

Whoa, what happened to those plants? And whose fault is it?

Herbicide Symptomology Refresher

October 29, 2021 Cal-IPC Symposium Video w live Q/A

Herbicides are important tools for vegetation management in some restoration projects



All images shamelessly stolen from the internet....

But, today's talk is not about when everything goes as planned...

Investigating and diagnosing herbicide symptoms



General investigative steps

- Observe and document symptoms
 - What, when, where?
 - Photos are really helpful
 - Overviews, closeups, aerial, time progression
- Look for patterns
- Questions for growers and advisors
- Gather information about the field, area, environment etc.
- Collect samples if needed

Primary routes of exposure

Foliar

- Drift from off-site
- Drift from within the site
- Vapor movement (volatility, "fuming")
- Movement on dust
- Soil/root
 - Good applications vs poor applications
 - Water or soil movement from off site
- Trunk/bark

Not all herbicides work the same way

- Herbicides with "contact" activity
- Translocated herbicides
 - Xylem-mobile
 - Phloem-mobility
- Mode and site of action where does it work?
 - Young tissue (meristems), older tissues, photosynthetic tissues, etc
 - This may provide a clue as to where symptoms occur (or are most obvious)

- Commonly used herbicide MOA groups by habitat restoration practitioners:
 - Amino acid synthesis inhibitors (e.g. glyphosate, imazapyr)
 - Auxin mimics (e.g. triclopyr, clopyralid, aminopyralid)
 - Lipid biosynthesis inhibitors (e.g. sethoxydim)

PRE/POST - Amino acid inhibitors - glyphosate

- #1 drift question in CA (mostly self-inflicted)
 - Foliar uptake. Slow acting (~7-10 d).
 - Symptoms on young tissue first
 - General chlorosis, stunting of new leaves
 - New growth may have shortened internodes causing "witches brooming"
- Glyphosate can persist in woody plants and show up next season if dose sufficient

Glyphosate



Prune suckers

Exposed nursery stock – last season



Drift from orchard strip spray

PRE/POST - Amino acid inhibitors - ALS inhibitors (Habitat, Oust, etc)

- Foliar exposure usually causes a general chlorosis leading to necrosis and leaf drop
 - Newest tissue (meristems) affected first
 - Typically does not "witches broom" like glyphosate
 - Sometimes kill growing points and release lateral buds (branching)

ALS inhibitors on walnut 28 DAT



Londax (bensulfuron)

Regiment (bispyribac-sodium

Suspected Pindar GT soil uptake





ACTIVE INGREDIENTS

Glyphosate, isopropylamine salt [†]	2.0%
Pelargonic acid and related fatty acids	2.0%
OTHER INGREDIENTS	96.0%
TOTAL	00.0%
[†] Contains 0.1 lbs. glyphosate acid equivalent per US	gallon.



ACTIVE INGREDIENTS	
Glyphosate, isopropylamine salt	1.00%
Pelargonic acid and related fatty acids	2.00%
Imazapic, anmonium salt	0.017%
OTHER INCREDIENTS.	96.983%
	7.7.7.7.7.7

POST - Synthetic auxins (2,4-D, Transline, Clarity, MCPA, Garlon, Milestone)

- Hormone mimic. Fast acting (epinasty)
 - More common to see foliar injury, occasionally soil issues (tomato sensitive)
 - Grapes are VERY sensitive



Garlon on watermelon



Garlon on grape cane

POST - Lipid synthesis inhib (Poast, Select, Fusilade, Prism)

Grass-specific herbicides

 Rarely injury on trees or other broadleaf plants (different form of ACCase enzyme)



Poast on corn



PRE - Root inhibitors (Prowl, Surflan, Treflan)

- Root inhibitors (Prowl, Surflan, Treflan)
 - Stops cell division at root tips
 - "never" see translocated symptoms, rarely any foliar activity (very lipophilic)
 - Above ground may have drought, nutrient deficiency symptoms



PRE - Cellulose synthesis inhib (Alion, Trellis, Gallery, Esplanade)

- Few foliar symptoms from root uptake.
 - Mostly see lack of emergence of seedlings.
 - Occasionally stunting due to root system truncation



Photo Miles Deprato

Sublethal herbicide symptom variability

- Symptoms can vary widely among:
 - Species
 - Dose/rate
 - Time since exposure

Patterns of injury (in the plants)

- What plant parts show the symptoms?
 - New leaves or old leaves (or both) affected?
 - What part of the leaves show symptoms?
 - Margins, veins, interveinal area, older/newer tissues, overall?
 - Where did symptoms first appear and how did that progress over time?

Patterns of injury (in the field)

- Aerial views can be really helpful!
- Field edges worse, symptoms fade towards interior
 - Look for possibly drift from adjacent area?
- Injury symptoms correspond to field traffic patterns
 - Look for over treatment, overlaps, incorporation or planting issues, irrigation-related, injury that corresponds to spray tank load size,
- Discrete areas of field affected
 - Are there soil differences, topography issues, etc? Gusty winds or equipment problems? Water issues?
- Whole fields uniformly affected
 - Not as likely to be drift. If herbicide, more likely self-inflicted. But also could be non-herbicide issues (biotic or abiotic)

Consider other plant disorders

- Subtle herbicide symptoms can be confused with a number of non-herbicide problems
 - Biotic issues
 - Pathogens, insects, nematodes, vertebrate pests
 - Many abiotic disorders can mimic herbicide injury
 - Too much or too little water
 - Macro- or micronutrients (tox. or def.)
 - Soil compaction/crusting
 - Root damage from cultivation



Zinc deficiency on plum (photo R. Duncan)

Troubleshooting suspected herbicide injury

- A cell phone photo of a completely dead plant from 10 ft away is pretty hard to diagnose!
- Helpful info:
 - Descriptive symptoms and photos
 - Symptom timeline
 - Herbicides and other practices used at site
 - Surrounding crops and weed management
 - Symptoms on other plants?
 - Is there a pattern in the field? (rarely a "magic bullet")
 - Pull and freeze samples for lab analyses if necessary



Herbicide symptomology training

 Training and photo sets to help diagnose field problems suspected to be related to herbicides



WRIC herbicide demo & diagnostic training:

- Weed Day (annually)
- UCD Weed Science School (odd years)
- Diagnosing Herbicide Symptoms (2016, 2017, 2018)



UC IPM Herbicide Symptoms

• Photo database and search tool



NEW! UC IPM Training Module

Diagnosing Herbicide Injury

Brad Hanson

bhanson@ucdavis.edu http://hanson.ucdavis.edu

UC Davis Weed Research and Information Center

http://wric.ucdavis.edu/ http://ucanr.org/blogs/UCDWeedScience/







DEPARTMENT OF PLANT SCIENCES College of Agricultural and Environmental Sciences