RAS Consult
(Pty) Ltd

Spray Nozzle Type Selection Protocol

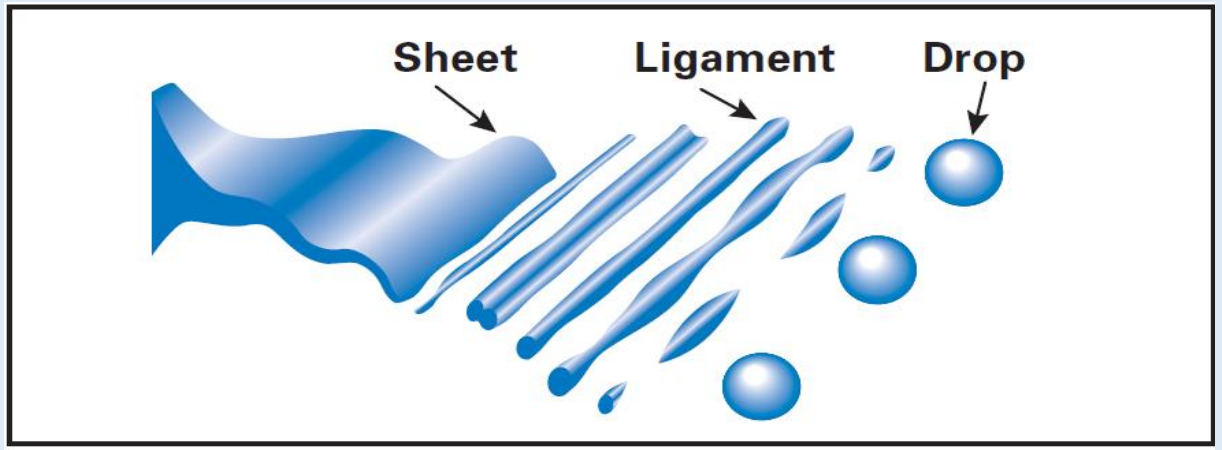
“The primary target area determines the required Droplet Spectrum VMD – and thus the nozzle type”

1. Droplet formation from Hydraulic Nozzles

The formation of droplets (atomization) by hydraulic nozzles is brought about by the conversion of the potential energy in the fluid stream, due to the pressure supplied by the pump, to shear and kinetic energy in the fluid stream exiting the shaped nozzle aperture.

Fan type Nozzles:

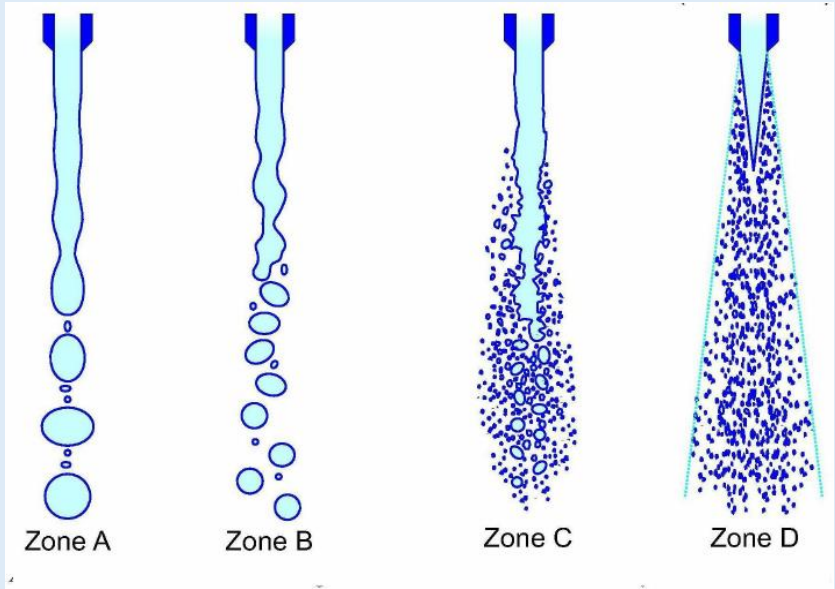
The fluid exits the nozzle tip in a sheet, dividing into ligaments and finally breaking up into droplets. (Figure 1) Factors like the **shape and size of the nozzle aperture, the pressure at the aperture and the chemical and physical properties of the fluid, will determine the size of droplet formation and the flow rate.**



Cone Type Nozzles:

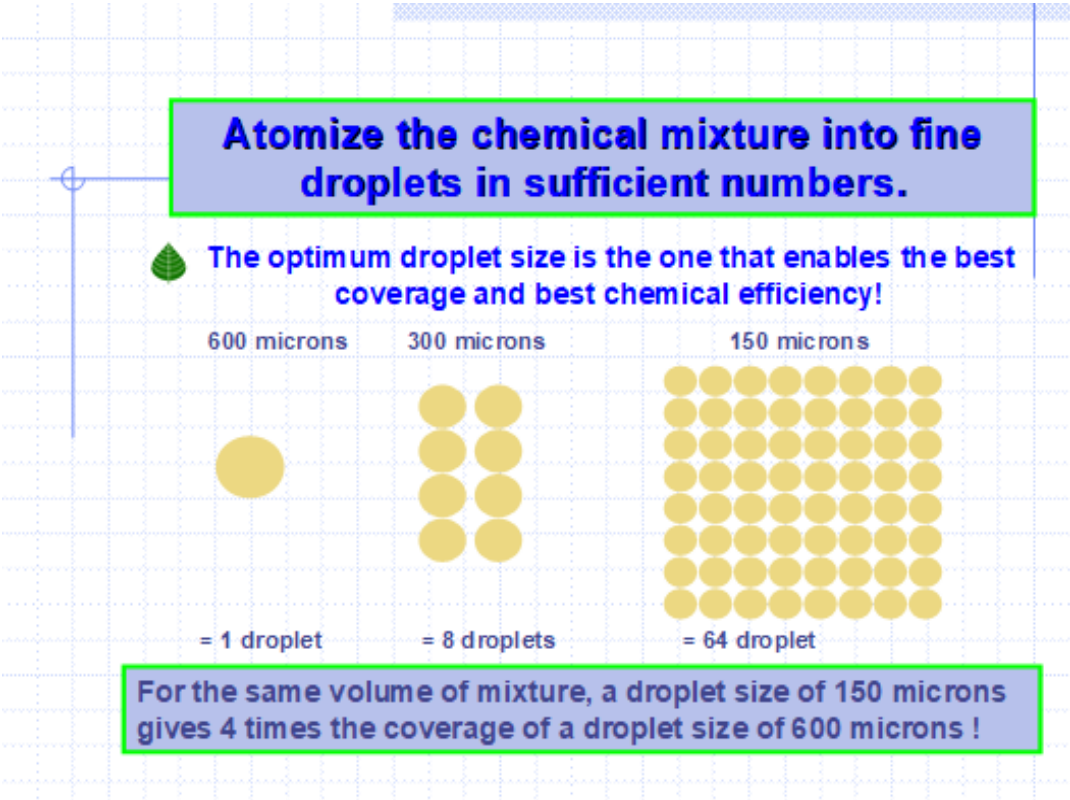
Pressure at the outlet aperture, size of the outlet aperture and whirl aggression will determine the flow rate, droplet spectrum and spray geometry.

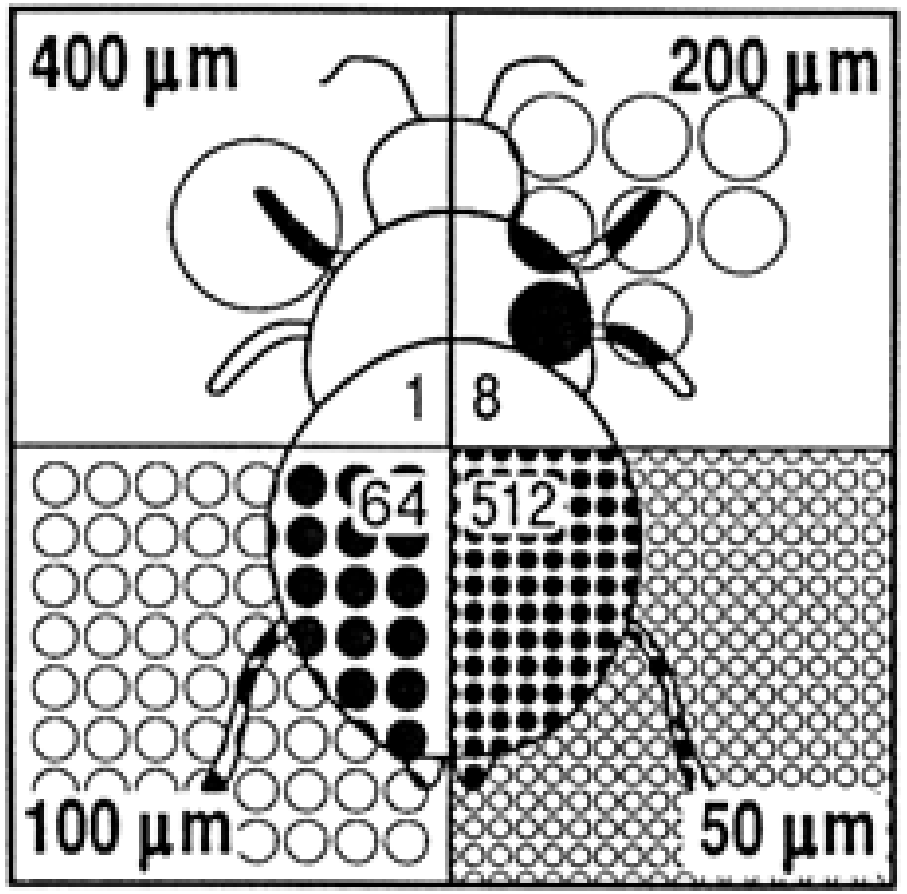
Ligament directly into droplet formation.



2. Droplet size: Volume = 4/3 x pie x Radius^3

When using the *same volume* of water per hectare, every halving of the droplet size will produce *8 x more droplets,* each with *¼ of the center plane surface area*, and has thus *double the potential of surface coverage*.



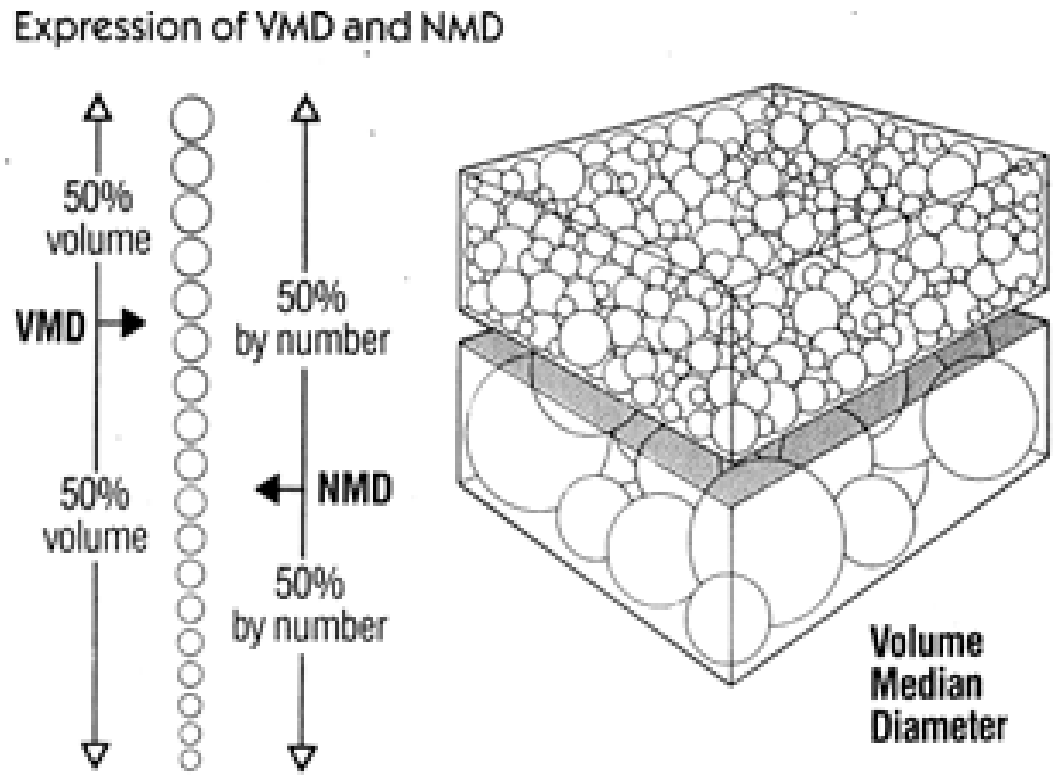


Thus: Deciding on an application volume/ha without defining the VMD makes little sense!

3. Droplet Spectrum VMD definition

The atomization of liquid through agricultural nozzles and atomizers produces a spectrum of droplets, and not a single droplet size – even in the case of rotary atomizers. To find a common basis of reference to describe the characteristic of a droplet spectrum, the Volume Median Diameter (VMD) is used:

The VMD of a droplet spectrum is that representative droplet size where 50% of the volume is made up of droplets larger than the VMD the other 50% of the volume smaller than the VMD.



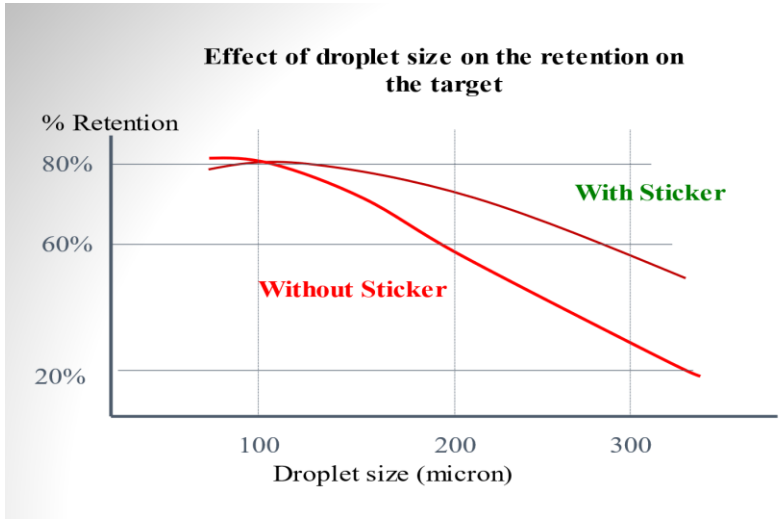
4. Droplet size, target impact & deposition

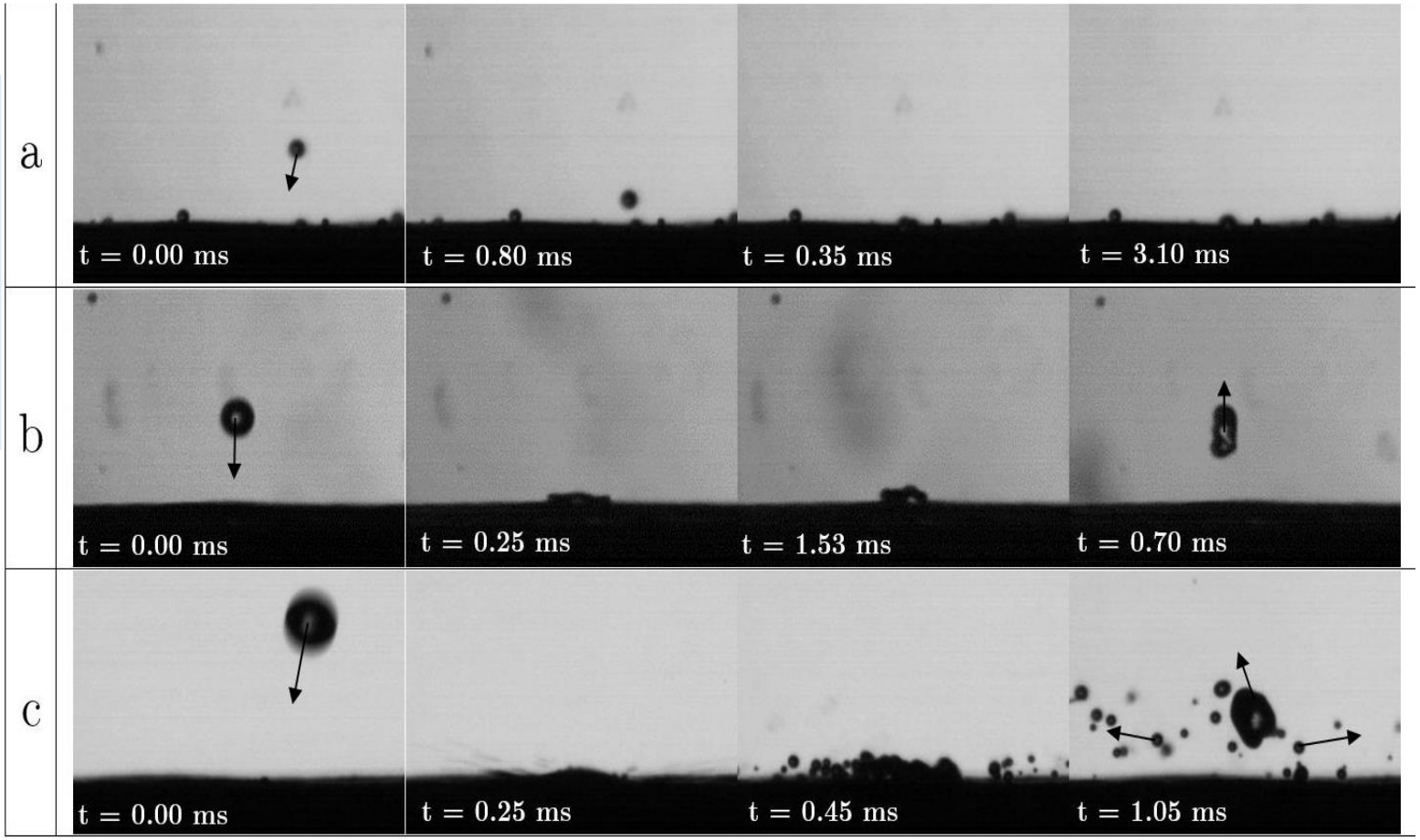
The impact on a natural leaf/fruit/stem surfaces and the subsequent behavior of the droplet are determined by:

- The droplet sizes
- The angle of impact
- The velocity of impact

Droplets impacting on a dry Cabbage leaf surface:

A = Adhesion (111 micron).
B = Bounce (236 micron).
C = Shatter & Bounce (357 micron)





5. Droplet Spectrum ISO categories & behavior

VF Very fine (< 159 µm) - F Fine (> 159 / < 231 µm) - M Médium (> 231 / < 326 µm) - C Coarse (> 326 /< 386 µm)
VC Very coarse (> 386 µm / < 484 µm) - XC Extremely coarse (> 484 /< 553 µm) - UC Ultra coarse (> 553 µm)

Values measured on the VMD or D50 on IRSTEA Dantec pda.

Spray quality: ASABE standard 572.1 describes the range of droplet sizes produced by a nozzle at a particular pressure. (Colours assigned to spray quality are NOT related to colours assigned to nozzle size.)

UC	XC	VC	C	M	F	VF
Ultra coarse	Extra coarse	Very coarse	Coarse	Medium	Fine	Very fine

Very good drift control ⟷ Poor drift control

Poor Deposition Potential
Bounce
Run off

Good Deposition Potential

6. Generic Nozzle Categories

FAN Type Nozzles: Conventional Boom Sprayers

- *Standard Flat Fan.*
- *Drift reduction Flat Fan.*
- *Air Induction Flat Fan.*

Variants on FAN type Nozzles:

- *Twin Flat Fan*
- *Anvil nozzles. (Liquid Fertilizer)*
- *Even Fan nozzles. (Strip application)*
- *Offset Fan nozzles. (Under band application)*

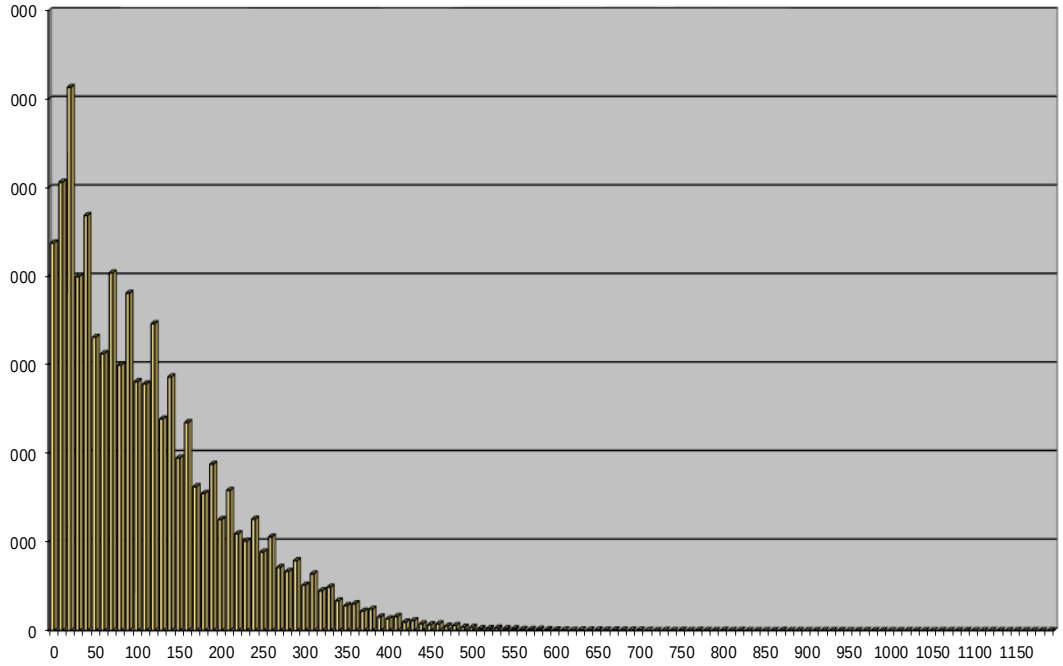
CONE type Nozzles: Air Assisted Sprayers

- *Hollow cone nozzles*
- *Solid/Full cone nozzles*

Standard Flat Fan nozzles

General characteristics:

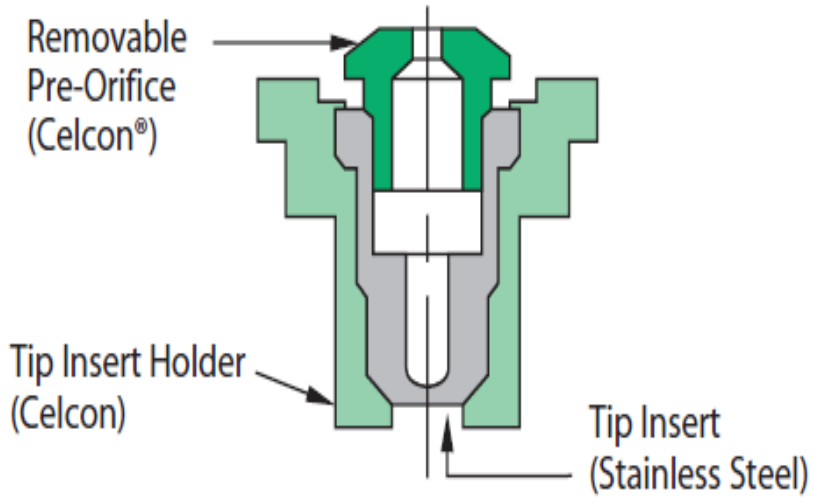
- A large % of droplets below 100 microns – and thus potentially a drift risk.
- Fine – Medium droplet spectrum.
- VMD extremely pressure sensitive.
- Generally used for Insecticides, Fungicides and Post Emergence Selective Herbicides with only leaf area as primary target.

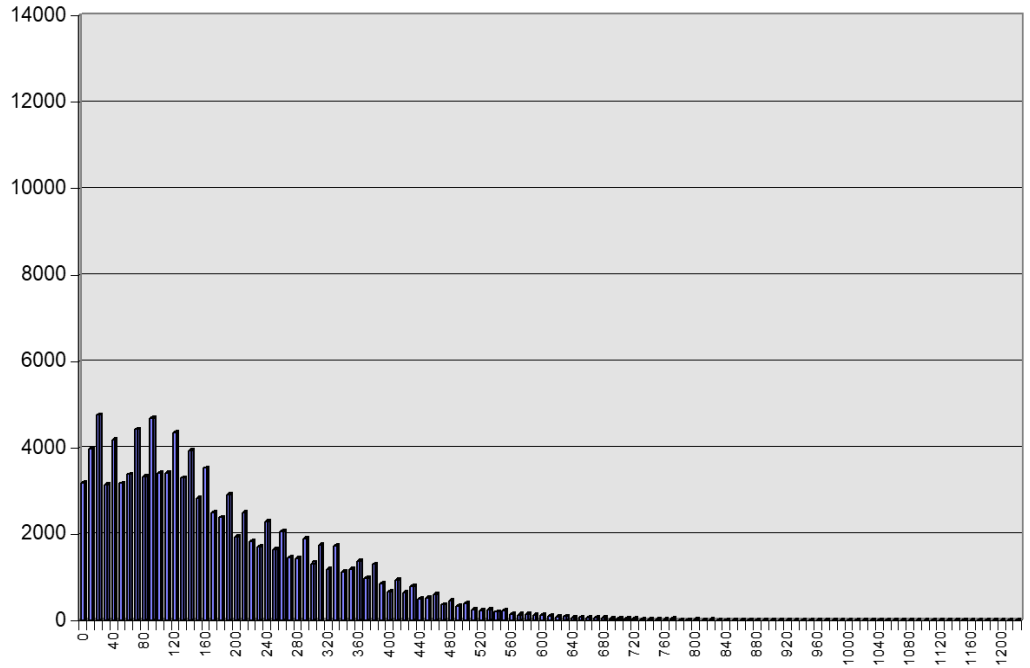


Drift Reduction Flat Fan Nozzles

General characteristics:

- Pre-orifice reduces the pressure on nozzle tip.
- Reduced % of droplets less than 100 microns – and thus reduced drift potential.
- Increased VMD at same flow and pressure.
- Medium – Course droplet spectrum.
- VMD pressure sensitive.
- Generally used for Post Emergence Selective herbicides with leaf & root areas as primary target or Broad-Spectrum Herbicides.

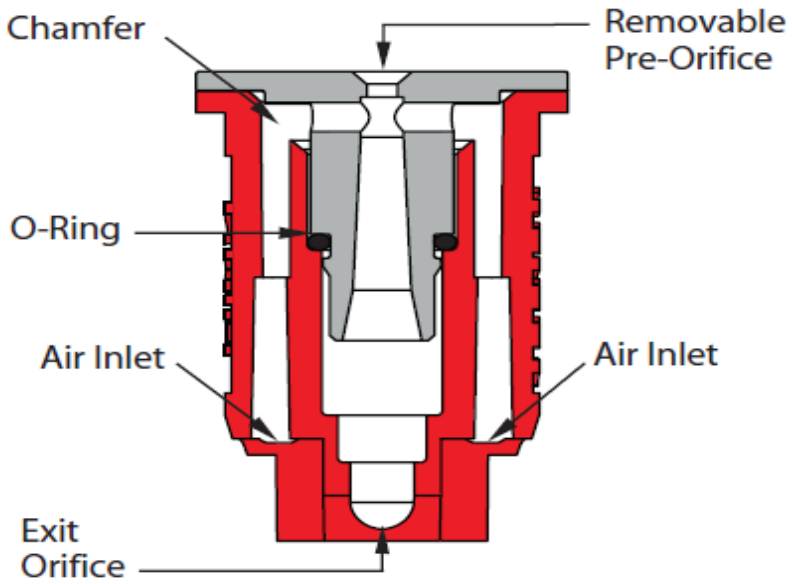


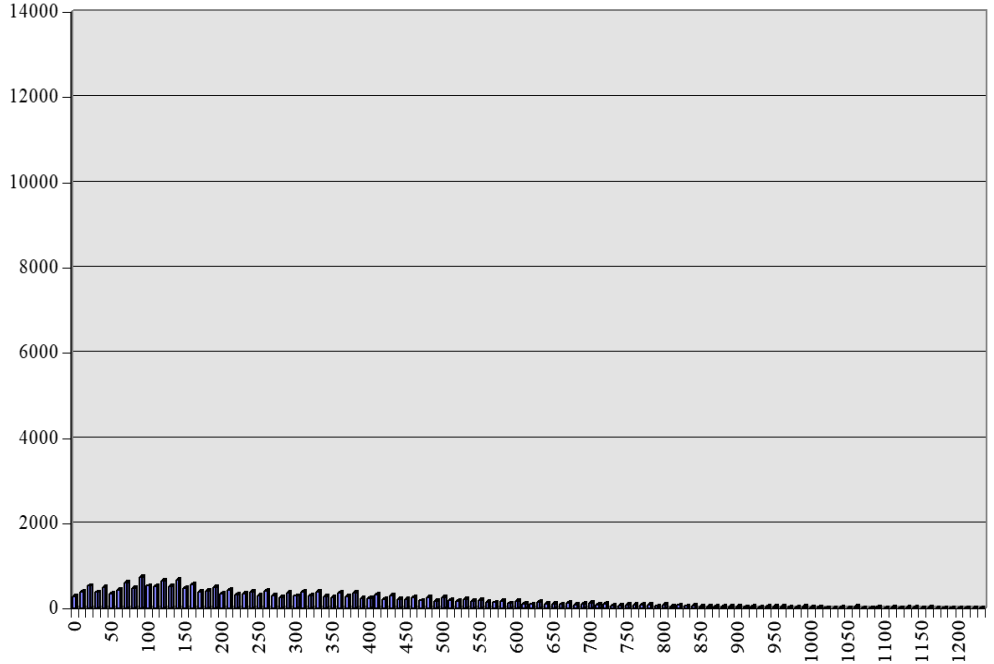


Air Induction Flat Fan Nozzles

General characteristics:

- Pre-orifice acts as a venturi to allow opening to atmosphere via air inlet. This reduces the pressure on the nozzle tip dramatically.
- Greatly reduced % of droplets less than 100 microns – and thus minimal drift potential.
- Greatly increased VMD at same flow and pressure.
- Very – Extremely course droplet spectrum.
- VMD moderately pressure sensitive.
- Generally used for Pre-Emergence Herbicides.

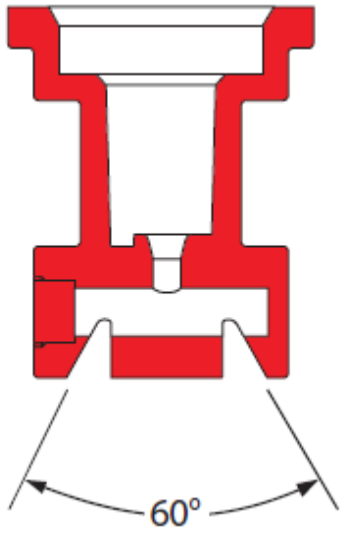


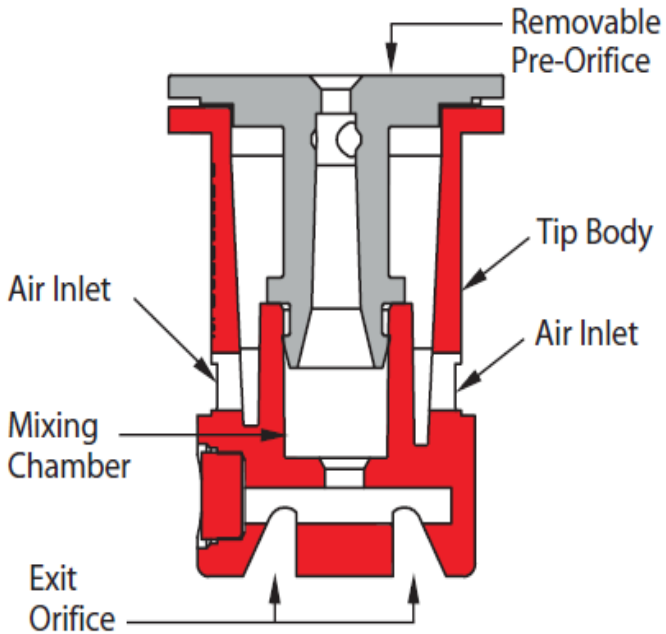


Twin Flat Fan variants

General characteristics:

- Twin fan spray outlet for multiple angles of impact of spray on the target area for potentially improved penetration into crop.
- Available in Standard Flat Fan, Reduced Drift and Air Induction designs.
- VMD less than equivalent in Standard Flat Fan, Reduced Drift and Air Induction Range.
- Generally used for Insecticides, Fungicides (Standard of Reduced Drift) and Selective Post Emergence Herbicides (Air Induction).

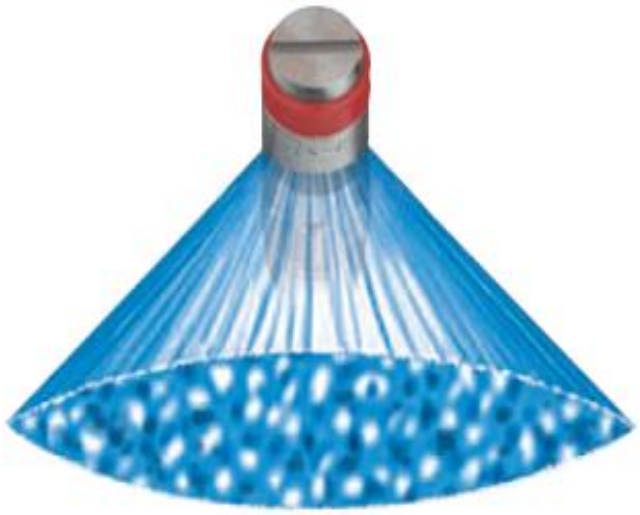




Anvil Nozzles

General characteristics:

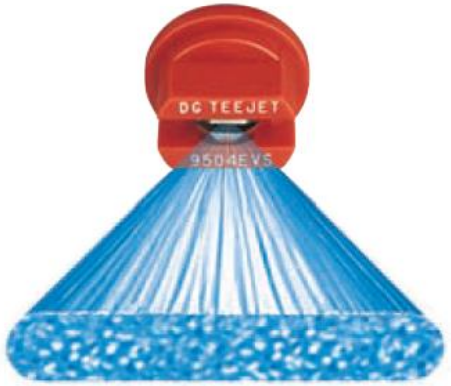
- Extremely Course droplet spectrum.
- Wide angle.
- Generally used for full surface liquid fertilizer application.

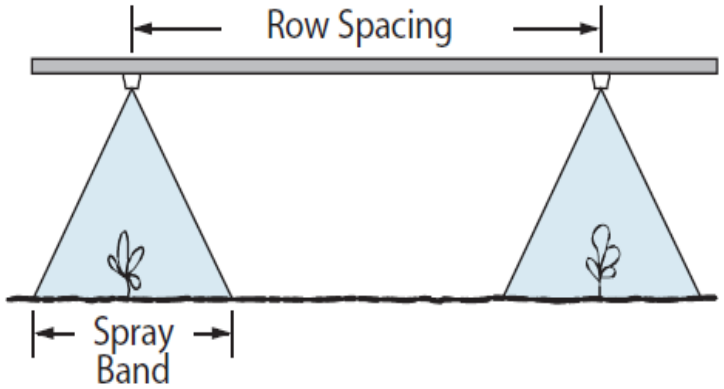


Even Fan Nozzles

General characteristics:

- Similar VMD to equivalent Flat Fan variant.
- Even distribution over spray angle – does not require overlap of spray patterns.
- Used for band spraying.

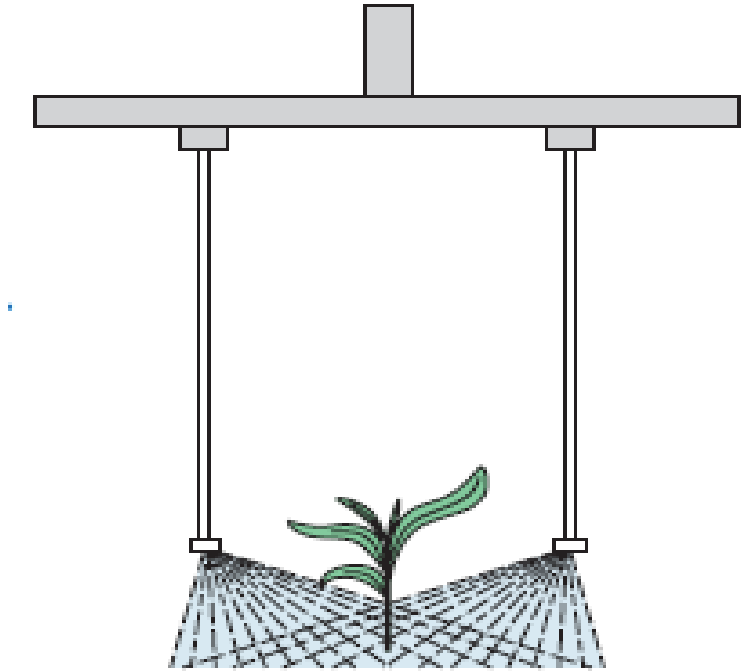




Offset Fan Nozzles

General characteristics:

- Similar VMD to equivalent Flat Fan variant.
- Mounted on drop arms for Selective Herbicide application in row crops.



Hollow Cone & Full/Solid Cone Nozzles

General characteristics:

- Extra Fine - Very Fine – Fine droplet Spectrum.
- Generally used in air-assisted spraying.

Selecting the optimum nozzle DROPLET SPECTRUM (VMD) based on ISO CLASSIFICATION

VF Very fine (< 159 µm) - F Fine (> 159 / < 231 µm) - M Médium (> 231 / < 326 µm) - C Coarse (> 326 /< 386 µm)

VC Very coarse (> 386 µm / < 484 µm) - XC Extremely coarse (> 484 /< 553 µm) - UC Ultra coarse (> 553 µm)

Values measured on the VMD or D50 on IRSTEA Dantec pda.

Conventional Boom Sprayers

Pre - emergent Herbicides

- Primary Target Area: ground surface
- Optimal Droplet Spectrum (ISO) XC - UC
- AVI Series AVI TWIN Series

Post-emergent Herbicides

Broad Spectrum

Primary Target Area: Leaves only	Primary Target Area: Leaves & Roots (ground surface)
Optimal Droplet Spectrum (ISO) M - C	Optimal Droplet Spectrum (ISO) C - VC
ADE Series AVI TWIN Series	ADE Series AVI & AVI TWIN Series

Selective

Primary Target Area: Leaves only	Primary Target Area: Leaves & Roots (ground surface)
Optimal Droplet Spectrum (ISO) M	Optimal Droplet Spectrum (ISO) M - C
ADE Series	ADE Series AVI TWIN Series

Insecticides

Contact	Local Systemic	Root uptake	Soil Borne
Primary Target Area: Leaves only	Primary Target Area: Leaves only	Primary Target Area: Leaves & Roots (ground surface)	Primary Target Area: Ground surface
Optimal Droplet Spectrum (ISO) F - M	Optimal Droplet Spectrum (ISO) F - M	Optimal Droplet Spectrum (ISO) M - C	Optimal Droplet Spectrum (ISO) VC - XC
APE Series AXI & AXI TWIN Series	APE Series AXI & AXI TWIN Series	ADE Series AVI TWIN Series	AVI Series AVI TWIN Series

Fungicides

Contact	Systemic
Primary Target Area: Leaves only	Primary Target Area: Leaves only
Optimal Droplet Spectrum (ISO) F - M	Optimal Droplet Spectrum (ISO) F - M
APE Series AXI & AXI TWIN Series	APE Series AXI & AXI TWIN Series

Selecting the optimum nozzle DROPLET SPECTRUM (VMD) based on ISO CLASSIFICATION

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Values measured on the VMD or D50 on IRSTEA Dantec pda.

Air Assisted Orchard/Vineyard sprayers

Citrus, Avocados, Mangoes, Macadamias (Evergreen)

- Foliage & Fruit directed sprays (Hydrophobic & Lipophobic surfaces)
  - Light & Medium formulation deposition
    - Optimal Droplet Spectrum (ISO) VF
      - ATR, ATI (hc) Series
        AC AD (hc) Series
  - Maximum formulation deposition
    - Optimal Droplet Spectrum (ISO) VF, F
      - ATR, ATI (hc) 60 degree Series
        AC AD (hc) Series
        AC AD (fc) Series
        ATF (fc) Series
- Central & all Branch directed sprays (Hydrophilic & Lipophilic surfaces)
  - Accumalative DRENCH deposition
    - Optimal Droplet Spectrum (ISO) M
      - AC AD (fc) Series
        ATF (fc) Series

Pome & Stone Fruit, Vineyard, Pecans (Deciduous)

- Winter Sprays with no foliage present Branch directed (Hydrophilic & Lipophilic surfaces)
  - Accumalative DRENCH deposition
    - Optimal Droplet Spectrum (ISO) M
      - AC AD (fc) Series
        ATF (fc) Series
- Foliage & Fruit directed sprays (Hydrophobic & Lipophobic surfaces)
  - Maximum formulation deposition
    - Dilute (1X) Applications
      - Optimal Droplet Spectrum (ISO) VF
        - ATR, ATI (hc) Series
          AC AD (hc) Series
    - Concentrate Applications
      - Optimal Droplet Spectrum (ISO) VF
        - ATR, ATI (hc) Series
          AC AD (hc) Series

DEPOSITION measured!

SA Patent #2022/02473

find the best spray calibration for your crop

dropsight

spray deposition tracer

WHAT YOU DO, DO IT RIGHT!

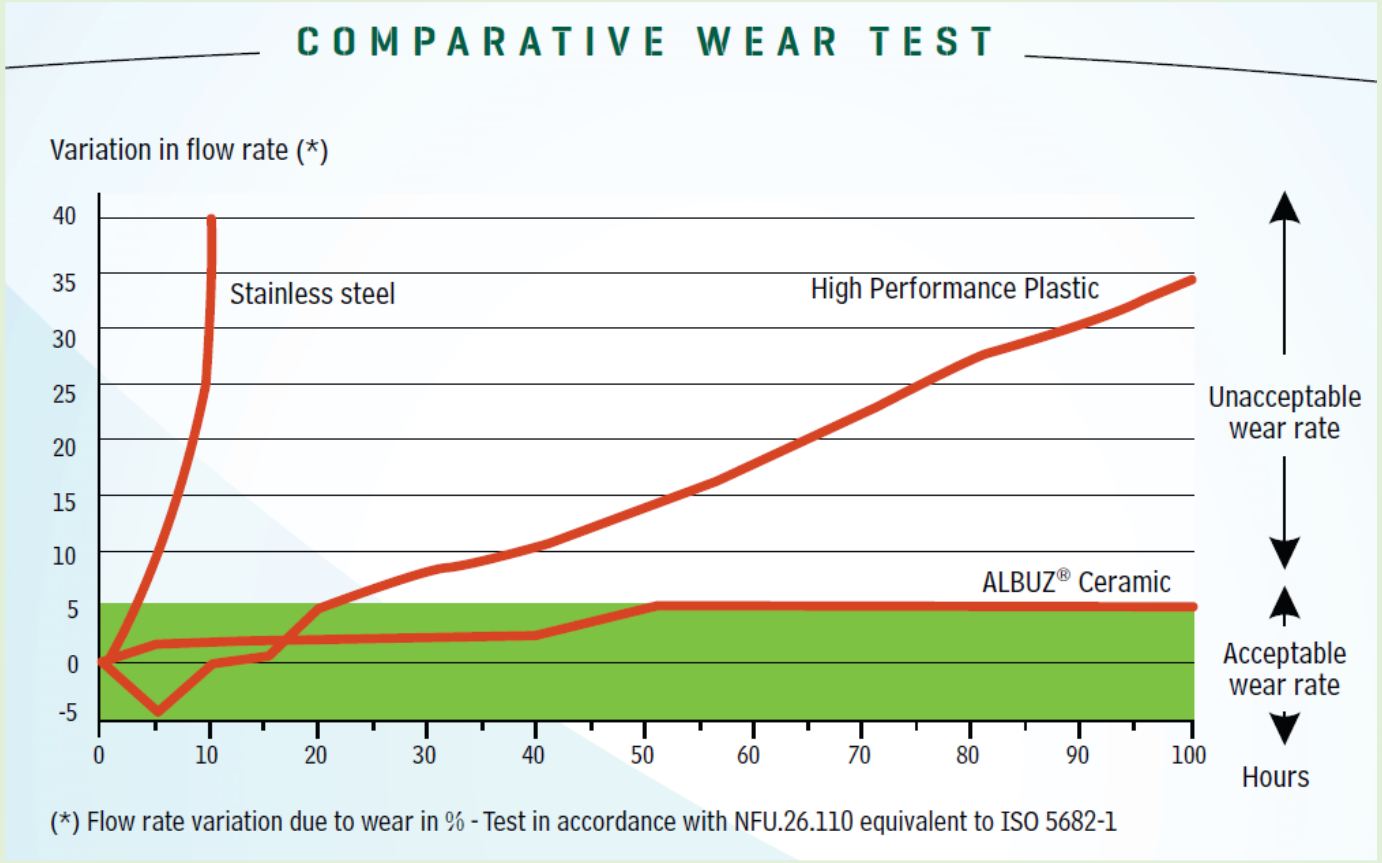
The Value of choosing ALBUZ® nozzle technology

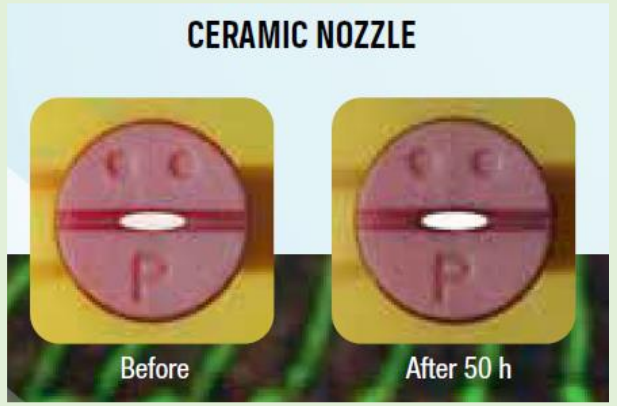
Crop spraying equipment could cost between USD 20 000 and USD 300 000, and the single biggest contributor to good outcomes are the nozzles, costing less than USD 200. Selecting the correct *specification* for the job and the best *brand* for *tested and certified quality* is the best assurance of optimal outcomes.

- ALBUZ® nozzles are *ISO and CEN certified* on the *tolerances of nozzle flow (l/min)* and on *spray patternation*.
- The *flow (l/min)* is certified to vary by *less than 10%* of the flow rates on the flow rate table, and *less than +-5%* of the *average value*.
- The *patternation performance* is certified to have *less than a 7% CV* when at the manufacturer *specified spray height* and less than *9% CV for incremental higher and lower spray height*.
- ALBUZ® nozzles are supplied with a droplet spectrum VMD Classification at all usable pressures.
- All nozzle wearing parts are manufactured from a specific pink ceramic, with hardness equivalent to a diamond – for maximum wear resistance and a long usable life.
- ALBUZ® nozzles are manufactured in Normandy, France to ISO 9001 Quality Certification standards for more than 50 years.
- A full range to chose from – broad acre, horticulture and industrial.

Why are ALBUZ® nozzles only available in Ceramic ?

Nozzles are *wearing parts* – the *business end* of your spray equipment – and need regular *maintenance checks* and timely *replacement* to *maintain the performance* required from your sprayer.





If ALBUZ® nozzles are treated correctly, they should last at least a full season of spraying – whilst all other materials will require multiple replacements through a season to maintain flow rate and droplet spectrum VMD accuracy.

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Thank you

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