray particles/cm²) at RRS, Dapchhari (2011)

Sprayer type	Height (Metre)
Mini tractor mounted with mist blower with modified impeller	26.8

Table 4b. Leaf retention at Echipara (2011)

Sprayer type	Leaf retention (%)
Mini tractor mounted with mist blower with modified impeller	50
Conventional micron sprayer	30

be due to the inability of the spraying systems to deliver the spray fluid to a greater height and also high disease pressure build up in the experimental area.

II. Mini tractor mounted conventional mist blower was fitted with modified atomizer

The data from Table 2 revealed that the optimum delivery height was more in plot sprayed using mini tractor with modified atomizer than in the plot sprayed using mini tractor using conventional atomizer. The average time taken to cover one hectare plantation was 20 minutes while for the conventional mist blower operated manually by four persons required 40 minutes. Variation in the delivery height with the same spraying system at different locations was noted. This could be due to

tractor with giant blower could throw the spray at a height of 26.8 m (Table 4a). However, the results on leaf retention (Table 4b) among all these spray types including conventional micron sprayer were not satisfactory which may be owing to high disease pressure build up in the experimental area. However, among the spray types, mini tractor with giant blower showed high leaf retention capacity of 50 per cent.

References

- Mathews, G.A. (1979). *Pesticides application methods*. Longman, New York, 334 p.
- Pillay, P.N.R. and George, M.K. (1973). Recent experiments on the control of abnormal leaf fall disease of rubber in India. *Quarterly Journal of the Rubber Research Institute of Sri Lanka*, 50(3&4): 223-227. ■