Adopting best spray practice

Bill Gordon, Bill Gordon Consulting

Summary of factors that influence spray drift and best practice

Setting appropriate spray release height

The amount of chemical left in the air may increase by up to 8 to 10 times as nozzle height increases from 50 cm above the target to 1 m above the target. It is important to set the height of the boom at the minimum practical height to achieve the correct spray pattern for the nozzles. Vertical movement (boom bounce) of the spray boom should be minimised.

Vertical movement can be limited by tuning the boom suspension and matching travel speed to release height. Alternatively consider fitting auto boom height. Auto boom height devices use ultrasonic sensors to detect the height of the boom above the target. These adjust the boom hydraulically to maintain the nozzles at a constant height above the target. Generally these systems will require a machine with good hydraulic capacity, but allow the machine to maintain boom height at travel speeds up to 28 km/h.

***my*BMP resources: Factsheet on boom height control**

Travel speed for ground rigs

Speeds above 15 km/h have been shown to increase the risk of drift for boom spraying and speeds above 10 km/h increase the risk from shielded sprayers. Higher speeds reduce deposition of spray droplets in the wheel track and behind stubble, and also increase the drift potential due to droplets being drawn into the machine's wake. When considering operating at higher travel speeds, greater attention must be paid to the potential risk of spray drift and ways of reducing that risk, such as nozzle selection.

***my*BMP resources: Factsheet on managing wheel tracks**

Pressure at the nozzle

Never operate nozzles outside of the pressure range recommended by the manufacturer. Higher or lower than recommended pressures changes the droplet spectrum and the spray pattern, affecting both the risk of drift and the efficacy of the spray application.

Be aware that many air induction nozzles will require slightly more pressure than the minimum indicated on the manufacturers spray chart. Always assess the spray pattern at various pressures, to determine an appropriate minimum operating pressure.

Where automatic rate controllers are fitted to the machine, carefully consider the true range of speeds the machine is likely to operate, from the slowest field to the fastest field. Identify what the pressure at the nozzle will be at your lowest speed and your fastest speed and identify a nozzle that will produce the required spray quality across that range of speeds. Operating at recommended pressures can also minimise wear and tear on nozzles.

***my*BMP resources: Factsheet PRE-SEASON SPRAYER CHECKS, Back pocket guide to nozzle selection**

Suitable water volumes and quality

Always follow label recommendations for water volumes for application. Typically in-crop applications to cotton will require application volumes of 100 L/sprayed hectare or more.

Whereas, for fallow spraying in low stubble situations with translocated herbicides (such as glyphosate and the phenoxys) equivalent efficacy has been shown for medium, coarse and even extremely coarse spray qualities at 50 L/ha and above. Equivalent efficacy in fallow spraying situations has also been shown at 70 L/ha and greater for products with minimal translocation, such as Spray.Seed®.

When using larger than a medium spray quality for translocated products, increasing water rate does not necessarily increase efficacy, and in some situations may actually reduce performance in the field.

Higher water rates with fully translocated products can reduce efficacy when a low rate of product is used, when water quality may be marginal or where diluting the adjuvants included in the product reduces the products performance.

***my*BMP resources: Factsheet Water Quality, Fact Sheet: Spray Mixing Order**

Nozzle selection

Spray nozzles produce a range of droplet sizes called the droplet size spectrum. Nozzle manufacturers now use internationally recognised classifications for droplet size spectrums referred to as the Spray Quality. These are Ultra Fine,Very fine, Fine, Medium, Coarse, Very Coarse, Extremely and Ultra Coarse (according to the ASABE or BCPC standards). As a guide, each time you move from one classification to the next coarser classification you approximately half the driftable fraction (e.g. from medium to coarse, or from coarse to very coarse). Hence it is always advisable to use the largest spray quality classification that will provide acceptable efficacy. Nozzle selection for the correct volume and spray quality requires careful consideration. Always follow label/permit directions in relation to spray drift including nominated droplet size category.

***my*BMP resources: Backpocket Guide Nozzle Selection for Booms and Bands**

Maintenance and hygiene

Calibration – replace worn nozzles

The output of each nozzle should be checked pre-season and regularly during the season. Nozzles that vary more than 10% from the manufacturer's specifications should be replaced. Regularly check wheel sensors and flow meters for accuracy, check pressure across the boom for evenness and monitor total volumes against areas on your GPS logs to indicate when things may have changed since your last calibration.

Decontamination

Application equipment that has been used to apply herbicides should be thoroughly decontaminated before being used to apply any product to a susceptible crop. Strictly follow the method of decontamination recommended on the label. No matter how much time is spent decontaminating the equipment there is always a risk of herbicides residues causing a problem.

***my*BMP resources: Decontamination Guide (Nufarm spraywise)**

Tank mix considerations

Always follow the manufacturers' recommendations for mixing. Where multiple product tank mixes and adjuvants are added to the one tank, incorrect mixing order can reduce the efficacy of those products.

Using adjuvants to manipulate droplet size

More can be done to manipulate droplet size (spray quality) with nozzle selection, than with the addition of an adjuvant. Many adjuvants, especially non-ionic wetters (wetter 1000 products) increase the amount the spray volume existing as droplets that are likely to drift, whereas some adjuvants can increase droplet size, care should be taken in ensuring that there is a decrease in small driftable droplets with diameter below 100–200µm, and not just an increase in the average or volume median diameter (VMD) of the spray. When considering adjuvants, compatibility with the tank mix and spraying system should also be considered, since some adjuvants do not perform as well when combined.

Product choice

Where a range of products are available for a particular job, try to select products that have the lowest impact on the environment or sensitive areas. To compare the relative toxicities of insecticides to non-target insect species such as beneficials and bees, refer to Table 3, pages 8–9.

Spray drift

Spray drift can occur as droplets and particles or as vapours.

Droplet and particle drift

Droplet and particle drift is a common cause of off-target damage from pesticides. It is particularly obvious where herbicides drift onto susceptible crops. Water in the spray droplets evaporates resulting in finer droplets and particles of herbicide. Smaller droplets remain airborne longer and hence are susceptible to further evaporation and drift kilometers away from the intended target. Droplet and particle drift is the easiest form of drift to prevent. Under good spraying conditions, droplets are carried down by air turbulence and gravity to collect on the intended plant surfaces.

Vapour drift

Vapour drift is the movement of volatile components of herbicides in air currents during or after application. Volatility refers to the likelihood that the herbicide will turn into a gas. Vapours may arise directly from spray or from the target surface for several hours or even days after application. The risk of vapour drift can be avoided by choosing active ingredients with low volatility. The amine and salt forms of herbicides have a lower volatility than the low volatile ester forms. Even products with low volatility are still susceptible to droplet and particle drift. Some examples of vapour drift risk from some different products are shown in the table on page 145.

Additional considerations for aerial applications

Aircraft setup and operation

Higher airspeeds (above approximately 110–115 knots) can cause air shear, where droplets shatter into smaller sizes. Some faster, larger turbine aircraft have difficulty in producing a Coarse Spray Quality due to their fast airspeed. Reducing air speed (through slower aircraft) and/or reducing nozzle angle or deflection is an effective way to reduce air shear. The lowest air shear occurs when aircraft nozzles are directed straight back on the aircraft (0°) and operated at higher pressure. The boom length on an aircraft should not exceed 65 to 75% of the wingspan, and sprays should only be released when the aircraft is level over the target (never while climbing).

All aerial operators (using hydraulic nozzles or rotary atomizers) should be able to provide a written assurance to the grower that they are complying with the product labels spray quality requirements.

Further information:

"Spray Drift Management Principles, Strategies and Supporting Information", www.publish.csiro.au/Books/download.cfm?ID=3452

SPRAYpak – Cotton Growers' Spray Application Handbook, 2nd Edition, available from CRDC.

Spraywise – Broadacre Application Guide – Available through Croplands Distributors.

The spray drift model 'AgDRIFT', is available for free download from www.agdrift.com

Fact sheets on droplet size classification, and drift management in aerial and ground applications are also available at this website.

For more information about using vegetative barriers in spray drift management, see the Queensland guidelines: Anon (1997) Planning Guidelines: Separating Agricultural and Residential Land Uses. Dept of Natural Resources, Queensland and Dept of Local Government and Planning, Queensland. DNRQ 97088. Available for free download at www.nrm.qld.gov.au/land/planning/pdf/public/plan_guide.pdf

Comprehensive information about droplet spectrums of nozzles under aerial application conditions is available from the United States Dept. of Agriculture at http://apmru.usda.gov/downloads/downloads.htm For aerially-applied 2,4-D sprays, from wind tunnel research, see www.aerialag.com.au

All additional resources can be found at www.myBMP.com.au