Micron Sprayers Limited

• UK based and owned
• Established 45 years
• Inventor of CDA using rotary atomisers
• 50 employees
• Sales to over 90 countries
• Micronair Division on Isle of Wight
Bembridge Fort
ULTRA LOW VOLUME (ULV) SPRAYING
The Target
The Objective

• To apply 3 litres of insecticide per hectare of forest
• To penetrate the forest canopy
• To give good coverage of foliage
• To minimise wastage of insecticide

This is achieved by Controlled Droplet Application (CDA)
Hydraulic Nozzles
Hydraulic Nozzle
Droplet Formation
Rotary Atomiser
Rotary Atomiser (CDA)
Droplet Formation
Comparison of Spray Droplets

From standard nozzle  From Micronair Atomiser

PERCENT  PERCENT

DROPLET DIAMETER  DROPLET DIAMETER
Droplet Size & Coverage

• Reducing droplet size increases the number of droplets
• Smaller droplets give more droplets/cm² than larger droplets
• Smaller droplets penetrate dense foliage better

200 μm = 100 μm
Number of Droplets on Target

1  8

64  512
Choice of Droplet Size

Droplets must be small enough to:
• Give good coverage
• Give effective penetration of foliage
But must be large enough to:
• Not evaporate significantly before reaching their target
• Not drift out of the target area
Evaporation of Droplets

- Water-based formulations evaporate quickly
- Most Ultra Low Volume (ULV) formulations use low volatility carriers
- Small droplets fall more slowly and evaporate more quickly than large ones
- Droplets will evaporate more quickly at high temperature and low Relative Humidity (RH)
MICRONAIR SPRAY EQUIPMENT
Typical Spray System

- TANK (HOPPER)
- CONTROL VALVE
- PUMP
- FLOWMETER TURBINE
- PRESSURE GAUGE
- BOOM
- VRUs
- DIAPHRAGM CHECK VALVES
- ATOMISERS
- RPM TRANSDUCERS

Legend:
- Standard spray system on aircraft
- Micronair atomisers
- Micronair application monitor

MICRONAIR
Micronair AU5000 Atomiser
Variable Restrictor Unit (VRU)

- One VRU used with each atomiser
- Regulates chemical flow rate to atomiser
- Installed on spray boom
- Adjusted on ground
Variable Restrictor Plates

- Fixed restrictor plate drilled with 7 different size holes
- Rotating selector plate exposes one hole in restrictor plate
- Selector plate rotated by knob on VRU
Diaphragm Check Valve

- Prevents leakage of chemical when atomiser is not operating
- Opens when control valve is opened and pressure in boom increases
- Installed on atomiser
Installation of Atomisers

- Atomisers may be fitted to standard booms or Micronair booms
- Outboard atomisers normally installed at about 66% of wing span
Position of Spray Booms

• The booms must be below the wing and far enough aft to prevent contamination of the wing with spray

• If necessary, the booms must be lowered
Installation of Booms on AN-2
Application Monitor

- Measures chemical flow rate with turbine in pipe to booms
- Displays flow and application data
- Measures atomiser RPM
- Installed in cockpit
Application Monitor Functions

- Chemical flow rate (Litres/Minute)
- Volume sprayed (Litres)
- Application Rate (Litres/Hectare)
- Area sprayed (Hectares)
- Spray time (Minutes : Seconds)
- Work rate (Hectares/Minute)
- Atomiser RPM
Flowmeter Turbine
Flowmeter Turbine Rotor
Atomiser RPM Indicator

- Measures speed of each atomiser (max 10 units)
- Allows all atomisers to be adjusted to rotate at same speed
- Magnetic transducer installed on each atomiser
Application Printer

- Prints data from application monitor
- Provides permanent record of each spray job
- Installed in cockpit of aircraft
CALIBRATION
Adjustment of Droplet Size

• Droplet size is determined by rotational speed (RPM) of atomiser
• Increasing RPM reduces droplet size
• RPM is controlled by atomiser fan blade angle
Adjustment of Atomiser RPM

- Atomiser fan blades must be adjusted on ground before flight
- Reducing blade angle increases atomiser RPM and makes smaller droplets
- Atomisers must not exceed 10,000 RPM
Adjustment of Fan Blade
Variation in Atomiser RPM

- Some atomisers will rotate faster than others because of:
  - Effect of propeller
  - Effect of fuselage
- RPM indicator can assist adjustment of all atomisers to rotate at correct speed
Swath Distribution

- Swath width depends upon:
  - Wind direction
  - Spray droplet size
  - Wind speed
  - Aircraft flying height

- With a cross-wind:
  - Swath distribution not symmetrical
  - Swath displaced downwind of centre-line of aircraft
Swath Width & Track Spacing

Track spacing must be narrower than swath width to give overlap and even coverage
Coverage of Aircraft

The coverage of an aircraft whilst spraying depends upon:

- Track Spacing
- Ground Speed

\[
\text{COVERAGE} = \frac{\text{TRACK SPACING (m)} \times \text{SPEED (Km/hr)}}{600}
\]

Example:
- Track Spacing = 40 m
- Speed = 160 Km/hr

\[
\text{COVERAGE} = \frac{40 \times 160}{600} = 10.7 \text{ ha/min}
\]
Output from Aircraft

- Output from aircraft depends upon:
  - Coverage of aircraft (Ha/Min)
  - Required application Rate (L/Ha)
- Output is set by adjusting VRUs and boom pressure

\[
\text{OUTPUT FROM AIRCRAFT (l/min)} = \text{COVERAGE (ha/min) x APPN RATE (l/ha)}
\]

Example:

Coverage = 10.7 ha/min
Application Rate = 3 l/ha

\[
\text{OUTPUT} = 10.7 \times 3 = 32 \text{ l/min}
\]
Output from Aircraft for ULV Application at 3 l/ha

<table>
<thead>
<tr>
<th>Ground Speed (Km/hr)</th>
<th>Track Spacing (m)</th>
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<tbody>
<tr>
<td></td>
<td>30</td>
</tr>
<tr>
<td>150</td>
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<td>24.8</td>
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<tr>
<td>170</td>
<td>25.5</td>
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</tbody>
</table>
Adjustment of VRUs

- VRUs must be adjusted to give correct output from each atomiser
- VRUs have setting numbers 1, 2, 3 … 7
- Higher numbers give higher outputs
- All VRUs should be set to the same number

\[
\text{OUTPUT FROM EACH VRU (l/min)} = \frac{\text{OUTPUT FROM AIRCRAFT (l/min)}}{\text{NUMBER OF VRUs}}
\]

Example:
- Output from Aircraft = 32 l/min
- Number of VRUs = 10
- \[
\text{OUTPUT FROM VRU} = \frac{32}{10} = 3.2 \text{ l/min}
\]
MICRONAIR SPRAY EQUIPMENT IN FORESTRY