Recognizing Temperature Inversions

Grow Smart™ with BASF

Recognizing when a temperature inversion exists is important to understanding when not to apply pesticides. Most pesticide labels prohibit applications during temperature inversion. This Technical Information Bulletin will help to explain what an inversion is, how to identify if one exists, and why they must be avoided for pesticide applications.

How Temperature Inversions Form

During daytime hours, dry air naturally cools with higher elevations. Solar radiation warms the earth's surface, and during days with little cloud cover, convection creates winds and gusts that heat the lower atmosphere. As sunset nears, the solar radiation lessens and the earth's surface is no longer heated by the sun and soon begins to cool. Heat from the warmer air is transferred back to the soil, creating a layer of cooler, denser air near the soil surface. This is the beginning of a temperature inversion.

Spraying pesticides during an inversion can result in the off-target movement of small droplets as physical drift which never reach their intended target. This is not to be confused with volatility, which is when a liquid droplet converts to a gas *after* it has reached its intended target.

Conditions Most Likely to Favor an Inversion:

- Clear skies during late afternoon and during the night
- Dry soil surface
- Wind speeds < 4 MPH that result in no air mixing
- Low areas, valleys, or basins where cool air will sink and collect. Inversions will form in these areas sooner, persist longer, and be more intense.

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How to Identify if an Inversion Exists:

- Measure air temperature at 6–12 inches above the soil and at 8–10 feet above the soil. An inversion exists if measured air temperature at 8–10 feet above the soil is higher than the measured air temperature at 6–12 inches above the soil. Be sure the instrument is shaded and not influenced by solar heating.
- Morning dew
- Morning fog (indicates that an inversion existed prior to fog formation)
- Smoke or dust hanging in the air or moving laterally
- Overnight cloud cover is 25% or less
- Inversions can begin forming three to four hours before sunset and can persist until one to two hours after sunrise

The Impact of Temperature Inversions on Pesticide Applications

Temperature inversions can negatively impact pesticide applications by trapping small droplets in the cool air of the inversion layer. These small droplets can then travel long distances, either downslope to low-lying areas or in an unpredictable manner with the light and variable winds. To avoid off-target movement of pesticides due to inversions, be mindful of inversions during the following spray timings:

- **Mornings**. Very early mornings around sunrise are when inversions can be at their most extreme. One of the worst times to spray is when overnight skies were clear and wind speeds are low. Inversions can persist for one to two hours after sunrise on a calm day.
- **Late afternoon/early evening**. The lowest five feet closest to the ground can sometimes begin to form an inversion three to four hours before sunset. Evening inversions pose a **greater** risk for off-target movement because they are very persistent and will intensify until after sunrise.
- **Nighttime**. Inversions may have already been established and continue to intensify until after dawn.

The importance of not spraying during a temperature inversion, as well as other important strategies for preventing spray drift, is covered in the On Target Application Academy offered from BASF. The On Target Application Academy was established to provide field-based applicator training with a practical and rigorous focus on proper application. Hands-on experience, including proper nozzle selection, calibration, boom placement, environmental considerations and the use of effective drift reduction additives, are all addressed.

ON TARGET APPLICATION ACADEMY

BASF now offers the OTAA educational experience online in the form of a digital training module. Go to: **GrowSmartUniversity.com**

Content adapted from:

Enz, J.W., Hofman, V., and Thostenson, A. 2014. *Air Temperature Inversions: Causes, Characteristics, and Potential Effects on Pesticide Spray Drift*. NDSU Extension Service, Publication AE1705.

http://www.omafra.gov.on.ca/english/crops/hort/news/hortmatt/2014/13hrt14a2.htm

To learn more about crop protection products from BASF, visit www.agproducts.basf.us

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