W 297-B

Diagnosing Suspected Off-target Herbicide Damage to Grape

Herbicide Stewardship
Protecting Crops Environment Technology

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Introduction

Pasture and right-of-way herbicides have the potential to move off-target and can severely impact grape production. While these herbicides are valuable tools for weed management, off-target damage to grape often results in reduced productivity for growers and bad publicity for the industry. Herbicide damage can lead to reduced yields and possible crop rejection.

Following proper stewardship recommendations can reduce the impact of off-target herbicides in grape (see UT Extension Fact Sheet W 297-A Preventing Off-target Herbicide Problems in Vineyards). However, these unfortunate events sometimes occur and diagnosing problems in the field is difficult. Symptoms can be quite similar, because many pasture herbicides mimic the plant hormone auxin. Images and descriptions in this publication are intended to highlight characteristic symptomology of each of these broadleaf herbicides on grape.

Healthy grapevines early in season.

Procedures

Grapevines were grown in a greenhouse and treated with simulated drift rates for aminocyclopyrachlor, aminopyralid, picloram, dicamba and 2,4-D (see table below). Products containing aminocyclopyrachlor are registered for noncropland use, but are not yet registered for use in pastures. Plants were photographed over time to illustrate the development of symptoms.

Common name	Chemical family	Trade names
aminocyclopyrachlor	Pyrimidine-carboxylic acid	Not yet registered for use in pastures and hay fields
aminopyralid	Pyridine-carboxylic acid	Milestone, ForeFront R&P, ForeFront HL, GrazonNext
picloram	Pyridine-carboxylic acid	Tordon, Surmount, Grazon P+D
2,4-D	Phenoxyacetic acid	Various names and mixtures
dicamba	Benzoic acid	Banvel, Clarity, Oracle, Rifle, Brash, Rangestar, Weedmaster

The following are descriptions of commonly observed symptoms resulting from exposure to synthetic auxin herbicides:

Curling — Folding of edge of leaf margins.
Epinasty — Twisting, bending and/or elongation of stems and leaf petioles.
Chlorosis — Yellowing or whitening of leaves resulting from loss of chlorophyll.
Necrosis — Browning of tissue resulting from cell death.

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Picloram

After exposure to picloram, grape plants exhibit symptoms relatively soon, with new leaves folding upward by four days after treatment. At one week, young leaves continue to curl and leaf petioles and stems begin to droop (Fig. 2). Plants are generally not as upright as those exposed to aminocyclopyrachlor or aminopyralid. Higher rates of picloram lead to severe drooping and early signs of necrosis by two weeks after treatment (Fig. 3). Large leaves are often folded in half lengthwise and new growth has nearly ceased. At low rates, drooping is not as severe and new leaves are cupped upward at two weeks (Fig. 4). By three weeks, high rates of picloram result in plant death (Fig. 5). Lower rates result in yellowing of younger leaves and down-cupping of older leaves (Fig. 6).

Fig. 1. Upward folding of young leaves.

Fig. 2. Epinasty in stems leaf petioles.

Fig. 3. Severe petiole drooping and early necrosis with high rates.

Fig. 4. Upward cupping of young leaves with low rates.

Fig. 5. Plant death with high rates.

Fig. 6. Downward cupping in older leaves and yellowing in younger leaves.

Aminocyclopyrachlor

By four days after treatment, petioles are drooping and new leaves are folded upward (Fig. 7). At one week, petiole epinasty has become more severe (Fig. 8). Also, young leaves are slightly puckered and rippled and are beginning to lose color. At two weeks, older leaves are cupped downward and some have started to turn brown (Fig. 9). New leaves are folded upward and curled around the margins (Fig. 10). At three weeks, low rates have resulted in more petiole bending and interveinal chlorosis in leaves (Fig. 11). High rates have caused severe yellowing and more pronounced puckering and rippling in young leaves (Fig. 12).

Fig. 7. Petioles drooping and folding of new leaves.

Fig. 8. Severe epinasty and puckering in young leaves.

Fig. 9. Older leaves cupped downward and some necrosis.

Fig. 10. Curling and cupping in young leaves.

Fig. 11. Petiole bending and chlorosis with low rates.

Fig. 12. Severe epinasty and chlorosis with high rates.

Aminopyralid

Symptoms typically develop slower with aminopyralid than with picloram or aminocyclopyrachlor. New leaves and petioles are curled by four days after exposure (Fig. 13). Around one week, young leaves begin to develop into a distinct cup shape and stems are elongated (Fig. 14). Later, the cup shape is more extreme in youngest leaves and all leaves show signs of chlorosis (Fig. 15). Also, slightly older leaves are curled around margins and rippled near the veins (Fig. 16). By three weeks, older leaves have become more yellowed and cupped downward, but petioles are only slightly epinastic (Fig. 17). In young leaves, cupping and rippling symptoms remain and new growth has slowed (Fig. 18).

Fig. 13. Moderate epinasty and leaf cupping.

Fig. 14. Young leaves cupping upward.

Fig. 15. Chlorosis and more pronounced cupping of youngest leaves.

Fig. 16. Curling around margins and rippling near veins.

Fig. 17. Advanced chlorosis and slight epinasty with low rates.

Fig. 18. Advanced cupping and rippling.

2,4-D

Symptoms begin to appear more quickly with 2,4-D than with aminocyclopyrachlor or aminopyralid. By four days after exposure, young leaves are folded in half lengthwise and petioles are drooping (Fig. 19). At one week, older leaves have cupped downward and petioles continue to twist and bend (Fig. 20). With high rates, plants exhibit necrotic symptoms by two weeks after exposure (Fig. 21). With low rates, new leaves have become fan shaped and are toothed from reduced lateral expansion (Fig. 22). At three weeks, young leaves are fan-shaped, strappy and have sharp points around the leaf margins (Fig. 23). Also, most leaves are losing color. Stems also may have a zigzag shape and shortened internodes (Fig. 24).

Fig. 21. Early necrosis with high rates.

Fig. 22. New leaves yellowed and fan shaped.

Fig. 19. Severe epinasty and leaf folding.

Fig. 20. Downward folding in older leaves and petioles bending.

Fig. 23. Fan shape and sharp points in young leaves.

Fig. 24. Zigzag shape in stems.

Dicamba

Overall, symptoms develop quickly in plants exposed to dicamba. Petioles are drooping and young leaves are folded by four days after exposure (Fig. 25). At one week, petioles have bent down farther and some of the older leaves are folded (Fig. 26). Yellowing and browning of leaves are apparent by two weeks with high rates (Fig. 27). With low rates, new leaves are cupped upward and puckered and are similar to aminopyralid symptoms (Fig. 28). Around three weeks with high rates, all petioles are epinastic, leaves are yellowed, and new growth has ceased (Fig. 29). With lower rates, older leaves are folded down and new leaves are severely cupped (Fig. 30).

Fig. 27. Necrosis with high rates.

Fig. 28. Cupping and restricted lateral expansion with low rates.

Fig. 25. Drooping petioles and folded young leaves.

Fig. 29. Severe epinasty and chlorosis.

Fig. 26. Advanced epinasty and folded older leaves.

Fig. 30. Folded older leaves and severe cupping in younger leaves.

Conclusions

Although diagnosing herbicide injury in the field is difficult, several steps can be taken to determine possible causes. First, always record the date, time, location and description of observed symptoms. Photographs of injury can help document symptom development, especially since the appearance of plants can change over a short period of time. Try to rule out other causes of plant stress, such as weather, soils, insects or misapplied fertilizer. Off-target movement of herbicides will cause multiple plants over a large area to exhibit similar symptoms. Pay particular attention to leaf margins, new growth and the main stem, as these areas can offer several clues for herbicide damage.

If herbicide injury is suspected, it can be difficult to determine if the herbicide was placed there by tank contamination, drift, carryover in manure, or if it moved well after application due to volatility. Research is important to narrow down the source of contamination. Therefore, determine when symptoms first appeared, what the previous crop was and what herbicides were applied in the previous three seasons, what sprayer was used, whether manure was used, and if there was an application of pesticides soon before the symptoms appeared.

Looking for patterns in fields also can narrow down the source of contamination. If the majority of plants are injured, then a change in the intensity of symptoms in the field may indicate from which direction the herbicide came. Vapor drift can travel several miles, though, making the direction of origin difficult to determine.

Herbicide residue testing is expensive, especially if the herbicide or family of herbicides is unknown. Being able to narrow the list of possible herbicides can significantly lower the cost of residue testing. One important thing to remember is that picloram, aminopyralid and dicamba are often sprayed in combination with 2,4-D. Even though pasture herbicides damage grape in similar ways, the descriptions listed in this publication can help to verify the source of injury.

Picture Credits

Healthy grape vines. Digital image. Accessed 10 May 2013. Available online at

http://www.tennesseewines.com/richland_vineyards.htm

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