UT Extension
W 295-B

Diagnosing Suspected Off-target Herbicide Damage to Tomato

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 tomato production. While these herbicides are valuable tools for weed management, off-target damage to tomato 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 tomato (see UT Extension fact sheet W 295-A). 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 tomato.

Healthy tomatoes in the field.

Procedures

Tomato plants 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 non-cropland 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.

Picloram

Tomato plants exposed to picloram typically exhibit symptoms relatively soon, with leaf petioles drooping within one day after treatment. New leaves are cupped and often curled around the margins. Leaf petioles then become epinastic and start to curl over themselves (Fig. 1). Within three days, the upper stem is twisting and later the main stem often bends horizontally at the base (Fig. 2). Around one week, older leaves show signs of yellowing and all leaves begin to appear withered (Fig. 3). Also, the main stem is swollen and is marked with several bumps and lesions (Fig. 4). As the main stem continues to elongate and bend, petioles become more epinastic, even near the base (Fig. 5). At three weeks, cracks are apparent on main stem and most of the plant is yellowed (Fig. 6).

Fig. 1. Leaves curled and petioles drooping.

Fig. 2. Stem bent horizontally and severe epinasty towards top of plant.

Fig. 3. Yellowed and withered leaves.

Fig. 4. Bumps and lesions on main stem.

Fig. 5. Severe curling over entire plant.

Fig. 6. Cracks on stem, yellowing, early signs of necrosis.

Aminocyclopyrachlor

Around two days after treatment, older petioles are drooping, but not as severe as picloram (Fig. 7). The main stem is bending and new leaves have started to curl around themselves. Young leaflet margins are often curled underneath. At three or four days, leaves have curled so that they are bunched around the main stem (Fig. 8). At one week the main stem is bent over and small brown lesions begin to appear (Fig. 9). Bumps form on the main stem as it continues to elongate and bend and the epinasty is more pronounced in younger leaves (Fig. 10). At two weeks, the stem is cracked and has large brown lesions and leaves are withered and yellow (Fig. 11). At lower rates, new petioles appear stringy and have underdeveloped leaflets at three weeks after exposure (Fig. 12).

Fig. 7. Petioles slightly drooping and upper stem epinastic.

Fig. 8. Stem bending over and leaves curled towards stem.

Fig. 9. Small brown lesions appearing on stem.

Fig. 10. Severe epinasty in stem and young petioles.

Fig. 11. Cracks in stem, leaves yellowed and becoming necrotic.

Fig. 12. Stunted leaflets on stringy petioles at lower rates.

Aminopyralid

Symptoms from exposure to aminopyralid are similar to aminocyclopyrachlor and picloram. Initially, young leaflets are curled around the margins and petioles droop (Fig. 13). Around three days, the petioles continue twisting and the main stem can become bent horizontally (Fig. 14). Later, cracks start to appear in the main stem and petioles continue to twist and bend (Fig. 15). As the main stem elongates, it often has sharp curves (Fig. 16). At two weeks, bumps and brown lesions appear on the stem (Fig. 17). At lower rates, the stem and petioles are long and stringy, with small, curled leaflets (Fig. 18).

Fig. 13. Curling around margins of new leaflets.

Fig. 14. Epinasty in main stem and petioles.

Fig. 15. Cracks appearing in stem and yellowing of leaves.

Fig. 16. Severe epinasty and stunted leaves.

Fig. 17. Bumps and necrotic lesions on stem.

Fig. 18. Curled and stunted leaves on elongated stem at low rates.

2,4-D

Symptoms begin to appear slower with 2,4-D than with picloram or dicamba. By two days after exposure, the upper stem is bent and leaf petioles are drooping (Fig. 19). By four days, all petioles are twisting and new leaves are often cupped upward (Fig. 20). Around one week after exposure, the main stem is often bent over and cracks begin to appear (Fig. 21). Large, red to dark brown patches will appear on the main stem (Fig. 22). Bumps are apparent on the main stem at two weeks after exposure (Fig. 23). At three weeks, new leaves have parallel venation and margins may appear toothed (Fig. 24).

Fig. 19. Upper stem bending.

Fig. 20. Petioles twisting, leaflets cupped.

Fig. 21. Stem bent over, cracks appearing,

Fig. 22. Large reddish brown lesions, elongated stem.

Fig. 23. Bumps on stem.

Fig. 24. Parallel venation in new leaves.

Dicamba

Overall, symptoms develop quickly in plants exposed to dicamba. All petioles are drooping by two days after exposure (Fig. 25). Severe epinasty is apparent in the main stem and petioles by three days (Fig. 26). Around one week after treatment, leaves are yellowed and new growth is limited (Fig. 27). Also, bumps appear along the base of the main stem (Fig. 28). At two weeks, leaves are withered and brown necrotic lesions appear on the stem (Fig. 29). At lower rates, new leaflets can have parallel venation and are stunted (Fig. 30).

Fig. 25. Petioles drooping, petiole twisting.

Fig. 26. Severe epinasty.

Fig. 27. Yellowing, stunted growth.

Fig. 28. Bumps along stem.

Fig. 29. Yellowing and signs of necrosis.

Fig. 30. Stunting and parallel venation with lower rates.

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 movement 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, 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 can also 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 tomato in similar ways, the descriptions listed in this publication can help to verify the source of injury.

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