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Preparation and Setting Up Air Blast Sprayers

M. Poffley, formerly Horticulture Division, Darwin

Basically an air blast sprayer operates on the principal of replacing the air in and around the tree with spray laden air. The aim is to apply sufficient chemical to the tree to control the target pest or disease. Too little chemical results in an outbreak, or worse still, resistance build up to the chemical. Too much chemical can be hazardous to the operator, cause environmental pollution or result in residue problems on the fruit, not to mention costing extra dollars. To carry out this task safely and efficiently the sprayer must be correctly calibrated.

SPRAYER PREPARATION

Before beginning calibration you should complete the following check list especially if the sprayer has not been used for a while:

- Check tank is clean, free of foreign matter, corrosion or leaks.
- Check all filters for damage (tank as well as nozzle filters) and ensure they are clean, half fill tank and flush lines with nozzles and filters removed.

- Check mechanical components are working properly i.e. fan revolves freely, pump is working.

- Pressure gauge must be working and needle must return to zero, replace if necessary.

- Check spray discs are operating properly, it is advisable to replace all spray discs annually as it is difficult to detect wear.

- Check all hoses and fittings at operating pressure for leaks.

Follow manufacturers service instructions for maintenance of pumps.

SETTING UP AN AIR BLAST SPRAYER

1. **Single or double sided air delivery**
   Double sided spraying can be carried out on trees up to a height of 3.5-4 metres. Trees higher than this require single sided delivery with a shroud to maximise air penetration of the canopy and to reach the tops of the trees.

2. **Spraying distance from tree canopy**
   This refers to the distance from the canopy to the nozzles. The sprayer should be at sufficient distance from the foliage to allow the spray patterns from each nozzle to merge. If the sprayer is too close strip spraying occurs, too far and penetration of the spray is reduced. To check spraying distance fill the tank with water, and, with spray operating, select the distance that allows spray patterns to overlap before reaching the foliage. Generally a spraying distance of one or two metres is enough.

3. **Spray swath**
   The width of the total spray pattern from the lowest to the highest nozzle, is the spray swath. Spray swath is checked with the sprayer operating next to the tree at the correct spraying distance. Spray should not pass over the top of the tree or be wasted by spraying the ground under the tree. Shut off any nozzles which are not directing spray onto the target area of the tree itself.

4. **Spray volume per tree**
   Measure the diameter of the tree canopy and refer to the chart "Spray Volumes for Mango Trees in the Top End". There is a range of options for tree canopies. Examine the density of the trees to be sprayed, chose the densest trees (the highest rate) to ensure all trees receive adequate spray to control the pest or disease targeted.

Table 1. Spray volumes for mango trees in the top end

Tree base diameter (m)	L/tree open	L/tree dense	Ave. L/ha (100 tree/ha)
2	1	2	120
3	1	3	200
4	2	5	350
5	3	6	450
6	5	8	650
7	6	9	750
8	7	11	900
9	8	14	1,100
10	10	20	1,500

These rates are meant as a guide only, growers will have to use their own judgement for their situation.

5. Engine operating speed (rpm)

Recommended operating speed for most PTO driven sprayers is 540 rpm at the PTO. At this speed both the fan and the pump are operating at maximum capacity. To get the most out of the sprayer all calibration and spraying operations should be done with the engine set at this speed.

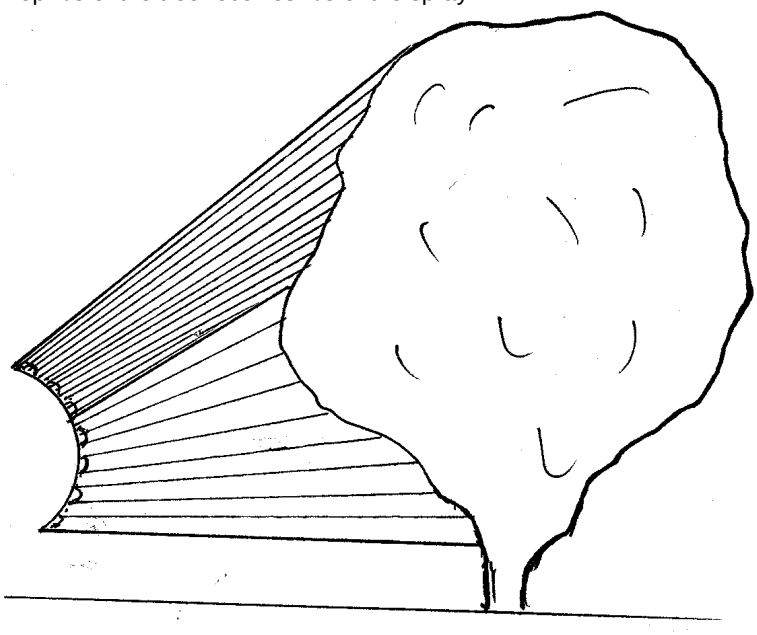
6. Operating pressure

Normal operating pressure for hollow or solid cone nozzles is in the range of 1,000-3,000 kPa (150-450 psi). Higher pressure creates more small droplets and this can increase the potential for spray drift and on hot days could result in the spray evaporating before reaching the target. Pressures in the range of 1,400-1,700 kPa are best.

7. Spray pattern

When applying spray to trees it is important to ensure even coverage of the tree. To achieve this with air blast sprayers two thirds (2/3) of the spray should be applied to the top one third (1/3) of the tree (see diagram: Jet Positions). Select nozzle sizes by referring to the Jet output charts supplied by manufacturers.

Top 1/3 of the tree receives 2/3 of the spray



Bottom 2/3 of the tree receives 1/3 of the spray

8. Measuring spray output

There are a number of ways of doing this, the following is one of the simplest.

- Fill the tank with water. Set the pressure, and selected rpm and run the sprayer to remove air from lines and check all nozzles are operating properly.
- Stop the sprayer and refill the spray tank to a known mark or to the brim.
- Run the sprayer at the selected operating pressure for exactly one minute.
- Measure amount of water need to refill the tank to the mark or brim. This is the sprayer output.

This can be varied by changing the pressure, engine rpm or the nozzle disc sizes.

9. Determining tractor speed by tree numbers

Air blast sprayers operate best at speeds below 5 km/hr. Trees must be evenly spaced to get an accurate reading using this method.

- Measure the tree spacing in metres.
- Get the tractor running through the orchard at operating speed with the pump and fan running. Time for one minute and count the number of trees passed.
- Multiply the number of trees passed in one minute by the distance between trees to get speed in metres per minute.

To convert to km/hr use the following formula:

$$\frac{\text{metres/min} \times 60}{1{,}000} = \text{km/hr.}$$

10. Keep records

Keep records of all the calibration settings for use in the future. Also keep records of amount of spray applied to each orchard, this way you can check the calibration each time you spray.

Once you have all the relevant information it can be used to determine the type and placement of nozzles. The following calibration chart gives a simple method of calculating this.

AIR BLAST SPRAYER OPERATION NOTES

- Only spray if necessary. Correct identification of pests and diseases is vital. Are they still active, or is the damage old? Does the infestation warrant treatment?
- Having identified the problem, selection of the correct treatment is the next step. Some chemicals are very specific to their targets and may not have any effect on the wrong pest.
- Trees should be of similar size, if not, calibrate on one of the larger trees to ensure adequate spray coverage of all trees.

- Ground speed should not exceed 4-5 km/hr. The higher the speed the less effective the penetration of the spray into the tree. Go to smaller nozzles if application rate is too high for slower speeds.

- Air volume output is important. To do an efficient job air around and in trees must be replaced with spray laden air. This is one of the limiting factors effecting operating speed. This can be varied by altering the pitch of the fan blades or changing the engine speed (rpm).

- Minor adjustments to application rates of spray can be achieved by varying the spray pressure or the engine speed (rpm).

- Major adjustments to application rates are achieved by selecting a different gear or by changing nozzle size.

- To obtain accurate readings the operating range of the pressure gauge should not cover excessively high pressures well above the pumps capacity i.e. if the pump is only capable of a maximum pressure of 6,000 kPa there is no point in having a gauge which reads up to 15,000 kPa.

- Calculate sprayer output per side in litres per minute

- Know pump output. Application rate should not exceed 2/3 of the pumps capacity. This is to allow enough by pass flow to keep the mix agitated, especially with wettable powders.

- Normal operating pressure for hollow or solid cone nozzles are in the range of 1,000-3,000 kPa. (150-400 psi) Higher pressure gives more small droplet sizes and can increase the problem of drift or, on hot days, evaporate before reaching the target.

- When selecting nozzle sizes and position remember 2/3 of spray should be directed to the top 1/3 of the tree for the optimum coverage. This is the spray pattern.

- Still days are not the best for spraying. A light breeze will increase the turbulence around the tree and give better droplet deposit on the target,and improve efficiency of application. Do not spray if the wind is more than a couple of km per hour.

- High temperatures make some chemicals phytotoxic, as well as reducing spray penetration due to evaporation of smaller droplets.

- In the more built up areas it may be better to spray during the day when most people are at work.

- Water and oil sensitive paper attached to various locations around the tree is a useful method of assessing spray efficiency. Droplet size and number on the paper indicates spray penetration and coverage patterns.

- Regular pruning to skirt and open up the centres of trees greatly enhances spray penetration and efficiency.

Keep an “Orchard Diary” to record all operations carried out in the orchard. This should include the number of tanks of spray used per orchard. In this way you can keep a check on the calibration of your sprayer.

AIR BLAST SPRAYER CALIBRATION CHART

DATE: - **ORCHARD:** -

(A) TREE DIAMETER: - m

(B) RATE/TREE (see chart): - l/tree

(C) APPLICATION RATE/M OF TREE : - $\frac{B}{A \times 2}$ = l/m of tree

(D) SELECT ENGINE SPEED: - rpm

(E) SELECT TRACTOR SPEED: - metres/min.

(F) SELECT SPRAYER OPERATING PRESSURE: - kPa

(G) DETERMINE SPRAY SWATH: - No. jets operating/side

(H) SPRAYER APPLICATION RATE: - C x E = l/min.
(If spraying both sides divide H by 2 to get rate per side)

(I) SPRAY PATTERN (refer operators manual for jet flow rates)

NOZZLE NUMBER FROM TOP	%FLOW EACH NOZZLE	DESIRED NOZZLE OUTPUT = FLOW PER SIDE x % / 100	JET / SWIRL SIZE	CHART FLOW l/min
1	13			
2	27			
3	27			
4	16			
5	8			
6	5			
7	4			
TOTAL	100%	TOTAL FLOW PER SIDE	=	

AIR BLAST SPRAYER CALIBRATION CHART

DATE: - *13th Apr. 06* **ORCHARD:** - *KP 3*

(A) TREE DIAMETER: - *4* m

(B) RATE/TREE (see chart): - *4* l/tree

(C) APPLICATION RATE/M OF TREE : - $\frac{B}{A \times 2}$ = *0.5* l/m of tree

(D) SELECT ENGINE SPEED: - *1600* rpm

(E) SELECT TRACTOR SPEED: - *50* metres/min.

(F) SELECT SPRAYER OPERATING PRESSURE: - *1700* kPa

(G) DETERMINE SPRAY SWATH: - *5* No. jets operating/side

(H) SPRAYER APPLICATION RATE: - C x E = *25* l/min.(2 sides)
(If spraying both sides divide H by 2 to get rate per side) = *12.5* l/min (single side)

(I) SPRAY PATTERN (refer operators manual for jet flow rates)

NOZZLE NUMBER FROM TOP	%FLOW EACH NOZZLE	DESIRED NOZZLE OUTPUT = FLOW PER SIDE x % / 100	JET / SWIRL SIZE	CHART FLOW l/min
1	*SHUT OFF*	-	-	-
2	*33*	*4.12*	*2.0/Cl*	*4.46*
3	*33*	*4.12*	*2.0/Cl*	*4.46*
4	*15*	*1.87*	*1.0/1.0*	*2.07*
5	*10*	*1.25*	*0.8/Cl*	*1.4*
6	*9*	*1.13*	*0.8/Cl*	*1.4*
7	*SHUT OFF*	-	-	-
TOTAL	100%	TOTAL FLOW PER SIDE	=	*13.26*

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