Enhanced efficacy, efficiency and safety through improved application

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Outline

- Introduction
- Spray technology
- Risk reduction
- Training
- Conclusions
More accurate and timely application of pesticides will be of increasing importance to integrate their use in IPM programmes and to minimise pollution
(van Emden & Peakall, 1996)
Novel application techniques and equipment
Industry involvement in design of application equipment

- Tree row volume and crop adapted spraying (the dose rate is adapted to the crop volume (height, width, row distance)
- Recycling spraying in vine (vine is sprayed horizontal, spray not cached by the leaves are recovered by a wall, fed back to the tank, and sprayed again). Savings about 30% of product.
- Direct injection systems (product from container is dosed to the water coming from the tank, no tank mix with product anymore).
Industry involvement in design of application equipment

- Rope application for some herbicides (products are not sprayed, but put drift-free with a rope to high weeds)
- Electrostatic spraying (3 main principles of charging) – little or no improvement or commercial success
- Air inclusion nozzles for low drift application: field trials not only in field crops, but also in vine and orchards (see next section)
- CDA low and ultra-low volume spraying with rotary discs
Novel application technique greenhouses Spain

In collaboration with the Agricultural Research Centre in Gent, Belgium novel application techniques with vertical spray booms were tested.

Trolley pulled manually

Fumimatic
Novel application technique greenhouses Spain

Compared to the standard spray gun operator exposure with the trolley is reduced by a factor of 25

Compared to the standard spray gun operator exposure with the Fumimatic is reduced by a factor of 70
Nozzle design to target spray

Targeted application to trees: increasing efficiency and reducing water use by 10 – 100 fold
Safety & Efficiency: Drift reduction through Spray Drift Reduction Technology (SDRT)
Factors Contributing to Spray Drift

- Nozzle fines (droplets $< 150 \mu m$)
- Wind speed and direction
- Effective release height
Nozzle fines

Droplets below 150 µm are the most significant contribution to drift.

Standard flat fan nozzle  Spray drift reducing nozzle
Drift Reduction Technology Applied to Boom Sprayer

Standard flat-fan nozzles

Low drift (air induction) nozzles
Drift Reduction Technology Applied to Vineyard Application Equipment

Standard nozzles

Low drift (air induction) nozzles
Drift Reduction Technology Applied to Orchard Application Equipment

Hollow cone nozzles

Low drift (air induction)
Effect of boom height

Figure 1.2. Effect of sprayer boom height (30cm, 50cm and 70cm above crop canopy) on spray drift deposition next to the field when spraying a potato field (spray volume 300 l/ha, Nozzle XR11004 @ 3bar; de Jong et al., 2000a).
Effective release height

Affecting contribution of wind and time to deposition.

No air-assistance  Air-assisted application
Impact of SDRT nozzles

- SDRT nozzles reduce the production of droplets < 150 μm, therefore reducing the influence of:
  - Wind speed
  - Release height
Efficacy

- How does SDRT affect efficacy?
  - Reducing drift increases in-field deposition
  - Efficacy can be maintained even when droplet size is increased
SDRT nozzle efficacy trials in vines –
standard nozzle is 100

Value to Growers

- SDRT nozzles can be used without changing other application parameters such as water volume, pressure, application speed, use rate or frequency of application etc.
- SDRT nozzles can easily substitute for standard hydraulic nozzles for a reasonable price, without any significant technical modification to the sprayer.
- This reduction in drift, also means that in-field buffers could be reduced, thereby helping the grower to maintain the tools and his hectares in production.
Advantages of SDRT

- Environmental safety
  - aquatic
  - non-target arthropods and plants
- Human safety
  - applicator and bystander exposure
- 12 years of trials demonstrate efficacy is maintained with insecticides, fungicides and herbicides
Global training
Use and maintenance of application equipment included in training material

Instructor guidelines

Global training guidelines

Local guidelines

Do not spray into the wind
Choice of Pesticide and Application Method

Pesticide Selection
Application Method and Choice of Equipment
Hand-Operated Sprayers
Nozzle Selection
Calibrating Sprayers
Cleaning and Maintenance of Sprayers

Pesticide Selection

The following is a guide to the major points when selecting a pesticide.

Pest Identification and Population

1. Sprayers with hydraulic nozzles designed with systems to generate pressure at the nozzle to achieve correct atomisation. With lever-operated sprayers the main tank is not pressurised, but spray pressure is generated in a pressure chamber by constant pumping. With compression sprayers, the whole tank is pressurised prior to spraying.

Lever-Operated Knapsack Sprayers

- Diaphragm Pump Knapsack Sprayers

A. Upstroke

B. Downstroke

- Piston Pump Knapsack Sprayers
Application included in IPM/’Safe Use’ training

- Industry participation in 80+ countries
- In 2003 almost 100,000 people trained (including 9000 trainers) in circa 30 countries in Africa, Asia and Latin America; over 2.5 million trained since 1991
- Participation in programmes in developed countries, e.g. certification schemes
- Independent audits (e.g. Kenya) show change in attitude and behaviour amongst farmers
  » Lesson learnt on improved training methodologies and monitoring behaviour change – will be incorporated in all programmes

More needs to be done!
IPM/’Safe Use’ training numbers – 2003

- Farmers: 47%
- School: 35%
- Retailers: 8%
- Leaders/Trainers: 7%
- Others: 5%
- Doctors/Nurses: 5%
Conclusions

· Industry recognises the importance that proper application plays in efficacy, efficiency and risk-reduction in the use of their products
· Industry has collaborated in development of new equipment and application strategies, as well as training of users
· Improvements in equipment and strategies has occurred, but there have also been failures
Conclusions

- Development of optimal application requires a compromise between differing requirements – formulation possibilities, engineering limitations, etc.
- Availability and practicality of equipment in different regions needs to be considered.
- The FAO Code of Conduct on the Distribution and Use of Pesticides encourages collaboration between the pesticide industry and application equipment manufacturers – *this has occurred, but further collaboration between these and with other stakeholders (farmers, governments) is needed.*
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