WHAT IS AN Air Temperature Inversion?

Many in the agriculture industry have heard the term air temperature inversion, but what is this weather phenomenon that can be so dangerous for pesticide applicators? To ensure compliance with state and federal laws concerning pesticide applications, applicators must fully understand what a temperature inversion is, how it occurs and the effects it can have on spray drift.

An air temperature inversion is a reversal of the typical daytime air temperature in the layer of atmosphere closest to the ground. Usually, the temperature of the air during the day decreases as altitude increases. However, with the presence of an atmospheric inversion, there is an increase of air temperature with the increase in altitude, meaning there is warmer, lighter air aloft with a cooler, heavier layer of air next to the ground. When there is little to no wind present, these two air masses will not mix, resulting in a distinct temperature inversion.

Inversions are caused by radiation cooling of the ground from daytime heating loss. Therefore, inversions typically last from late afternoon to several hours after sunrise. The early morning may seem like the best time to spray, but it may be one of the worst times. Sunrise is typically when maximum inversion intensity occurs because of clear overnight skies and low wind speeds. The period one to three hours prior to sunset, and sometimes earlier, is also ideal for intense inversions as daytime heating is lost, inducing rapid surface and atmospheric cooling. Again, this is intensified by clear skies and little to no wind.

Certain surface conditions can also make inversions more intense in certain areas, such as fields with exposed, freshly tilled soil, soil covered in heavy crop residue and closed crop canopies. Keep in mind that cooler air is heavier and will "drain" into lower lying areas, such as valleys, basins and along hillsides, resulting in more intense inversions. Some indicators that a temperature inversion may be present include dust hanging over a roadway, slowly dissipating smoke from a ground source or an aircraft, dew on surface leaves and ground fog when sufficient humidity is present.

In the absence of these visual indicators, the only way to tell if an inversion is present is to measure the air temperature at two different heights, typically 6 to 12 inches above the ground — or at the top of most canopies — and at 8 to 10 feet above the surface. If the temperature at the lower level is less than the temperature at the higher level, an inversion exists.

Because we know that temperature inversions often occur in the most stable atmospheric conditions with little to

no air mixing, this stable atmosphere can allow small, aerosol-like droplets of pesticide to remain suspended in the cooler air mass closest to the ground. Under these conditions, the cooler air cannot rise. Instead, it moves laterally with a light wind, resulting in an off-target movement of the suspended pesticide droplets. Stronger winds (greater than 3 mph) will induce mixing of the air, breaking the inversion.

As applicators, it is imperative to monitor the weather conditions both before an application and periodically during an application to reduce the risk of off-target pesticide movement. It is also important to remember to use the largest spray droplets possible that will still get the job done to reduce spray-drift of the pesticide. Applicators should always refer to the product label and adhere to the manufacturer's warnings pertaining to contact with non-target areas.

Important things to remember:

- Temperature inversions can form several hours before sunset and last until several hours after sunrise.
- Visible signs of an inversion may not always be present.
- Winds speeds greater than 3 mph will typically break inversions.
- The presence of an inversion combined with low wind speeds enables long-distance drifting of fine-spray droplets.
- Use the largest droplets possible that will still get the job done.
- Always follow the label.

References

Thomson, S.J., Huang, Y., Fritz, B.K. 2017. Atmospheric Stability Intervals Influencing the Potential for Off-Target Movement of Spray in Aerial Application. International Journal of Agricultural Science and Technology. 5(1):1-17.

Enz, J.W., V. Hofman, and A. Thostenson. 2014. Air Temperature Inversions: Causes, Characteristics and Potential Effects on Pesticide Spray Drift. North Dakota State University Extension Service Publication AE1705. North Dakota State University. https://www.ag.ndsu.edu/pubs/plantsci/pests/ae1705.pdf.

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