"Alternatives to Glyphosate" Tree-safe Weed Management

John Roncoroni,

UCCE Weed Science Farm Advisor, Napa

UC IPM | University of California Agriculture and Natural Resources | Integrated Pest Management Program

Disclaimer

Use of trade names does not constitute an endorsement

Mention of any herbicide does not constitute a recommendation

Herbicides mentioned may not be registered for this use and may not be currently registered in California

Always Read and Follow all label instructions

FDA Scientist Finds Weed Killer on Many Foods

Air Date: Week of May 18, 2018

0:00 / 9:23

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from you!

P.O. Box 990007
Prudential Station
Boston, MA, USA 02199
Telephone: 1-617-287-4121
E-mail: comments@loe.org

IUSD 2018-19 Pesticide/Herbicide List

GROUNDS

me of Hebacide (Organic)	Active Ingredient(s)	Purpose
Halo (25b exempt)	Eugenol and Clove Oil	Weeds
Preem (25b exempt)	Soybean Oil	Weed
Avenger	d-Limonene	Weed
Fiesta	Iron HEDTA	Broadleaf
Scythe	Pelargonic Acid	Weed
Suppress Herbacide	Caprylic Acid	Weed
Weed Pharm	Acetic Acid	Wee
Name of Pesticide (Organic)	**Active Ingredient(s)**	**Purp**
Why Spray (25b exempt)	Lemongrass and Clove Leaf Oil	Wasps a
ProVerde (25b exempt)	Geranoil	
Eco Via EC (25b exempt)	Thym Oil, 2--Phenet	

CITY OF IRVINE 1971

Public Works Department
Maintenance Operations
Policies and Procedures

INTEGRATED PEST MANAGEMENT PROGRAM

PURPOSE: To establish criteria for an Integrated Pest Management (IPM) Program.

POLICY: The City of Irvine will focus on long-term prevention or suppression of pest problems with minimum impact on human health, the environment, and nontarget organisms with the limited use of pesticides in accordance with direction provided by the City Council (2/23/16) for Parks, Fields and Playgrounds; City-wide Pest Management Guiding Principles, and an annual update:

Parks, Fields and Playgrounds

When pesticides are needed, use the following prioritized approach: (1) organic pesticides; (2) Water Quality Act Allowed Pesticides; and (3) EPA Level III "caution" labeled pesticides only when deemed necessary to protect public health and economic impact by a licensed pest control adviser.

Management Guiding Principles

15 Health Problems Linked to Monsanto's Roundup

By Guest Contributor | Jan. 23, 2015 11:44AM EST

24 SHARES

WeedKillerCrisis
Organization Tracking The Unfolding Legal & Health Crisis Surrounding Exposure to Weed Killer Products

Herbicides | Weed Killer | Glyphosate | Health Risks | Food Supply | Lawsuits & Claims | ALERT: Breaking News

Home / Lawsuits / Roundup Lymphoma Cancer Lawsuits Settlements & Payouts

Roundup Lymphoma Cancer Lawsuits Settlements & Payouts

By Michael Bennett - November 4, 2018

Views: 5273

More than 11,000 lawsuits are now pending against Bayer AG and Monsanto over their controversial weed-killer products, according to the German company's own 2018 financial reports.

Those thousands of cases come on the heels of a blockbuster jury verdict last fall in California and were disclosed just after a second California trial got underway in late February

enterprise
YOLO COUNTY NEWS

Local News

City considering a ban on use of weed killers

By Felicia Alvarez

A Davis ban on neonicotinoids and glyphosate — the active ingredients in weed killers like Roundup — could be on the horizon, after three city commissions and local residents are calling for a re-evaluation of the
nd pest management

Prop 65

STATE OF CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 CHEMICALS KNOWN TO THE STATE TO CAUSE CANCER OR REPRODUCTIVE TOXICITY July 7, 2017

The Safe Drinking Water and Toxic Enforcement Act of 1986 requires that the Governor revise and republish at least once per year the list of chemicals known to the State to cause cancer or reproductive toxicity. The identification number indicated in the following list is the Chemical Abstracts Service (CAS) Registry Number. No CAS number is given when several substances are presented as a single listing. The date refers to the initial appearance of the chemical on the list. For easy reference, chemicals which are shown underlined are newly added. Chemicals or endpoints shown in strikeout were placed on the Proposition 65 list on the date noted, and have subsequently been removed.

STATE OF CALIFORNIA ENVIRONMENTAL
PROTECTION AGENCY
OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT
SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986

CHEMICALS KNOWN TO THE STATE TO CAUSE CANCER OR REPRODUCTIVE TOXICITY
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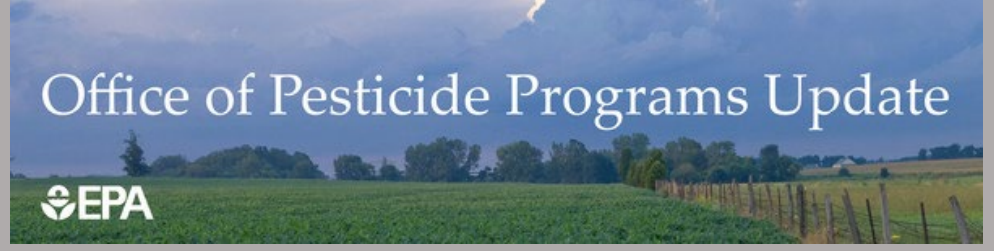
Chemical	Type of Toxicity	CAS No.	Date Listed
A-alpha-C (2-Amino-9H-pyrido [2,3-b]indole)	cancer	26148-68-5	January 1, 1990
Abiraterone acetate	developmental, female, male	154229-18-2	April 8, 2016
Acetaldehyde	cancer	75-07-0	April 1, 1988
Acetamide	cancer	60-35-5	January 1, 1990
Acetazolamide	developmental	59-66-5	August 20, 1999
Acetochlor	cancer	34256-82-1	January 1, 1989
Acetohydroxamic acid	developmental	546-88-3	April 1, 1990
2-Acetylaminofluorene	cancer	53-96-3	July 1, 1987
Acifluorfen sodium	cancer	62476-59-9	January 1, 1990
Acrylamide	cancer	79-06-1	January 1, 1990
Acrylamide	developmental, male	79-06-1	February 25, 2011
Acrylonitrile	cancer	107-13-1	July 1, 1987
Actinomycin D	cancer	50-76-0	October 1, 1989
	developmental		October 1, 1992
AF-2;[2-(2-furyl)-3-(5-nitro-2-furyl)] acrylamide	cancer	3688-53-7	July 1, 1987
Aflatoxins	cancer	---	January 1, 1988
Alachlor	cancer	15972-60-8	January 1, 1989
Alcoholic beverages, when associated with alcohol abuse	cancer	---	July 1, 1988
Aldrin	cancer	309-00-2	July 1, 1988
All-trans retinoic acid	developmental	302-79-4	January 1, 1989
~~Allyl chloride~~ Delisted October 29, 1999	~~cancer~~	~~107-05-1~~	~~January 1, 1990~~
Aloe Vera, non-decolorized whole leaf extract	cancer	---	December 4, 2015
Alprazolam	developmental	28981-97-7	July 1, 1990
Altretamine	developmental, male	645-05-6	August 20, 1999
Amantadine hydrochloride	developmental	665-66-7	February 27, 2001
Amikacin sulfate	developmental	39831-55-5	July 1, 1990
2-Aminoanthraquinone	cancer	117-79-3	October 1, 1989
p-Aminoazobenzene	cancer	60-09-3	January 1, 1990
o-Aminoazotoluene	cancer	97-56-3	July 1, 1987
4-Aminobiphenyl (4-amino-	cancer	92-67-1	February 27, 1987

CHEMICAL	TYPE OF TOXICITY	CAS No.	Date Listed
Wood dust	cancer		December 18, 2009
Bracken fern	cancer		January 1, 1990
Diesel engine exhaust	cancer		October 1, 1990
Alcohol beverages (when associated with alcohol abuse)	cancer		July 1, 1988
Leather dust	cancer		April 29, 2011
Orange oil SS	cancer	2646-17-5	April 1, 1988
Glyphosate	cancer	1071-83-6	July 7, 2017
Salted fish, Chinese-style	cancer		April 29, 2011
~~Saccharin~~	cancer	81-07-2	October 1, 1989 Delisted April 6, 2001



EPA Finalizes Glyphosate Mitigation

EPA has concluded its regulatory review of glyphosate—the most widely used herbicide in the United States. After a thorough review of the best available science, as required under the Federal Insecticide, Fungicide, and Rodenticide Act, EPA has concluded that there are no risks of concern to human health when glyphosate is used according to the label and that it is not a carcinogen. These findings on human health risk are consistent with the conclusions of science reviews by many other countries and other federal agencies, including the U.S. Department of Agriculture, the Canadian Pest Management Regulatory Agency, the Australian Pesticide and Veterinary Medicines Authority, the European Food Safety Authority, and the German Federal Institute for Occupational Safety and Health. The agency is requiring additional mitigation measures to help farmers target pesticide sprays to the intended pest and reduce the problem of increasing glyphosate resistance in weeds.

Glyphosate has been studied for decades and the agency reviewed thousands of studies since its registration. Glyphosate is used on more than 100 food crops, including glyphosate-resistant corn, soybean, cotton, canola, and sugar beet. It is the leading herbicide for the management of invasive and noxious weeds and is used to manage pastures, rangeland, rights of ways, forests, public land, and residential areas. In addition, glyphosate has low residual soil toxicity and helps retain no-till and low-till farming operations.

More information on glyphosate and EPA's interim decision is available at www.epa.gov/ingredients-used-pesticide-products/glyphosate

Background

EPA uses interim decisions to finalize enforceable mitigation measures while conducting other longer-term assessments, such as an endangered species assessment. EPA will next complete a draft biological evaluation for glyphosate, which is anticipated for public comment in Fall 2020.

What do we do if Glyphosate is Banned?

FDA Scientist Finds Weed Killer on Many Foods

Air Date: Week of May 18, 2018

Living on Earth wants to he
from you!

enterprise

YOLO COUNTY NEWS

IUSD 20

me of Hebacide (Organic)	A
Halo (25b exempt)	
Preem (25b exempt)	
Avenger	
Fiesta	
Scythe	
Suppress Herbacide	
Weed Pharm	
Name of Pesticide (Organic)	
Why Spray (25b exempt)	
ProVerde (25b exempt)	
Eco Via EC (25b exempt)	

n on use

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Management Guiding Principles

Weed Killer Crisis

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Herbicides | Weed Killer | Glyphosate | Health Risks | Food Supply | Lawsuits & Claims | ALERT: Breaking News

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Views: 5273

Used Roundup? Have Cancer?

Jury Returns $2 Billion Verdict Against Monsanto for Couple with Cancer -- File Your Lawsuit Claim Now!

The Hammer!

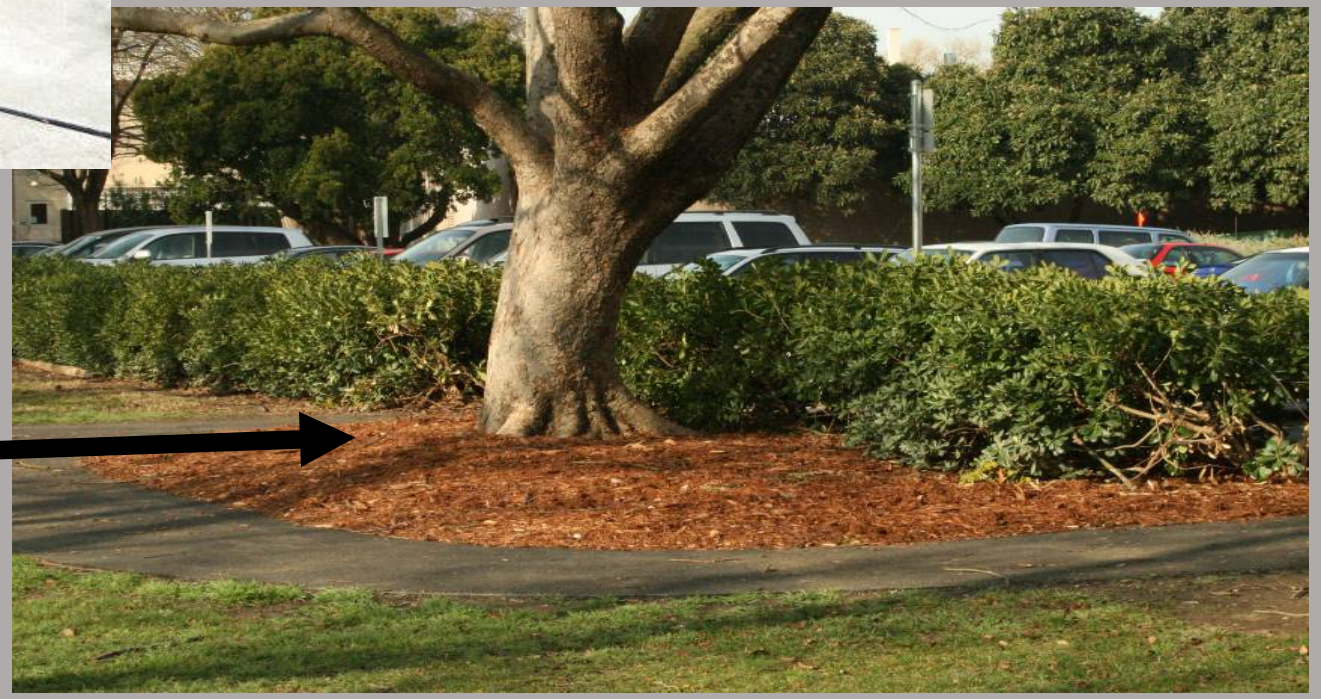
Implementing Integrated Pest Management for Weeds*

- 1. Pest identification
- 2. Monitoring and assessing pest numbers and damage
- 3. Guidelines for when management action is needed
- 4. Preventing pest problems
- 5. Using a combination of biological, cultural, physical/mechanical and chemical management tools.

* From UCIPM

1. Use No Herbicides

‘No-Mow’ Fescue



Mulching


DEWALT


UC Statewide IPM Project
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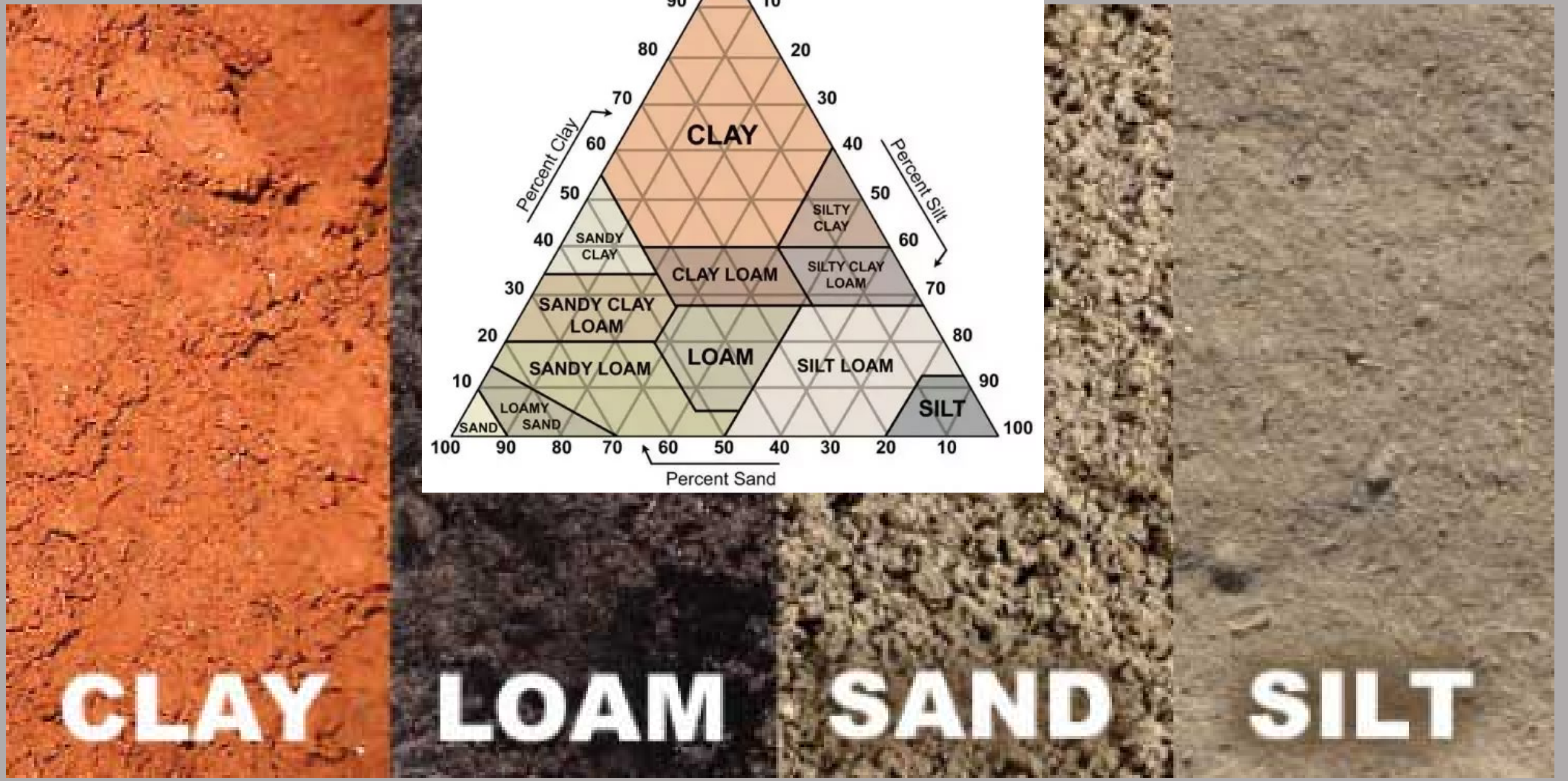
1. Use No Herbicides

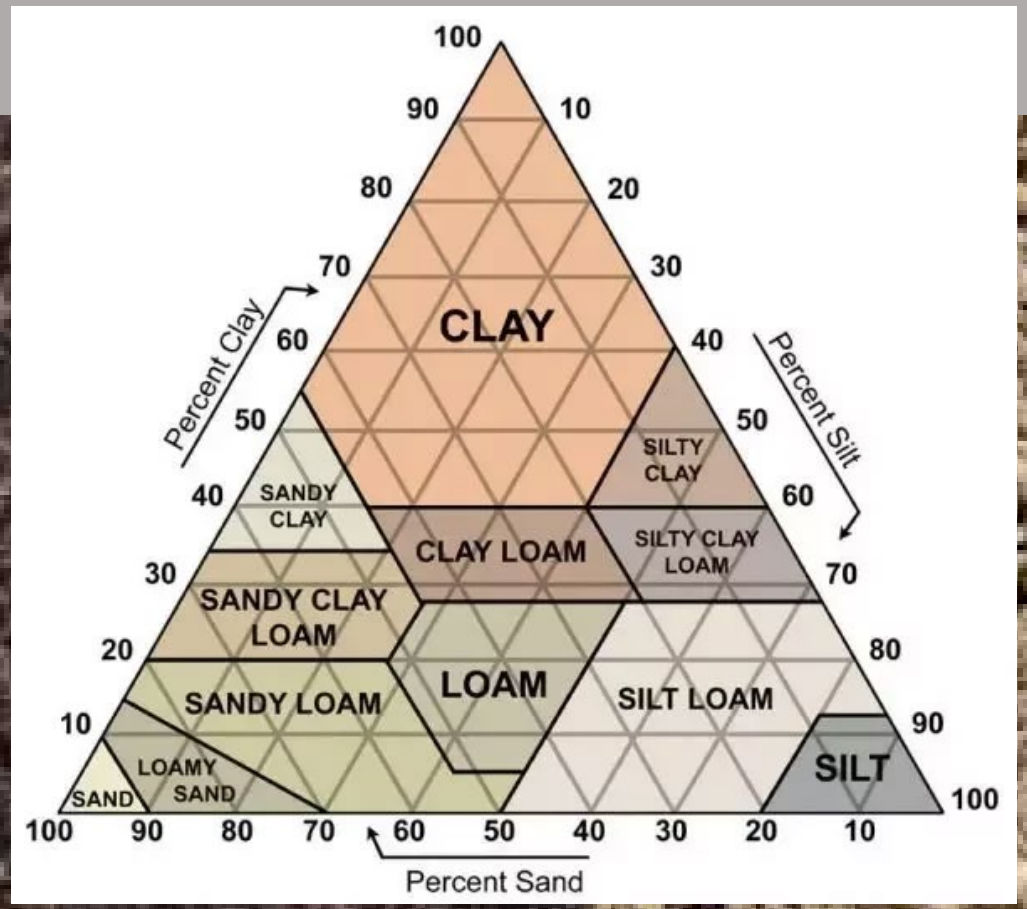
2. Use Preemergence Herbicides

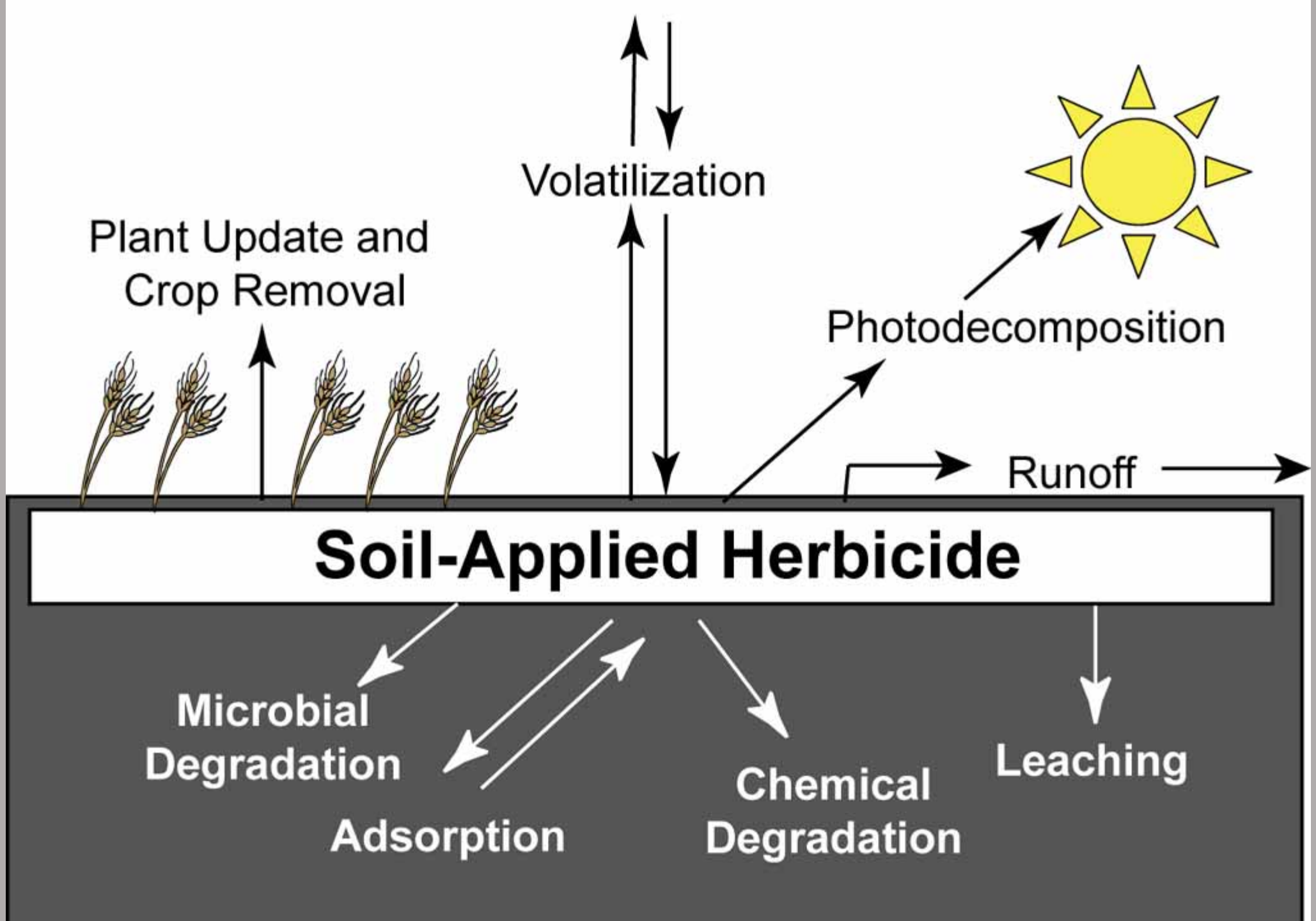
Soil Characteristics

Soil Composition- high clay or OM content will tie up herbicides-decreased initial uptake- may cause problems later.

- Soil Composition- high sand content-leaching potential
- Soil pH- Some herbicides- triazines- are affected by pH- less adsorbed to soil-more in soil solution


CLAY
LOAM
SAND
SILT

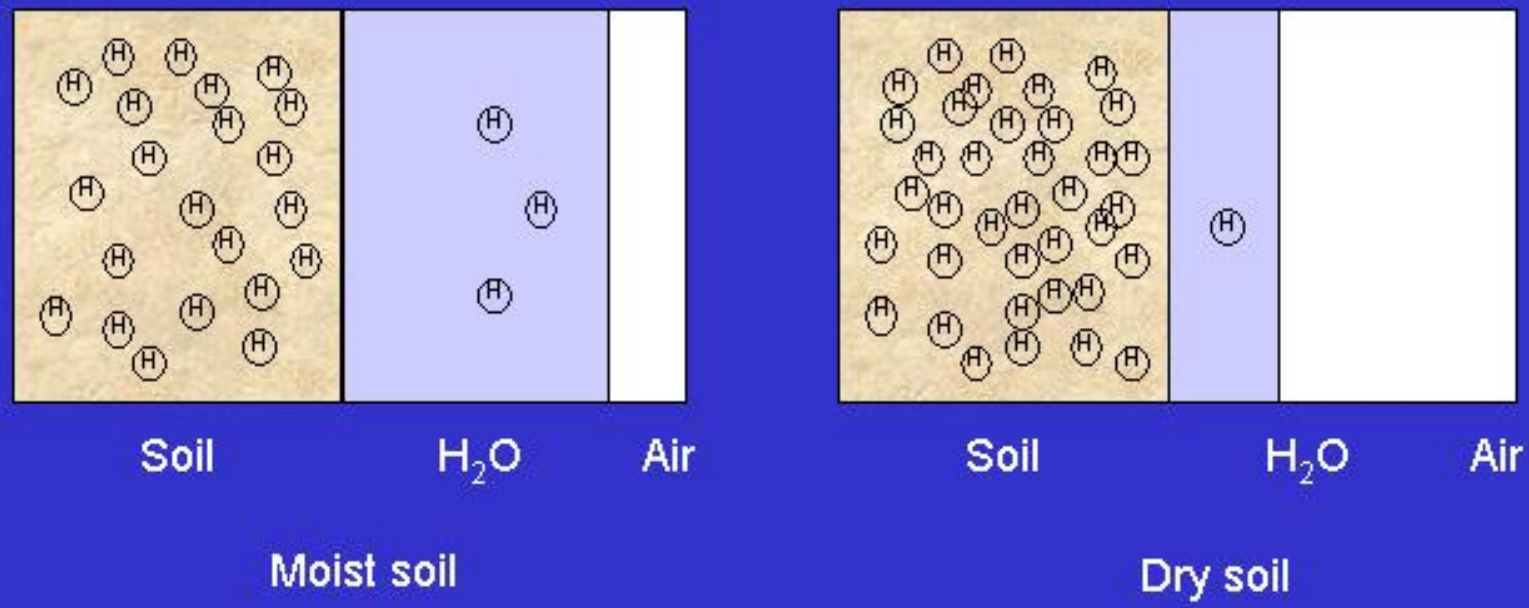

100
90
80
70
60
50
40
30
20
10
Percent Clay
Percent Silt
Percent Sand
CLAY
SILTY CLAY
SANDY CLAY
CLAY LOAM
SILTY CLAY LOAM
SANDY CLAY LOAM
LOAM
SILT LOAM
SANDY LOAM
SILT
LOAMY SAND
SAND


Volatilization
Plant Update and
Crop Removal
Photodecomposition
Runoff
Soil-Applied Herbicide
Microbial
Degradation
Adsorption
Chemical
Degradation
Leaching

Herbicide Characteristics

Water solubility. Refers to how readily the herbicide dissolves in water. This determines the extent to which an herbicide is in the solution phase (plant available) or the solid phase. Water solubility plays a major role in determining the fate of herbicides in water, soil and air.

Figure 2. Soil moisture effect on herbicide availability.

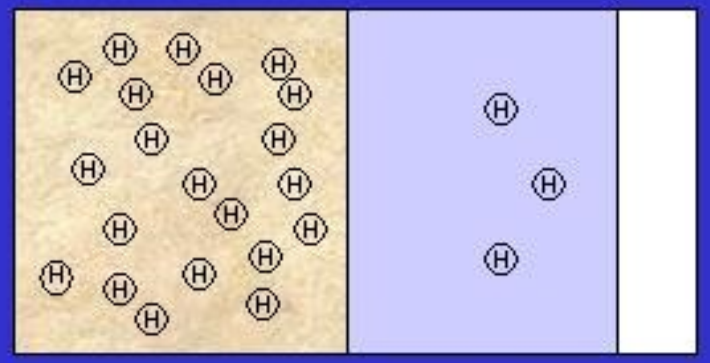


Herbicide Characteristics

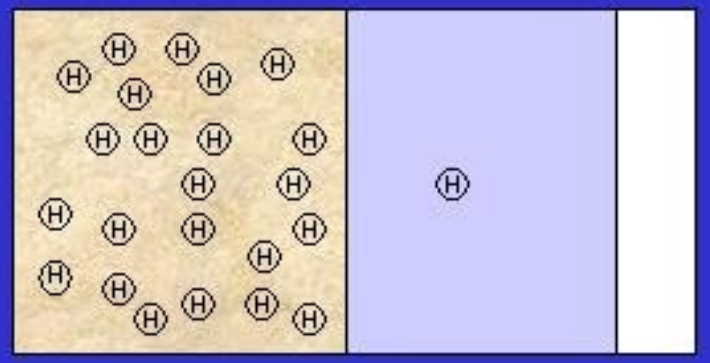
Soil retention (Adsorption) Soil retention is an index of the binding capacity of the herbicide molecule to soil organic matter and clay. In general, herbicides with high soil retention are strongly bound to soil and are not subject to leaching.

Figure 1. Influence of soil adsorption on herbicide availability.

K_{oc} = Amount on soil / Amount in water



K_{oc} = 7
21 molecules bound / 3 free

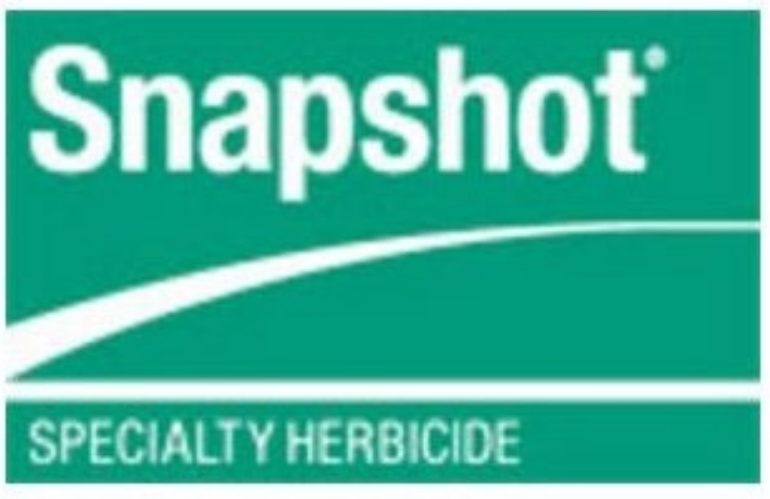


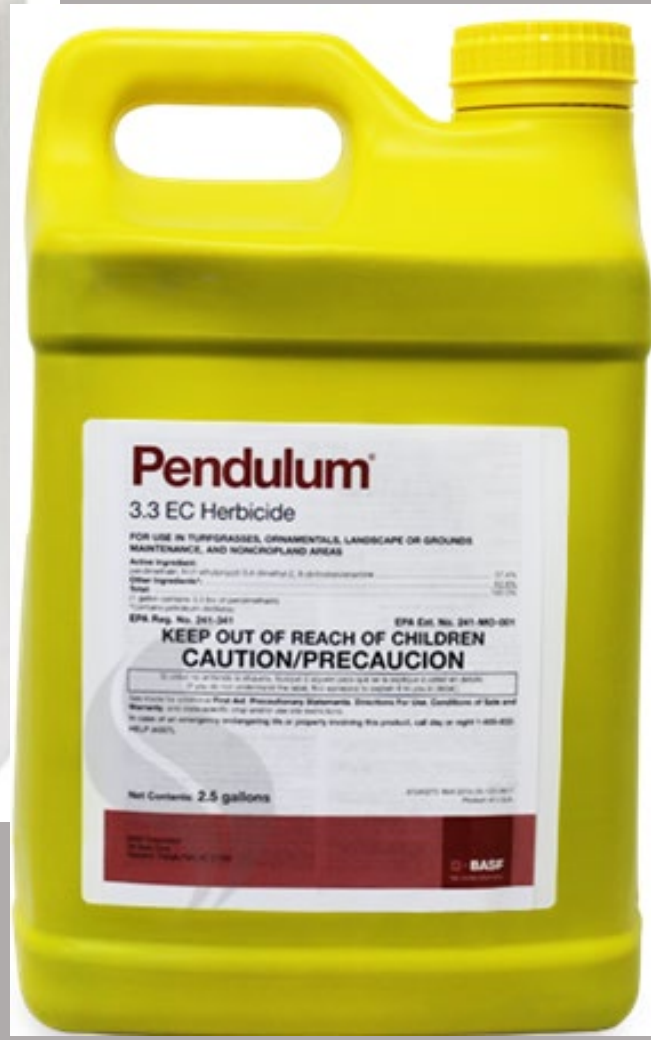
K_{oc} = 24
24 molecules bound / 1 free


BAYER
Spect(i)cle
G
50 Pounds


PULL APART TO OPEN • PRESS ZIPPER TO RESEAL
Barricade
65WG
Herbicide
KEEP OUT OF REACH OF CHILDREN
CAUTION
10 pounds
syngenta


Dow AgroSciences
Gallery
75 Dry Flowable
Herbicide
Keep Out of Reach of Children
CAUTION
Agricultural Use Requirements


Snapshot
SPECIALTY HERBICIDE


Pendulum
3.3 EC Herbicide
FOR USE IN TURFGRASSES, ORNAMENTALS, LANDSCAPE OR GROUNDS MAINTENANCE, AND NONCROPLAND AREAS
KEEP OUT OF REACH OF CHILDREN
CAUTION/PRECAUCION
Net Contents 2.5 gallons
BASF

Preemergence Herbicides

- **Trifluralin**
- **Oryzalin**
- **Pendimethalin**
- **Prodiamine**
- **Dithyopyr**
- **Pronamide**

- **Oxadiazon**
- **Flumioxazin**
- **Oxyfluorfen**
- **Sulfentrazone**

- **Isoxaben**
- **Indazaflam**

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Mitosis Inhibitors

Trifluralin

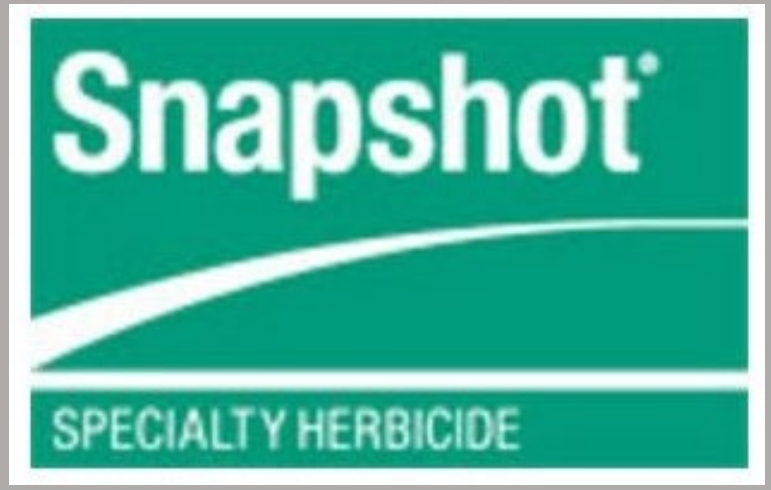
Oryzalin

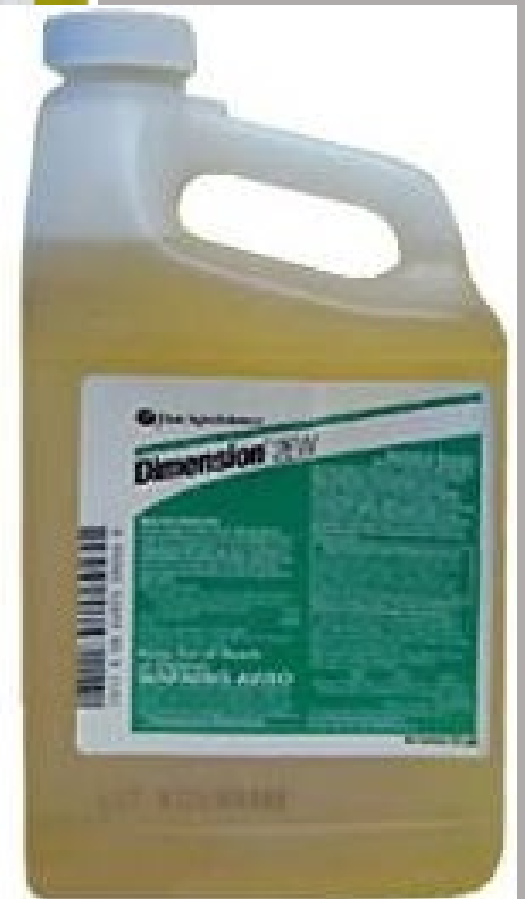
Pendimethalin

Prodiamine

Dithyopyr

Pronamide





Mitosis Inhibitors

- Herbicides need to be applied before or soon after germination.
- Cell division is stopped- roots may develop with no root hairs
- If plants germinate they will die of desiccation


UC Statewide IPM Project
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Preemergence Herbicides

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- **Oxadiazon**
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- **Sulfentrazone**

- Isoxaben
- Indazaflam

PPO Inhibitors

- Oxadiazon
- Flumioxazin
- Oxyfluorfen
- Sulfentrazone

PPO Inhibitors

- Oxadiazon
- Flumioxazin
- Oxyfluorfen
- Sulfentrazone
- Carfentrazone*

PPO Inhibitors

- PPO inhibitors inhibit an enzyme of chlorophyll and eventually cause free radicles that will cause leaky membranes which allows cells and cell organelles to dry out and disintegrate rapidly
- Do Not incorporate herbicides into soil.
- These herbicides have both pre and post emergence activity
- They work like a ‘sheet of plastic’- disturb as little as possible

Preemergence Herbicides

- Trifluralin
- Oryzalin
- Pendimethalin
- Prodiamine
- Dithyopyr
- Pronamide

- Oxadiazon
- Flumioxazin
- Oxyfluorfen

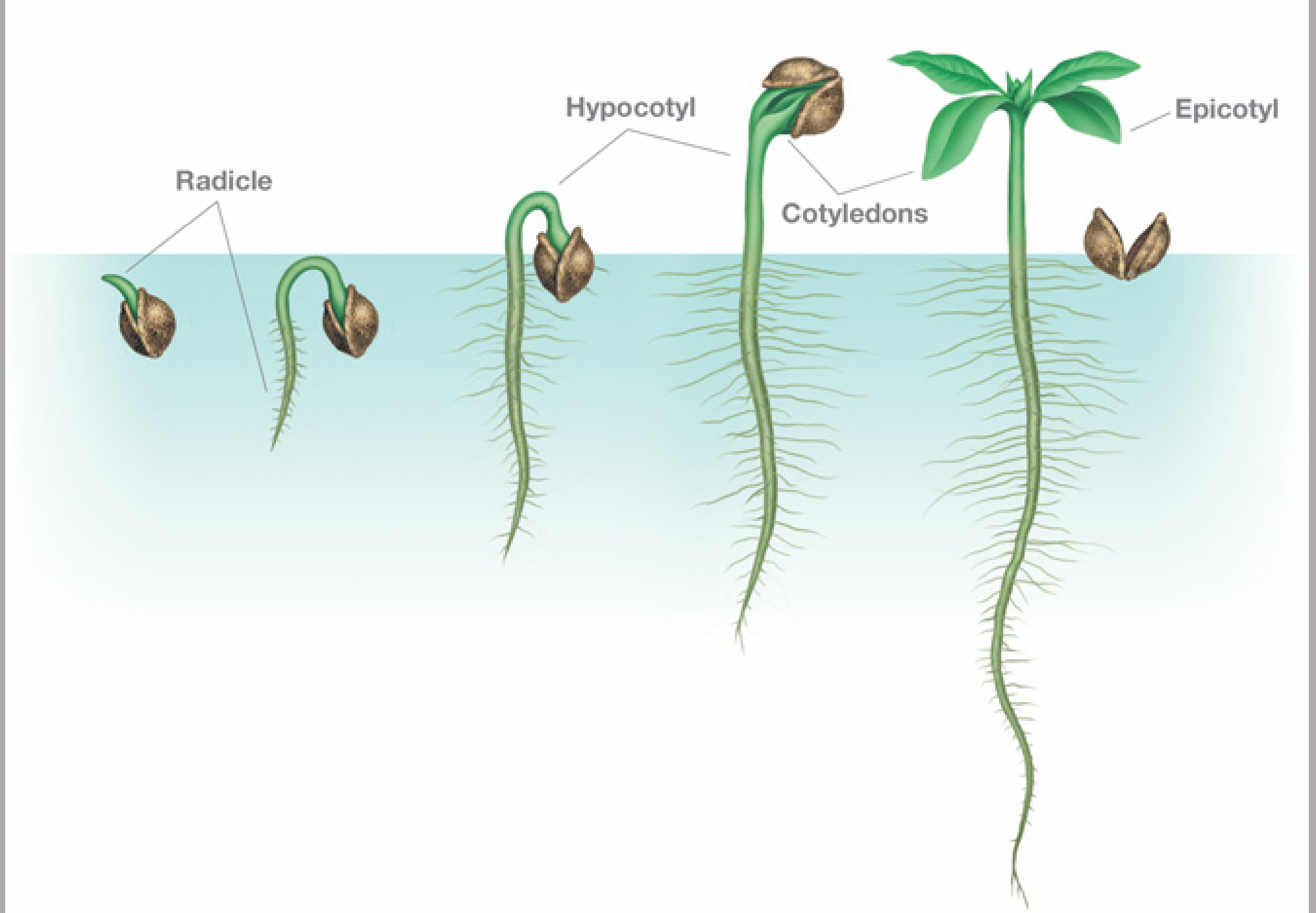
- **Isoxaben**
- **Indazaflam**

CBI herbicides

- **Isoxaben**
- **Indazaflam**

CBI Herbicides

- **Preemergence only-**
- **Gallery is broadleaf only**
- **Very long lasting**
- **Gallery very safe on young plants**
- **Specticle must be kept away from young tree roots**


Radicle
Hypocotyl
Cotyledons
Epicotyl

CBI Herbicides

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- **Very long lasting**
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- **Specticle must be kept away from young tree roots**

1. Use No Herbicides

2. Use Preemergence Herbicides

3. Use Other Conventional Postemergence Herbicides

Postemergence

- Glufosinate

- Fluazifop-p-butyl
- Sethoxydim
- Clethodim

- Flazasulfuron
- Halosulfuron

- Dicamba
- 2,4-D

- Triclopyr
- Clopyralid

Postemergence

- **Glufosinate**

- Fluazifop-p-butyl
- Sethoxydim
- Clethodim

- Flazasulfuron
- Halosulfuron

- Dicamba
- 2,4-D
- Triclopyr
- Clopyralid


BAYER
Finale®
HERBICIDE
KEEP OUT OF REACH OF CHILDREN
WARNING – AVISO
Net Contents
2.5 Gallons

WHERE TO APPLY

Trimming and Edging

FINALE Herbicide may be used for trimming and edging landscape areas such as: around individual trees and shrubs, landscape beds, foundations, fences, driveways, paths, and parking areas; also on golf courses along cart paths, around sign and light posts, and around sand traps.

For control of weeds emerging from seed, the use of FINALE Herbicide in a tank mix with preemergence herbicides is recommended. If spraying in areas adjacent to desirable plants, use a shield made of cardboard, plywood, or sheet metal while spraying to help prevent spray from contacting foliage of desirable plants. Refer to the How to Apply section of this labeling for appropriate application rates to control specific weeds.

Recreational and Public Areas

When applied as a spot or directed spray application, this product controls annual and perennial weeds listed on this label in areas such as: airports, commercial plants, storage and lumber yards, educational facilities, fence lines, ditch banks, dry ditches, schools, parking lots, tank farms, pumping stations, parks, other public areas and nonfood crop areas.

This product is nonselective and will injure or kill all green vegetation contacted by the spray. Avoid all contact with foliage or green tissue of desirable vegetation. Avoid direct spray contact with green, thin, or uncalloused bark of desirable vegetation or plant injury may result. If desirable vegetation is contacted, rinse the sprayed portion with water immediately.

Postemergence

- Glufosinate

- **Fluazifop-p-butyl**
- **Sethoxydim**
- **Clethodim**

- Flazasulfuron
- Halosulfuron

- Dicamba
- 2,4-D

- Triclopyr
- Clopyralid

Grass Herbicides

- Fluazifop-p-butyl
- Sethoxydim
- Clethodim

Grass Herbicides

- Only Control grass weeds
- May not control target grass weeds
- Always use Surfactant

Postemergence

- Glufosinate

- Fluazifop-p-butyl
- Sethoxydim
- Clethodim

- **Flazasulfuron**
- **Halosulfuron**

- Dicamba
- 2,4-D

- Triclopyr
- Clopyralid

ALS Inhibitors

- Flazasulfuron
- Halosulfuron

ALS Inhibitors

- Plant growth stops almost immediately-
- Takes time for plants to actually show symptoms and die-
- Nutsedge and other broadleaf weed control
- Applied at very low rates

- Low to moderate leaching

Postemergence

- Glufosinate

- Fluazifop-p-butyl
- Sethoxydim
- Clethodim

- Flazasulfuron
- Halosulfuron

- Dicamba
- 2,4-D
- Triclopyr
- Clopyralid

Synthetic Auxins

- **Dicamba**
- **2,4-D**
- **Triclopyr**
- **Clopyralid**

Synthetic Auxins

- **Broadleaf weed control**
- **Postemergence control- with some preemergence control**
- **Older chemistry**
- **Triclopyr has activity on Bermudagrass**

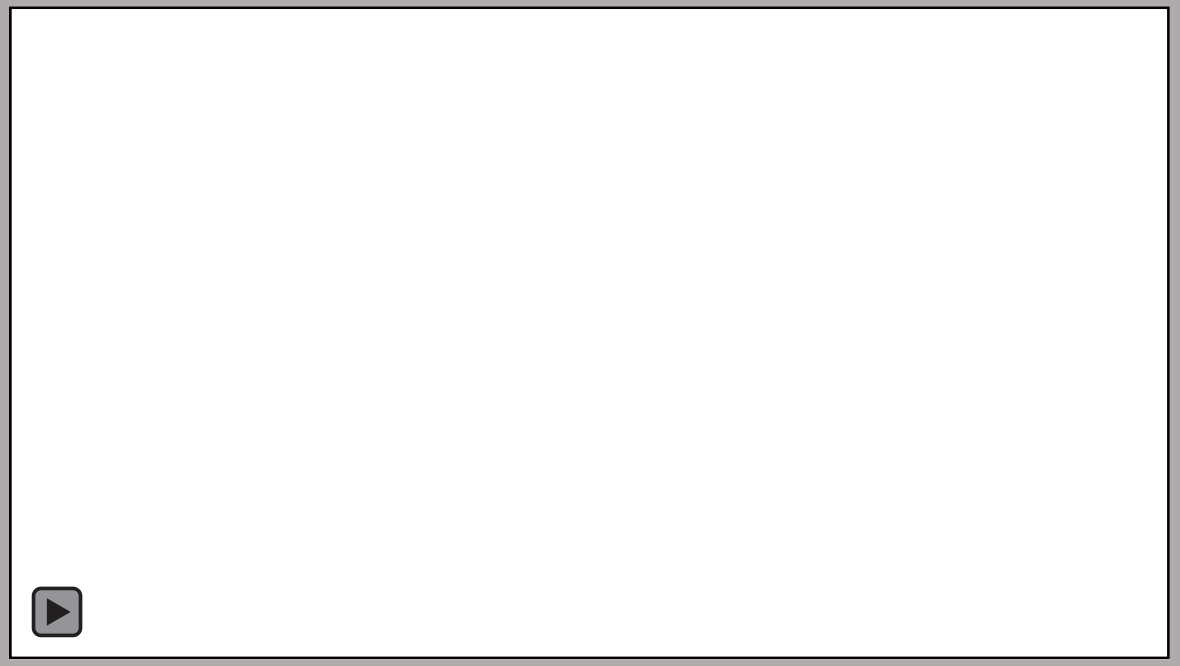

Monterey
Turflon® Ester
Specialty Herbicide
Controls Annual & Perennial Broadleaf Weeds & Bermudagrass in Ornamental Turf
KEEP OUT OF REACH OF CHILDREN
CAUTION

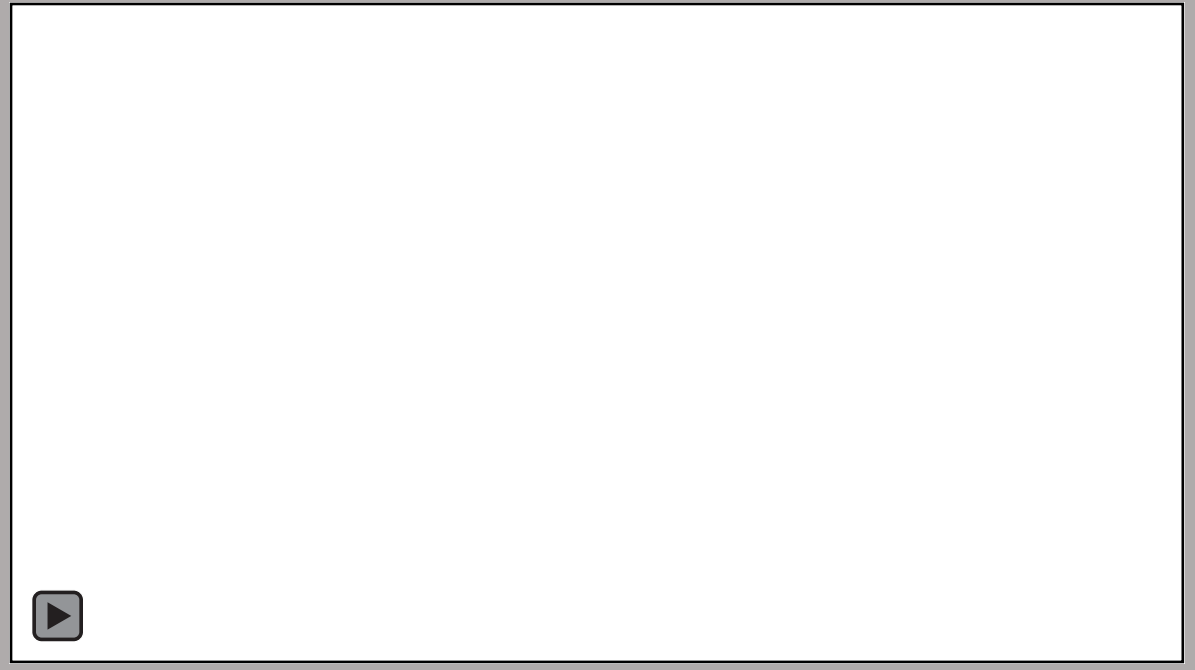

ORTHO
BRUSH-B-GON
POISON IVY KILLER
KILLS BRUSH, WOODY WEEDS & VINES
Concentrate
Also Kills Poison Oak, Blackberries, Kudzu & Stumps

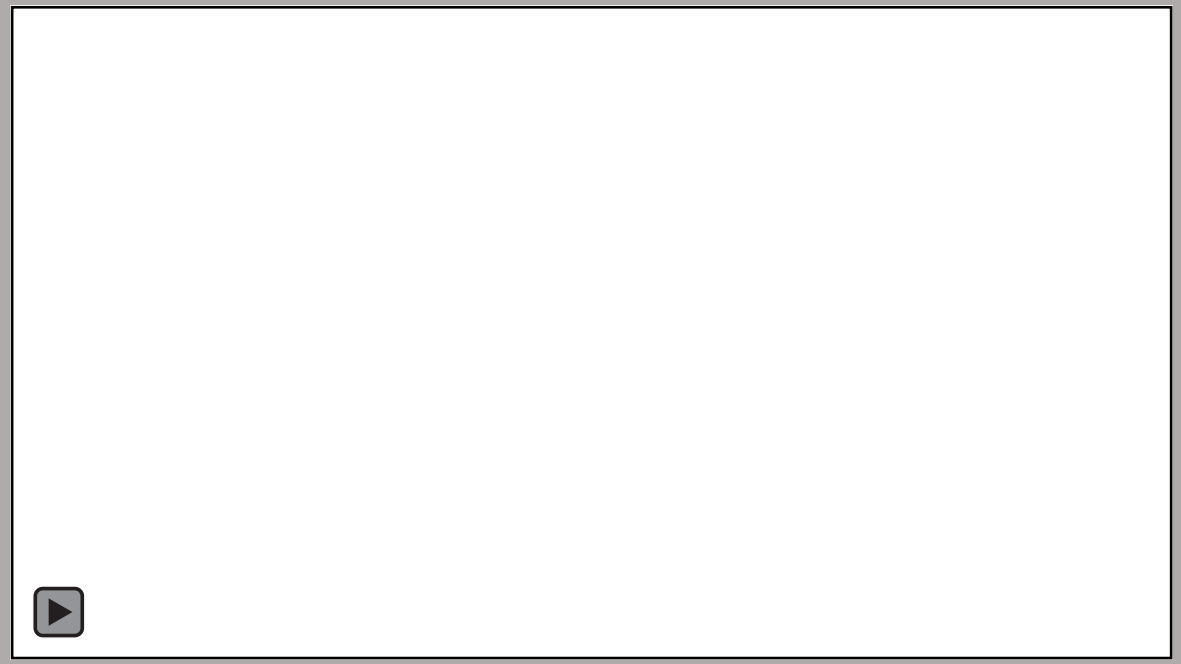
Application

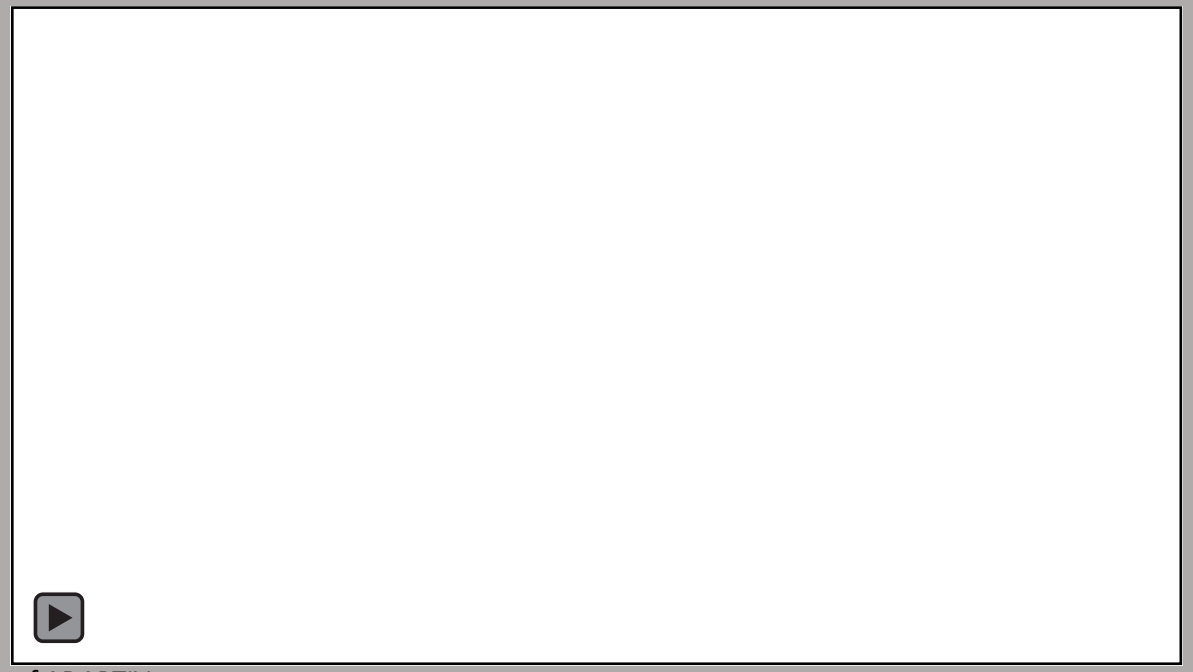
- Glyphosate was effective under many circumstances
- Inaccurate rate calculations of preemergence herbicides can lead to serious non-target plant injury

- Proper nozzle selection may become more important.









1. Use No Herbicides
2. Use Preemergence Herbicides
3. Use Other Conventional Postemergence Herbicides
4. Use ‘Alternative’ or Organic Herbicides

California Code of Regulations (CCR) section 6147

California Code of Regulations (CCR) section 6147 (enclosed) establishes an exemption from the requirements of Food and Agricultural Code (FAC) Division 7 for pesticide products containing certain substances or classes of substances. DPR has determined that the exemption of the pesticides covered by this regulation will not pose unreasonable risks to public health or the environment. Pesticide products that do not meet the criteria of CCR section 6147 will continue to be regulated by DPR.

Background

With certain limited exceptions, existing law requires every manufacturer of, importer of, or dealer in any pesticide to obtain a certificate of registration from DPR before offering the pesticide for sale in the State of California.

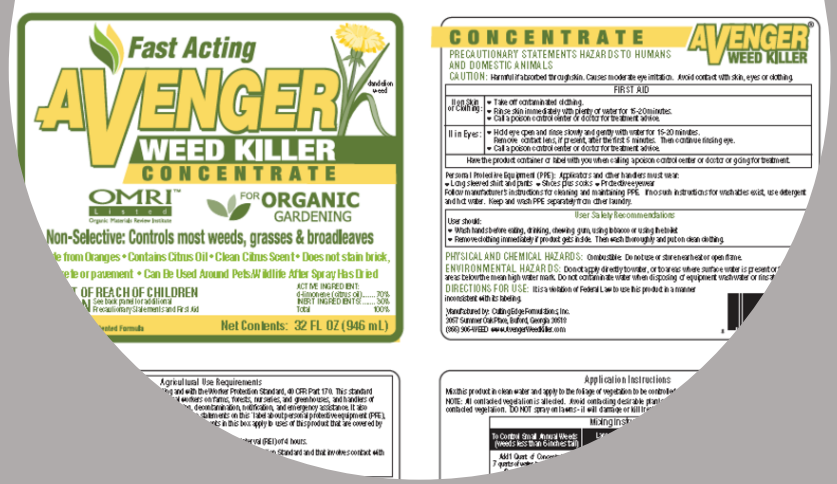
FAC section 12753 defines a "pesticide" as (1) any spray adjuvant, and (2) any substance, or mixture of substances that is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, as defined in FAC section 12754.5, that may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment.

“Why do we need to control weeds?”

“How do I control weeds naturally or organically?”

- Residential audiences/homeowners
- School and child care staff
- Municipalities, parks and recreation
- Landscape professionals
- Universities and colleges

Types of Organic and Alternative Herbicides



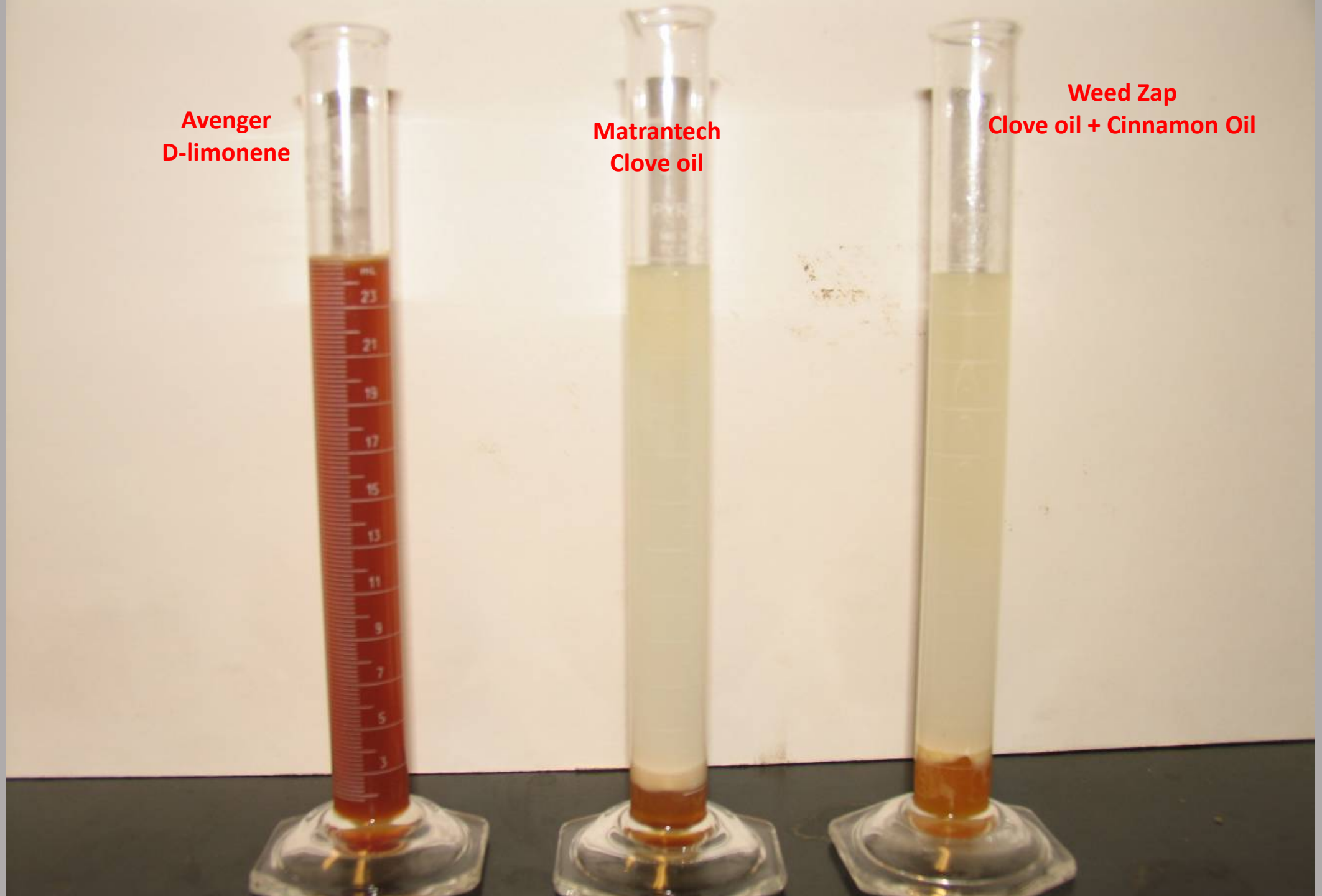
Plants oils, soaps, derived from natural sources. All organic?

Active Ingredients Which May Be in Minimum Risk Pesticide Products Exempted under section 25(b) of FIFRA

1. Castor Oil (U.S.P. or equivalent) 2. Cedar Oil
3. Cinnamon* and **Cinnamon Oil** * 4. **Citric Acid***
5. Citronella and Citronella Oil 6. Cloves* and **Clove Oil***
7. **Corn Gluten Meal*** 8. Corn Oil* 9. **Cottonseed Oil***
10. Dried Blood 11. **Eugenol** 12. Garlic* and Garlic Oil*
13. **Gerianiol** 14. Geranium Oil 15. Lamyl Sulfate
16. **Lemongrass Oil*** 17. Linseed Oil 18. Malic Acid*
19. Mint* and Mint Oil* 20. Peppermint* and Peppermint Oil*
21. 2-Phenethyl Propionate (2-phenylethyl propionate)
22. Potassium Sorbate 23. Putrescent Whole Egg Solids
24. Rosemary * and Rosemary Oil* 25. Sesame* (incl ground sesame plant stalks) and sesame oil* 26. Sodium Chloride (common salt)* 27. Sodium Lauryl Sulfate 28. Soybean Oil
29. Thyme* and Thyme Oil* 30. White Pepper*31. Zinc Metal Strips (consisting solely of zinc metal and impurities)

Herbicide	Trade name(s)	Signal word	OMRI certified
ammonium nonanoate (=pelargonic acid)	Axxe	Warning	Yes, with restrictions
ammonium soaps of fatty acids	FinalSan	Warning	Yes
caprylic and capric acid	Suppress	Warning	Yes
d-limonene	AvengerAG	Caution	Yes
glufosinate	Finale	Warning	No
pelargonic acid	Scythe	Warning	No
plant oils (clove, cinnamon, citric, eugenol, others)	Weed Zap, BurnOut II	Danger	Yes, check specific labels
acetic acid (vinegar)	WeedPharm, Nature's Wisdom	Danger	Yes, check specific labels
FeHEDTA (= IronHEDTA)	Fiesta	Caution	No

Modified from Neal, J and Senesac, A. 2018. "Are There Alternatives to Glyphosate for Weed Control in Landscapes?" NC State Extension Publications.


Avenger
D-limonene
Matrantech
Clove oil
Weed Zap
Clove oil + Cinnamon Oil

How Do Organic Herbicides Work?

- All are contact herbicides

How Do Organic Herbicides Work?

- All are contact herbicides
- Good spray coverage is essential

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- All are contact herbicides
- Good spray coverage is essential
- Work best on clear sunny days

How Do Organic Herbicides Work?

- Work best on clear sunny days

For example, nonanoic acid applied to growing plants in sufficient quantities rapidly desiccates green tissue by removing the waxy cuticle of the plant and disrupting the cell membrane, resulting in cell leakage and tissue death.

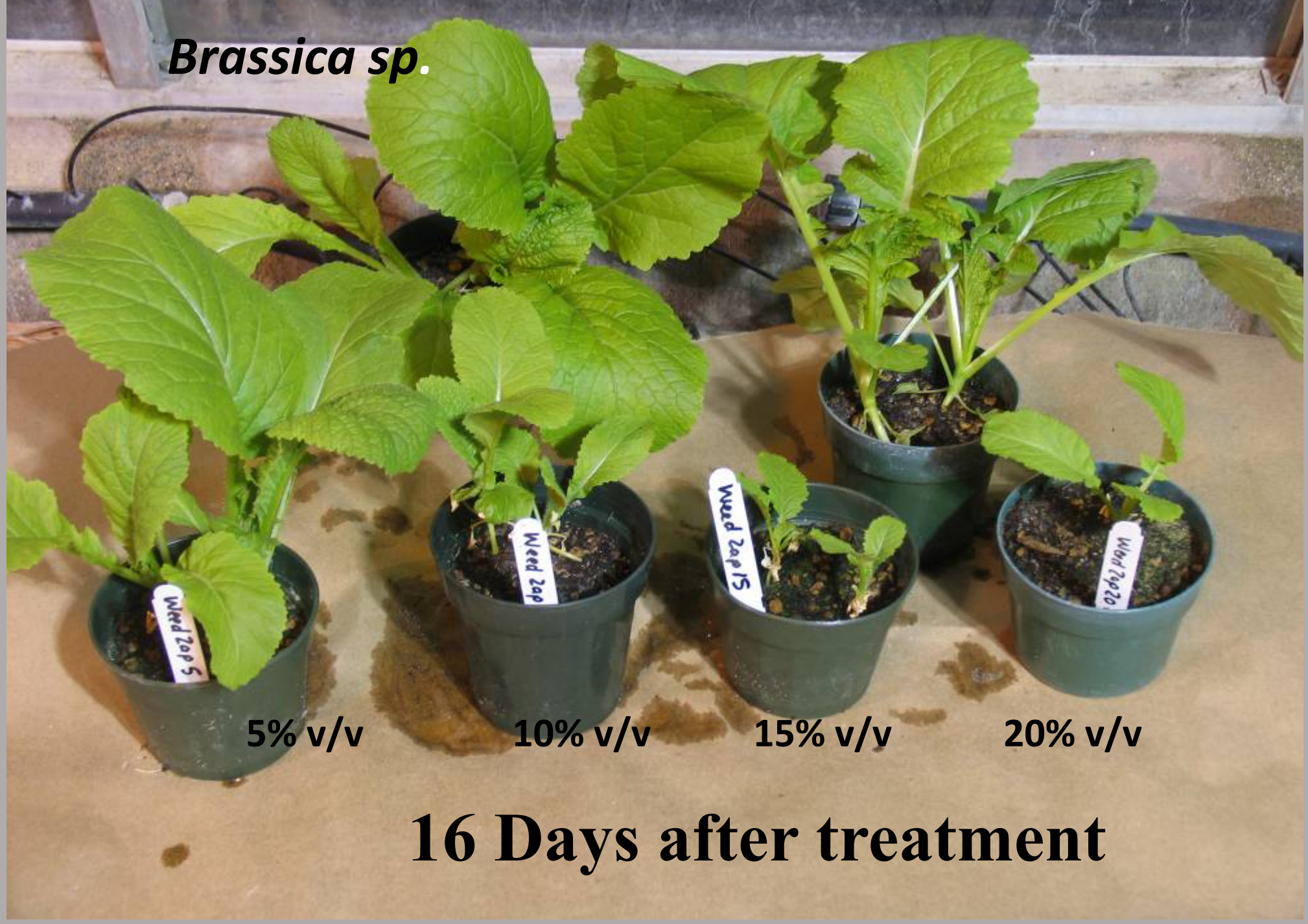
How Do Organic Herbicides Work?

- All are contact herbicides
- Good spray coverage is essential
- Work best on clear sunny days
- Usually work better in warm weather (80º F or above)

How Do Organic Herbicides Work?

- All are contact herbicides
- Good spray coverage is essential
- Work best on clear sunny days
- Usually work better in warm weather (80º F or above)
- Repeat applications are needed for larger weeds or very weedy areas


Brassica sp.
Weed Zap 5
Weed Zap 10
Weed Zap 10
Weed Zap 20
5% v/v
10% v/v
15% v/v
20% v/v
35 gal/ Ac spray volume
Weed Zap


Brassica sp.
5% v/v
10% v/v
15% v/v
20% v/v
16 Days after treatment


Echinochloa colona
Matran 5
Matran 10
Matran 15
Matran 20
organic herbicides tested
provided only temporary
suppression of grasses

Lemongrass oil

35 Gal/Ac spray volume

Lemongrass oil

70 Gal/ Ac spray volume

Broadleaf (pigweed and black nightshade) weed control by age

	----------Weed Age----------					
Treatments	---12 Days Old-					
	1 DAT	15 DAT				
GreenMatch EX 15%	94	89				
GreenMatch 15%	99	83				
Matran 15%	99	88				
Acetic Acid 20% (100%)	76	61				
WeedZap 10%	100	100				
Untreated	0	0				
Lsd .05	256	38				

Broadleaf (pigweed and black nightshade) weed control by age

	----------Weed Age----------					
Treatments	---12 Days Old-		--19 Days Old--			
	1 DAT	15 DAT	1 DAT	15 DAT		
GreenMatch EX 15%	94	89	38	11		
GreenMatch 15%	99	83	96	96		
Matran 15%	99	88	62	28		
Acetic Acid 20% (100%)	76	61	96	11		
WeedZap 10%	100	100	99	33		
Untreated	0	0	0	0		
Lsd .05	256	38	20	46		

Broadleaf (pigweed and black nightshade) weed control by age

	----------Weed Age----------					
Treatments	---12 Days Old-		--19 Days Old--		--26 Days Old--	
	1 DAT	15 DAT	1 DAT	15 DAT	1 DAT	15 DAT
GreenMatch EX 15%	94	89	38	11	32	0
GreenMatch 15%	99	83	96	96	48	17
Matran 15%	99	88	62	28	72	0
Acetic Acid 20% (100%)	76	61	96	11	52	17
WeedZap 10%	100	100	99	33	91	38
Untreated	0	0	0	0	0	0
Lsd .05	256	38	20	46	49	ns

Broadleaf (pigweed and black nightshade) weed control by age

	----------Weed Age----------					
Treatments					--26 Days Old--	
						15 DAT
GreenMatch EX 15%						0
GreenMatch 15%						17
Matran 15%						0
Acetic Acid 20% (100%)						17
WeedZap 10%						38
Untreated						0
Lsd .05						ns

Grass (barnyardgrass and crabgrass) weed control by age

	----------Weed Age----------					
Treatments	---12 Days Old-					
	1 DAT	15 DAT				
GreenMatch EX 15%	97	25				
GreenMatch 15%	99	42				
Matran 15%	79	25				
Acetic Acid 20% (100%)	37	25				
WeedZap 10%	81	0				
Untreated	0	0				
Lsd .05	25	ns				

Grass (barnyardgrass and crabgrass) weed control by age

	----------Weed Age----------					
Treatments	---12 Days Old-		--19 Days Old--			
	1 DAT	15 DAT	1 DAT	15 DAT		
GreenMatch EX 15%	97	25	28	19		
GreenMatch 15%	99	42	95	42		
Matran 15%	79	25	86	17		
Acetic Acid 20% (100%)	37	25	77	0		
WeedZap 10%	81	0	87	11		
Untreated	0	0	0	0		
Lsd .05	25	ns	17	22		

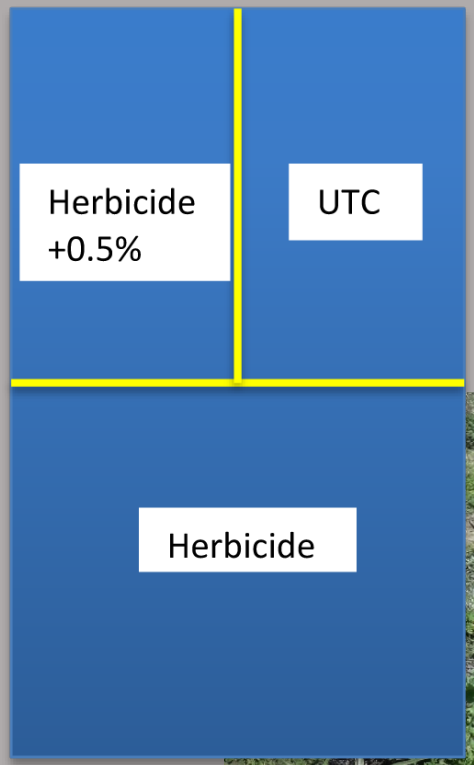
Grass (barnyardgrass and crabgrass) weed control by age

	----------Weed Age----------					
Treatments	---12 Days Old-		--19 Days Old--		--26 Days Old--	
	1 DAT	15 DAT	1 DAT	15 DAT	1 DAT	15 DAT
GreenMatch EX 15%	97	25	28	19	32	8
GreenMatch 15%	99	42	95	42	50	0
Matran 15%	79	25	86	17	51	0
Acetic Acid 20% (100%)	37	25	77	0	40	0
WeedZap 10%	81	0	87	11	51	0
Untreated	0	0	0	0	0	0
Lsd .05	25	ns	17	22	ns	ns

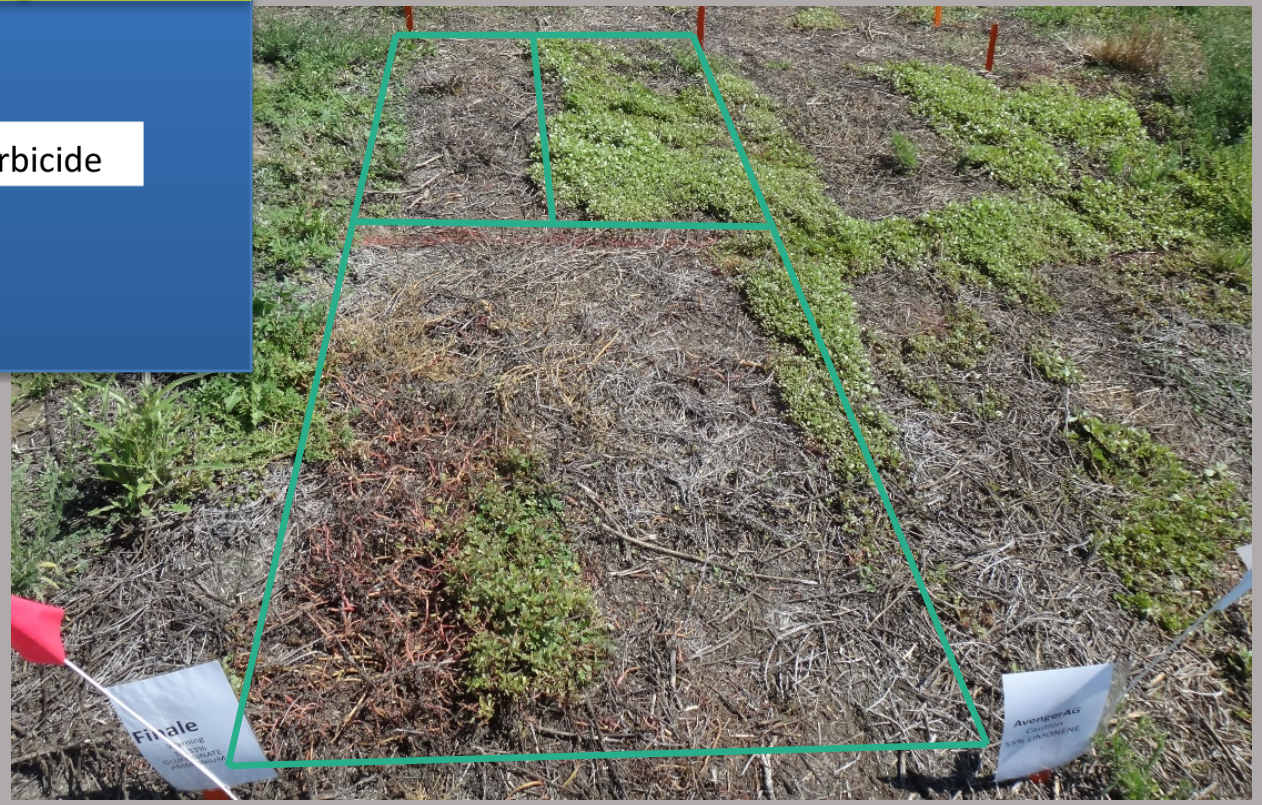
Grass (barnyardgrass and crabgrass) weed control by age

	----------Weed Age----------					
Treatments					--26 Days Old--	
						15 DAT
GreenMatch EX 15%						8
GreenMatch 15%						0
Matran 15%						0
Acetic Acid 20% (100%)						0
WeedZap 10%						0
Untreated						0
Lsd .05						ns

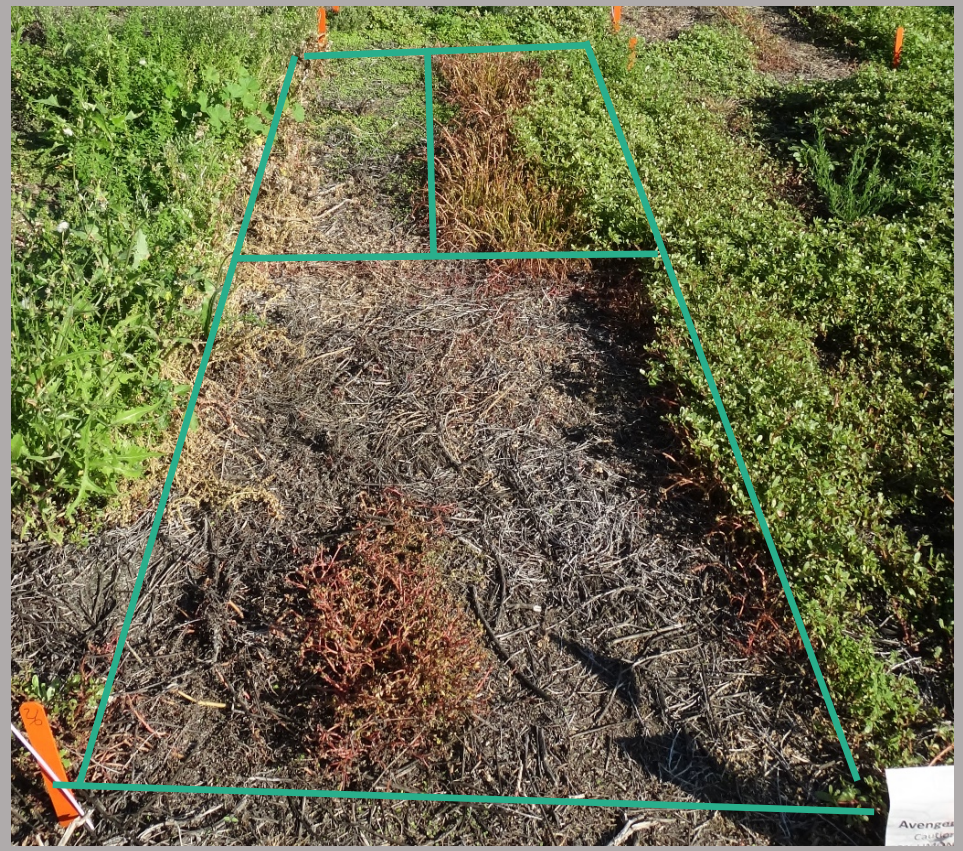
Research by Cheryl Wilen, UC Cooperative Extension and UC IPM, Southern California, 2016



Finale

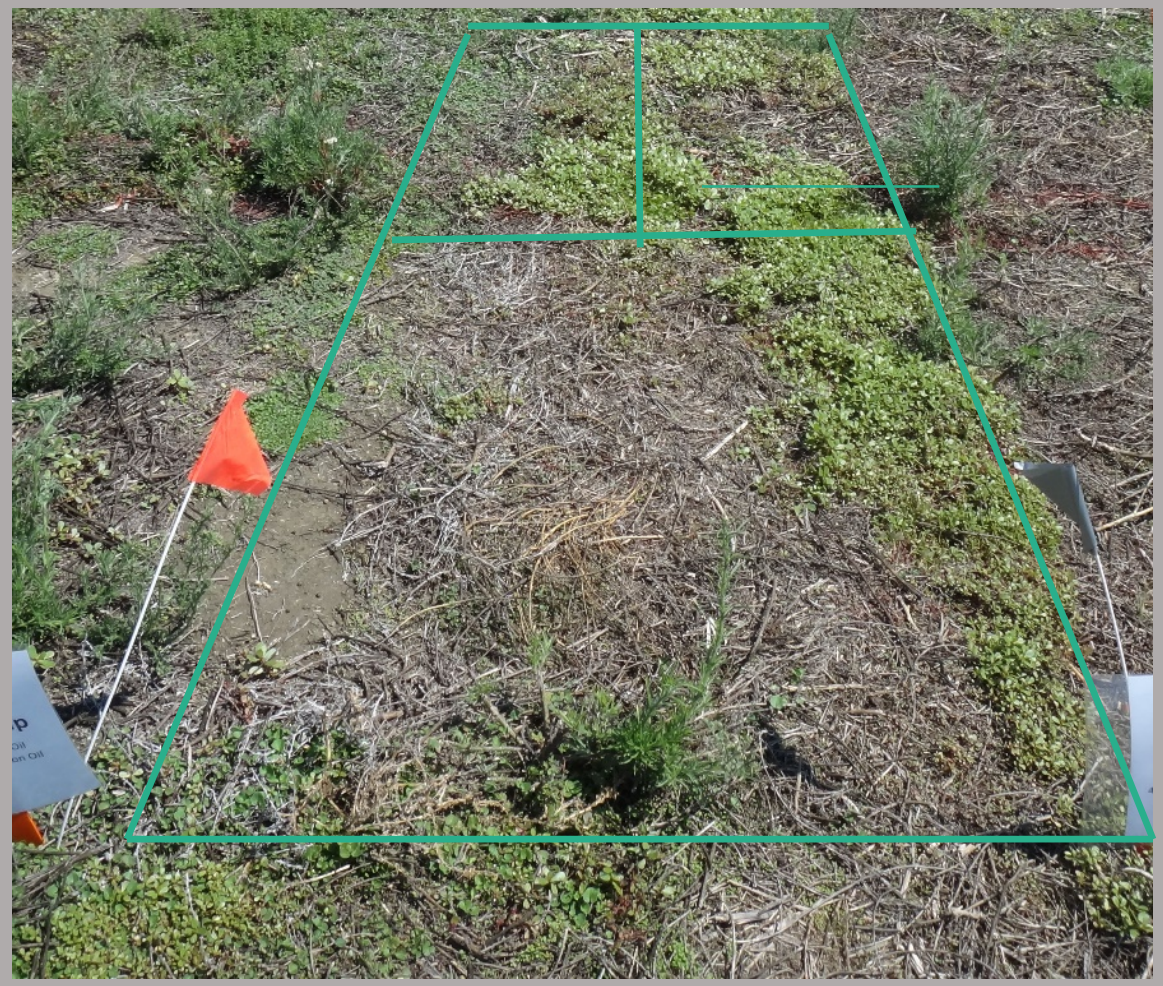


7dat1



10dat2

WeedZap



7dat1

10dat2

WeedPharm

7dat1

UC WEED SCIENCE

Weed control, management, ecology, and minutia

Update on "organic" herbicide test for landscapes

Author: Cheryl A. Wilen
Posted by: Gale Perez

Published on: December 11, 2016

A few months ago I wrote about starting some tests looking at various postemergence herbicides for non-crop use. This project was initiated due to new ordinances some cities in southern California were considering or adopted that limited the use products containing glyphosate on city owned property. I changed up some of the products from the original test I did and repeated some others.

Some are listed as organic and some are organic but not be organically approved by a certifying agency e.g. OMRI. One is listed as a biopesticide (Fiesta). One is a synthetic pesticide (Finale) that may be a good replacement in certain situations.

Product	Signal word	Active ingredient(s)		$	Unit (gal)	$/1000ft² 1 application, herbicide only
WeedZap*	25 (b)	45% Clove Oil	45% Cinnamon Oil	124.35	1	12.84
Roundup Pro	Caution	48.7% glyphosate (included for comparison)		69.99	2.5	0.87
AvengerAG*	Caution	55% LIMONENE		157.26	2.5	18.53
Fiesta***	Caution	26.52% IRON HEDTA		250.95	2.5	8.15
Suppress*	Warning	32% CAPRIC ACID	47% CAPRYLIC ACID	150.00		
Finale	Warning	11.33% GLUFOSINATE-AMMONIUM**				
AXXE*	Warning	40% AMMONIUM NONANO				
Scythe	Warning					
		24% Citric Acid		29.95	1	12.94
				135.00		7.80

https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=22761

CSU Sacramento, August- Sept 2019

- Same materials, one surfactant
- Single nozzle, flat fan; CO_2 backpack at 50 GPA
- Plots were 5 x 10 ft
- 12 plots per rep; 4 reps
- Temperature is 70-104º F


State University
Dr E Parking
Callery Pear Way
Callery Pear Way
Research Zone
Callery Pear Way
State University Dr
State University Dr
College Town Dr
College Town Dr
College Town Dr
College Town Dr
College Town Dr
College Town Dr


Major weeds in the site: dandelion, wild strawberry, sedge, bermudagrass, dallisgrass, crabgrass, broadleaf plantain

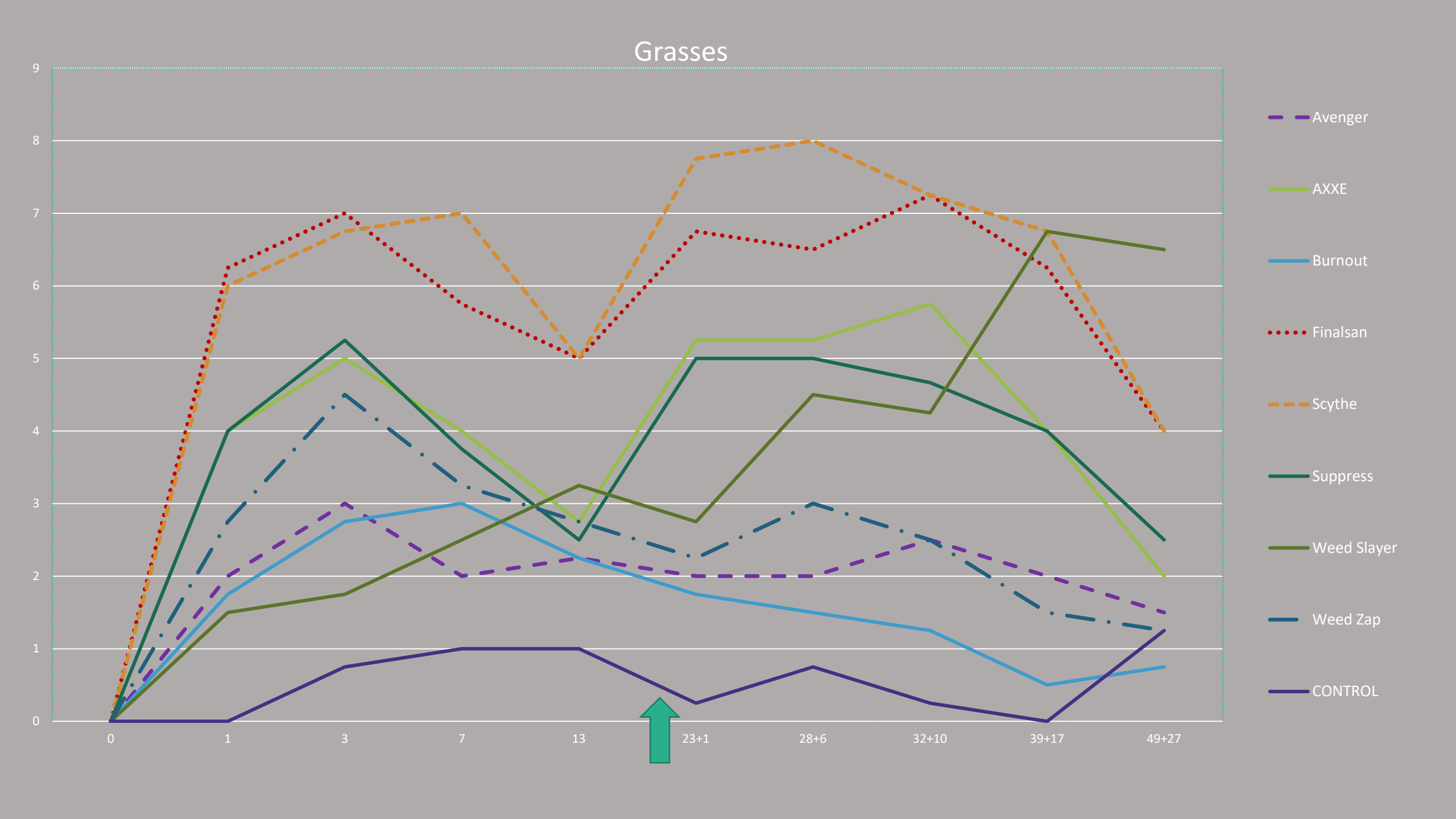
Materials used in CSUS Trials 2019

Trt	Product name	Rate	Formulation	Signal Word	Price/btl	Size	price/ 1000 sq ft
1	**Fiesta**	**4%**	**Iron HEDTA**	Caution	**$180**	**2.5 gal**	**$3.31**
2	**Weed Slayer**	**1.25% + 1.25% (+1%)**	**6% eugenol; Biosurfactant**	Caution	**$185**	**1 gal**	**$2.64**
3	**Finalsan**	**17%**	**22% ammoniated soap of fatty acids**	Warning	**$81**	**2.5 gal**	**$6.29**
4	**Weed Zap**	**6%**	**45% clove oil, 45% cinnamon oil**	Caution	**$175**	**2.5 gal**	**$4.81**
5	**Burnout**	**25%**	**8% citric acid, 2 % clove oil**	Danger	**$100**	**2.5 gal**	**$11.41**
6	**Avenger AG**	**6%**	**70% d-limonene**	Caution	**$200**	**2.5 gal**	**$5.50**
7	**AXXE**	**10%**	**40%, ammonium nonanoate**	Warning	**$207**	**2.5 gal**	**$9.45**
8	**Scythe**	**6%**	**57% pelargonic acid; 3% fatty acids**	Warning	**$180**	**2.5 gal**	**$4.95**
9	**Suppress + BioLink**	**6% + 1%**	**47% caprylic Acid, 32% capric acid**	Warning	**$190**	**2.5 gal**	**$5.22**
10	**Finale**	**1%**	**glufosinate-ammonium**	Warning	**$175**	**2.5 gal**	**$0.80**
11	**Ranger Pro**	**1%**	**41% glyphosate**	Caution	**$70**	**2.5 gal**	**$0.32**
12	**CONTROL**						

	Nature's Wisdom	**Full**	**20% acetic acid**	Danger	**$75**	**2.5 gal**	**$34.24**

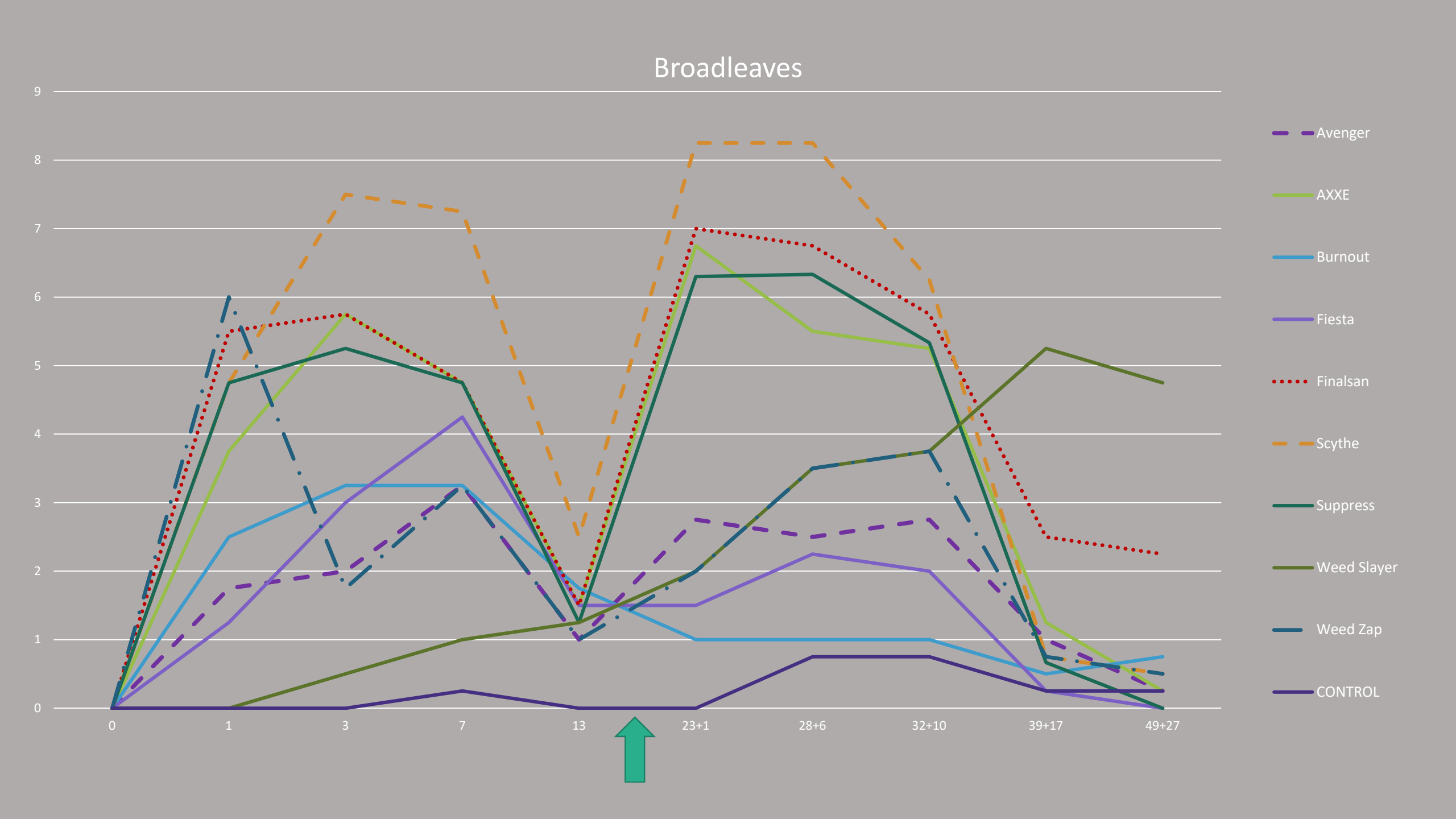
Grasses

		Days after application								
	1	3	7	13	2nd app	1(23)	6(28)	10(32)	17(39)	27(49)
Avenger	2.00	3.00	2.00	2.25		2.00	2.00	2.50	2.00	1.50
AXXE	4.00	5.00	4.00	2.75		5.25	5.25	5.75	4.00	2.00
Burnout	1.75	2.75	3.00	2.25		1.75	1.50	1.25	0.50	0.75
Finalsan	6.25	7.00	5.75	5.00		6.75	6.50	7.25	6.25	4.00
Scythe	6.00	6.75	7.00	5.00		7.75	8.00	7.25	6.75	4.00
Suppress	4.00	5.25	3.75	2.50		5.00	5.00	4.67	4.00	2.50
Weed Slayer	1.50	1.75	2.50	3.25		2.75	4.50	4.25	6.75	6.50
Weed Zap	2.75	4.50	3.25	2.75		2.25	3.00	2.50	1.50	1.25
CONTROL	0.00	0.75	1.00	1.00		0.25	0.75	0.25	0.00	1.25
		Days after application								
	1	3	7	13		23	28	32	39	49
Finale	2.50	4.25	6.75	7.50		6.75	6.25	6.25	6.00	4.00
RangerPro	0.75	2.00	6.50	8.25		8.75	8.25	9.00	9.25	8.50


Grasses
9
8
7
6
5
4
3
2
1
0
0
1
3
7
13
23+1
28+6
32+10
39+17
49+27
Avenger
AXXE
Burnout
Finalsan
Scythe
Suppress
Weed Slayer
Weed Zap
CONTROL

Broadleaves

		Days after application								
	1	3	7	13	2nd app	1(23)	6(28)	10(32)	17(39)	27(49)
Avenger	1.75	2.00	3.25	1.00		2.75	2.50	2.75	1.00	0.25
AXXE	3.75	5.75	4.75	1.50		6.75	5.50	5.25	1.25	0.25
Burnout	2.50	3.25	3.25	1.75		1.00	1.00	1.00	0.50	0.75
Fiesta	1.25	3.00	4.25	1.50		1.50	2.25	2.00	0.25	0.00
Finalsan	5.50	5.75	4.75	1.50		7.00	6.75	5.75	2.50	2.25
Scythe	4.75	7.50	7.25	2.50		8.25	8.25	6.25	0.75	0.50
Suppress	4.75	5.25	4.75	1.25		6.30	6.33	5.33	0.67	0.00
Weed Slayer	0.00	0.50	1.00	1.25		2.00	3.50	3.75	5.25	4.75
Weed Zap	6.00	1.75	3.25	1.00		2.00	3.50	3.75	0.75	0.50
CONTROL	0.00	0.00	0.25	0.00		0.00	0.75	0.75	0.25	0.25
		Days after application								
	1	3	7	13		23	28	32	39	49
Finale	0.75	4	7.5	7.75		7	5	4.5	2.5	0.75
RangerPro	0.25	0.25	1.5	3.25		7	6.75	7	8	8.75


Broadleaves
9
8
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6
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4
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2
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1
3
7
13
23+1
28+6
32+10
39+17
49+27
Avenger
AXXE
Burnout
Fiesta
Finalsan
Scythe
Suppress
Weed Slayer
Weed Zap
CONTROL

Materials used in CSUS Trials 2019

Trt	Product name	Rate	Formulation	Signal Word	price/ 1000 sq ft per application	Total chemical cost
1	Fiesta	4%	Iron HEDTA	Caution	$3.31	$6.62
2B	Weed Slayer	1.25% + 1.25% (+1%)*	6% eugenol; Biosurfactant	Caution	$2.64	$3.70
3	Finalsan	17%	22% ammoniated soap of fatty acids	Warning	$6.29	$12.58
4	Weed Zap	6%	45% clove oil, 45% cinnamon oil	Caution	$4.81	$9.62
5	Burnout	25%	8% citric acid, 2 % clove oil	Danger	$11.41	$22.82
6	Avenger AG	6%	70% d-limonene	Caution	$5.50	$11.00
7	AXXE	10%	40%, ammonium nonanoate	Warning	$9.45	$18.90
8	Scythe	6%	57% pelargonic acid; 3% fatty acids	Warning	$4.95	$9.90
9	Suppress + BioLink	6% + 1%	47% caprylic Acid, 32% capric acid	Warning	$5.22	$10.44
10	Finale	1%	glufosinate-ammonium	Warning	$0.80	$0.80
11	Ranger Pro	1%	41% glyphosate	Caution	$0.32	$0.32
12	CONTROL					
2A	*Weed Slayer	0.5% + 0.5% (+1%)*	6% eugenol; Biosurfactant		$1.06	
	Nature's Wisdom	Full	20% acetic acid	Danger	$34.24	

Disclaimer

Use of trade names does not constitute an endorsement

Mention of any herbicide does not constitute a recommendation

Herbicides mentioned may not be registered for this use and may not be currently registered in California

Always Read and Follow all label instructions


ipm.ucanr.edu
Questions?
UC IPM
University of California
Agriculture and Natural Resources
Integrated Pest Management Program