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Reducing Spray Drift from Glyphosate and Growth Regulator Herbicide Drift Caution

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If Indiana was the land of perfect, you would be able to pull into a field that had a dry surface, the temperature would be 75°F and the wind would be only 2 -3 MPH without a chance of a temperature inversion ever occurring. Weeds would never be over 2-3 inches tall and the corn would be in the V4 stage and soybeans plants would have 2-3 trifoliolates. But, since we don't live in the land of perfect, we have to deal with conditions that are not always ideal for spraying herbicides.

One of the biggest concerns of herbicide applications in the spring of the year is off-target drift. Managing spray applications to minimize drift is something that should take top priority in the total herbicide management scheme. Drift reduces product efficacy, damages crops that are economically or aesthetically important, hurts wildlife, and contaminates water supplies. Herbicide drift can also deposit illegal residues on eatable crops, especially organic grown crops or processed crops that are checked for contaminants.

There are two types of drift:

1. Vapor drift - which is related to the product formulation (ester vs. amine), temperature, relative humidity and is not a function of the application method or equipment, and
2. Particle drift – which is a function of the application method and equipment. The key factors associated with particle drift are:
    a. Droplet size
    b. The equipment and operation technique
    c. Wind speed and direction and climatic conditions

The simplified difference between vapor drift and particle drift is that with vapor drift, the application reaches its target and then moves off target some time after application. In the case of particle drift, the portion that moves off-target does not reach its target.

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Particle Drift

Particle drift occurs with all pesticide applications, regardless of the product or formulation, and is directly associated with droplet size in combination with boom height and wind speeds. Injury symptoms from drift will depend on the product used, environmental conditions, and sensitivity of the plants in the path of air flow. Low concentrations of glyphosate may or may not show injury symptoms while low concentrations of 2,4-D or dicamba may show major symptoms on sensitive plants. Controlling droplet size by choosing the proper nozzles and operating the equipment at the proper pressures will minimize drift problems more than anything else within the operator's control.

For burndown and early season applications, selecting nozzles that produce medium to course size droplets (220 – 400 microns) will provide good herbicide coverage. Operating the sprayer at 30 to 40 psi will usually provide the maximum droplets in this range. Obviously the pressure range will also depend in the nozzle type. Some wide-angle nozzles with pre-orifice or air-assist designs will allow pressures to be greater than other nozzles designs, while extended range flat-fan nozzles can be operated at lower pressures.

In "A Summary of Ground Application Studies" by the Spray Drift Task Force, a consortium of 38 agricultural chemical companies, reported that the average loss of active ingredient was approximately 0.5% with a 10 mph cross wind[1]. However, it should be noted that in Indiana winds and gusts of wind can often surpass 10 mph.

The most common ways to reduce herbicide drift onto susceptible crops or sensitive areas are:

1. Use the lower end of the pressure recommended range for that particular nozzle to produce course droplets
2. Lower the boom height – but, ensure that the spray pattern is maintained
3. Instead of increasing pressure to provide higher outputs, increase the nozzle size to increase the spray volume/acre while keeping within the recommended pressure.
4. Spray when the wind speeds are less than 10 MPH. Some labels, such as Banvel® provide a specific wind speed (15 MPH).
5. Spray when the wind direction is away from sensitive areas
6. In case of volatile herbicides like growth regulators, do not spray when there is no wind; this may suggest that an inversion is present.
7. Use a drift control agent if possible

Vapor Drift

Vapor drift is much harder to control than particle drift. Vapor drift is a function of the herbicide formulation and ambient temperature. In 1979, E. Behrens and W.E. Lueschen investigated dicamba drift using a closed system of bell jars; not quite field conditions, however, it provided some indication of how temperature can affect volatility of dicamba[2]. As temperature increased from 59^{o}F to 86^{o} F, visual symptoms on soybean increased from almost 0% to 40%. The same study looked at dicamba formulation and reporting that the dimethylamine and methylamine salts of dicamba produced the most injury in soybean. The sodium, lithium, and potassium salt did not produce any visual injury symptoms under the same conditions. The most common vapor drift of 2,4-D comes from ester formulations, but can also be seen from other herbicides like Command. Ester formulations of herbicides volatilize at temperatures of 70^{O}F or greater, and if calm conditions exist creating an inversion layer, these herbicides can drift for

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more than one mile. When volatile herbicides are applied in the spring, soil surface temperatures can be 10 – 15°F hotter than the air temperature, especially in mid-afternoon, increasing the possibility of volatilization. The Indiana State Climate Center indicated that inversion layers occur an average of 20 times per month during the periods of April through July but those strong enough to cause long distance herbicide drift occur, on average, between 6 and 8 times during the period of mid-April and mid-May in Indiana, while occurring only 1 or 2 times in June –July. This long distance movement usually occurs at night as the air temperature cools and there is light air movement. When such days occur, being aware of a volatile herbicide's ability to vaporize can help the applicator manage a potential drift problem by either not spraying until conditions improve or by choosing a formulation of the product that is less subject to volatilization.

Volatile herbicides are not unique to long distance movement. Any herbicide that is part of a spray droplet of 100 microns or less, which can be produced when spray pressures are increased over normal recommended ranges for that particular nozzle, can become an aerosol particle that is suspended in the air and will likewise move long distances with high winds or by a temperature inversion layer. On a calm day with low relative humidity a droplet of 100 micron or less will evaporate in less than 6 seconds and the herbicide molecules will suspend in the air similar to smoke. For example, at 90°F and 36% RH, a 50 micron droplet will travel only about 3 inches from the nozzle and evaporate in less than 2 seconds. These suspended molecules can then move horizontally for very long distances before being deposited on off-target areas. Once the dry molecules are rehydrated by wet leaves, they can then be absorbed by leaf tissue. If the herbicide residue is from an herbicide that has enough activity, it can cause injure symptoms to sensitive crops. These are usually herbicides like growth regulators (ester or amine), bleachers like Command, or contact herbicides like paraquat. Other herbicide chemistries may or may not show symptoms.

For Free Herbicide Labels go to

www.cdms.net

and

www.greenbook.net

References:

1) Spray Drift Task Force. 1997. A Summary of Ground Applications Studies. Agricultural Research Services, Inc., P.O. Box 509, Macon, Missouri 63552.

2) Behrens, R. and W.E. Lueschen. 1979. Dicamba volatility. Weed Science 27:486-493

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