Appendix 1 – Case Studies

Case Study 3:

Arable crop sprayer technology – delivering novel technology and systems

The UK crop spraying community has an international reputation for cutting edge technology from a strong manufacturing base, with good coordination between companies (via AEA) and effective links to world-class R&D (e.g. SSAU, ADAS and HSL). Its reputation has provided a platform for commercial activities in home and overseas markets, and strong input to the development of international standards. Standards development has had close links to development of regulatory instruments (e.g. European Sustainable Use Directive for plant protection products). The ability to support such developments depends on a well-coordinated, technically strong UK base.

The business sector is diverse. There are SME manufacturing companies producing specialised machines with a high technical specification and aimed at both the home and export markets, organisations concerned with sprayer component design and manufacture that are either UK companies or part of a larger multi-national group, both with significant activity in both home and overseas markets and importing organisations that are generally parts of multi-national groups.

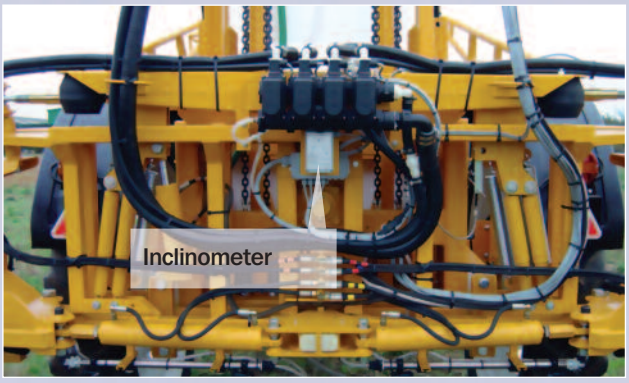
There have been many significant technical developments in the last two decades, often UK led:

- higher work rates by increasing working widths (to 36 m or more), increasing sprayer speeds (to 15 km/h or faster) and operating with lower application volumes (down to 100 l/ha) for timely applications, high product efficacy and hence the minimum quantity of pesticide being used;
- minimising spray drift risk and off-target exposure of waters, boundaries and bystanders. New nozzle designs have 75% less drift risk, and improved booms reduce drift more than 50%;
- higher uniformity within the treated area, avoiding localised over-dosing (with crop damage and the potential for higher residues) and under-dosing (resulting in a loss of control);
- matching chemicals to targets within the canopy (e.g. control fungal disease on ears, influencing crop quality) or in a spatially variable field, including less overlap in non-uniformly shaped fields;
- better machine monitoring and control, for remote diagnostics and automated record keeping.

Key commercial innovations with which the UK community has been particularly involved include:

- air-induction nozzles delivering reductions in spray drift while maintaining good deposits and product efficacy. They now account for more than 50% of spray nozzle sales worldwide;
- boom structures and suspension systems enabling booms up to 36 m wide to be operated close to the crop canopy with the advantages of reduced drift and controlled deposition;
- dose control systems that adjust the amount of chemical applied, responding rapidly to changes in spraying speed or required dose.

This successful sector has responded to the market, and been innovative and quick to adopt and adapt emerging technologies, utilising strategic R&D. Future changes in crop production technologies will set new requirements for crop protection. Equipment will need to match changing farmer needs to sustain domestic and international market share, and a strong technical base must underpin regulatory aspects of agricultural chemical use and address public concerns. The engineering science that has underpinned this includes fluid flow control and atomisation, surface chemistry and particle dispersal in air, and understanding of interaction between particles, wind flows and crop canopies. There are direct benefits to productivity and competitiveness of farming and major indirect benefits through protection of biodiversity, and reduced pesticide contamination of the environment. Further engineering advances in timeliness and targeting can reduce pesticide use by 50%. Developing countries will derive major benefits through access to well-researched technologies.



Improving agricultural efficiencies

Crop Sprayer Technology

The Challenge

Minimising the amount of pesticide needed to achieve a given biological effect whilst protecting non-target organisms (e.g. hedgerows, human residents and bystanders) from exposure to pesticides.

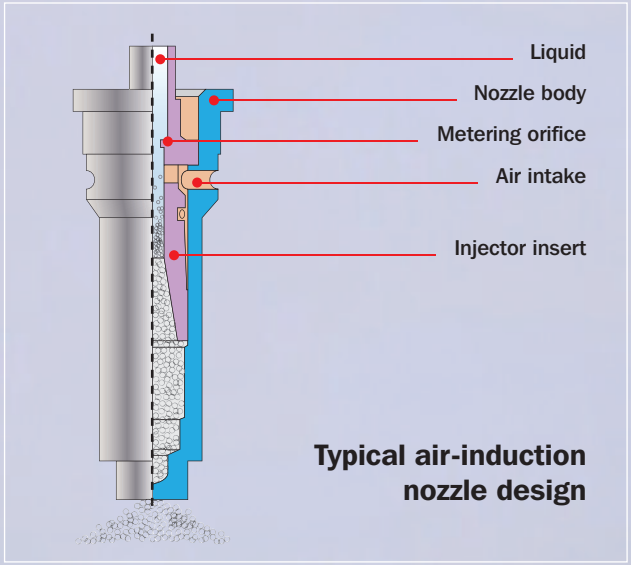
The Solution

Using:

- Appropriate spray nozzle technology (e.g. air intake induction design) that will minimise the risk of drift but will give good target deposition and high levels of product efficacy
- Well designed boom suspension systems with both passive and active elements to maintain the boom at the optimum operating height
- Computer based control systems that adjust output to match variations in forward speed and minimise over-lapping treatments.

Future developments

Will use sensing systems and guidance to identify target and apply chemicals only to the areas where they are needed.



Typical air-induction nozzle design