Why are we still having problems with spray drift?

By Bill Gordon, Consultant

I often wonder whether recent examples of spray drift are due to applicators not using the information that is available about suitable spraying conditions and droplet size data, or is it that some individuals are making really bad decisions about when to spray and when they should stop? Perhaps it is a little of both.

I don't see any point in assigning blame for incidents of spray drift — that doesn't seem to have fixed the problem so far. We should be seeking solutions, and the solutions must start with individuals taking responsibility for what happens on their farm and in their community.

We need to take control over how and when products are applied. The information and tools are available to greatly reduce the incidences of drift. It is up to us to make sure we can access and understand that information, and utilise the available tools on our farms.

We also have a responsibility to share that information with our neighbours and others in our community so that we can all benefit from less off-target movement of pesticides.

Every applicator needs to have clear guidelines as to what are acceptable spraying conditions for their situation. These guidelines must take into account the target, the product choices available and their modes of action, sensitive areas, the product label and the kinds of droplets we need to obtain efficacy and minimise loss.

WE NEED TO CHANGE THE WAY WE THINK ABOUT SPRAYING

Conventional thinking has continually told us that fine droplets equal better coverage which equals a better job. I even believed this once — what a load of rubbish! Coverage should be about how much product we get to the target, not just droplets per square centimetre. Using fine or medium spray qualities, unless the conditions are ideal, will result in too much loss of product, and the potential for drift.

WHAT ARE SUITABLE CONDITIONS FOR SPRAYING?

If you are not measuring and recording weather conditions during spray jobs you can't make informed decisions, and guidelines become irrelevant.

What are commonly regarded as suitable conditions for spraying, which we rarely get, often impact on our productivity. The current guidelines for suitable conditions were developed for spraying fine to medium spray qualities, well before some of the newer nozzle technologies became available (such as air induction nozzles).

Using larger droplets, and minimising the percentage of fine droplets we produce, can help increase the window for application while the target is at its most susceptible stage of development. Timing is often the critical factor in a successful application.

Delta T

The use of delta T (the difference between wet and dry bulb temperatures) is widely recognised as a useful guide to evaporative potential, since it is really a measure of how much moisture is in the air. Delta T value combines temperature and relative humidity, and should be one of the tools used in determining if the weather conditions are suitable for spraying.

When Delta T is high, the evaporative potential is high and droplet survival is lowered for smaller droplets — less than about 200 microns (1 micron = 1/1000th of a millimetre).

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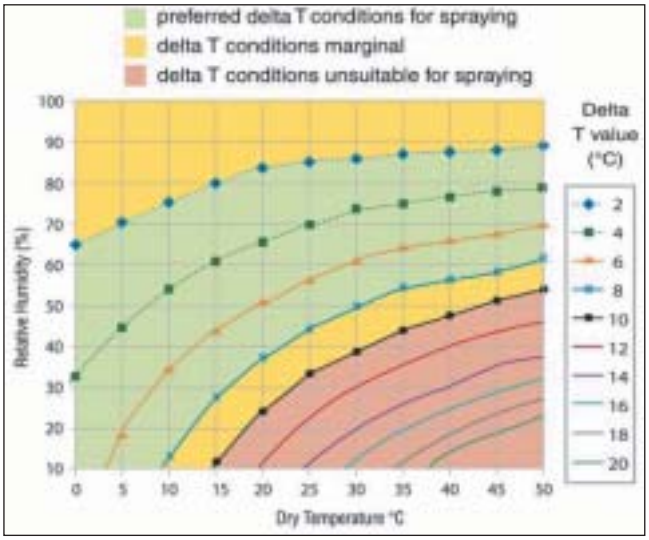
◁ 22...WHY ARE WE STILL HAVING SPRAY DRIFT PROBLEMS?

FIGURE 1: Selecting the right Delta T conditions for spraying



For fine and medium droplets (using spray quality guidelines from nozzle charts), a Delta T value of between two and eight is recommended. This recommendation exists because a large percentage of the droplets in these spray qualities are susceptible to evaporation when the moisture in the air is low.

For a fine spray quality (such as a standard 110-02 flat fan at two bar or 30 psi), up to 40 per cent of the spray solution (your chemical) may be lost when Delta T is above 10. For a medium spray quality, up to 20 per cent of the spray solution may not reach the target when the Delta T value is above 10 (check the combinations of temperature and relative humidity in Figure 1 to work out what a Delta T of 10 means).

With a coarse spray quality, the droplets produced are less susceptible to evaporation and will not reduce in size significantly before hitting the target. Less losses mean more chemical to the target — provided the spray quality also matches the target.

Even using a coarse spray quality does not completely remove the potential for drift to occur when conditions are not suitable — they simply reduce the risk. All nozzles will produce a percentage of small droplets capable of moving with the wind. If the wind is blowing towards a sensitive area, no nozzle is going to eliminate drift completely — so why take the risk?

RISKY SITUATIONS

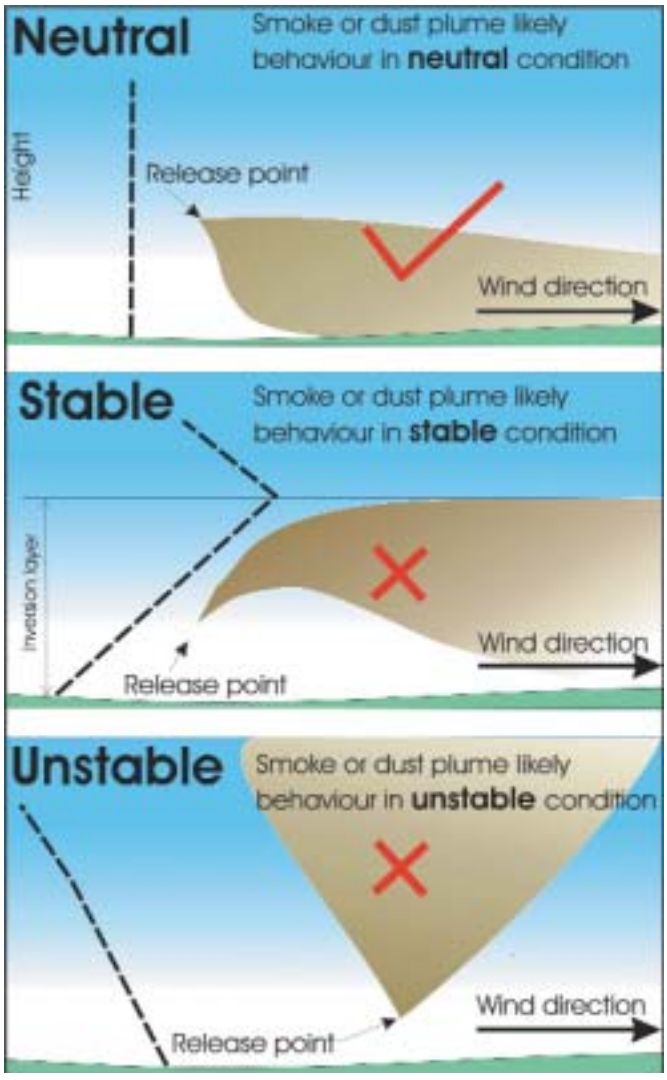
Regardless of which nozzle you choose, some situations are just too dangerous to spray in.

No wind

No wind is the most dangerous time for spraying. Wait until the wind speed is at least four kph, and constant for 30 to 45 minutes, before starting a spray to ensure that the air is mixing well, and potential for inversions to exist is reduced. Smoke will indicate if the air is not mixing (see Figure 2).

A lack of wind is a good indicator that either an inversion or some form of thermal activity (hot ground temperatures) may be present.

FIGURE 2: Smoke behaviour



Strong winds with fine or medium spray qualities

When wind speeds exceed label recommendations (where present) or are over 16–20 kph with fine to medium spray qualities, we start to risk the evenness of the application (particularly if the wind is gusting). With these spray qualities, too high a percentage of the volume we are putting out will move with the wind.

Inversions (early mornings)

An inversion exists when temperature increases with height, then decreases, producing layers of air that don't mix until the wind picks up.

Inversions can occur at any height, and at various times of the day. They typically form at night and are strongest in the early hours of the morning. They most frequently occur after nights with clear skies and cooler air temperatures.

Chemical released below an inversion layer remains concentrated and can move great distances before depositing — often following slopes with cold air drainage. It can also move unpredictably when the wind does pick up, so we must avoid spraying in conditions of little or no wind (see Figure 3). Similar problems occur when sprays are released above an inversion, since fine droplets continue to 'float' on top of the inversion layer until it breaks down.

Thermal activity from hot ground temperatures (late afternoon or early evening)

This is an effect we greatly underestimate, but has produced some severe consequences.

If you have ever seen spraying taking place later in the day or early evening you may have seen the spray 'hanging' in the air for more than 30 or 40 seconds (the time it takes to turn a spray rig).

If the spray hasn't deposited in that time it probably isn't going to deposit anywhere near its point of release.

Spray 'hangs' in the air because the droplets produced are not large enough to overcome the effects of hot air rising (mostly with fine and medium spray qualities). Air is clear, so the sun doesn't directly heat it. Instead the ground becomes hot and heats the air in contact with it, and hot air rises as 'parcels of air' (a similar effect to an inversion — see Figure 4).

Ground temperatures in summer can be more than 20°C hotter than the air temperature at 1.5 to two metres above the ground. This produces a large amount of lift and when a light breeze is present, the droplets that have not deposited will be carried long distances. They will eventually deposit where the soil temperature is cooler — often over an irrigated crop or a natural depression where cooler air drains to, such as a creek, gully or river banks.

MONITOR THE CONDITIONS AND MINIMISE THE RISK

We have to monitor the conditions in the paddock where spraying is actually taking place. Conditions should be monitored several times during the spray job, at least before starting any new load. Every spray operator must have a hand-held weather meter that can accurately measure temperature, relative humidity and wind speed. They should also have a compass to accurately assess and record wind direction. We should also have a Delta T chart with the spray rig and weather meter and know exactly where any sensitive areas are.

Smoke indicators should be used to assess conditions before starting a spray, particularly early in the morning. Several innovative growers have fitted injectors onto tractor exhausts to create smokers, similar to those used by aircraft. A small electric pump squirts a vegetable or mineral oil onto the hot exhaust which cre-

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FIGURE 3: Droplet movement with an inversion layer

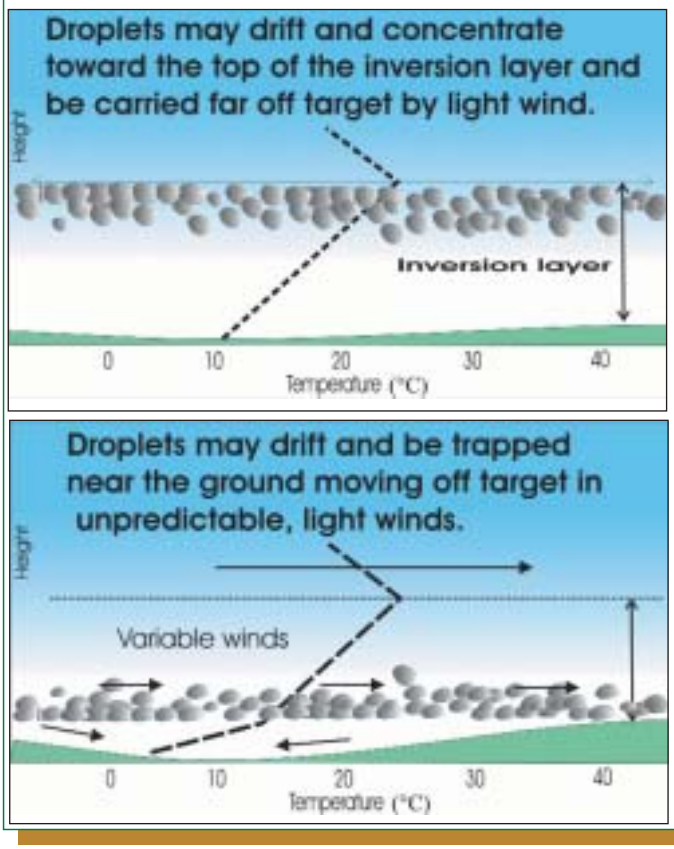
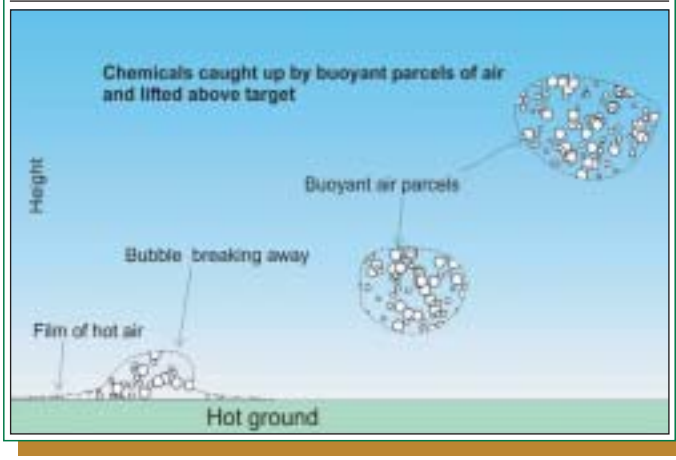


FIGURE 4: Diagram of parcels of air and thermal activity



ates a lot of smoke, and is great for determining if an inversion is present or a lot of thermal activity is occurring.

If we can assess the conditions correctly, we often find that conditions can remain suitable for longer than we think (they can also be unsuitable for longer than we think as well). We should have a plan in place and nozzles available to change the spray setup to suit the conditions if they change during the job.

Graham Betts has a saying, "plan the spray and spray the plan" — great advice, I think.

If the Delta T is increasing or the wind speed is increasing, we can increase droplet size to compensate and help minimise losses when we need to finish a job. Using larger droplets (coarse spray quality) to finish a job while the target is susceptible is probably better than waiting for conditions to be ideal.

There are limits to how far we can go, even with coarse droplets. There are also a few products and targets that these droplets may not suit — such as some contact grass herbicides and some very fine targets.

As a rough guide, when using a fine or medium spray quality, only operate between Delta T values of two and eight (provided all other conditions are suitable).

If using a coarse spray quality we can start in the same range, but can probably push the finishing Delta T out to 10 or even 12, provided the label allows us to do this and the plant is not going into a period of stress and all other conditions, such as wind speed, are suitable. I would never start a spray job if the Delta T was over 10 to begin with.

MISCONCEPTIONS ABOUT VOLUME AND LARGER DROPLETS

Conventional thinking also tells us that to achieve 'coverage' with larger droplets we need much higher application volumes — but this is not necessarily true. When conditions are becoming less favourable (say a Delta T moving from eight to 10), larger droplets will get more chemical to the target than medium or fine at the same application volume, because less spray is lost to off-target movement.

To achieve equivalent coverage in terms of product actually depositing on the target may only require a small increase in volume. As a rough guide, moving from fine to medium spray qualities for most herbicide work does not require an increase in volume to achieve the same number of droplets on the target. And, generally, more product will arrive at the target with the medium spray quality in those droplets than with a fine spray quality.

To move to a coarse spray quality, it would only take about a 10 L/ha increase in volume to achieve a similar result with a wide range of products, but with much less risk of drift or off-target movement. With a coarse spray quality, almost all of the droplets not hitting the target stay in the paddock, and are less likely to drift.

Changing to a coarser spray quality or increasing application rates to improve coverage has to suit the mode of action of the product and the target. For example, if you have hard water and are using a product such as glyphosate, increasing water volumes may actually be detrimental to the spray job.

TAKE HOME MESSAGE

Larger droplets do produce results, particularly when the target is at its most susceptible stage. Larger droplets can also help to improve the amount of chemical reaching the target and help to minimise drift under suitable conditions.

Moving to larger droplets is not just a matter of buying a bigger nozzle. It has to be the right type of nozzle to suit your needs and your sprayers' capabilities. Changing nozzle type will have a greater impact than using a bigger nozzle of the same type.

For more information contact Bill Gordon Consulting (Email: bill.gordon@bigpond.com) or Graham Betts of ASK GB (Mob: 0427 622 214) about in depth training in this area or see them at the Cotton Trade Show.

The figures in this article and much of the information about meteorological conditions comes from a Bureau of Meteorology publication,. The author, Graeme Tepper will also be a speaker at the Cotton Trade Show in May.

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