Before Spraying

# Nozzle Selection & Maintenance

**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 (<150l/ha in arable crops) improves work rates and timeliness. High application volumes (>150l/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 kh/h) improved work rates and timeliness. Lower speeds (8-12 kh/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**
  Nozzle flow rate (1/min) = application rate (1/ha) x speed (kph) x 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 (3.2-6.5km/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”.

Crop Protection Association

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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

The Voluntary Initiative

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# Nozzle selection

## for conventional boom sprayers treating cereals and oilseed rape

| Nozzle type | Air induction | | Conventional | | | | | Low drift (pre-orifice) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flat fan | | Flat fan | | | Hollow cone | | Flat fan | | Deflector | |
| Likely spray quality | *Small droplet* | *Large droplet* | Fine | Medium | Coarse | Fine | Medium | Medium | Coarse | Medium | Coarse |
| **Soil-acting herbicides** | | | | | | | | | | | |
| Pre- and early post-emergence | ▲ | ▲✱ | | ▲ | ▲ | | | ▲ | ▲ | ▲ | ▲ |
| **Foliage-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 (eg glyphosate) | ▲▲ | ▲✱ | | ▲▲ | ▲ | | | ▲▲ | ▲ | ▲ | ▲ |
| **Cereal plant growth regulators (PGR) and eyespot fungicides** | | | | | | | | | | | |
| Up to GS32 | ▲✱ | | | ▲▲ | | | | ▲ | | ▲ | |
| After GS32 | ▲▲✱ | | | ▲▲ | | | | ▲ | | ▲ | |
| **Cereal fungicides** | | | | | | | | | | | |
| Up to GS23 | ▲✱ | | ▲ | ▲▲ | | | ▲ | ▲ | | ▲ | |
| 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 efficacy

▲▲ = preferred nozzles for efficacy

✱ = nozzles offering best drift control

Nozzle selections indicated are based on spray volumes of 100-200 l/ha and forward speeds of 8–16km/h and using a typical range of pressures for each nozzle design. Generally, higher spray pressures give a smaller droplet size distribution therefore, a finer spray; wider spray angles give a finer spray.

## 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 (eg protectant fungicides).

When choosing an application volume, important sources of information are:

- Product label
- Code of Practice for Using Plant Protection Products
- Chemical manufacturers'/suppliers' websites or other information
- A qualified agronomist.

## Nozzle colour

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

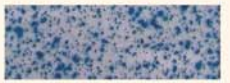
| Colour | Flow rate at 3.0 bar pressure, l/min | Common designation |
|---|---|---|
| Orange | 0.4 | '01' |
| Green | 0.6 | '015' |
| Yellow | 0.8 | '02' |
| Lilac | 1.0 | '025' |
| Blue | 1.2 | '03' |
| Brown-red | 1.4 | '035' |
| Red | 1.6 | '04' |
| Brown | 2.0 | '05' |
| Grey | 2.4 | '06' |
| White | 3.2 | '08' |

## Nozzles and droplet size

Different commercial designs of air induction (AI) nozzle 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.



**small droplet**

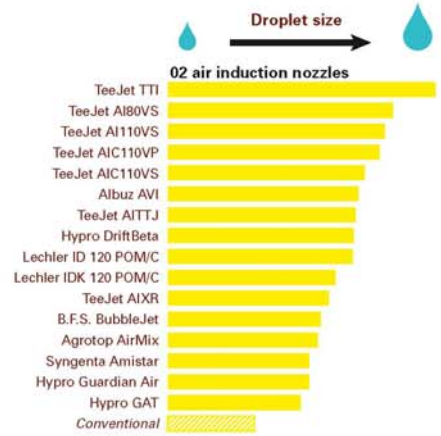
**large droplet**

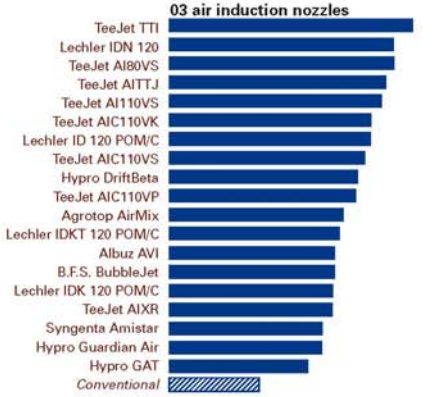
**conventional**

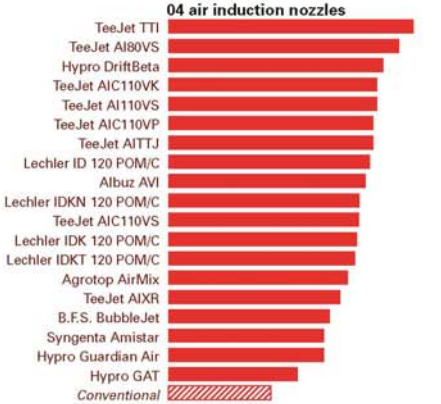
## Spray drift

The risk of drift is mainly related to:

- **Boom height** – for 110° nozzles, the boom should be stable and 500mm or less from the top of the crop.
- **Nozzle type, size and pressure** – LERAP 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 2.0-9.6km/h (0.5-2.6m/s).




Further graphs for nozzle sizes 025 and 05 are available on the HGCA website www.hgca.com/nozzlechart

**Always read the product label – follow label advice**