

Simulated Drift of Herbicides on Grapes, Tomatoes, Cotton, and Sunflower

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A field study was established in 1999 on the Vegetable Crops Farm at Davis California to evaluate the effects of simulated drift of clopyralid, 2,4-D, triclopyr ester, triclopyr amine, glyphosate, and dicamba on grapes, processing tomatoes, cotton, and sunflower. Herbicides were applied at 0.1X of the common use rate in California and were treated at the two leaf stage (grapes treated when new shoots were 10 inches) or at flowering (Table 1). A nonionic surfactant was added to all treatments at 0.25% v/v. Treatments were applied with a backpack sprayer using 8001 nozzles, with a final spray volume of 10 to 12 gal/a.

Tomato injury was greatest from simulated drift of triclopyr ester at both treatment timings (Table 2). Seedling tomato plants were generally more sensitive to herbicide drift, however, flowering tomatoes suffered more injury from dicamba. Treatment timing did not statistically influence yield, with the exception of dicamba. Dicamba caused flower abortion and severely reduced plant vigor when applied at flowering, with a drastic drop in yield.

Simulated drift of 2,4-D onto cotton caused significant injury, particularly when applied at the two true leaf stage (Table 3). Dicamba and triclopyr ester caused less injury than 2,4-D at the seedling stage, but were equally injurious at the flowering stage. Clopyralid caused moderate injury to seedling cotton, but did not cause much visual injury to flowering cotton. Glyphosate seemed relatively safe to cotton at the rate applied. Cotton yields were not statistically affected by simulated drift to seedling cotton, except from the 2,4-D treatment. However, all drift treatments except glyphosate caused significant yield decreases when applied to flowering cotton, with 2,4-D, triclopyr ester and dicamba all causing over 80% yield reductions.

Sunflower plants were very sensitive to clopyralid, 2,4-D, or dicamba when applied to seedlings with two true leaves (Table 4). Triclopyr ester and glyphosate were moderately injurious to seedling sunflower and triclopyr amine caused only slight injury. Applications made at flowering did not appear visually to cause much injury. Sunflower yields were severely reduced by clopyralid, 2,4-D, and dicamba when drift occurred to seedlings. Triclopyr ester and glyphosate drift to seedlings reduced sunflower yields about 50%. When drift occurred on flowering plants, visual injury was minimal, however, 2,4-D, triclopyr ester and dicamba caused significant yield reductions. Clopyralid did not cause yield reductions when applied at the flowering stage, however, previous years work indicated the potential for yield reductions when drift occurred at flowering.

Only 2,4-D caused significant visual injury when applied to new shoots of grapes (Table 5), with the major symptom being misshapen leaves. However, when grapes were flowering, triclopyr ester, 2,4-D, and triclopyr amine all caused significant leaf burn. Dicamba also caused significant injury when applied to flowering grapes, but to a lesser degree. Grape yields responded similarly to the visual injury, with yields reduced moderately by seedling drift from

2,4-D, triclopyr ester, and triclopyr amine. However, yields were wiped out by these same treatments when drift occurred at the flowering stage. Dicamba also caused significant yield loss when drift occurred at flowering. Clopyralid and glyphosate drift did not cause yield loss at either treatment time.

These results indicate that the effects of drift vary by crop species, timing of the drift, and the herbicide. In general, tomatoes, cotton, and grapes were less sensitive to yield reductions when drift occurred at two true leaves or when new shoots were forming, while sunflower was most sensitive at the two true leaf stage. The ester form of triclopyr was much more injurious than the amine form, which is probably related to greater absorption. When sensitive crop plants are close to treated areas, take extra precautions to avoid drift, as even small amounts of herbicide can cause large yield reductions.

Table 1. Treatment information for the simulated drift study.

Herbicide	Rate (lbs/a)
Clopyralid	0.025
2,4-D	0.10
Triclopyr ester	0.10
Triclopyr amine	0.10
Glyphosate	0.10
Dicamba	0.10

Treatment dates and phenology

Grapes

April 21, 1999 – New shoots about 6 to 12 inches and leaves expanding

June 3, 1999 – Flowering

Tomato

June 28, 1999 – Two true leaves

July 30, 1999 – Flowering

Cotton

June 29, 1999 – Two true leaves

July 30, 1999 – Flowering

Sunflower

May 27, 1999 – Two true leaves

June 28, 1999 – Flowering

Table 2. Tomato injury (%) on August 15, 1999 and yield (% of control) in response to simulated herbicide drift at two true leaves or at flowering.

Treatment	Injury %	Yield % of untreated
<u>Two true leaf</u>		
Clopyralid	2.5	79.7
2,4-D	35.0	78.6
Triclopyr ester	60.0	38.6
Triclopyr amine	27.5	55.5
Glyphosate	36.2	55.2
Dicamba	12.5	110.1
Untreated	0.0	100.0
<u>Flowering</u>		
Clopyralid	28.8	71.8
2,4-D	16.2	69.9
Triclopyr ester	47.5	27.2
Triclopyr amine	25.0	80.0
Glyphosate	28.8	54.5
Dicamba	47.5	33.8
Untreated	0.0	100.0
LSD .05	22.1	37.8

Table 3. Cotton injury (%) on August 15, 1999 and yield (% of control) in response to simulated herbicide drift at two true leaves or at flowering.

Treatment	Injury %	Yield % of untreated
<u>Two true leaf</u>		
Clopyralid	25.0	67.2
2,4-D	95.0	17.7
Triclopyr ester	42.5	82.2
Triclopyr amine	23.8	114.8
Glyphosate	8.8	116.1
Dicamba	36.2	68.8
Untreated	0.0	100.0
<u>Flowering</u>		
Clopyralid	3.8	56.2
2,4-D	38.8	5.5
Triclopyr ester	33.8	19.2
Triclopyr amine	17.5	41.2
Glyphosate	5.0	107.8
Dicamba	38.8	13.6
Untreated	0.0	100.0
LSD .05	12.7	42.8

Table 4. Sunflower injury (%) on August 15, 1999 and yield (% of control) in response to simulated herbicide drift at two true leaves or at flowering.

Treatment	Injury %	Yield % of untreated
<u>Two true leaf</u>		
Clopyralid	77.5	4.6
2,4-D	73.8	17.7
Triclopyr ester	40.0	45.5
Triclopyr amine	15.0	97.3
Glyphosate	32.5	53.0
Dicamba	87.5	2.0
Untreated	0.0	100.0
<u>Flowering</u>		
Clopyralid	8.8	87.0
2,4-D	11.2	56.1
Triclopyr ester	16.2	18.0
Triclopyr amine	6.2	27.6
Glyphosate	11.2	79.3
Dicamba	11.2	56.0
Untreated	0.0	100.0
LSD .05	12.0	32.0

Table 5. Grape injury (%) on August 9, 1999 and yield (% of control) in response to simulated herbicide drift at two true leaves or at flowering.

Treatment	Injury %	Yield % of untreated
<u>New Shoots</u>		
Clopyralid	0.0	83.7
2,4-D	15.0	61.6
Triclopyr ester	3.3	47.3
Triclopyr amine	5.0	62.3
Glyphosate	0.0	110.0
Dicamba	3.0	88.3
Untreated	0.0	100.0
<u>Flowering</u>		
Clopyralid	3.3	82.3
2,4-D	66.7	5.4
Triclopyr ester	76.7	0.0
Triclopyr amine	56.7	0.0
Glyphosate	3.3	97.6
Dicamba	25.0	33.2
Untreated	0.0	100.0
LSD .05	14.7	37.3