

Recognizing Temperature Inversions

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.

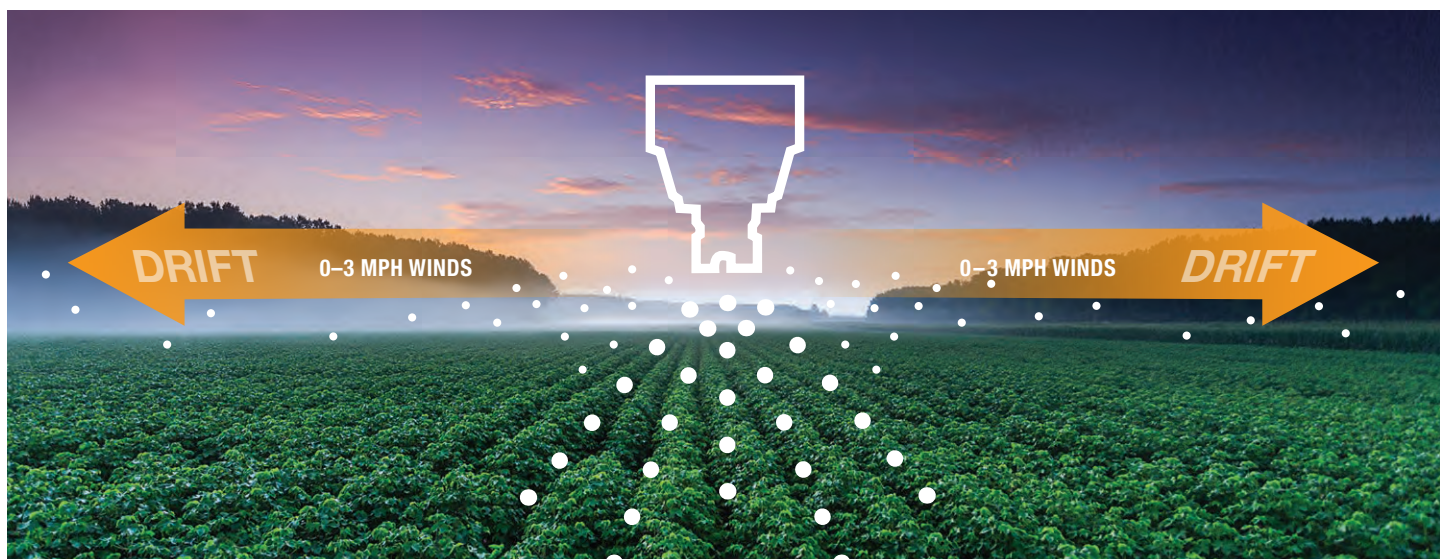
How Temperature Inversions Form

During daytime hours, dry air naturally cools with higher altitude. Solar radiation warms the earth's surface, and during days with little cloud cover, convection creates winds and gusts that transport air vertically. As sunset nears, the earth's surface is no longer heated by the sun. As a result, the ground and the air adjacent to the ground begins to cool more rapidly than parts of the overlying atmosphere. Heat from the warmer air is transferred back to the soil, creating a layer of cooler, denser air near the soil surface. This process creates a temperature inversion, where the cool air at ground level has warmer air above it through the very lowest levels of the atmosphere.

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.

Engenia® Herbicide Label

Requirements:

- DO NOT apply Engenia herbicide when temperature inversions exist at the field level
- Applications are only permitted beginning one hour after sunrise until two hours before sunset

Training and Education

Applicator training requirements vary depending on the state. Visit www.engeniastewardship.com for BASF resources on proper application according to label requirements. Proper nozzle selection, calibration, boom height, weather conditions and the use of approved tank mixtures are all addressed.

To learn more, go to: www.engeniastewardship.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>


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