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

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

It is used for broadcasting fertilizers and post emergence herbicides.
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
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.

\[ d = \frac{k}{w} \times \sqrt{\frac{\gamma}{D \rho}} \]

- Where, \( d \) = droplet size (um)
- \( W \) = angular velocity of disc (rad/s)
- \( D \) = diameter of the disc, mm
- \( \rho \) = density of liquid
- \( \gamma \) = surface tension of liquid, mN/m
- \( K \) = constant, 3.76
- This can be written as \( d = \frac{\text{Constant}}{\text{RPM}} \)
- Constant = 50 * 10⁴
<table>
<thead>
<tr>
<th>Type of coverage</th>
<th>Nozzle type</th>
<th>Spray angle, degree</th>
<th>Discharge, cc/min</th>
<th>Operating pressure, Kg/cm²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foliage spraying</td>
<td>Hollow cone nozzle</td>
<td>60</td>
<td>450</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Adjustable nozzle</td>
<td>75</td>
<td>450</td>
<td>2.8</td>
</tr>
<tr>
<td>Under leaf spraying</td>
<td>Solid cone nozzle with back to back arrangement</td>
<td>70</td>
<td>450</td>
<td>2.8</td>
</tr>
<tr>
<td>Shade trees</td>
<td>Adjustable nozzle</td>
<td>70</td>
<td>450</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Triple action nozzle</td>
<td>70</td>
<td>570</td>
<td>2.8</td>
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<tr>
<td>Weedicide spraying</td>
<td>Flooding nozzle</td>
<td>25 to 110</td>
<td>170-2100</td>
<td>0.7</td>
</tr>
<tr>
<td>Fertilizer spraying</td>
<td>Hollow cone nozzle</td>
<td>70 to 80</td>
<td>900-1200</td>
<td>2.8</td>
</tr>
</tbody>
</table>
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:

\[
\text{Volume of spray, (l/min)} \times 10000 \div \text{Swath (m)} \times \text{Speed, (m/min)}
\]
Example:

\[0.6 \text{ l/min} \times 10000 = 200 \text{ l/ha}\]

\[0.5 \text{ m} \times 60 \text{ m/min}\]

If the tank capacity is 15 l, then number of times the tank is to be filled is

\[
\frac{200}{15} = 13.3 \text{ loadings.}
\]

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.