Some sample droplet size spectra of hydraulic and CDA nozzles
Extracted from: Bateman, R.P. (2003)

Droplet size readings described here were measured with a Malvern 2600 particle size analyser, using techniques described by Bateman and Alves (2000).

Figure 1 shows that conventional hollow cone nozzles, irrespective of cost and quality, produce broader droplet size spectra than CDA technologies. The spectra from the 'Electrodyn' and the 'Ulva+' spinning disc atomiser have high proportions (>80%) of spray volume in size bands representing <10x dose variation. For comparison, the illustration also includes the droplet size spectra of two hollow cone nozzles at 300 kPa pressure. 'River Mountain' nozzles (or copies of them) are arguably one of the most widely used nozzles. They are fitted to many of the hydraulic knapsack sprayers used in China and adjacent countries: 80 million units are estimated to be in use at any given time (Chinese Academy of Agricultural Sciences, pers. comm.). Since hydraulic nozzles rely on random break-up of liquid sheets, there is little scope for narrowing droplet size spectra using this technology, and the D2 45 nozzle (more widely known in the west and much more expensive) has a similar droplet size spectrum to the 'River Mountain'.

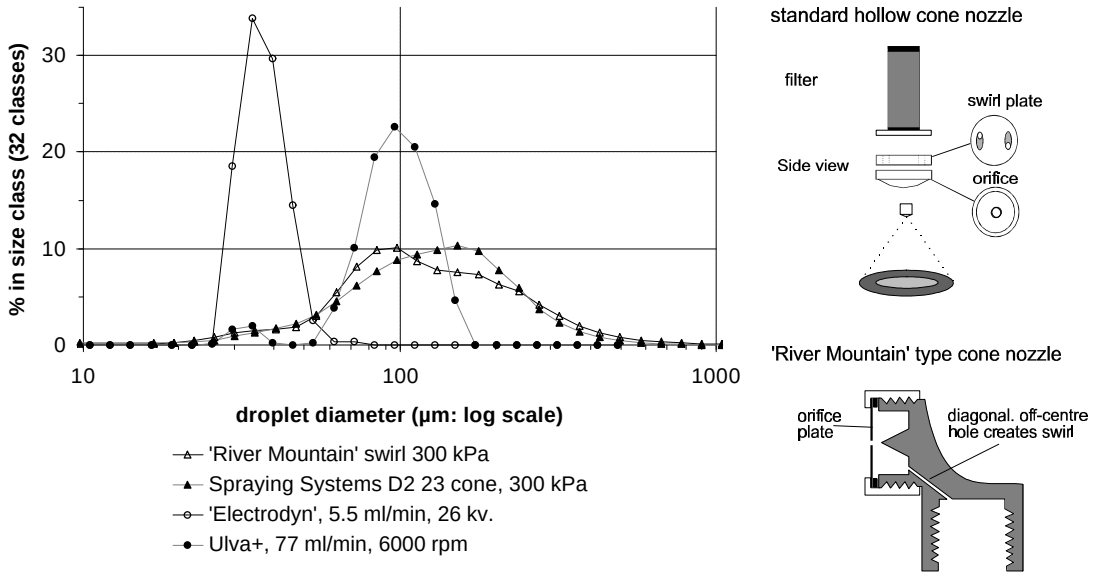

Fig. 1. Examples of droplet size spectra: nozzles designed for insecticides and fungicides.

Disappointingly few farmers world-wide are aware of alternatives to conventional hydraulic sprayers, which inefficiently use large volumes of water, but remain by far the most important method of pesticide application. Worse still, recent emphasis in application research has focused on the reduction of spray drift (especially in Europe and N. America). The most common solution to be implemented to date has been to increase droplet size spectra (without necessarily improving spray quality); thus spray application has probably become generally more inefficient.

Figure 2 shows the droplet size spectra produced by nozzles in a study by Thornhill *et al.* 1995 (Figure 3). They achieved lowest contamination by controlling pressure at

100 kPa, which like the newer low drift nozzles such the 'Turbo Teejet' produce larger spectra than standard flat fan atomisers. However, these settings simply shift the droplet size spectra out of the size range known to be most efficient for pesticides (*e.g.* Matthews, 1992, Knoche, 1994). The only way to reduce drift and maintain efficient dose transfer is to narrow the droplet spectrum with the optimum range illustrated: using nozzles such as the 'Herbi' rotary atomiser.

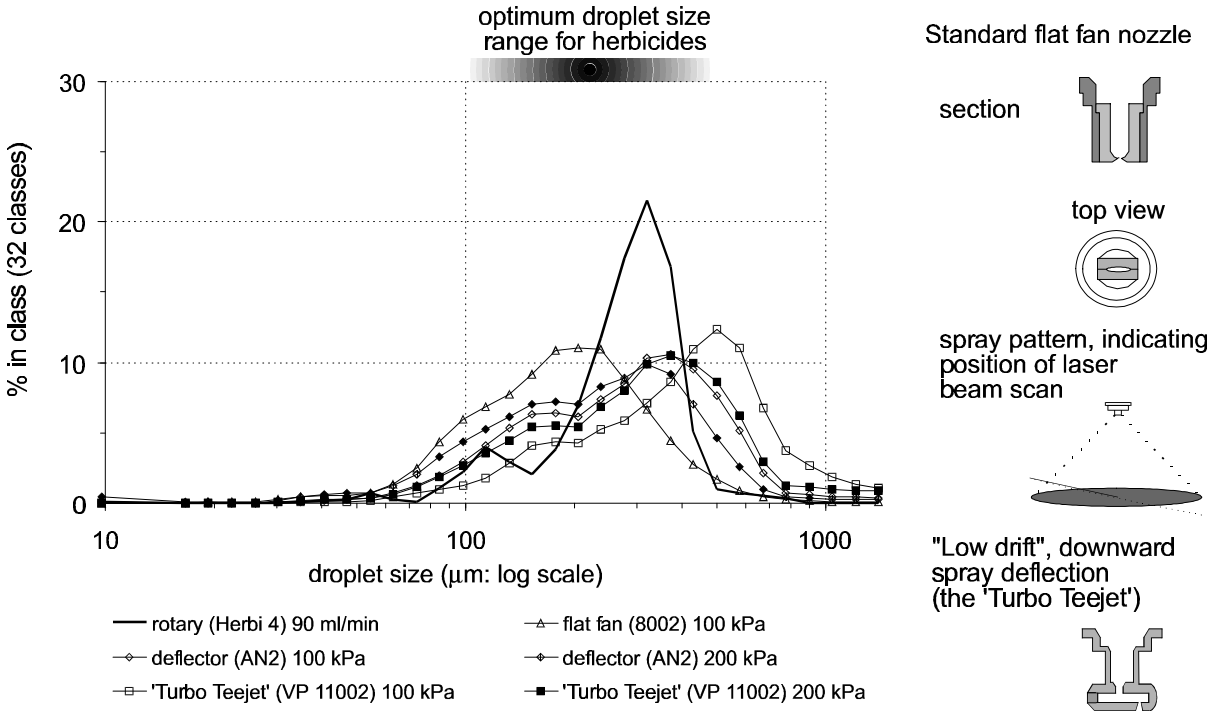

Fig. 2. Larger droplet size spectra: using water +0.1% Agral, atomised by the 'Herbi' rotary atomiser, compared with 3 hydraulic nozzles. The hydraulic nozzles were scanned diagonally though the centres of the spray fan (as indicated in the centre right diagram).

References

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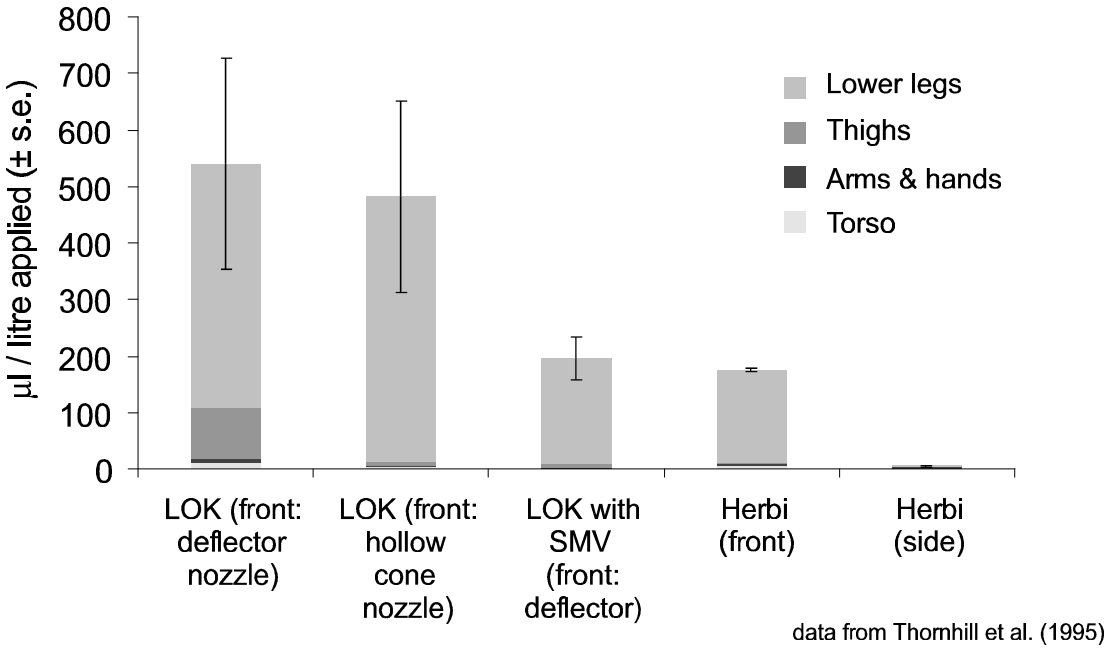
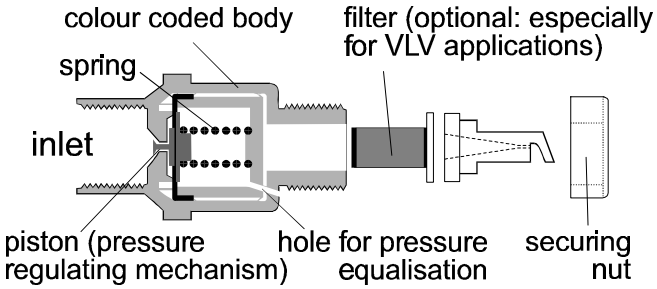


A 'Gate' spray management valve attached to a deflector ('Floodjet') tip



The Micron 'Herbi'

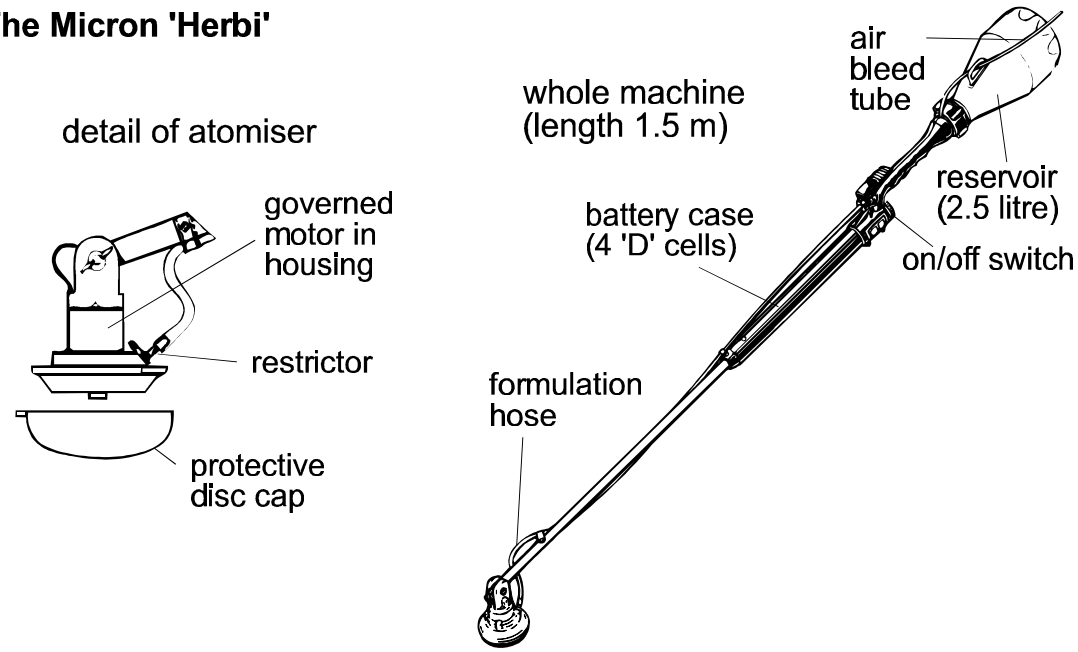


Fig. 3 Operator contamination with different spraying techniques for herbicide application using lever operated knapsack (LOK) and 'Herbi' CDA sprayers (data from Thornhill *et al.*, 1995); histogram shows ± s.e. for total deposits. Constant pressure (spray management) valves (SMV) are now available in a simplified form as illustrated (the 'Gate' valve).