UT Extension
W 290-B

Herbicide Stewardship
Protecting Crops Environment Technology

Diagnosing Suspected Off-target Herbicide Damage to Tobacco

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Introduction

A major issue in tobacco production is off-target movement of agricultural chemicals, particularly pasture and right-of-way herbicides. While these herbicides are valuable tools for weed management, off-target damage to tobacco often results in expensive fines and/or lawsuits, lost productivity for growers, and bad publicity for the industry. Herbicide damage can lead to poor leaf quality, reduced yield, and possible rejection by buyers.

Following proper stewardship recommendations can reduce the impact of off-target herbicides in tobacco (see UT Extension publication "W 290-A Preventing Off-target Problems in Tobacco Fields"). However, these unfortunate events sometimes occur and diagnosing problems in the field is difficult. Many pasture herbicides mimic the plant hormone auxin, and symptoms can be quite similar. Images and descriptions in this publication are intended to highlight characteristic symptomology of each of these broadleaf herbicides on tobacco.

Diagnosing herbicide injury to tobacco in the field can be difficult.

Procedures

Burley and flue-cured tobacco 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 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:

Hooding — Downward folding and cupping of entire leaves.
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

Plants exposed to picloram typically exhibit symptoms relatively soon, with down-cupping of the newest leaves within one day after treatment. Older leaves tend to droop down at the petiole a few days after treatment (Fig. 1). Another common symptom is a downward cupping of leaf tips and margins, resulting in a “cobra head” appearance (Fig. 2). Additionally, plants typically have swollen stems as well as splits or brown lesions developing a week to 10 days after treatment (Fig. 3). Petioles of new leaves also tend to roll over, having a pigtail shape (Fig. 4). Slightly older leaves will have a twisted shape (Fig. 5). At higher rates, the meristem is aborted and turns white around 10 days after treatment (Fig. 6). Because picloram use rates are higher than aminocyclopyrachlor or aminopyralid, drift damage to tobacco will often appear more rapidly and more pronounced.

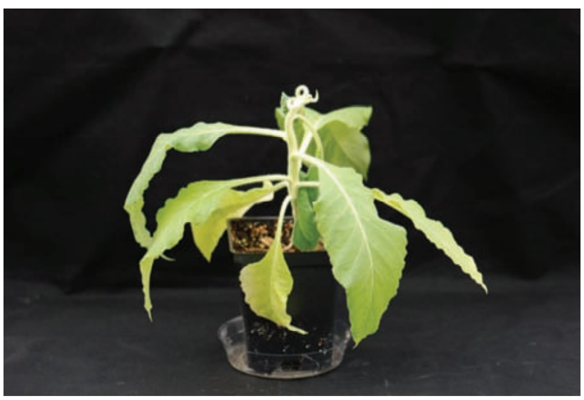

Fig. 1. Leaves drooping at petioles.

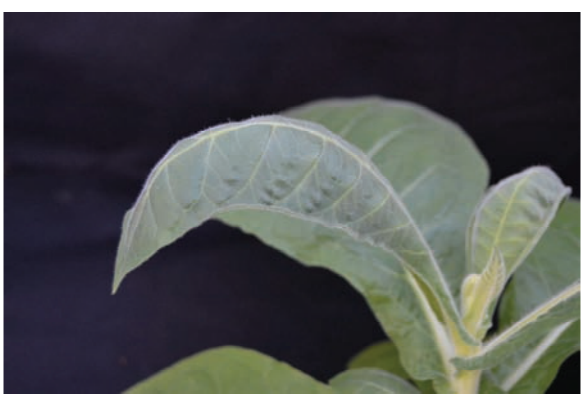

Fig. 2. Hooding.

Fig. 3. Stem swelling and splitting.

Fig. 4. Rolling of petiole and leaf.

Fig. 5. Leaf twisting.

Fig. 6. Abortion of apical meristem.

Aminocyclopyrachlor

Plants treated with aminocyclopyrachlor and aminopyralid display similar symptoms. Within three days after treatment, the youngest leaves curl downward along the leaf margin (Fig. 7). Around 10 days after exposure to aminocyclopyrachlor, those same leaves maintain their hooded shape, but new leaves formed after treatment are often cupped upwards (Figs. 8 and 9). Later, new leaves have reduced lateral expansion and are often spade-shaped (Fig. 10). Interveinal chlorosis is apparent in older leaves three to four weeks after treatment (Fig. 11). Abortion of the apical meristem and development of necrotic symptoms, such as stem splitting and brown lesions, are slower than with picloram. At higher rates, petioles of young leaves can pigtail, although not as common as with picloram. Older leaves often have prominent ridges and wavy leaf margins (Fig. 12).

Fig. 9. Up-cupping of new leaves.

Fig. 10. Spade-shaped new leaves.

Fig. 7. Hooding and curling of young leaves.

Fig. 11. Interveinal chlorosis.

Fig. 8. More severe hooding and curling.

Fig. 12. Ridges in mature leaves.

Aminopyralid

Symptoms develop slightly sooner from aminopyralid than aminocyclopyrachlor, but not as rapidly as with picloram. Initially, youngest leaves are cupped downwards around three days after treatment (Fig. 13). Similar to aminocyclopyrachlor, newly formed leaves curl upwards, while older leaves exhibit downward hooding (Fig. 14). Around three weeks after treatment, the newest leaves are often heart-shaped (Fig. 15). Bud leaves are light green in color and are clustered around the meristem (Fig. 16). Later, younger leaves emerging from the stem appear thick and strap-shaped (Fig. 17). At higher rates, the meristem is aborted and turns white and older leaves begin to yellow around four weeks after treatment (Fig. 18).

Fig. 15. Heart-shaped new leaves.

Fig. 16. Clustering of bud leaves.

Fig. 13. Downward hooding.

Fig. 14. Up-cupping of new leaves.

Fig. 17. Thick and strappy leaves from stem.

Fig. 18. Meristem abortion and leaf chlorosis.

2,4-D

Symptoms begin to appear sooner with 2,4-D than with aminocyclopyrachlor, but not as soon as picloram and dicamba. The first symptoms to appear with 2,4-D-treated plants are hooding of middle-aged leaves and an inversion of new leaves (Fig. 19). The new leaves are often folded up and over, exposing the underside of the leaf. Around t10 days after treatment, plants tend to exhibit more stalk elongation and curvature, resembling a zigzag shape (Fig. 20). Stems are also swollen a few inches above the soil surface. At two weeks after treatment, new leaves may have serrated edges and a thin needlelike projection at the end (Fig. 21). At higher rates, lesions appear on a good portion of the main stem at three weeks after exposure (Fig. 22). Within a month, older leaves are wrinkled (Fig. 23) and younger leaves from the stem resemble a piece of worn leather (Fig. 24).

Fig. 21. Points and serrated edges on new leaves.

Fig. 22. Necrotic lesions on stalk.

Fig. 19. Hooding and inversion.

Fig. 20. Stalk elongation and curvature.

Fig. 23. Wrinkled older leaves, elongated stalk.

Fig. 24. Leathery leaves from stalk.

Dicamba

Overall, symptoms develop quickly in dicamba-treated plants, similar to picloram. Initially, youngest leaves exhibit hooding and curling from the base (Fig. 25). Around 10 days after treatment, newer leaves are severely hooded and curled underneath all the way down the petiole (Fig. 26). Veins are also prominent and raised. Lower rates can cause some stem swelling and elongation. Around two weeks after exposure, stems develop lesions near the base (Fig. 27) and leaves develop interveinal chlorosis beginning from margins (Fig. 28). Drooping of older leaves is very apparent at three weeks after treatment. The apical meristem is aborted, bud leaves are nearly white, and necrotic lesions have formed near the top of the main stem (Figs. 29 and 30).

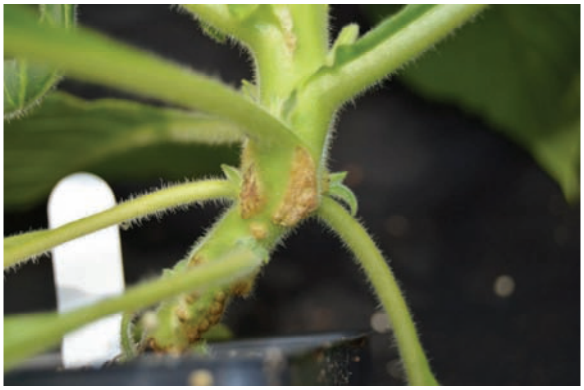

Fig. 27. Lesions near base of stem.

Fig. 28. Interveinal chlorosis.

Fig. 25. Hooding and curling from leaf base.

Fig. 29. Meristem abortion and drooping leaves.

Fig. 26. Severe curling and prominent veins.

Fig. 30. Necrosis near top of stalk.

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, moved well after application due to volatility, or possibly placed there by manure from livestock who fed on treated forage. Research is important to narrow down the source of contamination. Therefore, determine when symptoms first appeared, whether livestock were given access to the field in the offseason, what the previous crop was and what herbicides were applied in the previous three seasons, 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. Scattered patches of herbicide damage may indicate carryover in manure and urine. 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 tobacco in similar ways, the descriptions listed in this publication can help to verify the source of injury.

References

Diagnosing Herbicide Injury on Garden and Landscape Plants. Purdue Plant & Pest Diagnostic Laboratory. Purdue Extension pub. ID-184-W.

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