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Weed Management



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Why control weeds?

- Compete for water, nutrients, and light with trees
- Interference is especially problematic during establishment years
- Can affect crop management, irrigation, and harvest operations
- Impacts on other pest problems
- Crop quality concerns?



Complex populations

- Rarely just one weed species present
 - Annual vs perennial vs biennial
 - Grass vs sedges vs broadleaf
- Time of emergence
 - Fall vs spring emergence vs year-round
- Reproductive strategy
 - Seed vs vegetative



Factors affecting orchard weeds

- Orchard age and arrangement
 - Shading and space capture
- Irrigation type, timing, and amount
 - Furrow, sprinklers, micros, drip
- Tillage practices
 - Berms, cross-disking, etc.
- Herbicide options
- Orchard access



Integrated weed management

- Using all available strategies to manage weed populations in a manner that is economically and environmentally sound.
 - cultural
 - mechanical
 - chemical



Goals of IWM

- Both short- and long-term goals
 - Prevent or reduce weed spread
 - Delay and/or suppress weed growth
 - Prevent or suppress weed seed production
 - Reduction of weed seed bank in soil

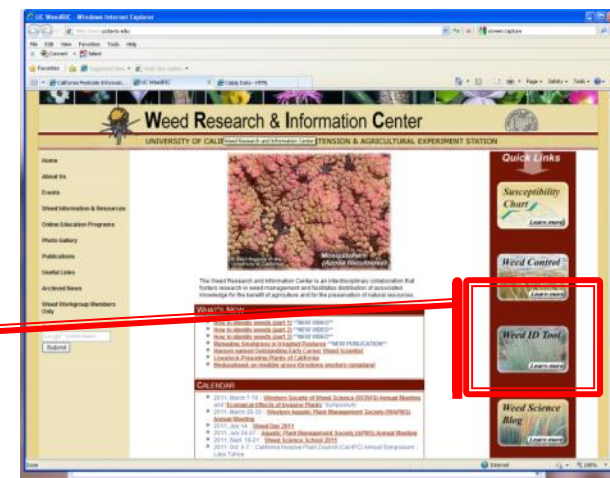


Weed identification

- Unknown weeds cannot be properly managed
 - No technique controls all weed species
 - Not all weeds cause equal damage (thresholds)
 - Species respond differently to control strategies
 - Even variants within a species (i.e. herbicide resistant biotypes)

Weed Research and Info Center
<http://wric.ucdavis.edu>

Online weed ID tool



Weed ID Books and Pamphlets

A number of weed books are available



Weed ID - Software

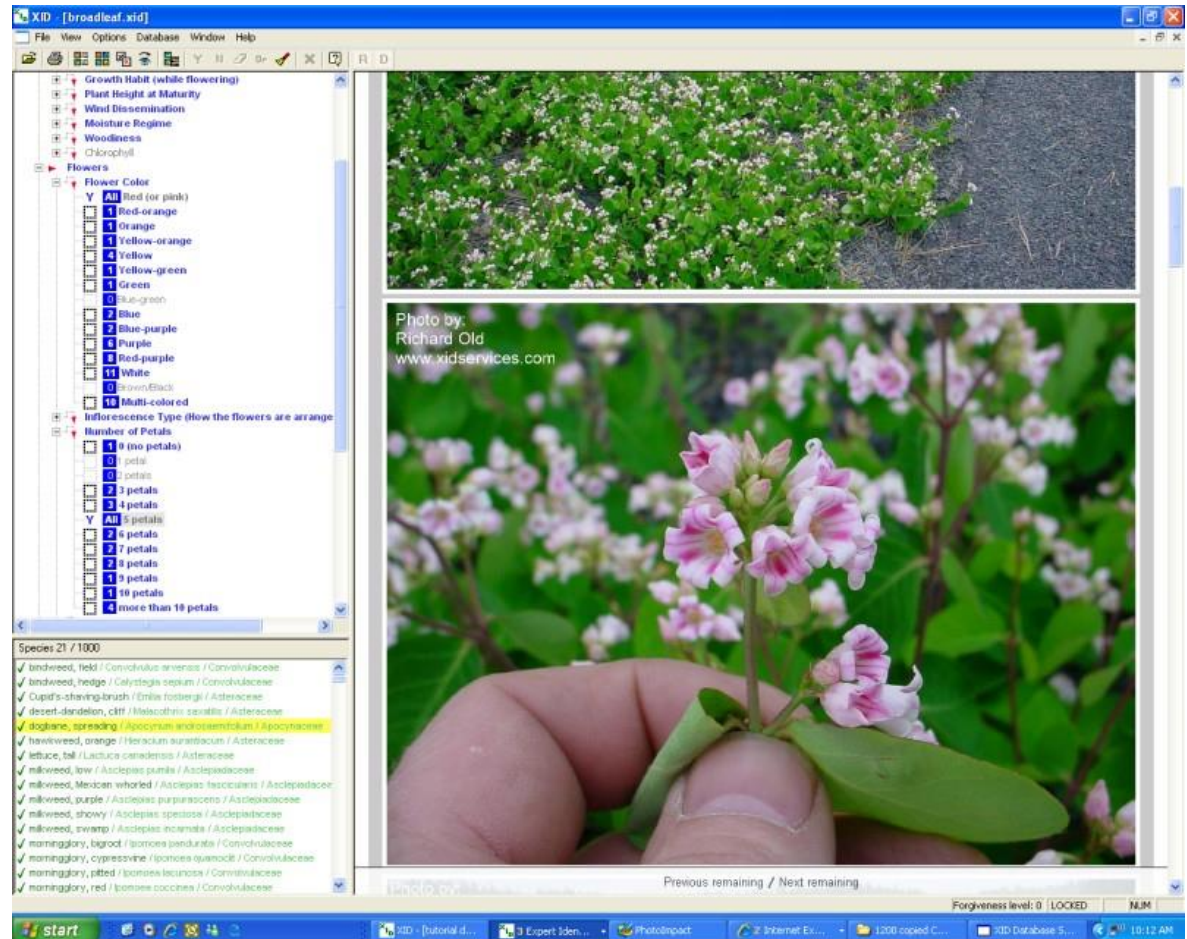
Several available.

I use a set by XID Services

- UC Davis
- WSSA
- WSWS
- others



- INCLUDES:
- Color photographs of all 1,200 species (over 6,000 images)
 - Graphic images of all terms and botanical drawings used in the identification process
 - A complete step-by-step tutorial so that you learn all of the program's features
 - Color illustrations of over 50 of the most common weeds
 - Easy-to-use icons for each species



Online Weed ID Resources

A few online (FREE) resources are available

The screenshot shows a web browser window displaying the University of Wisconsin Weed Identification & Management website. The page features a search bar at the top with the text "search database". Below the search bar, it states "Your database search has yielded 27 possible matches found in (CA)". The results are presented in a table with three columns: Scientific Name, Common Name, and Pictures.

Scientific Name	Common Name	Pictures
Abutilon theophrasti	velvetleaf	
Cardamine hirsuta	hairy bittercress	
Chenopodium album	common	

UC Davis Weed Research
and Information Center
www.wric.ucdavis.edu

Online Weed ID Resources

<http://ipm.ucdavis.edu/PMG/menu.weeds.html>

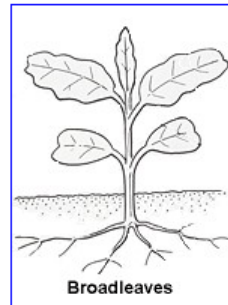


The UC Guide to Healthy Lawns

[Back to start](#)

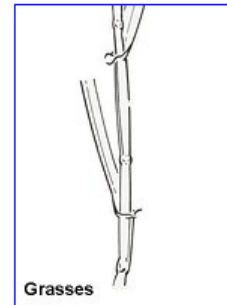
Begin key

Which illustrated characteristic best matches your weed species?



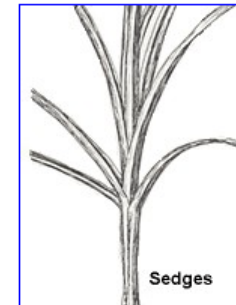
Broadleaves

Leaves are wide, veins branch out in different directions



Grasses

Leaves are narrow, arranged in sets of 2; stems are rounded or flattened



Sedges

Leaves are narrow, arranged in sets of 3; stems are triangular in cross section

[Grass ID characteristics](#)
[Sedge ID characteristics](#)
[Broadleaf ID characteristics](#)

Weed management

- Orchard and vineyard floors divided into two management zones: middles and crop row
 - Zones may have very different strategies
 - Also may differ during the life of the orchard



How do we manage weeds?

- A few broad categories
 - Exclusion/sanitation
 - Cultural
 - Mechanical
 - Biological
 - Chemical



Sanitation

- Weed management should be an ongoing concern
 - Scout and manage in the orchard
 - Manage weeds on field margins and access roads
 - Clean equipment between sites
 - Scout and prevent seed set of “new” problems



One years seeding...

Cultural practices

- Irrigation and fertilizer management
- Canopy management
- Cover crops
- Mulches
- Flaming
- Animals

Cover crops



Cover crop issues



ADVANTAGES

- Winter orchard access
- Reduced soil erosion
 - And pesticide and fertilizer runoff
- Addition of OM
- Soil structure and water/root penetration
- Competes with weeds

DISADVANTAGES

- Need to manage 2nd crop
 - More equipment
- Competes for water and nutrients
- Frost concerns
- Vertebrate and insect pests
- Addition of nutrients (N) may be unwanted (vineyard)



Flaming

- Non-chemical
- High fuel cost
- Just need to “heat” not “burn” weeds
- Best on young broadleaf
- No residual control
- Danger of damage to young trees or vines and irrigation systems



Animals

- Animals can be used to manage vegetation in some cases
 - Can work very well ... or very poorly
 - Expensive (own or rent?)
 - Management effort
 - Animal health and welfare limits weed control
 - Can damage trees or vines (buds) if left too long
 - Food safety concerns



Mechanical control

- Tillage / cultivation
- Mowing
- Hand labor

- T&V rows vs middles
 - equipment options and costs



Cultivation

ADVANTAGES

- Non-chemical tactic
- Organic matter additions and nitrogen release
- Reduces competition for water
- Reduces frost potential
- Easy control in middles
- No “resistance”

DISADVANTAGES

- Fuel and time costs
- Trunk and root injury
- Dust
- Erosion
- Compaction
- Can spread seed and fragments
- Weeds near tree difficult
- Effects on tree vigor?

Mowing



- **Advantages.**

- Suppresses weeds, reduces seed set
- Orchard access and erosion benefits

- **Disadvantages.**

- Frost potential
- Weeds still use water and nutrients
- Favors low growing and perennial weeds
- Favors grasses (*advantages or disadvantages?*)
- Cost of repeat operations (slow and frequent)

Chemical control



Herbicides

- CA orchards and vineyard herbicides usually applied to “strips” under the tree/vine row
 - 2-20 ft strip, may treat 20-50% of the floor
 - Middles managed with mowing, tillage, or less intensive herbicide program
 - Often with a “preharvest” broadcast application



Types of herbicides



- Preemergence (PRE)
 - Applied to bare soil and affect germinating seeds and seedlings
 - Provide residual effects (weeks or months)
- Postemergence (POST)
 - “Burn down” treatments applied to the foliage of emerged weeds
 - Can be “contact” or “translocated” materials
 - Some products have residual control, some do not

Factors affecting herbicide choice

- Availability in the crop (registration)
- Weeds to be controlled (weed ID)
- Toxicity and safety (to crop and non-target)
- Soil type and texture
- Cost



CA pistachio herbicide use

	Top active ingredients (2015)	2009 treated acreage	2015 treated acreage
1	glyphosate	249,586	323,493
2	oxyfluorfen (Goal, Goaltender)	113,934	145,193
3	saflufenacil (Treevix)	--	112,594
4	paraquat (Gramoxone)	38,610	74,441
5	pendimethalin (Prowl H2O)	56,048	73,335
6	glufosinate (Rely)	55,841	59,702
7	pyraflufen (Venue)	92	40,000
8	rimsulfuron (Matrix)	14,435	37,577
9	indaziflam (Alion)	--	36,562
10	flumioxazin (Chateau)	23,820	26,960
11	penoxsulam (PindarGT)	--	22,101
12	carfentrazone (Shark)	12,828	15,478
13	oryzalin (Surflan, etc)	26,693	10,408
14	isoxaben (Trellis)	290	10,173

* strip treatments!

301,967 A total (~239k bearing, 69k NB) in 2015

Conventional herbicides

ADVANTAGES

- Can be very cost effective (in some cases)
- Consistent results
- Ease of application (speed)
- Crop safety (generally)
- Erosion benefits (vs tillage)
- Season-long control with some products and combos
- Selectivity can be used to maintain desired cover

DISADVANTAGES

- Cost (in some cases)
- Potential for off-site movement with some products
- Regulations and record keeping
- Herbicide resistance can occur
- Crop injury can occur
- Some market sectors have preference against

Herbicide application considerations

- PRE, POST, or PRE/POST mix?
- Tank mixes
- Weed spectrum controlled
- Surfactants and adjuvants
- Coverage (GPA)
- Timing and weed size
- Sprayer calibration (esp. OC nozzles)
- Nozzle selection
- Litter and debris
- Check current herbicide labels
- Scouting and record keeping
- Training and PPE for handlers and applicators
- Potential for off-site movement?
- Double check calculations and recommendations!



Weed challenges in orchards

- Old favorites:
 - Normal mix of annual grasses and broadleaves
 - Challenge with perennial weeds, especially in new orchards or crops with fewer herbicide options
- New weed problems
 - Most of the “new” issues seem to be related to glyphosate resistance and/or shifting populations to tolerant species
- Changing control options
 - Less tillage, some new herbicides, water issues

Extra challenges in young orchards

- Crop less competitive with weeds
- Greater sensitivity to weed competition
- Greater sensitivity to injury from weed control tactics
- Fewer herbicides registered on new plantings



Orchard weed management

- Weed ID
 - Understand the problem and biology
- Use integrated management tactics
 - Cultural and mechanical approaches
 - Chemical tactics
 - Right herbicide, right target, right time
 - Resistance management considerations
 - Environmental impacts
 - VOC, surface water, ground water

Manage “your” weeds

- Weed management is an annual concern and production cost that must be considered in a local context
- No “one size fits all” solution for all orchards - integrated weed management requires systemic and long-term thinking



T&V herbicide registrations

Herbicide Registration on California Tree and Vine Crops -(updated April 2017 - UC Weed Science)

Herbicide- Common Name (example trade name)	Site of Action Group ¹	Almond	Pecan	Pistachio	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum/ Prune	Avocado	Citrus	Date	Fig	Grape	Kiwi	Olive	Pomegranate	
		----- tree nut -----				- pome -		----- stone fruit -----													
Preemergence																					
dichlobenil (Casoron)	L/20	N	N	N	N	R	R	N	R	N	N	N	N	N	N	N	R	N	N	N	N
diuron (Kamex,Diurex)	C2/7	N	R	N	R	R	R	N	N	N	R	N	N	R	N	N	R	N	R	N	N
EPTC (Eptam)	N/8	R	N	N	R	N	N	N	N	N	N	N	N	R	N	N	N	N	N	N	N
flazasulfuron (Mission)	B/2	R	N	R	R	N	N	N	N	N	N	N	N	R	N	N	R	N	N	N	N
flumioxazin (Chateau)	E/14	R	R	R	R	R	R	R	R	R	R	R	NB	NB	N	NB	R	N	R	R	R
indaziflam (Alion)	L/29	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	N	N
isoxaben (Trellis)	L/21	R	R	R	R	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	NB	R	NB	NB	NB	NB
mesotrione (Broadworks)	F2/27	R	R	R	R	N	N	N	N	R	N	R	N	R	N	N	N	N	N	N	N
napropamide (Devrinol)	K3/15	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	R	R	N	N	N
norflurazon (Solicam)	F1/12	R	R	N	R	R	R	R	R	R	R	R	R	R	N	N	R	N	N	N	N
oryzalin (Surlan)	K1/3	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R	R
oxyfluorfen (Goal, GoalTender)	E/14	R	R	R	R	R	R	R	R	R	R	R	R	NB	R	R	R	R	R	R	R
pendimethalin (ProwlH2O)	K1/3	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	R	R
penoxsulam (Pindar GT)	B/2	R	R	R	R	N	N	N	R	R	R	R	N	N	N	N	N	N	R	R	R
pronamide (Kerb)	K1/3	N	N	N	N	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N	N
rimsulfuron (Matrix)	B/2	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	N	N	N
sulfentrazone (Zeus)	E/14	N	R	R	R	N	N	N	N	N	N	N	N	R	N	N	R	N	N	N	N
simazine (Princep, Caliber 90)	C1/5	R	R	N	R	R	N	N	R ²	R	R	N	R	R	N	N	R	N	R	N	N
trifluralin (Treflan)	K1/3	R	R	N	R	N	N	R	N	R	R	R	N	R	N	N	R	N	N	N	N
Postemergence																					
carfentrazone (S hark)	E/14	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
clethodim (SelectMax)	A/1	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	R	N	N	NB	N	NB	N	N
2,4- D (Clean-crop, Orchard Master)	O/4	R	R	R	R	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N	N
diquat (Diquat)	D/22	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
fluzazifop-p-butyl(Fusilade)	A/1	NB	R	NB	NB	NB	NB	R	R	R	R	R	NB	R	NB	NB	R	N	NB	NB	NB
glyphosate (Roundup)	G/9	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
glufosinate (Rely 280)	H/10	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	N	N
halosulfuron (Sandea)	B/2	N	R	R	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
paraquat (Gramoxone)	D/22	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R	R
pelargonic acid (Scythe)	NC ²	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N
pyraflufen (Venue)	E/14	R	R	R	R	R	R	R	R	R	R	R	N	N	R	R	R	R	R	R	R
saflufenacil (Treevix)	E/14	R	N	R	R	R	R	N	N	N	N	N	N	R	N	N	N	N	N	R	R
sethoxydim (Poast)	A/1	R	R	R	R	R	R	R	R	R	R	NB	NB	R	NB	NB	R	N	NB	NB	NB
Organic																					
Caprylic/Capric acid (Suppress)	NC ²	R	R	R	R	R	R	R	R	R	R	R	R	R	N	N	R	R	R	N	R
ammoniated fatty acids (Final-San-	NC ²	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
d-limonene (AvengerAG)	NC ²	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	N	N	N
Ammonium nanoate (Axxe)	NC ²	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N

Notes: R = Registered, N = Not registered, NB = nonbearing. This chart is intended as a general guide only. Always consult a current label before using any herbicide as labels change frequently and often contain special restrictions regarding use of a company's product.

¹ Herbicide site of action designations are according to the Herbicide Resistance Action Committee (letters) and the Weed Science Society of America (number) systems. NC = no accepted site of action classification; these contact herbicides are general membrane disruptors.

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and Information Center**

<http://wric.ucdavis.edu/>

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