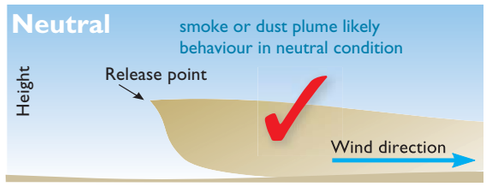
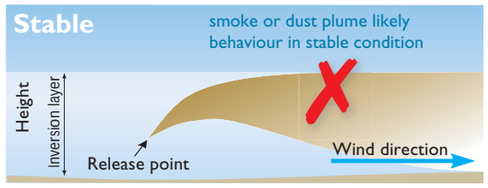
STABILITY

Stability refers to the atmosphere's ability to resist or assist vertical motion of air. A stable atmosphere will resist upward motion of air, an unstable atmosphere will assist it, while a neutral atmosphere will neither assist nor resist it. A neutral atmosphere is therefore best for spraying since droplets will fall solely under gravitational force – rather than being swept up by air currents in unstable conditions or concentrated within stable inversions.

Smoke plume generating devices are available to help determine stability. A rough smoke behavioural guide is shown below.



***Neutral Conditions**, most likely early morning and early evening. Smoke or dust will spread out in an even pattern and fall under gravity, reaching the ground a short distance from the release point.*

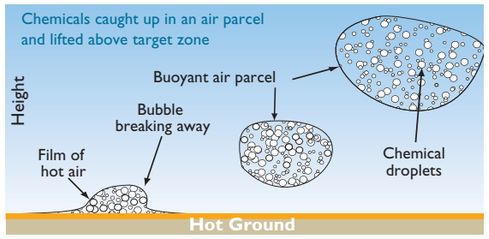


***Stable conditions**, most likely overnight. Smoke or dust may initially rise but will spread out at the inversion level and may slowly descend at some distance from the release point.*

***Unstable conditions**, most likely mid-morning to late afternoon. Smoke or dust will rise vertically.*

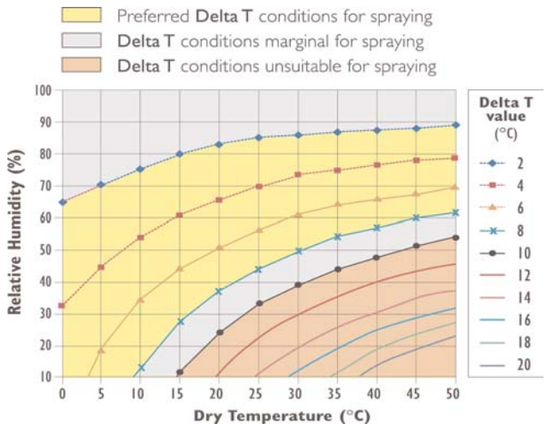
THERMAL DRIFT

Thermal drift occurs as a result of unstable meteorological conditions. Chemical droplets can be carried on thermal eddies and deposited some distance from the target site.



DELTA T

Delta T is becoming one of the standard indicators for acceptable spray conditions. It is indicative of evaporation rate and droplet lifetime. Delta T is calculated by subtracting the wet bulb temperature from the dry bulb temperature. The diagram below relates air temperature and relative humidity to values of Delta T. When applying pesticides, Delta T should ideally be between 2 and 8,

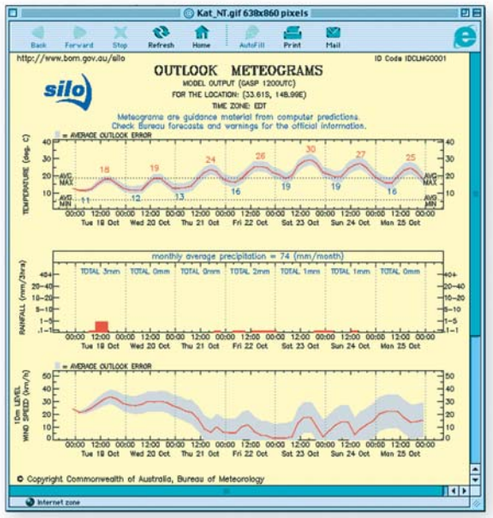


WEATHER INFORMATION

The Australian Government Bureau of Meteorology provides a wide range of weather information at http://www.bom.gov.au/

Information specific to ground sprayers is available at the Bureau's Registered Users Internet site. Please email webvic@bom.gov.au or phone (03)96694984 for information about accessing this site.

Seven day computer generated forecasts of temperature, humidity, precipitation and wind are available for any location around Australia through the Bureau's SILO web site for a small annual fee. For details, please visit the SILO home page: http://www.bom.gov.au/silo/products/MeteoGrams.shtml



Delta T diagram courtesy of NUFARM LTD.

Cover image courtesy of Goldacres Pty Ltd.

Published by the Bureau of Meteorology 2004 PO Box 1289K Melbourne Victoria 3001 Australia

Material No 507993 ABN 92 637 533 532

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Bureau of Meteorology

WEATHER *for* PESTICIDE SPRAYING

WEATHER GUIDELINES FOR PESTICIDE SPRAYING

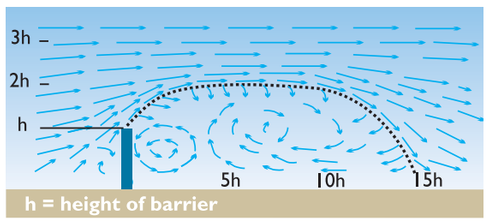
- Read the product label and follow all label instructions.
- Spray when wind is steady and ideally 3–15 km/h.
- Avoid variable or gusty wind conditions.
- Avoid calm conditions - small droplets may remain suspended for long periods.
- Spray when wind blows away from sensitive areas.
- Avoid spraying in temperatures above 28 °C.
- Aim to spray when Delta T is between 2 and 8 and not greater than 10.
- Do not spray when inversion conditions exist.
- Aim to spray when the atmosphere is neutrally stable.
- Most chemicals require a rain free period – check the label.
- Be aware of local topographic and convective influences on wind speed and direction.
- Record on-site weather conditions at spray time.

The Bureau gratefully acknowledges the Primary Industries Standing Committee "Spray Drift Management" publication, the Queensland Government DPI publication "How to prevent spray drift", the University of Queensland (Pesticide Application Information / Fact Sheets), Nufarm, Grains Research and Development Group (GRDC)

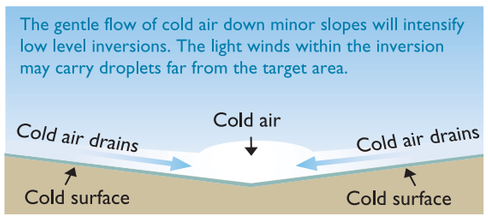
While the guidelines above are useful, more in-depth knowledge of how wind, temperature and humidity might vary over the target area will enhance the opportunity for successful spray application.

WIND

Wind values mentioned in Bureau forecasts and observations refer to the average wind over a 10-minute period at a height of 10 metres – crop level winds may be different. On weather maps wind is strongest where isobars (lines joining points of equal pressure) are close and light where isobars are far apart. Wind speed and direction may differ significantly from that anticipated from the weather map. This is because wind at ground level tends to flow in much the same way as water flows in a stream. Local wind may be deflected or blocked by obstacles and become chaotic in speed and direction. Daily variations of wind speed occur, generally with a minimum early in the morning increasing to a maximum sometime between late morning and mid afternoon. A sea breeze during the day and a katabatic* wind at night may completely mask 'weather map' inferred wind. Local convective cloud also has the potential to generate gusty wind. Virga (rain falling from cloud but not reaching the ground) warns of potential gusty conditions at ground level.



Beware of deflected winds over and around obstructions.



Check drainage wind potential and anticipate wind direction with respect to ground slope.

*Overnight, when air over a slope is cooled by cold ground it becomes dense and heavy and drains to lower levels.

TEMPERATURE AND HUMIDITY

Temperature. In meteorology, air temperature and humidity are measured in the shade at 1.25m above the ground. On hot days ground temperature may be up to 20°C higher. Volatile herbicides exposed to high temperatures and low humidities are inclined to vapourise, releasing damaging vapour even when the observed air temperature is measured to be within acceptable limits for spraying.

Humidity affects evaporation rate. Humidity of greater than 45% is often recommended for spraying – but very high humidity can suppress droplet evaporation, leading to extended life and unacceptable spray drift. On the other hand, if humidity is too low, droplets – especially small ones – quickly evaporate leading to a high risk of drift. In extreme cases where humidity is low and temperature high, pesticides convert to crystalline form and settle on the target, only later being activated by additional moisture. Late take up of pesticide may lead to unacceptable residue levels.

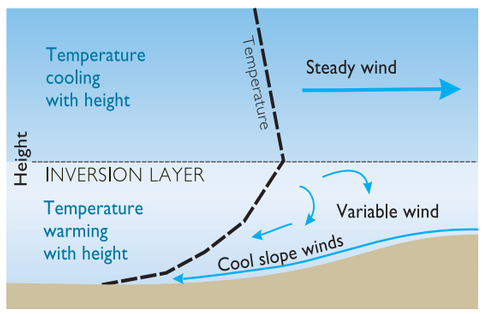
Optimal temperature and humidity conditions frequently occur in the early morning and into mid morning when conditions are not too hot nor too dry (See in Delta T section).

Temperature Inversions are layers of air in which temperature increases with height (as opposed to the normal decrease with height). A cold drainage wind (katabatic) can contribute to the strength of inversions (A) and add to the risk of drift.

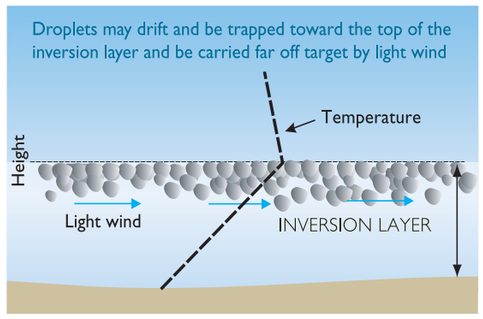
Inversions frequently form in the late evening and strengthen overnight (being strongest near sunrise) before being eroded by mid morning as the air near the ground heats up.

Inversion layers are stable (see stability section) and are characterised by calm, light or variable winds, that make it difficult to predict the movement, both vertically and horizontally of spray droplets (most drift complaints involve spraying under inversion conditions).

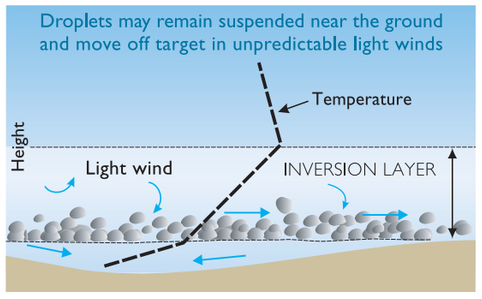
Within inversion layers droplets may rise and be trapped at some higher level before being carried out of the target area (B). On the other hand droplets may remain suspended at a lower level and drift off target in light winds (C).



A: *Characteristics of a temperature inversion layer.*



B: *Entrapment of rising droplets near the top of an inversion layer.*



C: *Suspended droplets at low level.*