AIR TEMPERATURE INVERSION EFFECTS ON HERBICIDE SPRAY DRIFT

What You’ll Learn...
- Air temperature inversions may occur in crop fields in the late afternoon and through the morning hours.
- Temperature inversions may create near-perfect conditions for small droplets to drift to nontarget areas.
- Most pesticide labels caution against applications during temperature inversions.
- Learning how to recognize when a temperature inversion may develop can help applicators avoid potential spray drift.

Inversion Effect on Spray Droplets
Air temperatures in crop fields are typically warmest near the ground and cooler at higher elevations. When an inversion occurs, the air near the crop or soil surface is cooler than the air above! The result is a very stable layer of air that prevents vertical air motion which causes small, suspended droplets to remain in a concentrated cloud of air for hours and potentially through the night and into the morning (Figure 2, page 2).
In the time between when they are sprayed and when they settle onto vegetation, these small particles can move to nontarget areas, potentially damaging susceptible crops or other vegetation (Figure 1). Even sprayer tips designed to produce large droplets also produce some small (200 microns and less) droplets.
Applicators should not confuse spray drift during an inversion with herbicide movement through volatilization (when a liquid droplet converts to a gas). Small droplets of any herbicide formulation can move to nontarget areas during an air temperature inversion.

Spray Timing
Early in the morning, when wind speeds are low (<3mph), may seem to be a good time to apply herbicides. However, when overnight skies were clear and wind speeds are low (<3mph), temperature inversions are likely to occur, making this one of the worst times to spray. Ground fog or moisture on plant leaves are indicators that an inversion exists.
An inversion usually persists for one to two hours, and sometimes longer, after sunrise on a clear calm day, depending on the surface conditions. In the morning when skies are clear, wait until the surface air begins to warm (generally 3°F from the morning low) or with increased winds (above 3 mph) to ensure the inversion has lifted.
In the late afternoon (one to three hours before sunset, and sometimes earlier), soil temperature and the temperature of the air above the soil begin to cool. These conditions can set up the beginning of an air temperature inversion.
Evening inversions may pose a greater risk for spray drift compared to morning inversions due to the fact that once formed, the inversions are persistent as long as skies remain clear. Once formed, the inversion will continue to intensify until shortly after sunrise. Windy or cloudy conditions will eventually disrupt the evening inversion. An inversion, plus low wind speed, is the best possible situation for long distance drift of spray droplets.
In mountainous areas, protected valleys, low areas, and shaded hillsides, cold air drainage can cause intense inversions. Applicators should be aware of the increased potential for inversion development and the increased risk of spray drift in these areas.

Identifying an Inversion
Applicators can confirm the presence of an inversion by measuring the air temperature at two heights: 6 to 12 inches above the sprayed surface (soil if no crop is emerged or above the crop canopy) and 8 to 10 feet above the surface to be sprayed. When the temperature at the higher level is greater than the temperature at the lower level, an inversion exists. The greater the temperature difference between the two levels, the more intense the inversion, and the more stable the lower atmosphere.

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Temperature Inversion Indicators

Precisely measuring temperatures at the soil or crop surface as well as 8 to 10 feet above the surface may be impractical. The following conditions indicate that a surface temperature inversion is likely to be present:

- Mist, fog, dew, or a frost are present.
- Dust or smoke hang in the air and moves sideways, just above the surface. An applicator can generate smoke to test for the presence of an inversion. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.
- Cumulous clouds disperse as evening approaches.
- Wind speed is less than 3 mph.
- Cool, off-slope breezes develop in the evening or overnight.
- Distant sounds become easier to hear.
- Distant smells are more distinct during the evening than during the day.

For more information on herbicide application requirements, contact your local seed representative or visit: www.XtendiMaxApplicationRequirements.com

Sources:
3. Colomon, C., Biggs, M., Bish, M.I, and Bradley, K. Minimizing the risk of drift: synthetic auxin herbicides on soybean and the factors that lead to off-target movement. Weedscience.missouri.edu.