Selecting the appropriate nozzle will have implications for product efficacy and the risk of losses both in run-off to the soil and as spray drift. Nozzle selection will often involve a compromise between the requirements for efficacy and those to minimise drift (see Guide on Drift Control).

**Selecting a Nozzle - The Main Steps**

- **Read the Product Label.** Follow specific advice if it is given.
- **Choose an application volume rate.** Low application volumes (<150 l/ha in arable crops) improves work rates and timeliness. High application volumes (>150 l/ha) are required for good coverage on a dense canopy.
- **Choose a forward speed.** Improved vehicle design and better boom suspension mean that spraying speeds of up to 20 km/h may now be possible. Higher speeds (12-16 km/h) improved work rates and timeliness. Lower speeds (8-12 km/h) are required to give canopy penetration.
- **Choose a spray quality.**
  - A fine spray quality will give improved coverage for a given volume rate, reduced canopy penetration and a high risk of drift.
  - A medium spray quality is the default choice.
  - A coarse spray quality will give low levels of drift and penetration to the base of the canopy.
  - Use very fine or very coarse spray qualities only in exceptional circumstances.
- **Calculate a nozzle flow rate from**
  \[ \text{Nozzle flow rate (1/min)} = \frac{\text{application rate (1/ha)} \times \text{speed (kph)} \times \text{nozzle spacing (m)}}{600} \]
- **Choose a nozzle type** See HGGA Nozzle selection guide overleaf

**Which Nozzle Should You Use?**

- Twin-fluid nozzles give a wide range of spray quality and flow rate depending of pressure settings—see manufacturers literature.
- Twin-caps give a relatively fine spray for higher flow rates and a variation of trajectory angle that will improve canopy coverage but reduce penetration.
- Avoid the use of higher pressures (>4.0 bar) that could cause leaks and component failure.
- A good boom suspension will enable lower boom heights and wider angle nozzles to be used. The preferred option for drift control, coverage and penetration is to use the lowest practical boom height (0.35-5m).
- Not all combinations of flow rate and spray quality can be achieved with conventional pressure nozzle designs. Wider spray angles and lower flow rate nozzles give finer sprays.
- Use manufacturers catalogues for final selections. PSD web-site gives details of LERAP star ratings.
- Refine selection—adjust forward speed and/or volume rate to give final selection.

**Install and Calibrate**

- Check all nozzles on the boom are the same size, type and angle—colour coding will help check size (flow rate).
- Visually check spray patterns—change any nozzles giving a disturbed patterns.
- Check flow rates at the selection pressure using a jug test on a sample of nozzles: - are they the same? do they agree with manufacturers data?

**Nozzle Maintenance**

- Check nozzle mounting for leaks, security and direction.
- Measure flow rates (jug test) - replace all nozzles on a boom if flow rate exceed manufacturers values by more than 10%.
- Visually check spray patterns—replace nozzles with a damaged pattern.
- Clean and unblock any blocked or partially blocked nozzles using a brush. Replace nozzles that cannot be cleaned or cleared.

**Avoiding Drift**

- Apply in ideal spraying conditions Force 2 light breeze (3.2-6.5 km/hour)
- Select drift reducing nozzles.
- Ensure correct boom height above target; keep it as low as practical. (0.35-5m).
- Ensure correct forward speed and pressure. More advice can be found in the CPA Guide “Avoiding Drift”.

This Guide was produced by the Crop Protection Association as part of The Voluntary Initiative. CPA is grateful to HGCA/AHDB for allowing the reproduction of the poster overleaf.

The Voluntary Initiative is a programme of measure agreed by Government to minimise the environmental impact of pesticides.

www.cropprotection.org.uk  www.voluntaryinitiative.org.uk

March 2011
Nozzle selection
for conventional boom sprayers treating cereals and oilseed rape

Nozzle type
Air induction
Conventional
Low drift (pre-orifice)

Likely spray quality
Flat fan
Flat fan
Flat fan

Soil acting herbicides
Small droplet
Large droplet
Fine
Medium
Coarse
Fine
Medium
Coarse
Medium
Coarse

Pre and early post-emergence

Foliation acting herbicides
Grass weeds – 3 leaves or less
Grass weeds – more than 3 leaves
Broad-leaved weeds – up to 2cm across
Broad-leaved weeds – 2-5cm across
Broad-leaved weeds – more than 5cm
Non-selective (e.g. glyphosate)
Cereal plant growth regulators (PGR) and eyespot fungicides

Up to GS32
After GS32
Cereal fungicides
Up to GS32
Up to GS24-49
After GS50 (ear spray)
Cereal insecticides
Cereals: autumn spray
Cereals: ear spray
Oilseed rape fungicides
Vegetative stage
From green bud
Oilseed rape insecticides
Vegetative stage
From green bud

Key
= nozzles offering acceptable efficiency
= preferred nozzles for efficacy
= nozzles offering best drift control

Nozzles and droplet size
Different commercial designs of air induction (AI) nozzles produce different droplet sizes. Those giving a small droplet size will often give higher levels of efficacy, but can also produce more drift than those generating a large droplet size. Recommendations are therefore given on the main chart (left) for AI nozzles giving small or large droplets.

Nozzles producing small or large droplets can be identified from the bar charts (right). Average droplet sizes from different designs of AI nozzles are shown relative to the same size conventional (flat fan) nozzle.

All measurements were made under standard testing conditions with all nozzles operating at 3.0 bar pressure. In each bar chart small droplet designs appear at the lower end, whereas large droplet designs are in the upper part.

Spray deposits and efficacy
Timing
Application timing is critical for high levels of efficacy. Timeliness is related to work rates that, in turn, depend on:
- Application volume
- Sprayer speed
- Boom width
- Sprayer filling time.

Application volume
For a given dose, higher volumes tend to deposit less active ingredient particularly on small plants. Hence, many products give improved control at low volume. However, higher volumes suit those products requiring greater leaf coverage (e.g. protectant fungicides).

When choosing an application volume, important sources of information are:
- Product label
- Code of Practice for Using Plant Protection Products
- Chemical manufacturer’s/suppliers’ websites or other information
- A qualified agronomist.

Nozzle colour
Industry standards specify that nozzles are colour-coded by flow rate.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Flow rate at 3.6 bar pressure, l/min</th>
<th>Common designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>0.4</td>
<td>‘01’</td>
</tr>
<tr>
<td>Green</td>
<td>0.6</td>
<td>‘015’</td>
</tr>
<tr>
<td>Yellow</td>
<td>0.8</td>
<td>‘02’</td>
</tr>
<tr>
<td>Brown</td>
<td>1.0</td>
<td>‘025’</td>
</tr>
<tr>
<td>Red</td>
<td>1.4</td>
<td>‘03’</td>
</tr>
<tr>
<td>Blue</td>
<td>1.6</td>
<td>‘04’</td>
</tr>
<tr>
<td>Brown</td>
<td>2.0</td>
<td>‘05’</td>
</tr>
<tr>
<td>White</td>
<td>2.2</td>
<td>‘06’</td>
</tr>
</tbody>
</table>

Boom height – for 110° nozzles, the boom should be stable at 2.0m or less from the top of the crop.

Nurse type, size and pressure – LEAP star ratings indicate if a nozzle is capable of operating with less drift than the conventional reference ‘03’ nozzle.

Wind speed – at boom height should be between 2.0-6.0ms⁻¹ (0.52-1.68mph).

Further graphs for nozzle sizes 025 and 035 are available on the HGCA website: www.hgca.com/nozzleschart

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Always read the product label – follow label advice