STOP #9

# HERBICIDE DRIFT AND VOLATILITY

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Herbicide drift and volatility have presented problems to agricultural professionals as long as these chemicals have been on the market. Drift occurs when spray droplets are carried downwind from the applicator before reaching the ground. Higher wind speed and smaller droplet size increase the amount of spray drift. Volatility, on the other hand, occurs after the spray has contacted the ground or target plant, at which point the herbicide vaporizes and is transported by air currents. The chemical nature of a herbicide, high air temperature, and low relative humidity are all related to volatility. While drift occurs within a few minutes after spraying, volatility can take place over several hours.

Two major problems arise in either situation. First of all, the herbicide does not maintain contact with the weeds being sprayed; thereby reducing the efficacy of the application. Secondly, airborne herbicide can land on sensitive, non-target plants, producing injury or even death. Herbicide drift and volatility can be dangerous in any situation, but these phenomena are of particular concern to lawn care professionals since home lawns are often surrounded by a wide variety of ornamental plants and vegetable crops.

In the present study, we evaluated drift and volatility damage from ten broadleaf herbicides using two week old dwarf cranberry beans as indicator plants. Two experiments were conducted and each included five different herbicides: Study 1 - 2,4-D ester, 2,4-D amine, triclopyr ester, triclopyr amine, and dicamba; Study 2 - 2,4-DP, Turflon D, Super Trimec, Break-thru, and Weedone DPC. Weather conditions during each experiment are shown in Table 6. Test plots consisted of 12 by 20 ft spray blocks with potted bean plants placed at 2, 4, 8, and 16 ft downwind from one edge. Separate plots were constructed for three replications of each herbicide. Herbicides were applied with a hand-held $CO_2$ sprayer with 8002 nozzle tips at 30 psi. To evaluate herbicide drift, bean plants were left in place downwind from the spray block during herbicide application and for five minutes thereafter. After the five-minute exposure period, they were replaced with a new set of plants which remained in place for twenty-four hours to receive herbicide vapor. Injury symptoms were visually rated on a scale of 0-100 where 0 = no injury and 100 = complete kill. Injury data on Tables 2 and 3 were taken 1, 7, and 14 days after herbicide exposure.

Moderate drift injury ranging from 25-53 resulted from both the amine and ester formulations of 2,4-D and triclopyr at 2 and 4 ft from the spray block (Table 7). Super Trimec caused similar levels of injury at the same distances. Dicamba appeared to be the most detrimental, producing moderate injury (53) as far as 16 ft. No injury symptoms were observed following exposure to drift from 2,4-DP, Break-thru, and Weedone DPC.

Date taken on plants exposed to herbicide volatility (Table 8) indicate that 2,4-D and triclopyr esters are more volatile and therefore induced more injury than the amine formulations. In nearly every case, amines resulted in only slight injury (<20) while esters produced ratings in the 50's at 2 and 4 ft. from the spray block. Turflon D volatility resulted in injury ratings of 68 and 45 at 2 and 4 ft, similar to that of Super Trimec. Dicamba again caused the most injury with ratings ranging from 87 at 2 ft to 70 at 16 ft.

Data from these experiments indicate that drift and volatility of some herbicides present more of a threat to non-target plants than others and therefore should be applied with extra caution and under mild conditions. Future studies will focus on the most volatile herbicides in an effort to determine the time period following application when most volatility occurs.

TABLE 6. Weather conditions during drift and volatility experiments.

| | Temperature | | Relative Humidity | | |
|---|---|---|---|---|---|
| | Day | Night | Day | Night | Wind |
| Experiment 1 | 65-75°F | 45-65°F | 45-60% | 95% | 4-12 mph |
| 2,4-D ester, amine | | | | | |
| triclopyr ester, amine | | | | | |
| dicamba | | | | | |
| Experiment 2 | 75-90°F | 70-75°F | 45-85% | 95% | 4-7 mph |
| 2,4-DP | | | | | |
| Turflon D | | | | | |
| Super Trimec | | | | | |
| Break-thru | | | | | |
| Weedone DPC | | | | | |

TABLE 7. Herbicide drift injury on Dwarf Cranberry bean plants.

| **Herbicide (lbs ai/A) | Days After Treatment | Injury rating (0-100)* Distance From Spray Block (ft.) 2 | 4 | 8 | 16 |
|---|---|---|---|---|---|
| 2,4-D ester (1.0) | 1 | 13 ± 12 | 2 ± 2 | 5 ± 0 | 10 ± 10 |
| | 7 | 3 ± 3 | 10 ± 13 | 10 ± 13 | 17 ± 18 |
| | 14 | 42 ± 33 | 17 ± 29 | 23 ± 32 | 42 ± 43 |
| 2,4-D amine (1.0) | 1 | 23 ± 4 | 13 ± 4 | 8 ± 8 | 2 ± 2 |
| | 7 | 18 ± 8 | 2 ± 3 | 2 ± 3 | 2 ± 3 |
| | 14 | 40 ± 10 | 35 ± 31 | 17 ± 21 | 3 ± 6 |
| Triclopyr ester (1.0) | 1 | 22 ± 12 | 8 ± 8 | 12 ± 16 | 2 ± 2 |
| | 7 | 30 ± 52 | 8 ± 14 | 10 ± 13 | 0 ± 0 |
| | 14 | 28 ± 40 | 25 ± 23 | 25 ± 35 | 9 ± 14 |
| Triclopyr amine (1.0) | 1 | 10 ± 9 | 13 ± 6 | 10 ± 5 | 5 ± 5 |
| | 7 | 57 ± 45 | 57 ± 49 | 28 ± 49 | 0 ± 0 |
| | 14 | 47 ± 41 | 53 ± 46 | 23 ± 43 | 3 ± 3 |
| Dicamba (1.0) | 1 | 13 ± 6 | 5 ± 9 | 2 ± 2 | 7 ± 12 |
| | 7 | 62 ± 18 | 50 ± 13 | 30 ± 30 | 25 ± 23 |
| | 14 | 54 ± 45 | 88 ± 12 | 58 ± 57 | 53 ± 38 |
| 2,4-DP (1.0) | 1 | 0 | 0 | 0 | 0 |
| | 7 | 0 | 0 | 0 | 0 |
| | 14 | 0 | 0 | 0 | 0 |
| Turflon D (1 + 0.5) | 1 | 13 ± 10 | 8 ± 8 | 3 ± 3 | 0 |
| | 7 | 7 ± 3 | 7 ± 3 | 2 ± 3 | 0 |
| | 14 | 2 ± 3 | 7 ± 12 | 3 ± 6 | 0 |
| Super Trimec (.75 + .75 + .18) | 1 | 10 ± 5 | 5 ± 5 | 5 ± 5 | 0 |
| | 7 | 55 ± 18 | 35 ± 38 | 13 ± 23 | 0 |
| | 14 | 65 ± 9 | 33 ± 28 | 17 ± 19 | 0 |
| Break-thru (.125) | 1 | 0 | 0 | 0 | 0 |
| | 7 | 0 | 0 | 0 | 0 |
| | 14 | 0 | 0 | 0 | 0 |
| Weedone DPC (2.0) | 1 | 5 ± 5 | 0 | 0 | 0 |
| | 7 | 0 | 0 | 0 | 0 |
| | 14 | 0 | 0 | 0 | 0 |

* Injury scale based on visual ratings: 0 = no injury, 100 = complete kill. Data are expressed as mean of 3 replications ± SE

** All control plants received ratings of "0" (data not shown).

TABLE 8. Herbicide volatility injury on Dwarf Cranberry bean plants.

| Herbicide (lbs ai/A) | Days After Treatment | Injury rating (0-100) Distance From Spray Block (ft.) 2 | 4 | 8 | 16 |
|---|---|---|---|---|---|
| 2,4-D ester (1.0) | 1 | 10 ± 10 | 3 ± 6 | 8 ± 4 | 12 ± 6 |
| | 7 | 3 ± 3 | 5 ± 9 | 3 ± 6 | 8 ± 10 |
| | 14 | 23 ± 40 | 52 ± 10 | 0 | 3 ± 6 |
| 2,4-D amine (1.0) | 1 | 10 ± 13 | 7 ± 12 | 2 ± 2 | 15 ± 0 |
| | 7 | 3 ± 6 | 0 | 0 | 8 ± 14 |
| | 14 | 8 ± 14 | 2 ± 3 | 0 | 17 ± 29 |
| Triclopyr ester (1.0) | 1 | 8 ± 14 | 25 ± 5 | 20 ± 5 | 8 ± 14 |
| | 7 | 43 ± 43 | 60 ± 52 | 5 ± 9 | 0 |
| | 14 | 58 ± 46 | 58 ± 57 | 7 ± 3 | 17 ± 29 |
| Triclopyr amine (1.0) | 1 | 8 ± 14 | 3 ± 6 | 5 ± 5 | 2 ± 2 |
| | 7 | 0 | 0 | 10 ± 17 | 2 ± 3 |
| | 14 | 0 | 0 | 28 ± 49 | 3 ± 6 |
| Dicamba (1.0) | 1 | 7 ± 3 | 10 ± 0 | 3 ± 6 | 10 ± 10 |
| | 7 | 42 ± 26 | 33 ± 18 | 17 ± 3 | 10 ± 5 |
| | 14 | 87 ± 3 | 88 ± 3 | 77 ± 14 | 70 ± 18 |
| 2,4-DP | 1 | 6 ± 8 | 5 ± 10 | 0 | 0 |
| | 7 | 0 | 0 | 0 | 0 |
| | 14 | 0 | 0 | 0 | 0 |
| Turflon D | 1 | 25 ± 5 | 23 ± 3 | 18 ± 6 | 10 ± 0 |
| | 7 | 90 ± 0 | 82 ± 6 | 45 ± 39 | 0 |
| | 14 | 68 ± 8 | 45 ± 18 | 18 ± 28 | 0 |
| Super Trimec | 1 | 23 ± 6 | 17 ± 13 | 15 ± 0 | 12 ± 8 |
| | 7 | 78 ± 6 | 75 ± 0 | 62 ± 10 | 60 ± 18 |
| | 14 | 72 ± 10 | 50 ± 25 | 30 ± 17 | 28 ± 25 |
| Break-thru | 1 | 0 | 0 | 0 | 0 |
| | 7 | 0 | 0 | 0 | 0 |
| | 14 | 0 | 0 | 0 | 0 |
| Weedone DPC | 1 | 0 | 0 | 0 | 0 |
| | 7 | 0 | 0 | 0 | 0 |
| | 14 | 0 | 0 | 0 | 0 |