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Different types of nozzles and their uses

Energy	Type	Uses
Hydraulic	Impact	Low pressure nozzle with coarse spray, herbicide application
	Flat Fan	Spraying flat surface, soil
	Flood Jet	Band spray
	Hollow cone	Foliage spray
Gaseous	Air blast	Foliage spray, tree & bushes
Centrifugal	Spinning disc type	Low volume spray, air carrier sprayer
Kinetic	Rose can	Coarse spray, Herbicide
Thermal	Fogging machine	Space treatment, inside building and forests



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Types of nozzle

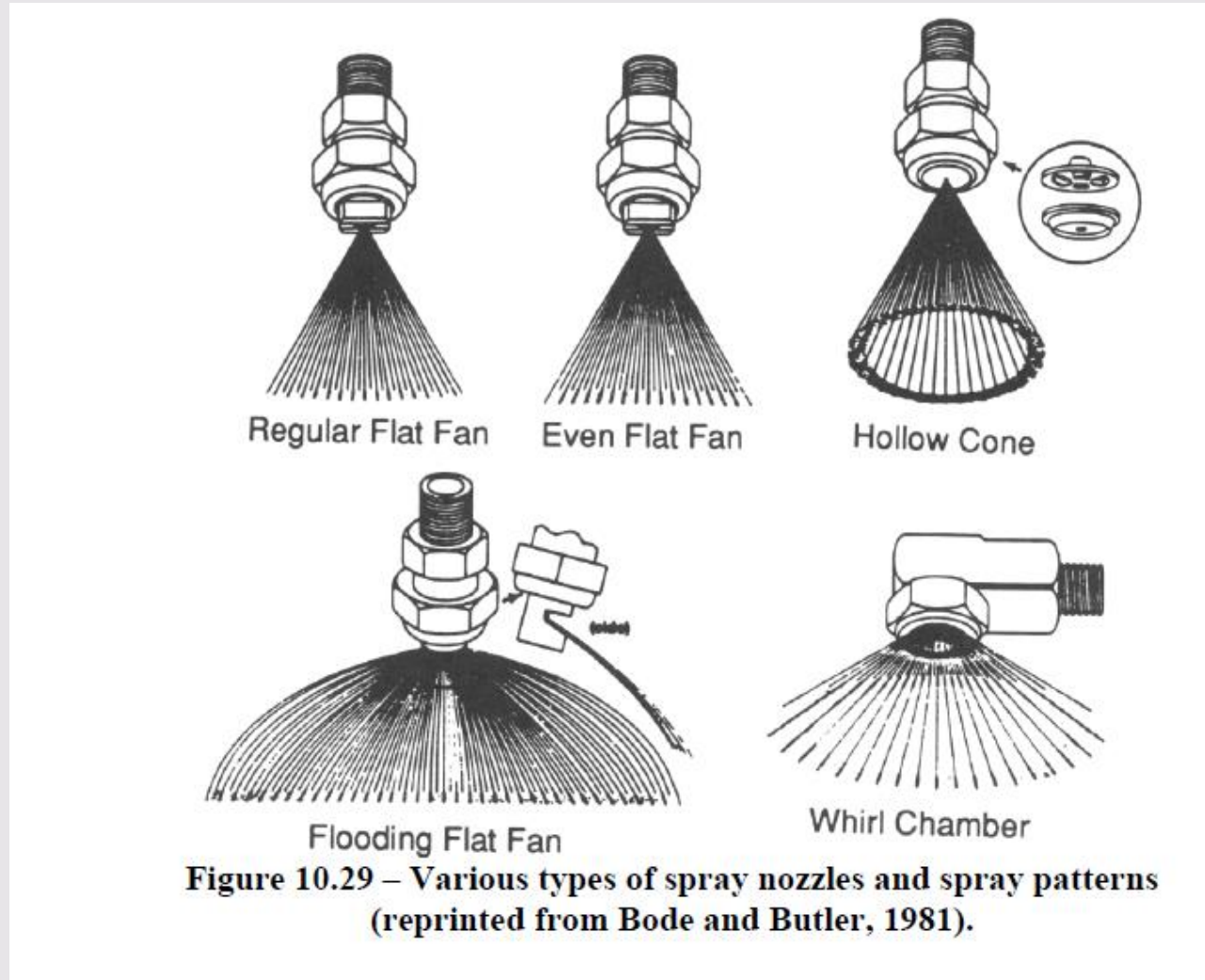


Figure 10.29 – Various types of spray nozzles and spray patterns (reprinted from Bode and Butler, 1981).



Hollow cone nozzle



Body



Cap



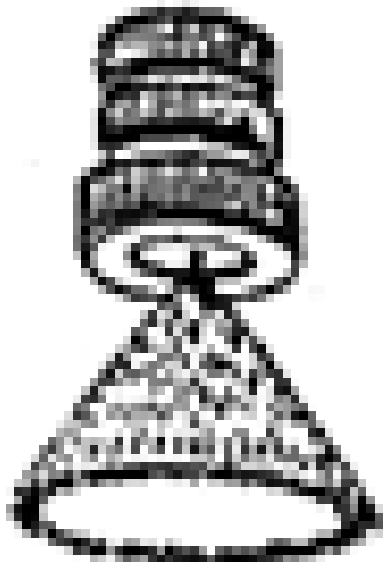
Swirl plate



Gasket



Disc



Hollow cone nozzle

Variable cone nozzles are also available. (Depth of swirl chamber can be changed)

Used where, Foliage penetration is essential for effective insect and disease control when drift is not a major consideration.

At pressure of 40-80 psi hollow cone nozzles give excellent spray coverage to the under side of the leaves.

Reduced pressure reduces the penetration correspondingly.



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Flat fan nozzle

Construction is same as that of the hollow cone nozzle without a swirl chamber.

If there is hole through the centre of the valve a solid cone spray is produced.

This type of nozzles produce medium size droplets and are primarily used for broadcast spraying where foliage penetration and coverage are not essential.

The spray angle is narrow to medium and gives even coverage.

At pressure of 15-30 psi the nozzles give excellent results.

It produces coarser droplets, which are not susceptible to drift.



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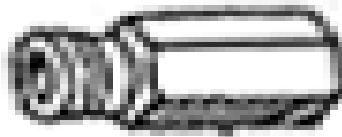
Flood jet Nozzle



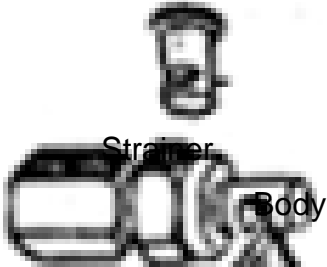
Cap



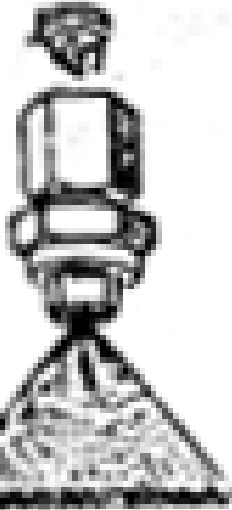
Strainer



Body



Flood-jet nozzle



Flat fan nozzle

Deliver a wide flat spray with large droplets.

Spray angle varying from 70 to 160 degree.

Operating flood-jet nozzle at 5-25 psi minimizes the drift but pressure changes critically affect the width of the spray pattern.

The spray is not as uniform as that from the flat fan type.

It is used for broadcasting fertilizers and post emergence herbicides.



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Gaseous Energy Nozzle

Principle: Striking one fluid, pesticide or herbicide, with another fluid, i. e air stream

Higher air velocity, smaller droplets

Higher flow rate bigger droplets

Highly viscous liquid can be used



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Centrifugal energy nozzle

- Used in spinning disc type sprayer
- Liquid fed near the centre of the rotating surface
- Disc rotates at 4000 to 5000 RPM
- Liquid leaves the disc as sheet of liquid, break into ligament due to aerodynamic waves and finally into droplets.
- $d = k * 1/w * \sqrt{(\gamma / D \rho)}$
 - Where, d = droplet size (um)
 - W = angular velocity of disc (rad/s)
 - D= diameter of the disc, mm
 - ρ = density of liquid
 - γ = surface tension of liquid, mN/m
 - K = constant, 3.76
 - This can be written as $d = \text{Constant} / \text{RPM}$
 - Constant = $50 * 10^4$



NOZZLE SELECTION

Type of coverage	Nozzle type	Spray angle, degree	Discharge, cc/min	Operating pressure, Kg/cm ²
Foliage spraying	Hollow cone nozzle	60	450	2.8
	Adjustable nozzle	75	450	2.8
Under leaf spraying	Solid cone nozzle with back to back arrangement	70	450	2.8
Shade trees	Adjustable nozzle	70	450	2.8
	Triple action nozzle	70	570	2.8
Weedicide spraying	Flooding nozzle	25 to 110	170-2100	0.7
Fertilizer spraying	Hollow cone nozzle	70 to 80	900-1200	2.8



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CALIBRATION

Put clean water into sprayer and check for leaks

Spray water into a bucket for one minute and measure the volume.

Measure the swath width by spraying water on a dry surface.

Measure the distance you can walk through your crop in one minute.

The application rate (l/ha) is calculated by using the following formula:

$$\frac{\text{Volume of spray, (l/min)}}{\text{Swath (m) X Speed, (m/min)}} \times 10000$$



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Example:

$$\frac{0.6 \text{ l/min} \quad \times 10000}{0.5 \text{ m} \times 60 \text{ m/min}} = 200 \text{ l/ha}$$

$$0.5 \text{ m} \times 60 \text{ m/min}$$

If the tank capacity is 15 l, then number of times the tank is to be filled is $200/15 = 13.3$ loadings.

If one litre of pesticide product/ha is required, then $1000\text{ml}/13.3 = 75 \text{ ml}$ pesticide is to be added per loading.